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ADVISORY GROUP FOR AEROSPACE RESEARCH & DEVELOPMENT

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AGARDograph No. 223

A Critical Compilation of Compressible Turbulent Boundary Layer Data

by

H. H. Fernholz and P. J. Finley

NORTH ATLANTIC TREATY ORGANIZATION

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ADVISORY GROUP FOR AEROSPACE RESEARCH AND DEVELOPMENT

(ORGANISATION DU TRAITE DE L'ATLANTIQUE NORD)

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A CRITICAL COMPILATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYER DATA

by

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i. GENERAL PREFACE

At the 1971 EUROVISC meeting in London the late Dietrich Küchemann suggested to the first author that the data collection which he had started for his own research purposes would be generally useful if it could be extended and made accessible in standardised form. Thus this project was launched under the auspices of EUROVISC, and it has remained so through the assistance and advice of an informal advisory group, consisting of L.C. Squire (Cambridge), J.L. Stollery (Cranfield) and K.G. Winter (RAE Bedford). The data collection and handling have throughout been funded by the German Research Council (DFG) and the Technical University Berlin. By 1973 the computational framework was established by H.J. Küster and the actual work had been started. At the beginning of 1974 the team was joined by Miss C. Mohr, who has since handled all the computational work, and by the second author, on leave from Imperial College. During that year we were able to lay the foundations and complete most of the structure of the catalogue. Our work was encouraged by the agreement of the Fluid Dynamics Panel of AGARD to support and arrange publication, with Professor Fanneløp (Trondheim) as AGARD editor. Since that time we have been engaged, principally, on the physical labour of handling all the data and the minutae of presentation, above all in the inevitably unsuccessful pursuit of consistency. Had we been fully aware of the force of Dr. Johnson's comment that "making dictionaries is dull work" it is doubtful that we would have had the temerity to start. As it is, the final product is the result of the labour of so many hands in addition to our own that the attempt at proper acknowledgement below must needs be hopelessly incomplete.

We hope to follow this volume, which is a compilation of fact, and as little coloured by opinion as we could contrive, with a volume of commentary on the general nature of compressible boundary layer data, and some of the problems of interpretation which arise.

ii. ACKNOWLEDGEMENTS

Firstly we must thank all the authors whose experiments are presented in the entries. The compilation describes their work, and ours is only the secondary occupation of ordering it. We have tested the authors' patience with often lengthy and repeated questionnaires, and must thank specially those who suffered our first attempts, when we were learning our trade. In addition to all those who answered our many questions, and who are mentioned in the entries, we thank J.C. Westkaemper, of the University of Texas in Austin, for assistance in obtaining many DRL reports and then checking our experimental accounts. We also thank K.G. Winter and the RAE for arranging a literature search on our behalf, D.M. Bushnell, lately of NASA Langley, for helping us to obtain a quantity of apparently inaccessible data, and P. Bradshaw of Imperial College for much helpful general advice and detailed criticism.

We could not have hoped to produce the catalogue without the able and uncomplaining assistance of our co-workers. H.J. Küster and Miss C. Mohr have been mentioned above. Unfortunately only direct experience could make real the sheer quantity of tiresome detail work done by C.M. - let alone the physical effort of continually moving around massive collections of computer printout. We must also thank T. Podtschaske who performed the greater part of the interpolation work which continually proved necessary. Mrs. H. Geib, who prepared the text, earns the special thanks of the second author for coping with endless revisions in his notoriously illegible handwriting, and we thank Mrs. I. Gereke for making all our drawings.

Amongst official bodies, our debt to the DFG and TUB for funding the research work is pre-eminent, while for nearly a whole year out of the last three the second author has been a grateful guest of the Hermann-Föttinger-Institut in Berlin. The publication is funded by AGARD, and we would thank the Fluid Dynamics Panel and its successive executives, J. Lawford and M. Fischer, for their help and encouragement.

Finally we must thank Cornelie and Sophia for their support and for not complaining too much at those frequent periods during which they have been "Catalogue widows".

iii. FOREWORD

The principal objective of this compilation is to provide ready access to a large body of boundary layer data. The printed volume contains a great part of this, but it has not proved possible to print the complete collection. However, all the data processed was reduced to a standard form and stored on magnetic tape. The original complete processed data tabulation was transcribed onto paper, and accompanies this volume as a microfiche. The precision of the data is an order, or orders, higher than its accuracy and we cannot state too forcefully that there are very few individual data presented here for which it would be possible to claim an accuracy of 1%. The much higher level of precision in the tables, usually at five significant figures, occurs purely as a result of our desire to standardise the presentation in a format which is convenient for the computer, and to eliminate any possibility of editor-induced rounding errors.

Ready access implies that the user should not have to undertake any substantial reprocessing of data, and especially should not be compelled to transcribe the information back into computer-digestible form. To this end, arrangements have been made with the following organizations in NATO countries to hold master copies of the data tape. These organizations will prepare copies on request; enquiries as to terms should be directed to the organization concerned. The tape will probably be an exact transcription of the data in the microfiche tabulation accompanying this publication, but may be modified slightly to make it easier for users to enter the information into their own programme.

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TAPE: GENERAL SPECIFICATION

Seven-track, half inch tape, recorded at 800 BPI
Coded: BCD, even parity
Block length - 1280 characters maximum
Overall length 720 m

iv. LIST OF ABBREVIATIONS

APG	-	adverse pressure gradient
AW	-	adiabatic wall
CC	-	constant current
CCP	-	cone cylinder static pressure probe
CPP	-	circular Pitot probe
CT	-	constant temperature
D	-	D-state is the nominal boundary layer edge state
E	-	estimated by editors
ECP	-	equilibrium cone probe
FEB	-	floating element balance
FPG	-	favourable pressure gradient
FPP	-	flattened Pitot probe
FWP	-	fine wire probe
H	-	height of the test section
HT	-	heat transfer
HWP	-	hot wire probe
MHT	-	moderate heat transfer
NA	-	not available
NC	-	not computed
NM	-	not measured
NPG	-	normal pressure gradient
NX	-	number of X-stations
PC	-	private communication
RUN	-	full 8-digit identification of the profile
RW	-	reflected wave
SH	-	severe heat transfer
SPP	-	static pressure probe
STP	-	static temperature probe
SW	-	simple wave
TPP	-	total pressure probe
TTP	-	total temperature probe
VPG	-	variable pressure gradient
W	-	width of the test wall
ZPG	-	zero pressure gradient

PROBE DIMENSIONS

d_1	-	outside diameter
d_2	-	inside diameter
h_1	-	overall height of face
h_2	-	height of opening
b_1	-	overall width
b_2	-	width of opening
l	-	length of slender portion
α	-	cone semi-angle

V. LIST OF SYMBOLS

Symbol: Computer	Symbol: Conventional	Meaning	Definition
-	a	velocity of sound	$(\gamma RT)^{1/2}$
CF	c_f	skin friction coefficient	$2\tau_w/\rho_\delta U_\delta^2$
CQ	c_q	heat transfer coefficient	$\dot{q}/(\rho_\delta U_\delta\, c_p\, T_{o\delta})$
	c_p	specific heat at constant pressure	
D	δ	boundary layer thickness or boundary layer edge-point selected	
D1	δ_1	displacement thickness	eqn. (3.7.1)
D2	δ_2	momentum defect thickness	eqn. (3.7.2)
D3	δ_3	kinetic energy defect thickness	eqn. (3.7.3)
D4	δ_4	total enthalpy defect thickness	eqn. (3.7.4)
D1K	δ_{1K}	displacement thickness ($\rho/\rho_\delta = 1$)	
D2K	δ_{2K}	momentum defect thickness ($\rho/\rho_\delta = 1$)	
D3K	δ_{3K}	kinetic energy defect thickness ($\rho/\rho_\delta = 1$)	
D1P	δ_{1p}	-	eqn. (3.7.6)
D2P	δ_{2p}	-	eqn. (3.7.7)
D3P	δ_{3p}	-	eqn. (3.7.8)
D4P	δ_{4p}	-	eqn. (3.7.9)
D STAR	δ^*	"true" displacement-thickness	eqn. (3.7.5)
	γ	ratio of specific heats	c_p/c_v
H12	H_{12}	shape factor	δ_1/δ_2
H32	H_{32}	shape factor	δ_3/δ_2
H42	H_{42}	shape factor	δ_4/δ_2
H12K	H_{12K}	shape factor	δ_{1K}/δ_{2K}
H32K	H_{32K}	shape factor	δ_{3K}/δ_{2K}
I	-	Y-station identity	-
KAP	κ, γ	ratio of specific heats	c_p/c_v
-	λ	heat conduction coefficient	
M	M	Mach number	u/a
MD	M_δ	Mach number at δ	u_δ/a_δ
M/MD	-	Mach number ratio	M/M_δ
MUE	μ	dynamic viscosity	eqns. (5.1), (5.2)
MUED	μ_δ	dynamic viscosity at δ	-
MUEW	μ_w	dynamic viscosity at w	-
P	p	static pressure	-
PD	p_δ	static pressure at δ	-
P/PD	-	static pressure ratio	p/p_δ
PI2	Π_2	pressure gradient parameter	$(\delta_2\, dp/dx)/\tau_w$
PO	p_o	stagnation pressure	

Symbol			
Computer	Conventional	Meaning	Definition
POD	$p_{o\delta}$	stagnation pressure at δ	
PT2	p_{t2}	pitot pressure	
PW	p_w	static pressure at w	
PWD	p_w/p_δ	-	p_w/p_δ
R	r	recovery factor	
RE	-	Reynolds number/m	$\rho_\delta U_\delta/\mu_\delta$
RED2D	Re_θ	Reynolds number based on δ_2	$\rho_\delta U_\delta \delta_2/\mu_\delta$
RED2W	$Re_{\delta 2}$	Reynolds number based on δ_2	$\rho_\delta U_\delta \delta_2/\mu_w$
RGAS	R	gas constant	
RO	ρ	density	
ROD	ρ_δ	density at δ	
ROW	ρ_w	density at w	
RO/ROD	-	ratio of densities	ρ/ρ_δ
RZ	R_z	transverse radius of curvature	
SW	-	number indicating the relative importance of longitudinal curvature in a pressure gradient	eqn. (5.5)
T	T	temperature	
TD	T	temperature at δ	
T/TD	-	temperature ratio	T/T_δ
TO	T_o	stagnation temperature	
TOD	$T_{o\delta}$	stagnation temperature at δ	
TR	T_r	recovery temperature	eqn. (5.3)
TRD	T_r/T_δ	recovery temperature ratio	
TW	T_w	temperature at w	
TWD	T_w/T_δ	wall temperature ratio	
TWR	T_w/T_r	wall-recovery temperature ratio	
U	u	velocity component in x-direction	
UD	u_δ	velocity component in x-direction at δ	
U/UD	-	velocity ratio	u/u_δ
X	x	streamwise or axial coordinate	
Y	y	coordinate normal to wall	

vi. GUIDANCE FOR USERS OF THE CATALOGUE

This volume and the associated microfiche collection provide descriptions of, and the data obtained from, 59 experimental studies of two-dimensional compressible turbulent boundary layers.

Each study is described at the start of the appropriate numbered ENTRY, to be found in § 8 below. The boundary conditions and evaluated data for all the profiles processed are also given, as section B of the entry. Each entry also contains, as section C, a selection of the profile data. The entire collection of data, boundary conditions, evaluated data and complete, detailed, profile data are provided in the microfiche version of the compilation which accompanies this printed volume. The microfiche does not, however, include the additional data which are printed where appropriate as section D of each entry.

The data collected and printed on the microfiche are also recorded in approximately the same form on a magnetic tape, copies of which can be obtained by following the procedure indicated in the Foreword (iii). The way in which an ENTRY is constructed is outlined in § 3, and we recommend, strongly, that readers should not attempt to use the compilation without assessing our own approach as we have there stated it. In particular, subsection § 15 of each entry constitutes our comment on the experiment in question, and is inevitably coloured by our own obsessions. We would therefore recommend that the editors' comments should always be interpreted in conjunction with the associated comment of § 4.

The computational framework is described in § 5, but we feel that, initially, this aspect should not particularly concern the user as the potential for heresy in numerical operations is small. Where, however, numerical procedures are likely to cause crucial differences - as for example in the evaluation of integral quantities, critical readers should ensure that any comparison they make is based on a foundation which is either the same as that which we have used, or which can easily be compared to ours, and so should study our assumptions (§§ 5.2, 5.5, 5.6, 3.6, 3.7).

Finally, and perhaps most important: the reader will wish to know how to find the entry most appropriate to his needs. To this end we have constructed the classified lists of § 7. The principal classification of § 7.1 is based on the considerations outlined in § 6, but our approach should be assessed in connection with the less quantifiable factors discussed in § 2, and especially in § 2.3.

REQUEST FOR FURTHER DATA

The editors hope to be able to issue a supplement to the data presented in this volume, and so would be grateful for an account of any suitable experiment which is not included. The greatest need is for functionally complete measurements in boundary layers on longitudinally curved surfaces, but high quality data of any kind would be appreciated. Cases including information on the turbulence structure are very rare, and it is possible that some information may now be available from "non-intrusive" techniques.

Authors may gain an impression of the information we would require from the present volume. We would especially appreciate the supply of data in some computer digestible form.

vii PROFILE DATA ON MICROFICHE

Fixed to the inside back cover of this volume are three pockets containing 28 microfiche. These provide a complete listing of the profile data as processed by the computer when preparing the catalogue. They consist of continuous strip photographs of the raw output, before cutting and selection for the printed form of the catalogue. The method of production requires the tables to run 'across' the microfiche when viewed in the normal sense, and in consequence a non-standard square format has been adopted. This allows the microfiche to be placed in the carrier of the older and cheaper forms of viewer with the columns in the right orientation for the reader.

A typical microfiche is headed

AG 223 No. 4 of 28 Profile 60010301-64010803

thus indicating that this is the fourth microfiche, and that it contains all profiles from 60010301 to 64010803. The distribution of profile data is given below:

Microfiche Profiles	Microfiche Profiles
1: 53010101-58020101	15: 70070111-71010401
2: 58020102-58050401	16: 71010501-71030404
3: 58050402-60010207	17: 71030405-72020104
4: 60010301-64010803	18: 72020105-72021005
5: 64010804-65020202	19: 72021101-72060705
6: 65020203-65030803	20: 72070101-73010901
7: 65030804-65051101	21: 73010902-73030304
8: 65051102-67010104	22: 73030305-73040702
9: 67010105-68010803	23: 73040703-73050203
10: 68010901-69020311	24: 73050204-74010307
11: 69020312-70020304	25: 74010308-74021302
12: 70020401-70031202	26: 74021303-76010203
13: 70040101-70040503	27: 76010204-76010409
14: 70040504-70070110	28: Section B - 'Reference flow values'

All computed data - sections B and C - are included. The 'additional data' of section D is given only in printed form, with the entries.

1. INTRODUCTION

1.1 Aims and objectives

Anyone undertaking to prepare a catalogue of boundary layer data must start by paying homage to Coles & Hirst (1968), who prepared the first such compilation. The Stanford Catalogue stemmed from the need to provide sets of boundary layer data which could serve as a basis of comparison for a wide variety of calculation methods. The present data collection can be considered as an extension of the Stanford Catalogue to Mach numbers beyond one, and to flows with heat transfer at the wall. The experimental data are presented as consistently as possible and in a form which has been chosen to suit both the user who wishes to plot or recalculate the data and for entry into a computer if theory and experiment are to be compared. The purpose of the present catalogue is to facilitate the interpretation of experimental data rather than to suggest or to support a particular theoretical analysis of compressible turbulent boundary layers. To that end we have attempted to confine our rôle as editors strictly to describing the general conditions of the experimental arrangement, the initial- and boundary-conditions of the experiment and the experimental data as given by the experimenters themselves. Information and opinion have been separated from each other as distinctly as possible, opinion, we hope, being confined to the introductory chapters and the "editors' comments" at the end of our description of each experiment.

One of our more obvious objectives has been to ensure, so far as it lay in our power, that any data processed by us should be available in a readily re-usable form. It is a sobering thought that every experiment forming the subject of an entry has already been published in some form, usually with numerical information. Nevertheless, with a few exceptions, we have had to arrange for the data to be transcribed once more to punched cards, so that it might be processed. For any modern experiment, this work is essentially unnecessary, since it would have been a simple matter for the originating institutions to have kept the information in some computer-digestible form. We have probably invested one or more person-years in routine number punching, and hope that the existence of the magnetic data tape which forms part of this enterprise will make any repetition of such drudgery needless.

The data compilation contains about 1400 profiles, and the ready availability of so large a data-bank in standard form contains its own dangers. We feel that we must issue a warning against any possible tendency amongst research workers to use only the data we have provided - because it is there and does not require further transcription. Disregarding any more subtle criteria which might be applied in selecting experiments for inclusion, there was no possibility of our preparing an entry unless we had access to the data in reasonably precise form. Data could be inaccessible for many reasons. The experiment could be so old that no full record remained, or so new that the clearance procedures required by authority could not be completed in time. Detailed experimental records often seem to be discarded with alarming rapidity and in some particularly regrettable cases the data were lost or scrapped before official permission to use it could be obtained. The experiments, however, remain valid, and for many purposes numerical values may be obtained with sufficient accuracy from graphical presentations in the published accounts. In the proposed commentary volume, associated with this data compilation, we hope to include a classified list of the experiments known to us, indicating the extent of the available information for each one.

A further simple objective is an indication of the experimental range covered. Only too often an investigation is performed largely because it is possible with the available experimental facility. A glance at figures 6.1 and 6.2 will show that the coverage of adiabatic zero-pressure gradient flows at moderate Mach and Reynolds numbers is almost excessive. There is no object in making more mean flow measurements in this range unless perhaps for the calibration of a new type of instrument. On the other hand, fluctuation measurements are so rare that almost any study of turbulence structure has great potential value. For more complex mean flows the coverage is much less complete. Section II of the classified list § 7.1 shows that experimental descriptions of curved-wall flows are particularly needed. (We have made provision in the list, as nil entries, for some types of flow for which we knew of the existence of appropriate experiments but did not have the necessary data.)

We hope that a thorough indication of the range already covered will help prevent expenditure on unnecessary repeat experiments.

A final scientific application of the data bank is the provision of test cases for theoreticians developing calculation methods. It is perhaps too early to consider the possibility of a Stanford-type tournament for compressible boundary layers, but we do feel that amongst the 59 experiments described here there is enough variety in the basic flows to allow theoretical workers to extract any mean-flow based ical constants they require. There are also several interesting test cases!

1.2 General principles guiding the form and content of the compilation

Since the fundamental purpose of the compilation is to transmit data, we consulted many potential users, and especially the members of the EUROVISC advisory group. The results of these discussion may be summarised as:

(a) The value of such a collection increases much more rapidly than its size, as extra entries are included.

(b) Every effort should be made to make a complete presentation of the data for each entry.

(c) It should be possible for a user to obtain complete tabular data without recourse to a computer.

(d) Preparation of the data in computer-digestible form would greatly increase the value of the collection.

Considerations (a) and (b) are clearly the principal factors affecting the overall size of the catalogue, without taking any account of the actual method of presentation to be used. In further discussion we have found it convenient to attach specific meanings to certain words, indicating the hierarchy of information. Thus below:

A REFERENCE is any paper consulted in connection with the project.

A SOURCE is the principal reference specifically describing an experiment in which compressible boundary layer data were obtained.

AN ENTRY is the text we have prepared from a source selected for inclusion in the data compilation. We refer to entries as CAT 7201 etc. where 7201 is the entry serial number in the compilation of § 8.

There are 59 entries selected from about 300 sources. Some indication of the principles guiding selection is given in § 2 below, so that (a) will not be discussed further here.

We have accepted point (b) almost without qualification, and often therefore pestered the authors of potential entries for much subsidiary information which did not appear in the source papers. There are however some sources which contain so many data that there was no possibility of our including them all (e. g. CAT 6503). Where we have rejected data, we have tried to ensure that we retained a fully representative selection, or that there were real grounds for believing that the data rejected were in some respect of inferior quality.

The remaining points concern matters of presentation. There is little difficulty in dealing with the publication of the boundary and initial conditions of an experiment, and these are given as "Section B" in the entries forming § 8 below (see also § 3). There are formidable problems, however, in making available the profile data, i. e. velocity-, temperature-, static pressure and fluctuating quantity profiles. For the 59 entries alone, these profiles number about 1400 in all and to print these in full in legible form would require 600 AGARD pages. We therefore had to look for a cheaper and more effective form of publication and the profiles have been made available in the following forms:

1. A magnetic tape of the complete data. Copies of this will be deposited at suitable centres in Europe and America and users will be able to obtain copies of all or part of the data from these on supplying their own blank tapes. (A fee may be charged - see the Foreword)
2. A microfiche copy has been made of the complete profile tables in a format similar to that used for the master tape. This has been issued with the printed collection.

3. A selection of the profiles edited from the complete tabular print-out of form 2 is presented in the printed collection as section C of each entry.

We feel that this will answer the needs of users whilst reducing the size of the printed collection to manageable proportions. The magnetic tape (form 1) allows a user to enter the data directly in his own computer programme, or should he so desire, to prepare his own full-size print-out of all the data, or any section in which he has an interest. The microfiche (form 2) allows a user to read the tabular print-out directly, or to obtain full-size tables of any data in which he has an interest through normal library channels.

The printed selection of form 3 is intended to satisfy the needs of a user who wishes to obtain a general view of the nature of profile data in the type of flow in question and in the relevant experimental range. If he wishes to obtain more detailed information, the complete tabulation of boundary conditions in section B of the entry will allow him to choose the data he wishes to call up from forms 1 or 2. He may assess the likely reliability of the data from the method by which they were obtained (entry-section A) and the internal evidence of scatter and consistency shown by plotting out some of the printed sample profiles of section C (form 3).

2. EVALUATION OF DATA

2.1 Experiments considered

With very few exceptions the experiments considered for inclusion had been published previously. Since it was from the open literature that we obtained all our general information, publication was almost a necessary condition, though in a few cases an enquiry about a published source paper led us to unpublished information or material being prepared for publication. In many cases the amount of information finally made available by our correspondents greatly exceeded that in the original source.

The total number of reported compressible boundary layer experiments is very large. We have here restricted ourselves to the study of nominally two-dimensional turbulent boundary layers (some of them transitional) formed on rigid impermeable walls, and have excluded cases in which it would be necessary to take account of chemical reactions or ionization. In fact we have assumed throughout that the test gas was a perfect gas, with constant specific heats, although in a few cases the temperature range is such that the relationship between reservoir conditions and test station conditions is detectably falsified as a result of vibrational excitation. Boundary layers with suction or injection through the wall were excluded, as the data known to us are relatively well documented. The data have been collected by another group and could, in principle, be edited without too great an effort, if need be. Although a number of correspondents have urged us to include these more complex flows, and also shock/boundary layer interactions or three dimensional flows, we have firmly resisted these suggestions, knowing the limits of the financial means available and not wishing to impose too great a load on our patience and perseverance, let alone that of our co-workers. In some cases regretfully, we have excluded any experiment for which we did not have access to tabulated data. In part as a consequence of the limited assistance available to us, but principally because of the lack of precision inherent in the procedure, we have not generally incorporated information scaled from graphs published in the source papers. In a few cases, auxiliary information has been so obtained, and for several entries we found it necessary to prepare our own graphs for interpolation. When this has been done, it is remarked in the text of the entry.

2.2 Principles of selection

In attempting to evaluate an experimental account, we looked to see how far the following conditions were satisfied:

i) The data should be given in uncorrected form. If corrections were applied by the author, the magnitude and method of correction should be stated, so that the data could be recalculated in their original form if need be.
ii) A certain minimum of information about the experimental arrangements, test conditions and boundary conditions should be available.
iii) The information about the boundary layer at a test station should be functionally complete.
iv) There should be a sequence of profiles, for successive streamwise measurement stations.
v) The upstream history of the layer should be known.

These are obvious statements of an ideal, and equally obviously there are very few experiments reported which begin to satisfy them all. If therefore we were to insist on a "full set" of measurements, there would be remarkably few entries in the catalogue. We now study the implications of each condition.

In dealing with i) there is an obvious difficulty in distinguishing between "calibration" and "correction". Whenever readings are altered to take account of phenomena not considered in the fundamental calibration procedure, as for instance wall proximity or shear corrections for a Pitot tube, it is clear that we are dealing with a correction. If however the Pitot tube is used in a very severe environment, as in the low density regions near the wall of CAT 7105, it is a moot point whether the adjustment made to the pressure recorded is a correction or a calibration. A possible criterion is to recognise adjustments as a calibration when made as the result of a subsidiary experiment covering the same range of relevant dimensionless groups as for the main tests, whether the calibration were performed by the same authors or no. On this basis we may suggest generally that adjustments to Pitot readings for wall proximity, shear and perhaps low density are "corrections", that total temperature probes are usually "calibrated" and otherwise uncorrected, but that static pressure probes are usually used with "corrections" - for viscous interaction, low density and thermal effects - which in hypersonic flows are often more than a little speculative. If only because of the "grey area" of indecision, we have usually found that i) therefore did not as a general rule particularly affect our decision as to inclusion in the catalogue, though we may have expressed reservations in the accounts of particular entries.

Condition ii) has also not proved, generally, to be crucial. We have often had difficulty in dealing with source papers, but have usually received assistance from the authors which has made reasonably clear, for us, the nature and extent of their experiments. In one or two cases we could not decide what the author had done, but did not request that he re-write his report as we thought that, on the evidence of the first version, we were unlikely to receive much enlightenment from a revision. Such an experiment was obviously automatically excluded.

For the measurements at a station to be functionally complete, as required by iii), we would need a complete mean flow profile description, wall shear stress and heat flux values, profiles of fluctuation quantities, and a substantial amount of detail describing the free stream flow and the test station geometry. Thus for the mean flow profile description it must be possible to obtain or infer at least three independent property profiles, of which one, or a group, must specify the dynamic state. The usual experimental grouping obtained from measurements is the set (p_{t2}, p, T_0) but other groups are possible if density is measured optically or by electron beam, or if velocity is determined, directly by Laser-doppler-velocimeter or indirectly with a hot wire. Whatever the original grouping, there are many possible sets which may be presented in the tables available to us. Wall shear stress and heat flux values should be measured by instruments on or in the wall (floating element balances, Preston tubes, heat flux meters, steady or unsteady conduction techniques) rather than inferred from the profile measurements. It is possible in simple flow cases to make satisfactory determinations from the profiles, but in the more difficult flows, it usually becomes necessary to differentiate profile data, and it is not usually possible to do so with any precision. Without considering the need for fluctuation measurements, it can be seen already that under iii), alone, the requirements so far are so severe as to eliminate all except about 8 of our entries. If we insist on substantial fluctuation measurements we are left with one.

We have in general given preference to measurements satisfying condition iv), but it proved necessary to include a large number of single-station measurements in order to cover a wide enough range of Mach number, Reynolds number and heat transfer parameter. Some single station tests are also included as comparison cases for other experiments.

Finally we were forced to recognise firstly that many unexplained effects in the experimental region were the consequence of the varied natures of the regions in which the test layer was formed, and secondly that it is rare for the upstream history - as a minimum, wall pressure and temperature - to be recorded. Thus condition v) is not usually observed. The obvious exceptions are the "flat plate type" flows (Category IA in the classified list of § 7.1) which in a sense have no history.

We hope that the discussion above will show that we have thought carefully about the information which is desirable - but have to recognise that we have demonstrated that it is virtually impossible for an experimental worker to satisfy our list of requirements. There is one case, CAT 7205, which does in practice fulfil our specification - but inevitably, as a consequence of the very close detail required of the study, the investigation covers a restricted range.

Our final selection has been guided by a desire to fulfil the conditions listed above. The number of experiments which on a crude marking scheme score 80 % or more is exceedingly small, so that we have drawn a majority of the entries from less "satisfactory" experiments. (We cannot overemphasise that this implies no judgement of the quality of the experiment - we refer simply to the extent to which the criteria of coverage (i) to (v), above are satisfied). We must confess that in the final result, we could not go through the list of entries and defend every one on an absolute basis.

We started by being very selective, only to find that our coverage of Mach and Reynolds number etc. was certainly inadequate if we were to show the extent of the generally successful experimental work. We were encouraged to make the scope of the catalogue as large as possible (see § 1.2 above), and partly in consequence the standards applied for entries which came late to our notice were probably less severe than those applied initially. We have also tended to give slight preference to source-papers which we believed to be difficult to obtain, or to describe experiments which were, quantitatively, unpublished. Our only certainty is that there will be just as many critics who say "why isn't X in" as there are those who say "why on earth did you include Y".

2.3 Scope of the catalogue

The general restrictions which we have observed are listed in § 2.1. Other restrictions are that this volume, with one exception, considers only experiments for which profile tabulations were available. A further limitation is that we have, in general, made no attempt either to "correct" the data, or to "uncorrect" it. We had hoped to be able to do the latter, but it proved impractical. By "correction" here we mean the adjustment of data to account for various secondary effects as discussed in connection with condition i) of § 2.2 above. We have on several occasions incorporated gross or minor textual corrections observed either by ourselves, or, after correspondence, by the authors.

The coverage in terms of the easily quantifiable variables such as Mach number, Reynolds number and heat transfer parameter (T_W/T_R) is effectively summarised in the tables of § 7 and for zero-pressure-gradient flows, in figures 6.1-3. We consider here the extent to which less quantifiable factors are covered, and concentrate firstly on the "history effects". A convenient division here is between cases in which there is "no" history in the sense that the boundary layer is formed under zero-pressure-gradient and constant wall temperature conditions, though it is still necessary to be aware of possible disturbances introduced by tripping devices, and cases in which there is a varied pressure and/or temperature history which has imprinted certain characteristics on the test layer. For a few experiments this history is either reasonably fully described or varied in a controlled manner.

The importance of the first group lies in the fact that, for the zero-pressure-gradient cases, the influence of Mach number, Reynolds number and heat transfer parameter can in some measure be studied in a "pure" form. If it is thought that these influences are reasonably well described, it is then possible to consider the effects of change of pressure gradient or wall temperature ratio in the test zone, in isolation in so far as the input layer is fully described and related to the full corpus of appropriate experimental data for zero pressure gradient layers.

Experiments of this type are listed in table 2.1. We have not limited this list to experiments described in the catalogue, as the really complex cases are so few that we feel that the free availability of numerical data is almost a secondary consideration.

Table 2.1 PRINCIPAL EXPERIMENTS WITH ZERO-PRESSURE-GRADIENT, CONSTANT TEMPERATURE UPSTREAM HISTORY (A SELECTION)

1. Zero pressure gradient in test zone

Source	MD	R THETA X 10^{-3}	TW/TR
Coles (CAT 5301)	2-4.5	2-10	1.0
Young (CAT 6506) (uniform roughness)	5	5-13	0.6-1.0
Hastings & Sawyer (CAT 7006)	4	2-25	1.0
Peake et al. (CAT 7102)	4	10-60	1.0
Lewis et al. (CAT 7201)	4	4-13	1.0
Horstman & Owen (CAT 7205)	7.2	6-13	0.5
Watson et al. (CAT 7305)	10	1-12	1.0
Mabey et al. (CAT 7402)	2.5-4.5	5-30	1.0
Gran et al. (1974) (Temp. discontinuity)	4	?	0.5

Source	MD	R THETA X 10^{-3}	TW/TR
2. Favourable pressure gradient in test zone			
NONE			
3. Adverse pressure gradient in test zone			
Peake et al. (CAT 7102)	4 to 2	10-60	1.0
Lewis et al. (CAT 7201)	4 to 2.4	10	1.0
Gran et al. (1974)	4 to 2.4	?	0.5

Experiments of the second group, for which the history is in part or fully described, often constitute succeeding portions of the first. There are however a number of cases in which a boundary layer was developed on a tunnel wall under, at least partially, described conditions before reaching the test zone of interest (see CAT 7101 as an example of a case in which an unknown history leads to an experimentally described zero pressure gradient region before entering the adverse pressure gradient region which is the point of the experiment).

Table 2.2 PRINCIPAL EXPERIMENTS WITH DESCRIBED UPSTREAM HISTORY

Source	MD	R THETA X 10^{-3}	TW/TR
1. Zero pressure gradient in the test zone			
Gates (CAT 7301 - temperature history)	4 & 6	8 - 31	0.9 - 1.0
Feller (1973 - temperature history)	6	35 - 50	0.7 - 0.8
Hastings & Sawyer (CAT 7006 - transition)	4	2 - 25	1.0
Fischer & Maddalon (CAT 7103 - transition)	6.5	0.5 - 6	1.0
Voisinet & Lee (CAT 7202 - transition, temperature history)	5	7 - 58	0.25 - 1.0
Watson et al. (CAT 7305 - transition)	10	1 - 13	1.0
Moore (CAT 5805 - Step)	2 - 4	6 - 14	1.0
Clutter & Kaups (CAT 6401 - blunt increase)	2 - 4	10 - 40	1.0
Peake et al. (CAT 7102 - ring)	4	12 - 30	1.0
Stone & Cary (CAT 7209 - trip)	8	6 - 10	0.8
2. Favourable pressure gradient in the test zone			
Boldman et al. (CAT 6901)	0 to 4.1	3 - 12	0.6 - 0.9
Lewis et al. (CAT 7201)	2.4 to 3.7	10	1.0
Back et al. (CAT 7207)	0 to 3.6	10	0.5, 1.1
Voisinet & Lee (CAT 7304)	3.8 to 4.6	6 - 50	0.25 - 1.0
3. Adverse pressure gradient in test zone			
Stroud & Miller (CAT 6503)	5 - 8	2 - 50	0.4 - 1.0
Zwarts (CAT 7007)	4 to 3	35 - 70	1.0
Sturek & Danberg (CAT 7101)	3.5 to 2.8	20 - 40	1.0
Peake et al. (CAT 7102)	4 to 2	10 - 60	1.0
Lewis et al. (CAT 7201)	4 to 2.4	10	1.0
Zakkay & Wang (CAT 7208)	6 to 4.6	100	0.7

Of the experiments listed in table 2.2, those performed by Boldman et al. (CAT 6901), Feller (1973), Gates (CAT 7301) and Sturek (1973 - included in CAT 7101) were specifically performed in part to investigate, and hopefully quantify, the effect of changes in the upstream wall-temperature history. All those experiments which study the "relaxation" of a constant pressure layer after a disturbance - whether a pressure gradient region, a heated or cooled wall region, or a brutal disturbance such as a step - are potentially useful "varied history" cases if measurements on an undisturbed layer with the same free stream conditions are provided for comparison. Examples are Moore (Step - CAT 5805) Peak et al. (Ring - CAT 7102) Stone & Cary (trips - CAT 7209) and Gran et al. (1974). Some of the "described history" experiments conclude with a constant pressure relaxation region, but do not provide comparison data - e. g. Clutter & Kaups (after a blunt increase in section - CAT 6401) Zwarts (CAT 7007) and Peake et al. (CAT 7102)- both after an adverse pressure gradient region.

The final factor not covered by the lists of § 7 is the existence of fluctuation measurements. Hot-wire measurements are reported by Kistler (CAT 5803), Horstman & Owen (CAT 7205) and Laderman & Demetriades (CAT 7403). In each of these cases, the fluctuation measurements were perhaps the principal objective of the experiment. Further measurements using wedges with a hot wire leading edge, and in the same facility as CAT 7205 are reported by Mikulla & Horstman (1975), who provide a first attempt at determining the shear stress. A valuable comparison between fluctuations in zero-pressure-gradient flow and a simple-wave compression region is provided by Sturek & Danberg in CAT 7101, and very limited observations in ZPG and reflected-wave APG conditions are provided by Waltrup & Schetz (CAT 7104). In some other cases (e.g. CAT 7001/7206) hot wire measurements were made but the problems of interpretation in the hypersonic region are extremely severe, and the authors, understandably, have only reported the results in very general terms.

Approximately over the same period that the catalogue was being prepared, the "non-intrusive" fluctuation measuring instruments such as laser-doppler velocimeters and electron beams have begun to give successful results in supersonic flows. We have not yet obtained tabular information for any of these experiments but hope that both mean flow and fluctuation data obtained using these new measuring techniques may be described in a later supplement to this catalogue.

3. STRUCTURE AND CONTENT OF A CATALOGUE ENTRY

3.1 Large scale structure

An entry is composed of three or sometimes four principal sections. These are:

SECTION A. Description of the experiment and outline of data reduction procedures. This is concluded by the final subsection "Editors' comments" which is enlarged upon in § 4 below.

SECTION B. Tables of profile boundary conditions and evaluated data. We list here the controlling parameters, and such calculated quantities as integral thicknesses, for all the profiles we have processed.

SECTION C. Tables of profile data. In the printed form of the catalogue, we present detailed tables for selected profiles. The total number is such that it is not practical to print the profiles in full. A full tabulation is however given in the attached microfiche, and the complete data are also available on magnetic tape (see the Foreword).

SECTION D. Tables of additional data which for one reason or another do not fit into the computer processing scheme. These are, in general, printed at the end of the entry, but will sometimes appear at the end of section A, for space-saving reasons.

3.2 List of marginal indexing marks for Section A

We have attempted to standardise our descriptions, so that in general the sequence of points discussed is common to all entries. Inevitably we have found it impossible to be completely consistent in this, but the intention is to present the features of the experiment in the order below. The subsections may, however, appear in any order, or the topic in question may crop up in several places. Accordingly, we have arranged that index marks should be printed in the left hand margin opposite that section of the text concerned with the headings as listed. We suggest that the reader should use a photocopy of the list as a key when reading the entries. The normal sequence is:

1. Description of test section
2. Flow quality
3. Observations of transition and tripping devices (trips)
4. Upstream history of the test boundary layer
5. Measures taken to test for, or ensure, two-dimensional flow
6. Measurements at the test-surface (wall measurements)
7. Probes used for boundary-layer traverses
8. Relative positions of measurement stations
9. Authors' interpolation procedures and assumptions
10. Corrections to the profile data
11. Viscosity law assumed by the authors
12. Editors' assumptions and interpolation procedures. Selection of data.
13. Profiles presented
14. Wall data presented

§ Data summary

15. Editors' comments.

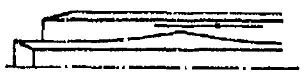
The subheadings are discussed individually in § 3.4 below, where they are indicated by their index marks in the same way as in the entries.

3.3 Recognition panel

Section A, the description, is headed by a standardised "recognition panel" laid out in semi-tabular form. An example is given here:

(d)

7201-A-1

<table>
<tr><td rowspan="2">oxisymmetric
</td><td rowspan="2">M : 4, falling to 2.4
then rising to 3.7 (Series 01).
: 4, ZPG (Series 02).
R THETA X 10^{-3} : 4 - 14.
TW / TR : 1.</td><td>7201</td><td>(a)</td></tr>
<tr><td>ZPG - APG - FPG
(ZPG)
AW</td><td>(b)</td></tr>
<tr><td colspan="3">Continuous tunnel with symmetrical flexible nozzle, W = H = 1 m. L = 5 m.
PO : 496 (± 3.5) KN/m^2. TO : 318 (± 1) K. Air: Dew point 239-247 K. RE/m X 10^{-6} : 20 at M = 4.</td><td>(e)</td></tr>
<tr><td colspan="3">LEWIS J.E., GRAN R.L. and KUBOTA T., 1972. An experiment on the adiabatic compressible turbulent boundary layer in adverse and favourable pressure gradients. J. Fluid Mech. 61, 657-672.
And Gran R.L., private communications.</td><td>(f)</td></tr>
</table>

(c)

Panel (a) in the top right hand corner contains the entry identification. Each individual profile is specified by an 8-digit number such as 72 01 01 02.
This is composed as follows:

72	01	01	02
Year of publication	Serial no. within year	Serial no. of sequence	Serial no. of profile

An entry is specified by the first four digits alone as in this case

"72 01" The first source processed which was published in 1972.

The third pair of digits specify the sequence of profiles in question, which usually consists of a set of profiles for successive streamwise values of X and broadly the same tunnel reservoir conditions. This is not always the case, as we have sometimes followed other schemes, whether for our own convenience or because there is some other rational method of grouping the profiles (e.g. CAT 5804).

The fourth pair of digits gives the position of the profile in the sequence.

The panel just below, (b), contains a number of abbreviations indicating the general nature of the test e.g. Z (A, F, V) PG - AW - MHT - SHT.

i.e. Zero (adverse, favourable, varied) pressure gradient - adiabatic wall - moderate heat transfer - severe heat transfer.

Brackets round the abbreviation imply that the appropriate comment should be given relatively less weight. Thus in CAT 7201, the main ZPG - APG - FPG sequence is supported by some additional ZPG data.

Panel (c) in the top left hand corner shows a sketch of the geometry of the test section. We have made no attempt to represent the proportions of the test area - the sketch is intended only to give an instant impression of the nature of the experiment. The actual test stations are indicated by asterisks, arrows, or if there are several stations, by a line parallel to the test surface.

The central panel at the top, (d), outlines the principal dimensionless parameters of the test. The values are only approximate, the precise data being given as a table in section B. The Reynolds number selected for this rapid assessment panel is that based on free-stream properties and momentum thickness, as it was felt that this, whilst not necessarily the most important, would be that most readily interpreted by the greatest number of users.

The panel below, (e), gives an indication of the type of tunnel and the test conditions. Where the tests were made on one of the tunnel walls, the "width" W refers to the test wall, regardless of the vertical orientation of the test section. Again, numerical values are approximate and the user should refer to subheading 1 below and the tabulated data of section B.

The bottom panel (f) gives, in full, a reference to what was, for us, the principal source. This is usually a source with full data tabulation, but in many cases we received the data as a private communication. Supporting references are given only by author / year, and are given in full in the reference list. We have used many of these to fill out the description, and frequently users will find some of these supporting sources more readily accessible, though possibly lacking some tabulated data. We have tried to adopt the convention that the use of the word and - underlined - implies that that source was essential for the completion of the entry, while if we write also, the sources in question are alternatives, or contain comment or an extension of the experiment under consideration.

3.4 Description of the experiment

The index marks to the left of the text in this section are those listed in § 3.2 above, and used throughout the entries. We here discuss the content of each subsection, and define the abbreviations used. Throughout, the mark (E) implies that the figure given or statement made represents an estimate by the editors.

1 Description of test section: A general description of the means by which the test flow was produced and observed. The geometry and dimensions of the section are specified where possible, frequently with the aid of the authors' tabulations, and include a statement of the zero for the longitudinal coordinate X. The start of the actual test-measurement area is specified and the way in which probes and other instruments were inserted in the flow. An author's description of a flow region as, for example, "uniform flow" had to be accepted. The wall roughness and waviness are given when known.

2 Flow quality: The authors' statement of the uniformity of the test flow in the free stream.

3 Transition: Description of the means, if any, used to force transition, and of any tests made by the authors to confirm the fully turbulent nature of the boundary layer.

4 Upstream history: Description of the mean-pressure history and wall-temperature history of the flow upstream of the test area, supported or replaced by authors' tables where possible. Also any other upstream information such as a selection of incomplete upstream profile data.

5 Tests for two-dimensionality of the boundary layer: Authors' statement, or description of any tests made to check the uniformity of the boundary layer in the crossflow (Z) direction:

6 Wall measurements: Nature of and means used to determine quantities at measuring stations fixed in the wall. The sequence and abbreviations used are:

PW - Wall static-pressure holes with dimensions if possible.

TW - Wall temperature sensors.

TAUW - Skin-friction measuring devices such as floating element balances (FEB), Preston tubes, or other surface Pitot tubes such as Stanton tubes.

Q - Wall heat-flux sensors.

7 Probes employed: A description of the sensing devices used for boundary-layer profiles. Where the probes are of the more usual patterns the principal dimensions may be given in a table. In other cases they will usually be described in the sequence below, which is here used to define the geometry and dimensions of the "normal" types.

TTP - Total temperature probes

STP - Stagnation temperature probe of the vented Pitot family. A thermocouple is placed in a vented cavity sensing the air temperature at low velocity after a nominally adiabatic compression. Symbols used for the dimensions are d_1 = outside diameter, d_2 = inside diameter of opening, l = length of parallel or near-parallel section.

ECP (equilibrum cone probe) - equilibrum temperature probe in which the tip of the probe is thermally isolated from the support. A thermocouple records the equilibrum temperature of the isolated tip. Symbols used for the dimensions are:

α - cone semi-included angle

d_1 - base diameter of cone

d_2 - diameter of support

l - length of cone support

FWP - fine wire probe in which a thermocouple junction at the centre of a fine wire, set normal to the mean flow, records the equilibrum temperature of the wire. The dimensions given are d - the wire diameter, b - the length of the fine wire, and l - the length of the slender supports for the wire. Where possible the thermocouple materials are stated.

TPP - Total pressure (Pitot) probes

CPP - circular Pitot probe. The symbols used are d_1 - the outside diameter, d_2 - the inside diameter and l - the length of the parallel or slender section of the probe.

FPP - flattened Pitot probe. The symbols used are h_1 - the overall height, h_2 - the height of the opening and l - the length of the slender portion of the probe.

SPP - Static pressure probes

CCP - cone-cylinder probe. The symbols used are α - cone semi-angle, d - cylinder diameter, l_1 - distance from cone tip to static holes, θ - the angle between static holes, and l - the length of the cylinder.

HWP - Hot wire probes, CC - constant current or CT - constant temperature.

8 Relative position of measuring stations: The number and longitudinal position of the profile measurements is given first. The X value is to an arbitrary local co-ordinate zero, usually on the centre line and at the X value of the tip of the Pitot probe used. A tabular presentation of the X and Z values, relative to this local zero, may follow for the measuring stations of, in order, PO, TAU, Q, PW, TW, TO, P. The last two entries refer to total temperature and static pressure profiles, and an additional entry Δ Y may be given indicating the relative position of the probes normal to the wall.

9 Interpolation procedures and assumptions used by the authors. Notes on the means used by the authors to reduce measured data obtained from a number of neighbouring stations to equivalent, presented, data for a single X - Z station. Authors' assumptions in data reduction.

10 Corrections applied to profile data: Corrections for low local Reynolds number, rarefied gas, shear-displacement and wall-proximity effects may be applied to measured probe data. A general description of these is given, with, where possible, an indication of the order of magnitude involved.

11 Viscosity law assumed: The viscosity law used by the authors. The most commonly used expression is "Sutherland's law", but at the low temperatures which are found in the free stream of hypersonic test flows, this may be substantially in error. In comparing published R THETA values with those given in section B, readers should bear in mind that we have evaluated viscosity as described in subsection 5.1.

12 Selection of data and assumptions used by the editors: A source will often present redundant data. The profile data selected for computation are listed in the computer printout, but any special difficulties or procedures are remarked here, as are any assumptions introduced by the editors in processing the data.

13 Profiles presented: For the simpler cases, a general description of the sets of profiles which are tabulated. Where it is more convenient, a table may be used to show which governing variables have been changed. The accent is on the gross differences between sequences, as all relevant variables are tabulated in Section B. In describing a sequence, the abbreviation NX refers to the number of successive X-stations.

14 Wall data presented: An account of the wall data in the tables and a note of any procedure used by the editors to relate the profiles to such information.

§ DATA: The description will finish with a straightforward listing of the terminal profile numbers of the data sets, and an abbreviated description of their nature. We list here only measured data - wall data deduced from the profiles do not qualify.

15 Editors' comments: In § 1 - 14 we have tried to avoid making any statements which we could not support by appeal to the source, or correspondence with the author. Here we remove that restriction and comment on the experiment, incorporating our own prejudices. Some of the recurrent themes are discussed in § 4 below.

3.5 Section B - Tables of profile boundary conditions and evaluated data.

The heading of a page in this section is arranged so:

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD *	PW/PD *	RED2D	CQ *	H32	H32K	TW *	TD
RZ *	TOD *	SW *	D2	PI2	H42	D2K	UD	TR

An asterisk against a quantity in the heading indicates that it was one of the input values. The symbols are defined in the list of symbols (v) and/or in the list of abbreviations (iv) so that only the less usual quantities are remarked here.

RUN - is the full 8-digit identification of the profile.

The "D" state is the arbitrary boundary layer edge state.

SW - the nominal value of $(\partial\theta/\partial x)/(\partial\nu/\partial x)$, where θ is the flow inclination and ν the Prandtl-Meyer angle, is a number indicating the relative importance of simple waves (curvature) and reflected waves in a pressure gradient.

CQ - is a heat transfer coefficient. We give heat transfer data as the coefficient $\dot{q}_w/(\rho_\delta\ c_p\ U_\delta\ \ T_{0\delta})$. We have preferred this form to the rather commonly met Stanton number as the value of the latter depends on the value of the recovery temperature assumed. Except in ideal conditions it is not possible to evaluate the recovery temperature with any certainty. Users may form their own heat transfer coefficient as they wish from the value of CQ.

PI2 - is the pressure gradient parameter $(\delta_2/\tau_w)\ (\partial p/\partial x)$, where δ_2 is the momentum defect thickness. This has usually been obtained by manual interpolation and/or differentation and so is not to be regarded as being a precise value.

H42 - is the ratio of the total enthalpy defect thickness to δ_2.

K - indicates an "incompressible" or "kinematic" integral quantity

RZ - INFINITE - implies a nominally planar flow.

NM - means "not measured" or "not available".

NC - means "not calculated", though the necessary information is available.

3.6 Evaluated data using a pressure-based reference flow.

In § 4.6 we give a brief account of the causes of normal pressure gradients in high-speed boundary-layers. The effect results in the main from streamline curvature, but whatever the cause, the normal definitions of boundary-layer integral thicknesses break down in the presence of a significant pressure gradient. The difficulty is best illustrated by an example, and we derive here a "true" value of the displacement thickness for a flow with streamline curvature.

We suppose that we have a known supersonic flow outside an axisymmetric boundary layer. We define the transverse curvature of the wall, RZ, written as R below, as positive for an external flow and negative for internal flows such as nozzles. Then an inviscid flow field can be calculated by the method of characteristics which in principle is determinate and fills the whole space occupied by the boundary layer, though possibly the wall may not be a stream surface of this flow. We will see below that it is only the outer part of this region which is important. We will call this flow the reference flow, and denote its local density and velocity values by ρ' and U'.

We then define the displacement surface as a stream surface of this reference flow, such that the mass flow between any surface in the free stream and the displacement surface is equal to the mass flow in the real viscous flow contained by the chosen free stream surface and the wall. This is in essence the normal definition, and gives the equation:

$$\int_0^h \rho U\ (R + y\cos\alpha)\ dy = \int_{\delta^*}^h \rho'\ U'\ (R + y\cos\alpha)\ dy \qquad (3.6.1)$$

where h is a value of y greater than the boundary layer thickness, α is the inclination of the wall surface to the axis and δ^* is the distance of the displacement surface from the wall. From this it can be seen that values of ρ' and U' for $y < \delta^*$ do not affect the result. The equation can be rearranged as

$$\int_0^{\delta^*} \rho' U' \left(1 + \frac{y \cos \alpha}{R}\right) dy = \int_{\delta}^{h} (\rho' U' - \rho U) \left(1 + \frac{y \cos \alpha}{R}\right) dy \qquad (3.6.2)$$

If there is no normal pressure gradient, $\rho' U'$ are constant at the free stream value and the equation reduces to

$$\delta^* + \frac{\delta^{*2} \cos \alpha}{2R} = \int_0^h \left(1 - \frac{\rho}{\rho'} \frac{U}{U'}\right) \left(1 + \frac{y \cos \alpha}{R}\right) dy \qquad (3.6.3)$$

which corresponds to the normal definition but taking full account of transverse curvature. [In a hypersonic nozzle flow, δ^* may be of order 0.5 R so that the second term becomes significant. The only catalogue entry for which the authors took full account of transverse curvature is CAT 7206 - Kemp & Owen. They solve the quadratic (3.6.3) for δ^*, but the resulting defining equation appears very unfamiliar (see eqn. 5.13) when compared with the usual planar definition. We have therefore left eqn. (3.6.3) as it stands. Kemp & Owen, however, have not taken account of the strong normal pressure gradient effects in their experiment, as a result of which ρ' would vary by as much as a factor of two, so that a proper calculation would require the use of eqn. (3.6.2).]

When ρ', U' are not constant, it becomes necessary to solve for δ^* as a limit in the original form of equations (3.6.1/2). The values of ρ', U' for $y < \delta^*$ do not affect the answer, but we do not know the value of δ^* until we have completed the calculation.

Once the δ^*-surface has been found, it is possible to define rational defect-thicknesses for momentum, kinetic energy and total enthalpy by finding the difference between the flux of the quantity in question in the reference flow, as bounded by the δ^*-surface, and the actual flow as bounded by the wall. We have not done this here as we are still working on the interpretation of data in this form.

In all the foregoing, it has been assumed that the property values of the reference flow, ρ', U', T' etc. were known. This is usually not the case, and it becomes necessary to deduce, so far as possible, the property values from the experimental results in the boundary layer. We have adopted the device of assuming that the reference flow is adequately represented by an isentropic flow which expands from the free stream reservoir pressure to the local static pressure in the boundary layer. This amounts to the assumption that the isobars in the boundary layer represent an extension of the isobars of the free stream as they would be extended in an inviscid flow. The simple wave data we have inspected in detail so far (CAT 7101, Sturek & Danberg, CAT 7105, Beckwith et al., CAT 7001, Fischer et al.) suggest that the free stream pressure distribution can be extended in to the δ^*-surface without introducing too great error. Within that surface, the differences between a pressure based reference flow and an extended characteristics calculation will become large, but in principle this does not matter if proper integral thickness definitions are used. There is a detailed examination of the influence of the boundary layer on the wave structure associated with pressure gradients in the papers by Myring (1968) and Myring & Young (1968). Their analysis suggests that the isobars in the boundary layer will, in a simple wave, lie close to the local Mach lines, and this leads to broadly the same conclusions.

We have therefore presented, where appropriate, a value of δ^*, D STAR, calculated from eqn. (3.6.2) using the pressure based reference flow as an approximation to $\rho' U'$ (eqn. 3.7.5). Properties and quantities so derived are marked by a subscript p - as $\rho_p U_p$. Because of a remaining uncertainty as to the proper scaling variables to use for definitions of the defect thicknesses, we have not here presented equivalent calculations for momentum thickness, etc. We have however calculated improperly defined quantities which are, ostensibly, in some measure equivalent. The main justification for this is that these integral quantities are in use (see the source papers of CAT 6401/6503/7001/7101/7304 and McLafferty & Barber (1959, 1962), Kepler & O'Brien (1962), Hoydysh & Zakkay (1969) for various approaches to the problem). Their principal virtue is that the values of the integrals in question are insensitive to the choice of the boundary layer edge point, but since the reference flow in all cases extends to the wall rather than the displacement surface, they tend to overestimate the defect of momentum or energy flux.

The integral quantities in question are listed in an addition to the tables of Section B, the table heading appearing so:

RUN	D2PD	H12PD	H32PD	H42PD	RED2PDD	RED2PDW	D STAR
	D?PW	H12PW	H32PW	H42PW	RED2PWD	RED2PWW	

The defining integrals are listed in § 3.7, and the manner of forming the Reynolds numbers is indicated by the last letter, as for the two forms of RED2 in the main tables. We have introduced a $\delta_n^2/2R$ term on the left hand side of the defining equations (3.7.6-9) in an attempt to allow for the axisymmetric correction represented by the $\delta^{*2}/2R$ term in equation (3.6.3), for the constant pressure case. Further work is needed, however, before it is safe to conclude that this is a reasonable procedure in the normal pressure-gradient case.

A comparison of the value of D STAR with the value of D1 from the main tabulation will give an estimate of the significance of normal pressure gradient effects.

3.7 Defining equations for integral thicknesses

i) Thicknesses appearing in, or implicit in, the main tables of Section B.

The defining equations take full account of axisymmetry, but it is assumed that the inclination of the test surface, α, to the axis is small enough for cos α to be taken as 1 without introducing significant error.

The reference flow properties are assumed constant and set equal to the properties at the D-state point, indicated by subscript δ.

Displacement thickness D1 or δ_1, or (δ^*)

$$\delta_1 + \frac{\delta_1^2}{2R_z} = \int_0^\delta \left(1 - \frac{\rho U}{\rho_\delta U_\delta}\right)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.1)$$

Momentum defect thickness D2 or δ_2 or (Θ)

$$\delta_2 + \frac{\delta_2^2}{2R_z} = \int_0^\delta \frac{\rho U}{\rho_\delta U_\delta}\left(1 - \frac{U}{U_\delta}\right)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.2)$$

Kinetic energy defect thickness D3 or δ_3 or (ε)

$$\delta_3 + \frac{\delta_3^2}{2R_z} = \int_0^\delta \frac{\rho U}{\rho_\delta U_\delta}\left(1 - \frac{U^2}{U_\delta^2}\right)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.3)$$

Total enthalpy defect thickness D4 or δ_4 or (δ_H)

$$\delta_4 + \frac{\delta_4^2}{2R_z} = \int_0^\delta \frac{\rho U}{\rho_\delta U_\delta}\left(1 - \frac{T_0}{T_{0\delta}}\right)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.4)$$

(Here as elsewhere in the catalogue, the fluid is assumed to be a perfect gas, so that the total enthalpy is $c_p T_0$)

The transverse body radius RZ is defined as positive for external, negative for internal, flows.

The "Kinetic" integral thicknesses D1K - D3K are defined by the above equations but with the density ratio ρ/ρ_δ set equal to one throughout.

The values of D1, D3, D4, D1K, D3K are not printed explicitly, but are given by the shape factors H12 (= D1/D2), H12K (= D1K/D2K) etc.

(ii) The "true" displacement thickness D STAR as defined in § 3.6. Here full account is taken of axisymmetry except that cos α is again taken as one.

The reference flow, $\rho' U'$ etc., is calculated on the assumption, discussed in § 3.6, that the pressure-based reference flow adequately represents an extension of the free stream flow for $y > \delta^*$. The property values are calculated assuming that the reference flow has expanded isentropically from the free stream reservoir state, assumed constant, to the local measured static pressure. Values so calculated are written ρ_p, U_p etc.

The displacement thickness D STAR or δ^* is then found by interpolation between the experimental steps in y from the equation:

$$\int_0^{\delta^*} \rho_p U_p \left(1 + \frac{y}{R_z}\right) dy = \int_0^{\delta} (\rho_p U_p - \rho U)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.5)$$

(iii) <u>Other integral quantities calculated using the pressure-based reference flow.</u>

These are integral thicknesses used by various authors on the grounds that in the absence of a normal pressure gradient they reduce to the constant reference flow expressions (3.7.1 - 3.7.4). They are so formulated that it is not necessary to specify a D-state, so long as the D point is at sufficiently large y.

We have included the transverse curvature correction term in the integrals, and introduced a $\delta_n^2/2R_z$ term on the left hand side as an approximation corresponding to the correct term which appears for the constant pressure case in equations (3.7.1-4). Equation (3.7.5) reduces to (3.7.1) if ρ_p, U_p are constant, but the quantities listed here do not retain their supposed physical significance, and we have not felt therefore that it was worthwile to refine the definitions further until we have fully analysed their meanings.

The definitions require scaling quantities, which may be evaluated at the wall or at the edge point. These are properties of the pressure-based reference flow, and are indicated by double subscripts. Thus U_{pw} and $U_{p\delta}$ are the velocities of the reference flow at the wall and at the boundary layer edge.

D1P has certain likenesses to the displacement thickness

$$(\rho U)_{pw}\left(D1PW + \frac{(D1PW)^2}{2 R_z}\right) = (\rho U)_{p\delta}\left(D1PD + \frac{(D1PD)^2}{2 R_z}\right) = \int_0^{\delta} (\rho_p U_p - \rho U)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.6)$$

D2P is related to the momentum defect thickness

$$(\rho U^2)_{pw}\left(D2PW + \frac{(D2PW)^2}{2 R_z}\right) = (\rho U^2)_{p\delta}\left(D2PD + \frac{(D2PD)^2}{2 R_z}\right) = \int_0^{\delta} \rho U (U_p - U)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.7)$$

D3P is related to the kinetic energy defect thickness

$$(\rho U^3)_{pw}\left(D3PW + \frac{(D3PW)^2}{2 R_z}\right) = (\rho U^3)_{p\delta}\left(D3PD + \frac{(D3PD)^2}{2 R_z}\right) = \int_0^{\delta} \rho U (U_p^2 - U^2)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.8)$$

D4P is related to the total enthalpy defect thickness

$$(\rho U T_o)_{pw}\left(D4PW + \frac{(D4PW)^2}{2 R_z}\right) = (\rho U T_o)_{p\delta}\left(D4PD + \frac{(D4PD)^2}{2 R_z}\right) = \int_0^{\delta} \rho U (T_{op} - T_o)\left(1 + \frac{y}{R_z}\right) dy \qquad (3.7.9)$$

(Note - $T_{op} = T_{o\delta}$ and is constant, so that D4PD = D4)

<u>3.8 Section C. Tables of Profile Data</u>

The printed tables associated with the entries provide only a sample of the total data collection, the full tables being given in the accompanying microfiche, and also recorded on magnetic tape. For access to the recorded data bank, please follow the instructions given in the Foreword (iii).

Each profile is headed by the full 8-digit profile identity, and the data tabulated are:

I, Y, PT2/P, P/PD, TO/TOD, M/MD, U/UD, T/TD,(RO/ROD) (U/UD)

I is the Y-station identity.
The next four columns represent the quantities most likely to be obtained fairly directly from experimental work, while the last five, with P/PD, are generally the most useful for analysis.

At the foot of each profile table there is a short statement listing the variables used as input to the programme and the assumptions made in completing the table. The remark "van Driest" means that the temperature distribution T/TD was determined according to a temperature-velocity relationship, given in subsection 5.3. If there is a remark "trapezoidal rule" the characteristic boundary layer thicknesses were calculated according to this integration procedure.
Instructions for handling the data as recorded on magnetic tape will accompany any copy that is made.

3.9 Section D. Supplementary data

A source often provides additional data which cannot be presented as part of sections B and C. Typically, this might be skin friction or heat transfer data for X-values other than those of the profiles, additional temperature probe data, or tables of fluctuation quantities. It will frequently be presented as a facsimile of the tables in the source when it will bear a label:

FACSIMILE FROM SOURCE PAPER - NB - AUTHORS' SYMBOLS AND UNITS.

The symbols and units will be defined, where appropriate, either on a heading page, or by superposed notes on the facsimile. The tables of this section will usually appear last, but occasionally, for printing reasons,will be attached to section A.

3.10 Closing remarks

We have tried to produce a standardised method of description which is nevertheless sufficiently flexible to cover most boundary layer investigations. We cannot claim that our format is a complete answer to the problem, but would implore any reader of these notes to make sure that any report he publishes should at least provide answers to the questions implied by 1 - 11 of Section A (§ 3.4). Ideally we would like writers to follow our own system, at least in indexing the material points as we have. Since the key numbers do not have to appear in sequence, any number may be added!

We also feel that merely to have provided data for sixty experiments in the same form allows us to make a general appeal to experimenters who are processing data. We beg any worker in the field to keep permanently, or to ensure that some agency keeps, a functionally complete record of his data, preferably in computer-digestible form, and preferably in a form consistent with that used here.

4. GENERAL POINTS IN THE "EDITORS' COMMENTS"

The description of the experiment which forms section A of each entry is concluded by § 15 - the "Editors' comments". Any user reading through these in rapid succession will soon realise that not only is there a large measure of repetition in these comments, but that we have tended to emphasise some features which interest us particularly, or which have caused us trouble in the overall presentation of the data. A reader will also note that we have introduced a certain amount of our own jargon, and that this is used not only in § 15 but appears frequently in the main body of Section A. The remarks made here are intended to enlarge upon, and explain, our preoccupations.

4.1 Remarks relating to the "quality" of the data

We obviously feel that we should, where appropriate, make general observations on the "quality" of the data. In a field for which experimental methods so often require the use of (sometimes complex) calibration procedures, it would be a brave man who commented too severely on any possible systematic errors. We would merely remark that the likely accuracy of any measurement, other than Pitot and wall static measurements in not-too-severe conditions, is very much less than the attainable precision or repeatability. We have not therefore made any assessment of quality on the basis of our appreciation of the likely error margin of the instrumentation used, but rather have inspected the evidence available to us in the form of automatically printed graphs of the velocity profiles in transformed coordinates. Regardless of the geometry, thermal state, and history of the test layer, these were prepared using a slightly modified Van Driest (1951) transformation, according to Fernholz (1969) and compared to the law of the wall, with the constants after Coles (1956) and the outer region correlation of Fernholz (1969). Where no CF value was given, we used an empirical correlation based on that reported in Fernholz (1971). On the evidence of these graphs we have felt free to comment on the degree of scatter visible in the profiles, and also, when the governing conditions were appropriate, on the extent to which the data matched our expectations in such features as the extent and slope of the log-law and the size of the "wake component" in the outer region.

The amount of data for each profile also contributes to the "quality". In general we feel that a profile should be described by at least 20-30 points, and have commented if the data fall "short" of this. But even this comment may not be sufficient for the reader since it does not say whether the data is spread evenly across the boundary layer or - as is often the case - is obtained mostly in the outer layer. If the data show very little scatter, the number of points is of less importance, but an even distribution is important.

4.2 Reliability of integral values

We have regularly commented on the relation of the innermost data point to the "momentum deficit peak". The integrands of D2, D3 and D4 all display a maximum, which may occur very close to the wall. If the data points do not describe this maximum, or "peak", it is not possible to evaluate the integral with much confidence, and the user should not place too great emphasis on the numerical values given in the tables of section B.

It is, in fact, very common for data to be defective in this particular. When considering older sources for which the evaluation of data was made by hand, this difficulty was probably overcome by a reasoned filling-in of the data near the wall. Later data, evaluated by computer, may or may not have had an inner region interpolated. In some cases we have found noticeable differences between the authors' D2 values and our own, which we have provisionally assigned to this cause, but since in general the source papers do not describe the integration procedure used, we cannot be certain. We have not performed any such inner region patching ourselves, as we feel that the way in which it is done must depend strongly on the preconceptions of the person doing it. Some further remarks about integration procedures and the experience we have had with them will be found in chapter 5.

4.3 Temperature values near the wall

In most experiments where total temperature measurements are made, the temperature probe is physically much larger than the Pitot probe, so that Pitot data are available in a region next to the wall for which there are no temperature measurements. In general, the experimental worker reduces data in this region with an inter-/extrapolated temperature value, but does not necessarily report the method used. If the total temperature distribution is extended to meet the wall temperature, the resultatnt error is unlikely to be serious unless the wall is very strongly cooled. Interpolations based on static temperature, and extrapolations made with no matching to the wall temperature are likely to be much less reliable.

We are aware that we have not checked every entry to see whether interpolation has taken place, and would recommend that any user intending to refine arguments on the details of the temperature distribution close to the wall should compare the lower values of y with the radius or half-height of the temperature probe used.

A commonly presented temperature-velocity correlation, in which (TO-TW)/(TOD-TW) is plotted against U/UD, is particularly sensitive to small variations of temperature near the wall, so that caution should be exercised in drawing conclusions as to the significance of apparently widely different temperature-velocity relationships, particularly for experiments in which heat-transfer was not severe.

4.4 Wall data deduced from profile data

We have on a number of occasions presented values of CF and/or CQ as deduced by the authors from the profile data. We would like to emphasise here, as we have intermittently in § 15, that we do not regard such values as data. In the absence of measured values, we feel that there is a justification for giving such deduced wall coefficients, as they are often required for theoretical developments. If the value presented is derived from a profile gradient very close to the wall, it is inherently exceedingly unreliable. If it is deduced by matching the whole profile to, for instance, a transformed version of the Coles' wall and wake law, the degree of fit can be stated statistically, but the reliability of the numerical value is only as good as the assumption that the wall- and wake-law description applies, and applies with the "universal" log-law constants in the particular circumstances of the experiment.

4.5 The boundary layer edge

The selection of a "D-state" point, which is then treated as the boundary layer edge state, will be discussed in the forthcoming commentary volume. A preliminary discussion may be found in Fernholz & Finley (1976). The variation of flow properties near the boundary layer edge may result from either the (asymptotically vanishing) influence of the boundary layer itself, or from variations of the free-stream flow, most obviously manifest as normal pressure gradients. In general the point selected is arbitrary, and the criteria used to guide selection are so various as to permit of variations in the Y-position of the D-point of 60 % or more. Where we feel this might have a real significance, as for instance for the experiments including fluctuation measurements (CAT 5803/7205/7403) we have commented on it in § 15. For the entries as a whole, we have followed no particular rules. If the author appears to have made a self-consistent D-point-selection, we have usually accepted it. If we have taken special measures (c.f. CAT 5901) we have remarked on them in § 12. We have throughout been guided in our action by a calculation of the local value of the total pressure, and would recommend, for future use, that the D-point be set at the Y-value for which (PO-P) = 0.99 (POE-P). For low speeds, this is the U_{995} point, while at hypersonic speeds it reduces, effectively, to the point where PO = 0.99 POE.

4.6 Normal pressure gradients

In § 6 below, we describe how the entries have been classified on the basis of the local pressure gradient. We place particular emphasis on the existence, or otherwise, of a gradient normal to the wall. If such a gradient is at all marked, then it becomes very difficult to make any rational calculation of the integral thicknesses or to decide where the boundary layer edge is. (See the discussion of D STAR in § 3.6 above, and the initial treatment of the problem in Fernholz & Finley, 1976.) We therefore distinguish between the types of pressure gradient which are observed on the basis of their origin and mode of propagation.

Normal pressure gradient effects may result from:

i) Wall curvature, so that the mean flow streamlines are curved and a normal pressure gradient is required to provide the centripetal acceleration. Typical cases are the two-dimensional ramp flow of Sturek & Danberg (CAT 7101) or the various contoured nozzle experiments (CAT 7001/7105/7206). The strength of the normal component is given approximately by

$$(\partial p/\partial y) \approx \pm \; (M^2 - 1)^{1/2} \; (\partial p/\partial x) \qquad (4.1)$$

and in an ideal flow the effect propagates as a simple wave. The isobars are the local Mach lines (Prandtl-Meyer fan, focussed compression etc.).

ii) Streamline divergence, so that a line normal to the wall does not intersect straight streamlines away from the wall at right angles. The isobar, on the other hand, is everywhere normal to the streamlines and so curves away from the profile normal. Such a flow would be observed in a pure conical expansion when the strength of the normal pressure component in inviscid flow is given approximately by

$$(1/p)\;(\partial p/\partial y) \approx -\,(i\gamma y/R^2)\;\; M^2\;\; (M^2 - 1)^{-1} \qquad (4.2)$$

where R is the radius from the source of the conical flow, y is the distance normal to the solid surface and i is 1 for planar and 2 for axisymmetric flow. The effect corresponds to a reflected wave in which the isobars run through successive equally stepped right and left running characteristics.
This effect is much weaker than that caused by a simple wave, and can usually be neglected. In practical cases where the ideal flow is not purely conical, there may be a superimposed simple wave element which swamps the reflected wave pressure gradient.

iii) Normal components of the Reynolds stresses may become large at high Mach numbers when compared to the static pressure. The mean flow field momentum changes are then the results of a normal stress made up of comparable contributions from the static pressure and the Reynolds stress. There is little evidence which can be used to quantify the effect, but a preliminary analysis based on the results of Fischer et al. (CAT 7001) and Beckwith et al. (CAT 7105) suggests that a pressure dip may be observed in the most intensely turbulent part of the layer, of order given by

$$\Delta p/p_w \quad \approx \quad 3\gamma M_\infty^2\, c_f \qquad (4.3)$$

This topic will be developed further in the commentary volume.

iv) Changes in longitudinal pressure gradient can give rise to substantial normal pressure gradient effects, even on a straight wall. This is, in effect, because the pressure gradient in a reflected wave region is generated elsewhere in the flow, so that there may be substantial regions away from the straight wall in which the incident and reflected waves are simple in character. Figure 4.1 shows an ideal flow field in which expansion is reflected at a straight wall. On the wall, from a to b, there is no pressure gradient, but an expansion fan generated on the other side of the experimental channel is being propagated towards the wall, and causes a negative pressure gradient at the wall from b to c. The region bcd is a "reflected wave region" in that the normal components of the incident and reflected simple waves oppose, while their longitudinal components reinforce. Along the wall abc no normal pressure gradients would be observed in a boundary layer of infinitesimal thickness. However, a traverse made over a finite range of y at AA would be made in an exclusively simple wave region, and traverses just upstream or downstream of AA would inevitably experience simple wave effects sufficiently far from the wall. The dashed arrows show the pressure gradient vectors involved, and taking due account of the reinforcement of the longitudinal pressure gradient in the region bcd it is apparent, from equation (4.1), that the normal pressure gradient on the line AA is given by

$$(\partial p/\partial y) = 1/2\;(M^2 - 1)^{1/2}\;(\partial p/\partial x \text{ along bc}) \qquad (4.4)$$

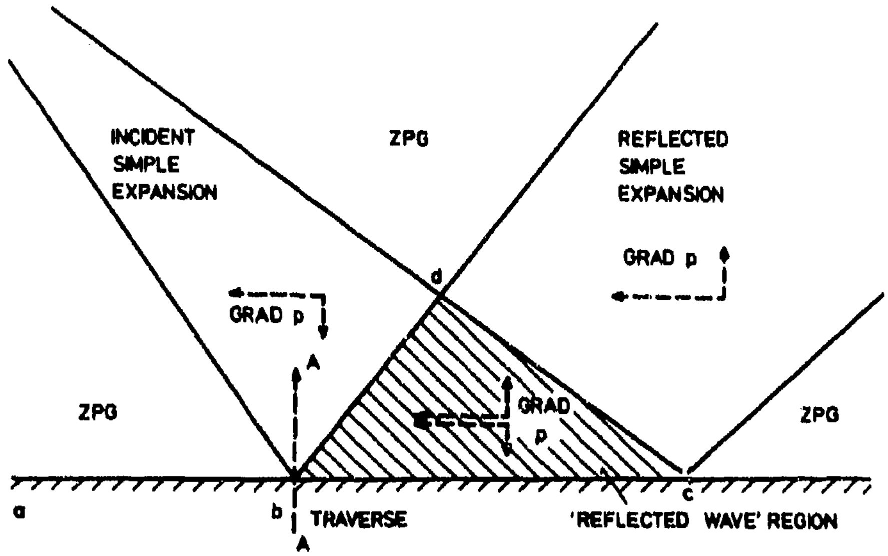


Figure 4.1 Normal pressure gradient effects near a change in longitudinal pressure gradient.

5. DATA PROCESSING

Figure 5.1 shows a flow diagram of the computer programme used to handle the data. We do not claim that it is elegant, or even efficient. It has grown naturally over the years, and we have never found the time to redesign it from scratch. The first version was provided by H.J. Küster and it has been adapted to the specific needs of the various entries, improved and run by Miss C. Mohr. We have not provided here a full listing as the programme is not inherently interesting and the details should not affect users in any significant way. The editors will provide a more detailed description on request.

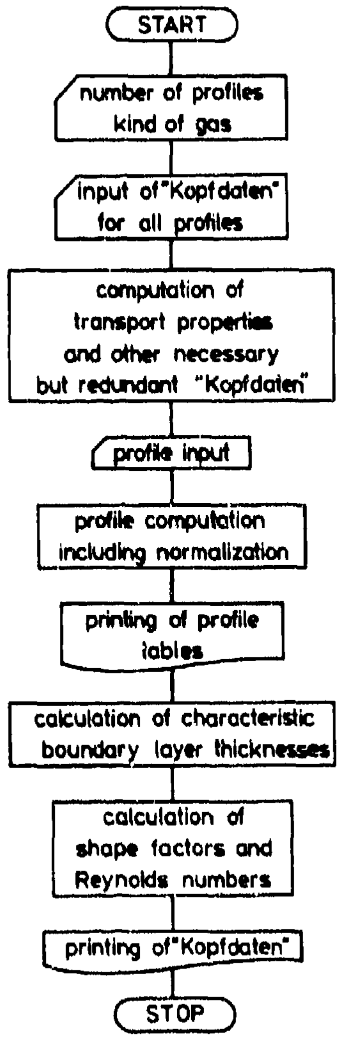


Fig. 5.1 Flow diagram of computer program

The purpose of the programme is to handle published data, as reduced by the original authors, and present it in standard form. In the discussion below we therefore lay most emphasis on the data input, the input of transport properties for the working gas and calculation procedures where we did anything unusual or experienced difficulties.

We use throughout this chapter the word "Kopfdaten" to describe all those quantities which in principle appear at the head of a profile table. The word is not elegant but has no short easily understood equivalent.

5.1 Properties of the working gas, recovery factors

There were only three gases used in the experiments described in the catalogue - air, nitrogen and helium. In some facilities the reservoir temperatures were high enough for the vibrational modes of the diatomic gases to become significantly excited. Very occasionally pressures were high enough for the compressibility factor (pv/RT) to depart detectably from one. In data processing we have ignored these real-gas effects and treated the working fluid as a perfect gas with constant specific heats. This may result in some falsification of the relationship between the free stream static state and the reservoir state, but will not introduce significant error in the inter-relationships between static properties and velocities etc. in the test region if the data input is selected from these variables.

The perfect gas properties assumed are:

Gas:	air	nitrogen	helium
Gas constant R in m^2/s^2 K:	287.1387	296.50	2078.739
Specific heat ratio γ:	1.40	1.40	1.667

The transport properties were calculated after Keyes (1952) for the diatomic gases (minor constituents of air being ignored) and Neubert (1974) for helium.
For the diatomic gases the expression

$$\mu = \frac{10^{-6}\, a_0\, T^{1/2}}{1 + a\, T^{-1}\, 10^{-a_1/T}} \quad NS/m^2 \tag{5.1}$$

was used, where the constants and the range of validity are given as

	a_0	a	a_1	range of validity
air:	1.488	122.1	5	79< T/K <1845
nitrogen:	1.418	116.4	5	81< T/K <1695

These relations were used also at lower temperatures down to 50 K for lack of better information.
For helium the expression

$$\mu = \left[\frac{50.23\, T^{0.647}}{[1 + T^{0.5}\,(T-0.3)\, e^{-T}]\,(T-0.3)} + e^{-T}(61.2730T^3 - 199.1754T^2 + 179.1353T - 59.05466)\right] \times 10^{-8}\ NS/m^2 \tag{5.2}$$

was used, and the range of validity is 0.4 < T/K < 400.

At present it is not possible to state a recovery factor with enough confidence to take account of upstream history effects, boundary conditions or other flow parameters. We have therefore chosen to use for all experiments a recovery factor r of 0.896, though this does not imply that we necessarily believe that there will be no heat transfer at a wall which is at the recovery temperature calculated using this. The numerical value represents the cube root of the Prandtl number for air, though a true recovery factor, if it could be defined, would of necessity be in some way a function of the shear stress distribution across the boundary layer, i. e. of the turbulence structure.

5.2 "Kopfdaten" - Boundary conditions and other evaluated data

The data quantities which we call "Kopfdaten" appear in printed tables as section B of each entry. They fall into three distinct groups. These are:

a) Boundary conditions given by the authors, or calculated by us from other data given by the authors, and used by us as input for the data processing. Such quantities are marked by an asterisk in the tables.

b) Calculated but redundant boundary values at the wall and the boundary layer edge.

c) Characteristic boundary layer thicknesses, shape factors and Reynolds numbers RED2.

A typical input set of group (a) might consist of:

Position X, transverse radius RZ, Mach number MD, longitudinal curvature parameter SW, heat flux at the wall, which in a dimensionless form will give the coefficient CQ, static pressure at the wall PW and the boundary layer edge PD, temperature at the wall TW and at the boundary layer edge TD.

The programme then completes the calculation for the array of boundary conditions by calculating the redundant group (b) from the input values. In this case group (b) consists of:

Total pressure and temperature at the boundary layer edge POD and TOD, the recovery temperature TR, the velocity at the boundary layer edge UD and the ratios PW/PD, TW/TD.

Apart from the obvious gas-dynamic relationships, the following relations and definitions are used:

Recovery temperature TR (T_r)

$$T_r = T_\delta \left(1 + r \frac{\gamma-1}{2} M^2_\delta\right) \tag{5.3}$$

Heat transfer coefficient CQ (C_q)

$$C_q = \dot{q}_w / \rho_\delta U_\delta c_p T_{o\delta} \tag{5.4}$$

Longitudinal pressure gradient parameter SW indicating the relative importance of streamline curvature - nominal value of

$$SW = (\partial\Theta/\partial x) \;/\; (\partial\nu/\partial x) \tag{5.5}$$

where Θ is the inclination of the flow and ν the Prandtl-Meyer angle, in principle at the boundary layer edge. In practice we have inserted nominal values of SW to indicate the importance of the simple-wave element of the pressure gradient. Thus SW = 1 for the curved wall studies, which in the test region were all either generating or cancelling a simple wave. SW was set to 0 for straight wall studies, except in one case where the pressure gradients were so severe that there was probably strong streamline curvature even within the boundary layer. For this case (CAT 7208) SW was set at 0.5.

Group (c) of the "Kopfdaten" involves the boundary layer thicknesses, and so is calculated at the end of the programme after the normalised profile data have been assembled. For cases in which transverse curvature is small (δ/R_z of order 10^{-2} or less) the definitions used are

Displacement thickness

$$\delta_1 = \int_0^\delta \left(1 - \frac{\rho U}{\rho_\delta U_\delta}\right)\left(1 + \frac{y}{R_z}\right) dy \tag{5.6}$$

Momentum defect thickness

$$\delta_2 = \int_0^\delta \frac{\rho U}{\rho_\delta U_\delta} \left(1 - \frac{U}{U_\delta}\right)\left(1 + \frac{y}{R_z}\right) dy \tag{5.7}$$

Kinetic energy defect thickness

$$\delta_3 = \int_0^\delta \frac{\rho U}{\rho_\delta U_\delta} \left[1 - \left(\frac{U}{U_\delta}\right)^2\right]\left(1 + \frac{y}{R_z}\right) dy \tag{5.8}$$

Enthalpy defect thickness

$$\delta_4 = \int_0^\delta \frac{\rho U}{\rho_\delta U_\delta} \left(1 - \frac{T_o}{T_{o\delta}}\right)\left(1 + \frac{y}{R_z}\right) dy \tag{5.9}$$

The "kinematic" integral thicknesses for which the density variation is ignored correspond to the "incompressible" definitions

$$\delta_{1K} = \int_0^\delta (1 - \frac{U}{U_\delta}) (1 + \frac{y}{R_z}) \; dy \tag{5.10}$$

$$\delta_{2K} = \int_0^\delta \frac{U}{U_\delta} (1 - \frac{U}{U_\delta}) (1 + \frac{y}{R_z}) \; dy \tag{5.11}$$

$$\delta_{3K} = \int_0^\delta \frac{U}{U_\delta} \left[1 - (\frac{U}{U_\delta})^2 \right] (1 + \frac{y}{R_z}) \; dy \tag{5.12}$$

where, in (5.6) to (5.12) R_z is defined as positive for flow on the exterior of an axisymmetric body and as negative in an internal flow. The inclination of the surface to the axis is assumed to have negligible effect. These equations reduce to those normally used on plane walls as R_z tends to infinity.

The above definitions hold for conditions in which the assumption of a constant reference flow is appropriate, and under those conditions (see §§ 3.6, 3.7) an exact allowance can be made for the effects of transverse curvature, even when δ is of the same order as R_z. The δ_n values calculated from equations (5.6) to (5.12) are replaced by corrected values δ_i using the relation (cited by Kemp & Owen CAT 7206)

$$\delta_i = - R_z (1 + \frac{\delta_n}{2R_z})^{1/2} \tag{5.13}$$

This is essentially the appropriate solution of a quadratic of the type found in equation (3.6.3) above.

It is then possible to calculate the longitudinal pressure gradient parameter PI2 (π_2)

$$\pi_2 = (\delta_2/\tau_w) \; (dp_w/dx) \tag{5.14}$$

Although provision was made in the programme for numerical differentiation of p_w (x) so as to calculate π_2, we have found that in nearly every case a human intelligence is needed to extract sensible values. Thus we have, so far as time allowed, obtained dp_w/dx by plotting p (x) and estimating the gradient. Such values are therefore essentially imprecise, but more accurate than the machine-derived values.

The shape factors are then calculated as ratios of δ_1, δ_2 etc.

$$H_{12} = \delta_1/\delta_2, \; H_{32} = \delta_3/\delta_2, \; H_{42} = \delta_4/\delta_2 \tag{5.15}$$

$$H_{12K} = \delta_{1K}/\delta_{2K} \qquad H_{32K} = \delta_{3K}/\delta_{2K} \tag{5.16}$$

and the Reynolds numbers as

$$Re_{\delta_2} = \rho_\delta U_\delta \;\; \delta_2/\mu_w \;\; ; \qquad Re_\Theta = \rho_\delta U_\delta \;\; \delta_2/\mu_\delta \tag{5.17}$$

5.3 Profile data

Profile data reached us in many forms. The programme was designed to cope with five standard types of input, and other variations allowed for by subroutines special to each entry, or in extreme cases by conversion into a standard form using compressible flow tables and hand calculation. Most of the difficulties occured when authors had not measured a variable and stated their auxiliary assumptions verbally or in analytic form. In particular, the static pressure variation was often fictitious and for many experiments, especially the earlier ones, total temperature was not measured.

When no total temperature profile was supplied, we assumed that the velocity and temperature were related by the expression

$$\frac{T}{T_\delta} = \frac{T_w}{T_\delta} + \frac{T_r - T_w}{T_\delta}\left(\frac{U}{U_\delta}\right) - r\,\frac{\gamma-1}{2} M^2_\delta \left(\frac{U}{U_\delta}\right)^2 \qquad (5.18)$$

This is a modification by Walz (1966) of van Driest's (1951) expression. When used, whether introduced by ourselves or the original author, a note appears at the foot of the profile tabulation as "VAN DRIEST".

The standard forms of input were:

1. U/U_δ, T/T_δ, $p/p_\delta = 1$. Calculate M/M_δ and ρ/ρ_δ.
2. U/U_δ, $p/p_\delta = 1$. Calculate T/T_δ (Van Driest) according to (5.18), M/M_δ and ρ/ρ_δ. Standard provision was made to deal with an author's set of U/U_δ values which had been calculated assuming that TO was constant (isoenergetic), and convert them to "Van Driest" values.
3. U/U_δ, T/T_δ, p/p_δ. Calculate M/M_δ and ρ/ρ_δ.
4. U/U_δ, ρ/ρ_δ, $p/p_\delta = 1$. Calculate M/M_δ, T/TD.
5. M/M_δ, $p/p_\delta = 1$. Calculate U/U_δ, ρ/ρ_δ and T/T_δ (Van Driest) according to (5.18).

Profile data were normalised with the boundary layer edge or D-state values. In many cases an author's set of figures was not consistently normalised, or was normalised on an exterior flow condition which was not in fact observed. In these circumstances we required that all normalised values should be 1.0 at the D-state point.

5.4 The D-state and consistency

The boundary layer edge point is a point within the boundary layer, selected arbitrarily or by the application of an arbitrary criterion. Consequently the reservoir state of the tunnel, p_{or}, T_{or} is not the same as the total state at the D-point. In fact we recommend (§ 4.5) as an ideal definition of the D-point, that it be set where PO/POR is 0.99. In practice this will be found to lie at a much greater Y-value than, for instance, the U_{995} point, and there are other advantages which will be developed in the commentary volume.

In most cases one is not presented with data enough to compare the values of p_o and p_{or}, but where it is possible to determine the two independently, a conflict can arise. When this happens, we have calculated p_o from the profile data for the selected D-point, and readers should not expect $p_{o\delta}$ to match the tunnel reservoir pressure, which as such does not appear in our tables. In most cases, however, $p_{o\delta}$ has been set arbitrarily equal to p_{or}, because no other information was available.

5.5 The integration procedures

The characteristic boundary layer thicknesses δ_n were determined by one of two integration procedures: INTVAR or a trapezoidal rule. If the latter was used - which is the case for a relatively small number of profiles only - this is noted in the output at the end of the profile in question.
The standard integration procedure "INTVAR" consists of a Simpson type formula using a second order parabola and allowing a variable step size (Haase et al. (1973)). The accuracy of INTVAR is of the order $(h_1 + h_2)^3 (h_1 - h_2)$ and better than that of the trapezoidal rule. The integration procedure is started at the outer edge of the boundary layer with a linear interpolation curve as the first step. This allows a better approximation for the near wall region of the integral, avoiding the disadvantages of a straight line interpolation in this region, especially for the many cases where the measurements do not extend within or as far in as the maximum of the integrands of δ_2 and δ_3.

INTVAR has, however, been found to be oversensitive to two special distributions of measured data points.

Its answers cannot then be trusted and we have therefore used the trapezoidal rule in these cases. One of these is when measuring stations lie extremely close together or when data are rather erratic over adjacent small intervals. In the first case averaging of the data in question cured the problem, but in the second case the reason for the deviation from the hand calculated result could not be found. The second case for which the trapezoidal rule is superior occurs when there are large gaps between measured data points. Here again INTVAR failed. Since these error sources could not be eliminated in the short time available before the catalogue deadline, all boundary layer thicknesses were checked either against the authors' values, against those obtained by the trapezoidal rule or, in a few cases, against hand calculated data.

5.6 Integral values using a pressure-based reference flow.

In § 3.6 we have briefly outlined some of the questions which arise when it is desired to calculate integral thicknesses for boundary layers experiencing significant normal pressure gradients. The quantities which we finally chose to calculate are defined in § 3.7 by equations (3.7.5) to (3.7.9).

In order to evaluate the integrals it is necessary to calculate the properties of the pressure-based reference flow from the tunnel reservoir state and the local static pressure. When the reservoir state was stated, it was read into the programme as an extra input. More generally the data available did not distinguish between the boundary layer edge state and the reservoir state, so that p_{or} was not equal to $p_{o\delta}$. The pressure based integral values were then calculated using stored profile data from the main programme.

The solution of equation(3.7.5)for D STAR was performed using a weighted interpolation between values of the integral

$$\int_0^{y_n} \rho_p U_p \left(1+ \frac{y}{R_z}\right) dy$$

for the four experimental values of y_n which lay two above and two below δ^* .

6. NATURE AND CLASSIFICATION OF DATA

6.1 General Considerations

All the data we present were obtained in wind-tunnel studies. Inevitably, therefore, the data do not fully represent the free flight situation. Some of the defects of representation are unavoidable, and result from the essential nature of tunnel tests. For instance, it seems very probable that nearly all hypersonic data are affected in some degree by a fluctuating free stream disturbance level together with a noise level, which have no analogue in free flight. In other cases, the representation is not complete for reasons which are in principle avoidable, though an attempt at proper reproduction of the intended flow would be inherently more expensive, or less convenient, than the course actually followed. A common example is the way in which constant-pressure high Reynolds number data are almost invariably obtained on tunnel side walls. The results are then presumed to describe a two-dimensional "flat-plate" boundary layer, when they must inevitably be influenced to an unknown extent by flow convergence or divergence, and by history effects inherited from the upstream region. The most obvious history effects stem from pressure gradients or wall temperature effects. It may well be valid to use the data as though these effects were negligible, but, if this be the case, some justification is desirable.

Our intention is to provide a data pool of general utility, so that the geometries described here are all, in some degree, simplifications of any "flight" or "application" situation. In selecting the data and classifying them, we need to bear this in mind. However the data were obtained, how are they likely to be <u>used</u>?

There are two principal modes of use. On the one hand we have the application of data to design purposes, where the highest degree of accuracy, and the finest detail of description, are irrelevant, since the situation-match between the data-store and the proposed application is inevitably only approximate. On the other hand, we have the provision of precise and detailed data for clearly defined test-cases, not necessarily of any direct applicability, which display particular phenomena sufficiently clearly to allow of the development of calculation methods. In an ideal world, any given experiment serves both purposes, but experimental technique and turbulence theory are not sufficiently developed to allow of this counsel of perfection.

In general, data obtained in ad-hoc situations on complex geometries are not published, as the results are usually not scientifically sufficiently detailed to allow us to make useful comparisons, and the data are in any case likely to be restricted by the need for commercial or military secrecy. Most of the available data then are not only laboratory data, but are for very simple geometries, and this factor, together with the complications of handling and presenting three-dimensional data, provided a strong incentive to restrict the catalogue to nominally two-dimensional cases.

There are numerous, and inter-related, factors which affect the local characteristics of a two-dimensional boundary layer. We cannot say that one factor is more "important" than another, since in general importance must relate not only to the numerically observed influence of the factor, but to its likely range of variation. The following list therefore is in no particular order of importance, but does perhaps reflect the order in which we think of the factors.

The principal controlling parameters are:

(i) The Reynolds number
(ii) The heat transfer condition
(iii) The Mach number
(iv) The pressure gradient
(v) The pressure and temperature history.

Of these, the first three are expressed by numerical values, which cover an essentially continuous range. It is not possible to make a distinction of <u>type</u> between high and low values of the quantity in question - there is a continuous gradation. We have chosen, instead, to make our classification of data on the basis, firstly, of the features of the local pressure gradient, and secondly, where, for the "zero pressure gradient" case, there is a large pool of data, on the history of the experimental boundary layer.

The classified lists of § 7 include a table giving nominal numerical values of Reynolds number, Mach number and wall temperature ratio TW/TR. The implications of classification by pressure gradient are examined below.

6.2 Classification by pressure gradient

More than half the available data describe tests made in nominally constant pressure layers (Group I) which we have subdivided firstly into cases in which the boundary layer has grown from a well-defined origin under constant pressure conditions throughout (IA). The second group (IB) contains those cases in which the layer is formed on a tunnel wall and passes through the nozzle expansion upstream of the test zone. In two cases (CAT 7202, 7301) this history is in some measure described and in one (7302) the development is so long and gradual that the boundary layer is probably fully "relaxed" so as to have the same characteristics as a flat plate layer. The experimental ranges covered by these two groups are summarised by figures 6.1 to 6.3. Cases with substantial heat transfer are relatively few, and are shown in figure 6.3. There is, in addition, a small group (IC) of cases describing the recovery of a severely disturbed layer, under local zero-pressure-gradient conditions.

The zero-pressure-gradient data form the main body of information for both the modes of use suggested in § 6.1. There is quite a wide range of available data, and it includes a few cases which have been studied in close detail - for instance CAT 7205, where the measurements fully describe the mean flow, and are supported by fluctuation measurements. Regrettably, the cases of practical interest do not generally give rise to any considerable regions of constant-pressure flow.

The pressure gradient cases have been divided on the basis of the manner in which the pressure gradient is produced. The first group (IIA) covers those flows in which a wave structure is generated somewhere else in the flow and imposed on a boundary layer flowing along a straight wall. The test layer thus passes through a "reflected wave", without significant streamline curvature. The second group (IIB) comprises those tests in which the pressure gradient is the result of streamline curvature. This is associated with a "simple wave" which may either be generated in the test-zone itself, and propagate downstream, or may be generated elsewhere and be propagated downstream so as to strike the test-zone. The wall curvature here is such as to cause the wave to be cancelled without reflection, as, for example, in the "bell" of a well designed contoured nozzle.

There is a vital physical distinction between the two cases as the curved mean flow of the simple wave cases is associated with normal pressure gradients, which at high Mach numbers become very large. There is very little available information on what effect this may have on the turbulent structure (CAT 7101 contains the only measurements of fluctuating quantities), but the effects are unlikely to be negligible. There are relatively few available accounts of simple wave flows, and this is especially unfortunate as the boundary layers on a hypervelocity vehicle will always experience locally-generated simple wave structures. The typical cases are the flow over the convex forward surface of a vehicle - a favourable pressure gradient giving rise to a generated simple wave - and the flow approaching an inlet where a concave surface gives rise to a generated simple compression wave. It seems improbable that data from reflected-wave pressure-gradient experiments can be applied very directly to these cases. Unfortunately, the reflected-wave experiments are much easier to perform.

There is a final class (IIC) intended to include cases with no longitudinal pressure gradient but a significant normal pressure gradient. Such a flow may be realised by causing an incident wave to strike a surface so contoured as to give rise, in isolation, to a generated wave of equal and opposite sign. Such an experiment has been performed (CAT 6800) and is the only case we have included in the catalogue for which no profile data is available. It is offered as a challenge to those developing calculation methods.

This classification in itself shows clearly where the gaps in our experimental knowledge lie. Boundary layers with larger longitudinal pressure gradients, with varying wall temperature, along curved walls and those recovering from a strong perturbation still await exploration. In particular, it would be desirable to perform more experiments like Thomann's (CAT 6800) but on a larger scale and including profile and turbulence measurements.

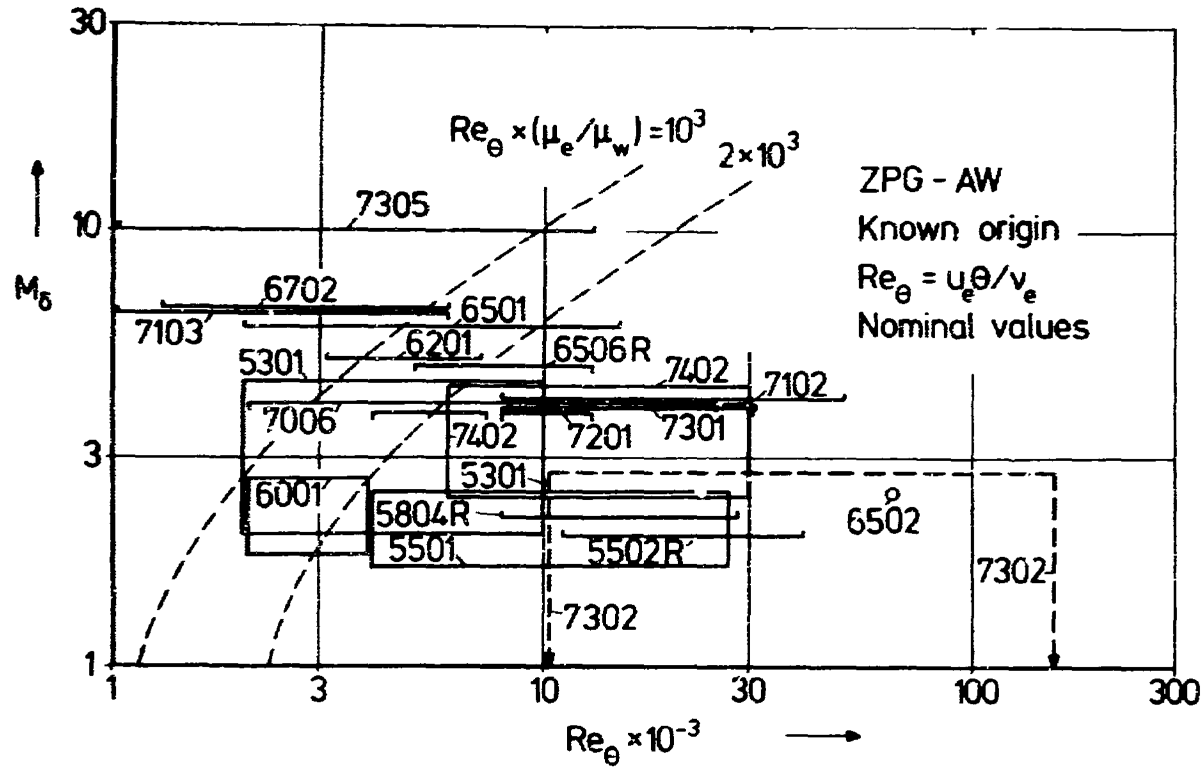


Fig. 6.1 Nominal experimental rcnge for group IA (adiabatic cases)
Zero pressure gradient boundary layers formed under constant pressure conditions

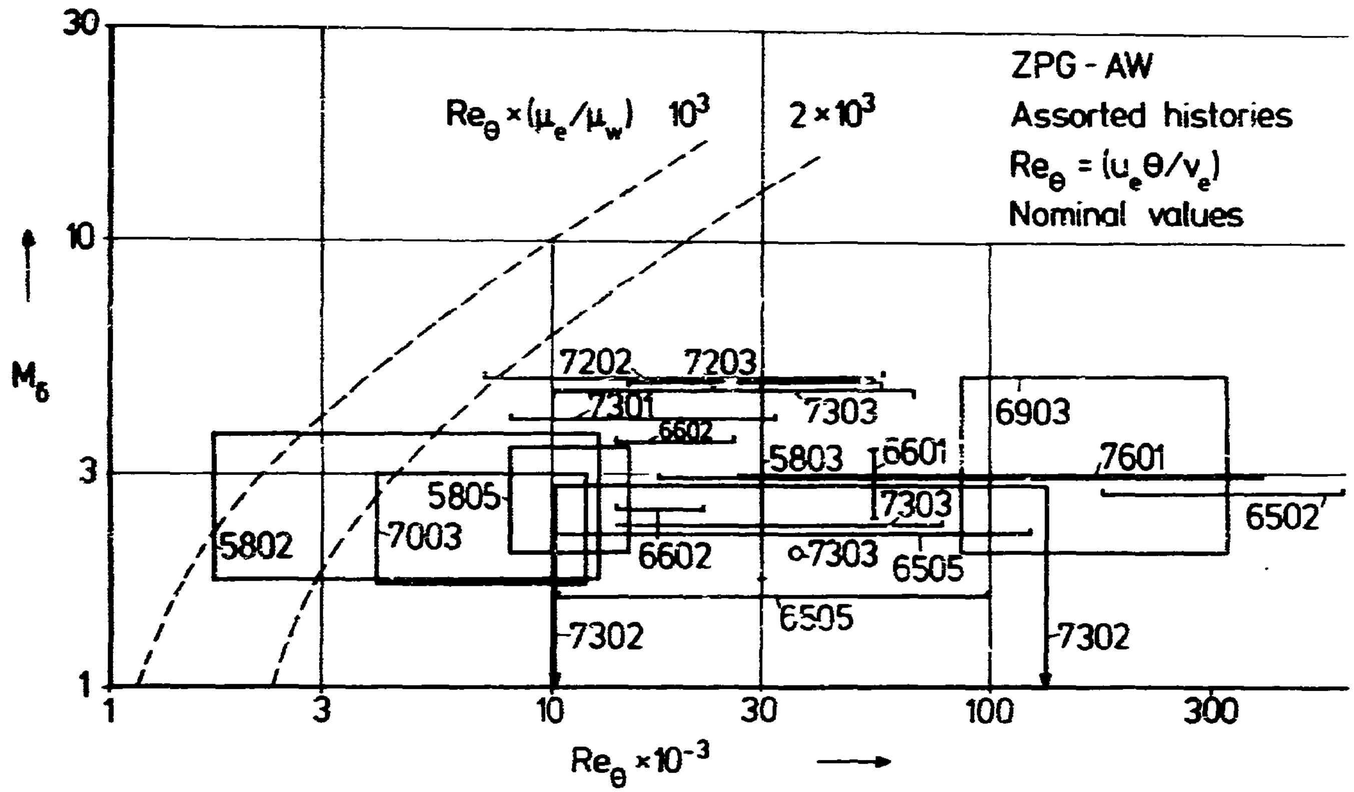


Fig. 6.2 Nominal experimental range for group IB (adiabatic cases)
Zero pressure gradient boundary layers formed on windtunnel nozzle walls

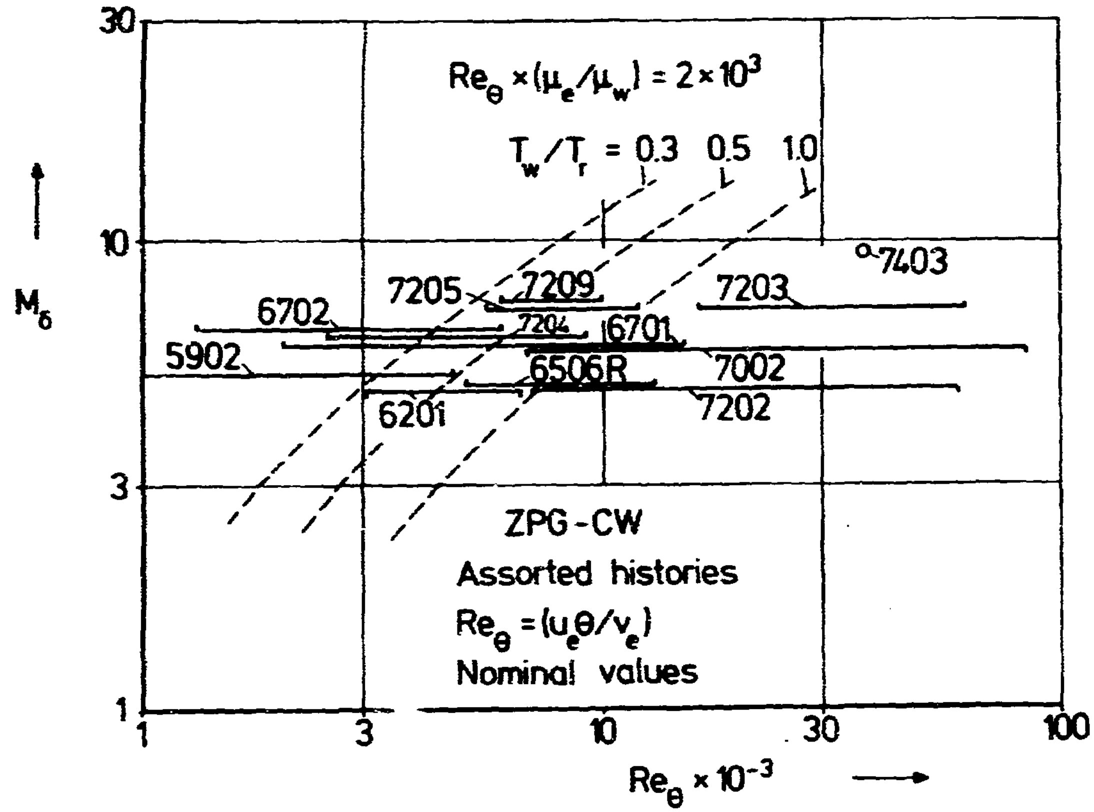


Fig. 6.3 Nominal experimental range for zero pressure gradient boundary layers with substantial heat transfer
Both groups IA and IB - varied histories

7. CLASSIFIED LISTS OF ENTRIES

As outlined in § 6.2 above, the principal basis of the classification is the type of pressure gradient experienced by the boundary layer in the test region. For the large class of zero- or near-zero pressure gradient flows, we have made further division between those cases in which the whole development of the boundary layer has been under zero pressure gradient conditions, and those with varied upstream histories. The pressure gradient cases are divided into reflected wave flows and simple wave flows. There are further subdivisions based on the geometry of the test zone.

The tabular information consists of nominal values of

- M - Mach number range. For pressure gradient cases, this may be either a local value, or the free stream value.
- R THETA X 10^{-3} - Reynolds number based on momentum defect thickness and boundary layer edge properties.
- TW/TR - The ratio of wall temperature to a nominal adiabatic wall or recovery temperature.
- TO - If total temperature profiles were obtained, the entry is marked P.
- CF - Determination of wall shear stress by:
  - F - Floating element balance (FEB)
  - P - Preston tube
  - S - Stanton tube or surface fence
  - V - Deduction from the velocity profile
- NX - Number of successive stations.
- Q - Measurement of heat flux (Table 7.2).
- PG - Classification as in Table 7.1 (Tables 7.2, 7.3, 7.4).

Brackets round an entry imply that the information is of small quantity or questionable quality.

The tables are, in order:

- 7.1 Classification by local pressure gradient
- 7.2 Experiments with significant heat transfer
- 7.3 Listing in alphabetical order
- 7.4 Listing in numerical order

Readers wishing to select zero pressure-gradient cases for study will find the experimental ranges of Mach number and Reynolds number displayed, approximately, in figures 6.1-3.

Figure 6.1 Nominal experimental range for group I A (Adiabatic cases). Zero pressure-gradient boundary layers formed under constant pressure conditions

Figure 6.2 Nominal experimental range for group I B (adiabatic cases). Zero pressure-gradient boundary layers formed on wind tunnel nozzle walls.

Figure 6.3 Nominal experimental range for zero pressure-gradient boundary layers with significant heat-transfer. (Groups I A & I B together).

TABLE 7.1. LIST OF ENTRIES CLASSIFIED BY LOCAL PRESSURE GRADIENT

I ZERO AND NEAR ZERO PRESSURE-GRADIENT CASES

Flows for which, in principle, the pressure is constant in the test zone.

I (A) Flows with a defined leading edge or origin, developed under ZPG conditions.

		M	R THETA X 10^{-3}	TW/TR	TO	CF	NX
Type I A 1 FLAT PLATES:							
5301	COLES	2-4.5	2-10	1.0	-	F	1 (2)
5501	SHUTTS et al.	1.7-2.5	6-21	1.0	-	F	3-5
5902	WINKLER & CHA	5.2	1-4.5	0.6-1.0	P	(V)	4
6201	MOORE	5	3-7	0.5-1.0	-	-	(1)
6502	MOORE & HARKNESS	2.7	60	1.0	-	F	1 (2)
6702	DANBERG	6.5	1.3-6	0.5-0.9	P	(V)	4
7006	HASTINGS & SAWYER	4	2-25	1.0	P	F/P	7
7103	FISCHER & MADDALON	6.5	0.5-6	1.0	-	-	7
7204	KEENER & HOPKINS	6.3	2-7	0.3-0.5	P	F	1
7301	GATES	4	8-31	0.9-1.0	P	-	2-3
7305	WATSON et al.	10	1-12	1.0	(P)	F	4
7402	MABEY et al.	2.5-4.5	5-30	1.0	P	F	5
I A 1 R FLAT PLATES WITH ROUGHNESS:							
5502	SHUTTS & FENTER	2	11-40	1.0	-	F	5
5804	FENTER & LYONS	2.2/2.7	8-28	1.0	-	-	7/2
6506	YOUNG	4.9	5-13	0.6-1.0	-	F	1
I A 2 CYLINDRICAL: (e-exterior - i-interior)							
6001e	MICHEL	1.8-2.7	2-4	1.0	-	-	7
6501e	ADCOCK et al.	6	2-15	1.0	(P)	-	7
6701e	SAMUELS et al.	6	2-15	0.4-0.5	P	-	5
7102i	PEAKE et al.	4	10-60	1.0	-	P	6
7201i	LEWIS et al.	4	4-13	1.0	-	V/(S)	9+
7205e	HORSTMAN & OWEN	7.2	6-13	0.5	P	F	3

(Some nose effects are possible for 7205 and probable for 6001)

I A 3 CONICAL (Divergence)

None

I (B) Flows with an uncertain origin

I B 1 FLAT WALLS FACING CONTOURED HALF-NOZZLES

		M	R THETA X 10^{-3}	TW/TR	TO	CF	NX
5803	KISTLER	1.7-4.8	30	1.0	P	V	1
6602	JEROMIN	2.5-3.5	14-20	1.0	P	V	10
7003	MEIER	1.7-3.0	4-10	0.9-1.0	P	V	6
7202	VOISINET & LEE	4.9	7-58	0.25-1.0	P	F	5
7301	GATES	4.4-9	8-31	0.9 -1.0	P	-	2-5

TABLE 7.1 cont.	M	R THETA	TW/TR	TO	CF	NX
I B 2 FLAT TUNNEL WALL AFTER CURVED NOZZLE SURFACE						
5802 STALMACH	1.7-3.7	2-12	1.0	-	F/P	1
5805 MOORE	2-3.5	6-14	1.0	-	F	4-6
6502 MOORE & HARKNESS	2.7	180-700	1.0	-	F	3
6903 THOMKE	2-5	85-350	1.0	-	P	2
7403 LADERMAN & DEMETRIADES	9.4	40	0.4	P	V	1
7601 VAS et al.	2.9	20-400	1.0	-	P	9
I B 3 CYLINDRICAL TUNNEL WALLS AFTER NOZZLE						
7002 JONES & FELLER	5.9	8-80	0.7-0.8	P	-	4
7203 HOPKINS & KEENER	7.2	15-55	0.3-0.5	(P)	F	1
I B 4 PLANE TUNNEL SIDE WALLS (NORMAL TO CURVED NOZZLE WALLS)						
6505 JACKSON et al.	1.6-2.2	10-120	1.0	-	F	2
6601 HOPKINS & KEENER	2.5-3.5	50-60	1.0	-	F/P/S	1
7302 WINTER & GAUDET	0.2-2.8	10-160	1.0	P	F	1
7303 ALLEN	2-4.6	10-80	1.0	-	F/P	1
I (C) Flows recovering from a severe perturbation.						
5805 MOORE (STEP)	2-3.5	6-14	1.0	-	F	4-6
6401 CLUTTER & KAUPS (BLUNT INCREASE)	2-4	10-40	1.0	P	-	5
7102 PEAKE et al. (RING)	4	10-60	1.0	-	P	6
7209 STONE & CARY (TRIPS)	7.7	6-10	0.8	P	-	2

II CLASSIFIED PRESSURE GRADIENT CASES

II (A) Reflected wave - straight wall

In principle, normal pressure gradients should be small except near large changes in the pressure gradient, where a simple wave element may be observed.

	M	R THETA	TW/TR	TO	CF	NX
II A 1 PLANAR - FPG						
5503 LOBB et al.	5-8	5-12	0.5-1.0	P	(V)	1
5801 NALEID	2	10	1.0	-	F/P	(1)
6504 PASIUK et al.	1.5 to 3	2-10	0.8-1.0	P	-	9
6902 MICHEL	1.4 to 3	4-2	1.0	-	-	12
7304 VOISINET & LEE	3.8 to 4.6	6-50	0.25-1.0	P	F	5
7401 THOMAS	2.5 to 3.0	14-24	1.05	P	S	15-18
II A 2 PLANAR - APG						
5801 NALEID	2	10	1.0	-	F/P	1
7007 ZWARTS	4 to 3	35-70	1.0	-	P	20
7104 WALTRUP & SCHETZ	2.4 to 1.9	20-40	1.0	P	F	4
7401 THOMAS	2.5 to 2.2	14-20	1.0	P	S	15
II A 3 CYLINDRICAL - FPG						
7201i LEWIS et al.	2.4 to 3.7	10	1.0	-	V/S	7
II A 4 CYLINDRICAL - APG						
7102i PEAKE et al.	4 to 2	10-60	1.0	-	P	6
7201i LEWIS et al.	4 to 2.4	10	1.0	-	V/S	12
7208a ZAKKAY & WANG	6 to 4.6	96-140	0.7	P	-	8

TABLE 7.1 cont.	M	R THETA	TW/TR	TO	CF	NX
II A 5 CONICAL - FPG - DIVERGENCE (all nozzle walls - internal)						
5901 HILL	8-10	1.5-3.5	0.5	P	V	1-2
6801 PERRY & EAST	8-11.5	6-35	0.3-0.4	P	V	3
6901 BOLDMAN et al.	0- 4.1	3-12	0.6-0.9	P	-	4
7207 BACK et al.	0- 3.6	10	0.5, 1.1	P	-	6

II A 6 CONICAL - APG - DIVERGENCE

None

II (B) Simple wave - curved walls

In these flows the curved streamlines require, in principle, normal pressure gradients, the significance of which increases with Mach number.

II B 1 PLANAR - FPG

None

II B 2 PLANAR - APG						
7101 STUREK & DANBERG	3.5 to 2.8	20-40	1.0	P	P	8
II B 3 AXISYMMETRIC - FPG - (All external, all generated)						
6401 CLUTTER & KAUPS	2-4	10-40	0.7-1.0	P	-	5
7005 ALLEN	3	1.4-10	1.0	-	P	7
II B 4 AXISYMMETRIC - APG - (All external, all generated)						
6401 CLUTTER & KAUPS	2-4	10-40	1.0	P	-	4
6503 STROUD & MILLER	5-8	2-60	0.4-1.0	P	-	7
7004 WINTER et al.	0.6-2.8	8-40	1.0	-	S	6
II B 5 AXISYMMETRIC - FPG - (All internal, all cancelled)						
7001 FISCHER et al.	19-22	4-6	1.0	(P)	-	5
7105 BECKWITH et al.	19.5	2-4	0.2	P	-	1
7206 KEMP & OWEN	19-45	1-8	0.35-0.85	P	F	4

II (C) Normal pressure-gradient cases

If suitable incident waves and generated waves are superimposed, it is possible to generate a region in which there are no streamwise pressure gradients, but nevertheless large transverse gradients. No case is reported in which profiles were measured, but a wide range of heat-transfer measurements were made by THOMANN (6800) in flows with carefully combined gradients giving fields of types A, B and C with a measure of commonality in other features. These results have been included in the catalogue.

TABLE 7.2 FLOWS WITH SIGNIFICANT HEAT TRANSFER

PG - Classification by local pressure-gradient as in Table 7.1 and § 6.2.

Q - Determination of wall heat flux

W - measurement at the wall

P - estimated from temperature profile.

		PG	M	TW/TP	TO	Q
5503	LOBB et al.	II A	5-8	0.5-1.0	P	W
5901	HILL	II A	8-10	0.5	P	P
5902	WINKLER & CHA	I A	5.2	0.6-1.0	P	W
6201	MOORE	I A	5	0.5-1.0	-	-
6401	CLUTTER & KAUPS	II B	1.6-4.5	0.7	P	(W)
6503	STROUD & MILLER	II B	5-8	0.4-1.0	P	W
6504	PASIUK et al.	II A	1-3	0.8-1.0	P	(W)
6506	YOUNG	I A R	5	0.6-1.0	-	W
6701	SAMUELS et al.	I A	6	0.4-0.5	P	(W)
6702	DANBERG	I A	6.5	0.5-0.9	P	P (W)
6800	THOMANN	II C	2.5	0.8	-	W
6801	PERRY & EAST	II A	8-12	0.3-0.4	P	W
6901	BOLDMAN et al.	II A	0-4	0.6-0.9	P	W
7002	JONES & FELLER	I B	6	0.7-0.8	P	-
7105	BECKWITH et al.	II B	20	0.2	P	W
7202	VOISINET & LEE	I B	4.9	0.25-1.0	P	W
7203	HOPKINS & KEENER	I B	7.4	0.3-0.5	(P)	-
7204	KEENER & HOPKINS	IA	6.5	0.3-0.5	(P)	-
7205	HORSTMAN & OWEN	IA	7.2	0.5	P	W
7206	KEMP & OWEN	II B	20-40	0.3-0.9	P	W
7207	BACK et al.	II A	0-3.6	0.5, 1.1	P	W
7208	ZAKKAY & WANG	II A	6	0.7	P	W
7209	STONE & CARY	I C	7.6	0.8	P	(W)
7301	GATES	I A/B	4, 5	0.85-1.0	P	W
7304	VOISINET & LEE	II A	4	0.25-1.0	P	W
7403	LADERMAN & DEMETRIADES	I B	9.4	0.4	P	-

TABLE 7.3 ALPHABETICAL LIST

PG - Classification by local pressure-gradient as in Table 7.1 and § 6.2.

		PG
Adcock et al.	6501	IA
Allen	7005	IIB
Allen	7303	IB
Back et al.	7207	IIA
Beckwith et al.	7105	IIB
Boldman et al.	6901	IIA
Clutter & Kaups	6401	IIB
Coles	5301	IA
Danberg	6702	IA
Fenter & Lyons (R)	5804	IA
Fischer et al.	7001	IIB
Fischer & Maddalon	7103	IA
Gates	7301	IA/B
Hastings & Sawyer	7006	IA
Hill	5901	IIA
Hopkins & Keener	6601	IB
Hopkins & Keener	7203	IB
Horstman & Owen	7205	IA
Jackson et al.	6505	IB
Jeromin	6602	IB
Jones & Feller	7002	IB
Keener & Hopkins	7204	IA
Kemp & Owen	7206	IIB
Kistler	5803	IB
Laderman & Demetriades	7403	IB
Lewis et al.	7201	IIA
Lobb et al.	5503	IIA
Mabey et al.	7402	IA
Meier	7003	IB
Michel	6001	IA
Michel et al.	6902	IIA
Moore (Step)	5805	IC
Moore	6201	IA
Moore & Harkness	6502	IB
Naleid	5801	IIA
Pasiuk et al.	6504	IIA
Peake et al.	7102	IIA
Perry & East	6801	IIA
Samuels et al.	6701	IA
Shutts & Fenter (R)	5502	IA

		PG
Shutts et al.	5601	IA
Stalmach	5802	IB
Stone & Cary	7209	IC
Stroud & Miller	6503	IIB
Sturek & Danberg	7101	IIB
Thomann	6800	IIC
Thomas	7401	IIA
Thomke	6903	IB
Voisinet & Lee (ZPG)	7202	IB
Voisinet & Lee (FPG)	7403	IIA
Waltrup & Schetz	7104	IIA
Watson et al.	7305	IA
Winkler & Cha	5902	IA
Winter & Gaudet	7302	IB
Winter et al.	7004	IIB
Vas et al.	7601	IB
Young (R)	6506	IA
Zakkay & Wang	7208	IIA
Zwarts	7007	IIA

TABLE 7.4 NUMERICAL LIST

PG - Classification by local pressure-gradient as in Table 7.1 and § 6.2

	PG			PG	
5301	IA	Coles	7105	IIB	Beckwith et al.
5501	IA	Shutts et al.	7201	IIA	Lewis et al.
5502	IA	Shutts & Fenter (R)	7202	IB	Voisinet & Lee (Z PG)
5503	IIA	Lobb et al.	7203	IB	Hopkins & Keener
5801	IIA	Naleid	7204	IA	Keener & Hopkins
5802	IB	Stalmach	7205	IA	Horstman & Owen
5803	IB	Kistler	7206	IIB	Kemp & Owen
5804	IA	Fenter & Lyons (R)	7207	IIA	Back et al.
5805	IC	Moore (Step)	7208	IIA	Zakkay & Wang
5901	IIA	Hill	7209	IC	Stone et al.
5902	IA	Winkler & Cha	7301	IA/B	Gates
6001	IA	Michel	7302	IB	Winter & Gaudet
6201	IA	Moore	7303	IB	Allen
6401	IIB	Clutter & Kaups	7304	IIA	Voisinet & Lee (F PG)
6501	IA	Adcock et al.	7305	IA	Watson et al.
6502	IB	Moore & Harkness	7401	IIA	Thomas
6503	IIB	Stroud & Miller	7402	IA	Mabey et al.
6504	IIA	Pasiuk et al.	7403	IB	Laderman & Demetriades
6505	IB	Jackson et al.	7601	IB	Vas et al.
6506	IA	Young (R)			
6601	IB	Hopkins & Keener			
6602	IB	Jeromin			
6701	IA	Samuels et al.			
6702	IA	Danberg			
6800	IIC	Thomann			
6801	IIA	Perry & East			
6901	IIA	Boldman et al.			
6902	IIA	Michel et al.			
6903	IB	Thomke			
7001	IIB	Fischer et al.			
7002	IB	Jones & Feller			
7003	IB	Meier			
7004	IIB	Winter et al.			
7005	IIB	Allen			
7006	IA	Hastings & Sawyer			
7007	IIA	Zwarts			
7101	IIB	Sturek & Danberg			
7102	IIA	Peake et al.			
7103	IA	Fischer & Maddalon			
7104	IIA	Waltrup & Schetz			

SECTION 8

THE ENTRIES

The entries are arranged in the sequence given in Table 7.4.

Note: Boundary conditions and evaluated data are given for all profiles as section B of each entry. This data is also printed on the microfiche, which gives complete data for all profiles. The tables of section C of each entry provide only a selection of the profile data. Section D, additional data, is not printed on the microfiche.

M : 2.0, 2.6, 3.7, 4.5.
R THETA X 10^{-3} : 2 - 10.
TW/TR : 1.0.

5301

ZPG - AW

Continuous wind tunnel with symmetrical flexible nozzle. W = H = 0.46 m.
$0.067 < PO < 1.01$ MN/m^2 TO: 310 K. Air. $3 < RE/m \times 10^{-6} < 16$.

COLES D., 1953. Measurements in the boundary layer on a smooth flat plate in supersonic flow: I. The problem of the turbulent boundary layer, II. Instrumentation and experimental techniques at the Jet-Propulsion Laboratory, and III. Measurements in a flat-plate boundary layer at the Jet-Propulsion Laboratory. JPL. CALTECH. Rep. nos. 20-69, 20-70 and 20-71. (Ph. D thesis, Cal. Inst. Tech., Pasadena, California 1953)
Also: Coles, D. (1954).

1 The test boundary layer was formed on the lower surface of a flat plate mounted 13 mm below the tunnel centre-line, completely spanning the tunnel. The leading edge (X = 0) was formed as a 15° wedge with a nose radius estimated as less than 0.013 mm. The overall length was 0.84 m and the width 0.46 m. Measurements were made 'in the central zone' of the plate which was not cooled. Up to 15 minutes was allowed for
2 temperatures to settle. 'Particular attention was paid to the working-surface finish'. The calibration of the empty tunnel showed static pressure variations of order 1 %. With the plate inserted, the pressure field produced by the plate and boundary layer caused static pressure variations of order 5 %. These correspond to 1 % in M at M = 3.7, for which the data on flow-uniformity are presented and which have
3 been presumed typical. The profile measurements were mainly made with a fence trip constructed of wires 0.34 mm in diameter spaced at 6.4 mm spanwise intervals and projecting about 2.5 mm normal to the surface of the plate at the leading edge. For some tests this was replaced by a sand strip extending from X = 20 to 30 mm, and for others by a set of airjets issuing from holes 6.4 mm apart at X = 19 mm. The holes were distributed over the central 405 mm width of the plate and connected to a common manifold. The transition region was determined from the boundary layer induced static pressure field and the wall shear-stress
5 measurements. The nozzle plates were adjusted to give constant pressure on the tunnel centre-line when empty, so allowing for the four tunnel wall boundary layers. Empty tunnel tests at M = 2.5 showed slight flow convergence in plan view and divergence in elevation. The static pressure on the plate at Z = 70 mm differed from that at Z = 0 by about 1.5 %.

6 Twenty seven static pressure holes were provided on the line Z = 70 mm. Additionally each balance incorporated three, one of which was the balance gap. The copper-constantan thermocouples buried in the plate measured TW at X = 245, 425 and 514 mm, Z = 30 mm. TAUW was measured by three JPL-design floating element balances mounted on the centre-line at X = 140, 330 and 610 mm. The element was rectangular, extending 6.4 mm in the X direction and 38.1 mm wide. The balances and their calibration procedure are described in
7 JPL Rep. 20-70. A variety of FPP probes were used to measure Pitot pressure, the original intention being to use the tubes as mass-flux probes so as to allow the determination of TO. A typical example is quoted
8 as having h_2 = 0.23 mm, b_2 = 1.35 mm. The Pitot pressure profiles presented were measured between X = 542
10 and 546 mm, with one exception for which X = 263 mm. No corrections were applied.

9 The author's interpolation of CF values for the profile boundary conditions has been accepted. The source
11 data were reduced assuming an iso-energetic boundary layer and Sutherland's viscosity law. The tables here
12 are calculated assuming a Crocco/Van Driest temperature-velocity relation and constant static pressure.
13 TW data were not presented and the editors' recovery temperature has been used. Fourteen individual profiles are presented, the sets for each Mach number being over a range of different total pressures. Most (0101-1101) were taken at X = 546 mm with the fence boundary-layer trip. The exceptions are 1201 (Sand trip, X = 542 mm) 1301 (Air-jet trip X = 263 mm) 1302 (Air-jet trip X = 542 mm).

§ DATA: 5301 0101-1302. PT2 Profiles. NX = 1 except for the pair 1301-2. CF obtained separately with floating element balances.

15 Editors' comments

This investigation was a pioneer attempt at a reasonably complete survey of a ZPG-AW boundary layer. Other early investigations also without TC profiles are those of Shutts et al. - CAT 5501, in which there were up to five successive stations, and of Stalmach - CAT 5802. Later, full, studies are those of Hastings & Sawyer - CAT 7006 and Mabey et al. - CAT 7402. Axisymmetric cases which overlap in Mach number and Reynolds number are the ZPG series of Lewis et al. - CAT 7201 and Peake et al. - CAT 7102. An examination of our wall-law plots suggested that the CF values may be slightly high, though any likely discrepancy lies within the indeterminacy of a single observation. The different types of tripping devices may have influenced the boundary layer at the measuring station.

CAT 5301 COLES BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR*	REDZW	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	REDZD	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	DZ	PI2*	H42	D2K	UD	TR
53010101	1.9660	1.0000	1.9971"+03	2.7200"-03	3.0784	1.4632	3.5927"+03	3.5927"+03
5.4559"-01	2.6664"+04	1.0000	3.0805"+03	NM	1.7814	1.7704	2.9170"+02	1.7234"+02
INFINITE	3.0556"+02	0.0000	9.6329"-04	0.0000"+00	0.0808	1.2144"-03	5.1746"+02	2.9170"+02
53010201	1.9780	1.0000	4.3574"+03	2.1800"-03	3.1025	1.4704	8.8160"+03	8.8160"+03
5.4559"-01	6.6661"+04	1.0000	6.7594"+03	NM	1.7873	1.7765	2.8789"+02	1.6924"+02
INFINITE	3.0167"+02	0.0000	8.3509"-04	0.0000"+00	0.0816	1.0503"-03	5.1592"+02	2.8789"+02
53010301	1.9820	1.0000	5.7051"+03	2.0200"-03	3.0982	1.4665	1.2441"+04	1.2441"+04
5.4559"-01	9.4659"+04	1.0000	8.9041"+03	NM	1.7943	1.7836	2.8892"+02	1.6956"+02
INFINITE	3.0278"+02	0.0000	7.8699"-04	0.0000"+00	0.0821	9.8475"-04	5.1746"+02	2.8892"+02
53010401	2.5400	1.0000	1.2170"+03	2.4200"-03	4.2269	1.5229	1.9065"+03	1.9065"+03
5.4559"-01	3.4664"+04	1.0000	2.3359"+03	NM	1.7851	1.7610	2.8818"+02	1.3365"+02
INFINITE	3.0411"+02	0.0000	7.4744"-04	0.0000"+00	0.1046	1.0617"-03	5.8876"+02	2.8818"+02
53010501	2.5680	1.0000	3.5017"+03	1.8100"-03	4.2135	1.4698	5.2657"+03	5.2657"+03
5.4559"-01	9.9991"+04	1.0000	6.7021"+03	NM	1.7910	1.7741	2.9062"+02	1.3320"+02
INFINITE	3.0089"+02	0.0000	7.7343"-04	0.0000"+00	0.1059	1.1035"-03	5.9424"+02	2.9062"+02
53010601	2.5780	1.0000	5.4630"+03	1.6600"-03	4.2558	1.4841	9.0560"+03	9.0560"+03
5.4559"-01	1.7465"+05	1.0000	1.0590"+04	NM	1.7903	1.7728	2.9683"+02	1.3548"+02
INFINITE	3.1556"+02	0.0000	7.1645"-04	0.0000"+00	0.1063	1.0252"-03	6.0162"+02	2.9683"+02
53010701	3.6900	1.0000	7.5974"+02	2.1100"-03	7.0550	1.4845	7.8984"+02	7.8984"+02
5.4559"-01	7.8060"+04	1.0000	2.2015"+03	NM	1.8105	1.7836	2.8334"+02	8.2366"+01
INFINITE	3.0667"+02	0.0000	6.0025"-04	0.0000"+00	0.1383	1.0585"-03	6.7144"+02	2.8334"+02
53010801	3.7010	1.0000	1.4842"+03	1.6200"-03	7.1536	1.4803	1.3580"+03	1.3580"+03
5.4559"-01	1.3732"+05	1.0000	4.4608"+03	NM	1.7980	1.7657	2.8792"+02	8.3345"+01
INFINITE	3.1167"+02	0.0000	6.9261"-04	0.0000"+00	0.1370	1.2821"-03	6.7744"+02	2.8792"+02
53010901	3.6970	1.0000	2.7295"+03	1.3800"-03	7.1461	1.4754	2.8372"+03	2.8372"+03
5.4559"-01	2.8531"+05	1.0000	8.1884"+03	NM	1.7966	1.7689	2.8845"+02	8.3626"+01
INFINITE	3.1222"+02	0.0000	6.1225"-04	0.0000"+00	0.1368	1.1394"-03	6.7784"+02	2.8845"+02
53011001	4.5120	1.0000	8.8021"+02	1.4800"-03	10.0077	1.5506	6.7166"+02	6.7166"+02
5.4559"-01	1.9732"+05	1.0000	3.5747"+03	NM	1.8101	1.7692	2.8106"+02	6.0467"+01
INFINITE	3.0667"+02	0.0000	5.6944"-04	0.0000"+00	0.1511	1.2502"-03	7.0346"+02	2.8106"+02
53011101	4.5540	1.0000	1.6029"+03	1.2200"-03	10.0634	1.5002	1.2578"+03	1.2578"+03
5.4559"-01	3.8930"+05	1.0000	6.6012"+03	NM	1.8067	1.7632	2.8199"+02	5.9788"+01
INFINITE	3.0778"+02	0.0000	5.4696"-04	0.0000"+00	0.1514	1.2210"-03	7.0601"+02	2.8199"+02
53011201	4.5450	1.0000	1.2883"+03	1.3100"-03	9.8558	1.4542	1.3111"+03	1.3111"+03
5.4229"-01	4.0130"+05	1.0000	5.2739"+03	NM	1.8232	1.7820	2.8557"+02	6.0737"+01
INFINITE	3.1167"+02	0.0000	4.3013"-04	0.0000"+00	0.1527	9.1890"-04	7.1018"+02	2.8557"+02
53011301	4.5040	1.0000	7.7640"+02	1.5500"-03	9.8867	1.5498	1.3797"+03	1.3797"+03
2.6289"-01	4.0130"+05	1.0000	3.1290"+03	NM	1.8259	1.7826	2.8719"+02	6.1958"+01
INFINITE	3.1333"+02	0.0000	2.5216"-04	0.0000"+00	0.1523	5.2867"-04	7.1081"+02	2.8719"+02
53011302	4.5440	1.0000	1.3530"+03	1.2600"-03	9.8612	1.4468	1.3171"+03	1.3171"+03
5.4229"-01	4.0263"+05	1.0000	5.5323"+03	NM	1.8186	1.7795	2.8659"+02	6.0975"+01
INFINITE	3.1278"+02	0.0000	4.5190"-04	0.0000"+00	0.1523	9.7838"-04	7.1142"+02	2.8659"+02

53010401 COLES PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	T0/T0D	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.94141	0.00000	0.00000	2.15615	0.00000
2	6.0706E-04	2.1417E+00	NM	0.96098	0.43442	0.57795	1.76594	0.32654
3	6.8580E-04	2.3493E+00	NM	0.96322	0.46447	0.61016	1.72571	0.35357
4	7.5946E-04	2.4834E+00	NM	0.96459	0.48257	0.62897	1.69876	0.37025
5	8.5344E-04	2.6732E+00	NM	0.96643	0.50685	0.65348	1.66242	0.39309
6	9.6520E-04	2.8365E+00	NM	0.96794	0.52662	0.67289	1.63265	0.41215
7	1.1024E-03	3.0020E+00	NM	0.96940	0.54584	0.69124	1.60372	0.43102
8	1.2598E-03	3.1644E+00	NM	0.97079	0.56397	0.70810	1.57644	0.44918
9	1.4529E-03	3.3313E+00	NM	0.97215	0.58194	0.72439	1.54947	0.46751
10	1.6840E-03	3.5102E+00	NM	0.97356	0.60055	0.74081	1.52165	0.48685
11	1.9710E-03	3.7050E+00	NM	0.97504	0.62021	0.75769	1.49242	0.50768
12	2.3063E-03	3.9229E+00	NM	0.97662	0.64126	0.77520	1.46136	0.53046
13	2.7127E-03	4.1770E+00	NM	0.97833	0.66501	0.79431	1.42669	0.55675
14	3.2004E-03	4.5012E+00	NM	0.98050	0.69407	0.81678	1.38485	0.58980
15	3.7897E-03	4.9180E+00	NM	0.98304	0.72965	0.84294	1.33464	0.63158
16	4.4856E-03	5.3868E+00	NM	0.98569	0.76764	0.86931	1.28244	0.67786
17	5.3391E-03	5.9839E+00	NM	0.98877	0.81333	0.89903	1.22168	0.73590
18	6.3678E-03	6.7234E+00	NM	0.99219	0.86663	0.93099	1.15406	0.80671
19	7.5641E-03	7.5303E+00	NM	0.99552	0.92116	0.96101	1.08840	0.88296
20	9.0576E-03	8.2928E+00	NM	0.99833	0.96984	0.98567	1.03291	0.95427
21	1.0813E-02	8.7058E+00	NM	0.99974	0.99521	0.99777	1.00516	0.99265
D 22	1.2974E-02	8.7851E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD, TW=TR, VAN DRIEST

53010601 COLES PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	T0/T0D	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.94065	0.00000	0.00000	2.19098	0.00000
2	6.0706E-04	2.3774E+00	NM	0.96274	0.46144	0.61003	1.74777	0.34904
3	6.8580E-04	2.5070E+00	NM	0.96405	0.47952	0.62785	1.72151	0.36471
4	7.5946E-04	2.6098E+00	NM	0.96505	0.49154	0.64115	1.70140	0.37684
5	8.5344E-04	2.7351E+00	NM	0.96623	0.50685	0.65650	1.67768	0.39132
6	9.6520E-04	2.8542E+00	NM	0.96732	0.52092	0.67032	1.65584	0.40482
7	1.1024E-03	2.9743E+00	NM	0.96856	0.53693	0.68571	1.63098	0.42043
8	1.2598E-03	3.1534E+00	NM	0.96991	0.55447	0.70218	1.60376	0.43783
9	1.4529E-03	3.3175E+00	NM	0.97126	0.57193	0.71816	1.57673	0.45547
10	1.6840E-03	3.4864E+00	NM	0.97260	0.58930	0.73366	1.54993	0.47335
11	1.9710E-03	3.6907E+00	NM	0.97415	0.60960	0.75127	1.51879	0.49465
12	2.3063E-03	3.9161E+00	NM	0.97578	0.63117	0.76940	1.48595	0.51778
13	2.7127E-03	4.1814E+00	NM	0.97762	0.65561	0.78922	1.44915	0.54461
14	3.2004E-03	4.5076E+00	NM	0.97975	0.68439	0.81163	1.40643	0.57709
15	3.7697E-03	5.0088E+00	NM	0.98275	0.72630	0.84251	1.34560	0.62612
16	4.4856E-03	5.4501E+00	NM	0.98523	0.76123	0.86671	1.29633	0.66859
17	5.3391E-03	6.1291E+00	NM	0.98867	0.81197	0.89953	1.22730	0.73293
18	6.3678E-03	7.0077E+00	NM	0.99261	0.87316	0.93567	1.14830	0.81483
19	7.5641E-03	8.0149E+00	NM	0.99654	0.93835	0.97040	1.06947	0.90737
20	9.0576E-03	8.8162E+00	NM	0.99930	0.98711	0.99405	1.01412	0.98021
D 21	1.0813E-02	9.0349E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD, TW=TR, VAN DRIEST

53011101 COLES PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	T0/T0D	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.91620	0.00000	0.00000	4.71641	0.00000
2	6.0706E-04	2.7086E+00	NM	0.94088	0.28512	0.54264	3.62210	0.14981
3	6.8580E-04	3.0661E+00	NM	0.94399	0.30048	0.57581	3.48423	0.16526
4	7.5946E-04	3.3581E+00	NM	0.94633	0.32616	0.59964	3.38011	0.17740
5	8.5344E-04	3.7037E+00	NM	0.94892	0.34581	0.62488	3.26527	0.19137
6	9.6520E-04	4.0511E+00	NM	0.95134	0.36441	0.64758	3.15784	0.20507
7	1.1024E-03	4.3925E+00	NM	0.95357	0.38176	0.66774	3.05934	0.21826
8	1.2598E-03	4.7274E+00	NM	0.95561	0.39801	0.68577	2.96866	0.23100
9	1.4529E-03	5.0855E+00	NM	0.95766	0.41460	0.70341	2.87757	0.24445
10	1.6840E-03	5.4176E+00	NM	0.95946	0.42950	0.71845	2.79810	0.25676
11	1.9710E-03	5.8115E+00	NM	0.96146	0.44645	0.73487	2.70942	0.27123
12	2.3063E-03	6.2439E+00	NM	0.96351	0.46433	0.75135	2.61841	0.28695
13	2.7127E-03	6.7743E+00	NM	0.96584	0.48534	0.76966	2.51488	0.30604
14	3.2004E-03	7.4601E+00	NM	0.96860	0.51120	0.79071	2.39265	0.33049
15	3.7897E-03	8.4107E+00	NM	0.97200	0.54501	0.81601	2.24175	0.36401
16	4.4856E-03	9.5832E+00	NM	0.97565	0.58399	0.84225	2.08005	0.40492
17	5.3391E-03	1.1261E+01	NM	0.98003	0.63559	0.87277	1.88555	0.46287
18	6.3678E-03	1.3570E+01	NM	0.98489	0.70063	0.90539	1.66994	0.54217
19	7.5641E-03	1.6033E+01	NM	0.98982	0.77303	0.93731	1.45136	0.64582
20	9.0576E-03	2.0828E+01	NM	0.99481	0.87321	0.96853	1.23023	0.78727
21	1.0813E-02	2.5168E+01	NM	0.99859	0.96181	0.99152	1.06274	0.93299
D 22	1.2974E-02	2.7160E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD, TW=TR, VAN DRIEST

53011201 COLES PROFILE TABULATION 19 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.91627	0.00000	0.00000	4.70174	0.00000
2	4.4704"-04	2.8424"+00	NM	0.94214	0.29470	0.55587	3.55792	0.15624
3	5.1054"-04	3.1426"+00	NM	0.94468	0.31384	0.58255	3.44552	0.16907
4	6.0706"-04	3.5724"+00	NM	0.94803	0.33916	0.61589	3.29760	0.18677
5	7.2644"-04	4.0962"+00	NM	0.95171	0.36748	0.65063	3.13471	0.20756
6	8.7884"-04	4.6691"+00	NM	0.95533	0.39602	0.68303	2.97476	0.22961
7	1.0541"-03	5.2658"+00	NM	0.95872	0.42362	0.71202	2.82505	0.25204
8	1.2700"-03	5.8846"+00	NM	0.96188	0.45041	0.73807	2.68521	0.27487
9	1.5240"-03	6.4873"+00	NM	0.96467	0.47503	0.76032	2.56184	0.29679
10	1.8440"-03	7.0740"+00	NM	0.96715	0.49779	0.77953	2.45230	0.31788
11	2.2276"-03	7.7659"+00	NM	0.96981	0.52335	0.79966	2.33464	0.34252
12	3.2715"-03	9.8461"+00	NM	0.97646	0.59354	0.84767	2.04060	0.41550
13	3.9675"-03	1.1443"+01	NM	0.98053	0.64220	0.87604	1.86082	0.47078
14	4.7955"-03	1.3545"+01	NM	0.98490	0.70111	0.90536	1.66752	0.54294
15	5.7861"-03	1.6216"+01	NM	0.98930	0.76944	0.93390	1.47318	0.63394
16	7.0383"-03	2.0065"+01	NM	0.99409	0.85838	0.96405	1.26136	0.76430
17	8.5217"-03	2.4478"+01	NM	0.99813	0.95017	0.98875	1.08285	0.91309
18	1.0358"-02	2.6954"+01	NM	0.99993	0.99795	0.99956	1.00324	0.99633
D 19	1.2593"-02	2.7063"+01	NM	1.00003	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD, TW=TR, VAN DRIEST

53011301 COLES PROFILE TABULATION 17 POINTS, DELTA AT POINT 17

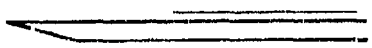
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.91656	0.00000	0.00000	4.63525	0.00000
2	4.4196"-04	3.4425"+00	NM	0.94736	0.33475	0.60751	3.29359	0.18445
3	5.2070"-04	3.9682"+00	NM	0.95116	0.36406	0.64390	3.12807	0.20585
4	6.1722"-04	4.5716"+00	NM	0.95505	0.39488	0.67918	2.95835	0.22958
5	7.3660"-04	5.2670"+00	NM	0.95904	0.42753	0.71346	2.78482	0.25620
6	8.8900"-04	6.0906"+00	NM	0.96318	0.46316	0.74744	2.60435	0.28700
7	1.0643"-03	6.9934"+00	NM	0.96714	0.49923	0.77853	2.43190	0.32013
8	1.2802"-03	7.9683"+00	NM	0.97086	0.53544	0.80667	2.26971	0.35541
9	1.5342"-03	8.9426"+00	NM	0.97411	0.56928	0.83047	2.12812	0.39024
10	1.8542"-03	9.9814"+00	NM	0.97715	0.60326	0.85216	1.99541	0.42706
11	2.2377"-03	1.1345"+01	NM	0.98062	0.64515	0.87619	1.84445	0.47504
12	2.7076"-03	1.3193"+01	NM	0.98455	0.69789	0.90269	1.67305	0.53955
13	3.2817"-03	1.5642"+01	NM	0.98876	0.76216	0.93022	1.48964	0.62446
14	3.9776"-03	1.8987"+01	NM	0.99321	0.84202	0.95847	1.29570	0.73973
15	4.8057"-03	2.2968"+01	NM	0.99720	0.92817	0.98310	1.12186	0.87631
16	5.7963"-03	2.5811"+01	NM	0.99945	0.98507	0.99672	1.02379	0.97356
D 17	7.0485"-03	2.6585"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD, TW=TR, VAN DRIEST

53011302 COLES PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.91627	0.00000	0.00000	4.70011	0.00000
2	4.2418"-04	2.6565"+00	NM	0.94047	0.28215	0.53761	3.63069	0.14807
3	5.0292"-04	2.9936"+00	NM	0.94345	0.30458	0.56973	3.49907	0.16282
4	5.9944"-04	3.4143"+00	NM	0.94684	0.33017	0.60423	3.34921	0.18041
5	7.1882"-04	3.8956"+00	NM	0.95036	0.35700	0.63801	3.19395	0.19975
6	8.7122"-04	4.4317"+00	NM	0.95389	0.38455	0.67025	3.03789	0.22063
7	1.0465"-03	4.9900"+00	NM	0.95720	0.41119	0.69910	2.89128	0.24183
8	1.2624"-03	5.5668"+00	NM	0.96031	0.43696	0.72518	2.75425	0.26330
9	1.5164"-03	6.1128"+00	NM	0.96298	0.45999	0.74686	2.63618	0.28331
10	1.8364"-03	6.6033"+00	NM	0.96545	0.48208	0.76635	2.52709	0.30325
11	2.2200"-03	7.2861"+00	NM	0.96800	0.50588	0.78601	2.41413	0.32559
12	2.6899"-03	8.1085"+00	NM	0.97104	0.53567	0.80879	2.27971	0.35478
13	3.2639"-03	9.2170"+00	NM	0.97464	0.57336	0.83495	2.12064	0.39372
14	3.9599"-03	1.0685"+01	NM	0.97870	0.61972	0.86347	1.94136	0.44478
15	4.7879"-03	1.2663"+01	NM	0.98319	0.67717	0.89399	1.74288	0.51294
16	5.7705"-03	1.5270"+01	NM	0.98787	0.74613	0.92473	1.53604	0.60202
17	7.0307"-03	1.8989"+01	NM	0.99290	0.83466	0.95667	1.31373	0.72821
18	8.5141"-03	2.3620"+01	NM	0.99744	0.93322	0.98460	1.11312	0.88453
19	1.0350"-02	2.6942"+01	NM	0.99993	0.99795	0.99956	1.00324	0.99633
D 20	1.2586"-02	2.7051"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD, TW=TR, VAN DRIEST



M : 1.7 - 2.5
R THETA X 10^{-3} : 6 - 21
TW / TR : 1.0

5501

ZPG - AW

Continuous wind tunnel with fixed symmetrical interchangeable nozzles. W = 0.48, H = 0.7, L = 1.0 m.
0.18 < PO < 0.3 MN/m^2. TO : 340 K. Air. RE/m X 10^{-6} : 25.

SHUTTS W.H., HARTWIG W.H. and WEILER J.E., 1955. Final report on turbulent boundary layer and skin friction measurements on a smooth, thermally insulated flat plate at supersonic speeds. DRL 364.

1 The test boundary layer was formed on the upper surface of a flat plate model 0.482 m wide (spanning the
tunnel) and 0.914 m long. The sharp leading edge (X = 0) was chamfered at 6.7° on the underside. Provision
was made for eight instrument stations (d = 33.4 mm) in which balances, traverse gear, or blanking plugs
could be placed. These were at 101.6 mm intervals along the centre line, the first being centred at
X = 147 mm. The surface was machined and polished so that irregularities were less than 2.5 μm. The surface
2 was not actively cooled, and was allowed to reach an equilibrium temperature during tests. Mach number
variation over the test region of the plate was up to 4 % in some cases, due to irregularity of the nozzle
3 walls or reflection of leading edge disturbances. For most tests a boundary layer trip consisting of a
2.54 mm wide band of No 100 Aloxite grit was bonded to the plate transverse to the flow direction 23 mm
behind the leading edge. For profile 0401 there was no trip, while for series 02 a second trip, identical
to the first, was mounted 124 mm from the leading edge. Transition occured ahead of the first measuring
station "even for the smooth plate".

6 Static pressure was measured at 50.8 mm intervals on the centre line of the plate starting at X = 70.6 mm.
The static pressure was measured in separate runs, with no traverse gear mounted. Wall shear stress was
measured, also in separate runs, using balances developed by Weiler & Hartwig (1952). The balance elements
7 were 25.4 mm in diameter. Pitot profiles were obtained with a CPP the tip of which consisted of tubing for
which d_1 = 0.508, d_2 = 0.254 mm. Over the first 0.508 mm, the outer surface was ground down to meet the
inner diameter, providing a sharp lip. After about 15 [E] diameters, the fine tube was cranked up and held
in progressively larger sleeving tubes which were attached to a movable double wedge traverse strut. The
8 profile normal was 55.3 mm ahead of the centre of the measuring station.

9 The authors have interpolated the static pressure readings to the positions of the profile measurements and
assumed that static pressure did not vary through the boundary layer. They reduced the profiles assuming
10 constant total temperature. No probe corrections were applied and viscosity was found from the Sutherland
11 formula.

12 The flat plate could be mounted at small angles of positive and negative incidence, so as to provide a
further small range of Mach number variation. The editors have presented only those measurements made at
zero incidence, half the total. When the plate was mounted at incidence, the leading edge disturbance was
relatively strong, and at M = 1.73 impinged on the plate about 2/3 of the way back from the leading edge,
giving rise to sharp variations in local Mach number etc. The editors have interpolated the CF values to
the X values of the profiles. The author's assumption of isoenergetic flow has been replaced by the
13 Crocco / Van Driest temperature velocity correlation. The profiles presented were measured at a near
constant unit Reynolds' number. The series are distinguished by Mach number and tripping arrangements.
Those profiles indicated by a star were obtained with extra screens in the settling chamber. The series are:

at M = 1.73	- series 01	-	one trip
M = 2.00	02	-	two trips
	03	-	one trip
	04	-	no trips
M = 2.23	05	-	one trip

M = 2.5 - series 06 - one trip
$0602^+/3^+$ with extra screens.

14 An interpolated CF value is given for each profile, but the values for $0602^+/3^+$ were measured without the extra screens.

§ DATA: 5501 0101-0604. Pitot profiles. NX = 3-5. CF measured by an FEB separately.

15 Editors' comments

The entry describes an early, and much quoted, set of systematic flat plate measurements. The authors made a careful investigation of the inaccuracies arising from misalignment of the floating elements, and compared several balances with each other. The authors state that the measured CF values are, on average, 6 - 9 % less than the "theoretical" prediction of Fenter (1955). Our log-law plots show that the CF values are low, as compared to Van Driest values, for about half the measured profiles.

The profiles contain relatively few data-points, and in only one case do measurements extend within the momentum-deficit peak. Profiles 0401/0502/0602/0604 show marked disturbances in the inner region, while the outer region of 0301 seems irregular.

The tests should be compared with the roughly contemporary work of Coles - CAT 5301 and the later work of Mabey et al. - CAT 7402 and Hastings & Sawyer - CAT 7006.

CAT 5501 SHUTTS /H /W BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD* TOD*	TW/TR* PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW UD	PD TD TR
55010101	1.7240	1.0000	4.2224"+03	2.2400"-03	2.6775	1.4546	3.6608"+04	3.6608"+04
1.9303"-01	1.8737"+05	1.0000	5.9278"+03	NM	1.8109	1.8042	3.2541"+02	2.1232"+02
INFINITE	3.3853"+02	0.0000	2.7512"-04	0.0000"+00	0.0702	3.2397"-04	5.0367"+02	3.2541"+02
55010102	1.8020	1.0000	8.7071"+03	1.9600"-03	2.6812	1.3614	3.3074"+04	3.3074"+04
3.9624"-01	1.9062"+05	1.0000	1.2554"+04	NM	1.8068	1.7987	3.2467"+02	2.0524"+02
INFINITE	3.3853"+02	0.0000	5.8963"-04	0.0000"+00	0.0740	7.0584"-04	5.1760"+02	3.2467"+02
55010103	1.7260	1.0000	1.4276"+04	1.7800"-03	2.5051	1.3096	3.7229"+04	3.7229"+04
8.0263"-01	1.9113"+05	1.0000	2.0055"+04	NM	1.8180	1.8113	3.2539"+02	2.1214"+02
INFINITE	3.3853"+02	0.0000	9.1313"-04	0.0000"+00	0.0706	1.0700"-03	5.0403"+02	3.2539"+02
55010201	2.0230	1.0000	3.8713"+03	1.9400"-03	3.1433	1.4598	2.9013"+04	2.9013"+04
1.9303"-01	2.3529"+05	1.0000	6.0357"+03	NM	1.8128	1.8046	3.2269"+02	1.8616"+02
INFINITE	3.3853"+02	0.0000	2.5236"-04	0.0000"+00	0.0849	3.1356"-04	5.5341"+02	3.2269"+02
55010202	2.0360	1.0000	1.0407"+04	1.7400"-03	2.9929	1.3294	2.8730"+04	2.8730"+04
5.9945"-01	2.3776"+05	1.0000	1.6302"+04	NM	1.8234	1.8145	3.2257"+02	1.8509"+02
INFINITE	3.3853"+02	0.0000	6.7857"-04	0.0000"+00	0.0860	8.3631"-04	5.5536"+02	3.2257"+02
55010203	2.0200	1.0000	1.3607"+04	1.5600"-03	2.9129	1.2899	2.9447"+04	2.9447"+04
8.0263"-01	2.3769"+05	1.0000	2.1192"+04	NM	1.8322	1.8251	3.2271"+02	1.8641"+02
INFINITE	3.3853"+02	0.0000	8.7589"-04	0.0000"+00	0.0856	1.0683"-03	5.5296"+02	3.2271"+02
55010301	2.0170	1.0000	3.8671"+03	2.0300"-03	3.1431	1.4683	2.9412"+04	2.9412"+04
1.9303"-01	2.3630"+05	1.0000	6.0159"+03	NM	1.8125	1.8033	3.2274"+02	1.8666"+02
INFINITE	3.3853"+02	0.0000	2.4976"-04	0.0000"+00	0.0846	3.0989"-04	5.5251"+02	3.2274"+02
55010302	1.9960	1.0000	7.1117"+03	1.7900"-03	2.9777	1.3685	3.0507"+04	3.0507"+04
3.9624"-01	2.3722"+05	1.0000	1.0980"+04	NM	1.8230	1.6156	3.2292"+02	1.8841"+02
INFINITE	3.3853"+02	0.0000	4.4979"-04	0.0000"+00	0.0841	5.5093"-04	5.4931"+02	3.2292"+02
55010303	2.0000	1.0000	1.2138"+04	1.6400"-03	2.9280	1.3219	3.0071"+04	3.0071"+04
8.0263"-01	2.3529"+05	1.0000	1.8767"+04	NM	1.8206	1.8123	3.2289"+02	1.8807"+02
INFINITE	3.3853"+02	0.0000	7.7649"-04	0.0000"+00	0.0842	9.5332"-04	5.4993"+02	3.2289"+02
55010401	2.0050	1.0000	8.1812"+03	1.8200"-03	2.9418	1.3356	2.9760"+04	2.9760"+04
3.9624"-01	2.3468"+05	1.0000	1.2672"+04	NM	1.8338	1.8255	3.2284"+02	1.8766"+02
INFINITE	3.3853"+02	0.0000	5.2687"-04	0.0000"+00	0.0850	6.3937"-04	5.5069"+02	3.2284"+02
55010501	2.2490	1.0000	3.5727"+03	1.9600"-03	3.5022	1.4319	2.2292"+04	2.2292"+04
1.9303"-01	2.5737"+05	1.0000	6.0529"+03	NM	1.8174	1.8105	3.2083"+02	1.6829"+02
INFINITE	3.3853"+02	0.0000	2.5810"-04	0.0000"+00	0.0951	3.3434"-04	5.8496"+02	3.2083"+02
55010502	2.2420	1.0000	4.8797"+03	1.7800"-03	3.4355	1.3936	2.2345"+04	2.2345"+04
2.9465"-01	2.5516"+05	1.0000	8.2457"+03	NM	1.8187	1.8094	3.2088"+02	1.6882"+02
INFINITE	3.3853"+02	0.0000	3.5338"-04	0.0000"+00	0.0948	4.5577"-04	5.8406"+02	3.2088"+02
55010503	2.2360	1.0000	6.4676"+03	1.6800"-03	3.3771	1.3583	2.2511"+04	2.2511"+04
3.9624"-01	2.5466"+05	1.0000	1.0904"+04	NM	1.8194	1.8091	3.2093"+02	1.6927"+02
INFINITE	3.3853"+02	0.0000	4.6685"-04	0.0000"+00	0.0946	6.0043"-04	5.8328"+02	3.2093"+02
55010504	2.2440	1.0000	1.2299"+04	1.6230"-03	3.3542	1.3268	2.2142"+04	2.2142"+04
8.0263"-01	2.5364"+05	1.0000	2.0797"+04	NM	1.8139	1.8014	3.2087"+02	1.6867"+02
INFINITE	3.3853"+02	0.0000	8.9756"-04	0.0000"+00	0.0947	1.1618"-03	5.8432"+02	3.2087"+02
55010601	2.5020	1.0000	3.2766"+03	1.5050"-03	4.1376	1.5177	1.6838"+04	1.6838"+04
1.9303"-01	2.8059"+05	1.0000	6.1082"+03	NM	1.7868	1.7629	3.1896"+02	1.5033"+02
INFINITE	3.3853"+02	0.0000	2.6505"-04	0.0000"+00	0.1033	3.7256"-04	6.1505"+02	3.1896"+02
55010602	2.5330	1.0000	4.9439"+03	1.6100"-03	3.9038	1.3366	1.5999"+04	1.5999"+04
3.9624"-01	2.5774"+05	1.0000	9.3263"+03	NM	1.8328	1.8227	3.1875"+02	1.4827"+02
INFINITE	3.3853"+02	0.0000	4.1269"-04	0.0000"+00	0.1071	5.5469"-04	6.1840"+02	3.1875"+02
55010602*	2.5150	1.0000	4.8131"+03	1.6100"-03	3.9010	1.3552	1.5616"+04	1.5616"+04
3.9624"-01	2.7311"+05	1.0000	9.0174"+03	NM	1.8256	1.8144	3.1887"+02	1.4946"+02
INFINITE	3.3053"+02	0.0000	4.1635"-04	0.0000"+00	0.1060	5.6277"-04	6.1647"+02	3.1887"+02
55010603*	2.4160	1.0000	8.8864"+03	1.5600"-03	3.6614	1.3176	1.8360"+04	1.8360"+04
5.9945"-01	2.7521"+05	1.0000	1.6033"+04	NM	1.8199	1.8090	3.1957"+02	1.5619"+02
INFINITE	3.3853"+02	0.0000	6.9694"-04	0.0000"+00	0.1019	9.2982"-04	6.0539"+02	3.1957"+02
55010604	2.4510	1.0000	1.0348"+04	1.5600"-03	3.6873	1.2963	1.8165"+04	1.8165"+04
8.0263"-01	2.8757"+05	1.0000	1.8920"+04	NM	1.8310	1.8176	3.1932"+02	1.5378"+02
INFINITE	3.3853"+02	0.0000	8.0179"-04	0.0000"+00	0.1039	1.0615"-03	6.0939"+02	3.1932"+02

55010501 SHUTTS /H /W PROFILE TABULATION 17 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94770	0.00000	0.00000	1.90639	0.00000
2	2.2860"-04	2.4574"+00	NM	0.97077	0.54113	0.66419	1.50654	0.44087
3	2.7940"-04	2.5021"+00	NM	0.97122	0.54780	0.67063	1.49874	0.44746
4	3.3274"-04	2.6816"+00	NM	0.97297	0.57359	0.69508	1.46848	0.47333
5	4.3180"-04	2.7719[illegible]	NM	0.97381	0.58604	0.70661	1.45383	0.48604
6	5.3594"-04	3.073[illegible]	NM	0.97650	0.62561	0.74213	1.40719	0.52739
7	6.8326"-04	3.249[illegible]	NM	0.97798	0.64740	0.76095	1.38155	0.55079
8	8.3820"-04	3.466[illegible]	NM	0.97973	0.67319	0.78256	1.35132	0.57910
9	9.8806"-04	3.716[illegible]	NM	0.98164	0.70165	0.80558	1.31819	0.61112
10	1.2446"-03	4.1336"+00	NM	0.98462	0.74655	0.84018	1.26656	0.66336
11	1.6256"-03	4.3989"+00	NM	0.98639	0.77368	0.86010	1.23587	0.69594
12	2.0066"-03	5.3183"+00	NM	0.99190	0.86083	0.91920	1.14042	0.80609
13	2.3851"-03	6.0051"+00	NM	0.99548	0.92041	0.95579	1.07837	0.88633
14	2.7661"-03	6.5040"+00	NM	0.99784	0.96132	0.97914	1.03742	0.94382
15	3.4061"-03	6.9730"+00	NM	0.99990	0.99822	0.99907	1.00169	0.99738
16	4.0386"-03	6.9961"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 17	4.6761"-03	6.9961"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55010502 SHUTTS /H /W PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94786	0.00000	0.00000	1.90076	0.00000
2	2.2860"-04	2.5384"+00	NM	0.97175	0.55486	0.67686	1.48809	0.45485
3	3.0226"-04	2.6816"+00	NM	0.97313	0.57535	0.69622	1.46414	0.47551
4	3.8100"-04	2.8145"+00	NM	0.97437	0.59367	0.71308	1.44274	0.49425
5	5.3848"-04	2.9729"+00	NM	0.97579	0.61463	0.73195	1.41818	0.51612
6	7.3660"-04	3.1340"+00	NM	0.97719	0.63515	0.74995	1.39416	0.53792
7	9.9314"-04	3.4665"+00	NM	0.97990	0.67529	0.78384	1.34733	0.58177
8	1.2421"-03	3.7045"+00	NM	0.98172	0.70250	0.80583	1.31583	0.61241
9	1.6281"-03	4.1465"+00	NM	0.98488	0.75022	0.84256	1.26131	0.66801
10	2.1361"-03	4.6101"+00	NM	0.98791	0.79706	0.87638	1.20844	0.72491
11	2.7737"-03	5.3629"+00	NM	0.99231	0.86753	0.92334	1.13281	0.81509
12	3.4036"-03	6.0636"+00	NM	0.99594	0.92819	0.96023	1.07023	0.89722
13	4.0437"-03	6.6209"+00	NM	0.99854	0.97368	0.98589	1.02523	0.96163
14	5.3111"-03	6.9442"+00	NM	0.99995	0.99911	0.99953	1.00085	0.99869
15	6.5786"-03	6.9557"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 16	7.8486"-03	6.9557"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55010503 SHUTTS /H /W PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94800	0.00000	0.00000	1.89595	0.00000
2	2.2860"-04	2.3671"+00	NM	0.97015	0.53041	0.65270	1.51426	0.43104
3	2.7940"-04	2.4483"+00	NM	0.97099	0.54293	0.66492	1.49983	0.44333
4	3.8354"-04	2.6217"+00	NM	0.97270	0.56843	0.68925	1.47031	0.46878
5	5.3086"-04	2.7491"+00	NM	0.97391	0.58631	0.70590	1.44951	0.48699
6	7.8740"-04	3.0246"+00	NM	0.97639	0.62299	0.73891	1.40677	0.52525
7	1.0414"-03	3.2570"+00	NM	0.97836	0.65206	0.76403	1.37294	0.55649
8	1.4199"-03	3.5473"+00	NM	0.98067	0.68649	0.79262	1.33307	0.59458
9	1.8009"-03	3.8497"+00	NM	0.98293	0.72048	0.81961	1.29409	0.63335
10	2.4409"-03	4.3945"+00	NM	0.98667	0.77773	0.86240	1.22960	0.70137
11	3.0759"-03	4.9118"+00	NM	0.98989	0.82826	0.89752	1.17422	0.76435
12	4.3409"-03	5.9628"+00	NM	0.99557	0.92218	0.95661	1.07606	0.88899
13	5.6134"-03	6.7334"+00	NM	0.99919	0.98524	0.99213	1.01404	0.97840
14	8.1559"-03	6.9041"+00	NM	0.99993	0.99866	0.99929	1.00127	0.99803
15	1.0698"-02	6.9098"+00	NM	0.99995	0.99911	0.99953	1.00085	0.99868
D 16	1.3233"-02	6.9213"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55010504 SHUTTS /H /W PROFILE TABULATION 25 POINTS, DELTA AT POINT 24

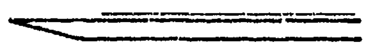
I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.94782	0.00000	0.00000	1.90237	0.00000
2	2.2860E-04	2.1174E+00	NM	0.96724	0.48752	0.61017	1.56641	0.38953
3	2.7940E-04	2.1200E+00	NM	0.96727	0.48797	0.61062	1.56591	0.38995
4	3.2766E-04	2.1123E+00	NM	0.96719	0.48663	0.60925	1.56743	0.38869
5	4.3180E-04	2.1123E+00	NM	0.96719	0.48663	0.60925	1.56743	0.38869
6	5.3594E-04	2.1123E+00	NM	0.96719	0.48663	0.60925	1.56743	0.38869
7	6.8326E-04	2.3077E+00	NM	0.96934	0.51916	0.64221	1.53020	0.41969
8	8.3820E-04	2.5263E+00	NM	0.97158	0.55258	0.67484	1.49142	0.45248
9	1.0439E-03	2.8778E+00	NM	0.97490	0.60160	0.72043	1.43403	0.50238
10	1.2421E-03	2.8344E+00	NM	0.97451	0.59581	0.71518	1.44083	0.49637
11	1.4986E-03	3.0597E+00	NM	0.97650	0.62522	0.74144	1.40631	0.52722
12	1.7526E-03	3.2937E+00	NM	0.97847	0.65419	0.76637	1.37238	0.55843
13	2.1361E-03	3.4208E+00	NM	0.97949	0.66934	0.77906	1.35470	0.57508
14	2.5146E-03	3.5589E+00	NM	0.98057	0.68538	0.79221	1.33604	0.59296
15	3.1496E-03	3.8293E+00	NM	0.98259	0.71569	0.81633	1.30103	0.62745
16	3.7846E-03	4.0911E+00	NM	0.98445	0.74376	0.83783	1.26895	0.66026
17	4.4196E-03	4.3680E+00	NM	0.98631	0.77228	0.85885	1.23676	0.69444
18	5.6871E-03	4.8740E+00	NM	0.98947	0.82175	0.89343	1.18208	0.75581
19	6.9621E-03	5.3928E+00	NM	0.99243	0.86743	0.92460	1.13094	0.81755
20	8.2296E-03	5.8996E+00	NM	0.99508	0.91355	0.95165	1.08515	0.87697
21	1.0767E-02	6.7221E+00	NM	0.99894	0.98084	0.98979	1.01833	0.97197
22	1.3310E-02	6.9327E+00	NM	0.99985	0.99733	0.99859	1.00254	0.99606
23	1.5852E-02	6.9500E+00	NM	0.99993	0.99866	0.99930	1.00127	0.99803
D 24	1.8390E-02	6.9672E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
25	2.0932E-02	6.9615E+00	NM	0.99998	0.99955	0.99977	1.00042	0.99934

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55010602 SHUTTS /H /W PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.94155	0.00000	0.00000	2.14976	0.00000
2	2.2860E-04	2.7948E+00	NM	0.96770	0.52310	0.66893	1.63529	0.40906
3	2.5400E-04	2.8245E+00	NM	0.96797	0.52665	0.67237	1.62997	0.41251
4	3.0480E-04	2.9798E+00	NM	0.96936	0.54481	0.68973	1.60278	0.43033
5	4.0386E-04	3.2680E+00	NM	0.97179	0.57679	0.71924	1.55498	0.46254
6	5.0800E-04	3.4588E+00	NM	0.97331	0.59692	0.73714	1.52500	0.48337
7	6.0706E-04	3.5745E+00	NM	0.97420	0.60876	0.74743	1.50745	0.49582
8	7.6200E-04	3.6371E+00	NM	0.97468	0.61508	0.75284	1.49811	0.50253
9	9.1440E-04	3.8620E+00	NM	0.97633	0.63719	0.77139	1.46560	0.52633
10	1.0668E-03	4.0488E+00	NM	0.97765	0.65495	0.78586	1.43969	0.54585
11	1.3208E-03	4.2152E+00	NM	0.97878	0.67035	0.79809	1.41742	0.56306
12	1.5748E-03	4.5692E+00	NM	0.98107	0.70193	0.82229	1.37233	0.59919
13	1.8263E-03	4.8131E+00	NM	0.98257	0.72286	0.83769	1.34295	0.62377
14	2.2123E-03	5.2149E+00	NM	0.98489	0.75602	0.86108	1.29725	0.66378
15	2.5883E-03	5.5690E+00	NM	0.98681	0.78405	0.87993	1.25953	0.69862
16	2.9718E-03	6.0903E+00	NM	0.98943	0.82353	0.90509	1.20789	0.74932
17	3.4798E-03	6.5595E+00	NM	0.99162	0.85748	0.92550	1.16494	0.79446
18	3.9878E-03	7.0597E+00	NM	0.99378	0.89222	0.94526	1.12243	0.84216
19	4.4933E-03	7.6646E+00	NM	0.99619	0.93249	0.96683	1.07501	0.89937
20	5.1308E-03	8.1643E+00	NM	0.99803	0.96447	0.98299	1.03878	0.94630
21	5.7658E-03	8.5712E+00	NM	0.99944	0.98974	0.99519	1.01104	0.98432
22	6.4033E-03	8.7200E+00	NM	0.99994	0.99882	0.99945	1.00127	0.99818
23	7.1628E-03	8.7330E+00	NM	0.99995	0.99961	0.99982	1.00042	0.99939
D 24	7.9073E-03	8.7395E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

rough 	M : 2 P THETA X 10^{-3} : 11 - 40 TW / TR : 1.0	5502 ZPG (ROUGH) AW

Continuous wind tunnel with fixed symmetrical nozzles. W = 0.48, H = 0.70, L = 1.0 m. 0.18 < PO < 0.3 MN/m^2. TO : 340 K. Air. RE/m X 10^{-6} : 25.

SHUTTS W.H. and FENTER F.W., 1955. Turbulent boundary layer and skin friction measurements on an artificially roughened, thermally insulated flat plate at supersonic speeds. DRL 366.

1- to -11 The experimental arrangements are as for the previous entry, Shutts, Hartwig and Weiler, CAT 5501, in every respect save that the surface of the plate and the floating elements of the shear stress balance was given a coating of grinding compound grit. Small wires were inserted in the static holes during the coating so as to keep them clear. The balance annuli were cleared, and kept clear, with a thin-walled steel tube. The tests reported here used Aloxite grit of 120 and 180 grain. The corresponding mean particle diameters are 162 and 109 μm respectively (the particles are in fact very irregular in shape). The coating was made by spraying the grit into a bonding layer until no more would adhere. The plate was then cured at about 320 K for three hours. "This procedure gave excellent results both from the standpoint of bonding and uniformity".

8, 9, 11, 12 The coordinate Y is measured from the mean top of the roughness, a slip gauge being rested on the surface and contact with the probe found electrically. The static pressure through the boundary layer was assumed constant, and Sutherland's viscosity law was used. The authors' assumption of isoenergetic flow has been replaced by the Crocco / Van Driest temperature-velocity correlation. Additional tests were made at boundary layer edge Mach numbers of 1.62, 1.66, 1.73, 2.10, 2.18 and 2.33 with roughnesses of mean diameter 54 and 141 μm, but since no balance readings were taken in conjunction with these tests, they are not presented here. For the M = 2 series, the editors have interpolated the reported CF values to X-stations corresponding

13 to the velocity profiles. The profiles consist of two sets at a common unit Reynolds number, one for each of the roughness sizes. Series 01 describes the boundary layer with mean roughness diameter of 109 μm, while series 02 describes the 162 μm diameter case. There are, additionally, two profiles, 0301 and 0401, for the

14 162 μm roughness in which the unit Reynolds number has been perturbed by changing the reservoir conditions. CF values are given only for the series 01 and 02.

§ DATA: 5502 0101-0401. Pitot profiles. NX = 5. CF measured with an FEB separately. Roughened surface.

15 Editors' comments

The entry describes one of the very few available experiments in which a boundary layer has developed over a uniformly rough surface. Other relevant tests, also made at the DRL, are those of Fenter & Lyons - CAT 5804 and Young - CAT 6506. A general description of the programme to 1959 is given by Fenter (1960).

The profiles are described in moderate detail, and in most cases measurements extended within the momentum deficit peak. The authors comment that "considerable scatter exists in the skin friction data for rough surfaces. This scatter may be attributed to experimental difficulties; for example, there was a tendency for loosened roughness particles to foul the narrow gaps which surround the floating discs of the skin friction balances." The original paper contains a further 75 profiles without associated CF values.

CAT 5502 SHUTTS /FENTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
55020101	2.0220	1.0000	1.0533"+04	3.2100"-03	3.1490	1.4397	2.9192"+04	2.9192"+04
2.9474"-01	2.3637"+05	1.0000	1.6416"+04	NM	1.7689	1.7542	3.2270"+02	1.8624"+02
INFINITE	3.3853"+02	0.0000	6.8207"-04	0.0000"+00	0.0828	8.7791"-04	5.5326"+02	3.2270"+02
55020102	1.9960	1.0000	1.3719"+04	3.0100"-03	3.0788	1.4181	3.0311"+04	3.0311"+04
3.9624"-01	2.3569"+05	1.0000	2.1182"+04	NM	1.7696	1.7568	3.2292"+02	1.8841"+02
INFINITE	3.3853"+02	0.0000	8.7226"-04	0.0000"+00	0.0816	1.1166"-03	5.4931"+02	3.2292"+02
55020103	2.0130	1.0000	1.6891"+04	2.8700"-03	3.1190	1.4284	2.9816"+04	2.9816"+04
4.9774"-01	2.3806"+05	1.0000	2.6239"+04	NM	1.7678	1.7529	3.2277"+02	1.8699"+02
INFINITE	3.3853"+02	0.0000	1.0780"-03	0.0000"+00	0.0823	1.3851"-03	5.5190"+02	3.2277"+02
55020104	2.0290	1.0000	1.9144"+04	2.7800"-03	3.1174	1.4076	2.9703"+04	2.9703"+04
5.9954"-01	2.4314"+05	1.0000	2.9911"+04	NM	1.7716	1.7573	3.2263"+02	1.8566"+02
INFINITE	3.3853"+02	0.0000	1.2121"-03	0.0000"+00	0.0832	1.5589"-03	5.5431"+02	3.2263"+02
55020105	2.01[illegible]0	1.0000	2.2104"+04	2.7000"-03	3.0657	1.3924	3.0505"+04	3.0505"+04
7.0104"-01	2.4280"+05	1.0000	3.4312"+04	NM	1.7748	1.7612	3.2279"+02	1.8716"+02
INFINITE	3.3853"+02	0.0000	1.3810"-03	0.0000"+00	0.0825	1.7650"-03	5.5160"+02	3.2279"+02
55020201	2.0110	1.0000	8.7365"+03	4.1600"-03	3.2068	1.4890	2.9611"+04	2.9611"+04
1.9294"-01	2.3569"+05	1.0000	1.3562"+04	NM	1.7551	1.7412	3.2279"+02	1.8716"+02
INFINITE	3.3853"+02	0.0000	5.6228"-04	0.0000"+00	0.0816	7.3067"-04	5.5160"+02	3.2279"+02
55020202	2.0020	1.0000	1.4924"+04	3.4200"-03	3.0644	1.4034	3.0115"+04	3.0115"+04
3.9624"-01	2.3637"+05	1.0000	2.3092"+04	NM	1.7765	1.7636	3.2287"+02	1.8791"+02
INFINITE	3.3853"+02	0.0000	9.5075"-04	0.0000"+00	0.0822	1.2117"-03	5.5023"+02	3.2287"+02
55020203	2.0260	1.0000	2.0457"+04	3.0000"-03	3.0532	1.3675	2.9011"+04	2.9011"+04
5.9954"-01	2.3637"+05	1.0000	3.1929"+04	NM	1.7846	1.7725	3.2266"+02	1.8591"+02
INFINITE	3.3853"+02	0.0000	1.3291"-03	0.0000"+00	0.0837	1.6916"-03	5.5386"+02	3.2266"+02
55020204	2.0150	1.0000	2.6225"+04	2.6700"-03	3.0320	1.3646	2.9512"+04	2.9512"+04
8.0254"-01	2.3637"+05	1.0000	4.0768"+04	NM	1.7832	1.7710	3.2276"+02	1.8682"+02
INFINITE	3.3853"+02	0.0000	1.6885"-03	0.0000"+00	0.0831	2.1463"-03	5.5221"+02	3.2276"+02
55020301	2.0200	1.0000	9.1715"+03	NM	3.1774	1.4623	3.1759"+04	3.1759"+04
1.9294"-01	2.5635"+05	1.0000	1.4356"+04	NM	1.7692	1.7568	3.0682"+02	1.7723"+02
INFINITE	3.2187"+02	0.0000	5.1297"-04	0.0000"+00	0.0827	6.6082"-04	5.3918"+02	3.0682"+02
55020401	2.0270	1.0000	6.9095"+03	NM	3.1688	1.4508	2.7306"+04	2.7306"+04
1.9294"-01	2.2282"+05	1.0000	1.0741"+04	NM	1.7759	1.7638	3.3695"+02	1.9406"+02
INFINITE	3.5353"+02	0.0000	5.0322"-04	0.0000"+00	0.0833	6.4557"-04	5.6615"+02	3.3695"+02

55020101 SHUTTS /FENTER PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95322	0.00000	0.00000	1.73266	0.00000
2	2.2860"-04	1.5615"+00	NM	0.96522	0.40752	0.50649	1.54471	0.32789
3	2.7432"-04	1.6055"+00	NM	0.96592	0.42087	0.52120	1.53363	0.33985
4	3.2512"-04	1.6950"+00	NM	0.96729	0.44609	0.54856	1.51218	0.36276
5	3.8862"-04	1.8037"+00	NM	0.96884	0.47379	0.57793	1.48794	0.38841
6	4.8006"-04	1.8776"+00	NM	0.96983	0.49110	0.59592	1.47247	0.40471
7	5.7912"-04	1.9656"+00	NM	0.97095	0.51039	0.61564	1.45497	0.42313
8	7.0612"-04	2.0373"+00	NM	0.97182	0.52522	0.63056	1.44135	0.43748
9	7.9248"-04	2.0794"+00	NM	0.97231	0.53363	0.63892	1.43357	0.44569
10	9.3472"-04	2.1510"+00	NM	0.97314	0.54748	0.65255	1.42068	0.45932
11	1.0439"-03	2.2716"+00	NM	0.97447	0.56973	0.67406	1.39977	0.48155
12	1.1633"-03	2.3557"+00	NM	0.97537	0.58457	0.68814	1.38572	0.49659
13	1.4402"-03	2.4931"+00	NM	0.97678	0.60781	0.70976	1.36358	0.52051
14	1.6739"-03	2.6374"+00	NM	0.97821	0.63106	0.73086	1.34130	0.54489
15	2.1895"-03	2.9183"+00	NM	0.98082	0.67359	0.76812	1.30038	0.59069
16	2.6975"-03	3.2205"+00	NM	0.98343	0.71612	0.80367	1.25945	0.63811
17	3.2131"-03	3.5356"+00	NM	0.98597	0.75767	0.83676	1.21968	0.68605
18	5.7175"-03	5.0787"+00	NM	0.99631	0.93323	0.95979	1.05773	0.90741
19	6.9926"-03	5.5792"+00	NM	0.99909	0.98318	0.99019	1.01430	0.97623
20	8.2677"-03	5.7175"+00	NM	0.99981	0.99654	0.99800	1.00293	0.99508
21	9.5377"-03	5.7330"+00	NM	0.99989	0.99802	0.99886	1.00167	0.99719
D 22	1.0815"-02	5.7537"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55020103 SHUTTS /FENTER PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95344	0.00000	0.00000	1.72615	0.00000
2	2.2860"-04	1.4267"+00	NM	0.96312	0.36314	0.45578	1.57530	0.28933
3	2.8194"-04	1.4523"+00	NM	0.96355	0.37258	0.46655	1.56809	0.29753
4	3.4036"-04	1.4732"+00	NM	0.96395	0.38003	0.47501	1.56231	0.30404
5	3.8354"-04	1.5153"+00	NM	0.96468	0.39444	0.49122	1.55093	0.31672
6	4.9022"-04	1.6241"+00	NM	0.96645	0.42822	0.52852	1.52331	0.34695
7	5.6642"-04	1.7042"+00	NM	0.96766	0.45057	0.55264	1.50438	0.36735
8	7.0104"-04	1.8160"+00	NM	0.96924	0.47889	0.58254	1.47973	0.39368
9	7.9756"-04	1.8798"+00	NM	0.97009	0.49379	0.59798	1.46650	0.40776
10	1.0312"-03	2.0011"+00	NM	0.97162	0.52012	0.62474	1.44274	0.43302
11	1.2929"-03	2.1484"+00	NM	0.97334	0.54943	0.65375	1.41580	0.46175
12	1.6027"-03	2.2854"+00	NM	0.97486	0.57476	0.67817	1.39210	0.48713
13	1.7958"-03	2.3614"+00	NM	0.97566	0.58818	0.69085	1.37958	0.50077
14	4.3358"-03	3.2937"+00	NM	0.98428	0.72926	0.81379	1.24526	0.65351
15	5.5956"-03	3.7605"+00	NM	0.98792	0.78937	0.86053	1.18843	0.72409
16	6.8656"-03	4.2066"+00	NM	0.99109	0.84252	0.89919	1.13903	0.78943
17	8.1356"-03	4.6879"+00	NM	0.99421	0.89617	0.93576	1.09030	0.85826
18	9.4005"-03	5.1224"+00	NM	0.99680	0.94188	0.96507	1.04985	0.91925
19	1.0676"-02	5.4529"+00	NM	0.99865	0.97516	0.98538	1.02107	0.96505
20	1.1946"-02	5.6149"+00	NM	0.99952	0.99106	0.99479	1.00755	0.98734
21	1.3216"-02	5.6763"+00	NM	0.99984	0.99702	0.99827	1.00251	0.99577
D 22	1.4481"-02	5.7072"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55020105 SHUTTS /FENTER PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95350	0.00000	0.00000	1.72471	0.00000
2	2.2860"-04	1.4564"+00	NM	0.96370	0.37444	0.46852	1.56563	0.29925
3	2.6670"-04	1.5034"+00	NM	0.96453	0.39085	0.48704	1.55280	0.31366
4	3.1750"-04	1.5521"+00	NM	0.96535	0.40676	0.50479	1.54004	0.32777
5	4.1910"-04	1.5988"+00	NM	0.96610	0.42118	0.52067	1.52824	0.34070
6	4.8260"-04	1.6448"+00	NM	0.96682	0.43461	0.53530	1.51704	0.35286
7	5.8420"-04	1.6931"+00	NM	0.96755	0.44804	0.54977	1.50567	0.36513
8	6.7310"-04	1.7518"+00	NM	0.96840	0.46345	0.56617	1.49240	0.37937
9	7.9756"-04	1.8390"+00	NM	0.96961	0.48483	0.58856	1.47366	0.39939
10	9.5758"-04	1.9197"+00	NM	0.97066	0.50323	0.60749	1.45726	0.41687
11	1.1811"-03	2.0083"+00	NM	0.97175	0.52213	0.62659	1.44017	0.43508
12	1.4529"-03	2.1226"+00	NM	0.97310	0.54500	0.64926	1.41921	0.45748
13	1.7018"-03	2.2064"+00	NM	0.97405	0.56071	0.66474	1.40447	0.47330
14	1.9831"-03	2.2716"+00	NM	0.97476	0.57285	0.67619	1.39335	0.48530
15	2.7178"-03	2.5202"+00	NM	0.97734	0.61561	0.71610	1.35308	0.52923
16	3.5052"-03	2.7361"+00	NM	0.97943	0.64993	0.74687	1.32048	0.56558
17	4.7549"-03	3.0879"+00	NM	0.98260	0.70164	0.79108	1.27118	0.62232
18	6.0401"-03	3.4360"+00	NM	0.98548	0.74888	0.82930	1.22630	0.67626
19	7.2898"-03	3.7807"+00	NM	0.98812	0.79264	0.86289	1.18511	0.72811
20	8.6030"-03	4.1507"+00	NM	0.99076	0.83690	0.89514	1.14402	0.78245
21	9.8294"-03	4.5109"+00	NM	0.99315	0.87767	0.92336	1.10682	0.83424
22	1.1100"-02	4.9505"+00	NM	0.99526	0.91447	0.94765	1.07389	0.88245
23	1.2382"-02	5.1661"+00	NM	0.99711	0.94729	0.96840	1.04507	0.92664
24	1.3647"-02	5.3978"+00	NM	0.99840	0.97066	0.98267	1.02490	0.95880
25	1.4940"-02	5.5487"+00	NM	0.99922	0.98558	0.99156	1.01218	0.97963
26	1.6185"-02	5.6456"+00	NM	0.99973	0.99503	0.99711	1.00419	0.99295
27	1.7455"-02	5.6918"+00	NM	0.99997	0.99950	0.99971	1.00042	0.99929
D 28	1.8727"-02	5.6969"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55020201 SHUTTS /FENTER PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95350	0.00000	0.00000	1.72471	0.00000
2	2.2860"-04	1.6241"+00	NM	0.96650	0.42864	0.52882	1.52204	0.34744
3	3.6830"-04	1.7211"+00	NM	0.96796	0.45549	0.55773	1.49928	0.37200
4	5.2070"-04	1.8603"+00	NM	0.96989	0.48981	0.59371	1.46926	0.40409
5	6.[illegible]762"-04	1.9633"+00	NM	0.97120	0.51260	0.61709	1.44875	0.42594
6	7.7470"-04	2.0325"+00	NM	0.97205	0.52710	0.63156	1.43564	0.43992
7	9.0678"-04	2.1098"+00	NM	0.97295	0.54252	0.64682	1.42150	0.45503
8	1.0236"-03	2.2145"+00	NM	0.97413	0.56241	0.66618	1.40308	0.47480
9	1.1552"-03	2.3415"+00	NM	0.97551	0.58528	0.68797	1.38170	0.49792
10	1.4122"-03	2.4961"+00	NM	0.97710	0.61164	0.71246	1.35685	0.52508
11	1.6637"-03	2.6912"+00	NM	0.97901	0.64296	0.74070	1.32711	0.55813
12	2.2987"-03	3.1807"+00	NM	0.98339	0.71457	0.80174	1.25887	0.63687
13	2.9312"-03	3.6648"+00	NM	0.98725	0.77822	0.85201	1.19863	0.71082
14	3.5687"-03	4.1550"+00	NM	0.99077	0.83739	0.89549	1.14356	0.78307
15	4.1986"-03	4.6741"+00	NM	0.99418	0.89557	0.93532	1.09072	0.85752
16	4.8387"-03	5.1661"+00	NM	0.99711	0.94729	0.96840	1.04507	0.92664
17	5.4712"-03	5.5032"+00	NM	0.99897	0.98110	0.98891	1.01598	0.97336
18	6.1057"-03	5.6251"+00	NM	0.99962	0.99304	0.99595	1.00586	0.99014
19	6.7437"-03	5.6661"+00	NM	0.99984	0.99702	0.99827	1.00251	0.99577
20	7.3787"-03	5.6712"+00	NM	0.99987	0.99751	0.99856	1.00209	0.99647
21	8.0137"-03	5.6918"+00	NM	0.99997	0.99950	0.99971	1.00042	0.99929
D 22	9.0297"-03	5.6969"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55020203 SHUTTS /FENTER PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

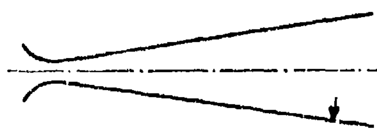
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95311	0.00000	0.00000	1.73556	0.00000
2	2.2860"-04	1.6553"+00	NM	0.96659	0.43435	0.53622	1.52406	0.35184
3	3.6068"-04	1.7079"+00	NM	0.96738	0.44867	0.55165	1.51172	0.36491
4	4.6736"-04	1.7976"+00	NM	0.96863	0.47137	0.57572	1.49175	0.38594
5	6.1214"-04	1.8689"+00	NM	0.96961	0.48815	0.59321	1.47672	0.40171
6	7.2390"-04	1.9333"+00	NM	0.97044	0.50247	0.60791	1.46373	0.41532
7	8.6614"-04	1.9797"+00	NM	0.97102	0.51234	0.61794	1.45469	0.42479
8	1.0033"-03	2.0252"+00	NM	0.97157	0.52172	0.62737	1.44604	0.43386
9	1.1227"-03	2.0895"+00	NM	0.97233	0.53455	0.64015	1.43413	0.44637
10	1.2446"-03	2.1432"+00	NM	0.97294	0.54492	0.65036	1.42444	0.45657
11	1.3614"-03	2.1958"+00	NM	0.97354	0.55479	0.65998	1.41517	0.46636
12	1.4961"-03	2.2361"+00	NM	0.97398	0.56219	0.66714	1.40818	0.47376
13	2.1514"-03	2.4426"+00	NM	0.97617	0.59822	0.70120	1.37390	0.51037
14	2.7711"-03	2.6240"+00	NM	0.97798	0.62784	0.72825	1.34545	0.54127
15	3.4036"-03	2.8014"+00	NM	0.97965	0.65499	0.75231	1.31926	0.57025
16	4.0386"-03	2.9833"+00	NM	0.98127	0.68164	0.77524	1.29349	0.59934
17	5.3086"-03	3.3457"+00	NM	0.98436	0.73149	0.81632	1.24539	0.65547
18	7.8406"-03	4.0826"+00	NM	0.98989	0.82280	0.88565	1.15860	0.76441
19	1.0384"-02	4.8131"+00	NM	0.99463	0.90375	0.94103	1.08420	0.86795
20	1.2929"-02	5.4375"+00	NM	0.99822	0.96742	0.98084	1.02792	0.95419
21	1.5469"-02	5.6918"+00	NM	0.99957	0.99210	0.99543	1.00671	0.98879
22	1.8011"-02	5.7433"+00	NM	0.99984	0.99704	0.99829	1.00251	0.99579
23	2.0549"-02	5.7537"+00	NM	0.99989	0.99803	0.99886	1.00167	0.99719
D 24	2.3089"-02	5.7744"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

55020204 SHUTTS /FENTER PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95339	0.00000	0.00000	1.72759	0.00000
2	2.2860"-04	1.5857"+00	NM	0.96579	0.41638	0.51572	1.53408	0.33617
3	4.0640"-04	1.6571"+00	NM	0.96691	0.43722	0.53845	1.51665	0.35502
4	4.2164"-04	1.6678"+00	NM	0.96707	0.44020	0.54166	1.51412	0.35774
5	5.5372"-04	1.7498"+00	NM	0.96827	0.46203	0.56499	1.49533	0.37784
6	5.6134"-04	1.7596"+00	NM	0.96841	0.46452	0.56762	1.49317	0.38014
7	6.8326"-04	1.8098"+00	NM	0.96911	0.47692	0.58065	1.48228	0.39173
8	6.8580"-04	1.8160"+00	NM	0.96919	0.47841	0.58220	1.48097	0.39312
9	9.3980"-04	1.9018"+00	NM	0.97032	0.49826	0.60273	1.46327	0.41190
10	1.1887"-03	2.0083"+00	NM	0.97165	0.52109	0.62587	1.44258	0.43385
11	1.4656"-03	2.0744"+00	NM	0.97244	0.53449	0.63922	1.43029	0.44692
12	2.0980"-03	2.2716"+00	NM	0.97465	0.57171	0.67541	1.39568	0.48393
13	2.7280"-03	2.4221"+00	NM	0.97624	0.59801	0.70018	1.37088	0.51075
14	3.9954"-03	2.7200"+00	NM	0.97918	0.64615	0.74380	1.32506	0.56133
15	5.2654"-03	2.9867"+00	NM	0.98161	0.68586	0.77810	1.28708	0.60495
16	6.5329"-03	3.2827"+00	NM	0.98413	0.72705	0.81212	1.24772	0.65089
17	7.8029"-03	3.5628"+00	NM	0.98637	0.76377	0.84113	1.21282	0.69353
18	1.0348"-02	4.1422"+00	NM	0.99059	0.83424	0.89340	1.14685	0.77900
19	1.2880"-02	4.7202"+00	NM	0.99436	0.89876	0.93751	1.08809	0.86161
20	1.5420"-02	5.2247"+00	NM	0.99733	0.95136	0.97097	1.04163	0.93216
21	1.7960"-02	5.5335"+00	NM	0.99903	0.98213	0.98954	1.01514	0.97478
22	2.0500"-02	5.6558"+00	NM	0.99968	0.99404	0.99654	1.00503	0.99156
23	2.3040"-02	5.6949"+00	NM	0.99989	0.99801	0.99885	1.00167	0.99718
D 24	2.4369"-02	5.7175"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST



M : 5 - 8.2
R THETA X 10^{-3} : 5 - 13
TW/TR : 0.5 - 1.0

5503

FPG-MHT/SHT

Continuous tunnel with two-dimensional adjustable wedge nozzle. W = H = 0.12 m.
0.3 < PO < 3.2 MN/m^2. 320 < TO < 660 K Air: 7 < RE/m X 10^{-6} < 18.

LOBB R.K., WINKLER E.M. and PERSH J., 1955. NOL Hypersonic tunnel No. 4 results VII: Experimental investigation of turbulent boundary layers in hypersonic flow. NOL NAVORD Rep. 3880.

1 The test boundary layer was formed on one of the straight diverging walls of the tunnel nozzle. The test station was in the centre of the wall approximately 0.5 m downstream of the throat [E]. The wall was
4 actively cooled and remained close to room temperature everywhere except at the throat, where it approached
3 recovery temperature. Surface probe tests indicated that transition took place just downstream of the throat.

6 Static pressure was measured at a tapping of 0.64 mm diameter, and the wall temperature was measured by four thermocouples embedded at various distances from the surface. After 10-20 minutes of tunnel operation these recorded a linear variation, giving the local heat-flux and the surface temperature. Previous investigations had shown that lateral temperature variations were negligible.

8 Probes were mounted on a sting about 0.3 m long [E] which swung about a pivot mounted in the diffuser about 0.2 m downstream of the nozzle exit plane. The path of the probe tips was thus slightly curved. The
7 Pitot profile was measured with a FPP (h_1 = 0.25, 1 = 70 mm [E]). Total temperatures were recorded with a STP (Winkler, 1954) of the single shield vented type. The probe used near the wall was flattened (h_1 = 0.96 mm) while elsewhere a circular probe was used (E) of about 6 mm [E] diameter. A CCP ($\alpha = 8^0$, d = 3 mm [E], l_1 = 17d, l_2 = 70 mm [E]) was used, but since the static pressure outside the boundary layer was within
9 1 % of the wall value, it was assumed that the normal pressure gradient was negligible. The temperature gradient in the wall gave a heat flux value which was used to compute the wall temperature gradient in the flow, and the measured TO profile was faired in to meet this. The authors have interpolated the TO readings to the Y-values of the PT2 readings.

12 The editors have presented all the measured profiles, incorporating the author's assumptions and procedures. The CF value given is that estimated by the authors from the limiting slope of the velocity profile. The
13 profiles fall into five Mach number groups. Within the groups for M = 5, 6 and 7 there is a range of heat
14 transfer conditions. CQ and CF are also given.

§ DATA: 55030101 - 1301. Pitot and TO profiles obtained separately. NX = 1. CQ from temperature profile in wall.

15 <u>Editors' comments</u>

The experiment was a very early attempt at obtaining hypersonic cooled-wall data, and in consequence it is not surprising that it is not ideally arranged. The pressure gradient at the test station is not large, but as in all nozzle tests there has been a continuous FPG history. If radial flow is assumed, the high Mach number approximation gives (1/p) (dp/dx) $\approx -\gamma/x$. The authors state that "the Mach number rise is about 3 % per tunnel caliber at M = 5 and decreases with increasing Mach number". The tests were made on a straight wall so that no pronounced normal pressure gradient effects are expected, and the authors quote a 1 % variation across the layer.

The skin friction data are dubious since they were obtained from the velocity gradient. On a log-law plot, the profiles suggested that in most cases CF was underestimated. It seems probable that they still display some transitional characteristics. The profiles include data close to the wall in a range for which the

TO data was interpolated. No description is given of any tests to check for cross-flow effects.

A flow of generally the same type is described by Pasiuk et al. - CAT 6504. Other planar straight wall flows are described by Michel - CAT 6902 and Voisinet & Lee - CAT 7304. More strictly comparable are the axisymmetric straight wall nozzle tests of Hill - CAT 5901 and Perry & East - CAT 6801.

CAT 5503 LOBB BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X	POD*	PW/PD*	RED2O	CQ *	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
55030101	4.9300	1.0117	1.0238"+03	1.0900"-03	11.4317	1.4166	6.4028"+02	6.4028"+02
NM	3.1208"+05	1.0000	4.7764"+03	NM	1.8418	1.7922	3.0081"+02	5.5520"+01
INFINITE	3.2540"+02	0.0000	6.4228"-04	NM	0.1126	1.4230"-03	7.3651"+02	2.9733"+02
55030102	5.0100	0.7800	1.7043"+03	1.0900"-03	8.7442	1.3858	9.4833"+02	9.4833"+02
NM	5.0764"+05	1.0000	6.3683"+03	1.3280"-04	1.8255	1.7852	2.8400"+02	6.6229"+01
INFINITE	3.9870"+02	0.0000	7.4202"-04	NM	0.5266	1.4726"-03	8.1747"+02	3.6412"+02
55030103	5.0300	0.6302	2.5697"+03	9.4300"-04	6.9886	1.4002	1.4517"+03	1.4517"+03
NM	7.9540"+05	1.0000	7.7559"+03	2.0420"-04	1.8186	1.7812	2.9524"+02	8.4651"+01
INFINITE	5.1300"+02	0.0000	8.4816"-04	NM	0.7817	1.5288"-03	9.2788"+02	4.6845"+02
55030104	5.0600	0.5831	2.6601"+03	9.1000"-04	6.6760	1.3998	1.5325"+03	1.5325"+03
NM	8.6937"+05	1.0000	7.4927"+03	NM	1.8180	1.7801	2.9921"+02	9.1819"+01
INFINITE	5.6200"+02	0.0000	8.7003"-04	NM	0.8309	1.5243"-03	9.7214"+02	5.1310"+02
55030105	5.7500	0.8943	2.0509"+03	8.2000"-04	12.5747	1.3991	1.1155"+03	1.1155"+03
NM	1.3578"+06	1.0000	1.0733"+04	4.8800"-05	1.8243	1.7786	3.2621"+02	5.2477"+01
INFINITE	4.0100"+02	0.0000	6.5611"-04	NM	0.3860	1.6179"-03	8.3673"+02	3.6477"+02
55030106	5.7900	0.8146	2.6756"+03	7.2500"-04	10.5036	1.3942	1.3368"+03	1.3368"+03
NM	1.6972"+06	1.0000	1.2849"+04	9.6700"-05	1.8261	1.7832	3.3117"+02	5.8016"+01
INFINITE	4.4700"+02	0.0000	7.5295"-04	NM	0.6256	1.6636"-03	8.8422"+02	4.0655"+02
55030107	5.8200	0.6240	2.8554"+03	7.1000"-04	8.4694	1.3847	1.3108"+03	1.3108"+03
NM	1.7175"+06	1.0000	1.0739"+04	1.4760"-04	1.8236	1.7790	3.1267"+02	7.0873"+01
INFINITE	5.5100"+02	0.0000	8.6265"-04	NM	0.8611	1.7503"-03	9.8237"+02	5.0107"+02
55030108	6.8300	0.6779	1.3530"+03	6.8300"-04	13.9318	1.4996	4.3761"+02	4.3761"+02
NM	1.5503"+06	1.0000	7.4810"+03	1.2110"-04	1.8264	1.7629	2.8720"+02	4.5267"+01
INFINITE	4.6760"+02	0.0000	7.8097"-04	NM	0.6944	2.1165"-03	9.2135"+02	4.2368"+02
55030109	6.7800	0.5652	1.8403"+03	6.6600"-04	11.7847	1.4583	6.3218"+02	6.3218"+02
NM	2.1380"+06	1.0000	8.2759"+03	1.6400"-04	1.8191	1.7680	3.0015"+02	5.7487"+01
INFINITE	5.8600"+02	0.0000	8.6375"-04	NM	0.8363	2.1240"-03	1.0307"+03	5.3103"+02
55030110	6.8300	0.5596	2.5703"+03	5.9300"-04	10.4067	1.4302	8.1516"+02	8.1516"+02
NM	2.8878"+06	1.0000	1.1623"+04	1.4390"-04	1.8200	1.7705	2.9711"+02	5.6729"+01
INFINITE	5.8600"+02	0.0000	9.1536"-04	NM	0.9591	2.1335"-03	1.0314"+03	5.3096"+02
55030111	6.7800	9.5023	1.0876"+03	6.9400"-04	[illegible]0.5165	1.4624	6.4117"+02	6.4117"+02
NM	2.1684"+06	1.0000	7.5924"+03	1.8730"-04	[illegible].8107	1.7650	2.9093"+02	6.2706"+01
INFINITE	6.3920"+02	0.0000	8.9057"-04	NM	[illegible].9320	2.0524"-03	1.0764"+03	5.7924"+02
55030112	7.6700	0.5144	1.4428"+03	5.9800"-04	[illegible]2.3029	1.5342	3.2989"+02	3.2989"+02
NM	2.4521"+06	1.0000	7.3864"+03	NM	1.8116	1.7511	2.9997"+02	5.0526"+01
INFINITE	6.4500"+02	0.0000	1.0749"-03	NM	1.0240	2.8446"-03	1.0931"+03	5.8317"+02
55030113	8.1800	0.5076	1.5215"+03	5.3000"-04	11.3397	1.5065	2.8558"+02	2.8558"+02
NM	3.2221"+06	1.0000	8.6555"+03	1.3710"-04	1.8160	1.7653	3.0030"+02	4.5542"+01
INFINITE	6.5500"+02	0.0000	1.1667"-03	NM	1.1591	2.8711"-03	1.1060"+0[illegible]	5.9162"+02

55030104 LOBB PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.53369	0.00000	0.00000	3.26780	0.00000
2	2.8000"-04	2.5014"+00	NM	0.62890	0.22779	0.40000	3.03000	0.13201
3	4.1000"-04	3.4894"+00	NM	0.67243	0.30037	0.50400	2.81500	0.17904
4	4.7000"-04	3.8799"+00	NM	0.70705	0.31984	0.53900	2.84000	0.18979
5	5.3000"-04	4.4309"+00	NM	0.71703	0.34530	0.57000	2.72500	0.20917
6	6.6000"-04	5.3218"+00	NM	0.72629	0.38275	0.61000	2.54000	0.24016
7	7.6000"-04	5.9022"+00	NM	0.73387	0.40524	0.63300	2.44000	0.25943
8	7.9000"-04	5.9363"+00	NM	0.73599	0.40652	0.63500	2.44000	0.26025
9	9.1000"-04	6.5300"+00	NM	0.74348	0.42820	0.65600	2.34700	0.27951
10	1.0400"-03	6.9320"+00	NM	0.75051	0.44227	0.67000	2.29500	0.29194
11	1.1700"-03	7.2774"+00	NM	0.75560	0.45400	0.68100	2.25000	0.30267
12	1.4000"-03	7.7136"+00	NM	0.76601	0.46839	0.69600	2.20800	0.31522
13	1.4200"-03	7.7398"+00	NM	0.76471	0.46924	0.69600	2.20000	0.31636
14	1.6500"-03	8.0563"+00	NM	0.77353	0.47939	0.70700	2.17500	0.32506
15	2.0300"-03	8.6296"+00	NM	0.78490	0.49725	0.72400	2.12000	0.34151
16	2.6700"-03	9.6917"+00	NM	0.80363	0.52871	0.75200	2.02300	0.37173
17	3.9400"-03	1.2118"+01	NM	0.83979	0.59433	0.80400	1.83000	0.43934
18	9.0200"-03	2.2484"+01	NM	0.93517	0.81724	0.93000	1.29500	0.71815
19	1.4100"-02	3.0819"+01	NM	0.98787	0.95956	0.98700	1.05800	0.93289
20	1.9180"-02	3.3299"+01	NM	1.00065	0.99801	1.00000	1.00400	0.99602
D 21	2.1720"-02	3.3431"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

55030105 LOBB PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.81261	0.00000	0.00000	6.18600	0.00000
2	2.8000"-04	1.7748"+00	NM	0.79082	0.16412	0.37100	5.11000	0.07260
3	3.5000"-04	2.0766"+00	NM	0.81267	0.18746	0.42000	5.02000	0.08367
4	4.1000"-04	2.4637"+00	NM	0.81968	0.21202	0.46500	4.81000	0.09667
5	5.3000"-04	3.2281"+00	NM	0.83041	0.25219	0.53200	4.45000	0.11955
6	6.1000"-04	3.6674"+00	NM	0.83396	0.27229	0.56200	4.26000	0.13192
7	6.6000"-04	3.9256"+00	NM	0.83667	0.28339	0.57800	4.16000	0.13894
8	7.9000"-04	4.5026"+00	NM	0.84579	0.30665	0.61100	3.97000	0.15390
9	9.9000"-04	5.2179"+00	NM	0.85642	0.33315	0.64600	3.76000	0.17181
10	1.1700"-03	5.7964"+00	NM	0.86036	0.35308	0.66900	3.59000	0.18635
11	1.5500"-03	6.4120"+00	NM	0.86785	0.37310	0.69200	3.44000	0.20116
12	1.6800"-03	6.5853"+00	NM	0.86984	0.37854	0.69800	3.40000	0.20529
13	1.8100"-03	6.8767"+00	NM	0.87391	0.38752	0.70800	3.33800	0.21210
14	2.1800"-03	7.2708"+00	NM	0.87980	0.39932	0.72100	3.26000	0.22117
15	2.8200"-03	8.2128"+00	NM	0.89060	0.42621	0.74800	3.08000	0.24286
16	3.4600"-03	9.4163"+00	NM	0.90209	0.45025	0.77700	2.87500	0.27026
17	4.7300"-03	1.1459"+01	NM	0.92185	0.50799	0.81800	2.59300	0.31546
18	6.0000"-03	1.3885"+01	NM	0.93976	0.56134	0.85500	2.32000	0.36853
19	7.2700"-03	1.6571"+01	NM	0.95665	0.61502	0.88700	2.08000	0.42644
20	8.5400"-03	1.9639"+01	NM	0.96933	0.67108	0.91400	1.85500	0.49272
21	9.7900"-03	2.2711"+01	NM	0.97915	0.72288	0.93500	1.67300	0.55888
22	1.1050"-02	2.6241"+01	NM	0.98595	0.77812	0.95300	1.50000	0.63533
23	1.2320"-02	2.9925"+01	NM	0.99180	0.83189	0.96800	1.35400	0.71492
24	1.4860"-02	3.7140"+01	NM	0.99675	0.92820	0.98800	1.13300	0.87202
25	1.6100"-02	4.0143"+01	NM	0.99749	0.96546	0.99400	1.06000	0.93774
26	1.7400"-02	4.1827"+01	NM	0.99782	0.98573	0.99700	1.02300	0.97458
27	1.8400"-02	4.2737"+01	NM	0.99892	0.99651	0.99900	1.00500	0.99403
D 28	1.9900"-02	4.3033"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

55030111 LOBB PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45929	0.00000	0.00000	4.64110	0.00000
2	3.0000"-04	1.3886"+00	NM	0.52365	0.10342	0.22800	4.86000	0.04691
3	3.3000"-04	1.4624"+00	NM	0.53036	0.11170	0.24600	4.85000	0.05072
4	4.1000"-04	1.7645"+00	NM	0.54921	0.13842	0.30200	4.76000	0.06345
5	4.3000"-04	1.8471"+00	NM	0.56006	0.14437	0.31600	4.79100	0.06596
6	5.1000"-04	2.2914"+00	NM	0.57352	0.17097	0.36700	4.60800	0.07964
7	6.1000"-04	3.0555"+00	NM	0.59936	0.20675	0.43300	4.38600	0.09872
8	7.1000"-04	3.8470"+00	NM	0.62377	0.23751	0.48600	4.18700	0.11607
9	7.6000"-04	4.2625"+00	NM	0.63372	0.25205	0.50900	4.07800	0.12482
10	9.6000"-04	5.6616"+00	NM	0.68105	0.29560	0.58000	3.85000	0.15065
11	1.2200"-03	6.9632"+00	NM	0.71589	0.33087	0.63100	3.63700	0.17349
12	1.4500"-03	7.8572"+00	NM	0.73129	0.35303	0.65800	3.47400	0.18941
13	1.7000"-03	8.3704"+00	NM	0.73736	0.36514	0.67100	3.37700	0.19870
14	2.9700"-03	1.0550"+01	NM	0.76844	0.41257	0.72100	3.05400	0.23608
15	5.5100"-03	1.5729"+01	NM	0.81664	0.50776	0.79800	2.47000	0.32308
16	8.0500"-03	2.1695"+01	NM	0.86127	0.59888	0.85600	2.04300	0.41899
17	1.0590"-02	2.8775"+01	NM	0.90066	0.69160	0.90200	1.70100	0.53028
18	1.3230"-02	3.7216"+01	NM	0.93851	0.78801	0.94100	1.42600	0.65989
19	1.5670"-02	4.6487"+01	NM	0.97129	0.88182	0.97200	1.21500	0.80000
20	1.8210"-02	5.5299"+01	NM	0.98972	0.96254	0.99100	1.06000	0.93491
21	1.8850"-02	5.6628"+01	NM	0.98926	0.97414	0.99200	1.03700	0.95661
22	1.9450"-02	5.8023"+01	NM	0.99277	0.98616	0.99500	1.01800	0.97741
D 23	2.0120"-02	5.9649"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

55030112 LOBB PROFILE TABULATION 25 POINTS, DELTA AT POINT 25

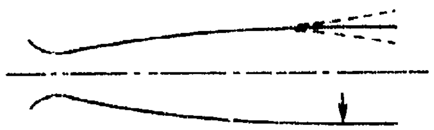
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.46535	0.00000	0.00000	5.94060	0.00000
2	4.6000"-04	1.2271"+00	NM	0.51990	0.07154	0.17900	6.26000	0.02859
3	6.8000"-04	1.6171"+00	NM	0.52751	0.11185	0.27100	5.87000	0.04617
4	7.7000"-04	1.8668"+00	NM	0.55129	0.13001	0.31500	5.87000	0.05366
5	9.6000"-04	2.7049"+00	NM	0.58266	0.16914	0.39900	5.56500	0.07170
6	1.2200"-03	3.7955"+00	NM	0.61529	0.20830	0.47500	5.20000	0.09135
7	1.4700"-03	4.9893"+00	NM	0.64649	0.24359	0.53700	4.86000	0.11049
8	1.7300"-03	5.7911"+00	NM	0.67709	0.26457	0.57600	4.74000	0.12152
9	1.8500"-03	6.2038"+00	NM	0.69141	0.27472	0.59400	4.67500	0.12706
10	2.4900"-03	8.0288"+00	NM	0.73265	0.31569	0.65500	4.30500	0.15215
11	3.7600"-03	1.0144"+01	NM	0.75449	0.35726	0.70100	3.85000	0.18208
12	5.0300"-03	1.2280"+01	NM	0.77147	0.39482	0.73600	3.47500	0.21180
13	6.3000"-03	1.4325"+01	NM	0.79209	0.42767	0.76600	3.20800	0.23878
14	7.5700"-03	1.6429"+01	NM	0.80319	0.45902	0.78800	2.94700	0.26739
15	8.8400"-03	1.8863"+01	NM	0.81833	0.49283	0.81100	2.70800	0.29948
16	1.0110"-02	2.1324"+01	NM	0.83694	0.52474	0.83300	2.52000	0.33056
17	1.1380"-02	2.4903"+01	NM	0.84529	0.56800	0.85200	2.25000	0.37867
18	1.2650"-02	2.7613"+01	NM	0.86106	0.59867	0.86900	2.10700	0.41243
19	1.3920"-02	3.1866"+01	NM	0.88170	0.64386	0.89100	1.91500	0.46527
20	1.6460"-02	4.0961"+01	NM	0.90804	0.73119	0.92200	1.59000	0.57987
21	1.9000"-02	5.2047"+01	NM	0.93758	0.82524	0.95100	1.32800	0.71611
22	2.1540"-02	6.4092"+01	NM	0.96085	0.91654	0.97300	1.12700	0.86335
23	2.4080"-02	7.4047"+01	NM	0.98832	0.98564	0.99300	1.01500	0.97833
24	2.6620"-02	7.6208"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 25	2.9160"-02	7.6208"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

55030113 LOBB PROFILE TABULATION 19 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45843	0.00000	0.00000	6.59340	0.00000
2	1.0000"-03	2.4225"+00	NM	0.52095	0.14733	0.35500	5.80600	0.06114
3	1.3000"-03	3.8097"+00	NM	0.56830	0.19575	0.45500	5.40300	0.08421
4	1.4500"-03	5.1370"+00	NM	0.58666	0.23215	0.51400	4.90200	0.10486
5	1.6500"-03	6.1348"+00	NM	0.61998	0.25603	0.55800	4.75000	0.11747
6	2.2100"-03	8.2923"+00	NM	0.65873	0.30114	0.62300	4.28000	0.14556
7	2.5000"-03	9.2349"+00	NM	0.66958	0.31883	0.64400	4.08000	0.15784
8	3.7300"-03	1.2208"+01	NM	0.72228	0.36907	0.70800	3.68000	0.19239
9	4.9500"-03	1.4813"+01	NM	0.74824	0.40801	0.74500	3.33400	0.22346
10	6.2200"-03	1.7419"+01	NM	0.76714	0.44356	0.77300	3.03700	0.25453
11	8.8000"-03	2.2765"+01	NM	0.80039	0.50874	0.81700	2.57900	0.31679
12	1.1300"-02	2.9026"+01	NM	0.83157	0.57577	0.85400	2.20000	0.38818
13	1.3800"-02	3.6457"+01	NM	0.86106	0.64635	0.88600	1.87900	0.47153
14	1.6400"-02	4.5671"+01	NM	0.89189	0.72439	0.91600	1.59900	0.57286
15	1.8900"-02	5.6676"+01	NM	0.92023	0.80776	0.94200	1.36000	0.69265
16	2.1500"-02	6.8593"+01	NM	0.95032	0.88928	0.96600	1.18000	0.81864
17	2.4000"-02	8.0451"+01	NM	0.97542	0.96356	0.98500	1.04500	0.94258
18	2.5300"-02	8.4240"+01	NM	0.98799	0.98612	0.99300	1.01400	0.97929
D 19	2.6500"-02	8.6015"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

	M : 1.9 P THETA X 10^{-3} : 11 - 12 TW / TR : Approx. 1	**5801** (F) APG AW

Continuous flow tunnel with symmetrical flexible nozzle. W = H = 50.8 mm.
PO : 0.27 MN/m^2 TO :300 K. Air. PE/m X 10^{-6} : 30.

NALEID J.F. 1958. Experimental investigation of the impact pressure probe method of measuring local skin friction at supersonic speeds in presence of an adverse pressure gradient. DRL 432.

1 The test boundary layer was formed on the floor of the wind tunnel. The roof of the tunnel was replaced by a flexible plate which could be deflected to cause a range of pressure gradients on the test wall. Measurements were made at a single station. The pressure history upstream of the test section was not
4 given. The pressure was approximately constant for the first 50.8 mm of the flat floor, the imposed pressure gradients spreading over the following 76.2 mm. The pressure gradients (one favourable and seven adverse) ranged from - 41 to + 191 $KN/m^2/m$ and were found to be repeatable within the limits + 2 %, - 1 %. The test
6 section floor had 11 static pressure tappings along the centre-line at 12.7 mm intervals. The survey station
8 was midway between the 8th and 9th of these. Wall shear stress was measured with an FEB which had a circular
6 element 6.35 mm in diameter, the maximum gap being 0.153 mm (designed by Moore - CAT 5805). The wall temperature was not reported but the "tunnel was operated for a sufficient length of time to permit all components of the balance to assume the operating temperature".

7 Only Pitot profiles were measured, with a CPP (d_1 = 0.508, d_2 = 0.254, 1 = 13 mm) at the same station.
8 The tip of the probe was brought into contact with the wall for the lowest Y-reading. No corrections were
10 applied to the profile data, and the Pitot probe was also treated as a Preston tube.

9 The author interpolated the PW values to give a local value for dp/dx at the survey station. This has been
12 read into the data tabulation below to give a PI2 value. The author's assumption of an isoenergetic boundary layer has been replaced by the Crocco / van Driest velocity temperature relation, and the static pressure in the boundary layer has been assumed constant. The edge reservoir state has been arbitrarily set at the reported tunnel reservoir state.

13 The eight profiles presented were measured in eight different pressure gradients with approximately the same
14 edge state. The CF values associated with them are those directly measured with the FEB.

§ DATA: 58010101-0801. Pitot profiles. NX = 1. CF from an FEB measured separately.

15 <u>Editors' comments</u>

The experiment represents an early attempt to determine the influence of pressure gradients on skin friction, and on the Preston tube calibration. The range of pressure gradients is small, and although arranged to occur with a near constant edge state, may be slightly confused by the varied upstream histories, which are not presented. The consequent CF variation is correspondingly small.

At this low Mach number, the absence of a TO determination is not important since the wall is near-adiabatic. The size of the Pitot probe is such that none of the profiles include measurements within the momentum-deficit peak, so that integral values must be treated with reserve. The profiles are so smooth that it seems probable that some smoothing or interpolation was employed which is not reported. The pressure gradient has little effect either in the log-law region or in the outer region.

The most nearby comparable measurements are those of Thomas - CAT 7401.

CAT 5801 NALEID BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X RZ	MD * POD* TOD*	TW/TR* PW/PD* SW *	RED2W RED2D D2	CF * CQ P12*	H12 H32 H42	H12K H32K D2K	PW TW UD	PD TD TR
58010101	1.9470	1.0000	7.5881"+03	1.8760"-03	2.9955	1.4459	3.7420"+04	3.7420"+04
NM	2.6966"+05	1.0000	1.1633"+04	NM	1.8200	1.8121	2.8957"+02	1.7243"+02
INFINITE	3.0317"+02	0.0000	3.5293"-04	-6.2662"-02	0.0816	4.2939"-04	5.1261"+02	2.8957"+02
58010201	1.9970	1.0000	7.1509"+03	1.8480"-03	3.0664	1.4415	3.4625"+04	3.4625"+04
NM	2.6966"+05	1.0000	1.1165"+04	NM	1.8245	1.8165	2.8917"+02	1.6864"+02
INFINITE	3.0316"+02	0.0000	3.4620"-04	2.0531"-02	0.0842	4.2336"-04	5.1996"+02	2.8917"+02
58010301	1.9360	1.0000	7.7816"+03	1.9160"-03	2.9831	1.4477	3.8040"+04	3.8040"+04
NM	2.6949"+05	1.0000	1.1879"+04	NM	1.8166	1.8086	2.9045"+02	1.7375"+02
INFINITE	3.0400"+02	0.0000	3.6028"-04	2.8967"-02	0.0809	4.3876"-04	5.1166"+02	2.9045"+02
58010401	1.9200	1.0000	7.9377"+03	1.9000"-03	2.9643	1.4511	3.8994"+04	3.8994"+04
NM	2.6949"+05	1.0000	1.2046"+04	NM	1.8137	1.8057	2.9085"+02	1.7515"+02
INFINITE	3.0428"+02	0.0000	3.6333"-04	9.3128"-02	0.0801	4.4223"-04	5.0946"+02	2.9085"+02
58010501	1.9180	1.0000	8.0191"+03	1.8800"-03	2.9719	1.4572	3.9066"+04	3.9066"+04
NM	2.6915"+05	1.0000	1.2171"+04	NM	1.8100	1.8019	2.8821"+02	1.7370"+02
INFINITE	3.0150"+02	0.0000	3.6267"-04	1.1534"-01	0.0798	4.4267"-04	5.0683"+02	2.8821"+02
58010601	1.8980	1.0000	8.1680"+03	1.8810"-03	2.9469	1.4610	4.0323"+04	4.0323"+04
NM	2.6935"+05	1.0000	1.2306"+04	NM	1.8077	1.7996	2.8863"+02	1.7540"+02
INFINITE	3.0178"+02	0.0000	3.6385"-04	1.6059"-01	0.0787	4.4328"-04	5.0399"+02	2.8863"+02
58010701	1.8830	1.0000	8.1778"+03	1.8770"-03	2.9262	1.4638	4.1210"+04	4.1210"+04
NM	2.6898"+05	1.0000	1.2288"+04	NM	1.8082	1.8000	2.8780"+02	1.7598"+02
INFINITE	3.0078"+02	0.0000	3.5994"-04	2.3228"-01	0.0780	4.3702"-04	5.0083"+02	2.8780"+02
58010801	1.8730	1.0000	8.2361"+03	1.9160"-03	2.9189	1.4679	4.1934"+04	4.1934"+04
NM	2.6952"+05	1.0000	1.2288"+04	NM	1.8045	1.7964	2.9123"+02	1.7882"+02
INFINITE	3.0428"+02	0.0000	3.6346"-04	3.8648"-01	0.0774	4.4183"-04	5.0217"+02	2.9123"+02

58010101 NALEID PROFILE TABULATION 22 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95515	0.00000	0.00000	1.67931	0.00000
2	2.5500"-04	2.1719"+00	NM	0.97535	0.57268	0.67112	1.37335	0.48867
3	5.1000"-04	2.4871"+00	NM	0.97571	0.63020	0.72473	1.32251	0.54800
4	7.6500"-04	2.7751"+00	NM	0.98150	0.67745	0.76651	1.28019	0.59874
5	1.0200"-03	3.0005"+00	NM	0.98354	0.71186	0.79565	1.24926	0.63690
6	1.2750"-03	3.2060"+00	NM	0.98531	0.74165	0.82003	1.22251	0.67077
7	1.5300"-03	3.4095"+00	NM	0.98698	0.76990	0.84241	1.19723	0.70363
8	1.7850"-03	3.6135"+00	NM	0.98858	0.79712	0.86333	1.17300	0.73600
9	2.0400"-03	3.8171"+00	NM	0.99011	0.82332	0.88285	1.14984	0.76780
10	2.2950"-03	4.0152"+00	NM	0.99154	0.84797	0.90070	1.12822	0.79833
11	2.5500"-03	4.2195"+00	NM	0.99295	0.87262	0.91804	1.10679	0.82946
12	2.8050"-03	4.4078"+00	NM	0.99420	0.89471	0.93315	1.08778	0.85785
13	3.0600"-03	4.6055"+00	NM	0.99548	0.91731	0.94822	1.06853	0.88741
14	3.3150"-03	4.8178"+00	NM	0.99679	0.94093	0.96354	1.04863	0.91886
15	3.5700"-03	4.9165"+00	NM	0.99738	0.95172	0.97039	1.03963	0.93341
16	3.8250"-03	5.0741"+00	NM	0.99831	0.96867	0.98095	1.02559	0.95651
17	4.0800"-03	5.1758"+00	NM	0.99890	0.97946	0.98761	1.01673	0.97137
18	4.3350"-03	5.2591"+00	NM	0.99937	0.98819	0.99291	1.00959	0.98348
19	4.5900"-03	5.3183"+00	NM	0.99970	0.99435	0.99662	1.00458	0.99208
20	4.8450"-03	5.3480"+00	NM	0.99986	0.99743	0.99847	1.00208	0.99640
D 21	5.1000"-03	5.3729"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
22	5.3550"-03	5.3530"+00	NM	0.99989	0.99795	0.99878	1.00166	0.99712

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58010201 NALEID PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95385	0.00000	0.00000	1.71465	0.00000
2	2.5500"-04	2.2606"+00	NM	0.97501	0.57486	0.67704	1.38707	0.48811
3	5.1000"-04	2.6217"+00	NM	0.97871	0.63645	0.73392	1.32972	0.55194
4	7.6500"-04	2.8980"+00	NM	0.98129	0.67902	0.77113	1.28969	0.59791
5	1.0200"-03	3.1412"+00	NM	0.98342	0.71407	0.80050	1.25671	0.63698
6	1.2750"-03	3.3532"+00	NM	0.98518	0.74311	0.82397	1.22945	0.67019
7	1.5300"-03	3.5706"+00	NM	0.98690	0.77166	0.04630	1.20281	0.70360
8	1.7850"-03	3.7880"+00	NM	0.98855	0.79920	0.06715	1.17727	0.73657
9	2.0400"-03	3.9901"+00	NM	0.99001	0.82374	0.88517	1.15471	0.76657
10	2.2950"-03	4.2109"+00	NM	0.99154	0.84977	0.90372	1.13099	0.79905
11	2.5500"-03	4.4122"+00	NM	0.99288	0.87281	0.91965	1.11022	0.82835
12	2.8050"-03	4.6146"+00	NM	0.99415	0.89534	0.93482	1.09013	0.85753
13	3.0600"-03	4.8131"+00	NM	0.99541	0.91688	0.94893	1.07114	0.88591
14	3.3150"-03	4.9925"+00	NM	0.99648	0.93590	0.96109	1.05454	0.91138
15	3.5700"-03	5.1612"+00	NM	0.99746	0.95343	0.97204	1.03941	0.93518
16	3.8250"-03	5.2886"+00	NM	0.99817	0.96645	0.98002	1.02828	0.95307
17	4.0800"-03	5.4228"+00	NM	0.99891	0.97997	0.98817	1.01681	0.97184
18	4.3350"-03	5.5083"+00	NM	0.99938	0.98848	0.99323	1.00964	0.98375
19	4.5900"-03	5.5538"+00	NM	0.99962	0.99299	0.99589	1.00586	0.99009
20	4.8450"-03	5.5945"+00	NM	0.99984	0.99700	0.99824	1.00251	0.99575
21	5.1000"-03	5.6149"+00	NM	0.99995	0.99900	0.99942	1.00084	0.99858
D 22	5.3550"-03	5.6251"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58010501 NALEID PROFILE TABULATION 23 POINTS, DELTA AT POINT 22

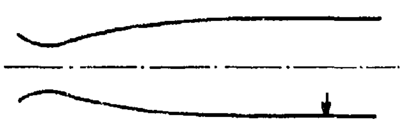
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95592	0.00000	0.00000	1.65923	0.00000
2	2.5500"-04	2.0945"+00	NM	0.97525	0.56569	0.66217	1.37018	0.48327
3	5.1000"-04	2.3330"+00	NM	0.97789	0.61210	0.70606	1.33059	0.53064
4	7.6500"-04	2.6030"+00	NM	0.98064	0.65954	0.74894	1.28946	0.58081
5	1.0200"-03	2.8344"+00	NM	0.98284	0.69708	0.78144	1.25667	0.62183
6	1.2750"-03	3.0492"+00	NM	0.98476	0.72993	0.80885	1.22794	0.65871
7	1.5300"-03	3.2680"+00	NM	0.98662	0.76173	0.83449	1.20016	0.69532
8	1.7850"-03	3.4665"+00	NM	0.98822	0.78936	0.85606	1.17612	0.72787
9	2.0400"-03	3.6648"+00	NM	0.98976	0.81595	0.87620	1.15312	0.75985
10	2.2950"-03	3.8743"+00	NM	0.99132	0.84307	0.89613	1.12984	0.79315
11	2.5500"-03	4.0711"+00	NM	0.99286	0.87018	0.91545	1.10676	0.82714
12	2.8050"-03	4.2977"+00	NM	0.99427	0.89520	0.93276	1.08567	0.85916
13	3.0600"-03	4.4880"+00	NM	0.99552	0.91762	0.94785	1.06697	0.88836
14	3.3150"-03	4.6879"+00	NM	0.99679	0.94056	0.96288	1.04803	0.91876
15	3.5700"-03	4.8224"+00	NM	0.99762	0.95568	0.97257	1.03566	0.93908
16	3.8250"-03	4.9640"+00	NM	0.99846	0.97132	0.98242	1.02298	0.96035
17	4.0800"-03	5.0644"+00	NM	0.99905	0.98227	0.98920	1.01416	0.97539
18	4.3350"-03	5.1369"+00	NM	0.99947	0.99009	0.99399	1.00789	0.98621
19	4.5900"-03	5.1758"+00	NM	0.99969	0.99426	0.99653	1.00456	0.99200
20	4.8450"-03	5.2149"+00	NM	0.99992	0.99844	0.99906	1.00124	0.99782
21	5.1000"-03	5.2198"+00	NM	0.99994	0.99896	0.99937	1.00083	0.99854
D 22	5.3550"-03	5.2296"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
23	5.6100"-03	5.2247"+00	NM	0.99997	0.99940	0.99969	1.00041	0.99927

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58010801 NALEID PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95712	0.00000	0.00000	1.62866	0.00000
2	2.5500"-04	1.9892"+00	NM	0.97521	0.55633	0.64959	1.36338	0.47645
3	5.1000"-04	2.2551"+00	NM	0.97828	0.61185	0.70253	1.31838	0.53288
4	7.6500"-04	2.5021"+00	NM	0.98087	0.65777	0.74430	1.28040	0.58130
5	1.0200"-03	2.7329"+00	NM	0.98312	0.69728	0.77877	1.24739	0.62432
6	1.2750"-03	2.9489"+00	NM	0.98511	0.73198	0.80793	1.21830	0.66317
7	1.5300"-03	3.1519"+00	NM	0.98688	0.76295	0.83309	1.19234	0.69871
8	1.7850"-03	3.3532"+00	NM	0.98855	0.79231	0.85621	1.16779	0.73318
9	2.0400"-03	3.5667"+00	NM	0.99025	0.82221	0.87901	1.14292	0.76908
10	2.2950"-03	3.7485"+00	NM	0.99164	0.84677	0.89719	1.12262	0.79919
11	2.5500"-03	3.9568"+00	NM	0.99316	0.87400	0.91678	1.10028	0.83322
12	2.8050"-03	4.0657"+00	NM	0.99393	0.88788	0.92654	1.08897	0.85084
13	3.0600"-03	4.3503"+00	NM	0.99587	0.92312	0.95064	1.06053	0.89639
14	3.3150"-03	4.5285"+00	NM	0.99703	0.94447	0.96479	1.04349	0.92458
15	3.5700"-03	4.6925"+00	NM	0.99807	0.96369	0.97723	1.02830	0.95034
16	3.8250"-03	4.8084"+00	NM	0.99878	0.97704	0.98572	1.01783	0.96845
17	4.0800"-03	4.9023"+00	NM	0.99935	0.98772	0.99241	1.00951	0.98306
18	4.3350"-03	4.9497"+00	NM	0.99963	0.99306	0.99572	1.00537	0.99040
19	4.5900"-03	4.9925"+00	NM	0.99989	0.99786	0.99869	1.00165	0.99704
D 20	4.8450"-03	5.0117"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

	M : 1.75, 2.75, 3.75 P THETA X 10^{-3} : 2 - 12 TW / TR : 1.0	**5802** ZPG - AW

Continuous tunnel with symmetrical flexible nozzle W = H = 50.8 mm.
0.1 < PO < 0.8 MN/m^2. TO : 300 K. Air. 8 < PE/m X 10^{-6} < 40.

STALMACH C.J., 1958. Experimental investigation of the surface impact pressure probe method of measuring local skin friction at supersonic speeds. DRL 410.
<u>And</u> Fenter and Stalmach (1957)

1 The test boundary layer was formed on a test block constructed as an extension of the lower half of the contoured nozzle. This was attached to the flexible nozzle plate, and moved slightly in the axial direction
4 as the Mach number was varied. The boundary layer surveyed, therefore, had passed through a predominately
5 simple-wave expansion. Transition was forced by a grit-type trip. No calibration of the tunnel is reported, but the author examined the characteristics of a larger geometrically and mechanically similar tunnel running in the same Reynolds number and Mach number range, and concluded that the flow would be effectively two dimensional over a central strip wider than 50 % of the test block width, and so wider than the balance element.

6 Wall static pressure was measured at tappings 0.406 mm in diameter on either side of the probe tip. The test block temperature was monitored by a thermocouple which indicated that slight heat transfer occured during the runs. Preston tube readings were taken with tube diameters of 0.305, 0.508, 0.890 and 1.65 mm. Direct wall stress measurements were made using FEB of the type used for CAT 5501 and described by Weiler and Hartwig (1952). The balance element was 25.4 mm in diameter, and the annular gap was 0.127 mm.
7 Pitot profiles were measured with a CPP for which d_1 = 0.508, 1 = 10.2 mm, with a square cut end so that
8 it could also be used as a Preston tube. The profile normal coincided with the axis of the balance. The
9 author found agreement between measured wall static pressure and free stream static pressure calculated from Pitot measurements, and assumed, therefore, constant static pressure through the boundary layer, using
10 the Pitot-derived value. The profiles were reduced assuming constant total temperature. No probe corrections
11 were applied, and viscosity was calculated from a 0.768 power law.

12 **The editors have presented 16 of the profiles obtained, out of a total of 42, with associated CF values from the FEB interpolated on the basis of R THETA values. The author's assumption of isoenergetic flow has been replaced by the Crocco / Van Driest temperature-velocity correlation. The boundary layer edge state is as**
13 **selected by the author. The Preston tube data is not presented as it is not available in raw form. The**
14 **profiles presented form three groups, each covering a range of Reynolds number at Mach numbers of about 1.7, 2.7 and 3.7. The CF value is an interpolated value from the balance measurements, by the editors.**

§ **DATA. 5802 0101-0306. Pitot profiles. NX = 1. CF values from an FEB measured separately.**

15 **<u>Editors' comments</u>**

The interest of this entry lies in the coverage of the post-transitional turbulent layer. Many of the profiles show exceptionally small "wake components", though as R THETA rises, the profiles may become "normal" (e.g. series 03. 0301-03 show tra. itional behaviour in the log-law region, while 0304/5 appear to be fully developed).

The experiment was performed in a very small tunnel, and suffers from the small physical scale. In nearly all cases measurements do not extend within the momentum-deficit peak, so that integral values should be treated with caution.

The Mach number and Reynolds number range closely matches the flat plate tests of Coles - CAT 5301.

Other comparisons are with Shutts et al. - CAT 5501 who used the same type of balance in a flat plate, and Moore - CAT 5805 whose flat wall tests provide a repeat experiment in the same facility.

CAT 5802 STALMACH BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X	POD*	PW/PD*	RED20	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
58020101	1.7390	1.0000	2.5818"+03	2.5400"-03	2.7507	1.4975	1.9681"+04	1.9681"+04
NM	1.0305"+05	1.0000	3.6804"+03	NM	1.8060	1.7972	2.8576"+02	1.8533"+02
INFINITE	2.9742"+02	0.0000	2.6230"-04	0.0000"+00	0.0708	3.1038"-04	4.7466"+02	2.8576"+02
58020102	1.7440	1.0000	5.9748"+03	2.1300"-03	2.7044	1.4496	3.4231"+04	3.4231"+04
NM	1.8060"+05	1.0000	8.5308"+03	NM	1.8026	1.7943	2.8626"+02	1.8527"+02
INFINITE	2.9798"+02	0.0000	3.4841"-04	0.0000"+00	0.0709	4.1386"-04	4.7595"+02	2.8626"+02
58020103	1.7390	1.0000	8.8590"+03	1.9900"-03	2.6735	1.4343	5.5181"+04	5.5181"+04
NM	2.8893"+05	1.0000	1.2610"+04	NM	1.8133	1.8068	2.9110"+02	1.8879"+02
INFINITE	3.0298"+02	0.0000	3.2869"-04	0.0000"+00	0.0711	3.8746"-04	4.7907"+02	2.9110"+02
5802[illegible]	2.7350	1.0000	9.5940"+02	2.5550" 03	4.5594	1.4984	4.2411"+03	4.2411"+03
[illegible]	1.0420"+05	1.0000	1.9966"+03	NM	1.8235	1.8011	2.7752"+02	1.1857"+02
INFINITE	2.9597"+02	0.0000	2.2483"-04	0.0000"+00	0.1137	3.1736"-04	5.9712"+02	2.7752"+02
58020202	2.7290	1.0000	1.5036"+03	2.2350"-03	4.5174	1.4623	5.3473"+03	5.3473"+03
NM	1.3017"+05	1.0000	3.1238"+03	NM	1.8134	1.7943	2.7631"+02	1.1836"+02
INFINITE	2.9464"+02	0.0000	2.7888"-04	0.0000"+00	0.1128	3.9996"-04	5.9526"+02	2.7631"+02
58020203	2.7310	1.0000	1.8327"+03	2.1150"-03	4.4729	1.4389	6.2226"+03	6.2226"+03
NM	1.5195"+05	1.0000	3.8077"+03	NM	1.8226	1.8042	2.7760"+02	1.1881"+02
INFINITE	2.9603"+02	0.0000	2.9351"-04	0.0000"+00	0.1135	4.1551"-04	5.9684"+02	2.7760"+02
58020204	2.7280	1.0000	2.9665"+03	1.8400"-03	4.4519	1.4215	9.0308"+03	9.0308"+03
NM	2.1951"+05	1.0000	6.1542"+03	NM	1.8179	1.8012	2.7821"+02	1.1922"+02
INFINITE	2.9666"+02	0.0000	3.2085"-04	0.0000"+00	0.1131	4.6906"-04	5.9721"+02	2.7821"+02
58020205	2.7240	1.0000	3.1394"+03	1.8150"-03	4.4825	1.4462	1.0694"+04	1.0694"+04
NM	2.5835"+05	1.0000	6.4832"+03	NM	1.8136	1.7944	2.8380"+02	1.2182"+02
INFINITE	3.0261"+02	0.0000	3.0218"-04	0.0000"+00	0.1127	4.3275"-04	6.0280"+02	2.8380"+02
58020206	2.7550	1.0000	4.4169"+03	1.6400"-03	4.5562	1.4477	1.4399"+04	1.4399"+04
NM	3.6478"+05	1.0000	9.2577"+03	NM	1.8128	1.7938	2.7877"+02	1.1812"+02
INFINITE	2.9742"+02	0.0000	3.0315"-04	0.0000"+00	0.1137	4.3778"-04	6.0033"+02	2.7877"+02
58020207	2.7390	1.0000	5.8533"+03	1.5150"-03	4.5506	1.4642	2.1221"+04	2.1221"+04
NM	5.2459"+05	1.0000	1.2154"+04	NM	1.8092	1.7906	2.8446"+02	1.2134"+02
INFINITE	3.0339"+02	0.0000	2.8231"-04	0.0000"+00	0.1129	4.0845"-04	6.0492"+02	2.8446"+02
58020301	3.6840	1.0000	7.0193"+02	2.0000"-03	6.8681	1.4197	1.7188"+03	1.7188"+03
NM	1.6976"+05	1.0000	2.1153"+03	NM	1.8409	1.8139	2.7533"+02	8.0223"+01
INFINITE	2.9798"+02	0.0000	2.4632"-04	0.0000"+00	0.1399	4.1482"-04	6.6157"+02	2.7533"+02
58020302	3.6720	1.0000	7.1329"+02	1.9900"-03	6.7973	1.4038	1.7387"+03	1.7387"+03
NM	1.6888"+05	1.0000	2.1385"+03	NM	1.8452	1.8217	2.7614"+02	8.0831"+01
INFINITE	2.9881"+02	0.0000	2.4977"-04	0.0000"+00	0.1400	4.1614"-04	6.6192"+02	2.7614"+02
58020303	3.6630	1.0000	1.7028"+03	1.4850"-03	6.7481	1.3948	4.3819"+03	4.3819"+03
NM	4.2032"+05	1.0000	5.0735"+03	NM	1.8494	1.8295	2.8002"+02	8.2252"+01
INFINITE	3.0298"+02	0.0000	2.4188"-04	0.0000"+00	0.1401	3.9909"-04	6.6607"+02	2.8002"+02
58020304	3.6670	1.0000	2.7139"+03	1.3060"-03	7.0169	1.4658	5.4238"+03	5.4238"+03
NM	5.2316"+05	1.0000	8.1349"+03	NM	1.8010	1.7698	2.7385"+02	8.0315"+01
INFINITE	2.9631"+02	0.0000	3.0210"-04	0.0000"+00	0.1365	5.5175"-04	6.5890"+02	2.7385"+02
58020305	3.6810	1.0000	3.4799"+03	1.2400"-03	6.8839	1.4016	7.7655"+03	7.7655"+03
NM	7.6377"+05	1.0000	1.0444"+04	NM	1.8270	1.8075	2.7945"+02	8.1516"+01
INFINITE	3.0242"+02	0.0000	2.7588"-04	0.0000"+00	0.1380	4.8180"-04	6.6634"+02	2.7945"+02
58020306	3.6810	1.0000	3.4727"+03	1.2200"-03	6.9605	1.4281	7.6736"+03	7.6736"+03
NM	7.5472"+05	1.0000	1.0484"+04	NM	1.8149	1.7908	2.7919"+02	8.1442"+01
INFINITE	3.0214"+02	0.0000	2.7988"-04	0.0000"+00	0.1379	5.0045"-04	6.6604"+02	2.7919"+02

58020201 STALMACH PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93767	0.00000	0.00000	2.34046	0.00000
2	2.5400"-04	3.0562"+00	NM	0.96602	0.51261	0.67440	1.73086	0.38964
3	3.0480"-04	3.6371"+00	NM	0.97066	0.56965	0.72751	1.63100	0.44605
4	3.5560"-04	3.8784"+00	NM	0.97242	0.59159	0.74669	1.59309	0.46871
5	4.0640"-04	4.1123"+00	NM	0.97405	0.61207	0.76399	1.55805	0.49035
6	5.3340"-04	4.5920"+00	NM	0.97686	0.64790	0.79290	1.49771	0.52941
7	6.6040"-04	4.8178"+00	NM	0.97854	0.66984	0.80977	1.46147	0.55408
8	7.8740"-04	5.0500"+00	NM	0.97990	0.68775	0.82310	1.43231	0.57466
9	1.0414"-03	5.6302"+00	NM	0.98305	0.73053	0.85332	1.36441	0.62541
10	1.2954"-03	6.1224"+00	NM	0.98550	0.76490	0.87604	1.31172	0.66786
11	1.5494"-03	6.6827"+00	NM	0.98807	0.80219	0.89923	1.25655	0.71563
12	1.8034"-03	7.2465"+00	NM	0.99044	0.83803	0.92014	1.20556	0.76324
13	2.0574"-03	7.8784"+00	NM	0.99288	0.87642	0.94114	1.15315	0.81614
14	2.3114"-03	8.3962"+00	NM	0.99473	0.90676	0.95678	1.11336	0.85936
15	2.5654"-03	8.7851"+00	NM	0.99602	0.92870	0.96759	1.08549	0.89138
16	2.8194"-03	9.0681"+00	NM	0.99693	0.94442	0.97508	1.06597	0.91473
17	3.0734"-03	9.4235"+00	NM	0.99803	0.96380	0.98404	1.04244	0.94398
18	3.3274"-03	9.5322"+00	NM	0.99835	0.96965	0.98669	1.03545	0.95291
19	3.8354"-03	9.8971"+00	NM	0.99941	0.98903	0.99527	1.01265	0.98283
20	4.3434"-03	9.9947"+00	NM	0.99969	0.99415	0.99749	1.00673	0.99082
21	4.8514"-03	1.0072"+01	NM	0.99990	0.99817	0.99922	1.00210	0.99713
22	5.3594"-03	1.0093"+01	NM	0.99996	0.99927	0.99969	1.00084	0.99885
D 23	5.8674"-03	1.0107"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD

58020203 STALMACH PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93774	0.00000	0.00000	2.33654	0.00000
2	2.5400"-04	2.7104"+00	NM	0.96301	0.47565	0.63710	1.79405	0.35512
3	3.0480"-04	3.0653"+00	NM	0.96615	0.51410	0.67553	1.72662	0.39124
4	3.5560"-04	3.2680"+00	NM	0.96785	0.53497	0.69547	1.69007	0.41151
5	4.0640"-04	3.3234"+00	NM	0.96830	0.54046	0.70062	1.68048	0.41692
6	5.3340"-04	3.6332"+00	NM	0.97070	0.57012	0.72764	1.62890	0.44670
7	6.6040"-04	3.8989"+00	NM	0.97264	0.59429	0.74873	1.58728	0.47170
8	7.8740"-04	4.3371"+00	NM	0.97562	0.63200	0.78003	1.52332	0.51206
9	1.0414"-03	4.7898"+00	NM	0.97845	0.66862	0.80862	1.46262	0.55286
10	1.2954"-03	5.1321"+00	NM	0.98044	0.69498	0.82814	1.41991	0.58324
11	1.5494"-03	5.6507"+00	NM	0.98324	0.73306	0.85485	1.35985	0.62863
12	1.8034"-03	6.1063"+00	NM	0.98550	0.76492	0.87589	1.31118	0.66801
13	2.0574"-03	6.5930"+00	NM	0.98775	0.79751	0.89625	1.26295	0.70965
14	2.3114"-03	6.9672"+00	NM	0.98937	0.82168	0.91063	1.22823	0.74142
15	2.5654"-03	7.5198"+00	NM	0.99160	0.85610	0.93009	1.18034	0.78799
16	2.8194"-03	8.0145"+00	NM	0.99345	0.88576	0.94596	1.14055	0.82939
17	3.0734"-03	8.3537"+00	NM	0.99465	0.90553	0.95609	1.11479	0.85764
18	3.3274"-03	8.7460"+00	NM	0.99597	0.92787	0.96713	1.08642	0.89020
19	3.5814"-03	9.0416"+00	NM	0.99693	0.94434	0.97500	1.06599	0.91465
20	4.0894"-03	9.5869"+00	NM	0.99859	0.97400	0.98862	1.03024	0.95960
21	4.5974"-03	9.9041"+00	NM	0.99951	0.99085	0.99605	1.01053	0.98567
22	5.1054"-03	1.0009"+01	NM	0.99980	0.99634	0.99843	1.00420	0.99425
23	5.6134"-03	1.0037"+01	NM	0.99988	0.99780	0.99906	1.00252	0.99655
D 24	6.1214"-03	1.0079"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58020207 STALMACH PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93759	0.00000	0.00000	2.34438	0.00000
2	2.5400"-04	2.7073"+00	NM	0.96283	0.47391	0.63594	1.80068	0.35317
3	3.0480"-04	3.0141"+00	NM	0.96558	0.50746	0.66967	1.74148	0.38454
4	3.5560"-04	3.2101"+00	NM	0.96723	0.52761	0.68912	1.70595	0.40395
5	4.0640"-04	3.4024"+00	NM	0.96878	0.54657	0.70690	1.67258	0.42264
6	5.3340"-04	3.7480"+00	NM	0.97140	0.57900	0.73604	1.61605	0.45546
7	6.6040"-04	4.0029"+00	NM	0.97322	0.60170	0.75558	1.57688	0.47916
8	7.8740"-04	4.2196"+00	NM	0.97470	0.62031	0.77106	1.54511	0.49903
9	9.1440"-04	4.4384"+00	NM	0.97612	0.63851	0.78575	1.51436	0.51886
10	1.1684"-03	4.9165"+00	NM	0.97905	0.67653	0.81503	1.45135	0.56156
11	1.4224"-03	5.3785"+00	NM	0.98165	0.71126	0.84018	1.39537	0.60212
12	1.6764"-03	5.8574"+00	NM	0.98413	0.74550	0.86357	1.34181	0.64358
13	1.9304"-03	6.3434"+00	NM	0.98647	0.77869	0.88495	1.29155	0.68519
14	2.1844"-03	6.8486"+00	NM	0.98871	0.81172	0.90505	1.24318	0.72801
15	2.4384"-03	7.3394"+00	NM	0.99074	0.84254	0.92280	1.19957	0.76927
16	2.6924"-03	7.8364"+00	NM	0.99265	0.87264	0.93923	1.15844	0.81077
17	2.9464"-03	8.3269"+00	NM	0.99440	0.90134	0.95412	1.12053	0.85149
18	3.4544"-03	9.3272"+00	NM	0.99766	0.95719	0.98105	1.05047	0.93391
19	3.9624"-03	9.8010"+00	NM	0.99906	0.98253	0.99243	1.02027	0.97272
20	4.4704"-03	1.0087"+01	NM	0.99987	0.99751	0.99893	1.00287	0.99608
D 21	4.9784"-03	1.0135"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

58020301 STALMACH PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92400	0.00000	0.00000	3.43208	0.00000
2	2.5400"-04	3.7646"+00	NM	0.95744	0.43160	0.66331	2.36200	0.28083
3	2.9718"-04	4.1679"+00	NM	0.96022	0.45793	0.69038	2.27296	0.30374
4	3.4798"-04	4.4333"+00	NM	0.96200	0.47503	0.70713	2.21596	0.31911
5	3.9878"-04	4.8084"+00	NM	0.96422	0.49674	0.72750	2.14488	0.33918
6	4.4958"-04	5.1515"+00	NM	0.96618	0.51629	0.74500	2.08222	0.35779
7	5.7658"-04	5.6558"+00	NM	0.96886	0.54370	0.76826	1.99661	0.38478
8	7.0358"-04	6.0264"+00	NM	0.97068	0.56298	0.78375	1.93812	0.40439
9	8.3058"-04	6.4046"+00	NM	0.97244	0.58198	0.79837	1.88189	0.42424
10	1.0846"-03	7.1120"+00	NM	0.97547	0.61591	0.82291	1.78514	0.46098
11	1.3386"-03	7.8477"+00	NM	0.97829	0.64929	0.84523	1.69458	0.49878
12	1.9736"-03	9.9947"+00	NM	0.98512	0.73806	0.89675	1.47628	0.60744
13	2.6086"-03	1.1884"+01	NM	0.98981	0.80809	0.93055	1.32607	0.70174
14	3.2436"-03	1.3904"+01	NM	0.99387	0.87676	0.95885	1.19602	0.80170
15	3.8786"-03	1.5547"+01	NM	0.99664	0.92888	0.97761	1.10768	0.88258
16	4.5136"-03	1.6897"+01	NM	0.99862	0.96960	0.99085	1.04431	0.94880
17	5.1486"-03	1.7594"+01	NM	0.99955	0.98996	0.99704	1.01437	0.98292
D 18	5.7836"-03	1.7943"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

58020304 STALMACH PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

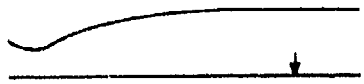
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92417	0.00000	0.00000	3.40968	0.00000
2	2.5400"-04	2.8977"+00	NM	0.95077	0.36976	0.59216	2.56471	0.23089
3	3.0480"-04	3.4096"+00	NM	0.95498	0.40877	0.63735	2.43083	0.26220
4	3.5560"-04	3.5821"+00	NM	0.95630	0.42109	0.65080	2.38910	0.27240
5	4.0640"-04	3.7484"+00	NM	0.95752	0.43250	0.66305	2.35030	0.28211
6	5.3340"-04	4.1213"+00	NM	0.96011	0.45708	0.68835	2.26793	0.30351
7	6.6040"-04	4.4076"+00	NM	0.96197	0.47504	0.70598	2.20867	0.31964
8	7.8740"-04	4.7070"+00	NM	0.96382	0.49313	0.72306	2.14988	0.33632
9	1.0414"-03	5.3149"+00	NM	0.96727	0.52777	0.75385	2.04027	0.36949
10	1.2954"-03	5.8896"+00	NM	0.97022	0.55852	0.77923	1.94652	0.40032
11	1.5494"-03	6.4774"+00	NM	0.97297	0.58827	0.80213	1.85925	0.43143
12	1.8034"-03	7.2542"+00	NM	0.97624	0.62539	0.82858	1.75534	0.47203
13	2.0574"-03	7.8286"+00	NM	0.97843	0.65146	0.84583	1.68574	0.50175
14	2.3114"-03	8.6812"+00	NM	0.98137	0.68831	0.86850	1.59209	0.54551
15	2.5654"-03	9.3437"+00	NM	0.98344	0.71562	0.88409	1.52624	0.57926
16	2.8194"-03	1.0019"+01	NM	0.98539	0.74243	0.89846	1.46450	0.61349
17	3.0734"-03	1.0786"+01	NM	0.98741	0.77174	0.91320	1.40018	0.65220
18	3.3274"-03	1.1810"+01	NM	0.98985	0.80920	0.93064	1.32268	0.70360
19	3.8354"-03	1.3591"+01	NM	0.99350	0.87049	0.95618	1.20657	0.79248
20	4.3434"-03	1.5376"+01	NM	0.99657	0.92786	0.97712	1.10900	0.88108
21	4.8514"-03	1.6865"+01	NM	0.99878	0.97314	0.99189	1.03892	0.95474
22	5.3594"-03	1.7643"+01	NM	0.99982	0.99596	0.99881	1.00573	0.99312
D 23	5.8674"-03	1.7782"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

58020306 STALMACH PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92403	0.00000	0.00000	3.42812	0.00000
2	2.5400"-04	3.1092"+00	NM	0.95241	0.38495	0.61122	2.52101	0.24245
3	2.9718"-04	3.3569"+00	NM	0.95441	0.40342	0.63237	2.45712	0.25736
4	3.4798"-04	3.6414"+00	NM	0.95658	0.42355	0.65451	2.38796	0.27409
5	3.9878"-04	3.9771"+00	NM	0.95897	0.44604	0.67814	2.31148	0.29338
6	4.4958"-04	4.2233"+00	NM	0.96062	0.46180	0.69402	2.25859	0.30728
7	5.0038"-04	4.2447"+00	NM	0.96076	0.46314	0.69534	2.25412	0.30848
8	6.2738"-04	4.6549"+00	NM	0.96334	0.48313	0.71934	2.17168	0.33124
9	7.5438"-04	4.8600"+00	NM	0.96456	0.50014	0.73040	2.13274	0.34247
10	8.8138"-04	5.1517"+00	NM	0.96622	0.51672	0.74518	2.07978	0.35830
11	1.1354"-03	5.7691"+00	NM	0.96946	0.55012	0.77331	1.97606	0.39134
12	1.3894"-03	6.5154"+00	NM	0.97297	0.58790	0.80263	1.86389	0.43062
13	1.6434"-03	7.1483"+00	NM	0.97565	0.61810	0.82425	1.77838	0.46350
14	2.2784"-03	9.0762"+00	NM	0.98246	0.70204	0.87701	1.56055	0.56199
15	2.9134"-03	1.1222"+01	NM	0.98831	0.78490	0.91988	1.37350	0.66973
16	3.5484"-03	1.3540"+01	NM	0.99324	0.86550	0.95446	1.21613	0.78483
17	4.8184"-03	1.7409"+01	NM	0.99934	0.98540	0.99567	1.02097	0.97523
D 18	6.0884"-03	1.7915"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST



M : 1.7, 3.6 and 4.8
R THETA X 10^{-3} : 26 - 35
TW / TR : 1

5803

ZPG - AW

Continuous tunnel with asymmetric flexible nozzle. W = H = 0.15 m.
$0.2 < PO < 0.64$ MN/m^2. TO : 300 K. Air, dewpoint 245 K. $20 < RE/m \times 10^{-6} < 30$.

KISTLER A.L., 1958. Fluctuation measurements in supersonic turbulent boundary layers. BRL Rep 1052.
And Kistler A.L. Private communication. Also Kistler (1959), Kistler and Chen (1963).

1 The measurements were made at a single station on the flat wall opposite the flexible nozzle plate. The test surface was allowed to settle to an equilibrium temperature which was within a few degrees of the adiabatic recovery temperature. The surface was polished to a mirror finish. The free stream Mach number
2 was constant within ± 0.02 after the termination of the nozzle expansion, at least 0.5 m upstream of the
3 test station. Boundary layer profile and hot-wire surveys made to check transition showed that this took
5 place near the tunnel throat. Three dimensional effects were small in the central region of the tunnel. Mean velocity profiles taken at 25.4 mm intervals in the Z-direction were identical within experimental accuracy, and oil and lampblack on the floor did not disclose any secondary flow.

6 Static pressure holes (d = 1.02 mm) were distributed at 25.4 mm intervals along the centre-line of the floor. The wall temperature was monitored by a thermocouple at the measuring station, but buried some
7 distance from the surface. The total temperature profile was obtained with an FWP consisting of a 0.5 mm Pt wire used as a resistance thermometer. TO was found from the recovery temperature using the data of Laufer and McClellan (1956). The FPP used (h_2 = 0.127, b = 1.27 mm) was formed by flattening a hypodermic needle. The hot-wire probe was operated in the constant current mode. The equipment used was basically that described by Kovasznay (1953) with modifications to increase the frequency response and improve matching with the 1.27 µm Pt-Rh wires employed. The length / diameter ratio was about 200. The compensated frequency response of the wires was flat to approximately 90 KHz.

9 The author has interpolated the TO data to the y-stations of the Pitot measurements. The hot-wires were operated in ten states, of which seven are in principle redundant, so as to allow separation of the fluctuation modes by fitting the data to a response characteristic based on the hypothesis of small pressure fluctuation levels. The question is discussed in Kistler and Chen (1963). The friction velocity used for scaling the fluctuation results was obtained from a correlation of published data and checked by comparing the resulting transformed velocity profile with the profiles obtained by Coles (1953). The
12 static pressure was assumed constant through the boundary layer. The editors present the data incorporating all the author's assumptions and data-reduction procedures.

13 Three mean-flow profiles are presented, each for a different Mach number but at approximately the same
14 value of R THETA. The associated fluctuation data is given in section D. The CF value is the author's estimate, determined according to Coles (1953).

§ DATA 5803 0101-0301. Pitot, TO and fluctuation profiles taken separately. NX = 1.

15 Editors' comments

These are the first available systematic hot-wire measurements at supersonic speeds. Even now there are few comparisons, and the interpretation of the measurements remains controversial. Substantial contributions, in each case at a single Mach number, have been made by Horstman & Owen - CAT 7205 and Laderman & Demetriades - CAT 7403. Supporting tabular data are also given in association with Sturek & Danberg - CAT 7101 and Waltrup & Schetz - CAT 7104.

The author's "delta" value is obtained by extrapolation of the semi-logarithmic part of the profile to meet the free-stream velocity, and consequently corresponds to a value of Y which is large when compared to that obtained as a result of the definitions used by most authors. Arguments based on the y/δ positions of turbulence features should take account of this.

The measurements do not extend very close to the wall, including only the outer part of the log-law region. There are no values measured inside the momentum deficit peak. The profiles display an unusually large wake component.

CAT 5803 KISTLER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X RZ	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
58030101	1.7200	1.0057	2.4681"+04	1.5600"-03	2.8441	1.4907	3.9310"+04	3.9310"+04
NM	1.9998"+05	1.0000	3.5072"+04	NM	1.8367	1.8314	2.9100"+02	1.8911"+02
INFINITE	3.0100"+02	0.0000	1.3004"-03	NM	-0.0060	1.5247"-03	4.7424"+02	2.8936"+02
58030201	3.5600	1.0305	1.1697"+04	9.4200"-04	7.1477	1.4270	4.8170"+03	4.8170"+03
NM	3.9997"+05	1.0000	5.4317"+04	NM	1.8176	1.7916	2.8800"+02	8.5438"+01
INFINITE	3.0200"+02	0.0000	1.6208"-03	NM	0.0033	2.8974"-03	6.5976"+02	2.7948"+02
58030301	4.6700	1.0451	5.7460"+03	7.8600"-04	11.3413	1.4725	1.7929"+03	1.7929"+03
NM	6.3995"+05	1.0000	2.5649"+04	NM	1.8184	1.7806	2.8700"+02	5.5952"+01
INFINITE	3.0000"+02	0.0000	1.3155"-03	NM	0.0013	3.0526"-03	7.0038"+02	2.7462"+02

58030101 KISTLER PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.00000	0.00000	0.00000	1.53880	0.00000
2	1.2677E-03	2.1328E+00	NM	0.99700	0.63953	0.72290	1.27770	0.56578
3	2.5248E-03	2.3872E+00	NM	0.99800	0.69360	0.77120	1.23652	0.62375
4	3.8049E-03	2.6124E+00	NM	0.99700	0.73721	0.80783	1.20078	0.67276
5	5.0673E-03	2.7981E+00	NM	0.99950	0.77093	0.83639	1.17699	0.71061
6	6.3297E-03	2.9764E+00	NM	1.00100	0.80174	0.86137	1.15427	0.74625
7	7.6098E-03	3.1483E+00	NM	1.00100	0.83023	0.88322	1.13172	0.78042
8	8.8900E-03	3.4626E+00	NM	1.00100	0.87965	0.91961	1.09290	0.84143
9	1.0152E-02	3.5279E+00	NM	1.00200	0.88953	0.92712	1.08629	0.85348
10	1.1397E-02	3.6925E+00	NM	1.00300	0.91395	0.94470	1.06841	0.88421
11	1.2677E-02	3.8620E+00	NM	1.00200	0.93837	0.96089	1.04856	0.91638
12	1.3957E-02	4.0110E+00	NM	1.00100	0.95930	0.97433	1.03158	0.94451
13	1.5271E-02	4.1465E+00	NM	1.00100	0.97791	0.98644	1.01753	0.96945
14	1.6535E-02	4.2107E+00	NM	1.00100	0.98663	0.99203	1.01098	0.98125
15	1.7730E-02	4.3021E+00	NM	1.00050	0.99884	0.99952	1.00137	0.99816
D 16	1.8936E-02	4.3108E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M,TO/TOD ASSUME P=PD

58030201 KISTLER PROFILE TABULATION 17 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.00000	0.00000	0.00000	3.37086	0.00000
2	1.0135E-03	2.7459E+00	NM	0.97500	0.36798	0.58942	2.56574	0.22973
3	3.5471E-03	4.2672E+00	NM	0.98500	0.48034	0.71195	2.19691	0.32407
4	6.0808E-03	5.2886E+00	NM	0.99100	0.54213	0.76812	2.00742	0.38264
5	8.6144E-03	6.3827E+00	NM	0.99400	0.60112	0.81404	1.83385	0.44390
6	1.1148E-02	7.5920E+00	NM	1.00000	0.66011	0.85550	1.67960	0.50935
7	1.3628E-02	8.9161E+00	NM	1.00300	0.71910	0.89073	1.53429	0.58054
8	1.6269E-02	1.0355E+01	NM	1.00300	0.77809	0.92025	1.39878	0.65789
9	1.8749E-02	1.1228E+01	NM	1.00400	0.81180	0.93584	1.32895	0.70420
10	2.1336E-02	1.3492E+01	NM	1.00300	0.89326	0.96744	1.17299	0.82477
11	2.3736E-02	1.4662E+01	NM	1.00250	0.93258	0.98068	1.10581	0.88684
12	2.6403E-02	1.5530E+01	NM	1.00200	0.96067	0.98938	1.06064	0.93281
13	2.8804E-02	1.5973E+01	NM	1.00000	0.97472	0.99265	1.03713	0.95711
14	3.1471E-02	1.6332E+01	NM	1.00000	0.98596	0.99597	1.02041	0.97604
15	3.3871E-02	1.6513E+01	NM	1.00000	0.99157	0.99759	1.01218	0.98559
16	3.6271E-02	1.6577E+01	NM	1.00000	0.99354	0.99816	1.00932	0.98894
D 17	3.8938E-02	1.6787E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M,TO/TOD ASSUME P=PD

58030301 KISTLER PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.00000	0.00000	0.00000	5.12944	0.00000
2	1.6065E-03	3.4971E+00	NM	0.96500	0.32591	0.61284	3.53593	0.17332
3	2.6143E-03	4.1038E+00	NM	0.97000	0.35803	0.65391	3.33582	0.19603
4	3.9433E-03	4.8552E+00	NM	0.97300	0.39400	0.69491	3.11070	0.22339
5	5.2578E-03	5.4881E+00	NM	0.97800	0.42184	0.72482	2.95230	0.24551
6	6.2801E-03	6.0583E+00	NM	0.98000	0.44540	0.74755	2.81703	0.26537
7	7.5946E-03	6.8298E+00	NM	0.98500	0.47537	0.77527	2.65972	0.29149
8	8.6169E-03	7.4242E+00	NM	0.98600	0.49722	0.79301	2.54372	0.31175
9	1.0282E-02	8.6486E+00	NM	0.99100	0.53940	0.82543	2.34172	0.35249
10	1.1976E-02	1.0002E+01	NM	0.99400	0.58244	0.85309	2.14931	0.39728
11	1.3583E-02	1.1452E+01	NM	0.99900	0.62527	0.87983	1.97999	0.44436
12	1.6942E-02	1.4920E+01	NM	1.00300	0.71734	0.92355	1.65753	0.55718
13	1.8694E-02	1.6851E+01	NM	1.00300	0.76381	0.94081	1.51716	0.62011
14	2.0389E-02	1.8894E+01	NM	1.00500	0.81006	0.95684	1.39521	0.68580
15	2.3719E-02	2.2269E+01	NM	1.00500	0.88116	0.97662	1.22841	0.79503
16	2.7165E-02	2.4774E+01	NM	1.00500	0.93041	0.98830	1.12831	0.87591
17	2.8626E-02	2.5620E+01	NM	1.00000	0.94647	0.98933	1.09262	0.90546
18	3.2715E-02	2.6852E+01	NM	1.00000	0.96938	0.99407	1.05159	0.94530
19	3.5636E-02	2.7592E+01	NM	1.00000	0.98287	0.99674	1.02842	0.96919
20	3.9141E-02	2.8186E+01	NM	1.00000	0.99358	0.99879	1.01053	0.98839
D 21	4.2647E-02	2.8545E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M,TO/TOD ASSUME P=PD

TABLES OF REDUCED TIME-MEAN FLUCTUATION QUANTITIES

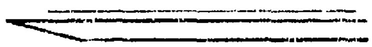
ε

Velocity Fluctuation Levels		Static Temperature Fluctuation Levels		Temperature-Velocity Correlation Coefficients	
y/δ	$\frac{\sqrt{\overline{\Delta u^2}}}{u_\tau}$	y/δ	$\frac{\sqrt{\overline{\Delta T^2}}}{2T}\;\frac{T_0+T_\infty}{T_0-T_\infty}$	y/δ	$\frac{\overline{\Delta T \Delta U}}{\sqrt{\overline{\Delta T^2}}\sqrt{\overline{\Delta U^2}}}$
58030101	M_δ = 1.72	u_τ =	16.66 m/s	δ =	17.78 mm
0.153	1.33	.122	0.042	0.161	- 0.566
0.159	1.44	.170	0.054	0.161	- 0.66
0.290	1.31	.255	0.053	0.270	- 0.71
0.353	1.27	.285	0.061	0.306	- 0.70
0.418	1.22	.346	0.065	0.45	- 0.76
0.619	0.92	.418	0.067	0.516	- 0.78
1.016	0.14	.479	0.067	0.75	- 0.76
1.016	0.19	.618	0.066	0.94	- 0.67
		.891	0.040	1.08	- 0.62
		1.018	0.016		
58030201	M_δ = 3.56	u_τ =	26.76 m/s	δ =	26.67 mm
0.135	1.06	0.139	0.051	.139	- 0.71
.135	1.11	.139	0.056	.139	- 0.74
.182	1.07	.28	0.064	.27	- 0.69
.540	0.91	.28	0.066	.41	- 0.70
.681	0.59	.406	0.078	.59	- 0.67
.816	0.32	.546	0.079	.68	- 0.66
.816	0.35	.685	0.072	.82	- 0.51
.960	0.13	.75	0.058	.95	- 0.47
1.096	0.07	.83	0.042		
		.96	0.020		
		1.09	0.008		
58030301	M_δ = 4.67	u_τ =	32.07 m/s	δ =	29.21 mm
0.071	0.99	0.066	0.047	0.067	- 0.58
0.130	0.99	.138	0.047	0.134	- 0.52
0.416	0.88	.186	0.058	0.306	- 0.54
.536	0.67	.308	0.064	0.428	- 0.68
.652	0.40	.412	0.084	0.58	- 0.69
.660	0.50	0.577	0.084	0.65	- 0.58
.825	0.22	0.657	0.080	0.83	- 0.52
.092	0.08	.836	0.049	1.00	- 0.47
		1.00	0.018	1.08	- 0.47

The reference velocity and length (u_τ and δ) have the values given by the author in accord with his definitions.

Δu etc. are more usually written u' etc.

rough



M : 2.2 and 2.7

R THETA X 10^{-3} : 8 - 50

TW / TR : 1

5804

ZPG (ROUGH) AW

Continuous wind tunnel with fixed symmetrical interchangeable nozzles. W = 0.48, H = 0.7, L = 1.0 m. 0.18 < PO < 0 3 MN/m^2. TO: 340 K. Air. RE/m X 10^{-6} : 25.

FENTER F.W. and LYONS W.C., 1958. An experimental investigation of the effects of several types of surface roughness on turbulent boundary layer characteristics at supersonic speeds. DRL 411.

The experimental arrangements were as for CAT 5501 and 5502 except that no balance measurements were made,
1 and that the surface of the plate was further modified. In the initial tests (series 01) the entire plate
to surface was coated with spherical beads of 0.105 mm diameter, and seven successive profiles were measured
11 on the centre-line from X = 194 mm to X = 804 mm, in increments of 103 mm (see section B). For the remaining tests, the basic plate was modified to carry 16 different insert plates.

1 The roughness of the various inserts is described in Table 1 and the associated figure, with reference to the normal zero plane of the insert, which was carefully adjusted to the plane of the basic plate. The insert extended from X = 230 mm to X = 840 mm, and was 301 mm wide, as compared to the overall plate width
3 of 483 mm. When modified to carry the inserts, the plate had a knurled transition trip extending transversly across the whole width from X = 19 to 25 mm. This was formed by a standard 1/4 inch knurling tool. The peaks of the knurled region where about 0.13 mm high. Otherwise the surface of the basic plate was flat, as was the first 72.2 mm of the insert. The first insert was completely flat, so that the model became a conventional smooth flat plate.

8 Profiles could be measured on the normal at X = 296 mm, just upstream of the start of the roughness on the insert at X = 302 mm, and also on the normal at X = 804 mm, just before the end of the roughness at X = 840 mm.

9 The static pressure through the boundary layer was assumed to be constant.

12 The editors have presented all the profiles for which tabulated data is available except one pair for insert 1 at a slightly lower unit Reynolds number. The author's assumption of isoenergetic flow has been replaced
13 by the Crocco / Van Driest temperature velocity correlation. The profiles consist of the consecutive set of seven (series 01) on a close-packed spherically rough surface, and upstream and downstream profiles for the varied roughnesses listed in table 1. These have been grouped as "series" 02, the upstream profiles, and "series" 03, the downstream profiles. The profile identification number in each case is the number of the relevant insert. All the profiles presented were obtained at the same unit Reynolds number, so that in
14 principle the profiles of series 02 should be identical. No wall data is presented.

§ DATA 5804 0101-0316. Pitot profiles. NX = 7 (Series 01), otherwise 2. Roughened surface.

15 **Editors' comments**

The entry describes a further systematic DRL attempt to describe the effects of roughness. For a complete view of the programme to 1959, see Fenter (1960). In the tests with varied roughness inserts the boundary layer was formed on a smooth "flat plate" leading edge with a trip, before encountering a step increase in roughness. A recent series of tests of similar type, but made on a tunnel wall, is described by Reda (1974) who was also able to measure the drag force on the second half of his insert. The absence of any shear stress measurement in the tests described here unfortunately reduces the value of the data greatly. The uniform roughness results (series 01) may be compared with those of Shutts & Fenter - CAT 5502 and Young - CAT 6506.

For about half the profiles described, measurements do not extend within the momentum-deficit peak, so that integral values should be treated with caution.

DIMENSIONS OF SURFACE ROUGHNESS FOR PLATE INSERTS (Refer to figure 1)

INSERT NO	Type	h (mm)	w (mm)	d (mm)	β^o
1	smooth	-	-	-	-
2	Uniform grain	(No 120 Aloxite, mean diameter		0.185 mm)	
3	"	(No 220 " " "		0.15 mm)	
4	"	(No 400 " " "		0.024 mm)	
5	"	(No 303 Optical grit, mean diameter		0.013 mm)	
6	A	0.51 (forward facing step)			0
7	B	0.127	4.78	19.1	-
8	B	0.127	4.78	9.5	-
9	C	0.127	0.254	10.2	0
10	C	0.127	0.254	2.54	0
11	C	0.127	0.254	1.27	0
12	C	0.127	0.254	0.51	0
13	C	0.127	0.254	0.25	0
14	C	0.127	0.254	0.25	20
15	C	0.127	0.254	0.25	40
16	D	2.6 mm	8.0	40	-

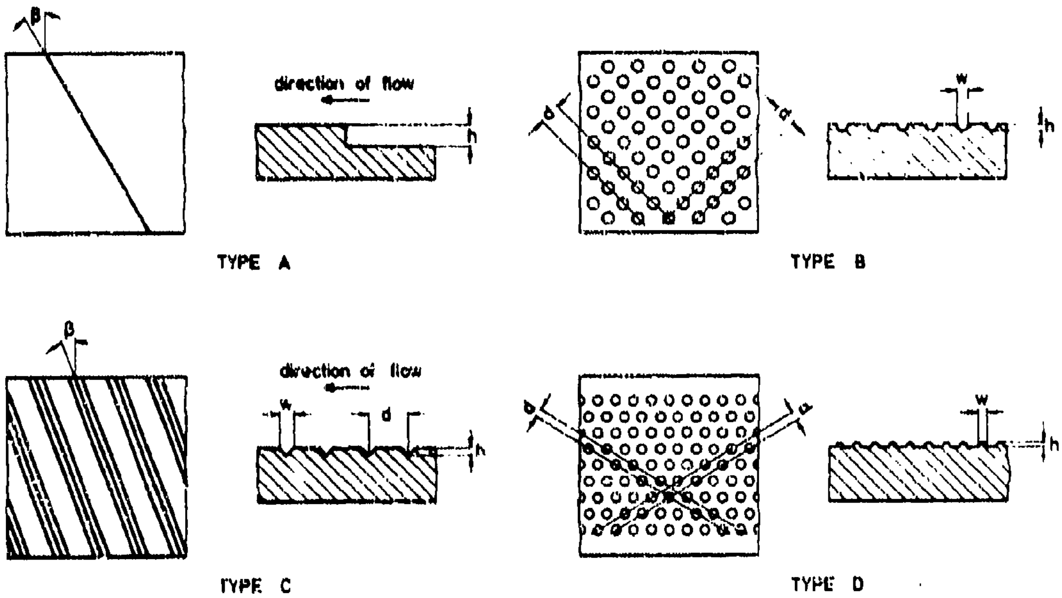


FIG. 1 TYPES OF MACHINED ROUGHNESS TESTED

5804 FENTER 27 PROFILES

CAT 5804 FENTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TCD*	SW *	D2	PI2*	H42	D2K	UD	TR
58040101	2.6990	1.0000	4.0675"+03	NM	4.5245	1.4715	1.4121"+04	1.4121"+04
1.9446"-01	3.2828"+05	1.0000	8.2436"+03	NM	1.7789	1.7615	3.0150"+02	1.3078"+02
INFINITE	3.2131"+02	0.0000	3.2496"-04	0.0000"+00	0.1097	4.8635"-04	6.1884"+02	3.0150"+02
58040102	2.7020	1.0000	6.3178"+03	NM	4.5304	1.4620	1.4001"+04	1.4001"+04
2.9596"-01	3.2699"+05	1.0000	1.2812"+04	NM	1.7680	1.7479	3.0252"+02	1.3106"+02
INFINITE	3.2242"+02	0.0000	5.1033"-04	0.0000"+00	0.1091	7.7408"-04	6.2019"+02	3.0252"+02
58040103	2.7020	1.0000	7.9627"+03	NM	4.4111	1.4002	1.3876"+04	1.3876"+04
3.9746"-01	3.2408"+05	1.0000	1.6147"+04	NM	1.7865	1.7677	3.0252"+02	1.3106"+02
INFINITE	3.2242"+02	0.0000	6.4899"-04	0.0000"+00	0.1103	9.6118"-04	6.2019"+02	3.0252"+02
58040104	2.6990	1.0000	9.8243"+03	NM	4.3527	1.3753	1.4053"+04	1.4053"+04
4.9926"-01	3.2668"+05	1.0000	1.9920"+04	NM	1.7962	1.7773	3.0045"+02	1.3033"+02
INFINITE	3.2020"+02	0.0000	7.8517"-04	0.0000"+00	0.1108	1.1464"-03	6.1777"+02	3.0045"+02
58040105	2.6860	1.0000	1.1367"+04	NM	4.3054	1.3608	1.4249"+04	1.4249"+04
6.0076"-01	3.2467"+05	1.0000	2.2908"+04	NM	1.7960	1.7786	3.0262"+02	1.3198"+02
INFINITE	3.2242"+02	0.0000	9.1103"-04	0.0000"+00	0.1103	1.3278"-03	6.1659"+02	3.0262"+02
58040106	2.6570	1.0000	1.3872"+04	NM	4.3063	1.3977	1.4905"+04	1.4905"+04
7.0226"-01	3.2479"+05	1.0000	2.7643"+04	NM	1.7859	1.7662	3.0279"+02	1.3368"+02
INFINITE	3.2242"+02	0.0000	1.0819"-03	0.0000"+00	0.1087	1.5845"-03	6.1593"+02	3.0279"+02
58040107	2.6350	1.0000	1.4655"+04	NM	4.2551	1.3969	1.5347"+04	1.5347"+04
8.0406"-01	3.2326"+05	1.0000	2.9321"+04	NM	1.7873	1.7678	3.0502"+02	1.3591"+02
INFINITE	3.2064"+02	0.0000	1.1504"-03	0.0000"+00	0.1081	1.6728"-03	6.1591"+02	3.0502"+02
58040201	2.2430	1.0000	5.5257"+03	NM	3.4373	1.3968	2.3163"+04	2.3163"+04
2.9596"-01	2.6492"+05	1.0000	9.3371"+03	NM	1.8178	1.8041	3.2193"+02	1.6930"+02
INFINITE	3.3964"+02	0.0000	3.8736"-04	0.0000"+00	0.0948	4.9876"-04	5.8514"+02	3.2193"+02
58040201A	2.2470	1.0000	5.3640"+03	NM	3.4587	1.4019	2.2671"+04	2.2671"+04
2.9596"-01	2.6092"+05	1.0000	9.0791"+03	NM	1.8124	1.7998	3.2137"+02	1.6872"+02
INFINITE	3.3909"+02	0.0000	3.8234"-04	0.0000"+00	0.0947	4.9605"-04	5.8518"+02	3.2137"+02
58040204	2.2390	1.0000	5.6371"+03	NM	3.4271	1.3965	2.3225"+04	2.3225"+04
2.9596"-01	2.6397"+05	1.0000	9.5094"+03	NM	1.8196	1.8052	3.2249"+02	1.6988"+02
INFINITE	3.4020"+02	0.0000	3.9602"-04	0.0000"+00	0.0947	5.0829"-04	5.8510"+02	3.2249"+02

5804 FENTER 27 PROFILES

CAT 5804 FENTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED20	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
58040301	2.2420	1.0000	1.1845"+04	NM	3.3263	1.3153	2.3288"+04	2.3288"+04
8.0406"-01	2.6593"+05	1.0000	2.0011"+04	NM	1.8235	1.8116	3.2141"+02	1.6910"+02
INFINITE	3.3909"+02	0.0000	8.2475"-04	0.0000"+00	0.0951	1.0558"-03	5.8454"+02	3.2141"+02
58040301A	2.2430	1.0000	1.1988"+04	NM	3.3114	1.3023	2.3065"+04	2.3065"+04
8.0406"-01	2.6380"+05	1.0000	2.0264"+04	NM	1.8257	1.8154	3.2088"+02	1.6874"+02
INFINITE	3.3853"+02	0.0000	8.4045"-04	0.0000"+00	0.0952	1.0747"-03	5.8419"+02	3.2088"+02
58040302	2.2310	1.0000	1.8797"+04	NM	3.4997	1.4231	2.3699"+04	2.3699"+04
8.0406"-01	2.6600"+05	1.0000	3.1621"+04	NM	1.7664	1.7491	3.2202"+02	1.7021"+02
INFINITE	3.3964"+02	0.0000	1.2986"-03	0.0000"+00	0.0916	1.7559"-03	5.8358"+02	3.2202"+02
58040303	2.2350	1.0000	1.7965"+04	NM	3.5299	1.4403	2.3158"+04	2.3158"+04
8.0406"-01	2.6156"+05	1.0000	3.0261"+04	NM	1.7648	1.7462	3.2252"+02	1.7018"+02
INFINITE	3.4020"+02	0.0000	1.2692"-03	0.0000"+00	0.0917	1.7185"-03	5.8458"+02	3.2252"+02
58040304	2.2350	1.0000	1.5079"+04	NM	3.4457	1.3890	2.3050"+04	2.3050"+04
8.0406"-01	2.6035"+05	1.0000	2.5399"+04	NM	1.7838	1.7680	3.2252"+02	1.7018"+02
INFINITE	3.4020"+02	0.0000	1.0703"-03	0.0000"+00	0.0927	1.4247"-03	5.8458"+02	3.2252"+02
58040305	2.2410	1.0000	1.2809"+04	NM	3.3631	1.3353	2.2760"+04	2.2760"+04
8.0406"-01	2.5950"+05	1.0000	2.1628"+04	NM	1.8102	1.7974	3.2194"+02	1.6945"+02
INFINITE	3.3964"+02	0.0000	9.1509"-04	0.0000"+00	0.0943	1.1883"-03	5.8488"+02	3.2194"+02
58040306	2.2400	1.0000	1.2257"+04	NM	3.3184	1.3122	2.3162"+04	2.3162"+04
8.0406"-01	2.6366"+05	1.0000	2.0695"+04	NM	1.8241	1.8122	3.2090"+02	1.6897"+02
INFINITE	3.3853"+02	0.0000	8.5748"-04	0.0000"+00	0.0950	1.0967"-03	5.8380"+02	3.2090"+02
58040307	2.2330	1.0000	1.2081"+04	NM	3.2503	1.2820	2.3318"+04	2.3318"+04
8.0406"-01	2.6255"+05	1.0000	2.0334"+04	NM	1.8421	1.8311	3.2253"+02	1.7033"+02
INFINITE	3.4020"+02	0.0000	8.4883"-04	0.0000"+00	0.0957	1.0622"-03	5.8432"+02	3.2253"+02
58040308	2.2440	1.0000	1.1549"+04	NM	3.2667	1.2766	2.2618"+04	2.2618"+04
8.0406"-01	2.5909"+05	1.0000	2.0025"+04	NM	1.8405	1.8315	3.2245"+02	1.6950"+02
INFINITE	3.4020"+02	0.0000	8.5178"-04	0.0000"+00	0.0960	1.0714"-03	5.8575"+02	3.2245"+02
58040309	2.2440	1.0000	1.1899"+04	NM	3.3147	1.3046	2.3242"+04	2.3242"+04
8.0406"-01	2.6624"+05	1.0000	2.0114"+04	NM	1.8265	1.8157	3.2192"+02	1.6922"+02
INFINITE	3.3964"+02	0.0000	8.3075"-04	0.0000"+00	0.0953	1.0612"-03	5.8527"+02	3.2192"+02
58040310	2.2560	1.0000	1.1891"+04	NM	3.3529	1.3158	2.2331"+04	2.2331"+04
8.0406"-01	2.6065"+05	1.0000	2.0191"+04	NM	1.8227	1.8104	3.2183"+02	1.6832"+02
INFINITE	3.3964"+02	0.0000	8.5699"-04	0.0000"+00	0.0956	1.1011"-03	5.8683"+02	3.2183"+02
58040311	2.2410	1.0000	1.2158"+04	NM	3.3314	1.3186	2.2677"+04	2.2677"+04
8.0406"-01	2.5855"+05	1.0000	2.0529"+04	NM	1.8207	1.8084	3.2194"+02	1.6945"+02
INFINITE	3.3964"+02	0.0000	8.7176"-04	0.0000"+00	0.0949	1.1192"-03	5.8488"+02	3.2194"+02
58040312	2.2390	1.0000	1.6266"+04	NM	3.4342	1.3763	2.2712"+04	2.2712"+04
8.0406"-01	2.5814"+05	1.0000	2.7445"+04	NM	1.7868	1.7717	3.2196"+02	1.6960"+02
INFINITE	3.3964"+02	0.0000	1.1661"-03	0.0000"+00	0.0930	1.5498"-03	5.8462"+02	3.2196"+02
58040313	2.2390	1.0000	1.5202"+04	NM	3.4415	1.3806	2.2689"+04	2.2689"+04
8.0406"-01	2.5787"+05	1.0000	2.5650"+04	NM	1.7851	1.7698	3.2196"+02	1.6960"+02
INFINITE	3.3964"+02	0.0000	1.0910"-03	0.0000"+00	0.0929	1.4524"-03	5.8462"+02	3.2196"+02
58040314	2.2390	1.0000	1.4370"+04	NM	3.4024	1.3587	2.2864"+04	2.2864"+04
8.0406"-01	2.5987"+05	1.0000	2.4256"+04	NM	1.7965	1.7823	3.2091"+02	1.6904"+02
INFINITE	3.3853"+02	0.0000	1.0191"-03	0.0000"+00	0.0935	1.3416"-03	5.8367"+02	3.2091"+02
58040315	2.2380	1.0000	1.4289"+04	NM	3.3864	1.3496	2.3005"+04	2.3005"+04
8.0406"-01	2.6106"+05	1.0000	2.4104"+04	NM	1.7995	1.7861	3.2144"+02	1.6940"+02
INFINITE	3.3909"+02	0.0000	1.0100"-03	0.0000"+00	0.0937	1.3255"-03	5.8402"+02	3.2144"+02
58040317	2.2260	1.0000	2.9359"+04	NM	3.4369	1.3763	2.3486"+04	2.3486"+04
8.0406"-01	2.6156"+05	1.0000	4.9305"+04	NM	1.7649	1.7537	3.2154"+02	1.7031"+02
INFINITE	3.3909"+02	0.0000	2.0495"-03	0.0000"+00	0.0914	2.7841"-03	5.8244"+02	3.2154"+02

58040201 FENTER PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94784	0.00000	0.00000	1.90156	0.00000
2	2.2860"-04	2.2011"+00	NM	0.96821	0.50201	0.62489	1.54951	0.40328
3	2.8702"-04	2.3843"+00	NM	0.97017	0.53143	0.65425	1.51565	0.43167
4	3.4290"-04	2.5324"+00	NM	0.97166	0.55372	0.67585	1.48975	0.45366
5	4.6990"-04	2.6816"+00	NM	0.97311	0.57512	0.69606	1.46476	0.47520
6	5.9690"-04	2.8778"+00	NM	0.97492	0.60187	0.72060	1.43342	0.50271
7	7.2390"-04	3.0492"+00	NM	0.97644	0.62416	0.74044	1.40728	0.52615
8	9.7790"-04	3.3420"+00	NM	0.97888	0.66028	0.77143	1.36504	0.56514
9	1.2319"-03	3.6018"+00	NM	0.98092	0.69059	0.79637	1.32979	0.59887
10	1.4910"-03	3.8989"+00	NM	0.98312	0.72358	0.82240	1.29179	0.63664
11	1.7399"-03	4.1721"+00	NM	0.98503	0.75256	0.84435	1.25881	0.67075
12	2.2479"-03	4.7202"+00	NM	0.98856	0.80740	0.88360	1.19767	0.73777
13	2.7559"-03	5.2787"+00	NM	0.99182	0.85956	0.91829	1.14131	0.80459
14	3.2639"-03	5.8473"+00	NM	0.99484	0.90950	0.94921	1.08925	0.87144
15	3.7719"-03	6.2085"+00	NM	0.99661	0.93981	0.96696	1.05860	0.91343
16	4.7904"-03	6.8412"+00	NM	0.99948	0.99064	0.99504	1.00892	0.98625
17	5.8039"-03	6.9098"+00	NM	0.99978	0.99599	0.99788	1.00381	0.99409
18	6.8199"-03	6.9155"+00	NM	0.99980	0.99643	0.99812	1.00339	0.99475
19	9.3599"-03	6.8926"+00	NM	0.99971	0.99465	0.99718	1.00509	0.99213
20	1.1902"-02	6.9385"+00	NM	0.99990	0.99822	0.99906	1.00169	0.99737
21	1.4442"-02	6.9500"+00	NM	0.99995	0.99911	0.99953	1.00085	0.99869
D 22	2.3564"-02	6.9615"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58040204 FENTER PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94793	0.00000	0.00000	1.89835	0.00000
2	2.2860"-04	2.1931"+00	NM	0.96821	0.50156	0.62412	1.54842	0.40307
3	3.0480"-04	2.3901"+00	NM	0.97032	0.53327	0.65574	1.51206	0.43368
4	4.3180"-04	2.6280"+00	NM	0.97269	0.56856	0.68961	1.47114	0.46876
5	5.6642"-04	2.8344"+00	NM	0.97463	0.59714	0.71602	1.43778	0.49800
6	6.8834"-04	3.0040"+00	NM	0.97614	0.61947	0.73602	1.41169	0.52138
7	9.3930"-04	3.2790"+00	NM	0.97846	0.65386	0.76576	1.37156	0.55831
8	1.1989"-03	3.5783"+00	NM	0.98084	0.68915	0.79495	1.33064	0.59742
9	1.4478"-03	3.8171"+00	NM	0.98262	0.71594	0.81625	1.29982	0.62797
10	1.7018"-03	4.0869"+00	NM	0.98454	0.74498	0.83848	1.26677	0.66190
11	2.2123"-03	4.6466"+00	NM	0.98821	0.80170	0.87949	1.20348	0.73079
12	2.7203"-03	5.2394"+00	NM	0.99170	0.85753	0.91686	1.14317	0.80203
13	3.2258"-03	5.7275"+00	NM	0.99432	0.90085	0.94393	1.09792	0.85974
14	3.7363"-03	6.2572"+00	NM	0.99694	0.94551	0.97016	1.05282	0.92149
15	4.4958"-03	6.7560"+00	NM	0.99921	0.98571	0.99239	1.01361	0.97907
16	5.2603"-03	6.8526"+00	NM	0.99963	0.99330	0.99645	1.00636	0.99016
17	6.5303"-03	6.8640"+00	NM	0.99968	0.99419	0.99693	1.00551	0.99147
18	7.2923"-03	6.8926"+00	NM	0.99980	0.99643	0.99811	1.00339	0.99474
19	9.6698"-03	6.8869"+00	NM	0.99978	0.99598	0.99780	1.00381	0.99409
D 20	2.4310"-02	6.9385"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58040301 FENTER PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94786	0.00000	0.00000	1.90076	0.00000
2	2.2860"-04	2.0669"+00	NM	0.96671	0.47904	0.60122	1.57517	0.38169
3	2.7178"-04	2.2415"+00	NM	0.96867	0.50892	0.63180	1.54120	0.40994
4	3.2258"-04	2.3217"+00	NM	0.96953	0.52186	0.64475	1.52634	0.42240
5	4.5212"-04	2.4603"+00	NM	0.97097	0.54326	0.66571	1.50157	0.44334
6	5.7150"-04	2.5968"+00	NM	0.97232	0.56334	0.68491	1.47821	0.46334
7	8.3312"-04	2.8377"+00	NM	0.97458	0.59679	0.71592	1.43908	0.49748
8	1.0871"-03	3.0353"+00	NM	0.97634	0.62266	0.73904	1.40878	0.52460
9	1.3437"-03	3.1951"+00	NM	0.97770	0.64273	0.75648	1.38529	0.54608
10	1.8466"-03	3.4550"+00	NM	0.97981	0.67395	0.78274	1.34888	0.58029
11	2.3546"-03	3.6846"+00	NM	0.98157	0.70027	0.80406	1.31841	0.60987
12	2.8626"-03	3.9030"+00	NM	0.98317	0.72435	0.82294	1.29074	0.63758
13	3.3757"-03	4.1166"+00	NM	0.98467	0.74710	0.84023	1.26484	0.66430
14	3.8786"-03	4.3240"+00	NM	0.98607	0.76851	0.85602	1.24071	0.68995
15	4.8946"-03	4.7387"+00	NM	0.98870	0.80955	0.88504	1.19520	0.74049
16	5.9157"-03	5.1807"+00	NM	0.99130	0.85103	0.91275	1.15032	0.79347
17	6.9266"-03	5.5894"+00	NM	0.99353	0.88760	0.93590	1.11178	0.84180
18	7.9426"-03	5.9945"+00	NM	0.99560	0.92239	0.95684	1.07608	0.88919
19	8.9586"-03	6.3662"+00	NM	0.99738	0.95317	0.97452	1.04531	0.93228
20	1.0483"-02	6.7560"+00	NM	0.99914	0.98439	0.99170	1.01490	0.97714
21	1.2007"-02	6.9155"+00	NM	0.99983	0.99688	0.99835	1.00296	0.99540
22	1.3531"-02	6.9442"+00	NM	0.99995	0.99911	0.99953	1.00085	0.99869
23	1.6071"-02	6.9500"+00	NM	0.99998	0.99955	0.99977	1.00042	0.99934
D 24	2.3685"-02	6.9557"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58040304 FENTER PROFILE TABULATION 29 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94802	0.00000	0.00000	1.89514	0.00000
2	2.2860"-04	1.5631"+00	NM	0.95999	0.36913	0.47974	1.68913	0.28402
3	2.8194"-04	1.6072"+00	NM	0.96069	0.38121	0.49366	1.67700	0.29437
4	3.3020"-04	1.6553"+00	NM	0.96143	0.39374	0.50793	1.66420	0.30521
5	4.5720"-04	1.8160"+00	NM	0.96373	0.43132	0.54976	1.62460	0.33840
6	5.8674"-04	1.9471"+00	NM	0.96543	0.45817	0.57870	1.59537	0.36274
7	7.1374"-04	2.0570"+00	NM	0.96676	0.47875	0.60035	1.57252	0.38178
8	9.6266"-04	2.2469"+00	NM	0.96890	0.51141	0.63374	1.53563	0.41269
9	1.2192"-03	2.4221"+00	NM	0.97075	0.53915	0.66117	1.50384	0.43965
10	1.4834"-03	2.5721"+00	NM	0.97225	0.56152	0.68266	1.47799	0.46188
11	1.7272"-03	2.7008"+00	NM	0.97348	0.57987	0.69986	1.45670	0.48044
12	2.2352"-03	2.9319"+00	NM	0.97560	0.61119	0.72837	1.42024	0.51285
13	2.7559"-03	3.1483"+00	NM	0.97747	0.63893	0.75273	1.38796	0.54233
14	3.2537"-03	3.3308"+00	NM	0.97898	0.66130	0.77176	1.36198	0.56664
15	3.7592"-03	3.5511"+00	NM	0.98072	0.68725	0.79317	1.33200	0.59547
16	4.2672"-03	3.7565"+00	NM	0.98227	0.71051	0.81176	1.30529	0.62190
17	5.0317"-03	4.0657"+00	NM	0.98449	0.74407	0.83759	1.26716	0.66100
18	5.7963"-03	4.3856"+00	NM	0.98664	0.77718	0.86196	1.23007	0.70074
19	6.5583"-03	4.6925"+00	NM	0.98859	0.80761	0.88342	1.19655	0.73830
20	7.3203"-03	5.0212"+00	NM	0.99056	0.83893	0.90459	1.16267	0.77803
21	8.0772"-03	5.3381"+00	NM	0.99235	0.86801	0.92344	1.13181	0.81590
22	8.8392"-03	5.6609"+00	NM	0.99408	0.89664	0.94128	1.10204	0.85413
23	1.0112"-02	6.1708"+00	NM	0.99662	0.94004	0.96698	1.05813	0.91386
24	1.1382"-02	6.6265"+00	NM	0.99874	0.97718	0.98776	1.02177	0.96671
25	1.2649"-02	6.7787"+00	NM	0.99941	0.98926	0.99429	1.01019	0.98426
26	1.3919"-02	6.8583"+00	NM	0.99975	0.99553	0.99763	1.00424	0.99342
27	1.5189"-02	6.8812"+00	NM	0.99985	0.99732	0.99858	1.00254	0.99605
28	1.7729"-02	6.8983"+00	NM	0.99993	0.99866	0.99929	1.00127	0.99802
D 29	2.0269"-02	6.9155"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58040308 FENTER PROFILE TABULATION 29 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94782	0.00000	0.00000	1.90237	0.00000
2	2.2860"-04	2.1693"+00	NM	0.96783	0.49643	0.61931	1.55627	0.39794
3	2.7178"-04	2.2716"+00	NM	0.96895	0.51337	0.63643	1.53687	0.41411
4	3.2512"-04	2.4017"+00	NM	0.97032	0.53387	0.65672	1.51319	0.43400
5	4.5212"-04	2.6658"+00	NM	0.97294	0.57264	0.69381	1.46799	0.47263
6	5.7658"-04	2.8477"+00	NM	0.97463	0.59759	0.71680	1.43873	0.49821
7	7.0866"-04	2.9558"+00	NM	0.97560	0.61185	0.72962	1.42200	0.51310
8	9.5504"-04	3.2314"+00	NM	0.97795	0.64661	0.75994	1.38124	0.55019
9	1.2217"-03	3.3794"+00	NM	0.97916	0.66444	0.77498	1.36041	0.56966
10	1.4757"-03	3.5356"+00	NM	0.98039	0.68271	0.79004	1.33914	0.58996
11	1.9787"-03	3.7204"+00	NM	0.98179	0.70365	0.80687	1.31489	0.61364
12	2.4841"-03	3.9113"+00	NM	0.98318	0.72460	0.82324	1.29081	0.63777
13	2.9870"-03	4.0278"+00	NM	0.98401	0.73708	0.83278	1.27655	0.65237
14	3.4976"-03	4.1550"+00	NM	0.98489	0.75045	0.84283	1.26136	0.66819
15	4.0081"-03	4.3459"+00	NM	0.98616	0.77005	0.85724	1.23926	0.69174
16	4.7701"-03	4.6879"+00	NM	0.98834	0.80392	0.88124	1.20160	0.73339
17	5.5296"-03	5.0069"+00	NM	0.99025	0.83422	0.90179	1.16854	0.77172
18	6.2992"-03	5.0934"+00	NM	0.99075	0.84225	0.90709	1.15990	0.78204
19	7.0561"-03	5.4830"+00	NM	0.99292	0.87745	0.92964	1.12251	0.82819
20	7.8232"-03	5.7433"+00	NM	0.99428	0.90018	0.94363	1.09887	0.85873
21	8.5776"-03	5.9945"+00	NM	0.99555	0.92157	0.95639	1.07699	0.88802
22	9.3396"-03	6.2735"+00	NM	0.99689	0.94474	0.96978	1.05371	0.92035
23	1.0610"-02	6.7221"+00	NM	0.99894	0.98084	0.98979	1.01833	0.97197
24	1.1880"-02	6.8583"+00	NM	0.99953	0.99153	0.99552	1.00806	0.98756
25	1.4420"-02	6.9557"+00	NM	0.99995	0.99911	0.99953	1.00085	0.99869
26	1.5692"-02	6.8185"+00	NM	0.99936	0.98841	0.99386	1.01105	0.98300
27	1.6965"-02	6.8755"+00	NM	0.99961	0.99287	0.99623	1.00679	0.98952
28	1.9502"-02	6.9615"+00	NM	0.99998	0.99955	0.99977	1.00042	0.99934
D 29	2.2090"-02	6.9672"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58040312 FENTER PROFILE TABULATION 29 POINTS, DELTA AT POINT 29

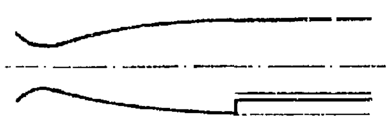
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94793	0.00000	0.00000	1.89835	0.00000
2	2.2860"-04	1.6022"+00	NM	0.96052	0.37919	0.49166	1.68120	0.29245
3	2.9210"-04	1.6876"+00	NM	0.96182	0.40107	0.51654	1.65866	0.31142
4	4.1656"-04	1.8285"+00	NM	0.96381	0.43323	0.55217	1.62445	0.33991
5	5.4864"-04	1.9311"+00	NM	0.96514	0.45422	0.57482	1.60152	0.35892
6	6.7310"-04	2.0179"+00	NM	0.96620	0.47075	0.59231	1.58318	0.37413
7	9.2710"-04	2.2333"+00	NM	0.96866	0.50826	0.63090	1.54078	0.40947
8	1.1760"-03	2.3786"+00	NM	0.97020	0.53149	0.65399	1.51412	0.43193
9	1.4554"-03	2.5172"+00	NM	0.97161	0.55248	0.67435	1.48983	0.45263
10	1.9431"-03	2.7556"+00	NM	0.97390	0.58642	0.70622	1.45030	0.48695
11	2.4409"-03	2.9626"+00	NM	0.97578	0.61411	0.73127	1.41795	0.51572
12	2.9616"-03	3.1627"+00	NM	0.97750	0.63957	0.75356	1.38822	0.54282
13	3.4696"-03	3.3606"+00	NM	0.97913	0.66369	0.77403	1.36013	0.56908
14	3.9903"-03	3.5473"+00	NM	0.98060	0.68557	0.79206	1.33477	0.59341
15	4.7371"-03	3.8009"+00	NM	0.98250	0.71416	0.81485	1.30186	0.62591
16	5.4915"-03	4.0869"+00	NM	0.98454	0.74498	0.83848	1.26677	0.66190
17	6.2738"-03	4.3945"+00	NM	0.98660	0.77669	0.86179	1.23116	0.69998
18	7.0282"-03	4.6695"+00	NM	0.98835	0.80393	0.88104	1.20103	0.73357
19	7.8003"-03	4.9592"+00	NM	0.99010	0.83162	0.89988	1.17089	0.76854
20	8.5471"-03	5.1030"+00	NM	0.99093	0.84502	0.90874	1.15649	0.78577
21	9.3091"-03	5.5538"+00	NM	0.99341	0.88566	0.93462	1.11362	0.83927
22	1.0577"-02	6.0317"+00	NM	0.99585	0.92675	0.95934	1.07157	0.89527
23	1.1849"-02	6.4432"+00	NM	0.99781	0.96070	0.97871	1.03785	0.94302
24	1.3119"-02	6.7165"+00	NM	0.99904	0.98258	0.99071	1.01661	0.97452
25	1.4389"-02	6.8640"+00	NM	0.99968	0.99419	0.99693	1.00551	0.99147
26	1.5659"-02	6.9098"+00	NM	0.99988	0.99777	0.99882	1.00212	0.99671
27	1.8199"-02	6.9270"+00	NM	0.99995	0.99911	0.99953	1.00085	0.99868
28	2.0739"-02	6.9327"+00	NM	0.99998	0.99955	0.99976	1.00042	0.99934
D 29	2.4173"-02	6.9385"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58040316 FENTER PROFILE TABULATION 29 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94823	0.00000	0.00000	1.88795	0.00000
2	2.2860"-04	1.6518"+00	NM	0.96159	0.39443	0.50800	1.65880	0.30625
3	2.8194"-04	1.7024"+00	NM	0.96235	0.40701	0.52215	1.64585	0.31725
4	4.0894"-04	1.8119"+00	NM	0.96389	0.43217	0.54995	1.61939	0.33961
5	5.3340"-04	1.9333"+00	NM	0.96547	0.45732	0.57707	1.59225	0.36242
6	6.6294"-04	2.0107"+00	NM	0.96642	0.47215	0.59273	1.57599	0.37610
7	9.1694"-04	2.0845"+00	NM	0.96729	0.48562	0.60675	1.56106	0.38868
8	1.1684"-03	2.1772"+00	NM	0.96835	0.50180	0.62331	1.54296	0.40397
9	1.6789"-03	2.3133"+00	NM	0.96983	0.52426	0.64584	1.51758	0.42557
10	2.1844"-03	2.4367"+00	NM	0.97111	0.54358	0.66476	1.49556	0.44449
11	2.6924"-03	2.5445"+00	NM	0.97219	0.55975	0.68028	1.47703	0.46057
12	3.4544"-03	2.6689"+00	NM	0.97340	0.57772	0.69719	1.45635	0.47872
13	4.2164"-03	2.7849"+00	NM	0.97448	0.59389	0.71210	1.43769	0.49531
14	4.9835"-03	3.0213"+00	NM	0.97660	0.62534	0.74027	1.40136	0.52825
15	5.7429"-03	2.9558"+00	NM	0.97603	0.61680	0.73273	1.41122	0.51922
16	6.5075"-03	3.0457"+00	NM	0.97681	0.62848	0.74302	1.39772	0.53160
17	7.7749"-03	3.2168"+00	NM	0.97826	0.65004	0.76165	1.37284	0.55480
18	9.0424"-03	3.4398"+00	NM	0.98007	0.67700	0.78422	1.34185	0.58443
19	1.0310"-02	3.7244"+00	NM	0.98225	0.70979	0.81066	1.30441	0.62148
20	1.1582"-02	4.0953"+00	NM	0.98491	0.75022	0.84173	1.25883	0.66866
21	1.2850"-02	4.5285"+00	NM	0.98778	0.79470	0.87403	1.20962	0.72257
22	1.4127"-02	4.9973"+00	NM	0.99064	0.84007	0.90503	1.16064	0.77977
23	1.5392"-02	5.4328"+00	NM	0.99308	0.88005	0.93080	1.11864	0.83208
24	1.6662"-02	5.8056"+00	NM	0.99504	0.91285	0.95089	1.08508	0.87633
25	1.7940"-02	6.1278"+00	NM	0.99664	0.94025	0.96698	1.05767	0.91426
26	1.9213"-02	6.4046"+00	NM	0.99795	0.96316	0.97997	1.03521	0.94664
27	2.0483"-02	6.6209"+00	NM	0.99893	0.98068	0.98963	1.01832	0.97182
28	2.1745"-02	6.7900"+00	NM	0.99960	0.99416	0.99689	1.00551	0.99143
D 29	2.3012"-02	6.8640"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST



M : 2, 2.5, 3, 3.5
R THETA X 10^{-3} : 6 - 14
TW/TR : 1.0

5805

ZPG
RECOVERY
AW

Continuous flow tunnel with flexible symmetrical nozzle. W = H = 50.8 mm
0.25 < PO < 0.55 MN/m^2. TO : 300 K. Air. RE/m X 10^{-6} : 32

MOORE D.R., 1958. An experimental investigation of the turbulent boundary layer behind a forward facing step in supersonic flow. DRL 425.

1 The test boundary layer was formed on one of the flexible nozzle plates and one of two extension plates.
One of these continued the nozzle contour as a flat plate (L = 0.185 m). The other had a vertical step
(X = 0 for both plates) 2.032 mm high approximately 25 mm downstream of the nozzle exit plane. Provision
8 was made for 10 survey stations on the centre line at 12.7 mm intervals starting at X = 6.8 mm. The surface
was not actively cooled. The tunnel was run for a time sufficient to ensure that all temperatures were
constant and the test surface was near-adiabatic. No checks are reported on uniformity of flow, transition,
2-6 or two dimensionality. The tunnel was that used by Naleid (CAT 5801) and Stalmach (CAT 5802).

6 Static pressure tappings were located just upstream of the first survey station, and half way between
succeeding stations. Wall shear stress was measured with a minaturized FEB, following earlier DRL designs,
7 with a circular element of 6.35 mm diameter. Pitot profiles were measured with a CPP for which d_1 = 0.508 mm.
This was cranked up and mounted in a streamwise tube for which d = 1.65 mm before being led through the wall
in a 22^o wedge fairing. The traverse gear was so mounted that the profile normal passed through the centre
8 line of the next station upstream. Thus profile and CF were determined at common values of X.

9 The profile data were reduced assuming constant static pressure through the layer, and this value was
obtained from an interpolation of the wall static values. Constant total temperature was also assumed.
11 No profile corrections were applied, and the viscosity was calculated from Sutherland's law.

12 The editors have presented all the measured profiles and the associated CF values. The assumption of constant
total temperature has been replaced by the Crocco / Van Driest temperature correlation with an adiabatic wall.
13 The unit Reynolds number for all the profiles was the same. For each of the four Mach numbers a set of
profiles were taken on both the flat plate and the stepped plate. For the flat plate there were six in each
set, at stations 1 (X = 6.77 mm), 2, 3, 4, 6 and 9 (X = 108.4 mm). For the stepped plate, profiles were
taken at stations 2, 3, 4, 6 and 9. For the M = 2.0 stepped case (series 05) there is no profile for station 9.
14 CF is presented for each profile.

§ DATA 5805 0101 - 0406 (flat plate), 0501 - 0805 (step). PT2 profiles. NX = 4-6. CF from an FEB measured
separately.

15 <u>Editors' comments</u>

The two test configurations allow of a direct comparison between a "normal" tunnel wall boundary layer, and the same layer subjected to an abrupt disturbance. Unfortunately, no attempt was made to check on cross-flow effects, which are likely to be marked in the region of the step, and the data throughout do not appear to be very accurate. The only comparisons are the "Ring" measurements of Peake et al. - CAT 7202, series 3 - which should be free of cross-flow effects, and the profiles measured downstream of violent trips by Stone & Cary - CAT 7209.

There are very few profiles for which measurements extend into the momentum-deficit-peak. The integral values should therefore be treated with reserve. The author remarks that data for station 9 (the last profiles) were "extremely erratic" and may have been affected by the tunnel diffuser.

CAT 5805 MOORE BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
58050101	1.9930	1.0000	5.8423"+03	2.2700"-03	3.1155	1.4768	3.3034"+04	3.3034"+04
6.8072"-03	2.5567"+05	1.0000	9.1184"+03	NM	1.8109	1.8018	2.8603"+02	1.6709"+02
INFINITE	2.9983"+02	0.0000	2.9319"-04	0.0000"+00	0.0834	3.6263"-04	5.1653"+02	2.8603"+02
58050102	1.9750	1.0000	6.0738"+03	2.2690"-03	3.0702	1.4595	3.4146"+04	3.4146"+04
1.9507"-02	2.5699"+05	1.0000	9.4156"+03	NM	1.8094	1.7998	2.8670"+02	1.6875"+02
INFINITE	3.0039"+02	0.0000	2.9958"-04	0.0000"+00	0.0803	3.6982"-04	5.1439"+02	2.8670"+02
58050103	1.9980	1.0000	6.0240"+03	2.2480"-03	3.1288	1.4756	3.2856"+04	3.2856"+04
3.2207"-02	2.5628"+05	1.0000	9.4191"+03	NM	1.8027	1.7923	2.8610"+02	1.6678"+02
INFINITE	2.9994"+02	0.0000	3.0296"-04	0.0000"+00	0.0832	3.7760"-04	5.1735"+02	2.8610"+02
58050104	2.0000	1.0000	6.1978"+03	2.2520"-03	3.0787	1.4424	3.2590"+04	3.2590"+04
4.4907"-02	2.5500"+05	1.0000	9.6913"+03	NM	1.8166	1.8073	2.8809"+02	1.6781"+02
INFINITE	3.0206"+02	0.0000	3.1661"-04	0.0000"+00	0.0840	3.8996"-04	5.1945"+02	2.8809"+02
58050105	1.9510	1.0000	7.0987"+03	2.2180"-03	3.0049	1.4380	3.4606"+04	3.4606"+04
5.7607"-02	2.5093"+05	1.0000	1.0910"+04	NM	1.8045	1.7955	2.8636"+02	1.7024"+02
INFINITE	2.9983"+02	0.0000	3.5094"-04	0.0000"+00	0.0811	4.3298"-04	5.1038"+02	2.8636"+02
58050106	1.9690	1.0000	8.1130"+03	2.0920"-03	2.9981	1.4106	3.3453"+04	3.3453"+04
1.0841"-01	2.4944"+05	1.0000	1.2540"+04	NM	1.8070	1.7980	2.8887"+02	1.7045"+02
INFINITE	3.0261"+02	0.0000	4.1418"-04	0.0000"+00	0.0821	5.1169"-04	5.1541"+02	2.8887"+02
58050201	2.5350	1.0000	4.5381"+03	1.9160"-03	4.0695	1.4448	1.7832"+04	1.7832"+04
6.8072"-03	3.2171"+05	1.0000	8.7142"+03	NM	1.8192	1.8051	2.8203"+02	1.3108"+02
INFINITE	2.9956"+02	0.0000	2.9058"-04	0.0000"+00	0.1064	3.9714"-04	5.8192"+02	2.8203"+02
58050202	2.5310	1.0000	4.6535"+03	1.9480"-03	4.0682	1.4462	1.8041"+04	1.8041"+04
1.9507"-02	3.2347"+05	1.0000	8.9296"+03	NM	1.8152	1.8002	2.8023"+02	1.3046"+02
INFINITE	2.9761"+02	0.0000	2.9280"-04	0.0000"+00	0.1060	4.0176"-04	5.7962"+02	2.8023"+02
58050203	2.4850	1.0000	5.1447"+03	1.8150"-03	3.9716	1.4427	1.9409"+04	1.9409"+04
3.2207"-02	3.2348"+05	1.0000	9.6774"+03	NM	1.8134	1.7988	2.8459"+02	1.3510"+02
INFINITE	3.0194"+02	0.0000	3.1565"-04	0.0000"+00	0.1042	4.2990"-04	5.7910"+02	2.8459"+02
58050204	2.4170	1.0000	5.4514"+03	1.9140"-03	3.8565	1.4495	2.1297"+04	2.1297"+04
4.4907"-02	3.1974"+05	1.0000	9.9908"+03	NM	1.8047	1.7909	2.8408"+02	1.3879"+02
INFINITE	3.0094"+02	0.0000	3.1719"-04	0.0000"+00	0.1011	4.3046"-04	5.7090"+02	2.8408"+02
58050205	2.4570	1.0000	5.8032"+03	2.0320"-03	3.8813	1.4191	2.0548"+04	2.0548"+04
5.7607"-02	3.2834"+05	1.0000	1.0796"+04	NM	1.8153	1.8017	2.8514"+02	1.3697"+02
INFINITE	3.0233"+02	0.0000	3.4301"-04	0.0000"+00	0.1033	4.6345"-04	5.7653"+02	2.8514"+02
58050206	2.4340	1.0000	6.7602"+03	1.6340"-03	3.8365	1.4088	2.1089"+04	2.1089"+04
1.0841"-01	3.2513"+05	1.0000	1.2466"+04	NM	1.8052	1.7929	2.8502"+02	1.3825"+02
INFINITE	3.0206"+02	0.0000	3.9470"-04	0.0000"+00	0.1018	5.3793"-04	5.7380"+02	2.8502"+02
58050301	2.9550	1.0000	4.1293"+03	1.7050"-03	4.9542	1.4144	1.2513"+04	1.2513"+04
6.8072"-03	4.2956"+05	1.0000	9.3485"+03	NM	1.8256	1.8092	2.8104"+02	1.0958"+02
INFINITE	3.0094"+02	0.0000	2.9473"-04	0.0000"+00	0.1207	4.3707"-04	6.2019"+02	2.8104"+02
58050302	3.0660	1.0000	3.5643"+03	1.8250"-03	5.2050	1.4118	1.0584"+04	1.0584"+04
1.9597"-02	4.2909"+05	1.0000	8.4465"+03	NM	1.8329	1.8154	2.7741"+02	1.0333"+02
INFINITE	2.9761"+02	0.0000	2.7865"-04	0.0000"+00	0.1244	4.1792"-04	6.2489"+02	2.7741"+02
58050303	3.0460	1.0000	3.7268"+03	1.7980"-03	5.1265	1.4018	1.0885"+04	1.0885"+04
3.2207"-02	4.2834"+05	1.0000	8.7397"+03	NM	1.8395	1.8225	2.8164"+02	1.0578"+02
INFINITE	3.0206"+02	0.0000	2.9193"-04	0.0000"+00	0.1243	4.3068"-04	6.2811"+02	2.8164"+02
58050304	3.0630	1.0000	3.9787"+03	1.6430"-03	5.1724	1.3954	1.0532"+04	1.0532"+04
4.4907"-02	4.2509"+05	1.0000	9.4137"+03	NM	1.8328	1.8149	2.7804"+02	1.0370"+02
INFINITE	2.9828"+02	0.0000	3.1399"-04	0.0000"+00	0.1243	4.7050"-04	6.2538"+02	2.7804"+02
58050305	3.0030	1.0000	4.4865"+03	1.7120"-03	5.0459	1.3906	1.1612"+04	1.1612"+04
5.7607"-02	4.2848"+05	1.0000	1.0342"+04	NM	1.8214	1.8063	2.8236"+02	1.0794"+02
INFINITE	3.0261"+02	0.0000	3.3022"-04	0.0000"+00	0.1219	5.1132"-04	6.2553"+02	2.8236"+02
58050306	2.9620	1.0000	5.3342"+03	1.1930"-03	4.9712	1.4011	1.2202"+04	1.2202"+04
1.0841"-01	4.2333"+05	1.0000	1.2117"+04	NM	1.8139	1.7950	2.7997"+02	1.0864"+02
INFINITE	2.9983"+02	0.0000	3.8704"-04	0.0000"+00	0.1202	5.8547"-04	6.1958"+02	2.7997"+02
58050401	3.5280	1.0000	3.1514"+03	1.5280"-03	6.4686	1.4127	7.0120"+03	7.0120"+03
6.8072"-03	5.5649"+05	1.0000	8.9337"+03	NM	1.8208	1.7987	2.7759"+02	8.5928"+01
INFINITE	2.9983"+02	0.0000	2.9484"-04	0.0000"+00	0.1351	5.0245"-04	6.5570"+02	2.7759"+02
58050402	3.4830	1.0000	3.3340"+03	1.4010"-03	6.3740	1.4272	7.4413"+03	7.4413"+03
1.9507"-02	5.5401"+05	1.0000	9.3252"+03	NM	1.8166	1.7930	2.7209"+02	8.5727"+01
INFINITE	2.9372"+02	0.0000	2.9274"-04	0.0000"+00	0.1338	4.9737"-04	6.4658"+02	2.7209"+02
58050403	3.5410	1.0000	3.1389"+03	1.3680"-03	6.4977	1.4124	6.8550"+03	6.8550"+03
3.2207"-02	5.5411"+05	1.0040	8.9348"+03	NM	1.8233	1.8006	2.7883"+02	8.5874"+01
INFINITE	3.0122"+02	0.0000	3.0025"-04	0.0000"+00	0.1356	5.1034"-04	6.5791"+02	2.7883"+02
58050404	3.5150	1.0000	3.3695"+03	1.5280"-03	6.4531	1.4202	7.1054"+03	7.1054"+03
4.4907"-02	5.5361"+05	1.0000	9.5274"+03	NM	1.8165	1.7924	2.7414"+02	8.5293"+01
INFINITE	2.9606"+02	0.0000	3.0805"-04	0.0000"+00	0.1345	5.2738"-04	6.5087"+02	2.7414"+02

CAT 5805 MOORE BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X * RZ	MD * POD* TOD*	TW/TR* PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW UD	PD TD TR
58050405	3.5240	1.0000	3.4146"+03	1.3540"-03	6.4327	1.4049	7.0141"+03	7.0141"+03
5.7607"-02	5.5351"+05	1.0000	9.6516"+03	NM	1.8234	1.7989	2.7956"+02	8.6673"+01
INFINITE	3.0194"+02	0.0000	3.2290"-04	0.0000"+00	0.1352	5.4583"-04	6.5779"+02	2.7956"+02
58050406	3.3150	1.0000	4.8115"+03	8.6040"-04	5.9558	1.4254	9.3613"+03	9.3613"+03
1.0841"-01	5.4744"+05	1.0000	1.2583"+04	NM	1.8003	1.7776	2.7531"+02	9.2719"+01
INFINITE	2.9650"+02	0.0000	3.7036"-04	0.0000"+00	0.1260	6.2408"-04	6.4000"+02	2.7531"+02
58050501	1.9780	1.0000	7.0136"+03	2.1770"-03	3.0502	1.4380	3.4082"+04	3.4082"+04
1.9507"-02	2.5770"+05	1.0000	1.0886"+04	NM	1.8048	1.7973	2.8614"+02	1.6821"+02
INFINITE	2.9983"+02	0.0000	3.4500"-04	0.0000"+00	0.0824	4.2822"-04	5.1435"+02	2.8614"+02
58050502	1.9950	1.0000	6.8671"+03	2.1240"-03	3.0657	1.4340	3.3154"+04	3.3154"+04
3.2207"-02	2.5740"+05	1.0000	1.0739"+04	NM	1.8131	1.8057	2.8257"+02	1.6493"+02
INFINITE	2.9622"+02	0.0000	3.3759"-04	0.0000"+00	0.0836	4.1730"-04	5.1370"+02	2.8257"+02
58050503	1.9640	1.0000	6.7339"+03	2.1900"-03	2.9937	1.4228	3.4822"+04	3.4822"+04
4.4907"-02	2.5764"+05	1.0000	1.0412"+04	NM	1.8223	1.8156	2.8254"+02	1.6706"+02
INFINITE	2.9594"+02	0.0000	3.2219"-04	0.0000"+00	0.0825	3.9268"-04	5.0897"+02	2.8254"+02
58050504	1.9580	1.0000	7.9245"+03	2.1150"-03	2.9821	1.4158	3.5120"+04	3.5120"+04
5.7607"-02	2.5743"+05	1.0000	1.2223"+04	NM	1.8114	1.8019	2.8312"+02	1.6782"+02
INFINITE	2.9650"+02	0.0000	3.7855"-04	0.0000"+00	0.0818	4.6462"-04	5.0857"+02	2.8312"+02
58050601	2.4030	1.0000	6.0244"+03	1.8470"-03	3.9637	1.4424	2.0201"+04	2.0201"+04
1.9507"-02	3.2584"+05	1.0000	1.1251"+04	NM	1.7961	1.7835	2.8169"+02	1.3497"+02
INFINITE	2.9872"+02	0.0000	3.5528"-04	0.0000"+00	0.0988	4.9342"-04	5.7371"+02	2.8169"+02
58050602	2.4370	1.0000	6.7165"+03	1.6180"-03	3.9011	1.4407	2.0945"+04	2.0945"+04
3.2207"-02	3.2442"+05	1.0000	1.2425"+04	NM	1.7930	1.7796	2.8054"+02	1.3591"+02
INFINITE	2.9733"+02	0.0000	3.8621"-04	0.0000"+00	0.1012	5.3423"-04	5.6962"+02	2.8054"+02
58050603	2.4050	1.0000	7.0103"+03	1.5040"-03	3.8324	1.4406	2.2105"+04	2.2105"+04
4.4907"-02	3.2570"+05	1.0000	1.2816"+04	NM	1.7954	1.7812	2.7944"+02	1.3721"+02
INFINITE	2.9594"+02	0.0000	3.8769"-04	0.0000"+00	0.1001	5.3058"-04	5.6484"+02	2.7944"+02
58050604	2.4830	1.0000	6.2635"+03	1.8550"-03	3.9268	1.4109	1.9635"+04	1.9635"+04
5.7607"-02	3.2672"+05	1.0000	1.1784"+04	NM	1.8121	1.7981	2.8261"+02	1.3427"+02
INFINITE	2.9983"+02	0.0000	3.7696"-04	0.0000"+00	0.1041	5.1423"-04	5.7687"+02	2.8261"+02
58050605	2.4330	1.0000	8.5625"+03	1.7480"-03	3.8059	1.3920	2.1072"+04	2.1072"+04
1.0841"-01	3.2435"+05	1.0000	1.5810"+04	NM	1.8071	1.7923	2.8136"+02	1.3653"+02
INFINITE	2.9817"+02	0.0000	4.9244"-04	0.0000"+00	0.1019	6.6823"-04	5.6999"+02	2.8136"+02
58050701	3.0190	1.0000	4.4922"+03	1.7630"-03	5.0960	1.3993	1.1341"+04	1.1341"+04
1.9507"-02	4.2862"+05	1.0000	1.0451"+04	NM	1.8219	1.8061	2.7736"+02	1.0533"+02
INFINITE	2.9733"+02	0.0000	3.3600"-04	0.0000"+00	0.1224	5.0916"-04	6.2123"+02	2.7736"+02
58050702	3.0090	1.0000	4.6435"+03	1.5410"-03	5.0783	1.4014	1.1609"+04	1.1609"+04
3.2207"-02	4.3224"+05	1.0000	1.0757"+04	NM	1.8199	1.8040	2.7793"+02	1.0598"+02
INFINITE	2.9789"+02	0.0000	3.4200"-04	0.0000"+00	0.1219	5.1871"-04	6.2107"+02	2.7793"+02
58050703	2.9810	1.0000	4.9694"+03	1.7320"-03	5.0086	1.4001	1.2041"+04	1.2041"+04
4.4907"-02	4.2987"+05	1.0000	1.1373"+04	NM	1.8199	1.8020	2.7988"+02	1.0796"+02
INFINITE	2.9983"+02	0.0000	3.6148"-04	0.0000"+00	0.1211	5.4534"-04	6.2102"+02	2.7988"+02
58050704	3.0030	1.0000	4.4898"+03	1.7470"-03	4.8015	1.4206	1.1613"+04	1.1613"+04
5.7607"-02	4.2851"+05	1.0000	1.0365"+04	NM	1.8155	1.7986	2.7977"+02	1.0695"+02
INFINITE	2.9983"+02	0.0000	3.3446"-04	0.0000"+00	0.2061	4.9560"-04	6.2265"+02	2.7977"+02
58050705	2.8970	1.0000	6.4752"+03	1.6530"-03	4.7883	1.3833	1.3626"+04	1.3626"+04
1.0841"-01	4.2855"+05	1.0000	1.4356"+04	NM	1.8156	1.7986	2.7796"+02	1.1101"+02
INFINITE	2.9733"+02	0.0000	4.3197"-04	0.0000"+00	0.1183	6.4261"-04	6.1197"+02	2.7796"+02
58050801	3.4970	1.0000	3.8569"+03	1.2810"-03	6.4387	1.4195	7.2991"+03	7.2991"+03
1.9507"-02	5.5435"+05	1.0000	1.0835"+04	NM	1.8035	1.7810	2.7348"+02	8.5692"+01
INFINITE	2.9528"+02	0.0000	3.4518"-04	0.0000"+00	0.1331	6.0460"-04	6.4905"+02	2.7348"+02
58050802	3.5250	1.0000	3.8172"+03	1.1630"-03	6.4819	1.4073	7.0162"+03	7.0162"+03
3.2207"-02	5.5445"+05	1.0000	1.0840"+04	NM	1.8096	1.7871	2.7348"+02	8.4757"+01
INFINITE	2.9539"+02	0.0000	3.5065"-04	0.0000"+00	0.1342	6.1109"-04	6.5066"+02	2.7348"+02
58050803	3.4640	1.0000	3.8948"+03	1.3110"-03	6.2581	1.3896	7.6488"+03	7.6488"+03
4.4907"-02	5.5425"+05	1.0000	1.0786"+04	NM	1.8186	1.7994	2.7576"+02	8.7536"+01
INFINITE	2.9761"+02	0.0000	3.4163"-04	0.0000"+00	0.1335	5.7718"-04	6.4980"+02	2.7576"+02
58050804	3.5250	1.0000	3.7571"+03	1.3250"-03	6.4443	1.3993	6.9875"+03	6.9875"+03
5.7607"-02	5.5218"+05	1.0000	1.0644"+04	NM	1.8181	1.7958	2.7683"+02	8.5793"+01
INFINITE	2.9900"+02	0.0000	3.5201"-04	0.0000"+00	0.1348	6.0273"-04	6.5463"+02	2.7683"+02
58050805	3.2600	1.0000	5.3817"+03	9.5350"-04	5.7704	1.4164	1.0321"+04	1.0321"+04
1.0841"-01	5.5713"+05	1.0000	1.3746"+04	NM	1.8046	1.7821	2.7863"+02	9.5931"+01
INFINITE	2.9983"+02	0.0000	3.9230"-04	0.0000"+00	0.1276	6.4632"-04	6.4019"+02	2.7863"+02

58050405 MOORE PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92585	0.00000	0.00000	3.22541	0.00000
2	2.5400"-04	3.1649"+00	NM	0.95479	0.40692	0.62472	2.35690	0.26506
3	3.0480"-04	3.4665"+00	NM	0.95714	0.42963	0.64961	2.28629	0.28413
4	3.5560"-04	3.6925"+00	NM	0.95884	0.44608	0.66696	2.23546	0.29835
5	4.8260"-04	4.1679"+00	NM	0.96215	0.47872	0.69965	2.13604	0.32755
6	7.3660"-04	4.7991"+00	NM	0.96610	0.51873	0.73677	2.01738	0.36521
7	9.9060"-04	5.3480"+00	NM	0.96919	0.55108	0.76452	1.92467	0.39722
8	1.2446"-03	5.8891"+00	NM	0.97197	0.58116	0.78862	1.84139	0.42827
9	1.4986"-03	6.4929"+00	NM	0.97479	0.61294	0.81239	1.75669	0.46246
10	1.7526"-03	7.0713"+00	NM	0.97726	0.64188	0.83262	1.68261	0.49484
11	2.0066"-03	7.6283"+00	NM	0.97944	0.66856	0.85015	1.61700	0.52576
12	2.2606"-03	8.2713"+00	NM	0.98176	0.69807	0.86835	1.54737	0.56118
13	2.5146"-03	8.8439"+00	NM	0.98367	0.72333	0.88301	1.49025	0.59252
14	2.7686"-03	9.5800"+00	NM	0.98591	0.75454	0.90001	1.42277	0.63258
15	3.0226"-03	1.0283"+01	NM	0.98788	0.78320	0.91463	1.36377	0.67066
16	3.2766"-03	1.0903"+01	NM	0.98948	0.80760	0.92636	1.31570	0.70408
17	3.5306"-03	1.1580"+01	NM	0.99111	0.83343	0.93810	1.26697	0.74043
18	4.0386"-03	1.3038"+01	NM	0.99422	0.88649	0.96026	1.17335	0.81839
19	4.5466"-03	1.4306"+01	NM	0.99659	0.93019	0.97670	1.10249	0.88590
20	5.3086"-03	1.5777"+01	NM	0.99899	0.97843	0.99316	1.03033	0.96392
21	6.3246"-03	1.6260"+01	NM	0.99971	0.99376	0.99805	1.00866	0.98948
22	7.5946"-03	1.6332"+01	NM	0.99982	0.99603	0.99876	1.00550	0.99330
D 23	8.8646"-03	1.6459"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58050801 MOORE PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92618	0.00000	0.00000	3.19144	0.00000
2	2.5400"-04	3.1021"+00	NM	0.95457	0.40463	0.62012	2.34872	0.26403
3	3.0480"-04	3.3982"+00	NM	0.95695	0.42780	0.64566	2.27789	0.28345
4	3.5560"-04	3.6293"+00	NM	0.95871	0.44495	0.66382	2.22576	0.29825
5	4.8260"-04	3.9610"+00	NM	0.96109	0.46840	0.68764	2.15521	0.31906
6	7.3660"-04	4.3459"+00	NM	0.96365	0.49414	0.71248	2.07899	0.34271
7	9.9060"-04	4.6603"+00	NM	0.96562	0.51415	0.73089	2.02077	0.36169
8	1.2446"-03	5.0069"+00	NM	0.96765	0.53532	0.74951	1.96036	0.38233
9	1.4986"-03	5.4328"+00	NM	0.96999	0.56019	0.77034	1.89098	0.40738
10	1.7526"-03	5.9417"+00	NM	0.97257	0.58850	0.79271	1.81437	0.43690
11	2.0066"-03	6.4156"+00	NM	0.97479	0.61367	0.81145	1.74847	0.46409
12	2.2606"-03	7.1236"+00	NM	0.97782	0.64941	0.83635	1.65857	0.50426
13	2.5146"-03	7.8170"+00	NM	0.98049	0.68259	0.85775	1.57911	0.54319
14	2.7686"-03	8.5712"+00	NM	0.98313	0.71690	0.87830	1.50095	0.58516
15	3.0226"-03	9.2953"+00	NM	0.98542	0.74836	0.89580	1.43288	0.62518
16	3.2766"-03	1.0093"+01	NM	0.98771	0.78153	0.91300	1.36474	0.66899
17	3.5306"-03	1.0838"+01	NM	0.98967	0.81127	0.92738	1.30673	0.70969
18	3.7846"-03	1.1640"+01	NM	0.99160	0.84215	0.94136	1.24948	0.75340
19	4.2926"-03	1.3142"+01	NM	0.99478	0.89705	0.96402	1.15487	0.83474
20	5.0546"-03	1.5084"+01	NM	0.99825	0.96340	0.98809	1.05191	0.93933
21	6.3246"-03	1.6152"+01	NM	0.99991	0.99800	0.99937	1.00275	0.99663
D 22	7.5946"-03	1.6215"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58050802 MOORE PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92584	0.00000	0.00000	3.22667	0.00000
2	2.5400"-04	3.0950"+00	NM	0.95416	0.40085	0.61794	2.37642	0.26003
3	3.0480"-04	3.3271"+00	NM	0.95604	0.41901	0.63818	2.31979	0.27510
4	4.5720"-04	3.9278"+00	NM	0.96050	0.46241	0.68367	2.18592	0.31276
5	7.1120"-04	4.4523"+00	NM	0.96398	0.49702	0.71710	2.08165	0.34449
6	9.6520"-04	4.8084"+00	NM	0.96615	0.51915	0.73721	2.01652	0.36559
7	1.2192"-03	5.1856"+00	NM	0.96830	0.54156	0.75662	1.95194	0.38763
8	1.4732"-03	5.5538"+00	NM	0.97026	0.56255	0.77397	1.89285	0.40889
9	1.7272"-03	6.0690"+00	NM	0.97282	0.59064	0.79594	1.81602	0.43829
10	1.9812"-03	6.5373"+00	NM	0.97497	0.61504	0.81395	1.75146	0.46473
11	2.2352"-03	7.1411"+00	NM	0.97753	0.64511	0.83485	1.67475	0.49849
12	2.4892"-03	7.7864"+00	NM	0.98002	0.67574	0.85474	1.59992	0.53424
13	2.7432"-03	8.4557"+00	NM	0.98238	0.70610	0.87314	1.52911	0.57101
14	2.9972"-03	9.1613"+00	NM	0.98465	0.73674	0.89050	1.46096	0.60953
15	3.2512"-03	9.8832"+00	NM	0.98677	0.76681	0.90641	1.39727	0.64870
16	3.5052"-03	1.0663"+01	NM	0.98886	0.79801	0.92185	1.33444	0.69081
17	3.7592"-03	1.1452"+01	NM	0.99079	0.82837	0.93588	1.27641	0.73321
18	4.0132"-03	1.2286"+01	NM	0.99266	0.85929	0.94924	1.22031	0.77787
19	4.5212"-03	1.3788"+01	NM	0.99564	0.91234	0.97018	1.13082	0.85795
20	5.2832"-03	1.5477"+01	NM	0.99851	0.96851	0.98991	1.04469	0.94757
21	6.5532"-03	1.6278"+01	NM	0.99972	0.99404	0.99814	1.00827	0.98996
D 22	7.8232"-03	1.6468"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58050803 MOORE PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92659	0.00000	0.00000	3.15027	0.00000
2	2.5400"-04	3.3644"+00	NM	0.95711	0.42927	0.64480	2.25625	0.28578
3	3.0480"-04	3.5550"+00	NM	0.95858	0.44371	0.66011	2.21330	0.29825
4	4.3180"-04	4.0278"+00	NM	0.96197	0.47748	0.69423	2.11394	0.32841
5	6.8580"-04	4.6010"+00	NM	0.96568	0.51530	0.72971	2.00530	0.36389
6	9.3980"-04	5.0021"+00	NM	0.96805	0.54013	0.75151	1.93587	0.38820
7	1.1938"-03	5.3978"+00	NM	0.97023	0.56351	0.77101	1.87204	0.41186
8	1.4478"-03	5.8056"+00	NM	0.97233	0.58661	0.78932	1.81058	0.43595
9	1.7018"-03	6.2735"+00	NM	0.97457	0.61201	0.80844	1.74492	0.46331
10	1.9558"-03	6.7844"+00	NM	0.97684	0.63857	0.82731	1.67852	0.49288
11	2.2098"-03	7.3469"+00	NM	0.97914	0.66657	0.84606	1.61106	0.52516
12	2.4638"-03	7.9154"+00	NM	0.98128	0.69371	0.86316	1.54822	0.55752
13	2.7178"-03	8.5390"+00	NM	0.98345	0.72229	0.88010	1.48472	0.59277
14	2.9718"-03	9.1947"+00	NM	0.98555	0.75115	0.89616	1.42337	0.62961
15	3.2258"-03	9.8208"+00	NM	0.98739	0.77771	0.91007	1.36935	0.66460
16	3.4798"-03	1.0569"+01	NM	0.98942	0.80831	0.92513	1.30992	0.70625
17	3.7338"-03	1.1235"+01	NM	0.99108	0.83458	0.93728	1.26125	0.74314
18	4.2418"-03	1.2758"+01	NM	0.99445	0.89174	0.96147	1.16250	0.82707
19	4.7498"-03	1.4239"+01	NM	0.99726	0.94400	0.98116	1.08028	0.90824
20	5.2578"-03	1.5276"+01	NM	0.99900	0.97893	0.99316	1.02930	0.96489
D 21	6.5278"-03	1.5919"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58050804 MOORE PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

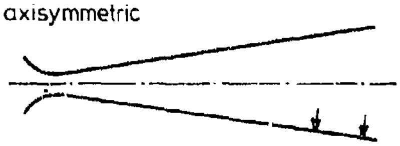
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92584	0.00000	0.00000	3.22647	0.00000
2	2.5400"-04	3.1305"+00	NM	0.95445	0.40369	0.62115	2.36756	0.26236
3	3.3020"-04	3.5356"+00	NM	0.95766	0.43461	0.65500	2.27137	0.28837
4	5.8420"-04	4.2977"+00	NM	0.96299	0.48709	0.70776	2.11129	0.33524
5	8.3820"-04	4.8318"+00	NM	0.96628	0.52057	0.73847	2.01239	0.36696
6	1.0922"-03	5.2935"+00	NM	0.96889	0.54790	0.76186	1.93423	0.39388
7	1.3462"-03	5.7537"+00	NM	0.97128	0.57362	0.78279	1.86227	0.42034
8	1.6002"-03	6.2139"+00	NM	0.97351	0.59830	0.80170	1.79553	0.44650
9	1.8542"-03	6.7165"+00	NM	0.97576	0.62411	0.82041	1.72796	0.47478
10	2.1082"-03	7.2172"+00	NM	0.97783	0.64879	0.83731	1.66557	0.50272
11	2.3622"-03	7.7742"+00	NM	0.97997	0.67518	0.85438	1.60128	0.53356
12	2.6162"-03	8.3346"+00	NM	0.98197	0.70071	0.86996	1.54144	0.56438
13	2.8702"-03	8.9096"+00	NM	0.98386	0.72596	0.88452	1.48456	0.59582
14	3.1242"-03	9.5254"+00	NM	0.98570	0.75206	0.89874	1.42812	0.62931
15	3.3782"-03	1.0184"+01	NM	0.98760	0.77901	0.91257	1.37232	0.66495
16	3.6322"-03	1.0823"+01	NM	0.98927	0.80426	0.92481	1.32226	0.69942
17	3.8862"-03	1.1535"+01	NM	0.99099	0.83149	0.93727	1.27061	0.73765
18	4.1402"-03	1.2270"+01	NM	0.99262	0.85872	0.94900	1.22172	0.77703
19	4.6482"-03	1.3755"+01	NM	0.99558	0.91121	0.96976	1.13264	0.85619
20	5.1562"-03	1.5058"+01	NM	0.99784	0.95489	0.98534	1.06479	0.92535
21	5.9182"-03	1.6018"+01	NM	0.99934	0.98582	0.99554	1.01982	0.97619
D 22	7.1882"-03	1.6468"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

58050805 PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92927	0.00000	0.00000	2.90447	0.00000
2	2.5400"-04	2.7158"+00	NM	0.95438	0.39908	0.59576	2.22852	0.26733
3	3.0480"-04	2.9936"+00	NM	0.95684	0.42454	0.62427	2.16227	0.28871
4	3.8100"-04	3.2387"+00	NM	0.95888	0.44571	0.64700	2.10724	0.30704
5	6.3500"-04	3.8212"+00	NM	0.96331	0.49202	0.69373	1.98793	0.34897
6	8.8900"-04	4.2932"+00	NM	0.96653	0.52638	0.72580	1.90122	0.38175
7	1.1430"-03	4.6877"+00	NM	0.96901	0.55337	0.74952	1.83456	0.40856
8	1.3970"-03	5.0982"+00	NM	0.97140	0.58006	0.77176	1.77015	0.43598
9	1.6510"-03	5.5234"+00	NM	0.97370	0.60644	0.79258	1.70810	0.46402
10	1.9050"-03	5.9364"+00	NM	0.97579	0.63098	0.81098	1.65192	0.49093
11	2.1590"-03	6.3444"+00	NM	0.97772	0.65427	0.82762	1.59999	0.51727
12	2.4130"-03	6.7787"+00	NM	0.97960	0.67822	0.84389	1.54820	0.54508
13	2.6670"-03	7.2760"+00	NM	0.98169	0.70460	0.86092	1.49292	0.57667
14	2.9210"-03	7.7681"+00	NM	0.98359	0.72975	0.87631	1.44399	0.60771
15	3.1750"-03	8.2903"+00	NM	0.98546	0.75552	0.89127	1.39163	0.64045
16	3.4290"-03	8.8112"+00	NM	0.98720	0.78037	0.90496	1.34480	0.67293
17	3.6830"-03	9.3357"+00	NM	0.98883	0.80460	0.91765	1.30075	0.70548
18	3.9370"-03	9.8405"+00	NM	0.99033	0.82761	0.92913	1.26038	0.73718
19	4.4450"-03	1.1028"+01	NM	0.99345	0.87822	0.95255	1.17644	0.80969
20	4.9530"-03	1.2239"+01	NM	0.99624	0.92730	0.97308	1.10117	0.88368
21	5.7150"-03	1.3556"+01	NM	0.99900	0.98160	0.99355	1.02450	0.96979
D 22	6.9850"-03	1.4155"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

axisymmetric	M : 8 - 10 R THETA X 10^{-3} : 1 - 3 TW/TR : 0.5	5901
		FPG - SHT

Conical nozzle. Continuous running. D = 50 mm.
3.4 < PO < 6.2 MN/m^2. TO : 756 K. "Superdry" Nitrogen. 5 < RE/m X 10^{-6} < 10.

HILL F.K., 1959. Turbulent boundary layer measurements at Mach numbers from 8 to 10. Physics Fluids, 2, 778-680.
And Hill (1956) and private communications.

1 The test boundary layer was formed on the wall of a conical nozzle (semi-apex angle 6^0) with an outlet
diameter of 50.8 mm. The surface was of electroformed nickel with a roughness less than 0.13 μm. An insert
could be placed in the throat so as to increase the expansion ratio. The nozzle wall was cooled by the
2 surrounding room air, and ran until temperatures had reached equilibrium. The flow was "uniform and stable".
3 No measurement of transition is reported, but it is stated to be "consistent". The boundary layer had passed
4 through the very strong expansion at the throat, but pressure and Mach number gradients in the test area
5 were small, the flow in the free stream being very close to a spherical source flow. There was no evidence
of cross-flow or separation in the boundary layer, and the nozzle was mounted so that it could be rotated
about its own axis, the probes remaining stationary, providing a check on the axial symmetry of the flow.
No circumferential variations were found within experimental accuracy.

6 Wall pressure was measured using a small static hole at the axial location of the profile normal. The wall
temperature was recorded by a thermocouple mounted in an open port, flush with the wall surface, and sealed
with cement.

7 Pitot measurements were made with a rake carrying four probes at y intervals of 13(E) mm. The two central
probes were CPP (d_1 = 1.07, d_2 = 0.71, l = 25 mm) while the two outer probes were FPP (h_1 = 0.20, h_2 = 0.13,
b_1 = 1.6 [E] , l = 25 mm) formed by flattening the tube used for the inner probes. The rake could be
traversed right across the nozzle so that the outer FPP could enter the boundary layer on either side and
approach the wall. Four identical total temperature probes were mounted in a similar manner. These were
STP consisting of a ceramic tubing shank (d = 2.5 mm) carrying an iron-constantan thermocouple with a
vented shield which reduced in diameter towards the tip, so that the tip face had d_1 = 1.27, d_2 = 0.51 mm.
The overall slender length of the probes was 51 mm. A static pressure survey showed negligible normal
8 pressure gradients. Measurements were made at two stations, 50.8 mm apart, and at distances X from the
throat of approximately 190 [E] and 240 [E] mm. Pitot and total temperature traverses were made on the
same normal using the same traverse gear, perpendicular to the axis of the nozzle.

9 The profiles were obtained in a very large number of runs, for which there were slight variations of total
temperature and pressure from the selected nominal values. Spot profile values were cross plotted and
normalised to the nominal total state. (For all runs one at least of the probes was in the free stream).
The total temperature values were interpolated to the y-values of Pitot measurements. In general the wall
temperature was obtained by extrapolating the TO profile to the wall. The value so deduced agreed with
that recorded by the thermocouple to "within a few degrees". The author also presents skin friction and
heat transfer values obtained from the gradients of the velocity and total temperature profiles close to
the wall. The author's recovery factor was 0.85.

10 No corrections were applied to the profile data, the possible viscous and rarefied flow effects having been
calculated to give errors less than 1 %, and any profile measurements near the wall being rejected when
11 interference effects were observed (approximately when Y was less than h_1). Viscosity values for data
12 reduction were taken from "Tables of thermal properties of gases" (Hilsenrath, 1955). The editors
have presented all those data supplied by the author. Some of the boundary values, especially wall temperature,
are revised, correct, values which differ from the published papers. The Y-value for the D-state has been

arbitrarily set well outside the boundary layer, and the D state stagnation values to the nominal tunnel stagnation values. Our standard integration procedures proved unable to handle the scatter in the data sensibly, so that for this entry the integral values have been obtained using a trapezoidal integration rule.

13 The profiles consist of three sets. The first two which have been combined in series 01-04 consist of profiles measured at two stations on the nozzle, one about 50 mm upstream of the exit (author's station B) and the other very close to the exit (author's station A). The third set consists of four individual profiles
14 taken at the nozzle exit with the throat insert in place, so giving a higher Mach number. The wall shear stress and heat transfer figures are the author's values obtained from the wall profile gradients.

§ DATA: 5901 0101-0801. Pitot and TO profiles obtained separately and normalised to nominal reservoir conditions. NX = 1 or 2.

15 Editors' comments

The geometrical arrangement here is similar to that of Perry & East - CAT 6801 and the Mach numbers are similar. The Reynolds numbers are, however, low by comparison and in no case has the inner region become fully turbulent. The outer region conforms very well to the transformed velocity profile expected of a fully developed ZPG boundary layer (Fernholz 1969). There are large differences between the measured temperature profiles and the values given by the Van Driest temperature velocity correlation.

Each profile is described by a great number of data points, which, however, display considerable scatter. The measurements extend within the momentum-deficit peak, but in some cases (0102, 0201, 0301) there remains a significant total pressure gradient in the outer part of the profile, so that the author's D-state position is not sufficiently far out.

CAT 5901 HILL BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD* TOD*	TW/TR PW/PD* SW *	REDZW RED2D D2	CF * CQ * PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
59010101	8.2540	0.5308	3.3245"+02	9.1000"-04	11.3585	1.9687	2.8812"+02	2.8812"+02
1.9000"-01	3.4474"+06	1.0000	1.8818"+03	1.5310"-04	1.7636	1.6829	3.6222"+02	5.1659"+01
-2.0069"-02	7.5556"+02	0.0000	3.0094"-04	NM	1.2480	7.5778"-04	1.2087"+03	6.8235"+02
59010102	9.0400	0.5160	2.5026"+02	9.1300"-04	13.8518	2.1738	1.5865"+02	1.5865"+02
2.4000"-01	3.4474"+06	1.0000	1.6434"+03	1.6520"-04	1.7960	1.6905	3.5167"+02	4.3562"+01
-2.5240"-02	7.5556"+02	0.0000	3.3757"-04	NM	1.2923	9.3649"-04	1.2156"+03	6.8151"+02
59010201	8.2740	0.5537	4.1967"+02	8.4000"-04	10.0068	1.8914	3.4033"+02	3.4033"+02
1.9000"-01	4.1368"+06	1.0000	2.4602"+03	1.3620"-04	1.7846	1.7045	3.7778"+02	5.1427"+01
-2.0069"-02	7.5556"+02	0.0000	3.3004"-04	NM	1.3186	7.7347"-04	1.2089"+03	6.8233"+02
59010202	9.0700	0.5274	2.8031"+02	8.7000"-04	13.9600	2.0820	1.8626"+02	1.8626"+02
2.4000"-01	4.1368"+06	1.0000	1.8821"+03	1.3750"-04	1.8043	1.7058	3.5944"+02	4.3291"+01
-2.5240"-02	7.5556"+02	0.0000	3.2515"-04	NM	1.2834	9.0488"-04	1.2159"+03	6.8148"+02
59010301	8.2060	0.5537	4.4535"+02	7.9600"-04	10.5651	1.8833	3.7927"+02	3.7927"+02
1.9000"-01	4.6540"+06	1.0000	2.6178"+03	1.2790"-04	1.7907	1.7102	3.7778"+02	5.1288"+01
-2.0069"-02	7.5556"+02	0.0000	3.1340"-04	NM	1.2941	7.4480"-04	1.2090"+03	6.8231"+02
59010401	8.2940	0.5423	4.7076"+02	7.3400"-04	11.0830	1.8771	4.1877"+02	4.1877"+02
1.9000"-01	5.1711"+06	1.0000	2.7307"+03	1.1780"-04	1.7946	1.7139	3.7000"+02	5.1196"+01
-2.0069"-02	7.5556"+02	0.0000	2.9500"-04	NM	1.2711	7.1514"-04	1.2091"+03	6.8230"+02
59010402	9.1000	0.5462	3.1666"+02	8.0500"-04	14.2930	2.0420	2.2781"+02	2.2781"+02
2.4000"-01	5.1711"+06	1.0000	2.1944"+03	1.2890"-04	1.8052	1.7159	3.7222"+02	4.3022"+01
-2.5240"-02	7.5556"+02	0.0000	3.0609"-04	NM	1.2646	8.5754"-04	1.2161"+03	6.8145"+02
59010501	10.0300	0.5157	1.3598"+02	8.4100"-04	21.4974	2.4460	9.5549"+01	9.5549"+01
2.4000"-01	4.1368"+06	1.0000	1.0592"+03	1.7960"-04	1.7859	1.6406	3.8333"+02	3.9062"+01
-2.5240"-02	8.2500"+02	0.0000	2.7675"-04	NM	1.2078	1.0391"-03	1.2772"+03	7.4326"+02
59010601	10.0400	0.4918	1.5186"+02	7.6100"-04	22.7155	2.4804	1.1074"+02	1.1074"+02
2.4000"-01	4.8263"+06	1.0000	1.1450"+03	1.6340"-04	1.7874	1.6518	3.6556"+02	3.8988"+01
-2.5240"-02	8.2500"+02	0.0000	2.5716"-04	NM	1.1724	9.8498"-04	1.2773"+03	7.4325"+02
59010701	10.0500	0.4694	1.8767"+02	6.9600"-04	21.0748	2.4556	1.2572"+02	1.2572"+02
2.4000"-01	5.5158"+06	1.0000	1.3701"+03	1.5890"-04	1.8029	1.6723	3.4889"+02	3.8914"+01
-2.5240"-02	8.2500"+02	0.0000	2.7000"-04	NM	1.2139	9.4490"-04	1.2773"+03	7.4325"+02
59010801	10.0600	0.4724	1.9043"+02	6.7300"-04	22.7848	2.4658	1.4050"+02	1.4050"+02
2.4000"-01	6.2053"+06	1.0000	1.3993"+03	1.6060"-04	1.8012	1.6676	3.5111"+02	3.8840"+01
-2.5240"-02	8.2500"+02	0.0000	2.4583"-04	NM	1.1682	9.1763"-04	1.2774"+03	7.4324"+02

TRAPEZOIDAL RULE FOR ALL INTEGRATIONS

59010101 HILL PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.47941	0.00000	0.00000	7.01173	0.00000
2	3.1750"-04	1.7971"+00	1.00000	0.51757	0.11568	0.29270	6.40250	0.04572
3	3.8100"-04	1.8870"+00	1.00000	0.52234	0.12083	0.30500	6.37202	0.04787
4	6.7310"-04	2.6478"+00	1.00000	0.54065	0.15499	0.37830	5.95740	0.06350
5	[illegible].0170"-04	3.2573"+00	1.00000	0.55503	0.17665	0.42160	5.69581	0.07402
6	9.[illegible]250"-04	3.3696"+00	1.00000	0.55896	0.18032	0.42920	5.66512	0.07576
7	9.[illegible]"-04	7.1879"+00	1.00000	0.57267	0.27647	0.56000	4.10274	0.13649
8	1.6510"-03	1.1500"+01	1.00000	0.62132	0.35454	0.64890	3.34979	0.19371
9	1.6891"-03	1.5722"+01	1.00000	0.63424	0.41699	0.69190	2.75324	0.25130
10	1.9558"-03	1.9835"+01	1.00000	0.65914	0.46988	0.72870	2.40510	0.30298
11	2.5273"-03	2.7052"+01	1.00000	0.70477	0.55053	0.78040	2.00941	0.38837
12	2.5908"-03	2.9839"+01	1.00000	0.71732	0.57868	0.79470	1.88597	0.42138
13	3.0861"-03	3.0990"+01	1.00000	0.74216	0.58991	0.81110	1.89052	0.42904
14	3.2512"-03	3.3239"+01	1.00000	0.75552	0.61126	0.82330	1.81414	0.45382
15	3.2766"-03	3.7642"+01	1.00000	0.76679	0.65102	0.83760	1.65534	0.50600
16	3.7592"-03	3.8629"+01	1.00000	0.79072	0.65961	0.85220	1.66921	0.51054
17	3.7973"-03	4.3128"+01	1.00000	0.80485	0.69741	0.86640	1.54335	0.56138
18	4.0513"-03	4.2680"+01	1.00000	0.81530	0.69374	0.87140	1.57778	0.55230
19	4.1148"-03	4.5924"+01	1.00000	0.82502	0.71990	0.88075	1.49679	0.58842
20	4.2291"-03	4.8964"+01	1.00000	0.88554	0.74358	0.91605	1.51769	0.60358
21	5.1308"-03	6.3578"+01	1.00000	0.91024	0.84824	0.94160	1.23223	0.76414
22	5.5499"-03	6.8639"+01	1.00000	0.93634	0.88160	0.95830	1.18158	0.81103
23	6.1722"-03	7.9740"+01	1.00000	0.98684	0.95067	0.98980	1.08402	0.91308
24	6.8961"-03	8.4004"+01	1.00000	1.00101	0.97590	0.99880	1.04748	0.95353
25	7.5565"-03	8.6135"+01	1.00000	1.00444	0.98827	1.00140	1.02676	0.97530
26	8.0645"-03	6.6031"+01	1.00000	1.00252	0.98767	1.00040	1.02595	0.97510
27	8.2423"-03	8.7060"+01	1.00000	1.00449	0.99359	1.00180	1.01659	0.98545
D 28	1.5240"-02	8.8181"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U/UD
D-STATE ARTIFICIAL Y=0.6 IN AT I=4,10,11,12,19,20,25 DATA WERE AVERAGED

59010102 HILL PROFILE TABULATION 38 POINTS, DELTA AT POINT 38

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.46544	0.00000	0.00000	8.07276	0.00000
2	6.4770"-04	1.7306"+00	1.00000	0.41324	0.10188	0.25220	6.12784	0.04116
3	7.2390"-04	1.8776"+00	1.00000	0.40478	0.10985	0.26600	5.86410	0.04536
4	7.4930"-04	1.7754"+00	1.00000	0.53189	0.10442	0.29220	7.82985	0.037[illegible]
5	9.0170"-04	1.7537"+00	1.00000	0.54409	0.10321	0.29260	8.03752	0.03640
6	9.5250"-04	2.2854"+00	1.00000	0.55570	0.12799	0.35290	7.60280	0.04642
7	1.0795"-03	2.7751"+00	1.00000	0.56125	0.14591	0.39210	7.22173	0.05429
8	1.1557"-03	2.3245"+00	1.00000	0.56524	0.12954	0.35930	7.69374	0.04670
9	1.1938"-03	2.9285"+00	1.00000	0.57048	0.15100	0.40540	7.20840	0.05624
10	1.2065"-03	3.2643"+00	1.00000	0.57161	0.16150	0.42580	6.95092	0.06126
11	1.2827"-03	3.8579"+00	1.00000	0.57805	0.17843	0.45820	6.59445	0.06948
12	1.5113"-03	4.5692"+00	1.00000	0.55005	0.19668	0.47550	5.84486	0.08135
13	1.5621"-03	5.6712"+00	1.00000	0.64158	0.22190	0.55100	6.16564	0.08937
14	1.9685"-03	1.0362"+01	1.00000	0.63137	0.30653	0.63700	4.31860	0.14750
15	2.1209"-03	1.0692"+01	1.00000	0.65240	0.31162	0.65170	4.37380	0.14900
16	2.1463"-03	1.1671"+01	1.00000	0.65612	0.32622	0.66490	4.15432	0.16005
17	2.3495"-03	1.6477"+01	1.00000	0.67928	0.39004	0.71700	3.37917	0.21218
18	2.6543"-03	1.9424"+01	1.00000	0.69952	0.42445	0.74440	3.07586	0.24201
19	2.9185"-03	2.5212"+01	1.00000	0.72321	0.48496	0.78040	2.58959	0.30136
20	2.9337"-03	2.7983"+01	1.00000	0.72791	0.51139	0.79120	2.39366	0.33054
21	3.0353"-03	2.5620"+01	1.00000	0.73062	0.48894	0.78570	2.58229	0.30426
22	3.4290"-03	3.0211"+01	1.00000	0.76000	0.53169	0.81425	2.34528	0.34719
23	3.4544"-03	2.9053"+01	1.00000	0.77122	0.52124	0.81730	2.45861	0.33242
24	3.7719"-03	3.4521"+01	1.00000	0.77786	0.56892	0.83320	2.14488	0.38846
25	3.9497"-03	3.6713"+01	1.00000	0.78506	0.58695	0.84110	2.05351	0.40959
26	4.2418"-03	3.9668"+01	1.00000	0.80275	0.61040	0.85540	1.96387	0.43557
27	5.7023"-03	5.7848"+01	1.00000	0.87248	0.73850	0.91240	1.52642	0.59774
28	5.9182"-03	5.9075"+01	1.00000	0.88098	0.74635	0.91780	1.51221	0.60693
29	6.2484"-03	6.5094"+01	1.00000	0.89641	0.78374	0.93010	1.40837	0.66041
30	7.1628"-03	8.2003"+01	1.00000	0.94133	0.88031	0.96220	1.19470	0.80539
31	7.4549"-03	8.6006"+01	1.00000	0.95417	0.90166	0.97040	1.15829	0.83779
32	7.6581"-03	8.6542"+01	1.00000	0.95149	0.90448	0.96925	1.14835	0.84404
33	7.7851"-03	8.8777"+01	1.00000	0.95423	0.91615	0.97150	1.12448	0.86395
34	8.6487"-03	1.0026"+02	1.00000	0.98476	0.97389	0.99080	1.03502	0.95728
35	8.6741"-03	1.0035"+02	1.00000	0.98570	0.97434	0.99130	1.03512	0.95766
36	9.0678"-03	1.0694"+02	1.00000	0.99652	1.00597	0.99860	0.98539	1.01340
37	9.1059"-03	1.0346"+02	1.00000	0.98330	0.98938	0.99100	1.00328	0.98776
D 38	1.5240"-02	1.0568"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U/UD
D-STATE ARTIFICIAL Y=0.6 IN AT I=22,32 DATA WERE AVERAGED

59010401 HILL PROFILE TABULATION 29 POINTS, DELTA AT POINT 29

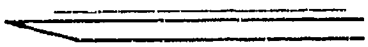
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.48971	0.00000	0.00000	7.22712	0.00000
2	3.1750"-04	2.0283"+00	1.00000	0.52915	0.12760	0.32230	6.38015	0.05052
3	3.8100"-04	2.3091"+00	1.00000	0.53516	0.14052	0.35020	6.21063	0.05639
4	6.7310"-04	2.9934"+00	1.00000	0.55742	0.16686	0.40695	5.94798	0.06842
5	9.0170"-04	4.0873"+00	1.00000	0.58138	0.20112	0.47220	5.51234	0.08566
6	9.5250"-04	4.7442"+00	1.00000	0.58704	0.21898	0.50030	5.21989	0.09584
7	9.7790"-04	1.2326"+01	1.00000	0.60425	0.36582	0.64810	3.13872	0.20649
8	1.6510"-03	1.5199"+01	1.00000	0.65890	0.40779	0.70130	2.95758	0.23712
9	1.6891"-03	1.9382"+01	1.00000	0.69670	0.46211	0.74670	2.61102	0.28598
10	1.9558"-03	2.2525"+01	1.00000	0.69296	0.49904	0.75855	2.31044	0.32831
11	2.5273"-03	2.8671"+01	1.00000	0.73933	0.56431	0.80355	2.02763	0.39630
12	2.5908"-03	3.1898"+01	1.00000	0.80339	0.59573	0.84575	2.01550	0.41962
13	3.0861"-03	3.2701"+01	1.00000	0.77605	0.60329	0.83300	1.90649	0.43693
14	3.2512"-03	3.4948"+01	1.00000	0.79085	0.62397	0.84550	1.83612	0.46048
15	3.2766"-03	3.9948"+01	1.00000	0.80190	0.66768	0.86000	1.65908	0.51836
16	3.3401"-03	4.2578"+01	1.00000	0.80862	0.68956	0.86740	1.58233	0.54818
17	3.7592"-03	4.1490"+01	1.00000	0.82726	0.68059	0.87580	1.65593	0.52889
18	3.7973"-03	4.5499"+01	1.00000	0.81242	0.71307	0.87320	1.49956	0.58230
19	4.0513"-03	4.4714"+01	1.00000	0.84472	0.70682	0.88940	1.58333	0.56173
20	4.1148"-03	4.8899"+01	1.00000	0.85719	0.73950	0.90090	1.48415	0.60701
21	4.2291"-03	5.1487"+01	1.00000	0.92490	0.75900	0.93860	1.52924	0.61377
22	5.1308"-03	6.7489"+01	1.00000	0.92702	0.86992	0.95250	1.19887	0.79450
23	5.5499"-03	7.3944"+01	1.00000	0.95183	0.91084	0.96890	1.13155	0.85626
24	6.1722"-03	8.3474"+01	1.00000	0.98157	0.96811	0.98850	1.04257	0.94814
25	6.8961"-03	8.6575"+01	1.00000	0.99553	0.98603	0.99680	1.02197	0.97537
26	7.5565"-03	8.6665"+01	1.00000	0.99606	0.98654	0.99710	1.02153	0.97609
27	8.0645"-03	8.6093"+01	1.00000	0.99252	0.98329	0.99510	1.02417	0.97162
28	8.2423"-03	8.6655"+01	1.00000	0.99347	0.98648	0.99580	1.01898	0.97726
D 29	1.5240"-02	8.9033"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U/UD
D-STATE ARTIFICIAL Y=0.6 IN AT I=4,10,11,12,20,21,26 DATA WERE AVERAGED

59010402 HILL PROFILE TABULATION 38 POINTS, DELTA AT POINT 38

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.49265	0.00000	0.00000	8.65187	0.00000
2	6.4770"-04	1.9749"+00	1.00000	0.55678	0.11384	0.32300	8.05027	0.04012
3	7.4930"-04	2.2091"+00	1.00000	0.56383	0.12407	0.34850	7.89043	0.04417
4	9.0170"-04	2.7653"+00	1.00000	0.57688	0.14462	0.39670	7.52481	0.05272
5	9.5250"-04	3.2132"+00	1.00000	0.58121	0.15890	0.42630	7.19742	0.05923
6	1.0795"-03	4.7063"+00	1.00000	0.59615	0.19868	0.49990	6.33071	0.07896
7	1.1557"-03	3.5861"+00	1.00000	0.58235	0.16978	0.44670	6.92242	0.06453
8	1.1938"-03	4.4433"+00	1.00000	0.60612	0.19231	0.49410	6.60141	0.07485
9	1.2065"-03	4.6466"+00	1.00000	0.60067	0.19725	0.49960	6.41503	0.07788
10	1.2827"-03	6.7447"+00	1.00000	0.61475	0.24231	0.56690	5.47367	0.10357
11	1.5113"-03	8.0331"+00	1.00000	0.63856	0.26615	0.60460	5.16025	0.11716
12	1.5621"-03	8.9030"+00	1.00000	0.64220	0.28110	0.62130	4.88522	0.12718
13	1.8415"-03	1.7839"+01	1.00000	0.68392	0.40363	0.72740	3.24779	0.22397
14	2.1209"-03	1.6989"+01	1.00000	0.69419	0.39363	0.72780	3.41866	0.21289
15	2.1463"-03	1.7962"+01	1.00000	0.69790	0.40505	0.73550	3.29714	0.22307
16	2.4765"-03	2.6100"+01	1.00000	0.71179	0.49033	0.77670	2.50917	0.30954
17	2.6492"-03	2.6215"+01	1.00000	0.74038	0.49143	0.79250	2.60063	0.30473
18	2.9185"-03	2.9259"+01	1.00000	0.75745	0.51967	0.81020	2.43068	0.33332
19	2.9337"-03	2.9871"+01	1.00000	0.75942	0.52516	0.81280	2.39539	0.33932
20	3.0353"-03	2.9259"+01	1.00000	0.76420	0.51967	0.81380	2.45233	0.33185
21	3.4290"-03	3.3274"+01	1.00000	0.78466	0.55473	0.83400	2.26035	0.36897
22	3.4544"-03	3.4494"+01	1.00000	0.75132	0.56495	0.81850	2.09906	0.38994
23	3.7719"-03	3.7001"+01	1.00000	0.80292	0.58538	0.85080	2.11238	0.40277
24	3.9497"-03	3.8609"+01	1.00000	0.80971	0.59813	0.85710	2.05338	0.41741
25	4.2418"-03	4.1886"+01	1.00000	0.82303	0.62330	0.86910	1.94424	0.44701
26	5.7023"-03	6.2030"+01	1.00000	0.89263	0.75989	0.92570	1.48402	0.62378
27	5.9182"-03	6.4276"+01	1.00000	0.90490	0.77363	0.93360	1.45633	0.64106
28	6.2484"-03	7.0607"+01	1.00000	0.91713	0.81110	0.94380	1.35398	0.69706
29	7.1628"-03	8.9954"+01	1.00000	0.95783	0.91615	0.97340	1.12888	0.86227
30	7.4549"-03	9.0470"+01	1.00000	0.96318	0.91879	0.97630	1.12910	0.86467
31	7.6581"-03	9.0298"+01	1.00000	0.96676	0.91791	0.97805	1.13532	0.86147
32	7.7851"-03	9.0384"+01	1.00000	0.96838	0.91835	0.97890	1.13621	0.86155
33	8.6487"-03	1.0536"+02	1.00000	0.99374	0.99187	0.99640	1.00916	0.98736
34	8.6741"-03	1.0443"+02	1.00000	0.98987	0.98747	0.99420	1.01367	0.98079
35	9.0678"-03	1.0788"+02	1.00000	0.99778	1.00374	0.99910	0.99078	1.00839
36	9.1059"-03	1.0680"+02	1.00000	0.99735	0.99868	0.99860	0.99984	0.99876
37	9.3726"-03	1.0758"+02	1.00000	0.99974	1.00231	1.00000	0.99540	1.00462
D 38	1.5240"-02	1.0708"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U/UD
D-STATE ARTIFICIAL Y=0.6 IN AT I=2,31 DATA WERE AVERAGED

	M : 5 R THETA X 10^{-3} : 1 - 4.5 TW/TR : 0.65 - 0.95	5902 ZPG-MHT

Continuous tunnel with fixed contoured nozzle, W = H = 0.12 m (E).
0.5 < PO < 0.75 MN/m^2. 340 < TO < 500 K. Air. 8 < RE/m X 10^{-6} < 16.

WINKLER E.M. and CHA M.H., 1959. Investigation of flat plate hypersonic turbulent boundary layers with heat transfer at a Mach number of 5.2. NOL NAVORD Rep 6631.
Also Winkler (1961)

1 The test boundary layer was formed on a smooth stainless steel flat plate 0.604 m long mounted with the test surface on the tunnel centre-line and spanning the tunnel. The leading edge (X = 0) was chamfered on the underside, and except for the first 40 mm (E) the whole length of the test surface could be actively
8 cooled. Measurements were made at stations for which X = 0.216, 0.2925, 0.3685 and 0.445 m. The static
2 pressure along the plate was constant to within 1.3 % and the plate surface was practically isothermal
4 for leading edge distances > 0.14 m. For X < 0.14 m the surface temperature deviated from the isothermal value by amounts dependant on the test conditions; for the lowest TW/TR reported here the deviation was
3 about 10 %. The test free stream conditions were selected to cause transition near X = 170 mm.

6 Static pressure tappings (d = 0.63 mm) were drilled at X = 70 mm and at subsequent intervals of 76.2 mm, alternately 9 mm to either side of the plate centre line. Thermocouple plugs, of the same material as the plate, were placed 4.75 mm to either side of the centre-line (E) at the same stations. Each plug contained five thermocouple junctions at known distances from the plate surface.

7 Boundary layer surveys were made with FPP and STP. The probes used had "nearly rectangular entrance openings of half heights between 0.1 and 0.13 mm" (h_1 = 0.2 - 0.26 mm). The STP was of the type described by Winkler (1954).

9 The authors have interpolated the TO readings to the Y-values of the Pitot readings. The TO profile was extrapolated to match the wall temperature gradient calculated from the wall heat transfer rate. This was deduced from the temperature gradient in the wall, and the authors present CF values deduced from the slope of the velocity profile near the wall, and from Reynolds analogy (Colburn's formula). Static pressure
12 was assumed constant across the boundary layer. The editors have presented all the reported profiles, incorporating the authors assumptions and procedures. The D-state is the authors', at the outermost point.
13 The CF value is that deduced from the velocity gradient. The profiles form three groups marked by differing heat transfer conditions. Within each group there are some repeats, and some slight variation of unit
14 Reynolds number. There are four successive profiles in each group. Heat transfer values are given for nearly all the profiles, and the authors' CF value referred to above.

§ DATA: 59020101-0306. Pitot and TO profiles obtained separately. NX = 4. Wall heat flux from temperature gradient in wall.

15 Editors' comments

The Reynolds number range of the test is low, and the test layer displays marked transitional characteristics. The experimental range overlaps, in some degree, the tests made by Danberg - CAT 6702 and Samuels et al. - CAT 6701.
The profiles include data taken very close to the plate surface, but it seems probable that the temperature values used in the wall region were interpolated. The CF values quoted should be treated with considerable reserve since they are obtained from the velocity gradient which must inevitably be somewhat ill-defined.

The entry has been prepared from a rather limited published account.

CAT 5902 WINKLER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
59020101	5.2100	0.9773	4.0164"+02	1.4650"-03	10.1251	1.6742	1.0694"+03	1.0694"+03
2.1600"-01	7.2042"+05	1.0000	2.1242"+03	9.3700"-04	1.8434	1.7598	3.0602"+02	5.9480"+01
INFINITE	3.8239"+02	0.0000	1.7955"-04	0.0000"+00	0.5230	3.7325"-04	8.0563"+02	3.4880"+02
59020102	5.1400	0.9598	5.7784"+02	1.3890"-03	8.1905	1.5583	1.1533"+03	1.1533"+03
2.1600"-01	7.1738"+05	1.0000	2.7364"+03	NM	1.8579	1.7847	3.0200"+02	5.4870"+01
INFINITE	3.4480"+02	0.0000	1.9249"-04	0.0000"+00	0.7277	3.6388"-04	7.6338"+02	3.1465"+02
59020103	5.2000	0.9193	6.3024"+02	1.4320"-03	11.2967	1.6730	1.0968"+03	1.0968"+03
2.9250"-01	7.3055"+05	1.0000	2.9030"+03	8.5800"-04	1.8241	1.7180	3.0659"+02	5.7050"+01
INFINITE	3.6558"+02	0.0000	2.2510"-04	0.0000"+00	0.3632	5.0578"-04	7.8748"+02	3.3349"+02
59020104	5.2600	0.9169	7.5907"+02	1.3460"-03	10.0987	1.4336	1.0390"+03	1.0390"+03
3.6850"-01	7.4069"+05	1.0000	3.5535"+03	8.4700"-04	1.8602	1.7954	3.0702"+02	5.6200"+01
INFINITE	3.6718"+02	0.0000	2.8111"-04	0.0000"+00	0.4797	5.7632"-04	7.9061"+02	3.3484"+02
59020105	5.2900	0.9251	8.2486"+02	1.3080"-03	12.3679	1.4167	9.7430"+02	9.7430"+02
4.4500"-01	7.1839"+05	1.0000	3.9366"+03	8.0400"-04	1.8292	1.7842	3.0602"+02	5.5000"+01
INFINITE	3.6283"+02	0.0000	3.1963"-04	0.0000"+00	0.1830	7.5294"-04	7.8659"+02	3.3081"+02
59020201	4.9800	0.8286	4.4438"+02	1.3350"-03	11.2871	1.5629	1.0625"+03	1.0625"+03
2.1600"-01	5.4918"+05	1.0000	1.7388"+03	8.5300"-04	1.8396	1.7707	2.9001"+02	6.4290"+01
INFINITE	3.8317"+02	0.0000	1.7398"-04	0.0000"+00	0.2143	3.8292"-04	8.0059"+02	3.5001"+02
59020202	5.1800	0.8137	4.3063"+02	1.6060"-03	9.8808	1.4909	1.0909"+03	1.0909"+03
2.1600"-01	7.1029"+05	1.0000	1.7570"+03	NM	1.8738	1.8304	2.9632"+02	6.2700"+01
INFINITE	3.9918"+02	0.0000	1.5852"-04	0.0000"+00	0.4748	3.0278"-04	8.2238"+02	3.6418"+02
59020203	5.2000	0.8223	6.3665"+02	1.2480"-03	11.3023	1.5198	1.0724"+03	1.0724"+03
2.9250"-01	7.1434"+05	1.0000	2.6752"+03	7.3500"-04	1.8510	1.7817	2.8073"+02	5.8400"+01
INFINITE	3.7423"+02	0.0000	2.1976"-04	0.0000"+00	0.3124	4.7624"-04	7.9675"+02	3.4138"+02
59020204	5.2400	0.8477	7.6239"+02	1.1510"-03	11.3939	1.5149	1.0162"+03	1.0162"+03
3.6850"-01	7.0826"+05	1.0000	3.3134"+03	7.3800"-04	1.8350	1.7699	2.9301"+02	5.8380"+01
INFINITE	3.7897"+02	0.0000	2.8490"-04	0.0000"+00	0.3196	6.3794"-04	8.0274"+02	3.4563"+02
59020205	5.2400	0.8397	8.3216"+02	NM	11.4975	1.3612	9.5224"+02	9.5224"+02
4.4500"-01	6.6368"+05	1.0000	3.5793"+03	6.7100"-04	1.8440	1.8001	2.9389"+02	5.9120"+01
INFINITE	3.8378"+02	0.0000	3.3473"-04	0.0000"+00	0.2696	7.6757"-04	8.0781"+02	3.5001"+02
59020301	5.1700	0.6717	2.8185"+02	1.4700"-03	11.7680	2.0454	1.0656"+03	1.0656"+03
2.1600"-01	6.8597"+05	1.0000	9.5886"+02	9.6800"-04	1.7670	1.6257	2.7904"+02	7.1750"+01
INFINITE	4.5531"+02	0.0000	1.0864"-04	0.0000"+00	0.4604	2.7850"-04	8.7803"+02	4.1542"+02
59020502	5.1600	0.6418	4.8604"+02	1.3230"-03	10.6369	1.5080	1.0683"+03	1.0683"+03
2.9250"-01	6.7989"+05	1.0000	1.5752"+03	8.3500"-04	1.8478	1.7776	2.7902"+02	7.5330"+01
INFINITE	4.7647"+02	0.0000	1.9184"-04	0.0000"+00	0.3731	4.0161"-04	8.9793"+02	4.3475"+02
59020303	5.1000	0.6324	5.2358"+02	1.3350"-03	10.4141	1.4972	1.1666"+03	1.1666"+03
2.9250"-01	6.9306"+05	1.0000	1.6517"+03	NM	1.8568	1.7919	2.6997"+02	7.5410"+01
INFINITE	4.6769"+02	0.0000	1.8668"-04	0.0000"+00	0.3635	3.7518"-04	8.8796"+02	4.2690"+02
59020304	5.2000	0.6448	7.1533"+02	1.2030"-03	10.8378	1.5619	1.1424"+03	1.1424"+03
3.6850"-01	7.6095"+05	1.0000	2.3661"+03	NM	1.8440	1.7805	2.7499"+02	7.2960"+01
INFINITE	4.6753"+02	0.0000	2.5492"-04	0.0000"+00	0.3708	5.2899"-04	8.9054"+02	4.2649"+02
59020305	5.1100	0.6182	7.8660"+02	1.2360"-03	9.9868	1.4692	1.2139"+03	1.2139"+03
3.6850"-01	7.2954"+05	1.0000	2.4160"+03	7.9900"-04	1.8532	1.7973	2.8000"+02	7.9750"+01
INFINITE	4.9624"+02	0.0000	2.8467"-04	0.0000"+00	0.4211	5.6749"-04	9.1495"+02	4.5292"+02
59020306	5.1200	0.6601	7.0596"+02	1.0540"-03	16.7644	1.8501	1.1667"+03	1.1667"+03
4.4500"-01	7.0927"+05	1.0000	2.3195"+03	6.7200"-04	1.7413	1.6361	2.8098"+02	7.4710"+01
INFINITE	4.6641"+02	0.0000	2.5748"-04	0.0000"+00	-0.2228	8.6902"-04	8.8730"+02	4.2567"+02

59020103 WINKLER PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.83864	0.00000	0.00000	5.37400	0.00000
2	1.9200"-04	2.0837"+00	NM	0.91864	0.20783	0.45400	4.77200	0.09514
3	2.1800"-04	2.2663"+00	NM	0.92176	0.22117	0.47800	4.67100	0.10233
4	2.4300"-04	2.4982"+00	NM	0.92575	0.23667	0.50500	4.55300	0.11092
5	2.6900"-04	3.0165"+00	NM	0.93208	0.26743	0.55500	4.30700	0.12886
6	2.9400"-04	3.0799"+00	NM	0.93148	0.27091	0.56000	4.27300	0.13106
7	3.1900"-04	3.6481"+00	NM	0.93670	0.30015	0.60300	4.03600	0.14941
8	3.4500"-04	3.8468"+00	NM	0.93775	0.30967	0.61600	3.95700	0.15567
9	3.9600"-04	4.5838"+00	NM	0.94124	0.34254	0.65800	3.69000	0.17832
10	4.4600"-04	5.1962"+00	NM	0.94357	0.36753	0.68700	3.49400	0.19662
11	4.9700"-04	5.7953"+00	NM	0.94427	0.39039	0.71100	3.31700	0.21435
12	5.7300"-04	6.6529"+00	NM	0.94451	0.42090	0.74000	3.09100	0.23940
13	7.0000"-04	7.9037"+00	NM	0.94650	0.46175	0.77500	2.81700	0.27512
14	8.2700"-04	9.0510"+00	NM	0.94571	0.49623	0.80000	2.59900	0.30781
15	9.5400"-04	1.0078"+01	NM	0.94561	0.52517	0.81900	2.43200	0.33676
16	1.0810"-03	1.1012"+01	NM	0.94563	0.55016	0.83400	2.29800	0.36292
17	1.2080"-03	1.1751"+01	NM	0.94434	0.56915	0.84400	2.19900	0.38381
18	1.4620"-03	1.2923"+01	NM	0.94690	0.59803	0.86000	2.06800	0.41586
19	1.7160"-03	1.3667"+01	NM	0.95042	0.61564	0.87000	1.99700	0.43565
20	2.2240"-03	1.5632"+01	NM	0.95661	0.65993	0.89200	1.82700	0.48823
21	2.7320"-03	1.8285"+01	NM	0.96188	0.71537	0.91500	1.63600	0.55929
22	3.2400"-03	2.0979"+01	NM	0.97143	0.76757	0.93600	1.48700	0.62946
23	3.7480"-03	2.3969"+01	NM	0.98053	0.82163	0.95500	1.35100	0.70688
24	5.0150"-03	3.0740"+01	NM	0.99495	0.93252	0.98600	1.11800	0.88193
25	6.2880"-03	3.4359"+01	NM	0.99822	0.98669	0.99700	1.02100	0.97649
D 26	8.8280"-03	3.5290"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

59020105 WINKLER PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.84344	0.00000	0.00000	5.56400	0.00000
2	1.9100"-04	1.6563"+00	NM	0.88862	0.16646	0.37500	5.07500	0.07389
3	2.2600"-04	1.8716"+00	NM	0.89117	0.18719	0.41500	4.91500	0.08444
4	2.6700"-04	2.2675"+00	NM	0.89533	0.21749	0.47000	4.67000	0.10064
5	3.1700"-04	2.5868"+00	NM	0.89806	0.23814	0.50500	4.49700	0.11230
6	3.9400"-04	3.1187"+00	NM	0.90310	0.26837	0.55300	4.24600	0.13024
7	4.4400"-04	3.4163"+00	NM	0.90633	0.28371	0.57600	4.12200	0.13974
8	5.2100"-04	4.2295"+00	NM	0.91261	0.32161	0.62800	3.81300	0.16470
9	7.7500"-04	5.7392"+00	NM	0.92026	0.38170	0.69800	3.34400	0.20873
10	1.2830"-03	8.0860"+00	NM	0.93120	0.45945	0.77100	2.81600	0.27379
11	1.7910"-03	9.7219"+00	NM	0.93726	0.50656	0.80700	2.53800	0.31797
12	2.4260"-03	1.1446"+01	NM	0.94535	0.55184	0.83800	2.30600	0.36340
13	3.0610"-03	1.3412"+01	NM	0.95502	0.59929	0.86700	2.09300	0.41424
14	3.5940"-03	1.5608"+01	NM	0.96428	0.64819	0.89300	1.89800	0.47050
15	4.3310"-03	1.8209"+01	NM	0.97868	0.70170	0.92000	1.71900	0.53519
16	4.9660"-03	2.0536"+01	NM	0.98803	0.74632	0.93900	1.58300	0.59318
17	5.6010"-03	2.3399"+01	NM	1.00140	0.79779	0.96000	1.44800	0.66298
18	6.2360"-03	2.6205"+01	NM	1.00618	0.84520	0.97400	1.32800	0.73343
19	6.8710"-03	2.9250"+01	NM	1.00520	0.89381	0.98400	1.21200	0.81188
20	7.5060"-03	3.1878"+01	NM	1.00802	0.93372	0.99300	1.13100	0.87798
21	8.1410"-03	3.3853"+01	NM	1.00998	0.96263	0.99900	1.07700	0.92758
22	9.4110"-03	3.5823"+01	NM	1.00288	0.99063	1.00000	1.01900	0.98135
D 23	1.0681"-02	3.6495"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

59020302 WINKLER PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

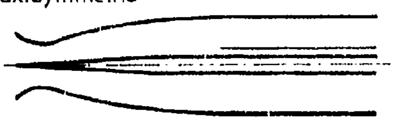
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.58560	0.00000	0.00000	3.70400	0.00000
2	1.5200"-04	1.7387"+00	NM	0.88047	0.17931	0.39100	4.75500	0.08223
3	2.2900"-04	1.7801"+00	NM	0.88232	0.18340	0.39900	4.73300	0.08430
4	2.5400"-04	1.9248"+00	NM	0.88699	0.19656	0.42400	4.65300	0.09112
5	2.7900"-04	2.1129"+00	NM	0.89294	0.21167	0.45200	4.56000	0.09912
6	3.3000"-04	2.5803"+00	NM	0.90405	0.24374	0.50800	4.34400	0.11694
7	3.8100"-04	3.1587"+00	NM	0.90228	0.27731	0.55800	4.04900	0.13781
8	4.3200"-04	4.1024"+00	NM	0.91437	0.32396	0.62400	3.71000	0.16819
9	4.8300"-04	5.0069"+00	NM	0.92263	0.36279	0.67200	3.43100	0.19586
10	5.3300"-04	5.9060"+00	NM	0.92874	0.39752	0.71000	3.19000	0.22257
11	5.8400"-04	6.8971"+00	NM	0.93384	0.43251	0.74400	2.95900	0.25144
12	7.1100"-04	9.1929"+00	NM	0.94151	0.50421	0.80200	2.53000	0.31700
13	8.3800"-04	1.1000"+01	NM	0.94149	0.55410	0.83300	2.26000	0.36858
14	1.3460"-03	1.4346"+01	NM	0.95230	0.63619	0.87900	1.90900	0.46045
15	1.6000"-03	1.6019"+01	NM	0.95573	0.67347	0.89600	1.77000	0.50621
16	1.8540"-03	1.6824"+01	NM	0.95884	0.69070	0.90400	1.71300	0.52773
17	2.3620"-03	1.9507"+01	NM	0.96602	0.74522	0.92600	1.54400	0.59974
18	2.8700"-03	2.2554"+01	NM	0.97303	0.80268	0.94600	1.38900	0.68107
19	3.3780"-03	2.5551"+01	NM	0.98316	0.85541	0.96400	1.27000	0.75906
20	3.8860"-03	2.8491"+01	NM	0.99024	0.90416	0.97800	1.17000	0.83590
21	4.6480"-03	3.1696"+01	NM	0.99725	0.95447	0.99100	1.07800	0.91929
22	5.9180"-03	3.4272"+01	NM	1.00021	0.99306	0.99900	1.01200	0.98715
D 23	7.1880"-03	3.4746"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

59020306 WINKLER PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.60245	0.00000	0.00000	3.76100	0.00000
2	5.9700"-04	4.1368"+00	NM	0.92988	0.32807	0.63200	3.71100	0.17030
3	6.2200"-04	4.3588"+00	NM	0.93245	0.33807	0.64500	3.64000	0.17720
4	6.4800"-04	4.3984"+00	NM	0.93222	0.33982	0.64700	3.62500	0.17848
5	6.7300"-04	4.5832"+00	NM	0.93388	0.34787	0.65700	3.56700	0.18419
6	8.0000"-04	5.8411"+00	NM	0.94048	0.39821	0.71300	3.20600	0.22240
7	9.2700"-04	6.8832"+00	NM	0.94512	0.43542	0.74900	2.95900	0.25313
8	1.0540"-03	7.7811"+00	NM	0.94924	0.46507	0.77500	2.77700	0.27908
9	1.1810"-03	9.9165"+00	NM	0.89050	0.52886	0.79400	2.25400	0.35226
10	1.3080"-03	9.2425"+00	NM	0.95099	0.50960	0.80800	2.51400	0.32140
11	1.4350"-03	9.7098"+00	NM	0.95141	0.52303	0.81700	2.44000	0.33484
12	1.5620"-03	1.0209"+01	NM	0.95198	0.53700	0.82600	2.36600	0.34911
13	1.6890"-03	1.0647"+01	NM	0.95384	0.54897	0.83400	2.30800	0.36135
14	1.8160"-03	1.0936"+01	NM	0.95494	0.55674	0.83900	2.27100	0.36944
15	2.0700"-03	1.1360"+01	NM	0.95652	0.56793	0.84600	2.21900	0.38125
16	2.3240"-03	1.1832"+01	NM	0.95737	0.58012	0.85300	2.16200	0.39454
17	2.5780"-03	1.2605"+01	NM	0.95737	0.59954	0.86300	2.07200	0.41651
18	2.8320"-03	1.3323"+01	NM	0.95847	0.61706	0.87200	1.99700	0.43665
19	3.0860"-03	1.4232"+01	NM	0.95894	0.63853	0.88200	1.90800	0.46226
20	3.3400"-03	1.5081"+01	NM	0.96049	0.65793	0.89100	1.83400	0.48582
21	3.5940"-03	1.5795"+01	NM	0.96172	0.67384	0.89800	1.77600	0.50563
22	3.8460"-03	1.6607"+01	NM	0.96222	0.69146	0.90500	1.71300	0.52831
23	4.1020"-03	1.7714"+01	NM	0.96348	0.71480	0.91400	1.63500	0.55902
24	4.3560"-03	1.8352"+01	NM	0.96461	0.72790	0.91900	1.59400	0.57654
25	4.9910"-03	2.0836"+01	NM	0.97245	0.77683	0.93800	1.45800	0.64335
26	5.6260"-03	2.3384"+01	NM	0.98315	0.82402	0.95600	1.34600	0.71025
27	6.2610"-03	2.5860"+01	NM	0.98846	0.86739	0.96900	1.24800	0.77644
28	6.8960"-03	2.8281"+01	NM	0.99121	0.90781	0.97900	1.16300	0.84179
29	8.1660"-03	3.2380"+01	NM	0.99915	0.97241	0.99500	1.04700	0.95033
30	9.4360"-03	3.3816"+01	NM	0.99992	0.99404	0.99900	1.01000	0.98911
D 31	1.0706"-02	3.4217"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

axisymmetric 	M : 1.85, 2.10, 2.57 R THETA X 10^{-3} : 2 - 4 TW/TR : About 1	**6001** ZPG - AW

Continuous running tunnel with interchangeable fixed nozzles. W = H = 0.30 m
0.05 < PO < 0.1 MN/m^2. TO : 313 K. Air. 3 < RE/m X 10^{-6} < 6.

MICHEL R., 1960. Résultats sur la couche limite turbulente aux grandes vitesses. X[me] Congrès de Mécanique Appliqué Stresa 1960. Publication ONERA no 102.
And Michel R., private communications.

1 The tests were made on the outer surface of a circular cylinder (diameter 39.25 mm) aligned with the axis of the 300 mm square tunnel test section. The cylinder had an ogival nose which was continued upstream as
3 a long thin rod, on which transition took place. The seven test stations were between X = 150 and 350 mm
2 from the point of the ogival nose (X = 0). The free stream Mach number did not vary more than 1 % in this region.

6 Static pressure was measured at intervals along the model surface, as was the wall temperature. The static
7 tappings (d = 0.3 mm) were drilled at 10 mm intervals. Pitot profiles were obtained with an FPP (h_1 = 0.12 h_2 = 0.07, b_1 = 6 mm) at X values of 150, 183, 216, 249, 282, 315 and 348 mm.

9 The data were reduced using a linear Crocco temperature relationship with a recovery factor of 0.88, determined from the equilibrium temperature of the model. The static pressure was assumed constant through the boundary layer.

12 The editors' have replaced the author's temperature-velocity correlation by the normal Crocco - Van Driest relationship, assuming a recovery factor of 0.896 and using the author's TW value. We thus presume that there
13 is slight heat transfer. We present all the data in our posession, consisting of three sequences of profiles each for a different Mach number. The author also reports measurements at M = 2.97 and a further set at M = 2.57 with moderate heat transfer.

§ DATA: 6001 0101 - 0306. Pitot profiles. NX = 6 or 7.

15 Editors' comments

The entry describes an early experiment in an axisymmetric configuration for which δ/RZ is up to 40 % so that transverse curvature effects may well be considerable. Upstream history effects should be weak, if not negligible. Comparisons should be made with other low Reynolds number tests made on flat plates. (Coles - CAT 5301, Shutts et al. - CAT 5501).

Despite the small physical scale of the experiment, measurements extend within the momentum deficit peak. The computed total pressure gradient in the outer part of the layer is large enough to suggest that measurements should have continued to rather greater values of y.

CAT 6001 MICHEL BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X * RZ *	MD * POD* TOD*	TW/TR PW/PD* SH *	RED2W RED2D D2	CF CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
60010101	1.8500	0.9930	1.4495"+03	NM	2.7262	1.3817	8.6884"+03	8.6884"+03
1.5000"-01	5.3900"+04	1.0000	2.1269"+03	NM	1.7932	1.7787	2.9957"+02	1.8700"+02
1.9625"-02	3.1500"+02	0.0000	3.2671"-04	0.0000"+00	0.0836	3.9259"-04	5.0723"+02	3.0169"+02
60010102	1.8500	0.9930	1.6391"+03	NM	2.7425	1.3944	8.8012"+03	8.8012"+03
1.8300"-01	5.4600"+04	1.0000	2.4032"+03	NM	1.7827	1.7669	3.0243"+02	1.8878"+02
1.9625"-02	3.1800"+02	0.0000	3.6913"-04	0.0000"+00	0.0833	4.4640"-04	5.0964"+02	3.0456"+02
60010103	1.8500	0.9930	1.7799"+03	NM	2.7283	1.3851	8.7529"+03	8.7529"+03
1.9900"-01	5.4300"+04	1.0000	2.6116"+03	NM	1.7829	1.7674	2.9957"+02	1.8700"+02
1.9625"-02	3.1500"+02	0.0000	3.9821"-04	0.0000"+00	0.0834	4.8116"-04	5.0723"+02	3.0169"+02
60010104	1.8500	0.9930	1.9170"+03	NM	2.7221	1.3816	9.0914"+03	9.0914"+03
2.1600"-01	5.6400"+04	1.0000	2.8105"+03	NM	1.7825	1.7669	3.0243"+02	1.8878"+02
1.9625"-02	3.1800"+02	0.0000	4.1793"-04	0.0000"+00	0.0835	5.0482"-04	5.0964"+02	3.0456"+02
60010105	1.8500	0.9930	2.1665"+03	NM	2.6995	1.3684	8.8335"+03	8.8335"+03
2.4900"-01	5.4800"+04	1.0000	3.1789"+03	NM	1.7823	1.7666	2.9957"+02	1.8700"+02
1.9625"-02	3.1500"+02	0.0000	4.8028"-04	0.0000"+00	0.0837	5.7909"-04	5.0723"+02	3.0169"+02
60010106	1.8500	0.9930	2.3434"+03	NM	2.6866	1.3613	8.8335"+03	8.8335"+03
2.8100"-01	5.4800"+04	1.0000	3.4384"+03	NM	1.7825	1.7666	2.9957"+02	1.8700"+02
1.9625"-02	3.1500"+02	0.0000	5.1951"-04	0.0000"+00	0.0838	6.2547"-04	5.0723"+02	3.0169"+02
60010201	2.1000	0.9908	1.2809"+03	NM	3.0920	1.3808	6.0582"+03	6.0582"+03
1.5000"-01	5.5400"+04	1.0000	2.0561"+03	NM	1.8025	1.7828	2.9499"+02	1.6631"+02
1.9625"-02	3.1300"+02	0.0000	3.3992"-04	0.0000"+00	0.0980	4.2323"-04	5.4299"+02	2.9774"+02
60010202	2.1000	0.9909	1.4559"+03	NM	3.0725	1.3683	6.1019"+03	6.1019"+03
1.8300"-01	5.5800"+04	1.0000	2.3358"+03	NM	1.8000	1.7809	2.9693"+02	1.6738"+02
1.9625"-02	3.1500"+02	0.0000	3.8677"-04	0.0000"+00	0.0979	4.8211"-04	5.4472"+02	2.9965"+02
60010203	2.1000	0.9913	1.6371"+03	NM	3.0651	1.3637	6.1347"+03	6.1347"+03
2.1700"-01	5.6100"+04	1.0000	2.6264"+03	NM	1.7950	1.7760	2.9798"+02	1.6791"+02
1.9625"-02	3.1600"+02	0.0000	4.3445"-04	0.0000"+00	0.0975	5.4347"-04	5.4559"+02	3.0060"+02
60010204	2.1000	0.9909	1.8677"+03	NM	3.0502	1.3565	6.2769"+03	6.2769"+03
2.4800"-01	5.7400"+04	1.0000	2.9764"+03	NM	1.7928	1.7739	2.9693"+02	1.6738"+02
1.9625"-02	3.1500"+02	0.0000	4.8232"-04	0.0000"+00	0.0979	6.0357"-04	5.4472"+02	2.9965"+02
60010205	2.1000	0.9913	1.9934"+03	NM	3.0477	1.3558	6.2769"+03	6.2769"+03
2.8200"-01	5.7400"+04	1.0000	3.1980"+03	NM	1.7895	1.7704	2.9798"+02	1.6791"+02
1.9625"-02	3.1600"+02	0.0000	5.1703"-04	0.0000"+00	0.0975	6.4839"-04	5.4559"+02	3.0060"+02
60010206	2.1000	0.9909	2.1142"+03	NM	3.0452	1.3569	6.1894"+03	6.1894"+03
3.1500"-01	5.6600"+04	1.0000	3.3918"+03	NM	1.7863	1.7668	2.9693"+02	1.6738"+02
1.9625"-02	3.1500"+02	0.0000	5.5370"-04	0.0000"+00	0.0979	6.9545"-04	5.4472"+02	2.9965"+02
60010207	2.1000	0.9909	2.2844"+03	NM	3.0415	1.3572	6.2659"+03	6.2659"+03
3.4800"-01	5.7300"+04	1.0000	3.6650"+03	NM	1.7840	1.7641	2.9693"+02	1.6738"+02
1.9625"-02	3.1500"+02	0.0000	5.9098"-04	0.0000"+00	0.0979	7.4273"-04	5.4472"+02	2.9965"+02
60010301	2.5700	0.9903	1.1190"+03	NM	4.0322	1.4545	4.6042"+03	4.6042"+03
1.5000"-01	8.7700"+04	1.0000	2.1448"+03	NM	1.8052	1.7753	2.9533"+02	1.3658"+02
1.9625"-02	3.1700"+02	0.0000	2.8960"-04	0.0000"+00	0.1174	3.9415"-04	6.0219"+02	2.9824"+02
60010302	2.5700	0.9904	1.3070"+03	NM	3.9941	1.4316	4.6409"+03	4.6409"+03
1.8300"-01	8.8400"+04	1.0000	2.5075"+03	NM	1.8032	1.7742	2.9351"+02	1.3572"+02
1.9625"-02	3.1500"+02	0.0000	3.3290"-04	0.0000"+00	0.1173	4.5377"-04	6.0029"+02	2.9635"+02
60010303	2.5700	0.9904	1.5187"+03	NM	3.9778	1.4252	4.6777"+03	4.6777"+03
2.1600"-01	8.9100"+04	1.0000	2.9139"+03	NM	1.7986	1.7699	2.9351"+02	1.3572"+02
1.9625"-02	3.1500"+02	0.0000	3.8381"-04	0.0000"+00	0.1173	5.2518"-04	6.0029"+02	2.9635"+02
60010304	2.5700	0.9901	1.7375"+03	NM	3.9509	1.4131	4.7406"+03	4.7406"+03
2.4900"-01	9.0300"+04	1.0000	3.3313"+03	NM	1.7964	1.7684	2.9436"+02	1.3615"+02
1.9625"-02	3.1600"+02	0.0000	4.3491"-04	0.0000"+00	0.1177	5.9571"-04	6.0124"+02	2.9730"+02
60010305	2.5700	0.9901	2.0714"+03	NM	3.9029	1.3970	4.7249"+03	4.7249"+03
3.1500"-01	9.0000"+04	1.0000	3.9716"+03	NM	1.7979	1.7690	2.9436"+02	1.3615"+02
1.9625"-02	3.1600"+02	0.0000	5.2023"-04	0.0000"+00	0.1182	7.0754"-04	6.0124"+02	2.9730"+02
60010306	2.5700	0.9901	2.1542"+03	NM	3.9108	1.4006	4.7459"+03	4.7459"+03
3.4800"-01	9.0400"+04	1.0000	4.1303"+03	NM	1.7928	1.7645	2.9436"+02	1.3615"+02
1.9625"-02	3.1600"+02	0.0000	5.3862"-04	0.0000"+00	0.1179	7.3740"-04	6.0124"+02	2.9730"+02

60010101 MICHEL PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95100	0.00000	0.00000	1.60197	0.00000
2	9.9900"-05	1.5177"+00	NM	0.96577	0.43007	0.51680	1.44402	0.35789
3	1.9980"-04	1.7748"+00	NM	0.97031	0.51010	0.60083	1.38738	0.43307
4	4.0005"-04	2.1839"+00	NM	0.97602	0.60515	0.69383	1.31459	0.52780
5	5.9850"-04	2.4701"+00	NM	0.97942	0.66015	0.74417	1.27076	0.58561
6	8.0100"-04	2.7281"+00	NM	0.98222	0.70514	0.78344	1.23441	0.63467
7	9.9900"-04	2.9747"+00	NM	0.98471	0.74514	0.81692	1.20194	0.67966
8	1.2510"-03	3.2032"+00	NM	0.98688	0.78013	0.84511	1.17352	0.72015
9	1.4985"-03	3.4435"+00	NM	0.98903	0.81512	0.87229	1.14520	0.76169
10	1.7505"-03	3.6586"+00	NM	0.99087	0.84510	0.89480	1.12106	0.79817
11	1.9980"-03	3.8443"+00	NM	0.99238	0.87009	0.91301	1.10108	0.82919
12	2.2500"-03	4.0748"+00	NM	0.99418	0.90008	0.93421	1.07729	0.86718
13	2.5020"-03	4.2330"+00	NM	0.99537	0.92006	0.94797	1.06158	0.89298
14	2.7495"-03	4.3949"+00	NM	0.99654	0.94005	0.96142	1.04598	0.91916
15	3.0015"-03	4.5187"+00	NM	0.99742	0.95504	0.97131	1.03436	0.93904
16	3.5010"-03	4.6954"+00	NM	0.99863	0.97602	0.98488	1.01824	0.96724
17	4.0005"-03	4.8155"+00	NM	0.99943	0.99001	0.99375	1.00757	0.98628
D 18	4.5000"-03	4.9023"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/L,U/UD,T/TD ASSUME P=PD AND VAN DRIEST

60010106 MICHEL PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95100	0.00000	0.00000	1.60197	0.00000
2	9.9830"-05	1.3795"+00	NM	0.96287	0.37505	0.45619	1.47951	0.30834
3	1.9966"-04	1.5753"+00	NM	0.96687	0.45008	0.53828	1.43037	0.37632
4	3.9999"-04	1.9291"+00	NM	0.97250	0.54711	0.63794	1.35961	0.46921
5	5.9965"-04	2.1595"+00	NM	0.97572	0.60015	0.68913	1.31852	0.52265
6	7.9730"-04	2.3622"+00	NM	0.97818	0.64015	0.72616	1.28680	0.56432
7	9.9830"-04	2.5368"+00	NM	0.98017	0.67215	0.75481	1.26110	0.59853
8	1.2529"-03	2.7103"+00	NM	0.98203	0.70214	0.78088	1.23685	0.63135
9	1.5008"-03	2.8804"+00	NM	0.98379	0.73014	0.80452	1.21413	0.66263
10	1.7487"-03	3.0582"+00	NM	0.98552	0.75813	0.82751	1.19138	0.69458
11	2.0033"-03	3.2166"+00	NM	0.98700	0.78213	0.84669	1.17190	0.72249
12	2.2512"-03	3.3667"+00	NM	0.98836	0.80412	0.86385	1.15409	0.74852
13	2.4991"-03	3.5000"+00	NM	0.98953	0.82311	0.87836	1.13875	0.77134
14	2.7470"-03	3.6294"+00	NM	0.99062	0.84111	0.89184	1.12427	0.79326
15	3.0016"-03	3.7917"+00	NM	0.99196	0.86310	0.90796	1.10666	0.82045
16	3.4974"-03	4.0591"+00	NM	0.99406	0.89808	0.93282	1.07887	0.86463
17	3.9999"-03	4.3135"+00	NM	0.99596	0.93006	0.95473	1.05376	0.90602
18	4.5024"-03	4.5104"+00	NM	0.99736	0.95404	0.97065	1.03514	0.93771
19	4.9982"-03	4.6445"+00	NM	0.99828	0.97003	0.98103	1.02283	0.95914
20	5.5007"-03	4.7467"+00	NM	0.99897	0.98202	0.98870	1.01366	0.97538
21	6.0032"-03	4.8155"+00	NM	0.99943	0.99001	0.99375	1.00757	0.98628
D 22	6.7000"-03	4.9023"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/L,U/UD,T/TD ASSUME P=PD AND VAN DRIEST

60010201 MICHEL PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94247	0.00000	0.00000	1.77373	0.00000
2	9.9900"-05	1.4322"+00	NM	0.95609	0.35007	0.44609	1.62385	0.27471
3	1.9980"-04	1.9594"+00	NM	0.96530	0.49015	0.60012	1.49905	0.40033
4	4.0014"-04	2.5243"+00	NM	0.97237	0.59017	0.69828	1.39995	0.49879
5	5.9940"-04	2.8871"+00	NM	0.97624	0.64417	0.74708	1.34502	0.55544
6	7.9920"-04	3.1949"+00	NM	0.97924	0.68617	0.78300	1.30217	0.60131
7	9.9900"-04	3.4842"+00	NM	0.98185	0.72316	0.81322	1.26456	0.64308
8	1.2474"-03	3.7901"+00	NM	0.98444	0.76015	0.84211	1.22724	0.68618
9	1.5012"-03	4.1034"+00	NM	0.98691	0.79614	0.86898	1.19135	0.72941
10	1.7496"-03	4.3762"+00	NM	0.98895	0.82613	0.89047	1.16183	0.76644
11	1.9980"-03	4.6500"+00	NM	0.99088	0.85511	0.91048	1.13368	0.80312
12	2.2518"-03	4.8445"+00	NM	0.99219	0.87510	0.92385	1.11452	0.82893
13	2.5002"-03	5.0338"+00	NM	0.99355	0.89609	0.93753	1.09462	0.85648
14	2.7486"-03	5.2475"+00	NM	0.99477	0.91508	0.94958	1.07684	0.88182
15	3.0024"-03	5.4139"+00	NM	0.99578	0.93106	0.95951	1.06203	0.90346
16	3.4992"-03	5.6907"+00	NM	0.99739	0.95704	0.97520	1.03830	0.93922
17	4.0014"-03	5.8978"+00	NM	0.99856	0.97602	0.98633	1.02123	0.96582
18	4.4982"-03	6.0196"+00	NM	0.99922	0.98701	0.99265	1.01145	0.98141
19	5.0004"-03	6.1091"+00	NM	0.99970	0.99501	0.99719	1.00439	0.99283
D 20	5.4000"-03	6.1654"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/L,U/UD,T/TD ASSUME P=PD AND VAN DRIEST

60010206 MICHEL PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94262	0.00000	0.00000	1.77401	0.00000
2	1.0010"-04	1.3390"+00	NM	0.95405	0.31405	0.40363	1.65183	0.24435
3	2.0020"-04	1.6408"+00	NM	0.96029	0.41509	0.51992	1.56884	0.33140
4	3.9970"-04	2.1953"+00	NM	0.96851	0.53516	0.64556	1.45516	0.44364
5	5.9990"-04	2.4864"+00	NM	0.97199	0.58417	0.69270	1.40608	0.49264
6	7.9800"-04	2.7010"+00	NM	0.97435	0.61717	0.72306	1.37260	0.52678
7	1.0010"-03	2.8730"+00	NM	0.97614	0.64217	0.74534	1.34711	0.55328
8	1.2530"-03	3.0849"+00	NM	0.97827	0.67217	0.77124	1.31649	0.58583
9	1.4980"-03	3.3034"+00	NM	0.98026	0.70017	0.79461	1.28796	0.61695
10	1.7500"-03	3.4923"+00	NM	0.98195	0.72416	0.81403	1.26358	0.64422
11	2.0020"-03	3.6724"+00	NM	0.98349	0.74616	0.83134	1.24135	0.66970
12	2.2470"-03	3.8412"+00	NM	0.98488	0.76615	0.84668	1.22126	0.69328
13	2.4990"-03	4.0236"+00	NM	0.98632	0.78715	0.86238	1.20030	0.71847
14	2.7510"-03	4.2113"+00	NM	0.98775	0.80814	0.87768	1.17952	0.74410
15	3.0030"-03	4.3855"+00	NM	0.98903	0.82713	0.89118	1.16087	0.76[illegible]
16	3.5000"-03	4.6982"+00	NM	0.99122	0.86011	0.91386	1.12[illegible]8	0.80952
17	3.9970"-03	5.0035"+00	NM	0.99320	0.89109	0.93431	1.09935	0.84987
18	4.5010"-03	5.2889"+00	NM	0.99503	0.91907	0.95209	1.07313	0.88720
19	4.9980"-03	5.5407"+00	NM	0.99653	0.94305	0.96682	1.05104	0.91987
20	5.5020"-03	5.7774"+00	NM	0.99789	0.96503	0.97992	1.03109	0.95037
21	5.9990"-03	5.9641"+00	NM	0.99892	0.98202	0.98979	1.01589	0.97431
22	6.5030"-03	6.0979"+00	NM	0.99964	0.99401	0.99662	1.00527	0.99140
D 23	7.0000"-03	6.1654"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/L,U/UD,T/TD ASSUME P=PD AND VAN DRIEST

60010301 MICHEL PROFILE TABULATION 17 POINTS, DELTA AT POINT 17

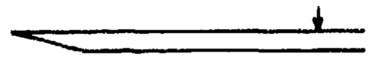
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93164	0.00000	0.00000	2.16231	0.00000
2	1.0185"-04	1.2423"+00	NM	0.94041	0.22003	0.31515	2.05146	0.15362
3	1.9805"-04	2.1272"+00	NM	0.95619	0.42716	0.57123	1.78826	0.31943
4	3.9770"-04	3.1905"+00	NM	0.96760	0.56020	0.70586	1.58762	0.44460
5	6.0140"-04	3.8117"+00	NM	0.97293	0.62321	0.76135	1.49244	0.51014
6	8.0025"-04	4.2654"+00	NM	0.97637	0.66521	0.79553	1.43019	0.55624
7	9.9910"-04	4.7028"+00	NM	0.97945	0.70320	0.82460	1.37506	0.59968
8	1.2513"-03	5.1655"+00	NM	0.98242	0.74120	0.85199	1.32130	0.64481
9	1.4986"-03	5.6007"+00	NM	0.98500	0.77518	0.87513	1.27448	0.68665
10	1.7508"-03	6.0150"+00	NM	0.98728	0.80617	0.89516	1.23295	0.72603
11	1.9982"-03	6.3893"+00	NM	0.98921	0.83315	0.91180	1.19770	0.76129
12	2.4977"-03	7.1156"+00	NM	0.99265	0.88312	0.94076	1.13481	0.82901
13	2.9973"-03	7.7901"+00	NM	0.99553	0.92708	0.96437	1.08207	0.89123
14	3.4968"-03	8.3177"+00	NM	0.99760	0.96005	0.98100	1.04414	0.93954
15	4.0012"-03	8.6963"+00	NM	0.99899	0.98302	0.99209	1.01851	0.97405
16	4.4959"-03	8.8806"+00	NM	0.99965	0.99401	0.99723	1.00649	0.99080
D 17	4.8500"-03	8.9820"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/L,U/UD,T/TD ASSUME P=PD AND VAN DRIEST

60010306 MICHEL PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93153	0.00000	0.00000	2.16206	0.00000
2	9.6200"-05	1.1235"+00	NM	0.93687	0.16001	0.23206	2.10332	0.11033
3	1.9980"-04	1.5158"+00	NM	0.94657	0.30908	0.43170	1.95078	0.22129
4	3.9960"-04	2.5631"+00	NM	0.96128	0.48719	0.63494	1.69856	0.37381
5	5.9940"-04	3.0264"+00	NM	0.96603	0.54220	0.68903	1.61496	0.42666
6	7.9920"-04	3.3414"+00	NM	0.96894	0.57621	0.72043	1.56326	0.46085
7	9.9900"-04	3.6160"+00	NM	0.97131	0.60421	0.74515	1.52093	0.48993
8	1.2506"-03	3.9381"+00	NM	0.97390	0.63521	0.77133	1.47449	0.52311
9	1.5022"-03	4.2097"+00	NM	0.97596	0.66021	0.79156	1.43750	0.55065
10	1.7464"-03	4.4579"+00	NM	0.97775	0.68221	0.80874	1.40534	0.57547
11	1.9980"-03	4.6910"+00	NM	0.97935	0.70220	0.82385	1.37687	0.59852
12	2.5012"-03	5.1655"+00	NM	0.98240	0.74120	0.85198	1.32127	0.64482
13	2.9970"-03	5.6928"+00	NM	0.98550	0.78218	0.87973	1.26499	0.69545
14	3.5002"-03	6.2075"+00	NM	0.98827	0.82016	0.90387	1.21455	0.74420
15	3.9960"-03	6.7036"+00	NM	0.99074	0.85514	0.92483	1.16963	0.79070
16	4.4992"-03	7.1155"+00	NM	0.99265	0.88312	0.94076	1.13480	0.82901
17	4.9950"-03	7.5873"+00	NM	0.99469	0.91409	0.95757	1.09739	0.87259
18	5.4982"-03	7.9957"+00	NM	0.99635	0.94007	0.97103	1.06696	0.91009
19	6.0014"-03	8.3502"+00	NM	0.99772	0.96204	0.98198	1.04188	0.94251
20	6.4972"-03	8.6464"+00	NM	0.99881	0.98002	0.99066	1.02181	0.96951
21	7.0004"-03	8.8806"+00	NM	0.99965	0.99401	0.99723	1.00649	0.99080
D 22	7.4000"-03	8.9820"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/L,U/UD,T/TD ASSUME P=PD AND VAN DRIEST



M : 5
R THETA X 10^{-3} : 3 - 7
TW/TR : 0.55, 0.65, 1.0

6201

ZPG
AW/SHT

Blow-down tunnel with fixed nozzle block. Running time 45-90 secs. W = 0.15, H = 0.18, L = 0.5 m.
PO : 1.7 MN/m^2. 330 < TO < 660 K. Air. 15 < RE/m X 10^{-6} < 45.

MOORE D.R., 1962. Velocity similarity in the compressible turbulent boundary layer with heat transfer. DRL 480.

1 The test boundary layer was formed on a flat plate model mounted with the test surface facing downwards
near the centre line of the tunnel. Two models were used, and "there was essentially no difference between
the constant temperature characteristics of the two plates". The second and principal model, which is
described, was fabricated from pure copper with a stainless steel leading edge (X = 0) chamfered at 15^0
on the upper side (L = 0.425, W = 0.152 m). The plate was actively cooled by two separate circuits which
3 were manually controlled to maintain a constant wall temperature. Near the leading edge a 12.7 mm strip
of No 80 grit cloth was bonded to the surface to act as a transition trip.

6 The plate temperature was monitored by seven thermocouples mounted at roughly 40 mm intervals back from
X = about 80 mm. The first two were on the centre line and the remainder about 20 mm to one side. Static
7 tappings were placed at X = 135, 240, 310 mm about 25 mm to the same side as the 5 thermocouples. Pitot
traverses were made with a double CPP. The two tubes (d_1 = 0.914 mm) were separated by 3.81 mm in the
Y-direction and after (E) about 20 mm they were successively sleeved into larger diameter tubing. The
8 traverse gear was driven from the floor of the tunnel to give a profile normal at X = 254 mm.

9 The author has reduced the data assuming that static pressure is constant at the wall value through the
layer and that the temperature and velocity are related by T/TW = 1 - (1 - TD/TW) $(U/UD)^2$ (the Crocco
10 temperature velocity relation). No probe corrections were applied.

12 The editors have presented the four complete profiles tabulated by the author. We have used the Crocco / Van Driest temperature-velocity correlation with recovery factor 0.896 in place of that used by the author. We found it necessary to replace our usual integration procedure with a trapezoidal integration rule. There are in addition some measurements made with the outer Pitot tube removed which do not, however, extend as far as the boundary layer edge. The authors' final measured point has been set as the D-state.

§ DATA: 6201 0101-0401. PT2 profiles.

15 Editors' comments

This entry is presented primarily as a comparison for the rough surface experiment of Young - CAT 6506. The tunnel is the same, and the model formed the basis for that used by Young. The paper is mainly concerned with fitting SHT data to the law of the wall and includes a description of some attempts to use special forms of Preston tube. An analysis of the results is to be found in Rochelle (1963).

The profile data is sparse, rough, and in two cases (0101, 0201) displays large gaps.

CAT 6201 MOORE BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CD	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
62010101	4.9180	0.9859	3.0234"+00	NM	11.9516	1.8171	7.3987"+00	7.3987"+00
2.5400"-01	3.5556"+03	1.0000	1.3661"+01	NM	1.8438	1.8319	3.0337"+02	5.7684"+01
INFINITE	3.3672"+02	0.0000	1.6882"-04	0.0000"+00	0.1718	3.7489"-04	7.4890"+02	3.0770"+02
62010201	4.7790	0.9917	3.2714"+00	NM	11.3113	1.8298	8.7097"+00	8.7097"+00
2.5400"-01	3.5472"+03	1.0000	1.4193"+01	NM	1.8606	1.8505	3.0322"+02	6.0038"+01
INFINITE	3.3428"+02	0.0000	1.6285"-04	0.0000"+00	0.1663	3.3271"-04	7.4244"+02	3.0576"+02
62010301	4.8900	0.6467	3.1336"+00	NM	9.3618	1.7503	7.6687"+00	7.6687"+00
2.5400"-01	3.5654"+03	1.0000	9.0736"+00	NM	1.8458	1.8233	3.2757"+02	9.5836"+01
INFINITE	5.5417"+02	0.0000	2.3202"-04	0.0000"+00	0.4817	4.4003"-04	9.5981"+02	5.0650"+02
62010401	4.7900	0.5473	3.1890"+00	NM	8.4349	1.7583	8.5014"+00	8.5014"+00
2.5400"-01	3.5084"+03	1.0000	7.6431"+00	NM	1.8409	1.8241	3.2446"+02	1.1598"+02
INFINITE	6.4817"+02	0.0000	2.3748"-04	0.0000"+00	0.5712	4.2948"-04	1.0343"+03	5.9282"+02

TRAPEZOIDAL RULE FOR ALL INTEGRATIONS

62010301 MOORE PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.59110	0.00000	0.00000	3.41798	0.00000
2	4.5720"-04	5.5386"+00	NM	0.84631	0.40491	0.67061	2.74300	0.24448
3	4.8260"-04	5.7433"+00	NM	0.85030	0.41309	0.67970	2.70737	0.25105
4	5.3340"-04	6.1654"+00	NM	0.85807	0.42945	0.69729	2.63640	0.26449
5	7.8740"-04	8.3982"+00	NM	0.89114	0.50716	0.77092	2.31065	0.33364
6	9.1440"-04	8.7200"+00	NM	0.89504	0.51738	0.77948	2.26978	0.34342
7	1.1684"-03	1.0213"+01	NM	0.91108	0.56237	0.81433	2.09681	0.38837
8	1.4224"-03	1.1080"+01	NM	0.91908	0.58691	0.83156	2.00746	0.41424
9	1.6764"-03	1.2138"+01	NM	0.92780	0.61554	0.85022	1.90786	0.44564
10	1.9304"-03	1.3410"+01	NM	0.93701	0.64826	0.86978	1.80020	0.48316
11	2.1844"-03	1.4748"+01	NM	0.94548	0.68098	0.88764	1.69904	0.52244
12	2.4384"-03	1.6062"+01	NM	0.95279	0.71166	0.90298	1.60997	0.56087
13	2.6924"-03	1.7482"+01	NM	0.95978	0.74335	0.91754	1.52357	0.60223
14	4.2672"-03	2.6771"+01	NM	0.99060	0.92434	0.98094	1.12622	0.87100
15	4.7244"-03	2.7592"+01	NM	0.99251	0.93865	0.98482	1.10079	0.89465
16	4.9784"-03	2.8786"+01	NM	0.99512	0.95910	0.99013	1.06575	0.92904
17	5.2324"-03	3.0316"+01	NM	0.99822	0.98466	0.99641	1.02400	0.97305
18	5.4864"-03	3.0876"+01	NM	0.99930	0.99387	0.99858	1.00951	0.98917
19	5.7404"-03	3.1190"+01	NM	0.99988	0.99898	0.99976	1.00158	0.99819
20	5.9944"-03	3.1329"+01	NM	1.00014	1.00123	1.00028	0.99811	1.00217
D 21	6.5024"-03	3.1253"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

62010401 MOORE PROFILE TABULATION 17 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.50058	0.00000	0.00000	2.79765	0.00000
2	4.5720"-04	6.0051"+00	NM	0.82130	0.43215	0.67943	2.47181	0.27487
3	4.8260"-04	6.3280"+00	NM	0.82840	0.44468	0.69280	2.42731	0.28542
4	5.0800"-04	6.6602"+00	NM	0.83531	0.45720	0.70575	2.38279	0.29619
5	6.0960"-04	7.1762"+00	NM	0.84532	0.47599	0.72442	2.31622	0.31276
6	6.8580"-04	8.2083"+00	NM	0.86309	0.51148	0.75728	2.19206	0.34547
7	8.1280"-04	9.3829"+00	NM	0.88034	0.54906	0.78888	2.06432	0.38215
8	1.0668"-03	1.1006"+01	NM	0.90021	0.59708	0.82489	1.90868	0.43218
9	1.3208"-03	1.2061"+01	NM	0.91121	0.62630	0.84465	1.81878	0.46440
10	1.5748"-03	1.2687"+01	NM	0.91714	0.64301	0.85526	1.76916	0.48343
11	1.8288"-03	1.3574"+01	NM	0.92491	0.66597	0.86910	1.70306	0.51032
12	4.2926"-03	2.5734"+01	NM	0.98788	0.92484	0.97922	1.12104	0.87349
13	4.4958"-03	2.7121"+01	NM	0.99215	0.94990	0.98656	1.07868	0.91459
14	4.6228"-03	2.7474"+01	NM	0.99319	0.95616	0.98833	1.06842	0.92504
15	4.8768"-03	2.8425"+01	NM	0.99586	0.97286	0.99292	1.04166	0.95321
16	5.1308"-03	2.9271"+01	NM	0.99812	0.98747	0.99679	1.01895	0.97825
D 17	5.3848"-03	3.0007"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

Three configurations tested See diagrams below	M : 1.6 - 4.5 (Free stream) R THETA X 10^{-3} : 8 - 45 TW/TR : 1.0 and 0.7	**6401** FPG/APG/Recovery AW/MHT

Continuous tunnel W = H = 0.56 m, L = 1.0 m.
0.16 < PO < 0.5 MN/m^2. 300 < TO < 340 K. Air. 14 < RE/m X 10^{-6} < 30.

CLUTTER D.C. and KAUPS K., 1964. Wind tunnel investigation of turbulent boundary layers on axially-symmetric bodies at supersonic speeds. Douglas Aircraft Company Rep. No. LB 31425.
And Kaups K., private communication.

Series 01 - 04   05 - 07   08 - 15

a   b   c

1 The tests were performed on the surface of a series of axisymmetric models mounted on the tunnel centre line. The boundary layer was formed on a nose piece, which finished as a parallel cylinder of 69.85 mm diameter. The length of the nose-piece used varied with Mach number as below:

Mach number:	1.61	2.50	3.30	4.50
Length of nose piece:	2.108	2.108	1.397	0.864 m

At low Mach numbers (M < 2.50) the nose extended upstream through the throat into the settling chamber. The coordinates of the nose fairing are given in table 1 together with those of the three centre bodies used. Each of these had an initial section 127 mm long, the same diameter as the nose piece, followed by a circular arc profile (X = 0 at the end of the parallel section) leading to a new parallel section of diameter 139.7 mm. For the blunt model (a) this started at X = 60.5 mm, while for the more gradual concave (b) and convex (c) models it started at X = 304.8 mm. The radii of curvature of the profiles were 69.85 mm for model (a) and 1.3475 m for the gradual models (b) and (c). Coordinates for the model surfaces are given in table 1. The centre bodies were made of electroformed nickel 2.54 mm thick, and the convex model (c) could be actively cooled with liquid nitrogen. The model surface was highly polished.

4 The boundary layer was formed, in each case, under essentially constant pressure conditions on the nose extension. The test zone extended, with one exception, downstream of the nose / centre body junction at X = 0. For model (a) all the profiles were measured on the parallel section downstream of the increase in diameter, where the layer was relaxing after traversing a strong shock-induced separation ahead of the junction, and reattaching to the shoulder of the centre-body. The region of study was limited by the downstream reflection of the centre-body bow shock. All the profiles from model (b) were measured on the concave section of the centre body in a region of, nominally, steadily increasing pressure. The sharp change in slope at X = 0 for model C caused a bow shock, which was not however strong enough to make the boundary layer separate. For one case (M = 1.61) profiles were measured on both sides of the shock. For all other cases measurements commenced at least 0.15 m downstream, and extended beyond the end of the curved portion to include a relaxation region on the parallel section of the body. In this region there is some evidence of a pressure rise after over-expansion. The nose piece was not cooled so that for the heat-transfer runs the wall temperature also changed abruptly near X = 0. The cooling system provided uniformly axisymmetric cooling, but could not maintain uniform cooling in the X direction. The wall temperature therefore varied in the X direction.

6 Static tappings (D = 1.23 mm) were provided at 25.4 mm intervals in the range - 0.102 < X < 0.559 m and copper-constantan thermocouples were mounted at 50.8 mm intervals in the same range. An FEB was mounted at X = 0.356 m in the wall of the blunt model (a) but did not provide usable results. Heat transfer rates

were determined for the convex model (c) by cutting off the liquid nitrogen cooling and observing the wall temperature as a function of time, using the thin wall transient technique.

7 Profiles were measured using a traversing rake mechanism carrying six FPP (flattened 1 mm tube - $h_1 = 0.20$, $h_2 = 0.05$, $b_1 = 0.46$, $b_2 = 0.30$, $l = 12.7$ mm) and six ECP ($\alpha = 5^0$, $d_1 = d_2 = 1.6$, $l = 12.7$ mm) of the type designed by Danberg (1961). The lengths given are to the first part of the bracing structure. The rakes continued as a slender bundle of tubes to a distance 114 mm back from their tips, where they were connected to a miniature traverse gear so constructed as to present a mean width to the flow of about 20 mm (E). The whole could be mounted on wedges and strapped to the model so that the probe tips moved normal to the local model surface. A pitot-tube, or a further TTP, could be attached to the top of the traverse gear to monitor the free stream state. A CCP (dimensions not given) could be mounted on the side of the rake, but could not be used simultaneously as it caused disturbances affecting the TPP and TTP. A separate rake carrying six CCP was therefore used for static pressure traverses, on separate occasions.

8 The profile normal always intersected the body surface at X-values for which there were both static holes and thermocouples. The normal for the TPP was on the centre line, with the TTP about 8 mm (E) to one side. The static probe, when mounted, was about 12 mm (E) off to the other side. The six TPP and TTP were mounted at vertical intervals of 5.08 mm.

9 Traverses were made so that the range covered by each probe in the rake overlapped that of its neighbour.
Only very small differences were observed between readings from adjacent probes. Data for reduction were
taken from a curve faired through the experimental points. The TTP did not approach the surface as closely
as the TPP, being mounted to one side, and being larger in size. A fourth order polynomial was fitted
to the wall temperature and the innermost few measured data points, to provide TO data in this inner
region. The static pressures recorded did not, when extrapolated, match the wall pressures. This dis-
crepancy was attributed to uncertainties of calibration. The normal pressure gradient recorded was however
very close, in the outer part of the boundary layer, to that predicted by an inviscid characteristic
10 solution for the flow. The pressure distribution used in the data reduction was therefore taken as the
measured distribution shifted so as to match the wall pressure. The shift ranged up to 10 %. No probe
11 shear or displacement corrections were applied and the Sutherland viscosity relation was used. The editors
12 have presented all the profiles published by the authors. The D-state has been set arbitrarily at the
13 outermost point presented. The profile series presented for each centre-body are distinguished by free
stream Mach number. All are for a near adiabatic wall excepting series 12-15 for which there was substantial
heat transfer. The original heat transfer data is presented graphically and is not reproduced here.

§ DATA: 6401 0101-1503. PT2 and TO profiles simultaneously, P profiles separately. NX up to 7.

15 Editors' comments

This series of tests includes some very interesting flows. Series 01-04 describe the recovery of a boundary layer which has undergone separation ahead of and reattachment to the blunt centre-body, followed by a rapid simple-wave expansion before entering the test-zone. Series 08-15 describe a boundary layer which has passed through a shock, without separation, before undergoing a relatively gentle simple wave expansion in the test-zone. There are no comparable results. Series 05-07, undergoing a simple wave compression, should be compared with Sturek & Danberg - CAT 7101.

The profiles contain a large number of data points and, on the evidence of our calculated PO values, extend well out into the free stream. The entropy gradients resulting from the shock systems of series 01-04 and 08-15 are, on the same evidence, not very severe. The shifting of the static pressure profile so as to match the wall pressure could have been checked, with advantage, by a Pitot derived value in the free stream, at least for series 05-07. In the light of the analysis of Myring (1968) and Myring & Young (1968), it would seem that the necessary shift is perhaps greater than that actually used. Any influence on the reduced data is, however, not likely to be very great, a 10 % shift in P resulting in about a 5 % change in local Mach number and changes of order 10 % in the Reynolds numbers.

The profile measurements do not extend within the momentum deficit peak in about half the cases, so that integral values should be treated with reserve. There is considerable scatter in the edge states within a given series (e.g. series 11) and some unexplained relatively large inconsistencies - as the edge Mach number variation for series 0 7, where it seems probable that there is a gross error for either 0701 or 0702. The author comments that in some cases it may not have been possible to arrange for the probes to be made parallel to the body surface, and that some unusual interference effects could result.

Values of δ/RZ can be as great as 40 %. The effects of transverse curvature, therefore, may well be significant.

Table 1

COORDINATES OF MODEL SURFACE

NOSEPIECE X = 0 at nose		MODEL A X = 0 at "Station 0"		MODEL B X = 0 at "Station 0"		MODEL C X = 0 at "Station 0"	
X	Y	X	Y	X	Y	X	Y
0	0	0	34.93	0	34.93	0	34.93
25.40	4.83	25.40	60.38	25.40	35.17	25.40	40.56
		50.80	69.16				
50.80	9.32	60.49	69.85	50.80	35.89	50.80	45.69
76.20	13.41		constant	76.20	37.08	76.20	50.32
101.60	17.20			101.60	38.76	101.60	54.44
127.00	20.55			127.00	40.93	127.00	58.06
152.40	23.67			152.40	43.59	152.40	61.21
203.20	28.52			177.80	46.71	177.80	63.85
254.00	32.08			203.20	50.34	203.20	66.01
304.80	34.19			228.60	54.46	228.60	67.69
355.60	34.93			254.00	59.08	254.00	68.89
	constant			279.40	64.21	279.40	69.61
"Station 0"	34.93			304.80	69.85	304.80	69.85
			constant		constant		constant
		558.80	69.85	558.80	69.85	558.80	69.85

Nominal dimensions in mm.

Actual model coordinates were "within a few 0.001 inch - 0.0254 mm - of these".

The three models have circular profile sections, for which the radii of curvature are A : 69.85 mm B & C : 1.3475 m

CAT 6401 CLUTTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW	PD*
X *	POD	PW/PD	RED2D	CQ	H32	H32K	TW*	TD*
RZ *	TOO	SW *	D2	PI2	H42	D2K	UD	TR
64010101	1.7380	0.9713	1.5637"+04	NM	2.2106	1.1769	3.3054"+04	3.3054"+04
1.0160"-01	1.7281"+05	1.0000	2.1731"+04	NM	1.8790	1.8741	2.8626"+02	1.9122"+02
6.9850"-02	3.0675"+02	1.0000	9.6268"-04	NM	0.1300	1.0566"-03	4.8187"+02	2.9473"+02
64010102	1.6760	0.9771	1.8292"+04	NM	2.1375	1.1892	3.6271"+04	3.6271"+04
1.5240"-01	1.7268"+05	1.0000	2.4995"+04	NM	1.8674	1.8621	2.8956"+02	1.9711"+02
6.9850"-02	3.0785"+02	1.0000	1.0901"-03	NM	0.1321	1.1934"-03	4.7178"+02	2.9633"+02
64010201	2.6310	0.9534	1.9178"+04	NM	3.4739	1.1697	1.4280"+04	1.4280"+04
1.5240"-01	2.9894"+05	1.0000	3.6572"+04	NM	1.8710	1.8593	2.8255"+02	1.3228"+02
6.9850"-02	3.1541"+02	1.0000	1.4863"-03	NM	0.2069	1.8208"-03	6.0670"+02	2.9636"+02
64010202	2.6250	0.9540	1.8668"+04	NM	3.4902	1.1839	1.4395"+04	1.4395"+04
2.0320"-01	2.9856"+05	1.0000	3.5579"+04	NM	1.8642	1.8521	2.8012"+02	1.3139"+02
6.9850"-02	3.1246"+02	1.0000	1.4240"-03	NM	0.2006	1.7474"-03	6.0328"+02	2.9363"+02
64010203	2.6340	0.9651	2.1396"+04	NM	3.5230	1.1923	1.6191"+04	1.6191"+04
3.0480"-01	3.4052"+05	1.0000	4.1290"+04	NM	1.8574	1.8437	2.8349"+02	1.3094"+02
6.9850"-02	3.1264"+02	1.0000	1.4572"-03	NM	0.2050	1.8242"-03	6.0432"+02	2.9375"+02
64010204	2.6150	0.9549	2.1966"+04	NM	3.4953	1.2051	1.6674"+04	1.6674"+04
3.5560"-01	3.4105"+05	1.0000	4.1728"+04	NM	1.8553	1.8394	2.8158"+02	1.3244"+02
6.9850"-02	3.1372"+02	1.0000	1.4633"-03	NM	0.2078	1.8264"-03	6.0362"+02	2.9487"+02
64010301	3.2770	0.9824	9.0838"+03	NM	4.7834	1.1937	6.2441"+03	6.2441"+03
2.5400"-01	3.4551"+05	1.0000	2.2851"+04	NM	1.8711	1.8512	2.8586"+02	9.9500"+01
6.9850"-02	3.1320"+02	1.0000	1.1313"-03	NM	0.2418	1.5452"-03	6.5539"+02	2.9098"+02
64010302	3.3090	0.9902	1.0343"+04	NM	4.5948	1.1882	6.5297"+03	6.3829"+03
3.0480"-01	3.7003"+05	1.0230	2.6496"+04	NM	1.8675	1.8490	2.8857"+02	9.8389"+01
6.9850"-02	3.1385"+02	1.0000	1.2502"-03	NM	0.2414	1.6978"-03	6.5808"+02	2.9144"+02
64010303	3.3110	0.9819	9.9382"+03	NM	4.6078	1.1884	6.1748"+03	6.0477"+03
3.5560"-01	3.5162"+05	1.0210	2.5310"+04	NM	1.8659	1.8482	2.8641"+02	9.8389"+01
6.9850"-02	3.1411"+02	1.0000	1.2596"-03	NM	0.2490	1.7128"-03	6.5840"+02	2.9168"+02
64010304	3.2060	1.0043	1.0099"+04	NM	4.6320	1.1923	6.5127"+03	6.5127"+03
4.0640"-01	3.2482"+05	1.0000	2.5112"+04	NM	1.8640	1.8450	2.9412"+02	1.0306"+02
6.9850"-02	3.1491"+02	1.0000	1.2824"-03	NM	0.2357	1.7523"-03	6.5254"+02	2.9287"+02
64010401	4.2430	0.9680	4.0313"+03	NM	7.5304	1.2127	1.3564"+03	1.4168"+03
2.5400"-01	2.9591"+05	0.9574	1.4446"+04	NM	1.8610	1.8300	2.7728"+02	6.7778"+01
6.9850"-02	3.1182"+02	1.0000	1.3773"-03	NM	0.3417	2.3078"-03	7.0037"+02	2.8644"+02
64010402	4.3230	0.9745	4.3254"+03	NM	7.6528	1.2065	1.4382"+03	1.4785"+03
3.0480"-01	3.4222"+05	0.9727	1.6024"+04	NM	1.8636	1.8320	2.7994"+02	6.6056"+01
6.9850"-02	3.1295"+02	1.0000	1.3824"-03	NM	0.3105	2.3213"-03	7.0445"+02	2.8727"+02
64010403	4.0720	0.9840	4.5567"+03	NM	7.3363	1.2174	1.6086"+03	1.6883"+03
3.5560"-01	2.8204"+05	0.9528	1.5529"+04	NM	1.8569	1.8265	2.8311"+02	7.2444"+01
6.9850"-02	3.1269"+02	1.0000	1.4305"-03	NM	0.3112	2.3782"-03	6.9490"+02	2.8770"+02
64010404	4.4880	0.9880	5.0548"+03	NM	7.1534	1.2192	1.6477"+03	1.5753"+03
4.0640"-01	4.4912"+05	1.0460	2.0033"+04	NM	1.8515	1.8190	2.8589"+02	6.2778"+01
6.9850"-02	3.1567"+02	1.0000	1.4474"-03	NM	0.3110	2.4411"-03	7.1296"+02	2.8937"+02

given series (e.g. series 11) and some unexplained relatively large inconsistencies - as the edge Mach number variation for series 0 7, where it seems probable that there is a gross error for either 0701 or 0702. The author comments that in some cases it may not have been possible to arrange for the probes to be made parallel to the body surface, and that some unusual interference effects could result.

Values of δ/RZ can be as great as 40 %. The effects of transverse curvature, therefore, may well be significant.

Table 1

COORDINATES OF MODEL SURFACE

NOSEPIECE X = 0 at nose		MODEL A X = 0 at "Station 0"		MODEL B X = 0 at "Station 0"		MODEL C X = 0 at "Station 0"	
X	Y	X	Y	X	Y	X	Y
0	0	0	34.93	0	34.93	0	34.93
25.40	4.83	25.40	60.38	25.40	35.17	25.40	40.56
		50.80	69.16				
50.80	9.32	60.49	69.85	50.80	35.89	50.80	45.69
76.20	13.41		constant	76.20	37.08	76.20	50.32
101.60	17.20			101.60	38.76	101.60	54.44
127.00	20.56			127.00	40.93	127.00	58.06
152.40	23.57			152.40	43.59	152.40	61.21
203.20	28.52			177.80	46.71	177.80	63.85
254.00	32.08			203.20	50.34	203.20	66.01
304.80	34.19			228.60	54.46	228.60	67.69
355.60	34.93			254.00	59.08	254.00	68.89
	constant			279.40	64.21	279.40	69.61
"Station 0"	34.93			304.80	69.85	304.80	69.85
			constant		constant		constant
		558.80	69.85	558.80	69.85	558.80	69.85

Nominal dimensions in mm.

Actual model coordinates were "within a few 0.001 inch - 0.0254 mm - of these".

The three models have circular profile sections, for which the radii of curvature are A : 69.85 mm B & C : 1.3475 m

CAT 6401 CLUTTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MO *	TW/TR	RED2W	CF	H12	H12K	PW	PD*
X *	POD	PW/PD	RED2D	CQ	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	P12	H42	D2K	UD	TR
64010501	1.6010	0.9820	2.8986"+04	NM	2.1212	1.2327	4.2793"+04	4.2793"+04
NM	1.8216"+05	1.0000	3.8795"+04	NM	1.8099	1.8010	2.8851"+02	2.0133"+02
3.4925"-02	3.0454"+02	1.0000	1.5447"-03	NM	0.1078	1.7258"-03	4.5547"+02	2.9381"+02
64010502	1.5890	0.9797	3.3262"+04	NM	1.8547	1.2533	4.6273"+04	4.4408"+04
5.0800"-02	1.8570"+05	1.0420	4.4260"+04	NM	1.7929	1.7851	2.8824"+02	2.0256"+02
3.5888"-02	3.0484"+02	1.0000	1.7250"-03	NM	0.1119	1.8834"-03	4.5343"+02	2.9421"+02
64010503	1.4920	0.9829	2.9919"+04	NM	1.7970	1.2574	5.2967"+04	5.1028"+04
1.5240"-01	1.8517"+05	1.0380	3.8672"+04	NM	1.8013	1.7954	2.8951"+02	2.1056"+02
4.3586"-02	3.0430"+02	1.0000	1.4713"-03	NM	0.1014	1.5922"-03	4.3407"+02	2.9455"+02
64010504	1.4780	0.9860	2.5432"+04	NM	1.9286	1.2453	5.4377"+04	5.1640"+04
2.0320"-01	1.8364"+05	1.0530	3.2807"+04	NM	1.8163	1.8108	2.9041"+02	2.1167"+02
5.0338"-02	3.0414"+02	1.0000	1.2539"-03	NM	0.0907	1.3725"-03	4.3113"+02	2.9453"+02
64010505	1.4310	0.9854	2.5164"+04	NM	1.8026	1.2544	5.6496"+04	5.5011"+04
2.5400"-01	1.8291"+05	1.0270	3.1960"+04	NM	1.8150	1.8102	2.9170"+02	2.1656"+02
5.9083"-02	3.0525"+02	1.0000	1.2209"-03	NM	0.0929	1.3188"-03	4.2222"+02	2.9602"+02
64010601	3.4000	0.9806	1.2734"+04	NM	4.8533	1.2283	6.7099"+03	6.7099"+03
NM	4.4364"+05	1.0000	3.3500"+04	NM	1.8222	1.7940	2.8714"+02	9.5333"+01
3.4925"-02	3.1574"+02	1.0000	1.3972"-03	NM	0.2746	2.0554"-03	6.6560"+02	2.9282"+02
64010602	3.2690	0.9794	1.3419"+04	NM	2.0840	1.2526	9.0723"+03	6.7856"+03
5.0800"-02	3.7112"+05	1.3370	3.3518"+04	NM	1.8119	1.7911	2.8756"+02	1.0072"+02
3.5888"-02	3.1399"+02	1.0000	1.5583"-03	NM	0.2213	1.8467"-03	6.5779"+02	2.9360"+02
64010603	3.1970	0.9765	1.2484"+04	NM	2.7100	1.2322	1.0454"+04	8.5198"+03
1.5240"-01	4.1934"+05	1.2270	3.0253"+04	NM	1.8294	1.8145	2.8695"+02	1.0378"+02
4.3586"-02	3.1592"+02	1.0000	1.1964"-03	NM	0.2495	1.4641"-03	6.5299"+02	2.9385"+02
64010604	3.0670	0.9726	1.0234"+04	NM	3.0572	1.2456	1.1548"+04	1.0033"+04
2.0320"-01	4.0738"+05	1.1510	2.3512"+04	NM	1.8386	1.8234	2.8543"+02	1.0928"+02
5.0338"-02	3.1486"+02	1.0000	8.8714"-04	NM	0.2455	1.1091"-03	6.4282"+02	2.9348"+02
64010605	3.0100	0.9678	9.1197"+03	NM	3.0686	1.2287	1.2415"+04	1.1045"+04
2.5400"-01	4.1184"+05	1.1240	2.0377"+04	NM	1.8557	1.8437	2.8719"+02	1.1311"+02
5.9083"-02	3.1807"+02	1.0000	7.4804"-04	NM	0.2651	9.1366"-04	6.4184"+02	2.9675"+02
64010701	4.0590	0.9817	3.2279"+03	NM	6.2267	1.3440	1.8041"+03	1.8041"+03
NM	2.9626"+05	1.0000	1.0903"+04	NM	1.7962	1.7553	2.8540"+02	7.3556"+01
3.4925"-02	3.1593"+02	1.0000	9.6459"-04	NM	0.3932	1.6654"-03	6.9797"+02	2.9072"+02
64010702	4.4850	0.9827	3.2849"+03	NM	4.9558	1.3013	2.0231"+03	1.4714"+03
5.0800"-02	4.1793"+05	1.3750	1.2959"+04	NM	1.8073	1.7724	2.8357"+02	6.2667"+01
3.5865"-02	3.1478"+02	1.0000	1.0004"-03	NM	0.2633	1.5650"-03	7.1185"+02	2.8856"+02
64010703	4.1660	0.9742	3.2884"+03	NM	5.1343	1.3382	2.6972"+03	2.1560"+03
1.5240"-01	4.0749"+05	1.2510	1.1494"+04	NM	1.8147	1.7824	2.8161"+02	7.0333"+01
4.3434"-02	3.1447"+02	1.0000	7.7530"-04	NM	0.2660	1.2104"-03	7.0050"+02	2.8908"+02
64010704	3.9600	0.9742	2.9782"+03	NM	4.6085	1.2827	3.2287"+03	2.6684"+03
2.0320"-01	3.8406"+05	1.2100	9.6389"+03	NM	1.8419	1.8158	2.8376"+02	7.6444"+01
5.0338"-02	3.1620"+02	1.0000	6.2596"-04	NM	0.2408	9.1196"-04	6.9419"+02	2.9126"+02
64010705	3.7350	0.9626	2.9865"+03	NM	4.1631	1.2526	3.9018"+03	3.3899"+03
2.5400"-01	3.5929"+05	1.1510	8.8061"+03	NM	1.8592	1.8398	2.8019"+02	8.3167"+01
5.9083"-02	3.1521"+02	1.0000	5.4102"-04	NM	0.2769	7.3922"-04	6.8293"+02	2.9107"+02

CAT 6401 CLUTTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD TOD	TW/TR PW/PD SW *	RED2W RED2O D2	CF CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD* TD* TR
64010801	1.5930	1.0249	2.4584"+04	NM	2.1223	1.2559	4.1039"+04	4.1039"+04
-5.0800"-02	1.7263"+05	1.0000	3.3931"+04	NM	1.8010	1.7922	3.0011"+02	2.0128"+02
3.4925"-02	3.0343"+02	1.0000	1.4153"-03	NM	0.1202	1.5863"-03	4.5313"+02	2.9281"+02
64010802	1.4090	1.0208	2.7668"+04	NM	2.0000	1.2964	5.4082"+04	5.4082"+04
5.0800"-02	1.7430"+05	1.0000	3.5881"+04	NM	1.7795	1.7728	3.0017"+02	2.1689"+02
4.5692"-02	3.0301"+02	1.0000	1.4188"-03	NM	0.0975	1.5762"-03	4.1604"+02	2.9405"+02
64010803	1.4670	1.0176	2.2260"+04	NM	2.0203	1.2593	5.0546"+04	5.0546"+04
1.0160"-01	1.7693"+05	1.0000	2.9334"+04	NM	1.8161	1.8099	2.9751"+02	2.1100"+02
5.4437"-02	3.0182"+02	1.0000	1.1491"-03	NM	0.1010	1.2692"-03	4.2725"+02	2.9237"+02
64010804	1.5050	1.0136	1.7810"+04	NM	2.1764	1.2425	4.6260"+04	4.7041"+04
1.5240"-01	1.7395"+05	0.9834	2.3663"+04	NM	1.8371	1.8305	3.0036"+02	2.1078"+02
6.1214"-02	3.0626"+02	1.0000	9.6952"-04	NM	0.1045	1.0790"-03	4.3809"+02	2.9633"+02
64010805	1.5700	1.0064	1.5397"+04	NM	2.2711	1.1990	4.2236"+04	4.3288"+04
2.0320"-01	1.7602"+05	0.9757	2.0786"+04	NM	1.8651	1.8603	2.9665"+02	2.0444"+02
6.6012"-02	3.0523"+02	1.0000	8.5171"-04	NM	0.1071	9.4704"-04	4.5009"+02	2.9475"+02
64010806	1.6260	1.0124	1.4501"+04	NM	2.4315	1.1914	3.8874"+04	4.0147"+04
2.5400"-01	1.7736"+05	0.9683	2.0046"+04	NM	1.8735	1.8682	2.9616"+02	1.9850"+02
6.8887"-02	3.0346"+02	1.0000	8.2188"-04	NM	0.1143	9.1956"-04	4.5932"+02	2.9255"+02
64010807	1.6530	1.0157	1.3982"+04	NM	2.2400	1.1904	3.7673"+04	3.8422"+04
3.0480"-01	1.7672"+05	0.9805	1.9551"+04	NM	1.8747	1.8709	2.9739"+02	1.9656"+02
6.9850"-02	3.0397"+02	1.0000	8.1308"-04	NM	0.1711	8.9015"-04	4.6465"+02	2.9280"+02
64010901	2.3510	0.9721	1.7314"+04	NM	4.0366	1.1793	2.0267"+04	2.2252"+04
1.5240"-01	3.0135"+05	0.9108	3.0133"+04	NM	1.8745	1.8624	2.8595"+02	1.4773"+02
6.1214"-02	3.1114"+02	1.0000	1.0281"-03	NM	0.2103	1.2907"-03	5.7302"+02	2.9415"+02
64010902	2.5090	0.9802	1.7625"+04	NM	4.1380	1.1947	1.7750"+04	1.9297"+04
2.0320"-01	3.3436"+05	0.9198	3.2818"+04	NM	1.8684	1.8534	2.8706"+02	1.3761"+02
6.6012"-02	3.1087"+02	1.0000	1.0945"-03	NM	0.2424	1.3967"-03	5.9012"+02	2.9285"+02
64010903	2.5120	0.9776	1.4502"+04	NM	5.0302	1.1777	1.6115"+04	1.8249"+04
2.5400"-01	3.1767"+05	0.8831	2.6974"+04	NM	1.8807	1.8675	2.8664"+02	1.3761"+02
6.8887"-02	3.1128"+02	1.0000	9.5016"-04	NM	0.1054	1.2533"-03	5.9082"+02	2.9322"+02
64010904	2.5530	0.9816	1.7188"+04	NM	4.6563	1.1978	1.4758"+04	1.6824"+04
3.0480"-01	3.1213"+05	0.8772	3.2594"+04	NM	1.8676	1.8498	2.8704"+02	1.3489"+02
6.9850"-02	3.1072"+02	1.0000	1.1912"-03	NM	0.2568	1.5718"-03	5.9450"+02	2.9244"+02
64010905	2.6110	0.9830	1.5165"+04	NM	4.1949	1.1913	1.4603"+04	1.4960"+04
3.5560"-01	3.0364"+05	0.9761	2.9447"+04	NM	1.8695	1.8539	2.8732"+02	1.3156"+02
6.9850"-02	3.1093"+02	1.0000	1.1422"-03	NM	0.1223	1.4647"-03	6.0044"+02	2.9227"+02
64010906	2.6350	0.9856	2.1276"+04	NM	3.4668	1.2127	1.5244"+04	1.5244"+04
4.5720"-01	3.2109"+05	1.0000	4.1760"+04	NM	1.8495	1.8324	2.8928"+02	1.3078"+02
6.9850"-02	3.1238"+02	1.0000	1.5619"-03	NM	0.2336	1.9496"-03	6.0417"+02	2.9349"+02
64011001	3.2760	0.9763	9.0277"+03	NM	5.6932	1.2171	7.6394"+03	8.4892"+03
2.0320"-01	4.6906"+05	0.8999	2.2482"+04	NM	1.8529	1.8366	2.9174"+02	1.0222"+02
6.6012"-02	3.2164"+02	1.0000	8.5188"-04	NM	0.2833	1.2857"-03	6.6409"+02	2.9882"+02
64011002	3.2990	0.9850	7.4125"+03	NM	6.0795	1.1951	6.3648"+03	7.3889"+03
2.5400"-01	4.2217"+05	0.8614	1.8798"+04	NM	1.8719	1.8563	2.9044"+02	9.9944"+01
6.8887"-02	3.1749"+02	1.0000	7.8634"-04	NM	0.3188	1.1719"-03	6.6126"+02	2.9487"+02
64011003	3.4770	0.9815	3.6901"+03	NM	8.5066	1.1896	5.4776"+03	5.8715"+03
3.0480"-01	4.3342"+05	0.9329	9.9787"+03	NM	1.9012	1.8866	2.9146"+02	9.3778"+01
6.9850"-02	3.2052"+02	1.0000	4.5399"-04	NM	-0.2989	6.7720"-04	6.7509"+02	2.9694"+02
64011004	3.5030	0.9791	5.1075"+03	NM	5.3519	1.1944	5.7005"+03	5.7499"+03
3.5560"-01	4.4043"+05	0.9914	1.3914"+04	NM	1.8895	1.8725	2.9162"+02	9.3111"+01
6.9850"-02	3.2162"+02	1.0000	6.3491"-04	NM	0.3008	8.6461"-04	6.7772"+02	2.9786"+02
64011005	3.4020	0.9837	5.5550"+03	NM	4.9219	1.2224	5.2817"+03	5.2817"+03
4.5720"-01	3.5022"+05	1.0000	1.4640"+04	NM	1.8697	1.8482	2.9030"+02	9.6000"+01
6.9850"-02	3.1821"+02	1.0000	7.8322"-04	NM	0.3043	1.0759"-03	6.6831"+02	2.9510"+02
64011101	4.4040	0.9775	3.1180"+03	NM	10.3645	1.2619	1.5795"+03	1.8487"+03
3.0480"-01	4.7427"+05	0.8544	1.1043"+04	NM	1.8728	1.8330	2.8875"+02	6.6000"+01
6.9850"-02	3.2202"+02	1.0000	8.0112"-04	NM	0.3407	1.5244"-03	7.1735"+02	2.9539"+02
64011102	4.2950	0.9808	3.3199"+03	NM	8.1600	1.2605	1.5244"+03	1.6432"+03
3.5560"-01	3.6696"+05	0.9277	1.2206"+04	NM	1.8537	1.8180	2.8505"+02	6.7500"+01
6.9850"-02	3.1653"+02	1.0000	9.8516"-04	NM	0.4166	1.7163"-03	7.0750"+02	2.9064"+02
64011103	3.9470	0.9763	3.5929"+03	NM	5.9911	1.2931	2.0971"+03	2.0459"+03
4.5720"-01	2.8938"+05	1.0250	1.1537"+04	NM	1.8251	1.7913	2.9081"+02	7.8556"+01
6.9850"-02	3.2332"+02	1.0000	1.0210"-03	NM	0.3090	1.6730"-03	7.0140"+02	2.9786"+02
64011104	4.2490	0.9820	2.9720"+03	NM	7.3819	1.2965	1.5961"+03	1.6432"+03
5.5880"-01	3.4588"+05	0.9713	1.0717"+04	NM	1.8517	1.8150	2.9044"+02	6.9833"+01
6.9850"-02	3.2199"+02	1.0000	9.2005"-04	NM	0.3552	1.5548"-03	7.1191"+02	2.9576"+02

CAT 6401 CLUTTER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW	PD*
X *	POD	PW/PD	RED2O	CQ	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD	TR
64011201	1.5070	0.6743	2.5165"+04	NM	2.0351	1.2271	4.7375"+04	4.8243"+04
1.5240"-01	1.7891"+05	0.9820	2.4074"+04	NM	1.8400	1.8381	1.9796"+02	2.0867"+02
6.1214"-02	3.0345"+02	1.0000	9.4768"-04	NM	0.1888	1.0267"-03	4.3647"+02	2.9359"+02
64011202	1.5700	0.6068	2.2468"+04	NM	2.0574	1.2123	4.1589"+04	4.2624"+04
2.0320"-01	1.7332"+05	0.9757	2.0048"+04	NM	1.8565	1.8555	1.7882"+02	2.0439"+02
6.6012"-02	3.0515"+02	1.0000	8.3392"-04	NM	0.2341	8.9690"-04	4.5003"+02	2.9467"+02
64011203	1.6330	0.6652	2.0676"+04	NM	2.2285	1.2206	3.7921"+04	3.9114"+04
2.5400"-01	1.7461"+05	0.9695	2.0379"+04	NM	1.8530	1.8503	1.9394"+02	1.9728"+02
6.8887"-02	3.0249"+02	1.0000	8.4685"-04	NM	0.2274	9.2652"-04	4.5987"+02	2.9155"+02
64011204	1.6620	0.7773	1.7901"+04	NM	2.3097	1.2142	3.7203"+04	3.7943"+04
3.0480"-01	1.7689"+05	0.9805	2.0290"+04	NM	1.8601	1.8548	2.2756"+02	1.9583"+02
6.9850"-02	3.0402"+02	1.0000	8.4562"-04	NM	0.1500	9.3904"-04	4.6632"+02	2.9277"+02
64011301	2.3630	0.6203	2.6892"+04	NM	3.4882	1.2171	2.0418"+04	2.2196"+04
1.5240"-01	3.0628"+05	0.7199	3.2541"+04	NM	1.8469	1.8369	1.8057"+02	1.4550"+02
6.1214"-02	3.0799"+02	1.0000	1.0836"-03	NM	0.3584	1.3370"-03	5.7149"+02	2.9109"+02
64011302	2.5180	0.5735	3.2052"+04	NM	2.9578	1.2626	1.8075"+04	1.8661"+04
2.0320"-01	3.2790"+05	0.9686	3.8430"+04	NM	1.8137	1.8063	1.6837"+02	1.3744"+02
6.6012"-02	3.1173"+02	1.0000	1.3184"-03	NM	0.5971	1.5757"-03	5.9187"+02	2.9361"+02
64011303	2.5290	0.6551	2.2207"+04	NM	4.3376	1.2205	1.5791"+04	1.7825"+04
2.5400"-01	3.1861"+05	0.8859	2.9992"+04	NM	1.8458	1.8342	1.9317"+02	1.3739"+02
6.8887"-02	3.1313"+02	1.0000	1.0718"-03	NM	0.3251	1.4117"-03	5.9434"+02	2.9486"+02
64011304	2.6350	0.6252	2.3996"+04	NM	3.5369	1.2344	1.4894"+04	1.5093"+04
3.5560"-01	3.1791"+05	0.9868	3.2441"+04	NM	1.8368	1.8239	1.8387"+02	1.3106"+02
6.9850"-02	3.1305"+02	1.0000	1.2292"-03	NM	0.3115	1.5450"-03	6.0481"+02	2.9412"+02
64011401	3.2190	0.6388	9.3986"+03	NM	5.0338	1.2686	6.9809"+03	8.0175"+03
2.5400"-01	4.0758"+05	0.8707	1.6222"+04	NM	1.8386	1.8247	1.8960"+02	1.0389"+02
6.8887"-02	3.1919"+02	1.0000	6.7615"-04	NM	0.5925	9.3428"-04	6.5783"+02	2.9680"+02
64011402	3.4020	0.6132	9.1805"+03	NM	4.7794	1.2460	6.1605"+03	6.5572"+03
3.0480"-01	4.3479"+05	0.9395	1.6452"+04	NM	1.8510	1.8368	1.7803"+02	9.4444"+01
6.9850"-02	3.1306"+02	1.0000	6.9218"-04	NM	0.5421	9.3818"-04	6.6288"+02	2.9032"+02
64011403	3.4560	0.6060	9.8737"+03	NM	3.9248	1.2802	5.4502"+03	5.4876"+03
3.5560"-01	3.9313"+05	0.9932	1.7862"+04	NM	1.8246	1.8117	1.7772"+02	9.3389"+01
6.9850"-02	3.1648"+02	1.0000	8.6944"-04	NM	0.6388	1.1250"-03	6.6962"+02	2.9327"+02
64011501	4.0840	0.7228	4.0569"+03	NM	5.4010	1.2906	2.0624"+03	2.1900"+03
2.5400"-01	3.7171"+05	0.9417	1.0807"+04	NM	1.8232	1.8028	2.0934"+02	7.2611"+01
6.8887"-02	3.1483"+02	1.0000	7.6783"-04	NM	0.7668	1.1530"-03	6.9775"+02	2.8964"+02
64011502	4.4110	0.6762	3.7773"+03	NM	8.1799	1.2754	1.5452"+03	1.7366"+03
3.0480"-01	4.4948"+05	0.8898	1.0711"+04	NM	1.8365	1.8107	1.9468"+02	6.4167"+01
6.9850"-02	3.1386"+02	1.0000	7.3813"-04	NM	0.6405	1.2595"-03	7.0844"+02	2.8790"+02
64011503	4.3270	0.7710	3.6809"+03	NM	5.9722	1.2965	1.5248"+03	1.5542"+03
3.5560"-01	3.6158"+05	0.9811	1.1284"+04	NM	1.8237	1.7984	2.2461"+02	6.6889"+01
6.9850"-02	3.1736"+02	1.0000	9.4280"-04	NM	0.6536	1.4516"-03	7.0953"+02	2.9131"+02

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
64010301	1.1312"-03	4.7839	1.8711	0.2419	2.2876"+04	9.0935"+03	5.4091"-03
	1.1312"-03	4.7839	1.8711	0.2419	2.2876"+04	9.0936"+03	
64010302	1.2351"-03	4.8130	1.8663	0.2443	2.6208"+04	1.0231"+04	5.8684"-03
	1.2190"-03	4.8081	1.8692	0.2439	2.6250"+04	1.0247"+04	
64010303	1.2469"-03	4.7932	1.8648	0.2515	2.5084"+04	9.8496"+03	5.9055"-03
	1.2320"-03	4.7887	1.8675	0.2512	2.5121"+04	9.8641"+03	
64010304	1.2827"-03	4.6319	1.8640	0.2357	2.5145"+04	1.0112"+04	5.9387"-03
	1.2826"-03	4.6319	1.8640	0.2357	2.5145"+04	1.0112"+04	
64010601	1.3970"-03	4.8540	1.8222	0.2746	3.3535"+04	1.2747"+04	6.7767"-03
	1.3970"-03	4.8539	1.8222	0.2746	3.3535"+04	1.2747"+04	
64010602	1.3269"-03	4.4435	1.7917	0.2600	2.8576"+04	1.1440"+04	5.0362"-03
	1.1269"-03	4.3941	1.8318	0.2541	2.9252"+04	1.1711"+04	
64010603	1.0741"-03	4.3415	1.8156	0.2780	2.7190"+04	1.1221"+04	4.1652"-03
	9.5745"-04	4.2972	1.8443	0.2736	2.7636"+04	1.1405"+04	
64010604	8.1940"-04	4.2274	1.8279	0.2662	2.1714"+04	9.4516"+03	3.1986"-03
	7.5710"-04	4.1901	1.8487	0.2632	2.1968"+04	9.5621"+03	
64010605	6.9712"-04	4.0546	1.8471	0.2845	1.9013"+04	8.5091"+03	2.6460"-03
	6.5375"-04	4.0215	1.8650	0.2817	1.9200"+04	8.5931"+03	
64011001	8.8869"-04	4.8388	1.8582	0.2716	2.3483"+04	9.4295"+03	4.5479"-03
	9.4479"-04	4.8637	1.8450	0.2735	2.3313"+04	9.3610"+03	
64011002	8.3777"-04	4.7903	1.8789	0.2992	2.0052"+04	7.9068"+03	4.3481"-03
	9.1395"-04	4.8251	1.8605	0.3022	1.9852"+04	7.8278"+03	
64011003	4.8063"-04	7.1994	1.9061	-0.2823	1.0577"+04	3.9113"+03	3.5980"-03
	5.0093"-04	7.2217	1.8982	-0.2835	1.0533"+04	3.8950"+03	
64011004	6.4120"-04	5.1624	1.8904	0.2978	1.4068"+04	5.1644"+03	3.3261"-03
	6.4450"-04	5.1644	1.8895	0.2979	1.4061"+04	5.1617"+03	
64011005	7.8321"-04	4.9222	1.8697	0.3043	1.4657"+04	5.5616"+03	3.8531"-03
	7.8320"-04	4.9222	1.8697	0.3043	1.4657"+04	5.5616"+03	

64010301 CLUTTER PROFILE TABULATION 49 POINTS, DELTA AT POINT 49

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.91272	0.00000	0.00000	2.87300	0.00000
2	1.2700"-04	2.2778"+00	1.00000	0.93624	0.35222	0.53730	2.32700	0.23090
3	2.5400"-04	3.0674"+00	1.00000	0.93814	0.42880	0.62390	2.11700	0.29471
4	3.8100"-04	3.7008"+00	1.00000	0.94073	0.48034	0.67590	1.98000	0.34136
5	5.0800"-04	4.0828"+00	1.00000	0.94256	0.50871	0.70250	1.90700	0.36838
6	6.3500"-04	4.4457"+00	1.00000	0.94434	0.53419	0.72520	1.84300	0.39349
7	7.6200"-04	4.7554"+00	1.00000	0.94586	0.55496	0.74290	1.79200	0.41456
8	8.8900"-04	5.0209"+00	1.00000	0.94737	0.57215	0.75710	1.75100	0.43238
9	1.0160"-03	5.2537"+00	1.00000	0.94886	0.58679	0.76890	1.71700	0.44782
10	1.1430"-03	5.4676"+00	1.00000	0.95021	0.59992	0.77920	1.68700	0.46189
11	1.2700"-03	5.6674"+00	1.00000	0.95147	0.61192	0.78840	1.66000	0.47494
12	1.9050"-03	6.4072"+00	1.00000	0.95690	0.65440	0.81970	1.56900	0.52243
13	2.5400"-03	6.9687"+00	1.00000	0.96166	0.68485	0.84100	1.50800	0.55769
14	3.1750"-03	7.4344"+00	1.00000	0.96538	0.70910	0.85710	1.46100	0.58665
15	3.8100"-03	7.8660"+00	1.00000	0.96863	0.73084	0.87090	1.42000	0.61331
16	4.4450"-03	8.2837"+00	1.00000	0.97128	0.75129	0.88320	1.38200	0.63907
17	5.0800"-03	8.5523"+00	1.00000	0.97317	0.76414	0.89080	1.35900	0.65548
18	5.7150"-03	8.8258"+00	1.00000	0.97477	0.77700	0.89810	1.33600	0.67223
19	6.3500"-03	9.0592"+00	1.00000	0.97611	0.78781	0.90410	1.31700	0.68648
20	6.9850"-03	9.2752"+00	1.00000	0.97740	0.79768	0.90950	1.30000	0.69962
21	7.6200"-03	9.5124"+00	1.00000	0.97890	0.80839	0.91530	1.28200	0.71396
22	8.2550"-03	9.7695"+00	1.00000	0.98038	0.81978	0.92130	1.26300	0.72945
23	8.8900"-03	9.9328"+00	1.00000	0.98123	0.82701	0.92500	1.25100	0.73941
24	9.5250"-03	1.0129"+01	1.00000	0.98222	0.83555	0.92930	1.23700	0.75125
25	1.0160"-02	1.0319"+01	1.00000	0.98343	0.84377	0.93350	1.22400	0.76266
26	1.0795"-02	1.0550"+01	1.00000	0.98435	0.85361	0.93820	1.20800	0.77666
27	1.1430"-02	1.0870"+01	1.00000	0.98603	0.86710	0.94470	1.18700	0.79587
28	1.2065"-02	1.1092"+01	1.00000	0.98727	0.87632	0.94910	1.17300	0.80912
29	1.2700"-02	1.1360"+01	1.00000	0.98823	0.88730	0.95400	1.15600	0.82526
30	1.3335"-02	1.1578"+01	1.00000	0.98945	0.89616	0.95810	1.14300	0.83823
31	1.3970"-02	1.1844"+01	1.00000	0.99040	0.90684	0.96270	1.12700	0.85421
32	1.4605"-02	1.2069"+01	1.00000	0.99140	0.91581	0.96660	1.11400	0.86768
33	1.5240"-02	1.2324"+01	1.00000	0.99277	0.92581	0.97100	1.10000	0.88273
34	1.5875"-02	1.2615"+01	1.00000	0.99393	0.93713	0.97570	1.08400	0.90009
35	1.6510"-02	1.2875"+01	1.00000	0.99482	0.94711	0.97970	1.07000	0.91561
36	1.7145"-02	1.3130"+01	1.00000	0.99605	0.95681	0.98370	1.05700	0.93065
37	1.7780"-02	1.3326"+01	1.00000	0.99677	0.96420	0.98660	1.04700	0.94231
38	1.8415"-02	1.3462"+01	1.00000	0.99710	0.96930	0.98850	1.04000	0.95048
39	1.9050"-02	1.3606"+01	1.00000	0.99772	0.97465	0.99060	1.03300	0.95895
40	1.9685"-02	1.3749"+01	1.00000	0.99820	0.97994	0.99260	1.02600	0.96745
41	2.0320"-02	1.3851"+01	1.00000	0.99851	0.98372	0.99400	1.02100	0.97356
42	2.0955"-02	1.3915"+01	1.00000	0.99878	0.98606	0.99490	1.01800	0.97731
43	2.1590"-02	1.3979"+01	1.00000	0.99905	0.98841	0.99580	1.01500	0.98108
44	2.2225"-02	1.4068"+01	1.00000	0.99954	0.99166	0.99710	1.01100	0.98625
45	2.2860"-02	1.4171"+01	1.00000	0.99972	0.99542	0.99840	1.00600	0.99245
46	2.3495"-02	1.4196"+01	1.00000	0.99995	0.99631	0.99880	1.00500	0.99383
47	2.4130"-02	1.4234"+01	1.00000	0.99986	0.99770	0.99920	1.00300	0.99621
48	2.4765"-02	1.4262"+01	1.00000	1.00023	0.99870	0.99970	1.00200	0.99770
D 49	2.5400"-02	1.4298"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,DELTA,U/UD,T/TD,P/PD

64010302 CLUTTER PROFILE TABULATION 50 POINTS, DELTA AT POINT 50

I	Y	PT2/P	P/PD	TO/TOD	M/MO	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.02300	0.91947	0.00000	0.00000	2.93300	0.00000
2	1.2757"-04	2.6373"+00	1.02300	0.93337	0.38561	0.57790	2.24600	0.26322
3	2.5514"-04	3.6253"+00	1.02300	0.93530	0.46993	0.66640	2.01100	0.33900
4	3.8011"-04	3.9947"+00	1.02300	0.93727	0.49746	0.69270	1.93900	0.36546
5	5.0768"-04	4.2893"+00	1.02200	0.93907	0.51831	0.71180	1.88600	0.38572
6	6.3525"-04	4.5203"+00	1.02200	0.94066	0.53405	0.72580	1.84700	0.40161
7	7.6283"-04	4.7450"+00	1.02200	0.94234	0.54892	0.73870	1.81100	0.41687
8	8.8779"-04	4.9517"+00	1.02200	0.94376	0.56223	0.74990	1.77900	0.43080
9	1.0154"-03	5.1418"+00	1.02200	0.94524	0.57419	0.75980	1.75100	0.44347
10	1.1429"-03	5.3111"+00	1.02200	0.94663	0.58463	0.76830	1.72700	0.45466
11	1.2705"-03	5.4609"+00	1.02200	0.94821	0.59371	0.77570	1.70700	0.46442
12	1.9058"-03	6.1076"+00	1.02100	0.95472	0.63138	0.80510	1.62600	0.50554
13	2.5410"-03	6.6426"+00	1.02100	0.95925	0.66088	0.82650	1.56400	0.53955
14	3.1763"-03	7.1341"+00	1.02000	0.96306	0.68685	0.84430	1.51100	0.56994
15	3.8089"-03	7.5370"+00	1.02000	0.96586	0.70742	0.85770	1.47000	0.59514
16	4.4442"-03	7.9150"+00	1.01900	0.96867	0.72618	0.86960	1.43400	0.61794
17	5.0794"-03	8.2975"+00	1.01800	0.97117	0.74468	0.88080	1.39900	0.64093
18	5.7147"-03	8.6160"+00	1.01800	0.97309	0.75976	0.88960	1.37100	0.66055
19	6.3479"-03	8.8694"+00	1.01700	0.97484	0.77150	0.89640	1.35000	0.67529
20	6.9852"-03	9.1236"+00	1.01700	0.97617	0.78312	0.90280	1.32900	0.69086
21	7.6204"-03	9.3277"+00	1.01600	0.97749	0.79233	0.90790	1.31300	0.70253
22	8.2557"-03	9.5057"+00	1.01600	0.97835	0.80027	0.91210	1.29900	0.71339
23	8.8910"-03	9.6940"+00	1.01500	0.97961	0.80859	0.91660	1.28500	0.72401
24	9.5262"-03	9.9506"+00	1.01500	0.98098	0.81979	0.92240	1.26600	0.73952
25	1.0159"-02	1.0184"+01	1.01400	0.98200	0.82982	0.92740	1.24900	0.75291
26	1.0794"-02	1.0401"+01	1.01300	0.98329	0.83908	0.93210	1.23400	0.76517
27	1.1429"-02	1.0633"+01	1.01300	0.98431	0.84883	0.93680	1.21800	0.77913
28	1.2065"-02	1.0952"+01	1.01200	0.98598	0.86210	0.94320	1.19700	0.79743
29	1.2700"-02	1.1150"+01	1.01200	0.98671	0.87022	0.94690	1.18400	0.80934
30	1.3335"-02	1.1376"+01	1.01100	0.98792	0.87938	0.95120	1.17000	0.82193
31	1.3970"-02	1.1667"+01	1.01100	0.98904	0.89107	0.95640	1.15200	0.83934
32	1.4606"-02	1.1900"+01	1.01000	0.98997	0.90029	0.96040	1.13800	0.85238
33	1.5241"-02	1.2159"+01	1.00900	0.99108	0.91043	0.96480	1.12300	0.86686
34	1.5876"-02	1.2411"+01	1.00900	0.99240	0.92024	0.96910	1.10900	0.88171
35	1.6509"-02	1.2678"+01	1.00800	0.99316	0.93045	0.97320	1.09400	0.89670
36	1.7144"-02	1.2869"+01	1.00800	0.99418	0.93771	0.97630	1.08400	0.90785
37	1.7779"-02	1.3072"+01	1.00700	0.99476	0.94540	0.97930	1.07300	0.91906
38	1.8415"-02	1.3269"+01	1.00700	0.99566	0.95275	0.98230	1.06300	0.93055
39	1.9050"-02	1.3484"+01	1.00600	0.99640	0.96074	0.98540	1.05200	0.94231
40	1.9685"-02	1.3702"+01	1.00600	0.99702	0.96874	0.98840	1.04100	0.95517
41	2.0320"-02	1.3830"+01	1.00500	0.99772	0.97341	0.99030	1.03500	0.96160
42	2.0956"-02	1.3969"+01	1.00400	0.79797	0.97850	0.99210	1.02800	0.96894
43	2.1591"-02	1.4098"+01	1.00400	0.99855	0.98314	0.99390	1.02200	0.97639
44	2.2226"-02	1.4241"+01	1.00300	0.99881	0.98832	0.79570	1.01500	0.98393
45	2.2859"-02	1.4310"+01	1.00300	0.99924	0.99077	0.99670	1.01200	0.98784
46	2.3494"-02	1.4351"+01	1.00200	0.99930	0.99225	0.99720	1.01000	0.98930
47	2.4129"-02	1.4393"+01	1.00200	0.99935	0.99373	0.99770	1.00800	0.99176
48	2.4764"-02	1.4462"+01	1.00100	0.99978	0.99621	0.99870	1.00500	0.99473
49	2.5400"-02	1.4529"+01	1.00100	1.00008	0.99860	0.99960	1.00200	0.99860
D 50	2.6035"-02	1.4569"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,DELTA,U/UD,T/TD,P/PD

64010303 CLUTTER PROFILE TABULATION 47 POINTS, DELTA AT POINT 47

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.02100	0.91181	0.00000	0.00000	2.91100	0.00000
2	1.2789"-04	2.6670"+00	1.02100	0.91515	0.38822	0.57530	2.19600	0.26748
3	2.5336"-04	3.6857"+00	1.02100	0.91762	0.47426	0.66430	1.96200	0.34569
4	3.8125"-04	4.2412"+00	1.02100	0.92045	0.51465	0.70170	1.85900	0.38539
5	5.0914"-04	4.6021"+00	1.02100	0.92321	0.53919	0.72340	1.80000	0.41033
6	6.3462"-04	4.8116"+00	1.02100	0.92603	0.55291	0.73560	1.77000	0.42432
7	7.6251"-04	4.9708"+00	1.02100	0.92871	0.56310	0.74470	1.74900	0.43473
8	8.8798"-04	5.1099"+00	1.02100	0.93151	0.57186	0.75260	1.73200	0.44365
9	1.0159"-03	5.2505"+00	1.02100	0.93418	0.58057	0.76030	1.71500	0.45263
10	1.1438"-03	5.3762"+00	1.02000	0.93703	0.58824	0.76720	1.70100	0.46005
11	1.2692"-03	5.5036"+00	1.02000	0.93985	0.59591	0.77400	1.68700	0.46798
12	1.9039"-03	6.0888"+00	1.02000	0.95419	0.62993	0.80400	1.62900	0.50343
13	2.5409"-03	6.6009"+00	1.01900	0.95832	0.65823	0.82450	1.56900	0.53548
14	3.1755"-03	7.0529"+00	1.01900	0.96196	0.68222	0.84110	1.52000	0.56387
15	3.8101"-03	7.4633"+00	1.01800	0.96500	0.70328	0.85500	1.47800	0.58890
16	4.4447"-03	7.8370"+00	1.01700	0.96780	0.72192	0.86690	1.44200	0.61140
17	5.0794"-03	8.1953"+00	1.01700	0.97028	0.73933	0.87760	1.40900	0.63344
18	5.7140"-03	8.5150"+00	1.01600	0.97253	0.75454	0.88670	1.38100	0.65234
19	6.3510"-03	8.7917"+00	1.01600	0.97394	0.76745	0.89400	1.35700	0.66935
20	6.9856"-03	9.0387"+00	1.01500	0.97569	0.77879	0.90050	1.33700	0.68363
21	7.6203"-03	9.2738"+00	1.01500	0.97694	0.78943	0.90630	1.31800	0.69795
22	8.2549"-03	9.4820"+00	1.01400	0.97829	0.79874	0.91140	1.30200	0.70980
23	8.8895"-03	9.6788"+00	1.01400	0.97937	0.80743	0.91600	1.28700	0.72170
24	9.5241"-03	9.9443"+00	1.01300	0.98055	0.81902	0.92190	1.26700	0.73708
25	1.0161"-02	1.0139"+01	1.01200	0.98162	0.82743	0.92620	1.25300	0.74806
26	1.0796"-02	1.0397"+01	1.01200	0.98300	0.83838	0.93170	1.23500	0.76347
27	1.1430"-02	1.0660"+01	1.01100	0.98429	0.84946	0.93710	1.21700	0.77848
28	1.2065"-02	1.0919"+0[illegible]	[illegible]01100	0.98568	0.86020	0.94230	1.20000	0.79389
29	1.2700"-02	1.1150"+0[illegible]	1.[illegible]1000	0.98669	0.86967	0.94670	1.18500	0.80689
30	1.3334"-02	1.1352"+0[illegible]	1.[illegible]1000	0.98744	0.87790	0.95040	1.17200	0.81903
31	1.3969"-02	1.1581"+01	[illegible].00900	0.98855	0.88709	0.95460	1.15800	0.83177
32	1.4606"-02	1.1780"+01	1.00800	0.98939	0.89499	0.95810	1.14600	0.84273
33	1.5241"-02	1.2005"+01	1.00800	0.99059	0.90387	0.96210	1.13300	0.85595
34	1.5875"-02	1.2300"+01	1.00700	0.99176	0.91537	0.96700	1.11600	0.87255
35	1.6510"-02	1.2602"+01	1.00700	0.99282	0.92700	0.97180	1.09900	0.89045
36	1.7144"-02	1.2862"+01	1.00600	0.99392	0.93689	0.97590	1.08500	0.90484
37	1.7779"-02	1.3068"+01	1.00600	0.99464	0.94467	0.97900	1.07400	0.91701
38	1.8416"-02	1.3262"+01	1.00500	0.99541	0.95191	0.98190	1.06400	0.92745
39	1.9051"-02	1.3459"+01	1.00500	0.99620	0.95924	0.98480	1.05400	0.93902
40	1.9685"-02	1.3635"+01	1.00400	0.99663	0.96571	0.98720	1.04500	0.94847
41	2.0320"-02	1.3825"+01	1.00300	0.99761	0.97265	0.99000	1.03600	0.95847
42	2.0954"-02	1.4031"+01	1.00300	0.99829	0.98014	0.99280	1.02600	0.97054
43	2.1589"-02	1.4201"+01	1.00200	0.99892	0.98626	0.99510	1.01800	0.97946
44	2.2226"-02	1.4305"+01	1.00200	0.99914	0.98999	0.99640	1.01300	0.98558
45	2.2861"-02	1.4412"+01	1.00100	0.99949	0.99383	0.99780	1.00800	0.99087
46	2.3495"-02	1.4521"+01	1.00100	0.99984	0.99770	0.99920	1.00300	0.99721
D 47	2.4130"-02	1.4586"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64010304 CLUTTER PROFILE TABULATION 48 POINTS, DELTA AT POINT 48

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.93400	0.00000	0.00000	2.85400	0.00000
2	1.2630"-04	2.6245"+00	1.00000	0.93602	0.39673	0.58320	2.16100	0.26988
3	2.5508"-04	3.2910"+00	1.00000	0.93914	0.45766	0.64820	2.00600	0.32313
4	3.8138"-04	3.6995"+00	1.00000	0.93908	0.49088	0.68000	1.91900	0.35435
5	5.0768"-04	4.0459"+00	1.00000	0.94044	0.51725	0.70430	1.85400	0.37988
6	6.3398"-04	4.3100"+00	1.00000	0.94221	0.53643	0.72150	1.80900	0.39884
7	7.6276"-04	4.5140"+00	1.00000	0.94365	0.55078	0.73400	1.77600	0.41329
8	8.8906"-04	4.6940"+00	1.00000	0.94494	0.56311	0.74450	1.74800	0.42592
9	1.0154"-03	4.8604"+0v	1.00000	0.94613	0.57427	0.75380	1.72300	0.43749
10	1.1441"-03	4.9888"+00	1.00000	0.94747	0.58273	0.76090	1.70500	0.44628
11	1.2704"-03	5.1212"+00	1.00000	0.94835	0.59132	0.76780	1.68600	0.45540
12	1.9044"-03	5.6820"+00	1.00000	0.95359	0.62636	0.79550	1.61300	0.49318
13	2.5409"-03	6.1878"+00	1.00000	0.95827	0.65632	0.81790	1.55300	0.52666
14	3.1749"-03	6.7246"+00	1.00000	0.95960	0.68666	0.83790	1.48900	0.56273
15	3.8089"-03	7.0101"+00	1.00000	0.96482	0.70226	0.84970	1.46400	0.58040
16	4.4453"-03	7.3668"+00	1.00000	0.96776	0.72126	0.86220	1.42900	0.60336
17	5.0793"-03	7.7262"+00	1.00000	0.97030	0.73990	0.87390	1.39500	0.62645
18	5.7158"-03	8.0672"+00	1.00000	0.97246	0.75717	0.88430	1.36400	0.64831
19	6.3497"-03	8.3445"+00	1.00000	0.97428	0.77092	0.89240	1.34000	0.66597
20	6.9862"-03	8.5888"+00	1.00000	0.97618	0.78283	0.89940	1.32000	0.68136
21	7.6202"-03	8.8307"+00	1.00000	0.97740	0.79444	0.90580	1.30000	0.69677
22	8.2542"-03	9.1094"+00	1.00000	0.97901	0.80762	0.91300	1.27800	0.71440
23	8.8906"-03	9.3221"+00	1.00000	0.98043	0.81753	0.91840	1.26200	0.72773
24	9.5246"-03	9.5390"+00	1.00000	0.98176	0.82751	0.92370	1.24600	0.74133
25	1.0161"-02	9.7561"+00	1.00000	0.98276	0.83738	0.92870	1.23000	0.75504
26	1.0795"-02	9.9717"+00	1.00000	0.98411	0.84707	0.93370	1.21500	0.76848
27	1.1429"-02	1.0128"+01	1.00000	0.98479	0.85403	0.93710	1.20400	0.77832
28	1.2066"-02	1.0317"+01	1.00000	0.98559	0.86234	0.94110	1.19100	0.79018
29	1.2699"-02	1.0499"+01	1.00000	0.98661	0.87031	0.94500	1.17900	0.80153
30	1.3336"-02	1.0684"+01	1.00000	0.98753	0.87829	0.94880	1.16700	0.81302
31	1.3970"-02	1.0901"+01	1.00000	0.98845	0.88761	0.95310	1.15300	0.82663
32	1.4604"-02	1.1115"+01	1.00000	0.98972	0.89669	0.95740	1.14000	0.83982
33	1.5240"-02	1.1297"+01	1.00000	0.99064	0.90434	0.96090	1.12900	0.85111
34	1.5874"-02	1.1514"+01	1.00000	0.99156	0.91338	0.96490	1.11600	0.86461
35	1.6511"-02	1.1735"+01	1.00000	0.99238	0.92246	0.96880	1.10300	0.87833
36	1.7145"-02	1.1948"+01	1.00000	0.99342	0.93115	0.97260	1.09100	0.89148
37	1.7779"-02	1.2163"+01	1.00000	0.99434	0.93988	0.97630	1.07900	0.90482
38	1.8415"-02	1.2382"+01	1.00000	0.99515	0.94864	0.97990	1.06700	0.91837
39	1.9049"-02	1.2592"+01	1.00000	0.99618	0.95697	0.98340	1.05600	0.93125
40	1.9686"-02	1.2780"+01	1.00000	0.99675	0.96437	0.98630	1.04600	0.94293
41	2.0320"-02	1.2972"+01	1.00000	0.99733	0.97186	0.98920	1.03600	0.95483
42	2.0956"-02	1.3153"+01	1.00000	0.99812	0.97887	0.99200	1.02700	0.96592
43	2.1590"-02	1.3276"+01	1.00000	0.99869	0.98363	0.99390	1.02100	0.97346
44	2.2224"-02	1.3373"+01	1.00000	0.99879	0.98733	0.99520	1.01600	0.97953
45	2.2861"-02	1.3460"+01	1.00000	0.99936	0.99067	0.99660	1.01200	0.98478
46	2.3495"-02	1.3558"+01	1.00000	0.99947	0.99443	0.99790	1.00700	0.99096
47	2.4131"-02	1.3647"+01	1.00000	1.00004	0.99780	0.99930	1.00300	0.99631
D 48	2.4765"-02	1.3705"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,DELTA,U/UD,T/TD,P/PD

64010601 CLUTTER PROFILE TABULATION 42 POINTS, DELTA AT POINT 42

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.90969	0.00000	0.00000	3.01290	0.00000
2	1.2783"-04	2.4207"+00	1.00000	0.91026	0.35427	0.54155	2.33670	0.23176
3	2.5356"-04	2.9948"+00	1.00000	0.91077	0.40716	0.60126	2.18065	0.27572
4	3.8138"-04	3.4474"+00	1.00000	0.91167	0.44382	0.63926	2.07462	0.30814
5	5.0711"-04	3.7848"+00	1.00000	0.91230	0.46912	0.66387	2.00260	0.33150
6	6.3494"-04	4.0273"+00	1.00000	0.91300	0.48644	0.68007	1.95459	0.34793
7	7.6276"-04	4.2330"+00	1.00000	0.91399	0.50063	0.69307	1.91657	0.36162
8	8.8849"-04	4.4060"+00	1.00000	0.91517	0.51224	0.70357	1.88657	0.37294
9	1.0163"-03	4.5488"+00	1.00000	0.91662	0.52162	0.71207	1.86356	0.38210
10	1.1420"-03	4.6861"+00	1.00000	0.91828	0.53048	0.72007	1.84255	0.39080
11	1.2699"-03	4.8078"+00	1.00000	0.92133	0.53820	0.72757	1.82755	0.39811
12	1.9048"-03	5.3166"+00	1.00000	0.93306	0.56931	0.75668	1.76653	0.42834
13	2.5397"-03	5.7180"+00	1.00000	0.94081	0.59268	0.77718	1.71952	0.45197
14	3.1747"-03	6.0920"+00	1.00000	0.94629	0.61362	0.79428	1.67550	0.47405
15	3.8096"-03	6.4171"+00	1.00000	0.94991	0.63125	0.80778	1.63749	0.49330
16	4.4446"-03	6.7506"+00	1.00000	0.95298	0.64883	0.82058	1.59948	0.51303
17	5.0795"-03	7.0719"+00	1.00000	0.95580	0.66533	0.83218	1.56447	0.53193
18	5.7144"-03	7.4091"+00	1.00000	0.95868	0.68220	0.84368	1.52946	0.55162
19	6.3494"-03	7.7300"+00	1.00000	0.96122	0.69787	0.85399	1.49745	0.57029
20	6.9843"-03	8.0601"+00	1.00000	0.96343	0.71363	0.86389	1.46544	0.58951
21	7.6192"-03	8.3871"+00	1.00000	0.96577	0.72890	0.87329	1.43543	0.60838
22	8.2542"-03	8.7759"+00	1.00000	0.96851	0.74664	0.88389	1.40142	0.63071
23	8.8891"-03	9.2335"+00	1.00000	0.97156	0.76700	0.89559	1.36341	0.65688
24	9.5240"-03	9.5762"+00	1.00000	0.97384	0.78189	0.90389	1.33640	0.67636
25	1.0159"-02	1.0036"+01	1.00000	0.97647	0.80146	0.91429	1.30139	0.70255
26	1.0796"-02	1.0439"+01	1.00000	0.97874	0.81817	0.92289	1.27238	0.72533
27	1.1431"-02	1.0842"+01	1.00000	0.98077	0.83459	0.93099	1.24437	0.74816
28	1.2066"-02	1.1299"+01	1.00000	0.98320	0.85282	0.93979	1.21436	0.77390
29	1.2701"-02	1.1699"+01	1.00000	0.98526	0.86844	0.94709	1.18936	0.79631
30	1.3336"-02	1.2097"+01	1.00000	0.98717	0.88373	0.95400	1.16535	0.81863
31	1.3971"-02	1.2441"+01	1.00000	0.98875	0.89674	0.95970	1.14534	0.83791
32	1.4606"-02	1.2794"+01	1.00000	0.99010	0.90986	0.96520	1.12534	0.85770
33	1.5241"-02	1.3074"+01	1.00000	0.99151	0.92016	0.96960	1.11033	0.87325
34	1.5876"-02	1.3301"+01	1.00000	0.99250	0.92842	0.97300	1.09833	0.88589
35	1.6510"-02	1.3531"+01	1.00000	0.99337	0.93670	0.97630	1.08633	0.89872
36	1.7145"-02	1.3763"+01	1.00000	0.99411	0.94501	0.97950	1.07432	0.91174
37	1.7780"-02	1.3965"+01	1.00000	0.99492	0.95215	0.98230	1.06432	0.92294
38	1.8415"-02	1.4192"+01	1.00000	0.99586	0.96014	0.98540	1.05332	0.93552
39	1.9050"-02	1.4509"+01	1.00000	0.99712	0.97117	0.98960	1.03831	0.95308
40	1.9685"-02	1.4830"+01	1.00000	0.99813	0.98222	0.99360	1.02331	0.97097
41	2.0320"-02	1.5167"+01	1.00000	0.99944	0.99368	0.99780	1.00830	0.98956
D 42	2.0955"-02	1.5354"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64010602 CLUTTER PROFILE TABULATION 46 POINTS, DELTA AT POINT 46

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.33700	0.91003	0.00000	0.00000	2.85500	0.00000
2	1.2687"-04	1.8985"+00	1.33500	0.91455	0.30667	0.47400	2.38900	0.26488
3	2.5375"-04	2.4007"+00	1.33300	0.91841	0.36636	0.54820	2.23900	0.32637
4	3.8062"-04	2.8387"+00	1.33100	0.92559	0.40939	0.59860	2.13800	0.37266
5	5.0749"-04	3.1396"+00	1.32900	0.92440	0.43608	0.62620	2.06200	0.40360
6	6.3436"-04	3.4286"+00	1.32700	0.92685	0.46010	0.65100	2.00200	0.43151
7	7.6124"-04	3.6305"+00	1.32500	0.92928	0.47609	0.66720	1.96400	0.45012
8	8.8811"-04	3.8132"+00	1.32300	0.93144	0.49007	0.68100	1.93100	0.46658
9	1.0150"-03	3.9745"+00	1.32100	0.93337	0.50207	0.69260	1.90300	0.48078
10	1.1419"-03	4.1211"+00	1.31900	0.93593	0.51272	0.70300	1.88000	0.49322
11	1.2711"-03	4.2576"+00	1.31700	0.93769	0.52242	0.71210	1.85800	0.50476
12	1.9054"-03	4.8434"+00	1.30800	0.94462	0.56209	0.74760	1.76900	0.55278
13	2.5398"-03	5.3438"+00	1.29900	0.94967	0.59381	0.77400	1.69900	0.59178
14	3.1742"-03	5.8051"+00	1.29000	0.95440	0.62157	0.79600	1.64000	0.62612
15	3.8109"-03	6.2365"+00	1.28100	0.95823	0.64643	0.81460	1.58800	0.65712
16	4.4453"-03	6.6257"+00	1.27200	0.96157	0.66805	0.83010	1.54400	0.68386
17	5.0796"-03	7.0167"+00	1.26300	0.96462	0.68907	0.84450	1.50200	0.71012
18	5.7140"-03	7.4024"+00	1.25400	0.96761	0.70919	0.85780	1.46300	0.73526
19	6.3507"-03	7.7960"+00	1.24400	0.97033	0.72914	0.87040	1.42500	0.75984
20	6.9851"-03	8.2036"+00	1.23500	0.97323	0.74924	0.88270	1.38800	0.78540
21	7.6194"-03	8.6083"+00	1.22600	0.97587	0.76867	0.89410	1.35300	0.81017
22	8.2561"-03	9.0234"+00	1.21700	0.97851	0.78809	0.90510	1.31900	0.83511
23	8.8905"-03	9.4681"+00	1.20800	0.98088	0.80838	0.91600	1.28400	0.86178
24	9.5249"-03	9.8724"+00	1.19900	0.98311	0.82638	0.92540	1.25400	0.88481
25	1.0159"-02	1.0282"+01	1.19000	0.98527	0.84424	0.93440	1.22500	0.90770
26	1.0796"-02	1.0724"+01	1.18100	0.98735	0.86309	0.94350	1.19500	0.93245
27	1.1430"-02	1.1069"+01	1.17200	0.98924	0.87752	0.95040	1.17300	0.94959
28	1.2065"-02	1.1452"+01	1.16300	0.99082	0.89326	0.95750	1.14900	0.96917
29	1.2699"-02	1.1816"+01	1.15400	0.99218	0.90797	0.96390	1.12700	0.98699
30	1.3336"-02	1.2130"+01	1.14500	0.99356	0.92043	0.96930	1.10900	1.00077
31	1.3970"-02	1.2472"+01	1.13600	0.99505	0.93388	0.97500	1.09000	1.01615
32	1.4604"-02	1.2783"+01	1.12700	0.99602	0.94588	0.97980	1.07300	1.02911
33	1.5239"-02	1.3011"+01	1.11800	0.99685	0.95462	0.98330	1.06100	1.03613
34	1.5876"-02	1.3222"+01	1.10900	0.99753	0.96263	0.98640	1.05000	1.04183
35	1.6510"-02	1.3382"+01	1.10000	0.99821	0.96867	0.98880	1.04200	1.04384
36	1.7144"-02	1.3430"+01	1.09100	0.99833	0.97085	0.98960	1.03900	1.03913
37	1.7781"-02	1.3440"+01	1.08200	0.99833	0.97085	0.98960	1.03900	1.03056
38	1.8415"-02	1.3397"+01	1.07300	0.99803	0.96923	0.98090	1.04100	1.01930
39	1.9050"-02	1.3450"+01	1.06300	0.99785	0.97122	0.98950	1.03800	1.01333
40	1.9684"-02	1.3529"+01	1.05400	0.99809	0.97418	0.99060	1.03400	1.00976
41	2.0321"-02	1.3612"+01	1.04500	0.99844	0.97725	0.99180	1.03000	1.00624
42	2.0955"-02	1.3731"+01	1.03600	0.99869	0.98169	0.99340	1.02400	1.00504
43	2.1590"-02	1.3855"+01	1.02700	0.99908	0.98626	0.99510	1.01800	1.00390
44	2.2224"-02	1.3978"+01	1.01800	0.99934	0.99077	0.99670	1.01200	1.00261
45	2.2861"-02	1.4104"+01	1.00900	0.99973	0.99542	0.99840	1.00600	1.00138
D 46	2.3495"-02	1.4230"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64010603 CLUTTER PROFILE TABULATION 39 POINTS, DELTA AT POINT 39

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.22700	0.90839	0.00000	0.00000	2.76528	0.00000
2	1.2764"-04	2.5630"+00	1.22500	0.91053	0.39163	0.56890	2.11021	0.33025
3	2.5336"-04	3.5379"+00	1.22300	0.91213	0.47938	0.65890	1.88919	0.42655
4	3.8100"-04	3.9336"+00	1.22200	0.91417	0.51027	0.68770	1.81618	0.46271
5	5.0864"-04	4.1816"+00	1.22000	0.91581	0.52869	0.70420	1.77418	0.48424
6	6.3436"-04	4.3422"+00	1.21900	0.91741	0.54024	0.71450	1.74917	0.49794
7	7.6200"-04	4.4802"+00	1.21700	0.91924	0.54997	0.72320	1.72917	0.50899
8	8.8963"-04	4.6102"+00	1.21600	0.92114	0.55897	0.73120	1.71117	0.51961
9	1.0154"-03	4.7300"+00	1.21400	0.92299	0.56713	0.73840	1.69517	0.52881
10	1.1430"-03	4.8483"+00	1.21300	0.92450	0.57508	0.74520	1.67917	0.53832
11	1.2706"-03	4.9558"+00	1.21100	0.92656	0.58220	0.75150	1.66617	0.54620
12	1.9050"-03	5.4593"+00	1.20400	0.93652	0.61441	0.77940	1.60916	0.58316
13	2.5394"-03	5.9094"+00	1.19600	0.94769	0.64181	0.80320	1.56616	0.61337
14	3.1756"-03	6.3298"+00	1.18900	0.95639	0.66636	0.82320	1.52615	0.64134
15	3.8100"-03	6.7426"+00	1.18100	0.96146	0.68959	0.84010	1.48415	0.66850
16	4.4444"-03	7.1384"+00	1.17400	0.96550	0.71115	0.85490	1.44514	0.69450
17	5.0806"-03	7.5048"+00	1.16600	0.96925	0.73052	0.86780	1.41114	0.71705
18	5.7150"-03	7.8690"+00	1.15900	0.97157	0.74929	0.87930	1.37714	0.74002
19	6.3494"-03	8.2504"+00	1.15100	0.97452	0.76844	0.89090	1.34413	0.76289
20	6.9856"-03	8.6278"+00	1.14300	0.97664	0.78692	0.90140	1.31213	0.78521
21	7.6200"-03	9.0055"+00	1.13600	0.97909	0.80499	0.91150	1.28213	0.80761
22	8.2544"-03	9.4166"+00	1.12800	0.98170	0.82420	0.92190	1.25113	0.83117
23	8.8906"-03	9.8429"+00	1.12100	0.98397	0.84366	0.93190	1.22012	0.85619
24	9.5250"-03	1.0310"+01	1.11300	0.98654	0.86449	0.94230	1.18812	0.88272
25	1.0139"-02	1.0786"+01	1.10600	0.98895	0.88520	0.95220	1.15712	0.91014
26	1.0796"-02	1.1270"+01	1.09800	0.99119	0.90576	0.96160	1.12711	0.93676
27	1.1430"-02	1.1677"+01	1.09100	0.99301	0.92270	0.96910	1.10311	0.95846
28	1.2064"-02	1.2050"+01	1.08300	0.99473	0.93795	0.97570	1.08211	0.97650
29	1.2701"-02	1.2381"+01	1.07500	0.99618	0.95128	0.98130	1.06411	0.99135
30	1.3335"-02	1.2660"+01	1.06800	0.99706	0.96235	0.98570	1.04910	1.00345
31	1.3969"-02	1.2855"+01	1.06000	0.99789	0.97002	0.98880	1.03910	1.00868
32	1.4606"-02	1.3031"+01	1.05300	0.99852	0.97691	0.99150	1.03010	1.01354
33	1.5240"-02	1.3148"+01	1.04500	0.99882	0.98144	0.99320	1.02410	1.01347
34	1.5874"-02	1.3246"+01	1.03800	0.99904	0.98523	0.99460	1.01910	1.01304
35	1.6511"-02	1.3324"+01	1.03000	0.99920	0.98827	0.99570	1.01510	1.01031
36	1.7145"-02	1.3404"+01	1.02300	0.99936	0.99131	0.99680	1.01110	1.00853
37	1.7779"-02	1.3471"+01	1.01500	0.99984	0.99388	0 99790	1.00810	1.00473
38	1.8416"-02	1.3549"+01	1.00800	0.99987	0.99686	0.99890	1.00410	1.00278
D 39	1.9050"-02	1.3631"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64010604 CLUTTER PROFILE TABULATION 32 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.15100	0.90654	0.00000	0.00000	2.61200	0.00000
2	1.2706"-04	2.2256"+00	1.15000	0.91142	0.37011	0.53481	2.08800	0.29455
3	2.5413"-04	3.0713"+00	1.14900	0.91588	0.45852	0.63053	1.89100	0.38312
4	3.8119"-04	3.7312"+00	1.14700	0.91959	0.51571	0.68534	1.76600	0.44512
5	5.0825"-04	4.2283"+00	1.14600	0.92323	0.55462	0.71994	1.68500	0.48965
6	6.3532"-04	4.5180"+00	1.14500	0.92618	0.57603	0.73835	1.64300	0.51455
7	7.6238"-04	4.7071"+00	1.14300	0.92932	0.58956	0.75015	1.61900	0.52960
8	8.8944"-04	4.8642"+00	1.14200	0.93209	0.60056	0.75765	1.60000	0.54220
9	1.0165"-03	5.0013"+00	1.14100	0.93517	0.60999	0.76795	1.58500	0.55283
10	1.1436"-03	5.1249"+00	1.14000	0.93746	0.61836	0.77506	1.57100	0.56242
11	1.2706"-03	5.2383"+00	1.13800	0.93991	0.62595	0.78156	1.55900	0.57050
12	1.9045"-03	5.7581"+00	1.13200	0.94917	0.65955	0.80886	1.50400	0.60880
13	2.5398"-03	6.2268"+00	1.12500	0.95653	0.68842	0.83097	1.45700	0.64162
14	3.1751"-03	6.6816"+00	1.11800	0.96381	0.71529	0.85087	1.41500	0.67228
15	3.8104"-03	7.1145"+00	1.11200	0.96878	0.73995	0.86767	1.37500	0.70171
16	4.4443"-03	7.5162"+00	1.10500	0.97251	0.76211	0.88188	1.33900	0.72776
17	5.0796"-03	7.8954"+00	1.09900	0.97533	0.78244	0.89418	1.30600	0.75245
18	5.7149"-03	8.3968"+00	1.09200	0.97823	0.80392	0.90668	1.27200	0.77838
19	6.3503"-03	8.7888"+00	1.08600	0.98114	0.82836	0.92018	1.23400	0.80982
20	6.9856"-03	9.2146"+00	1.07900	0.98417	0.84936	0.93159	1.20300	0.83556
21	7.6194"-03	9.7423"+00	1.07200	0.98713	0.87468	0.94449	1.16600	0.86835
22	8.2547"-03	1.0226"+01	1.06600	0.98768	0.89726	0.95549	1.13400	0.89820
23	8.8901"-03	1.0672"+01	1.05900	0.99187	0.91759	0.96499	1.10600	0.92399
24	9.5254"-03	1.1090"+01	1.05300	0.99383	0.93622	0.97339	1.08100	0.94818
25	1.0161"-02	1.1439"+01	1.04600	0.99544	0.95150	0.98010	1.06100	0.96624
26	1.0795"-02	1.1749"+01	1.09300	0.99695	0.96490	0.98590	1.04400	1.03217
27	1.1430"-02	1.1973"+01	1.03300	0.99798	0.97443	0.98990	1.03200	0.99086
28	1.2065"-02	1.2142"+01	1.02600	0.99861	0.98157	0.99280	1.02300	0.99571
29	1.2701"-02	1.2277"+01	1.02000	0.99917	0.98723	0.99510	1.01690	0.99902
30	1.3334"-02	1.2414"+01	1.01300	0.99973	0.99294	0.99740	1.00900	1.00135
31	1.3970"-02	1.2523"+01	1.00700	0.99974	0.99750	0.99900	1.00300	1.00298
D 32	1.4605"-02	1.2584"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64010605 CLUTTER PROFILE TABULATION 30 POINTS, DELTA AT POINT 30

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.12400	0.90300	0.00000	0.00000	2.53925	0.00000
2	1.2668"-04	2.6042"+00	1.12200	0.90481	0.42039	0.58360	1.92719	0.33977
3	2.5336"-04	3.4135"+00	1.12100	0.90661	0.49836	0.66080	1.75818	0.42132
4	3.8138"-04	4.4110"+00	1.12000	0.90897	0.57898	0.73010	1.59016	0.51423
5	5.0806"-04	4.9365"+00	1.11900	0.91172	0.61702	0.76000	1.51715	0.56055
6	6.3475"-04	5.1596"+00	1.11800	0.71462	0.63245	0.77230	1.49115	0.57904
7	7.6143"-04	5.2977"+00	1.11700	0.71800	0.64180	0.78030	1.47815	0.58965
8	8.8944"-04	5.4275"+00	1.11500	0.92177	0.65043	0.78790	1.46715	0.59879
9	1.0161"-03	5.5484"+00	1.11400	0.92591	0.65845	0.79510	1.45815	0.60744
10	1.1428"-03	5.6571"+00	1.11300	0.93344	0.66553	0.80310	1.45615	0.61385
11	1.2675"-03	5.7637"+00	1.11200	0.93883	0.67240	0.81000	1.45115	0.62070
12	1.9056"-03	6.2906"+00	1.10600	0.95627	0.70536	0.83880	1.41414	0.65603
13	2.5403"-03	6.7408"+00	1.10000	0.96565	0.73233	0.85940	1.37714	0.68645
14	3.1751"-03	7.1797"+00	1.09400	0.97080	0.75762	0.87640	1.33813	0.71651
15	3.8098"-03	7.5739"+00	1.08800	0.97395	0.77973	0.89010	1.30313	0.74316
16	4.4446"-03	8.0163"+00	1.08200	0.97732	0.80375	0.90440	1.26613	0.77288
17	5.0806"-03	8.4172"+00	1.07700	0.98002	0.82491	0.91640	1.23412	0.79973
18	5.7154"-03	8.8405"+00	1.07100	0.98279	0.84667	0.92830	1.20212	0.82705
19	6.3501"-03	9.2768"+00	1.06500	0.98572	0.86852	0.93990	1.17112	0.85473
20	6.9849"-03	9.6883"+00	1.05900	0.98819	0.88864	0.75010	1.'4311	0.88019
21	7.6176"-03	1.0089"+01	1.05300	0.99051	0.90781	0.95950	1. 1711	0.90443
22	8.2574"-03	1.0477"+01	1.04700	0.99266	0.72595	0.96810	1. 9311	0.92726
23	8.8904"-03	1.0859"+01	1.04100	0.99437	0.94349	0.97600	1.07011	0.94945
24	9.5252"-03	1.1189"+01	1.03500	0.99594	0.95842	0.78260	1.05111	0.96754
25	1.0160"-02	1.1460"+01	1.02900	0.99759	0.97073	0.98810	1.03610	0.98133
26	1.0795"-02	1.1695"+01	1.02400	0.99843	0.98036	0.99210	1.02410	0.99200
27	1.1429"-02	1.1830"+01	1.01800	0.79877	0.98669	0.99460	1.01610	0.99646
28	1.2066"-02	1.1946"+01	1.01200	0.99935	0.99170	0.79670	1.01010	0.99857
29	1.2700"-02	1.2063"+01	1.00600	0.99991	0.99676	0.99800	1.00410	1.00069
D 30	1.3335"-02	1.2158"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64011001 CLUTTER PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	0.89990	0.90706	0.00000	0.00000	2.85400	0.00000
2	1.2713E-04	3.0792E+00	0.90070	0.85101	0.42996	0.59530	1.91700	0.27970
3	2.5425E-04	3.8993E+00	0.90150	0.86577	0.49548	0.66180	1.78400	0.33442
4	3.8138E-04	4.4583E+00	0.90220	0.87968	0.53521	0.70070	1.71400	0.36883
5	5.0851E-04	4.8776E+00	0.90300	0.89201	0.56311	0.72770	1.67000	0.39348
6	6.3563E-04	5.1633E+00	0.90380	0.90424	0.58133	0.74650	1.64900	0.40915
7	7.6276E-04	5.3689E+00	0.90460	0.91272	0.59408	0.75940	1.63400	0.42041
8	8.8824E-04	5.5437E+00	0.90530	0.91955	0.60470	0.76990	1.62100	0.42998
9	1.0154E-03	5.7092E+00	0.90610	0.92482	0.61459	0.77910	1.60700	0.43929
10	1.1425E-03	5.8589E+00	0.90690	0.92977	0.62339	0.78730	1.59500	0.44765
11	1.2696E-03	5.9941E+00	0.90760	0.93457	0.63123	0.79470	1.58500	0.45506
12	1.9053E-03	6.5185E+00	0.9[illegible]50	0.94934	0.66075	0.82050	1.54200	0.48501
13	2.5392E-03	6.9282E+00	0.91530	0.95649	0.68291	0.83750	1.50400	0.50968
14	3.1749E-03	7.2682E+00	0.91920	0.96094	0.70076	0.85020	1.47200	0.53091
15	3.8105E-03	7.5476E+00	0.92300	0.96399	0.71510	0.85990	1.44600	0.54888
16	4.4445E-03	7.8023E+00	0.92690	0.96591	0.72790	0.86800	1.42200	0.56579
17	5.0801E-03	8.0634E+00	0.93070	0.96768	0.74080	0.87590	1.39800	0.58312
18	5.7158E-03	8.3385E+00	0.93460	0.96978	0.75415	0.88400	1.37400	0.60130
19	6.3497E-03	8.6477E+00	0.93840	0.97206	0.76888	0.89270	1.34800	0.62145
20	6.9854E-03	8.9893E+00	0.94230	0.97415	0.78483	0.90170	1.32000	0.64369
21	7.6194E-03	9.3740E+00	0.94610	0.97664	0.80244	0.91140	1.29000	0.66843
22	8.2550E-03	9.8057E+00	0.95000	0.97922	0.82168	0.92160	1.25800	0.69596
23	8.8906E-03	1.0331E+01	0.95380	0.98214	0.84453	0.93320	1.22100	0.72898
24	9.5246E-03	1.0877E+01	0.95770	0.98518	0.86765	0.94450	1.18500	0.76333
25	1.0160E-02	1.1404E+01	0.96150	0.98777	0.88940	0.95460	1.15200	0.79674
26	1.0794E-02	1.1948E+01	0.96540	0.99043	0.91127	0.96440	1.12000	0.83128
27	1.1430E-02	1.2500E+01	0.96920	0.99274	0.93297	0.97360	1.08900	0.86650
28	1.2066E-02	1.2970E+01	0.97310	0.99466	0.95104	0.98100	1.06400	0.89719
29	1.2699E-02	1.3391E+01	0.97690	0.99672	0.96693	0.98750	1.04300	0.92492
30	1.3335E-02	1.3733E+01	0.98080	0.99780	0.97965	0.99230	1.02600	0.94858
31	1.3971E-02	1.4035E+01	0.98460	0.99932	0.99077	0.99670	1.01200	0.96971
32	1.4605E-02	1.4182E+01	0.98850	0.99968	0.99611	0.99860	1.00500	0.98221
33	1.5240E-02	1.4248E+01	0.99230	0.99995	0.99850	0.99950	1.00200	0.98982
34	1.5874E-02	1.4289E+01	0.99620	1.00000	1.00000	1.00000	1.00000	0.99620
D 35	1.6510E-02	1.4289E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64011002 CLUTTER PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	0.86140	0.91479	0.00000	0.00000	2.90600	0.00000
2	1.2713E-04	3.1007E+00	0.86250	0.86173	0.42880	0.59956	1.95500	0.26451
3	2.5425E-04	4.8025E+00	0.86350	0.87102	0.55433	0.71377	1.65800	0.37174
4	3.8138E-04	5.3018E+00	0.86460	0.87969	0.58951	0.74357	1.59100	0.40408
5	5.0851E-04	5.6649E+00	0.86570	0.88809	0.60769	0.75998	1.56400	0.42066
6	6.3563E-04	5.8995E+00	0.86670	0.89397	0.62139	0.77188	1.54300	0.43356
7	7.6276E-04	6.0784E+00	0.86780	0.90401	0.63164	0.78308	1.53700	0.44213
8	8.8824E-04	6.2299E+00	0.86890	0.91243	0.64018	0.79233	1.53200	0.44941
9	1.0154E-03	6.3850E+00	0.86990	0.92053	0.64881	0.80148	1.52600	0.45689
10	1.1425E-03	6.5106E+00	0.87100	0.92690	0.65571	0.80868	1.52100	0.46309
11	1.2696E-03	6.6436E+00	0.87210	0.93314	0.66294	0.81598	1.51500	0.46971
12	1.9053E-03	7.2170E+00	0.87740	0.95196	0.69323	0.84278	1.47800	0.50031
13	2.5392E-03	7.6732E+00	0.88270	0.95904	0.71640	0.85939	1.43900	0.52716
14	3.1749E-03	8.0531E+00	0.88810	0.96325	0.73514	0.87169	1.40600	0.55060
15	3.8105E-03	8.3534E+00	0.89340	0.96575	0.74961	0.88059	1.38000	0.57009
16	4.4445E-03	8.6346E+00	0.89870	0.96765	0.76291	0.88839	1.35600	0.58879
17	5.0801E-03	8.9192E+00	0.90410	0.96982	0.77613	0.89609	1.33300	0.60777
18	5.7158E-03	9.1863E+00	0.90940	0.97172	0.78834	0.90297	1.31200	0.62590
19	6.3497E-03	9.4612E+00	0.91470	0.97356	0.80072	0.90979	1.29100	0.64461
20	6.9854E-03	9.7370E+00	0.92000	0.97565	0.81293	0.91649	1.27100	0.66339
21	7.6194E-03	1.0016E+01	0.92540	0.97742	0.82513	0.92249	1.25100	0.68269
22	8.2550E-03	1.0330E+01	0.93070	0.97913	0.83862	0.92969	1.22900	0.70404
23	8.8906E-03	1.0738E+01	0.93600	0.98163	0.85583	0.93829	1.20200	0.73065
24	9.5246E-03	1.1197E+01	0.94140	0.98426	0.87475	0.94739	1.17300	0.76034
25	1.0160E-02	1.1613E+01	0.94670	0.98670	0.89159	0.95530	1.14800	0.78779
26	1.0794E-02	1.2145E+01	0.95200	0.98917	0.91268	0.96460	1.11700	0.82211
27	1.1430E-02	1.2585E+01	0.95740	0.99144	0.92973	0.97200	1.09300	0.85141
28	1.2066E-02	1.3038E+01	0.96270	0.99338	0.94697	0.97910	1.06900	0.88174
29	1.2699E-02	1.3435E+01	0.96800	0.99516	0.96182	0.98510	1.04900	0.90903
30	1.3335E-02	1.3740E+01	0.97330	0.99639	0.97309	0.98950	1.03400	0.93141
31	1.3971E-02	1.4015E+01	0.97870	0.99759	0.98313	0.99340	1.02100	0.95224
32	1.4605E-02	1.4153E+01	0.98400	0.99857	0.98812	0.99550	1.01500	0.96510
33	1.5240E-02	1.4259E+01	0.98930	0.99091	0.99195	0.99690	1.01000	0.97647
34	1.5874E-02	1.4372E+01	0.99470	0.99952	0.99601	0.99850	1.00500	0.98827
D 35	1.6510E-02	1.4484E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64011003 CLUTTER PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.93290	0.90942	0.00000	0.00000	3.10831	0.00000
2	1.2713"-04	3.7850"+00	0.93340	0.92273	0.45874	0.66323	2.09021	0.29617
3	2.5425"-04	5.4096"+00	0.93380	0.93471	0.56208	0.75645	1.81118	0.39001
4	3.8138"-04	6.0630"+00	0.93430	0.94568	0.59847	0.78766	1.73217	0.42485
5	5.0851"-04	6.4620"+00	0.93480	0.95525	0.61962	0.80626	1.69317	0.44514
6	6.3563"-04	6.7793"+00	0.93530	0.96182	0.63592	0.81986	1.66217	0.46134
7	7.6276"-04	7.0796"+00	0.93570	0.96801	0.65097	0.83217	1.63416	0.47649
8	8.8824"-04	7.3496"+00	0.93620	0.97302	0.66421	0.84257	1.60916	0.49020
9	1.0154"-03	7.5041"+00	0.93670	0.97730	0.67549	0.85127	1.58816	0.50208
10	1.1425"-03	7.8163"+00	0.93720	0.98096	0.68648	0.85937	1.56716	0.51393
11	1.2696"-03	8.0258"+00	0.93760	0.98449	0.69624	0.86657	1.54915	0.52448
12	1.9053"-03	8.8999"+00	0.94000	0.99735	0.73556	0.89398	1.47715	0.56889
13	2.5392"-03	9.5693"+00	0.94240	1.00517	0.76429	0.91208	1.42414	0.60355
14	3.1749"-03	1.0081"+01	0.94470	1.01138	0.78554	0.92519	1.38714	0.63009
15	3.8105"-03	1.0486"+01	0.94710	1.01526	0.80195	0.93459	1.35814	0.65174
16	4.4445"-03	1.0841"+01	0.94940	1.01886	0.81606	0.94259	1.33413	0.67077
17	5.0801"-03	1.1164"+01	0.95180	1.02056	0.82869	0.94887	1.31113	0.68884
18	5.7158"-03	1.1492"+01	0.95420	1.02108	0.84132	0.95449	1.28713	0.70760
19	6.3497"-03	1.1808"+01	0.95650	1.02183	0.85332	0.95979	1.26513	0.72565
20	6.9854"-03	1.2130"+01	0.95890	1.02066	0.86539	0.96409	1.24112	0.74486
21	7.6194"-03	1.2460"+01	0.96120	1.01783	0.87777	0.96759	1.21512	0.76540
22	8.2530"-03	1.2893"+01	0.96360	1.01692	0.89293	0.97289	1.18712	0.78971
23	8.8906"-03	1.3235"+01	0.96600	1.01584	0.90551	0.97700	1.16412	0.81072
24	9.5246"-03	1.3606"+01	0.96830	1.01592	0.91859	0.98170	1.14211	0.83230
25	1.0160"-02	1.3962"+01	0.97070	1.01449	0.93097	0.98530	1.12011	0.85387
26	1.0794"-02	1.4339"+01	0.97310	1.01356	0.94388	0.98910	1.09811	0.87650
27	1.1430"-02	1.4612"+01	0.97540	1.01305	0.95314	0.99150	1.08211	0.89373
28	1.2066"-02	1.4935"+01	0.97890	1.01085	0.96398	0.99440	1.06411	0.91477
29	1.2699"-02	1.5242"+01	0.98120	1.01026	0.97414	0.99730	1.04810	0.93364
30	1.3335"-02	1.5492"+01	0.98360	1.00856	0.98239	0.99900	1.03410	0.95021
31	1.3971"-02	1.5684"+01	0.98590	1.00676	0.98865	1.00000	1.02310	0.96364
32	1.4605"-02	1.5810"+01	0.98870	1.00470	0.99273	1.00020	1.01510	0.97419
33	1.5240"-02	1.5898"+01	0.99300	1.00280	0.99558	1.00010	1.00910	0.98414
34	1.5874"-02	1.5978"+01	0.99570	1.00148	0.99816	1.00020	1.00410	0.99183
D 35	1.6510"-02	1.6036"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64011004 CLUTTER PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.99140	0.90081	0.00000	0.00000	3.13231	0.00000
2	1.2713"-04	3.2517"+00	0.99140	0.90106	0.41580	0.61466	2.18522	0.27886
3	2.5425"-04	4.7262"+00	0.99140	0.90715	0.51736	0.71147	1.89119	0.37297
4	3.8138"-04	5.5153"+00	0.99140	0.91242	0.56391	0.75028	1.77018	0.42020
5	5.0851"-04	6.0396"+00	0.99140	0.91774	0.59278	0.77338	1.70217	0.45044
6	6.3563"-04	6.3776"+00	0.99140	0.92323	0.61064	0.78798	1.66517	0.46914
7	7.6276"-04	6.6679"+00	0.99140	0.92860	0.62557	0.80018	1.63616	0.48485
8	8.8824"-04	6.9310"+00	0.99140	0.93297	0.63880	0.81058	1.61016	0.49909
9	1.0154"-03	7.1894"+00	0.99140	0.93697	0.65152	0.82028	1.58516	0.51303
10	1.1425"-03	7.4392"+00	0.99140	0.94098	0.66358	0.82938	1.56216	0.52636
11	1.2696"-03	7.6722"+00	0.99140	0.94514	0.67463	0.83778	1.54215	0.53858
12	1.9053"-03	8.6833"+00	0.99140	0.95750	0.72062	0.86899	1.45415	0.59245
13	2.5392"-03	9.5266"+00	0.99140	0.96679	0.75683	0.89169	1.38814	0.63684
14	3.1749"-03	1.0198"+01	0.99140	0.97319	0.78447	0.90779	1.33913	0.67206
15	3.8105"-03	1.0702"+01	0.99140	0.97734	0.80456	0.91879	1.30413	0.69847
16	4.4445"-03	1.1157"+01	0.99140	0.98017	0.82227	0.92779	1.27313	0.72248
17	5.0801"-03	1.1535"+01	0.99140	0.98220	0.83673	0.93479	1.24812	0.74252
18	5.7158"-03	1.1873"+01	0.99140	0.98355	0.84945	0.94059	1.22612	0.76053
19	6.3497"-03	1.2193"+01	0.99140	0.98487	0.86129	0.94589	1.20612	0.77750
20	6.9854"-03	1.2512"+01	0.99140	0.98638	0.87292	0.95110	1.18712	0.79429
21	7.6194"-03	1.2823"+01	0.99140	0.98781	0.88415	0.95600	1.16912	0.81068
22	8.2550"-03	1.3194"+01	0.99140	0.98922	0.89734	0.96150	1.14811	0.83025
23	8.8906"-03	1.3523"+01	0.99140	0.99045	0.90888	0.96620	1.13011	0.84760
24	9.5246"-03	1.3921"+01	0.99140	0.99194	0.92266	0.97170	1.10911	0.86857
25	1.0160"-02	1.4158"+01	0.99140	0.99289	0.93075	0.97490	1.09711	0.88096
26	1.0794"-02	1.4416"+01	0.99140	0.99371	0.93949	0.97820	1.08411	0.89455
27	1.1430"-02	1.4730"+01	0.99140	0.99508	0.95002	0.98230	1.06911	0.91090
28	1.2066"-02	1.5110"+01	0.99140	0.99630	0.96261	0.98690	1.05111	0.93084
29	1.2699"-02	1.5434"+01	0.99140	0.99716	0.97319	0.99060	1.03610	0.94786
30	1.3335"-02	1.5641"+01	0.99280	0.99807	0.97991	0.99310	1.02710	0.95993
31	1.3971"-02	1.5840"+01	0.99400	0.99844	0.98631	0.99520	1.01810	0.97164
32	1.4605"-02	1.5981"+01	0.99520	0.99896	0.99082	0.99680	1.01210	0.98015
33	1.5240"-02	1.6098"+01	0.99640	0.99936	0.99457	0.99810	1.00710	0.98749
34	1.5874"-02	1.6217"+01	0.99820	0.99976	0.99835	0.99940	1.00210	0.99551
D 35	1.6510"-02	1.6269"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

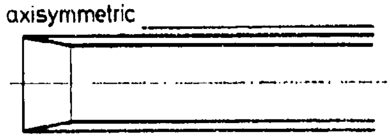
INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

64011005 CLUTTER PROFILE TABULATION 43 POINTS, DELTA AT POINT 43

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.91229	0.00000	0.00000	3.02400	0.00000
2	1.2738"-04	2.5503"+00	1.00000	0.86764	0.36681	0.54320	2.19300	0.24770
3	2.5476"-04	3.4743"+00	1.00000	0.87676	0.44363	0.62880	1.99100	0.31582
4	3.7998"-04	4.1701"+00	1.00000	0.88593	0.49604	0.67850	1.87100	0.36264
5	5.0736"-04	4.6021"+00	1.00000	0.89411	0.52477	0.70600	1.81000	0.39006
6	6.3475"-04	4.9783"+00	1.00000	0.90278	0.54850	0.72850	1.76400	0.41298
7	7.6213"-04	5.2971"+00	1.00000	0.90984	0.56782	0.74620	1.72700	0.43208
8	8.8951"-04	5.5999"+00	1.00000	0.91612	0.58556	0.76190	1.69300	0.45003
9	1.0169"-03	5.8736"+00	1.00000	0.92134	0.60113	0.77520	1.66300	0.46615
10	1.1421"-03	6.1165"+00	1.00000	0.92623	0.61461	0.78660	1.63800	0.48022
11	1.2695"-03	6.3445"+00	1.00000	0.93057	0.62699	0.79680	1.61500	0.49337
12	1.9042"-03	7.2946"+00	1.00000	0.94565	0.67612	0.83440	1.52300	0.54787
13	2.5390"-03	8.0742"+00	1.00000	0.95675	0.71387	0.86110	1.45500	0.59182
14	3.1759"-03	8.7514"+00	1.00000	0.96443	0.74510	0.88130	1.39900	0.62995
15	3.8106"-03	9.3422"+00	1.00000	0.97098	0.77130	0.89750	1.35400	0.66285
16	4.4454"-03	9.8422"+00	1.00000	0.96869	0.79279	0.90670	1.30800	0.69320
17	5.0801"-03	1.0292"+01	1.00000	0.97803	0.81164	0.91970	1.28400	0.71628
18	5.7149"-03	1.0707"+01	1.00000	0.98038	0.82864	0.92830	1.25500	0.73968
19	6.3496"-03	1.1077"+01	1.00000	0.98221	0.84351	0.93550	1.23000	0.76057
20	6.9844"-03	1.1399"+01	1.00000	0.98374	0.85626	0.94150	1.20900	0.77874
21	7.6191"-03	1.1708"+01	1.00000	0.98552	0.86830	0.94720	1.19000	0.79597
22	8.2560"-03	1.2033"+01	1.00000	0.98679	0.88077	0.95270	1.17000	0.81427
23	8.8908"-03	1.2307"+01	1.00000	0.98810	0.89114	0.95730	1.15400	0.82955
24	9.5255"-03	1.2573"+01	1.00000	0.98947	0.90111	0.96170	1.13900	0.84434
25	1.0160"-02	1.2892"+01	1.00000	0.99064	0.91294	0.96660	1.12100	0.86227
26	1.0795"-02	1.3264"+01	1.00000	0.99218	0.92654	0.97220	1.10100	0.88302
27	1.1430"-02	1.3634"+01	1.00000	0.99380	0.93983	0.97760	1.08200	0.90351
28	1.2064"-02	1.3913"+01	1.00000	0.99492	0.94974	0.98150	1.06800	0.91901
29	1.2699"-02	1.4154"+01	1.00000	0.99569	0.95823	0.98470	1.05600	0.93248
30	1.3334"-02	1.4360"+01	1.00000	0.99639	0.96544	0.98740	1.04600	0.94398
31	1.3971"-02	1.4552"+01	1.00000	0.99713	0.97208	0.98990	1.03700	0.95458
32	1.4606"-02	1.4702"+01	1.00000	0.99765	0.97725	0.99180	1.03000	0.96291
33	1.5240"-02	1.4814"+01	1.00000	0.99822	0.98111	0.99330	1.02500	0.96907
34	1.5875"-02	1.4965"+01	1.00000	0.99860	0.98626	0.99510	1.01800	0.97750
35	1.6510"-02	1.5078"+01	1.00000	0.99904	0.99009	0.99650	1.01300	0.98371
36	1.7145"-02	1.5145"+01	1.00000	0.99925	0.99235	0.99730	1.01000	0.98743
37	1.7779"-02	1.5171"+01	1.00000	0.99951	0.99324	0.99770	1.00900	0.98880
38	1.8414"-02	1.5212"+01	1.00000	0.99946	0.99462	0.99810	1.00700	0.99116
39	1.9051"-02	1.5238"+01	1.00000	0.99972	0.99552	0.99850	1.00600	0.99254
40	1.9686"-02	1.5280"+01	1.00000	0.99967	0.99691	0.99890	1.00400	0.99492
41	2.0321"-02	1.5309"+01	1.00000	1.00007	0.99790	0.99940	1.00300	0.99641
42	2.0955"-02	1.5351"+01	1.00000	1.00002	0.99930	0.99980	1.00100	0.99880
D 43	2.1590"-02	1.5372"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD,P/PD

axisymmetric	M : 6 R THETA X 10^{-3} : 2 - 15 TW/TR : 1	6501 ZPG - AW



Windtunnel: blow-down but effectively continuous, running time up to 45 minutes with 10 minutes settling time. W = 0.51, H = 0.52 m. PO : 3.6 MN/m^2 TO : 480 K. Air, Dew point 186 K. RE/m X 10^{-6} : 33.

ADCOCK J.B., PETERSON J.B. and McPEE D.I. 1965. Experimental investigation of a turbulent boundary layer at Mach 6, high Reynolds' numbers, and zero heat transfer. NASA TN D-2907.
And Peterson J.B. private communication. Also: Samuels, Peterson and Adcock (1967) CAT 6701.

1 The test boundary layer was formed on the exterior of a hollow cylindrical model. The leading edge (X = 0) was chamfered at 15° from the outer, test surface (D = 152.4 mm) to the hollow interior (D = 127 mm). From X = 0 to X = 1.07 m the diameter was constant. The model then flared out at 20° to a diameter of 203 mm which remained constant to the end of the model at X = 1.22 m. The model was supported on the tunnel floor by two pairs of sloping supports at approximately X = 0.8 and 1.15 m. Measurements were made on the top generator. The model surface roughness was less than 0.8 μm. For this experiment the model was
2 not actively cooled. There was a slight increase in Mach number along the test surface (see section B)
3 but departures from the mean gradient were no greater than 0.33 %. A boundary layer trip could be placed at X = 29 mm. This consisted of 1.9 mm diameter rods 0.64 mm high spaced round the periphery at intervals of about 6.4 mm. Schlieren photographs were taken in order to show the boundary layer development for both
5 natural and forced transition. After final alignment, the incidence determined from the static pressure distribution around the circumference was less than - 0.05° and the angle of yaw less than 0.10°.

6 Static pressure holes (d = 1.02 mm) were located circumferentially at intervals of 90° for X values
8 457, 660 and 864 mm, with an additional tapping on the top generator only at X = 254 mm. Five swaged copper-constantan thermocouples were welded to the inner side of the outer surface of the model at
7 X = 152, 356, 762 and 965 mm. The Pitot tube was a FPP (h_1 = 0.178, h_2 = 0.076, b_1 = 0.69, l = 12.7 mm)
8 and was carried by a traverse gear attached to the tunnel wall. Surveys were made at X = 127, 152, 203, 279, 838, 940 and 1016 mm. At X = 838 mm a total temperature survey was made using a STP (d_1 = approximately 0.51, l = 9.5 mm) containing a chromel-alumel thermocouple. This was directly calibrated over the greater part of the test range, with an interpolation between the calibration and the free stream reading for the upper unit Reynolds numbers.

9 Wall temperature is implicitly interpolated to the boundary layer traverse stations by the authors. The authors have taken the total temperature distribution, scaled on δ, to be the same for all values of X. The value of δ is defined by extrapolation to the free stream value of a near linear PT2 variation in the outer part of the layer. The scaled TO variation has then been interpolated to the appropriate Y values of the Pitot profiles. The static pressure has been assumed constant through the layer.

12 The editors have accepted the authors' interpolations and prepared the tables using the given U/UD and M/MD data, with the assumption of zero normal pressure gradient. The authors have calculated mean and local wall shear stress values from a longitudinal momentum balance. These have not been presented here.
13 The profiles presented were all obtained with forced transition except for one (0201) at X = 279 mm for which transition was natural. There is one duplicate (0107 A). Except for 0105 the total temperature data is assumed. The wall temperatures have been determined by the editors from the original data used to prepare the authors' graphical presentation of an "adiabatic recovery factor".

6 DATA: 6501 0101-0201. Pitot profiles. One TO profile used for all test cases. NX = 7.

15 Editors' comments

The entry describes the AW results obtained on the model also used, with a cooled wall, for Samuels et al. - CAT 6701. The experimental range overlaps the results of Danberg - CAT 6702 and Fischer & Maddalon - CAT 7103.

The profiles are given in moderately close detail. Some substantial corrections appear necessary close to the wall for profiles 0106 and 0107. It must be emphasised that the TO profile is assumed for all profiles except 0105. This measured profile appears to agree closely with the Crocco / Van Driest temperature-velocity correlation.

CAT 6501 ADCOCK BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ *	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
65010101	5.9500	0.9875	3.6382"+02	NM	18.5546	1.4050	2.4043"+03	2.4043"+03
1.2700"-01	3.6060"+06	1.0000	2.0582"+03	NM	1.8851	1.8359	4.3778"+02	6.0365"+01
7.6200"-02	4.8778"+02	0.0000	6.9280"-05	0.0000"+00	-0.2333	1.7070"-04	9.2687"+02	4.4333"+02
65010102	5.9500	0.9865	5.1944"+02	NM	17.2683	1.3501	2.4043"+03	2.4043"+03
1.5240"-01	3.6060"+06	1.0000	2.9425"+03	NM	1.8656	1.8163	4.3433"+02	5.9952"+01
7.6200"-02	4.8444"+02	0.0000	9.8025"-05	0.0000"+00	-0.0923	2.5275"-04	9.2370"+02	4.4030"+02
65010103	5.9500	0.9865	6.5242"+02	NM	17.6594	1.3324	2.3859"+03	2.3859"+03
2.0320"-01	3.5784"+06	1.0000	3.6970"+03	NM	1.8660	1.8178	4.3383"+02	5.9884"+01
7.6200"-02	4.8389"+02	0.0000	1.2390"-04	0.0000"+00	-0.1489	3.2243"-04	9.2317"+02	4.3979"+02
65010104	5.9600	0.9856	8.9252"+02	NM	16.6246	1.3007	2.3796"+03	2.3796"+03
2.7940"-01	3.6060"+06	1.0000	5.0677"+03	NM	1.8603	1.8205	4.3394"+02	5.9776"+01
7.6200"-02	4.8444"+02	0.0000	1.6953"-04	0.0000"+00	-0.0335	4.4368"-04	9.2389"+02	4.4028"+02
65010105	6.0200	0.9807	2.1444"+03	NM	15.9150	1.2545	2.2376"+03	2.2376"+03
8.3820"-01	3.6060"+06	1.0000	1.2351"+04	NM	1.8495	1.8121	4.3117"+02	5.8667"+01
7.6200"-02	4.8389"+02	0.0000	4.2294"-04	0.0000"+00	0.0348	1.1458"-03	9.2449"+02	4.3967"+02
65010106	6.0200	0.9796	2.1758"+03	NM	16.1528	1.2546	2.2376"+03	2.2376"+03
9.3980"-01	3.6060"+06	1.0000	1.2539"+04	NM	1.8511	1.8120	4.2872"+02	5.8397"+01
7.6200"-02	4.8167"+02	0.0000	4.2641"-04	0.0000"+00	0.0037	1.1537"-03	9.2237"+02	4.3765"+02
65010107	6.0200	0.9798	2.3177"+03	NM	15.9606	1.2397	2.2419"+03	2.2419"+03
1.0160"+00	3.6128"+06	1.0000	1.3341"+04	NM	1.8532	1.8164	4.3078"+02	5.8667"+01
7.6200"-02	4.8389"+02	0.0000	4.5594"-04	0.0000"+00	0.0167	1.2213"-03	9.2449"+02	4.3967"+02
65010107A	6.0200	0.9797	2.2583"+03	NM	16.5266	1.2479	2.2376"+03	2.2376"+03
1.0160"+00	3.6060"+06	1.0000	1.3042"+04	NM	1.8542	1.8177	4.2578"+02	5.7993"+01
7.6200"-02	4.7833"+02	0.0000	4.3889"-04	0.0000"+00	-0.0464	1.1912"-03	9.1917"+02	4.3462"+02
65010201	5.9600	0.9855	7.8539"+02	NM	17.3812	1.2859	2.3842"+03	2.3842"+03
2.7940"-01	3.6128"+06	1.0000	4.4426"+03	NM	1.8665	1.8284	4.3939"+02	6.0530"+01
7.6200"-02	4.9056"+02	0.0000	1.5117"-04	0.0000"+00	-0.1271	3.9440"-04	9.2970"+02	4.4583"+02

65010101 ADCOCK PROFILE TABULATION 17 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92821	0.00000	0.00000	7.50037	0.00000
2	8.8900"-05	3.9969"+00	NM	0.95108	0.27674	0.61776	4.98306	0.12397
3	2.0066"-04	5.9585"+00	NM	0.96584	0.34642	0.71158	4.21932	0.16665
4	2.3876"-04	8.0770"+00	NM	0.97592	0.40824	0.77645	3.61731	0.21465
5	3.0734"-04	1.0132"+01	NM	0.98766	0.46026	0.82236	3.19243	0.25760
6	4.1148"-04	1.1981"+01	NM	0.99492	0.50245	0.85329	2.88407	0.29586
7	5.5372"-04	1.5035"+01	NM	1.00586	0.56526	0.89222	2.49140	0.35812
8	7.3152"-04	1.6057"+01	NM	1.00995	0.59961	0.90968	2.30167	0.39523
9	9.4488"-04	1.8449"+01	NM	1.03505	0.62807	0.93263	2.20502	0.42296
10	1.3208"-03	2.3224"+01	NM	1.01794	0.70658	0.95160	1.81380	0.52464
11	1.6967"-03	2.8771"+01	NM	1.01626	0.78803	0.97206	1.52160	0.63884
12	2.0142"-03	3.2857"+01	NM	1.01300	0.84298	0.98204	1.35712	0.72362
13	2.4436"-03	3.9335"+01	NM	1.00512	0.92345	0.99202	1.15400	0.85963
14	2.9769"-03	4.4012"+01	NM	1.00077	0.97743	0.99750	1.04150	0.95776
15	3.5230"-03	4.5511"+01	NM	0.99947	0.99411	0.99900	1.00986	0.98925
16	4.1580"-03	4.5867"+01	NM	0.99949	0.99804	0.99950	1.00294	0.99658
D 17	5.0749"-03	4.6046"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD
AT I=2 DATA WERE AVERAGED

65010104 ADCOCK PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

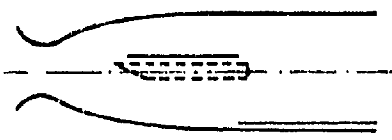
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88593	0.00000	0.00000	7.17983	0.00000
2	8.8900"-05	4.0064"+00	NM	0.92697	0.27666	0.61031	4.86633	0.12541
3	1.7272"-04	4.2883"+00	NM	0.92853	0.28773	0.62631	4.73831	0.13218
4	2.8448"-04	4.9154"+00	NM	0.93330	0.31087	0.65833	4.48479	0.14679
5	3.9370"-04	6.7194"+00	NM	0.94655	0.36922	0.72886	3.89703	0.18703
6	5.9944"-04	8.2609"+00	NM	0.95564	0.41247	0.77239	3.50650	0.22027
7	1.0287"-03	1.0787"+01	NM	0.97243	0.47485	0.82641	3.02889	0.27284
8	1.2878"-03	1.1861"+01	NM	0.97958	0.49899	0.84492	2.86710	0.29470
9	1.5646"-03	1.3230"+01	NM	0.98556	0.52817	0.86443	2.67865	0.32271
10	2.2073"-03	1.6857"+01	NM	0.99770	0.59859	0.90395	2.28050	0.39638
11	2.8524"-03	2.1309"+01	NM	1.00730	0.67505	0.93697	1.92654	0.48635
12	3.4874"-03	2.6504"+01	NM	1.01284	0.75453	0.96248	1.62718	0.59150
13	4.1783"-03	3.2431"+01	NM	1.01246	0.83602	0.98049	1.37549	0.71283
14	4.8412"-03	3.7875"+01	NM	1.00700	0.90443	0.98999	1.19817	0.82625
15	5.5829"-03	4.2328"+01	NM	1.00333	0.95674	0.99600	1.08375	0.91903
16	6.0579"-03	4.4558"+01	NM	1.00158	0.98189	0.99850	1.03411	0.96556
17	6.8504"-03	4.6107"+01	NM	0.99925	0.99899	0.99950	1.00101	0.99849
D 18	7.4498"-03	4.6199"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD
AT I=2 DATA WERE AVERAGED

65010107 ADCOCK PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88668	0.00000	0.00000	7.31344	0.00000
2	8.8900"-05	4.0735"+00	NM	0.92287	0.27655	0.61200	4.89718	0.12497
3	9.3980"-05	4.0735"+00	NM	0.92287	0.27655	0.61200	4.89718	0.12497
4	1.6764"-04	4.2283"+00	NM	0.92150	0.28257	0.62000	4.81445	0.12878
5	2.4638"-04	4.4942"+00	NM	0.92395	0.29259	0.63450	4.70282	0.13492
6	4.1402"-04	5.4702"+00	NM	0.93174	0.32665	0.68000	4.33355	0.15692
7	5.6134"-04	6.2259"+00	NM	0.93726	0.35070	0.70900	4.08712	0.17347
8	7.3152"-04	6.8287"+00	NM	0.94347	0.36874	0.73000	3.91932	0.18626
9	1.0973"-03	7.4983"+00	NM	0.94784	0.38778	0.75000	3.74078	0.20049
10	1.4300"-03	8.0136"+00	NM	0.95002	0.40180	0.76350	3.61069	0.21146
11	1.7374"-03	8.4314"+00	NM	0.95263	0.41283	0.77400	3.51519	0.22019
12	2.4079"-03	9.4645"+00	NM	0.95923	0.43888	0.79750	3.30198	0.24152
13	3.0175"-03	1.0561"+01	NM	0.96802	0.46493	0.82000	3.11066	0.26361
14	3.6525"-03	1.1630"+01	NM	0.97552	0.48898	0.83900	2.94405	0.28498
15	4.6838"-03	1.3681"+01	NM	0.98475	0.53206	0.86800	2.66141	0.32614
16	5.6642"-03	1.6013"+01	NM	0.99323	0.57715	0.89400	2.39934	0.37260
17	6.8758"-03	1.9240"+01	NM	1.00212	0.63427	0.92150	2.11079	0.43657
18	8.2042"-03	2.3161"+01	NM	1.00950	0.69739	0.94600	1.84003	0.51412
19	9.8146"-03	2.8968"+01	NM	1.01253	0.78156	0.96950	1.53875	0.63006
20	1.1428"-02	3.5680"+01	NM	1.00846	0.86874	0.98500	1.28557	0.76620
21	1.3033"-02	4.2656"+01	NM	1.00274	0.95090	0.99500	1.09490	0.90876
22	1.4635"-02	4.6472"+01	NM	0.99972	0.99299	0.99900	1.01215	0.98701
D 23	1.5278"-02	4.7125"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD



M : 2.8

R THETA X 10^{-3} : a) 180-700
b) 57

TW / TR : About 1.0

6502

ZPG - AW

Blow-down tunnel, running time 10-[illegible]0 s. W = H = 1.22 m
0.34 < PO < 1.04 MN/m^2. TO : 285 - 320 K. Air. 30 < RE/m X 10^{-6} < 90.

MOORE D.R. and HARKNESS J. 1965. Experimental investigations of the compressible turbulent boundary layer at very high Reynolds numbers. AIAA J. 3. 631-638.
And Harkness J., Private communication.

1a The test boundary layer was formed on a continuation of the floor of the 1.22 x 1.22 m tunnel, surveys
8a being made at 9.14, 11.89 and 14.63 m from the throat (X = 0). The test surface was constructed of rolled
1b aluminium finished to 0.63 µm. For comparison, tests were also made on a flat plate model (L = 3.05, W = 1.22 m) mounted, on separate occasions, at the centre of the working section. The leading edge (X = 0)
3 was 0.05 - 0.10 mm thick and the surface finish was 0.25 µm. For the tests described here, transition was
2 natural. Static pressure variations on the test surface were as much as 10 - 20 % on the tunnel floor and 5 - 10 % on the flat plate. The mean pressure variation on the tunnel floor extension showed a slight adverse pressure gradient.

6 Static pressure was measured at 32 - 34 stations for each test series, at intervals of about 85 mm on the plate and 305 mm on the floor. A FEB (element diameter 50.8 mm) could be mounted at the three floor stations and at two stations on the plate, data from the downstream station (X = 2.74 m) being presented here. No wall temperatures were measured, the temperature of the massive structure remaining at room temperature, about 290 K.

7 Pitot pressure profiles were measured with CPP. On the floor, four CPP were mounted as a rake, on a single traverse gear at vertical intervals of 38.1 mm. For the outer three, d_1 = 1.62 mm, and for the inner, d_1 = 1.07 mm. For the flat plate tests, a single CPP (d_1 = 1.07 mm) was used.

9 The wall shear stress and the profile for a given station were measured on separate occasions. The CF value has been interpolated to the profile boundary conditions on the basis of a common unit Reynolds number.
11 Sutherland's viscosity law was used.

12 The authors assumed that the boundary layer was isoenergetic. The editors have replaced this with the Crocco / Van Driest temperature / velocity correlation and the assumption TW = 290 K. The static pressure has also been assumed constant through the layer. The number of data points for each profile was exceptionally large. We have replaced our usual integration scheme with the trapezoidal rule so as to improve the handling of the scatter of the data.

13 The available profiles consist of two sets for the three successive floor stations at an approximately constant (10 %) unit Reynolds number. There are also two individual profiles for the first station. Two
14 individual profiles for the flat plate are also given. (0501, 0601). The authors' interpolated wall shear stress measurements are also presented.

§ DATA: 6502 0101-0601. Pitot profiles. NX = 1-3 (a), 1 (b). CF from FEB.

15 Editors' comments

The general experimental conditions for this entry would appear to have been fairly rough and ready. Nevertheless, the data are of value as the profiles were obtained at exceptionally high Reynolds number, and are supported by direct measurements of wall shear stress. At this moderate Mach number, the absence of TO profiles is not important for a near-adiabatic boundary layer. Since, for the tunnel wall tests, the X-dimension was as much as 10 times the width, it is probable that some three dimensional effects are present. Despite the large physical scale, the measurements do not generally extend within the momentum deficit peak. The source paper gives a greater range of CF and R THETA values than that presented here. The only comparable experiment is that of Thomke - CAT 6903 with very similar general conditions.

CAT 6502 MOORE/HARKNESS BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X RZ	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
65020101 NM INFINITE	2.8310 1.0342"+06 2.9778"+02	1.0405 1.0000 0.0000	1.9039"+05 4.2407"+05 5.1125"-03	9.0000"-04 NM NM	4.4017 1.8634 0.0978	1.2235 1.8521 6.9749"-03	3.6350"+04 2.9000"+02 6.0711"+02	3.6350"+04 1.1440"+02 2.7871"+02
65020102 NM INFINITE	2.7870 1.0055"+06 3.1556"+02	0.9811 1.0000 0.0000	2.5535"+05 5.2916"+05 6.9627"-03	8.4900"-04 NM NM	4.1466 1.8629 0.1457	1.2156 1.8516 9.3064"-03	3.7793"+04 2.9000"+02 6.2118"+02	3.7793"+04 1.2358"+02 2.9559"+02
65020103 NM INFINITE	2.6690 1.0246"+06 3.0444"+02	1.0146 1.0000 0.0000	3.5931"+05 7.3368"+05 8.4432"-03	8.6200"-04 NM NM	4.0274 1.8582 0.0999	1.2176 1.8472 1.1248"-02	4.6159"+04 2.9000"+02 5.9963"+02	4.6159"+04 1.2556"+02 2.8584"+02
65020201 NM INFINITE	2.8430 8.3216"+05 2.9167"+02	1.0626 1.0000 0.0000	1.5905"+05 3.6305"+05 5.3135"-03	9.5300"-04 NM NM	4.4477 1.8609 0.0941	1.2257 1.8494 7.3076"-03	2.8719"+04 2.9000"+02 6.0182"+02	2.8719"+04 1.1147"+02 2.7293"+02
65020202 NM INFINITE	2.8090 8.1684"+05 3.1667"+02	0.9781 1.0000 0.0000	2.0577"+05 4.2884"+05 7.0451"-03	8.7400"-04 NM NM	4.1890 1.8613 0.1493	1.2171 1.8501 9.5012"-03	2.9688"+04 2.9000"+02 6.2418"+02	2.9688"+04 1.2283"+02 2.9651"+02
65020203 NM INFINITE	2.6930 8.2737"+05 3.0056"+02	1.0282 1.0000 0.0000	2.8725"+05 5.9944"+05 8.4966"-03	8.9100"-04 NM NM	4.1034 1.8572 0.0928	1.2187 1.8460 1.1413"-02	3.5920"+04 2.9000"+02 5.9798"+02	3.5920"+04 1.2265"+02 2.8205"+02
65020301 NM INFINITE	2.8650 4.8359"+05 2.9500"+02	1.0510 1.0000 0.0000	9.8145"+04 2.2365"+05 5.7945"-03	9.8700"-04 NM NM	4.5674 1.8598 0.0725	1.2260 1.8476 8.0619"-03	1.6140"+04 2.9000"+02 6.0703"+02	1.6140"+04 1.1167"+02 2.7593"+02
65020401 NM INFINITE	2.8970 3.4474"+05 2.8889"+02	1.0738 1.0000 0.0000	7.0161"+04 1.6524"+05 5.9282"-03	1.0200"-03 NM NM	4.6959 1.8583 0.0580	1.2286 1.8454 8.3569"-03	1.0961"+04 2.9000"+02 6.0322"+02	1.0961"+04 1.0785"+02 2.7006"+02
65020501 NM INFINITE	2.9080 3.4342"+05 2.9500"+02	1.0518 1.0000 0.0000	2.1687"+04 5.0298"+04 1.8784"-03	1.2300"-03 NM NM	4.8277 1.8509 0.0784	1.3396 1.8376 2.6756"-03	1.0739"+04 2.9000"+02 6.1043"+02	1.0739"+04 1.0961"+02 2.7572"+02
65020601 NM INFINITE	2.9100 3.4563"+05 3.0444"+02	1.0192 1.0000 0.0000	2.1657"+04 4.8792"+04 1.8970"-03	1.2400"-03 NM NM	4.7646 1.8514 0.1031	1.3487 1.8385 2.6819"-03	1.0776"+04 2.9000"+02 6.2028"+02	1.0776"+04 1.1302"+02 2.8454"+02

TRAPEZOIDAL RULE FOR ALL INTEGRATIONS

65020101 MOORE/HARKNESS PROFILE TABULATION 72 POINTS, DELTA AT POINT 70

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96489	0.00000	0.00000	2.51152	0.00000
2	5.3340"-04	2.5558"+00	NM	0.96915	0.44143	0.61202	1.92221	0.31839
3	9.9314"-04	3.0245"+00	NM	0.97203	0.49203	0.66429	1.82278	0.36444
4	1.6612"-03	3.3777"+00	NM	0.97407	0.52651	0.69758	1.75541	0.39739
5	2.3800"-03	3.6790"+00	NM	0.97573	0.55408	0.72288	1.70213	0.42469
6	3.2106"-03	3.8891"+00	NM	0.97685	0.57245	0.73911	1.66701	0.44337
7	4.0716"-03	4.0707"+00	NM	0.97778	0.58784	0.75231	1.63787	0.45932
8	4.9860"-03	4.1727"+00	NM	0.97830	0.59630	0.75943	1.62197	0.46822
9	6.0554"-03	4.3240"+00	NM	0.97904	0.60862	0.76961	1.59897	0.48131
10	7.1577"-03	4.5972"+00	NM	0.98035	0.63023	0.78694	1.55914	0.50472
11	8.3083"-03	4.7159"+00	NM	0.98090	0.63938	0.79408	1.54247	0.51481
12	9.6190"-03	4.9103"+00	NM	0.98179	0.65407	0.80532	1.51595	0.53123
13	1.0993"-02	4.9835"+00	NM	0.98211	0.65952	0.80941	1.50621	0.53738
14	1.2502"-02	5.0958"+00	NM	0.98261	0.66779	0.81555	1.49151	0.54680
15	1.4067"-02	5.3103"+00	NM	0.98353	0.68329	0.82682	1.46424	0.56468
16	1.5646"-02	5.5365"+00	NM	0.98447	0.69925	0.83811	1.43657	0.58341
17	1.7313"-02	5.6651"+00	NM	0.98499	0.70817	0.84427	1.42131	0.59401
18	1.9149"-02	5.6870"+00	NM	0.98508	0.70967	0.84529	1.41876	0.59580
19	2.1036"-02	5.7530"+00	NM	0.98534	0.71419	0.84838	1.41107	0.60123
20	2.3045"-02	6.0513"+00	NM	0.98650	0.73426	0.86175	1.37743	0.62562
21	2.5108"-02	6.3448"+00	NM	0.98760	0.75347	0.87412	1.34587	0.64948
22	2.7264"-02	6.2946"+00	NM	0.98741	0.75022	0.87206	1.35116	0.64541
23	2.9588"-02	6.6846"+00	NM	0.98881	0.77511	0.88754	1.31113	0.67692
24	3.1880"-02	6.8217"+00	NM	0.98928	0.78367	0.89270	1.29762	0.68795
25	3.4607"-02	6.8217"+00	NM	0.98928	0.78367	0.89270	1.29762	0.68795
26	3.6403"-02	7.0783"+00	NM	0.99015	0.79944	0.90201	1.27308	0.70853
27	3.6485"-02	7.1076"+00	NM	0.99024	0.80122	0.90305	1.27034	0.71087
28	3.8976"-02	7.3482"+00	NM	0.99102	0.81569	0.91134	1.24827	0.73008
29	3.9436"-02	7.4413"+00	NM	0.99132	0.82122	0.91445	1.23994	0.73749
30	4.0104"-02	7.5042"+00	NM	0.99152	0.82494	0.91652	1.23437	0.74250
31	4.0823"-02	7.5679"+00	NM	0.99172	0.82868	0.91860	1.22878	0.74757
32	4.1653"-02	7.6976"+00	NM	0.99211	0.83625	0.92275	1.21757	0.75786
33	4.2515"-02	7.6976"+00	NM	0.99211	0.83625	0.92275	1.21757	0.75786
34	4.3429"-02	7.6324"+00	NM	0.99191	0.83245	0.92067	1.22318	0.75269
35	4.4498"-02	7.7968"+00	NM	0.99242	0.84200	0.92586	1.20912	0.76573
36	4.5601"-02	8.0354"+00	NM	0.99312	0.85566	0.93314	1.18929	0.78462
37	4.6751"-02	8.0007"+00	NM	0.99302	0.85369	0.93210	1.19213	0.78187
38	4.8062"-02	8.2122"+00	NM	0.99364	0.86564	0.93834	1.17502	0.79857
39	4.9436"-02	8.0354"+00	NM	0.99312	0.85566	0.93314	1.18929	0.78462
40	5.0945"-02	8.2122"+00	NM	0.99364	0.86564	0.93834	1.17502	0.79857
41	5.2509"-02	8.3208"+00	NM	0.99395	0.87171	0.94146	1.16642	0.80714
42	5.4089"-02	8.5824"+00	NM	0.99467	0.88617	0.94875	1.14622	0.82772
43	5.5796"-02	8.7764"+00	NM	0.99520	0.89674	0.95396	1.13169	0.84295
44	5.7592"-02	8.8958"+00	NM	0.99551	0.90318	0.95709	1.12293	0.85231
45	5.9479"-02	8.8558"+00	NM	0.99541	0.90103	0.95605	1.12586	0.84917
46	6.1488"-02	9.1001"+00	NM	0.99604	0.91410	0.96231	1.10826	0.86830
47	6.3551"-02	9.4412"+00	NM	0.99690	0.93204	0.97067	1.08460	0.89495
48	6.5707"-02	9.3975"+00	NM	0.99680	0.92976	0.96962	1.08757	0.89155
49	6.8031"-02	9.6638"+00	NM	0.99745	0.94356	0.97589	1.06970	0.91231
50	7.0322"-02	9.8475"+00	NM	0.99788	0.95297	0.98008	1.05771	0.92660
51	7.3132"-02	9.8011"+00	NM	0.99777	0.95060	0.97903	1.06072	0.92299
52	7.4846"-02	1.0036"+01	NM	0.99832	0.96253	0.98427	1.04567	0.94128
53	7.4927"-02	9.9412"+00	NM	0.99810	0.95773	0.98217	1.05170	0.93389
54	7.7076"-02	9.9412"+00	NM	0.99810	0.95773	0.98217	1.05170	0.93389
55	7.7536"-02	9.9412"+00	NM	0.99810	0.95773	0.98217	1.05170	0.93389
56	7.8204"-02	1.0036"+01	NM	0.99832	0.96253	0.98427	1.04567	0.94128
57	7.8923"-02	9.8942"+00	NM	0.99799	0.95534	0.98113	1.05471	0.93023
58	7.9753"-02	1.0230"+01	NM	0.99877	0.97227	0.98846	1.03357	0.95635
59	8.0615"-02	1.0181"+01	NM	0.99866	0.96982	0.98741	1.03660	0.95255
60	8.1529"-02	1.0280"+01	NM	0.99888	0.97474	0.98951	1.03054	0.96019
61	8.2598"-02	1.0380"+01	NM	0.99910	0.97970	0.99161	1.02446	0.96793
62	8.3701"-02	1.0481"+01	NM	0.99932	0.98470	0.99370	1.01837	0.97578
63	8.4851"-02	1.0430"+01	NM	0.99921	0.98219	0.99265	1.02141	0.97184
64	8.6162"-02	1.0584"+01	NM	0.99955	0.98975	0.99580	1.01226	0.98374
65	8.7536"-02	1.0380"+01	NM	0.99910	0.97970	0.99161	1.02446	0.96793
66	8.9045"-02	1.0584"+01	NM	0.99955	0.98975	0.99580	1.01226	0.98374
67	9.0609"-02	1.0430"+01	NM	0.99921	0.98219	0.99265	1.02141	0.97184
68	9.2189"-02	1.0584"+01	NM	0.99955	0.98975	0.99580	1.01226	0.98374
69	9.3836"-02	1.0636"+01	NM	0.99966	0.99230	0.99685	1.00920	0.98776
D 70	9.5692"-02	1.0794"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
71	9.7579"-02	1.0741"+01	NM	0.99989	0.99742	0.99895	1.00307	0.99589
72	9.9588"-02	1.0688"+01	NM	0.99977	0.99485	0.99790	1.00614	0.99181

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

65020103 MOORE/HARKNESS PROFILE TABULATION 60 POINTS, DELTA AT POINT 60

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.95255	0.00000	0.00000	2.30967	0.00000
2	5.3340E-04	2.2092E+00	NM	0.96505	0.42302	0.57763	1.86460	0.30979
3	9.4234E-04	2.3794E+00	NM	0.96651	0.44597	0.60255	1.82608	0.33002
4	1.7501E-03	2.8481E+00	NM	0.97022	0.50248	0.66093	1.73014	0.38201
5	2.7305E-03	3.0960E+00	NM	0.97202	0.52953	0.68718	1.68410	0.40804
6	3.9141E-03	3.4274E+00	NM	0.97429	0.56340	0.71858	1.62671	0.44174
7	5.2172E-03	3.6520E+00	NM	0.97574	0.58515	0.73789	1.59018	0.46403
8	7.0409E-03	3.7774E+00	NM	0.97653	0.59692	0.74806	1.57054	0.47631
9	9.1897E-03	4.1290E+00	NM	0.97864	0.62867	0.77459	1.51810	0.51024
10	1.1173E-02	4.0865E+00	NM	0.97839	0.62492	0.77153	1.52425	0.50617
11	1.4039E-02	4.3049E+00	NM	0.97964	0.64393	0.78687	1.49322	0.52696
12	1.7178E-02	4.6357E+00	NM	0.98144	0.67164	0.80839	1.44867	0.55803
13	2.1112E-02	4.8740E+00	NM	0.98268	0.69089	0.82278	1.41823	0.58015
14	2.5695E-02	4.8565E+00	NM	0.98259	0.68950	0.82175	1.42043	0.57853
15	3.0246E-02	5.3396E+00	NM	0.98496	0.72698	0.84855	1.36241	0.62283
16	3.4930E-02	5.4395E+00	NM	0.98543	0.73448	0.85371	1.35102	0.63190
17	3.9578E-02	5.7107E+00	NM	0.98666	0.75447	0.86716	1.32103	0.65642
18	3.9271E-02	5.8418E+00	NM	0.98723	0.76394	0.87337	1.30702	0.66822
19	4.0135E-02	5.6254E+00	NM	0.98628	0.74824	0.86302	1.33031	0.64873
20	4.1151E-02	5.8640E+00	NM	0.98733	0.76553	0.87441	1.30467	0.67021
21	4.2393E-02	5.9088E+00	NM	0.98752	0.76873	0.87648	1.29997	0.67423
22	4.3731E-02	6.0926E+00	NM	0.98830	0.78173	0.88478	1.28104	0.69067
23	4.5613E-02	5.7976E+00	NM	0.98704	0.76076	0.87130	1.31170	0.66425
24	4.7841E-02	6.1634E+00	NM	0.98860	0.78668	0.88789	1.27389	0.69700
25	5.0422E-02	6.3085E+00	NM	0.98919	0.79671	0.89413	1.25950	0.70991
26	5.3190E-02	6.4581E+00	NM	0.98979	0.80693	0.90037	1.24500	0.72319
27	5.5977E-02	6.4328E+00	NM	0.98969	0.80521	0.89933	1.24742	0.72095
28	6.1260E-02	6.6915E+00	NM	0.99070	0.82262	0.90974	1.22303	0.74384
29	6.4706E-02	6.7718E+00	NM	0.99101	0.82795	0.91287	1.21565	0.75093
30	6.9291E-02	7.2527E+00	NM	0.99276	0.85914	0.93061	1.17330	0.79316
31	7.4036E-02	7.4030E+00	NM	0.99329	0.86866	0.93584	1.16067	0.80630
32	7.7422E-02	7.4030E+00	NM	0.99329	0.86866	0.93584	1.16067	0.80630
33	7.7470E-02	7.4030E+00	NM	0.99329	0.86866	0.93584	1.16067	0.80630
34	7.8285E-02	7.1066E+00	NM	0.99224	0.84978	0.92539	1.18585	0.78036
35	7.9301E-02	7.5263E+00	NM	0.99371	0.87639	0.94003	1.15051	0.81706
36	8.0543E-02	7.3123E+00	NM	0.99297	0.86293	0.93270	1.16826	0.79837
37	8.1882E-02	7.5891E+00	NM	0.99392	0.88030	0.94212	1.14540	0.82253
38	8.3764E-02	7.2824E+00	NM	0.99287	0.86103	0.93166	1.17078	0.79576
39	8.5492E-02	7.6525E+00	NM	0.99413	0.88423	0.94422	1.14029	0.82805
40	8.8572E-02	7.8806E+00	NM	0.99488	0.89822	0.95156	1.12229	0.84787
41	9.1341E-02	8.0152E+00	NM	0.99532	0.90637	0.95575	1.11193	0.85954
42	9.4127E-02	7.8806E+00	NM	0.99488	0.89822	0.95156	1.12229	0.84787
43	9.9411E-02	8.0837E+00	NM	0.99553	0.91050	0.95785	1.10673	0.86548
44	1.0286E-01	8.2232E+00	NM	0.99597	0.91883	0.96206	1.09630	0.87755
45	1.0744E-01	8.7008E+00	NM	0.99740	0.94681	0.97573	1.06202	0.91875
46	1.1219E-01	8.7008E+00	NM	0.99740	0.94681	0.97573	1.06202	0.91875
47	1.1562E-01	8.7008E+00	NM	0.99740	0.94681	0.97573	1.06202	0.91875
48	1.1552E-01	8.9346E+00	NM	0.99807	0.96021	0.98205	1.04601	0.93886
49	1.1639E-01	8.6626E+00	NM	0.99729	0.94461	0.97468	1.06467	0.91547
50	1.1740E-01	9.0955E+00	NM	0.99852	0.96932	0.98627	1.03527	0.95267
51	1.1864E-01	8.8557E+00	NM	0.99785	0.95571	0.97994	1.05136	0.93208
52	1.1998E-01	9.0955E+00	NM	0.99852	0.96932	0.98627	1.03527	0.95267
53	1.2186E-01	8.8557E+00	NM	0.99785	0.95571	0.97994	1.05136	0.93208
54	1.2409E-01	9.1364E+00	NM	0.99863	0.97163	0.98732	1.03258	0.95618
55	1.2667E-01	9.3449E+00	NM	0.99920	0.98328	0.99260	1.01906	0.97404
56	1.2944E-01	9.4302E+00	NM	0.99943	0.98800	0.99472	1.01363	0.98134
57	1.3223E-01	9.3026E+00	NM	0.99909	0.98093	0.99155	1.02177	0.97042
58	1.3751E-01	9.4733E+00	NM	0.99954	0.99038	0.99577	1.01091	0.98502
59	1.4096E-01	9.5166E+00	NM	0.99966	0.99277	0.99683	1.00819	0.98873
D 60	1.4554E-01	9.6485E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

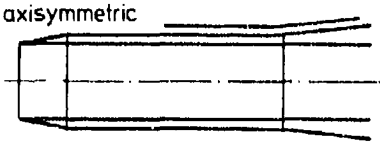
INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

65020501 MOORE/HARKNESS PROFILE TABULATION 73 POINTS, DELTA AT POINT 73

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.97982	0.00000	0.00000	2.63699	0.00000
2	7.0358"-04	2.7425"+00	NM	0.97659	0.45012	0.62977	1.95750	0.32172
3	9.3218"-04	3.0176"+00	NM	0.97775	0.47831	0.65884	1.89727	0.34725
4	1.1455"-03	3.3390"+00	NM	0.97907	0.50901	0.68898	1.83213	0.37605
5	1.3665"-03	3.5642"+00	NM	0.97998	0.52936	0.70811	1.78937	0.39573
6	1.6205"-03	3.7161"+00	NM	0.98058	0.54261	0.72021	1.76175	0.40880
7	1.8821"-03	3.9171"+00	NM	0.98135	0.55963	0.73535	1.72656	0.42591
8	2.1311"-03	4.0442"+00	NM	0.98184	0.57011	0.74445	1.70509	0.43660
9	2.4282"-03	4.1913"+00	NM	0.98238	0.58200	0.75457	1.68091	0.44890
10	2.6772"-03	4.2064"+00	NM	0.98244	0.58321	0.75558	1.67848	0.45016
11	2.9616"-03	4.3138"+00	NM	0.98283	0.59171	0.76267	1.66133	0.45907
12	3.2385"-03	4.3767"+00	NM	0.98306	0.59663	0.76672	1.65147	0.46427
13	3.5306"-03	4.5725"+00	NM	0.98376	0.61167	0.77889	1.62153	0.48034
14	3.8430"-03	4.6744"+00	NM	0.98412	0.61935	0.78498	1.60639	0.48866
15	4.1326"-03	4.7265"+00	NM	0.98430	0.62323	0.78803	1.59877	0.49290
16	4.4983"-03	4.8870"+00	NM	0.98485	0.63506	0.79718	1.57572	0.50591
17	4.8133"-03	4.9792"+00	NM	0.98516	0.64175	0.80226	1.56280	0.51335
18	5.1003"-03	5.0736"+00	NM	0.98548	0.64852	0.80735	1.54980	0.52094
19	5.4483"-03	5.1899"+00	NM	0.98586	0.65677	0.81346	1.53408	0.53026
20	5.8268"-03	5.2693"+00	NM	0.98612	0.66234	0.81754	1.52353	0.53661
21	6.1951"-03	5.3503"+00	NM	0.98638	0.66797	0.82161	1.51293	0.54306
22	6.5354"-03	5.4329"+00	NM	0.98664	0.67367	0.82569	1.50227	0.54963
23	6.9367"-03	5.5815"+00	NM	0.98711	0.68378	0.83284	1.48348	0.56141
24	7.3889"-03	5.6249"+00	NM	0.98724	0.68671	0.83488	1.47809	0.56484
25	7.8410"-03	5.7130"+00	NM	0.98751	0.69262	0.83897	1.46725	0.57180
26	8.2652"-03	5.8486"+00	NM	0.98792	0.70160	0.84510	1.45089	0.58247
27	8.7198"-03	5.9885"+00	NM	0.98834	0.71075	0.85124	1.43440	0.59344
28	9.1059"-03	6.1084"+00	NM	0.98869	0.71849	0.85635	1.42056	0.60283
29	9.6012"-03	6.2066"+00	NM	0.98897	0.72477	0.86045	1.40943	0.61049
30	1.0097"-02	6.2816"+00	NM	0.98919	0.72954	0.86352	1.40105	0.61634
31	1.0554"-02	6.4354"+00	NM	0.98962	0.73920	0.86967	1.38418	0.62829
32	1.0978"-02	6.5673"+00	NM	0.98999	0.74739	0.87480	1.37003	0.63853
33	1.1438"-02	6.7030"+00	NM	0.99035	0.75571	0.87993	1.35579	0.64902
34	1.1968"-02	6.7861"+00	NM	0.99058	0.76077	0.88302	1.34720	0.65544
35	1.2479"-02	6.8707"+00	NM	0.99080	0.76588	0.88610	1.33858	0.66197
36	1.2992"-02	6.9857"+00	NM	0.99110	0.77277	0.89021	1.32704	0.67082
37	1.3498"-02	7.1632"+00	NM	0.99156	0.78328	0.89638	1.30962	0.68446
38	1.4044"-02	7.3159"+00	NM	0.99194	0.79221	0.90153	1.29501	0.69616
39	1.4549"-02	7.4412"+00	NM	0.99225	0.79947	0.90565	1.28325	0.70574
40	1.5014"-02	7.5696"+00	NM	0.99257	0.80683	0.90977	1.27144	0.71554
41	1.5519"-02	7.6349"+00	NM	0.99272	0.81055	0.91183	1.26551	0.72052
42	1.6116"-02	7.9734"+00	NM	0.99352	0.82957	0.92215	1.23565	0.74628
43	1.6713"-02	7.9734"+00	NM	0.99352	0.82957	0.92215	1.23565	0.74628
44	1.7214"-02	8.0791"+00	NM	0.99376	0.83541	0.92525	1.22662	0.75430
45	1.7869"-02	8.3707"+00	NM	0.99441	0.85133	0.93351	1.20239	0.77638
46	1.8423"-02	8.4838"+00	NM	0.99466	0.85743	0.93662	1.19324	0.78494
47	1.8926"-02	8.5220"+00	NM	0.99474	0.85948	0.93765	1.19018	0.78782
48	1.9581"-02	8.6381"+00	NM	0.99499	0.86567	0.94076	1.18099	0.79658
49	2.0140"-02	8.8367"+00	NM	0.99541	0.87617	0.94593	1.16560	0.81154
50	2.0701"-02	8.8771"+00	NM	0.99550	0.87829	0.94697	1.16251	0.81459
51	2.1283"-02	9.2109"+00	NM	0.99618	0.89560	0.95526	1.13766	0.83967
52	2.1864"-02	9.3845"+00	NM	0.99652	0.90448	0.95941	1.12514	0.85270
53	2.2504"-02	9.5630"+00	NM	0.99686	0.91352	0.96356	1.11257	0.86607
54	2.3091"-02	9.2971"+00	NM	0.94635	0.90003	0.95734	1.13141	0.84615
55	2.3708"-02	9.4287"+00	NM	0.99660	0.90673	0.96045	1.12200	0.85601
56	2.4404"-02	9.7464"+00	NM	0.99721	0.92271	0.96772	1.09993	0.87979
57	2.4983"-02	9.9351"+00	NM	0.99756	0.93207	0.97187	1.08724	0.89389
58	2.5565"-02	1.0178"+01	NM	0.99801	0.94400	0.97707	1.07129	0.91205
59	2.6205"-02	1.0278"+01	NM	0.99818	0.94885	0.97916	1.06489	0.91949
60	2.6901"-02	1.0380"+01	NM	0.99836	0.95375	0.98124	1.05847	0.92704
61	2.7470"-02	1.0534"+01	NM	0.99863	0.96118	0.98436	1.04881	0.93855
62	2.8158"-02	1.0692"+01	NM	0.99890	0.96872	0.98749	1.03911	0.95032
63	2.8738"-02	1.0854"+01	NM	0.99917	0.97637	0.99061	1.02939	0.96233
64	2.9390"-02	1.0909"+01	NM	0.99927	0.97894	0.99165	1.02614	0.96640
65	2.9969"-02	1.0964"+01	NM	0.99936	0.98153	0.99270	1.02288	0.97049
66	3.0620"-02	1.1076"+01	NM	0.99954	0.98674	0.99478	1.01636	0.97877
67	3.1199"-02	1.1189"+01	NM	0.99972	0.99201	0.99687	1.00983	0.98717
68	3.1811"-02	1.1189"+01	NM	0.99972	0.99201	0.99687	1.00983	0.98717
69	3.2426"-02	1.1248"+01	NM	0.99982	0.99466	0.99791	1.00656	0.99141
70	3.3040"-02	1.1304"+01	NM	0.99991	0.99732	0.99896	1.00328	0.99569
71	3.3518"-02	1.1362"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
72	3.3917"-02	1.1362"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 73	3.4318"-02	1.1362"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

axisymmetric



M : 5, 6 and 8 falling to 3, 3.5, 4.
R THETA X 10^{-3} : 2 - 72
TW/TR : 0.4 - 1.0

6503

ZPG - APG
AW - MHT - SHT

Tunnel A (M = 5,6) : Continuous flow, variable nozzle. W = H = 1 m.
0.28 < PO < 1.4 MN/m^2. 350 < TO < 400 K. Air. 6 < RE/m X 10^{-6} < 23.
Tunnel B (M = 8) : Axisymmetric continuous flow, fixed nozzle. D = 1.3 m.
2.3 < PO < 5.5 MN/m^2. TO : 750 K. Air. 5 < RE/m X 10^{-6} < 12.

STROUD J.F. and MILLER L.D., 1965. An experimental and analytical investigation of hypersonic inlet boundary layers. Technical report AFFDL-TR-65-123 Vol. 1 and Vol. 2 (AD 621343/4)
And Stroud and Miller (1966), Stroud J.F., private communication.

1 The tests described here were made on the outer surface of a hollow axisymmetric model mounted on the
centre-line of the tunnels. Of the four models used by the authors we here describe only that one which
they designate the "Heat transfer Mach 8" model. The stainless steel model consisted of a nose-section,
a generating cylinder and the flared model proper. The sharp lipped nose section was 0.248 m long with an
initial (and internal) diameter of 48.3 mm. This front section expanded as a cone to a diameter of 76.2 mm
3 and carried two sets of vortex-generators. Each consisted of 16 triangular fins mounted normal to the
surface and set alternately at ± 18° (E) to the flow direction. The first ring was about 90 mm back from
the lip and the fins were 15 mm (E) long at the base and 3.3 mm high at their trailing edge which was
normal to the surface. The second set were about 200 mm back from the lip, about 30 mm long at the base
1 and 6.6 mm high. The nose section was followed by one of two cylindrical generating surfaces 76.2 mm in
diameter and 0.314 or 0.628 m long, finishing at the start of the model proper (X = 0). The short cylinder
was used for tests at M = 5, 6 and the long for M = 8. The curved surface of the model was designed to be
a streamline of a focused Prandtl-Meyer compression fan, followed by a short conical section intended to
avoid any upstream influence from the expansion at the trailing edge of the model. The length of the
compression surface was 0.933 m and the coordinates are given in table 1. The model surface was highly
polished and gold-plated. It was actively cooled with air which had been pre-cooled to less than 100 K.
4 The generating cylinder was also cooled, but not the nose piece. The test section flow, in the absence
2 of a model, was uniform to within 0.3 % in Mach number.

6 Static tappings (d = 0.75 - 1.0 mm) were distributed at up to 18 stations along the top generator, with
5 additional tappings at 90°, 180° and 270° at X = 0 and 0.838 m to provide a check on axi-symmetry. Chromel-
alumel thermocouples were distributed in the same manner, the majority being arranged to read the absolute
6 temperature of the model wall. At the profile stations, at X = - 95 and, when using the long generating
cylinder at - 413 mm, junctions were arranged on either side of a removeable plug, so as to provide values
of local heat transfer rate.

7 Pitot, P and TO profiles were obtained simultaneously, the three probes being mounted as a three-pronged
fork. They were carried on an independent traverse mechanism which could move parallel and normal to the
tunnel axis. This could also rotate the probes in pitch so as to traverse normal to the model surface.
The Pitot probe was a FPP (h_1 = 0.25, h_2 = 0.20, b_1 = 0.6 (E), l = 15 mm) and the TPP a STP (d_1 = 1.02,
d_2 = 0.63, l = 15 mm) with a chromel-alumel thermocouple junction opposite the 0.25 mm vents a distance
0.76 mm behind the sharp probe lip, which was chamfered internally. The SPP was a CCP (α = 10°, d = 0.76,
l_1 = 7.6, l_2 = 20 mm) with 4 static holes (d = 0.15 mm) round the circumference on axes at 45° to the
profile normal. Additional tests were made with two similar static probes mounted at + 2° and + 4° incidence
as a check on the sensitivity of the SPP to flow direction. Static pressure errors were below 5 % for
incidence up to 8°. The SPP was kept parallel to the model surface during a traverse while the TTP and TPP
were mounted at 3° negative incidence. The supporting structure for the three probes remained slender for
about 63 mm back from the profile normal.

8 The TPP formed the centre prong of the fork and traversed on the profile normal through the model axis. The TTP and the SPP were mounted 7.6 mm to either side. The tips of the TPP and the TTP and the static holes of the SPP lay on a single line which was perpendicular to the flow and the profile normal. Profiles were measured at seven stations with full wall instrumentation, the X values being given in Section B.

9 The TO and P data from the offset probes was interpolated to the Y-values of the central Pitot probe. The static pressure values were additionally fitted to Pitot-derived values at the boundary layer edge and to
10 the measured wall static pressure. No probe corrections were applied, and Sutherland's viscosity law was
11 used.

12 The authors present 42 series of profiles, half of which were obtained on three smaller models which are not described here. The editors have chosen to present a selection of the data from the larger model, which was the only one with active cooling and heat transfer instrumentation. We present, for each Mach number and heat transfer condition, the profile series obtained at the higher of two Reynolds numbers measured by the authors. The authors have specified the boundary layer edge state as the Y value for which PO is 95 % of the highest value observed. In the original tabulation, an interpolated profile point is given corresponding to this. The editors have set the D-state at the next measured point outwards. We have interpolated the differential thermocouple readings (temperature difference across the plugs), on the basis of the TW value, to give values which are appropriate to the wall temperatures of the profile tests. These data have then been reduced to the heat flux data given as CQ in section B, using conductivity values supplied by the authors. We found it necessary to use a trapezoidal integration rule.

13 The ten profile sets correspond to free stream Mach numbers of 5, 6 and 8. For Mach 5 and 6, there are
14 three heat transfer conditions, and for Mach 8, four. Heat transfer values are given for all the profiles, excepting a few cases of instrument-failure.

15 DATA: 6503 0101-1007. Pitot, TO and P-profiles obtained simultaneously. NX = 6 or 7. Steady state heat flux values from local conduction measurements.

16 <u>Editors' comments</u>

The experiment was made under extreme conditions, and understandably, some of the data appear somewhat erratic. The initial profiles are covered by a relatively large number of data points, but as the layer becomes thinner on the curved portion of the model, the number reduces. For the same reason, there is a tendency for measurements in the later profiles not to extend within the momentum deficit peak. The arrangements for tripping the boundary layer seem to be remarkably severe, and possibly explain why we did not get good agreement with ZPG profiles in transformed coordinates even under the nominally ZPG conditions on the generator cylinder. The effects of transverse curvature are likely to be large, as δ/RZ is of order 0.5. The plots of CQ data which we made for the purposes of interpolation suggest that Q data for X = 0.914 m are unreliable.

We have presented data for the largest model only, partly because of the massive quantity in the original report, but also because it appears to be of better quality. In particular the total temperature readings, for the small models, showed unlikely variations in the free stream. The authors suggest that this may be in part due to the fact that the STP can be at quite large incidence relative to the free stream while still parallel to the model surface at the profile station. In selection we took the authors' advice that the most representative series of profile data should be the high Reynolds number data on the large model. They also remark that the best heat transfer data should be that at M = 8. We would remind readers of the difficulties which can be experienced with instrumentation at recovery temperatures of the order of 700 K.

There are no comparable data, the most nearly akin being series 02 of Clutter & Kaups - CAT 6401. In principle, comparisons can also be drawn with the Sturek & Danberg - CAT 7101 tests, but both these studies were made at relatively low Mach number and without significant heat transfer.

Model coordinates

Facsimile from Source paper

NB - Authors' symbols and units

Mach 8 Design

x_c	y_c	x_c	y_c	x_c	y_c
.0045	1.500	27.8505	3.4590	33.5085	4.6935
2.0265	1.5090	28.1880	3.5160	33.6000	4.7220
3.9285	1.5345	28.5105	3.5715	33.6900	4.7490
5.7090	1.5750	28.8165	3.6270	33.7755	4.7760
7.3725	1.6245	29.1090	3.6795	33.8565	4.8015
8.9280	1.6830	29.3880	3.7320	33.9360	4.8270
10.3815	1.7475	29.6535	3.7815	34.0125	4.8510
11.7390	1.8165	29.9070	3.8310	34.0860	4.8750
13.0080	1.8900	30.1485	3.8805	34.1580	4.8990
14.1960	1.9665	30.3810	3.9270	34.2255	4.9230
15.3075	2.0430	30.6015	3.9735	34.2915	4.9455
16.3500	2.1225	30.8130	4.0170	34.3560	4.9645
17.3265	2.2005	31.0155	4.0620	34.4175	4.9890
18.2430	2.2800	31.2090	4.1040	34.4760	5.0100
19.1055	2.3595	31.3935	4.1460	34.5885	5.0505
19.9154	2.4375	31.5705	4.1865	34.6920	5.0895
20.6775	2.5140	31.7415	4.2270	34.7895	5.1270
21.3960	2.5905	31.9440	4.2660	34.8810	5.1630
22.0725	2.6655	32.0595	4.3035	34.9650	5.1960
22.7115	2.7390	32.2095	4.3395	35.0820	5.2455
23.3160	2.8110	32.3520	4 3770	35.1885	5.2905
23.8860	2.8830	32.4900	4.4115	35.3130	5.3460
24.4260	2.9520	32.6220	4.4460	35.4495	5.4105
24.9375	3.0210	32.7495	4.4790	35.5650	5.4675
25.4205	3.0870	32.8710	4.5120	35.6820	5.5290
25.8795	3.1530	32.9880	4.5450	35.8095	5.5995
26.3160	3.2175	33.1005	4.5765	35.9190	5.6670
26.7300	3.2790	33.2085	4.6065	36.0045	5.7240
27.1215	3.3405	33.3120	4.6365	36.0510	5.7570
27.4950	3.4005	33.4125	4.6650	36.0645	5.7675

Conical

36.750 5.158

All dimensions in inches.

CAT 6503 STROUD BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD	TW/TR	RED2W	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD*	TR
65030101	4.8300	0.7463	2.4304"+03	NM	11.6022	1.4115	1.9253"+03	1.9253"+03
-1.9050"-01	8.3348"+05	1.0000	8.4648"+03	NM	1.8298	1.7718	2.4167"+02	6.2511"+01
2.5400"-02	3.5417"+02	1.0000	4.6200"-04	NM	-0.1811	9.9452"-04	7.6566"+02	3.2384"+02
65030102	4.8554	0.7454	3.6133"+03	NM	10.6301	1.3950	1.9324"+03	1.9324"+03
0.0000"+00	8.6233"+05	1.0000	1.2679"+04	NM	1.7978	1.7370	2.4167"+02	6.2050"+01
2.5400"-02	3.5462"+02	1.0000	6.7820"-04	NM	-0.0196	1.5601"-03	7.6685"+02	3.2419"+02
65030103	4.5512	0.7424	4.5578"+03	NM	10.4321	1.2685	2.8728"+03	2.8671"+03
4.7625"-01	8.8426"+05	1.0020	1.4366"+04	1.2944"-04	1.8597	1.8325	2.4111"+02	6.8928"+01
5.9098"-02	3.5447"+02	1.0000	6.4715"-04	NM	-0.1534	1.2588"-03	7.5758"+02	3.2477"+02
65030104	4.2458	0.7251	5.6268"+03	NM	6.4309	1.2313	4.8024"+03	4.1297"+03
7.3660"-01	8.6566"+05	1.1629	1.5629"+04	NM	1.8990	1.8788	2.3556"+02	7.6789"+01
9.2961"-02	3.5364"+02	1.0000	6.1578"-04	NM	-0.2541	8.7648"-04	7.4597"+02	3.2485"+02
65030105	3.9707	0.7125	4.3712"+03	NM	3.3178	1.3459	7.6599"+03	6.0133"+03
8.3820"-01	8.7795"+05	1.2738	1.0823"+04	1.9217"-04	1.8919	1.8619	2.3333"+02	8.5611"+01
1.1553"-01	3.5596"+02	1.0000	3.6807"-04	NM	-0.2371	4.7720"-04	7.3661"+02	3.2749"+02
65030106	3.7872	0.7036	5.7548"+03	NM	1.6152	1.3601	1.0866"+04	7.7192"+03
8.7630"-01	8.7906"+05	1.4076	1.3183"+04	2.6934"-04	1.8833	1.8564	2.3056"+02	9.1783"+01
1.2747"-01	3.5507"+02	1.0000	4.0579"-04	NM	-0.1660	4.8096"-04	7.2747"+02	3.2769"+02
65030107	3.0325	0.7018	7.0527"+03	NM	1.3753	1.4636	3.2378"+04	2.2762"+04
9.1440"-01	8.7786"+05	1.4225	1.2153"+04	4.8333"-04	1.8979	1.8950	2.2917"+02	1.2332"+02
1.4531"-01	3.5013"+02	1.0000	2.4328"-04	NM	-0.2166	2.5173"-04	6.7519"+02	3.2654"+02
65030201	4.8303	0.8490	2.4146"+03	NM	11.1193	1.4415	1.9238"+03	1.9238"+03
-1.9050"-01	8.3315"+05	1.0000	9.3264"+03	NM	1.8245	1.7558	2.7444"+02	6.2389"+01
2.5400"-02	3.5352"+02	1.0000	5.0787"-04	NM	-0.0693	1.1248"-03	7.6496"+02	3.2324"+02
65030202	4.8619	0.8526	3.2761"+03	NM	11.1468	1.4722	1.9200"+03	1.9200"+03
0.0000"+00	8.6341"+05	1.0000	1.2832"+04	NM	1.7911	1.7153	2.7556"+02	6.1722"+01
2.5400"-02	3.5352"+02	1.0000	6.8446"-04	NM	-0.0743	1.6522"-03	7.6584"+02	3.2318"+02
65030203	5.0437	0.8458	3.5289"+03	NM	12.9317	1.2743	2.3318"+03	2.3318"+03
4.7625"-01	1.2981"+06	1.0000	1.4581"+04	1.1647"-04	1.8660	1.8299	2.7389"+02	5.8256"+01
5.9098"-02	3.5465"+02	1.0000	5.6582"-04	NM	-0.2218	1.2293"-03	7.7185"+02	3.2383"+02
65030204	4.2303	0.8475	5.6349".03	NM	6.7486	1.2473	5.0030"+03	4.1421"+03
7.3660"-01	8.5100"+05	1.2078	1.7637"+04	NM	1.8824	1.8611	2.7500"+02	7.7133"+01
9.2961"-02	3.5320"+02	1.0000	7.0003"-04	NM	-0.2687	1.0506"-03	7.4490"+02	3.2449"+02
65030205	3.9938	0.8450	7.8365"+03	NM	5.0727	1.2395	7.7705"+03	5.8668"+03
8.3820"-01	8.8342"+05	1.3245	2.2457"+04	1.7906"-04	1.8827	1.8696	2.7500"+02	8.4350"+01
1.1553"-01	3.5343"+02	1.0000	7.6133"-04	NM	-0.2739	1.0384"-03	7.3542"+02	3.2545"+02
65030206	3.8485	0.8485	1.0070"+04	NM	2.9248	1.2379	1.0997"+04	7.0930"+03
8.7630"-01	8.7819"+05	1.5504	2.7442"+04	2.3293"-04	1.8763	1.8677	2.7667"+02	8.9228"+01
1.2747"-01	3.5353"+02	1.0000	8.6780"-04	NM	-0.2081	1.0315"-03	7.2887"+02	3.2605"+02
65030207	3.5737	0.8493	2.2688"+04	NM	-0.8112	1.3059	3.3005"+04	1.0561"+04
9.1440"-01	8.9398"+05	3.1251	5.5853"+04	1.9680"-03	1.8144	1.8196	2.7722"+02	9.9256"+01
1.4531"-01	3.5278"+02	1.0000	1.4937"-03	NM	-0.1157	1.0820"-03	7.1384"+02	3.2641"+02
65030301	4.8274	1.0083	2.5300"+03	NM	10.1505	1.3646	1.9238"+03	1.9238"+03
-1.9050"-01	8.3029"+05	1.0000	1.1179"+04	NM	1.8312	1.7664	3.2222"+02	6.1739"+01
2.5400"-02	3.4949"+02	1.0000	5.9959"-04	NM	0.0686	1.2894"-03	7.6051"+02	3.1956"+02
65030302	4.8644	0.9920	2.9704"+03	NM	11.3654	1.4409	1.9152"+03	1.9152"+03
0.0000"+00	8.6380"+05	1.0000	1.3083"+04	NM	1.7915	1.7167	3.2111"+02	6.1772"+01
2.5400"-02	3.5411"+02	1.0000	7.0009"-04	NM	-0.1236	1.7368"-03	7.6654"+02	3.2370"+02
65030303	5.2006	0.9810	3.1128"+03	NM	14.0108	1.2741	2.2006"+03	2.2006"+03
4.7625"-01	1.4668"+06	1.0000	1.5177"+04	5.2797"-05	1.8622	1.8261	3.1778"+02	5.5406"+01
5.9098"-02	3.5511"+02	1.0000	5.6116"-04	NM	-0.2743	1.3134"-03	7.7614"+02	3.2394"+02
65030304	4.2644	0.9747	5.4585"+03	NM	7.2728	1.2537	4.9379"+03	4.1033"+03
7.3660"-01	8.8100"+05	1.2034	1.9264"+04	NM	1.8732	1.8495	3.1667"+02	7.6289"+01
9.2961"-02	3.5375"+02	1.0000	7.5318"-04	NM	-0.2882	1.1930"-03	7.4679"+02	3.2490"+02
65030305	4.0030	0.9681	7.8205"+03	NM	5.1248	1.2433	7.8050"+03	5.7911"+03
8.3820"-01	8.8279"+05	1.3477	2.4965"+04	6.0286"-05	1.8659	1.8510	3.1611"+02	8.4339"+01
1.1553"-01	3.5463"+02	1.0000	8.5529"-04	NM	-0.3179	1.2186"-03	7.3707"+02	3.2652"+02
65030306	3.8847	0.9695	1.0706"+04	NM	3.3078	1.2390	1.1101"+04	6.6879"+03
8.7630"-01	8.6977"+05	1.6598	3.2765"+04	5.5509"-05	1.8536	1.8450	3.1667"+02	8.8172"+01
1.2747"-01	3.5429"+02	1.0000	1.0697"-03	NM	-0.3995	1.3677"-03	7.3137"+02	3.2662"+02
65030307	3.5952	0.9724	2.6338"+04	NM	-0.6290	1.3244	3.3308"+04	9.8595"+03
9.1440"-01	8.6018"+05	3.3783	7.2496"+04	7.8262"-04	1.7786	1.7864	3.1889"+02	9.8894"+01
1.4531"-01	3.5454"+02	1.0000	2.0535"-03	NM	-0.0037	1.4470"-03	7.1683"+02	3.2795"+02

CAT 6503 STROUD BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS,

RUN	MD	TW/TR	RED2W	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CD *	H32	H32K	TW*	TO*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD*	TR
65030401	5.9223	0.6043	1.0957"+03	NM	16.1613	1.4619	8.6520"+02	8.6520"+02
-1.9050"-01	1.2610"+06	1.0000	4.4253"+03	NM	1.8340	1.7528	2.2083"+02	5.0161"+01
2.5400"-02	4.0203"+02	1.0000	3.1455"-04	NM	-0.0935	8.4417"-04	8.4097"+02	3.6543"+02
65030402	5.9464	0.6063	1.1202"+03	NM	16.2063	1.3094	8.6663"+02	8.6663"+02
0.0000"+00	1.2950"+06	1.0000	4.5708"+03	NM	1.8666	1.8207	2.2083"+02	4.9650"+01
2.5400"-02	4.0077"+02	1.0000	3.1609"-04	NM	-0.1512	7.8046"-04	8.4009"+02	3.6426"+02
65030403	5.2970	0.6057	1.0953"+03	NM	13.3395	1.4661	1.6231"+03	1.5159"+03
4.7625"-01	1.1266"+06	1.0708	3.6564"+03	2.7049"-04	1.8508	1.8030	2.2306"+02	6.1094"+01
5.9098"-02	4.0394"+02	1.0000	2.2327"-04	NM	-0.3107	4.5903"-04	8.3012"+02	3.6828"+02
65030404	4.5700	0.6503	1.6688"+03	NM	6.4315	1.4785	4.7052"+03	3.8721"+03
8.3820"-01	1.2223"+06	1.2152	4.6452"+03	2.8613"-04	1.0736	1.8487	2.3972"+02	7.7733"+01
1.1553"-01	4.0242"+02	1.0000	1.8469"-04	NM	-0.3656	2.8378"-04	8.0784"+02	3.6865"+02
65030405	4.2193	0.6569	2.3095"+03	NM	5.5998	1.4896	7.2189"+03	5.8074"+03
8.7630"-01	1.1763"+06	1.2431	5.7333"+03	3.5597"-04	1.8587	1.8358	2.4333"+02	8.8406"+01
1.2747"-01	4.0317"+02	1.0000	1.9924"-04	NM	-0.1926	2.9761"-04	7.9541"+02	3.7044"+02
65030406	3.3931	0.6534	3.6747"+03	NM	3.1407	1.6216	2.3166"+04	1.7966"+04
9.1440"-01	1.1761"+06	1.2895	6.7110"+03	8.2411"-04	1.8701	1.8595	2.4833"+02	1.2408"+02
1.4531"-01	4.0978"+02	1.0000	1.5346"-04	NM	0.0129	1.8369"-04	7.5779"+02	3.8007"+02
65030501	6.0432	0.7506	8.1483"+02	NM	17.0164	1.5217	8.6520"+02	8.6520"+02
-1.9050"-01	1.4277"+06	1.0000	4.0621"+03	NM	1.8637	1.7800	2.7361"+02	4.8317"+01
2.5400"-02	4.0123"+02	1.0000	2.6742"-04	NM	-0.0984	6.8504"-04	8.4222"+02	3.6452"+02
65030502	5.9024	0.7523	9.7664"+02	NM	16.5718	1.2865	8.9967"+02	8.9967"+02
0.0000"+00	1.2845"+06	1.0000	4.6838"+03	NM	1.0773	1.8332	2.7361"+02	5.0211"+01
2.5400"-02	4.0006"+02	1.0000	3.2173"-04	NM	-0.2299	7.7095"-04	8.3857"+02	3.6368"+02
65030503	5.7855	0.7491	7.4420"+02	NM	19.6500	1.4662	1.2770"+03	1.2770"+03
4.7625"-01	1.6136"+06	1.0000	3.4272"+03	1.7498"-04	1.8601	1.8079	2.7556"+02	5.2561"+01
5.9098"-02	4.0443"+02	1.0000	1.8130"-04	NM	-0.5391	4.4391"-04	8.4097"+02	3.6783"+02
65030504	4.7885	0.7523	7.2218"+02	NM	15.7146	1.5559	2.7756"+03	2.7756"+03
7.3660"-01	1.1434"+06	1.0000	2.4297"+03	NM	1.9049	1.8935	2.7833"+02	7.2411"+01
9.2961"-02	4.0449"+02	1.0000	1.1569"-04	NM	-0.7889	2.0169"-04	8.1699"+02	3.6995"+02
65030505	4.8082	0.7631	3.0816"+03	NM	-1.2339	1.2913	4.8603"+03	2.9451"+03
8.3820"-01	1.2422"+06	1.6503	1.0562"+04	2.6161"-04	1.9185	1.8951	2.8111"+02	7.1633"+01
1.1553"-01	4.0284"+02	1.0000	4.6444"-04	NM	-0.1684	5.0332"-04	8.1592"+02	3.6840"+02
65030506	4.2694	0.7658	2.3616"+03	NM	2.9983	1.4081	7.3707"+03	5.2922"+03
8.7630"-01	1.1436"+06	1.3927	6.7492"+03	2.9931"-04	1.9048	1.8862	2.8194"+02	8.6289"+01
1.2747"-01	4.0086"+02	1.0000	2.4540"-04	NM	-0.3125	3.0311"-04	7.9516"+02	3.6815"+02
65030507	4.3899	0.7679	1.0183"+04	NM	-6.0477	1.2875	2.4207"+04	5.0111"+03
9.1440"-01	1.2628"+06	4.8307	3.0403"+04	1.0823"-03	1.8875	1.8917	2.8333"+02	8.2850"+01
1.4531"-01	4.0217"+02	1.0000	1.0690"-03	NM	-0.0380	5.1356"-04	8.0114"+02	3.6896"+02
65030601	5.9710	0.9935	6.8475"+02	NM	16.6523	1.4281	8.6520"+02	8.6520"+02
-1.9050"-01	1.3259"+06	1.0000	4.1339"+03	NM	1.8638	1.7826	3.6389"+02	4.9572"+01
2.5400"-02	4.0305"+02	1.0000	2.8630"-04	NM	-0.1254	7.3969"-04	8.4289"+02	3.6628"+02
65030602	5.8082	0.9897	8.3897"+02	NM	15.9494	1.3912	9.0206"+02	9.0206"+02
0.0000"+00	1.1674"+06	1.0000	4.8149"+03	NM	1.8583	1.7864	3.6222"+02	5.1950"+01
2.5400"-02	4.0246"+02	1.0000	3.5287"-04	NM	-0.1790	8.9901"-04	8.3936"+02	3.6601"+02
65030603	5.0517	0.9689	5.9483"+02	NM	21.8168	1.5089	1.3143"+03	1.3143"+03
4.7625"-01	1.4412"+06	1.0000	3.2008"+03	1.5322"-05	1.8610	1.7922	3.5694"+02	5.4783"+01
5.9098"-02	4.0479"+02	1.0000	1.7925"-04	NM	-0.9252	4.4750"-04	8.3875"+02	3.6839"+02
65030604	4.9112	0.9633	9.5553"+02	NM	12.3911	1.4087	2.6621"+03	2.4223"+03
7.3660"-01	1.1548"+06	1.0990	4.0468"+03	NM	1.9016	1.8693	3.5500"+02	6.9244"+01
9.2961"-02	4.0328"+02	1.0000	2.0133"-04	NM	-0.8508	3.5418"-04	8.1939"+02	3.6854"+02
65030605	4.6604	0.9643	2.1849"+03	NM	4.5887	1.3283	4.6808"+03	3.3234"+03
8.3820"-01	1.1723"+06	1.4084	8.5166"+03	2.1636"-06	1.9038	1.8764	3.5500"+02	7.5256"+01
1.1553"-01	4.0215"+02	1.0000	3.6862"-04	NM	-0.4053	5.0214"-04	8.1059"+02	3.6815"+02
65030606	4.4140	0.9668	1.4707"+03	NM	2.3036	1.5587	7.0877"+03	4.5151"+03
8.7630"-01	1.1731"+06	1.5698	5.2800"+03	1.6055"-05	1.7745	1.7861	3.5556"+02	8.1878"+01
1.2747"-01	4.0093"+02	1.0000	2.0136"-04	NM	-1.9513	2.6893"-04	8.0080"+02	3.6775"+02
65030607	3.8133	0.9690	4.2477"+03	NM	-0.0257	1.4230	2.2994"+04	1.1704"+04
9.1440"-01	1.3813"+06	1.9647	1.2339"+04	1.9854"-03	1.8923	1.8876	3.5611"+02	1.0192"+02
1.4531"-01	3.9834"+02	1.0000	2.9009"-04	NM	-0.1860	2.6827"-04	7.7188"+02	3.6751"+02

CAT 6503 STROUD BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD	TW/TR	REDZW	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD	REDZD	CQ *	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD*	TR
65030701	7.8105	0.4093	6.5243"+02	NM	30.2895	1.3820	5.2572"+02	5.2572"+02
-1.9050"-01	4.3939"+06	1.0000	2.7809"+03	NM	1.8566	1.7956	2.8278"+02	5.7906"+01
2.5400"-02	7.6439"+02	1.0000	3.0630"-04	NM	-0.6330	9.9082"-04	1.1916"+03	6.9092"+02
65030702	7.6275	0.4059	9.0140"+02	NM	23.6304	1.3624	5.2477"+02	5.2477"+02
0.0000"+00	3.7634"+06	1.0000	3.6557"+03	NM	1.8464	1.7709	2.8000"+02	6.0372"+01
2.5400"-02	7.6285"+02	1.0000	4.3986"-04	NM	-0.1672	1.4087"-03	1.1883"+03	6.8980"+02
65030703	7.0137	0.4083	9.9829"+02	NM	22.6164	1.4168	1.0337"+03	9.3031"+02
4.7625"-01	3.8995"+06	1.1112	3.4973"+03	3.5288"-04	1.8353	1.7913	2.8000"+02	6.9861"+01
5.9098"-02	7.5718"+02	1.0000	3.2146"-04	NM	-0.5202	9.2952"-04	1.1754"+03	6.8570"+02
65030704	6.2351	0.4176	1.8491"+03	NM	11.4023	1.3377	2.2710"+03	1.8487"+03
7.3660"-01	3.7007"+06	1.2284	5.3605"+03	5.4356"-04	1.8736	1.8430	2.8672"+02	8.6183"+01
9.2961"-02	7.5629"+02	1.0000	3.8137"-04	NM	0.0346	7.1066"-04	1.1606"+03	6.8660"+02
65030705	5.7688	0.4433	2.4435"+03	NM	2.9563	1.3257	4.3767"+03	3.0375"+03
8.3820"-01	3.7714"+06	1.4409	6.5523"+03	7.2876"-04	1.8877	1.8787	2.9419"+02	9.5306"+01
1.1553"-01	7.2965"+02	1.0000	3.5565"-04	NM	0.4543	4.1797"-04	1.1292"+03	6.6368"+02
65030706	5.2998	0.4432	2.8434"+03	NM	2.4924	1.3742	7.1772"+03	4.9235"+03
8.7630"-01	3.6703"+06	1.4577	6.6254"+03	8.4558"-04	1.8881	1.8783	2.9941"+02	1.1196"+02
1.2747"-01	7.4090"+02	1.0000	3.0535"-04	NM	0.5823	3.4985"-04	1.1243"+03	6.7549"+02
65030707	4.2992	0.4547	4.3544"+03	NM	-0.6477	1.8168	2.9116"+04	1.5868"+04
9.1440"-01	3.5626"+06	1.8349	7.5934"+03	1.2011"-03	1.8038	1.8332	3.0987"+02	1.5805"+02
1.4531"-01	7.4229"+02	1.0000	2.1818"-04	NM	0.7740	1.4544"-04	1.0837"+03	6.8153"+02
65030801	7.8454	0.4632	7.6149"+02	NM	25.9710	1.4709	5.2572"+02	5.2572"+02
-1.9050"-01	4.5228"+06	1.0000	3.6075"+03	NM	1.8466	1.7549	3.1722"+02	5.6933"+01
2.5400"-02	7.5779"+02	1.0000	3.8560"-04	NM	-0.2341	1.2474"-03	1.1869"+03	6.8491"+02
65030802	7.7098	0.4590	1.1572"+03	NM	18.1712	1.4317	5.2477"+02	5.2477"+02
0.0000"+00	4.0331"+06	1.0000	5.2569"+03	NM	1.8137	1.7270	3.1820"+02	5.9494"+01
2.5400"-02	7.6678"+02	1.0000	6.1211"-04	NM	0.3598	1.9353"-03	1.1923"+03	6.9322"+02
65030803	7.0626	0.4693	1.1860"+03	NM	17.3681	1.4048	1.0548"+03	9.0589"+02
4.7625"-01	3.9687"+06	1.1644	4.6832"+03	3.6168"-04	1.8346	1.7928	3.2190"+02	6.9011"+01
5.9098"-02	7.5747"+02	1.0000	4.3104"-04	NM	-0.0705	1.1382"-03	1.1763"+03	6.8587"+02
65030804	6.3789	0.4660	2.2775"+03	NM	6.9862	1.3239	2.3437"+03	1.7251"+03
7.3660"-01	3.9794"+06	1.3586	7.4375"+03	3.3803"-04	1.8724	1.8395	3.2634"+02	8.4461"+01
9.2961"-02	7.7182"+02	1.0000	5.3793"-04	NM	0.6224	8.5207"-04	1.1754"+03	7.0033"+02
65030805	5.9765	0.4803	2.2229"+03	NM	4.2310	1.3375	4.5338"+03	2.5798"+03
8.3820"-01	3.9762"+06	1.7574	6.6643"+03	8.4229"-04	1.8860	1.8609	3.3226"+02	9.3483"+01
1.1553"-01	7.6130"+02	1.0000	3.9962"-04	NM	-0.1613	5.2283"-04	1.1586"+03	6.9185"+02
65030806	5.6557	0.4844	3.1277"+03	NM	2.2028	1.3532	7.5086"+03	3.6039"+03
8.7630"-01	3.9680"+06	2.0834	8.6184"+03	1.0971"-03	1.8731	1.8582	3.3448"+02	1.0257"+02
1.2747"-01	7.5874"+02	1.0000	4.4774"-04	NM	-0.2119	5.1451"-04	1.1484"+03	6.9049"+02
65030807	4.8959	0.4899	6.3889"+03	NM	-0.6233	1.4818	3.1158"+04	8.4121"+03
9.1440"-01	3.9385"+06	3.7039	1.4175"+04	1.7499"-03	1.7993	1.7988	3.3744"+02	1.3007"+02
1.4531"-01	7.5364"+02	1.0000	5.1312"-04	NM	0.0461	3.9476"-04	1.1195"+03	6.8879"+02

CAT 6503 STROUD COUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD	TW/TR	RED2W	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD*	TR
65030901	7.7309	0.7523	3.2796"+02	NM	44.7305	1.4841	5.2572"+02	5.2572"+02
-1.9050"-01	4.1126"+06	1.0000	2.1616"+03	NM	1.8169	1.7434	5.0333"+02	5.7133"+01
2.5400"-02	7.4008"+02	1.0000	2.3571"-04	NM	-1.9692	1.0536"-03	1.1716"+03	6.6905"+02
65030902	7.6059	0.7483	3.6066"+02	NM	45.4186	1.7223	5.2477"+02	5.2477"+02
0.0000"+00	3.6953"+06	1.0000	2.2940"+03	NM	1.7279	1.7014	5.0363"+02	5.9211"+01
2.5400"-02	7.4429"+02	1.0000	2.6882"-04	NM	-2.1197	1.4596"-03	1.1734"+03	6.7304"+02
65030903	6.9890	0.7386	6.7346"+02	NM	25.4372	1.7821	1.0108"+03	8.5706"+02
4.7625"-01	3.5129"+06	1.1793	3.6295"+03	1.1434"-04	1.7570	1.6968	5.0213"+02	6.9700"+01
5.9098"-02	7.5062"+02	1.0000	3.6216"-04	NM	-0.8870	1.2480"-03	1.1699"+03	6.7980"+02
65030904	6.3081	0.7173	7.5093"+02	NM	18.6247	1.4899	2.1560"+03	1.7007"+03
7.3660"-01	3.6598"+06	1.2677	3.3095"+03	3.2032"-05	1.8337	1.8007	4.8871"+02	8.3789"+01
9.2961"-02	7.5062"+02	1.0000	2.4263"-04	NM	-1.4017	5.3120"-04	1.1577"+03	6.8127"+02
65030905	5.7454	0.6795	9.3353"+02	NM	7.7043	1.4551	4.1512"+03	3.0428"+03
8.3820"-01	3.6856"+06	1.3643	3.3607"+03	4.3797"-04	1.8855	1.8368	4.7527"+02	1.0115"+02
1.1553"-01	7.6893"+02	1.0000	1.9948"-04	NM	-0.4117	3.3037"-04	1.1585"+03	6.9948"+02
65030906	5.3917	0.6631	1.1397"+03	NM	4.1378	1.4977	6.6022"+03	4.4629"+03
8.7630"-01	3.6860"+06	1.4793	3.6292"+03	5.4780"-04	1.8979	1.8685	4.7005"+02	1.1416"+02
1.2747"-01	7.7787"+02	1.0000	1.8653"-04	NM	-0.2036	2.4792"-04	1.1550"+03	7.0884"+02
65030907	4.5538	0.6627	3.1649"+03	NM	0.0930	1.6217	2.5504"+04	1.2755"+04
9.1440"-01	3.9470"+06	1.9995	7.8459"+03	8.6320"-04	1.8233	1.8200	4.6259"+02	1.4800"+02
1.4531"-01	7.6182"+02	1.0000	2.4161"-04	NM	0.2702	2.1562"-04	1.1108"+03	6.9799"+02
65031001	7.6682	0.9378	4.3773"+02	NM	29.7280	1.6010	5.2572"+02	5.2572"+02
-1.9050"-01	3.9019"+06	1.0000	3.2599"+03	NM	1.8038	1.7144	6.4722"+02	5.9822"+01
2.5400"-02	7.6335"+02	1.0000	3.8412"-04	NM	-0.6066	1.6431"-03	1.1891"+03	6.9018"+02
65031002	7.6148	0.9297	5.6213"+02	NM	23.4690	1.3949	5.2477"+02	5.2477"+02
0.0000"+00	3.7232"+06	1.0000	4.1162"+03	NM	1.8242	1.7402	6.3884"+02	6.0322"+01
2.5400"-02	7.5989"+02	1.0000	4.9547"-04	NM	-0.1606	1.7904"-03	1.1858"+03	6.8713"+02
65031003	7.0969	0.8962	7.1759"+02	NM	14.0007	1.3024	9.5952"+02	8.7717"+02
4.7625"-01	3.9631"+06	1.0939	3.4525"+03	3.7581"-05	1.8818	1.8382	6.4032"+02	7.1267"+01
5.9098"-02	7.8915"+02	1.0000	4.4198"-04	NM	0.4096	9.4388"-04	1.2012"+03	7.1449"+02
65031004	6.2408	0.9028	6.2515"+02	NM	13.8654	1.3814	2.1125"+03	1.8549"+03
7.3660"-01	3.7340"+06	1.1389	3.1173"+03	2.7597"-05	1.9019	1.8805	6.4106"+02	8.8994"+01
9.2961"-02	7.8221"+02	1.0000	2.3156"-04	NM	-0.2265	4.0290"-04	1.1804"+03	7.1011"+02
65031005	5.7736	0.9563	8.7173"+02	NM	5.1246	1.3858	4.1933"+03	2.9102"+03
8.3820"-01	3.6313"+06	1.4409	4.0333"+03	7.7338"-06	1.9158	1.9026	6.4106"+02	9.6128"+01
1.1553"-01	7.3699"+02	1.0000	2.3121"-04	NM	-0.6857	3.0527"-04	1.1350"+03	6.7034"+02
65031006	5.4349	0.9430	1.2648"+03	NM	3.0532	1.3904	6.6822"+03	4.3035"+03
8.7630"-01	3.7278"+06	1.5527	5.2348"+03	6.7542"-06	1.9112	1.8987	6.4032"+02	1.0789"+02
1.2747"-01	7.4529"+02	1.0000	2.5512"-04	NM	0.1304	3.0309"-04	1.1319"+03	6.7900"+02
65031007	4.3418	0.9179	1.3390"+03	NM	0.4062	1.8255	2.6448"+04	1.5258"+04
9.1440"-01	3.6172"+06	1.7334	3.8724"+03	1.9327"-06	1.9268	1.9285	6.4032"+02	1.5934"+02
1.4531"-01	7.6010"+02	1.0000	1.1588"-04	NM	-0.0091	1.0564"-04	1.0989"+03	6.9762"+02

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DBTAH
65030101	4.6191"-04	11.6043	1.8298	-0.1812	8.4735"+03	2.4329"+03	5.3488"-03
	4.6192"-04	11.6042	1.8298	-0.1812	8.4736"+03	2.4329"+03	
65030102	6.7817"-04	10.6305	1.7978	-0.0196	1.2693"+04	3.6173"+03	7.1991"-03
	6.7817"-04	10.6305	1.7978	-0.0196	1.2693"+04	3.6173"+03	
65030103	6.4656"-04	10.4710	1.8596	-0.1536	1.4370"+04	4.5591"+03	6.7564"-03
	6.4583"-04	10.4709	1.8597	-0.1536	1.4371"+04	4.5594"+03	
65030104	5.5564"-04	9.5756	1.8898	-0.2816	1.4120"+04	5.0833"+03	4.8296"-03
	5.0517"-04	9.5392	1.9018	-0.2798	1.4211"+04	5.1161"+03	
65030105	2.9057"-04	8.8840	1.8666	-0.3004	8.5545"+03	3.4551"+03	2.2142"-03
	2.5017"-04	8.7953	1.8884	-0.2909	8.6548"+03	3.4956"+03	
65030106	2.9656"-04	7.8802	1.8469	-0.2272	9.6466"+03	4.2109"+03	1.8798"-03
	2.4078"-04	7.7503	1.8812	-0.2231	9.8261"+03	4.2893"+03	
65030107	1.7077"-04	6.0415	1.8652	-0.3086	8.5408"+03	4.9634"+03	8.3027"-04
	1.4089"-04	5.8686	1.9215	-0.2996	8.7987"+03	5.1133"+03	
65030301	5.9956"-04	10.1510	1.8312	0.0687	1.1192"+04	2.5329"+03	6.0632"-03
	5.9956"-04	10.1510	1.8312	0.0687	1.1192"+04	2.5329"+03	
65030302	7.0016"-04	11.3641	1.7915	-0.1236	1.3100"+04	2.9742"+03	7.9433"-03
	7.0016"-04	11.3641	1.7915	-0.1236	1.3100"+04	2.9742"+03	
65030303	5.6119"-04	14.0103	1.8622	-0.2743	1.5196"+04	3.1167"+03	7.8530"-03
	5.6118"-04	14.0103	1.8622	-0.2743	1.5196"+04	3.1167"+03	
65030304	7.0038"-04	9.8511	1.8650	-0.3099	1.7935"+04	5.0819"+03	6.1604"-03
	6.2317"-04	9.8130	1.8797	-0.3074	1.8078"+04	5.1223"+03	
65030305	7.5094"-04	8.9344	1.8503	-0.3621	2.1946"+04	6.8747"+03	5.5973"-03
	6.2449"-04	8.8487	1.8772	-0.3567	2.2269"+04	6.9760"+03	
65030306	8.7173"-04	8.6703	1.8275	-0.4903	2.6734"+04	8.7356"+03	5.5597"-03
	6.4062"-04	8.5042	1.8777	-0.4769	2.7477"+04	8.9784"+03	
65030307	1.3615"-03	5.2596	1.7082	-0.0055	4.8123"+04	1.7483"+04	3.3901"-03
	6.8168"-04	4.8695	1.8672	-0.0051	5.2658"+04	1.9131"+04	
65030801	3.8539"-04	25.9853	1.8465	-0.2342	3.6099"+03	7.6199"+02	9.9563"-03
	3.8540"-04	25.9850	1.8466	-0.2342	3.6099"+03	7.6200"+02	
65030802	6.1238"-04	18.1634	1.8138	0.3596	5.2655"+03	1.1591"+03	1.1102"-02
	6.1237"-04	18.1637	1.8138	0.3596	5.2654"+03	1.1591"+03	
65030803	4.1987"-04	21.1678	1.8290	-0.0730	4.5237"+03	1.1456"+03	8.0538"-03
	3.7481"-04	21.2541	1.8335	-0.0729	4.5352"+03	1.1486"+03	
65030804	5.0972"-04	10.9134	1.8661	0.6568	7.0559"+03	2.1606"+03	4.6003"-03
	4.1438"-04	10.9058	1.8774	0.6530	7.0995"+03	2.1740"+03	
65030805	3.2621"-04	15.5592	1.8635	-0.1977	5.4469"+03	1.8168"+03	3.5355"-03
	2.2364"-04	15.4664	1.8875	-0.1951	5.5173"+03	1.8403"+03	
65030806	3.3031"-04	14.0667	1.8432	-0.2708	6.7504"+03	2.4498"+03	3.0636"-03
	2.1532"-04	13.9043	1.8785	-0.2656	6.8804"+03	2.4970"+03	
65030807	3.7915"-04	8.6166	1.7434	0.0624	1.0486"+04	4.7264"+03	1.3962"-03
	1.6448"-04	8.2466	1.8331	0.0594	1.1029"+04	4.9708"+03	
65031001	3.8473"-04	29.6828	1.8040	-0.6057	3.2689"+03	4.3894"+02	1.1392"-02
	3.8469"-04	29.6842	1.8040	-0.6057	3.2687"+03	4.3892"+02	
65031002	4.9542"-04	23.4711	1.8242	-0.1607	4.1207"+03	5.6275"+02	1.1601"-02
	4.9542"-04	23.4709	1.8242	-0.1607	4.1207"+03	5.6275"+02	
65031003	4.3145"-04	16.1650	1.8793	0.4196	4.3516"+03	7.0133"+02	6.6324"-03
	4.0578"-04	16.1931	1.8820	0.4190	4.3581"+03	7.0238"+02	
65031004	2.1572"-04	18.7523	1.8952	-0.2430	2.9074"+03	5.8309"+02	3.7198"-03
	1.9757"-04	18.7387	1.9000	-0.2424	2.9150"+03	5.8457"+02	
65031005	1.7125"-04	20.4746	1.8896	-0.9257	2.9910"+03	6.4646"+02	2.7519"-03
	1.3417"-04	20.3680	1.9037	-0.9177	3.0169"+03	6.5200"+02	
65031006	2.0962"-04	11.3985	1.8944	0.1587	4.3069"+03	1.0406"+03	1.7884"-03
	1.5669"-04	11.2932	1.9166	0.1569	4.3576"+03	1.0528"+03	
65031007	8.0926"-05	9.1551	1.9034	-0.0073	2.7077"+03	9.4627"+02	5.1859"-04
	5.7225"-05	8.9521	1.9480	-0.0072	2.7713"+03	9.5826"+02	

65030301 STROUD PROFILE TABULATION 25 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.92198	0.00000	0.00000	5.21911	0.00000
2	2.5400"-04	1.6804"+00	1.00000	0.94869	0.18520	0.39850	4.63016	0.08607
3	4.5720"-04	2.2245"+00	1.00000	0.96185	0.23506	0.48912	4.32979	0.11297
4	6.8580"-04	3.5840"+00	1.00000	0.97415	0.31993	0.61817	3.73338	0.16558
5	8.6360"-04	4.0369"+00	1.00000	0.98210	0.34307	0.65003	3.59003	0.18107
6	1.2954"-03	5.3170"+00	1.00000	0.98533	0.40099	0.71600	3.18834	0.22457
7	1.7272"-03	6.0447"+00	1.00000	0.98667	0.43035	0.74510	2.99775	0.24855
8	2.1590"-03	6.9114"+00	1.00000	0.98799	0.46283	0.77428	2.79861	0.27666
9	2.6162"-03	7.8564"+00	1.00000	0.98917	0.49580	0.80093	2.60965	0.30691
10	3.0480"-03	8.5840"+00	1.00000	0.98996	0.51974	0.81860	2.48070	0.32999
11	3.4290"-03	9.5891"+00	1.00000	0.99083	0.55109	0.83977	2.32206	0.36165
12	4.3180"-03	1.1499"+01	1.00000	0.99222	0.60619	0.87227	2.07055	0.42127
13	5.5880"-03	1.3386"+01	1.00000	1.00776	0.65605	0.90377	1.89778	0.47623
14	6.8326"-03	1.6854"+01	1.00000	0.99426	0.73897	0.93110	1.58760	0.58649
15	8.1280"-03	1.9500"+01	1.00000	0.99513	0.79644	0.95034	1.42383	0.66746
16	9.3980"-03	2.1800"+01	1.00000	0.99621	0.84320	0.96409	1.30730	0.73747
17	1.1506"-02	2.6953"+01	1.00000	0.99713	0.93956	0.98705	1.10366	0.89434
18	1.3665"-02	3.0084"+01	1.00000	0.99877	0.99355	0.99824	1.00945	0.98839
D 19	1.4732"-02	3.0470"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
20	1.5824"-02	3.0481"+01	1.00000	1.00138	1.00018	1.00072	1.00108	0.99964
21	1.7932"-02	3.0521"+01	1.00000	1.00427	1.00084	1.00228	1.00288	0.99941
22	2.0066"-02	3.0758"+01	1.00000	1.00763	1.00478	1.00465	0.99973	1.00492
23	2.2149"-02	3.0800"+01	1.00000	1.01132	1.00548	1.00661	1.00225	1.00435
24	2.4333"-02	3.0797"+01	1.00000	1.01553	1.00545	1.00870	1.00648	1.00220
25	2.6441"-02	3.0839"+01	1.00000	1.02005	1.00614	1.01106	1.00981	1.00124

INPUT VARIABLES Y,U,T,P

65030302 STROUD PROFILE TABULATION 29 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.90682	0.00000	0.00000	5.19831	0.00000
2	2.5400"-04	1.3868"+00	1.00000	0.92743	0.14385	0.31655	4.84225	0.06537
3	4.3434"-04	1.3275"+00	1.00000	0.93384	0.13347	0.29655	4.93704	0.06007
4	5.9436"-04	1.7270"+00	1.00000	0.94233	0.18895	0.40618	4.62110	0.08790
5	7.4930"-04	2.1626"+00	1.00000	0.94873	0.22849	0.47716	4.36109	0.10941
6	9.8552"-04	3.0934"+00	1.00000	0.95685	0.29038	0.57497	3.92059	0.14665
7	1.2040"-03	3.6129"+00	1.00000	0.96047	0.31902	0.61497	3.71607	0.16549
8	1.4224"-03	3.6992"+00	1.00000	0.96454	0.32351	0.62209	3.69772	0.16824
9	1.8898"-03	4.4510"+00	1.00000	0.97205	0.36011	0.66917	3.45310	0.19379
10	2.2708"-03	4.9045"+00	1.00000	0.97671	0.38041	0.69347	3.32314	0.20868
11	2.7076"-03	5.5377"+00	1.00000	0.98487	0.40700	0.72404	3.16476	0.22878
12	3.1267"-03	6.0124"+00	1.00000	0.99387	0.42582	0.74564	3.06619	0.24318
13	3.3839"-03	6.5453"+00	1.00000	1.00398	0.44598	0.76790	2.96466	0.25902
14	3.9827"-03	7.0809"+00	1.00000	1.01074	0.46535	0.78719	2.86150	0.27510
15	4.3917"-03	7.5527"+00	1.00000	1.01812	0.48176	0.80345	2.78137	0.28887
16	4.8616"-03	8.2467"+00	1.00000	1.02367	0.50491	0.82341	2.65950	0.30961
17	5.9004"-03	9.8087"+00	1.00000	1.02871	0.55346	0.85872	2.40732	0.35671
18	7.3762"-03	1.2478"+01	1.00000	1.02201	0.62774	0.89769	2.04497	0.43897
19	8.2372"-03	1.4515"+01	1.00000	1.01755	0.67894	0.91932	1.83344	0.50142
20	9.0856"-03	1.6494"+01	1.00000	1.01543	0.72523	0.93674	1.66832	0.56149
21	9.9263"-03	1.8553"+01	1.00000	1.01558	0.77045	0.95248	1.52837	0.62320
22	1.1478"-02	2.2808"+01	1.00000	1.01001	0.85633	0.97455	1.29517	0.75245
23	1.2951"-02	2.6155"+01	1.00000	1.00366	0.91826	0.98596	1.15289	0.85521
24	1.5060"-02	2.9777"+01	1.00000	1.00008	0.98087	0.99662	1.03238	0.96536
D 25	1.7181"-02	3.0931"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.9398"-02	3.1131"+01	1.00000	0.99998	1.00327	1.00056	0.99460	1.00599
27	2.1443"-02	3.1207"+01	1.00000	0.99995	1.00451	1.00076	0.99254	1.00828
28	2.3604"-02	3.1289"+01	1.00000	0.99996	1.00585	1.00049	0.99038	1.01072
29	2.5730"-02	3.1289"+01	1.00000	0.99996	1.00585	1.00099	0.99038	1.01072

INPUT VARIABLES Y,U,T,P

65030303 STROUD PROFILE TABULATION 27 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.89487	0.00000	0.00000	5.73549	0.00000
2	2.5400"-04	2.6333"+00	1.00000	0.92774	0.24511	0.51924	4.48772	0.11570
3	4.8260"-04	3.9490"+00	1.00000	0.94907	0.31441	0.62594	3.96350	0.15793
4	6.6040"-04	5.1263"+00	1.00000	0.96272	0.36473	0.69090	3.58829	0.19254
5	8.8646"-04	6.1313"+00	1.00000	0.97486	0.40258	0.73457	3.32939	0.22063
6	1.1049"-03	6.7922"+00	1.00000	0.98402	0.42560	0.75962	3.18560	0.23845
7	1.3233"-03	7.5531"+00	1.00000	0.99443	0.45063	0.78534	3.03730	0.25857
8	1.5799"-03	8.0725"+00	1.00000	1.00048	0.46693	0.80093	2.94234	0.27221
9	1.6942"-03	8.8685"+00	1.00000	1.00287	0.49085	0.81998	2.79063	0.29383
10	2.1717"-03	9.5635"+00	1.00000	1.01515	0.51082	0.83907	2.69808	0.31099
11	2.5857"-03	9.8393"+00	1.00000	1.01970	0.51853	0.84614	2.66279	0.31776
12	2.9972"-03	1.0737"+01	1.00000	1.02320	0.54286	0.86314	2.52803	0.34143
13	3.4823"-03	1.0947"+01	1.00000	1.02512	0.54838	0.86730	2.50135	0.34673
14	3.7287"-03	1.1468"+01	1.00000	1.02547	0.56187	0.87539	2.42735	0.36064
15	4.1504"-03	1.1468"+01	1.00000	1.02547	0.56187	0.87539	2.42735	0.36064
16	4.5745"-03	1.2090"+01	1.00000	1.02408	0.57759	0.88360	2.34032	0.37756
17	5.4204"-03	1.2924"+01	1.00000	1.02339	0.59797	0.89405	2.23544	0.39994
18	6.7005"-03	1.2992"+01	1.00000	1.02140	0.59960	0.89401	2.22310	0.40214
19	8.0035"-03	1.4551"+01	1.00000	1.02343	0.63588	0.91223	2.05806	0.44325
20	9.2558"-03	1.6769"+01	1.00000	1.02692	0.68415	0.93395	1.86353	0.50117
21	1.0579"-02	1.9608"+01	1.00000	1.02921	0.74137	0.95527	1.66028	0.57537
22	1.1674"-02	2.3213"+01	1.00000	1.02462	0.80821	0.97275	1.44861	0.67150
23	1.3076"-02	2.7784"+01	1.00000	1.01342	0.88571	0.98578	1.23874	0.79579
24	1.5006"-02	3.3692"+01	1.00000	1.00315	0.97681	0.99784	1.04352	0.95623
D 25	1.7120"-02	3.5288"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.9271"-02	3.5195"+01	1.00000	0.99885	0.99866	0.99921	1.00110	0.99811
27	2.1389"-02	3.5011"+01	1.00000	0.99627	0.99601	0.99851	1.00501	0.99353

INPUT VARIAULES Y,U,T,P

65030304 STROUD PROFILE TABULATION 28 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.20338	0.89516	0.00000	0.00000	4.15089	0.00000
2	2.5400"-04	2.9183"+00	1.20338	0.94148	0.31939	0.56994	3.18424	0.21539
3	4.5466"-04	3.4586"+00	1.20338	0.95976	0.35455	0.61961	3.05411	0.24414
4	6.8326"-04	4.7567"+00	1.20338	0.96622	0.42653	0.70038	2.69633	0.31258
5	8.9408"-04	5.0789"+00	1.20338	0.97448	0.44250	0.71887	2.63916	0.32778
6	1.1100"-03	6.4104"+00	1.20280	0.98268	0.50301	0.77487	2.37300	0.39276
7	1.3183"-03	7.2951"+00	1.20222	0.99237	0.53941	0.80654	2.23573	0.43370
8	1.5215"-03	7.9348"+00	1.20140	1.00660	0.56424	0.82984	2.16305	0.46091
9	1.7018"-03	8.2704"+00	1.19977	1.01273	0.57683	0.84082	2.12475	0.47478
10	2.1307"-03	9.4461"+00	1.19802	1.01951	0.61892	0.86988	1.97539	0.52756
11	2.6035"-03	1.0004"+01	1.19615	1.02548	0.63790	0.88331	1.91742	0.55104
12	3.0251"-03	1.0622"+01	1.19323	1.02761	0.65830	0.89531	1.84969	0.57756
13	3.4163"-03	1.0898"+01	1.19020	1.02742	0.66723	0.89988	1.81896	0.58882
14	3.8151"-03	1.1169"+01	1.18775	1.02756	0.67585	0.90433	1.79042	0.59993
15	4.7117"-03	1.1392"+01	1.17935	1.02530	0.68285	0.90682	1.76355	0.60642
16	5.5677"-03	1.1453"+01	1.16978	1.02326	0.68478	0.90686	1.75379	0.60488
17	6.4643"-03	1.1628"+01	1.16009	1.02171	0.69023	0.90882	1.73369	0.60813
18	7.2263"-03	1.1920"+01	1.15041	1.02138	0.69920	0.91294	1.70485	0.61604
19	8.0950"-03	1.2340"+01	1.13839	1.02175	0.71191	0.91898	1.66633	0.62782
20	8.9306"-03	1.3032"+01	1.12637	1.02206	0.73240	0.92817	1.60603	0.65096
21	1.0290"-02	1.4719"+01	1.10712	1.02435	0.78009	0.94845	1.47823	0.71034
22	1.1521"-02	1.5992"+01	1.08915	1.02395	0.81422	0.96061	1.39193	0.75165
23	1.3150"-02	1.9292"+01	1.06558	1.01673	0.89662	0.98282	1.20150	0.87163
24	1.4729"-02	2.1405"+01	1.04316	1.01008	0.94564	0.99245	1.10144	0.94173
25	1.6807"-02	2.3175"+01	1.02112	1.00374	0.98482	0.99853	1.02804	0.99181
D 26	1.8976"-02	2.3881"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
27	2.0937"-02	2.4177"+01	0.98016	0.99853	1.00631	1.00061	0.98871	0.99196
28	2.3020"-02	2.4254"+01	0.95916	0.99841	1.00793	1.00090	0.98609	0.97356

INPUT VARIABLES Y,U,T,P

65030305 STROUD PROFILE TABULATION 24 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.34775	0.89139	0.00000	0.00000	3.74811	0.00000
2	2.5400"-04	3.3561"+00	1.34634	0.94360	0.37092	0.61550	2.75351	0.30095
3	4.3688"-04	3.9417"+00	1.34502	0.96405	0.40804	0.66339	2.64324	0.33757
4	6.4262"-04	4.6262"+00	1.34370	0.98190	0.44730	0.70945	2.51564	0.37894
5	8.6614"-04	6.0548"+00	1.34163	0.99645	0.51945	0.77864	2.24689	0.46493
6	1.2725"-03	7.1399"+00	1.33898	1.01573	0.56802	0.82309	2.09973	0.52488
7	1.7043"-03	7.9784"+00	1.33559	1.02879	0.60285	0.85220	1.99835	0.56957
8	2.1209"-03	8.2190"+00	1.33154	1.03504	0.61247	0.86101	1.97629	0.58012
9	2.5400"-03	8.6766"+00	1.32749	1.03645	0.63036	0.87276	1.91694	0.60439
10	2.9870"-03	8.7705"+00	1.32212	1.03626	0.63397	0.87487	1.90435	0.60738
11	3.4392"-03	8.8662"+00	1.31674	1.03450	0.63762	0.87631	1.88881	0.61090
12	4.2901"-03	8.9991"+00	1.30591	1.03087	0.64267	0.87776	1.86542	0.61449
13	5.1105"-03	9.3175"+00	1.29243	1.02531	0.65459	0.88227	1.81661	0.62769
14	6.0173"-03	9.6596"+00	1.27631	1.02390	0.66716	0.88868	1.77432	0.63925
15	6.8097"-03	1.0108"+01	1.26077	1.02421	0.68330	0.89749	1.72518	0.65589
16	7.6581"-03	1.0765"+01	1.24465	1.02548	0.70625	0.90977	1.65938	0.68239
17	8.5776"-03	1.1585"+01	1.22439	1.02634	0.73388	0.92337	1.58310	0.71415
18	1.0226"-02	1.3575"+01	1.18867	1.02931	0.79694	0.95162	1.42586	0.79332
19	1.1928"-02	1.6196"+01	1.14626	1.02700	0.87308	0.97779	1.25427	0.89359
20	1.3635"-02	1.8523"+01	1.10376	1.01436	0.93548	0.99049	1.12107	0.97519
21	1.5339"-02	2.0109"+01	1.05862	1.00505	0.97571	0.99657	1.04321	1.01129
D 22	1.7460"-02	2.1099"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
23	1.9187"-02	2.1477"+01	0.95692	0.99802	1.00913	1.00116	0.98426	0.97336
24	2.0884"-02	2.1816"+01	0.91377	0.99735	1.01723	1.00269	0.97161	0.94299

INPUT VARIABLES Y,U,T,P

65030306 STROUD PROFILE TABULATION 26 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.65979	0.89379	0.00000	0.00000	3.59146	0.00000
2	2.5400"-04	3.4813"+00	1.65650	0.96247	0.39073	0.63576	2.64747	0.39779
3	4.2672"-04	4.2370"+00	1.65478	0.98821	0.43840	0.69498	2.51307	0.45762
4	6.3754"-04	5.0391"+00	1.65149	1.01026	0.48362	0.74603	2.37962	0.51775
5	8.3566"-04	5.9416"+00	1.64820	1.02274	0.52976	0.79021	2.22494	0.58537
6	1.3056"-03	6.7605"+00	1.64318	1.02857	0.56833	0.82217	2.09281	0.64553
7	1.6916"-03	7.1721"+00	1.63653	1.03022	0.58674	0.83601	2.03018	0.67390
8	2.1361"-03	7.3606"+00	1.62829	1.02872	0.59498	0.84109	1.99842	0.68531
9	2.5578"-03	7.6208"+00	1.61999	1.02713	0.60616	0.84797	1.95697	0.70195
10	2.9820"-03	7.5895"+00	1.61168	1.02412	0.60483	0.84584	1.95577	0.69703
11	3.3960"-03	7.7203"+00	1.60173	1.02252	0.61038	0.84884	1.93397	0.70302
12	3.8202"-03	7.7205"+00	1.59092	1.01900	0.61039	0.84738	1.92729	0.69949
13	4.6914"-03	7.8872"+00	1.56522	1.01632	0.61740	0.85080	1.89900	0.70126
14	5.5321"-03	8.2761"+00	1.53529	1.01527	0.63345	0.86043	1.84506	0.71597
15	6.3856"-03	4.1334"+00	1.50294	1.59128	0.43219	0.87393	4.08890	0.32123
16	6.7920"-03	9.2085"+00	1.48718	1.01838	0.67034	0.88339	1.73669	0.75648
17	7.6657"-03	9.7353"+00	1.44903	1.01921	0.69030	0.89464	1.67967	0.77180
18	8.5268"-03	1.0604"+01	1.41001	1.02075	0.72201	0.91152	1.59385	0.80638
19	1.0241"-02	1.2892"+01	1.32116	1.01827	0.79950	0.94491	1.39682	0.89372
20	1.1935"-02	1.5508"+01	1.23654	1.01249	0.87974	0.97154	1.21958	0.98504
21	1.3625"-02	1.7612"+01	1.15435	1.00456	0.93929	0.98604	1.10201	1.03287
22	1.5324"-02	1.9027"+01	1.07553	1.00017	0.97732	0.99429	1.03503	1.03319
D 23	1.7041"-02	1.9898"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
24	1.8793"-02	2.0610"+01	0.92948	0.99956	1.01816	1.00421	0.97278	0.95951
25	2.0419"-02	2.1116"+01	0.87056	0.99875	1.03088	1.00679	0.95382	0.91892
26	2.2154"-02	2.1439"+01	0.81665	0.99930	1.03891	1.00892	0.94310	0.87364

INPUT VARIABLES Y,U,T,P

65030307 STROUD PROFILE TABULATION 19 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	3.37830	0.89944	0.00000	0.00000	3.22454	0.00000
2	2.5400"-04	3.1717"+00	3.36985	0.97873	0.39901	0.62909	2.48576	0.85284
3	4.1910"-04	3.8202"+00	3.36310	1.00540	0.44608	0.68820	2.38009	0.97243
4	6.3246"-04	4.3985"+00	3.35465	1.02912	0.48396	0.73365	2.29807	1.07096
5	8.5852"-04	4.5750"+00	3.34625	1.04494	0.49491	0.74955	2.29380	1.09347
6	1.2751"-03	4.6997"+00	3.32425	1.04293	0.50250	0.75580	2.26229	1.11059
7	1.6891"-03	4.7044"+00	3.29725	1.03578	0.50278	0.75347	2.24577	1.10624
8	2.1260"-03	6.1215"+00	3.26345	0.87276	0.58184	0.75159	1.66861	1.46996
9	2.5603"-03	4.7006"+00	3.21955	1.02307	0.50255	0.74862	2.21903	1.08616
10	2.9870"-03	4.8249"+00	3.16550	1.01887	0.51000	0.75372	2.18415	1.09237
11	3.4011"-03	4.9136"+00	3.10130	1.01621	0.51524	0.75733	2.16050	1.08712
12	5.1460"-03	5.9866"+00	2.69590	1.01148	0.57480	0.80385	1.95579	1.10805
13	6.8174"-03	8.1082"+00	2.16210	1.00670	0.67703	0.87014	1.65182	1.13895
14	8.5166"-03	1.1118"+01	1.64525	1.00190	0.79972	0.93048	1.35374	1.13084
15	1.0229"-02	1.4489"+01	1.24320	0.99982	0.91778	0.97479	1.12808	1.07426
D 16	1.1935"-02	1.7111"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
17	1.3652"-02	1.8301"+01	0.85135	1.00150	1.03516	1.01020	0.95236	0.90306
18	1.5337"-02	1.9549"+01	0.72970	1.00444	1.07078	1.02058	0.90843	0.81978
19	1.7051"-02	2.0712"+01	0.62835	1.00595	1.10294	1.02883	0.87012	0.74296

INPUT VARIABLES Y,U,T,P

65030801 STROUD PROFILE TABULATION 18 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/U
1	0.0000"+00	1.0000"+00	1.00000	0.41861	0.00000	0.00000	5.57182	0.00000
2	2.5400"-04	1.8119"+00	1.00000	0.57766	0.12262	0.31233	6.48790	0.04814
3	7.0104"-04	2.3323"+00	1.00000	0.76751	0.14961	0.42339	8.00098	0.05287
4	1.1100"-03	4.7575"+00	1.00000	0.89540	0.23186	0.62093	7.17174	0.08658
5	1.5596"-03	9.7490"+00	1.00000	0.89445	0.34206	0.75552	4.87851	0.15487
6	1.9761"-03	1.2948"+01	1.00000	0.90642	0.39677	0.80403	4.10646	0.19580
7	3.3731"-03	1.7762"+01	1.00000	0.93877	0.46713	0.86004	3.38973	0.25372
8	4.9962"-03	2.1866"+01	1.00000	0.96669	0.51963	0.89638	2.97570	0.30123
9	6.5557"-03	2.6453"+01	1.00000	0.99092	0.57264	0.92666	2.61866	0.35387
10	8.6843"-03	3.2968"+01	1.00000	1.01876	0.64042	0.95886	2.24171	0.42774
11	1.0818"-02	4.0531"+01	1.00000	1.03366	0.71104	0.98128	1.90457	0.51522
12	1.2949"-02	5.0573"+01	1.00000	1.03156	0.79518	0.99417	1.56313	0.63601
13	1.5083"-02	6.3039"+01	1.00000	1.01698	0.88860	0.99851	1.26269	0.79078
14	1.7211"-02	7.2242"+01	1.00000	1.00162	0.95170	0.99692	1.09729	0.90853
15	1.9385"-02	7.7629"+01	1.00000	0.99863	0.98677	0.99831	1.02352	0.97537
D 16	2.1481"-02	7.9712"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
17	2.3480"-02	7.9717"+01	1.00000	1.00015	1.00003	1.00008	1.00010	0.99998
18	2.5781"-02	7.9335"+01	1.00000	0.99949	0.99762	0.99956	1.00390	0.99568

INPUT VARIABLES Y,U,T,P

65030802 STROUD PROFILE TABULATION 19 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.41498	0.00000	0.00000	5.34840	0.00000
2	2.5400"-04	2.1076"+00	1.00000	0.52983	0.14140	0.33212	5.51723	0.06020
3	8.9916"-04	2.3598"+00	1.00000	0.74499	0.15350	0.42039	7.50061	0.05605
4	1.5723"-03	6.3957"+00	1.00000	0.83595	0.27788	0.65860	5.61742	0.11724
5	2.1869"-03	9.1755"+00	1.00000	0.86329	0.33712	0.73337	4.73237	0.15497
6	3.4519"-03	1.2240"+01	1.00000	0.88600	0.39212	0.78795	4.03801	0.19513
7	5.1283"-03	1.5883"+01	1.00000	0.90619	0.44877	0.83246	3.44084	0.24193
8	6.4567"-03	1.9142"+01	1.00000	0.91961	0.49396	0.86104	3.03847	0.28338
9	7.7216"-03	2.2452"+01	1.00000	0.93241	0.53597	0.88425	2.72182	0.32487
10	9.0145"-03	2.6577"+01	1.00000	0.94409	0.58411	0.90613	2.40657	0.37652
11	1.0279"-02	3.1505"+01	1.00000	0.95687	0.63685	0.92691	2.11841	0.43755
12	1.1600"-02	3.7155"+01	1.00000	0.96835	0.69234	0.94504	1.86292	0.50729
13	1.2850"-02	4.2591"+01	1.00000	0.98171	0.74192	0.96084	1.67719	0.57289
14	1.4105"-02	4.9977"+01	1.00000	0.99248	0.80434	0.97579	1.47175	0.66301
15	1.5469"-02	5.5599"+01	1.00000	1.00655	0.84877	0.98850	1.35634	0.72880
16	1.7531"-02	6.6805"+01	1.00000	1.01627	0.93105	1.00215	1.15856	0.86500
17	1.9680"-02	7.4492"+01	1.00000	1.01311	0.98351	1.00521	1.04464	0.96226
D 18	2.1779"-02	7.6996"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
19	2.3929"-02	7.7067"+01	1.00000	0.99217	1.00047	0.99611	0.99132	1.00484

INPUT VARIABLES Y,U,T,P

65030803 STROUD PROFILE TABULATION 17 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.16438	0.42497	0.00000	0.00000	4.66447	0.00000
2	2.5400"-04	1.7142"+00	1.16438	0.63797	0.12910	0.31650	6.00306	0.06139
3	6.7310"-04	6.0950"+00	1.16226	0.82863	0.29548	0.65147	4.86105	0.15577
4	1.0922"-03	9.0958"+00	1.15856	0.88666	0.36632	0.74727	4.16133	0.20805
5	1.5367"-03	1.1139"+01	1.15751	0.90155	0.40750	0.78647	3.72492	0.24439
6	1.9482"-03	1.2099"+01	1.15381	0.91329	0.42547	0.80419	3.57261	0.25972
7	2.3749"-03	1.3169"+01	1.15328	0.92112	0.44463	0.82005	3.40155	0.27803
8	4.4983"-03	1.8247"+01	1.13848	0.95056	0.52614	0.87625	2.77363	0.35967
9	6.6751"-03	2.4027"+01	1.12315	0.97071	0.60568	0.91587	2.28651	0.44988
10	8.7732"-03	3.1527"+01	1.11099	0.99286	0.69545	0.95124	1.87087	0.56488
11	1.0892"-02	3.9912"+01	1.09395	1.01621	0.78373	0.98041	1.56488	0.68512
12	1.3053"-02	5.0932"+01	1.07611	1.03089	0.88647	1.00295	1.28007	0.84315
13	1.5174"-02	5.7721"+01	1.05708	1.02159	0.94421	1.00518	1.13331	0.93757
14	1.7323"-02	6.1791"+01	1.03647	1.01191	0.97720	1.00378	1.05514	0.98602
15	1.9439"-02	6.4396"+01	1.02167	1.00135	0.99774	1.00047	1.00547	1.01658
D 16	2.0569"-02	6.4686"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
17	2.2636"-02	6.5570"+01	0.96882	0.99980	1.00686	1.00052	0.98744	0.98165

INPUT VARIABLES Y,U,T,P

65030804 STROUD PROFILE TABULATION 15 POINTS, DELTA AT POINT 12

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.35859	0.42282	0.00000	0.00000	3.86378	0.00000
2	2.5400"-04	3.5585"+00	1.35720	0.71436	0.24109	0.50753	4.43163	0.15543
3	6.3246"-04	1.0022"+01	1.35554	0.83640	0.42685	0.74893	3.07847	0.32977
4	1.0160"-03	1.3454"+01	1.35054	0.87215	0.49778	0.80712	2.64204	0.41360
5	1.4097"-03	1.5672"+01	1.34499	0.88866	0.53866	0.83725	2.41590	0.46612
6	1.8542"-03	1.7408"+01	1.33805	0.70198	0.56561	0.85668	2.26988	0.50499
7	2.2682"-03	1.9082"+01	1.33139	0.91057	0.59606	0.87161	2.13833	0.54269
8	4.3790"-03	2.4612"+01	1.28782	0.93611	0.67888	0.91098	1.80063	0.65153
9	6.5126"-03	3.0384"+01	1.22537	0.96129	0.75569	0.94248	1.55548	0.74246
10	8.6665"-03	3.7371"+01	1.15348	0.98841	0.83931	0.97212	1.34151	0.83587
11	1.0785"-02	4.6044"+01	1.05662	1.00474	0.93274	0.99427	1.13629	0.92456
D 12	1.2936"-02	5.2854"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
13	1.5143"-02	4.2089"+01	0.93478	0.99304	0.89135	0.98270	1.21548	0.75576
14	1.7181"-02	4.2840"+01	0.88454	0.98864	0.89936	0.98169	1.19148	0.72880
15	1.9225"-02	4.1766"+01	0.85734	0.98675	0.88789	0.97907	1.21594	0.69033

INPUT VARIABLES Y,U,T,P

65030805 STROUD PROFILE TABULATION 20 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.75742	0.43644	0.00000	0.00000	3.55423	0.00000
2	2.5400"-04	5.1626"+00	1.75575	0.83765	0.31863	0.63358	3.95394	0.28134
3	4.7752"-04	7.8870"+00	1.74870	0.89138	0.40130	0.73731	3.37565	0.38195
4	6.7310"-04	1.1803"+01	1.74703	0.91828	0.49635	0.81703	2.70957	0.52679
5	9.1948"-04	1.4199"+01	1.73998	0.94794	0.54635	0.85770	2.46449	0.60555
6	1.1430"-03	1.5207"+01	1.73460	0.95883	0.56607	0.87219	2.37404	0.63727
7	1.3005"-03	1.6435"+01	1.72940	0.96187	0.58920	0.88398	2.25091	0.67917
8	1.7450"-03	1.8439"+01	1.71529	0.97130	0.62510	0.90290	2.08629	0.74234
9	2.1692"-03	1.9680"+01	1.69952	0.97595	0.64634	0.91287	1.99477	0.77775
10	2.5908"-03	2.0803"+01	1.67836	0.97997	0.66496	0.92115	1.91900	0.80564
11	2.9972"-03	2.1495"+01	1.65906	0.98508	0.67620	0.92723	1.88031	0.81813
12	4.2418"-03	2.3888"+01	1.58352	1.00134	0.71363	0.94625	1.75819	0.85225
13	5.3137"-03	2.5907"+01	1.52209	1.01548	0.74376	0.96117	1.67005	0.87601
14	6.4897"-03	2.9136"+01	1.43764	1.02767	0.78957	0.97811	1.53462	0.91630
15	7.4625"-03	3.2285"+01	1.36024	1.03073	0.83180	0.98858	1.41249	0.95202
16	8.9154"-03	3.7200"+01	1.23719	1.02698	0.89375	0.99808	1.24710	0.99015
17	9.5834"-03	3.9950"+01	1.17743	1.02130	0.92660	1.00053	1.16592	1.01040
18	1.0660"-02	4.3622"+01	1.08092	1.01082	0.96873	1.00137	1.06852	1.01299
D 19	1.1694"-02	4.6453"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
20	1.3884"-02	4.7854"+01	0.91221	0.98279	1.01511	0.99316	0.95721	0.94647

INPUT VARIABLES Y,U,T,P

65030806 STROUD PROFILE TABULATION 17 POINTS, DELTA AT POINT 16

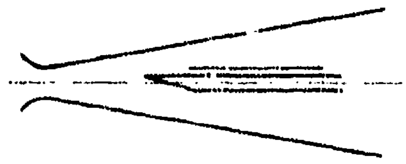
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	2.08343	0.44080	0.00000	0.00000	3.26108	0.00000
2	2.5400"-04	5.5759"+00	2.08144	0.72985	0.35139	0.61028	3.01636	0.42112
3	5.2324"-04	8.5182"+00	2.07387	0.95863	0.44181	0.78457	3.15350	0.51596
4	7.1628"-04	1.0967"+01	2.06443	0.97230	0.50474	0.83473	2.73497	0.63008
5	9.4742"-04	1.2620"+01	2.05620	0.97852	0.54310	0.85997	2.50731	0.70525
6	1.3157"-03	1.4396"+01	2.04172	0.98290	0.58147	0.88160	2.29872	0.78304
7	1.6358"-03	1.5152"+01	2.02298	1.02058	0.59706	0.90575	2.30132	0.79621
8	2.1006"-03	1.6170"+01	1.99389	1.02139	0.61742	0.91520	2.19722	0.83051
9	2.5806"-03	1.6891"+01	1.95842	1.02107	0.63145	0.92096	2.12718	0.84790
10	2.9464"-03	1.7404"+01	1.92706	1.01942	0.64125	0.92417	2.07708	0.85743
11	3.9929"-03	1.9668"+01	1.82304	1.01707	0.68278	0.93848	1.88923	0.90560
12	5.0724"-03	2.3072"+01	1.69576	1.02344	0.74085	0.95974	1.67820	0.96978
13	6.1747"-03	2.7050"+01	1.54178	1.02866	0.80342	0.97856	1.48348	1.01701
14	7.2187"-03	3.1333"+01	1.36469	1.02410	0.86573	0.98986	1.30733	1.03329
15	8.2906"-03	3.6243"+01	1.17710	1.01178	0.93205	0.99575	1.14137	1.02692
D 16	9.3243"-03	4.1649"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
17	1.1491"-02	4.3100"+01	0.85426	0.98525	1.02932	0.99689	0.93798	0.90791

INPUT VARIABLES Y,U,T,P

65030807 STROUD PROFILE TABULATION 14 POINTS, DELTA AT POINT 13

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	3.70391	0.44775	0.00000	0.00000	2.59424	0.00000
2	2.5400"-04	4.8673"+00	3.69981	0.82580	0.37635	0.63531	2.84970	0.82484
3	4.8260"-04	5.3046"+00	3.61865	0.96106	0.39487	0.70487	3.18652	0.80046
4	7.0358"-04	6.5598"+00	3.56702	0.98069	0.44365	0.75856	2.92355	0.92552
5	9.8298"-04	8.0880"+00	3.49980	1.00571	0.50942	0.82088	2.59668	1.10638
6	1.5132"-03	9.7791"+00	3.37031	1.00790	0.54902	0.84849	2.38842	1.19731
7	1.5265"-03	1.0143"+01	3.27771	1.01014	0.55968	0.85606	2.33951	1.19939
8	1.9583"-03	1.1493"+01	2.92606	1.01160	0.59754	0.87849	2.16145	1.18926
9	2.3673"-03	1.3014"+01	2.62935	1.01059	0.63749	0.89853	1.98663	1.18922
10	2.6873"-03	1.7968"+01	1.94416	1.01091	0.75300	0.94509	1.57528	1.16640
11	3.3426"-03	2.4623"+01	1.42598	1.00947	0.88472	0.98149	1.23073	1.13720
12	3.6805"-03	2.7615"+01	1.24094	1.00729	0.93791	0.99200	1.11865	1.10043
D 13	4.3891"-03	3.1327"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
14	5.3873"-03	3.4374"+01	0.75929	0.99040	1.04820	1.00299	0.91560	0.83176

INPUT VARIABLES Y,U,T,P



M : 1.0 Rising to 3.0

R THETA X 10^{-3} : 3 - 10

TW/TR : 0.80 - 1.0

6504

FPG - MHT

Special purpose extension of continuous running tunnel (see text). W = 0.4 m, H = 0.14 to 0.42 m. PO : 0.13 MN/m^2. TO : 340 K. Air. 8 < PE/m X 10^{-6} < 17.

PASIUK L., HASTINGS S.M. and CHATHAM R., 1965. Experimental Reynolds' analogy factor for a compressible turbulent boundary layer with a pressure gradient. NOLTR 64-200.

1 The test boundary layer was formed on a flat plate model (W = 0.305 m, L = 1.51 m) placed with its upper surface on the centre line of the tunnel. The leading edge (X = 0) was chamfered on the under side at 5^o, and placed at the tunnel throat. The space between the edge of the plate and the tunnel sidewalls was filled with fibre glass spacers insulating it thermally and electrically from the tunnel walls (the size stated in text is not big enough unless there are two on each side). The nozzle blocks were constructed of wood. On the upper (test) side the contour was chosen to give a predicted constant value of the "Pohlhausen parameter" (θ^2/ν_e) (T_o/T_e) (du_e/dx) for x > 0.4 m. The block ended at X = 0.935 m when the height above the plate was 0.197 m. The plate extended about 0.61 m beyond the exit-plane of the nozzle. The plate was actively cooled.

6 There were three static tappings and three thermocouple plugs, located at X = 0.287, 0.592 and 0.898 m. The thermocouple plugs contained four junctions, the uppermost at the plate surface and the others buried at
8 intervals of 3.18 mm. These were mounted on the centre line, with the static tappings 12.7 mm to one side.

7 Pitot profiles were measured with a CPP (d_1 = 0.559 mm) and temperature profiles with an ECP ($\alpha = 5^o$, d = 1.2 mm) as constructed by Danberg (1961). The Pitot probe was also used for a longitudinal traverse
9 in the free stream just outside the boundary layer. Values of static pressure and Mach number deduced from this were used in reducing the profile data. The static pressure values agreed with those measured at the orifices, and accordingly the pressure was assumed constant through the boundary layer. The wall heat flux was deduced from the temperature profiles in the thermocouple plugs. The recovery factor used
10 by the authors was 0.88. No profile corrections are reported.

12 The editors have presented all the profiles measured, and have interpolated the author's TO profiles to the Y-values of Pitot measurements. The D-state has been selected by the editors. The wall temperatures
13 are our interpolations from the three measured values. The profiles consist of three series of nine profiles, each at a different wall heat flux condition. Series 01 is for a near-adiabatic wall, while
14 series 02 and 03 describe flows with increasing heat transfer rates. Where available the experimental heat flux is also given.

§ DATA: 6504 0101-0309. Pitot and TO profiles obtained separately. NX = 9. Some heat flux measurements determined from the temperature gradient in the wall.

15 Editors' comments

The description of the experiment and presentation of the data in the original source is far from complete. The data itself is rough and generally of doubtful quality, but is presented here as the only other case of a relatively strongly accelerated flow with heat transfer results is the channel wall study of Voisinet & Lee - CAT 7304 at higher Mach numbers. Adiabatic studies, also on channel walls, were made by Michel et al. - CAT 6902 and Thomas - CAT 7401.

In no case do the measurements extend in as far as the momentum-deficit peak, so that integral values should be treated with reserve. We have transformed the profiles using CF values as correlated by Fernholz (1971), and the wall-law plots indicate that CF is substantially higher than for a zero-pressure-gradient flow.

This is a straight-wall, reflected wave, flow, and normal pressure gradient effects are expected to be negligible, as reported by the authors.

CAT 6504 PASIUK BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD* YOD*	TW/TR PW/PD* SW *	RED2W RED2O D2	CF CQ * PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
65040101	1.4010	0.9601	3.0242"+03	NM	2.5947	1.5591	4.1468"+04	4.1468"+04
2.6822"-01	1.3215"+05	1.0000	3.7117"+03	NM	1.8271	1.8239	3.1429"+02	2.4216"+02
INFINITE	3.3722"+02	0.0000	2.2265"-04	NM	-0.1609	2.4870"-04	4.3712"+02	3.2734"+02
65040102	1.6895	0.9665	2.7166"+03	NM	2.7370	1.5101	2.7200"+04	2.7200"+04
2.8651"-01	1.3215"+05	1.0000	3.6746"+03	NM	1.8437	1.8398	3.1362"+02	2.1467"+02
INFINITE	3.3722"+02	0.0000	2.3767"-04	NM	-0.0299	2.6961"-04	4.9631"+02	3.2448"+02
65040103	1.9740	0.9660	3.7204"+03	NM	3.0091	1.3929	1.7586"+04	1.7586"+04
3.9014"-01	1.3215"+05	1.0000	5.5530"+03	NM	1.8366	1.8292	3.1092"+02	1.8952"+02
INFINITE	3.3722"+02	0.0000	4.0219"-04	NM	0.0119	4.8282"-04	5.4486"+02	3.2186"+02
65040104	2.2510	0.9666	3.9481"+03	NM	3.2689	1.3536	1.1411"+04	1.1411"+04
4.9073"-01	1.3215"+05	1.0000	6.5257"+03	NM	1.8378	1.8264	3.0890"+02	1.6749"+02
INFINITE	3.3722"+02	0.0000	5.3958"-04	NM	0.1429	6.7181"-04	5.8409"+02	3.1957"+02
65040105	2.4925	0.9678	3.7663"+03	NM	3.7875	1.3332	7.8252"+03	7.8252"+03
5.9131"-01	1.3215"+05	1.0000	6.8264"+03	NM	1.8385	1.8248	3.0755"+02	1.5038"+02
INFINITE	3.3722"+02	0.0000	6.4013"-04	NM	0.0760	8.3757"-04	6.1282"+02	3.1779"+02
65040106	2.6790	0.9673	3.7674"+03	NM	4.2224	1.3229	5.8622"+03	5.8622"+03
6.9494"-01	1.3215"+05	1.0000	7.3324"+03	NM	1.8367	1.8204	3.0620"+02	1.3847"+02
INFINITE	3.3722"+02	0.0000	7.6053"-04	NM	0.0282	1.0382"-03	6.3205"+02	3.1655"+02
65040107	2.8260	0.9658	3.7715"+03	NM	4.5363	1.3196	4.6802"+03	4.6802"+03
7.9553"-01	1.3215"+05	1.0000	7.7597"+03	NM	1.8333	1.8152	3.0485"+02	1.2984"+02
INFINITE	3.3722"+02	0.0000	8.7245"-04	NM	0.0316	1.2323"-03	6.4563"+02	3.1565"+02
65040108	2.9560	0.9659	3.9697"+03	NM	4.7913	1.3065	3.8436"+03	3.8436"+03
8.9611"-01	1.3215"+05	1.0000	8.5898"+03	NM	1.8340	1.8151	3.0417"+02	1.2273"+02
INFINITE	3.3722"+02	0.0000	1.0376"-03	NM	0.0587	1.5058"-03	6.5659"+02	3.1492"+02
65040109	2.9730	0.9662	4.0557"+03	NM	4.8614	1.3065	3.7465"+03	3.7465"+03
9.2354"-01	1.3215"+05	1.0000	8.8357"+03	NM	1.8303	1.8123	3.0417"+02	1.2184"+02
INFINITE	3.3722"+02	0.0000	1.0774"-03	NM	0.0461	1.5838"-03	6.5796"+02	3.1482"+02
65040201	1.6030	0.9164	2.4098"+03	NM	2.5882	1.6241	3.1480"+04	3.1480"+04
2.6822"-01	1.3440"+05	1.0000	3.0401"+03	NM	1.8526	1.8499	2.9909"+02	2.2348"+02
INFINITE	3.3833"+02	0.0000	1.8889"-04	NM	0.0835	2.0871"-04	4.8047"+02	3.2639"+02
65040202	1.7970	0.9195	3.2269"+03	NM	2.5972	1.4756	2.3498"+04	2.3498"+04
2.8651"-01	1.3440"+05	1.0000	4.3563"+03	1.5141"-04	1.8485	1.8445	2.9841"+02	2.0557"+02
INFINITE	3.3833"+02	0.0000	2.8940"-04	NM	0.1578	3.2701"-04	5.1658"+02	3.2453"+02
65040203	2.0680	0.9138	3.6506"+03	NM	2.8430	1.4045	1.5450"+04	1.5450"+04
3.9014"-01	1.3440"+05	1.0000	5.3795"+03	NM	1.8417	1.8348	2.9435"+02	1.8236"+02
INFINITE	3.3833"+02	0.0000	4.0325"-04	NM	0.2291	4.7603"-04	5.5992"+02	3.2211"+02
65040204	2.3260	0.9091	3.4117"+03	NM	3.1235	1.3442	1.0320"+04	1.0320"+04
4.9073"-01	1.3440"+05	1.0000	5.5302"+03	NM	1.8615	1.8542	2.9097"+02	1.6250"+02
INFINITE	3.3833"+02	0.0000	4.6929"-04	NM	0.2850	5.6481"-04	5.9449"+02	3.2005"+02
65040205	2.5360	0.9075	3.4786"+03	NM	3.5891	1.3282	7.2107"+03	7.2107"+03
5.9131"-01	1.3440"+05	1.0000	6.1445"+03	1.6846"-04	1.8515	1.8406	2.8894"+02	1.4668"+02
INFINITE	3.3833"+02	0.0000	5.8888"-04	NM	0.2342	7.4613"-04	6.2066"+02	3.1840"+02
65040206	2.7330	0.9043	3.7238"+03	NM	3.9588	1.3097	5.4872"+03	5.4872"+03
6.9494"-01	1.3440"+05	1.0000	7.0218"+03	NM	1.8506	1.8365	2.869'"+02	1.3567"+02
INFINITE	3.3833"+02	0.0000	7.4102"-04	NM	0.2097	9.7183"-04	6.3824"+02	3.1726"+02
65040207	2.9120	0.9009	3.7683"+03	NM	4.2385	1.3040	4.1774"+03	4.1774"+03
7.9553"-01	1.3440"+05	1.0000	7.5920"+03	NM	1.8438	1.8283	2.8488"+02	1.2550"+02
INFINITE	3.3833"+02	0.0000	8.8421"-04	NM	0.2695	1.2051"-03	6.5406"+02	3.1620"+02
65040208	3.0190	0.9005	3.9268"+03	NM	4.4488	1.3082	3.5561"+03	3.5561"+03
8.9611"-01	1.3440"+05	1.0000	8.2421"+03	1.2127"-04	1.8354	1.8185	2.8420"+02	1.1985"+02
INFINITE	3.3833"+02	0.0000	1.0184"-03	NM	0.2938	1.4315"-03	6.6267"+02	3.1561"+02
65040209	3.0410	0.9008	4.0101"+03	NM	4.5123	1.3135	3.4410"+03	3.4410"+03
9.2354"-01	1.3440"+05	1.0000	8.4913"+03	NM	1.8308	1.8133	2.8420"+02	1.1873"+02
INFINITE	3.3833"+02	0.0000	1.0620"-03	NM	0.2978	1.5126"-03	6.6437"+02	3.1549"+02

CAT 6504 PASIUK BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN / X * / RZ	MD * / PCD* / TOD*	TW/TR / PW/PD* / SW *	RED2W / RED2D / D2	CF / CQ * / PI2	H12 / H32 / H42	H12K / H32K / D2K	PW / TW* / UD	PD / TD / TR
65040301	1.5980	0.8768	2.4818"+03	NM	2.5070	1.6452	3.0844"+04	3.0844"+04
2.6822"-01	1.3071"+05	1.0000	3.0205"+03	NM	1.8274	1.8261	2.8717"+02	2.2469"+02
INFINITE	3.3944"+02	0.0000	1.9352"-04	NM	0.1555	2.1456"-04	4.8026"+02	3.2751"+02
65040302	1.7510	0.8767	3.8480"+03	NM	2.5017	1.4761	2.4514"+04	2.4514"+04
2.8651"-01	1.3071"+05	1.0000	4.9269"+03	2.4578"-04	1.8223	1.8191	2.8581"+02	2.1042"+02
INFINITE	3.3944"+02	0.0000	3.3219"-04	NM	0.1674	3.7651"-04	5.0926"+02	3.2603"+02
65040303	1.9830	0.8677	4.4524"+03	NM	2.6770	1.4071	1.7153"+04	1.7153"+04
3.9014"-01	1.3071"+05	1.0000	6.1329"+03	NM	1.8244	1.8195	2.8106"+02	1.9001"+02
INFINITE	3.3944"+02	0.0000	4.5492"-04	NM	0.2230	5.3115"-04	5.4805"+02	3.2390"+02
65040304	2.2490	0.8610	4.4497"+03	NM	3.0739	1.3603	1.1322"+04	1.1322"+04
4.9073"-01	1.3071"+05	1.0000	6.7147"+03	NM	1.8393	1.8295	2.7699"+02	1.6874"+02
INFINITE	3.3944"+02	0.0000	5.6583"-04	NM	0.1928	6.8365"-04	5.8575"+02	3.2169"+02
65040305	2.4400	0.8501	4.3937"+03	NM	3.2648	1.3458	8.3997"+03	8.3997"+03
5.9131"-01	1.3071"+05	1.0000	7.0525"+03	2.3641"-04	1.8299	1.8212	2.7223"+02	1.5495"+02
INFINITE	3.3944"+02	0.0000	6.5616"-04	NM	0.2863	8.2171"-04	6.0896"+02	3.2026"+02
65040306	2.6600	0.8434	4.5534"+03	NM	3.5599	1.3095	5.9708"+03	5.9708"+03
6.9494"-01	1.3071"+05	1.0000	7.9004"+03	NM	1.8453	1.8326	2.6884"+02	1.4055"+02
INFINITE	3.3944"+02	0.0000	8.2752"-04	NM	0.3059	1.0486"-03	6.3228"+02	3.1876"+02
65040307	2.8290	0.8376	4.4880"+03	NM	3.8516	1.2968	4.6082"+03	4.6082"+03
7.9553"-01	1.3071"+05	1.0000	8.2654"+03	NM	1.8417	1.8284	2.6612"+02	1.3052"+02
INFINITE	3.3944"+02	0.0000	9.4990"-04	NM	0.3278	1.2487"-03	6.4802"+02	3.1772"+02
65040308	2.9360	0.8285	4.8792"+03	NM	4.0922	1.3269	3.9182"+03	3.9182"+03
8.9611"-01	1.3071"+05	1.0000	9.2844"+03	2.3883"-04	1.8189	1.8045	2.6273"+02	1.2461"+02
INFINITE	3.3944"+02	0.0000	1.1319"-03	NM	0.3386	1.5600"-03	6.5712"+02	3.1710"+02
65040309	2.9360	0.8264	5.1839"+03	NM	4.1219	1.3437	3.9182"+03	3.9182"+03
9.2354"-01	1.3071"+05	1.0000	9.8439"+03	NM	1.8133	1.7962	2.6205"+02	1.2461"+02
INFINITE	3.3944"+02	0.0000	1.2001"-03	NM	0.3295	1.6620"-03	6.5712"+02	3.1710"+02

65040101 PASIUK PROFILE TABULATION 11 POINTS, DELTA AT POINT 11

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93200	0.00000	0.00000	1.29787	0.00000
2	2.7940"-04	1.7976"+00	NM	0.98500	0.68166	0.73080	1.16007	0.62996
3	4.0640"-04	1.9563"+00	NM	0.99500	0.73376	0.77879	1.14384	0.68085
4	5.3340"-04	2.0155"+00	NM	1.00200	0.75161	0.79487	1.14208	0.69599
5	7.8740"-04	2.1798"+00	NM	1.00700	0.79800	0.83586	1.12186	0.74507
6	1.0414"-03	2.2937"+00	NM	1.00700	0.82798	0.86170	1.10495	0.77986
7	1.2954"-03	2.4338"+00	NM	1.00700	0.86296	0.89117	1.08510	0.82130
8	1.5494"-03	2.6500"+00	NM	1.00800	0.91363	0.93268	1.05726	0.88217
9	2.9210"-03	3.0213"+00	NM	1.01500	0.99358	0.99514	1.01868	0.97689
10	5.6358"-03	3.0527"+00	NM	1.00100	1.00000	1.00000	1.00100	0.99900
D 11	7.0358"-03	3.0527"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,TO/TOD ASSUMEP=PD

65040105 PASIUK PROFILE TABULATION 13 POINTS, DELTA AT POINT 13

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.91220	0.00000	0.00000	2.04562	0.00000
2	2.7940"-04	2.4470"+00	NM	0.94012	0.48696	0.62589	1.62843	0.38435
3	4.0640"-04	2.3652"+00	NM	0.94712	0.50261	0.64180	1.61654	0.39702
4	5.3340"-04	2.8005"+00	NM	0.95211	0.53229	0.67113	1.57918	0.42498
5	7.8740"-04	3.1581"+00	NM	0.96210	0.57401	0.71044	1.53082	0.46409
6	1.0414"-03	3.5810"+00	NM	0.96709	0.61933	0.75068	1.46872	0.51111
7	1.2954"-03	3.9513"+00	NM	0.97008	0.65624	0.78158	1.41713	0.55153
8	1.5494"-03	4.1024"+00	NM	0.97308	0.67063	0.79323	1.39980	0.56668
9	2.9210"-03	5.1984"+00	NM	0.98405	0.76695	0.86483	1.27495	0.67832
10	5.6642"-03	6.7989"+00	NM	0.99902	0.88849	0.94141	1.13099	0.83238
11	8.3312"-03	7.8632"+00	NM	1.00401	0.96069	0.98050	1.04880	0.93488
12	1.1024"-02	8.3887"+00	NM	1.00100	0.99438	0.99729	1.00725	0.99011
D 13	1.3691"-02	8.4780"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,TO/TOD ASSUMEP=PD

65040109 PASIUK PROFILE TABULATION 21 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.90110	0.00000	0.00000	2.49401	0.00000
2	2.7940"-04	2.5752"+00	NM	0.94605	0.42247	0.59550	1.99044	0.29918
3	4.0640"-04	2.7686"+00	NM	0.95403	0.44299	0.61792	1.96047	0.31519
4	5.3340"-04	2.8980"+00	NM	0.95904	0.45610	0.63188	1.94070	0.32560
5	6.6040"-04	3.0353"+00	NM	0.96104	0.46956	0.64591	1.91393	0.33740
6	7.8740"-04	3.1591"+00	NM	0.96104	0.48133	0.65793	1.88706	0.34865
7	9.1440"-04	3.4095"+00	NM	0.96104	0.50420	0.68063	1.83518	0.37088
8	1.0414"-03	3.5628"+00	NM	0.96104	0.51766	0.69350	1.80492	0.38427
9	1.1684"-03	3.6687"+00	NM	0.96104	0.52674	0.70216	1.78461	0.39345
10	1.2954"-03	3.7767"+00	NM	0.96104	0.53562	0.71061	1.76442	0.40274
11	1.4224"-03	3.8825"+00	NM	0.96104	0.54457	0.71862	1.74508	0.41180
12	1.5494"-03	3.9527"+00	NM	0.96104	0.55029	0.72379	1.73250	0.41777
13	2.9210"-03	4.8365"+00	NM	0.96903	0.61756	0.78089	1.60200	0.48745
14	5.6388"-03	6.5262"+00	NM	0.98701	0.72856	0.86116	1.40937	0.61103
15	8.3312"-03	7.5019"+00	NM	0.99700	0.78540	0.89631	1.32003	0.67901
16	1.0998"-02	9.5254"+00	NM	1.00300	0.89169	0.95282	1.15401	0.82566
17	1.3691"-02	1.0584"+01	NM	1.00500	0.94248	0.97612	1.08222	0.90196
18	1.6358"-02	1.1250"+01	NM	1.00500	0.97309	0.98914	1.04027	0.95085
19	1.9025"-02	1.1709"+01	NM	1.00300	0.99361	0.99747	1.01123	0.98640
D 20	2.1692"-02	1.1854"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
21	2.4384"-02	1.1854"+01	NM	0.99900	1.00000	1.00000	0.99900	1.00100

INPUT VARIABLES Y,M,TO/TOD ASSUMEP=PD

65040301 PASIUK PROFILE TABULATION 10 POINTS, DELTA AT POINT 9

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.84431	0.00000	0.00000	1.27552	0.00000
2	2.7940"-04	2.1614"+00	NM	0.93513	0.69524	0.74767	1.13302	0.65989
3	5.3340"-04	2.4221"+00	NM	0.96806	0.75407	0.80098	1.13335	0.70674
4	8.1280"-04	2.6531"+00	NM	0.97904	0.80163	0.84248	1.11359	0.75655
5	1.3208"-03	3.0353"+00	NM	0.98703	0.87359	0.90253	1.07293	0.84116
6	1.8288"-03	3.4057"+00	NM	0.99800	0.93742	0.95302	1.04066	0.91579
7	2.3114"-03	3.9113"+00	NM	1.00200	1.01752	1.01271	0.99016	1.02278
8	2.9210"-03	3.7807"+00	NM	1.00200	0.99750	0.99817	1.00369	0.99450
D 9	4.2672"-03	3.7969"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
10	5.6642"-03	3.7969"+00	NM	0.99800	1.00000	1.00000	0.99800	1.00200

INPUT VARIABLES Y,M,TO/TOD ASSUME P=PD

65040305 PASIUK PROFILE TABULATION 12 POINTS, DELTA AT POINT 12

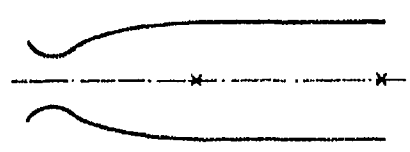
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.80236	0.00000	0.00000	1.75774	0.00000
2	2.7940"-04	2.7247"+00	NM	0.87421	0.53421	0.65488	1.42942	0.45814
3	5.3340"-04	3.1142"+00	NM	0.90019	0.58132	0.70029	1.40622	0.49799
4	7.8740"-04	3.4413"+00	NM	0.91317	0.61778	0.73368	1.37545	0.53341
5	1.2954"-03	3.8634"+00	NM	0.92815	0.66161	0.77183	1.33664	0.57744
6	1.8034"-03	4.3428"+00	NM	0.93813	0.70791	0.80979	1.28714	0.62914
7	2.3114"-03	4.6067"+00	NM	0.94812	0.73208	0.82869	1.26793	0.65358
8	2.8956"-03	4.7167"+00	NM	0.95712	0.74191	0.83620	1.26662	0.66018
9	5.6388"-03	6.7283"+00	NM	0.98604	0.90250	0.94519	1.09660	0.86192
10	8.3312"-03	7.7988"+00	NM	0.99901	0.97706	0.98780	1.02426	0.96440
11	1.1024"-02	8.1330"+00	NM	1.00000	0.99918	0.99957	1.00009	0.99868
D 12	1.3665"-02	8.1455"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,TO/TOD ASSUME P=PD

65040309 PASIUK PROFILE TABULATION 16 POINTS, DELTA AT POINT 15

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.77223	0.00000	0.00000	2.10356	0.00000
2	2.7940"-04	2.2492"+00	NM	0.81789	0.38959	0.53660	1.76588	0.30387
3	5.3340"-04	2.6711"+00	NM	0.84282	0.43624	0.59201	1.72477	0.34324
4	7.8740"-04	2.9102"+00	NM	0.85978	0.46308	0.61892	1.70989	0.36197
5	1.2954"-03	3.6112"+00	NM	0.87767	0.52841	0.68526	1.61391	0.42460
6	1.8034"-03	3.8146"+00	NM	0.88465	0.54576	0.70180	1.59219	0.44078
7	2.3114"-03	4.2163"+00	NM	0.89359	0.57843	0.73174	1.54372	0.47401
8	2.8956"-03	4.7070"+00	NM	0.90553	0.61586	0.76417	1.49146	0.51236
9	5.6642"-03	6.3215"+00	NM	0.93936	0.72508	0.84795	1.34225	0.63174
10	8.3312"-03	7.7593"+00	NM	0.96723	0.80980	0.90288	1.23665	0.73010
11	1.1024"-02	9.4324"+00	NM	0.98812	0.89826	0.95212	1.12570	0.84580
12	1.3691"-02	1.0200"+01	NM	0.99807	0.93603	0.97090	1.08295	0.89654
13	1.6358"-02	1.0830"+01	NM	1.00303	0.96632	0.98509	1.04692	0.94094
14	1.9025"-02	1.1572"+01	NM	1.00200	1.00000	1.00000	1.00200	0.99801
D 15	2.1717"-02	1.1572"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
16	2.4384"-02	1.1572"+01	NM	0.99900	1.00000	1.00000	0.99900	1.00100

INPUT VARIABLES Y,M,TO/TOD ASSUME P=PD



	M : 1.6 and 2.2 R THETA X 10^{-3} : 9 - 120 TW / TR : 1.0	6505 ZPG - AW

Two-dimensional continuous tunnel with adjustable nozzle. W = H = 1.2 m.
0.02 < PO < 0.21 MN/m^2. TO : 317 K. Air, dew point < 244 K. 0.24 < RE/m X 10^{-6} < 2.4.

JACKSON M.W., CZARNECKI K.R. and MONTA W.J. 1965. Turbulent skin friction at high Reynolds numbers and low supersonic velocities. NASA TN D-2687.
And Jackson, M.W. Private communication.

1 The test boundary layer was formed on the sidewall of the wind tunnel, which was not actively cooled. Measurements were made at five stations "within the constant Mach number area of the tunnel test section". No indication of flow quality or transition position is given. (The tunnel was also used by Allen CAT 7303). The boundary layer had passed through the three dimensional expansion region of the throat (X = 0). No direct checks on cross flows are reported. A momentum balance using the experimental CF values indicated that the layer was not strictly two-dimensional.

6 Static pressure was measured at points on the centre line, and wall temperature was measured on both inner and outer surfaces near the skin friction balances. These were on loan from the DRL and were those used by Shutts et al., CAT 5501. During the tests, the balances at various stations were interchanged.
9 Discrepancies between individual balance readings were noted, and the data presented are interpolated from a curve faired through all the experimental values.

7 Pitot profiles were measured using an FPP made by flattening tube of 1.27 mm diameter to give a face for which, after honing, h_1 = 0.23, h_2 = 0.076 mm. The slender portion of the probe mount was about 40 mm [E]
8 long. The profile normal, nominally, passed through the centre of the balance element at each of the five
9 stations at X = 3.36, 3.94, 4.36, 4.79 and 5.24 m. Static pressure was assumed constant through the layer. The tunnel total temperature was adjusted so that the inner and outer wall temperatures were the same and
10 equal to room temperature in the test zone, the flow thus being presumed adiabatic. No corrections were
11 applied to the probe data, and Sutherland's viscosity law was used.

12 Data are presented here for the X = 3.94 and 5.24 m stations only (corresponding to figure 9 of the source paper), as other tabular data could not be found. The author's assumption of isoenergetic flow has been replaced by the Crocco / Van Driest temperature/velocity correlation. The editors have taken CF values
13 from the graphical presentation in the source. The profiles consist of seven sets for each of two Mach
14 numbers. Each set represents a different unit Reynolds number for two successive stations. The CF values represent the average of values obtained at the same stations using a number of different balances in separate tests.

§ DATA 6505 0101 - 1402. Pitot profiles. NX = 2. CF values obtained separately with a number of FEB.

15 Editors' comments

The experiment provides data at modest Mach number for moderate to high Reynolds numbers. Comparable studies are those of Hopkins & Keener - CAT 6601, Winter & Gaudet - CAT 7302, and Allen - CAT 7303, which were obtained in a similar geometric situation. The range overlaps that of the study by Shutts et al. - CAT 5501, using the same balances.

The range of Y values in wall coordinates is very large ($10 < y^+ < 3 \times 10^4$), but in about half the profiles it seems that the results at small Y need correction for probe effects. Series 01-07 show velocity profiles with unusually small wake strength. Three dimensional effects may well be considerable as the length/width ratio is up to 4.5.

CAT 6505 JACKSON BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
65050101	1.6100	1.0000	8.9015"+03	2.1200"-03	2.3297	1.2904	4.8352"+03	4.8352"+03
3.9411"+00	2.0859"+04	1.0000	1.2102"+04	NM	1.8082	1.7995	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	4.3397"-03	0.0000"+00	0.0642	5.0102"-03	4.6198"+02	2.9996"+02
65050102	1.6100	1.0000	1.1848"+04	2.0000"-03	2.3688	1.3204	4.8352"+03	4.8352"+03
5.2365"+00	2.0859"+04	1.0000	1.6109"+04	NM	1.7938	1.7846	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	5.7763"-03	0.0000"+00	0.0649	6.7253"-03	4.6198"+02	2.9996"+02
65050201	1.6100	1.0000	1.3604"+04	1.9500"-03	2.2879	1.2596	8.0208"+03	8.0208"+03
3.9411"+00	3.4601"+04	1.0000	1.8495"+04	NM	1.8231	1.8154	2.9996"+02	2.0482"+02
INFINITE	3.1190"+02	0.0000	3.9981"-03	0.0000"+00	0.0647	4.5741"-03	4.6198"+02	2.9996"+02
65050202	1.6100	1.0000	1.9936"+04	1.8100"-03	2.2973	1.2659	8.0208"+03	8.0208"+03
5.2365"+00	3.4601"+04	1.0000	2.7104"+04	NM	1.8185	1.8106	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	5.8591"-03	0.0000"+00	0.0646	6.7233"-03	4.6198"+02	2.9996"+02
65050301	1.6100	1.0000	2.6856"+04	1.7700"-03	2.2580	1.2374	1.5871"+04	1.5871"+04
3.9411"+00	6.8466"+04	1.0000	3.6513"+04	NM	1.8342	1.8273	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	3.9889"-03	0.0000"+00	0.0651	4.5326"-03	4.6198"+02	2.9996"+02
65050302	1.6100	1.0000	3.8518"+04	1.5400"-03	2.2621	1.2391	1.5871"+04	1.5871"+04
5.2365"+00	6.8466"+04	1.0000	5.2368"+04	NM	1.8304	1.8238	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	5.7211"-03	0.0000"+00	0.0650	6.5188"-03	4.6198"+02	2.9996"+02
65050401	1.6100	1.0000	3.9487"+04	1.6500"-03	2.2436	1.2265	2.3778"+04	2.3778"+04
3.9411"+00	1.0258"+05	1.0000	5.3686"+04	NM	1.8393	1.8328	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	3.9147"-03	0.0000"+00	0.0653	4.4342"-03	4.6198"+02	2.9996"+02
65050402	1.6100	1.0000	5.4503"+04	1.5100"-03	2.2549	1.2335	2.3778"+04	2.3778"+04
5.2365"+00	1.0258"+05	1.0000	7.4101"+04	NM	1.8329	1.8265	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	5.4033"-03	0.0000"+00	0.0651	6.1480"-03	4.6198"+02	2.9996"+02
65050501	1.6100	1.0000	5.3089"+04	1.5900"-03	2.2313	1.2176	3.2709"+04	3.2709"+04
3.9411"+00	1.4110"+05	1.0000	7.2178"+04	NM	1.8446	1.8383	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	3.8261"-03	0.0000"+00	0.0655	4.3184"-03	4.6198"+02	2.9996"+02
65050502	1.6100	1.0000	7.1098"+04	1.4600"-03	2.2477	1.2284	3.2709"+04	3.2709"+04
5.2365"+00	1.4110"+05	1.0000	9.6663"+04	NM	1.8359	1.8297	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	5.1240"-03	0.0000"+00	0.0652	5.8189"-03	4.6198"+02	2.9996"+02
65050601	1.6100	1.0000	5.9675"+04	1.5600"-03	2.2318	1.2169	3.9137"+04	3.9137"+04
3.9411"+00	1.6883"+05	1.0000	8.1132"+04	NM	1.8456	1.8388	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	3.5943"-03	0.0000"+00	0.0655	4.0533"-03	4.6198"+02	2.9996"+02
65050602	1.6100	1.0000	8.1624"+04	1.4300"-03	2.2408	1.2236	3.9137"+04	3.9137"+04
5.2365"+00	1.6883"+05	1.0000	1.1097"+05	NM	1.8390	1.8329	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	4.9164"-03	0.0000"+00	0.0653	5.5714"-03	4.6198"+02	2.9996"+02
65050701	1.6100	1.0000	7.1070"+04	1.5400"-03	2.2286	1.2156	4.5963"+04	4.5963"+04
3.9411"+00	1.9828"+05	1.0000	9.6625"+04	NM	1.8455	1.8392	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	3.6450"-03	0.0000"+00	0.0655	4.1120"-03	4.6198"+02	2.9996"+02
65050702	1.6100	1.0000	9.4051"+04	1.4000"-03	2.2353	1.2192	4.5963"+04	4.5963"+04
5.2365"+00	1.9828"+05	1.0000	1.2787"+05	HM	1.8408	1.8350	2.9996"+02	2.0482"+02
INFINITE	3.1100"+02	0.0000	4.8236"-03	0.0000"+00	0.0654	5.4604"-03	4.6198"+02	2.9996"+02

CAT 6505 JACKSON BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
65050001	2.2000	1.0000	5.8517"+03	1.7100"-03	3.3091	1.3385	1.9581"+03	1.9581"+03
3.9411"+00	2.0938"+04	1.0000	9.8292"+03	NM	1.7909	1.7759	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	4.4715"-03	0.0000"+00	0.0916	5.8659"-03	5.5450"+02	2.9509"+02
65050802	2.2000	1.0000	8.0753"+03	1.5500"-03	3.3443	1.3569	1.9581"+03	1.9581"+03
5.2365"+00	2.0938"+04	1.0000	1.3564"+04	NM	1.7793	1.7645	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	6.1707"-03	0.0000"+00	0.0910	8.1904"-03	5.5450"+02	2.9509"+02
65050901	2.2000	1.0000	8.5674"+03	1.6400"-03	3.2556	1.3049	3.2733"+03	3.2733"+03
3.9411"+00	3.5001"+04	1.0000	1.4391"+04	NM	1.8037	1.7905	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	3.9163"-03	0.0000"+00	0.0923	5.0758"-03	5.5450"+02	2.9509"+02
65050902	2.2000	1.0000	1.3109"+04	1.4900"-03	3.2723	1.3139	3.2733"+03	3.2733"+03
5.2365"+00	3.5001"+04	1.0000	2.2020"+04	NM	1.7978	1.7844	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	5.9926"-03	0.0000"+00	0.0920	7.8132"-03	5.5450"+02	2.9509"+02
65051001	2.2000	1.0000	1.5602"+04	1.5100"-03	3.2015	1.2722	6.4589"+03	6.4589"+03
3.9411"+00	6.9064"+04	1.0000	2.6207"+04	NM	1.8179	1.8062	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	3.6145"-03	0.0000"+00	0.0933	4.6180"-03	5.5450"+02	2.9509"+02
65051002	2.2000	1.0000	2.3688"+04	1.3800"-03	3.2363	1.2909	6.4589"+03	6.4589"+03
5.2365"+00	6.9064"+04	1.0000	3.9788"+04	NM	1.8063	1.7942	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	5.4876"-03	0.0000"+00	0.0924	7.0977"-03	5.5450"+02	2.9509"+02
65051101	2.2000	1.0000	2.1935"+04	1.4600"-03	3.1816	1.2604	9.7030"+03	9.7030"+03
3.9411"+00	1.0375"+05	1.0000	3.6844"+04	NM	1.8245	1.8132	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	3.3825"-03	0.0000"+00	0.0933	4.2914"-03	5.5450"+02	2.9509"+02
65051102	2.2000	1.0000	3.0755"+04	1.3200"-03	3.1838	1.2599	9.7030"+03	9.7030"+03
5.2365"+00	1.0375"+05	1.0000	5.1660"+04	NM	1.8218	1.8110	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	4.7427"-03	0.0000"+00	0.0932	6.0366"-03	5.5450"+02	2.9509"+02
65051201	2.2000	1.0000	2.7686"+04	1.4200"-03	3.1647	1.2498	1.2859"+04	1.2859"+04
3.9411"+00	1.3750"+05	1.0000	4.6505"+04	NM	1.8292	1.8187	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	3.2215"-03	0.0000"+00	0.0936	4.0679"-03	5.5450"+02	2.9509"+02
65051202	2.2000	1.0000	3.9880"+04	1.2900"-03	3.1640	1.2503	1.2859"+04	1.2859"+04
5.2365"+00	1.3750"+05	1.0000	6.6988"+04	NM	1.8294	1.8177	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	4.6404"-03	0.0000"+00	0.0936	5.8541"-03	5.5450"+02	2.9509"+02
65051301	2.2000	1.0000	3.2804"+04	1.4000"-03	3.1537	1.2438	1.5782"+04	1.5782"+04
3.9411"+00	1.6875"+05	1.0000	5.5101"+04	NM	1.8332	1.8228	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	3.1102"-03	0.0000"+00	0.0938	3.9103"-03	5.5450"+02	2.9509"+02
65051302	2.2000	1.0000	4.5954"+04	1.2700"-03	3.1552	1.2433	1.5782"+04	1.5782"+04
5.2365"+00	1.6875"+05	1.0000	7.7190"+04	NM	1.8308	1.8209	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	4.3569"-03	0.0000"+00	0.0937	5.4922"-03	5.5450"+02	2.9509"+02
65051401	2.2000	1.0000	3.7604"+04	1.3900"-03	3.1432	1.2375	1.8556"+04	1.8556"+04
3.9411"+00	1.9844"+05	1.0000	6.3164"+04	NM	1.8364	1.8264	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	3.0319"-03	0.0000"+00	0.0939	3.7987"-03	5.5450"+02	2.9509"+02
65051402	2.2000	1.0000	5.3072"+04	1.2500"-03	3.1642	1.2464	1.8558"+04	1.0558"+04
5.2365"+00	1.9844"+05	1.0000	8.9145"+04	NM	1.8264	1.8172	2.9509"+02	1.5803"+02
INFINITE	3.1100"+02	0.0000	4.2790"-03	0.0000"+00	0.0934	5.4247"-03	5.5450"+02	2.9509"+02

PD,POD CALCULATED FROM RE (AUTHOR), CF INTERPOLATED

65050101 JACKSON PROFILE TABULATION 36 POINTS, DELTA AT POINT 36

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96449	0.00000	0.00000	1.46450	0.00000
2	7.6200"-05	1.1634"+00	NM	0.96876	0.29197	0.34656	1.40872	0.24601
3	1.0160"-04	1.1599"+00	NM	0.96867	0.28896	0.34310	1.40983	0.24336
4	1.2700"-04	1.2046"+00	NM	0.96972	0.32461	0.38356	1.39617	0.27472
5	1.7780"-04	1.2266"+00	NM	0.97021	0.34049	0.40138	1.38967	0.28884
6	2.2860"-04	1.2733"+00	NM	0.97123	0.37129	0.43560	1.37637	0.31648
7	2.7940"-04	1.2961"+00	NM	0.97171	0.38521	0.45088	1.37007	0.32909
8	3.3020"-04	1.3417"+00	NM	0.97264	0.41106	0.47901	1.35792	0.35275
9	4.5720"-04	1.3854"+00	NM	0.97350	0.43395	0.50357	1.34670	0.37394
10	5.8420"-04	1.4476"+00	NM	0.97466	0.46372	0.53509	1.33151	0.40187
11	8.3820"-04	1.4791"+00	NM	0.97522	0.47776	0.54976	1.32411	0.41519
12	1.0922"-03	1.5536"+00	NM	0.97650	0.50870	0.58164	1.30736	0.44490
13	1.3462"-03	1.5817"+00	NM	0.97697	0.51962	0.59275	1.30130	0.45551
14	1.9812"-03	1.6934"+00	NM	0.97871	0.55970	0.63285	1.27847	0.49501
15	2.6162"-03	1.7472"+00	NM	0.97951	0.57742	0.65023	1.26811	0.51276
16	3.2512"-03	1.8424"+00	NM	0.98083	0.60661	0.67840	1.25072	0.54241
17	3.8862"-03	1.8836"+00	NM	0.98138	0.61847	0.68969	1.24355	0.55461
18	5.1562"-03	1.9863"+00	NM	0.98269	0.64647	0.71592	1.22642	0.58375
19	6.4262"-03	2.0733"+00	NM	0.98374	0.66867	0.73634	1.21265	0.60722
20	8.9662"-03	2.2634"+00	NM	0.98591	0.71368	0.77667	1.18431	0.65580
21	1.1506"-02	2.4066"+00	NM	0.98745	0.74514	0.80400	1.16424	0.69058
22	1.6586"-02	2.6625"+00	NM	0.99002	0.79749	0.84794	1.13053	0.75004
23	2.1666"-02	2.8923"+00	NM	0.99219	0.84118	0.88313	1.10223	0.80122
24	2.6746"-02	3.0993"+00	NM	0.99403	0.87841	0.91207	1.07810	0.84599
25	3.1826"-02	3.3017"+00	NM	0.99575	0.91314	0.93820	1.05564	0.88875
26	3.6906"-02	3.4875"+00	NM	0.99726	0.94379	0.96058	1.03590	0.92729
27	3.9446"-02	3.5637"+00	NM	0.99786	0.95605	0.96936	1.02803	0.94293
28	4.1986"-02	3.6271"+00	NM	0.99835	0.96612	0.97649	1.02158	0.95586
29	4.4526"-02	3.6872"+00	NM	0.99881	0.97556	0.98312	1.01555	0.96806
30	4.7066"-02	3.7263"+00	NM	0.99911	0.98165	0.98736	1.01167	0.97597
31	4.9606"-02	3.7727"+00	NM	0.99946	0.98883	0.99233	1.00710	0.98534
32	5.2146"-02	3.7854"+00	NM	0.99955	0.99078	0.99368	1.00586	0.98789
33	5.4686"-02	3.8050"+00	NM	0.99970	0.99379	0.99575	1.00394	0.99184
34	5.7226"-02	3.8178"+00	NM	0.99979	0.99576	0.99710	1.00269	0.99442
35	5.9766"-02	3.8377"+00	NM	0.99994	0.99879	0.99917	1.00077	0.99840
D 36	6.2306"-02	3.8456"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

65050102 JACKSON PROFILE TABULATION 44 POINTS, DELTA AT POINT 44

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96384	0.00000	0.00000	1.46352	0.00000
2	7.6200"-05	1.1315"+00	NM	0.96740	0.26326	0.31349	1.41797	0.22108
3	1.0160"-04	1.1149"+00	NM	0.96697	0.24670	0.29432	1.42336	0.20678
4	1.2700"-04	1.1226"+00	NM	0.96717	0.25454	0.30341	1.42085	0.21354
5	1.5240"-04	1.1471"+00	NM	0.96778	0.27778	0.33019	1.41298	0.23368
6	1.7780"-04	1.1746"+00	NM	0.96845	0.30124	0.35700	1.40444	0.25419
7	2.0320"-04	1.1893"+00	NM	0.96880	0.31293	0.37027	1.39997	0.26448
8	2.2860"-04	1.2047"+00	NM	0.96916	0.32469	0.38354	1.39533	0.27487
9	2.5400"-04	1.2293"+00	NM	0.96973	0.34236	0.40336	1.38810	0.29059
10	3.0480"-04	1.2497"+00	NM	0.97018	0.35616	0.41874	1.38224	0.30294
11	3.8100"-04	1.2837"+00	NM	0.97092	0.37773	0.44257	1.37273	0.32240
12	5.3340"-04	1.3225"+00	NM	0.97174	0.40040	0.46742	1.36225	0.34312
13	6.6040"-04	1.3496"+00	NM	0.97230	0.41537	0.48354	1.35514	0.35682
14	7.8740"-04	1.3606"+00	NM	0.97252	0.42120	0.48981	1.35231	0.36220
15	9.1440"-04	1.3956"+00	NM	0.97320	0.43900	0.50884	1.34350	0.37874
16	1.0414"-03	1.4098"+00	NM	0.97348	0.44595	0.51622	1.34000	0.38524
17	1.1684"-03	1.4369"+00	NM	0.97399	0.45879	0.52977	1.33342	0.39731
18	1.4224"-03	1.4785"+00	NM	0.97475	0.47750	0.54936	1.32363	0.41504
19	1.6764"-03	1.5199"+00	NM	0.97542	0.49343	0.56586	1.31510	0.43027
20	1.9304"-03	1.5330"+00	NM	0.97572	0.50044	0.57306	1.31130	0.43702
21	2.1844"-03	1.5711"+00	NM	0.97636	0.51553	0.58848	1.30300	0.45163
22	2.4384"-03	1.6104"+00	NM	0.97701	0.53039	0.60351	1.29469	0.46614
23	2.6924"-03	1.6292"+00	NM	0.97732	0.53728	0.61043	1.29080	0.47291
24	3.3274"-03	1.6861"+00	NM	0.97821	0.55723	0.63030	1.27937	0.49266
25	3.9624"-03	1.7437"+00	NM	0.97907	0.57628	0.64899	1.26829	0.51171
26	4.5974"-03	1.7922"+00	NM	0.97977	0.59152	0.66379	1.25929	0.52711
27	5.2324"-03	1.8240"+00	NM	0.98022	0.60114	0.67305	1.25354	0.53692
28	6.5024"-03	1.9007"+00	NM	0.98126	0.62329	0.69412	1.24019	0.55969
29	7.7724"-03	1.9902"+00	NM	0.98242	0.64748	0.71675	1.22540	0.58491
30	9.0424"-03	2.0664"+00	NM	0.98336	0.66694	0.73465	1.21335	0.60547
31	1.1582"-02	2.1736"+00	NM	0.98463	0.69294	0.75815	1.19709	0.63333
32	1.7932"-02	2.4445"+00	NM	0.98761	0.75320	0.81080	1.15880	0.69969
33	2.4282"-02	2.6930"+00	NM	0.99014	0.80345	0.85274	1.12646	0.75701
34	3.0632"-02	2.9184"+00	NM	0.99228	0.84597	0.88685	1.09896	0.80699
35	3.6982"-02	3.1371"+00	NM	0.99425	0.88501	0.91705	1.07371	0.85409
36	4.3332"-02	3.3459"+00	NM	0.99604	0.92054	0.94362	1.05079	0.89801
37	4.9682"-02	3.5267"+00	NM	0.99752	0.95012	0.96510	1.03179	0.93537
38	4.9708"-02	3.5330"+00	NM	0.99757	0.95113	0.96582	1.03114	0.93666
39	5.4762"-02	3.6411"+00	NM	0.99843	0.96833	0.97803	1.02014	0.95872
40	5.9842"-02	3.7397"+00	NM	0.99919	0.98374	0.98880	1.01032	0.97870
41	6.4922"-02	3.8030"+00	NM	0.99968	0.99349	0.99554	1.00413	0.99145
42	6.7462"-02	3.8238"+00	NM	0.99984	0.99667	0.99772	1.00211	0.99561
43	7.0002"-02	3.8367"+00	NM	0.99993	0.99863	0.99907	1.00087	0.99820
D 44	7.2542"-02	3.8456"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST
AT I=33 DATA WERE AVERAGED

65050801 JACKSON PROFILE TABULATION 34 POINTS, DELTA AT POINT 34

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94885	0.00000	0.00000	1.86733	0.00000
2	1.2700"-04	1.2256"+00	NM	0.95445	0.24863	0.33099	1.77231	0.18676
3	3.8100"-04	1.4331"+00	NM	0.95859	0.33447	0.43637	1.70217	0.25636
4	9.6520"-04	1.7768"+00	NM	0.96403	0.42940	0.54483	1.60987	0.33843
5	1.5748"-03	1.9357"+00	NM	0.96613	0.46321	0.58120	1.57435	0.36917
6	2.4638"-03	2.1162"+00	NM	0.96828	0.49705	0.61639	1.53780	0.40082
7	3.7084"-03	2.2913"+00	NM	0.97022	0.52687	0.64635	1.50498	0.42948
8	5.0038"-03	2.4689"+00	NM	0.97206	0.55495	0.67369	1.47369	0.45714
9	6.2738"-03	2.6098"+00	NM	0.97346	0.57600	0.69361	1.45006	0.47833
10	9.9568"-03	2.9873"+00	NM	0.97693	0.62826	0.74100	1.39109	0.53268
11	1.1989"-02	3.1886"+00	NM	0.97866	0.65419	0.76342	1.36184	0.56058
12	1.3894"-02	3.3669"+00	NM	0.98012	0.67621	0.78191	1.33706	0.58480
13	1.5799"-02	3.5433"+00	NM	0.98151	0.69726	0.79911	1.31347	0.60839
14	1.7704"-02	3.7300"+00	NM	0.98293	0.71881	0.81624	1.28947	0.63301
15	1.9609"-02	3.8995"+00	NM	0.98417	0.73779	0.83094	1.26847	0.65508
16	2.1768"-02	4.1160"+00	NM	0.98569	0.76131	0.84866	1.24266	0.68294
17	2.3546"-02	4.2488"+00	NM	0.98659	0.77535	0.65898	1.22737	0.69986
18	2.5451"-02	4.4681"+00	NM	0.98803	0.79798	0.87521	1.20295	0.72755
19	2.7356"-02	4.6362"+00	NM	0.98909	0.81488	0.88702	1.18491	0.74860
20	2.9261"-02	4.8410"+00	NM	0.99035	0.83498	0.90072	1.16367	0.77404
21	3.1140"-02	5.0371"+00	NM	0.99150	0.85378	0.91320	1.14404	0.79822
22	3.3071"-02	5.1943"+00	NM	0.99240	0.86854	0.92278	1.12879	0.81749
23	3.7160"-02	5.6372"+00	NM	0.99481	0.90880	0.94793	1.08797	0.87128
24	4.0691"-02	5.9191"+00	NM	0.99625	0.93350	0.96269	1.06351	0.90520
25	4.2723"-02	6.0831"+00	NM	0.99706	0.94757	0.97087	1.04979	0.92482
26	4.4755"-02	6.2067"+00	NM	0.99766	0.95803	0.97685	1.03968	0.93957
27	4.7269"-02	6.3179"+00	NM	0.99819	0.96734	0.98211	1.03076	0.95280
28	5.0851"-02	6.5108"+00	NM	0.99900	0.98328	0.99094	1.01564	0.97568
29	5.3391"-02	6.5602"+00	NM	0.99930	0.98733	0.99315	1.01184	0.98154
30	5.7175"-02	6.6221"+00	NM	0.99958	0.99237	0.99589	1.00711	0.98886
31	6.1773"-02	6.6679"+00	NM	0.99978	0.99608	0.99789	1.00365	0.99426
32	6.6853"-02	6.6679"+00	NM	0.99978	0.99608	0.99789	1.00365	0.99426
33	7.1933"-02	6.6848"+00	NM	0.99986	0.99745	0.99863	1.00237	0.99626
D 34	7.6225"-02	6.7165"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

65050802 JACKSON PROFILE TABULATION 37 POINTS, DELTA AT POINT 37

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94885	0.00000	0.00000	1.86733	0.00000
2	7.6200"-05	1.2056"+00	NM	0.95401	0.23809	0.31763	1.77982	0.17846
3	1.2700"-04	1.2001"+00	NM	0.95388	0.23508	0.31380	1.78192	0.17610
4	1.7780"-04	1.2001"+00	NM	0.95388	0.23508	0.31380	1.78192	0.17610
5	2.2860"-04	1.1995"+00	NM	0.95388	0.23500	0.31371	1.78197	0.17604
6	2.7940"-04	1.2378"+00	NM	0.95472	0.25479	0.33876	1.76780	0.19163
7	3.3020"-04	1.2376"+00	NM	0.95471	0.25471	0.33866	1.76785	0.19157
8	3.8100"-04	1.2725"+00	NM	0.95546	0.27136	0.35952	1.75522	0.20483
9	4.5720"-04	1.3082"+00	NM	0.95619	0.28711	0.37902	1.74273	0.21748
10	5.8420"-04	1.3417"+00	NM	0.95686	0.30086	0.39587	1.73140	0.22864
11	7.1120"-04	1.4833"+00	NM	0.95948	0.35097	0.45587	1.68708	0.27021
12	8.3820"-04	1.5513"+00	NM	0.96062	0.37160	0.47986	1.66761	0.28776
13	1.0922"-03	1.6565"+00	NM	0.96228	0.40030	0.51255	1.63947	0.31263
14	1.3462"-03	1.7282"+00	NM	0.96334	0.41807	0.53237	1.62152	0.32831
15	1.9812"-03	1.8364"+00	NM	0.96484	0.44263	0.55920	1.59611	0.35035
16	2.6162"-03	1.9472"+00	NM	0.96627	0.46548	0.58360	1.57192	0.37127
17	3.8862"-03	2.1217"+00	NM	0.96834	0.49804	0.61739	1.53673	0.40176
18	5.1562"-03	2.2678"+00	NM	0.96996	0.52301	0.64253	1.50926	0.42572
19	7.6962"-03	2.4422"+00	NM	0.97179	0.55085	0.66975	1.47828	0.45306
20	1.0236"-02	2.6846"+00	NM	0.97417	0.58679	0.70363	1.43791	0.48934
21	1.5316"-02	2.9777"+00	NM	0.97685	0.62699	0.73988	1.39253	0.53132
22	2.0396"-02	3.3842"+00	NM	0.98026	0.67831	0.78365	1.33470	0.58714
23	2.4841"-02	3.6842"+00	NM	0.98259	0.71359	0.81213	1.29527	0.62700
24	3.0556"-02	4.0824"+00	NM	0.98546	0.75770	0.84598	1.24660	0.67863
25	3.7541"-02	4.6077"+00	NM	0.98892	0.81203	0.88505	1.18793	0.74504
26	4.3256"-02	4.9004"+00	NM	0.99070	0.84072	0.90457	1.15765	0.78138
27	5.0241"-02	5.4514"+00	NM	0.99382	0.89214	0.93769	1.10472	0.84881
28	5.5956"-02	5.8495"+00	NM	0.99590	0.92747	0.95913	1.06945	0.89685
29	5.8496"-02	6.1024"+00	NM	0.99716	0.94921	0.97182	1.04820	0.92713
30	6.1036"-02	6.2332"+00	NM	0.99779	0.96025	0.97812	1.03755	0.94272
31	6.2941"-02	6.3044"+00	NM	0.99812	0.96622	0.98148	1.03183	0.95120
32	6.6116"-02	6.4665"+00	NM	0.99888	0.97964	0.98894	1.01907	0.97043
33	6.8656"-02	6.5319"+00	NM	0.99917	0.98501	0.99189	1.01401	0.97818
34	7.1196"-02	6.5958"+00	NM	0.99946	0.99023	0.99473	1.00911	0.98575
35	7.3736"-02	6.6751"+00	NM	0.99982	0.99666	0.99821	1.00310	0.99512
36	7.5641"-02	6.6751"+00	NM	0.99982	0.99666	0.99821	1.00310	0.99512
D 37	7.8816"-02	6.7165"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

65051401 JACKSON PROFILE TABULATION 39 POINTS, DELTA AT POINT 39

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94885	0.00000	0.00000	1.86733	0.00000
2	1.2700"-04	1.7586"+00	NM	0.96378	0.42522	0.54024	1.61419	0.33468
3	1.5240"-04	1.7897"+00	NM	0.96421	0.43233	0.54802	1.60685	0.34105
4	1.7780"-04	1.8253"+00	NM	0.96469	0.44023	0.55661	1.59862	0.34818
5	2.2860"-04	1.8767"+00	NM	0.96537	0.45118	0.56840	1.58712	0.35813
6	2.7940"-04	1.9206"+00	NM	0.96594	0.46018	0.57800	1.57757	0.36638
7	3.5560"-04	1.9924"+00	NM	0.96682	0.47425	0.59281	1.56252	0.37940
8	4.3180"-04	2.0509"+00	NM	0.96752	0.48524	0.60424	1.55066	0.38967
9	5.5880"-04	2.1464"+00	NM	0.96862	0.50238	0.62181	1.53196	0.40589
10	6.8580"-04	2.2332"+00	NM	0.96959	0.51725	0.63679	1.51562	0.42015
11	8.1280"-04	2.3126"+00	NM	0.97044	0.53034	0.64978	1.50113	0.43286
12	9.3950"-04	2.4328"+00	NM	0.97169	0.54938	0.66834	1.47992	0.45160
13	1.1938"-03	2.4918"+00	NM	0.97229	0.55844	0.67702	1.46978	0.46063
14	1.4478"-03	2.5644"+00	NM	0.97301	0.56931	0.68733	1.45758	0.47156
15	1.7018"-03	2.6457"+00	NM	0.97380	0.58121	0.69847	1.44420	0.48364
16	2.0828"-03	2.7597"+00	NM	0.97488	0.59739	0.71337	1.42595	0.50027
17	2.3638"-03	2.8317"+00	NM	0.97554	0.60736	0.72240	1.41470	0.51064
18	3.0988"-03	2.9507"+00	NM	0.97661	0.62342	0.73673	1.39657	0.52753
19	4.3688"-03	3.1499"+00	NM	0.97833	0.64929	0.75924	1.36736	0.55526
20	5.3848"-03	3.2866"+00	NM	0.97947	0.66639	0.77373	1.34809	0.57395
21	6.5278"-03	3.5389"+00	NM	0.98148	0.69675	0.79870	1.31404	0.60782
22	8.0264"-03	3.6525"+00	NM	0.98235	0.70996	0.80926	1.29931	0.62284
23	9.9568"-03	3.8439"+00	NM	0.98376	0.73163	0.82621	1.27527	0.64787
24	1.1989"-02	4.0516"+00	NM	0.98524	0.75439	0.84351	1.25022	0.67469
25	1.3874"-02	4.2719"+00	NM	0.98674	0.77776	0.86074	1.22475	0.70279
26	1.5779"-02	4.4523"+00	NM	0.98793	0.79637	0.87408	1.20468	0.72557
27	1.7704"-02	4.6559"+00	NM	0.98922	0.81683	0.88837	1.18283	0.75106
28	1.9583"-02	4.8537"+00	NM	0.99042	0.83622	0.90155	1.16237	0.77562
29	2.2149"-02	5.1286"+00	NM	0.99203	0.86240	0.91882	1.13511	0.80945
30	2.4689"-02	5.3998"+00	NM	0.99354	0.88746	0.93477	1.10946	0.84254
31	2.7356"-02	5.6702"+00	NM	0.99498	0.91173	0.94971	1.08504	0.87527
32	3.0531"-02	5.9481"+00	NM	0.99640	0.93601	0.96416	1.06106	0.90868
33	3.3452"-02	6.2398"+00	NM	0.99782	0.96081	0.97843	1.03701	0.94351
34	3.6627"-02	6.4042"+00	NM	0.99859	0.97451	0.98610	1.02394	0.96305
35	3.9421"-02	6.4827"+00	NM	0.99895	0.98098	0.98968	1.01781	0.97236
36	4.3231"-02	6.5865"+00	NM	0.99942	0.98946	0.99431	1.00984	0.98462
37	4.8311"-02	6.6534"+00	NM	0.99972	0.99490	0.99726	1.00475	0.99255
38	5.5931"-02	6.6970"+00	NM	0.99991	0.99843	0.99916	1.00146	0.99770
D 39	6.3551"-02	6.7165"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST
AT I=12 DATA WERE AVERAGED

65051402 JACKSON PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94885	0.00000	0.00000	1.86733	0.00000
2	7.6200"-05	1.5764"+00	NM	0.96103	0.37876	0.48810	1.66069	0.29392
3	1.0160"-04	1.6053"+00	NM	0.96149	0.38676	0.49724	1.65288	0.30083
4	1.5240"-04	1.6704"+00	NM	0.96249	0.40385	0.51653	1.63592	0.31574
5	2.0320"-04	1.6931"+00	NM	0.96283	0.40955	0.52290	1.63018	0.32076
6	3.3020"-04	1.8182"+00	NM	0.96460	0.43866	0.55491	1.60026	0.34676
7	4.5720"-04	1.9081"+00	NM	0.96578	0.45764	0.57530	1.58027	0.36405
8	5.8420"-04	1.9999"+00	NM	0.96691	0.47569	0.59432	1.56098	0.38073
9	7.1120"-04	2.0530"+00	NM	0.96755	0.48562	0.60464	1.55024	0.39003
10	8.3820"-04	2.1262"+00	NM	0.96839	0.49882	0.61819	1.53587	0.40250
11	9.6520"-04	2.1761"+00	NM	0.96896	0.50754	0.62704	1.52632	0.41082
12	1.0922"-03	2.2225"+00	NM	0.96947	0.51544	0.63498	1.51762	0.41840
13	1.2192"-03	2.2770"+00	NM	0.97006	0.52453	0.64401	1.50757	0.42720
14	1.3462"-03	2.3202"+00	NM	0.97052	0.53157	0.65099	1.49977	0.43406
15	1.6002"-03	2.4019"+00	NM	0.97138	0.54450	0.66369	1.48520	0.44685
16	1.8542"-03	2.5514"+00	NM	0.97288	0.56738	0.68551	1.45975	0.46961
17	2.1082"-03	2.5335"+00	NM	0.97271	0.56471	0.68290	1.46275	0.46692
18	2.3622"-03	2.5936"+00	NM	0.97330	0.57362	0.69138	1.45274	0.47591
19	2.6162"-03	2.6420"+00	NM	0.97377	0.58066	0.69796	1.44481	0.48308
20	3.2512"-03	2.8276"+00	NM	0.97550	0.60680	0.72189	1.41534	0.51005
21	3.8862"-03	2.8640"+00	NM	0.97583	0.61177	0.72636	1.40973	0.51525
22	5.1562"-03	3.0299"+00	NM	0.97731	0.63384	0.74587	1.38479	0.53863
23	6.4262"-03	3.1518"+00	NM	0.97835	0.64952	0.75944	1.36709	0.55552
24	7.6962"-03	3.2718"+00	NM	0.97935	0.66457	0.77220	1.35015	0.57194
25	8.9662"-03	3.3893"+00	NM	0.98030	0.67893	0.78416	1.33400	0.58783
26	1.0236"-02	3.4854"+00	NM	0.98106	0.69043	0.79358	1.32112	0.60069
27	1.4300"-02	3.8201"+00	NM	0.98359	0.72897	0.82415	1.27821	0.64477
28	1.7856"-02	4.1147"+00	NM	0.98565	0.76117	0.84856	1.24281	0.68277
29	2.2733"-02	4.3574"+00	NM	0.98731	0.78664	0.86715	1.21515	0.71361
30	2.5476"-02	4.6468"+00	NM	0.98916	0.81593	0.88775	1.18379	0.74992
31	2.9286"-02	4.9215"+00	NM	0.99083	0.84275	0.90592	1.15553	0.78399
32	3.3096"-02	5.2364"+00	NM	0.99264	0.87245	0.92528	1.12478	0.82263
33	3.6906"-02	5.5093"+00	NM	0.99413	0.89737	0.94093	1.09944	0.85582
34	4.0716"-02	5.7689"+00	NM	0.99549	0.92043	0.95494	1.07640	0.88716
D 35	5.5956"-02	6.7165"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

rough	M : 4.95 R THETA X 10^{-3} : 4 - 12 TW / TR : 0.6 - 1.0	6506 ZPG (ROUGH) AW-MHT-SHT

Blow-down tunnel with fixed nozzle block. Running time 45-90 s. W = 0.15, H = 0.18, L = 0.60 m.
PO : 17.5 MN/m^2. 340 < TO < 610 K. Air. 16 < RE/m X 10^{-6} < 50.

YOUNG F.L., 1965. Experimental investigation of the effects of surface roughness on compressible turbulent boundary layer skin friction and heat transfer. DRL 532.

1 The test boundary layer was formed on a flat plate machined from solid copper (W = 0.152, L = 0.371 m) with a sharp leading edge (X = 0) chamfered at 15°. Various fairings and covers brought the overall length up to 0.487 m. The test surface was mounted facing downwards a little above [E] the tunnel centre line. The test stations were near X = 0.3 m. The plate was actively cooled by two separate circuits and maintained at a temperature close to 310 K throughout the tests. Four plate surfaces were employed. For the first series, 01, the basic upper plate was machined and ground to give an effectively smooth and flat surface. For the tests with a rough surface (series 02-04) the basic plate was covered with a layer of tin-lead solder approximately, after machining, 0.76 mm thick. The roughness was then formed in this solder layer under pressure by specially machined rollers. Both the plate surface and the balance and calorimeter elements had surfaces formed in this manner, and were held in suitable jigs so as to prevent distortion during the process. The roughness pattern had a regular 90° saw tooth (V-groove) section aligned across the plate, with wavelength of 0.127, 0.254 or 0.762 mm, and, correspondingly, peak to trough heights of one half the
3 wavelength. This roughness started about 12.7 mm behind a boundary layer trip consisting of a strip of "number 80 grit-cloth" running from X = 12 to 25 mm.

6 The plate contained buried iron-constantan thermocouples on the centre line at X = 50, 140, 185, 270 and 315 mm, used to record TW and to allow adjustment of the cooling system. Static tappings (d = 1.6 mm) were placed at X = 115, 240 and 370 mm. The FEB and isolated mass calorimeter were mounted at X = 317.5 mm and 25.4 mm to either side of the centre line. The FEB had an element of 25.4 mm diameter, with a nominal annular clearance of 0.05 mm. The balance was calibrated in a wide range of thermal conditions, and it was found that errors resulting from thermal strains in the flexures outweighed any other source of error. By trial and error selection and mounting of flexures, it is claimed that it was possible to obtain a repeatable calibration. The insulated mass calorimeter consisted of a small section of the surface, 25.4 mm in diameter and 3.8 mm thick, which was separated from the mass of the plate by a small teflon insulating ring and not cooled by the plate cooling system. Heat transfer determinations were made by cooling the insulated mass to a temperature below that of the plate, by means of an external supply tube delivering water directly on to the surface of the calorimeter during a tunnel run. The external supply was then removed, and an observation of the rate of change of temperature of the isolated mass as it passed through the temperature of the plate used to calculate the local heat flux.

7 The Pitot probes used for profile measurements were CPP for which d_1 ranged from 0.5 to 0.9 mm. The tubes were kept as short and as large as possible to minimise the effects of time lags, and to provide sufficient strength at the high temperatures used. The small tubes were rapidly faired, telescopically, to 2.5 mm diameter. The elbow of the probe was stiffened by a web (details in the photograph are obscure), after which it was soldered into a double wedge drive shaft. "The length of the unstiffened probe tip was then only" 12.7 mm. The traverse gear was driven from the floor of the tunnel.

8 The balance and calorimeter were centred (text) on X = 317.5 mm and 25.4 mm to either side of the centre line. The profiles were measured in a range from X = 286 to 297 mm (tables in source paper).

9 No significant difference was found between the pressures recorded at the three static tappings when

running with the smooth surface, and the average of the three was used for the wall measurement runs. For profile measurements the static pressure was taken as constant at an average value determined from the reservoir pressure and the free stream PT2 value, and assumed constant through the layer. Total temperature
10 was assumed to be given by the Crocco / Van Driest correlation. No probe corrections were applied, and
11 viscosity was determined from power laws matched over a range to the Sutherland formula.

12 The editors have presented all the author's profile data, incorporating the author's assumptions and procedures. The CF and CQ data have been interpolated on the basis of both Reynolds number and TW/TR values. These variables are strongly correlated, as unit Reynolds number was changed by ranging the tunnel reservoir temperature while changes in model temperature were relatively small. The values given are an average of the two interpolations. The differences between the two showed no systematic variation. The scatter of the
13 results, which became apparent during interpolation, is about ± 10 %. The profiles consist of four sets, one for each roughness, each describing five different TW/TR states.

§ DATA 6506 0101-0405. Pitot profiles. NX = 1. CF measured with an FEB, CQ with an isolated mass calorimeter, separately. Roughened surface.

15 Editors' comments

This difficult experiment is very fully described in the source paper, and seems to have been performed very carefully. There are no comparable experiments, though the smooth-wall adiabatic tests are supplemented by the earlier work of Moore - CAT 6201 with the same apparatus. The smooth-wall experimental range overlaps that of Voisinet & Lee - CAT 7202 who studied a tunnel-wall boundary layer.

For the majority of the profiles, measurements did not extend within the momentum-deficit peak, and it should be noted that, unfortunately, there are no measured TO data.

CAT 6506 YOUNG BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ * PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
65060101 2.9169"-01 INFINITE	4.8855 1.7580"+06 3.3722"+02	0.9721 1.0000 0.0000	2.0046"+03 8.8595"+03 2.1857"-04	1.0300"-03 NM 0.0000"+00	10.9815 1.8386 0.1969	1.5343 1.7990 4.7606"-04	3.8015"+03 2.9964"+02 7.4861"+02	3.8015"+03 5.8407"+01 3.0823"+02
65060102 2.8743"-01 INFINITE	4.9149 1.7580"+06 4.5789"+02	0.7105 1.0000 0.0000	1.9037"+03 6.2204"+03 2.4620"-04	1.2700"-03 7.1000"-04 0.0000"+00	9.3021 1.8396 0.4208	1.4394 1.8147 4.9064"-04	3.6716"+03 2.9728"+02 8.7322"+02	3.6716"+03 7.8523"+01 4.1843"+02
65060103 2.8743"-01 INFINITE	4.9051 1.7580"+06 4.9672"+02	0.6585 1.0000 0.0000	1.9255"+03 5.8127"+03 2.5841"-04	1.3300"-03 7.7000"-04 0.0000"+00	8.9661 1.8349 0.4658	1.4459 1.8078 5.0821"-04	3.7143"+03 2.9892"+02 9.0918"+02	3.7143"+03 8.5465"+01 4.5395"+02
65060104 2.8743"-01 INFINITE	4.8953 1.7580"+06 5.5267"+02	0.5951 1.0000 0.0000	1.9142"+03 5.2137"+03 2.6999"-04	1.4100"-03 8.6000"-04 0.0000"+00	8.4156 1.8384 0.5345	1.4338 1.8142 5.0855"-04	3.7576"+03 3.0059"+02 9.5869"+02	3.7576"+03 9.5406"+01 5.0511"+02
65060105 2.8743"-01 INFINITE	4.8609 1.7580"+06 6.3800"+02	0.5228 1.0000 0.0000	1.9460"+03 4.6194"+03 2.8997"-04	1.4800"-03 9.2000"-04 0.0000"+00	7.7394 1.8386 0.6135	1.4275 1.8157 5.2066"-04	3.9141"+03 3.0494"+02 1.0288"+03	3.9141"+03 1.1143"+02 5.8324"+02
65060201 2.9688"-01 INFINITE	4.9698 1.7580"+06 3.5761"+02	0.9442 1.0000 0.0000	1.8173"+03 7.9657"+03 2.2334"-04	1.0500"-03 NM 0.0000"+00	11.0895 1.8569 0.1982	1.4619 1.8354 4.7265"-04	3.4421"+03 3.0845"+02 7.7316"+02	3.4421"+03 6.0206"+01 3.2668"+02
65060202 2.9688"-01 INFINITE	4.9500 1.7580"+06 4.5233"+02	0.7476 1.0000 0.0000	1.8554"+03 6.3955"+03 2.5273"-04	1.2300"-03 6.7000"-04 0.0000"+00	9.7284 1.8468 0.3854	1.4784 1.8195 5.0467"-04	3.5230"+03 3.0897"+02 8.6896"+02	3.5230"+03 7.6660"+01 4.1326"+02
65060203 2.9688"-01 INFINITE	4.9500 1.7580"+06 5.0378"+02	0.6770 1.0000 0.0000	1.8100"+03 5.6465"+03 2.6187"-04	1.3100"-03 7.6000"-04 0.0000"+00	9.2588 1.8412 0.4542	1.4857 1.8135 5.1392"-04	3.5230"+03 3.1158"+02 9.1704"+02	3.5230"+03 8.5379"+01 4.6026"+02
65060204 2.9688"-01 INFINITE	4.9500 1.7580"+06 5.7261"+02	0.6011 1.0000 0.0000	1.7606"+03 4.8828"+03 2.7347"-04	1.3900"-03 8.5000"-04 0.0000"+00	8.6453 1.8584 0.5250	1.4473 1.8396 4.9802"-04	3.5230"+03 3.1446"+02 9.7769"+02	3.5230"+03 9.7045"+01 5.2315"+02
65060205 2.9688"-01 INFINITE	4.8708 1.7580"+06 6.2306"+02	0.5550 1.0000 0.0000	1.7094"+03 4.2791"+03 2.6082"-04	1.4700"-03 9.3000"-04 0.0000"+00	8.0136 1.8411 0.5960	1.5017 1.8169 4.7006"-04	3.8683"+03 3.1609"+02 1.0170"+03	3.8683"+03 1.0845"+02 5.6954"+02
65060301 2.9688"-01 INFINITE	4.9400 1.7580"+06 3.4444"+02	0.9621 1.0000 0.0000	2.0588"+03 9.1468"+03 2.3901"-04	1.1500"-03 NM 0.0000"+00	11.1202 1.8292 0.1925	1.4578 1.7939 5.4508"-04	3.5646"+03 3.0279"+02 7.5802"+02	3.5646"+03 5.8572"+01 3.1471"+02
65060302 2.9047"-01 INFINITE	4.9894 1.7580"+06 4.4344"+02	0.7382 1.0000 0.0000	1.9364"+03 6.7252"+03 2.6282"-04	1.3500"-03 8.0000"-04 0.0000"+00	9.9333 1.8290 0.3744	1.4418 1.7996 5.5881"-04	3.3641"+03 2.9899"+02 8.6153"+02	3.3641"+03 7.4169"+01 4.0504"+02
65060303 2.9200"-01 INFINITE	4.9400 1.7580"+06 4.9706"+02	0.6693 1.0000 0.0000	1.8727"+03 5.7088"+03 2.6193"-04	1.4400"-03 8.6000"-04 0.0000"+00	9.1666 1.8259 0.4598	1.4558 1.7973 5.3240"-04	3.5646"+03 3.0395"+02 9.1059"+02	3.5646"+03 8.4523"+01 4.5415"+02
65060304 2.8956"-01 INFINITE	4.9400 1.7580"+06 5.5689"+02	0.5972 1.0000 0.0000	1.8491"+03 5.1155"+03 2.7371"-04	1.5500"-03 9.3000"-04 0.0000"+00	8.6680 1.8267 0.5257	1.4492 1.8001 5.3710"-04	3.5646"+03 3.0388"+02 9.6384"+02	3.5646"+03 9.4697"+01 5.0882"+02
65060305 2.9047"-01 INFINITE	4.8412 1.7580"+06 6.2678"+02	0.5420 1.0000 0.0000	1.8453"+03 4.4893"+03 2.7202"-04	1.7000"-03 1.0200"-03 0.0000"+00	7.7099 1.8345 0.6151	1.4455 1.8118 4.9096"-04	4.0069"+03 3.1061"+02 1.0190"+03	4.0069"+03 1.1020"+02 5.7305"+02
65060401 2.8560"-01 INFINITE	4.9748 1.7580"+06 3.3728"+02	0.9669 1.0000 0.0000	2.5355"+03 1.1497"+04 2.9580"-04	1.4900"-03 NM 0.0000"+00	11.6718 1.7928 0.1722	1.4965 1.7504 7.5558"-04	3.4220"+03 2.9790"+02 7.5098"+02	3.4220"+03 5.6688"+01 3.0810"+02
65060402 2.8560"-01 INFINITE	4.9500 1.7580"+06 4.7494"+02	0.6964 1.0000 0.0000	2.4775"+03 8.0002"+03 3.3995"-04	1.7700"-03 9.0000"-04 0.0000"+00	9.5421 1.7893 0.4319	1.4777 1.7563 7.6428"-04	3.5230"+03 3.0220"+02 8.9041"+02	3.5230"+03 8.0492"+01 4.3392"+02
65060403 2.8560"-01 INFINITE	4.9698 1.7580"+06 5.0506"+02	0.6550 1.0000 0.0000	2.4529"+03 7.5049"+03 3.5266"-04	1.8200"-03 9.5000"-04 0.0000"+00	9.4091 1.7855 0.4612	1.4896 1.7504 7.8795"-04	3.4421"+03 3.0221"+02 9.1883"+02	3.4421"+03 8.5029"+01 4.6137"+02
65060404 2.8560"-01 INFINITE	4.9599 1.7580"+06 5.5817"+02	0.5948 1.0000 0.0000	2.4679"+03 6.8468"+03 3.7111"-04	1.9000"-03 1.0200"-03 0.0000"+00	8.9464 1.7797 0.5200	1.5016 1.7445 8.0774"-04	3.4823"+03 3.0332"+02 9.6560"+02	3.4823"+03 9.4283"+01 5.0992"+02
65060405 2.8560"-01 INFINITE	4.9253 1.7580"+06 6.2272"+02	0.5409 1.0000 0.0000	2.1676"+03 5.4138"+03 3.3861"-04	2.0300"-03 1.0800"-03 0.0000"+00	8.3595 1.7839 0.5829	1.5114 1.7503 6.9783"-04	3.6268"+03 3.0780"+02 1.0187"+03	3.6268"+03 1.0642"+02 5.6903"+02

PEAK-TO-PEAK ROUGHNESS SPACING SERIES 020 0.127MM, SERIES 030 0.254MM, SERIES 040 0.762MM

65060101 YOUNG PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88138	0.00000	0.00000	5.08876	0.00000
2	4.5720"-04	4.8612"+00	NM	0.94147	0.37688	0.67832	3.23927	0.20940
3	5.0800"-04	5.3355"+00	NM	0.94488	0.39698	0.70046	3.11324	0.22499
4	6.3500"-04	6.1735"+00	NM	0.95025	0.43015	0.73419	2.91322	0.25202
5	7.6200"-04	6.9949"+00	NM	0.95484	0.46030	0.76204	2.74079	0.27804
6	8.8900"-04	7.6928"+00	NM	0.95832	0.48442	0.78253	2.60964	0.29987
7	1.2700"-03	9.3618"+00	NM	0.96537	0.53769	0.82282	2.34179	0.35136
8	1.9050"-03	1.2061"+01	NM	0.97407	0.61407	0.87027	2.00850	0.43329
9	2.5400"-03	1.5121"+01	NM	0.98129	0.69085	0.90804	1.72959	0.52500
10	3.1750"-03	1.8634"+01	NM	0.98742	0.76884	0.93903	1.49171	0.62950
11	3.8100"-03	2.2474"+01	NM	0.99242	0.84623	0.96367	1.29681	0.74311
12	4.4450"-03	2.6171"+01	NM	0.99613	0.91457	0.98158	1.15190	0.85214
13	5.0800"-03	2.9073"+01	NM	0.99850	0.96482	0.99288	1.05901	0.93756
14	5.7150"-03	3.0582"+01	NM	0.99958	0.98995	0.99803	1.01639	0.98194
15	6.3500"-03	3.1073"+01	NM	0.99992	0.99799	0.99961	1.00325	0.99637
D 16	6.9850"-03	3.1196"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

65060105 YOUNG PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.47084	0.00000	0.00000	2.69585	0.00000
2	3.5560"-04	5.4333"+00	NM	0.78866	0.40303	0.64417	2.55465	0.25216
3	4.0640"-04	5.7330"+00	NM	0.79649	0.41515	0.65817	2.51337	0.26187
4	5.0800"-04	6.7702"+00	NM	0.82062	0.45455	0.70085	2.37738	0.29480
5	6.3500"-04	7.6927"+00	NM	0.83894	0.48687	0.73283	2.26560	0.32346
6	7.6200"-04	8.3641"+00	NM	0.85077	0.50909	0.75331	2.18955	0.34405
7	8.8900"-04	8.9360"+00	NM	0.86002	0.52727	0.76920	2.12816	0.36144
8	1.2700"-03	1.0245"+01	NM	0.87873	0.56667	0.80110	1.99856	0.40084
9	1.9050"-03	1.2831"+01	NM	0.90815	0.63737	0.85057	1.78087	0.47762
10	2.5400"-03	1.5810"+01	NM	0.93352	0.71010	0.89259	1.58002	0.56492
11	3.1750"-03	1.8920"+01	NM	0.95366	0.77879	0.92553	1.41234	0.65531
12	3.8100"-03	2.2317"+01	NM	0.97071	0.84747	0.95313	1.26488	0.75353
13	4.4450"-03	2.5441"+01	NM	0.98320	0.90606	0.97320	1.15369	0.84355
14	5.0800"-03	2.8068"+01	NM	0.99146	0.95253	0.98720	1.07414	0.91907
15	5.7150"-03	2.9551"+01	NM	0.99634	0.97778	0.99419	1.03384	0.96164
16	6.3500"-03	3.0155"+01	NM	0.99803	0.98788	0.99687	1.01828	0.97897
17	6.9850"-03	3.0888"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 18	7.6200"-03	3.0888"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

65060205 YOUNG PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.49517	0.00000	0.00000	2.84473	0.00000
2	4.5720"-04	6.1856"+00	NM	0.81503	0.43191	0.68069	2.48377	0.27406
3	5.0800"-04	6.6207"+00	NM	0.82449	0.44817	0.69793	2.42511	0.28779
4	6.3500"-04	7.8711"+00	NM	0.84816	0.49187	0.74083	2.26848	0.32658
5	7.6200"-04	8.7809"+00	NM	0.86289	0.52134	0.76711	2.16505	0.35431
6	8.8900"-04	9.5067"+00	NM	0.87340	0.54370	0.78571	2.08839	0.37623
7	1.2700"-03	1.1051"+01	NM	0.89283	0.58841	0.81974	1.94082	0.42237
8	1.9050"-03	1.3596"+01	NM	0.91830	0.65549	0.86368	1.73612	0.49748
9	2.5400"-03	1.6598"+01	NM	0.94111	0.72663	0.90243	1.54244	0.58507
10	3.1750"-03	2.0008"+01	NM	0.96078	0.79980	0.93541	1.36787	0.68384
11	3.8100"-03	2.3745"+01	NM	0.97728	0.87297	0.96276	1.21629	0.79155
12	4.4450"-03	2.7226"+01	NM	0.98937	0.93598	0.98265	1.10221	0.89152
13	5.0800"-03	2.9540"+01	NM	0.99613	0.97561	0.99370	1.03742	0.95785
14	5.7150"-03	3.0456"+01	NM	0.99857	0.99085	0.99768	1.01382	0.98408
15	6.3500"-03	3.0764"+01	NM	0.99937	0.99593	0.99897	1.00611	0.99291
16	6.9850"-03	3.1012"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
17	7.6200"-03	3.1012"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 18	8.2550"-03	3.1012"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

65060305 YOUNG PROFILE TABULATION 18 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45084	0.00000	0.00000	2.73475	0.00000
2	3.5560"-04	5.2962"+00	NM	0.78564	0.39898	0.63823	2.55891	0.24942
3	4.0640"-04	5.5684"+00	NM	0.79286	0.41020	0.65130	2.52097	0.25835
4	5.0800"-04	6.5410"+00	NM	0.81602	0.44796	0.69275	2.39154	0.28967
5	6.3500"-04	7.3349"+00	NM	0.83239	0.47653	0.72162	2.29320	0.31468
6	7.6200"-04	7.9326"+00	NM	0.84347	0.49694	0.74100	2.22344	0.33327
7	8.8900"-04	8.5556"+00	NM	0.85407	0.51735	0.75937	2.15449	0.35246
8	1.2700"-03	1.1044"+01	NM	0.88879	0.59184	0.81866	1.91339	0.42786
9	1.9050"-03	1.3142"+01	NM	0.91119	0.64796	0.85620	1.74606	0.49036
10	2.5400"-03	1.6131"+01	NM	0.93598	0.72041	0.89712	1.55076	0.57850
11	3.1750"-03	1.9535"+01	NM	0.95733	0.79490	0.93186	1.37430	0.67806
12	3.8100"-03	2.2902"+01	NM	0.97363	0.86224	0.95809	1.23467	0.77599
13	4.4450"-03	2.6600"+01	NM	0.98775	0.93061	0.98061	1.11034	0.88316
14	5.0800"-03	2.9423"+01	NM	0.99659	0.97959	0.99462	1.03092	0.96479
15	5.7150"-03	3.0457"+01	NM	0.99950	0.99694	0.99921	1.00456	0.99467
D 16	6.3500"-03	3.0642"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
17	6.9850"-03	3.0642"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
18	7.6200"-03	3.0642"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

65060401 YOUNG PROFILE TABULATION 19 POINTS, DELTA AT POINT 18

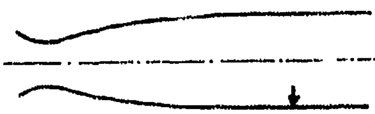
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.89043	0.00000	0.00000	5.29783	0.00000
2	3.5560"-04	3.1753"+00	NM	0.93380	0.28856	0.57236	3.93434	0.14548
3	4.0640"-04	3.2291"+00	NM	0.93432	0.29154	0.57669	3.91280	0.14739
4	5.0800"-04	3.3755"+00	NM	0.93572	0.29950	0.58808	3.85545	0.15253
5	6.3500"-04	3.7010"+00	NM	0.93865	0.31642	0.61145	3.73416	0.16374
6	7.6200"-04	3.9629"+00	NM	0.94085	0.32935	0.62856	3.64222	0.17258
7	8.8900"-04	4.2575"+00	NM	0.94317	0.34328	0.64627	3.54427	0.18234
8	1.2700"-03	5.3402"+00	NM	0.95062	0.39005	0.70061	3.22633	0.21715
9	1.9050"-03	7.0723"+00	NM	0.95988	0.45473	0.76394	2.82237	0.27067
10	2.5400"-03	8.9759"+00	NM	0.96757	0.51642	0.81347	2.48133	0.32784
11	3.1750"-03	1.1755"+01	NM	0.97584	0.59502	0.86420	2.10938	0.40969
12	3.8100"-03	1.5058"+01	NM	0.98286	0.67662	0.90537	1.79047	0.50566
13	4.4450"-03	1.8787"+01	NM	0.98856	0.75821	0.93767	1.52948	0.61308
14	5.0800"-03	2.2887"+01	NM	0.99314	0.83881	0.96305	1.31819	0.73059
15	5.7150"-03	2.6995"+01	NM	0.99660	0.91244	0.98184	1.15791	0.84794
16	6.3500"-03	3.0518"+01	NM	0.99896	0.97114	0.99445	1.04857	0.94838
17	6.9850"-03	3.1825"+01	NM	0.99972	0.99204	0.99851	1.01308	0.98561
D 18	7.6200"-03	3.2330"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
19	8.2550"-03	3.2330"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

65060405 YOUNG PROFILE TABULATION 18 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.49055	0.00000	0.00000	2.87055	0.00000
2	3.5560"-04	3.8406"+00	NM	0.75050	0.32663	0.55564	2.89381	0.19201
3	4.0640"-04	4.0458"+00	NM	0.75769	0.33668	0.56944	2.86057	0.19907
4	5.0800"-04	4.4316"+00	NM	0.77032	0.35477	0.59351	2.79867	0.21207
5	6.3500"-04	4.8155"+00	NM	0.78187	0.37186	0.61534	2.73822	0.22472
6	7.6200"-04	5.2912"+00	NM	0.79497	0.39196	[illegible]	2.66529	0.24009
7	1.2700"-03	7.0436"+00	NM	0.83447	0.45829	[illegible]	[illegible]	0.29469
8	1.9050"-03	9.2394"+00	NM	0.87078	0.52963	[illegible]	2.15819	0.36053
9	2.5400"-03	1.1869"+01	NM	0.90246	0.60402	0.83399	1.90641	0.43747
10	3.1750"-03	1.5016"+01	NM	0.93002	0.68241	0.88179	1.66971	0.52811
11	3.8100"-03	1.8595"+01	NM	0.95289	0.76181	0.92092	1.46134	0.63019
12	4.4450"-03	2.2253"+01	NM	0.97037	0.83518	0.95048	1.29519	0.73386
13	5.0800"-03	2.6134"+01	NM	0.98462	0.90653	0.97439	[illegible]	0.84340
14	5.7150"-03	2.9723"+01	NM	0.99508	0.96784	0.99183	[illegible]	0.94443
15	6.3500"-03	3.1137"+01	NM	0.99865	0.99095	0.99776	1.01379	0.98419
16	6.9850"-03	3.1636"+01	NM	0.99985	0.99899	0.99975	1.00152	0.99824
D 17	7.6200"-03	3.1699"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
18	8.2550"-03	3.1699"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST



M : 2.4, 3.0, 3.4
R THETA x 10^{-3} : 55
TW/TR : 1.0

6601

ZPG - AW

Continuous wind tunnel with flexible nozzle. W = 2.44 H = 2.13 m L = 10 m.
0.09 < PO < 0.15 MN/m^2. 310 < TO < 330 K. Air, absolute humidity < 4 x 10^{-4}. RE/m x 10^{-6} : 8.

HOPKINS E.J. and KEENER E.R. 1966. Study of surface Pitots for measuring skin friction at supersonic Mach numbers - adiabatic wall. NASA TN D 3478.
And Hopkins and Keener - private communications. Also Keener and Hopkins (1971)

1 The test-boundary layer was formed on the side-wall of the tunnel (W = 2.44 m) which in the nozzle region is flexible. Observations were made on a single vertical in a central region about 1 m wide.
4 The layer was thus formed in a largely simple wave favourable pressure gradient but without strong
1 three-dimensional effects, reaching a near-zero-pressure-gradient in the test-zone. The wall had a
2 hand-rubbed painted surface, finished to 0.8 μm, and was not actively cooled. A free-stream Pitot
3 survey showed that the flow was "quite uniform for M < 3 but less uniform at M > 3". There was free transition, the position of which is not known.

6 The static pressure was measured at a tapping 0.81 mm in diameter on the test vertical, 241 mm off the centre line, and at three points 152 mm upstream, one ahead of the traverse vertical and the other two ahead of a Pitot rake and a Stanton tube used in the calibration exercise which was the main concern of the source paper. A thermocouple measured the wall temperature. A skin friction balance (developed by NASA Ames Instrument Division) with a floating element 50.8 mm diameter was mounted on the centre line. This was calibrated directly over a range of working temperature. A buoyancy force correction was applied following the techniques of Smith and Walker (1959). Two forms of Stanton tube and six sizes of Preston tube were mounted at varying distances from the centre line.

7 The velocity profile was measured by Pitot tubes at two stations. At one, 175 mm off the centre line, a traversing FPP (h_1 = 0.33, h_2 = 0.23, b_1 = 2.0, l = 6.35 mm) was employed, while at the other, 356 mm off, a rake was employed with 12 CPP (d_1 = 1.07, l = 10.4 mm) at vertical intervals increasing from 2.5 to 38 mm. Values from the traversing FPP are presented here.
12 The authors reduced the profile data assuming constant total temperature. The editors have replaced this with the Crocco / van Driest temperature velocity correlation for an adiabatic wall and the assumed constant static pressure. The source paper provides a wide range of Preston and Stanton tube calibration data not presented here. The profiles obtained with the rake are presented graphically in Keener & Hopkins (1971), and compared with those given here.

13 The three profiles presented (Hopkins & Keener, PC) are for three Mach numbers at a near common momentum thickness Reynolds number.
14 The CF values are the author's values measured with the balance.
5 DATA 6601 0101 - 0301. PT2 profiles. NX = 1. CF from FEB.

15 Editors' comments
The special value of this investigation lies in the comparisons, made in the source paper, between the three different methods used to measure wall shear stress. The only comparable exercise with this geometry is that of Fenter & Stalmach (1957), based on the profiles measured by Stalmach (CAT 5802), at lower Reynolds numbers than here. With a slightly different geometry, similar Mach number and Reynolds number ranges are covered by Winter & Gaudet (CAT 7302) and Allen (CAT 7303).

The profiles presented include data as far in as the momentum deficit peak.

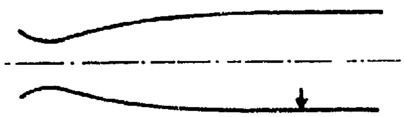
CAT 6601 HOPKINS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X RZ	MD * POD TOD	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD* TD* TR
66010101 NM INFINITE	2.4450 8.9285"+04 3.1470"+02	0.9955 1.0000 0.0000	3.4192"+04 6.2758"+04 7.7104"-03	1.2600"-03 NM 0.0000"+00	3.5699 1.8424 0.1086	1.2349 1.8307 1.0024"-02	5.6930"+03 2.9556"+02 5.8690"+02	5.6930"+03 1.4333"+02 2.9688"+02
66010201 NM INFINITE	2.9610 1.2009"+05 3.2583"+02	0.9678 1.0000 0.0000	2.6906"+04 5.8747"+04 7.4542"-03	1.1100"-03 NM 0.0000"+00	4.5693 1.8460 0.1524	1.2334 1.8312 1.0587"-02	3.4665"+03 2.9444"+02 6.4581"+02	3.4665"+03 1.1833"+02 3.0425"+02
66010301 NM INFINITE	3.4430 1.5286"+05 3.2772"+02	0.9712 1.0000 0.0000	2.1745"+04 5.7318"+04 7.4999"-03	9.1000"-04 NM 0.0000"+00	5.7658 1.8491 0.1620	1.2356 1.8300 1.1702"-02	2.1738"+03 2.9500"+02 6.8066"+02	2.1738"+03 9.7222"+01 3.0375"+02

66010101 HOPKINS PROFILE TABULATION 28 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93916	0.00000	0.00000	2.06202	0.00000
2	4.0640"-04	1.9014"+00	NM	0.95816	0.41057	0.54326	1.75087	0.31028
3	6.6040"-04	2.0298"+00	NM	0.95984	0.43310	0.56823	1.72137	0.33010
4	9.1440"-04	2.1496"+00	NM	0.96130	0.45254	0.58926	1.69550	0.34754
5	1.1684"-03	2.2547"+00	NM	0.96253	0.46864	0.60631	1.67381	0.36223
6	1.4224"-03	2.2870"+00	NM	0.96290	0.47345	0.61133	1.66731	0.36666
7	1.9304"-03	2.4078"+00	NM	0.96509	0.50193	0.64052	1.62844	0.39333
8	2.4384"-03	2.5933"+00	NM	0.96618	0.51610	0.65464	1.60897	0.40687
9	4.9784"-03	3.0386"+00	NM	0.97047	0.57135	0.70732	1.53260	0.46151
10	7.5184"-03	3.3495"+00	NM	0.97319	0.60655	0.73889	1.48398	0.49791
11	1.0058"-02	3.5479"+00	NM	0.97482	0.62788	0.75728	1.45467	0.52059
12	1.2598"-02	3.7608"+00	NM	0.97650	0.64993	0.77572	1.42456	0.54453
13	2.5298"-02	4.4707"+00	NM	0.98159	0.71825	0.82926	1.33300	0.62210
14	3.7998"-02	5.1332"+00	NM	0.98576	0.77637	0.87073	1.25786	0.69223
15	5.0698"-02	5.6727"+00	NM	0.98881	0.82057	0.89992	1.20276	0.74821
16	6.3398"-02	6.3120"+00	NM	0.99209	0.86997	0.93030	1.14349	0.81356
17	7.6098"-02	6.8360"+00	NM	0.99453	0.90842	0.95239	1.09914	0.86646
18	8.8798"-02	7.3331"+00	NM	0.99668	0.94342	0.97139	1.06016	0.91626
19	1.0150"-01	7.7546"+00	NM	0.99639	0.97210	0.98621	1.02922	0.95820
20	1.1420"-01	7.9781"+00	NM	0.99925	0.98697	0.99363	1.01355	0.98035
21	1.2690"-01	8.1098"+00	NM	0.99975	0.99562	0.99788	1.00453	0.99333
D 22	1.3960"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
23	1.5230"-01	8.2107"+00	NM	1.00012	1.00220	1.00106	0.99773	1.00334
24	1.6500"-01	8.2107"+00	NM	1.00012	1.00220	1.00106	0.99773	1.00334
25	1.7770"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.9040"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
27	2.1580"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
28	2.4120"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD AND VAN DRIEST



M : 2.4, 3.0, 3.4
R THETA x 10^{-3} : 55
TW/TR : 1.0

6601

ZPG - AW

Continuous wind tunnel with flexible nozzle. W = 2.44 H = 2.13 m L = 10 m.
0.09 < PO < 0.15 MN/m^2. 310 < TO < 330 K. Air, absolute humidity < 4 x 10^{-4}. RE/m x 10^{-6} : 8.

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3 survey showed that the flow was "quite uniform for M < 3 but less uniform at M > 3". There was free transition, the position of which is not known.

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The profiles presented include data as far in as the momentum deficit peak.

CAT 6601 HOPKINS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X RZ	MD * POD TOD	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD* TD* TR
66010101	2.4450	0.9955	3.4192"+04	1.2600"-03	3.5699	1.2349	5.6930"+03	5.6930"+03
NM	8.9285"+04	1.0000	6.2758"+04	NM	1.8424	1.8307	2.9556"+02	1.4333"+02
INFINITE	3.1470"+02	0.0000	7.7104"-03	0.0000"+00	0.1086	1.0024"-02	5.8690"+02	2.9688"+02
66010201	2.9610	0.9678	2.6906"+04	1.1100"-03	4.5693	1.2334	3.4665"+03	3.4665"+03
NM	1.2009"+05	1.0000	5.8747"+04	NM	1.8460	1.8312	2.9444"+02	1.1833"+02
INFINITE	3.2583"+02	0.0000	7.4542"-03	0.0000"+00	0.1524	1.0587"-02	6.4581"+02	3.0425"+02
66010301	3.4430	0.9712	2.1745"+04	9.1000"-04	5.7658	1.2356	2.1738"+03	2.1738"+03
NM	1.5286"+05	1.0000	5.7316"+04	NM	1.8491	1.8300	2.9500"+02	9.7222"+01
INFINITE	3.2772"+02	0.0000	7.4999"-03	0.0000"+00	0.1620	1.1702"-02	6.8066"+02	3.0375"+02

66010101 HOPKINS PROFILE TABULATION 28 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93916	0.00000	0.00000	2.06202	0.00000
2	4.0640"-04	1.9014"+00	NM	0.95816	0.41057	0.54326	1.75087	0.31028
3	6.6040"-04	2.0298"+00	NM	0.95984	0.43310	0.56823	1.72137	0.33010
4	9.1440"-04	2.1496"+00	NM	0.96130	0.45254	0.58926	1.69550	0.34754
5	1.1684"-03	2.2547"+00	NM	0.96253	0.46864	0.60631	1.67381	0.36223
6	1.4224"-03	2.2870"+00	NM	0.96290	0.47345	0.61133	1.66731	0.36666
7	1.9304"-03	2.4878"+00	NM	0.96509	0.50193	0.64052	1.62844	0.39333
8	2.4384"-03	2.5933"+00	NM	0.96618	0.51610	0.65464	1.60897	0.40687
9	4.9784"-03	3.0386"+00	NM	0.97047	0.57135	0.70732	1.53260	0.46151
10	7.5184"-03	3.3495"+00	NM	0.97319	0.60655	0.73889	1.48398	0.49791
11	1.0058"-02	3.5479"+00	NM	0.97482	0.62788	0.75728	1.45467	0.52059
12	1.2598"-02	3.7608"+00	NM	0.97650	0.64993	0.77572	1.42456	0.54453
13	2.5298"-02	4.4707"+00	NM	0.98159	0.71825	0.82926	1.33300	0.62210
14	3.7998"-02	5.1332"+00	NM	0.98576	0.77637	0.87073	1.25786	0.69223
15	5.0698"-02	5.6727"+00	NM	0.98881	0.82057	0.89992	1.20276	0.74821
16	6.3398"-02	6.3120"+00	NM	0.99209	0.86997	0.93030	1.14349	0.81356
17	7.6098"-02	6.8360"+00	NM	0.99453	0.90842	0.95239	1.09914	0.86648
18	8.8798"-02	7.3331"+00	NM	0.99668	0.94342	0.97139	1.06016	0.91626
19	1.0150"-01	7.7546"+00	NM	0.99839	0.97210	0.98621	1.02922	0.95820
20	1.1420"-01	7.9781"+00	NM	0.99925	0.98697	0.99363	1.01355	0.98035
21	1.2690"-01	8.1098"+00	NM	0.99975	0.99562	0.99788	1.00453	0.99338
D 22	1.3960"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
23	1.5230"-01	8.2107"+00	NM	1.00012	1.00220	1.00106	0.99773	1.00334
24	1.6500"-01	8.2107"+00	NM	1.00012	1.00220	1.00106	0.99773	1.00334
25	1.7770"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.9040"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
27	2.1580"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
28	2.4120"-01	8.1769"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD AND VAN DRIEST

66010201 HOPKINS PROFILE TABULATION 28 POINTS, DELTA AT POINT 22

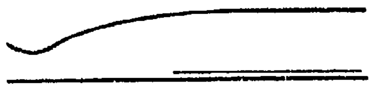
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.90367	0.00000	0.00000	2.48826	0.00000
2	4.0640"-04	2.1772"+00	NM	0.93952	0.37724	0.54280	2.07034	0.26218
3	6.6400"-04	2.3292"+00	NM	0.94180	0.39604	0.56481	2.03386	0.27770
4	9.1440"-04	2.5044"+00	NM	0.94426	0.41633	0.58790	1.99397	0.29484
5	1.1684"-03	2.5944"+00	NM	0.94546	0.42629	0.59897	1.97424	0.30339
6	1.4224"-03	2.6799"+00	NM	0.94657	0.43548	0.60905	1.95594	0.31138
7	1.9304"-03	2.8810"+00	NM	0.94907	0.45625	0.63128	1.91446	0.32974
8	2.4384"-03	3.0391"+00	NM	0.95093	0.47184	0.64750	1.88321	0.34383
9	4.9784"-03	3.6836"+00	NM	0.95776	0.53014	0.70463	1.76658	0.39887
10	7.5184"-03	4.0830"+00	NM	0.96150	0.56302	0.73444	1.70165	0.43160
11	1.0058"-02	4.4059"+00	NM	0.96430	0.58817	0.75613	1.65266	0.45752
12	1.2598"-02	4.6561"+00	NM	0.96634	0.60692	0.77167	1.61663	0.47733
13	2.5298"-02	5.6757"+00	NM	0.97371	0.67777	0.82592	1.48496	0.55619
14	3.7998"-02	6.5565"+00	NM	0.97909	0.73335	0.86383	1.38748	0.62259
15	5.0698"-02	7.4350"+00	NM	0.98376	0.78487	0.89564	1.30218	0.68780
16	6.3398"-02	8.2609"+00	NM	0.98761	0.83024	0.92124	1.23122	0.74823
17	7.6098"-02	9.0503"+00	NM	0.99090	0.87143	0.94268	1.17020	0.80557
18	8.8798"-02	9.9050"+00	NM	0.99410	0.91392	0.96315	1.11062	0.86722
19	1.0150"-01	1.0720"+01	NM	0.99685	0.95265	0.98045	1.05921	0.92565
20	1.1420"-01	1.1223"+01	NM	0.99842	0.97579	0.99021	1.02979	0.96157
21	1.2690"-01	1.1639"+01	NM	0.99965	0.99452	0.99782	1.00665	0.99123
D 22	1.3960"-01	1.1762"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
23	1.5230"-01	1.1762"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
24	1.6500"-01	1.1824"+01	NM	1.00018	1.00276	1.00109	0.99667	1.00444
25	1.7770"-01	1.1824"+01	NM	1.00018	1.00276	1.00109	0.99667	1.00444
26	1.9040"-01	1.1824"+01	NM	1.00018	1.00276	1.00109	0.99667	1.00444
27	2.1580"-01	1.1824"+01	NM	1.00018	1.00276	1.00109	0.99667	1.00444
28	2.4120"-01	1.1762"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD AND VAN DRIEST

66010301 HOPKINS PROFILE TABULATION 28 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.90015	0.00000	0.00000	3.03429	0.00000
2	4.0640"-04	2.2061"+00	NM	0.93370	0.32759	0.51889	2.50902	0.20601
3	6.6040"-04	2.4903"+00	NM	0.93759	0.35669	0.55580	2.42809	0.22890
4	9.1440"-04	2.6556"+00	NM	0.93967	0.37229	0.57483	2.38408	0.24111
5	1.1684"-03	2.7962"+00	NM	0.94136	0.38496	0.58990	2.34815	0.25122
6	1.4224"-03	2.8451"+00	NM	0.94193	0.38926	0.59493	2.33594	0.25469
7	1.9304"-03	3.1508"+00	NM	0.94532	0.41496	0.62420	2.26278	0.27586
8	2.4384"-03	3.3010"+00	NM	0.94689	0.42694	0.63737	2.22868	0.28598
9	4.9784"-03	3.9664"+00	NM	0.95318	0.47613	0.68830	2.08984	0.32936
10	7.5184"-03	4.5144"+00	NM	0.95772	0.51289	0.72321	1.98830	0.36373
11	1.0058"-02	4.8619"+00	NM	0.96035	0.53483	0.74282	1.92900	0.38508
12	1.2598"-02	5.2020"+00	NM	0.96275	0.55544	0.76043	1.87435	0.40570
13	2.5298"-02	6.6221"+00	NM	0.97138	0.63410	0.82099	1.67635	0.48975
14	3.7998"-02	7.5636"+00	NM	0.97609	0.68117	0.85262	1.56674	0.54420
15	5.0698"-02	8.7855"+00	NM	0.98132	0.73775	0.88660	1.44425	0.61388
16	6.3398"-02	9.8452"+00	NM	0.98521	0.78348	0.91119	1.35258	0.67367
17	7.6098"-02	1.0810"+01	NM	0.98833	0.82290	0.93052	1.27867	0.72773
18	8.8798"-02	1.1792"+01	NM	0.99117	0.86115	0.94779	1.21134	0.78243
19	1.0150"-01	1.3068"+01	NM	0.99442	0.90844	0.96729	1.13575	0.85317
20	1.1420"-01	1.4128"+01	NM	0.99681	0.94593	0.98143	1.07648	0.91170
21	1.2690"-01	1.5038"+01	NM	0.99868	0.97497	0.99234	1.03171	0.96184
22	1.3960"-01	1.5529"+01	NM	0.99962	0.99331	0.99781	1.00909	0.98882
23	1.5230"-01	1.5630"+01	NM	0.99981	0.99664	0.99891	1.00455	0.99436
D 24	1.6500"-01	1.5733"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
25	1.7770"-01	1.5836"+01	NM	1.00019	1.00338	1.00109	0.99544	1.00568
26	1.9040"-01	1.5836"+01	NM	1.00019	1.00338	1.00109	0.99544	1.00568
27	2.1580"-01	1.5836"+01	NM	1.00019	1.00338	1.00109	0.99544	1.00568
28	2.4120"-01	1.5733"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC)
ASSUME P=PD AND VAN DRIEST



	M : 2.5, 3.5 R THETA X 10^{-3} : 14 - 20 TW/TR : 1.0	6602 ZPG - AW

Blow-down wind tunnel with half block nozzle. Running time 50 seconds. W = 0.114, H = 0.083 m.
PO = 0.52, 0.81 MN/m^2. TO : 295 K. Air. RE/m X 10^{-6} : 50.

JEROMIN L.O.F., 1966. Compressible turbulent boundary layer with fluid injection. Ph.D. thesis Cambridge.
And Jeromin (1968)

1 The test boundary layer was formed on a solid straight wall opposing a block half-nozzle. The test zone
extended from X = 0.33 to 0.45 m where X = 0 at the throat. The ten measuring stations were at intervals
2 of 12.7 mm on the centre line. The surface was polished and was not actively cooled. The free stream Mach
3 number varied by 1 1/2 % over the test zone. From earlier investigations it was known that the boundary
4 layer was fully turbulent at the start of the test zone. No specific checks on the two-dimensionality of
the layer are reported, but a correction for three-dimensional effects caused a 20 % change in the value
of CF derived from a momentum analysis at the higher Mach number.

6 Static pressure holes (D = 0.25 mm) were drilled in the surface of the plate, and the wall temperature was
7 measured by a thermocouple. The Pitot probe used was a FPP made from 1.068 mm diameter tubing flattened
so that h_1 = 0.204 mm. This small diameter tubing, cranked up from the surface, continued inside a long
slender support structure of 6.25 mm diameter which was further stiffened by three slender fins. The TTP
was an ECP (α = 5^0, d_1 = 1.53, d_2 = 1.58, 1 = 25.4 mm) mounted on a support similar to that of the TPP.
An additional, cranked, TPP was constructed to make possible measurements 25.4 mm off the centre line.

9 The experimental Pitot and TO readings were recorded continuously on an X - Y plotter, and the tabulated
values measured from the trace. In data reduction a Crocco - Van Driest temperature-velocity relationship
was used, with recovery factor 0.89, as this was indistinguishable from the experimental temperature data.
The static pressure was set equal to that determined from the Pitot probe outside the boundary layer, as
10 that was considered a more accurate measurement than a value obtained from the static tappings. No profile
11 corrections were applied and Sutherland's viscosity law was used.

12 The editors have accepted all the authors assumptions and reduction procedures. Only the two sets of
13 profiles measured on a solid plate are presented here. The author also gives data for three distributed
mass injection rates.

§ DATA: 6602 0101-0210. Pitot and TO profiles. NX = 10.

15 Editors' comments

This entry is included principally as a reference case for the pressure gradient experiments of Thomas - CAT 7401 who used the same facility and similar instrumentation. No CF measurements were made, but the author gives some values deduced from a momentum balance. These do not give a good fit to the wall law in transformed coordinates. Two other CF values are tabulated, but these are obtained from various correlation schemes, and do not represent data. The profile data do transform reasonably well using CF values from the correlation of Fernholz (1971). The CF value is however slightly high. The profiles 0101-0107 show no or very little log-law region.

The profiles are given in fine detail, with stations at close intervals so that the layer development may be followed in detail.

CAT 6602 JEROMIN BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	REO2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	REO2D	CQ	H32	H32K	TW*	TD
HZ	TUD*	SW *	D2	PI2*	H42	D2K	UD	TR
66020101	2.5516	1.0283	7.6517"+03	NM	4.1720	1.4197	2.7589"+04	2.7589"+04
3.3400"-01	5.1073"+05	1.0000	1.5147"+04	NM	1.7909	1.7707	2.8550"+02	1.2814"+02
INFINITE	2.9500"+02	0.0000	3.1404"-04	0.0000"+00	0.0822	4.4888"-04	5.7912"+02	2.7765"+02
66020102	2.5414	1.0350	8.1041"+03	NM	4.1613	1.4116	2.8029"+04	2.8029"+04
3.4650"-01	5.1073"+05	1.0000	1.6083"+04	NM	1.7907	1.7706	2.8450"+02	1.2741"+02
INFINITE	2.9200"+02	0.0000	3.2687"-04	0.0000"+00	0.0744	4.6748"-04	5.7516"+02	2.7488"+02
66020103	2.5503	1.0280	8.2762"+03	NM	4.1599	1.4115	2.7645"+04	2.7645"+04
3.5950"-01	5.1073"+05	1.0000	1.6388"+04	NM	1.7925	1.7726	2.8350"+02	1.2735"+02
INFINITE	2.9300"+02	0.0000	3.3626"-04	0.0000"+00	0.0808	4.7980"-04	5.7703"+02	2.7577"+02
66020104	2.5520	1.0195	8.4726"+03	NM	4.1228	1.4012	2.7577"+04	2.7577"+04
3.7200"-01	5.1083"+05	1.0000	1.6651"+04	NM	1.7930	1.7736	2.8450"+02	1.2877"+02
INFINITE	2.9650"+02	0.0000	3.4773"-04	0.0000"+00	0.0894	4.9465"-04	5.8063"+02	2.7906"+02
66020105	2.5537	1.0336	8.5647"+03	NM	4.1574	1.3968	2.7505"+04	2.7505"+04
3.8450"-01	5.1083"+05	1.0000	1.7046"+04	NM	1.7954	1.7767	2.8600"+02	1.2759"+02
INFINITE	2.9400"+02	0.0000	3.5202"-04	0.0000"+00	0.0764	5.0198"-04	5.7834"+02	2.7669"+02
66020106	2.5571	1.0247	8.9385"+03	NM	4.1446	1.3985	2.7365"+04	2.7365"+04
3.9750"-01	5.[illegible]93"+05	1.0000	1.7689"+04	NM	1.7950	1.7759	2.8400"+02	1.2761"+02
INFINITE	[illegible].9450"+02	0.0000	3.6679"-04	0.0000"+00	0.0840	5.2220"-04	5.7917"+02	2.7714"+02
6602[illegible]	2.5608	1.0231	9.1631"+03	NM	4.1273	1.3892	2.7208"+04	2.7208"+04
[illegible]030"-01	5.1093"+05	1.0000	1.8133"+04	NM	1.7987	1.7797	2.8400"+02	1.2762"+02
INFINITE	2.9500"+02	0.0000	3.7763"-04	0.0000"+00	0.0867	5.3515"-04	5.8002"+02	2.7759"+02
66020108	2.5644	1.0215	9.0477"+03	NM	4.1098	1.3817	2.7057"+04	2.7057"+04
4.2200"-01	5.1093"+05	1.0000	1.7899"+04	NM	1.8028	1.7847	2.8450"+02	1.2785"+02
INFINITE	2.9600"+02	0.0000	3.7529"-04	0.0000"+00	0.0904	5.2914"-04	5.8136"+02	2.7851"+02
66020109	2.5754	1.0358	9.3494"+03	NM	4.1914	1.3862	2.6600"+04	2.6600"+04
4.3500"-01	5.1093"+05	1.0000	1.8811"+04	NM	1.7987	1.7797	2.8500"+02	1.2572"+02
INFINITE	2.9250"+02	0.0000	3.9004"-04	0.0000"+00	0.0747	5.5687"-04	5.7898"+02	2.7516"+02
66020110	2.5619	1.0320	9.5686"+03	NM	4.1345	1.3753	2.7162"+04	2.7162"+04
4.4850"-01	5.1093"+05	1.0000	1.9081"+04	NM	1.8022	1.7842	2.8550"+02	1.2713"+02
INFINITE	2.9400"+02	0.0000	3.9570"-04	0.0000"+00	0.0773	5.6036"-04	5.7915"+02	2.7665"+02
66020201	3.6058	1.0485	4.3211"+03	NM	7.0109	1.4462	9.1738"+03	9.1738"+03
3.3400"-01	8.1238"+05	1.0000	1.3122"+04	NM	1.7920	1.7577	2.8800"+02	8.2492"+01
INFINITE	2.9700"+02	0.0000	3.0488"-04	0.0000"+00	0.0930	5.6623"-04	6.5662"+02	2.7469"+02
66020202	3.6007	1.0501	4.5140"+03	NM	6.9470	1.4207	9.2397"+03	9.2397"+03
3.4680"-01	8.1238"+05	1.0000	1.3708"+04	NM	1.7949	1.7632	2.8750"+02	8.2382"+01
INFINITE	2.9600"+02	0.0000	3.1603"-04	0.0000"+00	0.0926	5.8405"-04	6.5526"+02	2.7378"+02
66020203	3.5882	1.0428	4.7823"+03	NM	6.9132	1.4320	9.4021"+03	9.4021"+03
3.5900"-01	8.1228"+05	1.0000	1.4364"+04	NM	1.7910	1.7592	2.8650"+02	8.3076"+01
INFINITE	2.9700"+02	0.0000	3.3066"-04	0.0000"+00	0.0980	6.1229"-04	6.5573"+02	2.7475"+02
66020204	3.5916	1.0627	4.8374"+03	NM	6.9700	1.4133	9.3562"+03	9.3562"+03
3.7200"-01	8.1219"+05	1.0000	1.4790"+04	NM	1.7942	1.7631	2.8950"+02	8.2264"+01
INFINITE	2.9450"+02	0.0000	3.3687"-04	0.0000"+00	0.0793	6.2568"-04	6.5314"+02	2.7243"+02
66020205	3.5780	1.0515	5.0527"+03	NM	6.8731	1.4129	9.5368"+03	9.5368"+03
3.8450"-01	8.1219"+05	1.0000	1.5241"+04	NM	1.7949	1.7654	2.8650"+02	8.2715"+01
INFINITE	2.9450"+02	0.0000	3.4466"-04	0.0000"+00	0.0909	6.3443"-04	6.5244"+02	2.7247"+02
66020206	3.5768	1.0461	5.1485"+03	NM	6.8481	1.4096	9.5518"+03	9.5518"+03
3.9700"-01	8.1209"+05	1.0000	1.5450"+04	NM	1.7931	1.7633	2.8600"+02	8.3036"+01
INFINITE	2.9550"+02	0.0000	3.5096"-04	0.0000"+00	0.0952	6.4710"-04	6.5349"+02	2.7340"+02
66020207	3.5721	1.0424	5.2877"+03	NM	6.8207	1.4122	9.6152"+03	9.6152"+03
4.1000"-01	8.1209"+05	1.0000	1.5791"+04	NM	1.7948	1.7645	2.8550"+02	8.3334"+01
INFINITE	2.9600"+02	0.0000	3.5870"-04	0.0000"+00	0.0978	6.5733"-04	6.5380"+02	2.7388"+02
66020208	3.5527	1.0405	5.5273"+03	NM	6.7751	1.4222	9.8817"+03	9.8817"+03
4.2300"-01	8.1209"+05	1.0000	1.6348"+04	NM	1.7929	1.7623	2.8600"+02	8.4271"+01
INFINITE	2.9700"+02	0.0000	3.6939"-04	0.0000"+00	0.0993	6.7506"-04	6.5390"+02	2.7468"+02
66020209	3.5504	1.0369	5.7808"+03	NM	6.7557	1.4194	9.9139"+03	9.9139"+03
4.3500"-01	8.1209"+05	1.0000	1.7031"+04	NM	1.7912	1.7612	2.8550"+02	8.4491"+01
INFINITE	2.9750"+02	0.0000	3.8530"-04	0.0000"+00	0.1023	7.0578"-04	6.5432"+02	2.7535"+02
66020210	3.5529	1.0405	5.7557"+03	NM	6.7511	1.4094	9.8789"+03	9.8789"+03
4.4800"-01	8.1209"+05	1.0000	1.7020"+04	NM	1.7941	1.7647	2.8650"+02	8.4406"+01
INFINITE	2.9750"+02	0.0000	3.8558"-04	0.0000"+00	0.0995	7.0380"-04	6.5446"+02	2.7534"+02

66020106 JEROMIN PROFILE TABULATION 42 POINTS, DELTA AT POINT 42

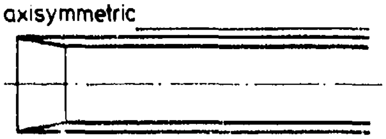
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96464	0.00000	0.00000	2.22614	0.00000
2	1.1400"-04	1.6524"+00	NM	0.96635	0.34350	0.47745	1.93198	0.24713
3	1.6500"-04	1.8676"+00	NM	0.96815	0.38654	0.52845	1.86906	0.28273
4	2.0200"-04	2.0070"+00	NM	0.96921	0.41041	0.55564	1.83295	0.30314
5	2.7400"-04	2.3237"+00	NM	0.97155	0.45783	0.60734	1.75973	0.34513
6	3.4700"-04	2.6146"+00	NM	0.97357	0.49616	0.64684	1.69961	0.38058
7	4.2000"-04	2.8672"+00	NM	0.97514	0.52671	0.67683	1.65130	0.40988
8	4.9300"-04	3.0195"+00	NM	0.97615	0.54416	0.69343	1.62389	0.42702
9	5.6600"-04	3.1337"+00	NM	0.97688	0.55684	0.70523	1.60398	0.43967
10	6.3800"-04	3.2730"+00	NM	0.97770	0.57188	0.71893	1.58037	0.45491
11	7.8400"-04	3.5002"+00	NM	0.97894	0.59552	0.73983	1.54336	0.47936
12	9.2900"-04	3.7032"+00	NM	0.98013	0.61580	0.75722	1.51205	0.50079
13	1.0750"-03	3.8933"+00	NM	0.98121	0.63417	0.77252	1.48395	0.52059
14	1.2210"-03	4.0443"+00	NM	0.98195	0.64836	0.78402	1.46224	0.53618
15	1.3660"-03	4.2346"+00	NM	0.98292	0.66579	0.79782	1.43593	0.55561
16	1.5120"-03	4.4372"+00	NM	0.98394	0.68383	0.81172	1.40902	0.57609
17	1.6570"-03	4.6149"+00	NM	0.98485	0.69926	0.82332	1.38632	0.59389
18	1.8030"-03	4.8040"+00	NM	0.98565	0.71528	0.83502	1.36281	0.61272
19	1.9480"-03	5.0191"+00	NM	0.98667	0.73308	0.84772	1.33720	0.63395
20	2.0940"-03	5.1969"+00	NM	0.98749	0.74745	0.85771	1.31680	0.65137
21	2.2390"-03	5.4116"+00	NM	0.98838	0.76444	0.86921	1.29289	0.67230
22	2.3850"-03	5.5768"+00	NM	0.98912	0.77726	0.87771	1.27518	0.68830
23	2.5310"-03	5.8037"+00	NM	0.98996	0.79451	0.88881	1.25148	0.71021
24	2.6760"-03	6.0194"+00	NM	0.99083	0.81056	0.89891	1.22987	0.73090
25	2.8220"-03	6.2343"+00	NM	0.99164	0.82624	0.90851	1.20906	0.75142
26	2.9670"-03	6.4375"+00	NM	0.99241	0.84078	0.91721	1.19006	0.77073
27	3.1130"-03	6.6645"+00	NM	0.99319	0.85676	0.92651	1.16945	0.79226
28	3.2580"-03	6.8678"+00	NM	0.99396	0.87077	0.93451	1.15175	0.81138
29	3.4040"-03	7.0829"+00	NM	0.99464	0.88538	0.94261	1.13344	0.83163
30	3.5500"-03	7.3116"+00	NM	0.99544	0.90064	0.95090	1.11473	0.85303
31	3.6950"-03	7.5250"+00	NM	0.99608	0.91465	0.95830	1.09773	0.87299
32	3.8410"-03	7.7157"+00	NM	0.99668	0.92699	0.96470	1.08302	0.89075
33	3.9860"-03	7.9312"+00	NM	0.99738	0.94074	0.97170	1.06692	0.91076
34	4.1320"-03	8.1210"+00	NM	0.99787	0.95267	0.97760	1.05302	0.92838
35	4.2770"-03	8.3358"+00	NM	0.99851	0.96601	0.98410	1.03781	0.94825
36	4.4230"-03	8.5130"+00	NM	0.99900	0.97687	0.98930	1.02561	0.96460
37	4.5680"-03	8.6268"+00	NM	0.99925	0.98378	0.99250	1.01781	0.97514
38	4.7140"-03	8.7294"+00	NM	0.99957	0.98997	0.99540	1.01100	0.98457
39	4.8600"-03	8.8077"+00	NM	0.99984	0.99467	0.99760	1.00590	0.99175
40	5.0050"-03	8.8594"+00	NM	0.99995	0.99775	0.99900	1.00250	0.99651
41	5.1510"-03	8.8853"+00	NM	1.00001	0.99930	0.99970	1.00080	0.99890
D 42	5.2960"-03	8.8971"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

66020205 JEROMIN PROFILE TABULATION 43 POINTS, DELTA AT POINT 43

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.97284	0.00000	0.00000	3.46370	0.00000
2	1.1400"-04	1.6992"+00	NM	0.96541	0.25274	0.43440	2.95410	0.14705
3	2.0200"-04	2.3135"+00	NM	0.96789	0.32619	0.53680	2.70830	0.19821
4	2.7400"-04	2.7477"+00	NM	0.96979	0.36629	0.58720	2.57000	0.22848
5	3.4700"-04	3.0368"+00	NM	0.97098	0.39028	0.61550	2.48710	0.24748
6	4.9300"-04	3.5785"+00	NM	0.97314	0.43126	0.66070	2.34710	0.28150
7	6.3800"-04	3.9405"+00	NM	0.97461	0.45642	0.68660	2.26300	0.30340
8	7.8400"-04	4.2655"+00	NM	0.97577	0.47781	0.70750	2.19250	0.32269
9	9.2900"-04	4.3015"+00	NM	0.95620	0.48012	0.70250	2.14090	0.32813
10	1.0750"-03	4.8072"+00	NM	0.97767	0.51139	0.73840	2.08490	0.35417
11	1.2210"-03	5.0602"+00	NM	0.97851	0.52630	0.75140	2.03830	0.36864
12	1.3660"-03	5.3142"+00	NM	0.97942	0.54086	0.76370	1.99380	0.38304
13	1.5120"-03	5.5308"+00	NM	0.98011	0.55295	0.77360	1.95730	0.39524
14	1.6570"-03	5.8204"+00	NM	0.98101	0.56871	0.78610	1.91060	0.41144
15	1.8030"-03	6.1453"+00	NM	0.98196	0.58588	0.79920	1.86080	0.42949
16	1.9480"-03	6.4699"+00	NM	0.98281	0.60253	0.81140	1.81350	0.44742
17	2.0940"-03	6.7599"+00	NM	0.98367	0.61702	0.82170	1.77350	0.46332
18	2.2390"-03	7.1213"+00	NM	0.98458	0.63460	0.83370	1.72590	0.48305
19	2.3850"-03	7.4822"+00	NM	0.98547	0.65168	0.84490	1.68090	0.50265
20	2.6030"-03	7.9528"+00	NM	0.98665	0.67330	0.85850	1.62580	0.52805
21	2.8220"-03	8.4948"+00	NM	0.98780	0.69735	0.87280	1.56650	0.55717
22	3.0400"-03	9.1097"+00	NM	0.98909	0.72366	0.88760	1.50440	0.59000
23	3.2580"-03	9.6880"+00	NM	0.99025	0.74756	0.90030	1.45040	0.62073
24	3.4040"-03	1.0157"+01	NM	0.99108	0.76638	0.90980	1.40930	0.64557
25	3.5500"-03	1.0592"+01	NM	0.99188	0.78344	0.91810	1.37330	0.66854
26	3.6950"-03	1.1026"+01	NM	0.99264	0.80009	0.92590	1.33920	0.69138
27	3.8410"-03	1.1423"+01	NM	0.99323	0.81500	0.93260	1.30940	0.71223
28	3.9860"-03	1.1638"+01	NM	0.99352	0.82301	0.93610	1.29370	0.72358
29	4.1320"-03	1.2470"+01	NM	0.99475	0.85315	0.94880	1.23680	0.76714
30	4.2770"-03	1.2975"+01	NM	0.99544	0.87095	0.95590	1.20460	0.79354
31	4.4230"-03	1.3481"+01	NM	0.99609	0.88841	0.96260	1.17400	0.81993
32	4.5680"-03	1.3990"+01	NM	0.99680	0.90561	0.96900	1.14490	0.84636
33	4.7140"-03	1.4421"+01	NM	0.99727	0.91995	0.97410	1.12120	0.86880
34	4.8600"-03	1.4930"+01	NM	0.99795	0.93660	0.97990	1.09460	0.89521
35	5.0050"-03	1.5398"+01	NM	0.99842	0.95165	0.98490	1.07110	0.91952
36	5.1510"-03	1.5833"+01	NM	0.99896	0.96542	0.98940	1.05030	0.94202
37	5.2960"-03	1.6159"+01	NM	0.99925	0.97563	0.99260	1.03510	0.95894
38	5.4420"-03	1.6411"+01	NM	0.99948	0.98341	0.99500	1.02370	0.97196
39	5.5870"-03	1.6626"+01	NM	0.99965	0.99004	0.99700	1.01410	0.98314
40	5.7330"-03	1.6773"+01	NM	0.99989	0.99453	0.99840	1.00780	0.99067
41	5.8790"-03	1.6879"+01	NM	0.99986	0.99775	0.99930	1.00310	0.99621
42	6.0240"-03	1.6918"+01	NM	0.99999	0.99895	0.99970	1.00150	0.99820
D 43	6.1700"-03	1.6952"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

axisymmetric 	M : 6 R THETA X 10^{-3} : 3 - 14 TW/TR : 0.4 - 0.5	6701 ZPG - SHT

Windtunnel: blow-down but effectively continuous, running time up to 45 minutes with 10 minutes settling time. W = 0.51, H = 0.52 m. PO : 3.6 MN/m^2. TO : 480, 550 K. Air, dewpoint 186 K. RE/m x 10^{-6} : 33, 29.

SAMUELS R.D., PETERSON J.B. and ADCOCK J.B. 1967. Experimental investigation of the turbulent boundary layer at a Mach number of 6 with heat transfer at high Reynolds' numbers. NASA TN D-3858.
And Adcock, Peterson and McCree (1965) - CAT 6501., Peterson J.B. private communication.

The test arrangements were generally those for Adcock et al. CAT 6501 and only the differences will be described here.

1 The model was actively cooled by passing cold Freon in the gap between the inner (t = 2.39 mm) and outer (t = 3.05 mm) skins. The variation in TW/TR was obtained mainly as a result of changing the reservoir TO. The wall temperature was effectively independent of X for the TW/TR = 0.44 case, but varied by about 8 % [E]
3 for the TW/TR = 0.5 case. Transition was forced.

6 Provision was made to measure the heat-flux at X = 305, 610 and 914 mm, using a differential thermocouple
7 heat-flow meter of the type described by Beckwith & Gallagher (1957). The total temperature in the boundary layer was measured with a STP for which d_1 = 0.61, d_2 = 0.36 and l = 9.5 mm. The tip was chamfered towards the outside surface at 45^0, and contained a chromel-alumel thermocouple 1.1 mm back from the entry. There
8 were two vent-holes 0.18 mm in diameter 1.27 mm back. The probe was calibrated as in CAT 6501. Pitot profiles were taken at X = 203, 279, 838, 940 and 1016 mm. TO profiles were taken for all these stations when TW/TR = 0.44, but only for the last three for TW/TR = 0.50.

9 The authors have interpolated the TO data to the Y-values of the Pitot data. For those cases (0201,2) for which no TO profile was measured an assumed profile was used based on that observed downstream at the same station for TW/TR = 0.44. The authors found an unexpectedly large "overshoot" in the TO profiles, and in the calculation of their integral data, replaced the measured distribution in the outer part of the layer with an exponential variation without overshoot. Wall data necessary for the reduction of the profiles was adjusted to the appropriate X-value. No TW data is explicitly presented in the source paper, the measurements being absorbed in global average values of TW/TR.

12 The editors have presented the profiles using the measured temperature data, with overshoot. They have accepted the notional TO profiles for 0201,2. It has been assumed that there is no normal pressure gradient.

13 Sets of profiles, each for 5 successive X values, are given for each of two TW/TR values. The heat transfer
16 data in Section D is a global average of up to 12 readings for each X and TW/TR value, prepared from the authors' original data. No attempt has been made to interpolate it to the X values of the profiles.

§ DATA: 6701 0101-0204. Pitot and TO profiles, obtained separately. NX = 5. Some heat flux data.

15 Editors' comments

The results should be taken in conjunction with the earlier AW case reported by Adcock et al. - CAT 6501. There remains little comparable data, the closest comparisons being Danberg - CAT 6702 and Keener & Hopkins - CAT 7204.

The overshoot of the measured temperature profiles is large enough to cause an apparent associated over-shoot in the velocity profiles. This seems improbable, but we have presented the measured values as users are free to insert their own assumptions if they so wish. Leaving aside the overshoot question, there are substantial differences between the measured TO values and the Van Driest correlation. The temperature measurements must clearly be treated with reserve. The innermost TO values (sometimes up to 5) are interpolations.

CAT 6701 SAMUELS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
67010101	5.9200	0.4867	9.6556"+02	NM	16.4048	1.4250	2.4759"+03	2.4759"+03
2.0300"-01	3.6000"+06	1.0000	3.1481"+03	NM	1.8265	1.7885	2.1500"+02	6.0680"+01
7.6200"-02	4.8600"+02	0.0000	1.0424"-04	0.0000"+00	-0.0440	2.4948"-04	9.2460"+02	4.4177"+02
67010102	5.9400	0.4867	1.7517"+03	NM	14.8045	1.3130	2.4319"+03	2.4319"+03
2.7900"-01	3.6100"+06	1.0000	5.7452"+03	NM	1.8437	1.8156	2.1500"+02	6.0322"+01
7.6200"-02	4.8600"+02	0.0000	1.9130"-04	0.0000"+00	0.1225	4.3928"-04	9.2499"+02	4.4173"+02
67010103	5.9800	0.4848	3.2404"+03	NM	14.9950	1.2994	2.3338"+03	2.3338"+03
8.3800"-01	3.6100"+06	1.0000	1.0710"+04	NM	1.8214	1.7998	2.1500"+02	5.9862"+01
7.6200"-02	4.8800"+02	0.0000	3.6489"-04	0.0000"+00	0.0908	8.8912"-04	9.2766"+02	4.4347"+02
67010104	5.9800	0.4898	3.2529"+03	NM	15.3237	1.3565	2.3330"+03	2.3338"+03
9.4000"-01	3.6100"+06	1.0000	1.0863"+04	NM	1.8263	1.7919	2.1500"+02	5.9249"+01
7.6200"-02	4.8300"+02	0.0000	3.6442"-04	0.0000"+00	0.0729	8.9571"-04	9.2289"+02	4.3893"+02
67010105	5.9700	0.4888	3.5480"+03	NM	14.8384	1.3019	2.3579"+03	2.3579"+03
1.0160"+00	3.6100"+06	1.0000	1.1790"+04	NM	1.8264	1.8000	2.1500"+02	5.9546"+01
7.6200"-02	4.8400"+02	0.0000	3.9507"-04	0.0000"+00	0.1021	9.5084"-04	9.2366"+02	4.3986"+02
67010201	5.9900	0.4272	9.1304"+02	NM	15.0323	1.4448	2.3100"+03	2.3100"+03
2.0300"-01	3.6100"+06	1.0000	2.6759"+03	NM	1.8186	1.7882	2.1000"+02	6.6169"+01
7.6200"-02	5.4100"+02	0.0000	1.0691"-04	0.0000"+00	0.1361	2.3900"-04	9.7693"+02	4.9162"+02
67010202	5.9800	0.4248	1.3737"+03	NM	13.9348	1.3864	2.3274"+03	2.3274"+03
2.7900"-01	3.6000"+06	1.0000	3.9918"+03	NM	1.8232	1.7971	2.1000"+02	6.6731"+01
7.6200"-02	5.4400"+02	0.0000	1.6059"-04	0.0000"+00	0.2476	3.5719"-04	9.7944"+02	4.9436"+02
67010203	6.0800	0.4345	3.1343"+03	NM	13.9278	1.3246	2.1016"+03	2.1016"+03
8.3800"-01	3.6000"+06	1.0000	9.5907"+03	NM	1.8332	1.7979	2.1000"+02	6.3384"+01
7.6200"-02	5.3200"+02	0.0000	3.8898"-04	0.0000"+00	0.2774	9.1382"-04	9.7052"+02	4.8326"+02
67010204	6.0400	0.4257	3.4933"+03	NM	13.7921	1.3053	2.1949"+03	2.1949"+03
9.4000"-01	3.6100"+06	1.0000	1.0351"+04	NM	1.8241	1.7973	2.1000"+02	6.5451"+01
7.6200"-02	5.4300"+02	0.0000	4.2462"-04	0.0000"+00	0.2617	1.0057"-03	9.7972"+02	4.4333"+02

67010101 SAMUELS PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.44239	0.00000	0.00000	3.54320	0.00000
2	8.9000"-05	3.5866"+00	NM	0.62392	0.26100	0.48000	3.33222	0.14192
3	1.0400"-04	3.8225"+00	NM	0.63099	0.27100	0.49500	3.33635	0.14837
4	2.7200"-04	7.1369"+00	NM	0.82216	0.38400	0.69100	3.23813	0.21340
5	3.2000"-04	9.3726"+00	NM	0.85079	0.44400	0.75100	2.86097	0.26250
6	4.7800"-04	1.2768"+01	NM	0.90532	0.52200	0.82400	2.49160	0.33068
7	[illegible]	[illegible]	NM	0.93709	0.54600	0.85100	2.42926	0.35031
8	9.0200"-04	1.5337"+01	NM	0.95578	0.57400	0.87300	2.31315	0.37741
9	1.0690"-03	1.6660"+01	NM	0.96584	0.59900	0.89000	2.20763	0.40315
10	1.3310"-03	1.9474"+01	NM	0.98301	0.64900	0.91600	1.99206	0.45983
11	1.6990"-03	2.2767"+01	NM	1.00288	0.70300	0.94300	1.79934	0.52408
12	1.9810"-03	2.5713"+01	NM	1.01008	0.74800	0.95900	1.64374	0.58342
13	2.6160"-03	3.2153"+01	NM	1.02159	0.83800	0.98500	1.38161	0.71294
14	3.3120"-03	3.9240"+01	NM	1.02657	0.92700	1.00300	1.17069	0.85676
15	4.0130"-03	4.3272"+01	NM	1.01079	0.97400	1.00200	1.05832	0.94678
16	5.0290"-03	4.4958"+01	NM	0.99976	0.99300	0.99900	1.01212	0.98704
17	6.0710"-03	4.5497"+01	NM	1.00025	0.99900	1.00000	1.00200	0.99800
D 18	7.1860"-03	4.5587"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/U/UD/M/MD ASSUME P=PD

67010105 SAMUELS PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.44510	0.00000	0.00000	3.61708	0.00000
2	8.9000"-05	2.9671"+00	NM	0.53547	0.23054	0.40959	3.15654	0.12976
3	1.3000"-04	3.4640"+00	NM	0.58185	0.25349	0.45654	3.24364	0.14075
4	2.3900"-04	4.4243"+00	NM	0.69152	0.29242	0.54645	3.49226	0.15648
5	4.4500"-04	7.2575"+00	NM	0.80092	0.38423	0.68432	3.17195	0.21574
6	4.9000"-04	7.9405"+00	NM	0.81040	0.40319	0.70430	3.05129	0.23082
7	7.7500"-04	8.8119"+00	NM	0.83579	0.42615	0.73327	2.96076	0.24766
8	9.8800"-04	9.1264"+00	NM	0.84735	0.43413	0.74426	2.93901	0.25323
9	1.3110"-03	9.8555"+00	NM	0.86376	0.45210	0.76424	2.85755	0.26744
10	1.5240"-03	1.0443"+01	NM	0.87414	0.46607	0.77822	2.78810	0.27912
11	1.8420"-03	1.1181"+01	NM	0.88799	0.48303	0.79520	2.71021	0.29341
12	2.1590"-03	1.1991"+01	NM	0.89961	0.50100	0.81119	2.62163	0.30942
13	2.5300"-03	1.2784"+01	NM	0.91159	0.51796	0.82617	2.54416	0.32473
14	2.9150"-03	1.3652"+01	NM	0.92577	0.53593	0.84216	2.46930	0.34105
15	4.1480"-03	1.6759"+01	NM	0.95856	0.59581	0.88511	2.20692	0.40106
16	5.7050"-03	2.0924"+01	NM	0.98879	0.66766	0.92607	1.92386	0.48136
17	7.3510"-03	2.6313"+01	NM	1.01171	0.75050	0.96104	1.63977	0.58608
18	8.9690"-03	3.2256"+01	NM	1.02319	0.83234	0.98501	1.40052	0.70332
19	1.0627"-02	3.8982"+01	NM	1.02559	0.91617	1.00100	1.19376	0.83853
20	1.2159"-02	4.3913"+01	NM	1.01497	0.97305	1.00400	1.06461	0.94307
21	1.3848"-02	4.5714"+01	NM	1.00374	0.99301	1.00100	1.01615	0.98509
D 22	1.5433"-02	4.6353"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

67010201 SAMUELS PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.38895	0.00000	0.00000	3.18003	0.00000
2	8.9000"-05	3.3589"+00	NM	0.62519	0.24800	0.46703	3.54632	0.13170
3	1.0200"-04	4.0611"+00	NM	0.64532	0.27745	0.51149	3.39874	0.15049
4	1.4500"-04	6.3181"+00	NM	0.68351	0.35529	0.60839	2.93226	0.20748
5	2.5100"-04	9.7115"+00	NM	0.75784	0.44711	0.71329	2.54512	0.28026
6	5.2600"-04	1.3988"+01	NM	0.86949	0.54092	0.81918	2.29349	0.35718
7	6.7600"-04	1.6216"+01	NM	0.90212	0.58383	0.85415	2.14036	0.39907
8	8.0800"-04	1.6487"+01	NM	0.92695	0.58882	0.86513	2.15873	0.40076
9	1.2070"-03	1.9670"+01	NM	0.95582	0.64471	0.90310	1.96218	0.46025
10	1.5320"-03	2.3142"+01	NM	0.97897	0.70060	0.93207	1.76993	0.52661
11	1.9280"-03	2.7043"+01	NM	1.00281	0.75848	0.95904	1.59876	0.59987
12	2.6670"-03	3.4180"+01	NM	1.02037	0.85429	0.98801	1.33756	0.73867
13	3.4270"-03	4.1468"+01	NM	1.02770	0.94212	1.00599	1.14020	0.88229
14	4.0640"-03	4.5107"+01	NM	1.01835	0.98303	1.00699	1.04934	0.95964
15	5.0270"-03	4.6385"+01	NM	0.99874	0.99701	0.99900	1.00401	0.99501
D 16	6.0550"-03	4.6661"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD
AT I=2 DATA WERE AVERAGED

67010204 SAMUELS PROFILE TABULATION 21 POINTS, DELTA AT POINT 20

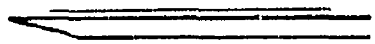
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.38674	0.00000	0.00000	3.20852	0.00000
2	8.9000"-05	2.8630"+00	NM	0.48557	0.22278	0.38312	2.95747	0.12954
3	1.6300"-04	3.7765"+00	NM	0.59072	0.26374	0.47552	3.25092	0.14627
4	2.6900"-04	5.6572"+00	NM	0.72153	0.33167	0.60440	3.32074	0.18201
5	3.0700"-04	6.5608"+00	NM	0.74510	0.35964	0.64136	3.18028	0.20167
6	4.8300"-04	7.6847"+00	NM	0.79133	0.39161	0.68931	3.09832	0.22248
7	6.9900"-04	8.7477"+00	NM	0.81599	0.41958	0.72228	2.96332	0.24374
8	1.0190"-03	9.2260"+00	NM	0.83431	0.43157	0.73926	2.93424	0.25194
9	1.3410"-03	9.8011"+00	NM	0.84797	0.44555	0.75524	2.87325	0.26285
10	1.6050"-03	1.0481"+01	NM	0.85744	0.46154	0.77023	2.78500	0.27656
11	2.3550"-03	1.2099"+01	NM	0.88813	0.49750	0.80619	2.62596	0.30701
12	3.0000"-03	1.3739"+01	NM	0.90455	0.53147	0.83217	2.45170	0.33943
13	3.7010"-03	1.5435"+01	NM	0.92842	0.56444	0.85914	2.31686	0.37082
14	5.0930"-03	1.9311"+01	NM	0.96447	0.63337	0.90410	2.03760	0.44371
15	6.3830"-03	2.3371"+01	NM	0.98930	0.69830	0.93706	1.80074	0.52038
16	7.6680"-03	2.7820"+01	NM	1.00755	0.76324	0.96304	1.59209	0.60489
17	9.2130"-03	3.4016"+01	NM	1.02116	0.84515	0.98701	1.36387	0.72369
18	1.0932"-02	4.1183"+01	NM	1.01851	0.93107	1.00000	1.15355	0.86689
19	1.2487"-02	4.5946"+01	NM	1.00796	0.98402	1.00200	1.03688	0.96636
D 20	1.4094"-02	4.7435"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
21	1.6121"-02	4.7154"+01	NM	0.99873	0.99700	0.99900	1.00401	0.99501

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD
AT I=2 DATA WERE AVERAGED

6701 SECTION D: ADDITIONAL DATA: HEAT TRANSFER MEASUREMENTS

The data are presented for mean values of the wall temperature in each case. The number of readings given is steadily reduced by eliminating the least characteristic point.

TW/TR (nominal)	X (m)	Number of Readings	CQ mean X 10⁴	Standard deviation %
0.5	0.305	9	3.77	3.2
(series	"	8	3.80	2.8
01)	0.610	9	3.73	2.3
	"	8	3.76	0.5
	0.914	3	3.03	-
0.44	0.305	12	4.32	5.1
(series	"	11	4.36	3.7
02)	"	10	4.39	3.3
	0.610	12	4.53	6.0
	"	11	4.48	3.8
	"	10	4.46	3.2
	0.914	8	3.81	7.8
		7	3.90	3.2



M : 6.5
R THETA X 10^{-3} : 1.3 - 6
TW/TR : 0.5 - 0.9

6702

ZPG
MHT / SHT

Continuous tunnel with symmetrical nozzle. W = H = 0.25 m.
1.5 < PO < 4 MN/m^2. TO : 550 K. Air, dew point 215 K. 8 < RE/m X 10^{-6} < 20.

DANBERG J.E., 1967. Characteristics of the turbulent boundary layer with heat and mass transfer: Data tabulation NOLTR 67-6.
And Danberg (1964); Danberg J.E., private communications.

1 The test boundary layer was formed on a flat plate model 0.59 m long spanning the tunnel and aligned with
the plane of symmetry of the nozzle. The leading edge (X = 0), chamfered at 10^{o}, had a radius of approxi-
mately 0.015 mm and was located approximately in the nozzle exit plane. Tunnel wall boundary layers were
compensated for by increasing the working section and the plate widths from 0.254 to 0.272 m over their
length. The plate was designed for tests with mass addition, and for X > 50.8 mm, the surface was composed
of a sintered steel insert 10.67 mm thick. The roughness was less than 1.8 μm and the surface was flat
within ± 0.127 mm. The insert was actively cooled by passing a coolant through 15 passages aligned with
2 the long axis of the plate, buried in the under surface of the sintered portion. Static pressure variation
3 along the surface of the plate was about ± 4 %. No boundary layer trip was used, a local wall temperature
maximum indicating that natural transition occured at or before X = 0.33 m for all runs. This local
temperature rise could not be controlled by the cooling system, and reached its greatest value of about
25 K in the highest unit Reynolds number runs. The detail variation is given graphically in Danberg (1964)
5 figure 9. Some off-centre boundary layer surveys were made and these indicated that the flow was symmetri-
cal with nearly constant properties across the region studied.

6 Static pressure and wall temperature were measured at 9 successive stations, starting at X = 123.8 mm and
then at intervals of 50.8 mm, the static holes (d = 0.635 mm) alternating with temperature stations 5.56 mm
on each side of the centre line. Four thermocouples were mounted at each temperature station, one at
approximately 1.27 mm below the surface, and three others at intervals of about 2.29 mm, so allowing a
determination of the heat transfer rate from the temperature gradient.

7 Total temperature profiles were measured with an ECP (Danberg 1961) for which $\alpha = 5^{o}$, d_1 = 1.14 mm, l = 25 mm.
Pitot profiles were mostly made with a CPP (d_1 = 0.559, d_2 = 0.254 mm with a 10^{o} bevelled lip) though some
data were obtained with an FPP. Static pressure surveys were made using a 1.14 mm probe with the orifices
76.2 mm behind the sharp tip. This probe was affected by aerodynamic loading, and profiles were only
presented graphically for their qualitative value. The pressure at the boundary layer edge is close to the
wall value though both are higher than the free stream value. The difference was explained as due to the
8 displacement effect of the boundary layer itself. Profiles were obtained at four stations for which
X = 0.378, 0.[illegible]9, 0.479 and 0.530 m, thus coinciding with wall static pressure and temperature measurements.

9 The author has interpolated the Pitot profile data to the Y-values of the TO data. The static pressure was
set constant and equal to the wall static pressure. Heat transfer values were obtained from the limiting
gradient of the TO profiles extrapolated to the wall temperature. This agreed with the values obtained
from temperature measurements within the plate to within 20 %, which were considered the less reliable in
view of the experimental and constructional difficulties. A skin friction value was estimated from the
10 limiting slope of the Mach number profile. No corrections were applied to the profile data and viscosity
11 values were taken from Hilsenrath (1955).

12 The editors have incorporated the author's calibration and interpolation procedures. The heat transfer data
is derived from the Stanton number presented by the author, based on a adiabatic wall recovery factor of
13 the one-third power of the wall-state Prandtl number (0.896). The profiles presented, all with zero mass
addition, are three series for three different wall temperatures at a single unit Reynolds number and

one for a higher unit RE. There are also six supplementary individual profiles. The wall data consists of heat transfer and shear stress as determined by the author from profile measurements.

§ DATA: 6702 0101-1001. Pitot and TO profiles. NX = 4. Additional single station runs.

15 Editors' comments

The experiment provides data on a transitional boundary layer. The outer part of the layer is perhaps fully turbulent for the highest Reynolds number runs,but despite the relatively high R THETA values, the high Mach number and wall cooling influences are such that the inner regions are not characteristic of fully developed turbulence. The few possible comparison cases of a high Mach number layer developed under constant pressure conditions are Keener & Hopkins - CAT 7204, Samuels et al. - CAT 6701 and the earlier studies of Winkler & Cha - CAT 5902.

The author reports a difference between wall and free stream static pressure of up to 10 % at low values of x, which decreases downstream (Danberg 1964, figure 10). It is difficult to conceive of a mechanism which would cause this, other than a convex curvature of the displacement surface. The necessary radius of curvature is of order 500 δ, and so feasible. Static pressure measurement at high Mach numbers is very difficult (for an extreme case see Beckwith et al. - CAT 7105) so that we have followed the author here in setting the static pressure at the wall value, which is at least accurately measurable.

The wall data, being derived from the limiting gradients of the profiles, should be treated with reserve. The CF value especially should only be regarded as an approximation. The profiles themselves are presented in fair detail. The inner values of TO are interpolations.

CAT 6702   DAHBERG   BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
67020101	6.6000	0.5082	4.7225"+02	1.4580"-03	13.3435	1.5610	5.3878"+02	5.3878"+02
3.7780"-01	1.5381"+06	1.0000	1.8892"+03	2.2163"-04	1.8119	1.7629	2.5239"+02	5.6400"+01
INFINITE	5.4776"+02	0.0000	2.3093"-04	0.0000"+00	0.6145	5.2166"-04	9.9379"+02	4.9666"+02
67020102	6.5500	0.5156	6.0653"+02	1.3850"-03	12.2585	1.5010	5.6399"+02	5.6399"+02
4.2860"-01	1.5351"+06	1.0000	2.4215"+03	2.1830"-04	1.8292	1.7819	2.5626"+02	5.7200"+01
INFINITE	5.4800"+02	0.0000	2.9103"-04	0.0000"+00	0.6926	6.2026"-04	9.9323"+02	4.9696"+02
67020103	6.5400	0.5169	6.4516"+02	1.4460"-03	12.9536	1.5287	5.6942"+02	5.6942"+02
4.7940"-01	1.5351"+06	1.0000	2.5743"+03	2.3088"-04	1.8313	1.7818	2.5665"+02	5.7300"+01
INFINITE	5.4746"+02	0.0000	3.0772"-04	0.0000"+00	0.6347	6.7488"-04	9.9258"+02	4.9649"+02
67020104	6.4900	0.5253	8.2427"+02	1.3360"-03	12.5506	1.4[illegible]92	5.9942"+02	5.9942"+02
5.3020"-01	1.5401"+06	1.0000	3.2882"+03	1.8472"-04	1.9345	1.7881	2.5997"+02	5.7900"+01
INFINITE	5.4565"+02	0.0000	3.8222"-04	0.0000"+00	0.6492	8.2499"-04	9.9013"+02	4.9492"+02
67020201	6.6300	0.4870	7.7406"+02	1.1860"-03	14.6362	1.4585	6.5971"+02	6.5971"+02
4.7940"-01	2.0316"+06	1.0000	3.0541"+03	2.8647"-04	1.8435	1.7983	2.4315"+02	5.5500"+01
INFINITE	5.5081"+02	0.0000	2.9401"-04	0.0000"+00	0.5274	6.8907"-04	9.9778"+02	4.9930"+02
67020301	6.4100	0.4922	1.2178"+03	9.4600"-04	13.4013	1.4709	1.0632"+03	1.0632"+03
4.7940"-01	2.5281"+06	1.0000	4.4981"+03	2.4420"-04	1.8359	1.7892	2.4696"+02	6.0000"+01
INFINITE	5.5306"+02	0.0000	3.1492"-04	0.0000"+00	0.5472	7.1912"-04	9.9551"+02	5.0178"+02
67020401	6.4600	0.6428	3.7946"+02	1.5600"-03	15.5648	1.6212	6.1786"+02	6.1786"+02
3.7780"-01	1.5422"+06	1.0000	1.7544"+03	2.1937"-04	1.8125	1.7390	3.1991"+02	5.8700"+01
INFINITE	5.4863"+02	0.0000	2.0292"-04	0.0000"+00	0.4009	5.2369"-04	9.9234"+02	4.9768"+02
67020402	6.4600	0.6034	4.7416"+02	1.1850"-03	14.4813	1.7110	6.1908"+02	6.1908"+02
4.2860"-01	1.5452"+06	1.0000	2.0879"+03	2.3095"-04	1.8287	1.7414	3.0082"+02	5.8800"+01
INFINITE	5.4956"+02	0.0000	2.4164"-04	0.0000"+00	0.5224	5.7923"-04	9.9319"+02	4.9852"+02
67020403	6.6200	0.6463	4.7353"+02	1.4740"-03	16.7567	1.5758	5.2515"+02	5.2515"+02
4.7940"-01	1.5280"+06	1.0000	2.2785"+03	2.1454"-04	1.8391	1.7740	3.2043"+02	5.6000"+01
INFINITE	5.4683"+02	0.0000	2.8431"-04	0.0000"+00	0.3428	7.1886"-04	9.9326"+02	4.9579"+02
67020404	6.4500	0.6419	6.3590"+02	1.2100"-03	14.6140	1.5112	6.1977"+02	6.1977"+02
5.3020"-01	1.5320"+06	1.0000	2.9318"+03	1.6829"-04	1.8363	1.7838	3.1802"+02	5.8600"+01
INFINITE	5.4618"+02	0.0000	3.3771"-04	0.0000"+00	0.4598	8.0905"-04	9.8996"+02	4.9547"+02
67020501	6.5300	0.6460	3.3223"+02	1.6620"-03	18.3046	1.8598	5.7111"+02	5.7111"+02
3.7780"-01	1.5249"+06	1.0000	1.5736"+03	2.3213"-04	1.8171	1.7316	3.1985"+02	5.7300"+01
INFINITE	5.4596"+02	0.0000	1.8784"-04	0.0000"+00	0.2307	5.0555"-04	9.9106"+02	4.9514"+02
67020601	6.3100	0.9360	2.7519"+02	1.9540"-03	21.0877	1.6757	7.1063"+02	7.1063"+02
3.7780"-01	1.5320"+06	1.0000	1.6036"+03	1.6451"-04	1.8433	1.7547	4.6674"+02	6.1300"+01
INFINITE	5.4945"+02	0.0000	1.7624"-04	0.0000"+00	-0.1588	5.2440"-04	9.9053"+02	4.9868"+02
67020602	6.4500	0.9201	2.9733"+02	1.7700"-03	22.2856	1.7344	6.1690"+02	6.1690"+02
4.2860"-01	1.5249"+06	1.0000	1.7778"+03	2.1297"-04	1.8520	1.7617	4.6058"+02	5.9200"+01
INFINITE	5.5177"+02	0.0000	2.0892"-04	0.0000"+00	-0.1929	6.1177"-04	9.9502"+02	5.0055"+02
67020603	6.6100	0.9151	3.1817"+02	1.5740"-03	22.4341	1.6337	5.3157"+02	5.3157"+02
4.7940"-01	1.5320"+06	1.0000	1.9828"+03	1.7936"-04	1.8509	1.7649	4.5571"+02	5.6400"+01
INFINITE	5.4925"+02	0.0000	2.4528"-04	0.0000"+00	-0.1438	7.2966"-04	9.9529"+02	4.9799"+02
67020604	6.6200	0.9056	3.9779"+02	1.4500"-03	21.1812	1.5576	5.2515"+02	5.2515"+02
5.3020"-01	1.5280"+06	1.0000	2.4683"+03	1.7624"-04	1.8620	1.7782	4.5061"+02	5.6200"+01
INFINITE	5.4879"+02	0.0000	3.0696"-04	0.0000"+00	-0.0468	8.6774"-04	9.9503"+02	4.9756"+02
67020701	6.4300	0.9282	5.3154"+02	1.4560"-03	18.5322	1.5036	8.3628"+02	8.3628"+02
4.7940"-01	2.0275"+06	1.0000	3.1871"+03	1.5037"-04	1.8620	1.7893	4.6128"+02	5.9100"+01
INFINITE	5.4780"+02	0.0000	2.7643"-04	0.0000"+00	0.1021	7.5047"-04	9.9109"+02	4.9697"+02
67020801	6.3400	0.8607	1.0724"+03	9.9200"-04	17.2894	1.4263	1.7372"+03	1.7372"+03
5.3020"-01	3.8574"+06	1.0000	5.9341"+03	1.0496"-04	1.8475	1.7878	4.3066"+02	6.1000"+01
INFINITE	5.5139"+02	0.0000	2.6356"-04	0.0000"+00	0.1588	7.1559"-04	9.9281"+02	5.0039"+02
67020901	6.5000	0.5443	9.5628"+02	6.2600"-04	15.1900	1.3402	1.4869"+03	1.4869"+03
4.2860"-01	3.8574"+06	1.0000	3.9293"+03	1.9056"-04	1.8717	1.8463	2.7104"+02	5.8100"+01
INFINITE	5.4904"+02	0.0000	1.8480"-04	0.0000"+00	0.4163	4.5617"-04	9.9337"+02	4.9799"+02
67020902	6.4900	0.5539	1.2571"+03	6.9700"-04	13.8729	1.5022	1.5013"+03	1.5013"+03
4.7940"-01	3.8574"+06	1.0000	5.2164"+03	1.8086"-04	1.8365	1.7902	2.7747"+02	5.8600"+01
INFINITE	5.5225"+02	0.0000	2.4652"-04	0.0000"+00	0.5487	5.8639"-04	9.9610"+02	5.0091"+02
67020903	6.3700	0.5682	1.0583"+03	6.8100"-04	13.4771	1.4612	1.6842"+03	1.6842"+03
5.3020"-01	3.8514"+06	1.0000	7.6203"+03	1.5672"-04	1.8432	1.7887	2.8294"+02	6.0200"+01
INFINITE	5.4875"+02	0.0000	3.4061"-04	0.0000"+00	0.5386	7.9417"-04	9.9094"+02	4.9794"+02
67021001	6.3400	0.5266	1.6695"+03	7.7300"-04	14.7078	1.4798	1.5976"+03	1.5976"+03
5.3020"-01	3.5474"+06	1.0000	6.3945"+03	1.9934"-04	1.8279	1.7812	2.6222"+02	6.0700"+01
INFINITE	5.4867"+02	0.0000	3.0654"-04	0.0000"+00	0.3987	7.4919"-04	9.9036"+02	4.9793"+02

67020601 DANBERG PROFILE TABULATION 21 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.84947	0.00000	0.00000	7.61400	0.00000
2	2.7900"-04	1.5651"+00	NM	0.88024	0.13094	0.34500	6.94200	0.04970
3	4.8300"-04	2.7712"+00	NM	0.91407	0.20884	0.51500	6.08100	0.08469
4	6.1000"-04	3.7873"+00	NM	0.93534	0.25287	0.59600	5.55500	0.10729
5	7.3700"-04	5.0996"+00	NM	0.95059	0.29973	0.66800	4.96700	0.13449
6	9.9100"-04	8.0290"+00	NM	0.97852	0.38373	0.77100	4.03700	0.19098
7	1.2450"-03	1.0480"+01	NM	0.99619	0.44177	0.82600	3.49600	0.23627
8	1.4990"-03	1.2424"+01	NM	1.00164	0.48284	0.85600	3.14300	0.27235
9	1.8800"-03	1.4732"+01	NM	1.00766	0.52744	0.88400	2.80900	0.31470
10	2.5150"-03	1.7744"+01	NM	1.00766	0.58050	0.90900	2.45200	0.37072
11	3.7850"-03	2.5516"+01	NM	1.00788	0.69902	0.95000	1.84700	0.51435
12	4.4200"-03	3.0426"+01	NM	1.00927	0.76448	0.96700	1.60000	0.60437
13	5.0550"-03	3.4923"+01	NM	1.00853	0.81985	0.97800	1.42300	0.68728
14	6.3250"-03	4.2907"+01	NM	1.00891	0.90990	0.99300	1.19100	0.83375
15	7.5950"-03	4.7873"+01	NM	1.00504	0.96166	0.99800	1.07700	0.92665
16	8.8650"-03	5.0674"+01	NM	1.00234	0.98966	1.00000	1.02100	0.97943
D 17	1.0140"-02	5.1728"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
18	1.1410"-02	5.1728"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
19	1.3940"-02	5.1728"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
20	1.7760"-02	5.1728"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
21	2.4100"-02	5.1728"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020602 DANBERG PROFILE TABULATION 27 POINTS, DELTA AT POINT 27

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.83472	0.00000	0.00000	7.76000	0.00000
2	2.7900"-04	1.4660"+00	NM	0.87188	0.11782	0.31800	7.28500	0.04365
3	3.1800"-04	1.8072"+00	NM	0.87732	0.14880	0.39100	6.90500	0.05663
4	4.4500"-04	2.4228"+00	NM	0.89473	0.18686	0.47500	6.46200	0.07351
5	5.7200"-04	3.1302"+00	NM	0.90985	0.22061	0.54200	6.03600	0.08979
6	6.9900"-04	4.2534"+00	NM	0.92754	0.26498	0.61900	5.45700	0.11343
7	9.5300"-04	7.1525"+00	NM	0.96071	0.35286	0.74000	4.39800	0.16826
8	1.2070"-03	9.5493"+00	NM	0.98408	0.41155	0.80300	3.80700	0.21093
9	1.4610"-03	1.1525"+01	NM	0.99447	0.45421	0.83900	3.41200	0.24590
10	2.0960"-03	1.4688"+01	NM	1.00207	0.51519	0.87900	2.91100	0.30196
11	2.7310"-03	1.7208"+01	NM	1.00119	0.55902	0.90000	2.59200	0.34722
12	3.3660"-03	2.0035"+01	NM	0.99983	.60439	0.91800	2.30700	0.39792
13	4.0010"-03	2.2895"+01	NM	1.00015	0.64707	0.93300	2.07900	0.44877
14	4.6360"-03	2.5856"+01	NM	1.00358	0.68848	0.94700	1.89200	0.50053
15	5.2710"-03	2.9411"+01	NM	1.00780	0.73511	0.96100	1.70900	0.56232
16	5.9060"-03	3.3094"+01	NM	1.00983	0.78048	0.97200	1.55100	0.62669
17	6.5410"-03	3.6818"+01	NM	1.01125	0.82382	0.98100	1.41800	0.69182
18	7.1760"-03	4.0439"+01	NM	1.01175	0.86388	0.98800	1.30800	0.75535
19	7.8110"-03	4.3773"+01	NM	1.01314	0.89919	0.99400	1.22200	0.81342
20	8.4460"-03	4.6523"+01	NM	1.01139	0.92729	0.99700	1.15600	0.86246
21	9.0810"-03	4.8929"+01	NM	1.00927	0.95121	0.99900	1.10300	0.90571
22	9.7160"-03	5.0618"+01	NM	1.00730	0.96764	1.00000	1.06800	0.93633
23	1.0350"-02	5.1869"+01	NM	1.00451	0.97964	1.00000	1.04200	0.95969
24	1.0990"-02	5.2722"+01	NM	1.00268	0.98773	1.00000	1.02500	0.97561
25	1.1620"-02	5.3446"+01	NM	1.00118	0.99454	1.00000	1.01100	0.98912
26	1.2260"-02	5.3762"+01	NM	1.00054	0.99751	1.00000	1.00500	0.99502
D 27	1.2890"-02	5.4028"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020603 DANBERG PROFILE TABULATION 23 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.82970	0.00000	0.00000	8.08000	0.00000
2	2.7900"-04	1.4862"+00	NM	0.86384	0.11712	0.32100	7.51200	0.04273
3	3.5600"-04	1.8352"+00	NM	0.89247	0.14724	0.39800	7.30700	0.05447
4	4.8300"-04	2.1040"+00	NM	0.89010	0.16471	0.43600	7.00700	0.06222
5	6.1000"-04	2.9712"+00	NM	0.90589	0.20840	0.52700	6.39500	0.08241
6	7.3700"-04	4.0588"+00	NM	0.92037	0.25134	0.60400	5.77500	0.10459
7	8.6400"-04	5.1954"+00	NM	0.93446	0.28911	0.66300	5.25900	0.12607
8	1.1180"-03	7.7630"+00	NM	0.96113	0.35978	0.75400	4.39200	0.17168
9	1.3720"-03	9.9151"+00	NM	0.97322	0.40962	0.80300	3.84300	0.20895
10	1.6260"-03	1.1466"+01	NM	0.98727	0.44205	0.83300	3.55100	0.23458
11	2.2610"-03	1.4408"+01	NM	0.99060	0.49775	0.86900	3.04800	0.28510
12	2.8960"-03	1.6880"+01	NM	0.99167	0.54025	0.89100	2.72000	0.32757
13	4.1660"-03	2.1732"+01	NM	0.99157	0.61482	0.92100	2.24400	0.41043
14	5.4360"-03	2.7315"+01	NM	0.99975	0.69085	0.94800	1.88300	0.50345
15	6.7060"-03	3.3458"+01	NM	1.00694	0.76582	0.96900	1.60100	0.60525
16	7.9760"-03	4.0073"+01	NM	1.01210	0.83910	0.98500	1.37800	0.71480
17	9.2460"-03	4.6077"+01	NM	1.01374	0.90046	0.99500	1.22100	0.81491
18	1.0520"-02	5.0636"+01	NM	1.01043	0.94439	0.99900	1.11900	0.89276
19	1.1790"-02	5.3435"+01	NM	1.00637	0.97037	1.00000	1.06200	0.94162
20	1.4330"-02	5.6162"+01	NM	1.00103	0.99504	1.00000	1.01000	0.99010
D 21	1.6740"-02	5.6719"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
22	1.8140"-02	5.6719"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
23	1.9410"-02	5.6719"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020604 DANBERG PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.82111	0.00000	0.00000	8.01800	0.00000
2	2.7900"-04	1.4690"+00	NM	0.85589	0.11511	0.31500	7.48800	0.04207
3	4.0600"-04	1.8398"+00	NM	0.87166	0.14734	0.39400	7.15100	0.05510
4	5.3300"-04	2.1092"+00	NM	0.88769	0.16477	0.43600	7.00200	0.06227
5	6.6000"-04	3.2587"+00	NM	0.90315	0.22031	0.54800	6.18700	0.08857
6	7.8700"-04	4.2715"+00	NM	0.91932	0.25846	0.61500	5.66200	0.10862
7	1.0410"-03	6.7442"+00	NM	0.94649	0.33307	0.72100	4.68600	0.15386
8	1.6760"-03	1.0924"+01	NM	0.97538	0.43033	0.82000	3.63100	0.22583
9	2.3110"-03	1.3594"+01	NM	0.97578	0.48225	0.85400	3.13600	0.27232
10	2.9460"-03	1.5631"+01	NM	0.97679	0.51835	0.87400	2.84300	0.30742
11	3.5810"-03	1.7803"+01	NM	0.97942	0.55426	0.89200	2.59000	0.34440
12	4.2160"-03	2.0105"+01	NM	0.98264	0.58993	0.90800	2.36900	0.38328
13	4.8510"-03	2.2262"+01	NM	0.98626	0.62150	0.92100	2.19600	0.41940
14	6.1210"-03	2.7057"+01	NM	0.99353	0.68648	0.94400	1.89100	0.49921
15	7.3910"-03	3.2435"+01	NM	1.00626	0.75271	0.96600	1.64700	0.58652
16	8.6610"-03	3.7863"+01	NM	1.01044	0.81413	0.98000	1.44900	0.67633
17	9.9310"-03	4.2984"+01	NM	1.01088	0.86808	0.98900	1.29800	0.76194
18	1.1200"-02	4.7368"+01	NM	1.01061	0.91173	0.99500	1.19100	0.83543
19	1.2470"-02	5.0486"+01	NM	1.00502	0.94155	0.99600	1.11900	0.89008
20	1.3740"-02	5.2646"+01	NM	1.00430	0.96166	0.99800	1.07700	0.92665
21	1.7550"-02	5.5456"+01	NM	1.00066	0.98722	0.99900	1.02400	0.97559
D 22	2.3900"-02	5.6889"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020901 DANBERG PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.49365	0.00000	0.00000	4.66500	0.00000
2	3.0400"-04	4.3723"+00	NM	0.69950	0.26677	0.54200	4.12800	0.13130
3	4.0600"-04	4.3354"+00	NM	0.73260	0.26548	0.55300	4.33900	0.12745
4	4.3100"-04	4.8888"+00	NM	0.76481	0.28417	0.58900	4.29600	0.13710
5	4.6200"-04	5.9181"+00	NM	0.78807	0.31592	0.63500	4.04000	0.15718
6	6.0900"-04	8.6824"+00	NM	0.84114	0.38834	0.72600	3.49500	0.20773
7	7.3600"-04	1.0711"+01	NM	0.86582	0.43379	0.77100	3.15900	0.24406
8	8.6300"-04	1.1642"+01	NM	0.88643	0.45311	0.79300	3.06300	0.25890
9	1.1170"-03	1.3164"+01	NM	0.90401	0.48302	0.81900	2.87500	0.28487
10	1.3710"-03	1.4694"+01	NM	0.91868	0.51134	0.84100	2.70500	0.31091
11	1.6250"-03	1.6242"+01	NM	0.92694	0.53846	0.85800	2.53900	0.33793
12	1.8790"-03	1.7990"+01	NM	0.93614	0.56754	0.87500	2.37700	0.36811
13	2.1330"-03	1.9912"+01	NM	0.94490	0.59787	0.89100	2.22100	0.40117
14	2.6310"-03	2.4139"+01	NM	0.96265	0.65967	0.92000	1.94500	0.47301
15	3.1490"-03	2.9065"+01	NM	0.97620	0.72508	0.94400	1.69500	0.55693
16	3.7840"-03	3.5354"+01	NM	0.99452	0.80085	0.96900	1.46400	0.66189
17	4.4190"-03	4.1659"+01	NM	0.99906	0.87022	0.98300	1.27600	0.77038
18	5.0540"-03	4.5892"+01	NM	1.00260	0.91384	0.99100	1.17600	0.84269
19	5.6890"-03	5.0001"+01	NM	0.99830	0.95427	0.99400	1.08500	0.91613
20	6.3240"-03	5.2153"+01	NM	0.99752	0.97479	0.99600	1.04400	0.95402
21	6.9590"-03	5.3582"+01	NM	0.99854	0.98817	0.99800	1.02000	0.97843
22	7.5840"-03	5.4269"+01	NM	0.99916	0.99453	0.99900	1.00900	0.99009
23	8.2290"-03	5.4591"+01	NM	1.00053	0.99751	1.00000	1.00500	0.99502
24	8.8640"-03	5.4645"+01	NM	1.00042	0.99801	1.00000	1.00400	0.99602
25	9.4990"-03	5.4753"+01	NM	1.00021	0.99900	1.00000	1.00200	0.99800
D 26	1.0770"-02	5.4862"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020902 DANBERG PROFILE TABULATION 32 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.50244	0.00000	0.00000	4.73500	0.00000
2	3.7900"-04	4.3219"+00	NM	0.71555	0.26541	0.54600	4.23200	0.12902
3	4.3000"-04	5.1384"+00	NM	0.73743	0.29265	0.58800	4.03700	0.14565
4	5.0600"-04	6.7903"+00	NM	0.76794	0.34099	0.65200	3.65600	0.17834
5	5.3200"-04	7.2815"+00	NM	0.77889	0.35407	0.66900	3.57000	0.18739
6	5.5700"-04	7.6965"+00	NM	0.78674	0.36475	0.68200	3.49600	0.19508
7	7.6000"-04	1.0103"+01	NM	0.84576	0.42133	0.75300	3.19400	0.23575
8	1.0140"-03	1.1497"+01	NM	0.87697	0.45086	0.78700	3.04700	0.25829
9	1.2680"-03	1.2727"+01	NM	0.88796	0.47536	0.80700	2.88200	0.28001
10	1.5520"-03	1.4041"+01	NM	0.89270	0.50021	0.82300	2.70700	0.30403
11	1.7760"-03	1.7550"+01	NM	0.89974	0.56121	0.85500	2.32100	0.36838
12	2.0300"-03	1.6995"+01	NM	0.90802	0.55202	0.85500	2.39900	0.35640
13	2.2840"-03	1.8689"+01	NM	0.91774	0.57964	0.87100	2.25800	0.38574
14	2.6650"-03	2.1146"+01	NM	0.93057	0.61750	0.89100	2.08200	0.42795
15	2.9190"-03	2.2513"+01	NM	0.93756	0.63758	0.90100	1.99700	0.45118
16	3.3000"-03	2.5090"+01	NM	0.95024	0.67384	0.91800	1.85600	0.49461
17	3.5540"-03	2.6790"+01	NM	0.96013	0.69671	0.92900	1.77800	0.52250
18	3.9330"-03	2.9907"+01	NM	0.96870	0.73681	0.94300	1.63800	0.57570
19	4.5700"-03	3.5007"+01	NM	0.98755	0.79809	0.96500	1.46200	0.66005
20	5.2050"-03	4.0233"+01	NM	0.99543	0.85634	0.97900	1.30700	0.74904
21	5.8400"-03	4.4705"+01	NM	1.00156	0.90321	0.98900	1.19900	0.82485
22	6.4750"-03	4.8135"+01	NM	1.00246	0.93757	0.99400	1.12400	0.88434
23	7.1100"-03	5.0796"+01	NM	1.00218	0.96339	0.99700	1.07100	0.93091
24	7.7450"-03	5.2405"+01	NM	1.00267	0.97866	0.99900	1.04200	0.95873
25	8.3800"-03	5.3269"+01	NM	1.00287	0.98677	1.00000	1.02700	0.97371
26	9.6500"-03	5.3999"+01	NM	1.00138	0.99356	1.00000	1.01300	0.98717
27	1.0920"-02	5.4317"+01	NM	0.99874	0.99651	0.99900	1.00500	0.99403
28	1.3460"-02	5.4478"+01	NM	0.99843	0.99800	0.99900	1.00200	0.99701
29	1.6000"-02	5.4478"+01	NM	0.99843	0.99800	0.99900	1.00200	0.99701
30	1.8540"-02	5.4533"+01	NM	1.00032	0.99850	1.00000	1.00300	0.99701
D 31	2.1080"-02	5.4695"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
32	2.3620"-02	5.4695"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020903 DANBERG PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.51561	0.00000	0.00000	4.70000	0.00000
2	3.3600"-04	3.2260"+00	NM	0.70486	0.22755	0.48400	4.52400	0.10698
3	4.6300"-04	5.1569"+00	NM	0.74779	0.29876	0.59400	3.95300	0.15027
4	5.9000"-04	6.7885"+00	NM	0.78385	0.34737	0.66000	3.61000	0.18283
5	8.4400"-04	8.6120"+00	NM	0.82685	0.39456	0.72000	3.33000	0.21622
6	1.0980"-03	9.5193"+00	NM	0.85048	0.41603	0.74700	3.22400	0.23170
7	1.3520"-03	1.0519"+01	NM	0.86394	0.43846	0.76900	3.07600	0.25000
8	1.9870"-03	1.3065"+01	NM	0.88274	0.49095	0.81000	2.72200	0.29758
9	2.6220"-03	1.5674"+01	NM	0.90059	0.53945	0.84300	2.44200	0.34521
10	3.2570"-03	1.8909"+01	NM	0.92169	0.59412	0.87600	2.17400	0.40294
11	3.8920"-03	2.2254"+01	NM	0.93838	0.64577	0.90200	1.95100	0.46233
12	5.1620"-03	2.9339"+01	NM	0.96821	0.74342	0.94300	1.60900	0.58608
13	6.4320"-03	3.7157"+01	NM	0.99075	0.83805	0.97300	1.34800	0.72181
14	7.7020"-03	4.4080"+01	NM	1.00137	0.91369	0.99000	1.17400	0.84327
15	8.9720"-03	4.8511"+01	NM	1.00555	0.95899	0.99800	1.08300	0.92151
16	1.0240"-02	5.0026"+01	NM	1.00392	0.97400	0.99900	1.05200	0.94962
17	1.1510"-02	5.0594"+01	NM	1.00061	0.97956	0.99800	1.03800	0.96146
18	1.4050"-02	5.1429"+01	NM	0.99875	0.98768	0.99800	1.02100	0.97747
19	1.6590"-02	5.1579"+01	NM	0.99842	0.98914	0.99800	1.01800	0.98035
20	1.9130"-02	5.1882"+01	NM	0.99776	0.99207	0.99800	1.01200	0.98617
21	2.1670"-02	5.2190"+01	NM	0.99910	0.99503	0.99900	1.00800	0.99107
22	2.4210"-02	5.2499"+01	NM	0.99844	0.99800	0.99900	1.00200	0.99701
D 23	2.6750"-02	5.2708"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020604 DANBERG PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.82111	0.00000	0.00000	8.01800	0.00000
2	2.7900"-04	1.4690"+00	NM	0.85589	0.11511	0.31500	7.48800	0.04207
3	4.0600"-04	1.8398"+00	NM	0.87166	0.14734	0.39400	7.15100	0.05510
4	5.3300"-04	2.1092"+00	NM	0.88769	0.16477	0.43600	7.00200	0.06227
5	6.6000"-04	3.2587"+00	NM	0.90315	0.22031	0.54800	6.18700	0.08857
6	7.8700"-04	4.2715"+00	NM	0.91932	0.25846	0.61500	5.66200	0.10862
7	1.0410"-03	6.7442"+00	NM	0.94649	0.33307	0.72100	4.68600	0.15386
8	1.6760"-03	1.0924"+01	NM	0.97538	0.43033	0.82000	3.63100	0.22583
9	2.3110"-03	1.3594"+01	NM	0.97578	0.48225	0.85400	3.13600	0.27232
10	2.9460"-03	1.5631"+01	NM	0.97679	0.51835	0.87400	2.84300	0.30742
11	3.5810"-03	1.7803"+01	NM	0.97942	0.55426	0.89200	2.59000	0.34440
12	4.2160"-03	2.0105"+01	NM	0.98264	0.58993	0.90800	2.36900	0.38328
13	4.8510"-03	2.2262"+01	NM	0.98626	0.62150	0.92100	2.19600	0.41940
14	6.1210"-03	2.7057"+01	NM	0.99353	0.68648	0.94400	1.89100	0.49921
15	7.3910"-03	3.2435"+01	NM	1.00626	0.75271	0.96600	1.64700	0.58652
16	8.6610"-03	3.7863"+01	NM	1.01044	0.81413	0.98000	1.44900	0.67633
17	9.9310"-03	4.2984"+01	NM	1.01088	0.86808	0.98900	1.29800	0.76194
18	1.1200"-02	4.7368"+01	NM	1.01061	0.91173	0.99500	1.19100	0.83543
19	1.2470"-02	5.0486"+01	NM	1.00502	0.94155	0.99600	1.11900	0.89008
20	1.3740"-02	5.2646"+01	NM	1.00430	0.96166	0.99800	1.07700	0.92665
21	1.7550"-02	5.5456"+01	NM	1.00066	0.98722	0.99900	1.02400	0.97559
D 22	2.3900"-02	5.6889"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020901 DANBERG PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.49365	0.00000	0.00000	4.66500	0.00000
2	3.0400"-04	4.3723"+00	NM	0.69950	0.26677	0.54200	4.12800	0.13130
3	4.0600"-04	4.3354"+00	NM	0.73260	0.26548	0.55300	4.33900	0.12745
4	4.3100"-04	4.8888"+00	NM	0.76481	0.28417	0.58900	4.29600	0.13710
5	4.8200"-04	5.9181"+00	NM	0.78807	0.31592	0.63500	4.04000	0.15718
6	6.0900"-04	8.6824"+00	NM	0.84114	0.38834	0.72600	3.49500	0.20773
7	7.3600"-04	1.0711"+01	NM	0.86582	0.43379	0.77100	3.15900	0.24406
8	8.6300"-04	1.1642"+01	NM	0.88643	0.45311	0.79300	3.06300	0.25890
9	1.1170"-03	1.3164"+01	NM	0.90401	0.48302	0.81900	2.87500	0.28487
10	1.3710"-03	1.4694"+01	NM	0.91868	0.51134	0.84100	2.70500	0.31091
11	1.6250"-03	1.6242"+01	NM	0.92694	0.53846	0.85800	2.53900	0.33793
12	1.8790"-03	1.7990"+01	NM	0.93614	0.56754	0.87500	2.37700	0.36811
13	2.1330"-03	1.9912"+01	NM	0.94490	0.59787	0.89100	2.22100	0.40117
14	2.6310"-03	2.4139"+01	NM	0.96265	0.65967	0.92000	1.94500	0.47301
15	3.1490"-03	2.9065"+01	NM	0.97620	0.72508	0.94400	1.69500	0.55693
16	3.7840"-03	3.5354"+01	NM	0.99452	0.80085	0.96900	1.46400	0.66189
17	4.4190"-03	4.1659"+01	NM	0.99906	0.87022	0.98300	1.27600	0.77038
18	5.0540"-03	4.5892"+01	NM	1.00260	0.91384	0.99100	1.17600	0.84269
19	5.6890"-03	5.0001"+01	NM	0.99830	0.95427	0.99400	1.08500	0.91613
20	6.3240"-03	5.2153"+01	NM	0.99752	0.97479	0.99600	1.04400	0.95402
21	6.9590"-03	5.3582"+01	NM	0.99854	0.98817	0.99800	1.02000	0.97843
22	7.5840"-03	5.4269"+01	NM	0.99916	0.99453	0.99900	1.00900	0.99009
23	8.2290"-03	5.4591"+01	NM	1.00053	0.99751	1.00000	1.00500	0.99502
24	8.8640"-03	5.4645"+01	NM	1.00042	0.99801	1.00000	1.00400	0.99602
25	9.4990"-03	5.4753"+01	NM	1.00021	0.99900	1.00000	1.00200	0.99800
D 26	1.0770"-02	5.4862"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020902 DANBERG PROFILE TABULATION 32 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.50244	0.00000	0.00000	4.73500	0.00000
2	3.7900"-04	4.3219"+00	NM	0.71555	0.26541	0.54600	4.23200	0.12902
3	4.3000"-04	5.1384"+00	NM	0.73743	0.29265	0.58800	4.03700	0.14565
4	5.0600"-04	6.7903"+00	NM	0.76794	0.34099	0.65200	3.65600	0.17834
5	5.3200"-04	7.2815"+00	NM	0.77889	0.35407	0.66900	3.57000	0.18739
6	5.5700"-04	7.6965"+00	NM	0.78674	0.36475	0.68200	3.49600	0.19508
7	7.6000"-04	1.0103"+01	NM	0.84576	0.42133	0.75300	3.19400	0.23575
8	1.0140"-03	1.1497"+01	NM	0.87697	0.45086	0.78700	3.04700	0.25829
9	1.2680"-03	1.2727"+01	NM	0.88796	0.47536	0.80700	2.88200	0.28001
10	1.5520"-03	1.4041"+01	NM	0.89270	0.50021	0.82300	2.70700	0.30403
11	1.7760"-03	1.7550"+01	NM	0.89974	0.56121	0.85500	2.32100	0.36838
12	2.0300"-03	1.6995"+01	NM	0.90802	0.55202	0.85500	2.39900	0.35640
13	2.2840"-03	1.8689"+01	NM	0.91774	0.57964	0.87100	2.25800	0.38574
14	2.6650"-03	2.1146"+01	NM	0.93057	0.61750	0.89100	2.08200	0.42795
15	2.9190"-03	2.2513"+01	NM	0.93736	0.63758	0.90100	1.99700	0.45118
16	3.3000"-03	2.5090"+01	NM	0.95024	0.67384	0.91800	1.85600	0.49461
17	3.5540"-03	2.6790"+01	NM	0.96013	0.69671	0.92900	1.77800	0.52250
18	3.9350"-03	2.9907"+01	NM	0.96870	0.73681	0.94300	1.63800	0.57570
19	4.5700"-03	3.5007"+01	NM	0.98755	0.79809	0.96500	1.46200	0.66005
20	5.2050"-03	4.0233"+01	NM	0.99543	0.85634	0.97900	1.30700	0.74904
21	5.8400"-03	4.4705"+01	NM	1.00156	0.90321	0.98900	1.19900	0.82485
22	6.4750"-03	4.8135"+01	NM	1.00246	0.93757	0.99400	1.12400	0.88434
23	7.1100"-03	5.0796"+01	NM	1.00218	0.96339	0.99700	1.07100	0.93091
24	7.7450"-03	5.2405"+01	NM	1.00267	0.97866	0.99900	1.04200	0.95873
25	8.3800"-03	5.3269"+01	NM	1.00287	0.98677	1.00000	1.02700	0.97371
26	9.6500"-03	5.3999"+01	NM	1.00138	0.99356	1.00000	1.01300	0.98717
27	1.0920"-02	5.4317"+01	NM	0.99874	0.99651	0.99900	1.00500	0.99403
28	1.3460"-02	5.4478"+01	NM	0.99843	0.99800	0.99900	1.00200	0.99701
29	1.6000"-02	5.4478"+01	NM	0.99843	0.99800	0.99900	1.00200	0.99701
30	1.8540"-02	5.4533"+01	NM	1.00032	0.99850	1.00000	1.00300	0.99701
D 31	2.1080"-02	5.4695"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
32	2.3620"-02	5.4695"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

67020903 DANBERG PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.51561	0.00000	0.00000	4.70000	0.00000
2	3.3600"-04	3.2260"+00	NM	0.70486	0.22755	0.48400	4.52400	0.10698
3	4.6300"-04	5.1569"+00	NM	0.74779	0.29876	0.59400	3.95300	0.15027
4	5.9000"-04	6.7885"+00	NM	0.78385	0.34737	0.66000	3.61000	0.18283
5	8.4400"-04	8.6120"+00	NM	0.82685	0.39456	0.72000	3.33000	0.21622
6	1.0980"-03	9.5193"+00	NM	0.85048	0.41603	0.74700	3.22400	0.23170
7	1.3520"-03	1.0519"+01	NM	0.86394	0.43846	0.76900	3.07600	0.25000
8	1.9870"-03	1.3065"+01	NM	0.88274	0.49095	0.81000	2.72200	0.29758
9	2.6220"-03	1.5674"+01	NM	0.90059	0.53945	0.84300	2.44200	0.34521
10	3.2570"-03	1.8909"+01	NM	0.92169	0.59412	0.87600	2.17400	0.40294
11	3.8920"-03	2.2254"+01	NM	0.93838	0.64577	0.90200	1.95100	0.46233
12	5.1620"-03	2.9339"+01	NM	0.96821	0.74342	0.94300	1.60900	0.58608
13	6.4320"-03	3.7157"+01	NM	0.99075	0.83805	0.97300	1.34800	0.72181
14	7.7020"-03	4.4080"+01	NM	1.00137	0.91369	0.99000	1.17400	0.84327
15	8.9720"-03	4.8511"+01	NM	1.00555	0.95899	0.99800	1.08300	0.92151
16	1.0240"-02	5.0026"+01	NM	1.00392	0.97400	0.99900	1.05200	0.94962
17	1.1510"-02	5.0594"+01	NM	1.00061	0.97956	0.99800	1.03800	0.96146
18	1.4050"-02	5.1429"+01	NM	0.99875	0.98768	0.99800	1.02100	0.97747
19	1.6590"-02	5.1579"+01	NM	0.99842	0.98914	0.99800	1.01800	0.98035
20	1.9130"-02	5.1882"+01	NM	0.99776	0.99207	0.99800	1.01200	0.98617
21	2.1670"-02	5.2190"+01	NM	0.99910	0.99503	0.99900	1.00800	0.99107
22	2.4210"-02	5.2499"+01	NM	0.99844	0.99800	0.99900	1.00200	0.99701
D 23	2.6750"-02	5.2708"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

For model arrangements see figure 1, on following pages.	M : ZPG, NPG, 2.5 APG, 2.5 to 1.6 FPG, 2.5 to 3.25 R THETA X 10^{-3} : 7 TW/TR : 0.8	**6800** ZPG. APG. FPG. NORMAL PG. MHT

Blow-down wind-tunnel, effectively continuous running. W = 0.234, H = 0.334 m.
PO : 0.1 MN/m^2 TO : 290 K. Air, specific humidity 1-3 X 10^{-4}. RE/m: 14 X 10^6 at M = 2.5

THOMANN H. 1968. Effect of streamwise wall curvature on heat-transfer in a turbulent boundary layer. J. Fluid Mech. 33, 283-292.
And Drougge, G. Private communications.
Also Thomann H. (1967).

1 The test surfaces were two flexible stainless steel sheets, one with pressure taps and the other with thermocouples attached. In all cases these were mounted so that the first 317.5 mm (= L) from the leading edge (X = 0) formed a flat plate on which the test boundary layer was grown under identical conditions.
2 The Mach number in this region was 2.48 with a small high velocity region (M = 2.51) around X = 100 mm. A boundary layer trip of carborundum grains either 0.22 or 0.35 mm in diameter extended 3.5 mm downstream from X = 25 mm. The larger trip was used for all tests except the flat plate case. Heat transfer data indicate that transition took place near X = 100 mm.

1 The supporting structure after X = 317.5 mm could be changed so as to give either a straight continuation of the flat surface, or provide a bend in either direction with radii of curvature of either 150 or 300 mm. The curvature ceased when the deflection was 20^0, with a further straight section downstream. With no further addition this provided for ZPG - flat plate tests and APG, FPG - SW (simple wave) generated expansions and compressions of two strengths. Additionally various ramps could be mounted over the test surfaces. One of these was shaped to give, if mounted above the test surface when arranged as a continuous flat plate, an APG-RW (reflected wave) compression with the same longitudinal pressure history as the more gentle (RZ = 300 mm) simple wave APG case. Other bodies were shaped and mounted as to produce on the curved surfaces incident waves of equal and opposite strength to those produced by the curved surfaces themselves. The results were flows with zero longitudinal pressure gradients but strong normal pressure gradients - the NPG cases. The NPG is negative on a concave surface, which without the body would cause
4 an APG, and vice versa. In all cases the imposed pressure gradient started at X = 317.5 mm. The various
5 arrangements are shown in figure 1. Great care was taken to ensure that the flow was two-dimensional.

6 The stainless steel sheet used for pressure plotting had tappings (d = 0.8 mm) on the centre-line at X = 47.5 mm and thereafter at intervals of 30 mm until X = 317.5 mm. On the rear part of the sheet the tappings were placed at longitudinal and lateral intervals of 10 mm in the locations shown in figure 2 and listed in the table below. The placing of the 0.25 mm iron constantan thermocouples on the heat transfer plate was the same. Heat transfer was measured by a transient technique. The model was covered by a layer of crushed solid Carbon Dioxide, to precool the thin stainless steel sheet. The CO_2 was blown away when the tunnel started and the subsequent time history allowed the heat transfer rate to be determined. The large number of thermocouples on the rear portion (X > 317.5 mm) allowed the longitudinal conduction correction to be determined for those points, 7 in all, surrounded by 4 other thermocouples.

9 Some interpolation or adjustment is implicit in the use of curve fitting to obtain the temperature differentials needed for the heat transfer determination. The author's values have been accepted.
14 The wall data is presented in the tables below. These consist of tabulated wall pressure values and uncorrected Stanton numbers for each of the ten two dimensional configurations tested. Conduction corrections, when applied, were in general less than 5 %. The larger corrections are indicated by arrows in figures 4 to 7 of the source paper.

5 DATA: 6800. No profiles. Heat transfer by the transient technique, wall pressures.

15 Editors' comments

This, the only entry which is not profile-based, and for which there are in fact no profiles, is included because of the complete coverage of the possible types of pressure gradient which is provided. We feel that, in spite of the high quality of this experiment, a repeat on a larger scale, incorporating profile measurements, would be invaluable. The lack of profile information at the start of the pressure gradients may be easily overcome by correlating known flat plate data. The differences in succeeding wall heat transfer provide a very good test for any advanced turbulence calculation method. There is a 30 - 40 % range in the local heat transfer coefficients for different values of the normal pressure gradient, and while some part of this for the concave configurations 06 and 07 may result from longitudinal vortex structures, the differences of up to 20 % for the convex configurations 08 and 09 is unlikely to have any such cause.

The Mach numbers presented are based on the wall pressure measurements, and because of the normal component of the pressure gradients, the Mach number at the boundary layer edge will be significantly different for all cases except configurations 1 and 10.

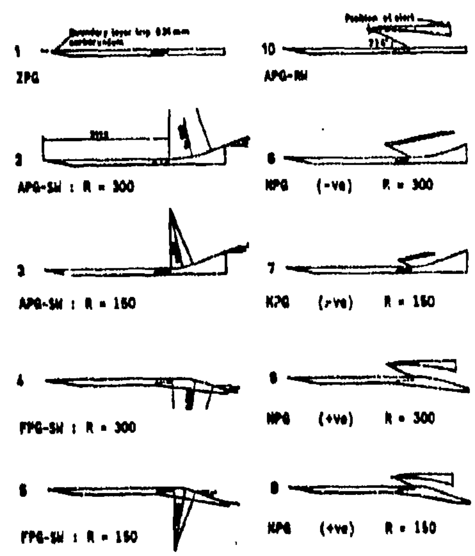


Figure 1 - ARRANGEMENT OF MODELS (FACSIMILE)

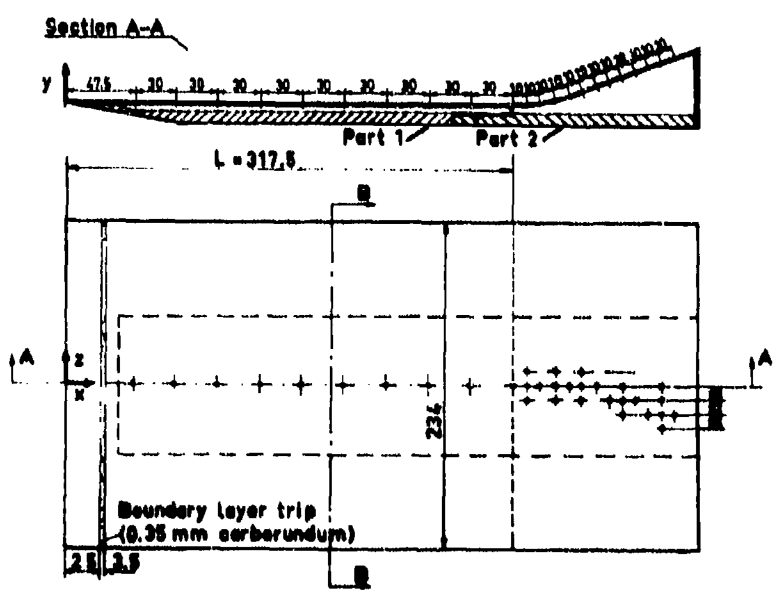


FIGURE 2: LOCATION OF MEASURING STATIONS (FACSIMILE)

The nominal position of each measuring station is given by X-distance from the leading edge, x-distance from the start of the pressure gradient, z-distance from the centre line. All dimensions are in mm, and the actual placing of instrumentation was within 0.1 mm of its nominal position.

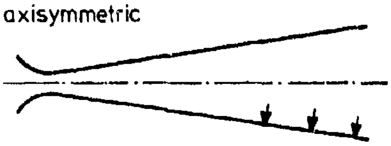
The Stanton numbers given represent the mean of a large number of determinations taken as the model temperature rose. They are normalised to conditions for which T0 = 290 K, TJ = 212.5 K.

Location of measuring station			Configuration 1 ZPG			Configuration 2 APG SW RX = 300			Configuration 3 APG SW RX = 150			Configuration 4 FPG SW RX = 300			Configuration 5 FPG SW RX = 150		
X mm	x mm	z mm	$StX10^3$	p/po	M	$StX10^3$	p/po	M	$St X 10^3$	p/po	M	$StX10^3$	p/po	M	$StX10^3$	p/po	M
47.5	- 270	0	1.28051	0.0598	2.49	3.28328	0.0591	2.49	3.56489	0.0596	2.49	0.44179	0.0600	2.48	-	0.0596	2.49
77.5	- 240	0	2.00516	0.0580	2.51	1.87991	0.0577	2.51	1.95582	0.0584	2.50	1.91033	0.0586	2.50	-	0.0584	2.50
107.5	- 210	0	1.76443	0.0584	2.50	1.73625	0.0573	2.51	1.77047	0.0580	2.51	1.73723	0.0578	2.51	-	0.0576	2.51
137.5	- 180	0	1.71658	0.0598	2.49	1.70850	0.0587	2.50	1.74729	0.0590	2.49	1.70132	0.0588	2.50	-	0.0582	2.50
167.5	- 150	0	1.57595	0.0594	2.49	1.53036	0.0587	2.50	1.54925	0.0590	2.49	1.54843	0.0586	2.50	-	0.0580	2.50
197.5	- 120	0	1.51350	0.0596	2.49	1.44462	0.0591	2.49	1.49733	0.0590	2.49	1.47186	0.0588	2.50	-	0.0586	2.50
227.5	- 90	0	1.43051	0.0603	2.48	1.40718	0.0595	2.49	1.43502	0.0594	2.49	1.42264	0.0598	2.49	-	0.0594	2.49
257.5	- 60	0	1.37567	0.0601	2.48	1.36394	0.0593	2.49	1.39841	0.0590	2.49	1.39985	0.0602	2.48	-	0.0596	2.49
287.5	- 30	0	1.39556	0.0600	2.48	1.35887	0.0605	2.48	1.38066	0.0606	2.48	1.39158	0.0604	2.48	1.48616	0.0602	2.48
317.5	0	0	1.39166	0.0605	2.48	1.36430	0.0664	2.42	1.43841	0.0712	2.37	1.44049	0.0558	2.52	1.38876	0.0535	2.56
327.5	10	0	1.38115	0.0609	2.47	1.35253	0.0710	2.37	1.45067	0.0801	2.30	1.46428	0.0524	2.57	1.38376	0.0460	2.65
327.5	10	10	1.37134	0.0603	2.48	1.36270	0.0702	2.38	1.47193	0.0797	2.30	1.40845	0.0520	2.57	1.34630	0.0458	2.66
327.5	10	- 10	1.36530	0.0611	2.47	1.36258	0.0710	2.37	1.46855	0.0803	2.30	1.48215	0.0524	2.57	1.31365	0.0462	2.66
327.5	20	0	1.33040	0.0609	2.47	1.36361	0.0763	2.33	1.45229	0.0965	2.18	1.41505	0.0485	2.62	1.20676	0.0371	2.80
347.5	30	0	1.28976	-	-	1.37511	0.0837	2.27	1.44195	0.1226	2.01	1.47939	0.0451	2.67	0.97301	0.0290	2.96
347.5	30	- 10	1.31751	0.0611	2.47	1.38342	0.0839	2.27	1.46737	0.1216	2.03	1.36330	0.0451	2.67	1.13582	0.0290	2.96
347.5	30	10	1.30988	0.0611	2.47	1.39108	0.0833	2.27	1.45407	0.1216	2.03	1.30901	0.0445	2.67	1.08955	0.0290	2.96
357.5	40	0	1.3000	0.0609	2.47	1.42403	0.0934	2.20	1.53909	0.1457	1.92	1.34088	0.0401	2.74	1.02755	0.0231	3.11
367.5	50	0	1.29974	0.0607	2.48	1.44556	0.1050	2.13	1.62906	0.1596	1.86	1.35882	0.0345	2.84	0.82899	0.0192	3.24
367.5	50	10	1.30954	0.0605	2.48	1.44466	0.1058	2.12	1.62748	0.1615	1.85	1.33279	0.0343	2.84	0.98040	0.0190	3.24
367.5	50	- 10	1.29532	0.0613	2.47	1.44486	0.1062	2.12	1.63907	0.1600	1.85	1.27841	0.0345	2.84	1.03477	0.0192	3.24
377.5	60	0	1.31400	0.0603	2.48	1.49032	0.1187	2.05	1.68707	0.1724	1.81	1.26095	0.0293	2.95	0.95242	0.0164	3.34
387.5	70	- 10	1.30312	0.0613	2.47	1.51676	0.1349	1.96	1.67458	0.1890	1.75	1.13116	0.0255	3.04	0.99621	0.0149	3.41
397.5	80	0	1.28802	0.0607	2.48	1.57405	0.1498	1.90	1.66661	0.1951	1.72	1.09584	0.0217	3.17	0.91605	0.0139	3.46
397.5	80	- 10	1.27719	0.0607	2.48	1.57325	0.1484	1.90	1.65027	0.1975	1.72	0.93265	0.0221	3.14	0.79991	0.0139	3.46
397.5	80	- 20	1.30711	0.0615	2.47	1.54682	0.1510	1.89	1.64295	0.2003	1.70	1.13845	0.0221	3.14	1.06147	0.0139	3.46
407.5	90	- 10	1.27329	0.0609	2.47	1.58002	0.1652	1.83	1.63668	0.2003	1.70	1.06278	0.0193	3.23	0.86099	0.0160	3.36
417.5	100	- 20	1.28309	0.0617	2.47	1.56793	0.1799	1.78	1.59156	0.1880	1.75	1.10255	0.0183	3.27	0.83968	0.0176	3.29
427.5	110	0	1.25501	0.0623	2.46	1.57685	0.1927	1.73	1.62908	0.2003	1.70	1.18705	0.0163	3.35	0.68973	0.0225	3.13
427.5	110	- 10	1.20326	0.0619	2.46	1.54752	0.1925	1.73	1.58847	0.2003	1.70	0.99820	0.0163	3.35	0.55933	0.0223	3.13
427.5	110	- 20	1.21238	0.0619	2.46	1.45007	0.1918	1.74	1.52346	0.1949	1.72	1.13260	0.0179	3.28	1.03981	0.0223	3.13
427.5	110	- 30	1.25121	0.0621	2.46	1.54435	0.1916	1.74	1.52581	0.1904	1.74	0.95900	0.0173	3.28	0.50468	0.0222	3.13
427.5	110	- 40	1.53155	0.0623	2.46	1.71354			1.62788			1.26004			1.19532		
427.5	110	10	-	0.0621	2.46	-	0.1892	1.75	-	0.2003	1.70	-	0.0167	3.33	-	0.0231	3.11
427.5	110	20	-	0.0633	2.45	-	0.1914	1.74	-	0.1937	1.73	-	0.0155	3.33	-	0.0237	3.09
427.5	110	30	-	0.0629	2.45	-	0.1918	1.74	-	0.1894	1.74	-	0.0167	3.33	-	0.0237	3.09
427.5	110	40	-	0.0623	2.46	-	0.1927	1.73	-	0.1947	1.73	-	0.0165	3.33	-	0.0237	3.09
437.5	120	- 20	1.26720	0.0619	2.46	1.55546	0.1991	1.71	1.58186	0.2003	1.70	1.28173	0.0181	3.27	0.18604	0.1934	1.73

The nominal position of each measuring station is given by X-distance from the leading edge, x-distance from the start of the pressure gradient, z-distance from the centre line. All dimensions are in mm, and the actual placing of instrumentation was within 0.1 mm of its nominal position.

The Stanton numbers given represent the mean of a large number of determinations taken as the model temperature rose. They are normalised to conditions for which T0 = 290 K, TW = 212.5 K.

Location of measuring station			Configuration 6 NPG -ve RX = 300			Configuration 7 NPG -ve RX = 150			Configuration 8 NPG +ve RX = 300			Configuration 9 NPG +ve RX = 150			Configuration 10 APG RW		
X mm	x mm	z mm	$StX10^3$	p/po	M	$StX10^3$	p/po	M	$StX10^3$	p/po	M	$StX10^3$	p/po	M	$StX10^3$	p/po	M
47.5	- 270	0	1.51364	0.0595	2.49	2.91960	0.0594	2.49	0.49306	0.0597	2.49	1.23486	0.0587	2.50	2.55807	0.0589	2.50
77.5	- 240	0	1.96926	0.0581	2.50	1.95175	0.0578	2.51	1.88348	0.0585	2.50	1.99142	0.0573	2.51	1.98614	0.0579	2.51
107.5	- 210	0	1.75473	0.0579	2.50	1.74957	0.0576	2.51	1.70887	0.0575	2.51	1.79312	0.0567	2.52	1.74977	0.0575	2.51
137.5	- 180	0	1.72734	0.0591	2.49	1.72764	0.0586	2.50	1.67757	0.0587	2.50	1.76199	0.0577	2.51	1.73848	0.0585	2.50
167.5	- 150	0	1.54416	0.0589	2.49	1.58836	0.0586	2.50	1.53566	0.0585	2.50	1.61005	0.0575	2.51	1.54758	0.0583	2.50
197.5	- 120	0	1.46863	0.0593	2.49	1.51237	0.0586	2.50	1.47519	0.0589	2.50	1.52650	0.0579	2.51	1.50282	0.0587	2.50
227.5	- 90	0	1.41629	0.0597	2.49	1.45344	0.0590	2.51	1.40816	0.0601	2.48	1.47112	0.0587	2.50	1.44709	0.0595	2.49
257.5	- 60	0	1.38747	0.0595	2.49	1.41949	0.0586	2.50	1.37282	0.0601	2.48	1.40830	0.0593	2.49	1.40577	0.0591	2.49
287.5	- 30	0	1.38544	0.0609	2.47	1.38057	0.0604	2.48	1.37179	0.0603	2.48	1.55177	0.0605	2.48	1.38444	0.0607	2.48
317.5	0	0	1.35880	0.0647	2.44	1.43052	0.0667	2.42	1.38487	0.0577	2.51	1.45738	0.0573	2.51	1.41086	0.0697	2.48
327.5	10	0	1.31156	0.0575	2.51	1.38086	0.0562	2.52	1.36517	0.0525	2.57	1.36682	0.0486	2.62	1.37853	0.0573	2.51
327.5	10	10	1.35643	0.0567	2.52	1.45011	0.0560	2.53	1.36639	0.0523	2.57	1.41799	0.0490	2.61	1.43096	0.0567	2.52
327.5	10	- 10	1.37266	0.0575	2.51	1.46410	0.0562	2.52	1.37955	0.0523	2.57	1.41145	0.0492	2.61	1.41745	0.0575	2.51
327.5	20	0	1.36237	0.0546	2.54	1.36580	0.0588	2.50	1.35045	0.0513	1.58	1.30053	0.0505	2.60	1.40813	0.0625	2.46
347.5	30	0	1.42363	0.0538	2.55	1.42723	0.0533	2.56	1.35898	0.0541	2.55	1.25722	0.0531	2.56	1.36306	0.0744	2.35
347.5	30	- 10	1.41745	0.0540	2.55	1.40141	0.0551	2.54	1.31769	0.0537	2.56	1.27124	0.0553	2.56	1.35861	0.0756	2.34
347.5	30	10	1.36524	0.0536	2.55	1.40956	0.0541	2.55	1.29482	0.0527	2.57	1.24492	0.0531	2.56	1.34764	0.0760	2.33
357.5	40	0	1.41615	0.0536	2.56	1.41411	0.0537	2.56	1.30373	0.0555	2.53	1.23244	0.0533	2.56	1.31449	0.0866	2.25
367.5	50	0	1.43610	0.0546	2.55	1.48472	0.0503	2.60	1.34560	0.0539	2.56	1.17595	0.0557	2.53	1.33039	0.0948	2.19
367.5	50	10	1.42795	0.0546	2.55	1.48028	0.0513	2.59	1.30617	0.0543	2.55	1.19860	0.0549	2.54	1.33145	0.0954	2.19
367.5	50	- 10	1.44824	0.0548	2.55	1.48719	0.0497	2.61	1.28337	0.0541	2.55	1.19976	0.0557	2.53	1.33953	0.0950	2.19
377.5	60	0	1.42134	0.0573	2.51	1.60907	0.0476	2.63	1.27626	0.0525	2.57	1.17597	0.0579	2.52	1.33635	0.1059	2.12
387.5	70	- 10	1.48656	0.0556	2.52	1.93023	0.0564	2.52	1.18993	0.0535	2.56	1.14720	0.0619	2.47	1.33068	0.1261	2.01
397.5	80	0	1.46188	0.0573	2.51	1.57025	0.1196	2.04	1.13210	0.0555	2.53	1.12711	0.0561	2.53	1.34520	0.1400	1.94
397.5	80	- 10	1.48159	0.0571	2.51	1.6235[illegible]	0.1181	2.05	1.01685	0.0557	2.53	1.10660	0.0561	2.53	1.33076	0.1394	1.94
397.5	80	- 20	1.50144	0.0579	2.51	1.54022	0.1210	2.04	1.12578	0.0571	2.51	1.21923	0.0573	2.51	1.33317	0.1412	1.94
407.5	90	- 10	1.45267	0.0573	2.51	1.57329	0.1521	1.89	1.11362	0.0577	2.51	1.15585	0.0541	2.55	1.32193	0.1560	1.87
417.5	100	- 20	1.50014	0.0567	2.52	1.46403	0.1740	1.80	1.09024	0.0615	2.47	1.23214	0.0533	2.56	1.33217	0.1891	1.74
427.5	110	0	1.50031	0.0567	2.52	1.44818	0.1872	1.75	1.05568	0.0609	2.48	1.20676	0.0543	2.55	1.37007	0.1967	1.72
427.5	110	- 10	1.38757	0.0563	2.52	1.40190	0.1862	1.76	1.03323	0.0603	2.48	1.18767	0.0543	2.55	1.31420	0.1967	1.72
427.5	110	- 20	1.77479	0.0565	2.52	1.40393	0.1895	1.74	1.10038	0.0597	2.49	1.21949	0.0545	2.55	1.30890	0.1967	1.72
427.5	110	- 30	1.43805	0.0567	2.52	1.19492	0.1895	1.74	1.04596	0.0585	2.50	1.23647	0.0553	2.54	1.30933	0.1967	1.72
427.5	110	- 40	1.75001			1.65838			1.17167			1.49688			1.43090		
427.5	110	10	-	0.0561	2.53	-	0.1872	1.75	-	0.0607	2.48	-	0.0569	2.52	-	0.1963	1.72
427.5	110	20	-	0.0567	2.53	-	0.1901	1.74	-	0.0593	2.49	-	0.0705	2.38	-	0.1963	1.72
427.5	110	30	-	0.0571	2.53	-	0.1911	1.74	-	0.0575	2.51	-	0.0962	2.18	-	0.1967	1.72
427.5	110	40	-	0.0565	2.53	-	0.1886	1.75	-	0.0571	2.51	-	0.0876	2.24	-	0.1967	1.72
437.5	120	- 20	1.74096	0.0579	2.51	1.40623	0.1988	1.71	1.10879	0.0597	2.49	1.26375	0.0587	2.50	1.30649	0.1779	1.79

axisymmetric 	M : 8 to 9 and 10 to 11.6 R THETA X 10^{-3} : 4 - 30 TW/TR : 0.3 - 0.4	6801 FPG - SHT
Axisymmetric gun-tunnel. Running time 10 - 20 ms. D = 0.1 m PO : 12 - 32 MN/m^2. TO : 823 - 1120 K. Nitrogen. RE/m X 10^{-6} : 9 - 47.		
PERRY J.H. and EAST R.A. 1968. Experimental measurements of cold wall turbulent hypersonic boundary layers. AGARD CP no 30. And Perry J.H., PhD Thesis, University of Southampton 1968, East R.A., private communications.		

1 The test boundary layer was formed on the wall of a 7.5° included angle conical nozzle. Two different throat blocks were used, the throat (X = 0) diameters being 4.80 and 2.44 mm. Measurements were made at three instrumentation ports in the downstream half of the nozzle. The diameter at the middle port was
3 87.7 mm. The test surface was finished to within 1.3 µm, and was not actively cooled. The throat Reynolds numbers were in the range 9.7 - 27 X 10^6 and "should have been sufficiently high to ensure transition of the boundary layer at the throat".

6 Wall static pressure was measured with piezo-electric (Kistler 7013) transducers mounted in cavities immediately behind the static tappings (d = 0.4 mm) while it was assumed that, during the very short run, the wall temperature did not vary significantly from room temperature, approximately 290 K, except perhaps at the throat. The wall heat transfer rate was measured using platinum thin-film gauges mounted flush with the surface on a Pyrex substrate.

7 Pitot profiles were measured by a rapidly traversed FPP (h_1 = 1.12, h_2 = 0.56, b_1 = 1.78, b_2 = 1.22, l = 51 mm) the observed pressures being compared to values obtained with an identical fixed FPP. Agreement outside the inner 15 % of the boundary layer was good, but only values from the fixed probe were used in the inner region. For some of the low Mach number runs a fixed FPP with h_1 = 0.56 mm was used. Total temperature profiles were measured with a special STP (East and Perry 1967). This had a heating circuit built into the outer shield so that the probe could be pre-heated to temperatures near those expected in the run. The procedure used required two readings, with the probe body temperature slightly above and below that recorded by the thermo-couple bead. For the front face d_1 = 1.78, d_2 = 0.79 mm, while a conical fairing ran back to the main probe body for which d_1 = 2.79 mm.

8 The three measuring stations were at 101.6 mm axial intervals, the first at X = 549 mm with the large throat and at 565 mm with the small throat. The design of the probes was such that TO profiles were taken 17.8 mm downstream of the equivalent PT2 profiles, with additional values 33 mm upstream of the last station. The
9 authors have interpolated the TO data to the X and Y stations of the PT2 data. The data presented is calculated from curves faired through the original data points of the Mach number and TO profiles. The
12 editors have accepted this. In association with the profiles the editors have quoted the Stanton number and the CF value as obtained from the velocity gradient at the wall by the authors. Static pressure was assumed
10 constant through the boundary layer and no corrections were applied to the profile data.

13 The profiles presented consist of four sets of three obtained at Mach numbers near 9 with the large throat and four sets of three and one individual profile at Mach numbers near 10.5 with the small throat. The wall
14 data consists of the measured heat flux and CF deduced from the wall velocity gradient.

§ DATA: 6801 0101-0903. Pitot and TO profiles obtained piecemeal separately in a great number of runs. NX = 3. Heat transfer measurements.

15 Editors' comments

It is probably impossible at present to interpret these measurements in terms of correlations drawn directly from flat plate experience. Despite the apparently high Reynolds numbers, the majority of the profiles display marked transitional characteristics in both the inner and outer regions. There are no available direct comparisons, the geometrically similar study by Hill - CAT 5901 being made at much lower Reynolds number. The profiles form a self-consistent set differing markedly from both ZPG results and FPG results measured in contoured nozzles.

The profiles are presented in fine detail, which is notable in view of the great amount of work required (each TO measurement required two runs) and the difficulty of normalising the data in a facility of this type, for which free stream conditions are never entirely repeatable. The TTP was larger than the TPP so that some TO data near the wall are interpolated.

The layer is growing on a straight (conical) wall so that the assumption of zero normal pressure gradient is reasonable (Hill reports no detectable difference across the layer in CAT 5901).

CAT 6801 PERRY BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ *	H32	H32K	TW*	TD
RZ *	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
68010101	8.0000	0.3900	3.2655"+03	5.2300"-04	8.8645	1.4765	1.3771"+03	1.3771"+03
5.4864"-01	1.3445"+07	1.0000	1.3558"+04	2.1791"-04	1.8235	1.7858	2.9000"+02	5.9638"+01
-3.6820"-02	8.2300"+02	0.0000	5.8050"-04	NM	1.3029	1.2233"-03	1.2587"+03	7.4361"+02
68010102	8.5000	0.3903	2.6483"+03	5.4600"-04	10.8667	1.4945	8.9894"+02	8.9894"+02
6.5024"-01	1.3031"+07	1.0000	1.2309"+04	2.9653"-04	1.8210	1.7816	2.9000"+02	5.3269"+01
-4.3830"-02	8.2300"+02	0.0000	6.4150"-04	NM	1.2629	1.4846"-03	1.2640"+03	7.4295"+02
68010103	8.8700	0.3906	2.9693"+03	5.9400"-04	9.7352	1.4905	6.6162"+02	6.6162"+02
7.5184"-01	1.2686"+07	1.0000	1.4949"+04	3.7092"-04	1.8217	1.7824	2.9000"+02	4.9177"+01
-5.0810"-02	8.2300"+02	0.0000	8.9981"-04	NM	1.3657	2.0364"-03	1.2673"+03	7.4252"+02
68010201	8.0300	0.3504	3.1118"+03	5.4800"-04	7.8731	1.5142	1.2958"+03	1.2958"+03
5.4864"-01	1.2962"+07	1.0000	1.1694"+04	2.1804"-04	1.8161	1.7743	2.9000"+02	6.5917"+01
-3.6820"-02	9.1600"+02	0.0000	6.1575"-04	NM	1.3582	1.2305"-03	1.3283"+03	8.2759"+02
68010202	8.6100	0.3508	2.6141"+03	5.7900"-04	9.2609	1.5167	8.2631"+02	8.2631"+02
6.5024"-01	1.3031"+07	1.0000	1.1183"+04	2.9861"-04	1.8130	1.7733	2.9000"+02	5.7878"+01
-4.3830"-02	9.1600"+02	0.0000	7.0889"-04	NM	1.3490	1.5356"-03	1.3346"+03	8.2676"+02
68010203	8.7000	0.3508	3.2876"+03	5.3900"-04	9.1655	1.5085	7.6772"+02	7.6772"+02
7.5184"-01	1.2962"+07	1.0000	1.4341"+04	3.1494"-04	1.8066	1.7745	2.9000"+02	5.6760"+01
-5.0810"-02	9.1600"+02	0.0000	9.4044"-04	NM	1.3586	2.0220"-03	1.3354"+03	8.2664"+02
68010301	8.0500	0.3452	7.0854"+03	2.7500"-04	6.1211	1.4588	2.8756"+03	2.8756"+03
5.4864"-01	2.9234"+07	1.0000	2.6350"+04	9.7150"-05	1.8421	1.7942	2.9000"+02	6.6617"+01
-3.6820"-02	9.3000"+02	0.0000	6.3355"-04	NM	1.4684	1.1300"-03	1.3386"+03	8.4021"+02
68010302	8.5000	0.3454	6.5750"+03	3.2000"-04	8.3153	1.4524	2.1070"+03	2.1070"+03
6.5024"-01	3.0544"+07	1.0000	2.7047"+04	1.1932"-04	1.8238	1.7908	2.9000"+02	6.0194"+01
-4.3830"-02	9.3000"+02	0.0000	7.2232"-04	NM	1.3793	1.4550"-03	1.3436"+03	8.3954"+02
68010303	9.0500	0.3457	6.7155"+03	2.9600"-04	8.2852	1.4891	1.4175"+03	1.4175"+03
7.5184"-01	3.1026"+07	1.0000	3.1073"+04	1.5682"-04	1.8173	1.7806	2.9000"+02	5.3508"+01
-5.0810"-02	9.3000"+02	0.0000	9.7113"-04	NM	1.4355	2.0068"-03	1.3488"+03	8.3884"+02

CAT 6801 PERRY BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	PED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ *	H32	H32K	TW*	TD
RZ *	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
68010401	8.0600	0.3178	7.3012"+03	2.8000"-04	5.6353	1.4472	2.8323"+03	2.8323"+03
5.4864"-01	2.9027"+07	1.0000	2.5081"+04	9.4267"-05	1.8376	1.8009	2.9000"+02	7.2180"+01
-3.6820"-02	1.0100"+03	0.0000	6.8909"-04	NM	1.4852	1.1530"-03	1.3952"+03	9.1247"+02
68010402	8.5000	0.3181	6.8165"+03	2.9400"-04	7.3676	1.4555	2.0928"+03	2.0928"+03
6.5024"-01	3.0337"+07	1.0000	2.5829"+04	1.1502"-04	1.8250	1.7927	2.9000"+02	6.5372"+01
-4.3830"-02	1.0100"+03	0.0000	7.8572"-04	NM	1.4249	1.4808"-03	1.4002"+03	9.1176"+02
68010403	9.0000	0.3183	6.7473"+03	2.9200"-04	8.0184	1.4959	1.4539"+03	1.4539"+03
7.5184"-01	3.0682"+07	1.0000	2.8451"+04	1.4822"-04	1.8130	1.7773	2.9000"+02	5.8721"+01
-5.0810"-02	1.0100"+03	0.0000	1.0021"-03	NM	1.4411	2.0531"-03	1.4051"+03	9.1107"+02
68010501	9.9500	0.3537	1.1878"+03	5.7700"-04	14.8158	1.6158	3.3092"+02	3.3092"+02
5.6388"-01	1.3583"+07	1.0000	6.7200"+03	5.6637"-04	1.8365	1.7780	2.9000"+02	4.3749"+01
-3.6820"-02	9.1000"+02	0.0000	6.0511"-04	NM	1.3195	1.6906"-03	1.3409"+03	8.1991"+02
68010502	10.6000	0.3539	8.8535"+02	5.9700"-04	17.7132	1.6403	2.1900"+02	2.1900"+02
6.6548"-01	1.3721"+07	1.0000	5.6457"+03	7.5385"-04	1.8364	1.7726	2.9000"+02	3.8770"+01
-4.3830"-02	9.1000"+02	0.0000	6.0222"-04	NM	1.2962	1.8902"-03	1.3447"+03	8.1939"+02
68010503	11.2700	0.3541	7.5485"+02	5.9700"-04	18.3505	1.6612	1.4435"+02	1.4435"+02
7.6708"-01	1.3652"+07	1.0000	5.4009"+03	1.0143"-03	1.8434	1.7755	2.9000"+02	3.4466"+01
-5.0810"-02	9.1000"+02	0.0000	6.9081"-04	NM	1.3480	2.1934"-03	1.3480"+03	8.1894"+02
68010601	9.9000	0.3155	1.0679"+03	5.6300"-04	14.6900	1.6227	3.1790"+02	3.1790"+02
5.6388"-01	1.2617"+07	1.0000	5.3401"+03	5.6292"-04	1.8378	1.7793	2.9000"+02	4.9510"+01
-3.6820"-02	1.0200"+03	0.0000	6.0547"-04	NM	1.3184	1.6659"-03	1.4192"+03	9.1907"+02
68010602	10.4800	0.3157	8.8818"+02	6.2100"-04	16.7123	1.6178	2.2567"+02	2.2567"+02
6.6548"-01	1.3100"+07	1.0000	4.9500"+03	7.0768"-04	1.8383	1.7773	2.9000"+02	4.4413"+01
-4.3830"-02	1.0200"+03	0.0000	6.3472"-04	NM	1.3107	1.8963"-03	1.4230"+03	9.1854"+02
68010603	11.2000	0.3159	7.3121"+02	5.8700"-04	18.6365	1.6640	1.4445"+02	1.4445"+02
7.6708"-01	1.3100"+07	1.0000	4.6241"+03	9.7037"-04	1.8438	1.7775	2.9000"+02	3.9098"+01
-5.0810"-02	1.0200"+03	0.0000	7.1668"-04	NM	1.3334	2.2300"-03	1.4268"+03	9.1799"+02
68010701	11.4300	0.3223	1.1853"+03	5.4600"-04	15.5523	1.6149	2.0818"+02	2.0818"+02
7.6708"-01	2.1650"+07	1.0000	7.9429"+03	6.5313"-04	1.8360	1.7714	2.9000"+02	3.6861"+01
-5.0810"-02	1.0000"+03	0.0000	7.6699"-04	NM	1.4222	2.2597"-03	1.4139"+03	8.9983"+02
68010801	10.2500	0.3157	2.2164"+03	4.3800"-04	12.9600	1.5176	5.9795"+02	5.9795"+02
5.6388"-01	2.9923"+07	1.0000	1.1841"+04	2.7878"-04	1.8414	1.7965	2.9000"+02	4.6337"+01
-3.6820"-02	1.0200"+03	0.0000	6.2427"-04	NM	1.3908	1.5746"-03	1.4216"+03	9.1874"+02
68010802	10.8700	0.3158	1.7622"+03	5.9500"-04	15.7326	1.5190	4.1926"+02	4.1926"+02
6.6548"-01	3.1095"+07	1.0000	1.0529"+04	3.5384"-04	1.8346	1.7823	2.9000"+02	4.1411"+01
-4.3830"-02	1.0200"+03	0.0000	6.3104"-04	NM	1.3597	1.8597"-03	1.4252"+03	9.1823"+02
68010803	11.5000	0.3160	1.9563"+03	5.5300"-04	12.7106	1.5399	2.9267"+02	2.9267"+02
7.6708"-01	3.1716"+07	1.0000	1.3007"+04	4.5451"-04	1.8355	1.7833	2.9000"+02	3.7158"+01
-5.0810"-02	1.0200"+03	0.0000	8.9856"-04	NM	1.4916	2.3769"-03	1.4282"+03	9.1778"+02
68010901	10.2000	0.2875	2.3088"+03	4.2400"-04	12.0183	1.5461	6.1069"+02	6.1069"+02
5.6388"-01	2.9578"+07	1.0000	1.1130"+04	2.6396"-04	1.8290	1.7891	2.9000"+02	5.1357"+01
-3.6820"-02	1.1200"+03	0.0000	6.7362"-04	NM	1.4097	1.6344"-03	1.4893"+03	1.0089"+03
68010902	10.6500	0.2876	2.1376"+03	5.4900"-04	12.9819	1.5337	4.7452"+02	4.7452"+02
6.6548"-01	3.0682"+07	1.0000	1.1191"+04	3.1116"-04	1.8259	1.7794	2.9000"+02	4.7288"+01
-4.3830"-02	1.1200"+03	0.0000	7.3765"-04	NM	1.4151	1.9409"-03	1.4921"+03	1.0084"+03
68010903	11.6000	0.2878	1.9350"+03	5.4100"-04	11.5067	1.5537	2.7006"+02	2.7006"+02
7.6708"-01	3.1026"+07	1.0000	1.1927"+04	4.6270"-04	1.8330	1.7817	2.9000"+02	4.0126"+01
-5.0810"-02	1.1200"+03	0.0000	9.9224"-04	NM	1.5259	2.4718"-03	1.4971"+03	1.0077"+03

CF AUTHOR (DU/DY)W

68010301 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 51

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.31183	0.00000	0.00000	4.35330	0.00000
2	2.7940"-04	3.8463"+00	NM	0.46237	0.20002	0.41240	4.25100	0.09701
3	5.5880"-04	7.6522"+00	NM	0.53548	0.29316	0.55130	3.53640	0.15589
4	8.3820"-04	1.1006"+01	NM	0.58601	0.35528	0.62590	3.10370	0.20166
5	1.1176"-03	1.3903"+01	NM	0.62684	0.40122	0.67560	2.83540	0.23827
6	1.3970"-03	1.6334"+01	NM	0.64738	0.43605	0.70430	2.60880	0.26997
7	1.6764"-03	1.8383"+01	NM	0.66883	0.46337	0.72800	2.46840	0.29493
8	1.9558"-03	2.0866"+01	NM	0.68500	0.49444	0.74890	2.29410	0.32645
9	2.2352"-03	2.3286"+01	NM	0.70535	0.52297	0.76980	2.16670	0.35529
10	2.5146"-03	2.5617"+01	NM	0.72145	0.54904	0.78660	2.05260	0.38322
11	2.7940"-03	2.8184"+01	NM	0.73435	0.57637	0.80120	1.93230	0.41464
12	3.0734"-03	2.9763"+01	NM	0.74735	0.59257	0.81240	1.87960	0.43222
13	3.3528"-03	3.2139"+01	NM	0.75588	0.61613	0.82260	1.78250	0.46149
14	3.6322"-03	3.4220"+01	NM	0.76778	0.63605	0.83340	1.71680	0.48544
15	3.9116"-03	3.7043"+01	NM	0.78065	0.66212	0.84560	1.63100	0.51845
16	4.1910"-03	3.8988"+01	NM	0.78708	0.67950	0.85230	1.57330	0.54173
17	4.4704"-03	4.1132"+01	NM	0.79679	0.69816	0.86080	1.52020	0.56624
18	4.7498"-03	4.3336"+01	NM	0.80653	0.71682	0.86910	1.47000	0.59122
19	5.0292"-03	4.6044"+01	NM	0.81396	0.73912	0.87650	1.40630	0.62327
20	5.3086"-03	4.8374"+01	NM	0.82259	0.75777	0.88380	1.36030	0.64971
21	5.5880"-03	5.0918"+01	NM	0.82900	0.77763	0.88990	1.30960	0.67952
22	5.8674"-03	5.2704"+01	NM	0.83865	0.79128	0.89680	1.28450	0.69817
23	6.1468"-03	5.5194"+01	NM	0.84511	0.80991	0.90250	1.24170	0.72683
24	6.4262"-03	5.7570"+01	NM	0.85376	0.82731	0.90910	1.20750	0.75288
25	6.7056"-03	5.9473"+01	NM	0.86017	0.84098	0.91400	1.18120	0.77379
26	6.9850"-03	6.6022"+01	NM	0.91577	0.88642	0.94930	1.14690	0.82771
27	7.2644"-03	6.3918"+01	NM	0.87209	0.87208	0.92350	1.12140	0.82352
28	7.5438"-03	6.5914"+01	NM	0.88060	0.88569	0.92930	1.10090	0.84413
29	7.8232"-03	6.8321"+01	NM	0.88594	0.90183	0.93360	1.07170	0.87114
30	8.1026"-03	6.9263"+01	NM	0.89249	0.90807	0.93760	1.06610	0.87947
31	8.3820"-03	7.0784"+01	NM	0.89788	0.91805	0.94130	1.05130	0.89537
32	8.6614"-03	7.2316"+01	NM	0.90544	0.92800	0.94610	1.03940	0.91024
33	8.9408"-03	7.4054"+01	NM	0.91076	0.93915	0.94980	1.02280	0.92863
34	9.2202"-03	7.6000"+01	NM	0.91713	0.95149	0.95410	1.00550	0.94888
35	9.4996"-03	7.6796"+01	NM	0.92465	0.95649	0.95840	1.00400	0.95458
36	9.7790"-03	7.7995"+01	NM	0.93010	0.96397	0.96180	0.99550	0.96615
37	1.0058"-02	7.9392"+01	NM	0.93542	0.97262	0.96520	0.98480	0.98010
38	1.0338"-02	8.0216"+01	NM	0.94090	0.97768	0.96840	0.98110	0.98706
39	1.0617"-02	8.1230"+01	NM	0.94624	0.98388	0.97160	0.97520	0.99631
40	1.0897"-02	8.2039"+01	NM	0.95159	0.98879	0.97470	0.97170	1.00309
41	1.1176"-02	8.2653"+01	NM	0.95478	0.99251	0.97660	0.96820	1.00868
42	1.1455"-02	8.3082"+01	NM	0.96030	0.99509	0.97960	0.96910	1.01083
43	1.1735"-02	8.3698"+01	NM	0.96783	0.99680	0.98370	0.97000	1.01412
44	1.2014"-02	8.3900"+01	NM	0.97101	1.00001	0.98540	0.97100	1.01483
45	1.2294"-02	8.3903"+01	NM	0.97535	1.00003	0.98760	0.97530	1.01261
46	1.2573"-02	8.3907"+01	NM	0.98069	1.00005	0.99030	0.98060	1.00989
47	1.2852"-02	8.3896"+01	NM	0.98387	0.99998	0.99190	0.98390	1.00813
48	1.3132"-02	8.3894"+01	NM	0.98705	0.99997	0.99350	0.98710	1.00648
49	1.3411"-02	8.3908"+01	NM	0.99360	1.00006	0.99680	0.99350	1.00332
50	1.3691"-02	8.3907"+01	NM	0.99899	1.00005	0.99950	0.99890	1.00060
D 51	1.3970"-02	8.3899"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

68010401 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 50

I	Y	PT2/P	P/PO	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.28770	0.00000	0.00000	4.02575	0.00000
2	2.7940"-04	3.8874"+00	NM	0.42167	0.20102	0.39540	3.86904	0.10219
3	5.5880"-04	1.1830"+01	NM	0.49109	0.36848	0.58098	2.48597	0.23370
4	8.3820"-04	1.4662"+01	NM	0.55952	0.41190	0.64384	2.44329	0.26352
5	1.1176"-03	1.7809"+01	NM	0.60513	0.45531	0.68937	2.29248	0.30072
6	1.3970"-03	2.0251"+01	NM	0.63590	0.48634	0.71882	2.18457	0.32904
7	1.6764"-03	2.1692"+01	NM	0.66276	0.50374	0.74004	2.15822	0.34289
8	1.9558"-03	2.4052"+01	NM	0.68354	0.53101	0.76046	2.05090	0.37079
9	2.2352"-03	2.5846"+01	NM	0.69839	0.55085	0.77457	1.97725	0.39174
10	2.5146"-03	2.7945"+01	NM	0.71126	0.57317	0.78779	1.88908	0.41702
11	2.7940"-03	3.0010"+01	NM	0.72429	0.59433	0.80030	1.81323	0.44137
12	3.0734"-03	3.1762"+01	NM	0.73618	0.61170	0.81091	1.75741	0.46142
13	3.3528"-03	3.3563"+01	NM	0.74709	0.62906	0.82072	1.70220	0.48215
14	3.6322"-03	3.5141"+01	NM	0.76086	0.64388	0.83133	1.66703	0.49869
15	3.9116"-03	3.7455"+01	NM	0.77184	0.66501	0.84143	1.60100	0.52557
16	4.1910"-03	3.9412"+01	NM	0.77780	0.68230	0.84785	1.54379	0.54920
17	4.4704"-03	4.1562"+01	NM	0.78668	0.70096	0.85586	1.49078	0.57410
18	4.7498"-03	4.3035"+01	NM	0.79568	0.71341	0.86276	1.46253	0.58991
19	5.0292"-03	4.5293"+01	NM	0.80275	0.73209	0.86947	1.41052	0.61642
20	5.3086"-03	4.7435"+01	NM	0.81052	0.74938	0.87618	1.36703	0.64093
21	5.5880"-03	4.9160"+01	NM	0.81946	0.76301	0.88288	1.33888	0.65942
22	5.8674"-03	5.1246"+01	NM	0.82946	0.77918	0.89039	1.30581	0.68187
23	6.1468"-03	5.3198"+01	NM	0.83532	0.79402	0.89540	1.27164	0.70412
24	6.4262"-03	5.5369"+01	NM	0.84236	0.81020	0.90110	1.23697	0.72847
25	6.7056"-03	5.7579"+01	NM	0.85128	0.82635	0.90771	1.20661	0.75228
26	6.9850"-03	5.9123"+01	NM	0.86010	0.83744	0.91361	1.19018	0.76763
27	7.2644"-03	6.0705"+01	NM	0.86615	0.84866	0.91802	1.17014	0.78454
28	7.5438"-03	6.3012"+01	NM	0.87402	0.86475	0.92382	1.14128	0.80946
29	7.8232"-03	6.4821"+01	NM	0.87797	0.87718	0.92713	1.11713	0.82992
30	8.1026"-03	6.6290"+01	NM	0.88397	0.88713	0.93123	1.10190	0.84511
31	8.3820"-03	6.8325"+01	NM	0.89282	0.90073	0.93714	1.08246	0.86574
32	8.6614"-03	6.9836"+01	NM	0.90087	0.91071	0.94224	1.07044	0.88024
33	8.9408"-03	7.1158"+01	NM	0.90576	0.91934	0.94555	1.05782	0.89387
34	9.2202"-03	7.2898"+01	NM	0.91181	0.93059	0.94965	1.04138	0.91191
35	9.4996"-03	7.4447"+01	NM	0.91871	0.94049	0.95405	1.02906	0.92711
36	9.7790"-03	7.5620"+01	NM	0.92567	0.94791	0.95826	1.02194	0.93768
37	1.0058"-02	7.7192"+01	NM	0.93249	0.95778	0.96256	1.01002	0.95301
38	1.0338"-02	7.8199"+01	NM	0.93855	0.96404	0.96617	1.00441	0.96193
39	1.0617"-02	7.9402"+01	NM	0.94446	0.97147	0.96977	0.99649	0.97318
40	1.0897"-02	8.0413"+01	NM	0.94843	0.97768	0.97227	0.98898	0.98311
41	1.1176"-02	8.1433"+01	NM	0.95438	0.98389	0.97578	0.98357	0.99208
42	1.1455"-02	8.2249"+01	NM	0.95937	0.98884	0.97868	0.97956	0.99910
43	1.1735"-02	8.2869"+01	NM	0.96729	0.99258	0.98298	0.98076	1.00227
44	1.2014"-02	8.3492"+01	NM	0.97328	0.99632	0.98629	0.97996	1.00646
45	1.2294"-02	8.3906"+01	NM	0.97728	0.99880	0.98849	0.97946	1.00922
46	1.2573"-02	8.4098"+01	NM	0.98207	0.99995	0.99099	0.98216	1.00899
47	1.2852"-02	8.4094"+01	NM	0.98604	0.99993	0.99299	0.98617	1.00692
48	1.3132"-02	8.4101"+01	NM	0.99002	0.99997	0.99499	0.99008	1.00496
49	1.3411"-02	8.4099"+01	NM	0.99501	0.99996	0.99750	0.99509	1.00242
D 50	1.3691"-02	8.4106"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	1.3970"-02	8.4106"+01	NM	1.00200	1.00000	1.00100	1.00200	0.99900

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PO

68010501 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 49

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.31868	0.00000	0.00000	6.62870	0.00000
2	4.5720"-04	1.8281"+00	NM	0.40987	0.09747	0.26110	7.17560	0.03639
3	9.1440"-04	4.5322"+00	NM	0.49227	0.17787	0.44630	6.29560	0.07089
4	1.3716"-03	9.5856"+00	NM	0.56479	0.26732	0.58960	4.86470	0.12120
5	1.8288"-03	1.1678"+01	NM	0.62415	0.29647	0.64530	4.73750	0.13621
6	2.2860"-03	1.3737"+01	NM	0.66479	0.32260	0.68570	4.51800	0.15177
7	2.7432"-03	1.6064"+01	NM	0.69894	0.34977	0.72090	4.24810	0.16970
8	3.2004"-03	1.7810"+01	NM	0.71866	0.36883	0.74200	4.04710	0.18334
9	3.6576"-03	1.9753"+01	NM	0.74072	0.38897	0.76380	3.85600	0.19808
10	4.1148"-03	2.2008"+01	NM	0.75610	0.41108	0.78200	3.61880	0.21609
11	4.5720"-03	2.4493"+01	NM	0.76919	0.43415	0.79830	3.38100	0.23611
12	5.0292"-03	2.6890"+01	NM	0.78248	0.45530	0.81300	3.18850	0.25498
13	5.4864"-03	2.9269"+01	NM	0.79444	0.47535	0.82590	3.01870	0.27359
14	5.9436"-03	3.2012"+01	NM	0.80547	0.49748	0.83830	2.83950	0.29523
15	6.4008"-03	3.4219"+01	NM	0.81432	0.51459	0.84760	2.71310	0.31241
16	6.8580"-03	3.7317"+01	NM	0.82089	0.53769	0.85680	2.53920	0.33743
17	7.3152"-03	3.9976"+01	NM	0.82849	0.55675	0.86510	2.41440	0.35831
18	7.7724"-03	4.2735"+01	NM	0.83292	0.57586	0.87140	2.28980	0.38056
19	8.2296"-03	4.5743"+01	NM	0.84179	0.59600	0.87990	2.17960	0.40370
20	8.6868"-03	4.8843"+01	NM	0.84612	0.61607	0.88570	2.06690	0.42852
21	9.1440"-03	5.2223"+01	NM	0.85391	0.63722	0.89320	1.96480	0.45460
22	9.6012"-03	5.5528"+01	NM	0.85929	0.65726	0.89900	1.87090	0.48052
23	1.0058"-02	5.8775"+01	NM	0.86477	0.67636	0.90450	1.78840	0.50576
24	1.0516"-02	6.2842"+01	NM	0.87041	0.69954	0.91040	1.69370	0.53752
25	1.0973"-02	6.6277"+01	NM	0.87685	0.71855	0.91600	1.62510	0.56366
26	1.1430"-02	7.0023"+01	NM	0.88468	0.73872	0.92230	1.55880	0.59167
27	1.1887"-02	7.3856"+01	NM	0.88900	0.75879	0.92660	1.49120	0.62138
28	1.2344"-02	7.7200"+01	NM	0.89450	0.77589	0.93110	1.44010	0.64655
29	1.2802"-02	8.1440"+01	NM	0.90009	0.79704	0.93590	1.37880	0.67878
30	1.3259"-02	8.5572"+01	NM	0.90667	0.81712	0.94100	1.32620	0.70955
31	1.3716"-02	8.8529"+01	NM	0.91436	0.83119	0.94610	1.29560	0.73024
32	1.4173"-02	9.2614"+01	NM	0.91758	0.85025	0.94920	1.24630	0.76161
33	1.4630"-02	9.6358"+01	NM	0.92530	0.86735	0.95440	1.21080	0.78824
34	1.5088"-02	9.9495"+01	NM	0.93082	0.88142	0.95820	1.18180	0.81080
35	1.5545"-02	1.0314"+02	NM	0.93405	0.89749	0.96090	1.14630	0.83826
36	1.6002"-02	1.0638"+02	NM	0.93956	0.91154	0.96460	1.11980	0.86140
37	1.6459"-02	1.0967"+02	NM	0.94612	0.92561	0.96880	1.09550	0.88435
38	1.6916"-02	1.1255"+02	NM	0.95063	0.93772	0.97180	1.07400	0.90484
39	1.7374"-02	1.1545"+02	NM	0.95500	0.94976	0.97470	1.05320	0.92547
40	1.7831"-02	1.1764"+02	NM	0.95934	0.95879	0.97740	1.03920	0.94053
41	1.8288"-02	1.1962"+02	NM	0.96480	0.96682	0.98060	1.02870	0.95324
42	1.8745"-02	1.2086"+02	NM	0.96922	0.97184	0.98310	1.02330	0.96072
43	1.9152"-02	1.2260"+02	NM	0.97246	0.97886	0.98510	1.01280	0.97265
44	1.9600"-02	1.2411"+02	NM	0.97799	0.98491	0.98820	1.00670	0.98162
45	2.0117"-02	1.2488"+02	NM	0.98245	0.98794	0.99060	1.00540	0.98528
46	2.0574"-02	1.2614"+02	NM	0.98792	0.99295	0.99360	1.00130	0.99231
47	2.1031"-02	1.2693"+02	NM	0.99240	0.99605	0.99600	0.99990	0.99610
48	2.1488"-02	1.2769"+02	NM	1.00009	0.99905	1.00000	1.00190	0.99810
D 49	2.1946"-02	1.2793"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000
50	2.2403"-02	1.2793"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	2.2860"-02	1.2793"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

68010401 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 50

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.28770	0.00000	0.00090	4.02575	0.00000
2	2.7940"-04	3.8874"+00	NM	0.42167	0.20102	0.39540	3.86904	0.10219
3	5.5880"-04	1.1830"+01	NM	0.49109	0.36848	0.58098	2.48597	0.23370
4	8.3820"-04	1.4662"+01	NM	0.55952	0.41190	0.64384	2.44329	0.26352
5	1.1176"-03	1.7809"+01	NM	0.60513	0.45531	0.68939	2.29248	0.30072
6	1.3970"-03	2.0251"+01	NM	0.63590	0.48634	0.71882	2.18457	0.32904
7	1.6764"-03	2.1692"+01	NM	0.66276	0.50374	0.74004	2.15822	0.34289
8	1.9558"-03	2.4052"+01	NM	0.68354	0.53101	0.76046	2.05090	0.37079
9	2.2352"-03	2.5846"+01	NM	0.69839	0.55085	0.77457	1.97725	0.39174
10	2.5146"-03	2.7945"+01	NM	0.71126	0.57317	0.78779	1.88908	0.41702
11	2.7940"-03	3.0010"+01	NM	0.72429	0.59433	0.80030	1.81323	0.44137
12	3.0734"-03	3.1762"+01	NM	0.73618	0.61170	0.81091	1.75741	0.46142
13	3.3528"-03	3.3563"+01	NM	0.74709	0.62906	0.82072	1.70220	0.48215
14	3.6322"-03	3.5141"+01	NM	0.76086	0.64388	0.83133	1.66703	0.49869
15	3.9116"-03	3.7455"+01	NM	0.77184	0.66501	0.84144	1.60100	0.52557
16	4.1910"-03	3.9412"+01	NM	0.77780	0.68238	0.84785	1.54379	0.54920
17	4.4704"-03	4.1562"+01	NM	0.78668	0.70096	0.85586	1.49078	0.57410
18	4.7498"-03	4.3035"+01	NM	0.79568	0.71341	0.86276	1.46253	0.58991
19	5.0292"-03	4.5293"+01	NM	0.80275	0.73209	0.86947	1.41052	0.61642
20	5.3086"-03	4.7435"+01	NM	0.81052	0.74938	0.87618	1.36703	0.64093
21	5.5880"-03	4.9160"+01	NM	0.81946	0.76301	0.88288	1.33888	0.65942
22	5.8674"-03	5.1246"+01	NM	0.82946	0.77918	0.89037	1.30581	0.68187
23	6.1468"-03	5.3198"+01	NM	0.83532	0.79402	0.89540	1.27164	0.70412
24	6.4262"-03	5.5369"+01	NM	0.84236	0.81020	0.90110	1.23697	0.72847
25	6.7056"-03	5.7579"+01	NM	0.85128	0.82635	0.90771	1.20661	0.75228
26	6.9850"-03	5.9123"+01	NM	0.86010	0.83744	0.91361	1.19018	0.76763
27	7.2644"-03	6.0705"+01	NM	0.86615	0.84866	0.91802	1.17014	0.78454
28	7.5438"-03	6.3012"+01	NM	0.87402	0.86475	0.92382	1.14128	0.80946
29	7.8232"-03	6.4821"+01	NM	0.87797	0.87718	0.92713	1.11713	0.82992
30	8.1026"-03	6.6290"+01	NM	0.88397	0.88713	0.93123	1.10199	0.84511
31	8.3820"-03	6.8325"+01	NM	0.89282	0.90073	0.93714	1.08246	0.86574
32	8.6614"-03	6.9836"+01	NM	0.90087	0.91071	0.94224	1.07044	0.88024
33	8.9408"-03	7.1158"+01	NM	0.90576	0.91934	0.94555	1.05782	0.89387
34	9.2202"-03	7.2898"+01	NM	0.91181	0.93059	0.94965	1.04138	0.91191
35	9.4996"-03	7.4447"+01	NM	0.91871	0.94049	0.95405	1.02906	0.92711
36	9.7790"-03	7.5620"+01	NM	0.92567	0.94791	0.95826	1.02194	0.93768
37	1.0058"-02	7.7192"+01	NM	0.93249	0.95778	0.96256	1.01002	0.95301
38	1.0338"-02	7.8199"+01	NM	0.93855	0.96404	0.96617	1.00441	0.96193
39	1.0617"-02	7.9402"+01	NM	0.94446	0.97147	0.96977	0.99649	0.97318
40	1.0897"-02	8.0413"+01	NM	0.94843	0.97768	0.97227	0.98898	0.98311
41	1.1176"-02	8.1433"+01	NM	0.95438	0.98389	0.97578	0.98357	0.99208
42	1.1455"-02	8.2249"+01	NM	0.95937	0.98884	0.97868	0.97956	0.99910
43	1.1735"-02	8.2869"+01	NM	0.96729	0.99258	0.98298	0.98076	1.00227
44	1.2014"-02	8.3492"+01	NM	0.97328	0.99632	0.98629	0.97996	1.00646
45	1.2294"-02	8.3906"+01	NM	0.97728	0.99880	0.98849	0.97946	1.00922
46	1.2573"-02	8.4098"+01	NM	0.98207	0.99995	0.99099	0.98216	1.00899
47	1.2852"-02	8.4094"+01	NM	0.98604	0.99993	0.99299	0.98617	1.00692
48	1.3132"-02	8.4101"+01	NM	0.99002	0.99997	0.99499	0.99008	1.00496
49	1.3411"-02	8.4099"+01	NM	0.99501	0.99996	0.99750	0.99509	1.00242
D 50	1.3691"-02	8.4106"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	1.3970"-02	8.4106"+01	NM	1.00200	1.00000	1.00100	1.00200	0.99900

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

68010502 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 49

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.31860	0.00000	0.00000	7.48010	0.00000
2	5.0000"-04	1.5875"+00	NM	0.41980	0.07926	0.23290	8.63460	0.02697
3	1.0160"-03	4.1376"+00	NM	0.50328	0.15848	0.43550	7.55100	0.05767
4	1.5240"-03	8.3989"+00	NM	0.57365	0.23397	0.57490	6.03750	0.09522
5	2.0320"-03	1.1831"+01	NM	0.62639	0.28017	0.64620	5.31880	0.12149
6	2.5400"-03	1.3328"+01	NM	0.66810	0.29810	0.68190	5.23250	0.13032
7	3.0480"-03	1.5354"+01	NM	0.69781	0.32076	0.71330	4.94530	0.14424
8	3.5560"-03	1.7158"+01	NM	0.72533	0.33964	0.73940	4.73930	0.15601
9	4.0640"-03	1.9254"+01	NM	0.73939	0.36036	0.75790	4.42340	0.17134
10	4.3720"-03	2.1793"+01	NM	0.75598	0.38394	0.77880	4.11450	0.18928
11	5.0800"-03	2.3512"+01	NM	0.77029	0.39999	0.79340	3.93450	0.20165
12	5.5880"-03	2.6306"+01	NM	0.78348	0.42263	0.80940	3.66780	0.22068
13	6.0960"-03	2.8303"+01	NM	0.79224	0.43866	0.81980	3.49270	0.23472
14	6.6040"-03	3.1130"+01	NM	0.80225	0.46040	0.83220	3.26730	0.25471
15	7.1120"-03	3.4348"+01	NM	0.81098	0.48396	0.84370	3.03920	0.27761
16	7.6200"-03	3.6632"+01	NM	0.81868	0.50000	0.85209	2.90360	0.29343
17	8.1280"-03	4.0120"+01	NM	0.82630	0.52356	0.86170	2.70880	0.31811
18	8.6360"-03	4.3476"+01	NM	0.83292	0.54527	0.86990	2.54520	0.34178
19	9.1440"-03	4.6811"+01	NM	0.84170	0.56601	0.87860	2.40950	0.36464
20	9.6520"-03	5.0279"+01	NM	0.84619	0.58681	0.88479	2.27300	0.38922
21	1.0160"-02	5.3207"+01	NM	0.85283	0.60381	0.89100	2.17750	0.40918
22	1.0668"-02	5.6551"+01	NM	0.86047	0.62266	0.89799	2.07950	0.43179
23	1.1176"-02	6.0698"+01	NM	0.86698	0.64527	0.90450	1.96490	0.46033
24	1.1684"-02	6.4822"+01	NM	0.87366	0.66699	0.91080	1.86470	0.48844
25	1.2192"-02	6.8507"+01	NM	0.88123	0.68582	0.91700	1.78780	0.51292
26	1.2700"-02	7.2305"+01	NM	0.88680	0.70470	0.92200	1.71180	0.53861
27	1.3208"-02	7.7195"+01	NM	0.89117	0.72829	0.92670	1.61910	0.57236
28	1.3716"-02	8.1426"+01	NM	0.89774	0.74809	0.93200	1.55210	0.60048
29	1.4224"-02	8.5565"+01	NM	0.90222	0.76698	0.93600	1.48930	0.62848
30	1.4732"-02	9.0241"+01	NM	0.91106	0.78777	0.94230	1.43080	0.65858
31	1.5240"-02	9.6352"+01	NM	0.91644	0.81414	0.94710	1.35330	0.69984
32	1.5748"-02	1.0107"+02	NM	0.92302	0.83394	0.95190	1.30290	0.73060
33	1.6256"-02	1.0522"+02	NM	0.92974	0.85097	0.95650	1.26340	0.75708
34	1.6764"-02	1.0944"+02	NM	0.93407	0.86793	0.95980	1.22290	0.78486
35	1.7272"-02	1.1422"+02	NM	0.93947	0.88674	0.96370	1.18110	0.81593
36	1.7780"-02	1.1917"+02	NM	0.94536	0.90583	0.96780	1.14150	0.84783
37	1.8288"-02	1.2286"+02	NM	0.95270	0.91981	0.97230	1.11740	0.87014
38	1.8796"-02	1.3110"+02	NM	0.99496	0.95027	0.99520	1.09680	0.90737
39	1.9304"-02	1.2870"+02	NM	0.95935	0.94150	0.97680	1.07640	0.90747
40	1.9812"-02	1.3206"+02	NM	0.96486	0.95377	0.98020	1.05620	0.92804
41	2.0320"-02	1.3441"+02	NM	0.96919	0.96224	0.98280	1.04320	0.94210
42	2.0828"-02	1.3705"+02	NM	0.97465	0.97168	0.98600	1.02970	0.95756
43	2.1336"-02	1.3946"+02	NM	0.97804	0.98019	0.98810	1.01620	0.97235
44	2.1844"-02	1.4080"+02	NM	0.98238	0.98490	0.99050	1.01140	0.97934
45	2.2352"-02	1.4240"+02	NM	0.98785	0.99053	0.99350	1.00600	0.98757
46	2.2860"-02	1.4323"+02	NM	0.98899	0.99341	0.99420	1.00160	0.99261
47	2.3368"-02	1.4403"+02	NM	0.99334	0.99620	0.99650	1.00060	0.99590
48	2.3876"-02	1.4487"+02	NM	0.99788	0.99910	0.99890	0.99960	0.99930
D 49	2.4384"-02	1.4513"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000
50	2.4892"-02	1.4513"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	2.5400"-02	1.4513"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

68010503 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 48

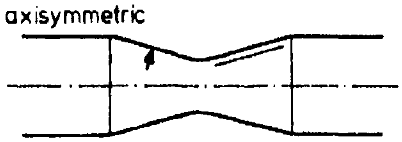
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.31349	0.00000	0.00000	8.40895	0.00000
2	5.8420"-04	1.4133"+00	NM	0.42510	0.06395	0.20392	10.16750	0.02006
3	1.1684"-03	3.3434"+00	NM	0.51647	0.13144	0.40464	9.47671	0.04270
4	1.7526"-03	7.4834"+00	NM	0.58587	0.20691	0.56324	7.40975	0.07601
5	2.3368"-03	1.2081"+01	NM	0.62668	0.26642	0.64729	5.90286	0.10966
6	2.9210"-03	1.4947"+01	NM	0.66199	0.29752	0.69011	5.38017	0.12827
7	3.5052"-03	1.7843"+01	NM	0.68954	0.32595	0.72313	4.92195	0.14692
8	4.0894"-03	1.9783"+01	NM	0.71035	0.34367	0.74415	4.68839	0.15872
9	4.6736"-03	2.2149"+01	NM	0.72692	0.36412	0.76326	4.39396	0.17371
10	5.2578"-03	2.4765"+01	NM	0.74133	0.38546	0.78047	4.09964	0.19037
11	5.8420"-03	2.7055"+01	NM	0.75565	0.40322	0.79518	3.88897	0.20447
12	6.4262"-03	2.9321"+01	NM	0.76654	0.42006	0.80709	3.69168	0.21862
13	7.0104"-03	3.2201"+01	NM	0.77549	0.44053	0.81857	3.45293	0.23707
14	7.5946"-03	3.4673"+01	NM	0.78640	0.45736	0.82940	3.28853	0.25221
15	8.1788"-03	3.8493"+01	NM	0.79740	0.48223	0.84191	3.04807	0.27621
16	8.7630"-03	4.1636"+01	NM	0.80290	0.50176	0.84951	2.86648	0.29636
17	9.3472"-03	4.4906"+01	NM	0.81394	0.52131	0.85962	2.71907	0.31614
18	9.9314"-03	4.7990"+01	NM	0.81952	0.53907	0.86612	2.58125	0.33554
19	1.0516"-02	5.1986"+01	NM	0.82834	0.56130	0.87482	2.42914	0.36014
20	1.1100"-02	5.5127"+01	NM	0.83382	0.57816	0.88053	2.31951	0.37962
21	1.1684"-02	5.8881"+01	NM	0.84368	0.59768	0.88873	2.21107	0.40195
22	1.2268"-02	6.2942"+01	NM	0.84808	0.61811	0.89394	2.09165	0.42738
23	1.2852"-02	6.6589"+01	NM	0.85584	0.63589	0.90034	2.00470	0.44912
24	1.3437"-02	7.0526"+01	NM	0.86354	0.65454	0.90664	1.91865	0.47254
25	1.4021"-02	7.4568"+01	NM	0.87119	0.67316	0.91275	1.83850	0.49646
26	1.4605"-02	7.9546"+01	NM	0.87786	0.69540	0.91855	1.74475	0.52646
27	1.5189"-02	8.3627"+01	NM	0.88551	0.71312	0.92425	1.67979	0.55022
28	1.5773"-02	8.7411"+01	NM	0.89002	0.72917	0.92806	1.61993	0.57290
29	1.6358"-02	9.1910"+01	NM	0.89987	0.74779	0.93476	1.56256	0.59822
30	1.6942"-02	9.6310"+01	NM	0.90543	0.76557	0.93906	1.50460	0.62413
31	1.7526"-02	1.0171"+02	NM	0.91300	0.78683	0.94457	1.44114	0.65543
32	1.8110"-02	1.0565"+02	NM	0.91753	0.80199	0.94797	1.39716	0.67850
33	1.8694"-02	1.1011"+02	NM	0.92409	0.81882	0.95247	1.35309	0.70392
34	1.9279"-02	1.1589"+02	NM	0.92851	0.84014	0.95607	1.29502	0.73827
35	1.9863"-02	1.2032"+02	NM	0.93505	0.85610	0.96038	1.25844	0.76315
36	2.0447"-02	1.2611"+02	NM	0.93948	0.87653	0.96378	1.20897	0.79719
37	2.1031"-02	1.3537"+02	NM	0.98377	0.90828	0.98789	1.18299	0.83508
38	2.1615"-02	1.3493"+02	NM	0.95170	0.90679	0.97158	1.14801	0.84632
39	2.2200"-02	1.3891"+02	NM	0.95830	0.92011	0.97559	1.12423	0.86778
40	2.2784"-02	1.4431"+02	NM	0.96378	0.93787	0.97919	1.09005	0.89830
41	2.3368"-02	1.4731"+02	NM	0.96806	0.94760	0.98179	1.07346	0.91461
42	2.3952"-02	1.5117"+02	NM	0.97353	0.95999	0.98509	1.05297	0.93554
43	2.4536"-02	1.5428"+02	NM	0.97589	0.96983	0.98669	1.03508	0.95325
44	2.5121"-02	1.5739"+02	NM	0.97907	0.97958	0.98869	1.01869	0.97055
45	2.5705"-02	1.5966"+02	NM	0.98567	0.98664	0.99230	1.01149	0.98102
46	2.6289"-02	1.6167"+02	NM	0.99116	0.99287	0.99530	1.00490	0.99045
47	2.6873"-02	1.6313"+02	NM	0.99560	0.99735	0.99770	1.00070	0.99700
D 48	2.7457"-02	1.6400"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000
49	2.8042"-02	1.6429"+02	NM	1.00113	1.00090	1.00060	0.99940	1.00120
50	2.8626"-02	1.6429"+02	NM	1.00113	1.00090	1.00060	0.99940	1.00120
51	2.9210"-02	1.6429"+02	NM	1.00113	1.00090	1.00060	0.99940	1.00120

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

68010901 PERRY PROFILE TABULATION 51 POINTS, DELTA AT POINT 50

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.26033	0.00000	0.00000	5.67736	0.00000
2	4.0640"-04	2.4963"+00	NM	0.34562	0.12059	0.29008	5.78635	0.05013
3	8.1280"-04	1.0498"+0,	NM	0.43540	0.27354	0.52712	3.71355	0.14195
4	1.2192"-03	1.3985"+01	NM	0.52511	0.31763	0.61055	3.69495	0.16524
5	1.6256"-03	1.6697"+01	NM	0.57995	0.34005	0.65968	3.59230	0.18364
6	2.0320"-03	1.8768"+01	NM	0.61402	0.36960	0.68996	3.48482	0.19799
7	2.4384"-03	2.1069"+01	NM	0.64278	0.39217	0.71643	3.33742	0.21467
8	2.8448"-03	2.3503"+01	NM	0.67413	0.41469	0.74311	3.21114	0.23142
9	3.2512"-03	2.5965"+01	NM	0.69399	0.43630	0.76206	3.05077	0.24979
10	3.6576"-03	2.7707"+01	NM	0.71181	0.45095	0.77680	2.96722	0.26179
11	4.0640"-03	3.0130"+01	NM	0.72532	0.47058	0.79033	2.82063	0.28020
12	4.4704"-03	3.2015"+01	NM	0.73795	0.48531	0.80146	2.72733	0.29386
13	4.8768"-03	3.4479"+01	NM	0.75223	0.50391	0.81420	2.61070	0.31187
14	5.2832"-03	3.6907"+01	NM	0.76307	0.52158	0.82443	2.49839	0.32998
15	5.6896"-03	3.9131"+01	NM	0.77295	0.53727	0.83335	2.40589	0.34638
16	6.0960"-03	4.1709"+01	NM	0.78367	0.55489	0.84288	2.30736	0.36530
17	6.5024"-03	4.4228"+01	NM	0.79450	0.57158	0.85200	2.22190	0.38346
18	6.9088"-03	4.6354"+01	NM	0.80435	0.58530	0.85982	2.15805	0.39842
19	7.3152"-03	4.9313"+01	NM	0.81144	0.60388	0.86684	2.06053	0.42069
20	7.7216"-03	5.1891"+01	NM	0.81869	0.61961	0.87326	1.98633	0.43963
21	8.1280"-03	5.4528"+01	NM	0.82589	0.63529	0.87947	1.91645	0.45891
22	8.5344"-03	5.7738"+01	NM	0.93298	0.65389	0.88589	1.83551	0.48264
23	8.9408"-03	5.9993"+01	NM	0.84016	0.66663	0.89141	1.70806	0.49853
24	9.3472"-03	6.3191"+01	NM	0.84920	0.68431	0 89843	1.72371	0.52122
25	9.7536"-03	6.6285"+01	NM	0.85551	0.70098	0.90374	1.66218	0.54371
26	1.0160"-02	6.9075"+01	NM	0.86361	0.71568	0.90966	1.61552	0.56307
27	1.0566"-02	7.1931"+01	NM	0.86902	0.73042	0.91407	1.56606	0.58367
26	1.0973"-02	7.5030"+01	NM	0.87441	0.74609	0.91848	1.51548	0.60606
29	1.1379"-02	7.8204"+01	NM	0.88342	0.76181	0.92470	1.47336	0.62761
30	1.1786"-02	8.1426"+01	NM	0.89050	0.77743	0.92981	1.43042	0.65002
31	1.2192"-02	8.4733"+01	NM	0.89502	0.79315	0.93352	1.38528	0.67389
32	1.2598"-02	8.7881"+01	NM	0.90216	0.80783	0.93843	1.34949	0.69540
33	1.3005"-02	9.1089"+01	NM	0.90574	0.82252	0.94144	1.31007	0.71862
34	1.3411"-02	9.4798"+01	NM	0.91380	0.83918	0.94686	1.27307	0.74376
35	1.3818"-02	9.8370"+01	NM	0.92019	0.85492	0.95127	1.23809	0.76834
36	1.4224"-02	1.0130"+02	NM	0.92552	0.86763	0.95488	1.21124	0.78835
37	1.4630"-02	1.0429"+02	NM	0.93092	0.88038	0.95849	1.18530	0.80865
38	1.5037"-02	1.0778"+02	NM	0.93890	0.89507	0.96350	1.15876	0.83150
39	1.5443"-02	1.1231"+02	NM	0.94319	0.91378	0.96681	1.11945	0.86365
40	1.5850"-02	1.1471"+02	NM	0.94975	0.92351	0.97072	1.10487	0.87859
41	1.6256"-02	1.1741"+02	NM	0.95428	0.93434	0.97363	1.08586	0.89664
42	1.6662"-02	1.2062"+02	NM	0.96062	0.94708	0.97754	1.06535	0.91757
43	1.7069"-02	1.2236"+02	NM	0.96504	0.95394	0.98015	1.05570	0.92843
44	1.7475"-02	1.2538"+02	NM	0.97039	0.96566	0.98346	1.03720	0.94818
45	1.7882"-02	1.2742"+02	NM	0.97577	0.97353	0.98656	1.02695	0.96068
46	1.8288"-02	1.2923"+02	NM	0.98126	0.98045	0.98967	1.01890	0.97131
47	1.8694"-02	1.3128"+02	NM	0.98650	0.98822	0.99268	1.00905	0.98378
48	1.9101"-02	1.3285"+02	NM	0.98934	0.99413	0.99438	1.00050	0.99389
49	1.9507"-02	1.3388"+02	NM	0.99458	0.99800	0.99719	0.99839	0.99880
D 50	1.9914"-02	1.3442"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	2.0320"-02	1.3442"+02	NM	1.00542	1.00000	1.00271	1.00543	0.99729

INPUT VARIAULES Y,U/UD,T/TD ASSUME P8PD

axisymmetric 	M : Subsonic to 4.4 R THETA X 10^{-3} : 0.6 - 7.0 TW/TR : 0.85 to 0.65	6901 FPG SHT (TEMP. HISTORY)

Special purpose rig. Continuous running. D = (inlet) 0.165 m, (throat) 37.85 mm.
PO : 2.1 MN/m^2. TO : 540 K. Air: RE/m X 10^{-6} of order 50.

GOLDMAN D.R., SCHMIDT J.F. and EHLERS R.C. 1969. Experimental and theoretical turbulent boundary layer development in a Mach 4.4 water-cooled conical nozzle. NASA TN D-5377.
And Boldman, Schmidt and Fortini (1966), Boldman, Schmidt and Gallagher (1968), Boldman and Graham (1972) and extensive supporting bibliography (see references), Boldman D.R., private communications.

1 The test boundary layer was formed in a conical convergent-divergent nozzle and one of two cylindrical inlet-passages leading to it. The inlets were 0.165 m diameter and met the conical convergence with no fairing. The 30^0 semiangle convergence was faired into the throat (X = 0, D = 37.85 mm) by a part of the wall having a constant radius in longitudinal direction of 37.85 mm. This circular contour was carried through the throat until the tangent point (X = 10.16 mm) with the 15^0 semi angle divergent section, which ran from this point to X = 0.280 m where the diameter was 0.186 m. Provision was made for boundary layer traverses in the cylindrical inlet, the convergence, and at three stations in the divergence. The test surfaces were machine-turned to a finish of 1.6 μm rms, and both the nozzle and one of the inlet cylinders could be
3 actively cooled. The earlier tests (1966, 1968) showed that the boundary layer became turbulent after
4 natural transition very near the start of the inlet sections. Of these one (series 01) was uncooled, and ran from X = -0.552 to X = -0.120 m the start of the convergent portion. The other (series 02) was 0.955 m long (X = - 1.075 to - 0.120 m) and actively cooled by water passages from X = - 0.734 m. The upstream edges of the inlets were machined to give a leading edge radius of 0.76 mm and a boundary layer bleed bypass outside the inlets ensured that the experimental boundary layer started at this leading edge. The wall temperature and pressure history for the nozzle itself is presented in section D.

6 Static pressure was measured by tappings of 0.79 mm diameter at the points indicated in the wall data table of section D. The wall temperature and heat flux rate were measured with a plug type heat flux meter. A conducting rod of constant cross section is placed in a cavity in the wall so shaped that it is in thermal contact with the wall at the test surface and insulated elsewhere by the cavity. The temperature gradient in the plug then gives the heat flux, and can be extrapolated to give the test surface temperature (Boldman et al. 1967). Uncertainty in correction procedures to allow for the local distortion of the heat flux pattern is believed to give a residual uncertainty of 10 % in heat flux.

7 Boundary layer profiles were measured with TPP and TTP. The FPP were constructed from tubing (d_1 = 0.711, d_2 = 0.355 mm) flattened to give a rectangular opening (h_2 = 0.051, b_2 = 0.76 mm) and ground down so as to have a sharp lip. The overall probe lengths were 19 and 15.2 mm for the subsonic and supersonic profiles respectively. About the last 5 mm (E) of the tube was unsupported. The TTP for the subsonic profiles consisted of an unshielded Chromel-Alumel thermocouple bead 0.13 mm in diameter mounted at the end of a short cylindrical support (d = 0.35, l = 2.5 mm). This in turn was mounted in a conical (15^0) housing. For the supersonic profiles, the bead size was reduced to 0.08 mm and the diameter of the support to
8 0.2 mm. The overall lengths were as for the TPP. The profiles were obtained normal to the conical surfaces of the nozzle at the X-stations indicated in section B. At any given value of X the Pitot and TO profiles were obtained on opposite sides of the nozzle.

9 The calibration procedure for the TTP is described in an appendix to the source paper. The authors have interpolated the TO data to the Y values of the Pitot data, and PW and TW values to the profile position.

12 The editors have accepted the authors' calibration and interpolation procedures. For one of the profiles (0101) the data was received in raw form and interpolated by the editors. In data reduction for this profile the input values of T/TD were assumed, for computing reasons, equal to the measured value of TO/TOD.

Resulting error is less than 0.13 %. The wall data is presented in normalised form from the tables in Boldman & Graham (1972), so that the profile wall temperatures do not agree with the values in Section D. These differences are caused by seasonal variations in the temperature of the cooling water supply. The
13 two sets of profile data are differentiated by their upstream thermal history. For series 01 the inlet duct was not cooled, and the flow in this region was near adiabatic. For series 02 a cooled inlet duct was used. All measurements are taken in the nozzle itself, which is actively cooled. In each series one
14 profile is in the subsonic, convergent, part of the nozzle and three are in the divergent part. The wall data with the profiles are scaled to the wall temperature of the profile. Full normalised data is given in section D.

§ DATA: 6901 0101-0204. Pitot and T0 profiles. NX = 4. Heat flux from conduction measurements in the nozzle wall.

15 Editors' comments

This entry is included principally as a challenge for calculation methods. The state of the boundary layer in the contraction is described, and there is very complete wall temperature and pressure information for the flow through to the three measuring stations in the conical expansion. Series 02 is very similar to the CW case of Back et al. (7207 series 01), and series 01 provides an interesting difference in the upstream history.

The experiments form part of a continuing study into which many other effects are introduced - wall roughness etc. There is a large number of reports concerned with the tests, and the normalisation procedures vary from one to the next. We believe that the data given with the profiles is appropriate to the test conditions in each case, but repeat that the extended wall data tables are differently normalised.

Note added in proof. We remain uncertain of the proper free stream conditions at the first station. For profile 0101 the Mach number corresponds to the wall data given in section D, while for profile 0201 the free stream velocity was taken as stated in figure 7a of NASA TN D-4788. The Mach numbers in the two cases should be in close agreement, and we have not yet reconciled the conflict. The dimensionless profile data is not affected by this discrepancy.

CAT 6901 BOLDMAN BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF CQ * PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
69010101	0.0789	0.7463	1.2920"+03	NM	0.0306	1.2851	2.0594"+06	2.0594"+06
-6.3800"-02	2.0684"+06	1.0000	1.0537"+03	NC	1.9442	1.9485	4.0080"+02	5.3642"+02
-4.9960"-02	5.3709"+02	0.0000	6.0592"-05	NC	1.1721	5.6663"-05	3.6657"+01	5.3702"+02
69010102	2.1000	0.8507	4.5980"+03	NM	1.4683	1.4852	2.2619"+05	2.2619"+05
3.1010"-02	2.0684"+06	1.0000	6.2829"+03	1.4197"-04	1.8548	1.8400	4.3778"+02	2.8746"+02
-2.5935"-02	5.4100"+02	0.0000	5.7545"-05	NC	0.9550	6.3224"-05	7.1387"+02	5.1463"+02
69010103	3.7000	0.7107	2.9339"+03	NM	4.7431	1.3428	2.0483"+04	2.0483"+04
1.3889"-01	2.0684"+06	1.0000	6.1393"+03	2.4985"-04	1.0371	1.8160	3.5389"+02	1.4419"+02
-5.4890"-02	5.3900"+02	0.0000	1.3970"-04	NC	0.6058	2.0432"-04	8.9081"+02	4.9794"+02
69010104	4.4000	0.6404	3.1127"+03	NM	5.9197	1.3753	8.1033"+03	8.1033"+03
2.4179"-01	2.0684"+06	1.0000	7.6571"+03	2.6476"-04	1.8280	1.7942	3.1667"+02	1.1063"+02
-8.2600"-02	5.3900"+02	0.0000	2.5384"-04	NC	0.7138	4.2262"-04	9.2790"+02	4.9445"+02
69010201	0.0307	0.6205	3.7287"+03	NM	0.8665	1.1891	2.0671"+06	2.0671"+06
-6.3800"-02	2.0684"+06	1.0000	2.6535"+03	NC	1.8670	1.8707	3.3510"+02	5.3995"+02
-4.9960"-02	5.4005"+02	0.0000	3.9401"-04	NC	0.2657	3.7568"-04	1.4300"+01	5.4004"+02
69010202	2.1000	0.8338	7.9357"+03	NM	0.5650	1.3556	2.2619"+05	2.2619"+05
3.1010"-02	2.0684"+06	1.0000	1.0692"+04	1.1293"-04	1.8859	1.8695	4.2833"+02	2.8693"+02
-2.5935"-02	5.4000"+02	0.0000	9.7700"-05	NC	1.3364	1.0231"-04	7.1321"+02	5.1368"+02
69010203	3.6000	0.7028	6.1900"+03	NM	1.8924	1.2574	2.3548"+04	2.3548"+04
1.3889"-01	2.0684"+06	1.0000	1.2397"+04	2.0291"-04	1.8923	1.8620	3.5167"+02	1.5061"+02
-5.4890"-02	5.4100"+02	0.0000	2.6804"-04	NC	1.2653	3.2784"-04	8.8581"+02	5.0040"+02
69010204	4.5000	0.6432	4.3092"+03	NM	3.8684	1.3012	7.1469"+03	7.1469"+03
2.4179"-01	2.0684"+06	1.0000	1.0997"+04	2.4071"-04	1.8718	1.8265	3.1778"+02	1.0673"+02
-8.2500"-02	5.3900"+02	0.0000	3.6367"-04	NC	1.1207	5.7179"-04	9.3212"+02	4.9404"+02

TRAPEZOIDAL RULE FOR ALL INTEGRATIONS - FOR 0201 UD FROM NASA TN D-4788 FIG.7A

69010101 BOLDMAN PROFILE TABULATION 22 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.74531	0.00000	0.00000	0.74624	0.00000
2	2.5400"-05	1.0032"+00	NM	0.80589	0.85537	0.76800	0.80615	0.95267
3	3.5560"-05	1.0036"+00	NM	0.81631	0.90194	0.81500	0.81650	0.99816
4	5.0800"-05	1.0038"+00	NM	0.83188	0.93187	0.85000	0.83201	1.02162
5	6.3500"-05	1.0040"+00	NM	0.84020	0.95454	0.87500	0.84029	1.04131
6	7.6200"-05	1.0042"+00	NM	0.84748	0.97761	0.90000	0.84753	1.06191
7	9.1440"-05	1.0042"+00	NM	0.85990	0.97915	0.90800	0.85994	1.05588
8	1.0160"-04	1.0042"+00	NM	0.86611	0.98209	0.91400	0.86615	1.05525
9	1.5240"-04	1.0042"+00	NM	0.89405	0.98566	0.93200	0.89408	1.04242
10	1.7780"-04	1.0042"+00	NM	0.90749	0.98568	0.93900	0.90752	1.03468
11	2.2860"-04	1.0043"+00	NM	0.92923	0.99380	0.95800	0.92925	1.03094
12	3.0480"-04	1.0042"+00	NM	0.95404	0.98488	0.96200	0.95407	1.00831
13	3.5560"-04	1.0043"+00	NM	0.96438	0.98672	0.96900	0.96442	1.00475
14	4.0640"-04	1.0042"+00	NM	0.97058	0.98457	0.97000	0.97062	0.99936
15	5.8420"-04	1.0043"+00	NM	0.97785	0.99406	0.98300	0.97786	1.00525
16	8.3820"-04	1.0043"+00	NM	0.98404	0.98992	0.98200	0.98407	0.99790
17	1.0414"-03	1.0043"+00	NM	0.98714	0.98836	0.98200	0.98717	0.99476
18	1.1176"-03	1.0043"+00	NM	0.98715	0.99037	0.98400	0.98717	0.99679
19	1.2954"-03	1.0043"+00	NM	0.98818	0.98885	0.98300	0.98821	0.99473
20	1.5748"-03	1.0043"+00	NM	0.98922	0.99135	0.98600	0.98924	0.99672
21	1.8542"-03	1.0044"+00	NM	0.99131	0.99835	0.99400	0.99131	1.00271
D 22	5.0800"-03	1.0044"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UE,TO ASSUME T/TD = TO/TOD AND P=PD

69010102 BOLDMAN PROFILE TABULATION 25 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.80921	0.00000	0.00000	1.52292	0.00000
2	3.2000"-05	2.1328"+00	NM	0.87431	0.52381	0.60291	1.32484	0.45508
3	6.2000"-05	2.4075"+00	NM	0.88355	0.57143	0.64928	1.29102	0.50292
4	8.8000"-05	3.0492"+00	NM	0.89094	0.66667	0.73168	1.20456	0.60743
5	1.1300"-04	3.4133"+00	NM	0.89834	0.71429	0.77129	1.16598	0.66150
6	1.6400"-04	4.2238"+00	NM	0.91312	0.80952	0.84479	1.08904	0.77573
7	2.1500"-04	5.1418"+00	NM	0.92606	0.90476	0.91022	1.01211	0.89933
8	2.2700"-04	5.1418"+00	NM	0.92976	0.90476	0.91204	1.01615	0.89754
9	2.4000"-04	5.1418"+00	NM	0.93346	0.90476	0.91385	1.02019	0.89576
10	2.5300"-04	5.6404"+00	NM	0.93715	0.95238	0.94273	0.97985	0.96213
11	2.6500"-04	5.1418"+00	NM	0.94085	0.90476	0.91746	1.02827	0.89224
12	2.7800"-04	5.1418"+00	NM	0.94455	0.90476	0.91926	1.03231	0.89049
13	2.9100"-04	5.1418"+00	NM	0.94824	0.90476	0.92106	1.03635	0.88875
14	3.0400"-04	5.1418"+00	NM	0.95009	0.90476	0.92196	1.03837	0.88789
15	3.1600"-04	5.1418"+00	NM	0.95194	0.90476	0.92285	1.04039	0.88703
16	3.4200"-04	5.6404"+00	NM	0.95564	0.95238	0.95199	0.99917	0.95278
17	3.6700"-04	5.6404"+00	NM	0.95933	0.95238	0.95383	1.00304	0.95094
18	3.9200"-04	5.6404"+00	NM	0.96118	0.95238	0.95474	1.00497	0.95002
19	4.1800"-04	5.6404"+00	NM	0.96488	0.95238	0.95658	1.00884	0.94820
20	4.6900"-04	6.1654"+00	NM	0.97227	1.00000	0.98604	0.97227	1.01416
21	5.1900"-04	6.1654"+00	NM	0.97782	1.00000	0.98885	0.97782	1.01128
22	5.3200"-04	6.1554"+00	NM	0.97967	1.00000	0.98978	0.97967	1.01032
23	1.0270"-03	6.1654"+00	NM	0.99076	1.00000	0.99537	0.99076	1.00465
24	4.8200"-03	6.1654"+00	NM	0.99815	1.00000	0.99908	0.99815	1.00093
D 25	8.6300"-03	6.1654"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,TO,M ASSUME P=PD

69010103 BOLDMAN PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.65657	0.00000	0.00000	2.45425	0.00000
2	3.2000"-05	2.4075"+00	NM	0.76252	0.32432	0.48247	2.21297	0.21802
3	4.4000"-05	2.7136"+00	NM	0.77365	0.35135	0.51654	2.16138	0.23899
4	5.7000"-05	3.0492"+00	NM	0.78479	0.37838	0.54929	2.10742	0.26065
5	7.0000"-05	3.4133"+00	NM	0.79406	0.40541	0.58003	2.04764	0.28335
6	8.3000"-05	3.8050"+00	NM	0.80519	0.43243	0.61012	1.99062	0.30650
7	9.5000"-05	4.2238"+00	NM	0.81633	0.45946	0.63892	1.93373	0.33041
8	1.0800"-04	4.2238"+00	NM	0.82746	0.45946	0.64326	1.96010	0.32818
9	1.2100"-04	4.6695"+00	NM	0.83488	0.48649	0.66946	1.89368	0.35352
10	1.3300"-04	4.6695"+00	NM	0.84230	0.48649	0.67243	1.91051	0.35196
11	1.5900"-04	5.6404"+00	NM	0.85158	0.54054	0.71883	1.76844	0.40647
12	1.8400"-04	5.6404"+00	NM	0.85714	0.54054	0.72117	1.78000	0.40515
13	1.9700"-04	6.1654"+00	NM	0.85900	0.56757	0.74135	1.70613	0.43452
14	2.1000"-04	6.1654"+00	NM	0.86085	0.56757	0.74215	1.70981	0.43405
15	2.8600"-04	6.7165"+00	NM	0.87570	0.59459	0.76684	1.66329	0.46104
16	3.3700"-04	7.2937"+00	NM	0.88312	0.62162	0.78729	1.60403	0.49082
17	4.3800"-04	7.8969"+00	NM	0.89610	0.64865	0.80926	1.55652	0.51991
18	7.5600"-04	9.8624"+00	NM	0.92393	0.72973	0.86499	1.40507	0.61562
19	1.0730"-03	1.2061"+01	NM	0.94620	0.81081	0.91128	1.26317	0.72142
20	1.4030"-03	1.3656"+01	NM	0.96475	0.86486	0.94074	1.18315	0.79511
21	1.7080"-03	1.5354"+01	NM	0.97774	0.91892	0.96530	1.10350	0.87477
22	2.0380"-03	1.7156"+01	NM	0.98887	0.97297	0.98701	1.02906	0.95914
23	2.3560"-03	1.8095"+01	NM	0.99258	1.00000	0.99628	0.99258	1.00373
24	2.6730"-03	1.8095"+01	NM	0.99629	1.00000	0.99814	0.99629	1.00186
25	3.0040"-03	1.8095"+01	NM	0.99629	1.00000	0.99814	0.99629	1.00186
26	3.3080"-03	1.8095"+01	NM	0.99814	1.00000	0.99907	0.99814	1.00093
27	3.6390"-03	1.8095"+01	NM	0.99814	1.00000	0.99907	0.99814	1.00093
28	3.9560"-03	1.8095"+01	NM	0.99814	1.00000	0.99907	0.99814	1.00093
29	4.2740"-03	1.8095"+01	NM	0.99814	1.00000	0.99907	0.99814	1.00093
30	4.9090"-03	1.8095"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 31	6.3060"-03	1.8095"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,TO,M ASSUME P=PD

69010104 BOLDMAN PROFILE TABULATION 25 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.58751	0.00000	0.00000	2.86237	0.00000
2	3.2000"-05	1.2755"+00	NM	0.71429	0.13636	0.24569	3.24627	0.07568
3	7.6000"-05	1.8929"+00	NM	0.74212	0.22727	0.39450	3.01299	0.13093
4	8.3000"-05	2.7136"+00	NM	0.74583	0.29545	0.48689	2.71574	0.17929
5	1.3300"-04	3.4133"+00	NM	0.77551	0.34091	0.55030	2.60571	0.21119
6	1.8400"-04	4.2238"+00	NM	0.79777	0.38636	0.60637	2.46309	0.24618
7	2.3500"-04	5.1418"+00	NM	0.80891	0.43182	0.65326	2.28861	0.28544
8	3.3700"-04	5.6404"+00	NM	0.82189	0.45455	0.67796	2.22459	0.30476
9	4.3800"-04	6.7165"+00	NM	0.83302	0.50000	0.71803	2.06224	0.34818
10	5.9100"-04	7.2937"+00	NM	0.84787	0.52273	0.74058	2.00719	0.36896
11	7.1800"-04	7.8969"+00	NM	0.85714	0.54545	0.75983	1.94052	0.39156
12	1.0480"-03	9.8624"+00	NM	0.87941	0.61364	0.81016	1.74307	0.46479
13	1.6570"-03	1.2846"+01	NM	0.91280	0.70455	0.86918	1.52196	0.57109
14	2.1910"-03	1.5354"+01	NM	0.93878	0.77273	0.90806	1.38095	0.65756
15	2.6230"-03	1.8095"+01	NM	0.95547	0.84091	0.93841	1.24534	0.75354
16	3.0800"-03	2.0051"+01	NM	0.96846	0.88636	0.95765	1.16733	0.82038
17	3.6000"-03	2.3179"+01	NM	0.98145	0.95455	0.98091	1.05601	0.92889
18	3.8040"-03	2.3179"+01	NM	0.98516	0.95455	0.98277	1.06000	0.92714
19	4.0450"-03	2.4273"+01	NM	0.98887	0.97727	0.98965	1.02549	0.96505
20	4.2480"-03	2.4273"+01	NM	0.99072	0.97727	0.99058	1.02742	0.96415
21	4.4010"-03	2.5393"+01	NM	0.99258	1.00000	0.99628	0.99258	1.00373
22	4.5280"-03	2.5393"+01	NM	0.99258	1.00000	0.99628	0.99258	1.00373
23	4.6550"-03	2.5393"+01	NM	0.99258	1.00000	0.99628	0.99258	1.00373
24	5.0100"-03	2.5393"+01	NM	0.99443	1.00000	0.99721	0.99443	1.00279
D 25	1.2275"-02	2.5393"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,TO,M ASSUME P=PD

69010201 BOLDMAN PROFILE TABULATION 22 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.62038	0.00000	0.00000	0.62050	0.00000
2	1.4000"-05	1.0003"+00	NM	0.74038	0.69264	0.59601	0.74045	0.80493
3	4.6000"-05	1.0003"+00	NM	0.88639	0.72809	0.68551	0.88647	0.77331
4	7.8000"-05	1.0004"+00	NM	0.89100	0.75916	0.71662	0.89108	0.80422
5	1.4200"-04	1.0004"+00	NM	0.89876	0.77104	0.73099	0.89883	0.81327
6	2.0600"-04	1.0004"+00	NM	0.90595	0.78802	0.75008	0.90602	0.82788
7	3.6600"-04	1.0004"+00	NM	0.92228	0.81331	0.78109	0.92233	0.84686
8	5.2600"-04	1.0005"+00	NM	0.93433	0.83504	0.80718	0.93438	0.86387
9	8.4600"-04	1.0005"+00	NM	0.95137	0.86528	0.84400	0.95142	0.88709
10	1.1660"-03	1.0005"+00	NM	0.96314	0.88778	0.87129	0.96318	0.90459
11	1.4860"-03	1.0005"+00	NM	0.97247	0.90430	0.89178	0.97250	0.91699
12	1.8060"-03	1.0006"+00	NM	0.97973	0.91967	0.91031	0.97976	0.92912
13	2.1260"-03	1.0006"+00	NM	0.98491	0.93145	0.92441	0.98493	0.93855
14	2.4460"-03	1.0006"+00	NM	0.98857	0.94226	0.93687	0.98859	0.94768
15	2.7660"-03	1.0006"+00	NM	0.99138	0.95158	0.94748	0.99139	0.95570
16	3.4060"-03	1.0006"+00	NM	0.99539	0.96539	0.96317	0.99541	0.96762
17	4.0460"-03	1.0006"+00	NM	0.99758	0.97582	0.97465	0.99759	0.97700
18	4.6860"-03	1.0006"+00	NM	0.99869	0.98324	0.98261	0.99870	0.98388
19	5.3260"-03	1.0006"+00	NM	0.99909	0.98956	0.98907	0.99900	0.99006
20	5.9660"-03	1.0006"+00	NM	0.99936	0.99244	0.99213	0.99936	0.99276
21	7.2460"-03	1.0007"+00	NM	1.00000	0.99766	0.99766	1.00000	0.99766
D 22	8.5260"-03	1.0007"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UE,TO ASSUME T/TD = TO/TOD AND P=PD

69010202 BOLDMAN PROFILE TABULATION 37 POINTS, DELTA AT POINT 37

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.79320	0.00000	0.00000	1.49281	0.00000
2	3.2000"-05	1.8929"+00	NM	0.87037	0.47619	0.55635	1.36503	0.40758
3	1.0300"-04	3.0492"+00	NM	0.87593	0.66667	0.72549	1.18426	0.61261
4	1.1600"-04	3.0492"+00	NM	0.87778	0.66667	0.72626	1.18677	0.61196
5	1.4100"-04	3.4133"+00	NM	0.88148	0.71429	0.76402	1.14410	0.66779
6	1.5400"-04	3.8050"+00	NM	0.88333	0.76190	0.79891	1.09949	0.72662
7	2.0400"-04	4.2238"+00	NM	0.89074	0.80952	0.83438	1.06234	0.78541
8	2.2700"-04	4.6695"+00	NM	0.89630	0.85714	0.86718	1.02356	0.84722
9	2.5500"-04	5.1418"+00	NM	0.90370	0.90476	0.89917	0.98767	0.91039
10	2.6500"-04	5.1418"+00	NM	0.90556	0.90476	0.90009	0.98970	0.90946
11	2.8100"-04	5.6404"+00	NM	0.91111	0.95238	0.92954	0.95262	0.97578
12	3.1100"-04	5.6404"+00	NM	0.91852	0.95238	0.93331	0.96036	0.97184
13	3.1600"-04	5.6404"+00	NM	0.92037	0.95238	0.93426	0.96230	0.97086
14	3.2100"-04	5.6404"+00	NM	0.92222	0.95238	0.93519	0.96423	0.96988
15	3.2600"-04	5.6404"+00	NM	0.92407	0.95238	0.93613	0.96617	0.96891
16	3.3700"-04	5.6404"+00	NM	0.92593	0.95238	0.93707	0.96811	0.96794
17	3.4400"-04	5.6404"+00	NM	0.92778	0.95238	0.93801	0.97004	0.96697
18	3.4900"-04	5.6404"+00	NM	0.92778	0.95238	0.93801	0.97004	0.96697
19	3.5200"-04	5.6404"+00	NM	0.92778	0.95238	0.93801	0.97004	0.96697
20	3.5700"-04	5.6404"+00	NM	0.92963	0.95238	0.93894	0.97198	0.96601
21	3.6700"-04	5.6404"+00	NM	0.93148	0.95238	0.93988	0.97392	0.96505
22	3.7200"-04	5.6404"+00	NM	0.93148	0.95238	0.93988	0.97392	0.96505
23	3.9500"-04	5.6404"+00	NM	0.93704	0.95238	0.94268	0.97972	0.96219
24	4.3300"-04	5.6404"+00	NM	0.94074	0.95238	0.94454	0.98360	0.96029
25	4.5800"-04	6.1654"+00	NM	0.94259	1.00000	0.97087	0.94259	1.03000
26	4.8400"-04	6.1654"+00	NM	0.94444	1.00000	0.97103	0.94444	1.02899
27	5.0900"-04	6.1654"+00	NM	0.94630	1.00000	0.97278	0.94630	1.02798
28	5.3500"-04	6.1654"+00	NM	0.94815	1.00000	0.97373	0.94815	1.02698
29	5.8500"-04	6.1654"+00	NM	0.95000	1.00000	0.97468	0.95000	1.02598
30	7.1200"-04	6.1654"+00	NM	0.95370	1.00000	0.97658	0.95370	1.02398
31	8.3900"-04	6.1654"+00	NM	0.95741	1.00000	0.97847	0.95741	1.02200
32	2.1090"-03	6.1654"+00	NM	0.97407	1.00000	0.98695	0.97407	1.01322
33	3.3790"-03	6.1654"+00	NM	0.98519	1.00000	0.99256	0.98519	1.00749
34	4.6490"-03	6.1654"+00	NM	0.99444	1.00000	0.99722	0.99444	1.00279
35	5.9190"-03	6.1654"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
36	7.1890"-03	6.1654"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 37	7.8240"-03	6.1654"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,TO,M ASSUME P=PD

69010203 BOLDMAN PROFILE TABULATION 32 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/U
1	0.0000"+00	1.0000"+00	NM	0.65004	0.00000	0.00000	2.33493	0.00000
2	3.2000"-05	2.1328"+00	NM	0.78189	0.30556	0.45948	2.26130	0.20319
3	1.0800"-04	3.4133"+00	NM	0.81146	0.41667	0.59075	2.01018	0.29388
4	1.3300"-04	4.2238"+00	NM	0.82070	0.47222	0.64544	1.86816	0.34549
5	1.5900"-04	4.6695"+00	NM	0.82625	0.50000	0.67099	1.80090	0.37258
6	2.1000"-04	5.6404"+00	NM	0.83734	0.55556	0.71814	1.67096	0.42978
7	2.6000"-04	6.1654"+00	NM	0.84658	0.58333	0.74150	1.61579	0.45891
8	3.1100"-04	6.7165"+00	NM	0.85582	0.61111	0.76378	1.56205	0.48896
9	4.1300"-04	7.2937"+00	NM	0.86691	0.63889	0.78588	1.51310	0.51939
10	4.6400"-04	7.2937"+00	NM	0.87246	0.63889	0.78839	1.52277	0.51773
11	5.4000"-04	7.8969"+00	NM	0.87616	0.66667	0.80621	1.46243	0.55128
12	6.6700"-04	9.1813"+00	NM	0.88540	0.72222	0.83983	1.35219	0.62109
13	7.9400"-04	9.8624"+00	NM	0.89464	0.75000	0.85756	1.30738	0.65593
14	1.0480"-03	1.1302"+01	NM	0.90943	0.80556	0.88903	1.21799	0.72992
15	1.1750"-03	1.2061"+01	NM	0.91867	0.83333	0.90466	1.17852	0.76763
16	1.3020"-03	1.2846"+01	NM	0.92421	0.86111	0.91785	1.13613	0.80788
17	1.3780"-03	1.3656"+01	NM	0.92791	0.88889	0.92953	1.09352	0.85003
18	1.5560"-03	1.4492"+01	NM	0.93715	0.91667	0.94343	1.05924	0.89067
19	1.7840"-03	1.5354"+01	NM	0.94640	0.94444	0.95683	1.02640	0.93222
20	1.9370"-03	1.6242"+01	NM	0.95009	0.97222	0.96696	0.98920	0.97752
21	2.0640"-03	1.6242"+01	NM	0.95194	0.97222	0.96790	0.99112	0.97657
22	2.2160"-03	1.7156"+01	NM	0.95379	1.00000	0.97662	0.95379	1.02394
23	2.3180"-03	1.7156"+01	NM	0.95564	1.00000	0.97757	0.95564	1.02295
24	2.4190"-03	1.7156"+01	NM	0.95564	1.00000	0.97757	0.95564	1.02295
25	2.4560"-03	1.7156"+01	NM	0.95749	1.00000	0.97851	0.95749	1.02196
26	2.5720"-03	1.7156"+01	NM	0.95749	1.00000	0.97851	0.95749	1.02196
27	2.8260"-03	1.7156"+01	NM	0.95933	1.00000	0.97946	0.95933	1.02097
28	3.5880"-03	1.7156"+01	NM	0.96303	1.00000	0.98134	0.96303	1.01901
29	4.3500"-03	1.7156"+01	NM	0.96673	1.00000	0.98322	0.96673	1.01706
30	6.3820"-03	1.7156"+01	NM	0.97597	1.00000	0.98791	0.97597	1.01224
31	1.1970"-02	1.7156"+01	NM	0.99630	1.00000	0.99815	0.99630	1.00185
D 32	1.6796"-02	1.7156"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,TO,M ASSUME P=PD

69010204 BOLDMAN PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.58957	0.00000	0.00000	2.97735	0.00000
2	3.2000"-05	1.6913"+00	NM	0.74212	0.20000	0.35918	3.22520	0.11137
3	1.0800"-04	3.0492"+00	NM	0.77180	0.31111	0.52059	2.79999	0.18592
4	2.6000"-04	4.6695"+00	NM	0.81262	0.40000	0.63120	2.49012	0.25348
5	3.6200"-04	5.6404"+00	NM	0.82560	0.44444	0.67641	2.31627	0.29203
6	5.1400"-04	6.7165"+00	NM	0.83859	0.48889	0.71716	2.15187	0.33327
7	9.2100"-04	8.5261"+00	NM	0.86271	0.55556	0.77306	1.93630	0.39925
8	1.5810"-03	1.2061"+01	NM	0.89239	0.66667	0.84577	1.60950	0.52549
9	2.1400"-03	1.5354"+01	NM	0.91466	0.75556	0.89227	1.39463	0.63979
10	2.6480"-03	1.8095"+01	NM	0.93135	0.82222	0.92230	1.25825	0.73300
11	3.1560"-03	2.1068"+01	NM	0.94620	0.88889	0.94811	1.13769	0.83337
12	3.3590"-03	2.2111"+01	NM	0.94991	0.91111	0.95547	1.09973	0.86882
13	3.6130"-03	2.3179"+01	NM	0.95547	0.93333	0.96347	1.06562	0.90414
14	3.8670"-03	2.4273"+01	NM	0.95918	0.95556	0.97028	1.03105	0.94106
15	4.0700"-03	2.5393"+01	NM	0.96104	0.97778	0.97589	0.99615	0.97967
16	4.3240"-03	2.5393"+01	NM	0.96289	0.97778	0.97684	0.99807	0.97872
17	4.4770"-03	2.5393"+01	NM	0.96475	0.97778	0.97778	1.00000	0.97778
18	4.6800"-03	2.6539"+01	NM	0.96475	1.00000	0.98222	0.96475	1.01811
19	4.9340"-03	2.6539"+01	NM	0.96475	1.00000	0.98222	0.96475	1.01811
20	5.0360"-03	2.6539"+01	NM	0.96475	1.00000	0.98222	0.96475	1.01811
21	5.1880"-03	2.6539"+01	NM	0.96660	1.00000	0.98316	0.96660	1.01713
22	5.6960"-03	2.6539"+01	NM	0.96660	1.00000	0.98316	0.96660	1.01713
23	6.2040"-03	2.6539"+01	NM	0.96846	1.00000	0.98410	0.96846	1.01615
24	6.4580"-03	2.6539"+01	NM	0.97032	1.00000	0.98505	0.97032	1.01515
25	7.9820"-03	2.6539"+01	NM	0.97403	1.00000	0.98693	0.97403	1.01325
26	9.5060"-03	2.6539"+01	NM	0.97774	1.00000	0.98881	0.97774	1.01132
27	1.0116"-02	2.6539"+01	NM	0.97959	1.00000	0.98974	0.97959	1.01036
28	1.2300"-02	2.6539"+01	NM	0.98701	1.00000	0.99349	0.98701	1.00656
29	1.6110"-02	2.6539"+01	NM	0.99443	1.00000	0.99721	0.99443	1.00279
30	1.8650"-02	2.6539"+01	NM	0.99814	1.00000	0.99907	0.99814	1.00093
D 31	2.1952"-02	2.6539"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,TO,M ASSUME P=PD

SECTION D: ADDITIONAL DATA - WALL PRESSURE, TEMPERATURE AND HEAT TRANSFER.

From Boldman & Graham (1972).

STATIONS		X	Diameter	PW/POD	MD	Series 01		Series 02	
PROFILE CAT 6901	AUTHOR'S NUMBER	mm (AXIAL)	mm	EXPERIMENTAL		TW K	h_i kg/m^2s	TW K	h_i kg/m^2s
	2	- 114.68	158.75	0.99946	0.02778	406.6	0.717	376.2	0.448
	3	- 89.28	129.34	0.99847	0.04667	415.7	0.823	389.3	0.598
XX01		- 63.80	99.92	0.99565	0.07894	446.6	1.294	419.6	0.970
	5	- 54.81	89.61	0.99326	0.09841	449.4	1.455	423.8	1.097
	6	- 46.02	79.45	0.98887	0.12655	448.1	1.638	427.7	1.174
	7	- 37.08	69.14	0.9804	0.16840	454.8	1.891	434.6	1.336
	8	- 28.19	58.83	0.9624	0.23463	463.9	2.390	444.4	1.715
	9	- 15.57	44.70	0.8399	0.50553	479.5	3.122	456.9	2.088
	10	- 4.55	38.35	0.5733	0.92813	481.0	3.382	457.3	2.348
THROAT	11	0	37.90	0.4600	1.11446	478.8	3.347	457.7	2.299
	12	3.30	38.15	0.3733	1.27507	468.9	2.587	445.9	1.828
	13	6.48	39.12	0.2785	1.48469	459.8	2.383	441.3	1.701
	14	9.96	40.74	0.2084	1.68125	451.7	2.229	436.7	1.708
	15	16.10	43.99	0.1820	1.77070	452.5	2.299	434.5	1.610
XX02	16	31.01	51.87	0.1125	2.08183	444.2	1.955	424.8	1.399
	17	69.49	72.59	0.0375	2.78852	411.0	0.970	397.8	0.893
XX03	18	138.89	109.78	0.0094	3.73770	365.8	0.412	350.5	0.356
	19	208.31	147.12	0.0038	4.42415	330.0	0.214	321.6	0.193
XX04	19a	241.79	165.19	0.0027	4.70038	-	-	-	-
	20	280.21	185.93	0.0024	4.7980	321.6	0.174	316.7	0.141

NOTES:

a) All data have been normalised to the reservoir conditions:

PO = 2.068 MN/m^2 TO = 539 K.

b) The wall temperatures given here were taken over a period of time, and do not necessarily match the values given with the profiles. The shape of the distribution and the variation and values of the enthalpy heat transfer coefficient should, however, be representative.

c) The heat transfer coefficient h_i is defined as

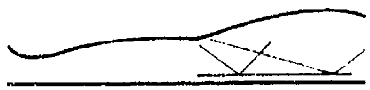
$$h_i = q / \left(i_{ad} - i_w\right)$$

where q = heat flux rate / unit area

i = enthalpy of fluid

ad = at recovery temperature

w = at wall temperature

	M : Approximately 1.4 rising to 3 R THETA X 10^{-3} : 4 - 2 TH/TR : 1	6902 FPG - AW

Continuous running tunnel with a single block half-nozzle. W = 80 mm.
PO : 0.1 MN/m^2. TO : 300 K. Air. RE/m X 10^{-6} : 10 - 15.

MICHEL R., QUEMARD C. and ELENA M-P., 1969. Distributions de vitesses des couches limites turbulentes en écoulement compressible, uniform ou accéléré. La Recherche Aérospatiale no 128, 33-47.
And Michel R., private communication.

1 The test boundary layer was formed on a straight wall (W = 80 mm) opposite a rigid nozzle block. Three tests were made. For series 01 the throat height was 35 mm and the flow expanded to the nozzle design Mach number of 1.4. The nominally uniform flow is then accelerated by expansion waves originating from a convex circular arc continuation (radius 182 mm) of the upper surface of the nozzle. For the second test the circular arc was replaced by a sharp corner turning the flow through 21°. For the third, the sharp corner was retained but the flat surface was closer to the nozzle block so that the throat height was reduced to 20 mm giving a nominal (one-dimensional) Mach number of 1.55 just before the expansion. The test area on the flat wall extended from X = - 19 to X = 120 mm, in all cases including an initial constant
4 pressure region before entering (X = 0) the reflected wave expansion. The tests were complete upstream of any second reflection of the expansion.

6 Static pressure (tapping diameter 0.5 mm) could be measured at 10 mm intervals along the flat test surface.
7 The wall "was adiabatic" but no measurements of temperature were made. Pitot profiles were obtained with
9 an FPP (h_1 = 0.18, h_2 = 0.08, b_1 = 2 mm) and the data was reduced assuming no normal pressure gradient and a modified Crocco relationship (Michel, 1963) for the total temperature, with a recovery factor of 0.9. For each case at least two profiles out of a total of 12 were taken in the flow upstream of the
12 expansion. The editors have assumed that the flow was adiabatic and applied the usual Crocco-Van Driest temperature velocity relationship with a recovery factor of 0.896.

§ DATA: 6902 0101-0313. Pitot profiles. NX = 12, 13.

15 Editors' comments

These tests were performed at relatively low Reynolds number, and the profiles downstream of the fourth station almost certainly display marked re-laminarisation characteristics. Comparisons are not possible, the most nearly matched available data (Pasiuk et al. - CAT 6504, Thomas - CAT 7401) being at much higher Reynolds number.

The expansion was applied as a reflected wave so that normal pressure gradient effects should be small except at the start, near X = 0. The author writes that "results from regions where a normal pressure gradient could be noticed have not been retained".

The physical scale of the equipment is small, and measurements do not extend within the momentum deficit peak, so that integral values should be treated with reserve.

CAT 6902   MICHEL   BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
69020101	1.3900	1.0000	2.5908"+03	NM	2.1978	1.4030	3.1942"+04	3.1942"+04
-7.0000"-03	1.0023"+05	1.0000	3.2909"+03	NM	1.7916	1.7850	2.8839"+02	2.1422"+02
INFINITE	2.9700"+02	0.0000	2.1969"-04	NM	0.0519	2.4702"-04	4.0790"+02	2.8839"+02
69020102	1.4420	1.0000	2.7192"+03	NM	2.1949	1.3539	3.0082"+04	3.00[illegible]2"+04
1.2000"-02	1.0160"+05	1.0000	3.5121"+03	NM	1.8130	1.8071	2.8599"+02	2.0835"+02
INFINITE	2.9500"+02	0.0000	2.3125"-04	NM	0.0554	2.5949"-04	4.1732"+02	2.8599"+02
69020103	1.5000	1.0000	2.4082"+03	NM	2.2409	1.3379	2.7172"+04	2.7172"+04
1.8000"-02	9.9750"+04	1.0000	3.1642"+03	NM	1.8242	1.8183	2.9225"+02	2.0828"+02
INFINITE	3.0200"+02	0.0000	2.2162"-04	NM	0.0589	2.4937"-04	4.3403"+02	2.9225"+02
69020104	1.5700	1.0000	2.2515"+03	NM	2.3154	1.3313	2.4401"+04	2.4401"+04
2.4000"-02	9.9220"+04	1.0000	3.0301"+03	NM	1.8319	1.8254	2.8680"+02	1.9893"+02
INFINITE	2.9700"+02	0.0000	2.1231"-04	NM	0.0629	2.4022"-04	4.4398"+02	2.8680"+02
69020105	1.6150	1.0000	2.1938"+03	NM	2.3590	1.3226	2.2998"+04	2.2998"+04
2.8500"-02	9.9950"+04	1.0000	2.9973"+03	NM	1.8385	1.8315	2.8641"+02	1.9518"+02
INFINITE	2.9700"+02	0.0000	2.1114"-04	NM	0.0655	2.3940"-04	4.5238"+02	2.8641"+02
69020106	1.7000	1.0000	2.0626"+03	NM	2.4475	1.3083	1.9804"+04	1.9804"+04
3.9000"-02	9.7750"+04	1.0000	2.9010"+03	NM	1.8490	1.8409	2.8569"+02	1.8821"+02
INFINITE	2.9700"+02	0.0000	2.1463"-04	NM	0.0704	2.4443"-04	4.6761"+02	2.8569"+02
69020107	1.7700	1.0000	1.9762"+03	NM	2.5425	1.3076	1.8247"+04	1.8247"+04
4.7500"-02	1.0015"+05	1.0000	2.8494"+03	NM	1.8494	1.8409	2.8366"+02	1.8167"+02
INFINITE	2.9550"+02	0.0000	2.0943"-04	NM	0.0741	2.4093"-04	4.7833"+02	2.8366"+02
69020108	1.8350	1.0000	1.9779"+03	NM	2.6046	1.2881	1.6405"+04	1.6405"+04
5.6000"-02	9.9450"+04	1.0000	2.9173"+03	NM	1.8600	1.8509	2.8457"+02	1.7748"+02
INFINITE	2.9700"+02	0.0000	2.2284"-04	NM	0.0778	2.5645"-04	4.9014"+02	2.8457"+02
69020109	1.9400	1.0000	1.9636"+03	NM	2.7517	1.2828	1.4068"+04	1.4068"+04
7.0000"-02	1.0028"+05	1.0000	3.0059"+03	NM	1.8614	1.8507	2.8373"+02	1.6945"+02
INFINITE	2.9700"+02	0.0000	2.3790"-04	NM	0.0831	2.7749"-04	5.0633"+02	2.8373"+02
69020110	2.0500	1.0000	1.8185"+03	NM	3.0087	1.3422	1.1793"+04	1.1793"+04
8.6000"-02	9.9750"+04	1.0000	2.9016"+03	NM	1.8383	1.8206	2.8289"+02	1.6137"+02
INFINITE	2.9700"+02	0.0000	2.4213"-04	NM	0.0873	2.9302"-04	5.2212"+02	2.8289"+02
69020111	2.1450	1.0000	1.8178"+03	NM	3.0669	1.2776	1.0086"+04	1.0086"+04
1.0000"-01	9.8950"+04	1.0000	3.0060"+03	NM	1.8652	1.8511	2.8220"+02	1.5467"+02
INFINITE	2.9700"+02	0.0000	2.6430"-04	NM	0.0930	3.1633"-04	5.3486"+02	2.8220"+02
69020112	2.2600	1.0000	1.6884"+03	NM	3.2772	1.2856	8.4756"+03	8.4756"+03
1.1600"-01	9.9550"+04	1.0000	2.9171"+03	NM	1.8612	1.8452	2.8139"+02	1.4692"+02
INFINITE	2.9700"+02	0.0000	2.6962"-04	NM	0.0978	3.3006"-04	5.4923"+02	2.8139"+02

CAT 6902 MICHEL BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
69020201	1.3800	1.0000	2.8033"+03	NM	2.2186	1.4297	3.2725"+04	3.2725"+04
-1.9000"-02	1.0126"+05	1.0000	3.5492"+03	NM	1.7900	1.7841	2.8945"+02	2.1580"+02
INFINITE	2.9800"+02	0.0000	2.3524"-04	NM	0.0510	2.6444"-04	4.0646"+02	2.8945"+02
69020202	1.3800	1.0000	2.8960"+03	NM	2.2095	1.4214	3.2359"+04	3.2359"+04
-6.0000"-03	1.0012"+05	1.0000	3.6650"+03	NM	1.7874	1.7809	2.9178"+02	2.1754"+02
INFINITE	3.0040"+02	0.0300	2.4830"-04	NM	0.0509	2.7932"-04	4.0809"+02	2.9178"+02
69020203	1.4200	1.0000	2.9352"+03	NM	2.2013	1.3758	3.0587"+04	3.0587"+04
6.5000"-03	1.0012"+05	1.0000	3.7577"+03	NM	1.7965	1.7904	2.9608"+02	2..749"+02
INFINITE	3.0520"+02	0.0000	2.6166"-04	NM	0.0533	2.9510"-04	4.1987"+02	2.9608"+02
69020204	1.6200	1.0000	2.3391"+03	NM	2.3461	1.3082	2.2639"+04	2.2639"+04
2.0000"-02	9.9125"+04	1.0000	3.2027"+03	NM	1.8460	1.8402	2.8444"+02	1.9346"+02
INFINITE	2.9500"+02	0.0000	2.2576"-04	NM	0.0661	2.5506"-04	4.5177"+02	2.8444"+02
69020205	1.7500	1.0000	1.8969"+03	NM	2.5126	1.3100	1.8781"+04	1.8781"+04
2.7500"-02	9.9992"+04	1.0000	2.7079"+03	NM	1.8572	1.8493	2.9449"+02	1.9014"+02
INFINITE	3.0660"+02	0.0000	2.0808"-04	NM	0.0734	2.3720"-04	4.8382"+02	2.9449"+02
69020206	1.8500	1.0000	1.7341"+03	NM	2.6456	1.3074	1.6075"+04	1.6075"+04
3.4000"-02	9.9725"+04	1.0000	2.5651"+03	NM	1.8632	1.8527	2.9269"+02	1.8142"+02
INFINITE	3.0560"+02	0.0000	2.0437"-04	NM	0.0783	2.3481"-04	4.9960"+02	2.9269"+02
69020207	1.8900	1.0000	1.7830"+03	NM	2.6843	1.2932	1.5034"+04	1.5034"+04
3.7000"-02	9.9192"+04	1.0000	2.6849"+03	NM	1.8695	1.8602	2.8126"+02	1.7149"+02
INFINITE	2.9400"+02	0.0000	2.0730"-04	NM	0.0806	2.3833"-04	4.9623"+02	2.8126"+02
69020208	2.0500	1.0000	1.6457"+03	NM	2.9041	1.2809	1.1885"+04	1.1885"+04
4.8000"-02	1.0052"+05	1.0000	2.6178"+03	NM	1.8795	1.8672	2.9166"+02	1.6637"+02
INFINITE	3.0620"+02	0.0000	2.2609"-04	NM	0.0890	2.6267"-04	5.3015"+02	2.9166"+02
69020209	2.1800	1.0000	1.5353"+03	NM	3.1290	1.2912	9.6873"+03	9.6873"+03
5.8000"-02	1.0039"+05	1.0000	2.5646"+03	NM	1.8759	1.8589	2.9011"+02	1.5668"+02
INFINITE	3.0560"+02	0.0000	2.3518"-04	NM	0.0948	2.7882"-04	5.4711"+02	2.9011"+02
69020210	2.2900	1.0000	1.4445"+03	NM	3.2955	1.2761	8.1227"+03	8.1227"+03
6.7000"-02	9.9992"+04	1.0000	2.5173"+03	NM	1.8814	1.8638	2.8810"+02	1.4852"+02
INFINITE	3.0430"+02	0.0000	2.4326"-04	NM	0.0998	2.9105"-04	5.5956"+02	2.8810"+02
69020211	2.3800	1.0000	1.4313"+03	NM	3.4493	1.2740	7.0469"+03	7.0469"+03
7.6500"-02	9.9858"+04	1.0000	2.5795"+03	NM	1.8864	1.8685	2.8985"+02	1.4384"+02
INFINITE	3.0680"+02	0.0000	2.6433"-04	NM	0.1038	3.1819"-04	5.7231"+02	2.8985"+02
69020212	2.5600	1.0000	1.3537"+03	NM	3.8321	1.2951	5.3208"+03	5.3208"+03
9.9000"-02	9.9792"+04	1.0000	2.6160"+03	NM	1.8735	1.8500	2.8889"+02	1.3286"+02
INFINITE	3.0700"+02	0.0000	2.9508"-04	NM	0.1101	3.7161"-04	5.9162"+02	2.8889"+02

CAT 6902 MICHEL BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
69020301	1.5400	1.0000	2.2327"+03	NM	2.3915	1.4121	2.5844"+04	2.5844"+04
-1.3000"-02	1.0056"+05	1.0000	2.9735"+03	NM	1.7879	1.7803	2.8958"+02	2.0321"+02
INFINITE	2.9960"+02	0.0000	2.0637"-04	NM	0.0598	2.3846"-04	4.4015"+02	2.8958"+02
69020302	1.5450	1.0000	2.2929"+03	NM	2.3532	1.3774	2.5308"+04	2.5308"+04
-3.0000"-03	9.9200"+04	1.0000	3.0617"+03	NM	1.8005	1.7944	2.8518"+02	1.9974"+02
INFINITE	2.9510"+02	0.0000	2.1134"-04	NM	0.0605	2.4289"-04	4.3780"+02	2.8518"+02
69020303	1.7450	1.0000	1.7612"+03	NM	2.5625	1.3473	1.9043"+04	1.9043"+04
1.1000"-02	1.0062"+05	1.0000	2.5115"+03	NM	1.8343	1.8251	2.9203"+02	1.8894"+02
INFINITE	3.0400"+02	0.0000	1.8924"-04	NM	0.0722	2.1934"-04	4.8091"+02	2.9203"+02
69020304	1.9300	1.0000	1.6487"+03	NM	2.7565	1.2992	1.4083"+04	1.4083"+04
1.9000"-02	9.8850"+04	1.0000	2.5180"+03	NM	1.8611	1.8513	2.8228"+02	1.6929"+02
INFINITE	2.9540"+02	0.0000	1.9965"-04	NM	0.0826	2.3269"-04	5.0347"+02	2.8228"+02
69020305	2.1150	1.0000	1.3688"+03	NM	3.0572	1.3128	1.0561"+04	1.0561"+04
2.7500"-02	9.8870"+04	1.0000	2.2389"+03	NM	1.8655	1.8504	2.8146"+02	1.5623"+02
INFINITE	2.9600"+02	0.0000	1.9333"-04	NM	0.0916	2.3001"-04	5.3003"+02	2.8146"+02
69020306	2.2350	1.0000	1.3097"+03	NM	3.2808	1.3331	8.8607"+03	8.8607"+03
3.4000"-02	1.0008"+05	1.0000	2.2445"+03	NM	1.8650	1.8442	2.7815"+02	1.4677"+02
INFINITE	2.9340"+02	0.0000	2.0037"-04	NM	0.0969	2.4219"-04	5.4288"+02	2.7815"+02
69020307	2.3500	1.0000	1.2140"+03	NM	3.4714	1.3234	7.3920"+03	7.3920"+03
4.0000"-02	9.9950"+04	1.0000	2.1717"+03	NM	1.8680	1.8459	2.8069"+02	1.4108"+02
INFINITE	2.9690"+02	0.0000	2.0908"-04	NM	0.1020	2.5637"-04	5.5964"+02	2.8069"+02
69020308	2.4600	1.0000	1.0846"+03	NM	3.6778	1.3329	6.2388"+03	6.2388"+03
4.6000"-02	1.0016"+05	1.0000	2.0247"+03	NM	1.8761	1.8525	2.8028"+02	1.3446"+02
INFINITE	2.9720"+02	0.0000	2.0617"-04	NM	0.1068	2.5418"-04	5.7193"+02	2.8028"+02
69020309	2.5450	1.0000	1.0235"+03	NM	3.7990	1.3030	5.4902"+03	5.4902"+03
5.1000"-02	1.0060"+05	1.0000	1.9736"+03	NM	1.8816	1.8581	2.8145"+02	1.3026"+02
INFINITE	2.9900"+02	0.0000	2.1102"-04	NM	0.1104	2.6157"-04	5.8238"+02	2.8145"+02
69020310	2.6300	1.0000	9.5665"+02	NM	4.0270	1.3500	4.8054"+03	4.8054"+03
5.6000"-02	1.0044"+05	1.0000	1.9017"+03	NM	1.8774	1.8469	2.8659"+02	1.2797"+02
INFINITE	3.0500"+02	0.0000	2.1920"-04	NM	0.1133	2.7600"-04	5.9651"+02	2.8659"+02
69020311	2.7250	1.0000	9.1127"+02	NM	4.1678	1.3062	4.1613"+03	4.1613"+03
6.2500"-02	1.0068"+05	1.0000	1.8818"+03	NM	1.8813	1.8539	2.8464"+02	1.2213"+02
INFINITE	3.0350"+02	0.0000	2.2614"-04	NM	0.1169	2.8814"-04	6.0378"+02	2.8464"+02
69020312	2.8000	1.0000	8.8394"+02	NM	4.3207	1.3062	3.6996"+03	3.6996"+03
6.8000"-02	1.0040"+05	1.0000	1.8800"+03	NM	1.8843	1.8547	2.8423"+02	1.1819"+02
INFINITE	3.0350"+02	0.0000	2.3595"-04	NM	0.1197	3.0226"-04	6.1031"+02	2.8423"+02
69020313	2.9050	1.0000	9.0619"+02	NM	4.6022	1.3455	3.0964"+03	3.0964"+03
7.8500"-02	9.8570"+04	1.0000	2.0082"+03	NM	1.8797	1.8422	2.8415"+02	1.1310"+02
INFINITE	3.0400"+02	0.0000	2.7285"-04	NM	0.1228	3.5632"-04	6.1943"+02	2.8415"+02

69020302 MICHEL PROFILE TABULATION 27 POINTS, DELTA AT POINT 27

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96639	0.00000	0.00000	1.42775	0.00000
2	9.0000"-05	1.5591"+00	NM	0.97852	0.53232	0.60070	1.27340	0.47173
3	1.0000"-04	1.5669"+00	NM	0.97865	0.53550	0.60390	1.27175	0.47486
4	1.2000"-04	1.6029"+00	NM	0.97924	0.54980	0.61820	1.26428	0.48897
5	1.4000"-04	1.6368"+00	NM	0.97977	0.56271	0.63100	1.25744	0.50181
6	1.6000"-04	1.6791"+00	NM	0.98043	0.57818	0.64620	1.24914	0.51732
7	1.8000"-04	1.7163"+00	NM	0.98098	0.59122	0.65890	1.24205	0.53050
8	2.0000"-04	1.7622"+00	NM	0.98165	0.60667	0.67380	1.23355	0.54623
9	2.5000"-04	1.8483"+00	NM	0.98285	0.63391	0.69970	1.21833	0.57431
10	3.0000"-04	1.9095"+00	NM	0.98366	0.65208	0.71670	1.20803	0.59328
11	3.5000"-04	1.9692"+00	NM	0.98442	0.66895	0.73230	1.19837	0.61108
12	4.0000"-04	2.0230"+00	NM	0.98509	0.68372	0.74580	1.18983	0.62681
13	4.5000"-04	2.0732"+00	NM	0.98568	0.69677	0.75760	1.18224	0.64082
14	5.0000"-04	2.1265"+00	NM	0.98631	0.71039	0.76980	1.17427	0.65556
15	6.0000"-04	2.2266"+00	NM	0.98745	0.73496	0.79150	1.15978	0.68246
16	7.0000"-04	2.3204"+00	NM	0.98848	0.75698	0.81060	1.14669	0.70690
17	8.0000"-04	2.4095"+00	NM	0.98942	0.77714	0.82780	1.13463	0.72957
18	1.0000"-03	2.5921"+00	NM	0.99128	0.81650	0.86060	1.11095	0.77466
19	1.2000"-03	2.7868"+00	NM	0.99316	0.85603	0.89250	1.08702	0.82105
20	1.4000"-03	2.9615"+00	NM	0.99477	0.88976	0.91890	1.06657	0.86155
21	1.6000"-03	3.1547"+00	NM	0.99647	0.92543	0.94600	1.04495	0.90531
22	1.8000"-03	3.2968"+00	NM	0.99767	0.95070	0.96470	1.02967	0.93691
23	2.0000"-03	3.4203"+00	NM	0.99868	0.97208	0.98020	1.01677	0.96403
24	2.2000"-03	3.5122"+00	NM	0.99942	0.98765	0.99130	1.00741	0.98401
25	2.4000"-03	3.5545"+00	NM	0.99975	0.99473	0.99630	1.00316	0.99316
26	2.6000"-03	3.5784"+00	NM	0.99994	0.99872	0.99910	1.00077	0.99833
D 27	2.8000"-03	3.5861"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

69020305 MICHEL PROFILE TABULATION 37 POINTS, DELTA AT POINT 37

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95089	0.00000	0.00000	1.80160	0.00000
2	9.0000"-05	2.0008"+00	NM	0.96901	0.49497	0.60740	1.50586	0.40336
3	1.0000"-04	2.0712"+00	NM	0.96985	0.50862	0.62130	1.49217	0.41637
4	1.2000"-04	2.1950"+00	NM	0.97126	0.53132	0.64400	1.46915	0.43835
5	1.4000"-04	2.3693"+00	NM	0.97313	0.56112	0.67300	1.43853	0.46784
6	1.6000"-04	2.5162"+00	NM	0.97463	0.58470	0.69530	1.41407	0.49170
7	1.8000"-04	2.6778"+00	NM	0.97621	0.60936	0.71800	1.38836	0.51716
8	2.0000"-04	2.8176"+00	NM	0.97752	0.62975	0.73630	1.36702	0.53862
9	2.5000"-04	3.1121"+00	NM	0.98012	0.67037	0.77150	1.32448	0.58249
10	3.0000"-04	3.3826"+00	NM	0.98236	0.70537	0.80050	1.28794	0.62154
11	3.5000"-04	3.6607"+00	NM	0.98453	0.73947	0.82760	1.25257	0.66072
12	4.0000"-04	3.9240"+00	NM	0.98646	0.77025	0.85110	1.22094	0.69708
13	4.5000"-04	4.1384"+00	NM	0.98797	0.79439	0.86890	1.19640	0.72626
14	5.0000"-04	4.2987"+00	NM	0.98905	0.81193	0.88150	1.17872	0.74784
15	6.0000"-04	4.4842"+00	NM	0.99026	0.83174	0.89540	1.15892	0.77261
16	7.0000"-04	4.5925"+00	NM	0.99095	0.84309	0.90320	1.14768	0.78698
17	8.0000"-04	4.6435"+00	NM	0.99127	0.84838	0.90680	1.14246	0.79373
18	9.0000"-04	4.7069"+00	NM	0.99167	0.85490	0.91120	1.13604	0.80208
19	1.0000"-03	4.7580"+00	NM	0.99198	0.86013	0.91470	1.13092	0.80881
20	1.2000"-03	4.8232"+00	NM	0.99238	0.86675	0.91910	1.12445	0.81738
21	1.4000"-03	4.9323"+00	NM	0.99303	0.87770	0.92630	1.11380	0.83166
22	1.6000"-03	5.0714"+00	NM	0.99384	0.89147	0.93520	1.10052	0.84978
23	1.8000"-03	5.1875"+00	NM	0.99451	0.90279	0.94240	1.08969	0.86484
24	2.0000"-03	5.3355"+00	NM	0.99533	0.91701	0.95130	1.07617	0.88396
25	2.2000"-03	5.4766"+00	NM	0.99610	0.93036	0.95950	1.06361	0.90211
26	2.4000"-03	5.5881"+00	NM	0.99670	0.94078	0.96580	1.05389	0.91641
27	2.6000"-03	5.7358"+00	NM	0.99747	0.95439	0.97390	1.04130	0.93528
28	2.8000"-03	5.8294"+00	NM	0.99795	0.96292	0.97890	1.03347	0.94720
29	3.0000"-03	5.9307"+00	NM	0.99846	0.97206	0.98420	1.02513	0.96007
30	3.2000"-03	6.0106"+00	NM	0.99886	0.97921	0.98830	1.01865	0.97021
31	3.4000"-03	6.0899"+00	NM	0.99925	0.98625	0.99230	1.01230	0.98025
32	3.6000"-03	6.1442"+00	NM	0.99951	0.99105	0.99500	1.00800	0.98711
33	3.8000"-03	6.1869"+00	NM	0.99972	0.99479	0.99710	1.00464	0.99249
34	4.0000"-03	6.2134"+00	NM	0.99984	0.99712	0.99840	1.00256	0.99585
35	4.2000"-03	6.2361"+00	NM	0.99995	0.99910	0.99950	1.00080	0.99870
36	4.4000"-03	6.2402"+00	NM	0.99997	0.99946	0.99970	1.00048	0.99922
D 37	4.6000"-03	6.2464"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

69020309 MICHEL PROFILE TABULATION 37 POINTS, DELTA AT POINT 37

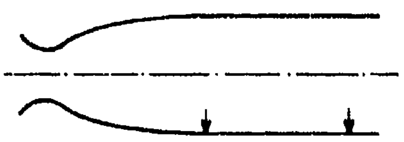
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94131	0.00000	0.00000	2.16068	0.00000
2	9.0000"-05	1.7889"+00	NM	0.95654	0.37356	0.50940	1.85950	0.27394
3	1.0000"-04	1.9485"+00	NM	0.95734	0.38488	0.52260	1.84369	0.28345
4	1.2000"-04	2.0653"+00	NM	0.96003	0.42174	0.56440	1.79095	0.31514
5	1.4000"-04	2.3342"+00	NM	0.96296	0.46147	0.60740	1.73247	0.35060
6	1.6000"-04	2.5727"+00	NM	0.96536	0.49320	0.64020	1.68497	0.37995
7	1.8000"-04	2.8524"+00	NM	0.96798	0.52747	0.67410	1.63326	0.41273
8	2.0000"-04	3.1352"+00	NM	0.97044	0.55965	0.70450	1.58461	0.44459
9	2.5000"-04	3.8058"+00	NM	0.97567	0.62876	0.76520	1.48107	0.51665
10	3.0000"-04	4.2511"+00	NM	0.97877	0.67045	0.79890	1.41989	0.56265
11	4.0000"-04	5.1008"+00	NM	0.98399	0.74324	0.85280	1.31656	0.64775
12	4.5000"-04	5.3565"+00	NM	0.98542	0.76373	0.86690	1.28841	0.67284
13	5.0000"-04	5.6482"+00	NM	0.98697	0.78645	0.88200	1.25776	0.70125
14	6.0000"-04	6.0464"+00	NM	0.98896	0.81641	0.90110	1.21823	0.73968
15	7.0000"-04	6.3334"+00	NM	0.99033	0.83733	0.91390	1.19127	0.76717
16	8.0000"-04	6.5026"+00	NM	0.99110	0.84941	0.92110	1.17593	0.78329
17	9.0000"-04	6.6039"+00	NM	0.99156	0.85656	0.92530	1.16693	0.79294
18	1.0000"-03	6.6431"+00	NM	0.99173	0.85931	0.92690	1.16349	0.79666
19	1.1000"-03	6.6431"+00	NM	0.99173	0.85931	0.92690	1.16349	0.79666
20	1.2000"-03	6.6900"+00	NM	0.99194	0.86259	0.92880	1.15940	0.80111
21	1.3000"-03	6.7223"+00	NM	0.99208	0.86485	0.93010	1.15659	0.80417
22	1.4000"-03	6.7851"+00	NM	0.99235	0.86921	0.93260	1.15119	0.81012
23	1.6000"-03	6.9052"+00	NM	0.99287	0.87748	0.93730	1.14099	0.82148
24	1.8000"-03	7.0546"+00	NM	0.99350	0.88767	0.94300	1.12855	0.83559
25	2.0000"-03	7.1349"+00	NM	0.99383	0.89310	0.94600	1.12197	0.84316
26	2.2000"-03	7.3077"+00	NM	0.99453	0.90466	0.95230	1.10809	0.85941
27	2.4000"-03	7.4259"+00	NM	0.99500	0.91249	0.95650	1.09878	0.87051
28	2.6000"-03	7.5409"+00	NM	0.99545	0.92004	0.96050	1.08988	0.88129
29	2.8000"-03	7.6317"+00	NM	0.99580	0.92596	0.96360	1.08296	0.88978
30	3.0000"-03	7.7540"+00	NM	0.99627	0.93387	0.96770	1.07377	0.90122
31	3.5000"-03	8.0383"+00	NM	0.99732	0.95200	0.97690	1.05300	0.92773
32	4.0000"-03	8.2938"+00	NM	0.99823	0.96800	0.98480	1.03502	0.95148
33	4.5000"-03	8.4988"+00	NM	0.99894	0.98064	0.99090	1.02103	0.97049
34	5.0000"-03	8.6475"+00	NM	0.99944	0.98971	0.99520	1.01112	0.98426
35	5.5000"-03	8.7462"+00	NM	0.99977	0.99569	0.99800	1.00464	0.99339
36	6.0000"-03	8.7926"+00	NM	0.99992	0.99849	0.99930	1.00162	0.99768
D 37	6.5000"-03	8.8178"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

69020313 MICHEL PROFILE TABULATION 41 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93469	0.00000	0.00000	2.51227	0.00000
2	9.0000"-05	1.5027"+00	NM	0.94550	0.27041	0.40670	2.26214	0.17979
3	1.0000"-04	1.5233"+00	NM	0.94584	0.27514	0.41310	2.25420	0.18326
4	1.2000"-04	1.6524"+00	NM	0.94787	0.30236	0.44920	2.20713	0.20352
5	1.4000"-04	2.0380"+00	NM	0.95294	0.36567	0.52860	2.08972	0.25295
6	1.6000"-04	2.2936"+00	NM	0.95577	0.39930	0.56810	2.02421	0.28065
7	1.8000"-04	2.5720"+00	NM	0.95857	0.43201	0.60470	1.95929	0.30863
8	2.0000"-04	2.8311"+00	NM	0.96099	0.45990	0.63450	1.90345	0.33334
9	2.5000"-04	3.3857"+00	NM	0.96565	0.51383	0.68850	1.79541	0.38348
10	3.0000"-04	3.8605"+00	NM	0.96923	0.55546	0.72700	1.71299	0.42440
11	3.5000"-04	4.3099"+00	NM	0.97228	0.59201	0.75860	1.64200	0.46200
12	4.0000"-04	4.7187"+00	NM	0.97484	0.62330	0.78410	1.58251	0.49548
13	4.5000"-04	5.1455"+00	NM	0.97733	0.65431	0.80800	1.52496	0.52985
14	5.0000"-04	5.5314"+00	NM	0.97942	0.68109	0.82760	1.47648	0.56052
15	6.0000"-04	6.2622"+00	NM	0.98304	0.72906	0.86040	1.39276	0.61777
16	7.0000"-04	6.7798"+00	NM	0.98536	0.76117	0.88080	1.33904	0.65779
17	8.0000"-04	7.0652"+00	NM	0.98656	0.77830	0.89120	1.31117	0.67970
18	9.0000"-04	7.3370"+00	NM	0.98766	0.79426	0.90060	1.28570	0.70048
19	1.0000"-03	7.5762"+00	NM	0.98860	0.80805	0.90850	1.26408	0.71870
20	1.2000"-03	7.8748"+00	NM	0.98972	0.82492	0.91790	1.23812	0.74136
21	1.4000"-03	8.0669"+00	NM	0.99041	0.83560	0.92370	1.22197	0.75591
22	1.6000"-03	8.3180"+00	NM	0.99130	0.84935	0.93100	1.20149	0.77487
23	1.8000"-03	8.5196"+00	NM	0.99196	0.85975	0.93640	1.18624	0.78938
24	2.0000"-03	8.7207"+00	NM	0.99266	0.87095	0.94210	1.17005	0.80518
25	2.4000"-03	9.0122"+00	NM	0.99360	0.88625	0.94970	1.14831	0.82704
26	2.8000"-03	9.2805"+00	NM	0.99443	0.90011	0.95640	1.12900	0.84712
27	3.2000"-03	9.4713"+00	NM	0.99501	0.90983	0.96100	1.11566	0.86130
28	3.6000"-03	9.6547"+00	NM	0.99555	0.91907	0.96530	1.10313	0.87505
29	4.0000"-03	9.8565"+00	NM	0.99613	0.92914	0.96990	1.08967	0.89009
30	4.5000"-03	1.0073"+01	NM	0.99674	0.93984	0.97470	1.07555	0.90623
31	5.0000"-03	1.0307"+01	NM	0.99738	0.95122	0.97970	1.06078	0.92357
32	5.5000"-03	1.0480"+01	NM	0.99784	0.95956	0.98330	1.05009	0.93640
33	6.0000"-03	1.0652"+01	NM	0.99829	0.96779	0.98680	1.03966	0.94916
34	6.5000"-03	1.0828"+01	NM	0.99874	0.97615	0.99030	1.02920	0.96221
35	7.0000"-03	1.1004"+01	NM	0.99918	0.98439	0.99370	1.01899	0.97518
36	7.5000"-03	1.1130"+01	NM	0.99949	0.99029	0.99610	1.01177	0.98451
37	8.0000"-03	1.1188"+01	NM	0.99963	0.99301	0.99720	1.00846	0.98884
38	8.5000"-03	1.1258"+01	NM	0.99980	0.99624	0.99850	1.00453	0.99399
39	9.0000"-03	1.1280"+01	NM	0.99986	0.99724	0.99890	1.00333	0.99557
40	9.5000"-03	1.1301"+01	NM	0.99991	0.99824	0.99930	1.00212	0.99719
D 41	1.0000"-02	1.1340"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

	M : 2 - 5 R THETA X 10^{-3} : 85 - 350 TW/TR : Approximately 1	6903 ZPG - AW

Blow down tunnel with flexible symmetrical nozzle. Running time 10 - 100 s. W = H = 1.22, L = 5.2 m. 0.16 < PO < 1.6 MN/m^2 TO : 300 K. Air. dewpoint 228 K. 1.3 < RE/m X 10^{-6} < 5.6.

THOMKE G.J., Boundary layer and skin friction characteristics in the supersonic test section of the Mc Donnell-Douglas Aerophysics Laboratory Four-Foot Trisonic Wind Tunnel (Unpublished DAC Report - Private communication)
And Thomke and Roshko (1969), Roshko and Thomke (1970)

1 The test boundary layer was formed on the lower nozzle plate. Measurements were made on the floor of the tunnel test section, extending from the nozzle exit plane (X = 0) to X = 1.52 m, and a rectangular plate-
8 steel extension continuing to X = 5.18 m. The test stations were X = 1.83, 4.19 and 4.38 m. All joints and seals were filled and faired with a jointing compound, resulting in flow uniformity within ± 0.5 % in
2 Mach number with a mean Mach number gradient of - 0.013/m and - 0.0065/m at M = 2 and M = 5 respectively.
3 Transition was believed to occur naturally upstream of the nozzle. The test layer had passed through the
4 nozzle expansion, growing on one of the curved flexible nozzle plates. Pitot profiles obtained on the
5 tunnel centre-line at the last station agreed well with those obtained 0.38 m to the side. Preston tubes on the centre line and 102 mm to either side agreed well with the average reading.

6 Wall static pressure was found at orifices (d = 1.27 mm). These were placed 25.4 mm ahead of Preston tubes and Pitot rakes. An additional three tappings were placed at 25.4 mm intervals ahead of the rakes. A copper constantan thermocouple was buried 1.6 mm below the tunnel floor at X = 3.61 m. Wall shear stress was determined using Preston tubes (d_1 = 1.6, d_2 = 1.1, l = 51 mm) mounted in accordance with the practice of Hopkins and Keener (CAT 6601). The data were obtained as the average of readings from the three tubes
7 mounted at 102 mm spanwise intervals. Pitot profiles were obtained using rakes mounting 30 CPP (d_1 = 1.24 d_2 = 0.89 l = 12.4 mm) at the Y values given in the profile tables of section B. The rake mounting body
8 had a wedge cross-section with a total included leading edge angle of 7°. Profiles and Preston tube measurements for each station were made at the same value of X. The front rake was 0.38 m to the "right" of the centre line while the rear rake was 0.38 m to the "left". The Preston tubes were no closer than 152 mm (spanwise) to the rakes. Check runs at the downstream station, with and without the upstream rake in position, showed that it had no measurable influence at the downstream station.

9 The Mach number profiles obtained from the Pitot measurements were reduced to velocity profiles using
10 the Crocco / Van Driest velocity temperature correlation, the measured wall temperature, and a recovery
11 factor of 0.89. No corrections were applied to the Pitot data, and Sutherland's viscosity law was used.

12 The editors have presented the data incorporating all the assumptions and interpolation procedures of the
13 author, but using a recovery factor of 0.896. The sixteen sets of profiles represent measurements at two
14 streamwise stations for a range of Mach and Reynolds number. The associated wall shear stress data were obtained simultaneously for half the profile series.

§ DATA: 69030101-1602. PT2 profiles, NX = 2, CF obtained from Preston tubes for half the series.

15 Editors' comments

This experiment provides data at a virtually unmatched Reynolds Number over a range of Mach Number. Moore & Harkness - CAT 6502 describe a boundary layer at M = 2.7 and even higher Reynolds Number, but their experiment is not fully reported. In both cases the test layer develops over a streamwise distance which is large compared to the width of the test surface, so that the results are not necessarily completely typical of a two-dimensional flow.

Despite the very large scale of the experiment, the measurements do not reach further in than the momentum-deficit peak in 60 % of the cases. There is some evidence, in the velocity profiles, that the points nearest the wall are affected by probe interference effects, and that profiles 0502, 0801/2 and 1001 are not completely normal in the outer region.

CAT 6903 THOMKE BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CO	H32	H32K	TW*	TD
RZ	TOD	SW *	D2	PI2	H42	D2K	UD	YR
69030101	1.9900	1.0660	8.6475"+04	1.3060"-03	2.9851	1.2588	2.7159"+04	2.7159"+04
2.1336"+00	2.0923"+05	1.0000	1.4282"+05.	NM	1.8381	1.8293	2.8722"+02	1.5730"+02
INFINITE	2.8189"+02	0.0000	5.1458"-03	NM	0.0075	6.3143"-03	5.0042"+02	2.6893"+02
69030102	1.9500	1.0590	1.1529"+05	1.2060"-03	2.8764	1.2582	2.8643"+04	2.8643"+04
4.3764"+00	2.0737"+05	1.0000	1.8638"+05	NM	1.8394	1.8305	2.8500"+02	1.6006"+02
INFINITE	2.8178"+02	0.0000	6.6563"-03	NM	0.0253	8.0614"-03	4.9463"+02	2.6912"+02
69030201	2.4900	1.0790	5.0135"+04	NM	3.8837	1.2421	1.1125"+04	1.1125"+04
2.1336"+00	1.8715"+05	1.0000	1.0106"+05	NM	1.8472	1.8362	2.9000"+02	1.2731"+02
INFINITE	2.8519"+02	0.0000	5.2757"-03	NM	0.0256	7.0290"-03	5.6331"+02	2.6877"+02
69030202	2.4500	1.0780	6.3047"+04	NM	3.8523	1.2474	1.1653"+04	1.1653"+04
4.1910"+00	1.8419"+05	1.0000	1.2501"+05	NM	1.8455	1.8339	2.9000"+02	1.2961"+02
INFINITE	2.8520"+02	0.0000	6.4951"-03	NM	0.0081	8.6390"-03	5.5923"+02	2.6902"+02
69030301	2.4800	1.0770	9.8961"+04	1.0890"-03	3.8530	1.2412	2.4940"+04	2.4940"+04
2.1336"+00	4.1306"+05	1.0000	1.9877"+05	NM	1.8503	1.8397	2.8611"+02	1.2637"+02
INFINITE	2.8182"+02	0.0000	4.5984"-03	NM	0.0272	6.0849"-03	5.5897"+02	2.6566"+02
69030302	2.4600	1.0720	1.3395"+05	9.7800"-04	3.8653	1.2453	2.5919"+04	2.5919"+04
4.3764"+00	4.1611"+05	1.0000	2.6595"+05	NM	1.8467	1.8359	2.8500"+02	1.2754"+02
INFINITE	2.8191"+02	0.0000	6.0472"-03	NM	0.0099	8.0454"-03	5.5702"+02	2.6586"+02
69030401	2.9700	1.0880	3.4288"+04	NM	5.0478	1.2377	5.7196"+03	5.7196"+03
2.1336"+00	2.0697"+05	1.0000	8.4053"+04	NM	1.8511	1.8371	2.8944"+02	1.0224"+02
INFINITE	2.8505"+02	0.0000	5.2297"-03	NM	0.0257	7.6843"-03	6.0616"+02	2.6603"+02
69030402	2.9400	1.0840	4.7532"+04	NM	4.9112	1.2389	6.1885"+03	6.1885"+03
4.1910"+00	2.0770"+05	1.0000	1.1496"+05	NM	1.8516	1.8369	2.8889"+02	1.0455"+02
INFINITE	2.8530"+02	0.0000	6.8008"-03	NM	0.0284	9.7776"-03	6.0274"+02	2.6650"+02
69030501	2.9800	1.0860	4.4402"+04	NM	5.0034	1.2330	7.7164"+03	7.7164"+03
2.1336"+00	2.7506"+05	1.0000	1.0922"+05	NM	1.8544	1.8407	2.9000"+02	1.0305"+02
INFINITE	2.8607"+02	0.0000	5.0641"-03	NM	0.0275	7.3739"-03	6.0652"+02	2.6703"+02
69030502	2.9300	1.0840	6.3820"+04	NM	4.8704	1.2315	8.3366"+03	8.3366"+03
4.1910"+00	2.7561"+05	1.0000	1.5365"+05	NM	1.8551	1.8413	2.9000"+02	1.0539"+02
INFINITE	2.8635"+02	0.0000	6.9297"-03	NM	0.0284	9.9658"-03	6.0309"+02	2.6753"+02
69030601	2.9800	0.9950	7.0927"+04	9.8500"-04	4.6720	1.2279	1.2678"+04	1.2678"+04
2.1336"+00	4.5192"+05	1.0000	1.6064"+05	NM	1.8578	1.8450	2.8889"+02	1.1204"+02
INFINITE	3.1104"+02	0.0000	5.1187"-03	NM	0.1249	7.2061"-03	6.3243"+02	2.9034"+02
69030602	2.9600	0.9980	8.7752"+04	9.3100"-04	4.6682	1.2260	1.2986"+04	1.2986"+04
4.3764"+00	4.4717"+05	1.0000	1.9764"+05	NM	1.8579	1.8461	2.9000"+02	1.1306"+02
INFINITE	3.1119"+02	0.0000	6.2716"-03	NM	0.1106	8.8296"-03	6.3105"+02	2.9058"+02
69030701	2.7800	1.0240	1.1150"+05	9.2900"-04	4.7571	1.2280	2.2143"+04	2.2143"+04
2.1336"+00	7.8930"+05	1.0000	2.5942"+05	NM	1.8598	1.8471	2.8944"+02	1.0908"+02
INFINITE	3.0281"+02	0.0000	4.5528"-03	NM	0.0980	6.4333"-03	6.2401"+02	2.8266"+02
69030702	2.9500	1.0250	1.5069"+05	8.6500"-04	4.6856	1.2243	2.3097"+04	2.3097"+04
4.3764"+00	7.8698"+05	1.0000	3.4671"+05	NM	1.8597	1.8479	2.9000"+02	1.1054"+02
INFINITE	3.0294"+02	0.0000	6.0073"-03	NM	0.0962	8.4467"-03	6.2186"+02	2.8293"+02
69030801	3.4000	1.0890	3.2234"+04	NM	6.5562	1.2325	3.7930"+03	3.7930"+03
2.1336"+00	2.8117"+05	1.0000	9.6985"+04	NM	1.8583	1.8385	2.8556"+02	8.2714"+01
INFINITE	2.8303"+02	0.0000	5.6494"-03	NM	-0.0197	9.2248"-03	6.3457"+02	2.6222"+02
69030802	3.4200	1.0840	3.8401"+04	NM	6.1306	1.2430	4.0631"+03	4.0631"+03
4.1910"+00	2.7647"+05	1.0000	1.1246"+05	NM	1.8507	1.8334	2.8444"+02	8.4756"+01
INFINITE	2.8302"+02	0.0000	6.4746"-03	NM	0.0527	1.0373"-02	6.3128"+02	2.6240"+02

CAT 6903 THOMKE BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD TOD	TW/TR* PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
69030901	3.4800	1.0910	5.0674"+04	NM	6.6788	1.2216	6.1050"+03	6.1050"+03
2.1336"+00	4.5252"+05	1.0000	1.5260"+05	NM	1.8640	1.8451	2.6611"+02	8.2723"+01
INFINITE	2.8303"+02	0.0000	5.5461"-03	NM	-0.0588	9.7969"-03	6.3460"+02	2.6225"+02
69030902	3.4300	1.0860	5.9004"+04	NM	6.1960	1.2319	6.5010"+03	6.5010"+03
4.1910"+00	4.4874"+05	1.0000	1.7372"+05	NM	1.8573	1.8410	2.8500"+02	8.4430"+01
INFINITE	2.8309"+02	0.0000	6.1972"-03	NM	0.0351	7.8535"-03	6.3191"+02	2.6243"+02
69031001	3.4500	1.0230	8.3135"+04	8.1600"-04	6.1621	1.2174	1.0559"+04	1.0559"+04
2.1336"+00	7.5001"+05	1.0000	2.3250"+05	NM	1.8651	1.8484	2.8944"+02	9.0311"+01
INFINITE	3.0530"+02	0.0000	5.6081"-03	NM	0.0471	8.7469"-03	6.5735"+02	2.8294"+02
69031002	3.4300	1.0240	9.6711"+04	7.6500"-04	5.9633	1.2309	1.0817"+04	1.0817"+04
4.3764"+00	7.4662"+05	1.0000	2.6790"+05	NM	1.8572	1.8410	2.9000"+02	9.1113"+01
INFINITE	3.0550"+02	0.0000	6.4283"-03	NM	0.0536	1.0041"-02	6.5644"+02	2.8320"+02
69031101	3.9900	1.0520	4.2911"+04	NM	7.6877	1.2228	4.5031"+03	4.5031"+03
2.1336"+00	6.7460"+05	1.0000	1.5124"+05	NM	1.8635	1.8441	2.8667"+02	7.0725"+01
INFINITE	2.9592"+02	0.0000	5.1426"-03	NM	.0828	8.7460"-03	6.7278"+02	2.7250"+02
69031102	4.0100	1.0490	4.9386"+04	NM	7.6909	1.2111	4.4732"+03	4.4732"+03
4.1910"+00	6.8830"+05	1.0000	1.7494"+05	NM	1.8722	1.8545	2.8611"+02	7.0767"+01
INFINITE	2.9625"+02	0.0000	5.9003"-03	NM	0.0862	1.0042"-02	6.7396"+02	2.7275"+02
69031201	3.9400	0.9440	6.2496"+04	7.4900"-04	7.0652	1.2303	6.8532"+03	6.8532"+03
2.1336"+00	9.6025"+05	1.0000	1.9412"+05	NM	1.8600	1.8436	2.8722"+02	8.0453"+01
INFINITE	3.3024"+02	0.0000	5.3235"-03	NM	0.1827	8.9387"-03	7.0856"+02	3.0426"+02
69031202	3.9300	0.9510	7.5054"+04	6.6200"-04	7.0508	1.2248	7.0147"+03	7.0147"+03
4.3764"+00	9.6776"+05	1.0000	2.3359"+05	NM	1.8628	1.8445	2.8944"+02	8.0780"+01
INFINITE	3.3031"+02	0.0000	6.3124"-03	NM	0.1762	1.0528"-02	7.0820"+02	3.0436"+02
69031301	3.9400	1.0150	9.0782"+04	6.9500"-04	7.3203	1.2210	1.0821"+04	1.0821"+04
2.1336"+00	1.5163"+06	1.0000	3.0247"+05	NM	1.8629	1.8450	2.8944"+02	7.5405"+01
INFINITE	3.0951"+02	0.0000	4.7697"-03	NM	0.1266	8.1110"-03	6.8597"+02	2.8517"+02
69031302	3.9300	1.0170	1.1033"+05	6.4700"-04	7.3660	1.2180	1.1022"+04	1.1022"+04
4.3764"+00	1.5238"+06	1.0000	3.6681"+05	NM	1.8678	1.8500	2.9000"+02	7.5083"+01
INFINITE	3.0947"+02	0.0000	5.7247"-03	NM	0.1051	9.6440"-03	6.8549"+02	2.8515"+02
69031401	4.4000	1.0370	3.1809"+04	NM	8.9542	1.2292	2.8947"+03	2.8947"+03
2.1336"+00	7.3089"+05	1.0000	1.2018"+05	NM	1.8607	1.8391	2.8722"+02	6.1972"+01
INFINITE	3.0193"+02	0.0000	5.0415"-03	NM	0.1126	9.5706"-03	6.9448"+02	2.7697"+02
69031402	4.4300	1.0320	3.6611"+04	NM	8.8893	1.2126	2.8423"+03	2.8423"+03
4.1910"+00	7.5351"+05	1.0000	1.4891"+05	NM	1.8719	1.8529	2.8611"+02	6.1380"+01
INFINITE	3.0229"+02	0.0000	5.8238"-03	NM	0.1305	1.0675"-02	6.9587"+02	2.7724"+02
69031501	4.4400	0.9750	5.3791"+04	6.5500"-04	8.7974	1.2235	5.1050"+03	5.1050"+03
2.1336"+00	1.3703"+06	1.0000	2.0629"+05	NM	1.8671	1.8446	2.8944"+02	6.5495"+01
INFINITE	3.2372"+02	0.0000	4.9546"-03	NM	0.1580	9.1375"-03	7.2044"+02	2.9687"+02
69031502	4.4000	0.9800	6.6532"+04	6.0200"-04	8.6981	1.2257	5.3741"+03	5.3741"+03
4.3764"+00	1.3718"+06	1.0000	2.5254"+05	NM	1.8652	1.8426	2.9111"+02	6.6465"+01
INFINITE	3.2382"+02	0.0000	5.9440"-03	NM	0.1531	1.0958"-02	7.1921"+02	2.9705"+02
69031601	4.9200	0.9080	2.0393"+04	NM	10.8718	1.2355	1.5504"+03	1.5504"+03
2.1336"+00	7.4683"+05	1.0000	9.3017"+04	NM	1.8632	1.8355	2.9500"+02	5.5930"+01
INFINITE	3.2675"+02	0.0000	5.2348"-03	NM	0.1169	1.0979"-02	7.3778"+02	2.9858"+02
69031602	4.9200	0.9940	2.2331"+04	NM	10.4583	1.2228	1.5542"+03	1.5542"+03
4.1910"+00	7.4064"+05	1.0000	1.0230"+05	NM	1.8687	1.8447	2.9722"+02	5.6019"+01
INFINITE	3.2722"+02	0.0000	5.7559"-03	NM	0.1720	1.1625"-02	7.3832"+02	2.9902"+02

PD,POD CALCULATED FROM RE/IN,DELTA2 (AUTHOR), TOD CALCULATED FROM TW/TR,R (AUTHOR)

69030101 THOMKE PROFILE TABULATION 31 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	1.02522	0.00000	0.00000	1.83721	0.00000
2	5.8420"-04	1.7970"+00	NM	1.00070	0.37977	0.59064	1.51675	0.38941
3	2.0320"-03	2.1691"+00	NM	0.99955	0.55977	0.67032	1.43508	0.46710
4	3.5560"-03	2.3913"+00	NM	0.99919	0.60021	0.70817	1.39308	0.50835
5	5.0546"-03	2.5685"+00	NM	0.99900	0.63007	0.73506	1.36198	0.53970
6	7.4422"-03	2.8165"+00	NM	0.99884	0.66914	0.76892	1.32135	0.58192
7	9.7790"-03	2.9681"+00	NM	0.99878	0.69176	0.78785	1.29792	0.60701
8	1.2725"-02	3.1653"+00	NM	0.99876	0.71996	0.81076	1.26887	0.63896
9	1.5113"-02	3.2931"+00	NM	0.99876	0.73760	0.82470	1.25082	0.65933
10	1.7450"-02	3.3594"+00	NM	0.99877	0.74656	0.83167	1.24169	0.66979
11	2.0244"-02	3.4967"+00	NM	0.99879	0.76478	0.84562	1.22322	0.69131
12	2.2733"-02	3.6728"+00	NM	0.99884	0.78745	0.86255	1.20041	0.71855
13	2.5324"-02	3.7924"+00	NM	0.99889	0.80247	0.87351	1.18543	0.73687
14	3.0353"-02	3.9868"+00	NM	0.99897	0.82623	0.89044	1.16195	0.76633
15	3.5331"-02	4.2311"+00	NM	0.99910	0.85511	0.91036	1.13379	0.80294
16	4.0411"-02	4.5076"+00	NM	0.99926	0.88661	0.93127	1.10360	0.84385
17	4.5542"-02	4.6899"+00	NM	0.99938	0.90676	0.94422	1.08460	0.87057
18	5.0521"-02	4.9119"+00	NM	0.99952	0.93066	0.95916	1.06238	0.90284
19	5.6845"-02	5.1470"+00	NM	0.99969	0.95532	0.97410	1.03984	0.93678
20	6.3297"-02	5.3624"+00	NM	0.99984	0.97734	0.98705	1.02004	0.96766
21	6.9571"-02	5.5007"+00	NM	0.99994	0.99121	0.99502	1.00774	0.98738
22	7.6022"-02	5.5537"+00	NM	0.99997	0.99647	0.99801	1.00310	0.99492
23	8.2296"-02	5.5537"+00	NM	0.99997	0.99647	0.99801	1.00310	0.99492
24	8.8671"-02	5.5894"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 25	9.5377"-02	5.5894"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.0132"-01	5.5183"+00	NM	0.99995	0.99296	0.99602	1.00619	0.98989
27	1.1151"-01	5.5183"+00	NM	0.99995	0.99296	0.99602	1.00619	0.98989
28	1.2174"-01	5.5183"+00	NM	0.99795	0.99296	0.99602	1.00619	0.98989
29	1.3183"-01	5.5183"+00	NM	0.99995	0.99296	0.99602	1.00619	0.98989
30	1.4133"-01	5.5183"+00	NM	0.99995	0.99296	0.99602	1.00619	0.98989
31	1.5260"-01	5.5359"+00	NM	0.99996	0.99471	0.99701	1.00465	0.99240

INPUT VARIABLES Y,U/UD ASSUME P=PD AND VAN DRIEST

69030102 THOMKE PROFILE TABULATION 29 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	1.01142	0.00000	0.00000	1.78061	0.00000
2	7.1120"-04	1.6839"+00	NM	0.99404	0.45947	0.56400	1.50791	0.37403
3	2.6162"-03	2.0440"+00	NM	0.99392	0.54614	0.65200	1.42626	0.45714
4	3.9116"-03	2.3035"+00	NM	0.99414	0.59668	0.70000	1.37728	0.50825
5	5.5800"-03	2.4636"+00	NM	0.99435	0.62518	0.72600	1.34944	0.53800
6	7.8740"-03	2.6814"+00	NM	0.99463	0.66149	0.75800	1.31390	0.57691
7	1.0617"-02	2.8842"+00	NM	0.99503	0.69329	0.78300	1.28284	0.61193
8	1.2802"-02	3.0134"+00	NM	0.99527	0.71267	0.80100	1.26396	0.63372
9	2.0777"-02	3.3305"+00	NM	0.99589	0.75791	0.83700	1.22020	0.68595
10	2.3216"-02	3.3968"+00	NM	0.99602	0.76699	0.84400	1.21149	0.69666
11	2.5857"-02	3.4646"+00	NM	0.99616	0.77616	0.85100	1.20271	0.70757
12	3.0632"-02	3.7420"+00	NM	0.99672	0.81250	0.87400	1.16822	0.75157
13	3.6043"-02	3.9075"+00	NM	0.99706	0.83338	0.88300	1.14863	0.77744
14	4.1097"-02	4.0701"+00	NM	0.99739	0.85335	0.90700	1.13007	0.80260
15	4.6203"-02	4.1180"+00	NM	0.99749	0.85913	0.91100	1.12472	0.80998
16	5.1283"-02	4.3040"+00	NM	0.99787	0.88123	0.92600	1.10446	0.83842
17	5.7887"-02	4.5137"+00	NM	0.99830	0.90549	0.94200	1.08250	0.87020
18	6.4084"-02	4.6793"+00	NM	0.99863	0.92416	0.95400	1.06581	0.89509
19	7.0637"-02	4.8819"+00	NM	0.99903	0.94650	0.96800	1.04609	0.92535
20	7.6708"-02	5.0020"+00	NM	0.99926	0.95955	0.97600	1.03470	0.94327
21	8.2906"-02	5.2230"+00	NM	0.99969	0.98290	0.99000	1.01455	0.97580
22	8.9103"-02	5.2881"+00	NM	0.99981	0.98969	0.99400	1.00875	0.98538
23	9.5479"-02	5.3211"+00	NM	0.99987	0.99311	0.99600	1.00584	0.99022
24	1.0190"-01	5.3543"+00	NM	0.99994	0.99655	0.99300	1.00292	0.99509
D 25	1.1191"-01	5.3878"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.2197"-01	5.3710"+00	NM	0.99997	0.99827	0.99900	1.00146	0.99754
27	1.3226"-01	5.3710"+00	NM	0.99997	0.99827	0.99900	1.00146	0.99754
28	1.4232"-01	5.3878"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
29	1.5321"-01	5.3710"+00	NM	0.99997	0.99827	0.99900	1.00146	0.99754

INPUT VARIABLES Y,U/UD ASSUME P=PD AND VAN DRIEST

69030701 THOMKE PROFILE TABULATION 31 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95587	0.00000	0.00000	2.65356	0.00000
2	5.8420"-04	2.8342"+00	NM	0.96854	0.44863	0.63100	1.98070	0.31857
3	2.0320"-03	3.8218"+00	NM	0.97455	0.53931	0.71900	1.78617	0.40254
4	3.5560"-03	4.0859"+00	NM	0.97598	0.55966	0.73800	1.74093	0.42391
5	5.0546"-03	4.3409"+00	NM	0.97730	0.57940	0.75500	1.69949	0.44425
6	7.4422"-03	4.7865"+00	NM	0.97947	0.61252	0.78200	1.63177	0.47924
7	9.7790"-03	5.0959"+00	NM	0.98083	0.63440	0.79900	1.58794	0.50317
8	1.2725"-02	5.5129"+00	NM	0.98268	0.66272	0.82000	1.53253	0.53506
9	1.5113"-02	5.7484"+00	NM	0.98364	0.67815	0.83100	1.50294	0.55292
10	1.7450"-02	6.0291"+00	NM	0.98470	0.69557	0.84300	1.47023	0.57338
11	2.0244"-02	6.2591"+00	NM	0.98560	0.71052	0.85300	1.44262	0.59129
12	2.2733"-02	6.5105"+00	NM	0.98651	0.72590	0.86300	1.41469	0.61003
13	2.5324"-02	6.8297"+00	NM	0.98762	0.74496	0.87500	1.38075	0.63371
14	3.0353"-02	7.3485"+00	NM	0.98931	0.77492	0.89300	1.32899	0.67194
15	3.5331"-02	7.8547"+00	NM	0.99084	0.80306	0.90900	1.28211	0.70899
16	4.0411"-02	8.3371"+00	NM	0.99221	0.82899	0.92300	1.24042	0.74410
17	4.5542"-02	9.1000"+00	NM	0.99418	0.86837	0.94300	1.17979	0.79929
18	5.0521"-02	9.6053"+00	NM	0.99539	0.89352	0.95500	1.14280	0.83567
19	5.6845"-02	1.0247"+01	NM	0.99681	0.92443	0.96900	1.09906	0.88166
20	6.3277"-02	1.0591"+01	NM	0.99752	0.94059	0.97600	1.07696	0.90625
21	6.9571"-02	1.1058"+01	NM	0.99845	0.96211	0.98500	1.04832	0.93960
22	7.6022"-02	1.1443"+01	NM	0.99917	0.97946	0.99200	1.02586	0.96700
23	8.2296"-02	1.1614"+01	NM	0.99948	0.98707	0.99500	1.01618	0.97915
24	8.8671"-02	1.1786"+01	NM	0.99979	0.99479	0.99800	1.00648	0.99157
25	9.5377"-02	1.1907"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.0132"-01	1.1907"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
27	1.1151"-01	1.1907"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
28	1.2174"-01	1.1907"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 29	1.3183"-01	1.1907"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
30	1.4153"-01	1.1730"+01	NM	0.99967	0.99221	0.99700	1.00972	0.98740
31	1.5260"-01	1.1499"+01	NM	0.99927	0.98198	0.99300	1.02264	0.97102

INPUT VARIABLES Y,U/UD ASSUME P=PD AND VAN DRIEST

69030702 THOMKE PROFILE TABULATION 31 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95730	0.00000	0.00000	2.62348	0.00000
2	7.1120"-04	2.7466"+00	NM	0.96875	0.44415	0.62400	1.97632	0.31574
3	2.6162"-03	3.6545"+00	NM	0.97433	0.52963	0.70900	1.79418	0.39517
4	3.9116"-03	4.0291"+00	NM	0.97637	0.56078	0.73700	1.72925	0.42620
5	5.3880"-03	4.2941"+00	NM	0.97774	0.58175	0.75500	1.68622	0.44775
6	7.8740"-03	4.6303"+00	NM	0.97938	0.60727	0.77600	1.63473	0.47469
7	1.0617"-02	4.9624"+00	NM	0.98091	0.63142	0.79500	1.58697	0.50095
8	1.2802"-02	5.1681"+00	NM	0.98182	0.64590	0.80600	1.55880	0.51706
9	1.5631"-02	5.4454"+00	NM	0.98300	0.66492	0.82000	1.52241	0.53862
10	1.7932"-02	5.6335"+00	NM	0.98377	0.67751	0.82900	1.49869	0.55315
11	2.0777"-02	5.8973"+00	NM	0.98481	0.69476	0.84100	1.46667	0.57341
12	2.3216"-02	5.9657"+00	NM	0.98507	0.69917	0.84400	1.45859	0.57864
13	2.5857"-02	6.1530"+00	NM	0.98577	0.71109	0.85200	1.43692	0.59294
14	3.0632"-02	6.4485"+00	NM	0.98685	0.72948	0.86400	1.40404	0.61537
15	3.6043"-02	6.8443"+00	NM	0.98821	0.75341	0.87900	1.36231	0.64523
16	4.1097"-02	7.1843"+00	NM	0.98932	0.77335	0.89100	1.32841	0.67072
17	4.6203"-02	7.6098"+00	NM	0.99063	0.79761	0.90500	1.28831	0.70247
18	5.1283"-02	8.0360"+00	NM	0.99186	0.82117	0.91800	1.25052	0.73410
19	5.7887"-02	8.5692"+00	NM	0.99331	0.84973	0.93300	1.20626	0.77347
20	6.4084"-02	9.1120"+00	NM	0.99468	0.87783	0.94700	1.16432	0.81335
21	7.0637"-02	9.6165"+00	NM	0.99586	0.90316	0.95900	1.12788	0.85027
22	7.6708"-02	1.0068"+01	NM	0.99686	0.92523	0.96900	1.09717	0.88318
23	8.2906"-02	1.0451"+01	NM	0.99767	0.94355	0.97700	1.07238	0.91105
24	8.9103"-02	1.0804"+01	NM	0.99837	0.96012	0.98400	1.05053	0.93667
25	9.5479"-02	1.1120"+01	NM	0.99898	0.97473	0.99000	1.03167	0.95961
26	1.0190"-01	1.1450"+01	NM	0.99957	0.98975	0.99600	1.01271	0.98350
27	1.1191"-01	1.1621"+01	NM	0.99990	0.99742	0.99900	1.00318	0.99583
28	1.2197"-01	1.1678"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 29	1.3226"-01	1.1678"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
30	1.4232"-01	1.1563"+01	NM	0.99980	0.99485	0.99800	1.00636	0.99169
31	1.5321"-01	1.1621"+01	NM	0.99990	0.99742	0.99900	1.00318	0.99583

INPUT VARIABLES Y,U/UD ASSUME P=PD AND VAN DRIEST

69031201 THOMKE PROFILE TABULATION 31 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.87442	0.00000	0.00000	3.58927	0.00000
2	5.8420"-04	2.9535"+00	NM	0.92966	0.34831	0.57942	2.77192	0.20903
3	2.0320"-03	4.3039"+00	NM	0.94433	0.43615	0.68032	2.43722	0.27914
4	3.5560"-03	4.7431"+00	NM	0.94832	0.46091	0.70529	2.34556	0.30069
5	5.0546"-03	5.1337"+00	NM	0.95199	0.48181	0.72527	2.26972	0.31954
6	7.4422"-03	5.7254"+00	NM	0.95586	0.51181	0.75225	2.16378	0.34765
7	9.7790"-03	6.1418"+00	NM	0.95866	0.53188	0.76923	2.09499	0.36718
8	1.2725"-02	6.7683"+00	NM	0.96252	0.56070	0.79221	1.99935	0.39623
9	1.5113"-02	7.0972"+00	NM	0.96439	0.57524	0.80320	1.95256	0.41136
10	1.7450"-02	7.3496"+00	NM	0.96576	0.58616	0.81119	1.91810	0.42291
11	2.0244"-02	7.7857"+00	NM	0.96800	0.60454	0.82418	1.86135	0.44278
12	2.2733"-02	8.2950"+00	NM	0.97044	0.62532	0.83816	1.79918	0.46586
13	2.5324"-02	8.7683"+00	NM	0.97255	0.64401	0.85015	1.74501	0.48719
14	3.0353"-02	9.3239"+00	NM	0.97486	0.66529	0.86314	1.68543	0.51212
15	3.5331"-02	1.0028"+01	NM	0.97754	0.69131	0.87812	1.61550	0.54356
16	4.0411"-02	1.0755"+01	NM	0.98007	0.71719	0.89211	1.54910	0.57589
17	4.5542"-02	1.1391"+01	NM	0.98207	0.73873	0.90310	1.49615	0.60361
18	5.0521"-02	1.2062"+01	NM	0.98408	0.76146	0.91409	1.44254	0.63367
19	5.6845"-02	1.2947"+01	NM	0.98647	0.79003	0.92707	1.37829	0.67262
20	6.3297"-02	1.3854"+01	NM	0.98868	0.81825	0.93900	1.31816	0.71240
21	6.9571"-02	1.4860"+01	NM	0.99090	0.84850	0.95105	1.25721	0.75647
22	7.6022"-02	1.5786"+01	NM	0.99276	0.87544	0.96104	1.20581	0.79701
23	8.2296"-02	1.6597"+01	NM	0.99425	0.89828	0.96903	1.16429	0.83230
24	8.8671"-02	1.7589"+01	NM	0.99592	0.92549	0.97802	1.11714	0.87547
25	9.5377"-02	1.8552"+01	NM	0.99741	0.95117	0.98601	1.07486	0.91734
26	1.0132"-01	1.9331"+01	NM	0.99852	0.97145	0.99201	1.04291	0.95119
27	1.1131"-01	2.0164"+01	NM	0.99963	0.99269	0.99800	1.01076	0.98738
D 28	1.2174"-01	2.0455"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
29	1.3183"-01	2.0164"+01	NM	0.99963	0.99269	0.99800	1.01076	0.98738
30	1.4133"-01	1.9880"+01	NM	0.99926	0.98550	0.99600	1.02150	0.97504
31	1.5260"-01	2.0021"+01	NM	0.99945	0.98908	0.99700	1.01613	0.98117

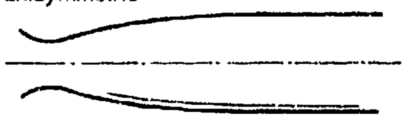
INPUT VARIABLES Y,U/UD ASSUME P=PD AND VAN DRIEST

69031202 THOMKE PROFILE TABULATION 30 POINTS, DELTA AT POINT 30

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88100	0.00000	0.00000	3.60239	0.00000
2	7.1120"-04	3.0593"+00	NM	0.93391	0.35697	0.59041	2.74017	0.21546
3	2.6162"-03	4.4005"+00	NM	0.94758	0.44284	0.68731	2.41296	0.28484
4	3.9116"-03	4.9882"+00	NM	0.95239	0.47534	0.71920	2.29352	0.31361
5	5.5880"-03	5.1911"+00	NM	0.95392	0.48604	0.72927	2.25503	0.32340
6	7.8740"-03	5.6743"+00	NM	0.95734	0.51058	0.75125	2.16839	0.34645
7	1.0617"-02	6.2671"+00	NM	0.96115	0.53914	0.77522	2.07080	0.37436
8	1.2802"-02	6.5931"+00	NM	0.96309	0.55420	0.78721	2.02080	0.38955
9	1.5621"-02	6.9413"+00	NM	0.96504	0.56984	0.79920	1.97000	0.40568
10	1.7932"-02	7.2183"+00	NM	0.96652	0.58198	0.80819	1.93138	0.41845
11	2.0777"-02	7.5769"+00	NM	0.96834	0.59733	0.81918	1.88356	0.43491
12	2.3216"-02	8.0321"+00	NM	0.97051	0.61624	0.83217	1.82618	0.45569
13	2.5857"-02	8.3307"+00	NM	0.97185	0.62834	0.84016	1.79040	0.46926
14	3.0632"-02	8.8076"+00	NM	0.97389	0.64719	0.85215	1.73606	0.49085
15	3.6043"-02	9.4129"+00	NM	0.97628	0.67034	0.86613	1.67165	0.51813
16	4.1097"-02	9.9302"+00	NM	0.97818	0.68950	0.87712	1.62028	0.54134
17	4.6203"-02	1.0128"+01	NM	0.97887	0.69670	0.88112	1.60143	0.55021
18	5.1283"-02	1.0813"+01	NM	0.98113	0.72101	0.89411	1.53957	0.58075
19	5.7887"-02	1.1505"+01	NM	0.98324	0.74480	0.90609	1.48162	0.61156
20	6.4084"-02	1.2956"+01	NM	0.98713	0.79231	0.92807	1.37331	0.67579
21	7.0637"-02	1.3629"+01	NM	0.98873	0.81342	0.93706	1.32822	0.70550
22	7.6708"-02	1.4357"+01	NM	0.99033	0.83564	0.94605	1.28269	0.73756
23	8.2906"-02	1.4527"+01	NM	0.99069	0.84074	0.94805	1.27251	0.74503
24	8.9103"-02	1.5331"+01	NM	0.99230	0.86447	0.95704	1.22642	0.78036
25	9.5479"-02	1.6105"+01	NM	0.99373	0.88672	0.96503	1.18507	0.81433
26	1.0190"-01	1.7163"+01	NM	0.99553	0.91624	0.97502	1.13289	0.86065
27	1.1191"-01	1.8336"+01	NM	0.99732	0.94789	0.98501	1.08015	0.91192
28	1.3226"-01	2.0064"+01	NM	0.99964	0.99269	0.99800	1.01076	0.98738
29	1.4232"-01	2.0354"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 30	1.5321"-01	2.0354"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD ASSUME P=PD AND VAN DRIEST

axisymmetric



M : 19 to 21.6

R THETA X 10^{-3} : 8 - 12

TW/TR : 1.1

7001

FPG / ZPG

MHT / AW

Axially symmetric blow-down tunnel. Running time: 50 s. D = 0.56 m.
PO : 13.6 MN/m^2. TO : 300 K. Helium. RE/m X 10^{-6} : 45.

FISCHER M.C., MADDALON D.V., WEINSTEIN L.M. and WAGNER R.D. 1970. Boundary layer surveys on a nozzle wall at M = 20 including hot-wire fluctuation measurements. AIAA Paper 70-746.
And Fischer M.C. private communications.
Also Fischer, Maddalon, Weinstein & Wagner (1971) and Wagner, Maddalon & Weinstein (1970).

1 The test boundary layer was formed on the wall of a contoured axisymmetric nozzle approximately 4 m long.
The nozzle radius at the measuring stations is given in table 1, with X = 0 at the throat. The nozzle wall
had a smooth polished surface and was not actively cooled. Calibration tests reported by Arrington et al.
2 (1964) indicate that Mach number variations across the test section at X = 3.531 m are about ± 0.3 so that
3 longitudinal variations from the mean expansion may be expected to be of the same order. Preston tube tests
by Wagner et al. (1970) at X = 2.066 indicated that transition at this point occured when PO was about
4 3 MN/m^2. PO for the test described here is about 14 MN/m^2. The test boundary layer was formed by expansion
in the nozzle, with a very strong simple wave generated expansion in the throat region followed by an
extended simple wave cancelled expansion in which the nozzle contour and boundary layer growth give near
zero longitudinal pressure gradient conditions at X = 3.53 m. The last test station (3.76 m) may be
affected by the upstream influence of the APG flow in the diffuser.

6 Wall pressure measurements were made at 17 stations along the wall between X = 1.47 and 3.81 m with holes
7 2.3 mm in diameter. At the X = 3.53 m station the velocity profile was determined from PO, TO and P
traverses. The Pitot probe was a CPP (d_1 = 3.2, d_2 = 2.6 mm) while two static probes (CCP - α = 42.5°,
8 d = 3.2, l_1 = 11.7, l_2 = 94 mm) were mounted on a rake, separated vertically by 166 mm so that the outer
7 tube was always in the free stream. TO was measured with shielded tungsten resistance thermometers with
an oval shield entrance for which b_1 = 0.76, b_2 = 3 mm. At all other stations a Pitot rake only was used
with 18 CPP (d_1 = 1.5, d_2 = 1.0, l = 25.4 mm) mounted at intervals of 6.4 mm near the wall, increasing to
19 mm in the outer region on the layer. At station X = 3.53 m a hot-wire survey of the layer was also made
using the constant current techniques described by Wagner et al. (1970).

9 The static pressure profile measured at X = 3.5 m was replaced in data reduction by a series of linear
variations (see source figure 14 inset and tables of section C below) and this variation was applied to all
the other profiles presented here. The total temperature was within a few percent of tunnel total temperature
throughout and the measured values were replaced by the isoenergetic assumption. A wall temperature of 300 K
10 was assumed. The Pitot measurements were corrected for real gas effects (Erickson, 1960) and viscous inter-
action and rarefaction effects (Beckwith et al., 1971 and Rogers et al., 1966). The maximum correction was
a 20 % reduction of PT2, and at the relatively high pressure levels considered in this entry, only the
first few data points near the wall received significant adjustments. Uncorrected Pitot data is tabulated
11 in the source. The viscosity law assumed was $\mu = 5.0236\ (T/K)^{0.647} \times 10^{-7}\ Ns/m^2$.

12 The editors have accepted all the assumptions and adjustments made by the authors.+ In order to do this it
proved necessary to reconstitute the assumed static pressure profiles from the authors' description and the
wall and free-stream static pressures. This procedure was followed since the tabulated data, although
functionally complete, required the use of computed density data which was presented to one significant
13 figure. This profile set is the only one tabulated, but a great quantity of reduced integral data is also
given in the source paper for a range of tunnel reservoir pressures. For this integral data, the static
pressure was assumed constant. The hot wire data are presented graphically in the source and Fischer et al.
14 (1971). We present the authors' CF values estimated from the slope of the velocity profile at the wall.

+ We have however calculated viscosity as discussed in the introduction.

§ DATA: 7001 0101-0105. Pitot profiles. TO and P profiles for 0104 only. NX = 5.

15 Editors' comments

The three hypersonic contoured nozzle wall studies, including this entry, Beckwith et al. - CAT 7105 and Kemp & Owen - CAT 7206 provide the highest Mach number data in the catalogue. In all three there are strong normal pressure gradient effects, as although the radii of curvature are large, the dynamic pressure is orders of magnitude greater than the static pressure. The most thorough attack on the problems of measurement which result from this is that of Beckwith et al., whose correction procedures are used here. In addition to normal pressure gradient effects due to streamline curvature, at these Mach numbers, it is necessary to distinguish between the normal stress which must balance the centrifugal effects, and its component parts, the static pressure as such and the normal Reynolds stress due to turbulence, which is of the same order.

The profiles are given in average detail, and the measurements extend within the momentum deficit peak. With the boundary conditions used, replacement of the measured TO profile by the assumption of constant TO will have little effect on the reduced data. The influence of the PT2 corrections can be seen by comparing the tabulated values with the uncorrected values given in the source paper. The Mach number range of the series is not large so that the balance between the components of the static pressure variation should not change much from one station to another, and therefore the static pressure profile used at each station will be valid in so far as it represents the variation at the station at which it was measured.

As is typically the case with very high Mach number measurements, the profiles display marked transitional features.

TABLE 1

MEASURING STATION X:	2.007	2.743	3.302	3.631	3.760	m
NOZZLE RADIUS R:	203.2	236.2	273.1	278.1	279.4	mm

CAT 7001 FISCHER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD* TOD*	TW/TR PW/PD SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
70010101	19.0000	1.1150	2.4599"+02	2.6000"-04	337.7607	2.0510	1.1881"+02	8.6[illegible]8"+01
2.0066"+00	1.4238"+07	1.3500	8.2764"+03	NM	1.9520	1.7422	3.0000"+02	2.4713"+00
-2.0320"-01	3.0000"+02	1.0000	1.6432"-04	NM	-0.3401	1.7740"-03	1.7583"+03	2.6906"+02
70010102	20.8000	1.1152	2.0476"+02	1.9500"-04	342.0757	2.0033	7.5831"+01	5.6171"+01
2.7432"+00	1.4238"+07	1.3500	8.3710"+03	NM	1.9277	1.6873	3.0000"+02	2.0649"+00
-2.3622"-01	3.0000"+02	1.0000	1.7094"-04	NM	-0.0313	2.6614"-03	1.7595"+03	2.6901"+02
70010103	21.6000	1.1152	2.2405"+02	1.8000"-04	324.0265	2.0521	6.2873"+01	4.6573"+01
3.3020"+00	1.4233"+07	1.3500	9.8151"+03	NM	1.9396	1.7287	3.0000"+02	1.9157"+00
-2.7305"-01	3.0000"+02	1.0000	2.1904"-04	NM	0.1973	2.8089"-03	1.7599"+03	2.6900"+02
70010104	21.6000	1.1152	2.4039"+02	1.7500"-04	303.6261	1.9064	6.1350"+01	4.5444"+01
3.5306"+00	1.3893"+07	1.3500	1.0531"+04	NM	1.9329	1.7383	3.0000"+02	1.9157"+00
-2.7813"-01	3.0000"+02	1.0000	2.4085"-04	NM	0.3212	3.4172"-03	1.7599"+03	2.6900"+02
70010105	21.5000	1.1152	2.7945"+02	NM	328.4272	2.1372	6.4027"+01	4.7427"+01
3.7592"+00	1.4169"+07	1.3500	1.2144"+04	NM	1.9437	1.7314	3.0000"+02	1.9335"+00
-2.7940"-01	3.0000"+02	1.0000	2.7077"-04	NM	0.1531	3.2355"-03	1.7599"+03	2.6900"+02

CF ESTIMATED FROM FIG.7

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
70010101	1.6668"-04	341.0896	1.9527	-0.3347	8.3955"+03	2.4953"+02	5.4084"-02
	1.3937"-04	330.7443	1.9536	-0.3346	8.3995"+03	2.4965"+02	
70010102	1.8050"-04	355.2281	1.9283	-0.0310	8.4438"+03	2.0654"+02	5.9167"-02
	1.5089"-04	344.8846	1.9291	-0.0310	8.4472"+03	2.0662"+02	
70010103	2.2300"-04	333.3162	1.9407	0.1942	9.9968"+03	2.2819"+02	6.7306"-02
	1.8647"-04	323.5885	1.9413	0.1942	1.0000"+04	2.2827"+02	
70010104	2.4534"-04	312.5020	1.9341	0.3153	1.0727"+04	2.4487"+02	6.9143"-02
	2.0507"-04	303.2406	1.9348	0.3152	1.0731"+04	2.4495"+02	
70010105	2.7366"-04	350.1207	1.9444	0.1513	1.2274"+04	2.6244"+02	8.3128"-02
	2.2875"-04	336.2742	1.9451	0.1512	1.2279"+04	2.6254"+02	

70010102 FISCHER PROFILE TABULATION 21 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.35000	1.07875	0.00000	0.00000	156.72600	0.00000
2	1.7780"-03	1.2490"+00	1.35000	1.07107	0.02539	0.30300	142.36354	0.00287
3	5.0800"-03	2.6254"+00	1.35000	1.05179	0.05738	0.58400	103.60086	0.00761
4	7.5692"-03	4.9406"+00	1.35000	1.03751	0.08377	0.72500	74.89536	0.01307
5	1.0160"-02	2.2428"+01	1.35000	1.01123	0.18596	0.92100	24.52859	0.05069
6	1.3538"-02	3.7394"+01	1.35000	1.00737	0.24111	0.95200	15.59008	0.08244
7	1.9736"-02	5.3797"+01	1.35000	1.00532	0.28973	0.96700	11.13916	0.11719
8	2.6111"-02	8.1195"+01	1.24500	1.00377	0.35644	0.97900	7.54369	0.16157
9	3.2944"-02	1.2609"+02	1.10500	1.00138	0.44463	0.98700	4.92772	0.22133
10	3.9675"-02	2.0393"+02	0.91500	1.00046	0.56583	0.99300	3.07983	0.29501
11	4.6482"-02	2.3844"+02	0.80500	0.99940	0.61192	0.99400	2.63862	0.30325
12	5.8242"-02	3.1839"+02	0.84000	1.00084	0.70728	0.99700	1.98706	0.42147
13	7.1196"-02	3.9663"+02	0.88000	1.00014	0.78957	0.99800	1.59763	0.54972
14	8.4455"-02	5.0431"+02	0.92000	0.99980	0.89037	0.99900	1.25890	0.73007
15	9.7155"-02	5.6912"+02	0.96000	0.99881	0.94590	0.99900	1.11543	0.85980
16	1.1062"-01	5.8845"+02	1.00000	0.99856	0.96185	0.99900	1.07875	0.92607
17	1.2954"-01	5.9860"+02	1.00000	1.00043	0.97011	1.00000	1.06257	0.94112
18	1.4884"-01	6.1804"+02	1.00000	1.00020	0.98575	1.00000	1.02913	0.97170
D 19	1.6744"-01	6.3603"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
20	1.8618"-01	6.2657"+02	1.00000	1.00010	0.99253	1.00000	1.01510	0.98512
21	2.0599"-01	6.3671"+02	1.00000	0.99999	1.00054	1.00000	0.99892	1.00108

INPUT VARIABLES Y,U/UD,T/TD,P/PD

70010103 FISCHER PROFILE TABULATION 20 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.35000	1.00806	0.00000	0.00000	157.85988	0.00000
2	1.7780E-03	1.1104E+00	1.35000	1.00764	0.01658	0.20400	151.31956	0.00182
3	5.0800E-03	2.9774E+00	1.35000	1.00479	0.05991	0.60200	100.95867	0.00805
4	7.5672E-03	1.9136E+01	1.35000	1.00087	0.11083	0.83200	49.02621	0.02291
5	1.0160E-02	2.1570E+01	1.35000	1.00082	0.17562	0.91300	27.02520	0.04561
6	1.3538E-02	3.3729E+01	1.35000	1.00051	0.22036	0.94300	18.31250	0.06952
7	1.9736E-02	5.0221E+01	1.35000	0.99883	0.26749	0.96100	12.71673	0.10202
8	2.6111E-02	6.2145E+01	1.35000	0.99957	0.30004	0.96900	10.43044	0.12542
9	3.2944E-02	9.0565E+01	1.29250	0.99887	0.36261	0.97900	7.28931	0.17359
10	3.9675E-02	1.3469E+02	1.16750	0.99971	0.44256	0.98700	4.97379	0.23168
11	5.8242E-02	2.7860E+02	0.82500	0.99928	0.63705	0.99500	2.43952	0.33649
12	7.1196E-02	3.5063E+02	0.82500	1.00009	0.71478	0.99700	1.94556	0.42277
13	8.4455E-02	4.1804E+02	0.85500	0.99938	0.80310	0.99300	1.52520	0.55946
14	9.7155E-02	5.2934E+02	0.88250	0.99789	0.87843	0.99700	1.29335	0.68166
15	1.1062E-01	6.1509E+02	0.91250	0.99873	0.94697	0.99900	1.11290	0.81911
16	1.2954E-01	6.7163E+02	0.95500	0.99814	0.98957	0.99900	1.01915	0.93612
17	1.4834E-01	6.8037E+02	1.00000	1.00005	0.99597	1.00000	1.00806	0.99200
D 18	1.6744E-01	6.8586E+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
19	1.8619E-01	6.6053E+02	1.00000	0.97825	0.98135	0.99900	1.03629	0.96402
20	2.0579E-01	6.8037E+02	1.00000	1.00005	0.99597	1.00000	1.00806	0.99200

INPUT VARIABLES Y,U/UD,T/TD,P/PD

70010104 FISCHER PROFILE TABULATION 21 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.35000	1.00000	0.00000	0.00000	156.59700	0.00000
2	1.7780E-03	1.1247E+00	1.35000	0.99998	0.01757	0.21500	149.40200	0.00194
3	3.3020E-03	1.2809E+00	1.35000	0.99957	0.02587	0.30800	141.77600	0.00293
4	4.0640E-03	1.9766E+00	1.35000	0.99972	0.04488	0.49000	119.19500	0.00555
5	5.3340E-03	2.7423E+00	1.35000	0.99890	0.05685	0.58000	104.08200	0.00752
6	6.8580E-03	4.9773E+00	1.35000	0.99984	0.08101	0.71300	77.47200	0.01242
7	8.1280E-03	8.0213E+00	1.35000	0.99909	0.10501	0.79700	57.60400	0.01868
8	1.2446E-02	1.7514E+01	1.35000	0.99914	0.15778	0.89400	32.10300	0.03759
9	1.7018E-02	2.8970E+01	1.35000	0.99851	0.20400	0.93300	20.91800	0.06021
10	2.1082E-02	3.8088E+01	1.35000	0.99968	0.23422	0.94900	16.41600	0.07804
11	3.7338E-02	9.5500E+01	1.22500	0.99849	0.37241	0.98000	6.92500	0.17336
12	5.1054E-02	1.9606E+02	0.93000	0.99983	0.53423	0.99200	3.44800	0.26756
13	6.2738E-02	2.7406E+02	0.80500	0.99954	0.63183	0.99500	2.48800	0.32297
14	7.4422E-02	3.6932E+02	0.83000	0.99946	0.73360	0.99700	1.84700	0.44803
15	9.2964E-02	5.0463E+02	0.87000	0.99329	0.85767	0.99800	1.35400	0.64126
16	1.0414E-01	5.5839E+02	0.89550	0.99946	0.90224	0.99900	1.22600	0.72969
17	1.1074E-01	6.2343E+02	0.90550	0.99864	0.95330	0.99900	1.09800	0.82386
18	1.2649E-01	6.7305E+02	0.94250	0.99812	0.99062	0.99900	1.01700	0.92582
19	1.3605E-01	6.7772E+02	0.96500	0.99805	0.99404	0.99900	1.01000	0.95449
D 20	1.5240E-01	6.8586E+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
21	1.8034E-01	7.0199E+02	1.00000	0.99985	1.01170	1.00000	0.97700	1.02354

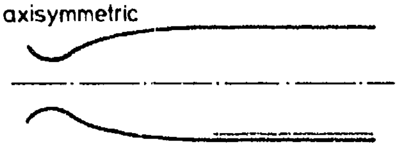
INPUT VARIABLES Y,U/UD,T/TD,P/PD

70010105 FISCHER PROFILE TABULATION 20 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.35000	1.01833	0.00000	0.00000	158.00407	0.00000
2	3.1496E-03	1.2168E+00	1.35000	1.01674	0.02302	0.27800	145.84420	0.00257
3	6.3500E-03	3.2531E+00	1.35000	1.01089	0.06358	0.62500	96.63136	0.00873
4	8.7154E-03	1.2162E+01	1.35000	1.00425	0.13130	0.85700	42.60183	0.02716
5	1.0160E-02	1.9018E+01	1.35000	1.00235	0.16536	0.90300	29.82179	0.04088
6	1.4910E-02	3.1329E+01	1.35000	1.00099	0.21326	0.93900	19.38798	0.06538
7	2.1107E-02	4.3857E+01	1.35000	1.00015	0.25284	0.95600	14.29633	0.09027
8	2.7483E-02	5.2873E+01	1.35000	1.00088	0.27786	0.96400	12.03666	0.10812
9	3.4315E-02	6.4804E+01	1.35000	1.00088	0.30786	0.97100	9.94807	0.13177
10	4.1046E-02	9.5636E+01	1.35000	0.99946	0.35419	0.97800	7.62424	0.17317
11	5.9614E-02	1.8156E+02	1.11000	0.99948	0.51643	0.99100	3.68228	0.29873
12	7.2568E-02	2.6838E+02	0.93500	0.99982	0.62814	0.99500	2.50916	0.37077
13	8.5827E-02	3.5116E+02	0.80500	1.00001	0.71865	0.99700	1.92404	0.41700
14	9.8527E-02	4.1401E+02	0.82500	1.00013	0.78039	0.99800	1.63544	0.50344
15	1.1199E-01	4.8349E+02	0.84500	0.99861	0.84340	0.99800	1.40020	0.60228
16	1.3091E-01	5.5971E+02	0.87500	0.99938	0.90750	0.99900	1.21181	0.72134
17	1.5022E-01	6.2476E+02	0.90750	0.99857	0.95883	0.99900	1.08554	0.83515
18	1.6881E-01	6.4847E+02	0.93750	0.99831	0.97687	0.99900	1.04582	0.89553
D 19	1.8755E-01	6.7953E+02	0.96750	1.00000	1.00000	1.00000	1.00000	0.96750
20	2.0737E-01	6.6610E+02	1.00000	0.99833	0.99007	0.99910	1.01833	0.98112

INPUT VARIABLES Y,U/UD,T/TD,P/PD

axisymmetric	M : 5.9 R THETA X 10^{-3} : 8 - 80 TW/TR : 0.7 - 0.8	7002 ZFG (FPG HISTORY) MHT



Axisymmetric blow-down tunnel, maximum running time 6 minutes. D = 305 mm.
0.45 < PO < 4.24 MN/m^2. 460 < TO < 500 K. Air, dew point : 211 K. 4 < RE/m X 10^{-6} < 35.

JONES R.A. and FELLER W.V., 1970. Preliminary surveys of the wall boundary layer in a Mach 6 axisymmetric tunnel. NASA TN D-5620.
And Feller W.V., private communication, Also Feller (1973).

1 The test boundary layer was formed on a cylindrical extension (D = 0.305, L = 4.0 m) of a contoured axi-
symmetric nozzle. The cylinder was constructed in four interchangeable sections (L = 0.457, 0.761, 1.22
8 and 1.525 m) of which the longest carried the survey equipment. Four stations (X = 2.388, 3.150, 4.369,
5.461 m) were studied in the test zone stretching up to more than 6 m from the throat (X = 0). The test
surface when constructed was finished to better than 1.6 μm rms with a maximum departure from the prescribed
2 ordinates of 0.013 mm. The surface was not actively cooled. Pitot surveys in the "inviscid" core flow showed
3 no asymmetry or waves. Natural transition was believed to occur upstream of the throat, and the pressure
4 history of the layer is represented by the Mach number distribution in Table 1. The wall temperature history
is discussed by Feller (1973) and in the cases discussed here probably corresponds to TW/TR between 0.7 and
0.8 throughout (E).

6 Wall measurements generally suffered from undetermined instrumental difficulties, so that the static pressure
presented with the profiles is deduced from Pitot measurements in the free stream. The wall temperatures
were measured by thermocouples, each held by a screw in contact with the bottom of a drilled hole so as to
sense the temperature 2 mm from the test surface.

7 A CPP and a circular STP were mounted permanently in the free stream and their readings recorded in conjunction
with the traversing probes, which were in general of the same construction. Two probes were mounted on the
traverse strut at any one time. The probe dimensions and Y separation are listed in table 2. The Pitot probes
were FPP and the TO probes flattened circular STP in which the chromel-alumel thermocouple bead had itself
been flattened so as to increase the surface area to volume ratio, with the aim of giving a more rapid
response and reducing sensitivity to conduction errors. The TTP were calibrated directly in the free stream
over a wide range of Reynolds numbers. The calibration was extrapolated where necessary in the low Reynolds
10 number range. No corrections other than this calibration were applied to probe data. An empirical curve
11 fitted to a compilation of viscosity data was used.

9 Since the PT2 and TO profiles were taken on separate occasions and at different Y values, the Pitot data
were faired and interpolated to the Y values of the TO data. All values were normalized with the simultaneous
value recorded by the fixed free stream probes. The wall temperature values presented were obtained from
the initial no-flow value with a correction based on a heat transfer calculation. The computed variation
of TW was usually less than 22 K in the course of a run. Long period total pressure fluctuations of up to
2.5 % were observed in the middle part of the layer and it is suggested that these fluctuations may account
for some of the scatter in the profile data.

12 The profile measurements are presented in the tables for all Y values of both the TO probes. Where two
Y values coincided, the profile data were averaged. The U/UD and M values have been taken as presented
by the authors, and the variations in edge conditions averaged to give reference values representative of
the whole profile (The source paper gives TOD and TW values for every profile point). The static pressure
has been assumed constant through the boundary layer. Our normal integration procedure proved unable to
13 handle the scatter of the data and was replaced by a trapezoidal integration rule. Four successive profiles
are presented for each of four total pressure levels. The reservoir pressure variation within each series
14 is negligible except for the last series, where there is a fall of 17 % from 0401 to 0404. Measurements

of skin friction in the same facility have been made by Srokowski et al. (1976). The possible use of this data is discussed in § 15 below.

§ DATA: 7002 0101-0404. Pitot and TO profiles obtained separately. NX = 4.

15 Editors' comments

The experiment provides data in a region which is not well covered. In Reynolds number and Mach number range it falls between Voisinet & Lee - CAT 7202 and Hopkins & Keener - CAT 7203. The test area is cylindrical and δ/RZ is of order 0.7, so that the effect of transverse curvature may well be substantial. Although we have described the flow as having a nominally zero pressure gradient, the growth of the boundary layer results in a rise in pressure ratio (P/PO) of 36 - 55 % between stations 1 and 4 (see source, figures 7 and 8). In the tables of reduced data below, this is masked for series 04 by the fall in POD.

The data is fairly rough, and showed much scatter. As remarked above, our spline-fit integration procedure was replaced by a trapezoidal rule. We still found differences of 50 % between the authors' integral values and ours, and so made a check by "counting squares". The trapezoidal rule and quadrature values agreed to 1 %, so that we presume that the authors' integration procedure was also unsuited to the spread of the data.

We give below a table of CF values based on the measurements of Srokowski et al. (1976). These measurements were made between Stations 1 and 2, with two different balances. Six or more years have passed between the two sets of measurements, so that there may well have been significant changes in the facility. We have not therefore entered any of these values in the profile tables. The scatter of the data was about 7 %, and we have interpolated on the basis of the authors' RE (x) values. We have very slightly extrapolated the curve in two cases, and although the Reynolds number range overlaps, values for stations 3 and 4 should only be used for very approximate arguments.

CF FROM SROKOWSKI et al. (1976)

PROFILE:	0103	0104	0202	0203	0204	0301	0302	0303	0401
$CFX10^4$:	8.60	8.05	8.30	7.65	7.30	7.40	6.98	6.53	6.60
NOTE:	a,b	a	b	a	a	-	-	a	-

a) Profile station remote from balance station

b) Extrapolated value.

Table 1. Design Mach number history in nozzle

X (m)	0	0.051	0.102	0.152	0.200	0.254	0.381
M	1.0	1.22	1.44	1.66	1.87	2.08	2.65
X (m)	0.584	0.788	0.939	1.270	1.421	1.929	2.260
M	3.54	4.29	4.70	5.32	5.54	5.89	5.99

Table 2. Dimensions of probes (mm)

	Outer TPP	Inner TPP	Outer TTP	Inner TTP
h_1	0.46	0.33	1.8	1.1
h_2	0.25	0.10	-	-
b_1	1.9	0.79	3.9	4.6
b_2	1.6	0.41	-	-
1	47.6	35 (E)	47.6	47.6
shank dia.	1.52	0.508	3.15	3.15
Separation in Y	24.1		20.5	

CAT 7002 JONES BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TP	RED2W	CF	H12	H12K	PW	PD
X *	PQD*	PW/PD*	RED2O	CQ	H32	H32K	TW*	TO
R2 *	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
70020101	5.8600	0.8037	1.5522"+03	NM	12.3030	1.3754	3.2938"+02	3.2938"+02
2.3876"+00	4.5000"+05	1.0000	7.4970"+03	NM	1.8490	1.8192	3.3309"+02	5.7936"+01
-1.5240"-01	4.5584"+02	0.0000	1.7580"-03	NM	0.5522	4.1650"-03	8.9430"+02	4.1446"+02
70020102	5.7600	0.8118	2.0486"+03	NM	12.6203	1.3905	3.6583"+02	3.6583"+02
3.1496"+00	4.5000"+05	1.0000	9.7178"+03	NM	1.8373	1.8090	3.3098"+02	5.8702"+01
-1.5240"-01	4.4022"+02	0.0000	2.1292"-03	NM	0.5107	5.2677"-03	8.8483"+02	4.0771"+02
70020103	5.5800	0.8043	3.1905"+03	NM	11.4970	1.4011	4.4340"+02	4.4340"+02
4.3688"+00	4.5000"+05	1.0000	1.4107"+04	NM	1.8251	1.8037	3.3966"+02	6.4184"+01
-1.5240"-01	4.6388"+02	0.0000	3.0111"-03	NM	0.5964	7.3751"-03	8.9631"+02	4.2231"+02
70020104	5.4500	0.7748	4.0337"+03	NM	12.1542	1.4306	5.1091"+02	5.1091"+02
5.4610"+00	4.5000"+05	1.0000	1.8344"+04	NM	1.8052	1.7942	3.2509"+02	6.6358"+01
-1.5240"-01	4.6056"+02	0.0000	3.6577"-03	NM	0.5238	9.3664"-03	8.9013"+02	4.1956"+02
70020201	5.8700	0.8097	2.5419"+03	NM	11.6110	1.3632	5.7226"+02	5.7226"+02
2.3876"+00	7.9000"+05	1.0000	1.2380"+04	NM	1.8602	1.8275	3.3600"+02	5.7835"+01
-1.5240"-01	4.5640"+02	0.0000	1.6637"-03	NM	0.6174	3.7770"-03	8.9504"+02	4.1495"+02
70020202	5.8300	0.7487	3.2924"+03	NM	12.0163	1.3742	5.9666"+02	5.9666"+02
3.1496"+00	7.9000"+05	1.0000	1.5490"+04	NM	1.8445	1.8171	3.3097"+02	5.9183"+01
-1.5240"-01	4.6149"+02	0.0000	2.0013"-03	NM	0.5865	4.9649"-03	8.9924"+02	4.1965"+02
70020203	5.6700	0.7926	4.3691"+03	NM	12.5872	1.3751	7.0666"+02	7.0666"+02
4.3688"+00	7.9000"+05	1.0000	1.9659"+04	NM	1.8326	1.8127	3.3322"+02	6.2181"+01
-1.5240"-01	4.6199"+02	0.0000	2.4704"-03	NM	0.4917	6.1600"-03	8.9644"+02	4.2041"+02
70020204	5.5400	0.7672	6.2762"+03	NM	11.6539	1.3836	8.1291"+02	8.1291"+02
5.4610"+00	7.9000"+05	1.0000	2.6359"+04	NM	1.8292	1.8133	3.2876"+02	6.5930"+01
-1.5240"-01	4.7063"+02	0.0000	3.2182"-03	NM	0.5637	7.7343"-03	9.0191"+02	4.2854"+02
70020301	5.9500	0.7668	4.7739"+03	NM	12.3317	1.3310	1.4469"+03	1.4469"+03
2.3876"+00	2.1700"+06	1.0000	2.2413"+04	NM	1.8690	1.8475	3.4306"+02	6.0914"+01
-1.5240"-01	4.9222"+02	0.0000	1.2709"-03	NM	0.5396	2.8207"-03	9.3108"+02	4.4736"+02
70020302	5.9500	0.7643	7.8028"+03	NM	9.7060	1.3196	1.4469"+03	1.4469"+03
3.1496"+00	2.1700"+06	1.0000	3.6559"+04	NM	1.8719	1.8443	3.4134"+02	6.0810"+01
-1.5240"-01	4.9130"+02	0.0000	2.0676"-03	NM	0.8341	4.2843"-03	9.3028"+02	4.4660"+02
70020303	5.7500	0.7661	1.0545"+04	NM	10.2534	1.3180	1.7828"+03	1.7828"+03
4.3688"+00	2.1700"+06	1.0000	4.6425"+04	NM	1.8607	1.8403	3.4868"+02	6.5729"+01
-1.5240"-01	5.0036"+02	0.0000	2.4787"-03	NM	0.7274	5.3635"-03	9.3466"+02	4.5516"+02
70020304	5.6000	0.7817	1.2465"+04	NM	11.4150	1.3146	1.9619"+03	1.9619"+03
5.4610"+00	2.1700"+06	1.0000	5.4772"+04	NM	1.8552	1.8423	3.4222"+02	6.4944"+01
-1.5240"-01	4.8103"+02	0.0000	2.6513"-03	NM	0.5835	5.9767"-03	9.1453"+02	4.3778"+02
70020401	5.9000	0.7773	9.2357"+03	NM	10.6693	1.3223	2.7411"+03	2.7411"+03
2.3876"+00	4.2400"+06	1.0000	4.3839"+04	NM	1.8751	1.8527	3.6122"+02	6.2730"+01
-1.5240"-01	5.1138"+02	0.0000	1.3645"-03	NM	0.7196	2.8301"-03	9.4961"+02	4.6472"+02
70020402	5.8200	0.7887	1.1952"+04	NM	11.4914	1.3251	3.1497"+03	3.1597"+03
3.1496"+00	4.1400"+06	1.0000	5.4753"+04	NM	1.8630	1.8421	3.6259"+02	6.5028"+01
-1.5240"-01	5.0556"+02	0.0000	1.6035"-03	NM	0.5906	3.5356"-03	9.4099"+02	4.5975"+02
70020403	5.7000	0.7988	1.7731"+04	NM	10.0131	1.3058	3.0964"+03	3.0964"+03
4.3688"+00	3.8900"+06	1.0000	8.1749"+04	NM	1.8646	1.8466	3.5508"+02	6.3625"+01
-1.5240"-01	4.8875"+02	0.0000	2.3807"-03	NM	0.7507	5.0029"-03	9.2438"+02	4.4453"+02
70020404	5.6900	0.7673	1.7247"+04	NM	12.0339	1.3142	3.1085"+03	3.1085"+03
5.4610"+00	3.5500"+06	1.0000	7.4837"+04	NM	1.8585	1.8435	3.4621"+02	6.6336"+01
-1.5240"-01	4.9588"+02	0.0000	2.3480"-03	NM	0.5181	5.3277"-03	9.2918"+02	4.5121"+02

TRAPEZOIDAL RULE FOR ALL INTEGRATIONS

70020401 JONES PROFILE TABULATION 50 POINTS, DELTA AT POINT 46

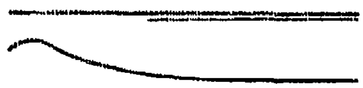
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.70510	0.00000	0.00000	5.74800	0.00000
2	6.0960"-04	4.9023"+00	NM	0.79957	0.30936	0.60855	3.86950	0.15727
3	1.0668"-03	6.3280"+00	NM	0.83777	0.35619	0.67399	3.58059	0.18824
4	1.2192"-03	6.5484"+00	NM	0.84108	0.36288	0.68189	3.53107	0.19311
5	1.6764"-03	7.5319"+00	NM	0.85893	0.39130	0.71536	3.34207	0.21405
6	1.5258"-03	7.7742"+00	NM	0.86426	0.39799	0.72335	3.30327	0.21898
7	2.2860"-03	8.4620"+00	NM	0.86771	0.41639	0.73993	3.15784	0.23432
8	2.7432"-03	8.9820"+00	NM	0.87502	0.42977	0.75342	3.07335	0.24515
9	3.2004"-03	9.5186"+00	NM	0.87880	0.44314	0.76491	2.97943	0.25673
10	3.6576"-03	1.0142"+01	NM	0.88652	0.45819	0.77880	2.88903	0.26957
11	4.1148"-03	1.0859"+01	NM	0.89189	0.47492	0.79219	2.78281	0.28471
12	5.1816"-03	1.1984"+01	NM	0.89903	0.50000	0.81067	2.62879	0.30839
13	5.3340"-03	1.2061"+01	NM	0.90398	0.50167	0.81387	2.63189	0.30923
14	5.6388"-03	1.2294"+01	NM	0.90357	0.50669	0.81657	2.59716	0.31441
15	7.0104"-03	1.3574"+01	NM	0.90647	0.53344	0.83235	2.43464	0.34188
16	8.2296"-03	1.4662"+01	NM	0.91004	0.55518	0.84474	2.31511	0.36488
17	1.1175"-02	1.7156"+01	NM	0.92092	0.60201	0.87032	2.09003	0.41641
18	1.3868"-02	2.0051"+01	NM	0.92379	0.65217	0.89020	1.86315	0.47779
19	1.6307"-02	2.2749"+01	NM	0.93659	0.69565	0.91005	1.71150	0.53175
20	1.8288"-02	2.5054"+01	NM	0.94244	0.73077	0.92267	1.59416	0.57878
21	2.0574"-02	2.7829"+01	NM	0.93947	0.77090	0.93106	1.45867	0.63829
22	2.1031"-02	2.8425"+01	NM	0.93786	0.77926	0.93216	1.43091	0.65145
23	2.1184"-02	2.8595"+01	NM	0.94476	0.78094	0.93596	1.43642	0.65159
24	2.1641"-02	2.9150"+01	NM	0.95290	0.78930	0.94185	1.42391	0.66145
25	2.1793"-02	2.9393"+01	NM	0.94723	0.79264	0.93975	1.40564	0.66856
26	2.1946"-02	2.9638"+01	NM	0.95405	0.79599	0.94385	1.40603	0.67129
27	2.2250"-02	3.0007"+01	NM	0.94566	0.80100	0.94075	1.37938	0.68201
28	2.2708"-02	3.0627"+01	NM	0.94940	0.80936	0.94935	1.36137	0.69367
29	2.3165"-02	3.1127"+01	NM	0.94667	0.81605	0.94735	1.33915	0.70519
30	2.3622"-02	3.1695"+01	NM	0.95993	0.82358	0.95247	1.33742	0.71215
31	2.4079"-02	3.2525"+01	NM	0.95950	0.83445	0.95434	1.30800	0.72962
32	2.5146"-02	3.3954"+01	NM	0.95125	0.85284	0.95364	1.25035	0.76270
33	2.5298"-02	3.3951"+01	NM	0.96345	0.85284	0.95774	1.26639	0.75785
34	2.5603"-02	3.4481"+01	NM	0.95887	0.85953	0.95864	1.24390	0.77067
35	2.6518"-02	3.5683"+01	NM	0.96420	0.87450	0.96393	1.21476	0.79351
36	2.6975"-02	3.6359"+01	NM	0.96415	0.88294	0.96533	1.19533	0.80759
37	2.8194"-02	3.7731"+01	NM	0.96634	0.89767	0.96913	1.16038	0.83518
38	2.9718"-02	3.9412"+01	NM	0.96595	0.91973	0.97203	1.11695	0.87025
39	3.1090"-02	4.0841"+01	NM	0.97896	0.93645	0.98102	1.09744	0.89392
40	3.1547"-02	4.1275"+01	NM	0.97892	0.94147	0.98172	1.08732	0.90288
41	3.3833"-02	4.3330"+01	NM	0.97967	0.96488	0.98531	1.04280	0.94488
42	3.6271"-02	4.5131"+01	NM	0.99198	0.98495	0.99411	1.01868	0.97588
43	3.6576"-02	4.5283"+01	NM	0.98280	0.98662	0.98971	1.00627	0.98354
44	3.8405"-02	4.5893"+01	NM	0.99586	0.99331	0.99710	1.00765	0.98953
45	4.1910"-02	4.6507"+01	NM	1.00180	1.00000	1.00090	1.00180	0.99910
D 46	4.3586"-02	4.6507"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
47	4.6402"-02	4.6507"+01	NM	0.99401	1.00000	0.99700	0.99401	1.00301
48	4.9632"-02	4.6507"+01	NM	0.99023	1.00000	0.99510	0.99023	1.00492
49	5.1511"-02	4.6507"+01	NM	0.99740	1.00000	0.99870	0.99740	1.00130
50	5.6540"-02	4.6507"+01	NM	0.99401	1.00000	0.99700	0.99401	1.00301

INPUT VARIABLES Y/R,U/UD,M ASSUME P=PD
AT I=2,21,30 DATA WERE AVERAGED

70020404 JONES PROFILE TABULATION 27 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.69743	0.00000	0.00000	5.21344	0.00000
2	6.0960"-04	3.2278"+00	NM	0.81089	0.25483	0.52642	4.26723	0.12336
3	1.8238"-03	5.4378"+00	NM	0.85832	0.34446	0.65615	3.62838	0.18084
4	3.0400"-03	6.5484"+00	NM	0.87895	0.38137	0.70152	3.38366	0.20733
5	4.1148"-03	7.2348"+00	NM	0.88822	0.40246	0.72451	3.24072	0.22356
6	5.6388"-03	8.0850"+00	NM	0.90102	0.42707	0.75049	3.08821	0.24302
7	7.9248"-03	9.2483"+00	NM	0.90351	0.45870	0.77558	2.85889	0.27129
8	1.3259"-02	1.1452"+01	NM	0.92121	0.51318	0.81876	2.54548	0.32165
9	1.8136"-02	1.3167"+01	NM	0.92280	0.55185	0.84075	2.32111	0.36222
10	2.0574"-02	1.4155"+01	NM	0.92330	0.57293	0.85139	2.20824	0.38555
11	2.1793"-02	1.4748"+01	NM	0.92465	0.58524	0.85774	2.14805	0.39931
12	2.3012"-02	1.5354"+01	NM	0.93262	0.59754	0.86693	2.10492	0.41186
13	2.4079"-02	1.5884"+01	NM	0.93403	0.60808	0.87213	2.05700	0.42398
14	2.5603"-02	1.6604"+01	NM	0.93979	0.62214	0.88062	2.00355	0.43953
15	2.7889"-02	1.7622"+01	NM	0.93967	0.64148	0.88812	1.91683	0.46333
16	3.0785"-02	1.9158"+01	NM	0.94461	0.66760	0.90061	1.80905	0.49784
17	3.3223"-02	2.0354"+01	NM	0.95290	0.69069	0.91161	1.74203	0.52330
18	3.8100"-02	2.2856"+01	NM	0.95428	0.73286	0.92500	1.59308	0.58064
19	4.1300"-02	2.4710"+01	NM	0.96054	0.76274	0.93609	1.50621	0.62149
20	5.0749"-02	3.0791"+01	NM	0.98030	0.85237	0.96608	1.28459	0.75205
21	5.6083"-02	3.5012"+01	NM	0.97304	0.91037	0.97307	1.14250	0.85170
22	6.1265"-02	3.8567"+01	NM	0.99076	0.95606	0.98917	1.07045	0.92407
23	7.6048"-02	4.2150"+01	NM	1.00172	1.00000	1.00086	1.00172	0.99914
D 24	7.7114"-02	4.2150"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
25	8.2144"-02	4.2150"+01	NM	0.99672	1.00000	0.99836	0.99672	1.00164
26	1.0211"-01	4.2150"+01	NM	1.02972	1.00000	1.01475	1.02972	0.98546
27	9.7079"-02	4.2150"+01	NM	1.02992	1.00000	1.01485	1.02992	0.98537

INPUT VARIABLES Y/R,U/UD,M ASSUME P=PD
AT I=2,10 DATA WERE AVERAGED



M : 1.75 to 3.00 in steps of 0.25
R THETA X 10^{-3} : 4 - 10
TW/TR : 0.9 - 1.02

7003

ZPG-AW-MHT

Continuous channel with interchangeable nozzle blocks. W = H = 0.10 m, L = 1 m.
PO : 0.1 MN/m^2. 280 < TO < 420 K. Air, dew point 240 K. 5 < RE/M X 10^{-6} < 14.

MEIER H.U., 1970. Experimentelle und theoretische Untersuchungen von turbulenten Grenzschichten bei Oberschallströmung. Mitt. M.P.I. und AVA no. 49.
And Meier H.U. private communications.
Also (Data superseded) Meier (1969) and (1967)

1 The test boundary layer was formed on a flat wall facing an interchangeable nozzle block. The throat (X=0)
was always at the same position and measurements could be made using six ports spaced at 45 mm intervals
8 from X = 425 to 650 mm. The surface of the plate was polished and it was not actively cooled. Constant wall
2 temperature was reached after one hour's running time. A calibration of the tunnel (Fütterer, 1967) showed
that the maximum Mach number variation in the test region was 2 % and usually it was less. The nozzle walls
3 were polished but disturbances due to joints could not be completely avoided. The location of the unforced
4 transition zone was not determined. The test boundary layer had experienced the strong acceleration of the
throat region.

6 Static pressure and wall temperature were measured at each profile station using an instrumented plug The static tapping (d = 0.4 - 0.5 mm) and the thermocouple (chromel alumel) were 5 mm to either side of the centre line. Measurements were made simultaneously with the profile traverse.

7 Total pressure and total temperature profiles were obtained in a single traverse with a combined pitot /
total temperature probe. The front face is circular (d_1 = 0.48, d_2 = 0.40 mm) and is followed by a conical
section (α = 6.6^o(E), l = 4.4 mm) leading to a cylindrical support (d_1 = 1.5 mm). The overall length is
45 mm and the probe was inclined at 7^o to the wall. A thermocouple bead is supported by its own leads 0.4 mm
behind the opening. The leads are kept coaxial with the support tube by an insulating spacer so that the l/d
ratio is greater than 100. The supporting spacer is located only by three ridges which allow air to pass
through the probe and minimise conduction errors. The probe is used alternately as a CPP and as an STP, when
the probe passage is switched to one of a series of calibrated orifices so that the mass flow may be regu-
lated and measured. The effective thermocouple recovery temperature calibration is obtained as a function
of the mass flow with the probe in the free stream, and becomes nearly constant when the mass flow is large
8 enough. The design and procedure are further discussed by Meier (1967, 1969). In the test zone the wall
static tappings and thermocouple beads were located in the plugs at each station on lines at Z = ± 5 mm
and at the X-value of the port centre. The traverses were made on the centre-line-normals through the port
centres.

9 The data were reduced assuming constant static pressure through the layer. The wall shear stress was
determined from the velocity profile using a best-fit matching procedure to Rotta's wall law and Coles' wake
11 law in transformed coordinates. The author assumed a recovery factor of 0.896 and used Sutherland's
viscosity law.

12 The editors have presented the data incorporating the authors' assumptions and calibration procedures. The
boundary layer edge state (D state) is here calculated from the experimental data at the author's selected
13 edge point. The author presents adiabatic wall data for six successive stations at six Mach numbers. This
is presented in full (0101-0606). A series of single station tests was made at each Mach number, in which
14 TW/TR was varied. These are presented as series 07 to 14. The author's shear stress data, deduced from
the profiles, are also presented.

5 DATA: 7003 0101-1402. Pitot and TO profiles. NX = 6 or 1.

15 Editors' comments

The special interest of the experiment is the use of a fully developed combined pressure-temperature probe. The thermal conditions, however, are never severe. The experimental range is covered fully and systematically, but the upstream history is not known. Experiments with significantly overlapping ranges are those of Stalmach - CAT 6802 on a tunnel wall, and the flat plate tests of Coles - CAT 5301, Shutts et al. - CAT 5501 and Mabey et al. - CAT 7402.

The profiles are described in fine detail, but in about half the cases measurements do not extend within the momentum-deficit peak. There is evidence of considerable disturbance in the outer region of profile 0506.

CAT 7003 MEIER BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
70030101	1.7170	1.0031	4.8122E+03	2.3820E-03	2.6760	1.3993	1.8792E+04	1.8792E+04
4.2500E-01	9.5170E+04	1.0000	6.8447E+03	NM	1.8101	1.8015	2.7501E+02	1.7992E+02
INFINITE	2.8600E+02	0.0000	4.9697E-04	0.0000E+00	0.0248	5.8569E-04	4.6176E+02	2.7497E+02
70030102	1.6980	1.0031	5.0410E+03	2.2670E-03	2.5881	1.3559	1.8889E+04	1.8889E+04
4.7000E-01	9.3094E+04	1.0000	7.1023E+03	NM	1.8179	1.8124	2.8784E+02	1.8912E+02
INFINITE	2.9830E+02	0.0000	5.5485E-04	0.0000E+00	0.0300	6.4900E-04	4.6846E+02	2.8695E+02
70030103	1.7080	1.0054	5.6311E+03	2.1690E-03	2.6860	1.3945	1.8825E+04	1.8825E+04
5.1500E-01	9.4047E+04	1.0000	7.9051E+03	NM	1.8002	1.7909	2.8271E+02	1.8406E+02
INFINITE	2.9240E+02	0.0000	6.0280E-04	0.0000E+00	0.0162	7.1810E-04	4.6535E+02	2.8120E+02
70030104	1.6810	1.0031	6.4039E+03	2.0870E-03	2.6735	1.4316	1.9000E+04	1.9000E+04
5.6000E-01	9.1139E+04	1.0000	8.9776E+03	NM	1.7613	1.7697	2.8339E+02	1.8752E+02
INFINITE	2.9350E+02	0.0000	6.9664E-04	0.0000E+00	0.0280	8.3245E-04	4.6153E+02	2.8248E+02
70030105	1.7000	1.0034	7.1463E+03	2.0570E-03	2.6178	1.3550	1.9231E+04	1.9231E+04
6.0500E-01	9.4926E+04	1.0000	1.0096E+04	NM	1.8023	1.7955	2.7999E+02	1.8384E+02
INFINITE	2.9010E+02	0.0000	7.4501E-04	0.0000E+00	0.0210	8.6527E-04	4.6215E+02	2.7909E+02
70030106	1.6970	1.0072	7.0582E+03	2.0230E-03	2.5987	1.3585	1.8697E+04	1.8697E+04
6.5000E-01	9.1874E+04	1.0000	1.0003E+04	NM	1.8020	1.7961	2.7673E+02	1.8122E+02
INFINITE	2.8560E+02	0.0000	7.4580E-04	0.0000E+00	0.0297	8.8235E-04	4.5803E+02	2.7478E+02
70030201	1.9630	1.0151	3.6830E+03	2.3000E-03	3.0390	1.3818	1.2938E+04	1.2938E+04
4.2500E-01	9.9574E+04	1.0000	5.7635E+03	NM	1.8178	1.8081	2.8463E+02	1.6587E+02
INFINITE	2.9370E+02	0.0000	4.7596E-04	0.0000E+00	0.0361	5.0463E-04	5.0689E+02	2.8041E+02
70030202	1.9830	1.0078	3.9597E+03	2.2030E-03	3.1271	1.3468	1.2500E+04	1.2500E+04
4.7000E-01	9.9256E+04	1.0000	6.1978E+03	NM	1.8242	1.8170	2.8697E+02	1.6703E+02
INFINITE	2.9840E+02	0.0000	5.2904E-04	0.0000E+00	-0.0140	6.5518E-04	5.1389E+02	2.8474E+02
70030203	1.9410	1.0041	4.8637E+03	2.0450E-03	3.0677	1.4261	1.3559E+04	1.3559E+04
5.1500E-01	9.6804E+04	1.0000	7.9777E+03	NM	1.7860	1.7738	2.8508E+02	1.6949E+02
INFINITE	2.9720E+02	0.0000	6.1337E-04	0.0000E+00	0.0350	7.0737E-04	5.0609E+02	2.8392E+02
70030204	1.9020	0.9995	5.1829E+03	1.9960E-03	2.9822	1.3739	1.2995E+04	1.2995E+04
5.6000E-01	9.5830E+04	1.0000	8.0032E+03	NM	1.7994	1.7905	2.8299E+02	1.6752E+02
INFINITE	2.9650E+02	0.0000	6.6086E-04	0.0000E+00	0.0607	8.2719E-04	5.0919E+02	2.8309E+02
70030205	1.9410	1.0202	5.6131E+03	1.9270E-03	2.9913	1.3703	1.3428E+04	1.3428E+04
6.0500E-01	9.5070E+04	1.0000	8.7506E+03	NM	1.7960	1.7877	2.8527E+02	1.6692E+02
INFINITE	2.9270E+02	0.0000	7.0971E-04	0.0000E+00	0.0392	8.0400E-04	5.0280E+02	2.7962E+02
70030206	1.9680	1.0094	5.8200E+03	1.9160E-03	3.0729	1.3883	1.2819E+04	1.2819E+04
6.5000E-01	9.5439E+04	1.0000	8.0953E+03	NM	1.7914	1.7807	2.7973E+02	1.6359E+02
INFINITE	2.9030E+02	0.0000	7.4115E-04	0.0000E+00	0.0343	9.3210E-04	5.0467E+02	2.7712E+02
70030301	2.1940	1.0169	3.2377E+03	2.1700E-03	3.3687	1.3419	9.1059E+03	9.1059E+03
4.2500E-01	9.6453E+04	1.0000	5.5345E+03	NM	1.8233	1.8106	2.6293E+02	1.4938E+02
INFINITE	2.9320E+02	0.0000	4.0202E-04	0.0000E+00	0.0494	6.3981E-04	5.3709E+02	2.7824E+02
70030302	2.1990	1.0077	3.4194E+03	2.0650E-03	3.4923	1.3944	9.0034E+03	9.0034E+03
4.7000E-01	9.6121E+04	1.0000	5.8052E+03	NM	1.8025	1.7896	2.8457E+02	1.5129E+02
INFINITE	2.9760E+02	0.0000	5.4081E-04	0.0000E+00	0.0389	7.0809E-04	5.4230E+02	2.8238E+02
70030303	2.2140	1.0030	3.8150E+03	1.9910E-03	3.4913	1.3820	6.9495E+03	6.9499E+03
5.1500E-01	9.7815E+04	1.0000	6.4914E+03	NM	1.8010	1.7893	2.8312E+02	1.5048E+02
INFINITE	2.9760E+02	0.0000	5.9862E-04	0.0000E+00	0.0445	7.0504E-04	5.4417E+02	2.8228E+02
70030304	2.2390	0.9982	4.2562E+03	1.9150E-03	3.4675	1.3605	6.7583E+03	6.7583E+03
5.6000E-01	9.9544E+04	1.0000	7.2962E+03	NM	1.7989	1.7895	2.7729E+02	1.4631E+02
INFINITE	2.9300E+02	0.0000	6.5489E-04	0.0000E+00	0.0660	8.0076E-04	5.4300E+02	2.7774E+02
70030305	2.2180	1.0114	4.5994E+03	1.8750E-03	3.4832	1.3754	8.7651E+03	8.7651E+03
6.0500E-01	9.6401E+04	1.0000	7.9219E+03	NM	1.7963	1.7849	2.7920E+02	1.4801E+02
INFINITE	2.8090E+02	0.0000	7.0556E-04	0.0000E+00	0.0481	9.2915E-04	5.3478E+02	2.7210E+02
70040306	2.1780	1.0064	5.0222E+03	1.7850E-03	3.4165	1.3856	9.3560E+03	9.3560E+03
6.5000E-01	9.6650E+04	1.0000	8.4789E+03	NM	1.7874	1.7767	2.7595E+02	1.4820E+02
INFINITE	2.8880E+02	0.0000	7.4565E-04	0.0000E+00	0.0531	9.8164E-04	5.3161E+02	2.7418E+02

CAT 7003 MEIER BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X * RZ	MD * POD TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
70030401	2.4170	1.0230	2.6099E+03	2.0600E-03	3.7489	1.3759	6.4756E+03	6.4756E+03
4.2500E-01	9.7219E+04	1.0000	4.9460E+03	NM	1.8077	1.7973	2.6923E+02	1.3812E+02
INFINITE	2.9950E+02	0.0000	5.1301E-04	0.0000E+00	0.0953	6.6733E-04	5.6953E+02	2.0272E+02
70030402	2.4180	1.0153	2.9743E+03	1.8890E-03	3.8882	1.3830	6.4356E+03	6.4356E+03
4.7000E-01	9.6770E+04	1.0000	5.5293E+03	NM	1.7987	1.7859	2.6396E+02	1.3659E+02
INFINITE	2.9630E+02	0.0000	5.6773E-04	0.0000E+00	0.0543	7.6101E-04	5.6659E+02	2.7909E+02
70030403	2.4390	1.0053	3.1298E+03	1.6810E-03	3.9057	1.3814	6.3232E+03	6.3232E+03
5.1500E-01	9.8240E+04	1.0000	5.8181E+03	NM	1.7974	1.7857	2.8218E+02	1.3586E+02
INFINITE	2.9750E+02	0.0000	5.9824E-04	0.0000E+00	0.0609	6.2312E-04	5.6999E+02	2.6009E+02
70030404	2.4560	1.0101	3.3405E+03	1.8290E-03	3.9650	1.4011	6.1260E+03	6.1260E+03
5.6000E-01	9.7737E+04	1.0000	6.2751E+03	NM	1.7907	1.7749	2.6323E+02	1.3075E+02
INFINITE	2.9730E+02	0.0000	6.5374E-04	0.0000E+00	0.0689	9.1295E-04	5.7160E+02	2.8030E+02
70030405	2.4460	1.0077	3.4077E+03	1.8050E-03	3.9153	1.3693	6.1292E+03	6.1292E+03
6.0500E-01	9.6270E+04	1.0000	6.4923E+03	NM	1.7964	1.7850	2.7338E+02	1.3264E+02
INFINITE	2.9180E+02	0.0000	6.6524E-04	0.0000E+00	0.0613	9.2336E-04	5.6524E+02	2.7527E+02
70030406	2.4560	1.0221	3.8642E+03	1.7240E-03	3.9420	1.3633	6.1049E+03	6.1049E+03
6.5000E-01	9.7481E+04	1.0000	7.3565E+03	NM	1.7944	1.7858	2.7802E+02	1.3071E+02
INFINITE	2.8840E+02	0.0000	7.3600E-04	0.0000E+00	0.0551	1.0255E-03	5.6298E+02	2.7200E+02
70030501	2.6830	1.0157	2.2778E+03	1.9290E-03	4.3600	1.3818	4.3089E+03	4.3089E+03
4.2500E-01	9.7734E+04	1.0000	4.6975E+03	NM	1.8035	1.7890	2.7944E+02	1.2018E+02
INFINITE	2.9310E+02	0.0000	5.4083E-04	0.0000E+00	0.0675	7.7407E-04	5.6902E+02	2.7511E+02
70030502	2.6970	1.0206	2.3777E+03	1.8470E-03	4.4930	1.4163	4.2140E+03	4.2140E+03
4.7000E-01	9.7061E+04	1.0000	4.0597E+03	NM	1.7905	1.7714	2.6090E+02	1.1948E+02
INFINITE	2.9330E+02	0.0000	5.7632E-04	0.0000E+00	0.0790	8.4726E-04	5.9107E+02	2.7922E+02
70030503	2.6910	1.0141	2.5829E+03	1.8090E-03	4.4131	1.3654	4.2988E+03	4.2988E+03
5.1500E-01	9.8713E+04	1.0000	5.3454E+03	NM	1.8008	1.7884	2.7998E+02	1.2017E+02
INFINITE	2.9420E+02	0.0000	6.1523E-04	0.0000E+00	0.0716	8.9250E-04	5.9144E+02	2.7610E+02
70030504	2.7023	1.0120	2.9042E+03	1.7030E-03	4.5590	1.4152	4.2771E+03	4.2771E+03
5.6000E-01	9.9090E+04	1.0000	6.0254E+03	NM	1.7822	1.7632	2.7963E+02	1.1979E+02
INFINITE	2.9470E+02	0.0000	6.9107E-04	0.0000E+00	0.0664	1.0354E-03	5.9293E+02	2.7651E+02
70030505	2.6730	1.0220	2.9205E+03	1.6810E-03	4.3909	1.3730	4.2991E+03	4.2991E+03
6.0500E-01	9.6020E+04	1.0000	6.0485E+03	NM	1.7904	1.7774	2.8015E+02	1.2013E+02
INFINITE	2.9180E+02	0.0000	7.0053E-04	0.0000E+00	0.0759	1.0290E-03	5.8741E+02	2.7399E+02
70030506	2.6560	1.0211	3.3791E+03	1.6260E-03	4.4293	1.4208	4.4648E+03	4.4648E+03
6.5000E-01	9.7142E+04	1.0000	6.9624E+03	NM	1.7784	1.7604	2.7475E+02	1.1884E+02
INFINITE	2.8690E+02	0.0000	7.6936E-04	0.0000E+00	0.0764	1.1395E-03	5.8052E+02	2.6906E+02
70030601	2.9210	1.0158	1.8720E+03	1.8720E-03	4.9725	1.4447	3.0474E+03	3.0474E+03
4.2500E-01	9.9380E+04	1.0000	4.2439E+03	NM	1.7900	1.7605	2.6139E+02	1.0952E+02
INFINITE	2.9640E+02	0.0000	5.5531E-04	0.0000E+00	0.1125	8.5423E-04	6.1289E+02	2.7696E+02
70030602	2.8980	1.0224	2.1364E+03	1.7420E-03	4.7682	1.3232	3.1303E+03	3.1303E+03
4.7000E-01	9.8599E+04	1.0000	4.8228E+03	NM	1.8065	1.7969	2.6356E+02	1.1072E+02
INFINITE	2.9670E+02	0.0000	6.2914E-04	0.0000E+00	0.0999	9.5172E-04	6.1140E+02	2.7736E+02
70030603	2.9030	1.0202	2.2238E+03	1.7030E-03	4.8087	1.3758	3.1239E+03	3.1239E+03
5.1500E-01	9.9133E+04	1.0000	5.0218E+03	NM	1.7933	1.7779	2.8299E+02	1.1048E+02
INFINITE	2.9670E+02	0.0000	6.5334E-04	0.0000E+00	0.0925	1.0042E-03	6.1179E+02	2.7733E+02
70030604	2.9020	1.0314	2.4600E+03	1.6610E-03	4.9320	1.4009	3.1799E+03	3.1799E+03
5.6000E-01	1.0070E+05	1.0000	5.6037E+03	NM	1.7799	1.7626	2.6509E+02	1.1016E+02
INFINITE	2.9570E+02	0.0000	7.1342E-04	0.0000E+00	0.0957	1.1160E-03	6.1068E+02	2.7640E+02
70030605	2.9340	1.0194	2.4092E+03	1.6610E-03	5.0710	1.4553	2.9508E+03	2.9508E+03
6.0500E-01	9.8344E+04	1.0000	5.5195E+03	NM	1.7783	1.7525	2.7790E+02	1.0721E+02
INFINITE	2.9180E+02	0.0000	7.1858E-04	0.0000E+00	0.1042	1.1321E-03	6.0911E+02	2.7260E+02
70030606	2.8820	1.0276	2.8109E+03	1.6810E-03	5.2407	1.6123	3.1427E+03	3.1427E+03
6.5000E-01	9.6620E+04	1.0000	6.3674E+03	NM	1.7537	1.7122	2.7780E+02	1.0867E+02
INFINITE	2.8920E+02	0.0000	8.0846E-04	0.0000E+00	0.0889	1.2857E-03	6.0237E+02	2.7043E+02

CAT 7003 MEIER BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
70030701	1.6820	0.9881	6.9721E+03	2.0940E-03	2.6229	1.4370	1.9111E+04	1.9111E+04
6.0500E-01	9.1807E+04	1.0000	9.5940E+03	NM	1.7777	1.7656	3.0800E+02	2.0685E+02
INFINITE	3.2389E+02	0.0000	8.4427E-04	0.0000E+00	0.0580	1.0039E-03	4.6503E+02	3.1172E+02
70030702	1.6980	0.9435	5.3066E+03	2.0990E-03	2.4970	1.4054	1.6734E+04	1.6734E+04
6.0500E-01	9.2194E+04	1.0000	6.9672E+03	NM	1.7825	1.7733	3.6266E+02	2.0741E+02
INFINITE	4.2161E+02	0.0000	8.6831E-04	0.0000E+00	0.1135	1.0180E-03	5.5672E+02	4.0557E+02
70030801	1.9640	0.9910	4.8819E+03	2.0430E-03	3.0034	1.4081	1.2334E+04	1.2334E+04
6.0500E-01	9.1253E+04	1.0000	7.4314E+03	NM	1.7088	1.7706	3.0638E+02	1.6280E+02
INFINITE	3.2383E+02	0.0000	7.3449E-04	0.0000E+00	0.0751	9.1621E-04	5.3241E+02	3.0916E+02
70030802	1.9840	0.9335	4.3461E+03	2.0860E-03	2.8803	1.3847	1.2382E+04	1.2382E+04
6.0500E-01	9.4502E+04	1.0000	6.2221E+03	NM	1.7669	1.7768	3.7717E+02	2.3692E+02
INFINITE	4.2343E+02	0.0000	8.5769E-04	0.0000E+00	0.1317	1.0585E-03	6.1228E+02	4.0404E+02
70030901	2.1950	0.9880	4.1536E+03	1.9780E-03	3.3321	1.3713	8.7341E+03	6.7341E+03
6.0500E-01	9.2663E+04	1.0000	6.8716E+03	NM	1.7972	1.7857	3.0213E+02	1.6411E+02
INFINITE	3.2225E+02	0.0000	7.0016E-04	0.0000E+00	0.0914	9.6062E-04	5.6379E+02	3.0561E+02
70030902	2.1640	0.9238	3.8531E+03	1.9820E-03	3.2376	1.4443	9.4538E+03	9.4538E+03
6.0500E-01	9.5549E+04	1.0000	5.8267E+03	NM	1.7696	1.7546	3.7136E+02	2.1858E+02
INFINITE	4.2329E+02	0.0000	8.6710E-04	0.0000E+00	0.1502	1.1233E-03	6.4146E+02	4.0200E+02
70031001	2.4380	0.9888	3.4567E+03	1.8620E-03	3.8585	1.4403	6.0514E+03	6.0514E+03
6.0500E-01	9.3876E+04	1.0000	6.2731E+03	NM	1.7768	1.7577	3.0140E+02	1.4760E+02
INFINITE	3.2306E+02	0.0000	7.5766E-04	0.0000E+00	0.1153	1.0514E-03	5.9386E+02	3.0881E+02
70031002	2.4440	0.9187	2.9832E+03	1.9730E-03	3.7956	1.4991	6.2046E+03	6.2046E+03
6.0500E-01	9.7157E+04	1.0000	4.9713E+03	NM	1.7639	1.7413	3.6348E+02	1.9110E+02
INFINITE	4.1940E+02	0.0000	8.3363E-04	0.0000E+00	0.1716	1.1882E-03	6.7740E+02	3.9506E+02
70031101	2.6840	0.9896	2.7506E+03	1.7850E-03	4.3232	1.4418	4.1949E+03	4.1949E+03
6.0500E-01	9.5294E+04	1.0000	5.4951E+03	NM	1.7774	1.7560	2.9913E+02	1.3195E+02
INFINITE	3.2206E+02	0.0000	7.4261E-04	0.0000E+00	0.1442	1.0890E-03	6.1816E+02	3.0229E+02
70031102	2.7550	0.9105	2.1890E+03	1.9920E-03	4.1461	1.4121	3.8646E+03	3.8646E+03
6.0500E-01	9.7906E+04	1.0000	4.0610E+03	NM	1.7798	1.7628	3.5881E+02	1.6697E+02
INFINITE	4.2042E+02	0.0000	8.0657E-04	0.0000E+00	0.2346	1.1624E-03	7.1375E+02	3.9406E+02
70031201	2.9050	0.9967	2.4697E+03	1.7220E-03	4.7274	1.4055	3.0625E+03	3.0625E+03
6.0500E-01	9.7493E+04	1.0000	5.4216E+03	NM	1.7840	1.7637	2.9537E+02	1.1796E+02
INFINITE	3.1706E+02	0.0000	7.9009E-04	0.0000E+00	0.1614	1.2087E-03	6.3259E+02	2.9635E+02
70031202	2.8630	0.8960	2.1634E+03	1.9060E-03	4.3233	1.4304	3.2951E+03	3.2951E+03
6.0500E-01	9.8426E+04	1.0000	4.1286E+03	NM	1.7777	1.7555	3.5169E+02	1.5899E+02
INFINITE	4.1964E+02	0.0000	8.6495E-04	0.0000E+00	0.2607	1.2745E-03	7.2380E+02	3.9253E+02

POD CALCULATED FROM TOD,RHOD (AUTHOR)

70030401 MEIER PROFILE TABULATION 25 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.95487	0.00000	0.00000	2.07052	0.00000
2	2.8000E-04	2.2077E+00	NM	0.96175	0.46693	0.60197	1.66205	0.36218
3	3.0000E-04	2.2184E+00	NM	0.96286	0.46854	0.60398	1.66164	0.36348
4	3.2000E-04	2.2709E+00	NM	0.96221	0.47652	0.61191	1.64895	0.37109
5	3.5000E-04	2.3440E+00	NM	0.96300	0.48743	0.62315	1.63445	0.38126
6	4.0000E-04	2.4291E+00	NM	0.96307	0.49955	0.63520	1.61688	0.39286
7	5.0000E-04	2.5766E+00	NM	0.96328	0.51984	0.65499	1.58752	0.41258
8	7.5000E-04	2.8825E+00	NM	0.96371	0.55912	0.69174	1.53061	0.45193
9	1.0000E-03	3.1563E+00	NM	0.96653	0.59174	0.72160	1.48731	0.48521
10	1.3000E-03	3.4402E+00	NM	0.97047	0.62355	0.75008	1.44700	0.51836
11	1.6000E-03	3.8094E+00	NM	0.97396	0.66243	0.78271	1.39613	0.56063
12	1.9000E-03	4.0300E+00	NM	0.97785	0.68454	0.80129	1.37018	0.58480
13	2.2000E-03	4.3250E+00	NM	0.98123	0.71302	0.82378	1.33481	0.61715
14	2.5000E-03	4.6204E+00	NM	0.98342	0.74028	0.84406	1.30003	0.64926
15	3.0000E-03	5.1362E+00	NM	0.98889	0.78562	0.87690	1.24586	0.70385
16	3.5000E-03	5.6324E+00	NM	0.99340	0.82682	0.90481	1.19755	0.75555
17	4.0000E-03	6.0853E+00	NM	0.99706	0.86267	0.92770	1.15646	0.80219
18	4.5000E-03	6.5267E+00	NM	0.99919	0.89619	0.94746	1.11774	0.84766
19	5.0000E-03	6.9067E+00	NM	1.00023	0.92406	0.96285	1.08570	0.88684
20	5.5000E-03	7.2274E+00	NM	1.00129	0.94658	0.97490	1.06072	0.91909
21	6.0000E-03	7.4960E+00	NM	1.00146	0.96567	0.98444	1.03925	0.94726
22	6.5000E-03	7.6444E+00	NM	1.00143	0.97587	0.98936	1.02784	0.96256
23	7.0000E-03	7.8019E+00	NM	1.00169	0.98657	0.99458	1.01630	0.97863
24	7.5000E-03	7.9069E+00	NM	1.00088	0.99364	0.99749	1.00777	0.98980
D 25	8.0000E-03	8.0020E+00	NM	1.00030	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

70030402 MEIER PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.95624	0.00000	0.00000	2.07442	0.00000
2	2.8000E-04	2.1163E+00	NM	0.96097	0.45225	0.58659	1.68232	0.34868
3	3.0000E-04	2.1163E+00	NM	0.96097	0.45225	0.58659	1.68232	0.34868
4	3.2000E-04	2.1570E+00	NM	0.96198	0.45886	0.59379	1.67457	0.35459
5	3.5000E-04	2.2304E+00	NM	0.96179	0.47019	0.60541	1.65787	0.36517
6	4.0000E-04	2.3030E+00	NM	0.96184	0.48111	0.61652	1.64210	0.37544
7	5.0000E-04	2.4377E+00	NM	0.96234	0.50055	0.63604	1.61461	0.39393
8	7.5000E-04	2.6857E+00	NM	0.96461	0.53402	0.66897	1.56926	0.42630
9	1.0000E-03	2.9201E+00	NM	0.96646	0.56398	0.69720	1.52819	0.45622
10	1.3000E-03	3.1829E+00	NM	0.96964	0.59455	0.72533	1.48830	0.48735
11	1.6000E-03	3.4524E+00	NM	0.97339	0.62461	0.75215	1.45008	0.51870
12	1.9000E-03	3.7113E+00	NM	0.97712	0.65207	0.77588	1.41578	0.54802
13	2.2000E-03	3.9802E+00	NM	0.98008	0.67933	0.79830	1.38093	0.57809
14	2.5000E-03	4.2292E+00	NM	0.98285	0.70358	0.81762	1.35044	0.60544
15	3.0000E-03	4.6945E+00	NM	0.98858	0.74667	0.85075	1.29822	0.65532
16	3.5000E-03	5.1509E+00	NM	0.99235	0.78655	0.87908	1.24911	0.70376
17	4.0000E-03	5.6170E+00	NM	0.99720	0.82523	0.90561	1.20427	0.75199
18	4.5000E-03	6.0724E+00	NM	0.99938	0.86131	0.92803	1.16093	0.79939
19	5.0000E-03	6.4765E+00	NM	1.00214	0.89207	0.94665	1.12609	0.84065
20	5.5000E-03	6.8701E+00	NM	1.00248	0.92103	0.96236	1.09176	0.88148
21	6.0000E-03	7.2223E+00	NM	1.00369	0.94619	0.97588	1.06374	0.91740
22	6.5000E-03	7.4707E+00	NM	1.00307	0.96352	0.98418	1.04335	0.94330
23	7.0000E-03	7.6780E+00	NM	1.00310	0.97775	0.99104	1.02747	0.96459
24	7.5000E-03	7.8229E+00	NM	1.00238	0.98757	0.99540	1.01590	0.97981
25	8.0000E-03	7.8944E+00	NM	1.00167	0.99230	0.99730	1.00993	0.98749
26	8.5000E-03	7.9467E+00	NM	1.00080	0.99589	0.99850	1.00524	0.99329
27	9.0000E-03	7.9977E+00	NM	1.00085	0.99930	1.00010	1.00160	0.99850
D 28	9.5000E-03	8.0083E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

70030403 MEIER PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.94775	0.00000	0.00000	2.07534	0.00000
2	2.8000E-04	2.1685E+00	NM	0.95957	0.45062	0.59240	1.68356	0.35191
3	3.0000E-04	2.1898E+00	NM	0.96046	0.45992	0.59610	1.68029	0.35481
4	3.2000E-04	2.2323E+00	NM	0.96012	0.46643	0.60278	1.67014	0.36092
5	3.5000E-04	2.2851E+00	NM	0.96021	0.47433	0.61088	1.65664	0.36830
6	4.0000E-04	2.3586E+00	NM	0.96146	0.48504	0.62209	1.64493	0.37818
7	5.0000E-04	2.4855E+00	NM	0.96137	0.50285	0.63969	1.61831	0.39528
8	7.5000E-04	2.7480E+00	NM	0.96439	0.53748	0.67380	1.57162	0.42873
9	1.0000E-03	2.9705E+00	NM	0.96634	0.56470	0.69941	1.53405	0.45593
10	1.3000E-03	3.2234E+00	NM	0.96911	0.59402	0.72622	1.49464	0.48586
11	1.6000E-03	3.4878E+00	NM	0.97262	0.62304	0.75203	1.45693	0.51617
12	1.9000E-03	3.6986E+00	NM	0.97628	0.64515	0.77143	1.42974	0.53954
13	2.2000E-03	3.9304E+00	NM	0.97904	0.66857	0.79094	1.39956	0.56513
14	2.5000E-03	4.1627E+00	NM	0.98157	0.69118	0.80914	1.37045	0.59042
15	3.0000E-03	4.5849E+00	NM	0.98701	0.73041	0.83985	1.32212	0.63523
16	3.5000E-03	4.9848E+00	NM	0.99163	0.76564	0.86590	1.27924	0.67693
17	4.0000E-03	5.4287E+00	NM	0.99527	0.80286	0.89167	1.23346	0.72290
18	4.5000E-03	5.8508E+00	NM	0.99881	0.83669	0.91397	1.19326	0.76593
19	5.0000E-03	6.2772E+00	NM	1.00156	0.86911	0.93400	1.15510	0.80860
20	5.5000E-03	6.6838E+00	NM	1.00357	0.89963	0.95189	1.11955	0.85024
21	6.0000E-03	7.0532E+00	NM	1.00464	0.92615	0.96639	1.08674	0.88758
22	6.5000E-03	7.3797E+00	NM	1.00472	0.94896	0.97799	1.06212	0.92080
23	7.0000E-03	7.6757E+00	NM	1.00392	0.96918	0.98750	1.03616	0.95120
24	7.5000E-03	7.9282E+00	NM	1.00327	0.98609	0.99520	1.01856	0.97707
25	8.0000E-03	8.0660E+00	NM	1.00241	0.99520	0.99900	1.00766	0.99141
26	8.5000E-03	8.0965E+00	NM	1.00077	0.99720	0.99910	1.00382	0.99530
27	9.0000E-03	8.1178E+00	NM	1.00088	0.99860	0.99980	1.00241	0.99700
D 28	9.5000E-03	8.1392E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,H/HD ASSUME P=PD

70030404 MEIER PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.94831	0.00000	0.00000	2.09235	0.00000
2	2.8000E-04	2.0960E+00	NM	0.95950	0.44215	0.57869	1.71305	0.33782
3	3.0000E-04	2.1513E+00	NM	0.95859	0.45078	0.58751	1.69863	0.34587
4	3.2000E-04	2.1940E+00	NM	0.95957	0.45750	0.59481	1.69035	0.35189
5	3.5000E-04	2.2492E+00	NM	0.95961	0.46573	0.60332	1.67816	0.35952
6	4.0000E-04	2.3250E+00	NM	0.95981	0.47687	0.61474	1.66181	0.36992
7	5.0000E-04	2.4553E+00	NM	0.95913	0.49523	0.63280	1.63305	0.38754
8	7.5000E-04	2.7052E+00	NM	0.96092	0.52625	0.66530	1.58619	0.41943
9	1.0000E-03	2.9223E+00	NM	0.96222	0.55504	0.69053	1.54779	0.44614
10	1.3000E-03	3.1510E+00	NM	0.96461	0.58174	0.71510	1.51131	0.47321
11	1.6000E-03	3.3788E+00	NM	0.96767	0.60702	0.73799	1.47605	0.49930
12	1.9000E-03	3.5961E+00	NM	0.97032	0.63011	0.75811	1.44756	0.52371
13	2.2000E-03	3.8131E+00	NM	0.97380	0.65278	0.77725	1.41981	0.54742
14	2.5000E-03	4.0310E+00	NM	0.97648	0.67376	0.79495	1.39212	0.57104
15	3.0000E-03	4.4001E+00	NM	0.98197	0.70858	0.82309	1.34932	0.61000
16	3.5000E-03	4.7693E+00	NM	0.98638	0.74170	0.84832	1.30817	0.64847
17	4.0000E-03	5.1501E+00	NM	0.98998	0.77431	0.87175	1.26751	0.68776
18	4.5000E-03	5.5415E+00	NM	0.99351	0.80642	0.89377	1.22837	0.72761
19	5.0000E-03	5.9420E+00	NM	0.99720	0.83803	0.91460	1.19107	0.76788
20	5.5000E-03	6.3343E+00	NM	0.99911	0.86774	0.93262	1.15513	0.80737
21	6.0000E-03	6.7250E+00	NM	1.00108	0.89644	0.94934	1.12151	0.84648
22	6.5000E-03	7.0844E+00	NM	1.00294	0.92193	0.96360	1.09258	0.88200
23	7.0000E-03	7.4634E+00	NM	1.00311	0.94812	0.97697	1.06179	0.92012
24	7.5000E-03	7.8004E+00	NM	1.00333	0.97080	0.98809	1.03593	0.95381
25	8.0000E-03	8.0177E+00	NM	1.00243	0.98515	0.99439	1.01886	0.97599
26	8.5000E-03	8.1370E+00	NM	1.00160	0.99298	0.99760	1.00935	0.98838
27	9.0000E-03	8.1809E+00	NM	1.00083	0.99574	0.99850	1.00546	0.99308
D 28	9.5000E-03	8.2461E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,H/HD ASSUME P=PD

70030405 METER PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.95057	0.00000	0.00000	2.08800	0.00000
2	2.8000E-04	2.0836E+00	NM	0.96154	0.44180	0.57810	1.71270	0.33764
3	3.0000E-04	2.1052E+00	NM	0.96152	0.44530	0.58180	1.70703	0.34083
4	3.2000E-04	2.1480E+00	NM	0.95233	0.45220	0.58930	1.69629	0.34700
5	3.5000E-04	2.2026E+00	NM	0.96250	0.46060	0.59810	1.68616	0.35471
6	4.0000E-04	2.3009E+00	NM	0.96257	0.47530	0.61520	1.66444	0.36841
7	5.0000E-04	2.3990E+00	NM	0.96324	0.48940	0.62760	1.64452	0.38163
8	7.5000E-04	2.6600E+00	NM	0.96514	0.52460	0.66250	1.59483	0.41540
9	1.0000E-03	2.8662E+00	NM	0.96696	0.55050	0.68730	1.55876	0.44093
10	1.3000E-03	3.0943E+00	NM	0.96901	0.57760	0.71240	1.52172	0.46831
11	1.6000E-03	3.3597E+00	NM	0.97149	0.60700	0.73870	1.48101	0.49878
12	1.9000E-03	3.5184E+00	NM	0.97411	0.62450	0.75430	1.45889	0.51704
13	2.2000E-03	3.7142E+00	NM	0.97675	0.64490	0.77190	1.43264	0.53880
14	2.5000E-03	3.9319E+00	NM	0.97925	0.66680	0.79010	1.40402	0.56274
15	3.0000E-03	4.2906E+00	NM	0.98291	0.70130	0.81760	1.35917	0.60154
16	3.5000E-03	4.6494E+00	NM	0.98723	0.73410	0.84290	1.31636	0.63934
17	4.0000E-03	5.0377E+00	NM	0.99178	0.76540	0.86020	1.28074	0.67633
18	4.5000E-03	5.3998E+00	NM	0.99435	0.79820	0.88860	1.23934	0.71700
19	5.0000E-03	5.8025E+00	NM	0.99791	0.83050	0.91010	1.20098	0.75786
20	5.5000E-03	6.1608E+00	NM	1.00058	0.85820	0.92760	1.16827	0.79399
21	6.0000E-03	6.6281E+00	NM	1.00241	0.89300	0.94790	1.12674	0.84128
22	6.5000E-03	7.0093E+00	NM	1.00313	0.92040	0.96280	1.09426	0.87987
23	7.0000E-03	7.4110E+00	NM	1.00413	0.94880	0.97750	1.06231	0.92017
24	7.5000E-03	7.6831E+00	NM	1.00342	0.96090	0.98620	1.04032	0.94796
25	8.0000E-03	7.9332E+00	NM	1.00256	0.98360	0.99370	1.02064	0.97360
26	8.5000E-03	8.0638E+00	NM	1.00175	0.99220	0.99730	1.01031	0.98713
27	9.0000E-03	8.1509E+00	NM	1.00092	0.99790	0.99950	1.00321	0.99630
D 28	9.5000E-03	8.1831E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

70030406 METER PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.96402	0.00000	0.00000	2.12700	0.00000
2	2.8000E-04	2.0866E+00	NM	0.94500	0.44050	0.57860	1.72530	0.33536
3	3.0000E-04	2.0972E+00	NM	0.96431	0.44220	0.58020	1.72154	0.33702
4	3.2000E-04	2.1406E+00	NM	0.96434	0.44910	0.58750	1.71131	0.34330
5	3.5000E-04	2.1941E+00	NM	0.96471	0.45740	0.59630	1.69956	0.35085
6	4.0000E-04	2.2699E+00	NM	0.96383	0.46880	0.60780	1.68092	0.36159
7	5.0000E-04	2.3883E+00	NM	0.96345	0.48590	0.62500	1.65450	0.37776
8	7.5000E-04	2.6140E+00	NM	0.96435	0.51650	0.65530	1.60968	0.40710
9	1.0000E-03	2.7972E+00	NM	0.96550	0.53980	0.67770	1.57619	0.42996
10	1.3000E-03	3.0019E+00	NM	0.96788	0.56450	0.70110	1.54252	0.45451
11	1.6000E-03	3.2601E+00	NM	0.97030	0.59400	0.72790	1.50166	0.48473
12	1.9000E-03	3.3897E+00	NM	0.97220	0.60820	0.74070	1.48317	0.49940
13	2.2000E-03	3.5730E+00	NM	0.97431	0.62770	0.75770	1.45710	0.52000
14	2.5000E-03	3.7666E+00	NM	0.97750	0.64760	0.77500	1.43215	0.54114
15	3.0000E-03	4.0676E+00	NM	0.98078	0.67730	0.79940	1.39305	0.57385
16	3.5000E-03	4.4014E+00	NM	0.98490	0.70870	0.82440	1.35317	0.60924
17	4.0000E-03	4.7468E+00	NM	0.98908	0.73970	0.84810	1.31457	0.64516
18	4.5000E-03	5.0798E+00	NM	0.99234	0.76840	0.86890	1.27869	0.67952
19	5.0000E-03	5.4360E+00	NM	0.99543	0.79790	0.88930	1.24222	0.71589
20	5.5000E-03	5.7805E+00	NM	0.99861	0.82540	0.90770	1.20936	0.75056
21	6.0000E-03	6.1899E+00	NM	1.00092	0.85690	0.92730	1.17106	0.79184
22	6.5000E-03	6.4905E+00	NM	1.00322	0.87930	0.94100	1.14526	0.82165
23	7.0000E-03	6.8900E+00	NM	1.00463	0.90820	0.95730	1.11195	0.86162
24	7.5000E-03	7.2881E+00	NM	1.00503	0.93610	0.97190	1.07795	0.90162
25	8.0000E-03	7.6211E+00	NM	1.00555	0.95880	0.98340	1.05197	0.93482
26	8.5000E-03	7.8909E+00	NM	1.00408	0.97680	0.99130	1.02991	0.96251
27	9.0000E-03	8.0521E+00	NM	1.00336	0.98740	0.99590	1.01729	0.97897
28	9.5000E-03	8.1380E+00	NM	1.00259	0.99300	0.99610	1.01030	0.98793
29	1.0000E-02	8.1920E+00	NM	1.00179	0.99650	0.99930	1.00563	0.99371
30	1.0500E-02	8.2136E+00	NM	1.00091	0.99790	0.99950	1.00321	0.99630
D 31	1.1000E-02	8.2461E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

70030901 MEIER PROFILE TABULATION 30 POINTS, DELTA AT POINT 30

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93756	0.00000	0.00000	1.84100	0.00000
2	2.8000"-04	1.9280"+00	NM	0.95390	0.46287	0.57674	1.55256	0.37148
3	3.0000"-04	1.9280"+00	NM	0.95390	0.46287	0.57674	1.55256	0.37148
4	3.2000"-04	1.9610"+00	NM	0.95470	0.46925	0.58355	1.54651	0.37733
5	3.5000"-04	2.0390"+00	NM	0.95480	0.48428	0.59888	1.52925	0.39162
6	4.0000"-04	2.1123"+00	NM	0.95560	0.49749	0.61230	1.51500	0.40418
7	5.0000"-04	2.2333"+00	NM	0.95650	0.51845	0.63323	1.49180	0.42448
8	7.5000"-04	2.4722"+00	NM	0.95780	0.55672	0.66997	1.44822	0.46261
9	1.0000"-03	2.6180"+00	NM	0.96150	0.57859	0.69129	1.42752	0.48426
10	1.3000"-03	2.8270"+00	NM	0.96400	0.60820	0.71847	1.39550	0.51485
11	1.6000"-03	3.0283"+00	NM	0.96650	0.63508	0.74284	1.36667	0.54325
12	1.9000"-03	3.1483"+00	NM	0.96890	0.65057	0.75620	1.35139	0.55963
13	2.2000"-03	3.3234"+00	NM	0.97130	0.67244	0.77504	1.32843	0.58342
14	2.5000"-03	3.4856"+00	NM	0.97370	0.69203	0.79153	1.30824	0.60503
15	3.0000"-03	3.7807"+00	NM	0.97930	0.72620	0.82000	1.27503	0.64312
16	3.5000"-03	4.0446"+00	NM	0.98260	0.75535	0.84281	1.24497	0.67697
17	4.0000"-03	4.2890"+00	NM	0.98660	0.78132	0.86292	1.21977	0.70744
18	4.5000"-03	4.6010"+00	NM	0.98990	0.81321	0.88607	1.18722	0.74634
19	5.0000"-03	4.8552"+00	NM	0.99310	0.83827	0.90391	1.16274	0.77740
20	5.5000"-03	5.1710"+00	NM	0.99630	0.86834	0.92431	1.13308	0.81575
21	6.0000"-03	5.4677"+00	NM	0.99880	0.89567	0.94201	1.10616	0.85161
22	6.5000"-03	5.6609"+00	NM	0.99960	0.91298	0.95254	1.08852	0.87508
23	7.0000"-03	5.9101"+00	NM	1.00100	0.93485	0.96566	1.06700	0.90502
24	7.5000"-03	6.1273"+00	NM	1.00100	0.95353	0.97594	1.04767	0.93158
25	8.0000"-03	6.3007"+00	NM	1.00100	0.96811	0.98386	1.03281	0.95261
26	8.5000"-03	6.4708"+00	NM	1.00100	0.98223	0.99133	1.01860	0.97322
27	9.0000"-03	6.5484"+00	NM	1.00100	0.98861	0.99465	1.01225	0.98261
28	9.5000"-03	6.6042"+00	NM	1.00100	0.99317	0.99700	1.00774	0.98935
29	1.0000"-02	6.6540"+00	NM	1.00000	0.99727	0.99861	1.00269	0.99593
D 30	1.0500"-02	6.6883"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

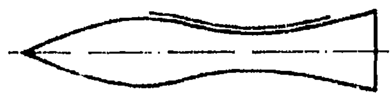
INPUT VARIABLES Y,M,TO/TOD ASSUME P=PD

70030902 MEIER PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	F/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.87732	0.00000	0.00000	1.69900	0.00000
2	3.0000"-04	1.6895"+00	NM	0.92620	0.41543	0.51622	1.54408	0.33432
3	3.2000"-04	1.7113"+00	NM	0.92630	0.42089	0.52207	1.53858	0.33932
4	3.5000"-04	1.7333"+00	NM	0.92810	0.42625	0.52827	1.53597	0.34393
5	4.0000"-04	1.7988"+00	NM	0.93010	0.44159	0.54497	1.52305	0.35782
6	5.0000"-04	1.9311"+00	NM	0.93160	0.46996	0.57460	1.49489	0.38438
7	7.5000"-04	2.1320"+00	NM	0.93560	0.50832	0.61396	1.45883	0.42086
8	1.0000"-03	2.3240"+00	NM	0.93900	0.54133	0.64643	1.42708	0.45298
9	1.3000"-03	2.4842"+00	NM	0.94230	0.56654	0.67107	1.40306	0.47829
10	1.6000"-03	2.8047"+00	NM	0.94710	0.61368	0.71458	1.35589	0.52702
11	1.7000"-03	2.8544"+00	NM	0.94960	0.62061	0.72147	1.35146	0.53385
12	2.2000"-03	2.8980"+00	NM	0.95440	0.62662	0.72842	1.35133	0.53904
13	2.5000"-03	3.1269"+00	NM	0.95770	0.65712	0.75514	1.32059	0.57182
14	3.0000"-03	3.4095"+00	NM	0.96290	0.69270	0.78570	1.28655	0.61070
15	3.5000"-03	3.5979"+00	NM	0.96800	0.71534	0.80528	1.26726	0.63545
16	4.0000"-03	3.8702"+00	NM	0.97260	0.74677	0.83065	1.23724	0.67135
17	4.5000"-03	4.1465"+00	NM	0.97630	0.77726	0.85497	1.20994	0.70662
18	5.0000"-03	4.4740"+00	NM	0.98230	0.81192	0.88053	1.17614	0.74866
19	5.5000"-03	4.7155"+00	NM	0.98560	0.83641	0.89818	1.15314	0.77890
20	6.0000"-03	5.0260"+00	NM	0.98950	0.86691	0.91935	1.12464	0.81746
21	6.5000"-03	5.2149"+00	NM	0.99270	0.88494	0.93193	1.10903	0.84031
22	7.0000"-03	5.4373"+00	NM	0.99480	0.90573	0.94537	1.08946	0.86775
23	7.5000"-03	5.7072"+00	NM	0.99680	0.93022	0.96054	1.06625	0.90086
24	8.0000"-03	5.9101"+00	NM	0.99820	0.94824	0.97137	1.04937	0.92567
25	7.5000"-03	6.0853"+00	NM	0.99900	0.96349	0.98015	1.03488	0.94712
26	9.0000"-03	6.1923"+00	NM	0.99970	0.97274	0.98549	1.02640	0.96014
27	9.5000"-03	6.3007"+00	NM	0.99920	0.98198	0.99017	1.01676	0.97385
28	1.0000"-02	6.3991"+00	NM	0.99930	0.99030	0.99461	1.00872	0.98600
29	1.0500"-02	6.4648"+00	NM	0.99990	0.99584	0.99780	1.00393	0.99389
30	1.1000"-02	6.5151"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 31	1.1500"-02	6.5151"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,TO/TOD ASSUME P=PD

axisymmetric



M : 1.4 - 2.8 (free stream)

R THETA X 10^{-3} : 8-40

TW/TR : 1.0

7004

APG (VPG)
AW

Continuous wind tunnel with flexible nozzle: W = H = 2.4 m.
0.04 < PO < 0.08 MN/m^2. TO : 290 K. Air, dew-point 243 K. 5 < RE/m X 10^{-6} < 13.

WINTER K.G., ROTTA J.C. and SMITH K.G., 1970. Studies of the turbulent boundary layer on a waisted body of revolution in subsonic and supersonic flow. ARC R & M 3633 (replaces RAE TR 68215, 1968)
And Winter K.G., private communication.
Also Winter et al. (1965 a & b).

1 The test boundary layer was formed on the exterior surface of a pointed body of revolution aligned with the axis of the wind-tunnel. The model was constructed of fibreglass on a steel core. The overall length was 1.524 m and the maximum diameter approximately 0.25 m. The body geometry is specified in figure 1.
4 The resultant pressure history is tabulated in section D. The free stream Mach number was uniform to within
3 ± 0.006. A transition trip consisting of 0.127 mm ballotini was attached 38 mm from the nose of the model. This size proved inadequate at Mach numbers greater than 1.4, transition occurring downstream of the trip.

6 Static holes (d = 0.762 mm) were provided at 29 stations along each of two generators separated by 30° and extra holes were drilled 90° apart at X = 0.152, 0.610, 1.067 and 1.499 m. The pressures recorded at these
5 stations provide a check on twodimensionality and are given in section D. Skin friction was measured by the
6 razor-blade technique (Smith et al. 1972) the calibration however being based on later measurements taken during the floating element balance tests of CAT 7302. The height of the razor blades was about 0.13 mm, and for some tests alternate blades were removed to check that the results were not affected by the presence
7 of the blades. The data are presented in section D. The Pitot surveys were obtained by traversing a rake carrying 5 CPP (d_1 = 0.50, d_2 = 0.25 mm) mounted at 2.54 mm intervals. The traverse mechanism actually moved the rake along a circular arc of radius 76.2 mm, but the data was reduced using the normal distance from the surface. The tubes could not be aligned exactly with the local direction of a body generator, but
8 the misalignment was less than 5° except in the body waist at X = 1.067 m, where it was 11°. Assigning the value ϕ = 0 to the generator on which static pressure measurements were made the skin-friction measurements were made by mounting razor blades over the holes at ϕ = 30°. The X-positions are given (in the author's units) in Section D. X is measured axially and is 0 at the nose of the body. The profiles were taken at X = 0.610, 0.724, 0.838, 1.067, 1.269 and 1.498 m (24, 28.5, 33, 42, 50, 59 in).

9 The authors have assumed negligible static pressure variation across the boundary layer, calculating the free stream Mach number from the measured wall pressure at subsonic speeds, and from the Pitot tube reading outside the boundary layer at supersonic speeds. They present profile data calculated either with the assumption of isoenergetic flow or using the Crocco / Van Driest relationship with a recovery factor of 0.89.
12 The editors have presented the data as calculated by the authors with a recovery factor of 0.89. The boundary layer edge state has been set arbitrarily to agree with the stated Reynolds numbers and mean total temperature at the authors' specified edge point. We have not included the authors' case with subsonic (M = 0.6) free
13 stream flow. The profiles presented consist of 6 sets at a single Reynolds number, each for a different Mach
14 number. One set at M = 1.4 (02) is for a higher Reynolds number. The wall data of section D cover a wider range of Reynolds numbers.

§ DATA: 7004 0101-0606. Pitot profiles. NX = 5 or 6. CF from razor blade surface Pitots.

15 Editors' comments

The entry describes an interesting flow which provides a good test case for calculation methods owing to the simultaneous presence of both longitudinal and transverse curvature. In the profile test zone, for the supersonic cases presented here, the pressure gradient is always positive, but the full pressure and skin friction history is given including values for the forepart of the body in the region of accelerated flow.

The pressure gradient is a simple wave one generated by curvature of the body itself, but the maximum static pressure change likely to occur across the boundary layer is only of the order 10 %. The authors present the results of calculations allowing for static pressure variation (source paper figures 33 and 34). "Though appreciable changes of the profiles result" ... "there is no significant improvement in the relationship with "law of the wall" lines". There is also very little effect on the values of H12K. The effects are more marked than in the only comparable study - Allen, CAT 7005, but still not large.

Comparing the profiles in transformed wall law coordinates, we find that there is considerable scatter in the CF values and that on average the values seem to be low as compared to ZPG values. Series 06, as far as the inner region is concerned, appears to display transitional characteristics. The profiles are given in fine detail, but in about half the cases measurements do not extend within the momentum deficit peak. At stations 3 and 4 it appears that some correction of the innermost values is necessary. This is the zone in which the authors report difficulty in aligning the probes, which might make angles of up to 11° with the local generator of the model.

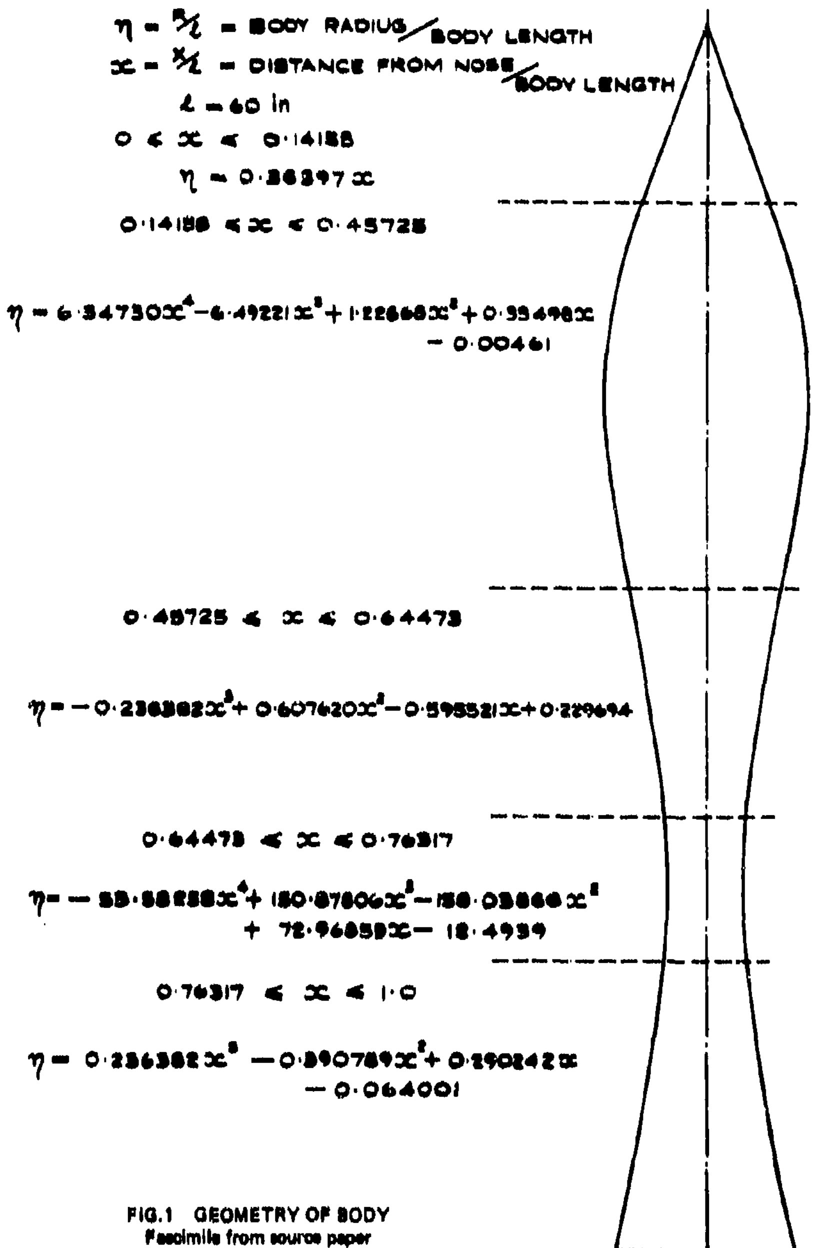


FIG.1 GEOMETRY OF BODY
Facsimile from source paper

CAT 7004 WINTER/9/5 BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2K	CF *	H12	H12K	PW	PD
X *	PUD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ *	TUD*	SN *	D2	PI2	H42	D2K	UD	TR
70040101	1.7060	1.0000	2.5161"+03	2.7200"-03	2.6970	1.4195	7.8386"+03	7.8386"+03
6.0960"-01	4.2762"+04	1.0000	3.6215"+03	NM	1.7778	1.7678	2.7775"+02	1.7860"+02
1.1070"-01	2.9000"+02	1.0000	6.0676"-04	NC	0.0743	7.3318"-04	4.7319"+02	2.7775"+02
70040102	1.6330	1.0000	4.1587"+03	1.9200"-03	2.6578	1.5310	9.6234"+03	9.6234"+03
7.2390"-01	4.2960"+04	1.0000	5.7165"+03	NM	1.7304	1.7194	2.7890"+02	1.8913"+02
8.9278"-02	2.9000"+02	1.0000	9.1206"-04	NC	0.0673	1.1013"-03	4.5027"+02	2.7890"+02
70040103	1.4540	1.0000	7.7421"+03	1.4300"-03	2.3801	1.4969	1.2368"+04	1.2368"+04
8.3820"-01	4.2493"+04	1.0000	1.0033"+04	NM	1.7022	1.6929	2.8052"+02	2.0382"+02
7.1071"-02	2.9000"+02	1.0000	1.5474"-03	NC	0.0588	1.8180"-03	4.1620"+02	2.8052"+02
70040104	1.2880	1.0000	1.7733"+04	8.3000"-04	2.3057	1.5992	1.5759"+04	1.5759"+04
1.0668"+00	4.2960"+04	1.0000	2.1840"+04	NM	1.6386	1.6290	2.8205"+02	2.1775"+02
8.4649"-02	2.9000"+02	1.0000	3.2593"-03	NC	0.0510	3.7692"-03	3.8107"+02	2.8205"+02
70040105	1.2540	1.0000	1.2428"+04	1.7100"-03	1.9686	1.3412	1.6509"+04	1.6509"+04
1.2700"+00	4.2991"+04	1.0000	1.5155"+04	NM	1.7595	1.7537	2.8237"+02	2.2062"+02
9.1120"-02	2.9000"+02	1.0000	2.2564"-03	NC	0.0467	2.4988"-03	3.7344"+02	2.8237"+02
70040106	1.2150	1.0000	9.2878"+03	2.1700"-03	1.8108	1.2438	1.7263"+04	1.7263"+04
1.4986"+00	4.2692"+04	1.0000	1.1200"+04	NM	1.8278	1.8239	2.8273"+02	2.2390"+02
9.8153"-02	2.9000"+02	1.0000	1.6783"-03	NC	0.0468	1.8029"-03	3.6451"+02	2.8273"+02
70040201	1.7770	1.0000	4.4281"+03	2.3100"-03	2.7341	1.4389	1.4917"+04	1.4917"+04
6.0960"-01	8.2752"+04	1.0000	6.3982"+03	NM	1.7759	1.7652	2.7765"+02	1.7775"+02
1.1070"-01	2.9000"+02	1.0000	5.5618"-04	NC	0.0773	6.7441"-04	4.7500"+02	2.7765"+02
70040202	1.6460	1.0000	6.8832"+03	1.7300"-03	2.6602	1.5291	1.8160"+04	1.8160"+04
7.2390"-01	8.2657"+04	1.0000	9.5035"+03	NM	1.7385	1.7281	2.7879"+02	1.8808"+02
8.9278"-02	2.9000"+02	1.0000	7.9118"-04	NC	0.0747	9.5331"-04	4.5260"+02	2.7879"+02
70040203	1.4700	1.0000	1.3070"+04	1.4000"-03	2.5058	1.5776	2.3700"+04	2.3700"+04
8.3820"-01	8.3318"+04	1.0000	1.7025"+04	NM	1.6872	1.6768	2.8037"+02	2.0249"+02
7.1071"-02	2.9000"+02	1.0000	1.3434"-03	NC	0.0576	1.5955"-03	4.1940"+02	2.8037"+02
70040204	1.2090	1.0000	3.0131"+04	8.6000"-04	2.2680	1.5622	2.9767"+04	2.9767"+04
1.0668"+00	8.1256"+04	1.0000	3.7121"+04	NM	1.6594	1.6499	2.8204"+02	2.1767"+02
8.4649"-02	2.9000"+02	1.0000	2.9290"-03	NC	0.0477	3.3701"-03	3.8129"+02	2.8204"+02
70040205	1.2690	1.0000	2.0361"+04	1.6500"-03	1.9382	1.3051	3.0538"+04	3.0538"+04
1.2700"+00	8.1141"+04	1.0000	2.4937"+04	NM	1.7822	1.7774	2.8223"+02	2.1935"+02
9.1120"-02	2.9000"+02	1.0000	1.9683"-03	NC	0.0491	2.1665"-03	3.7683"+02	2.8223"+02
70040206	1.2110	1.0000	1.6042"+04	1.9500"-03	1.7841	1.2237	3.3818"+04	3.3818"+04
1.4986"+00	8.3196"+04	1.0000	1.9322"+04	NM	1.8444	1.8413	2.8277"+02	2.2423"+02
9.8153"-02	2.9000"+02	1.0000	1.4859"-03	NC	0.0462	1.5865"-03	3.6358"+02	2.8277"+02
70040301	2.0870	1.0000	2.1389"+03	2.3400"-03	3.2544	1.4720	5.1063"+03	5.1063"+03
6.0960"-01	4.5757"+04	1.0000	3.4612"+03	NM	1.7883	1.7743	2.7515"+02	1.5499"+02
1.1070"-01	2.9000"+02	1.0000	6.1955"-04	NC	0.0916	7.9124"-04	5.2093"+02	2.7515"+02
70040302	1.8150	1.0000	6.3596"+03	1.4700"-03	2.7976	1.4576	7.7785"+03	7.7785"+03
8.3820"-01	4.5732"+04	1.0000	9.3140"+03	NM	1.7333	1.7153	2.7733"+02	1.7482"+02
7.1071"-02	2.9000"+02	1.0000	1.4860"-03	NC	0.0786	1.8482"-03	4.8115"+02	2.7733"+02
70040303	1.5970	1.0000	1.2576"+04	8.3000"-04	2.6469	1.5665	1.0803"+04	1.0803"+04
1.0668"+00	4.5715"+04	1.0000	1.7078"+04	NM	1.6662	1.6522	2.7922"+02	1.9204"+02
8.4649"-02	2.9000"+02	1.0000	2.5337"-03	NC	0.0651	3.1113"-03	4.4372"+02	2.7922"+02
70040304	1.5290	1.0000	9.5346"+03	1.9300"-03	2.2562	1.3302	1.1727"+04	1.1727"+04
1.2700"+00	4.4904"+04	1.0000	1.2659"+04	NM	1.7730	1.7655	2.7984"+02	1.9761"+02
9.1120"-02	2.9000"+02	1.0000	1.8782"-03	NC	0.0633	2.1648"-03	4.3094"+02	2.7984"+02
70040305	1.4950	1.0000	7.2441"+03	2.4300"-03	2.0853	1.2301	1.2623"+04	1.2623"+04
1.4986"+00	4.6007"+04	1.0000	9.5123"+03	NM	1.8460	1.8407	2.8015"+02	2.0041"+02
9.8153"-02	2.9000"+02	1.0000	1.3466"-03	NC	0.0615	1.5065"-03	4.2434"+02	2.8015"+02

CAT 7004 WINTER/R/S BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ /	TODA	SW *	D2	PI2	H42	D2K	UD	TR
70040401	2.4140	1.0000	1.7019"+03	1.5800"-03	3.7897	1.4230	3.3223"+03	3.3223"+03
6.0960"-01	4.9645"+04	1.0000	3.1220"+03	NM	1.7872	1.7667	2.7283"+02	1.3392"+02
1.1070"-01	2.9000"+02	1.0000	6.0487"-04	NC	0.1033	8.2856"-04	5.6010"+02	2.7283"+02
70040402	2.3330	1.0000	2.4824"+03	1.6900"-03	3.6075	1.4229	3.7614"+03	3.7614"+03
7.2370"-01	4.9525"+04	1.0000	4.4128"+03	NM	1.7618	1.7446	2.7337"+02	1.3885"+02
8.9278"-02	2.9000"+02	1.0000	8.2234"-04	NC	0.1150	1.1308"-03	5.5119"+02	2.7337"+02
70040403	2.1530	1.0000	4.2232"+03	1.4400"-03	3.5640	1.5639	4.9783"+03	4.9783"+03
8.3820"-01	4.9457"+04	1.0000	7.0066"+03	NM	1.6743	1.6574	2.7465"+02	1.5049"+02
7.1071"-02	2.9000"+02	1.0000	1.1768"-03	NC	0.0870	1.7025"-03	5.2954"+02	2.7465"+02
70040404	1.9180	1.0000	9.2704"+03	8.5000"-04	3.0406	1.3132	7.3772"+03	7.3772"+03
1.0668"+00	5.0026"+04	1.0000	1.4091"+04	NM	1.6902	1.6733	2.7648"+02	1.6708"+02
8.4649"-02	2.9000"+02	1.0000	2.1079"-03	NC	0.0845	2.7635"-03	4.9707"+02	2.7648"+02
70040405	1.8040	1.0000	7.7484"+03	1.9800"-03	2.6048	1.3275	8.7980"+03	8.7980"+03
1.2700"+00	5.0862"+04	1.0000	1.1304"+04	NM	1.7822	1.7717	2.7742"+02	1.7566"+02
9.1120"-02	2.9000"+02	1.0000	1.6148"-03	NC	0.0817	1.9451"-03	4.7939"+02	2.7742"+02
70040406	1.7510	1.0000	5.9817"+03	2.3700"-03	2.4100	1.2367	9.5548"+03	9.5548"+03
1.4986"+00	5.0948"+04	1.0000	8.5643"+03	NM	1.8488	1.8414	2.7787"+02	1.7977"+02
9.8153"-02	2.9000"+02	1.0000	1.1979"-03	NC*	0.0753	1.3642"-03	4.7071"+02	2.7787"+02
70040501	2.8810	1.0000	6.3969"+02	1.5000"-03	5.1984	1.6602	2.0019"+03	2.0019"+03
6.0960"-01	6.1454"+04	1.0000	1.4105"+03	NM	1.7576	1.7084	2.7009"+02	1.0902"+02
1.1070"-01	2.9000"+02	1.0000	2.8299"-04	NC	0.1239	4.4959"-04	6.0313"+02	2.7009"+02
70040502	2.6150	1.0000	2.0331"+03	1.2400"-03	3.9863	1.3861	2.9935"+03	2.9935"+03
8.3820"-01	6.1134"+04	1.0000	4.0354"+03	NM	1.7823	1.7601	2.7157"+02	1.2248"+02
7.1071"-02	2.9000"+02	1.0000	7.0543"-04	NC	0.1702	1.0126"-03	5.8026"+02	2.7157"+02
70040503	2.3540	1.0000	4.8947"+03	9.1000"-04	3.5062	1.3393	4.4021"+03	4.4021"+03
1.0668"+00	5.9897"+04	1.0000	8.7720"+03	NM	1.7720	1.7607	2.7323"+02	1.3755"+02
8.4649"-02	2.9000"+02	1.0000	1.3661"-03	NC	0.1169	1.8698"-03	5.5354"+02	2.7323"+02
70040504	2.1450	1.0000	4.9384"+03	1.9000"-03	2.9668	1.2332	6.1228"+03	6.1228"+03
1.2700"+00	6.0071"+04	1.0000	8.1684"+03	NM	1.8542	1.8438	2.7471"+02	1.5103"+02
9.1120"-02	2.9000"+02	1.0000	1.1444"-03	NC	0.1021	1.3720"-03	5.2852"+02	2.7471"+02
70040505	2.0960	1.0000	3.7371"+03	2.1500"-03	2.9143	1.2478	6.5882"+03	6.5882"+03
1.4986"+00	5.9872"+04	1.0000	6.0679"+03	NM	1.8668	1.8547	2.7508"+02	1.5437"+02
9.8153"-02	2.9000"+02	1.0000	8.3356"-04	NC	0.0957	9.8054"-04	5.2213"+02	2.7508"+02
70040601	3.3270	1.0000	6.0479"+02	1.1300"-03	6.1246	1.5690	1.2629"+03	1.2629"+03
6.0960"-01	7.5149"+04	1.0000	1.5899"+03	NM	1.8048	1.7680	2.6803"+02	9.0236"+01
1.1070"-01	2.9000"+02	1.0000	3.3211"-04	NC	0.1326	5.4840"-04	6.3366"+02	2.6803"+02
70040602	3.0530	1.0000	1.5794"+03	1.1300"-03	4.9465	1.3175	1.8909"+03	1.8909"+03
8.3820"-01	7.5189"+04	1.0000	3.7278"+03	NM	1.8237	1.8024	2.6924"+02	1.0125"+02
7.1071"-02	2.9000"+02	1.0000	6.7105"-04	NC	0.1247	1.0045"-03	6.1594"+02	2.6924"+02
70040603	2.7590	1.0000	2.4485"+03	8.3000"-04	4.1883	1.2621	2.8670"+03	2.8670"+03
1.0668"+00	7.3078"+04	1.0000	5.1444"+03	NM	1.8516	1.8349	2.7075"+02	1.1497"+02
8.4649"-02	2.9000"+02	1.0000	8.1260"-04	NC	0.1102	1.0900"-03	5.9313"+02	2.7075"+02
70040604	2.4760	1.0000	3.4034"+03	1.6900"-03	3.5304	1.2501	4.4332"+03	4.4332"+03
1.2700"+00	7.2968"+04	1.0000	6.3964"+03	NM	1.8533	1.8413	2.7243"+02	1.3027"+02
9.1120"-02	2.9000"+02	1.0000	8.7068"-04	NC	0.1361	1.1064"-03	5.6661"+02	2.7243"+02
70040605	2.4270	1.0000	2.9001"+03	1.8800"-03	3.4733	1.2240	4.8050"+03	4.8050"+03
1.4986"+00	7.3272"+04	1.0000	5.3471"+03	NM	1.8872	1.8756	2.7275"+02	1.3315"+02
9.8153"-02	2.9000"+02	1.0000	7.0664"-04	NC	0.0966	8.5497"-04	5.6149"+02	2.7275"+02

POD,PD CALCULATED FROM RE (AUTHOR) - TRAPEZOIDAL RULE FOR RUN 0102,0202,0203,0301,0601

70040201 WINTER/R/S PROFILE TABULATION 40 POINTS, DELTA AT POINT 36

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95725	0.00000	0.00000	1.56180	0.00000
2	2.5400"-04	1.7126"+00	NM	0.97270	0.51294	0.59838	1.36088	0.43970
3	3.3020"-04	1.7665"+00	NM	0.97346	0.52870	0.61428	1.34994	0.45504
4	4.0640"-04	1.7852"+00	NM	0.97405	0.53399	0.61968	1.34670	0.46015
5	4.3180"-04	1.8291"+00	NM	0.97441	0.54603	0.63157	1.33789	0.47207
6	5.5880"-04	1.9297"+00	NM	0.97599	0.57197	0.65707	1.31971	0.49789
7	7.1120"-04	2.0084"+00	NM	0.97685	0.59093	0.67526	1.30580	0.51713
8	1.0668"-03	2.2349"+00	NM	0.97966	0.64073	0.72186	1.26927	0.56872
9	1.4732"-03	2.4727"+00	NM	0.98238	0.68777	0.76405	1.23412	0.61910
10	1.8542"-03	2.6997"+00	NM	0.98471	0.72912	0.79964	1.20278	0.66483
11	2.2352"-03	2.9134"+00	NM	0.98679	0.76564	0.82993	1.17499	0.70633
12	2.4892"-03	3.1779"+00	NM	0.98920	0.80824	0.86393	1.14255	0.75614
13	2.5400"-03	3.2261"+00	NM	0.98979	0.81572	0.86983	1.13705	0.76498
14	2.6162"-03	3.2326"+00	NM	0.98988	0.81673	0.87063	1.13632	0.76618
15	2.6670"-03	3.2707"+00	NM	0.98993	0.82259	0.87502	1.13156	0.77329
16	2.7940"-03	3.3522"+00	NM	0.99068	0.83497	0.88452	1.12223	0.78818
17	2.9210"-03	3.4104"+00	NM	0.99138	0.84369	0.89122	1.11586	0.79869
18	3.1242"-03	3.3832"+00	NM	0.99107	0.83964	0.88812	1.11883	0.79380
19	3.3020"-03	3.5921"+00	NM	0.99287	0.87030	0.91102	1.09576	0.83141
20	3.6576"-03	3.7546"+00	NM	0.99409	0.89337	0.92771	1.07836	0.86030
21	4.0386"-03	3.9308"+00	NM	0.99544	0.91768	0.94491	1.06023	0.89123
22	4.3942"-03	3.9789"+00	NM	0.99592	0.92421	0.94951	1.05551	0.89958
23	4.4196"-03	4.0941"+00	NM	0.99675	0.93962	0.96011	1.04408	0.91958
24	4.8260"-03	4.2842"+00	NM	0.99820	0.96449	0.97690	1.02590	0.95224
25	4.9022"-03	4.3087"+00	NM	0.99819	0.96765	0.97890	1.02341	0.95652
26	4.9530"-03	4.3218"+00	NM	0.99824	0.96933	0.98000	1.02214	0.95878
27	5.0292"-03	4.3337"+00	NM	0.99852	0.97085	0.98110	1.02123	0.96071
28	5.1308"-03	4.3715"+00	NM	0.99881	0.97569	0.98430	1.01773	0.96716
29	5.2578"-03	4.4287"+00	NM	0.99910	0.98295	0.98900	1.01235	0.97694
30	5.3086"-03	4.3622"+00	NM	0.99870	0.97451	0.98350	1.01854	0.96560
31	5.6388"-03	4.4487"+00	NM	0.99934	0.98548	0.99070	1.01062	0.98029
32	5.9944"-03	4.5339"+00	NM	0.99970	0.99617	0.99750	1.00267	0.99485
33	6.0198"-03	4.4769"+00	NM	0.99954	0.98903	0.99300	1.00805	0.98507
34	6.3754"-03	4.5520"+00	NM	0.99993	0.99842	0.99900	1.00115	0.99785
35	6.5786"-03	4.5502"+00	NM	1.00001	0.99820	0.99890	1.00140	0.99750
D 36	6.7564"-03	4.5646"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
37	9.3726"-03	4.5764"+00	NM	1.00021	1.00146	1.00100	0.99908	1.00193
38	1.1735"-02	4.5832"+00	NM	1.00017	1.00231	1.00150	0.99839	1.00311
39	1.3462"-02	4.5941"+00	NM	1.00032	1.00366	1.00240	0.99749	1.00492
40	1.5037"-02	4.6393"+00	NM	1.00054	1.00923	1.00590	0.99341	1.01257

INPUT VARIABLES Y,M,U/UD ASSUME P=PD
AT I=31 DATA WERE AVERAGED

70040202 WINTER/R/S PROFILE TABULATION 44 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96064	0.00000	0.00000	1.48118	0.00000
2	2.5400"-04	1.4443"+00	NM	0.97127	0.45387	0.52680	1.34718	0.39104
3	3.3020"-04	1.4797"+00	NM	0.97230	0.46755	0.54130	1.34038	0.40384
4	3.8100"-04	1.5058"+00	NM	0.97236	0.47849	0.55260	1.33378	0.41431
5	4.5720"-04	1.5258"+00	NM	0.97290	0.48663	0.56110	1.32949	0.42204
6	8.3820"-04	1.6545"+00	NM	0.97505	0.53434	0.60970	1.30197	0.46829
7	1.2446"-03	1.7785"+00	NM	0.97705	0.57445	0.64940	1.27797	0.50815
8	1.6510"-03	1.9022"+00	NM	0.97886	0.61006	0.68370	1.25597	0.54436
9	2.0574"-03	2.0464"+00	NM	0.98099	0.64744	0.71880	1.23258	0.58317
10	2.4304"-03	2.2115"+00	NM	0.98279	0.68646	0.75420	1.20710	0.62480
11	2.6416"-03	2.2434"+00	NM	0.98316	0.69363	0.76060	1.20242	0.63256
12	2.7178"-03	2.2796"+00	NM	0.98353	0.70165	0.76770	1.19712	0.64129
13	2.7686"-03	2.3055"+00	NM	0.98412	0.70731	0.77280	1.19377	0.64736
14	2.8448"-03	2.3512"+00	NM	0.98456	0.71715	0.78140	1.18721	0.65818
15	3.2258"-03	2.4540"+00	NM	0.98566	0.73867	0.80000	1.17296	0.68203
16	3.6322"-03	2.6812"+00	NM	0.97834	0.78364	0.83370	1.13185	0.73658
17	4.0132"-03	2.8357"+00	NM	0.98951	0.81251	0.86130	1.12371	0.76648
18	4.2926"-03	2.9808"+00	NM	0.99108	0.83858	0.88210	1.10649	0.79721
19	4.4196"-03	3.0266"+00	NM	0.99133	0.84660	0.88830	1.10093	0.80686
20	4.8260"-03	3.2122"+00	NM	0.99307	0.87833	0.91270	1.07980	0.84525
21	4.7530"-03	3.2797"+00	NM	0.99356	0.88872	0.92050	1.07280	0.85804
22	5.1562"-03	3.3332"+00	NM	0.99413	0.89832	0.92770	1.06647	0.86988
23	5.2070"-03	3.3930"+00	NM	0.99469	0.90817	0.93500	1.05996	0.88211
24	5.2324"-03	3.3533"+00	NM	0.99423	0.90160	0.93010	1.06421	0.87398
25	5.2832"-03	3.3886"+00	NM	0.99470	0.90732	0.93440	1.06059	0.88102
26	5.3594"-03	3.4184"+00	NM	0.99489	0.91212	0.93790	1.05733	0.88705
27	5.6134"-03	3.5088"+00	NM	0.99566	0.92652	0.94840	1.04778	0.90515
28	5.7404"-03	3.5630"+00	NM	0.99625	0.93503	0.95460	1.04230	0.91586
29	5.9944"-03	3.6619"+00	NM	0.99702	0.95035	0.96550	1.03214	0.93543
30	6.1468"-03	3.6972"+00	NM	0.99727	0.95576	0.96930	1.02854	0.94240
31	6.2992"-03	3.7308"+00	NM	0.99757	0.96086	0.97290	1.02522	0.94897
32	6.5278"-03	3.8093"+00	NM	0.99809	0.97210	0.98070	1.01776	0.96358
33	6.6548"-03	3.8480"+00	NM	0.99840	0.97849	0.98510	1.01357	0.97192
34	6.9342"-03	3.9133"+00	NM	0.99906	0.98815	0.99180	1.00740	0.98451
35	7.3152"-03	3.9609"+00	NM	0.99932	0.99514	0.99650	1.00274	0.99378
36	7.6200"-03	3.9826"+00	NM	0.99961	0.99830	0.99870	1.00080	0.99790
37	7.6962"-03	3.9822"+00	NM	0.99949	0.99824	0.99860	1.00073	0.99788
38	7.7216"-03	3.9868"+00	NM	0.99962	0.99891	0.99910	1.00039	0.99871
39	7.7470"-03	3.9918"+00	NM	0.99967	0.99964	0.99960	0.99993	0.99967
40	7.8232"-03	3.9910"+00	NM	0.99963	0.99951	0.99950	0.99997	0.99953
D 41	7.9756"-03	3.9943"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
42	1.0465"-02	3.9943"+00	NM	0.99960	1.00000	0.94980	0.99960	1.00020
43	1.2700"-02	4.0068"+00	NM	0.99964	1.00182	1.00100	0.99836	1.00265
44	1.5418"-02	3.9893"+00	NM	0.99949	0.99854	0.99880	1.00052	0.99828

INPUT VARIABLES Y,M,U/UD ASSUME P=PD
AT I=14,16,35 DATA WERE AVERAGED

70040203 WINTER/R/S PROFILE TABULATION 59 POINTS, DELTA AT POINT 56

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96635	0.00000	0.00000	1.38399	0.00000
2	2.5400"-04	1.2765"+00	NM	0.97375	0.40883	0.46625	1.30064	0.35848
3	3.3020"-04	1.2726"+00	NM	0.97386	0.40618	0.46345	1.30191	0.35598
4	3.8100"-04	1.2817"+00	NM	0.97392	0.41237	0.47005	1.29934	0.36176
5	4.5720"-04	1.3015"+00	NM	0.97450	0.42536	0.48395	1.29444	0.37387
6	5.8420"-04	1.3137"+00	NM	0.97462	0.43312	0.49215	1.29116	0.38117
7	9.9060"-04	1.3814"+00	NM	0.97595	0.47306	0.53405	1.27447	0.41903
8	1.3716"-03	1.4290"+00	NM	0.97721	0.49844	0.56034	1.26384	0.44337
9	1.7780"-03	1.4730"+00	NM	0.97788	0.52034	0.58264	1.25379	0.46471
10	2.1590"-03	1.5159"+00	NM	0.97886	0.54041	0.60294	1.24479	0.48437
11	2.6670"-03	1.5955"+00	NM	0.97997	0.57484	0.63704	1.22810	0.51872
12	2.7432"-03	1.5994"+00	NM	0.98022	0.57640	0.63864	1.22758	0.52024
13	2.7686"-03	1.5870"+00	NM	0.98007	0.57130	0.63364	1.23012	0.51510
14	2.7940"-03	1.6043"+00	NM	0.98029	0.57845	0.64064	1.22658	0.52229
15	2.8702"-03	1.6202"+00	NM	0.98067	0.58483	0.64694	1.22362	0.52871
16	2.9972"-03	1.6284"+00	NM	0.98054	0.58811	0.65003	1.22169	0.53208
17	3.3020"-03	1.6945"+00	NM	0.98189	0.61342	0.67463	1.20955	0.55776
18	3.4036"-03	1.7121"+00	NM	0.98189	0.61988	0.68073	1.20597	0.56447
19	3.7846"-03	1.7835"+00	NM	0.98335	0.64492	0.70463	1.19375	0.59027
20	4.1910"-03	1.8511"+00	NM	0.98404	0.66717	0.72533	1.18196	0.61367
21	4.5974"-03	1.9060"+00	NM	0.98495	0.68445	0.74133	1.17311	0.63193
22	5.1816"-03	2.0409"+00	NM	0.98669	0.72343	0.77662	1.15246	0.67388
23	5.2578"-03	2.0899"+00	NM	0.98726	0.73683	0.78852	1.14521	0.68854
24	5.3340"-03	2.0979"+00	NM	0.98754	0.73901	0.79052	1.14426	0.69086
25	5.3848"-03	2.1104"+00	NM	0.98759	0.74235	0.79342	1.14234	0.69456
26	5.4610"-03	2.1343"+00	NM	0.98796	0.74867	0.79902	1.13902	0.70150
27	5.5880"-03	2.1522"+00	NM	0.98814	0.75337	0.80312	1.13644	0.70670
28	5.7658"-03	2.2014"+00	NM	0.98869	0.76684	0.81482	1.12905	0.72168
29	5.8166"-03	2.2449"+00	NM	0.98914	0.77704	0.82362	1.12346	0.73310
30	5.9944"-03	2.2775"+00	NM	0.98966	0.78514	0.83062	1.11920	0.74215
31	6.3754"-03	2.3891"+00	NM	0.99080	0.81202	0.85331	1.10431	0.77271
32	6.7818"-03	2.4885"+00	NM	0.99106	0.83501	0.87241	1.09159	0.79921
33	7.1628"-03	2.5955"+00	NM	0.99323	0.85889	0.89201	1.07861	0.82700
34	7.7216"-03	2.7481"+00	NM	0.99471	0.89162	0.91811	1.06030	0.86589
35	7.7724"-03	2.7306"+00	NM	0.99453	0.88794	0.91521	1.06235	0.86147
36	7.7978"-03	2.7516"+00	NM	0.99476	0.89237	0.91871	1.05991	0.86678
37	7.8486"-03	2.7636"+00	NM	0.79471	0.89488	0.92061	1.05832	0.86988
38	7.9248"-03	2.7954"+00	NM	0.99507	0.90148	0.92581	1.05469	0.07780
39	8.0518"-03	2.8214"+00	NM	0.99555	0.90686	0.93011	1.05193	0.88419
40	8.2804"-03	2.9261"+00	NM	0.99657	0.92809	0.94651	1.04009	0.91002
41	8.3312"-03	2.9234"+00	NM	0.99657	0.92795	0.94641	1.04017	0.90985
42	8.3820"-03	2.9061"+00	NM	0.99633	0.92407	0.94341	1.04228	0.90513
43	8.4582"-03	2.9547"+00	NM	0.99670	0.93380	0.95080	1.03675	0.91710
44	8.8372"-03	3.0703"+00	NM	0.99775	0.95646	0.96790	1.02408	0.94519
45	9.2456"-03	3.1415"+00	NM	0.99845	0.97013	0.97810	1.01650	0.96223
46	9.6520"-03	3.2009"+00	NM	0.99904	0.98136	0.98640	1.01030	0.97634
47	9.7282"-03	3.1814"+00	NM	0.99887	0.97768	0.98370	1.01235	0.97170
48	1.0135"-02	3.2746"+00	NM	0.99966	0.99510	0.99640	1.00261	0.99380
49	1.0236"-02	3.2599"+00	NM	0.99945	0.99238	0.99440	1.00408	0.99036
50	1.0262"-02	3.2735"+00	NM	0.99954	0.99490	0.99620	1.00262	0.99360
51	1.0312"-02	3.2733"+00	NM	0.99954	0.99490	0.99620	1.00262	0.99360
52	1.0389"-02	3.2816"+00	NM	0.99964	0.99639	0.99730	1.00182	0.99549
53	1.0516"-02	3.2853"+00	NM	0.99967	0.99707	0.99780	1.00146	0.99635
54	1.0795"-02	3.2923"+00	NM	0.99988	0.99837	0.99880	1.00087	0.99793
55	1.0846"-02	3.2967"+00	NM	0.99994	0.99910	0.99940	1.00043	0.99897
D 56	1.0922"-02	3.3011"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
57	1.3360"-02	3.3004"+00	NM	0.99999	0.99986	0.99990	1.00007	0.99983
58	1.5875"-02	3.2923"+00	NM	0.99988	0.99837	0.99880	1.00087	0.99793
59	1.8410"-02	3.2886"+00	NM	0.99983	0.99769	0.99830	1.00123	0.99707

INPUT VARIABLES Y,M,U/UD ASSUME P=PD
AT I=6,16,27,39,53 DATA WERE AVERAGED

70040204 WINTER/R/S PROFILE TABULATION 82 POINTS, DELTA AT POINT 79

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.97304	0.00000	0.00000	1.29638	0.00000
2	2.5400E-04	1.1797E+00	NM	0.97735	0.38141	0.42507	1.24208	0.34223
3	3.0480E-04	1.1892E+00	NM	0.97798	0.39079	0.43517	1.24003	0.35093
4	3.8100E-04	1.1922E+00	NM	0.97788	0.39373	0.43827	1.23900	0.35373
5	4.3180E-04	1.2020E+00	NM	0.97816	0.40304	0.44817	1.23646	0.36246
6	5.0800E-04	1.2053E+00	NM	0.97821	0.40606	0.45136	1.23557	0.36531
7	6.3500E-04	1.2116E+00	NM	0.97854	0.41180	0.45756	1.23413	0.37076
8	7.6200E-04	1.2179E+00	NM	0.97833	0.41754	0.46346	1.23206	0.37617
9	8.8900E-04	1.2267E+00	NM	0.97864	0.42529	0.47166	1.22993	0.38348
10	1.1176E-03	1.2362E+00	NM	0.97911	0.43351	0.48036	1.22779	0.39124
11	1.3970E-03	1.2463E+00	NM	0.97918	0.44204	0.48925	1.22502	0.39938
12	1.6256E-03	1.2526E+00	NM	0.97920	0.44724	0.49465	1.22328	0.40437
13	1.8796E-03	1.2591E+00	NM	0.97973	0.45251	0.50025	1.22214	0.40932
14	2.2606E-03	1.2717E+00	NM	0.97960	0.46251	0.51055	1.21851	0.41899
15	2.5654E-03	1.2905E+00	NM	0.98027	0.47693	0.52554	1.21423	0.43282
16	2.6162E-03	1.2905E+00	NM	0.98027	0.47693	0.52554	1.21423	0.43282
17	2.6416E-03	1.2837E+00	NM	0.98008	0.47182	0.52024	1.21582	0.42789
18	2.6924E-03	1.2936E+00	NM	0.97996	0.47926	0.52784	1.21302	0.43515
19	2.7432E-03	1.2972E+00	NM	0.98034	0.48190	0.53064	1.21254	0.43763
20	2.8194E-03	1.3004E+00	NM	0.98050	0.48430	0.53314	1.21187	0.43993
21	2.9464E-03	1.3034E+00	NM	0.98044	0.48647	0.53534	1.21101	0.44206
22	3.0734E-03	1.3097E+00	NM	0.98057	0.49104	0.54004	1.20950	0.44650
23	3.2004E-03	1.3154E+00	NM	0.98064	0.49515	0.54424	1.20808	0.45050
24	3.4544E-03	1.3249E+00	NM	0.98118	0.50190	0.55123	1.20626	0.45698
25	3.7084E-03	1.3351E+00	NM	0.98103	0.50896	0.55833	1.20344	0.46395
26	3.9624E-03	1.3477E+00	NM	0.98138	0.51748	0.56703	1.20065	0.47227
27	4.2164E-03	1.3572E+00	NM	0.98176	0.52384	0.57353	1.19869	0.47846
28	4.5974E-03	1.3731E+00	NM	0.98201	0.53416	0.58392	1.19503	0.48863
29	4.9530E-03	1.3920E+00	NM	0.98237	0.54610	0.59592	1.19080	0.50044
30	5.0038E-03	1.3952E+00	NM	0.98236	0.54811	0.59792	1.19000	0.50245
31	5.0800E-03	1.3952E+00	NM	0.98236	0.54811	0.59792	1.19000	0.50245
32	5.1308E-03	1.4011E+00	NM	0.98265	0.55176	0.60162	1.18891	0.50603
33	5.2070E-03	1.4018E+00	NM	0.98237	0.55214	0.60192	1.18843	0.50648
34	5.3340E-03	1.4090E+00	NM	0.98283	0.55594	0.60582	1.18747	0.51017
35	5.4610E-03	1.4176E+00	NM	0.98295	0.56168	0.61152	1.18532	0.51591
36	5.5850E-03	1.4230E+00	NM	0.98306	0.56540	0.61522	1.18396	0.51962
37	5.8420E-03	1.4391E+00	NM	0.98382	0.57432	0.62411	1.18092	0.52850
38	6.1214E-03	1.4550E+00	NM	0.98363	0.58339	0.63301	1.17734	0.53766
39	6.3246E-03	1.4651E+00	NM	0.98390	0.58905	0.63861	1.17534	0.54334
40	6.6040E-03	1.4807E+00	NM	0.98413	0.59774	0.64711	1.17201	0.55213
41	6.9850E-03	1.5031E+00	NM	0.98459	0.60960	0.65870	1.16759	0.56416
42	7.3660E-03	1.5217E+00	NM	0.98488	0.61929	0.66810	1.16384	0.57405
43	7.4422E-03	1.5506E+00	NM	0.98547	0.63387	0.68220	1.15830	0.58896
44	7.4930E-03	1.5539E+00	NM	0.98534	0.63550	0.68369	1.15744	0.59070
45	7.5692E-03	1.5586E+00	NM	0.98532	0.63782	0.68589	1.15642	0.59312
46	7.6200E-03	1.5597E+00	NM	0.98528	0.63837	0.68639	1.15613	0.59370
47	7.6962E-03	1.5599E+00	NM	0.98564	0.63844	0.68659	1.15653	0.59367
48	7.8232E-03	1.5791E+00	NM	0.98567	0.64775	0.69539	1.15252	0.60337
49	7.9502E-03	1.5918E+00	NM	0.98626	0.65380	0.70129	1.15056	0.60952
50	8.0772E-03	1.5918E+00	NM	0.98626	0.65380	0.70129	1.15056	0.60952
51	8.3312E-03	1.6134E+00	NM	0.98642	0.66388	0.71079	1.14632	0.62006
52	8.5852E-03	1.6325E+00	NM	0.98671	0.67256	0.71898	1.14282	0.62913
53	8.8372E-03	1.6490E+00	NM	0.98689	0.67993	0.72588	1.13975	0.63688
54	8.9662E-03	1.6263E+00	NM	0.98670	0.66977	0.71639	1.14405	0.62618
55	9.0932E-03	1.6615E+00	NM	0.98720	0.68543	0.73108	1.13764	0.64263
56	9.4742E-03	1.6902E+00	NM	0.98763	0.69776	0.74258	1.13259	0.65565
57	9.7770E-03	1.7253E+00	NM	0.98816	0.71234	0.75607	1.12657	0.67113
58	9.8298E-03	1.7281E+00	NM	0.98827	0.71350	0.75717	1.12617	0.67234
59	9.9060E-03	1.7296E+00	NM	0.98837	0.71412	0.75777	1.12599	0.67298
60	9.9568E-03	1.7402E+00	NM	0.98846	0.71838	0.76167	1.12414	0.67756
61	1.0033E-02	1.7467E+00	NM	0.98850	0.72102	0.76407	1.12298	0.68040
62	1.0160E-02	1.7500E+00	NM	0.98852	0.72234	0.76527	1.12240	0.68182
63	1.0287E-02	1.7629E+00	NM	0.98874	0.72746	0.76997	1.12030	0.68729
64	1.0389E-02	1.7758E+00	NM	0.98892	0.73250	0.77457	1.11817	0.69271
65	1.0668E-02	1.8006E+00	NM	0.98933	0.74203	0.78327	1.11422	0.70297
66	1.0922E-02	1.8292E+00	NM	0.98986	0.75281	0.79306	1.10980	0.71460
67	1.1176E-02	1.8455E+00	NM	0.98990	0.75878	0.79836	1.10704	0.72116
68	1.1227E-02	1.8290E+00	NM	0.98978	0.75273	0.79296	1.10974	0.71455
69	1.1405E-02	1.8613E+00	NM	0.99025	0.76452	0.80356	1.10474	0.72738
70	1.1811E-02	1.9024E+00	NM	0.99079	0.77910	0.81656	1.09847	0.74336
71	1.2167E-02	1.9337E+00	NM	0.99111	0.78987	0.82605	1.09370	0.75528
72	1.3564E-02	2.0700E+00	NM	0.99293	0.83415	0.86464	1.07445	0.80473
73	1.5109E-02	2.2474E+00	NM	0.99509	0.88687	0.90923	1.05105	0.86507
74	1.6078E-02	2.3741E+00	NM	0.99696	0.92200	0.93812	1.03528	0.90615
75	1.7374E-02	2.5107E+00	NM	0.99804	0.95797	0.96701	1.01895	0.94902
76	1.8313E-02	2.5959E+00	NM	0.99904	0.97961	0.98410	1.00920	0.97513
77	1.9710E-02	2.6303E+00	NM	0.99959	0.99310	0.99460	1.00303	0.99160
78	2.1285E-02	2.6689E+00	NM	0.99990	0.99767	0.99820	1.00106	0.99715
D 79	2.2200E-02	2.6785E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
80	2.4384E-02	2.6785E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
81	2.5679E-02	2.6753E+00	NM	0.99976	0.99922	0.99930	1.00015	0.99915
82	2.8118E-02	2.6753E+00	NM	0.99976	0.99922	0.99930	1.00015	0.99915

INPUT VARIABLES Y,M,U/UD ASSUME P=PD
AT I=4,16,29,31,45,59 DATA WERE AVERAGED

70040205 WINTER/R/3 PROFILE TABULATION 89 POINTS, DELTA AT POINT 84

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.97305	0.00000	0.00000	1.28644	0.00000
2	2.5400E-04	1.4179E+00	NM	0.98115	0.57073	0.61840	1.17402	0.52674
3	3.3020E-04	1.4321E+00	NM	0. 8360	0.57924	0.62750	1.17357	0.53470
4	3.8100E-04	1.4446E+00	NM	0.98405	0.58657	0.63480	1.17120	0.54201
5	4.5720E-04	1.4568E+00	NM	0.98430	0.59353	0.64170	1.16869	0.54908
6	5.0800E-04	1.4662E+00	NM	0.98431	0.59894	0.64690	1.16655	0.55454
7	6.6040E-04	1.4842E+00	NM	0.98471	0.60895	0.65670	1.16297	0.56468
8	7.8740E-04	1.4968E+00	NM	0.98503	0.61581	0.66340	1.16054	0.57163
9	9.1440E-04	1.5281E+00	NM	0.98556	0.63236	0.67940	1.15431	0.58857
10	1.0414E-03	1.5377E+00	NM	0.98579	0.63732	0.68420	1.15251	0.59366
11	1.3208E-03	1.5526E+00	NM	0.98588	0.64489	0.69140	1.14945	0.60151
12	1.5748E-03	1.5804E+00	NM	0.98640	0.65860	0.70450	1.14424	0.61569
13	1.8542E-03	1.5864E+00	NM	0.98655	0.66152	0.70730	1.14321	0.61870
14	2.0828E-03	1.5989E+00	NM	0.98685	0.66751	0.71300	1.14095	0.62492
15	2.3368E-03	1.6143E+00	NM	0.98723	0.67476	0.71990	1.13828	0.63245
16	2.6670E-03	1.6237E+00	NM	0.98716	0.67909	0.72390	1.13632	0.63706
17	2.7432E-03	1.6362E+00	NM	0.98735	0.68485	0.72930	1.13404	0.64310
18	2.8194E-03	1.6456E+00	NM	0.98753	0.68910	0.73330	1.13239	0.64757
19	2.8702E-03	1.6456E+00	NM	0.98753	0.68910	0.73330	1.13239	0.64757
20	2.9464E-03	1.6456E+00	NM	0.98753	0.68910	0.73330	1.13239	0.64757
21	2.9972E-03	1.6484E+00	NM	0.98763	0.69036	0.73450	1.13196	0.64888
22	3.1496E-03	1.6545E+00	NM	0.98778	0.69312	0.73710	1.13093	0.65176
23	3.2766E-03	1.6607E+00	NM	0.98795	0.69588	0.73970	1.12991	0.65465
24	3.4036E-03	1.6752E+00	NM	0.98805	0.70226	0.74560	1.12723	0.66144
25	3.5306E-03	1.6738E+00	NM	0.98800	0.70163	0.74500	1.12744	0.66079
26	3.8100E-03	1.6887E+00	NM	0.98823	0.70009	0.75100	1.12486	0.66764
27	4.0640E-03	1.7008E+00	NM	0.98864	0.71329	0.75590	1.12303	0.67309
28	4.3130E-03	1.7163E+00	NM	0.98879	0.71984	0.76190	1.12029	0.68009
29	4.5212E-03	1.7349E+00	NM	0.98907	0.72756	0.76900	1.11716	0.68835
30	4.8006E-03	1.7411E+00	NM	0.98913	0.73008	0.77130	1.11610	0.69107
31	5.1308E-03	1.7627E+00	NM	0.98947	0.73883	0.77930	1.11256	0.70046
32	5.2070E-03	1.7661E+00	NM	0.98947	0.74017	0.78050	1.11195	0.70192
33	5.2832E-03	1.7754E+00	NM	0.98968	0.74387	0.78390	1.11051	0.70589
34	5.3340E-03	1.7754E+00	NM	0.98968	0.74387	0.78390	1.11051	0.70589
35	5.4102E-03	1.7784E+00	NM	0.98977	0.74505	0.78500	1.11010	0.70714
36	5.4610E-03	1.7754E+00	NM	0.98968	0.74387	0.78390	1.11051	0.70589
37	5.6134E-03	1.7814E+00	NM	0.98965	0.74624	0.78600	1.10941	0.70849
38	5.7404E-03	1.8036E+00	NM	0.99009	0.75491	0.79390	1.10598	0.71783
39	5.8674E-03	1.8038E+00	NM	0.99017	0.75498	0.79400	1.10602	0.71789
40	5.9944E-03	1.8065E+00	NM	0.99014	0.75601	0.79490	1.10553	0.71902
41	6.2738E-03	1.8249E+00	NM	0.99035	0.76302	0.80120	1.10257	0.72667
42	6.5278E-03	1.8370E+00	NM	0.99051	0.76759	0.80530	1.10066	0.73165
43	6.8072E-03	1.8491E+00	NM	0.99086	0.77209	0.80940	1.09899	0.73649
44	7.0358E-03	1.8730E+00	NM	0.99123	0.78115	0.81750	1.09524	0.74641
45	7.3132E-03	1.8894E+00	NM	0.99127	0.78674	0.82240	1.09269	0.75263
46	7.6200E-03	1.9109E+00	NM	0.99163	0.79439	0.82920	1.08956	0.76104
47	7.7724E-03	1.9363E+00	NM	0.99202	0.80322	0.83700	1.08589	0.77079
48	7.8436E-03	1.9363E+00	NM	0.99202	0.80322	0.83700	1.08589	0.77079
49	7.8994E-03	1.9363E+00	NM	0.99202	0.80322	0.83700	1.08584	0.77074
50	7.9756E-03	1.9424E+00	NM	0.99194	0.80534	0.83880	1.08481	0.77322
51	8.0264E-03	1.9424E+00	NM	0.99194	0.80534	0.83880	1.08481	0.77322
52	8.1788E-03	1.9549E+00	NM	0.99227	0.80960	0.84260	1.08319	0.77789
53	8.3058E-03	1.9614E+00	NM	0.99228	0.81181	0.84450	1.08217	0.78038
54	8.4328E-03	1.9726E+00	NM	0.99241	0.81559	0.84780	1.08055	0.78460
55	8.5598E-03	1.9830E+00	NM	0.99273	0.81906	0.85090	1.07927	0.78840
56	8.8392E-03	2.0073E+00	NM	0.99285	0.82709	0.85780	1.07563	0.79749
57	9.0932E-03	2.0222E+00	NM	0.99320	0.83198	0.86210	1.07372	0.80291
58	9.3726E-03	2.0375E+00	NM	0.99343	0.83695	0.86640	1.07162	0.80849
59	9.3980E-03	2.0375E+00	NM	0.99343	0.83695	0.86640	1.07162	0.80849
60	9.6012E-03	2.0624E+00	NM	0.99365	0.84491	0.87320	1.06810	0.81753
61	9.8552E-03	2.0779E+00	NM	0.99388	0.84979	0.87740	1.06603	0.82305
62	1.0185E-02	2.1057E+00	NM	0.99423	0.85846	0.88480	1.06231	0.83290
63	1.0211E-02	2.1064E+00	NM	0.99402	0.85870	0.88490	1.06196	0.83327
64	1.0287E-02	2.1125E+00	NM	0.99430	0.86059	0.88660	1.06137	0.83534
65	1.0338E-02	2.1184E+00	NM	0.99451	0.86240	0.88820	1.06073	0.83735
66	1.0414E-02	2.1248E+00	NM	0.99443	0.86437	0.88980	1.05970	0.83967
67	1.0465E-02	2.1248E+00	NM	0.99443	0.86437	0.88980	1.05970	0.83967
68	1.0617E-02	2.1559E+00	NM	0.99482	0.87383	0.89780	1.05562	0.85050
69	1.0744E-02	2.1502E+00	NM	0.99467	0.87209	0.89630	1.05628	0.84854
70	1.0871E-02	2.1614E+00	NM	0.99490	0.87548	0.89920	1.05491	0.85239
71	1.0998E-02	2.1656E+00	NM	0.99504	0.87674	0.90030	1.05446	0.85380
72	1.1278E-02	2.1960E+00	NM	0.99539	0.88581	0.90790	1.05051	0.86425
73	1.1532E-02	2.2139E+00	NM	0.99537	0.89109	0.91220	1.04795	0.87046
74	1.1786E-02	2.2355E+00	NM	0.99574	0.89739	0.91750	1.04532	0.87772
75	1.1836E-02	2.2385E+00	NM	0.99595	0.89826	0.91830	1.04512	0.87865
76	1.2014E-02	2.2573E+00	NM	0.99594	0.90370	0.92270	1.04250	0.88508
77	1.2268E-02	2.2757E+00	NM	0.99624	0.90898	0.92710	1.04027	0.89121
78	1.2624E-02	2.3035E+00	NM	0.99660	0.91686	0.93360	1.03686	0.90041
79	1.4326E-02	2.4270E+00	NM	0.99793	0.95090	0.96120	1.02178	0.94072
80	1.5977E-02	2.5166E+00	NM	0.99892	0.97462	0.98010	1.01127	0.96918
81	1.6866E-02	2.5598E+00	NM	0.99936	0.98581	0.98890	1.00627	0.98274
82	1.8390E-02	2.5940E+00	NM	0.99964	0.99456	0.99570	1.00229	0.99343
83	1.9279E-02	2.6061E+00	NM	0.99998	0.99764	0.99820	1.00113	0.99707
D 84	2.0853E-02	2.6155E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
85	2.2530E-02	2.6155E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
86	2.3393E-02	2.6186E+00	NM	1.00001	1.00079	1.00060	0.99962	1.00098
87	2.5832E-02	2.6155E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
88	2.9870E-02	2.6155E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
89	3.2283E-02	2.6155E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U/UD ASSUME P=PD
AT I=9,24,38,53,69 DATA WERE AVERAGED

70040206 WINTER/R/S PROFILE TABULATION 98 POINTS, DELTA AT POINT 94

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.97453	0.00000	0.00000	1.26036	0.00000
2	2.5400"-04	1.4405"+00	NM	0.98529	0.61219	0.65595	1.14808	0.57135
3	3.3020"-04	1.4551"+00	NM	0.98584	0.62104	0.66466	1.14542	0.58028
4	3.8100"-04	1.4866"+00	NM	0.98634	0.63948	0.68249	1.13902	0.59919
5	4.5720"-04	1.4976"+00	NM	0.98670	0.64577	0.68860	1.13703	0.60561
6	5.0800"-04	1.5115"+00	NM	0.98681	0.65354	0.69600	1.13416	0.61367
7	5.8420"-04	1.5226"+00	NM	0.98716	0.65966	0.70191	1.13219	0.61996
8	6.6040"-04	1.5481"+00	NM	0.98746	0.67339	0.71493	1.12717	0.63427
9	7.8740"-04	1.5620"+00	NM	0.98774	0.68067	0.72184	1.12462	0.64185
10	1.0414"-03	1.6184"+00	NM	0.98892	0.70904	0.74857	1.11462	0.67159
11	1.1684"-03	1.6414"+00	NM	0.98905	0.72012	0.75879	1.11026	0.68343
12	1.2954"-03	1.6579"+00	NM	0.98960	0.72790	0.76610	1.10771	0.69160
13	1.4478"-03	1.6760"+00	NM	0.98990	0.73625	0.77301	1.10462	0.70052
14	1.7018"-03	1.6899"+00	NM	0.99020	0.74254	0.77961	1.10236	0.70722
15	1.9558"-03	1.7127"+00	NM	0.99056	0.75271	0.78893	1.09855	0.71815
16	2.2098"-03	1.7414"+00	NM	0.99089	0.76320	0.80024	1.09369	0.73169
17	2.4892"-03	1.7531"+00	NM	0.99109	0.77016	0.80475	1.09183	0.73706
18	2.7432"-03	1.7730"+00	NM	0.99156	0.77851	0.81236	1.08883	0.74608
19	2.8194"-03	1.7676"+00	NM	0.99126	0.77628	0.81025	1.08944	0.74373
20	2.8702"-03	1.7762"+00	NM	0.99163	0.77984	0.81356	1.08835	0.74751
21	2.9464"-03	1.7814"+00	NM	0.99163	0.78199	0.81546	1.08744	0.74989
22	2.9972"-03	1.7814"+00	NM	0.99163	0.78199	0.81546	1.08744	0.74989
23	3.0734"-03	1.7870"+00	NM	0.99153	0.78430	0.81746	1.08635	0.75249
24	3.1496"-03	1.7898"+00	NM	0.99172	0.78546	0.81856	1.08607	0.75370
25	3.2766"-03	1.8067"+00	NM	0.99187	0.79232	0.82467	1.08332	0.76125
26	3.4036"-03	1.8121"+00	NM	0.99214	0.79448	0.82667	1.08270	0.76353
27	3.5306"-03	1.8125"+00	NM	0.99203	0.79464	0.82677	1.08251	0.76376
28	3.6830"-03	1.8264"+00	NM	0.99311	0.80018	0.83208	1.08132	0.76951
29	3.8100"-03	1.8308"+00	NM	0.99211	0.80192	0.83318	1.07949	0.77183
30	3.9370"-03	1.8428"+00	NM	0.99256	0.80663	0.83749	1.07797	0.77691
31	4.2164"-03	1.8567"+00	NM	0.99263	0.81201	0.84219	1.07573	0.78290
32	4.4958"-03	1.8679"+00	NM	0.99280	0.81631	0.84600	1.07407	0.78766
33	4.7498"-03	1.8851"+00	NM	0.99316	0.82284	0.85181	1.07164	0.79486
34	5.0038"-03	1.8937"+00	NM	0.99320	0.82607	0.85461	1.07030	0.79848
35	5.2324"-03	1.9000"+00	NM	0.99345	0.82838	0.85671	1.06957	0.80099
36	5.2832"-03	1.9082"+00	NM	0.99339	0.83144	0.85932	1.06817	0.80448
37	5.3086"-03	1.9000"+00	NM	0.99345	0.82838	0.85671	1.06957	0.80099
38	5.3594"-03	1.9029"+00	NM	0.99317	0.82946	0.85751	1.06879	0.80232
39	5.4356"-03	1.9031"+00	NM	0.99323	0.82954	0.85761	1.06883	0.80239
40	5.4864"-03	1.9136"+00	NM	0.99361	0.83343	0.86112	1.06755	0.80663
41	5.5626"-03	1.9136"+00	NM	0.99361	0.83343	0.86112	1.06755	0.80663
42	5.6388"-03	1.9190"+00	NM	0.99361	0.83541	0.86282	1.06669	0.80888
43	5.7658"-03	1.9306"+00	NM	0.99360	0.83963	0.86643	1.06484	0.81367
44	5.8928"-03	1.9388"+00	NM	0.99396	0.84261	0.86913	1.06394	0.81690
45	6.0198"-03	1.9356"+00	NM	0.99393	0.84145	0.86813	1.06441	0.81560
46	6.1722"-03	1.9425"+00	NM	0.99390	0.84393	0.87023	1.06329	0.81843
47	6.2992"-03	1.9517"+00	NM	0.99409	0.84724	0.87314	1.06206	0.82212
48	6.4262"-03	1.9636"+00	NM	0.99413	0.85146	0.87674	1.06026	0.82691
49	6.6802"-03	1.9718"+00	NM	0.99424	0.85435	0.87924	1.05911	0.83017
50	6.9596"-03	1.9942"+00	NM	0.99461	0.86221	0.88605	1.05606	0.83901

70040206 WINTER/R/S PROFILE TABULATION 98 POINTS, DELTA AT POINT 94

I	Y	PT2/P	P/PO	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
51	7.2136"-03	1.9973"+00	NM	0.99460	0.86329	0.88695	1.05558	0.84025
52	7.4930"-03	2.0117"+00	NM	0.99488	0.86825	0.89126	1.05370	0.84583
53	7.7724"-03	2.0236"+00	NM	0.99489	0.87230	0.89466	1.05193	0.85050
54	7.8486"-03	2.0238"+00	NM	0.99496	0.87238	0.89476	1.05196	0.85057
55	7.8994"-03	2.0324"+00	NM	0.99513	0.87528	0.89727	1.05087	0.85383
56	7.9756"-03	2.0294"+00	NM	0.99520	0.87429	0.89647	1.05138	0.85266
57	8.0264"-03	2.0346"+00	NM	0.99530	0.87602	0.89797	1.05073	0.85462
58	8.1026"-03	2.0431"+00	NM	0.99527	0.87892	0.90037	1.04941	0.85798
59	8.1788"-03	2.0486"+00	NM	0.99523	0.88074	0.90187	1.04857	0.86010
60	8.3058"-03	2.0486"+00	NM	0.99523	0.88074	0.90187	1.04857	0.86010
61	8.4328"-03	2.0597"+00	NM	0.99546	0.88446	0.90508	1.04716	0.86431
62	8.7122"-03	2.0732"+00	NM	0.99566	0.88893	0.90888	1.04540	0.86941
63	8.8392"-03	2.0754"+00	NM	0.99584	0.88967	0.90958	1.04526	0.87019
64	8.9662"-03	2.0847"+00	NM	0.99577	0.89273	0.91209	1.04383	0.87379
65	9.2456"-03	2.1009"+00	NM	0.99605	0.89802	0.91659	1.04178	0.87983
66	9.3980"-03	2.1090"+00	NM	0.99610	0.90067	0.91879	1.04065	0.88290
67	9.4742"-03	2.1090"+00	NM	0.99610	0.90067	0.91879	1.04065	0.88290
68	9.7282"-03	2.1236"+00	NM	0.99637	0.90538	0.92280	1.03884	0.88830
69	1.0008"-02	2.1381"+00	NM	0.99659	0.91002	0.92670	1.03701	0.89363
70	1.0160"-02	2.1363"+00	NM	0.99654	0.90944	0.92620	1.03721	0.89297
71	1.0236"-02	2.1394"+00	NM	0.99651	0.91043	0.92701	1.03674	0.89415
72	1.0287"-02	2.1500"+00	NM	0.99679	0.91382	0.92991	1.03552	0.89801
73	1.0363"-02	2.1477"+00	NM	0.99659	0.91308	0.92921	1.03565	0.89722
74	1.0434"-02	2.1527"+00	NM	0.99663	0.91465	0.93051	1.03499	0.89906
75	1.0490"-02	2.1555"+00	NM	0.99675	0.91556	0.93131	1.03471	0.90007
76	1.0566"-02	2.1591"+00	NM	0.99681	0.91638	0.93201	1.03440	0.90102
77	1.0693"-02	2.1608"+00	NM	0.99686	0.91721	0.93271	1.03409	0.90197
78	1.0820"-02	2.1721"+00	NM	0.99688	0.92077	0.93562	1.03251	0.90615
79	1.0973"-02	2.1747"+00	NM	0.99694	0.92159	0.93632	1.03221	0.90710
80	1.1100"-02	2.1871"+00	NM	0.99704	0.92548	0.93952	1.03057	0.91165
81	1.1227"-02	2.1935"+00	NM	0.99723	0.92747	0.94122	1.02989	0.91391
82	1.1354"-02	2.1967"+00	NM	0.99723	0.92846	0.94202	1.02943	0.91509
83	1.1633"-02	2.2217"+00	NM	0.99764	0.93615	0.94843	1.02641	0.92403
84	1.1887"-02	2.2271"+00	NM	0.99757	0.93780	0.94973	1.02560	0.92603
85	1.1913"-02	2.2241"+00	NM	0.99764	0.93690	0.94903	1.02608	0.92491
86	1.2141"-02	2.2387"+00	NM	0.99766	0.94136	0.95264	1.02410	0.93022
87	1.2421"-02	2.2532"+00	NM	0.99785	0.94574	0.95624	1.02232	0.93536
88	1.2700"-02	2.2614"+00	NM	0.99809	0.94823	0.95835	1.02146	0.93821
89	1.4427"-02	2.3249"+00	NM	0.99877	0.96708	0.97367	1.01366	0.96054
90	1.6078"-02	2.3736"+00	NM	0.99937	0.98123	0.98508	1.00787	0.97739
91	1.6942"-02	2.3938"+00	NM	0.99954	0.98702	0.98969	1.00542	0.98435
92	1.8491"-02	2.4168"+00	NM	0.99978	0.99355	0.99407	1.00271	0.99221
93	1.9380"-02	2.4253"+00	NM	0.99987	0.99545	0.99680	1.00170	0.99510
D 94	2.1031"-02	2.4397"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
95	2.5095"-02	2.4456"+00	NM	1.00025	1.00165	1.00140	0.99950	1.00191
96	2.7635"-02	2.4426"+00	NM	1.00012	1.00083	1.00070	0.99975	1.00095
97	3.0150"-02	2.4426"+00	NM	1.00012	1.00083	1.00070	0.99975	1.00095
98	3.2614"-02	2.4426"+00	NM	1.00012	1.00083	1.00070	0.99975	1.00095

INPUT VARIABLES Y,M,U/UD ASSUME P=PD
AT I=11,18,28,46,53,62,72,80 DATA WERE AVERAGED

SECTION D: ADDITIONAL DATA.

FACSIMILE FROM SOURCE PAPER: NB. AUTHORS' SYMBOLS AND UNITS

PRESSURE DISTRIBUTION AND SKIN FRICTION.

		$M_\infty = 0.597$, $Re_\ell = 9.85 \times 10^6$			$M_\infty = 0.801$, $Re_\ell = 9.98 \times 10^6$			$M_\infty = 1.390$, $Re_\ell = 5.04 \times 10^6$			$M_\infty = 1.398$, $Re_\ell = 10.2 \times 10^6$		
x in	φ deg	c_p	M_δ	$10^3\ c_f$	c_p	M_δ	$10^3\ c_f$	c_p	M_δ	$10^3\ c_f$	c_p	M_δ	$10^3\ c_f$
3.0	0	0.311	0.493	3.92	0.371	0.631	3.66	0.413	1.050	2.52	0.417	1.053	3.88
3.0	90	0.310			0.369			0.407			0.406		
3.0	-180	0.314			0.374			0.409			0.402		
3.0	- 90	0.310			0.368			0.411			0.401		
6.0	0	0.202	0.530	3.70	0.262	0.681	3.70	0.427	1.040	1.91	0.433	1.042	3.79
12.0	0	-0.222	0.666	3.59	-0.218	0.900	3.87	0.153	1.251	0.68	0.151	1.260	1.01
15.0	0	-0.382	0.715	2.80	-0.458	1.012	3.37	-0.040	1.427	2.24	-0.042	1.438	3.56
18.0	0	-0.399	0.720	2.37	-0.499	1.032	2.72	-0.180	1.582	1.78	-0.181	1.593	3.17
21.0	0	-0.313	0.694	2.45	-0.349	0.960	2.37	-0.281	1.715	1.69	-0.281	1.727	3.37
21.0	90	-0.313			-0.348			-0.280			-0.284		
21.0	-180	-0.310			-0.346			-0.279			-0.275		
21.0	- 90	-0.313			-0.350			-0.279			-0.280		
24.0	0	-0.145	0.642	1.83	-0.133	0.861	1.62	-0.273			-0.302	1.759	2.72
27.0	0	-0.004	0.598	1.53	0.027	0.788	1.27	-0.256	1.679	0.65	-0.258	1.695	2.23
28.5	0	0.037	0.585	1.42	0.068	0.770	1.25	-0.248	1.669	0.71	-0.208	1.626	1.92
30.0	0	0.058	0.578	1.35	0.095	0.758	1.20	-0.204	1.611	0.74	-0.154	1.561	1.54
31.5	0	0.073	0.573	1.59	0.108	0.752	1.48	-0.116	1.508	1.97	-0.109	1.509	1.58
33.0	0	0.084	0.569	1.47	0.117	0.748	1.39	-0.062	1.450	2.99	-0.070	1.467	1.43
34.5	0	0.090	0.567	1.47	0.123	0.745	1.42	-0.021	1.409	2.90	-0.038	1.434	1.34
36.0	0	0.103	0.563	1.48	0.137	0.739	1.44	0.009	1.379	2.90	-0.010	1.406	1.31
37.5	0	0.115	0.559	1.31	0.149	0.733	1.35	0.034	1.356	2.58	0.016	1.381	1.16
40.0	0	0.158	0.545	1.31	0.197	0.711	1.19	0.091	1.304	2.24	0.093	1.310	1.00
42.0	0	0.183	0.537	1.43	0.221	0.700	1.38	0.196	1.215	1.73	0.166	1.247	0.83
42.0	90	0.181			0.218			0.191			0.166		
42.0	-180	0.182			0.222			0.198			0.168		
42.0	- 90	0.178			0.219			0.191			0.165		
44.0	0	0.168	0.542	1.40	0.208	0.707	1.29	0.249	1.173	1.75	0.200	1.219	0.91
45.5	0	0.138	0.552	1.62	0.178	0.720	1.53	0.228	1.182	2.02	0.198	1.221	1.14
47.0	0	0.118	0.558	1.72	0.150	0.733	1.74	0.208	1.206	2.24	0.188	1.229	1.33
48.5	0	0.103	0.563	1.76	0.133	0.740	1.79	0.191	1.219	2.46	0.178	1.237	1.56
50.0	0	0.092	0.567	1.85	0.128	0.743	1.84	0.188	1.222	2.50	0.176	1.238	1.71
51.5	0	0.086	0.569	1.79	0.124	0.745	1.70	0.186	1.223	2.30	0.178	1.237	1.70
53.0	0	0.074	0.573	2.12	0.116	0.748	2.02	0.197	1.215	2.63	0.188	1.229	1.97
54.5	0	0.058	0.578	2.10	0.097	0.757	2.06	0.197	1.215	2.63	0.190	1.227	2.05
56.0	0	0.037	0.585	2.10	0.077	0.766	2.09	0.218	1.197	2.44	0.207	1.213	2.00
57.5	0	-0.000	0.597	2.27	0.038	0.783	2.30	0.229	1.189	2.63	0.222	1.201	2.09
59.0	0	-0.083	0.623	3.47	-0.047	0.822	2.54	0.248	1.174	2.56	0.236	1.189	2.17
59.0	90	-0.074			-0.037			0.254			0.244		
59.0	-180	-0.080			-0.044			0.246			0.237		
59.0	- 90	-0.081			-0.045			0.253			0.237		

SECTION D: ADDITIONAL DATA.

FACSIMILE FROM SOURCE PAPER: NB. AUTHORS' SYMBOLS AND UNITS

PRESSURE DISTRIBUTION AND SKIN FRICTION.

		$M_\infty = 1.404$			$M_\infty = 1.700$			$M_\infty = 1.996$			$M_\infty = 2.000$		
		$Re_\ell = 19.97 \times 10^6$			$Re_\ell = 10.08 \times 10^6$			$Re_\ell = 4.98 \times 10^6$			$Re_\ell = 9.96 \times 10^6$		
x in	φ deg	c_p	M_δ	$10^3 c_f$	c_p	M_δ	$10^3 c_f$	c_p	M_δ	$10^3 c_f$	c_p	M_δ	$10^3 c_f$
3.0	0	0.417	1.057	3.95	0.360	1.319	1.40	0.333	1.553	1.91	0.325	1.567	1.27
3.0	90	0.403			0.354			0.334			0.327		
3.0	-180	0.400			0.350			0.330			0.324		
3.0	- 90	0.408			0.350			0.329			0.323		
6.0	0	0.437	1.043	3.20	0.368	1.311	3.93	0.333	1.553	1.44	0.336	1.556	3.63
12.0	0	0.155	1.261	0.91	0.166	1.501	3.69	0.166	1.737	1.42	0.163	1.749	3.20
15.0	0	-0.040	1.442		0.000	1.696		0.029	1.933	1.46	0.022	1.954	2.54
18.0	0	-0.179	1.598	2.76	-0.115	1.870	2.58	-0.075	2.130	1.12	-0.080	2.154	2.10
21.0	0	-0.282	1.738	2.99	-0.201	2.036	2.75	-0.141	2.298	1.14	-0.150	2.341	2.19
21.0	90	-0.284			-0.199			-0.140			-0.149		
21.0	-180	-0.279			-0.198			-0.141			-0.149		
21.0	- 90	-0.277			-0.196			-0.140			-0.148		
24.0	0	-0.299	1.763	2.31	-0.223	2.086	2.34	-0.162	2.360	0.29	-0.173	2.416	1.88
27.0	0	-0.253	1.695	1.93	-0.196	2.025	1.96	-0.139	2.291	0.36	-0.160	2.372	1.73
28.5	0	-0.206	1.632	1.73	-0.168	1.966	1.90	-0.138			-0.140	2.310	1.69
30.0	0	-0.156	1.570	1.46	-0.134	1.903	1.60	-0.134			-0.116	2.244	1.50
31.5	0	-0.110	1.517	1.59	-0.104	1.852	1.67	-0.115			-0.094	2.187	1.47
33.0	0	-0.069	1.472	1.40	-0.074	1.803	1.47	-0.083	2.149	0.30	-0.070	2.134	1.44
34.5	0	-0.038	1.441	1.40	-0.050	1.767	1.38	-0.056	2.089	1.56	-0.051	2.093	1.34
36.0	0	-0.010	1.412	1.45	-0.029	1.737	1.38	-0.025	2.029	2.60	-0.033	2.054	1.33
37.5	0	0.016	1.386	1.26	-0.007	1.706	1.20	0.001	1.981	2.38	-0.015	2.021	1.16
40.0	0	0.089	1.318	1.13	0.046	1.637	1.07	0.038	1.917	2.49	0.024	1.951	1.11
42.0	0	0.174	1.245	0.86	0.123	1.547	0.83	0.118	1.799	2.24	0.095	1.840	0.85
42.0	90	0.171			0.122			0.106			0.092		
42.0	-180	0.174			0.125			0.112			0.100		
42.0	- 90	0.169			0.122			0.108			0.093		
44.0	0	0.211	1.215	0.90	0.169	1.498	0.92	0.181	1.718	2.20	0.147	1.770	0.94
45.5	0	0.205	1.219	1.17	0.172	1.495	1.18	0.181	1.719	2.51	0.154	1.761	1.23
47.0	0	0.191	1.231	1.40	0.163	1.504	1.46	0.173	1.728	2.45	0.150	1.765	1.53
48.5	0	0.180	1.241	1.54	0.156	1.512	1.75	0.163	1.740	2.60	0.145	1.772	1.82
50.0	0	0.181	1.239	1.65	0.156	1.512	1.93	0.157	1.748	2.64	0.144	1.773	1.98
51.5	0	0.182	1.239	1.56	0.154	1.513	1.94	0.153	1.753	2.44	0.142	1.776	1.96
53.0	0	0.194	1.229	1.83	0.164	1.504	2.23	0.157	1.748	2.75	0.148	1.767	2.26
54.5	0	0.194	1.229	1.87	0.162	1.505	2.38	0.160	1.744	2.69	0.150	1.766	2.35
56.0	0	0.210	1.216	1.83	0.178	1.489	2.27	0.174	1.727	2.4[illegible]	0.165	1.746	2.17
57.5	0	0.224	1.204	1.90	0.190	1.476	2.38	0.184	1.715	2.59	0.175	1.734	2.[illegible]3
59.0	0	0.239	1.192	1.55	0.202	1.464	2.43	0.194	1.702	2.58	0.185	1.721	2.37
59.0	90	0.249			0.211			0.199			0.188		
59.0	-180	0.240			0.204			0.191			0.181		
59.0	- 90	0.245			0.206			0.194			0.184		

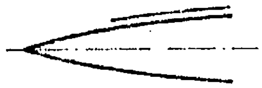
SECTION D: ADDITIONAL DATA.

FACSIMILE FROM SOURCE PAPER: NB. AUTHORS' SYMBOLS AND UNITS

PRESSURE DISTRIBUTION AND SKIN FRICTION.

		$M_\infty = 2.002$ $Re_\ell = 16.85 \times 10^6$			$M_\infty = 2.401$ $Re_\ell = 10.03 \times 10^6$			$M_\infty = 2.793$ $Re_\ell = 5.03 \times 10^6$			$M_\infty = 2.799$ Re_ℓ 10.05×10^6		
x in	φ deg	c_p	M_δ	$10^3 c_f$	c_p	M_δ	$10^3 c_f$	c_p	M_δ	$10^3 c_f$	c_p	M_δ	$10^3 c_f$
3.0	0	0.330	1.564	3.50	0.307	1.868	1.11	0.300	2.133	1.49	0.291	2.153	1.06
3.0	90	0.331			0.306			0.298			0.289		
3.0	-180	0.323			0.304			0.299			0.288		
3.0	- 90	0.322			0.302			0.294			0.286		
6.0	0	0.337	1.557	2.99	0.312	1.862	3.35	0.301	2.132	1.10	0.292	2.151	2.34
12.0	0	0.162	1.752	2.83	0.165	2.058	2.73	0.168	2.336	1.12	0.158	2.364	2.35
15.0	0	0.019	1.962	2.40	0.038	2.292	2.05	0.056	2.580	0.85	0.040	2.636	1.83
18.0	0	-0.081	2.162	2.01	-0.050	2.528	1.73	-0.028	2.859	0.93	-0.036	2.908	1.57
21.0	0	-0.153	2.354	2.17	-0.109	2.756	1.78	-0.048	2.950	1.06	-0.082	3.162	1.45
21.0	90	-0.152			-0.108			-0.049			-0.080		
21.0	-180	-0.150			-0.110			-0.046			-0.080		
21.0	- 90	-0.151			-0.106			-0.041			-0.078		
24.0	0	-0.176	2.430	1.82	-0.130	2.865	1.50	-0.074			-0.101	3.301	1.13
27.0	0	-0.163	2.385	1.60	-0.123	2.826	1.39	-0.065			-0.096	3.261	1.04
28.5	0	-0.142	2.321	1.58	-0.111	2.766	1.39	-0.068	3.050	0.35	-0.089	3.208	1.09
30.0	0	-0.118	2.252	1.35	-0.094	2.691	1.31	-0.066	3.043	0.45	-0.077	3.131	1.21
31.5	0	-0.096	2.196	1.42	-0.080	2.633	1.29	-0.068	3.051	0.87	-0.066	3.064	1.14
33.0	0	-0.074	2.143	1.35	-0.063	2.571	1.24	-0.066	3.039	0.41	-0.056	3.005	1.13
34.5	0	-0.053	2.099	1.27	-0.048	2.522	1.18	-0.061	3.011	0.31	-0.045	2.954	1.23
36.0	0	-0.035	2.061	1.26	-0.036	2.484	1.22	-0.050			-0.031	2.890	1.03
37.5	0	-0.017	2.026	1.11	-0.022	2.444	1.09	-0.037			-0.021	2.844	0.95
40.0	0	0.022	1.957	1.11	0.009	2.361	1.04	0.008	2.724	0.63	0.004	2.751	0.98
42.0	0	0.095	1.842	0.93	0.066	2.233	0.91	0.068	2.547	1.55	0.053	2.600	0.83
42.0	90	0.091			0.064			0.066			0.048		
42.0	-180	0.093			0.069			0.070			0.052		
42.0	- 90	0.090			0.064			0.069			0.050		
44.0	0	0.147	1.771	0.88	0.119	2.134	1.00	0.131	2.407	1.96	0.106	2.468	0.93
45.5	0	0.153	1.763	1.22	0.131	2.114	1.33	0.147	2.376	2.19	0.122	2.435	1.21
47.0	0	0.148	1.769	1.55	0.132	2.112	1.53	0.145	2.378	2.06	0.125	2.429	1.36
48.5	0	0.143	1.776	1.79	0.127	2.120	1.78	0.137	2.395	2.18	0.120	2.438	1.56
50.0	0	0.143	1.776	1.93	0.128	2.118	1.90	0.136	2.397	2.20	0.121	2.437	1.68
51.5	0	0.140	1.780	1.87	0.129	2.117	1.77	0.158	2.393	1.73	0.122	2.435	1.51
53.0	0	0.147	1.771	2.13	0.133	2.110	2.08	0.140	2.389	2.06	0.126	2.426	1.77
54.5	0	0.148	1.770	2.20	0.135	2.106	2.12	0.136	2.397	2.20	0.127	2.424	1.83
56.0	0	0.162	1.752	2.04	0.148	2.086	1.94	0.149	2.372	2.01	0.137	2.404	1.72
57.5	0	0.174	1.737	2.14	0.157	2.070	2.09	0.152	2.366	2.19	0.144	2.390	1.87
59.0	0	0.183	1.726	2.14	0.167	2.056	2.15	0.167	2.337	2.05	0.155	2.369	1.88
59.0	90	0.186			0.170			0.172			0.159		
59.0	-180	0.176			0.164			0.168			0.152		
59.0	- 90	0.181			0.167			0.166			0.156		

axisymmetric



M : 2.96 (free stream)
R THETA X 10^{-3} : 1.4 - 10
TW/TR : 1

7005

VPG - AW

Continuous tunnel with asymmetric sliding block variable nozzle.
PO : 0.17 MN/m^2. TO : 340 K. Dried Air. RE/m X 10^{-6} : 10 (in free stream).

ALLEN J.M., 1970. Experimental Preston tube and law-of-the-wall study of turbulent skin friction on axi-symmetric bodies at supersonic speeds. NASA TN D-5660.
<u>And</u> Allen J.M., private communication.

1 The test boundary layer was formed on a "Haack-Adams body" constructed of aluminium and mounted on the centre line of the test section. The body was not actively cooled, the temperatures being allowed to settle for up to 30 minutes. The form of the body is given by

$$\frac{r}{r_{max}} = \left\{0.70700\ [1-Z^2]^{1.5} + 0.16934\ Z\ [1-Z^2]^{0.5} + 0.16934\ \cos^{-1} -Z \right\}^{0.5}$$

where $Z = (\frac{2x}{l} - 1)$, r_{max} = 45.72 mm and l = 914.4 mm.

4 Surveys were made at seven stations on the model surface such that the boundary layer initially accelerated before reaching a maximum edge velocity and then slowed down slightly. The stations and MD values are
3 listed in section B. A transition strip of No 60 carborundum grit 3.2 mm wide was placed at X = 12.7 mm,
5 where X = 0 at the model nose. At two stations, X = 0.1778 and X = 0.6604 m, static holes at 90° intervals round the model provided a check on axi-symmetry

6 Wall static pressure was measured by static tappings (d = 0.9 mm) along a single generator of the model, except for the two stations mentioned above. A circular Preston tube (d_1 = 0.71, d_2 = 0.41, l = 15 mm) was
7 used to determine wall shear stress, and also to obtain a free stream Pitot value. Pitot profiles were
9 obtained with a FPP for which h_1 = 0.28, h_2 = 0.13, b_1 = 1.6 [E] , l = 15 mm. The static pressure was
10 assumed constant through the boundary layer and no profile corrections were applied. Viscosity was determined from Sutherlands' law.

12 The editors present all the profiles measured by the author, replacing the isoenergetic assumption by the Crocco / Van Driest correlation, assuming that the model was adiabatic. The CF values are those reduced by the author, using the Hopkins and Keener (CAT 6601) calibration. He also presents values reduced using the Fenter & Stalmach (1957) Preston tube calibration, and the Baronti & Libby (1966) velocity profile correlation. The boundary layer edge has been set at the point with the highest velocity, as reported by the author. The POD value is calculated from the reported unit RE value. The author also reports additional Preston tube CF data for M = 2.5, 4 and 4.5, but without associated profile measurements. The
13 profiles form a single set at seven successive stations, presented with Preston tube CF values at the
14 same positions.

§ DATA 7005 0101-0107. Pitot profiles. NX = 7. Preston tube CF values obtained separately.

15 <u>Editors' comments</u>

These profiles are included as providing a test case in which the edge Mach number varies systematically. The pressure gradient is not very severe, so that the effects of acceleration should not be expected to be very marked. However, there is very little comparable data and the only similar test case is the experiment with a waisted body made by Winter et al. - CAT 7004. In that experiment the pressure gradients are stronger and more varied, but profiles were measured at relatively wide intervals.

The effects of normal pressure gradients here should be small - the simple wave element would give rise to about 1 % change in static pressure across the boundary layer. That there is a detectable effect is demonstrated by the experimentally observed velocity maximum used to specify the boundary layer edge.

There are not many data points for each profile, and it seems likely that the first one or two profiles are still influenced by the transition process. A further experiment of this type, with more detailed measurements, would be valuable.

CAT 7005 ALLEN BOUNDARY CONDITIONS D EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	REDZW	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ *	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
70050101	2.8320	1.0000	6.8643E+02	2.7180E-03	4.8785	1.5611	5.7398E+03	5.7398E+03
1.2700E-01	1.6356E+05	1.0000	1.4526E+03	NP	1.7901	1.7603	3.1728E+02	1.3018E+02
2.4130E-02	3.3900E+02	1.0000	1.3339E-04	NC	0.1152	2.0025E-04	6.4786E+02	3.1728E+02
70050102	2.9730	1.0000	1.1157E+03	2.1960E-03	4.9835	1.4423	4.8788E+03	4.8788E+03
2.5400E-01	1.7209E+05	1.0000	2.4733E+03	NP	1.8117	1.7829	3.1648E+02	1.2248E+02
3.6300E-02	3.3900E+02	1.0000	2.3521E-04	NC	0.1210	3.5265E-04	6.5969E+02	3.1648E+02
70050103	3.0380	1.0000	1.5245E+03	1.8910E-03	5.0607	1.4025	4.4449E+03	4.4449E+03
3.8100E-01	1.7283E+05	1.0000	3.4937E+03	NP	1.8136	1.7845	3.1613E+02	1.1912E+02
4.3080E-02	3.3900E+02	1.0000	3.4019E-04	NC	0.1232	5.1493E-04	6.6480E+02	3.1613E+02
70050104	3.0500	1.0000	1.9553E+03	1.6820E-03	5.0829	1.4023	4.2067E+03	4.2067E+03
5.0800E-01	1.6053E+05	1.0000	4.5016E+03	NM	1.8039	1.7724	3.1607E+02	1.1851E+02
4.5670E-02	3.3900E+02	1.0000	4.5794E-04	NC	0.1230	7.0373E-04	6.6572E+02	3.1607E+02
70050105	3.0720	1.0000	2.4024E+03	1.5840E-03	5.0816	1.3852	4.0117E+03	4.0117E+03
6.3500E-01	1.6410E+05	1.0000	5.5784E+03	NM	1.8025	1.7713	3.1595E+02	1.1741E+02
4.4500E-02	3.3900E+02	1.0000	5.8290E-04	NC	0.1239	8.9914E-04	6.6738E+02	3.1595E+02
70050106	3.0710	1.0000	3.0435E+03	1.4390E-03	5.0059	1.3703	3.9147E+03	3.9147E+03
7.6200E-01	1.5990E+05	1.0000	7.0641E+03	NM	1.7988	1.7662	3.1596E+02	1.1746E+02
4.0030E-02	3.3900E+02	1.0000	7.5714E-04	NC	0.1242	1.1653E-03	6.6731E+02	3.1596E+02
70050107	2.9350	1.0000	4.0896E+03	1.3100E-03	4.6507	1.3726	4.3956E+03	4.3956E+03
8.8900E-01	1.4642E+05	1.0000	9.0059E+03	NM	1.7819	1.7484	3.1669E+02	1.2450E+02
3.4010E-02	3.3900E+02	1.0000	9.7783E-04	NC	0.1201	1.4806E-03	6.5661E+02	3.1669E+02

PD,POD CALCULATED FROM RE (AUTHOR) - CF (HOPKINS/KEENER)

70050103 ALLEN PROFILE TABULATION 12 POINTS, DELTA AT POINT 11

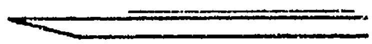
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.93254	0.00000	0.00000	2.65392	0.00000
2	1.2700E-04	1.8056E+00	NM	0.94893	0.32807	0.49262	2.25289	0.21857
3	5.0800E-04	3.5444E+00	NM	0.96460	0.50593	0.68997	1.86655	0.36965
4	8.8900E-04	4.7472E+00	NM	0.97277	0.59804	0.77227	1.66752	0.46312
5	1.2700E-03	5.8202E+00	NM	0.97711	0.65054	0.81281	1.56117	0.52056
6	2.1590E-03	7.1580E+00	NM	0.98467	0.74947	0.87903	1.37579	0.63907
7	3.4290E-03	9.7195E+00	NM	0.99344	0.88194	0.95317	1.16072	0.81860
8	4.6990E-03	1.1087E+01	NM	0.99852	0.97149	0.98897	1.03629	0.95433
9	5.9690E-03	1.2133E+01	NM	0.99954	0.99097	0.99657	1.01133	0.98541
10	7.2390E-03	1.2295E+01	NM	0.99987	0.99745	0.99903	1.00319	0.99586
D 11	8.5090E-03	1.2356E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
12	9.7790E-03	1.2249E+01	NM	0.99977	0.99547	0.99828	1.00567	0.99266

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

70050106 ALLEN PROFILE TABULATION 13 POINTS, DELTA AT POINT 13

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.93203	0.00000	0.00000	2.69004	0.00000
2	1.2700E-04	1.4659E+00	NM	0.94210	0.24743	0.38632	2.43781	0.15847
3	7.6200E-04	3.1702E+00	NM	0.96117	0.46698	0.65471	1.96562	0.33308
4	1.3970E-03	3.9768E+00	NM	0.96727	0.53461	0.72002	1.81388	0.39695
5	2.0320E-03	4.5747E+00	NM	0.97119	0.57930	0.75902	1.71638	0.44222
6	2.6670E-03	5.1881E+00	NM	0.97479	0.62179	0.79311	1.62697	0.48748
7	3.3020E-03	5.8401E+00	NM	0.97821	0.66383	0.82427	1.54179	0.53462
8	3.9370E-03	6.4334E+00	NM	0.98103	0.69985	0.84903	1.47177	0.57687
9	6.4770E-03	8.9688E+00	NM	0.99063	0.83021	0.92852	1.23298	0.75307
10	9.0170E-03	1.1463E+01	NM	0.99749	0.95132	0.98105	1.06346	0.92250
11	1.1557E-02	1.2463E+01	NM	0.99960	0.99369	0.99764	1.00797	0.98975
12	1.4097E-02	1.2553E+01	NM	0.99987	0.99741	0.99903	1.00326	0.99579
D 13	1.6637E-02	1.2615E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST



M : 4
P THETA X 10^{-3} : 2 - 25
TW/TR : 1

7006

ZPG - AW

Continuous tunnel with fixed symmetrical nozzle. W = 0.91, H = 1.22 m.
0.084 < PO < 0.68 MN/m². TO: 313 K. Air, Dew-point 243 K. 3.7 < RE/m × 10^{-6} < 29.

HASTINGS P.C. and SAWYER W.G. 1970. Turbulent boundary layers on a large flat plate at M = 4.
RAE TR 70040. (Also ARC R & M 3678).
Also Mabey et al. CAT 7402.

1 The test boundary layer was formed on a mild-steel plate 1.65 m long and 0.89 m wide. A clearance of 12.7 mm was allowed on each side between the plate and the tunnel wall. The plate leading edge was chamfered at 10° to a thickness of 0.25 mm, and ground smooth on the test surface to within 0.64 m. Twenty two instrument ports were placed in alternate staggered rows of three and two in the central 127 mm of the plate. The port diameter was 41.3 mm and the plugs were ground flush with the plate surface to within 13 m. The plate was not actively cooled. Surface temperature varied along the plate
2 but was within +2, -3 % of the adiabatic value for a recovery factor of 0.89. The Mach number along the
3 surface varied by about 1 %. Transition was observed by sublimation of a surface coating of azobenzene. Transition was complete by approximately X = 0.2 m at the highest unit Reynolds numbers and by about X = 0.6 m for the lowest. The profiles presented are in all cases from stations downstream of transition as indicated not only by the sublimation technique but also by surface Pitot measurements. The sublimation
5 patterns also indicated some flow convergence, which was confirmed by an imbalance in the two dimensional momentum integral equation of up to 25 %.

6 Two configurations of pressure tapped plugs were used. In one, static holes (d = 1 mm) were drilled 12.7 mm upstream and downstream of the plug centre while in the other, used in conjunction with surface Pitot shear stress sensors, a row of three tappings was drilled 6.35 mm downstream of the centre on the centreline and 10.16 mm to either side. Sections of razor blade were ground down and mounted over two of the static holes on each of two similar plugs. The blades were about 6.35 mm square with the sharp edge mounted over the front of the static hole. It was found that only the blades with the larger value of h (0.566 and 0.323 mm) on each plug gave reliable readings. The smaller blades (h = 0.152 and 0.157 mm) were thought to suffer from interference from the larger ones. The calibration function used was that presented in figure 18 of Hopkins and Keener 1966 (CAT 6601). A floating element balance was also mounted in a plug. The element was circular (d = 7.925 mm) with a mean gap of 0.127 mm.

7 Profile measurements were made with two combined Pitot / temperature probe assemblies. These consisted of small (d_1 = 0.36 mm) CPP which after an approximately 10 mm length nearly parallel to the flow was bent up nearly normal to the test surface before entering a larger diameter crook-shaped holding tube. This looped round to re-enter the plug to which the traverse gear was attached. The profile normal lay 12.7 mm ahead of the centre of the plug. A thermocouple bead was mounted inside the holding tube near the end of the narrow-bore Pitot. The probe could be connected either to a pressure sensor for Pitot measurements or to a vacuum pump which ensured that the inflow was choked, when the thermocouple was used as a TO sensor.
6 For one of the assemblies (No 1) d_2 was 0.28 mm whilst for no 2 it was 0.13 mm. A thermocouple used for measuring wall temperature was fitted to the same plug.

8 The arrangement of the ports was such that there were five longitudinal rows, one on the centre line and two on each side at distances of 31.75 and 63.5 mm. In each row the distance between successive ports was 254 mm. The FEB was used only at stations on the centre line for which X = 0.622, 0.876 and 1.120 m. Pitot traverses were made in the rows 63.5 mm to either side, no 1 being used for traverses on normals at X = 0.559, 0.813 and 1.067 m, and no 2 for traverses at X = 0.406, 0.660, 0.914 and 1.168 m. Razor blade shear stress determinations were made on the centre line and 31.75 mm to one side, as were the associated

static measurements. The X-values are to be found in section D.

9 The authors have interpolated static pressure values to the profile stations. By a leap-frog deployment
of the two razor-blade sensors it was possible to extend the calibration function to lower readings, and
the low-dynamic-head skin friction results were obtained in this manner. The R-THETA values presented with
10 the shear stress data are those interpolated by the authors from their own integral value calculations.
11 No profile corrections were employed and Sutherland's viscosity law was used.

12 The editors have presented all the data available to them using the authors' tabulated values for the
measured temperature distribution (values determined from the Crocco / Van Driest temperature relation for
recovery factors of 1 and 0.89 were also given). The boundary layer edge reservoir state has been arbitrarily
13 set at the nominal tunnel reservoir conditions given by the authors. The CF values given with the profiles
have been interpolated by the editors from the data given in section D. The authors' R THETA values were
used throughout. The relationship between CF and R THETA was fitted in two separate ranges, with a dis-
14 continuity in the value of CF at R THETA = 6800 (see fig. 10 of the source paper). The skin friction data
is also presented in its original form in section D. Balance readings are only available for the higher
unit Reynolds numbers.

6 DATA: 7006 0101-0407. NX up to 7. Pitot and TO profiles measured with the same probe. CF measured at different stations with FEB and Stanton tubes.

15 <u>Editors' comments</u>

The data cover a 10 : 1 Reynolds number range, starting with boundary layers which are still strongly influenced by the transition process. Low Reynolds number effects are evident both in the profiles and in the anomalous CF behaviour which we have attempted to describe by using a two-branch data fit for interpolation. Comparable but fully turbulent data is presented by Coles - CAT 5301, and the development of the transition process is fully described by Watson et al. - CAT 7305, though at high Mach numbers.

Mabey et al. used a modification of the same plate to extend the experiment, covering a higher Reynolds number range for Mach numbers from 2.5 to 4.5 - CAT 7402. They observed disturbances caused by the gaps at the sides of the plate which are not remarked here.

The profiles are described in close detail, and measurements extend to within the momentum deficit peak.

CAT 7006 HASTINGS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * PUD* TOD*	TW/TR PW/PD* SW *	PLD2W PLD2D DB	CF * CQ PI2*	H12 H32 H42	H12K H32K UPK	PW TW* UD	PD TD TR
70060101	3.9130	1.0026	6.9708E+02	NM	7.0514	1.3384	6.2657E+02	6.2657E+02
8.1280E-01	8.4660E+04	1.0000	2.2719E+03	NM	1.8541	1.6167	2.8921E+02	7.7050E+01
INFINITE	3.1300E+02	0.0000	6.4340E-04	0.0000E+00	0.2150	1.0803E-03	6.8866E+02	2.8846E+02
70060102	3.9160	1.0070	8.3739E+02	1.6500E-03	7.3623	1.3052	6.2404E+02	6.2404E+02
9.1440E-01	8.4660E+04	1.0000	2.7415E+03	NM	1.8493	1.8117	2.9046E+02	7.6961E+01
INFINITE	3.1300E+02	0.0000	7.7760E-04	0.0000E+00	0.1426	1.3601E-03	6.8879E+02	2.8845E+02
70060103	3.8930	1.0002	9.7986E+02	1.5200E-03	7.4489	1.3439	6.4372E+02	6.4372E+02
1.0668E+00	8.4660E+04	1.0000	3.1349E+03	NM	1.8435	1.8059	2.8859E+02	7.7646E+01
INFINITE	3.1300E+02	0.0000	8.7864E-04	0.0000E+00	0.1219	1.5356E-03	6.8779E+02	2.8852E+02
70060104	3.8990	0.9949	1.0801E+03	1.4300E-03	7.2253	1.3105	6.3852E+02	6.3852E+02
1.1684E+00	8.4660E+04	1.0000	3.4809E+03	NM	1.8348	1.8031	2.8702E+02	7.7467E+01
INFINITE	3.1300E+02	0.0000	9.7866E-04	0.0000E+00	0.1679	1.7364E-03	6.8805E+02	2.8850E+02
70060201	3.9420	1.0000	7.5096E+02	NM	7.3784	1.3341	1.2052E+03	1.2052E+03
5.5880E-01	1.6932E+05	1.0000	2.4691E+03	NM	1.8531	1.6214	2.8837E+02	7.6195E+01
INFINITE	3.1300E+02	0.0000	3.5492E-04	0.0000E+00	0.1625	6.0837E-04	6.8991E+02	2.8837E+02
70060202	3.9430	0.9997	8.7508E+02	1.4500E-03	7.4036	1.3649	1.2035E+03	1.2035E+03
6.6040E-01	1.6932E+05	1.0000	2.8776E+03	NM	1.8397	1.6032	2.8027E+02	7.6166E+01
INFINITE	3.1300E+02	0.0000	4.1384E-04	0.0000E+00	0.1627	7.1681E-04	6.8995E+02	2.8837E+02
70060203	3.9210	1.0016	1.3247E+03	1.2700E-03	7.3423	1.3343	1.2397E+03	1.2397E+03
8.1280E-01	1.6932E+05	1.0000	4.3269E+03	NM	1.8387	1.6057	2.8890E+02	7.6813E+01
INFINITE	3.1300E+02	0.0000	6.1524E-04	0.0000E+00	0.1654	1.0893E-03	6.8903E+02	2.8844E+02
70060204	3.9370	1.0126	1.4682E+03	1.2300E-03	7.5581	1.3346	1.2133E+03	1.2133E+03
9.1440E-01	1.6932E+05	1.0000	4.8524E+03	NM	1.8320	1.6000	2.9203E+02	7.6342E+01
INFINITE	3.1300E+02	0.0000	6.9569E-04	0.0000E+00	0.1346	1.2657E-03	6.8909E+02	2.8839E+02
70060205	3.9150	0.9972	1.8202E+03	1.2050E-03	7.3672	1.2986	1.2498E+03	1.2498E+03
1.0668E+00	1.6932E+05	1.0000	5.9119E+03	NM	1.8352	1.8073	2.8765E+02	7.6990E+01
INFINITE	3.1300E+02	0.0000	8.3799E-04	0.0000E+00	0.1467	1.5085E-03	6.8875E+02	2.8845E+02
70060206	3.9150	0.9972	1.9784E+03	1.4400E-03	7.2280	1.3113	1.2498E+03	1.2498E+03
1.1684E+00	1.6932E+05	1.0000	6.4259E+03	NM	1.8313	1.8017	2.8765E+02	7.6990E+01
INFINITE	3.1300E+02	0.0000	9.1085E-04	0.0000E+00	0.1830	1.6379E-03	6.8875E+02	2.8845E+02

CAT 7006 HASTINGS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RLD2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RLD2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2*	H42	U2K	UD	TR
70060301	3.9760	1.0000	9.9705E+02	1.4200E-03	7.6307	1.3905	2.3029E+03	2.3029E+03
4.0640E-01	3.3864E+05	1.0000	3.3200E+03	NM	1.8327	1.8020	2.8827E+02	7.5209E+01
INFINITE	3.1300E+02	0.0000	2.4284E-04	0.0000E+00	0.1651	4.4068E-04	6.9134E+02	2.8827E+02
70060302	3.9400	0.9975	1.6902E+03	1.2100E-03	7.4084	1.3222	2.4168E+03	2.4168E+03
5.5880E-01	3.3864E+05	1.0000	5.5424E+03	NM	1.8404	1.8139	2.8705E+02	7.0254E+01
INFINITE	3.1300E+02	0.0000	3.9793E-04	0.0000E+00	0.1595	7.0545E-04	6.8982E+02	2.8858E+02
70060303	3.9430	0.9964	1.9724E+03	1.3300E-03	7.5262	1.3377	2.4071E+03	2.4071E+03
6.6040E-01	3.3864E+05	1.0000	6.4695E+03	NM	1.8317	1.8031	2.8733E+02	7.0166E+01
INFINITE	3.1300E+02	0.0000	4.6521E-04	0.0000E+00	0.1437	8.4203E-04	6.6995E+02	2.8857E+02
70060304	3.9360	1.0115	2.5063E+03	1.2500E-03	7.4424	1.3222	2.4299E+03	2.4299E+03
8.1280E-01	3.3864E+05	1.0000	8.4945E+03	NM	1.8301	1.8018	2.9172E+02	7.6371E+01
INFINITE	3.1300E+02	0.0000	6.0862E-04	0.0000E+00	0.1560	1.1100E-03	6.8965E+02	2.8859E+02
70060305	3.9460	1.0117	2.7098E+03	1.2050E-03	7.5803	1.3272	2.3974E+03	2.3974E+03
9.1440E-01	3.3864E+05	1.0000	9.2018E+03	NM	1.8288	1.7991	2.9172E+02	7.6078E+01
INFINITE	3.1300E+02	0.0000	6.6272E-04	0.0000E+00	0.1383	1.2255E-03	6.9008E+02	2.8856E+02
70060306	3.9250	1.0114	3.3493E+03	1.1350E-03	7.5148	1.3127	2.4601E+03	2.4601E+03
1.0668E+00	3.3864E+05	1.0000	1.1027E+04	NM	1.8271	1.7997	2.9172E+02	7.6695E+01
INFINITE	3.1300E+02	0.0000	7.8555E-04	0.0000E+00	0.1320	1.4524E-03	6.8918E+02	2.8842E+02
70060307	3.9270	0.9854	3.8070E+03	1.1250E-03	7.2142	1.3048	2.4594E+03	2.4594E+03
1.1684E+00	3.3864E+05	1.0000	1.2306E+04	NM	1.8280	1.8018	2.8420E+02	7.6636E+01
INFINITE	3.1300E+02	0.0000	8.7758E-04	0.0000E+00	0.1939	1.5912E-03	6.8926E+02	2.8842E+02
70060401	3.9720	1.0032	2.6149E+03	1.2200E-03	7.4571	1.3368	4.6306E+03	4.6306E+03
4.0640E-01	6.7728E+05	1.0000	8.7179E+03	NM	1.8307	1.8032	2.8921E+02	7.5324E+01
INFINITE	3.1300E+02	0.0000	3.1810E-04	0.0000E+00	0.1892	5.7833E-04	6.9117E+02	2.8828E+02
70060402	3.9550	0.9868	3.4268E+03	1.1700E-03	7.5141	1.3431	4.7373E+03	4.7373E+03
5.5880E-01	6.7728E+05	1.0000	1.1209E+04	NM	1.8294	1.8016	2.8852E+02	7.5816E+01
INFINITE	3.1300E+02	0.0000	4.0538E-04	0.0000E+00	0.1599	7.3985E-04	6.9046E+02	2.8853E+02
70060403	3.9590	0.9944	3.8422E+03	1.0950E-03	8.0347	1.3442	4.7119E+03	4.7119E+03
6.6040E-01	6.7728E+05	1.0000	1.2790E+04	NM	1.8166	1.7933	2.8671E+02	7.5700E+01
INFINITE	3.1300E+02	0.0000	4.6366E-04	0.0000E+00	0.0481	8.7582E-04	6.9063E+02	2.8832E+02
70060404	3.9500	1.0106	[illegible].8791E+03	1.0700E-03	7.4099	1.3110	4.7692E+03	4.7692E+03
8.1280E-01	6.7728E+05	1.0000	1.6209E+04	NM	1.8323	1.8063	2.9140E+02	7.5962E+01
INFINITE	3.1300E+02	0.0000	5.8490E-04	0.0000E+00	0.1569	1.0684E-03	6.9025E+02	2.8835E+02
70060405	3.9550	1.0085	5.3571E+03	1.0600E-03	7.5580	1.3056	4.7373E+03	4.7373E+03
9.1440E-01	6.7728E+05	1.0000	1.7816E+04	NM	1.8320	1.8066	2.9078E+02	7.5816E+01
INFINITE	3.1300E+02	0.0000	6.4455E-04	0.0000E+00	0.1383	1.1836E-03	6.9046E+02	2.8833E+02
70060406	3.9380	0.9790	6.7514E+03	1.0900E-03	7.0627	1.3118	4.8467E+03	4.8467E+03
1.0668E+00	6.7728E+05	1.0000	2.1802E+04	NM	1.8247	1.7999	2.8233E+02	7.6312E+01
INFINITE	3.1300E+02	0.0000	7.8184E-04	0.0000E+00	0.2310	1.4025E-03	6.8974E+02	2.8838E+02
70060407	3.9320	0.9637	7.4053E+03	NM	7.1283	1.2944	4.8859E+03	4.8859E+03
1.1684E+00	6.7728E+05	1.0000	2.3568E+04	NM	1.8321	1.8078	2.7794E+02	7.6408E+01
INFINITE	3.1300E+02	0.0000	8.4256E-04	0.0000E+00	0.2067	1.5029E-03	6.8948E+02	2.8840E+02

70060401 HASTINGS PROFILE TABULATION 34 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.92399	0.00000	0.00000	3.83952	0.00000
2	1.7780E-04	3.1140E+00	NM	0.93499	0.35709	0.59424	2.76932	0.21458
3	2.2860E-04	3.4197E+00	NM	0.93768	0.37807	0.61954	2.68528	0.23072
4	2.7940E-04	3.7362E+00	NM	0.94052	0.39853	0.64304	2.60349	0.24699
5	3.3020E-04	3.9912E+00	NM	0.94242	0.41421	0.66023	2.54065	0.25987
6	3.8100E-04	4.2373E+00	NM	0.94498	0.42878	0.67593	2.48599	0.27200
7	4.3180E-04	4.4652E+00	NM	0.94664	0.44182	0.68933	2.43427	0.28318
8	5.5880E-04	4.8900E+00	NM	0.95006	0.46510	0.71283	2.34632	0.30364
9	6.8580E-04	5.2130E+00	NM	0.95248	0.48203	0.72843	2.28363	0.31898
10	8.1280E-04	5.5047E+00	NM	0.95445	0.49680	0.74183	2.22965	0.33271
11	9.3980E-04	5.7803E+00	NM	0.95603	0.51035	0.75362	2.18055	0.34561
12	1.0668E-03	6.0913E+00	NM	0.96324	0.52522	0.76832	2.13995	0.35904
13	1.1938E-03	6.4036E+00	NM	0.96020	0.53973	0.77822	2.07900	0.37432
14	1.4478E-03	7.0683E+00	NM	0.96379	0.56936	0.80112	1.97981	0.40465
15	1.8288E-03	8.4400E+00	NM	0.96981	0.62602	0.84032	1.80180	0.46638
16	2.4638E-03	9.9375E+00	NM	0.97609	0.68240	0.87461	1.64231	0.53255
17	2.7178E-03	1.0767E+01	NM	0.97884	0.71180	0.89051	1.56519	0.56895
18	2.9718E-03	1.1579E+01	NM	0.98116	0.73981	0.90441	1.49411	0.60451
19	3.4798E-03	1.3163E+01	NM	0.98596	0.79043	0.92790	1.37770	0.67328
20	3.9878E-03	1.4827E+01	NM	0.98908	0.84068	0.94831	1.27283	0.74527
21	4.6228E-03	1.7002E+01	NM	0.99371	0.90215	0.97050	1.15727	0.83861
22	5.2578E-03	1.8873E+01	NM	0.99686	0.95188	0.98620	1.07342	0.91875
23	5.8928E-03	2.0010E+01	NM	0.99863	0.98083	0.99460	1.02828	0.96725
24	6.5278E-03	2.0415E+01	NM	0.99940	0.99095	0.99750	1.01327	0.98443
25	7.1628E-03	2.0598E+01	NM	0.99978	0.99550	0.99880	1.00664	0.99221
26	7.7978E-03	2.0603E+01	NM	0.99984	0.99660	0.99910	1.00503	0.99410
27	8.4328E-03	2.0694E+01	NM	1.00004	0.99785	0.99950	1.00351	0.99620
28	9.0678E-03	2.0734E+01	NM	0.99995	0.99885	0.99970	1.00170	0.99800
29	9.7028E-03	2.0720E+01	NM	1.00005	0.99865	0.99970	1.00210	0.99760
30	1.0338E-02	2.0690E+01	NM	0.99999	0.99795	0.99900	1.00210	0.99690
31	1.1608E-02	2.0748E+01	NM	0.99999	0.99920	0.99980	1.00120	0.99860
D 32	1.2878E-02	2.0781E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
33	1.5418E-02	2.0760E+01	NM	0.99924	0.99990	0.99950	1.00000	0.99950
34	1.7958E-02	2.0765E+01	NM	0.99939	0.99960	0.99960	1.00000	0.99960

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
AT I=19 DATA WERE AVERAGED

70060403 HASTINGS PROFILE TABULATION 37 POINTS, DELTA AT POINT 37

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.92352	0.00000	0.00000	3.81850	0.00000
2	1.7780E-04	2.7461E+00	NM	0.93289	0.33091	0.56075	2.87195	0.19528
3	2.2860E-04	3.0977E+00	NM	0.93561	0.35710	0.59360	2.76371	0.21481
4	2.7940E-04	3.3480E+00	NM	0.93741	0.37454	0.61453	2.69212	0.22827
5	3.3020E-04	3.5394E+00	NM	0.93808	0.38721	0.62898	2.63848	0.23836
6	3.8100E-04	3.7321E+00	NM	0.93982	0.39957	0.64302	2.58978	0.24829
7	4.3180E-04	3.9047E+00	NM	0.94236	0.41030	0.65520	2.55047	0.25692
8	5.5880E-04	4.2345E+00	NM	0.94617	0.43003	0.67673	2.47654	0.27326
9	6.8580E-04	4.5001E+00	NM	0.94833	0.44524	0.69236	2.41833	0.28631
10	8.1280E-04	4.7281E+00	NM	0.95104	0.45789	0.70533	2.37279	0.29726
11	9.3980E-04	4.9697E+00	NM	0.95279	0.47089	0.71787	2.32411	0.30886
12	1.0668E-03	5.1780E+00	NM	0.95504	0.48180	0.72840	2.28509	0.31869
13	1.1938E-03	5.3974E+00	NM	0.95698	0.49303	0.73884	2.24568	0.32900
14	1.4478E-03	5.8073E+00	NM	0.95962	0.51334	0.75670	2.17284	0.34825
15	1.9558E-03	6.6120E+00	NM	0.96297	0.55100	0.78700	2.04000	0.38577
16	2.4638E-03	7.4070E+00	NM	0.96717	0.58578	0.81300	1.92662	0.42203
17	2.9718E-03	8.2002E+00	NM	0.97121	0.62093	0.83720	1.81821	0.46049
18	3.4798E-03	9.1620E+00	NM	0.97598	0.65003	0.85984	1.71784	0.50053
19	3.9878E-03	1.0040E+01	NM	0.97982	0.68064	0.87900	1.62920	0.53950
20	4.6228E-03	1.1200E+01	NM	0.98627	0.73041	0.90228	1.52596	0.59129
21	5.2578E-03	1.2600E+01	NM	0.99105	0.77539	0.92415	1.42090	0.65056
22	5.8928E-03	1.3912E+01	NM	0.99492	0.81701	0.94231	1.33025	0.70837
23	6.5278E-03	1.5341E+01	NM	0.99661	0.85042	0.95870	1.24786	0.76857
24	7.1628E-03	1.6720E+01	NM	0.99996	0.89752	0.97201	1.17287	0.82874
25	7.7978E-03	1.8057E+01	NM	1.00144	0.93350	0.98335	1.10990	0.88630
26	8.1788E-03	1.9142E+01	NM	1.00300	0.96190	0.99187	1.06317	0.93294
27	9.0678E-03	1.9843E+01	NM	1.00399	0.97983	0.99699	1.03533	0.96297
28	9.7028E-03	2.0268E+01	NM	1.00485	0.99053	1.00010	1.01941	0.98105
29	1.0338E-02	2.0440E+01	NM	1.00615	0.99483	1.00181	1.01408	0.98789
30	1.0973E-02	2.0530E+01	NM	1.00600	0.99717	1.00231	1.01032	0.99207
31	1.1608E-02	2.0550E+01	NM	1.00621	0.99757	1.00251	1.00992	0.99260
32	1.2243E-02	2.0572E+01	NM	1.00493	0.99812	1.00201	1.00780	0.99425
33	1.2878E-02	2.0603E+01	NM	1.00396	0.99887	1.00171	1.00569	0.99604
34	1.3513E-02	2.0602E+01	NM	1.00316	0.99887	1.00130	1.00488	0.99644
35	1.4148E-02	2.0574E+01	NM	1.00290	0.99817	1.00190	1.00569	0.99534
36	1.6688E-02	2.0635E+01	NM	1.00438	0.99967	1.00211	1.00488	0.99724
D 37	1.9228E-02	2.0680E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
AT I=13,21 DATA WERE AVERAGED

70060406 HASTINGS PROFILE TABULATION 38 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PO	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.93640	0.00000	0.00000	3.84108	0.00000
2	1.7780E-04	2.6072E+00	NM	0.94714	0.32661	0.55924	2.93179	0.19075
3	2.2860E-04	2.9117E+00	NM	0.94870	0.34388	0.58145	2.85098	0.20338
4	2.7940E-04	3.1772E+00	NM	0.95099	0.36310	0.60536	2.77963	0.21779
5	3.3020E-04	3.3705E+00	NM	0.95241	0.37640	0.62127	2.72443	0.22604
6	3.8100E-04	3.5404E+00	NM	0.95359	0.38767	0.63438	2.67781	0.23690
7	4.3180E-04	3.6757E+00	NM	0.95446	0.39640	0.64429	2.64178	0.24388
8	5.5880E-04	3.9830E+00	NM	0.95673	0.41550	0.66540	2.56466	0.25945
9	6.8580E-04	4.2212E+00	NM	0.95820	0.42968	0.68041	2.50751	0.27135
10	8.1280E-04	4.4237E+00	NM	0.95974	0.44136	0.69252	2.46190	0.28129
11	9.3980E-04	4.6175E+00	NM	0.96041	0.45224	0.70322	2.41791	0.29084
12	1.0668E-03	4.7946E+00	NM	0.96205	0.46196	0.71293	2.38169	0.29934
13	1.1938E-03	4.9761E+00	NM	0.96288	0.47169	0.72213	2.34379	0.30811
14	1.4478E-03	5.3106E+00	NM	0.96506	0.48912	0.73834	2.27873	0.32402
15	1.9558E-03	5.9970E+00	NM	0.96859	0.52304	0.76776	2.15469	0.35632
16	2.4638E-03	6.6053E+00	NM	0.97108	0.55125	0.79027	2.05520	0.38452
17	2.9718E-03	7.2063E+00	NM	0.97415	0.57779	0.81039	1.96720	0.41195
18	3.4798E-03	7.8320E+00	NM	0.97613	0.60416	0.82870	1.88146	0.44045
19	3.9878E-03	8.4471E+00	NM	0.97759	0.62899	0.84471	1.80353	0.46836
20	4.6228E-03	9.2044E+00	NM	0.98051	0.65827	0.86292	1.71843	0.50216
21	5.2578E-03	1.0043E+01	NM	0.98268	0.68939	0.88053	1.63137	0.53975
22	5.8928E-03	1.0983E+01	NM	0.98530	0.72234	0.89794	1.54529	0.58108
23	6.5278E-03	1.1827E+01	NM	0.98690	0.75081	0.91165	1.47431	0.61835
24	7.7978E-03	1.3826E+01	NM	0.99111	0.81430	0.93981	1.33090	0.70585
25	9.0678E-03	1.5794E+01	NM	0.99348	0.87229	0.96108	1.21394	0.79170
26	1.0338E-02	1.7854E+01	NM	0.99702	0.92911	0.97989	1.11228	0.88097
27	1.1608E-02	1.9508E+01	NM	0.99862	0.97232	0.99240	1.04171	0.95266
28	1.2878E-02	2.0309E+01	NM	1.00029	0.99245	0.99830	1.01182	0.98664
29	1.4148E-02	2.0537E+01	NM	1.00025	0.99625	0.99970	1.00290	0.99681
30	1.5418E-02	2.0603E+01	NM	1.00025	0.99990	1.00010	1.00040	0.99970
D 31	1.6688E-02	2.0607E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
32	1.7958E-02	2.0595E+01	NM	0.99995	0.99970	0.99990	1.00040	0.99950
33	1.9228E-02	2.0591E+01	NM	1.00019	0.99960	1.00000	1.00080	0.99920
34	2.0498E-02	2.0583E+01	NM	1.00029	0.99940	1.00000	1.00120	0.99880
35	2.1768E-02	2.0575E+01	NM	0.99999	0.99920	0.99980	1.00120	0.99860
36	2.3038E-02	2.0585E+01	NM	1.00055	0.99885	0.99990	1.00290	0.99700
37	2.4308E-02	2.0551E+01	NM	1.00028	0.99860	0.99980	1.00240	0.99740
38	2.5578E-02	2.0567E+01	NM	1.00008	0.99904	0.99980	1.00160	0.99820

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
AT I=24 DATA WERE AVERAGED

70060407 HASTINGS PROFILE TABULATION 32 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PO	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.88337	0.00000	0.00000	3.61486	0.00000
2	1.7780E-04	2.6314E+00	NM	0.92247	0.32405	0.54702	2.84961	0.19196
3	2.2860E-04	2.7506E+00	NM	0.92399	0.33353	0.55944	2.81335	0.19885
4	2.7940E-04	2.9786E+00	NM	0.92677	0.35058	0.58117	2.74807	0.21148
5	3.3020E-04	3.1658E+00	NM	0.92858	0.36441	0.59810	2.69374	0.22203
6	3.8100E-04	3.3489E+00	NM	0.93088	0.37712	0.61382	2.64574	0.23185
7	4.3180E-04	3.5065E+00	NM	0.93242	0.38770	0.62574	2.60487	0.24022
8	5.5880E-04	3.8236E+00	NM	0.93568	0.40809	0.64877	2.52744	0.25669
9	6.8580E-04	4.0596E+00	NM	0.93818	0.42250	0.66460	2.47340	0.26870
10	8.1280E-04	4.2653E+00	NM	0.93997	0.43473	0.67742	2.42753	0.27906
11	9.3980E-04	4.4373E+00	NM	0.94153	0.44472	0.68763	2.39077	0.28762
12	1.0668E-03	4.6183E+00	NM	0.94272	0.45493	0.69775	2.35243	0.29662
13	1.1938E-03	4.7726E+00	NM	0.94413	0.46346	0.70616	2.32159	0.30417
14	1.4478E-03	5.0691E+00	NM	0.94684	0.47939	0.72148	2.26503	0.31853
15	1.9558E-03	5.6592E+00	NM	0.95116	0.50958	0.74872	2.15885	0.34682
16	2.4638E-03	6.1354E+00	NM	0.95457	0.53266	0.76835	2.08074	0.36927
17	2.9718E-03	6.6638E+00	NM	0.95802	0.55713	0.78798	2.00020	0.39391
18	3.4798E-03	7.0771E+00	NM	0.96056	0.57553	0.80200	1.94183	0.41301
19	3.9878E-03	7.5651E+00	NM	0.96283	0.59652	0.81703	1.87592	0.43553
20	4.6228E-03	8.1670E+00	NM	0.96609	0.62142	0.83415	1.80185	0.46294
21	5.2578E-03	8.7604E+00	NM	0.96888	0.64502	0.84937	1.73401	0.48983
22	5.8928E-03	9.4161E+00	NM	0.97165	0.67012	0.86460	1.66466	0.51938
23	6.5278E-03	1.0068E+01	NM	0.97414	0.69418	0.87032	1.60090	0.54864
24	7.7978E-03	1.1446E+01	NM	0.97990	0.74243	0.90380	1.48212	0.60984
25	9.0678E-03	1.2884E+01	NM	0.98395	0.78963	0.92579	1.37460	0.67350
26	1.0338E-02	1.4297E+01	NM	0.98778	0.83339	0.94482	1.28419	0.73542
27	1.1608E-02	1.5935E+01	NM	0.99172	0.88142	0.96264	1.19281	0.80704
28	1.2878E-02	1.7509E+01	NM	0.99492	0.92521	0.97757	1.11637	0.87566
29	1.4148E-02	1.8847E+01	NM	0.99715	0.96087	0.98898	1.05852	0.93393
30	1.5418E-02	1.9724E+01	NM	0.99851	0.98367	0.99519	1.02356	0.97228
31	1.6688E-02	2.0167E+01	NM	0.99936	0.99478	0.99840	1.00724	0.99117
D 32	1.7958E-02	2.0374E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

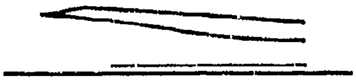
INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
AT I=26,29 DATA WERE AVERAGED

SECTION D: ADDITIONAL DATA

NB. FACSIMILE FROM SOURCE PAPER. AUTHORS SYMBOLS AND UNITS

Local Skin-Friction Coefficients.

X in from l.e.	P_e in Hg	C_f Floating element	C_f Surface pitot $h = 0·0223$	Interpolation from Table 3 $R\delta_2$	Interpolation from Table 3 M_e
54·75	200		0·00100		
48·75					
44·75			0·00106	24035	3·934
44·5		0·00103		23820	3·934
38·75					
34·75			0·00106	18695	3·953
34·5		0·00108		18590	3·953
28·75			0·00105	16180	3·955
24·75			0·00112	14125	3·958
24·5		0·00115		13945	3·957
18·75					
14·75					
54·75	100		0·00115		
48·75					
44·75			0·00116	12455	3·926
44·5		0·00114		12360	3·926
38·75					
34·75			0·00120	9480	3·942
34·5		0·00124		9420	3·942
28·75			0·00123	8125	3·940
24·75			0·00139	7035	3·942
24·5		0·00137		6930	3·942
18·75					
14·75					
54·75	50		0·00123		
48·75					
44·75			0·00120	6504	3·915
38·75					
34·75			0·00124	5065	3·932
28·75			0·00132	3910	3·933
24·75			0·00152	3115	3·943
54·75	25		0·00174		
48·75					
44·75			0·00145	3455	3·897
38·75					



	M : 4 falling to 2.95 R THETA X 10^{-3} : 35 - 70 TW/TR : 1	7007 ZPG - APG - ZPG AW

Continuous tunnel, fixed nozzle. W = H = 0.127 m.
PO: 1.5 MN/m^2. TO: 295 K. Air, absolute humidity 2×10^{-4}. RE/m : 6.5×10^7 at M = 4.

ZWARTS F.J. 1970 The compressible turbulent boundary layer in a pressure gradient. PhD Thesis McGill University, Montreal.
And Zwarts F.J., Private communications.

1 The test boundary layer was formed on the floor of the 0.127 m square wind tunnel. The test section started
4 about 0.75 m downstream of the nozzle throat so that the starting boundary layer thickness was about 10 mm. A contoured splitter plate was designed by the method of characteristics to give a Mach number distribution on the tunnel floor such that the initial flow at M = 4 passed through a constant Mach number gradient falling to M = 3 over a distance of 0.15 m, followed by a second region of constant Mach number flow. The
3 test surface roughness was less than 0.9 μm, and it was not actively cooled. No boundary layer trip was used as it was presumed that the prevailing high Reynolds number levels would ensure fully turbulent flow a short distance downstream of the nozzle throat. Surface flow visualisation tests showed that there was
5 considerable flow convergence in the APG region as well as divergence in the ZPG regions. This was attributed to inflow/outflow from the tunnel sidewall driven by the significant pressure differences normal to the test surface. Pitot traverses and Preston tube measurements were made at stations 38.1 mm to either side of the centre line, at streamwise intervals of 50.8 mm. CF differed from the centre line value by up to 10 %. Differences in integral thicknesses were up to 5 %.

6 The test wall was provided with 48 static holes of 1.04 mm diameter. "Goose-necked" Pitot tubes could be
7 inserted into the static holes and were also used as Preston tubes. The Pitot probes were CPP for which d_1 was either 0.419 or 0.813 mm. The tubes emerged from the wall normally and then curved over in a series of approximate circular arcs to finish parallel to the surface. The overall upstream extension was 6.35 mm for the smaller tube and 12.7 mm for the larger. The end faces were ground square to the test surface. The profile traverses were taken with the small tube, the larger one being used to supply supplementary Preston
8 tube data. On the centre line the static holes extended at 12.7 mm intervals from the first (X = 0) to X = 228.6 mm. There were then holes at X = 254 and 279.4 mm followed by holes at 50.8 mm intervals until X = 431.8 mm. Holes were also drilled on lines 38.1 mm to either side of the centre line at 50.8 mm intervals from X = 0 to X = 457.2 mm. Pitot traverses were made with the small CPP mounted in all these holes excepting those for X = 457.2 mm. The profile traverse was thus in each case at an X value 6.35 mm upstream of the static hole.

9 The author has interpolated the static pressure data to the X-stations of the profiles. Static pressure was assumed constant through the layer, the characteristic solution having shown that the limiting isobars of the ideal flow approached normally. The total temperature was assumed constant. The boundary layer edge was specified by fitting a power law to the outer two thirds of the velocity profile, and the edge stagnation state set equal to the reservoir state. The effects of finite static hole size (d_s) were allowed for by an adjustment in the form

$$\Delta p / \tau_w = 0.0045 \, (u_\tau d_s / \nu) \qquad \text{for } u_\tau d_s / \nu \leq 611$$

$$\Delta p / \tau_w = 2.75 \qquad \text{for } u_\tau d_s / \nu > 611$$

The fluid properties were evaluated at an intermediate reference temperature (T*) and Sutherland's viscosity law was used. The correction varied from 1 % to 1.5 %. A Pitot tube displacement and shear correction was applied in the form of an effective centre-position displacement Δy given in terms of the tube diameter d_p by

$$\Delta y/d_p = 0.15 - 0.04\,(\frac{d_p}{y} - 0.5) \text{ for } \frac{d_p}{2} \leq y \leq 2\,d_p; \quad \Delta y/d_p = 0.15 \text{ for } y > 2\,d_p.$$

12 The editors have replaced the author's assumption of isoenergetic flow by the assumption of an adiabatic wall and the Crocco/Van Driest temperature relation. The boundary layer edge and edge stagnation state
13 have been retained at the authors' values. The profiles presented are those for the centre line in the region covered by the designed pressure distribution. In this region variation of Mach number across the tunnel is small. The author gives further data downstream, where the pressure gradient is rather irregular,
14 and, although symmetrical, the flow displays threedimensional variations. The author presents CF values reduced from the Preston tube measurements with the calibration functions of Sigalla (1966), Hopkins and Keener (1966 - Reference Temperature) and Fenter and Stalmach (1957). The Hopkins and Keener value has been selected for the profile tabulation of section B. The other values are given in Section D.

§ DATA 70070101 - 0120. PT2 profiles. NX = 20. CF from Preston tubes.

15 <u>Editors' comments</u>

The test layer is described at close intervals as it passes from a constant pressure region into an adverse pressure gradient followed by a region of constant pressure. An inspection of our transformed log-law plots suggests that the outer region has not reached equilibrium at the last station presented here. We have not presented further profiles downstream as the pressure history after profile 20 is rather random. The pressure gradient is imposed as a reflected wave, so that normal pressure gradients should be negligible except at the start and end of the APG (profiles 03, 15, 16).

The wall temperature was not measured, but "should be between room temperature (same as total temperature) and the adiabatic wall temperature". We have arbitrarily chosen the latter, but variation in this range should have little effect on the numerical results. The profiles extend in as far as the momentum deficit peak. The power-law velocity profile determination of the boundary layer edge results in a D-state at which there is still a marked total pressure deficit. Three-dimensional effects (see § 5 above) are to be expected as the length to width ratio of the tunnel floor is about 8.

Comparable planar investigations are those of Waltrup & Schetz - CAT 7104 and Thomas - CAT 7401. The closest comparison is with Lewis et al. - CAT 7201 - who, however, used an axisymmetric test arrangement.

7007 ZWARTS. SECTION D. ADDITIONAL DATA.

SKIN FRICTION COEFFICIENT USING DIFFERENT CALIBRATIONS.
A - SIGALLA, B - HOPKINS & KEENER, C - STALMACH, VALUES OF CF X 10^4

PROFILE 7007	CALIBRATION A	B	C	PROFILE 7007	CALIBRATION A	B	C
0101	8.92	8.22	8.35	0111	8.44	7.57	7.98
0102	9.11	8.45	8.54	0112	8.52	7.68	8.10
0103	9.32	8.72	8.77	0113	8.23	7.36	7.83
0104	8.73	7.96	8.16	0114	7.95	7.04	7.55
0105	8.09	7.20	7.52	0115	8.16	7.27	7.79
0106	8.16	7.26	7.59	0116	8.80	7.98	8.47
0107	8.15	7.24	7.61	0117	9.30	8.57	9.01
0108	8.52	7.66	8.01	0118	9.80	9.16	9.55
0109	8.25	7.35	7.75	0119	10.17	9.62	9.96
0110	8.23	7.34	7.75	0120	11.52	11.38	11.46

CAT 7007 ZWARTS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
70070101	4.0203	1.0000	1.0435E+04	8.2200E-04	7.8489	1.3617	9.4452E+03	9.4452E+03
-6.3500E-03	1.4734E+06	1.0000	3.5786E+04	NM	1.8289	1.8017	2.7106E+02	6.9566E+01
INFINITE	2.9444E+02	0.0000	5.6166E-04	NC	0.1453	1.0525E-03	6.7231E+02	2.7106E+02
70070102	4.0206	1.0000	1.0634E+04	8.4500E-04	7.8142	1.3492	9.4414E+03	9.4414E+03
6.3500E-03	1.4734E+06	1.0000	3.6473E+04	NM	1.8332	1.8077	2.7106E+02	6.9559E+01
INFINITE	2.9444E+02	0.0000	5.7253E-04	NC	0.1456	1.0625E-03	6.7232E+02	2.7106E+02
70070103	4.0156	1.0000	1.0773E+04	8.7200E-04	7.8485	1.3626	9.5044E+03	9.5044E+03
1.9050E-02	1.4734E+06	1.0000	3.6880E+04	NM	1.8248	1.7965	2.7107E+02	6.9691E+01
INFINITE	2.9444E+02	0.0000	5.7744E-04	NC	0.1449	1.0915E-03	6.7212E+02	2.7107E+02
70070104	3.9342	1.0000	1.1807E+04	7.7600E-04	7.5834	1.3547	1.0598E+04	1.0598E+04
3.1750E-02	1.4734E+06	1.0000	3.9210E+04	NM	1.8221	1.7954	2.7130E+02	7.1893E+01
INFINITE	2.9444E+02	0.0000	5.8878E-04	NC	0.1432	1.0994E-03	6.6882E+02	2.7130E+02
70070105	3.8250	1.0000	1.2981E+04	7.2000E-04	7.3351	1.3868	1.2287E+04	1.2287E+04
4.4450E-02	1.4734E+06	1.0000	4.1375E+04	NM	1.8094	1.7798	2.7162E+02	7.4996E+01
INFINITE	2.9444E+02	0.0000	5.8712E-04	NC	0.1402	1.0971E-03	6.6414E+02	2.7162E+02
70070106	3.7270	1.0000	1.4189E+04	7.2600E-04	7.0156	1.3841	1.4036E+04	1.4036E+04
5.7150E-02	1.4713E+06	1.0000	4.3487E+04	NM	1.8132	1.7831	2.7460E+02	7.8699E+01
INFINITE	2.9733E+02	0.0000	5.9569E-04	NC	0.1387	1.0759E-03	6.6291E+02	2.7460E+02
70070107	3.6099	1.0000	1.5731E+04	7.2400E-04	6.7578	1.4159	1.6520E+04	1.6520E+04
6.9850E-02	1.4713E+06	1.0000	4.6090E+04	NM	1.7992	1.7664	2.7529E+02	8.2541E+01
INFINITE	2.9767E+02	0.0000	5.9451E-04	NC	0.1352	1.0733E-03	6.5757E+02	2.7529E+02
70070108	3.5375	1.0000	1.6304E+04	7.6600E-04	6.6259	1.4300	1.8292E+04	1.8292E+04
8.2550E-02	1.4713E+06	1.0000	4.6460E+04	NM	1.7821	1.7557	2.7539E+02	8.4933E+01
INFINITE	2.9750E+02	0.0000	5.7018E-04	NC	0.1324	1.0594E-03	6.5365E+02	2.7539E+02
70070109	3.4640	1.0000	1.7939E+04	7.3500E-04	6.4277	1.4379	2.0305E+04	2.0305E+04
9.5250E-02	1.4713E+06	1.0000	4.9676E+04	NM	1.7804	1.7525	2.7587E+02	8.7569E+01
INFINITE	2.9772E+02	0.0000	5.9300E-04	NC	0.1307	1.0720E-03	6.4992E+02	2.7587E+02
70070110	3.3956	1.0000	1.9240E+04	7.3400E-04	6.2865	1.4528	2.2395E+04	2.2395E+04
1.0795E-01	1.4713E+06	1.0000	5.1877E+04	NM	1.7699	1.7437	2.7628E+02	9.0105E+01
INFINITE	2.9789E+02	0.0000	5.9745E-04	NC	0.1284	1.0813E-03	6.4525E+02	2.7628E+02
70070111	3.3412	1.0000	2.0116E+04	7.5700E-04	6.1407	1.4504	2.4223E+04	2.4223E+04
1.2065E-01	1.4713E+06	1.0000	5.3104E+04	NM	1.7668	1.7437	2.7639E+02	9.2114E+01
INFINITE	2.9778E+02	0.0000	5.9360E-04	NC	0.1269	1.0666E-03	6.4295E+02	2.7639E+02
70070112	3.2661	1.0000	2.2101E+04	7.6800E-04	5.9539	1.4574	2.7028E+04	2.7028E+04
1.3335E-01	1.4720E+06	1.0000	5.6771E+04	NM	1.7625	1.7398	2.7359E+02	9.3967E+01
INFINITE	2.9444E+02	0.0000	5.9909E-04	NC	0.1248	1.0624E-03	6.3479E+02	2.7359E+02
70070113	3.1720	1.0000	2.4455E+04	7.3600E-04	5.7799	1.4827	3.0978E+04	3.0978E+04
1.4605E-01	1.4713E+06	1.0000	6.0555E+04	NM	1.7471	1.7267	2.7398E+02	9.7714E+01
INFINITE	2.9444E+02	0.0000	6.0782E-04	NC	0.1214	1.0774E-03	6.2683E+02	2.7398E+02
70070114	3.0722	1.0000	2.7478E+04	7.0400E-04	5.5419	1.4977	3.5958E+04	3.5958E+04
1.5875E-01	1.4713E+06	1.0000	6.5202E+04	NM	1.7427	1.7203	2.7919E+02	1.0374E+02
INFINITE	2.9956E+02	0.0000	6.3542E-04	NC	0.1185	1.1006E-03	6.2737E+02	2.7919E+02
70070115	2.9867	1.0000	3.0651E+04	7.2700E-04	5.3258	1.4995	4.0863E+04	4.0863E+04
1.7145E-01	1.4713E+06	1.0000	7.0325E+04	NM	1.7410	1.7189	2.7944E+02	1.0754E+02
INFINITE	2.9939E+02	0.0000	6.5364E-04	NC	0.1160	1.1005E-03	6.2098E+02	2.7944E+02
70070116	2.9640	1.0000	3.1425E+04	7.9800E-04	5.1858	1.4646	4.2282E+04	4.2282E+04
1.8415E-01	1.4713E+06	1.0000	7.1455E+04	NM	1.7553	1.7349	2.7965E+02	1.0863E+02
INFINITE	2.9950E+02	0.0000	6.5035E-04	NC	0.1163	1.0855E-03	6.1939E+02	2.7965E+02
70070117	2.9635	1.0000	3.2099E+04	3.5700E-04	5.0894	1.4271	4.2313E+04	4.2313E+04
1.9685E-01	1.4713E+06	1.0000	7.2975E+04	NM	1.7740	1.7538	2.7960E+02	1.0863E+02
INFINITE	2.9944E+02	0.0000	6.6995E-04	NC	0.1176	1.0786E-03	6.1929E+02	2.7960E+02
70070118	2.9578	1.0000	3.1532E+04	9.1600E-04	5.0581	1.4162	4.2718E+04	4.2718E+04
2.0955E-01	1.4727E+06	1.0000	7.1545E+04	NM	1.7760	1.7585	2.7916E+02	1.0872E+02
INFINITE	2.9894E+02	0.0000	6.5259E-04	NC	0.1175	1.0478E-03	6.1834E+02	2.7916E+02
70070119	2.9725	1.0000	3.2157E+04	9.6200E-04	5.0156	1.3845	4.1783E+04	4.1783E+04
2.2225E-01	1.4727E+06	1.0000	7.3416E+04	NM	1.7920	1.7751	2.7842E+02	1.0777E+02
INFINITE	2.9822E+02	0.0000	6.7267E-04	NC	0.1190	1.0582E-03	6.1871E+02	2.7842E+02
70070120	2.9742	1.0000	3.1354E+04	1.1380E-03	4.9061	1.3403	4.1677E+04	4.1677E+04
2.4765E-01	1.4727E+06	1.0000	7.1683E+04	NM	1.8179	1.8024	2.7721E+02	1.0723E+02
INFINITE	2.9694E+02	0.0000	6.5331E-04	NC	0.1208	9.8674E-04	6.1751E+02	2.7721E+02

70070103 ZWARTS PROFILE TABULATION 22 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92062	0.00000	0.00000	3.88961	0.00000
2	2.4638"-04	2.8739"+00	NM	0.94689	0.33590	0.57527	2.93328	0.19612
3	5.8420"-04	3.4103"+00	NM	0.95130	0.37335	0.62168	2.77280	0.22421
4	9.9678"-04	4.2809"+00	NM	0.95744	0.42062	0.68113	2.54902	0.26721
5	1.2243"-03	4.9342"+00	NM	0.96142	0.46238	0.71696	2.40427	0.29820
6	1.5418"-03	5.4839"+00	NM	0.96443	0.49043	0.74292	2.29473	0.32375
7	2.1768"-03	6.4865"+00	NM	0.96925	0.53761	0.78268	2.11947	0.36928
8	2.8118"-03	7.3563"+00	NM	0.97286	0.57540	0.81126	1.98782	0.40812
9	3.4468"-03	8.1837"+00	NM	0.97591	0.60915	0.83456	1.87702	0.44462
10	4.0818"-03	9.0418"+00	NM	0.97872	0.64225	0.85555	1.77451	0.48213
11	4.7168"-03	9.9134"+00	NM	0.98128	0.67420	0.87420	1.68128	0.51996
12	5.3518"-03	1.0824"+01	NM	0.98369	0.70602	0.89134	1.59386	0.55923
13	5.9868"-03	1.1831"+01	NM	0.98607	0.73961	0.90801	1.50719	0.60245
14	6.6218"-03	1.3236"+01	NM	0.98899	0.78410	0.92805	1.40087	0.66248
15	7.2568"-03	1.4573"+01	NM	0.99141	0.82416	0.94432	1.31285	0.71929
16	7.8918"-03	1.5732"+01	NM	0.99327	0.85737	0.95660	1.24502	0.76839
17	9.1618"-03	1.7962"+01	NM	0.99636	0.91793	0.97682	1.13242	0.86259
18	1.0432"-02	1.9869"+01	NM	0.99859	0.96667	0.99110	1.05119	0.94284
D 19	1.1420"-02	2.1229"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
20	1.1702"-02	2.1513"+01	NM	1.00028	1.00681	1.00174	0.98995	1.01191
21	1.1829"-02	2.1693"+01	NM	1.00045	1.01113	1.00283	0.98365	1.01949
22	1.1956"-02	2.1785"+01	NM	1.00054	1.01330	1.00337	0.98050	1.02332

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

70070105 ZWARTS PROFILE TABULATION 23 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92249	0.00000	0.00000	3.62181	0.00000
2	2.4638"-04	2.3570"+00	NM	0.94394	0.30915	0.52610	2.89613	0.18166
3	3.8608"-04	2.6993"+00	NM	0.94725	0.33871	0.56518	2.78434	0.20298
4	7.1374"-04	3.5132"+00	NM	0.95402	0.39900	0.63781	2.55525	0.24961
5	1.0338"-03	4.1069"+00	NM	0.95879	0.44220	0.68425	2.39430	0.28578
6	1.3513"-03	4.6818"+00	NM	0.96189	0.47129	0.71301	2.28891	0.31151
7	1.6608"-03	5.0966"+00	NM	0.96430	0.49429	0.73443	2.20765	0.33267
8	1.9863"-03	5.5106"+00	NM	0.96653	0.51620	0.75370	2.13222	0.35351
9	2.6213"-03	6.3548"+00	NM	0.97063	0.55815	0.78806	1.99354	0.39531
10	3.2563"-03	7.0720"+00	NM	0.97371	0.59141	0.81290	1.88931	0.43026
11	3.8913"-03	8.0145"+00	NM	0.97730	0.63242	0.84087	1.76794	0.47563
12	4.5263"-03	9.2363"+00	NM	0.98131	0.68189	0.87114	1.63214	0.53374
13	5.1613"-03	1.0205"+01	NM	0.98408	0.71869	0.89142	1.53845	0.57943
14	5.7963"-03	1.1145"+01	NM	0.98649	0.75263	0.90859	1.45739	0.62344
15	6.4313"-03	1.2079"+01	NM	0.98862	0.78494	0.92370	1.38482	0.66702
16	7.0663"-03	1.3155"+01	NM	0.99084	0.82055	0.93707	1.30976	0.71698
17	7.7013"-03	1.4269"+01	NM	0.99290	0.85595	0.95310	1.24017	0.76852
18	8.9713"-03	1.7025"+01	NM	0.99716	0.93749	0.98150	1.09610	0.89545
19	1.0241"-02	1.8885"+01	NM	0.99951	0.98870	0.99686	1.01645	0.98072
D 20	1.1037"-02	1.9306"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
21	1.1511"-02	1.9695"+01	NM	1.00034	1.00792	1.00217	0.98862	1.01371
22	1.1638"-02	1.9651"+01	NM	1.00039	1.00912	1.00249	0.98691	1.01579
23	1.1765"-02	1.9727"+01	NM	1.00047	1.01113	1.00304	0.98405	1.01929

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

70070109 ZWARTS PROFILE TABULATION 24 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92659	0.00000	0.00000	3.15027	0.00000
2	2.4638"-04	2.2279"+00	NM	0.94679	0.32794	0.52456	2.55860	0.20502
3	3.8608"-04	2.4550"+00	NM	0.94912	0.35110	0.55404	2.49021	0.22249
4	5.2070"-04	2.7161"+00	NM	0.95161	0.37552	0.58384	2.41731	0.24152
5	6.5024"-04	2.9033"+00	NM	0.95329	0.39191	0.60310	2.36815	0.25467
6	7.7978"-04	3.0870"+00	NM	0.95486	0.40726	0.62060	2.32210	0.26726
7	1.0338"-03	3.3681"+00	NM	0.95716	0.42956	0.64511	2.25539	0.28603
8	1.3513"-03	3.7278"+00	NM	0.95986	0.45636	0.67317	2.17587	0.30938
9	1.6688"-03	4.0549"+00	NM	0.96216	0.47934	0.69604	2.10852	0.33011
10	1.9863"-03	4.4559"+00	NM	0.96478	0.50601	0.72125	2.03169	0.35500
11	2.3038"-03	4.7871"+00	NM	0.96680	0.52697	0.74010	1.97247	0.37522
12	2.6213"-03	5.2018"+00	NM	0.96917	0.55206	0.76158	1.90310	0.40018
13	3.2563"-03	6.0591"+00	NM	0.97356	0.60050	0.79991	1.77440	0.45081
14	3.8913"-03	6.9482"+00	NM	0.97753	0.64685	0.83298	1.65830	0.50231
15	4.5263"-03	7.9724"+00	NM	0.98149	0.69637	0.86478	1.54219	0.56075
16	5.1613"-03	9.1534"+00	NM	0.98542	0.74931	0.89520	1.42707	0.62730
17	5.7963"-03	1.0277"+01	NM	0.98865	0.79650	0.91944	1.33252	0.69000
18	6.4313"-03	1.1427"+01	NM	0.99154	0.84200	0.94059	1.24789	0.75375
19	7.0663"-03	1.2629"+01	NM	0.99419	0.88706	0.95960	1.17024	0.82001
20	7.7013"-03	1.3851"+01	NM	0.99656	0.93061	0.97632	1.10064	0.88705
21	8.3363"-03	1.4670"+01	NM	0.99800	0.95869	0.98631	1.05845	0.93185
22	8.9713"-03	1.5408"+01	NM	0.99921	0.98330	0.99461	1.02313	0.97212
D 23	9.0957"-03	1.5919"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
24	9.6063"-03	1.5559"+01	NM	0.99945	0.98825	0.99622	1.01621	0.98034

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

70070114 ZWARTS PROFILE TABULATION 22 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93202	0.00000	0.00000	2.69136	0.00000
2	2.4638"-04	1.9747"+00	NM	0.94946	0.33718	0.50659	2.25730	0.22442
3	3.8608"-04	2.1435"+00	NM	0.95141	0.35937	0.53413	2.20883	0.24182
4	5.2070"-04	2.3430"+00	NM	0.95355	0.38329	0.56275	2.15572	0.26105
5	6.5024"-04	2.4888"+00	NM	0.95502	0.39957	0.58166	2.11913	0.27448
6	7.7978"-04	2.6013"+00	NM	0.95611	0.41157	0.59529	2.09200	0.28456
7	1.0338"-03	2.7956"+00	NM	0.95791	0.43137	0.61719	2.04709	0.30149
8	1.3513"-03	3.0487"+00	NM	0.96013	0.45565	0.64308	1.99189	0.32285
9	1.6688"-03	3.2531"+00	NM	0.96183	0.47424	0.66219	1.94971	0.33963
10	1.9863"-03	3.4953"+00	NM	0.96374	0.49526	0.68307	1.90221	0.35909
11	2.3038"-03	3.7292"+00	NM	0.96549	0.51468	0.70167	1.85864	0.37752
12	2.6213"-03	4.0187"+00	NM	0.96754	0.53767	0.72287	1.80755	0.39992
13	3.2563"-03	4.6421"+00	NM	0.97159	0.58395	0.76292	1.70690	0.44697
14	3.8913"-03	5.4049"+00	NM	0.97595	0.63381	0.80385	1.59844	0.50290
15	4.5263"-03	6.3287"+00	NM	0.98053	0.69336	0.84475	1.48439	0.56909
16	5.1613"-03	7.4010"+00	NM	0.98509	0.75458	0.88354	1.37102	0.64444
17	5.7963"-03	8.6657"+00	NM	0.98963	0.82079	0.92059	1.25796	0.73181
18	6.4313"-03	1.0025"+01	NM	0.99375	0.88645	0.95291	1.15555	0.82463
19	7.0663"-03	1.1357"+01	NM	0.99718	0.94634	0.97901	1.07024	0.91476
20	7.7013"-03	1.2175"+01	NM	0.99904	0.98129	0.99292	1.02385	0.96979
D 21	7.9461"-03	1.2625"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
22	8.3363"-03	1.2545"+01	NM	0.99985	0.99712	0.99893	1.00363	0.99532

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

70070117 ZWARTS PROFILE TABULATION 24 POINTS, DELTA AT POINT 23

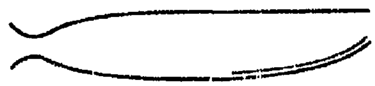
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93373	0.00000	0.00000	2.57379	0.00000
2	2.4638"-04	2.2225"+00	NM	0.95403	0.38265	0.55342	2.09178	0.26457
3	3.8608"-04	2.4765"+00	NM	0.95665	0.41284	0.58812	2.02944	0.28980
4	5.2070"-04	2.6799"+00	NM	0.95861	0.43511	0.61271	1.98297	0.30899
5	6.5024"-04	2.8085"+00	NM	0.95977	0.44851	0.62710	1.95489	0.32078
6	7.7978"-04	2.9195"+00	NM	0.96078	0.45972	0.63889	1.93140	0.33079
7	1.0338"-03	3.1446"+00	NM	0.96270	0.48151	0.66121	1.88573	0.35064
8	1.3513"-03	3.3645"+00	NM	0.96449	0.50178	0.68127	1.84335	0.36958
9	1.6688"-03	3.5598"+00	NM	0.96600	0.51906	0.69783	1.80742	0.38609
10	1.9863"-03	3.7825"+00	NM	0.96765	0.53802	0.71544	1.76824	0.40460
11	2.3038"-03	4.0130"+00	NM	0.96929	0.55699	0.73249	1.72940	0.42355
12	2.6213"-03	4.2643"+00	NM	0.97097	0.57680	0.74968	1.68930	0.44378
13	3.2563"-03	4.8318"+00	NM	0.97452	0.61920	0.78451	1.60520	0.48873
14	3.8913"-03	5.5304"+00	NM	0.97841	0.66758	0.82109	1.51276	0.54278
15	4.5263"-03	6.3116"+00	NM	0.98225	0.71773	0.85571	1.42141	0.60201
16	5.1613"-03	7.2347"+00	NM	0.98624	0.77273	0.89011	1.32688	0.67083
17	5.7963"-03	8.2308"+00	NM	0.98997	0.82793	0.92125	1.23812	0.74407
18	6.4313"-03	9.2034"+00	NM	0.99317	0.87846	0.94705	1.16226	0.81483
19	7.0663"-03	1.0095"+01	NM	0.99577	0.92231	0.96755	1.10049	0.87919
20	7.7013"-03	1.0731"+01	NM	0.99746	0.95235	0.98065	1.06031	0.92487
21	8.3363"-03	1.1102"+01	NM	0.99839	0.96949	0.98781	1.03815	0.95151
22	8.9713"-03	1.1252"+01	NM	0.99876	0.97629	0.99058	1.02950	0.96220
D 23	9.0272"-03	1.1781"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
24	9.6063"-03	1.1263"+01	NM	0.99879	0.97682	0.99080	1.02883	0.96303

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST

70070120 ZWARTS PROFILE TABULATION 26 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93356	0.00000	0.00000	2.58518	0.00000
2	2.4638"-04	2.8331"+00	NM	0.95983	0.44940	0.62888	1.95826	0.32114
3	3.8608"-04	3.2711"+00	NM	0.96356	0.49151	0.67201	1.86931	0.35950
4	5.2070"-04	3.4037"+00	NM	0.96508	0.50880	0.68885	1.83209	0.37581
5	6.5024"-04	3.6090"+00	NM	0.96619	0.52143	0.70087	1.80657	0.38794
6	7.7978"-04	3.7301"+00	NM	0.96709	0.53171	0.71041	1.78516	0.39796
7	1.0338"-03	3.9963"+00	NM	0.96871	0.55036	0.72735	1.74657	0.41644
8	1.3513"-03	4.1875"+00	NM	0.97029	0.56875	0.74350	1.70890	0.43508
9	1.6688"-03	4.4017"+00	NM	0.97169	0.58524	0.75754	1.67549	0.45213
10	1.9863"-03	4.6228"+00	NM	0.97307	0.60177	0.77120	1.64239	0.46956
11	2.3038"-03	4.8470"+00	NM	0.97442	0.61806	0.78427	1.61016	0.48708
12	2.6213"-03	5.0871"+00	NM	0.97581	0.63503	0.79748	1.57705	0.50568
13	3.2563"-03	5.6258"+00	NM	0.97872	0.67149	0.82449	1.50761	0.54688
14	3.8913"-03	6.1809"+00	NM	0.98146	0.70704	0.84912	1.44226	0.58874
15	4.5263"-03	6.8509"+00	NM	0.98446	0.74766	0.87532	1.37064	0.63862
16	5.1613"-03	7.6001"+00	NM	0.98748	0.79058	0.90091	1.29859	0.69376
17	5.7963"-03	8.4068"+00	NM	0.99040	0.83429	0.92493	1.22907	0.75254
18	6.4313"-03	9.1792"+00	NM	0.99291	0.87408	0.94513	1.16916	0.80837
19	7.0663"-03	9.8980"+00	NM	0.99503	0.90953	0.96190	1.11848	0.86001
20	7.7013"-03	1.0516"+01	NM	0.99672	0.93894	0.97500	1.07828	0.90422
21	8.3363"-03	1.0899"+01	NM	0.99769	0.95646	0.98246	1.05511	0.93115
22	8.9713"-03	1.1107"+01	NM	0.99822	0.96623	0.98652	1.04244	0.94635
23	9.6063"-03	1.1205"+01	NM	0.99846	0.97066	0.98834	1.03676	0.95330
D 24	1.0180"-02	1.1863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
25	1.0241"-02	1.1458"+01	NM	0.99906	0.98204	0.99294	1.02232	0.97126
26	1.0876"-02	1.1856"+01	NM	0.99999	0.99972	0.99989	1.00034	0.99955

INPUT VARIABLES Y,U/UD (ISOENERGETIC) ASSUME P=PD AND VAN DRIEST



M : 3.5 falling to 2.8
R THETA X 10^{-3} : 18 - 42
TW/TR : 1.0

7101

ZPG - APG
AW

Continuous wind tunnel with asymmetric flexible nozzle. W = H = 0.15 m.
0.26 < PO < 0.40 MN/m^2. TO : 307 K. Air: Dewpoint < 245 K. 14 < RE/m X 10^{-6} < 30.

STUREK W.B. and DANBERG J.E., 1971. Supersonic turbulent boundary-layer in an adverse pressure gradient. Data tabulation. Dept. Mech. & Aerosp. Engrg. Univ. Delaware. Tech. Rep. No. 141.
<u>And</u> Danberg J.E., Sturek W.B. Private communications, Sturek 1973.
<u>Also</u> Extensive bibliography referring to same experiment listed under Sturek or Sturek & Danberg 1970-74.

1 The tests took place on a ramp forming a continuation of the flat test wall opposite the flexible plate nozzle. The test section extended 559 mm downstream from the nozzle exit plane (X = 0). The curved ramp started with a faired step (Δ Y = 0.254 mm) at X = 305 mm with a maximum height and surface inclination of 35.6 mm and 14.65°. The coordinates are given in table 1. The test zone includes a ZPG region before the ramp (from X = 0 to X = 0.279 m) followed by a simple wave isentropic compression. The test surface was allowed an hour to settle to a bulk equilibrium temperature. Thus only small local heat transfer is likely, as a consequence of the variation of recovery temperature. The surface was "polished to a mirror
2 finish" and the mean dimensions were held to 0.0254 mm. The Mach number in the ZPG region was constant
3 within limits of ± 0.01. A schlieren photographic study indicated that natural transition occured in the nozzle region, the transition zone extending from X = - 0.6 to X = - 0.35 m. The test boundary layer was
4 formed in the favourable pressure gradient of the nozzle (throat at X = - 1.25 m). The temperature of the
5 metal test wall was constant within about ± 1 K. Oil flow visualisation did not show appreciable divergence of the streamlines near the centreline, but streamlines near the side walls diverged considerably. Wall pressure measurements on lines normal to the centre line at the last three stations on the ramp showed that the lateral pressure gradient was very small compared to the streamwise pressure gradient. The values are presented graphically in figure 8 of Sturek & Danberg 1972a.

6 Wall static pressure was measured by six static holes of 1.02 mm diameter on the centre line at the measuring stations on the ramp and the test wall. Eight additional measurements were made upstream on the test wall, and, with 11 holes of 0.64 mm diameter on lines normal to the flow at the last three measuring stations. The holes were drilled normal to the local surface. For the test described, the wall temperature was monitored at one station (X = 50.8 mm) in the ZPG region. The wall shear stress was determined using a Preston tube of 3.18 mm diameter.

7 The total temperature probe used was a wedge recovery probe formed by placing an iron constantan thermocouple junction (diameter 0.127 mm) at the centre of the leading edge of an insulated wedge. The probe was calibrated in the range 1.5 < M < 3.5, and for lower Mach numbers the calibration was extrapolated using the trend of the data of Spangenberg (1956). The Pitot probe was a FPP for which h_1 = 0.127 (E), h_2 = 0.076, b_1 = 1.68 (E) and b_2 = 1.52 mm. Two static pressure probes were used. One, a CCP for which α = 10°, d = 1.27, l_1 = 12.7, l_2 = 19 mm with two holes of 0.34 mm diameter. The other was a flat plate probe approximately 35 mm square. The leading edge was chamfered on the underside (which was curved so as to fit flush with the model) at 20° and ten 1.03 mm diameter static holes were drilled at 3 mm intervals along a line 28.5 mm back from the leading edge. At two stations a constant temperature hot-wire probe (d = 0.0063, l = 2.54 mm) was used for the measurement of fluctuating quantities.

8 Profiles and Preston readings were made at the same nominal X values, X = 152.4, 203.2, 254.0, 433.1, 458.8, 484.6, 510.8 and 536.7 mm all on the centre line (Z = 0). The coordinates and local surface slopes of the measuring stations are given in table 2. The results are presented for Y values corresponding to PO measurements.

9 The P and T0 values in the tables are interpolated from smoothed curves such as those presented in figure 11 of Sturek & Danberg 1972a. The Preston tube readings were reduced using the calibration of Yanta et al.,
10 equation 2b, (1969). No corrections were applied to the profile data (the authors remark upon a 5 K
11 discrepancy between the T0 probe in the free stream and the tunnel reservoir temperature). Sutherland's viscosity law was used.

12 The editors have incorporated the calibrations and interpolations of the authors. The integral data of section B is presented in two forms. In the main tables the reference flow is a single state flow corresponding to a D state taken at ρU (max), which was also set as the D state for the profile tables whilst an auxiliary table gives integral values based on a reference flow which has the tunnel reservoir pressure and local static pressure.

13 The main portion of the data consists of three sets of eight profiles, each set for a different reservoir pressure. In each case three ZPG stations were followed by five on the curved ramp. To these are added two individual profiles (Sturek, 1973) measured at X = 458.8 mm for which the tunnel total temperature was
4 varied so as to cause, in the nozzle region, heat flux from the flow (0401) or to the flow (0501). The Mach
9 number distribution was taken to be the same as for the profile of the earlier set (0205) with the same total pressure. The total temperature was measured using a probe consisting of an iron-constantan thermocouple mounted in a truncated cone-cylinder body. The thermocouple consisted of a 0.25 mm diameter wire sheathed in stainless steel with magnesium dioxide insulation. The thermocouple junction was worked to a sharp tip with a conical epoxy filling to the diameter of the sheath. The probe tip presented a frontal
9 area to the flow of 0.08 mm diameter. The probe was calibrated in the free stream and the calibration was assumed to vary through the boundary layer in the same general manner as the probe used earlier.

13 The earlier hot wire data (Sturek & Danberg 1972a) was presented graphically, as sufficient data had not been obtained to provide more than a qualitative assessment. Further data (Danberg, PC) is given here for
8 profiles taken at X = 203.2 and 458.8 mm. The general conditions correspond to profiles 0202 and 0205.

14 The CF values given with the profiles are those evaluated by the authors. The raw Preston tube data is given in section D.

§ DATA: 7101 0101-0501. Pitot, T0 and P profiles obtained separately. NX = 8. CF from Preston tubes. Some supporting hot wire data.

15 Editors' comments

Sturek and Danberg provide the only fully documented account of a simple wave flow. The experiment is therefore of the first importance to any research worker wishing to consider the effects of streamline curvature. The Mach number is high enough for the static pressure to vary by 50 % across a boundary layer for which the ratio δ/RX is about 0.02, but not so high that the interpretation of static pressure measurements becomes too contentious. The value of the experiment is further increased by the inclusion of wall shear stress measurements in association with each profile, and the fluctuation measurements, however restricted they may be. There is room for differences of opinion as to the precise calibration of the sensors, but the qualitative results and the trends established must stand.

The authors present a full analysis of the original data in Sturek & Danberg (1972b). This is extended by Sturek (1974) to include a determination, from the mean flow data, of shear stress, mixing length and eddy viscosity.

There is a marked fall in the general level of CF as the flow passes on to the ramp, followed by a rising tendency. The shear stress itself, however, rises continuously, so that the change in CF is associated rather with the change in the reference dynamic pressure. Both the numerical value of CF and the trend with X are sensitive to the choice of reference state, there being differences of up to 15 % between values calculated using the arbitrary D-state (at ρU max) and those calculated using the wall-state of the pressure-based reference flow mentioned in § 12 above.

The two additional profiles, 0401, 0501, of Sturek (1973) are both for near adiabatic flow in the test region but correspond to, respectively, heat transfer from and to the flow in the throat region. The author shows a considerable difference between the two on a "Van Driest" plot of (TO-TW) / (TOD-TW) against U/UD. It should be noted that this choice of axes is very sensitive to TO variations, and the variation noted is 4 - 8 K, or less than 3 %. We are not completely sure of the extent to which total temperature data near the wall are interpolations. In Sturek 1973, it is stated that measurements can be made to within 0.25 mm of the wall. Another description (Danberg, PC) suggests much larger values, perhaps as much as 5 mm.

The ZPG data from the first three stations can be compared with the results of Mabey et al. - CAT 7402, on a flat plate, and those of Voisinet & Lee - CAT 7202 on a tunnel wall. Comparisons may also be made with the other reported simple wave compression tests, Clutter & Kaups - CAT 6401 and Stroud & Miller - CAT 6503 which do not, however, provide so much detail.

FACSIMILES OF TABLES SUPPLIED BY AUTHORS. DIMENSIONS IN INCHES.

TABLE 1 CORRECTED MODEL COORDINATES (INCHES)

X	Y		X	Y		X	Y
12.006	.010		15.756	.224		18.661	.673
12.914	.023		16.000	.252		18.901	.722
					06	···········	···········
13.141	.030		16.243	.282		19.141	.772
13.368	.038		16.486	.313		19.380	.824
13.594	.049		16.729	.346		19.619	.877
13.821	.061		16.971	.381		19.858	.932
		04	···········	···········	07	···········	···········
14.048	.074		17.213	.418		20.097	.989
14.292	.090		17.455	.455		20.368	1.055
14.537	.108		17.697	.496		20.638	1.124
14.781	.128		17.938	.538		20.908	1.194
		05	···········	···········	08	···········	···········
15.025	.149		18.180	.581		21.178	1.266
15.269	.172		18.420	.627		21.447	1.341
15.513	.197						

CORRECTED TABLE 2

STA	X	Y	φ	CAT 7101
116	16.000	.252	6.75	-
117	17.019	.388	8.13	04
118	18.035	.559	9.85	05
119	19.021	.747	11.48	06
120	20.024	.969	13.24	07
121	21.016	1.215	14.65	08

CAT 7101 STUREK BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
71010101	3.5090	1.0213	6.5554"+03	1.0722"-03	6.5853	1.3544	3.3623"+03	3.3626"+03
1.5240"-01	2.5977"+05	0.9999	1.8664"+04	NM	1.8023	1.7738	2.9056"+02	8.8722"+01
INFINITE	3.0721"+02	1.0000	1.3540"-03	0.0000"+00	0.0666	2.3769"-03	6.6269"+02	2.8449"+02
71010102	3.5320	1.0244	6.7225"+03	1.0929"-03	6.7025	1.3510	3.3477"+03	3.3474"+03
2.0320"-01	2.6716"+05	1.0001	1.9365"+04	NM	1.7988	1.7706	2.9056"+02	8.7667"+01
INFINITE	3.0640"+02	1.0000	1.3775"-03	0.0000"+00	0.0573	2.4621"-03	6.6305"+02	2.8365"+02
71010103	3.4890	1.0217	7.0625"+03	1.0846"-03	6.5986	1.3571	3.3800"+03	3.3798"+03
2.5400"-01	2.5379"+05	1.0001	1.9961"+04	NM	1.7990	1.7713	2.9056"+02	8.9389"+01
INFINITE	3.0702"+02	1.0000	1.4651"-03	0.0000"+00	0.0517	2.5870"-03	6.6138"+02	2.8438"+02
71010104	3.2450	1.0183	1.0678"+04	9.3101"-04	4.2465	1.4812	6.0456"+03	4.8891"+03
4.3307"-01	2.5819"+05	1.2366	2.7381"+04	NM	1.7368	1.7128	2.9056"+02	9.8833"+01
INFINITE	3.0698"+02	1.0000	1.7313"-03	1.5068"+00	0.0755	2.6448"-03	6.4681"+02	2.8533"+02
71010105	3.1650	1.0230	1.1430"+04	9.1943"-04	4.3163	1.4765	6.8158"+03	5.6047"+03
4.5872"-01	2.6316"+05	1.2161	2.8538"+04	NM	1.7346	1.7118	2.9056"+02	1.0161"+02
INFINITE	3.0518"+02	1.0000	1.6805"-03	1.4557"+00	0.0397	2.5843"-03	6.3967"+02	2.8401"+02
71010106	3.0550	1.0305	1.1879"+04	9.3654"-04	4.0283	1.4614	7.6395"+03	6.3480"+03
4.8463"-01	2.5318"+05	1.2035	2.8612"+04	NM	1.7412	1.7199	2.9056"+02	1.0550"+02
INFINITE	3.0243"+02	1.0000	1.6278"-03	1.3830"+00	0.0443	2.4219"-03	6.2914"+02	2.8195"+02
71010107	2.9820	1.0169	1.2814"+04	9.1815"-04	4.1472	1.4635	8.5486"+03	7.3815"+03
5.1079"-01	2.6391"+05	1.1717	2.9620"+04	NM	1.7365	1.7165	2.9056"+02	1.1017"+02
INFINITE	3.0609"+02	1.0000	1.5809"-03	1.3116"+00	0.0513	2.3780"-03	6.2754"+02	2.8572"+02
71010108	2.9050	1.0175	1.3377"+04	9.7906"-04	4.1479	1.4673	9.4723"+03	8.3006"+03
5.3670"-01	2.6424"+05	1.1412	3.0022"+04	NM	1.7417	1.7226	2.9056"+02	1.1367"+02
INFINITE	3.0551"+02	1.0000	1.5303"-03	1.1699"+00	0.0612	2.2869"-03	6.2097"+02	2.8556"+02
71010201	3.5100	1.0183	8.1975"+03	1.0429"-03	6.6118	1.3598	4.1929"+03	4.1927"+03
1.5240"-01	3.2436"+05	1.0001	2.3290"+04	NM	1.7983	1.7688	2.9000"+02	8.8778"+01
INFINITE	3.0753"+02	1.0000	1.3560"-03	0.0000"+00	0.0662	2.4033"-03	6.6308"+02	2.8478"+02
71010202	3.5400	1.0218	8.0409"+03	1.0578"-03	6.7987	1.3490	4.1494"+03	4.1493"+03
2.0320"-01	3.3493"+05	1.0000	2.3186"+04	NM	1.8008	1.7739	2.9000"+02	8.7444"+01
INFINITE	3.0661"+02	1.0000	1.3226"-03	0.0000"+00	0.0354	2.3621"-03	6.6371"+02	2.8382"+02
71010203	3.5000	1.0185	8.6932"+03	1.0567"-03	6.6072	1.3582	4.2020"+03	4.2017"+03
2.5400"-01	3.2047"+05	1.0001	2.4608"+04	NM	1.7998	1.7716	2.9000"+02	8.9111"+01
INFINITE	3.0743"+02	1.0000	1.4417"-03	0.0000"+00	0.0588	2.5480"-03	6.6244"+02	2.8473"+02
71010204	3.2350	1.0136	1.2718"+04	9.2766"-04	4.1686	1.4575	7.5495"+03	6.1212"+03
4.3307"-01	3.1856"+05	1.2333	3.2354"+04	NM	1.7462	1.7229	2.9000"+02	9.9500"+01
INFINITE	3.0776"+02	1.0000	1.6552"-03	1.3927"+00	0.0743	2.4931"-03	6.4699"+02	2.8610"+02
71010205	3.1610	1.0139	1.3762"+04	9.0079"-04	4.1987	1.4503	8.5265"+03	7.0333"+03
4.5872"-01	3.2830"+05	1.2123	3.4024"+04	NM	1.7435	1.7216	2.9000"+02	1.0250"+02
INFINITE	3.0733"+02	1.0000	1.6191"-03	1.4103"+01	0.0677	2.4508"-03	6.4165"+02	2.8603"+02
71010206	3.0670	1.0134	1.4135"+04	9.6454"-04	4.3941	1.4642	9.5647"+03	8.0772"+03
4.8412"-01	3.2796"+05	1.1842	3.3676"+04	NM	1.7451	1.7185	2.9000"+02	1.0656"+02
INFINITE	3.0702"+02	1.0000	1.5217"-03	1.3443"+00	0.0641	2.3669"-03	6.3476"+02	2.8617"+02
71010207	2.9950	1.0106	1.5429"+04	9.1215"-04	4.1367	1.4512	1.0809"+04	9.1866"+03
5.1079"-01	3.3493"+05	1.1767	3.5649"+04	NM	1.7401	1.7210	2.9000"+02	1.1006"+02
INFINITE	3.0750"+02	1.0000	1.5199"-03	1.2884"+00	0.0629	2.2807"-03	6.2996"+02	2.8696"+02
71010208	2.9090	1.0089	1.5908"+04	9.7347"-04	4.1065	1.4280	1.1865"+04	1.0415"+04
5.3670"-01	3.3357"+05	1.1392	3.5486"+04	NM	1.7524	1.7360	2.9000"+02	1.1422"+02
INFINITE	3.0754"+02	1.0000	1.4498"-03	1.1273"+00	0.0717	2.1466"-03	6.2335"+02	2.8743"+02

CAT 7101 STUREK BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * PUD TOD	TW/TR PW/PD SW *	RED2W RED2D D2	CF CQ PI2*	H12 H32 H42	H12K H32K D2K	PW* TW* UD	PD* TD* TR
71010301	3.5120	1.0156	9.3955"+03	1.0254"-03	6.5465	1.3398	5.0136"+03	5.0139"+03
1.5240"-01	3.8899"+05	0.9999	2.6654"+04	NM	1.8073	1.7796	2.8944"+02	8.8778"+01
INFINITE	3.0778"+02	1.0000	1.2969"-03	0.0000"+00	0.0705	2.2581"-03	6.6346"+02	2.8500"+02
71010302	3.5360	1.0169	9.4905"+03	1.0443"-03	6.7104	1.3463	4.9635"+03	4.9635"+03
2.0320"-01	3.9840"+05	1.0000	2.7206"+04	NM	1.8017	1.7744	2.8944"+02	8.7833"+01
INFINITE	3.0747"+02	1.0000	1.3073"-03	0.0000"+00	0.0525	2.3197"-03	6.6443"+02	2.8463"+02
71010303	3.5050	1.0139	9.7002"+03	1.0300"-03	6.4990	1.3365	5.0262"+03	5.0263"+03
2.5400"-01	3.8610"+05	1.0000	2.7401"+04	NM	1.8088	1.7812	2.8944"+02	8.9167"+01
INFINITE	3.0825"+02	1.0000	1.3413"-03	0.0000"+00	0.0745	2.3205"-03	6.6359"+02	2.8546"+02
71010304	3.2300	1.0120	1.4577"+04	9.2243"-04	4.1979	1.4355	9.0125"+03	7.3560"+03
4.3307"-01	3.8003"+05	1.2252	3.6968"+04	NM	1.7537	1.7318	2.8944"+02	9.9667"+01
INFINITE	3.0763"+02	1.0000	1.5800"-03	1.4348"+00	0.0693	2.3761"-03	6.4653"+02	2.8600"+02
71010305	3.1400	1.0135	1.5638"+04	8.9992"-04	4.2659	1.4338	1.0244"+04	8.5240"+03
4.5872"-01	3.8572"+05	1.2018	3.8347"+04	NM	1.7494	1.7290	2.8944"+02	1.0322"+02
INFINITE	3.0677"+02	1.0000	1.5313"-03	1.3739"+00	0.0560	2.3188"-03	6.3963"+02	2.8560"+02
71010306	3.0550	1.0070	1.6567"+04	8.9979"-04	4.3486	1.4419	1.1507"+04	9.8064"+03
4.8463"-01	3.9111"+05	1.1734	3.9063"+04	NM	1.7438	1.7256	2.8944"+02	1.0756"+02
INFINITE	3.0832"+02	1.0000	1.4795"-03	1.2832"+00	0.0447	2.2585"-03	6.3524"+02	2.8744"+02
71010307	2.9700	1.0119	1.7702"+04	9.1775"-04	4.0224	1.4227	1.3032"+04	1.1075"+04
5.1079"-01	3.8889"+05	1.1767	4.0567"+04	NM	1.7484	1.7308	2.8944"+02	1.1083"+02
INFINITE	3.0636"+02	1.0000	1.4616"-03	1.2413"+00	0.0599	2.1594"-03	6.2690"+02	2.8603"+02
71010308	2.9000	1.0001	1.8800"+04	9.7469"-04	4.0561	1.4230	1.4423"+04	1.2643"+04
5.3670"-01	3.9944"+05	1.1408	4.1457"+04	NM	1.7555	1.7404	2.8944"+02	1.1544"+02
1.0000"+06	3.0962"+02	1.0000	1.4212"-03	1.1108"+00	0.0869	2.0863"-03	6.2473"+02	2.8943"+02
71010401	3.1742	0.9918	1.4149"+04	NM	4.0402	1.4845	8.5247"+03	6.9609"+03
4.8463"-01	3.3130"+05	1.2247	3.4491"+04	NM	1.7433	1.7223	2.8700"+02	1.0315"+02
INFINITE	3.1100"+02	1.0000	1.6667"-03	0.0000"+00	0.1077	2.4699"-03	6.4636"+02	2.8938"+02
71010501	3.1277	1.0272	1.3885"+04	NM	4.2527	1.4926	8.5247"+03	7.1511"+03
4.8463"-01	3.1775"+05	1.1921	3.4400"+04	NM	1.7430	1.7232	2.8600"+02	1.0113"+02
INFINITE	2.9900"+02	1.0000	1.5956"-03	0.0000"+00	0.1030	2.4032"-03	6.3064"+02	2.7842"+02

FREE STREAM DEFINITION ARBITRARY - INPUT TAUW NOT CF - RUN 0401,0501 TOD INPUT

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
71010101	1.3901"-03	6.6601	1.8075	0.0649	1.9184"+04	6.7382"+03	9.1541"-03
	1.3722"-03	6.6715	1.8044	0.0650	1.9152"+04	6.7266"+03	
71010102	1.3877"-03	6.7022	1.8003	0.0569	1.9532"+04	6.7806"+03	9.2811"-03
	1.3841"-03	6.7053	1.7995	0.0569	1.9524"+04	6.7776"+03	
71010103	1.5415"-03	6.6965	1.8091	0.0491	2.1027"+04	7.4396"+03	1.0119"-02
	1.5061"-03	6.7188	1.8031	0.0493	2.0958"+04	7.4149"+03	
71010104	1.6335"-03	5.9865	1.7216	0.0800	2.5865"+04	1.0087"+04	8.4536"-03
	1.4226"-03	5.9054	1.7453	0.0790	2.6221"+04	1.0225"+04	
71010105	1.6071"-03	5.7336	1.7229	0.0416	2.7325"+04	1.0944"+04	8.1357"-03
	1.4265"-03	5.6652	1.7437	0.0411	2.7654"+04	1.1076"+04	
71010106	1.6572"-03	5.1762	1.7460	0.0435	2.9165"+04	1.2108"+04	7.5477"-03
	1.4568"-03	5.1539	1.7536	0.0433	2.9291"+04	1.2160"+04	
71010107	1.5383"-03	5.2187	1.7294	0.0527	2.8856"+04	1.2483"+04	7.2426"-03
	1.3932"-03	5.1699	1.7457	0.0522	2.9128"+04	1.2601"+04	
71010108	1.4831"-03	5.0345	1.7337	0.0631	2.9128"+04	1.2979"+04	6.8754"-03
	1.3711"-03	4.9885	1.7497	0.0625	2.9396"+04	1.3098"+04	
71010201	1.3970"-03	6.6093	1.8043	0.0643	2.4020"+04	8.4557"+03	9.2148"-03
	1.3791"-03	6.6813	1.8010	0.0644	2.3980"+04	8.4405"+03	
71010202	1.3226"-03	6.7975	1.8009	0.0354	2.3215"+04	8.0511"+03	8.9909"-03
	1.3227"-03	6.7975	1.8009	0.0354	2.3215"+04	8.0511"+03	
71010203	1.4994"-03	6.6898	1.8076	0.0565	2.5625"+04	9.0523"+03	9.8778"-03
	1.4728"-03	6.7065	1.8031	0.0567	2.5561"+04	9.0298"+03	
71010204	1.5721"-03	5.9243	1.7332	0.0783	3.0767"+04	1.2094"+04	8.0384"-03
	1.3643"-03	5.8503	1.7551	0.0773	3.1156"+04	1.2247"+04	
71010205	1.5175"-03	5.7213	1.7270	0.0722	3.1928"+04	1.2914"+04	7.6757"-03
	1.3492"-03	5.6408	1.7517	0.0712	3.2384"+04	1.3098"+04	
71010206	1.4578"-03	5.4657	1.7344	0.0669	3.2299"+04	1.3559"+04	7.3871"-03
	1.3145"-03	5.4025	1.7547	0.0661	3.2677"+04	1.3716"+04	
71010207	1.4449"-03	5.2332	1.7271	0.0662	3.3928"+04	1.4685"+04	6.8677"-03
	1.3176"-03	5.1671	1.7492	0.0653	3.4362"+04	1.4873"+04	
71010208	1.3805"-03	5.0038	1.7403	0.0753	3.3831"+04	1.5166"+04	6.3955"-03
	1.2842"-03	4.9466	1.7605	0.0745	3.4223"+04	1.5341"+04	
71010301	1.3424"-03	6.5711	1.8139	0.0682	2.7622"+04	9.7367"+03	8.7302"-03
	1.3260"-03	6.5839	1.8104	0.0683	2.7568"+04	9.7177"+03	
71010302	1.3064"-03	6.7755	1.8016	0.0526	2.7219"+04	9.4951"+03	0.8266"-03
	1.3031"-03	6.7752	1.8016	0.0526	2.7221"+04	9.4955"+03	
71010303	1.3878"-03	6.5930	1.8152	0.0720	2.8386"+04	1.0049"+04	9.0284"-03
	1.3667"-03	6.6060	1.8117	0.0721	2.8330"+04	1.0029"+04	
71010304	1.5106"-03	5.8868	1.7427	0.0725	3.5386"+04	1.3953"+04	7.7104"-03
	1.3141"-03	5.8186	1.7632	0.0717	3.5801"+04	1.4117"+04	
71010305	1.4817"-03	5.6109	1.7413	0.0579	3.7150"+04	1.5150"+04	7.3613"-03
	1.3131"-03	5.5921	1.7598	0.0572	3.7544"+04	1.5310"+04	
71010306	1.4040"-03	5.5884	1.7305	0.0471	3.7112"+04	1.5741"+04	7.0744"-03
	1.2701"-03	5.5185	1.7524	0.0465	3.7582"+04	1.5940"+04	
71010307	1.4421"-03	5.0473	1.7451	0.0607	4.0076"+04	1.7488"+04	6.5486"-03
	1.2971"-03	5.0064	1.7594	0.0602	4.0404"+04	1.7630"+04	
71010308	1.3330"-03	5.0458	1.7400	0.0927	3.8932"+04	1.7654"+04	6.2376"-03
	1.2341"-03	5.0161	1.7641	0.0914	3.9473"+04	1.7900"+04	
71010401	1.5533"-03	5.5232	1.7253	0.1156	3.2181"+04	1.3201"+04	7.5978"-03
	1.3549"-03	5.4408	1.7518	0.1138	3.2668"+04	1.3401"+04	
71010501	1.5066"-03	5.4747	1.7284	0.1091	3.2522"+04	1.3127"+04	7.4326"-03
	1.3648"-03	5.4022	1.7516	0.1077	3.2959"+04	1.3303"+04	

71010201 STUREK PROFILE TABULATION 70 POINTS, DELTA AT POINT 69

I	Y	PT2/P	P/PD	T0/T0D	A/AD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.00006	0.94300	0.00000	0.00000	3.26656	0.00000
2	8.8900E-05	1.3862E+00	1.00000	0.94440	0.19922	0.34391	2.97997	0.11541
3	1.9050E-04	1.7608E+00	1.00000	0.94537	0.26684	0.44539	2.78596	0.15987
4	2.7940E-04	2.0674E+00	1.00000	0.94606	0.30603	0.49938	2.66270	0.18755
5	3.8100E-04	2.3029E+00	1.00000	0.93792	0.33142	0.52996	2.55695	0.20726
6	6.5024E-04	2.5836E+00	1.00000	0.93613	0.35861	0.56274	2.46245	0.22853
7	9.4996E-04	2.8087E+00	1.00000	0.93761	0.37869	0.58666	2.39987	0.24445
8	1.1989E-03	3.0077E+00	1.00000	0.94000	0.39546	0.60629	2.35044	0.25795
9	1.4529E-03	3.2465E+00	1.00000	0.94350	0.41457	0.62818	2.29599	0.27360
10	1.7069E-03	3.4349E+00	1.00000	0.94655	0.42098	0.64432	2.25594	0.28561
11	2.2149E-03	3.6809E+00	1.00000	0.95224	0.44703	9.66460	2.21026	0.30069
12	2.7229E-03	3.9755E+00	1.00000	0.95662	0.46766	0.68626	2.15332	0.31870
13	3.2509E-[illegible]	4.2749E+00	1.00000	0.96012	0.48768	0.70621	2.09700	0.33677
14	3.7389E-03	4.5053E+00	1.00000	0.96299	0.50252	0.72061	2.05632	0.35043
15	4.2469E-03	4.8297E+00	1.00000	0.96570	0.52267	0.73904	1.99437	0.36964
16	4.7549E-03	5.0827E+00	1.00000	0.96784	0.53783	0.75247	1.95745	0.38441
17	5.2629E-03	5.3658E+00	1.00000	0.96970	0.55429	0.76640	1.91176	0.40089
18	5.7709E-03	5.6498E+00	1.00000	0.97208	0.57032	0.77974	1.86921	0.41715
19	6.2789E-03	5.8783E+00	1.00000	0.97442	0.58289	0.79009	1.83730	0.43003
20	6.7869E-03	6.2152E+00	1.00000	0.97707	0.60092	0.80420	1.79099	0.44903
21	7.2949E-03	6.5342E+00	1.00000	0.97933	0.61751	0.81666	1.74906	0.46692
22	7.8029E-03	6.8030E+00	1.00000	0.98153	0.63113	0.82673	1.71589	0.48181
23	8.3109E-03	7.1724E+00	1.00000	0.98391	0.64939	0.83956	1.67146	0.50229
24	8.8189E-03	7.4250E+00	1.00000	0.98570	0.66162	0.84798	1.64268	0.51622
25	9.3269E-03	7.7907E+00	1.00000	0.98758	0.67883	0.85920	1.60200	0.53633
26	9.8349E-03	8.1270E+00	1.00000	0.98967	0.69432	0.86913	1.56696	0.55466
27	1.0343E-02	8.4618E+00	1.00000	0.99141	0.70937	0.87837	1.53317	0.57291
28	1.0851E-02	8.8447E+00	1.00000	0.99329	0.72625	0.88835	1.49625	0.59372
29	1.1359E-02	9.1625E+00	1.00000	0.99514	0.73994	0.89635	1.46746	0.61082
30	1.1867E-02	9.5635E+00	1.00000	0.99675	0.75686	0.90564	1.43179	0.63252
31	1.2375E-02	9.9195E+00	1.00000	0.99825	0.77157	0.91351	1.40175	0.65169
32	1.2883E-02	1.0277E+01	1.00000	0.99936	0.78607	0.92086	1.37234	0.67102
33	1.3391E-02	1.0678E+01	1.00000	1.00025	0.80201	0.92854	1.34043	0.69272
34	1.3899E-02	1.1003E+01	1.00000	1.00125	0.81470	0.93461	1.31602	0.71018
35	1.4407E-02	1.1426E+01	1.00000	1.00185	0.83093	0.94183	1.28473	0.73310
36	1.4915E-02	1.1750E+01	1.00000	1.00264	0.84315	0.94726	1.26220	0.75048
37	1.5423E-02	1.2087E+01	1.00000	1.00298	0.85566	0.95245	1.23905	0.76870
38	1.5931E-02	1.2485E+01	1.00000	1.00339	0.87022	0.95839	1.21277	0.79021
39	1.6439E-02	1.2750E+01	1.00000	1.00360	0.87976	0.96206	1.19587	0.80449
40	1.6947E-02	1.3091E+01	1.00000	1.00376	0.89193	0.96666	1.17459	0.82298
41	1.7455E-02	1.3388E+01	1.00000	1.00422	0.90238	0.97066	1.15707	0.83890
42	1.7963E-02	1.3646E+01	1.00000	1.00440	0.91135	0.97393	1.14205	0.85279
43	1.8471E-02	1.3946E+01	1.00000	1.00413	0.92167	0.97738	1.12453	0.86914
44	1.8979E-02	1.4176E+01	1.00000	1.00386	0.92950	0.97991	1.11139	0.88169
45	1.9487E-02	1.4396E+01	1.00000	[illegible]	0.930[illegible]	0.98243	1.09950	0.89353
46	1.9995E-02	1.4616E+01	1.00000	1.00387	0.94433	0.98483	1.08761	0.90550
47	2.0503E-02	1.4794E+01	1.00000	1.00380	0.95025	0.98671	1.07822	0.91513
48	2.1011E-02	1.4999E+01	1.00000	1.00313	0.95703	0.98855	1.06696	0.92651
49	2.1519E-02	1.5143E+01	1.00000	1.00291	0.96175	0.98993	1.05945	0.93438
50	2.2027E-02	1.5294E+01	1.00000	1.00294	0.96671	0.99149	1.05194	0.94254
51	2.2535E-02	1.5437E+01	1.00000	1.00246	0.97134	0.99269	1.04443	0.95046
52	2.3043E-02	1.5535E+01	1.00000	1.00225	0.97454	0.99356	1.03942	0.95588
53	2.3551E-02	1.5675E+01	1.00000	1.00209	0.97905	0.99485	1.03254	0.96350
54	2.4059E-02	1.5774E+01	1.00000	1.00181	0.98225	0.99560	1.02753	0.96900
55	2.4567E-02	1.5857E+01	1.00000	1.00133	0.98489	0.99625	1.02315	0.97368
56	2.5075E-02	1.5935E+01	1.00000	1.00122	0.98739	0.99692	1.01940	0.97795
57	2.5583E-02	1.6035E+01	1.00000	1.00089	0.99060	0.99770	1.01439	0.98354
58	2.6091E-02	1.6091E+01	1.00000	1.00095	0.99237	0.99825	1.01189	0.98652
59	2.6599E-02	1.6137E+01	1.00000	1.00055	0.99383	0.99848	1.00939	0.98920
60	2.7107E-02	1.6174E+01	1.00000	1.00034	0.99498	0.99871	1.00751	0.99127
61	2.7615E-02	1.6210E+01	1.00000	1.00012	0.99614	0.99894	1.00563	0.99335
62	2.8123E-02	1.6251E+01	1.00000	1.00010	0.99744	0.99931	1.00375	0.99557
63	2.8631E-02	1.6275E+01	1.00000	1.00058	0.99821	0.99977	1.00313	0.99665
64	2.9139E-02	1.6298E+01	1.00000	1.00035	0.99892	0.99986	1.00188	0.99799
65	2.9647E-02	1.6314E+01	1.00000	0.99979	0.99941	0.99972	1.00063	0.99910
66	3.0155E-02	1.6326E+01	1.00000	0.99974	0.99982	0.99982	1.00000	0.99982
67	3.0663E-02	1.6321E+01	1.00000	1.00012	0.99964	0.99995	1.00063	0.99933
68	3.1171E-02	1.6334E+01	1.00000	1.00007	1.00005	1.00005	1.00000	1.00005
0 69	3.1679E-02	1.6332E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
70	3.2187E-02	1.6327E+01	1.00000	1.00038	0.99983	1.00014	1.00063	0.99951

INPUT VARIABLES Y,U,T,P

71010202 STUREK PROFILE TABULATION 70 POINTS, DELTA AT POINT 70

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.00003	0.94583	0.00000	0.00000	3.31659	0.00000
2	1.1938E-04	1.5378E+00	1.00000	0.94602	0.22847	0.39130	2.93329	0.13340
3	2.2098E-04	1.9524E+00	1.00000	0.94722	0.28992	0.48020	2.74333	0.17504
4	3.9878E-04	2.4278E+00	1.00000	0.93967	0.34095	0.54461	2.55146	0.21345
5	5.4102E-04	2.6250E+00	1.00000	0.93894	0.35933	0.56671	2.48729	0.22784
6	6.7056E-04	2.7663E+00	1.00000	0.93908	0.37183	0.58146	2.44536	0.23778
7	8.1026E-04	2.8992E+00	1.00000	0.93940	0.38315	0.59455	2.40788	0.24692
8	9.2964E-04	3.0074E+00	1.00000	0.94003	0.39209	0.60480	2.37429	0.25419
9	1.1506E-03	3.1964E+00	1.00000	0.94205	0.40716	0.62198	2.33355	0.26654
10	1.4046E-03	3.3616E+00	1.00000	0.94492	0.41985	0.63645	2.29797	0.27696
11	1.6586E-03	3.6107E+00	1.00000	0.94879	0.43821	0.65671	2.24587	0.29241
12	2.1666E-03	3.8933E+00	1.00000	0.95445	0.45809	0.67840	2.19314	0.30933
13	2.6746E-03	4.1512E+00	1.00000	0.95829	0.47545	0.69632	2.14885	0.32464
14	3.1826E-03	4.4047E+00	1.00000	0.96258	0.49189	0.71299	2.10102	0.33936
15	3.6906E-03	4.6998E+00	1.00000	0.96518	0.51033	0.73027	2.04765	0.35664
16	4.1986E-03	4.9030E+00	1.00000	0.96767	0.52268	0.74175	2.01398	0.36830
17	4.7066E-03	5.1900E+00	1.00000	0.96992	0.53952	0.75655	1.96633	0.38475
18	5.2146E-03	5.4356E+00	1.00000	0.97161	0.55355	0.76840	1.92694	0.39877
19	5.7226E-03	5.6775E+00	1.00000	0.97407	0.56701	0.77979	1.89136	0.41229
20	6.2306E-03	5.9982E+00	1.00000	0.97621	0.58438	0.79362	1.84435	0.43030
21	6.7386E-03	6.2309E+00	1.00000	0.97857	0.59712	0.80370	1.81194	0.44360
22	7.2466E-03	6.6023E+00	1.00000	0.98093	0.61572	0.81770	1.76360	0.46364
23	7.7546E-03	6.9019E+00	1.00000	0.98345	0.63068	0.82877	1.72681	0.47994
24	8.2626E-03	7.1440E+00	1.00000	0.98582	0.64251	0.83745	1.69886	0.49295
25	8.7706E-03	7.4783E+00	1.00000	0.98725	0.65849	0.84811	1.65883	0.51127
26	9.2786E-03	7.7834E+00	1.00000	0.98924	0.67274	0.85762	1.62516	0.52772
27	9.7866E-03	8.1737E+00	1.00000	0.99117	0.69054	0.86888	1.58323	0.54880
28	1.0295E-02	8.5271E+00	1.00000	0.99278	0.70626	0.87843	1.54701	0.56783
29	1.0803E-02	8.8226E+00	1.00000	0.99478	0.71914	0.88634	1.51906	0.58348
30	1.1311E-02	9.2477E+00	1.00000	0.99648	0.73726	0.89663	1.47903	0.60623
31	1.1819E-02	9.4961E+00	1.00000	0.99800	0.74765	0.90260	1.45743	0.61931
32	1.2327E-02	9.8895E+00	1.00000	0.99935	0.76381	0.91119	1.42313	0.64027
33	1.2835E-02	1.0355E+01	1.00000	1.00075	0.78252	0.92070	1.38437	0.66507
34	1.3343E-02	1.0686E+01	1.00000	1.00231	0.79551	0.92736	1.35896	0.68241
35	1.3851E-02	1.1130E+01	1.00000	1.00310	0.81265	0.93531	1.32465	0.70608
36	1.4359E-02	1.1436E+01	1.00000	1.00397	0.82427	0.94069	1.30241	0.72226
37	1.4867E-02	1.1837E+01	1.00000	1.00505	0.83920	0.94740	1.27446	0.74337
38	1.5375E-02	1.2197E+01	1.00000	1.00547	0.85242	0.95291	1.24968	0.76252
39	1.5883E-02	1.2560E+01	1.00000	1.00580	0.86554	0.95819	1.22554	0.78185
40	1.6391E-02	1.2959E+01	1.00000	1.00619	0.87973	0.96375	1.20013	0.80304
41	1.6899E-02	1.3208E+01	1.00000	1.00647	0.88946	0.96710	1.18488	0.81621
42	1.7407E-02	1.3569E+01	1.00000	1.00674	0.90097	0.97174	1.16328	0.83535
43	1.7915E-02	1.3849E+01	1.00000	1.00670	0.91057	0.97510	1.14676	0.85031
44	1.8423E-02	1.4090E+01	1.00000	1.00650	0.91872	0.97781	1.13278	0.86319
45	1.8931E-02	1.4411E+01	1.00000	1.00657	0.92950	0.98148	1.11499	0.88026
46	1.9439E-02	1.4615E+01	1.00000	1.00621	0.93627	0.98355	1.10356	0.89126
47	1.9947E-02	1.4858E+01	1.00000	1.00584	0.94431	0.98599	1.09022	0.90440
48	2.0455E-02	1.5100E+01	1.00000	1.00565	0.95221	0.98842	1.07751	0.91732
49	2.0963E-02	1.5263E+01	1.00000	1.00506	0.95750	0.98980	1.06661	0.92625
50	2.1471E-02	1.5450E+01	1.00000	1.00527	0.96380	0.99187	1.05909	0.93655
51	2.1979E-02	1.5582E+01	1.00000	1.00503	0.96778	0.99297	1.05273	0.94323
52	2.2487E-02	1.5745E+01	1.00000	1.00469	0.97299	0.99439	1.04447	0.95205
53	2.2995E-02	1.5867E+01	1.00000	1.00419	0.97687	0.99531	1.03812	0.95877
54	2.3503E-02	1.5948E+01	1.00000	1.00421	0.97944	0.99609	1.03431	0.96305
55	2.4011E-02	1.6063E+01	1.00000	1.00389	0.98306	0.99701	1.02859	0.96930
56	2.4519E-02	1.6144E+01	1.00000	1.00385	0.98561	0.99775	1.02478	0.97362
57	2.5027E-02	1.6229E+01	1.00000	1.00337	0.98830	0.99830	1.02033	0.97841
58	2.5535E-02	1.6303E+01	1.00000	1.00294	0.99061	0.99876	1.01652	0.98253
59	2.6043E-02	1.6350E+01	1.00000	1.00254	0.99208	0.99899	1.01396	0.98522
60	2.6551E-02	1.6423E+01	1.00000	1.00269	0.99437	0.99972	1.01080	0.98904
61	2.7059E-02	1.6474E+01	1.00000	1.00242	0.99594	1.00005	1.00826	0.99185
62	2.7567E-02	1.6513E+01	1.00000	1.00227	0.99716	1.00032	1.00635	0.99401
63	2.8075E-02	1.6507E+01	1.00000	1.00201	0.99698	1.00014	1.00635	0.99382
64	2.8583E-02	1.6546E+01	1.00000	1.00186	0.99820	1.00041	1.00445	0.99598
65	2.9091E-02	1.6551E+01	1.00000	1.00206	0.99833	1.00095	1.00445	0.99612
66	2.9599E-02	1.6593E+01	1.00000	1.00204	0.99965	1.00092	1.00254	0.99838
67	3.0107E-02	1.6585E+01	1.00000	1.00043	0.99941	1.00005	1.00127	0.99878
68	3.0615E-02	1.6585E+01	1.00000	1.00043	0.99941	1.00005	1.00127	0.99878
69	3.1123E-02	1.6596E+01	1.00000	1.00025	0.99973	1.00005	1.00064	0.99941
D 70	3.1631E-02	1.6604E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U,T,P

71010203 STUREK PROFILE TABULATION 70 POINTS, DELTA AT POINT 70

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00007	0.94329	0.00000	0.00000	3.25436	0.00000
2	1.2954"-04	1.4341"+00	1.00000	0.94469	0.21045	0.36085	2.94015	0.12273
3	1.3970"-04	1.4935"+00	1.00000	0.94476	0.22262	0.37954	2.90648	0.13058
4	2.3876"-04	1.7990"+00	1.00000	0.94421	0.27306	0.45317	2.75436	0.16453
5	5.5118"-04	2.5847"+00	1.00000	0.93820	0.35973	0.56395	2.45761	0.22947
6	8.8900"-04	2.9491"+00	1.00000	0.93789	0.39173	0.60072	2.35162	0.25545
7	1.1100"-03	3.1197"+00	1.00000	0.93977	0.40571	0.61669	2.31047	0.26691
8	1.3589"-03	3.3035"+00	1.00000	0.94230	0.42019	0.63298	2.26933	0.27893
9	1.5129"-03	3.4919"+00	1.00000	0.94586	0.43447	0.64899	2.23130	0.29086
10	2.1209"-03	3.6507"+00	1.00000	0.95083	0.44613	0.66248	2.20511	0.30043
11	2.6289"-03	3.8970"+00	1.00000	0.95556	0.46358	0.68126	2.15960	0.31545
12	3.1369"-03	4.1623"+00	1.00000	0.95933	0.48163	0.69966	2.11035	0.33154
13	3.6449"-03	4.4080"+00	1.00000	0.96264	0.49773	0.71554	2.06671	0.34622
14	4.1529"-03	4.6511"+00	1.00000	0.96528	0.51314	0.73008	2.02431	0.36066
15	4.6609"-03	4.9042"+00	1.00000	0.96695	0.52869	0.74394	1.98005	0.37572
16	5.1689"-03	5.1598"+00	1.00000	0.96935	0.54392	0.75737	1.93890	0.39062
17	5.6769"-03	5.3290"+00	1.00000	0.97125	0.55376	0.76598	1.91334	0.40034
18	6.1849"-03	5.5976"+00	1.00000	0.97349	0.56903	0.77873	1.87282	0.41581
19	6.6929"-03	5.8535"+00	1.00000	0.97598	0.58320	0.79037	1.83666	0.43033
20	7.2009"-03	6.1158"+00	1.00000	0.97815	0.59736	0.80156	1.80050	0.44519
21	7.7089"-03	6.3790"+00	1.00000	0.98055	0.61124	0.81232	1.76621	0.45993
22	8.2169"-03	6.6728"+00	1.00000	0.98275	0.62635	0.82355	1.72880	0.47637
23	8.7249"-03	6.9575"+00	1.00000	0.98471	0.64066	0.83382	1.69389	0.49225
24	9.2329"-03	7.2494"+00	1.00000	0.98667	0.65500	0.84380	1.65960	0.50844
25	9.7409"-03	7.5756"+00	1.00000	0.98872	0.67065	0.85434	1.62282	0.52646
26	1.0249"-02	7.9162"+00	1.00000	0.99070	0.68661	0.86470	1.58603	0.54519
27	1.0757"-02	8.2026"+00	1.00000	0.99213	0.69974	0.87289	1.55611	0.56094
28	1.1265"-02	8.5524"+00	1.00000	0.99389	0.71545	0.88242	1.52120	0.58008
29	1.1773"-02	8.8742"+00	1.00000	0.99558	0.72961	0.89079	1.49065	0.59759
30	1.2281"-02	9.2195"+00	1.00000	0.99707	0.74449	0.89921	1.45885	0.61638
31	1.2789"-02	9.5423"+00	1.00000	0.99873	0.75814	0.90685	1.43080	0.63381
32	1.3297"-02	9.8770"+00	1.00000	0.99988	0.77203	0.91417	1.40212	0.65199
33	1.3805"-02	1.0243"+01	1.00000	1.00117	0.78693	0.92181	1.37219	0.67178
34	1.4313"-02	1.0574"+01	1.00000	1.00217	0.80018	0.92834	1.34601	0.68970
35	1.4821"-02	1.0929"+01	1.00000	1.00286	0.81415	0.93488	1.31858	0.70901
36	1.5329"-02	1.1295"+01	1.00000	1.00380	0.82830	0.94141	1.29177	0.72878
37	1.5837"-02	1.1646"+01	1.00000	1.00447	0.84165	0.94731	1.26683	0.74777
38	1.6345"-02	1.1972"+01	1.00000	1.00492	0.85382	0.95246	1.24439	0.76540
39	1.6853"-02	1.2288"+01	1.00000	1.00527	0.86552	0.95725	1.22319	0.78258
40	1.7361"-02	1.2624"+01	1.00000	1.00553	0.87775	0.96208	1.20137	0.80082
41	1.7869"-02	1.3002"+01	1.00000	1.00523	0.89131	0.96700	1.17706	0.82154
42	1.8377"-02	1.3246"+01	1.00000	1.00520	0.89993	0.97013	1.16209	0.83481
43	1.8885"-02	1.3563"+01	1.00000	1.00480	0.91104	0.97391	1.14277	0.85223
44	1.9393"-02	1.3811"+01	1.00000	1.00429	0.91966	0.97667	1.12781	0.86599
45	1.9901"-02	1.4060"+01	1.00000	1.00454	0.92819	0.97970	1.11409	0.87938
46	2.0409"-02	1.4278"+01	1.00000	1.00413	0.93562	0.98201	1.10162	0.89142
47	2.0917"-02	1.4492"+01	1.00000	1.00384	0.94285	0.98426	1.08978	0.90318
48	2.1425"-02	1.4651"+01	1.00000	1.00357	0.94820	0.98587	1.08105	0.91196
49	2.1933"-02	1.4837"+01	1.00000	1.00326	0.95438	0.98771	1.07107	0.92217
50	2.2441"-02	1.4962"+01	1.00000	1.00282	0.95852	0.98882	1.06421	0.92915
51	2.2949"-02	1.5116"+01	1.00000	1.00254	0.96362	0.99029	1.05611	0.93768
52	2.3457"-02	1.5275"+01	1.00000	1.00233	0.96883	0.99181	1.04800	0.94638
53	2.3965"-02	1.5369"+01	1.00000	1.00198	0.97191	0.99259	1.04302	0.95165
54	2.4473"-02	1.5490"+01	1.00000	1.00224	0.97584	0.99393	1.03741	0.95809
55	2.4981"-02	1.5587"+01	1.00000	1.00196	0.97901	0.99475	1.03242	0.96352
56	2.5489"-02	1.5652"+01	1.00000	1.00134	0.98111	0.99508	1.02868	0.96733
57	2.5997"-02	1.5715"+01	1.00000	1.00121	0.98314	0.99563	1.02556	0.97081
58	2.6505"-02	1.5836"+01	1.00000	1.00128	0.98703	0.99682	1.01995	0.97733
59	2.7013"-02	1.5934"+01	1.00000	1.00088	0.99018	0.99756	1.01496	0.98285
60	2.7521"-02	1.5957"+01	1.00000	1.00071	0.99093	0.99770	1.01372	0.98420
61	2.8029"-02	1.6019"+01	1.00000	1.00046	0.99291	0.99816	1.01060	0.98769
62	2.8537"-02	1.6041"+01	1.00000	1.00023	0.99362	0.99825	1.00935	0.98900
63	2.9045"-02	1.6090"+01	1.00000	0.99996	0.99517	0.99857	1.00686	0.99177
64	2.9553"-02	1.6117"+01	1.00000	0.99993	0.99601	0.99880	1.00561	0.99323
65	3.0061"-02	1.6145"+01	1.00000	0.99996	0.99691	0.99908	1.00436	0.99474
66	3.0569"-02	1.6163"+01	1.00000	0.99953	0.99748	0.99903	1.00312	0.99593
67	3.1077"-02	1.6206"+01	1.00000	0.99964	0.99887	0.99949	1.00125	0.99825
68	3.1585"-02	1.6225"+01	1.00000	0.99985	0.99946	0.99977	1.00062	0.99915
69	3.2093"-02	1.6219"+01	1.00000	0.99959	0.99927	0.99959	1.00062	0.99896
D 70	3.2601"-02	1.6242"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U,T,P

71010204 STUREK PROFILE TABULATION 66 POINTS, DELTA AT POINT 50

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.23334	0.94230	0.00000	0.00000	2.91457	0.00000
2	1.7272"-04	1.5464"+00	1.23316	0.94196	0.25175	0.40376	2.57231	0.19356
3	1.9304"-04	1.6235"+00	1.23305	0.94186	0.26635	0.42421	2.53657	0.20621
4	2.6416"-04	1.7914"+00	1.23305	0.94058	0.29427	0.46181	2.46287	0.23121
5	3.7338"-04	1.9264"+00	1.23282	0.9391[illegible]	0.31374	0.48692	2.40871	0.24922
6	4.7498"-04	2.0147"+00	1.23271	0.93944	0.32541	0.50186	2.37856	0.26009
7	5.8674"-04	2.0975"+00	1.23260	0.93997	0.33576	0.51496	2.35232	0.26984
8	7.1628"-04	2.1884"+00	1.23237	0.94135	0.34659	0.52867	2.32663	0.28003
9	8.0772"-04	2.2356"+00	1.23226	0.94233	0.35204	0.53555	2.31435	0.28515
10	1.0312"-03	2.3544"+00	1.23203	0.94562	0.36524	0.55228	2.28643	0.29759
11	1.2624"-03	2.4655"+00	1.23170	0.94816	0.37704	0.56684	2.26019	0.30890
12	1.4961"-03	2.5630"+00	1.23102	0.95011	0.38703	0.57890	2.23730	0.31853
13	2.0041"-03	2.7866"+00	1.22944	0.95369	0.40881	0.60434	2.18537	0.33999
14	2.5121"-03	2.9560"+00	1.22787	0.95630	0.42444	0.62206	2.14796	0.35560
15	3.0201"-03	3.1451"+00	1.22629	0.95826	0.44114	0.64020	2.10609	0.37276
16	3.5281"-03	3.3105"+00	1.22449	0.96016	0.45519	0.65514	2.07147	0.38727
17	4.0361"-03	3.5243"+00	1.22269	0.96221	0.47266	0.67309	2.02792	0.40582
18	4.5441"-03	3.7236"+00	1.22088	0.96395	0.48834	0.68869	1.98883	0.42276
19	5.0521"-03	3.9416"+00	1.21784	0.96615	0.50490	0.70480	1.94863	0.44048
20	5.5601"-03	4.1615"+00	1.21469	0.96900	0.52103	0.72030	1.91122	0.45779
21	6.0681"-03	4.4386"+00	1.21153	0.97119	0.54063	0.73807	1.86376	0.47978
22	6.5761"-03	4.6779"+00	1.20782	0.97328	0.55698	0.75249	1.82524	0.49794
23	7.0841"-03	4.9752"+00	1.20342	0.97598	0.57662	0.76931	1.78001	0.52011
24	7.5921"-03	5.2623"+00	1.19914	0.97890	0.59495	0.78462	1.73925	0.54096
25	8.1001"-03	5.5930"+00	1.19441	0.98098	0.61549	0.80069	1.69[illegible]35	0.56510
26	8.6081"-03	5.8870"+00	1.18968	0.98338	0.63295	0.81412	1.65438	0.58544
27	9.1161"-03	6.2554"+00	1.18506	0.98574	0.65430	0.82971	1.60804	0.61147
28	9.6241"-03	6.5991"+00	1.17966	0.98793	0.67360	0.84328	1.56728	0.63472
29	1.0132"-02	6.9526"+00	1.17335	0.99018	0.69288	0.85638	1.52764	0.65777
30	1.0640"-02	7.3257"+00	1.16715	0.99209	0.71265	0.86915	1.48744	0.68200
31	1.1148"-02	7.7016"+00	1.16085	0.99421	0.73202	0.88131	1.44947	0.70582
32	1.1656"-02	8.1416"+00	1.15431	0.99629	0.75406	0.89445	1.40704	0.73380
33	1.2164"-02	8.5269"+00	1.14778	0.99759	0.77283	0.90501	1.37130	0.75749
34	1.2672"-02	8.8610"+00	1.14125	0.99946	0.78875	0.91401	1.34283	0.77680
35	1.3180"-02	9.3622"+00	1.13460	1.00154	0.81204	0.92640	1.30151	0.80760
36	1.3688"-02	9.7720"+00	1.12807	1.00234	0.83059	0.93549	1.26857	0.83189
37	1.4196"-02	1.0216"+01	1.11906	1.00302	0.85024	0.94468	1.23451	0.85634
38	1.4704"-02	1.0653"+01	1.10993	1.00356	0.86910	0.95312	1.20268	0.87962
39	1.5212"-02	1.1079"+01	1.10081	1.00400	0.88713	0.96084	1.17309	0.90164
40	1.5720"-02	1.1449"+01	1.09203	1.00436	0.90250	0.96721	1.14852	0.91963
41	1.6228"-02	1.1836"+01	1.08335	1.00477	0.91831	0.97357	1.12395	0.93040
42	1.6736"-02	1.2152"+01	1.07457	1.00431	0.93099	0.97814	1.10385	0.95219
43	1.7244"-02	1.2476"+01	1.06578	1.00369	0.94384	0.98257	1.08375	0.96627
44	1.7752"-02	1.2757"+01	1.05699	1.00323	0.95482	0.98629	1.06700	0.97704
45	1.8260"-02	1.3032"+01	1.04753	1.00253	0.96546	0.98968	1.05081	0.98660
46	1.8768"-02	1.3249"+01	1.03796	1.00216	0.97379	0.99237	1.03853	0.99183
47	1.9276"-02	1.3404"+01	1.02838	1.00156	0.97967	0.99406	1.02959	0.99290
48	1.9784"-02	1.3632"+01	1.01870	1.00127	0.98820	0.99680	1.01731	0.99816
49	2.0292"-02	1.3787"+01	1.00935	1.00035	0.99410	0.99826	1.00838	0.99922
D 50	2.0800"-02	1.3946"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
51	2.1308"-02	1.4019"+01	0.99054	0.99976	1.00272	1.00075	0.99609	0.99517
52	2.1816"-02	1.4168"+01	0.98051	0.99877	1.00824	1.00203	0.98772	0.99472
53	2.2324"-02	1.4272"+01	0.96959	0.99825	1.01205	1.00297	0.98213	0.99016
54	2.2832"-02	1.4409"+01	0.95866	0.99813	1.01705	1.00448	0.97543	0.98721
55	2.3340"-02	1.4483"+01	0.94762	0.99776	1.01976	1.00514	0.97152	0.98041
56	2.3848"-02	1.4560"+01	0.93670	0.99722	1.02278	1.00580	0.96706	0.97422
57	2.4356"-02	1.4678"+01	0.92577	0.99745	1.02684	1.00710	0.96203	0.96920
58	2.4864"-02	1.4733"+01	0.91485	0.99776	1.02881	1.00792	0.95980	0.96071
59	2.5372"-02	1.4869"+01	0.90392	0.99733	1.03372	1.00919	0.95310	0.95711
60	2.5880"-02	1.4912"+01	0.89288	0.99706	1.03527	1.00952	0.95087	0.94796
61	2.6388"-02	1.4985"+01	0.88196	0.99700	1.03788	1.01027	0.94752	0.94037
62	2.6896"-02	1.5057"+01	0.87171	0.99689	1.04044	1.01098	0.94417	0.93339
63	2.7404"-02	1.5126"+01	0.86236	0.99664	1.04292	1.01159	0.94082	0.92723
64	2.7912"-02	1.5189"+01	0.85289	0.99721	1.04514	1.01253	0.93858	0.92010
65	2.8420"-02	1.5265"+01	0.84355	0.99786	1.04786	1.01366	0.93579	0.91374
66	2.8928"-02	1.5374"+01	0.83273	0.99759	1.05171	1.01465	0.93076	0.90779

INPUT VARIABLES Y,U,T,P

71010205 STUREK PROFILE TABULATION 64 POINTS, DELTA AT POINT 47

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.21230	0.94360	0.00000	0.00000	2.82927	0.00000
2	1.2192"-04	1.5841"+00	1.21204	0.94234	0.26512	0.41730	2.47751	0.20415
3	1.6256"-04	1.6940"+00	1.21204	0.94229	0.28518	0.44458	2.43035	0.22172
4	2.0320"-04	1.7671"+00	1.21194	0.94183	0.29732	0.46060	2.40000	0.23259
5	3.2512"-04	1.8967"+00	1.21165	0.94045	0.31690	0.48565	2.34851	0.25056
6	4.7752"-04	2.0239"+00	1.21145	0.94153	0.33423	0.50775	2.30786	0.26653
7	5.3848"-04	2.0875"+00	1.21125	0.94218	0.34236	0.51797	2.28889	0.27410
8	8.0264"-04	2.2451"+00	1.21076	0.94505	0.36138	0.54173	2.24715	0.29188
9	1.0160"-03	2.3502"+00	1.21037	0.94849	0.37333	0.55680	2.22439	0.30297
10	1.5240"-03	2.5695"+00	1.20949	0.95338	0.39676	0.58508	2.17453	0.32542
11	2.0320"-03	2.7459"+00	1.20704	0.95739	0.41443	0.60585	2.13713	0.34218
12	2.5400"-03	2.9187"+00	1.20469	0.95916	0.43092	0.62410	2.09756	0.35844
13	3.0480"-03	3.0958"+00	1.20233	0.96104	0.44708	0.64154	2.05908	0.37461
14	3.5560"-03	3.2745"+00	1.19988	0.96254	0.46276	0.65789	2.02114	0.39057
15	4.0640"-03	3.4570"+00	1.19675	0.96444	0.47817	0.67367	1.98482	0.40619
16	4.5720"-03	3.6394"+00	1.19361	0.96611	0.49306	0.68845	1.94959	0.42149
17	5.0800"-03	3.8220"+00	1.19037	0.96790	0.50750	0.70247	1.91599	0.43643
18	5.5880"-03	4.0439"+00	1.18724	0.97037	0.52446	0.71863	1.87751	0.45442
19	6.0960"-03	4.2921"+00	1.18410	0.97271	0.54277	0.73541	1.83577	0.47435
20	6.6040"-03	4.6025"+00	1.18086	0.97474	0.56480	0.75456	1.78482	0.49923
21	7.1120"-03	4.8987"+00	1.17616	0.97742	0.58501	0.77177	1.74038	0.52157
22	7.6200"-03	5.1714"+00	1.17136	0.97942	0.60300	0.78641	1.70081	0.54160
23	8.1280"-03	5.4708"+00	1.16655	0.98291	0.62213	0.80200	1.66179	0.56299
24	8.6360"-03	5.8367"+00	1.16185	0.98515	0.64472	0.81896	1.61355	0.58970
25	9.1440"-03	6.1529"+00	1.15704	0.98726	0.66361	0.83270	1.57453	0.61191
26	9.6520"-03	6.5125"+00	1.15234	0.98979	0.68445	0.84739	1.53279	0.63706
27	1.0160"-02	6.8861"+00	1.14753	0.99218	0.70543	0.86155	1.49160	0.66282
28	1.0668"-02	7.3096"+00	1.14185	0.99448	0.72847	0.87633	1.44715	0.69145
29	1.1176"-02	7.6862"+00	1.13616	0.99637	0.74836	0.88855	1.40976	0.71610
30	1.1684"-02	8.0631"+00	1.13038	0.99839	0.76774	0.90010	1.37453	0.74022
31	1.2192"-02	8.4461"+00	1.12469	1.00026	0.78694	0.91107	1.34038	0.76447
32	1.2700"-02	8.8924"+00	1.11901	1.00171	0.80873	0.92277	1.30190	0.79314
33	1.3208"-02	9.3417"+00	1.11185	1.00372	0.83009	0.93403	1.26612	0.82022
34	1.3716"-02	9.7817"+00	1.10470	1.00435	0.85048	0.94377	1.23144	0.84664
35	1.4224"-02	1.0152"+01	1.09754	1.00491	0.86725	0.95152	1.20379	0.86753
36	1.4732"-02	1.0612"+01	1.09038	1.00527	0.88766	0.96046	1.17073	0.89454
37	1.5240"-02	1.0992"+01	1.08333	1.00502	0.90417	0.96716	1.14417	0.91572
38	1.5748"-02	1.1379"+01	1.07578	1.00514	0.92070	0.97381	1.11870	0.93645
39	1.6256"-02	1.1681"+01	1.06823	1.00481	0.93337	0.97856	1.09919	0.95100
40	1.6764"-02	1.1967"+01	1.06068	1.00401	0.94523	0.98265	1.08076	0.96440
41	1.7272"-02	1.2235"+01	1.05313	1.00315	0.95616	0.98626	1.06396	0.97623
42	1.7780"-02	1.2417"+01	1.04558	1.00235	0.96354	0.98855	1.05257	0.98198
43	1.8288"-02	1.2644"+01	1.03804	1.00222	0.97267	0.99173	1.03957	0.99027
44	1.8796"-02	1.2873"+01	1.02853	1.00135	0.98180	0.99449	1.02602	0.99692
45	1.9304"-02	1.3044"+01	1.01902	1.00081	0.98853	0.99653	1.01626	0.99923
46	1.9812"-02	1.3147"+01	1.00951	1.00033	0.99257	0.99767	1.01030	0.99689
D 47	2.0320"-02	1.3337"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
48	2.0828"-02	1.3440"+01	0.99039	0.99934	1.00400	1.00100	0.99404	0.99733
49	2.1336"-02	1.3526"+01	0.98088	0.99886	1.00733	1.00185	0.98916	0.99347
50	2.1844"-02	1.3659"+01	0.97138	0.99854	1.01247	1.00337	0.98211	0.99240
51	2.2352"-02	1.3721"+01	0.96187	0.99835	1.01482	1.00404	0.97886	0.98661
52	2.2860"-02	1.3809"+01	0.95236	0.99836	1.01819	1.00513	0.97453	0.98227
53	2.3368"-02	1.3886"+01	0.94187	0.99781	1.02113	1.00580	0.97019	0.97644
54	2.3876"-02	1.3960"+01	0.93138	0.99819	1.02396	1.00689	0.96694	0.96986
55	2.4384"-02	1.4013"+01	0.92089	0.99805	1.02598	1.00746	0.96423	0.96218
56	2.4892"-02	1.4083"+01	0.91040	0.99762	1.02863	1.00808	0.96043	0.95557
57	2.5400"-02	1.4149"+01	0.90001	0.99806	1.03111	1.00908	0.95772	0.94827
58	2.5908"-02	1.4214"+01	0.88952	0.99843	1.03354	1.01003	0.95501	0.94076
59	2.6416"-02	1.4267"+01	0.87903	0.99823	1.03555	1.01055	0.95230	0.93280
60	2.6924"-02	1.4319"+01	0.86854	0.99910	1.03751	1.01160	0.95068	0.92420
61	2.7432"-02	1.4363"+01	0.85805	0.99726	1.03914	1.01117	0.94688	0.91631
62	2.7940"-02	1.4436"+01	0.84756	0.99739	1.04186	1.01207	0.94363	0.90904
63	2.8448"-02	1.4522"+01	0.83492	0.99817	1.04508	1.01345	0.94038	0.89979
64	2.8956"-02	1.4627"+01	0.82217	0.99751	1.04899	1.01431	0.93496	0.89195

INPUT VARIABLES Y,U,T,P

71010206 STUREK PROFILE TABULATION 65 POINTS, DELTA AT POINT 44

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.18416	0.94457	0.00000	0.00000	2.72158	0.00000
2	1.9304"-04	1.6511"+00	1.18370	0.94201	0.28615	0.43884	2.35193	0.22086
3	2.5400"-04	1.7926"+00	1.18353	0.94174	0.31058	0.47068	2.29666	0.24255
4	3.7846"-04	1.9231"+00	0.32966	0.94252	0.33045	0.49599	2.25287	0.07258
5	5.4102"-04	2.0322"+00	1.18284	0.94449	0.34558	0.51515	2.22211	0.27422
6	6.7310"-04	2.1310"+00	1.18250	0.94570	0.35842	0.53095	2.19447	0.28611
7	8.7884"-04	2.2407"+00	1.18199	0.94821	0.37193	0.54762	2.16788	0.29858
8	1.1328"-03	2.3725"+00	1.18122	0.95152	0.38732	0.56635	2.13816	0.31288
9	1.6408"-03	2.5621"+00	1.17909	0.95704	0.40813	0.59137	2.09958	0.33210
10	2.1488"-03	2.7526"+00	1.17695	0.96061	0.42780	0.61385	2.05892	0.35090
11	2.6568"-03	2.9118"+00	1.17465	0.96209	0.44345	0.63081	2.02346	0.36619
12	3.1648"-03	3.0713"+00	1.17226	0.96363	0.45852	0.64675	1.98957	0.38107
13	3.6728"-03	3.2419"+00	1.16987	0.96518	0.47404	0.66274	1.95464	0.39666
14	4.1808"-03	3.4273"+00	1.16679	0.96677	0.49028	0.67903	1.91614	0.41305
15	4.6888"-03	3.6242"+00	1.16347	0.96796	0.50692	0.69507	1.88008	0.43013
16	5.1968"-03	3.8336"+00	1.16014	0.96979	0.52398	0.71125	1.84254	0.44783
17	5.7048"-03	4.0449"+00	1.15689	0.97146	0.54061	0.72653	1.80605	0.46539
18	6.2128"-03	4.2801"+00	1.15356	0.97341	0.55851	0.74252	1.76747	0.48462
19	6.7208"-03	4.5605"+00	1.15023	0.97565	0.57910	0.76029	1.72367	0.50735
20	7.2288"-03	4.7985"+00	1.14691	0.97866	0.59598	0.77484	1.69030	0.52575
21	7.7368"-03	5.1263"+00	1.14341	0.98109	0.61845	0.79295	1.64390	0.55153
22	8.2448"-03	5.4398"+00	1.13922	0.98316	0.63919	0.80894	1.60167	0.57538
23	8.7528"-03	5.7897"+00	1.13478	0.98585	0.66154	0.82570	1.55787	0.60146
24	9.2608"-03	6.1241"+00	1.12924	0.98829	0.68220	0.84059	1.51825	0.62521
25	9.7688"-03	6.5085"+00	1.12377	0.99084	0.70519	0.85644	1.47497	0.65252
26	1.0277"-02	6.8402"+00	1.11822	0.99287	0.72443	0.86917	1.43952	0.67517
27	1.0785"-02	7.2902"+00	1.11268	0.99516	0.74972	0.88507	1.39364	0.70663
28	1.1293"-02	7.7299"+00	1.10713	0.99753	0.77363	0.89952	1.35193	0.73664
29	1.1801"-02	8.1248"+00	1.10166	0.99948	0.79449	0.91158	1.31648	0.76284
30	1.2309"-02	8.6001"+00	1.09612	1.00137	0.81887	0.92493	1.27581	0.79466
31	1.2817"-02	9.0026"+00	1.09057	1.00305	0.83897	0.93555	1.24348	0.82050
32	1.3325"-02	9.4555"+00	1.08485	1.00444	0.86101	0.94654	1.20855	0.84966
33	1.3833"-02	9.8766"+00	1.07862	1.00522	0.88101	0.95591	1.17727	0.87581
34	1.4341"-02	1.0279"+01	1.07247	1.00617	0.89971	0.96446	1.14911	0.90013
35	1.4849"-02	1.0615"+01	1.06624	1.00603	0.91501	0.97080	1.12565	0.91956
36	1.5357"-02	1.0954"+01	1.05975	1.00571	0.93020	0.97680	1.10271	0.93875
37	1.5865"-02	1.1308"+01	1.05224	1.00543	0.94581	0.98281	1.07977	0.95775
38	1.6373"-02	1.1587"+01	1.04481	1.00489	0.95791	0.98718	1.06204	0.97116
39	1.6881"-02	1.1828"+01	1.03730	1.00424	0.96827	0.99073	1.04692	0.98163
40	1.7389"-02	1.2079"+01	1.02988	1.00317	0.97890	0.99409	1.03176	0.99274
41	1.7897"-02	1.2203"+01	1.02236	1.00245	0.98415	0.99563	1.02346	0.99456
42	1.8405"-02	1.2357"+01	1.01494	1.00169	0.99060	0.99755	1.01406	0.99840
43	1.8913"-02	1.2471"+01	1.00751	1.00115	0.99532	0.99894	1.00730	0.99915
D 44	1.9421"-02	1.2584"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
45	1.9929"-02	1.2635"+01	0.99257	1.00016	1.00212	1.00082	0.99739	0.99598
46	2.0437"-02	1.2717"+01	0.98472	0.99985	1.00550	1.00183	0.99270	0.99377
47	2.0945"-02	1.2789"+01	0.97559	0.99947	1.00844	1.00264	0.98853	0.98951
48	2.1453"-02	1.3421"+01	0.96645	0.98469	1.03402	1.00365	0.94213	1.02956
49	2.1961"-02	1.2926"+01	0.95732	0.99933	1.01403	1.00447	0.98123	0.97999
50	2.2469"-02	1.2995"+01	0.94819	0.99926	1.01684	1.00538	0.97758	0.97515
51	2.2977"-02	1.3050"+01	0.93897	0.99949	1.01908	1.00624	0.97497	0.96908
52	2.3485"-02	1.3112"+01	0.92949	0.99954	1.02159	1.00711	0.97185	0.96322
53	2.3993"-02	1.3146"+01	0.91993	0.99915	1.02378	1.00764	0.96872	0.95689
54	2.4501"-02	1.3234"+01	0.91037	0.99946	1.02651	1.00869	0.96554	0.95101
55	2.5009"-02	1.3304"+01	0.90081	0.99933	1.02934	1.00956	0.96194	0.94540
56	2.5517"-02	1.3367"+01	0.89117	0.99988	1.03186	1.01066	0.95933	0.93885
57	2.6025"-02	1.3437"+01	0.88118	0.99969	1.03467	1.01148	0.95568	0.93262
58	2.6533"-02	1.3509"+01	0.87119	0.99957	1.03753	1.01234	0.95203	0.92638
59	2.7041"-02	1.3577"+01	0.86112	0.99976	1.04023	1.01330	0.94891	0.91956
60	2.7549"-02	1.3646"+01	0.85113	1.00000	1.04298	1.01431	0.94576	0.91281
61	2.8057"-02	1.3726"+01	0.84114	0.99964	1.04613	1.01513	0.94161	0.90682
62	2.8565"-02	1.3792"+01	0.83090	1.00076	1.04873	1.01652	0.93952	0.89900
63	2.9073"-02	1.3884"+01	0.82015	1.00097	1.05236	1.01777	0.93535	0.89241
64	2.9581"-02	1.3954"+01	0.80939	1.00004	1.05511	1.01815	0.93118	0.88499
65	3.0089"-02	1.4033"+01	0.79855	0.99892	1.05818	1.01854	0.92649	0.87789

INPUT VARIABLES Y,U,T,P

71010207 STUREK PROFILE TABULATION 60 POINTS, DELTA AT POINT 47

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.17665	0.94310	0.00000	0.00000	2.63503	0.00000
2	1.2192"-04	1.5310"+00	1.17637	0.94415	0.26858	0.41047	2.33569	0.20674
3	2.6670"-04	1.8742"+00	1.17600	0.94388	0.33103	0.49143	2.20394	0.26222
4	4.1148"-04	1.9664"+00	1.17562	0.94379	0.34468	0.50818	2.17365	0.27485
5	6.0706"-04	2.1462"+00	1.17510	0.94732	0.36900	0.53818	2.12721	0.29730
6	8.5344"-04	2.3112"+00	1.17450	0.95054	0.38941	0.56267	2.08783	0.31653
7	1.0490"-03	2.4364"+00	1.17390	0.95505	0.40397	0.58038	2.06411	0.33007
8	1.3691"-03	2.5441"+00	1.17240	0.95816	0.41598	0.59456	2.04291	0.34121
9	1.5215"-03	2.5909"+00	1.17165	0.95969	0.42106	0.60056	2.03435	0.34589
10	1.8923"-03	2.6945"+00	1.16984	0.96231	0.43207	0.61319	2.01413	0.35615
11	2.1463"-03	2.7722"+00	1.16864	0.96406	0.44010	0.62224	1.99899	0.36377
12	2.4003"-03	2.8577"+00	1.16744	0.96556	0.44874	0.63173	1.98183	0.37213
13	2.6543"-03	2.9282"+00	1.16617	0.96666	0.45573	0.63928	1.96769	0.37887
14	2.9083"-03	3.0039"+00	1.16497	0.96717	0.46329	0.64712	1.95103	0.38639
15	3.1623"-03	3.0846"+00	1.16376	0.96764	0.47081	0.65481	1.93438	0.39395
16	3.4163"-03	3.1634"+00	1.16256	0.96794	0.47820	0.66221	1.91772	0.40145
17	3.6703"-03	3.2414"+00	1.16129	0.96677	0.48539	0.66952	1.90257	0.40866
18	4.1783"-03	3.3335"+00	1.16009	0.96991	0.49373	0.67794	1.88541	0.41714
19	4.4323"-03	3.5211"+00	1.15678	0.96986	0.51026	0.69348	1.84705	0.43432
20	4.9403"-03	3.7076"+00	1.15311	0.97207	0.52614	0.70877	1.81474	0.45036
21	5.4483"-03	3.9265"+00	1.14853	0.97322	0.54414	0.72513	1.77587	0.46897
22	5.9563"-03	4.1723"+00	1.14365	0.97513	0.56362	0.74250	1.73549	0.48929
23	6.4543"-03	4.4210"+00	1.13877	0.97704	0.58263	0.75890	1.69662	0.50938
24	6.9723"-03	4.7135"+00	1.13472	0.97860	0.60419	0.77662	1.65220	0.53338
25	7.4803"-03	4.9799"+00	1.13104	0.98091	0.62315	0.79201	1.61535	0.55455
26	7.9883"-03	5.3200"+00	1.12736	0.98355	0.64652	0.81020	1.57042	0.58162
27	6.4963"-03	5.5972"+00	1.12376	0.98539	0.66195	0.82414	1.53609	0.60292
28	9.0043"-03	5.9836"+00	1.11918	0.98861	0.68979	0.84204	1.49016	0.63242
29	9.5123"-03	6.3646"+00	1.11431	0.99095	0.71342	0.85826	1.44725	0.66081
30	1.0020"-02	6.7533"+00	1.10943	0.99348	0.73673	0.87369	1.40636	0.68922
31	1.0528"-02	7.1448"+00	1.10380	0.99554	0.75948	0.88797	1.36699	0.71701
32	1.1036"-02	7.5809"+00	1.09794	0.99768	0.78402	0.90268	1.32559	0.74766
33	1.1544"-02	8.0038"+00	1.09201	0.99952	0.80711	0.91589	1.28773	0.77669
34	1.2052"-02	8.4280"+00	1.08616	1.00130	0.82961	0.92823	1.25189	0.80535
35	1.2560"-02	8.8664"+00	1.08031	1.00317	0.85223	0.94019	1.21706	0.83454
36	1.3068"-02	9.3136"+00	1.07445	1.00435	0.87470	0.95127	1.18274	0.86418
37	1.3576"-02	9.7141"+00	1.06860	1.00521	0.89434	0.96051	1.15346	0.88985
38	1.4084"-02	1.0084"+01	1.06267	1.00601	0.91210	0.96859	1.12771	0.91273
39	1.4592"-02	1.0456"+01	1.05681	1.00634	0.92962	0.97609	1.10247	0.93567
40	1.5100"-02	1.0763"+01	1.05096	1.00593	0.94383	0.98166	1.08178	0.95369
41	1.5608"-02	1.1044"+01	1.04406	1.00518	0.95663	0.98635	1.06310	0.96868
42	1.6116"-02	1.1288"+01	1.03670	1.00461	0.96763	0.99032	1.04745	0.98016
43	1.6624"-02	1.1495"+01	.02935	1.00350	0.97689	0.99327	1.03382	0.98897
44	1.7132"-02	1.1654"+01	1.02199	1.00224	0.98390	0.99526	1.02322	0.99406
45	1.7640"-02	1.1807"+01	1.01464	1.00146	0.99061	0.99734	1.01363	0.99033
46	1.8148"-02	1.1915"+01	1.00736	1.00055	0.99534	0.99860	1.00656	0.99938
D 47	1.8656"-02	1.2022"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
48	1.9164"-02	1.2071"+01	0.99264	0.99966	1.00210	1.00058	0.99697	0.99624
49	1.9672"-02	1.2139"+01	0.98529	0.99989	1.00505	1.00174	0.99344	0.99333
50	2.0180"-02	1.2177"+01	0.97891	0.99982	1.00666	1.00208	0.99091	0.98903
51	2.0688"-02	1.2237"+01	0.97013	0.99916	1.00924	1.00286	0.90738	0.98533
52	2.1196"-02	1.2283"+01	0.96202	0.99968	1.01125	1.00382	0.98536	0.98005
53	2.1704"-02	1.2334"+01	0.95399	1.00039	1.01341	1.00494	0.98334	0.97494
54	2.2212"-02	1.2372"+01	0.94589	1.00042	1.01504	1.00552	0.98132	0.96921
55	2.2720"-02	1.2413"+01	0.93786	1.00008	1.01679	1.00595	0.97880	0.96387
56	2.3228"-02	1.2463"+01	0.92923	0.99968	1.01890	1.00648	0.97577	0.95848
57	2.3736"-02	1.2512"+01	0.92044	1.00027	1.02099	1.00750	0.97375	0.95235
58	2.4244"-02	1.2554"+01	0.91159	1.00049	1.02279	1.00823	0.97173	0.94582
59	2.4752"-02	1.2612"+01	0.90271	1.00047	1.02522	1.00905	0.96670	0.94041
60	2.5260"-02	1.2660"+01	0.89403	1.00045	1.02725	1.00973	0.96618	0.93432

INPUT VARIABLES Y,U,T,P

71010208 STUREK PROFILE TABULATION 60 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.13924	0.94297	0.00000	0.00000	2.53891	0.00000
2	2.6924"-04	1.9872"+00	1.13869	0.94409	0.35792	0.51731	2.08901	0.28198
3	3.3020"-04	2.0610"+00	1.13855	0.94340	0.36837	0.52944	2.06566	0.29182
4	5.8928"-04	2.2777"+00	1.13802	0.94485	0.39678	0.56235	2.00875	0.31859
5	6.7310"-04	2.3651"+00	1.13789	0.94622	0.40746	0.57463	1.98881	0.32877
6	8.1788"-04	2.4536"+00	1.13756	0.95045	0.41791	0.58734	1.97519	0.33827
7	1.0744"-03	2.5778"+00	1.13710	0.95492	0.43206	0.60392	1.95379	0.35148
8	1.3233"-03	2.6584"+00	1.13644	0.95915	0.44093	0.61463	1.94309	0.35947
9	1.5824"-03	2.7579"+00	1.13511	0.96203	0.45160	0.62666	1.92558	0.36941
10	1.7780"-03	2.8394"+00	1.13412	0.96432	0.46012	0.63615	1.91148	0.37744
11	2.2860"-03	2.9956"+00	1.13154	0.96764	0.47596	0.65317	1.88327	0.39245
12	2.7940"-03	3.1336"+00	1.12929	0.96937	0.48947	0.66701	1.85700	0.40562
13	3.3020"-03	3.2806"+00	1.12737	0.97005	0.50342	0.68060	1.82782	0.41978
14	3.8100"-03	3.4466"+00	1.12545	0.97086	0.51867	0.69513	1.79621	0.43555
15	4.3180"-03	3.6229"+00	1.12267	0.97181	0.53434	0.70970	1.76411	0.45165
16	4.8260"-03	3.8186"+00	1.11989	0.97293	0.55117	0.72496	1.73006	0.46928
17	5.3340"-03	4.0152"+00	1.11717	0.97415	0.56754	0.73944	1.69747	0.48665
18	5.8420"-03	4.2513"+00	1.11419	0.97590	0.58657	0.75553	1.65905	0.50740
19	6.3500"-03	4.4950"+00	1.11095	0.97693	0.60555	0.77147	1.62305	0.52806
20	6.8580"-03	4.7432"+00	1.10771	0.97822	0.62426	0.78643	1.58706	0.54890
21	7.3660"-03	5.0470"+00	1.10400	0.98162	0.64640	0.80428	1.54815	0.57354
22	7.8740"-03	5.3474"+00	1.09970	0.98329	0.66754	0.82008	1.50924	0.59754
23	8.3820"-03	5.6590"+00	1.09539	0.98585	0.68877	0.83573	1.47228	0.62179
24	8.8900"-03	5.9917"+00	1.09109	0.98747	0.71071	0.85089	1.43337	0.64770
25	9.3980"-03	6.3695"+00	1.08685	0.99017	0.73482	0.86727	1.39300	0.67667
26	9.9060"-03	6.7365"+00	1.08255	0.99274	0.75749	0.88209	1.35603	0.70419
27	1.0414"-02	7.0821"+00	1.07798	0.99464	0.77823	0.89495	1.32247	0.72950
28	1.0922"-02	7.5164"+00	1.07315	0.99651	0.80352	0.90982	1.28210	0.76154
29	1.1430"-02	7.9278"+00	1.06832	0.99860	0.82675	0.92307	1.24660	0.79106
30	1.1938"-02	8.3755"+00	1.06355	1.00071	0.85130	0.93647	1.21012	0.82305
31	1.2446"-02	8.7626"+00	1.05845	1.00178	0.87197	0.94699	1.17947	0.84982
32	1.2954"-02	9.1130"+00	1.05309	1.00368	0.89025	0.95643	1.15418	0.87266
33	1.3462"-02	9.5334"+00	1.04773	1.00477	0.91171	0.96660	1.12403	0.90099
34	.3970"-02	9.8873"+00	1.04237	1.00553	0.92939	0.97462	1.09971	0.92380
35	1.4478"-02	1.0217"+01	1.03701	1.00515	0.94556	0.98122	1.07685	0.94492
36	1.4986"-02	1.0504"+01	1.03164	1.00501	0.95942	0.98680	1.05788	0.96232
37	1.5494"-02	1.0719"+01	1.02575	1.00408	0.96965	0.99041	1.04329	0.97377
38	1.6002"-02	1.0959"+01	1.01933	1.00337	0.98097	0.99447	1.02772	0.98635
39	1.6510"-02	1.1142"+01	1.01284	1.00222	0.98949	0.99716	1.01556	0.99449
40	1.7018"-02	1.1260"+01	1.00642	1.00142	0.99496	0.99883	1.00778	0.99748
D 41	1.7526"-02	1.1369"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
42	1.8034"-02	1.1443"+01	0.99325	0.99985	1.00337	1.00117	0.99562	0.99879
43	1.8542"-02	1.1493"+01	0.98610	0.99884	1.00568	1.00152	0.99173	0.99583
44	1.9050"-02	1.1548"+01	0.97895	0.99850	1.00815	1.00225	0.98833	0.99274
45	1.9558"-02	1.1586"+01	0.97180	0.99870	1.00988	1.00298	0.98638	0.98816
46	2.0066"-02	1.1618"+01	0.96465	0.99908	1.01137	1.00372	0.98492	0.98306
47	2.0574"-02	1.1645"+01	0.95657	0.99861	1.01257	1.00391	0.98298	0.97695
48	2.1082"-02	1.1691"+01	0.94856	0.99826	1.01467	1.00450	0.98006	0.97222
49	2.1590"-02	1.1724"+01	0.94055	0.99865	1.01616	1.00523	0.97860	0.96615
50	2.2098"-02	1.1764"+01	0.93248	0.99842	1.01797	1.00577	0.97617	0.96076
51	2.2606"-02	1.1801"+01	0.92447	0.99900	1.01963	1.00665	0.97471	0.95476
52	2.3114"-02	1.1844"+01	0.91639	0.99841	1.02155	1.00704	0.97179	0.94963
53	2.3622"-02	1.1901"+01	0.90838	0.99862	1.02414	1.00807	0.96887	0.94513
54	2.4130"-02	1.1918"+01	0.90030	0.99906	1.02489	1.00856	0.96839	0.93765
55	2.4638"-02	1.1978"+01	0.89117	0.99892	1.02759	1.00944	0.96498	0.93223
56	2.5146"-02	1.2040"+01	0.88197	0.99901	1.03033	1.01086	0.96255	0.92623
57	2.5654"-02	1.2161"+01	0.87277	1.00016	1.03305	1.01198	0.95963	0.92038
58	2.6162"-02	1.2160"+01	0.86390	0.99885	1.03566	1.01223	0.95525	0.91542
59	2.6670"-02	1.2219"+01	0.85529	0.99956	1.03829	1.01350	0.95282	0.90976
60	2.7178"-02	1.2266"+01	0.84675	1.00113	1.04037	1.01501	0.95185	0.90294

INPUT VARIABLES Y,U,T,P

SECTION D, ADDITIONAL DATA, TABLE 1, RAW PRESTON TUBE DATA
FACSIMILE FROM SOURCE PAPER. NB - AUTHORS SYMBOLS AND UNITS.

Run	T_w, °R	p_w/p_o	p_s/p_o	p_o, psia	τ_w, psf	CAT 7101 RUN SERIAL
06200	523	.01253	.03877	38.674	.64902	0101
06250	522	.01252	.04023	48.342	.78759	0201
06300	521	.01250	.04165	58.011	.92721	0301
08200	523	.01245	.03954	38.674	.66722	0102
08250	522	.01239	.04074	48.342	.80412	0202
08300	521	.01238	.04224	58.011	.94751	0302
10200	523	.01257	.03899	38.674	.65237	0103
10250	522	.01254	.04058	48.342	.79518	0203
10300	521	.01253	.04191	58.011	.92982	0303
117203	523	.02253	.05488	38.674	.70073	0104
117253	522	.02253	.05759	48.342	.86879	0204
117303	521	.02247	.05987	58.011	1.03496	0304
118203	523	.02540	.06162	38.674	.75468	0105
118253	522	.02546	.06422	48.342	.92550	0205
118303	521	.02554	.06708	58.011	1.10573	0305
119203	523	.02847	.06838	38.674	.81120	0106
119253	522	.02856	.07233	48.342	1.00475	0206
119303	521	.02869	.07578	58.011	1.20397	0306
120201	523	.03190	.07755	38.674	.88108	0107
120250	522	.03207	.08195	48.342	1.09889	0207
120300	521	.03228	.08567	58.011	1.31077	0307
121201	523	.03530	.08970	38.674	1.00266	0108
121251	522	.03543	.09501	48.342	1.25435	0208
121301	521	.03564	.10044	58.011	1.51514	0308

Preston tube diameter: 3.18 mm.
Preston tube pressure reading: p_s
Wall shear τ_w from Yanta, Brott and Lee (1969)
NOTE: Reservoir conditions are not identical with those of the profile runs.

SECTION D, ADDITIONAL DATA, TABLE 2, REDUCED HOT-WIRE OBSERVATIONS

FACSIMILE FROM TABLES SUPPLIED BY AUTHORS. NB. AUTHORS SYMBOLS AND UNITS.

TABULATED FLUCTUATION DATA
(UNPUBLISHED)

7101 0202

STA 08250 dp/dx = 0

$$A = \frac{1}{2}\frac{T_{re} + T_e}{T_{re} - T_e}\cdot\frac{\Delta T}{T}$$

y/δ	$\frac{\Delta u}{u}$	$\frac{\Delta u}{u_\tau}$	$\frac{\Delta(\rho u)}{(\rho u)}$	$\frac{\Delta T_t}{T_{re}-T_e}$	A	$R_{\rho u T_t}$	R_{uT}
.044	.0466	.670	.0862	.0159	.0367	-.092	-.923
.089	.0520	.836	.1023	.0215	.0502	.171	-.920
.200	.0393	.705	.0922	.0243	.0543	.002	[illegible]
.312	.0304	.589	.0891	.0241	.0500	-.143	-.873
.423	.0231	.477	.0852	.0214	.0620	-.343	[illegible]
.534	.0204	.441	.0822	.0212	.0632	-.326	-.853
.645	.0122	.274	.0694	.0165	.0563	-.550	-.855
.756	.0092	.213	.0551	.0131	.0457	-.482	-.850
.868	.0042	.098	.0324	.0077	.0235	-.823	-.656
.979	.0027	.064	.0194	.0049	.0178	-.946	[illegible]
1.090	.0012	.028	.0123	.0035	.0113	-.895	-.755
1.201	.0016	.039	.0101	.0030	.0089	-.492	[illegible]

δ = 22.8 mm

7101 0205

STA 118250

$$A = \frac{1}{2}\frac{T_{re} + T_e}{T_{re} - T_e}\cdot\frac{\Delta T}{T}$$

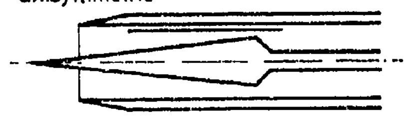
$$\frac{dp}{dx}\,\frac{\theta}{\tau_W} = 1.36$$

y/δ	$\frac{\Delta u}{u}$	$\frac{\Delta u}{u_\tau}$	$\frac{\Delta(\rho u)}{(\rho u)}$	$\frac{\Delta T_t}{T_{re}-T_e}$	A	R_{mT_t}	R_{uT}
.051	.072	1.234	.114	.0237	.0387	.051	-.862
.102	.073	1.369	.125	.0255	.0490	.053	-.806
.204	.074	1.533	.140	.0308	.0699	.115	-.920
.306	.061	1.389	.133	.0305	.0774	-.046	[illegible]
.408	.046	1.139	.126	.0356	.0858	-.315	-.664
.510	.039	1.039	.119	.0369	.0883	-.249	-.843
.611	.029	.824	.112	.0319	.0913	-.479	-.860
.739	.018	.467	.080	.0252	.0694	-.554	-.805
.841	.008	.243	.048	.0184	.0437	-.507	[illegible]
.943	.002	.059	.019	.0092	.0199	-1.122	[illegible]
1.045	.002	.060	.010	.0054	.0099	-.480	-.302
1.121	.003	.091	.012	.0043	.0112	-.237	-.721

δ = 19.9 mm

T_{re} = wire recovery temperature at edge of boundary-layer

T_e = static temperature at edge of boundary-layer

axisymmetric 	M : 4 (ZPG-Series 01) : 4 falling to 2 (02) - followed by recovery : 4 (03) recovery after step-induced separation R THETA X 10^{-3} : 10 - 60 TW / TR : 1.0	7102 ZPG - APG Recovery AW

Blow-down wind-tunnel with 12 seconds running time. W = H = 1.5 m.
PO : 1.16 MN/m^2. TO : 298 K. Air: absolute humidity 2 x 10^{-4}. RE/m X 10^{-6} : 50 at M = 4.

PEAKE D.J., BRAKMANN G. and ROMESKIE J.M., 1971. Comparisons between some high Reynolds number turbulent boundary layer experiments at Mach 4 and various recent calculation procedures. AGARD-CP-93-71 paper 11. And Peake D.J., private communications.

1 The test boundary layer was formed on the inner surface of a cylinder (D = 0.229, L = 0.838 m) mounted on the centre-line of the wind tunnel. The exterior of the leading edge (X = 0) was chamfered at 14° (E). A retractable centre body could be placed so as to cause a streamwise pressure gradient. Three cases were studied:

Series 01: Centre-body retracted. ZPG

Series 02: Centrebody forward. APG followed by recovery as tabulated in sections B and D.

Series 03: Centrebody retracted and a ring of rectangular cross section (height 3.8 and length 12.3 mm) mounted at X = 0.254 m , giving a test boundary layer recovering in nearly constant pressure from the disturbance of flowing up and down a step ("RPG").

Traversing probes could be inserted at six X stations such that in the APG case, one was just before the start of the pressure gradient, two during it and three in the constant pressure recovery region which followed. In the RPG case the last survey station was after a second disturbance caused by the shock structure of the ring, transmitted across the duct. The test duct was not actively cooled, but received some preliminary cooling due to "Canadian winter air reaching the model from the exhaust area". Measurements indicated that the surface temperature resulting was close to the recovery temperature. The surface roughness was close to 0.25 μm rms., with waviness less than 2 x 10^{-4} m/m.

2 Mach number variation in the ZPG case was less than 0.02. The authors calculate, on the basis of acoustic
measurements, that turbulent velocity fluctuations are probably less than 0.1 %. No trips were used and
3 Preston tube readings (Section D) showed that natural transition occured between X = 50 and 165 mm. The
flow was therefore fully turbulent before being perturbed in the RPG case. Oil dot flow visualisation
5 confirmed these conclusions. Incidence and yaw of the model were less than 10' wind off. The maximum
eccentricity of the centrebody was within ± 0.013 mm. Circumferential Mach number variations were less
than 0.03 as determined from static pressure surveys at X = 299 and 552 mm. Oil dot streak-lines showed
no perceptible convergence and boundary layer yaw measurements at X = 422 and 804 mm showed a maximum yaw
very close to the wall of order 1° relative to a generator and 1.5° relative to the free stream.

6 Seventy static holes of 1.016 mm diameter were drilled normal to the surface from X = 6.3 to 831.8 mm at 12.7 mm intervals. At two stations (X = 299, 552 mm) three additional holes gave a check on two-dimensionality. An iron-constantan thermocouple bead was attached to a thin plate mounted in the duct surface at X = 426 mm, and this thin plate achieved an equilibrium temperature during the run. Small Preston tubes (d_1 = 0.406, d_2 = 0.203, l = 5.54 mm) could be mounted in each static hole and ten Preston tube readings were collected in any one run. Four calibration relationships were used to give the results presented in section D.

7 A single combined Pitot, yaw and equilibrium temperature probe was employed. The unshielded thermocouple
did not function. The face normal to the flow was 0.305 mm high (h_1) and 0.71 mm (b_1) wide, the opening
being 0.127 (∿ h_2) by 0.508 mm (b_2) and the lower lip 0.102 mm thick. The two side tubes were chamfered
at 45° and a servo-mechanism kept the probe aligned with the local flow direction. In section the top
8 surface was inclined at 7.5° to the axis. The six ports for the probe allowed traverses at X = 295, 422,

523, 574, 676 and 803 mm. Static pressure holes were 9.4 mm ahead of and 3.3 mm behind each traverse normal. The face of a Preston tube lay 5.5 mm ahead of the static hole in which the tube was mounted.

9 The authors have interpolated static pressure data to the X values of the Preston tube tips as presented in section D, and to those of the normals for the velocity profiles presented in sections B and C. The Crocco/Van Driest parabolic temperature-velocity distribution was assumed, as was constant static pressure
10 through the boundary layer. The Pitot data have been adjusted for the effects of shear and wall proximity by applying an outward displacement Δ of the effective probe centre given by $\Delta /h = 0.24 - 0.04\,((h/y) - 0.5)$, in which h is the overall height of the probe face and y is the height of the geometric centre. Static hole errors were assessed using a curve-fit to the hole size corrections of Franklin & Wallace (1970).
11 Sutherland's viscosity law was assumed.

12 The CF values presented with the profiles in sections B and C are interpolated from the measured values of section D, the editors having arbitrarily chosen those reduced with the calibration of Hopkins & Keener
13 (TR method), 1966. The data are presented with the author's recovery factor of 0.89. The three sequences
14 of profiles are distinguished by their different pressure histories. The very full static pressure and Preston tube data obtained by the authors is presented in facsimile in section D.

§ DATA: 7102 0101-0306. PT2 profiles. NX = 6. CF from Preston tubes.

15 <u>Editors' comments</u>
The axi-symmetric configuration eliminates end-effects, and δ /RZ at ~ 0.05 is small enough for there to be negligible distortion by axi-symmetry. The three sequences presented include the ZPG case, and ZPG regions in which the boundary layer recovers from a strong APG and from the severe disturbance of flowing over a rectangular fence.

The pressure gradient of series 02 is imposed as a reflected wave, so that in most of the test boundary layer there should be very little normal pressure gradient. However, profiles 01 and 03 are taken at stations which coincide with the start and finish of the longitudinal wall-pressure gradient. Consequently they are taken in regions traversed by simple waves, with the associated normal pressure gradients. The authors present data for profiles 02 (where there should be no significant $\delta p/\delta y$) and for 03, assuming a linear static pressure variation through the boundary layer given by

$$\delta p/\delta y = - \cot \mu \; \delta p/\delta x$$

where μ is the Mach angle at the boundary layer edge. This assumes a wave structure corresponding to that generated by a curved wall (as for Sturek & Danberg CAT 7101), with the isobars extrapolated into the boundary layer. A more detailed study of the wave structure suggests that the appropriate relationships are, while still assuming that the isobars may be extrapolated,

0201 : $\delta p/\delta y = 1/2 \cot \mu . \; \delta p/\delta x$ (at wall, downstream)
0203 : $\delta p/\delta y = - 1/2 \cot \mu . \; \delta p/\delta x$ (at wall, upstream).

The authors' calculations for 0203 therefore show the effect of a normal pressure gradient of double the probable magnitude, and, for this station, of the correct sign. The most obvious change in the calculated integral values is a 5 % increase in the momentum thickness. It seems probable that there is a printer's error in the calculated 90 % increase in THETA reported for 0202, since it is not reflected in the associated R THETA and shape factor values. These calculations should be regarded as a numerical experiment suggesting the magnitude of possible normal pressure gradient effects.

The wall temperature is stated to be measured by a thermocouple attached to a thin plate mounted in the model surface. Temperatures measured there are stated to reach equilibrium temperature, as might be expected. The editors feel, however, that this does not guarantee that the bulk temperature of the model had dropped to the recovery temperature.

Direct comparisons for the ZPG and APG data may be made with Lewis et al. - CAT 7201. The most appropriate planar ZPG comparisons are with Hastings & Sawyer - CAT 7006, and Mabey et al. - CAT 7402. Comparable planar APG cases are those of Zwarts - CAT 7007 and Thomas - CAT 7401. There are no strictly comparable recovery cases except possibly Moore - CAT 5805 who studied a planar flow which had mounted a step.

CAT 7102 PEAKE BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD*
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD	TR
71020101	3.9256	1.0000	3.1079"+03	1.1482"-03	7.8621	1.5237	8.4668"+03	8.4668"+03
2.9515"-01	1.1636"+06	1.0000	1.0221"+04	NM	1.8177	1.7776	2.7345"+02	7.3056"+01
-1.1445"-01	2.9822"+02	0.0000	1.9721"-04	NC	0.1517	3.6777"-04	6.7273"+02	2.7345"+02
71020102	3.9051	1.0000	4.6275"+03	1.0782"-03	7.6641	1.4409	8.6667"+03	8.6667"+03
4.2215"-01	1.1586"+06	1.0000	1.5106"+04	NM	1.8188	1.7870	2.7322"+02	7.3556"+01
-1.1445"-01	2.9790"+02	0.0000	2.8916"-04	NC	0.1531	5.3869"-04	6.7151"+02	2.7322"+02
71020103	3.9006	1.0000	5.6030"+03	1.0400"-03	7.5614	1.3991	8.7563"+03	8.7563"+03
5.2375"-01	1.1635"+06	1.0000	1.8255"+04	NM	1.8300	1.8022	2.7358"+02	7.3778"+01
-1.1445"-01	2.9828"+02	0.0000	3.4782"-04	NC	0.1520	6.3288"-04	6.7174"+02	2.7358"+02
71020104	3.9046	1.0000	6.2526"+03	1.0300"-03	7.5628	1.3776	8.7081"+03	8.7081"+03
5.7455"-01	1.1633"+06	1.0000	2.0499"+04	NM	1.8265	1.8019	2.7358"+02	7.3667"+01
-1.1445"-01	2.9829"+02	0.0000	3.9147"-04	NC	0.1518	7.2135"-04	6.7193"+02	2.7358"+02
71020105	3.9212	1.0000	7.1874"+03	1.0200"-03	7.6709	1.3985	8.5219"+03	8.5219"+03
6.7615"-01	1.1642"+06	1.0000	2.3596"+04	NM	1.8221	1.7902	2.7362"+02	7.3222"+01
-1.1445"-01	2.9839"+02	0.0000	4.5438"-04	NC	0.1517	8.4552"-04	6.7274"+02	2.7362"+02
71020106	3.9016	1.0000	7.7588"+03	1.0246"-03	7.6187	1.3891	8.7563"+03	8.7563"+03
8.0315"-01	1.1651"+06	1.0000	2.5286"+04	NM	1.8164	1.7859	2.7369"+02	7.3778"+01
-1.1445"-01	2.9839"+02	0.0000	4.8167"-04	NC	0.1508	9.0558"-04	6.7192"+02	2.7369"+02
71020201	3.9256	1.0000	3.0026"+03	1.1000"-03	7.9374	1.5535	8.4874"+03	8.4874"+03
2.9515"-01	1.1664"+06	1.0000	9.8750"+03	NM	1.8112	1.7681	2.7345"+02	7.3056"+01
-1.1445"-01	2.9822"+02	0.0000	1.9007"-04	NC	0.1511	3.5911"-04	6.7273"+02	2.7345"+02
71020202	2.9013	1.0000	1.0088"+04	1.3764"-03	5.1018	1.5616	3.7032"+04	3.7032"+04
4.2215"-01	1.1723"+06	1.0000	2.2317"+04	NM	1.7681	1.7585	2.7801"+02	1.1128"+02
-1.1445"-01	2.9861"+02	0.0000	2.4759"-04	NC	0.1232	3.8147"-04	6.1363"+02	2.7801"+02
71020203	2.0752	1.0000	2.5701"+04	1.4244"-03	3.2802	1.4928	1.3270"+05	1.3270"+05
5.2375"-01	1.1674"+06	1.0000	4.1285"+04	NM	1.7977	1.7846	2.8314"+02	1.6028"+02
-1.1445"-01	2.9832"+02	0.0000	2.9961"-04	NC	0.0913	3.8053"-04	5.2675"+02	2.8314"+02
71020204	2.0002	1.0000	3.5972"+04	1.6218"-03	2.9932	1.3862	1.4917"+05	1.4917"+05
5.7455"-01	1.1675"+06	1.0000	5.6197"+04	NM	1.8344	1.8252	2.8384"+02	1.6578"+02
-1.1445"-01	2.9843"+02	0.0000	3.9439"-04	NC	0.0894	4.7809"-04	5.1635"+02	2.8384"+02
71020205	1.9882	1.0000	3.9146"+04	1.5782"-03	2.9666	1.3868	1.5193"+05	1.5193"+05
6.7615"-01	1.1671"+06	1.0000	6.0887"+04	NM	1.8395	1.8267	2.8384"+02	1.6661"+02
-1.1445"-01	2.9833"+02	0.0000	4.2502"-04	NC	0.0890	5.1044"-04	5.1454"+02	2.8384"+02
71020206	2.0120	1.0000	3.6446"+04	1.4364"-03	2.9641	1.3733	1.4636"+05	1.4636"+05
8.0315"-01	1.1665"+06	1.0000	5.7186"+04	NM	1.8456	1.8337	2.8370"+02	1.6489"+02
-1.1445"-01	2.9839"+02	0.0000	4.0363"-04	NC	0.0905	4.8425"-04	5.1800"+02	2.8370"+02
71020301	3.7884	1.0000	3.9930"+03	1.2028"-03	7.3123	1.4151	7.2946"+03	7.2946"+03
2.9515"-01	8.3205"+05	1.0000	1.2871"+04	NM	1.8099	1.7898	2.7391"+02	7.7056"+01
-1.1445"-01	2.9824"+02	0.0000	3.1338"-04	NC	0.1473	5.8382"-04	6.6676"+02	2.7391"+02
71020302	3.6210	1.0000	7.3655"+03	1.0100"-03	6.9696	1.4646	9.1976"+03	9.1976"+03
4.2215"-01	8.3202"+05	1.0000	2.1581"+04	NM	1.7666	1.7555	2.7467"+02	8.2307"+01
-1.1445"-01	2.9844"+02	0.0000	4.9707"-04	NC	0.1418	9.2543"-04	6.5898"+02	2.7467"+02
71020303	3.6080 .	1.0000	8.5712"+03	1.0100"-03	6.7254	1.3804	9.3631"+03	9.3631"+03
5.2375"-01	8.3170"+05	1.0000	2.4991"+04	NM	1.8137	1.7904	2.7459"+02	8.2778"+01
-1.1445"-01	2.9829"+02	0.0000	5.7147"-04	NC	0.1435	1.0117"-03	6.5816"+02	2.7459"+02
71020304	3.6190	1.0000	9.1030"+03	1.0200"-03	6.7221	1.3665	9.2252"+03	9.2252"+03
5.7455"-01	8.3218"+05	1.0000	2.6652"+04	NM	1.8193	1.7964	2.7465"+02	8.2444"+01
-1.1445"-01	2.9840"+02	0.0000	6.1289"-04	NC	0.1450	1.0760"-03	6.5884"+02	2.7465"+02
71020305	3.6160	1.0000	8.4222"+03	1.0136"-03	6.5371	1.3115	9.2665"+03	9.2665"+03
6.6599"-01	8.3241"+05	1.0000	2.4630"+04	NM	1.8475	1.8286	2.7470"+02	8.2556"+01
-1.1445"-01	2.9845"+02	0.0000	5.6555"-04	NC	0.1472	9.3361"-04	6.5874"+02	2.7470"+02
71020306	3.1983	1.0000	1.2826"+04	1.0808"-03	5.5396	1.3663	1.6871"+04	1.6871"+04
8.0315"-01	8.3199"+05	1.0000	3.1897"+04	NM	1.8179	1.7985	2.7628"+02	9.7944"+01
-1.1445"-01	2.9832"+02	0.0000	5.8518"-04	NC	0.1337	9.3316"-04	6.3463"+02	2.7628"+02

71020201 PEAKE PROFILE TABULATION 59 POINTS, DELTA AT POINT 59

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.91644	0.00000	0.00000	3.74099	0.00000
2	2.2860E-04	2.5916E+00	NM	0.94160	0.32130	0.54865	2.91589	0.18816
3	3.4290E-04	3.3354E+00	NM	0.94839	0.37682	0.61836	2.69291	0.22963
4	4.2672E-04	4.0648E+00	NM	0.95404	0.42358	0.67077	2.50774	0.26748
5	4.7498E-04	4.8465E+00	NM	0.95925	0.46824	0.71577	2.33670	0.30632
6	5.5880E-04	5.3097E+00	NM	0.96201	0.49273	0.73847	2.24621	0.32876
7	6.4262E-04	5.9145E+00	NM	0.96530	0.52294	0.76469	2.13825	0.35762
8	7.0104E-04	6.1995E+00	NM	0.96674	0.53656	0.77588	2.09095	0.37106
9	7.8232E-04	6.5838E+00	NM	0.96859	0.55440	0.78998	2.03043	0.38907
10	8.4074E-04	6.9324E+00	NM	0.97017	0.57009	0.80188	1.97850	0.40530
11	9.2202E-04	7.2539E+00	NM	0.97156	0.58418	0.81218	1.93295	0.42018
12	9.9314E-04	7.5039E+00	NM	0.97260	0.59490	0.81978	1.89893	0.43171
13	1.0744E-03	7.6126E+00	NM	0.97304	0.59950	0.82298	1.88452	0.43671
14	1.1328E-03	7.7444E+00	NM	0.97356	0.60504	0.82678	1.86733	0.44276
15	1.2040E-03	8.0322E+00	NM	0.97467	0.61694	0.83478	1.83089	0.45594
16	1.2852E-03	8.4167E+00	NM	0.97609	0.63249	0.84488	1.78439	0.47344
17	1.3564E-03	8.7767E+00	NM	0.97735	0.64671	0.85379	1.74295	0.48985
18	1.4021E-03	9.0488E+00	NM	0.97827	0.65725	0.86019	1.71288	0.50219
19	1.4834E-03	9.4796E+00	NM	0.97966	0.67360	0.86979	1.66735	0.52166
20	1.5418E-03	9.9498E+00	NM	0.98109	0.69099	0.87959	1.62035	0.54284
21	1.6256E-03	1.0561E+01	NM	0.98284	0.71298	0.89139	1.56307	0.57028
22	1.6942E-03	1.1059E+01	NM	0.98417	0.73039	0.90029	1.51936	0.59255
23	1.7526E-03	1.1567E+01	NM	0.98545	0.74773	0.90879	1.47720	0.61521
24	1.8237E-03	1.2038E+01	NM	0.98658	0.76344	0.91619	1.44018	0.63616
25	1.8821E-03	1.2657E+01	NM	0.98798	0.78363	0.92529	1.39425	0.66365
26	1.9634E-03	1.3047E+01	NM	0.98882	0.79608	0.93069	1.36677	0.68094
27	2.0345E-03	1.3363E+01	NM	0.98947	0.80603	0.93489	1.34529	0.69494
28	2.0803E-03	1.3643E+01	NM	0.99004	0.81476	0.93849	1.32681	0.70733
29	2.1615E-03	1.3851E+01	NM	0.99045	0.82117	0.94109	1.31341	0.71653
30	2.2200E-03	1.4006E+01	NM	0.99075	0.82592	0.94299	1.30360	0.72338
31	2.2784E-03	1.4080E+01	NM	0.99089	0.82819	0.94389	1.29894	0.72666
32	2.3368E-03	1.4164E+01	NM	0.99104	0.83072	0.94489	1.29376	0.73035
33	2.5019E-03	1.4680E+01	NM	0.99200	0.84626	0.95090	1.26258	0.75313
34	2.6314E-03	1.5264E+01	NM	0.99302	0.86348	0.95730	1.22911	0.77886
35	2.7711E-03	1.5845E+01	NM	0.99398	0.88028	0.96330	1.19752	0.80441
36	2.8981E-03	1.6429E+01	NM	0.99490	0.89686	0.96900	1.16732	0.83010
37	3.0404E-03	1.7015E+01	NM	0.99578	0.91319	0.97440	1.13856	0.85582
38	3.1572E-03	1.7588E+01	NM	0.99659	0.92886	0.97940	1.11178	0.88093
39	3.2969E-03	1.8093E+01	NM	0.99728	0.94247	0.98360	1.08918	0.90307
40	3.4366E-03	1.8532E+01	NM	0.99786	0.95414	0.98710	1.07027	0.92229
41	3.5535E-03	1.9015E+01	NM	0.99847	0.96683	0.99080	1.05021	0.94343
42	3.6830E-03	1.9190E+01	NM	0.99869	0.97137	0.99210	1.04314	0.95107
43	3.8354E-03	1.9561E+01	NM	0.99913	0.98095	0.99480	1.02843	0.96729
44	3.9751E-03	1.9744E+01	NM	0.99935	0.98564	0.99610	1.02134	0.97529
45	4.1148E-03	1.9886E+01	NM	0.99952	0.98928	0.99710	1.01588	0.98152
46	4.2570E-03	1.9987E+01	NM	0.99963	0.99184	0.99780	1.01205	0.98592
47	4.3840E-03	2.0088E+01	NM	0.99975	0.99442	0.99850	1.00822	0.99036
48	4.5237E-03	2.0132E+01	NM	0.99980	0.99553	0.99850	1.00658	0.99228
49	4.6533E-03	2.0162E+01	NM	0.99983	0.99627	0.99900	1.00548	0.99356
50	4.7930E-03	2.0206E+01	NM	0.99988	0.99739	0.99930	1.00384	0.99548
51	4.9225E-03	2.0206E+01	NM	0.99988	0.99739	0.99930	1.00384	0.99548
52	5.0749E-03	2.0235E+01	NM	0.99992	0.99813	0.99950	1.00274	0.99677
53	5.2019E-03	2.0235E+01	NM	0.99992	0.99813	0.99950	1.00274	0.99677
54	5.3543E-03	2.0279E+01	NM	0.99997	0.99925	0.99980	1.00110	0.99871
55	5.4839E-03	2.0279E+01	NM	0.99997	0.99925	0.99980	1.00110	0.99871
56	5.6134E-03	2.0279E+01	NM	0.99997	0.99925	0.99980	1.00110	0.99871
57	5.7302E-03	2.0279E+01	NM	0.99997	0.99925	0.99980	1.00110	0.99871
58	5.8572E-03	2.0279E+01	NM	0.99997	0.99925	0.99980	1.00110	0.99871
D 59	5.9868E-03	2.0309E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y, U/UD ASSUME P=PD AND VAN DRIEST

71020202 PEAKE PROFILE TABULATION 60 POINTS, DELTA AT POINT 60

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TO	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93099	0.00000	0.00000	2.49832	0.00000
2	2.2860"-04	2.0679"+00	NM	0.95060	0.37031	0.53310	2.07251	0.25722
3	3.3020"-04	2.8004"+00	NM	0.95844	0.45728	0.63070	1.90232	0.33154
4	4.2672"-04	3.1823"+00	NM	0.96193	0.49545	0.66960	1.82653	0.36660
5	5.1054"-04	3.5183"+00	NM	0.96476	0.52649	0.69950	1.76519	0.39627
6	5.9436"-04	3.7897"+00	NM	0.96689	0.55018	0.72130	1.71878	0.41966
7	6.7818"-04	4.0284"+00	NM	0.96868	0.57014	0.73900	1.68006	0.43987
8	7.5946"-04	4.2344"+00	NM	0.97015	0.58678	0.75330	1.64808	0.45708
9	8.4074"-04	4.4404"+00	NM	0.97157	0.60295	0.76680	1.61734	0.47411
10	9.2202"-04	4.6321"+00	NM	0.97284	0.61759	0.77870	1.58978	0.48982
11	1.0058"-03	4.7751"+00	NM	0.97375	0.62829	0.78720	1.56984	0.50145
12	1.0871"-03	4.9467"+00	NM	0.97483	0.64087	0.79700	1.54657	0.51533
13	1.1684"-03	5.1222"+00	NM	0.97589	0.65349	0.80660	1.52351	0.52944
14	1.2497"-03	5.3151"+00	NM	0.97702	0.66707	0.81670	1.49894	0.54485
15	1.3208"-03	5.4420"+00	NM	0.97774	0.67585	0.82310	1.48322	0.55494
16	1.4249"-03	5.6333"+00	NM	0.97881	0.68886	0.83240	1.46015	0.57008
17	1.5088"-03	5.9666"+00	NM	0.98058	0.71096	0.84770	1.42163	0.59629
18	1.5773"-03	6.2362"+00	NM	0.98195	0.72833	0.85930	1.39197	0.61733
19	1.6713"-03	6.5190"+00	NM	0.98332	0.74611	0.87080	1.36216	0.63928
20	1.7526"-03	6.8159"+00	NM	0.98470	0.76433	0.88220	1.33221	0.66221
21	1.8364"-03	7.1307"+00	NM	0.98610	0.78317	0.89360	1.30188	0.68639
22	1.9279"-03	7.4289"+00	NM	0.98736	0.80060	0.90380	1.27441	0.70919
23	2.0117"-03	7.8206"+00	NM	0.98894	0.82294	0.91640	1.24005	0.73900
24	2.0803"-03	8.1345"+00	NM	0.99015	0.84040	0.92590	1.21382	0.76280
25	2.1742"-03	8.4195"+00	NM	0.99120	0.85594	0.93410	1.19097	0.78432
26	2.3495"-03	8.9695"+00	NM	0.99313	0.88516	0.94890	1.14922	0.82569
27	2.5146"-03	9.4403"+00	NM	0.99467	0.90941	0.96060	1.11574	0.86095
28	2.6899"-03	9.8353"+00	NM	0.99589	0.92927	0.96980	1.08913	0.89043
29	2.8651"-03	1.0193"+01	NM	0.99696	0.94691	0.97770	1.06608	0.91710
30	3.0277"-03	1.0459"+01	NM	0.99771	0.95977	0.98330	1.04963	0.93681
31	3.2029"-03	1.0571"+01	NM	0.99803	0.96514	0.98560	1.04284	0.94511
32	3.3680"-03	1.0789"+01	NM	0.99863	0.97556	0.99000	1.02982	0.96134
33	3.5077"-03	1.0917"+01	NM	0.99897	0.98157	0.99250	1.02239	0.97076
34	3.6830"-03	1.0979"+01	NM	0.99913	0.98448	0.99370	1.01882	0.97534
35	3.8354"-03	1.1025"+01	NM	0.99926	0.98667	0.99460	1.01614	0.97880
36	4.0107"-03	1.1072"+01	NM	0.99938	0.98887	0.99550	1.01345	0.98228
37	4.1732"-03	1.1088"+01	NM	0.99942	0.98960	0.99580	1.01256	0.98345
38	4.3485"-03	1.1120"+01	NM	0.99950	0.99108	0.99640	1.01077	0.98578
39	4.5136"-03	1.1136"+01	NM	0.99955	0.99182	0.99670	1.00987	0.98696
40	4.6761"-03	1.1151"+01	NM	0.99959	0.99256	0.99700	1.00898	0.98813
41	4.8514"-03	1.1151"+01	NM	0.99959	0.99256	0.99700	1.00898	0.98813
42	5.0165"-03	1.1151"+01	NM	0.99959	0.99256	0.99700	1.00898	0.98813
43	5.1791"-03	1.1162"+01	NM	0.99961	0.99305	0.99720	1.00838	0.98891
44	5.3442"-03	1.1162"+01	NM	0.99961	0.99305	0.99720	1.00838	0.98891
45	5.5067"-03	1.1178"+01	NM	0.99966	0.99379	0.99750	1.00748	0.99009
46	5.6820"-03	1.1178"+01	NM	0.99966	0.99379	0.99750	1.00746	0.99009
47	5.8471"-03	1.1194"+01	NM	0.99970	0.99453	0.99780	1.00659	0.99127
48	6.0096"-03	1.1194"+01	NM	0.99970	0.99453	0.99780	1.00659	0.99127
49	6.1620"-03	1.1210"+01	NM	0.99974	0.99527	0.99810	1.00569	0.99245
50	6.3246"-03	1.1210"+01	NM	0.99974	0.99527	0.99810	1.00569	0.99245
51	6.5126"-03	1.1226"+01	NM	0.99978	0.99602	0.99840	1.00479	0.99364
52	6.6650"-03	1.1226"+01	NM	0.99978	0.99602	0.99840	1.00479	0.99364
53	6.8402"-03	1.1226"+01	NM	0.99978	0.99602	0.99840	1.00479	0.99364
54	7.0155"-03	1.1242"+01	NM	0.99982	0.99676	0.99870	1.00389	0.99483
55	7.1806"-03	1.1253"+01	NM	0.99986	0.99751	0.99900	1.00300	0.99602
56	7.3304"-03	1.1269"+01	NM	0.99989	0.99800	0.99920	1.00240	0.99681
57	7.4828"-03	1.1269"+01	NM	0.99989	0.99800	0.99920	1.00240	0.99681
58	7.6708"-03	1.1280"+01	NM	0.99992	0.99850	0.99940	1.00180	0.99761
59	7.8232"-03	1.1296"+01	NM	0.99996	0.99925	0.99970	1.00090	0.99880
D 60	7.9858"-03	1.1312"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y, U/UD ASSUME P=PD AND VAN DRIEST

71020203 PEAKE PROFILE TABULATION 43 POINTS, DELTA AT POINT 43

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94910	0.00000	0.00000	1.76655	0.00000
2	2.2060"-04	1.8414"+00	NM	0.96611	0.47039	0.57810	1.51037	0.38275
3	3.1750"-04	2.1245"+00	NM	0.96979	0.52850	0.63750	1.45502	0.43814
4	4.1656"-04	2.4216"+00	NM	0.97319	0.58059	0.68790	1.40381	0.49002
5	5.0038"-04	2.5821"+00	NM	0.97489	0.60633	0.71180	1.37817	0.51648
6	5.7150"-04	2.7268"+00	NM	0.97636	0.62843	0.73180	1.35604	0.53966
7	6.6548"-04	2.9017"+00	NM	0.97806	0.65396	0.75439	1.33041	0.56697
8	7.3660"-04	3.0394"+00	NM	0.97935	0.67328	0.77090	1.31100	0.58802
9	8.3058"-04	3.1465"+00	NM	0.98032	0.68788	0.78320	1.29635	0.60416
10	9.2202"-04	3.2609"+00	NM	0.98133	0.70309	0.79580	1.28110	0.62119
11	1.0058"-03	3.3830"+00	NM	0.98239	0.71896	0.80870	1.26523	0.63917
12	1.0973"-03	3.4825"+00	NM	0.98322	0.73159	0.81880	1.25263	0.65367
13	1.1684"-03	3.5360"+00	NM	0.98367	0.73829	0.82410	1.24595	0.66142
14	1.2497"-03	3.5906"+00	NM	0.98411	0.74505	0.82940	1.23924	0.66928
15	1.3437"-03	3.7123"+00	NM	0.98509	0.75991	0.84090	1.22451	0.68672
16	1.4249"-03	3.8043"+00	NM	0.98581	0.77094	0.84930	1.21363	0.69980
17	1.5088"-03	3.8968"+00	NM	0.98653	0.78184	0.85750	1.20290	0.71286
18	1.6002"-03	3.9731"+00	NM	0.98711	0.79073	0.86410	1.19419	0.72359
19	1.6942"-03	4.0813"+00	NM	0.98791	0.80314	0.87320	1.18207	0.73870
20	1.7653"-03	4.1656"+00	NM	0.98853	0.81268	0.88010	1.17280	0.75043
21	1.8466"-03	4.2042"+00	NM	0.98880	0.81700	0.88320	1.16861	0.75577
22	1.9406"-03	4.2890"+00	NM	0.98941	0.82643	0.88990	1.15950	0.76748
23	2.0117"-03	4.3890"+00	NM	0.99011	0.83740	0.89760	1.14895	0.78123
24	2.1031"-03	4.4743"+00	NM	0.99070	0.84663	0.90400	1.14011	0.79290
25	2.1869"-03	4.5740"+00	NM	0.99137	0.85730	0.91130	1.12995	0.80649
26	2.2682"-03	4.6892"+00	NM	0.99213	0.86945	0.91950	1.11845	0.82212
27	2.3495"-03	4.8064"+00	NM	0.99290	0.88164	0.92760	1.10698	0.83796
28	2.4562"-03	4.8597"+00	NM	0.99324	0.88712	0.93120	1.10185	0.84513
29	2.6314"-03	5.1546"+00	NM	0.99507	0.91685	0.95030	1.07430	0.88457
30	2.7940"-03	5.3630"+00	NM	0.99630	0.93726	0.96300	1.05568	0.91221
31	2.9820"-03	5.5659"+00	NM	0.99747	0.95672	0.97480	1.03815	0.93898
32	3.1344"-03	5.7218"+00	NM	0.99833	0.97139	0.98350	1.02509	0.95943
33	3.3096"-03	5.7990"+00	NM	0.99876	0.97857	0.98770	1.01874	0.96953
34	3.4722"-03	5.8775"+00	NM	0.99918	0.98582	0.99190	1.01237	0.97978
35	3.6373"-03	5.9078"+00	NM	0.99934	0.98860	0.99350	1.00993	0.98373
36	3.8125"-03	5.9401"+00	NM	0.99951	0.99157	0.99520	1.00734	0.98795
37	3.9624"-03	5.9631"+00	NM	0.99963	0.99367	0.99640	1.00551	0.99094
38	4.1275"-03	5.9862"+00	NM	0.99976	0.99577	0.99760	1.00368	0.99395
39	4.3028"-03	5.9939"+00	NM	0.99980	0.99648	0.99800	1.00306	0.99495
40	4.4780"-03	6.0094"+00	NM	0.99988	0.99788	0.99880	1.00184	0.99697
41	4.6406"-03	6.0172"+00	NM	0.99992	0.99859	0.99920	1.00123	0.99798
42	4.7930"-03	6.0250"+00	NM	0.99996	0.99929	0.99960	1.00061	0.99899
D 43	4.9809"-03	6.0327"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y, U/UD ASSUME P=PD AND VAN DRIEST

71020204 PEAKE PROFILE TABULATION 60 POINTS, DELTA AT POINT 60

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95111	0.00000	0.00000	1.71214	0.00000
2	2.2860"-04	1.9159"+00	NM	0.96918	0.50511	0.60800	1.44889	0.41963
3	3.4036"-04	2.3419"+00	NM	0.97435	0.58852	0.68970	1.37339	0.50219
4	4.0132"-04	2.5867"+00	NM	0.97790	0.62981	0.72770	1.33503	0.54508
5	4.9022"-04	2.7805"+00	NM	0.97895	0.66026	0.75470	1.30653	0.57764
6	5.7912"-04	3.0129"+00	NM	0.98117	0.69472	0.78420	1.27426	0.61545
7	6.5278"-04	3.1670"+00	NM	0.98258	0.71653	0.80230	1.25375	0.63992
8	7.4168"-04	3.2058"+00	NM	0.98292	0.72191	0.80670	1.24671	0.64603
9	8.1534"-04	3.2706"+00	NM	0.98349	0.73079	0.81390	1.24040	0.65616
10	9.0170"-04	3.3351"+00	NM	0.98405	0.73951	0.82090	1.23225	0.66618
11	9.7536"-04	3.3736"+00	NM	0.98438	0.74465	0.82500	1.22744	0.67213
12	1.0643"-03	3.4126"+00	NM	0.98472	0.74983	0.82910	1.22261	0.67814
13	1.1506"-03	3.4637"+00	NM	0.98515	0.75657	0.83440	1.21633	0.68600
14	1.2395"-03	3.5020"+00	NM	0.98547	0.76156	0.83830	1.21169	0.69185
15	1.3411"-03	3.5278"+00	NM	0.98568	0.76490	0.84090	1.20856	0.69578
16	1.4300"-03	3.5538"+00	NM	0.98589	0.76826	0.84350	1.20546	0.69973
17	1.5164"-03	3.5922"+00	NM	0.98621	0.77319	0.84730	1.20088	0.70556
18	1.5900"-03	3.6445"+00	NM	0.98663	0.77985	0.85240	1.19471	0.71348
19	1.6764"-03	3.6956"+00	NM	0.98704	0.78630	0.85730	1.18874	0.72118
20	1.7653"-03	3.7475"+00	NM	0.98745	0.79280	0.86220	1.18274	0.72898
21	1.8517"-03	3.7733"+00	NM	0.98766	0.79600	0.86460	1.17979	0.73284
22	1.9253"-03	3.8243"+00	NM	0.98805	0.80230	0.86930	1.17399	0.74047
23	2.0142"-03	3.8762"+00	NM	0.98845	0.80865	0.87400	1.16815	0.74619
24	2.1006"-03	3.9153"+00	NM	0.98875	0.813[illegible]	0.87750	1.16379	0.75400
25	2.1742"-03	3.9664"+00	NM	0.98914	0.81957	0.88200	1.15815	0.76156
26	2.3216"-03	4.0182"+00	NM	0.98953	0.82577	0.88650	1.15248	0.76921
27	2.3343"-03	4.1207"+00	NM	0.99029	0.83790	0.89520	1.14144	0.78427
28	2.4232"-03	4.1859"+00	NM	0.99076	0.84552	0.90060	1.13454	0.79380
29	2.4968"-03	4.2623"+00	NM	0.99131	0.85435	0.90680	1.12656	0.80493
30	2.5984"-03	4.3403"+00	NM	0.99186	0.86327	0.91300	1.11852	0.81626
31	2.6848"-03	4.4174"+00	NM	0.99240	0.87200	0.91900	1.11069	0.82741
32	2.7584"-03	4.5082"+00	NM	0.99302	0.88216	0.92590	1.10163	0.84048
33	2.8321"-03	4.6231"+00	NM	0.99380	0.89484	0.93440	1.09037	0.85696
34	2.9058"-03	4.6756"+00	NM	0.99414	0.90058	0.93820	1.08530	0.86446
35	3.1090"-03	4.8173"+00	NM	0.99507	0.91586	0.94820	1.07187	0.88462
36	3.2715"-03	4.9078"+00	NM	0.99564	0.92548	0.95440	1.06347	0.89744
37	3.4468"-03	4.9717"+00	NM	0.99604	0.93222	0.95870	1.05761	0.90648
38	3.6068"-03	5.0230"+00	NM	0.99636	0.93759	0.96210	1.05296	0.91371
39	3.7821"-03	5.0489"+00	NM	0.99652	0.94029	0.96380	1.05063	0.91736
40	3.9573"-03	5.0573"+00	NM	0.99676	0.94428	0.96630	1.04719	0.92276
41	4.1046"-03	5.1136"+00	NM	0.99692	0.94700	0.96800	1.04485	0.92645
42	4.2799"-03	5.1903"+00	NM	0.99739	0.95489	0.97290	1.03808	0.93722
43	4.4399"-03	5.2556"+00	NM	0.99778	0.96156	0.97700	1.03238	0.94636
44	4.5872"-03	5.3073"+00	NM	0.99808	0.96680	0.98020	1.02792	0.95357
45	4.7625"-03	5.3317"+00	NM	0.99823	0.96926	0.98170	1.02583	0.95698
46	4.9073"-03	5.3976"+00	NM	0.99861	0.97588	0.98570	1.02022	0.96616
47	5.0825"-03	5.4359"+00	NM	0.99883	0.97971	0.98800	1.01699	0.97150
48	5.2451"-03	5.4611"+00	NM	0.99898	0.98222	0.98950	1.01488	0.97500
49	5.4051"-03	5.4746"+00	NM	0.99906	0.98356	0.99030	1.01375	0.97687
50	5.5651"-03	5.5136"+00	NM	0.99928	0.98743	0.99260	1.01050	0.98229
51	5.7277"-03	5.5650"+00	NM	0.99957	0.99250	0.99560	1.00625	0.98941
52	5.8877"-03	5.5771"+00	NM	0.99964	0.99369	0.99630	1.00526	0.99109
53	6.0477"-03	5.5909"+00	NM	0.99972	0.99505	0.99710	1.00412	0.99300
54	6.1951"-03	5.5909"+00	NM	0.99972	0.99505	0.99710	1.00412	0.99300
55	6.3856"-03	5.6031"+00	NM	0.99979	0.99624	0.99780	1.00313	0.99469
56	6.5608"-03	5.6152"+00	NM	0.99985	0.99744	0.99850	1.00213	0.99637
57	6.7208"-03	5.6152"+00	NM	0.99985	0.99744	0.99850	1.00213	0.99637
58	6.8656"-03	5.6292"+00	NM	0.99993	0.99880	0.99930	1.00100	0.99831
59	7.0409"-03	5.6292"+00	NM	0.99993	0.99880	0.99930	1.00100	0.99831
D 60	7.2034"-03	5.6415"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y, U/UD ASSUME P=PD AND VAN DRIEST

71020205 PEAKE PROFILE TABULATION 60 POINTS, DELTA AT POINT 60

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.95143	0.00000	0.00000	1.70362	0.00000
2	2.2860"-04	1.7840"+00	NM	0.96766	0.47696	0.57800	1.46855	0.39358
3	3.2512"-04	2.4349"+00	NM	0.97572	0.60827	0.70720	1.35172	0.52319
4	4.0132"-04	2.7051"+00	NM	0.97854	0.65252	0.74710	1.31089	0.56992
5	5.0546"-04	2.8817"+00	NM	0.98027	0.67958	0.77060	1.28579	0.59932
6	5.9436"-04	[illegible].9902"+00	NM	0.98130	0.69561	0.78420	1.27092	0.61704
7	6.8326"-04	3.0986"+00	NM	0.98230	0.71120	0.79720	1.25645	0.63449
8	7.8486"-04	3.1930"+00	NM	0.98315	0.72449	0.80810	1.24414	0.64953
9	8.5852"-04	3.2745"+00	NM	0.98387	0.73573	0.81720	1.23373	0.66238
10	9.4742"-04	3.3566"+00	NM	0.98458	0.74686	0.82610	1.22344	0.67523
11	1.0338"-03	3.3971"+00	NM	0.98492	0.75229	0.83040	1.21843	0.68153
12	1.1227"-03	3.4652"+00	NM	0.98550	0.76133	0.83750	1.21010	0.69209
13	1.1938"-03	3.5192"+00	NM	0.98595	0.76840	0.84300	1.20359	0.70040
14	1.2675"-03	3.5330"+00	NM	0.98606	0.77021	0.84440	1.20193	0.70254
15	1.3564"-03	3.5470"+00	NM	0.98618	0.77202	0.84580	1.20027	0.70468
16	1.4300"-03	3.5741"+00	NM	0.98640	0.77553	0.84850	1.19705	0.70883
17	1.5316"-03	3.6014"+00	NM	0.98662	0.77904	0.85120	1.19382	0.71301
18	1.6332"-03	3.6557"+00	NM	0.98706	0.78599	0.85650	1.18745	0.72129
19	1.7069"-03	3.6963"+00	NM	0.98739	0.79114	0.86040	1.18274	0.72746
20	1.7932"-03	3.7375"+00	NM	0.98771	0.79633	0.86430	1.17801	0.73370
21	1.8974"-03	3.7652"+00	NM	0.98793	0.79980	0.86690	1.17484	0.73789
22	1.9685"-03	3.8062"+00	NM	0.98825	0.80490	0.87070	1.17019	0.74407
23	2.0574"-03	3.8334"+00	NM	0.98846	0.80827	0.87320	1.16713	0.74816
24	2.1463"-03	3.8874"+00	NM	0.98888	0.81491	0.87810	1.16109	0.75627
25	2.2327"-03	3.9424"+00	NM	0.98930	0.82161	0.88300	1.15502	0.76449
26	2.3216"-03	3.9834"+00	NM	0.98961	0.82657	0.88660	1.15053	0.77060
27	2.4079"-03	4.0376"+00	NM	0.99002	0.83308	0.89130	1.14465	0.77866
28	2.4968"-03	4.0786"+00	NM	0.99032	0.83796	0.89480	1.14026	0.78474
29	2.5679"-03	4.1475"+00	NM	0.99082	0.84612	0.90060	1.13293	0.79493
30	2.6568"-03	4.2020"+00	NM	0.99122	0.85250	0.90510	1.12721	0.80296
31	2.7305"-03	4.2710"+00	NM	0.99171	0.86051	0.91070	1.12006	0.81308
32	2.8169"-03	4.3388"+00	NM	0.99219	0.86831	0.91610	1.11312	0.82301
33	2.9058"-03	4.4078"+00	NM	0.99267	0.87618	0.92150	1.10613	0.83308
34	2.9921"-03	4.4351"+00	NM	0.99286	0.87926	0.92360	1.10341	0.83704
35	3.0658"-03	4.4901"+00	NM	0.99324	0.88545	0.92780	1.09794	0.84504
36	3.1674"-03	4.5313"+00	NM	0.99352	0.89006	0.93090	1.09388	0.85101
37	3.2410"-03	4.5581"+00	NM	0.99370	0.89304	0.93290	1.09126	0.85488
38	3.4163"-03	4.5864"+00	NM	0.99389	0.89619	0.93500	1.08850	0.85898
39	3.6068"-03	4.6410"+00	NM	0.99426	0.90221	0.93900	1.08322	0.86686
40	3.7541"-03	4.6943"+00	NM	0.99462	0.90827	0.94300	1.07793	0.87483
41	3.9294"-03	4.7243"+00	NM	0.99480	0.91132	0.94500	1.07527	0.87885
42	4.1046"-03	4.7652"+00	NM	0.99507	0.91577	0.94790	1.07141	0.88472
43	4.2647"-03	4.8339"+00	NM	0.99551	0.92317	0.95270	1.06499	0.89456
44	4.4120"-03	4.8892"+00	NM	0.99587	0.92909	0.95650	1.05988	0.90246
45	4.5872"-03	4.9586"+00	NM	0.99630	0.93646	0.96120	1.05354	0.91235
46	4.7473"-03	5.0261"+00	NM	0.99673	0.94358	0.96570	1.04744	0.92196
47	4.8920"-03	5.0687"+00	NM	0.99699	0.94804	0.96850	1.04363	0.92801
48	5.0698"-03	5.1242"+00	NM	0.99733	0.75381	0.97210	1.03871	0.93587
49	5.2578"-03	5.2056"+00	NM	0.99782	0.96222	0.97730	1.03158	0.94738
50	5.4331"-03	5.2485"+00	NM	0.99808	0.96663	0.98000	1.02786	0.95343
51	5.5956"-03	5.2886"+00	NM	0.99832	0.97072	0.98250	1.02441	0.95909
52	5.7556"-03	5.3716"+00	NM	0.99880	0.97915	0.98760	1.01734	0.97077
53	5.9157"-03	5.4145"+00	NM	0.99905	0.98347	0.99020	1.01372	0.97680
54	6.0782"-03	5.4562"+00	NM	0.99929	0.98766	0.99270	1.01024	0.98264
55	6.2382"-03	5.5101"+00	NM	0.99960	0.99305	0.99590	1.00576	0.99020
56	6.3856"-03	5.5254"+00	NM	0.99969	0.99457	0.99680	1.00450	0.99234
57	6.5735"-03	5.5391"+00	NM	0.99977	0.99592	0.99760	1.00337	0.99425
58	6.7361"-03	5.5527"+00	NM	0.99984	0.99728	0.99840	1.00225	0.99616
59	6.8961"-03	5.5665"+00	NM	0.99992	0.99864	0.99920	1.00113	0.99808
D 60	7.0409"-03	5.5802"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y, U/UD ASSUME P=PD AND VAN DRIEST

71020206 PEAKE PROFILE TABULATION 61 POINTS, DELTA AT POINT 61

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	0.95079	0.00000	0.00000	1.72057	0.00000
2	2.2860E-04	1.9625E+00	NM	0.96947	0.51226	0.61620	1.44697	0.42586
3	3.2512E-04	2.3152E+00	NM	0.97374	0.58037	0.68290	1.38453	0.49324
4	4.0132E-04	2.4977E+00	NM	0.97573	0.61160	0.71200	1.35528	0.52535
5	4.9022E-04	2.7572E+00	NM	0.97840	0.65283	0.74900	1.31633	0.56901
6	5.6388E-04	2.9096E+00	NM	0.97987	0.67567	0.76880	1.29467	0.59382
7	6.4008E-04	3.0630E+00	NM	0.98131	0.69778	0.78750	1.27370	0.61828
8	7.1374E-04	3.1859E+00	NM	0.98242	0.71494	0.80170	1.25744	0.63756
9	7.8486E-04	3.2934E+00	NM	0.98336	0.72958	0.81360	1.24359	0.65423
10	8.8900E-04	3.3700E+00	NM	0.98402	0.73981	0.82180	1.23393	0.66600
11	9.6012E-04	3.4633E+00	NM	0.98481	0.75207	0.83150	1.22237	0.68023
12	1.0338E-03	3.4938E+00	NM	0.98507	0.75603	0.83460	1.21865	0.68486
13	1.1074E-03	3.5245E+00	NM	0.98532	0.76000	0.83770	1.21492	0.68951
14	1.1811E-03	3.5860E+00	NM	0.98583	0.76785	0.84380	1.20753	0.69878
15	1.2522E-03	3.6178E+00	NM	0.98608	0.77191	0.84690	1.20375	0.70355
16	1.3411E-03	3.6791E+00	NM	0.98658	0.77963	0.85280	1.19652	0.71273
17	1.4148E-03	3.7107E+00	NM	0.98683	0.78358	0.85580	1.19283	0.71745
18	1.5011E-03	3.7880E+00	NM	0.98744	0.79314	0.86300	1.18391	0.72894
19	1.5748E-03	3.8185E+00	NM	0.98768	0.79689	0.86580	1.18042	0.73347
20	1.6637E-03	3.8494E+00	NM	0.98792	0.80066	0.86860	1.17692	0.73803
21	1.7501E-03	3.8649E+00	NM	0.98804	0.80254	0.87000	1.17517	0.74032
22	1.8390E-03	3.8962E+00	NM	0.98828	0.80633	0.87280	1.17165	0.74493
23	1.9101E-03	3.9426E+00	NM	0.98863	0.81191	0.87690	1.16649	0.75175
24	1.9837E-03	3.9746E+00	NM	0.98887	0.81575	0.87970	1.16294	0.75644
25	2.0726E-03	4.0058E+00	NM	0.98911	0.81946	0.88240	1.15951	0.76101
26	2.1463E-03	4.0361E+00	NM	0.98933	0.82305	0.88500	1.15620	0.76544
27	2.2327E-03	4.0833E+00	NM	0.98968	0.82860	0.88900	1.15109	0.77231
28	2.2911E-03	4.1456E+00	NM	0.99014	0.83588	0.89420	1.14441	0.78137
29	2.3927E-03	4.2090E+00	NM	0.99060	0.84322	0.89940	1.13769	0.79055
30	2.4663E-03	4.2548E+00	NM	0.99092	0.84848	0.90310	1.13288	0.79717
31	2.6264E-03	4.3645E+00	NM	0.99170	0.86099	0.91180	1.12150	0.81302
32	2.7737E-03	4.4600E+00	NM	0.99236	0.87164	0.91910	1.11187	0.82662
33	2.9337E-03	4.5535E+00	NM	0.99299	0.88197	0.92610	1.10257	0.83995
34	3.0810E-03	4.7122E+00	NM	0.99405	0.89925	0.93760	1.08712	0.86246
35	3.2258E-03	4.8223E+00	NM	0.99476	0.91102	0.94530	1.07667	0.87798
36	3.4163E-03	4.9176E+00	NM	0.94537	0.92109	0.95180	1.06779	0.89137
37	3.5636E-03	4.9805E+00	NM	0.99576	0.92767	0.95600	1.06202	0.90018
38	3.7236E-03	5.0612E+00	NM	0.99626	0.93604	0.96130	1.05469	0.91145
39	3.8710E-03	5.0612E+00	NM	0.99626	0.93604	0.96130	1.05469	0.91145
40	4.0157E-03	5.0612E+00	NM	0.99626	0.93604	0.96130	1.05469	0.91145
41	4.1758E-03	5.0612E+00	NM	0.99626	0.93604	0.96130	1.05469	0.91145
42	4.3383E-03	5.0612E+00	NM	0.99626	0.93604	0.96130	1.05469	0.91145
43	4.4704E-03	5.0612E+00	NM	0.99626	0.93604	0.96130	1.05469	0.91145
44	4.6304E-03	5.0920E+00	NM	0.99645	0.93923	0.96330	1.05192	0.91575
45	4.7752E-03	5.1403E+00	NM	0.99675	0.94419	0.96640	1.04761	0.92248
46	4.9225E-03	5.1718E+00	NM	0.99694	0.94740	0.96840	1.04482	0.92686
47	5.0978E-03	5.2035E+00	NM	0.99713	0.95063	0.97040	1.04203	0.93126
48	5.2451E-03	5.2515E+00	NM	0.99742	0.95550	0.97340	1.03782	0.93792
49	5.4051E-03	5.3000E+00	NM	0.99770	0.96039	0.97640	1.03361	0.94465
50	5.5499E-03	5.3475E+00	NM	0.99798	0.96516	0.97930	1.02952	0.95122
51	5.6972E-03	5.3955E+00	NM	0.99826	0.96995	0.98220	1.02542	0.95785
52	5.8725E-03	5.4440E+00	NM	0.99854	0.97477	0.98510	1.02131	0.96454
53	5.9893E-03	5.4931E+00	NM	0.99883	0.97962	0.98800	1.01719	0.97130
54	6.1366E-03	5.5720E+00	NM	0.99927	0.98737	0.99260	1.01062	0.98216
55	6.2967E-03	5.6050E+00	NM	0.99946	0.99059	0.99450	1.00790	0.98670
56	6.4567E-03	5.6050E+00	NM	0.99946	0.99059	0.99450	1.00790	0.98670
57	6.6192E-03	5.6208E+00	NM	0.99955	0.99212	0.99540	1.00661	0.98806
58	6.7640E-03	5.6366E+00	NM	0.99964	0.99366	0.99630	1.00532	0.99103
59	6.9240E-03	5.6542E+00	NM	0.99973	0.99537	0.99730	1.00389	0.99344
60	7.0714E-03	5.6860E+00	NM	0.99991	0.99845	0.99910	1.00130	0.99781
D 61	7.2187E-03	5.7020E+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y, U/UD ASSUME P=PD AND VAN DRIEST

SECTION D - SUPPLEMENTARY DATA - CAT 7102

Wall pressure and wall shear stress correlations

FACSIMILE FROM SOURCE PAPER - NB - AUTHORS' SYMBOLS AND UNITS

Table 2: Zero pressure gradient - profiles 0101 - 0106

Table 3: Adverse pressure gradient - profiles 0201 - 0206

Table 4: "Ring" pressure gradient - profiles 0301 - 0306

SYMBOLS (where not as in CAT)

Subscripts:	0	- Reservoir stagnation state
	E	- Boundary layer edge (D) state
ΔP_{F+W}		- Static pressure hole-size correction based on wall property values using the deep hole correlation of Franklin + Wallace (1970)
T'		- Reference temperature as specified by Sommer and Short (1955)
C_{pp}		- Preston tube pressure coefficient ($= (P_P - P_E)/q_E$ where P_P is the Preston tube pressure and q_E is the free stream dynamic pressure)
R_D		- Reynolds' number based on Preston tube diameter and local free-stream conditions.
$(u_{\tau W}\, d_s/\nu_W)$		- Wall-similarity static hole Reynolds number. (d_s - static hole diameter)

Subscripts to CF indicate the Preston tube correlation used as:

F + S	- Fenter & Stalmach (1957)
HKTR	- Hopkins & Keener (1966) Equation 9
HKT'	- Hopkins & Keener (1966) Equation 4
SIG	- Sigalla (1965)

UNITS - are indicated at the foot of each table.

TABLE 2: SKIN FRICTION CORRELATIONS IN ZERO PRESSURE GRADIENT FLOW

C_F CALCULATED FROM CORRELATIONS BY FENTER & STALMACH, HOPKINS & KEENER, AND SIGALLA:
HOPKINS & KEENER CORRELATION WITH (1): ADIABATIC WALL RECOVERY TEMPERATURE, T_R, AND (2): INTERMEDIATE TEMPERATURE, T', AS INPUT;
STATIC PRESSURES CORRECTED FOR HOLE ERROR GIVEN BY FRANKLIN & WALLACE

P_C = 168.9 PSIA; T_0 = 537.0 °R

X	P_W	$\Delta P_{F\&W}$	M_E	u_E	T_E	ρ_E	T_R	T'	C_{PP}	R_D	$\frac{u_{\tau W} d_S}{\nu_W}$	C_F F&S	C_F HKTR	C_F HKT'	$u_{\tau W}$	C_F SIG
0.03	1.187	0.025	3.952	2210.5	130.2	0.00076	492.3	364.3	0.420	0.230E 05	0.247E 03	0.00143	0.00227	0.00187	131.2	0.00157
0.53	1.205	0.012	3.941	2208.9	130.8	0.00077	492.3	364.6	0.234	0.231E 05	0.199E 03	0.00103	0.00137	0.00118	104.1	0.00118
1.03	1.215	0.005	3.934	2208.0	131.1	0.00078	492.4	364.7	0.132	0.232E 05	0.162E 03	0.00073	0.00084	0.00078	84.2	0.00087
1.53	1.220	0.003	3.931	2207.7	131.3	0.00078	492.4	364.8	0.093	0.232E 05	0.144E 03	0.00059	0.00062	0.00060	74.4	0.00072
2.03	1.222	0.003	3.930	2207.4	131.3	0.00078	492.4	364.8	0.089	0.232E 05	0.141E 03	0.00057	0.00059	0.00059	73.1	0.00070
2.53	1.223	0.005	3.929	2207.4	131.4	0.00078	492.4	364.8	0.115	0.232E 05	0.155E 03	0.00067	0.00074	0.00070	79.9	0.00081
3.03	1.222	0.007	3.930	2207.4	131.3	0.00078	492.4	364.8	0.161	0.232E 05	0.175E 03	0.00082	0.00099	0.00089	90.2	0.00097
3.53	1.220	0.010	3.931	2207.6	131.3	0.00078	492.4	364.8	0.207	0.232E 05	0.191E 03	0.00095	0.00123	0.00107	99.1	0.00111
4.53	1.219	0.014	3.932	2207.7	131.2	0.00078	492.4	364.8	0.264	0.232E 05	0.209E 03	0.00110	0.00151	0.00129	108.6	0.00126
5.03	1.219	0.015	3.932	2207.8	131.2	0.00078	492.4	364.7	0.280	0.232E 05	0.214E 03	0.00114	0.00159	0.00135	111.2	0.00129
5.53	1.219	0.016	3.932	2207.7	131.2	0.00078	492.4	364.8	0.292	0.232E 05	0.218E 03	0.00117	0.00165	0.00139	112.9	0.00132
6.53	1.219	0.016	3.932	2207.7	131.2	0.00078	492.4	364.8	0.303	0.232E 05	0.221E 03	0.00119	0.00171	0.00144	114.6	0.00134
7.03	1.220	0.016	3.931	2207.6	131.3	0.00078	492.4	364.8	0.303	0.232E 05	0.221E 03	0.00119	0.00170	0.00144	114.6	0.00134
7.53	1.220	0.016	3.931	2207.6	131.3	0.00078	492.4	364.8	0.300	0.232E 05	0.221E 03	0.00119	0.00169	0.00143	114.2	0.00134
8.03	1.221	0.016	3.931	2207.6	131.3	0.00078	492.4	364.8	0.294	0.232E 05	0.219E 03	0.00117	0.00166	0.00140	113.2	0.00132
8.53	1.222	0.015	3.930	2207.5	131.3	0.00078	492.4	364.8	0.285	0.232E 05	0.216E 03	0.00115	0.00161	0.00137	111.8	0.00130
9.03	1.223	0.014	3.929	2207.4	131.4	0.00078	492.4	364.8	0.272	0.232E 05	0.212E 03	0.00112	0.00155	0.00132	109.8	0.00127
9.53	1.225	0.013	3.928	2207.3	131.4	0.00078	492.4	364.8	0.259	0.233E 05	0.209E 03	0.00109	0.00149	0.00127	107.7	0.00124
10.03	1.226	0.012	3.928	2207.1	131.4	0.00078	492.4	364.8	0.246	0.233E 05	0.205E 03	0.00106	0.00142	0.00122	105.5	0.00121
10.53	1.227	0.012	3.927	2207.1	131.5	0.00078	492.4	364.9	0.238	0.233E 05	0.202E 03	0.00104	0.00138	0.00119	104.2	0.00119
11.03	1.227	0.011	3.927	2207.0	131.5	0.00078	492.4	364.9	0.231	0.233E 05	0.200E 03	0.00102	0.00135	0.00117	103.1	0.00117
11.53	1.228	0.011	3.926	2207.0	131.5	0.00078	492.4	364.9	0.226	0.233E 05	0.199E 03	0.00101	0.00132	0.00115	102.2	0.00116
12.03	1.229	0.011	3.926	2206.9	131.5	0.00078	492.4	364.9	0.223	0.233E 05	0.198E 03	0.00100	0.00131	0.00114	101.8	0.00115
12.53	1.229	0.011	3.926	2206.9	131.6	0.00078	492.4	364.9	0.221	0.233E 05	0.197E 03	0.00099	0.00129	0.00113	101.3	0.00115
13.03	1.230	0.011	3.925	2206.8	131.6	0.00078	492.4	364.9	0.219	0.233E 05	0.197E 03	0.00099	0.00129	0.00112	101.0	0.00114
13.53	1.232	0.011	3.924	2206.7	131.6	0.00079	492.4	364.9	0.219	0.233E 05	0.197E 03	0.00099	0.00129	0.00112	100.9	0.00114
14.03	1.234	0.011	3.923	2206.4	131.7	0.00079	492.4	365.0	0.217	0.233E 05	0.196E 03	0.00098	0.00128	0.00111	100.6	0.00114
14.53	1.237	0.011	3.921	2206.2	131.8	0.00079	492.4	365.0	0.215	0.233E 05	0.196E 03	0.00098	0.00127	0.00110	100.2	0.00113
15.03	1.241	0.011	3.919	2205.9	131.9	0.00079	492.4	365.0	0.213	0.234E 05	0.196E 03	0.00097	0.00126	0.00110	99.8	0.00113
15.53	1.246	0.011	3.916	2205.5	132.1	0.00079	492.5	365.1	0.213	0.234E 05	0.196E 03	0.00097	0.00125	0.00109	99.6	0.00112
16.03	1.252	0.011	3.912	2205.0	132.2	0.00079	492.5	365.2	0.210	0.234E 05	0.196E 03	0.00096	0.00124	0.00108	99.0	0.00112
16.53	1.256	0.011	3.909	2204.6	132.4	0.00080	492.5	365.2	0.209	0.235E 05	0.196E 03	0.00096	0.00123	0.00108	98.8	0.00111
17.03	1.261	0.011	3.907	2204.2	132.5	0.00080	492.5	365.3	0.207	0.235E 05	0.196E 03	0.00095	0.00122	0.00107	98.3	0.00111
17.53	1.265	0.011	3.904	2203.9	132.6	0.00080	492.5	365.3	0.207	0.235E 05	0.196E 03	0.00095	0.00122	0.00107	98.1	0.00111
18.03	1.268	0.010	3.903	2203.7	132.7	0.00080	492.5	365.4	0.205	0.235E 05	0.196E 03	0.00095	0.00121	0.00106	97.8	0.00110
18.53	1.269	0.010	3.902	2203.6	132.8	0.00080	492.5	365.4	0.205	0.235E 05	0.196E 03	0.00095	0.00120	0.00106	97.7	0.00110
19.03	1.271	0.010	3.901	2203.5	132.8	0.00080	492.5	365.4	0.203	0.236E 05	0.196E 03	0.00094	0.00120	0.00105	97.4	0.00110
19.53	1.271	0.010	3.901	2203.4	132.8	0.00080	492.5	365.4	0.202	0.236E 05	0.195E 03	0.00094	0.00119	0.00105	97.1	0.00109
20.03	1.271	0.010	3.901	2203.4	132.8	0.00080	492.5	365.4	0.201	0.236E 05	0.195E 03	0.00093	0.00118	0.00104	96.9	0.00109
20.53	1.270	0.010	3.901	2203.5	132.8	0.00080	492.5	365.4	0.200	0.236E 05	0.194E 03	0.00093	0.00118	0.00104	96.8	0.00108
21.03	1.269	0.010	3.902	2203.6	132.7	0.00080	492.5	365.4	0.200	0.235E 05	0.194E 03	0.00093	0.00118	0.00104	96.8	0.00109
21.53	1.267	0.010	3.903	2203.7	132.7	0.00080	492.5	365.4	0.199	0.235E 05	0.194E 03	0.00093	0.00118	0.00104	96.7	0.00108

TABLE 2: (continued)

X	P_W	$\Delta P_{P\&W}$	M_E	u_E	T_E	ρ_E	T_R	T'	C_{PP}	R_D	$\frac{u_{\tau W} d_S}{\nu_W}$	C_F P&S	C_F HKTR	C_F HKT'	$u_{\tau W}$	C_F SIG
22.03	1.265	0.010	3.904	2203.9	132.6	0.00080	492.5	365.3	0.198	0.235E 05	0.193E 03	0.00093	0.00117	0.00103	96.6	0.00108
22.53	1.263	0.010	3.905	2204.1	132.6	0.00080	492.5	365.3	0.197	0.235E 05	0.193E 03	0.00093	0.00117	0.00103	96.4	0.00108
23.03	1.260	0.010	3.907	2204.3	132.5	0.00080	492.5	365.3	0.196	0.235E 05	0.192E 03	0.00092	0.00116	0.00103	96.4	0.00108
23.53	1.257	0.010	3.909	2204.6	132.4	0.00080	492.5	365.2	0.196	0.235E 05	0.191E 03	0.00092	0.00116	0.00103	96.3	0.00107
24.03	1.254	0.010	3.911	2204.9	132.3	0.00080	492.5	365.2	0.195	0.234E 05	0.191E 03	0.00092	0.00116	0.00102	96.2	0.00107
24.53	1.250	0.009	3.913	2205.2	132.2	0.00079	492.5	365.1	0.194	0.234E 05	0.190E 03	0.00092	0.00116	0.00102	96.2	0.00107
25.03	1.247	0.009	3.915	2205.4	132.1	0.00079	492.5	365.1	0.194	0.234E 05	0.190E 03	0.00092	0.00115	0.00102	96.1	0.00107
25.53	1.242	0.009	3.918	2205.8	131.9	0.00079	492.4	365.1	0.193	0.234E 05	0.189E 03	0.00091	0.00115	0.00102	96.1	0.00107
26.03	1.239	0.009	3.920	2206.1	131.8	0.00079	492.4	365.0	0.192	0.233E 05	0.188E 03	0.00091	0.00115	0.00102	96.1	0.00107
26.53	1.236	0.009	3.922	2206.3	131.8	0.00079	492.4	365.0	0.193	0.233E 05	0.188E 03	0.00091	0.00115	0.00102	96.2	0.00107
27.03	1.233	0.009	3.923	2206.6	131.7	0.00079	492.4	364.9	0.193	0.233E 05	0.188E 03	0.00092	0.00115	0.00102	96.3	0.00107
27.53	1.230	0.009	3.925	2206.8	131.6	0.00078	492.4	364.9	0.194	0.233E 05	0.188E 03	0.00092	0.00116	0.00102	96.5	0.00107
28.03	1.226	0.009	3.927	2207.1	131.5	0.00078	492.4	364.8	0.194	0.233E 05	0.188E 03	0.00092	0.00116	0.00102	96.7	0.00107
28.53	1.223	0.009	3.929	2207.4	131.4	0.00078	492.4	364.8	0.195	0.232E 05	0.187E 03	0.00092	0.00117	0.00103	96.8	0.00108
29.03	1.220	0.009	3.931	2207.6	131.3	0.00078	492.4	364.8	0.196	0.232E 05	0.187E 03	0.00092	0.00117	0.00103	97.0	0.00108
29.53	1.217	0.009	3.933	2207.9	131.2	0.00078	492.4	364.7	0.196	0.232E 05	0.187E 03	0.00092	0.00117	0.00103	97.2	0.00108
30.03	1.214	0.009	3.935	2208.2	131.1	0.00078	492.3	364.7	0.197	0.232E 05	0.187E 03	0.00093	0.00118	0.00103	97.3	0.00108
30.53	1.216	0.009	3.934	2208.0	131.1	0.00078	492.4	364.7	0.196	0.232E 05	0.187E 03	0.00093	0.00117	0.00103	97.2	0.00108
31.03	1.225	0.009	3.928	2207.2	131.4	0.00078	492.4	364.8	0.195	0.233E 05	0.188E 03	0.00092	0.00126	0.00103	96.8	0.00107
31.53	1.261	0.009	3.907	2204.2	132.5	0.00080	492.5	365.3	0.190	0.235E 05	0.190E 03	0.00091	0.00113	0.00100	95.2	0.00106
32.03	1.308	0.010	3.880	2200.4	133.9	0.00082	492.7	365.9	0.185	0.238E 05	0.193E 03	0.00089	0.00110	0.00098	93.3	0.00104
32.53	1.511	0.010	3.774	2185.0	139.5	0.00091	493.3	368.3	0.158	0.250E 05	0.203E 03	0.00080	0.00093	0.00086	85.1	0.00094
INS.	PSIA	PSIA		FT/SEC	°R	SLUGS/ CU.FT.	°R	°R							FT/SEC	

TABLE 3: SKIN FRICTION CORRELATIONS IN ADVERSE PRESSURE GRADIENT FLOW

C_F CALCULATED FROM CORRELATIONS BY PENTER & STALMACH, HOPKINS & KEENER, AND SIGALLA;
HOPKINS & KEENER CORRELATION WITH (1): ADIABATIC WALL RECOVERY TEMPERATURE, T_R, AND (2): INTERMEDIATE TEMPERATURE, T', AS INPUT;
STATIC PRESSURES CORRECTED FOR HOLE ERROR GIVEN BY FRANKLIN & WALLACE

P_0 = 169.2 PSIA; T_0 = 537.0 °R

X	P_W	$\Delta P_{P\&W}$	M_E	u_E	T_E	ρ_E	T_R	T'	C_{PP}	R_D	$\frac{u_{\tau W} d_S}{\nu_W}$	C_F P&S	C_F HKTR	C_F HKT'	$u_{\tau W}$	C_F SIG
0.03	1.189	0.025	3.952	2210.5	130.2	0.00077	492.3	364.3	0.420	0.230E 05	0.247E 03	0.00143	0.00227	0.00186	131.2	0.00157
0.53	1.207	0.012	3.941	2208.9	130.8	0.00077	492.3	364.6	0.234	0.232E 05	0.199E 03	0.00103	0.00137	0.00118	104.1	0.00118
1.03	1.217	0.005	3.934	2208.0	131.1	0.00078	492.4	364.7	0.132	0.232E 05	0.162E 03	0.00073	0.00084	0.00077	84.2	0.00087
1.53	1.222	0.003	3.931	2207.7	131.3	0.00078	492.4	364.8	0.093	0.233E 05	0.144E 03	0.00059	0.00062	0.00060	74.3	0.00072
2.03	1.224	0.003	3.930	2207.4	131.3	0.00078	492.4	364.8	0.089	0.233E 05	0.142E 03	0.00057	0.00059	0.00059	73.1	0.00070
2.53	1.225	0.005	3.929	2207.4	131.4	0.00078	492.4	364.8	0.115	0.233E 05	0.155E 03	0.00067	0.00074	0.00070	79.9	0.00081
3.03	1.224	0.007	3.930	2207.4	131.3	0.00078	492.4	364.8	0.161	0.233E 05	0.175E 03	0.00082	0.00099	0.00089	90.2	0.00097
3.53	1.222	0.010	3.931	2207.6	131.3	0.00078	492.4	364.8	0.207	0.233E 05	0.192E 03	0.00095	0.00123	0.00107	99.1	0.00111
4.53	1.221	0.014	3.932	2207.7	131.2	0.00078	492.4	364.8	0.264	0.233E 05	0.210E 03	0.00110	0.00151	0.00129	108.6	0.00125
5.03	1.220	0.015	3.932	2207.8	131.2	0.00078	492.4	364.7	0.280	0.232E 05	0.215E 03	0.00114	0.00159	0.00135	111.2	0.00129
5.53	1.221	0.016	3.932	2207.7	131.2	0.00078	492.4	364.8	0.292	0.233E 05	0.218E 03	0.00117	0.00165	0.00139	112.9	0.00132
6.53	1.221	0.016	3.932	2207.7	131.2	0.00078	492.4	364.8	0.303	0.233E 05	0.221E 03	0.00119	0.00170	0.00144	114.6	0.00134
7.03	1.222	0.016	3.931	2207.6	131.3	0.00078	492.4	364.8	0.303	0.233E 05	0.222E 03	0.00119	0.00170	0.00144	114.5	0.00134
7.53	1.222	0.016	3.931	2207.6	131.3	0.00078	492.4	364.8	0.300	0.233E 05	0.221E 03	0.00119	0.00169	0.00143	114.1	0.00134
8.03	1.223	0.016	3.931	2207.6	131.3	0.00078	492.4	364.8	0.294	0.233E 05	0.219E 03	0.00117	0.00166	0.00140	113.2	0.00132
8.53	1.224	0.015	3.930	2207.5	131.3	0.00078	492.4	364.8	0.285	0.233E 05	0.216E 03	0.00115	0.00161	0.00137	111.8	0.00130
9.03	1.225	0.014	3.929	2207.4	131.4	0.00078	492.4	364.8	0.272	0.233E 05	0.213E 03	0.00112	0.00155	0.00132	109.7	0.00127
9.53	1.226	0.013	3.928	2207.3	131.4	0.00078	492.4	364.8	0.259	0.233E 05	0.209E 03	0.00109	0.00149	0.00127	107.6	0.00124
10.03	1.228	0.012	3.928	2207.1	131.4	0.00078	492.4	364.8	0.246	0.233E 05	0.205E 03	0.00106	0.00142	0.00122	105.5	0.00121
10.53	1.229	0.012	3.927	2207.1	131.5	0.00078	492.4	364.9	0.238	0.233E 05	0.203E 03	0.00104	0.00138	0.00119	104.2	0.00119
11.03	1.229	0.011	3.927	2207.0	131.5	0.00078	492.4	364.9	0.226	0.233E 05	0.199E 03	0.00101	0.00132	0.00115	102.2	0.00116
11.53	1.231	0.010	3.926	2206.9	131.5	0.00079	492.4	364.9	0.213	0.233E 05	0.195E 03	0.00097	0.00126	0.00110	100.0	0.00113
12.03	1.232	0.010	3.925	2206.8	131.6	0.00079	492.4	364.9	0.213	0.233E 05	0.195E 03	0.00097	0.00126	0.00110	99.9	0.00113
12.53	1.342	0.011	3.862	2197.9	134.8	0.00084	492.8	366.3	0.206	0.240E 05	0.205E 03	0.00095	0.00120	0.00106	96.6	0.00110
13.03	1.510	0.013	3.775	2185.2	139.5	0.00091	493.3	368.2	0.192	0.251E 05	0.218E 03	0.00090	0.00110	0.00099	91.4	0.00105
13.53	1.711	0.015	3.685	2171.3	144.5	0.00099	493.8	370.4	0.191	0.262E 05	0.239E 03	0.00089	0.00106	0.00097	88.6	0.00103
14.03	2.145	0.020	3.524	2144.4	154.2	0.00117	494.9	374.5	0.184	0.284E 05	0.278E 03	0.00087	0.00098	0.00092	82.6	0.00099
14.53	2.541	0.031	3.405	2122.9	161.8	0.00132	495.7	377.7	0.217	0.301E 05	0.334E 03	0.00095	0.00109	0.00102	84.0	0.00107
15.03	3.018	0.044	3.286	2099.7	170.0	0.00149	496.6	381.2	0.250	0.320E 05	0.398E 03	0.00102	0.00118	0.00111	84.6	0.00114
15.53	3.623	0.066	3.161	2073.5	179.1	0.00170	497.6	385.1	0.301	0.341E 05	0.487E 03	0.00114	0.00133	0.00125	86.5	0.00124
16.03	4.398	0.086	3.031	2043.8	189.3	0.00195	498.7	389.4	0.323	0.365E 05	0.574E 03	0.00118	0.00136	0.00129	84.4	0.00127
16.53	5.168	0.111	2.924	2017.4	198.2	0.00219	499.7	393.2	0.361	0.386E 05	0.671E 03	0.00125	0.00145	0.00138	84.2	0.00133
17.03	6.293	0.137	2.794	1982.9	209.7	0.00252	501.0	398.0	0.378	0.413E 05	0.784E 03	0.00128	0.00144	0.00140	81.2	0.00135
17.53	7.451	0.164	2.684	1951.3	220.0	0.00284	502.1	402.4	0.401	0.437E 05	0.902E 03	0.00132	0.00147	0.00144	79.2	0.00138
18.03	8.983	0.188	2.563	1913.7	232.1	0.00325	503.5	407.6	0.405	0.466E 05	0.103E 04	0.00133	0.00142	0.00143	75.5	0.00137
18.53	10.416	0.210	2.468	1882.0	242.1	0.00361	504.6	411.8	0.413	0.489E 05	0.115E 04	0.00135	0.00141	0.00144	72.9	0.00138
19.03	11.948	0.235	2.380	1850.9	251.8	0.00398	505.6	415.9	0.430	0.511E 05	0.128E 04	0.00138	0.00142	0.00147	71.1	0.00140
19.53	13.841	0.254	2.286	1815.4	262.6	0.00442	506.8	420.5	0.429	0.535E 05	0.141E 04	0.00138	0.00137	0.00145	67.9	0.00140
20.03	16.479	0.273	2.174	1770.5	276.0	0.00501	508.3	426.2	0.421	0.564E 05	0.158E 04	0.00137	0.00131	0.00142	64.0	0.00138
20.53	18.999	0.291	2.083	1731.2	287.5	0.00555	509.6	431.1	0.420	0.589E 05	0.173E 04	0.00137	0.00127	0.00141	61.2	0.00137
21.03	20.378	0.317	2.038	1710.9	293.3	0.00583	510.2	433.6	0.453	0.601E 05	0.186E 04	0.00144	0.00134	0.00149	61.5	0.00143
21.53	20.981	0.339	2.019	1702.3	295.8	0.00595	510.5	434.6	0.489	0.606E 05	0.195E 04	0.00151	0.00142	0.00157	62.6	0.00149

TABLE 3: (continued)

X	P_W	$\Delta P_{F\&W}$	M_E	u_E	T_E	ρ_E	T_R	T'	C_{PP}	R_D	$\frac{u_{\tau W} d_S}{\nu_W}$	C_F F&S	C_F HKTR	C_F HKT'	$u_{\tau W}$	C_F SIG
22.03	21.361	0.348	2.008	1696.9	297.3	0.00603	510.6	435.2	0.502	0.609E 05	0.199E 04	0.00154	0.00145	0.00160	62.9	0.00152
22.53	21.608	0.355	2.001	1693.4	298.3	0.00608	510.7	435.7	0.512	0.611E 05	0.202E 04	0.00156	0.00147	0.00162	63.1	0.00153
23.03	21.758	0.357	1.996	1691.3	298.9	0.00611	510.8	435.9	0.514	0.612E 05	0.203E 04	0.00156	0.00147	0.00163	63.0	0.00154
23.53	21.859	0.358	1.993	1689.9	299.3	0.00613	510.8	436.1	0.514	0.613E 05	0.204E 04	0.00156	0.00147	0.00163	62.9	0.00154
24.03	21.978	0.357	1.990	1688.3	299.7	0.00615	510.9	436.3	0.512	0.614E 05	0.204E 04	0.00156	0.00146	0.00162	62.7	0.00153
24.53	22.013	0.356	1.989	1687.8	299.9	0.00616	510.9	436.3	0.509	0.614E 05	0.204E 04	0.00156	0.00146	0.00161	62.6	0.00153
25.03	22.066	0.354	1.987	1687.1	300.1	0.00617	510.9	436.4	0.505	0.614E 05	0.204E 04	0.00155	0.00145	0.00160	62.4	0.00152
25.53	22.101	0.353	1.986	1686.6	300.2	0.00618	511.0	436.5	0.502	0.614E 05	0.204E 04	0.00154	0.00144	0.00160	62.2	0.00152
26.03	22.069	0.351	1.987	1687.0	300.1	0.00617	510.9	436.4	0.498	0.614E 05	0.203E 04	0.00153	0.00143	0.00159	62.0	0.00151
26.53	22.038	0.348	1.988	1687.4	299.[illegible]	0.00617	510.9	436.4	0.493	0.614E 05	0.202E 04	0.00153	0.00142	0.00158	61.9	0.00150
27.03	22.024	0.345	1.988	1687.6	299.9	0.00616	510.9	436.3	0.488	0.614E 05	0.201E 04	0.00152	0.00141	0.00157	61.6	0.00149
27.53	21.994	0.342	1.989	1688.1	299.8	0.00616	510.9	436.3	0.482	0.614E 05	0.200E 04	0.00150	0.00139	0.00155	61.4	0.00148
28.03	21.912	0.340	1.992	1689.2	299.5	0.00614	510.9	436.2	0.478	0.613E 05	0.199E 04	0.00150	0.00138	0.00154	61.3	0.00148
28.53	21.796	0.337	1.995	1690.8	299.0	0.00612	510.8	436.0	0.474	0.612E 05	0.198E 04	0.00149	0.00137	0.00153	61.2	0.00147
29.03	21.530	0.333	2.000	1693.1	298.3	0.00608	510.7	435.7	0.470	0.611E 05	0.196E 04	0.00148	0.00136	0.00152	61.2	0.00146
29.53	21.497	0.331	2.004	1695.0	297.8	0.00606	510.7	435.5	0.466	0.610E 05	0.195E 04	0.00147	0.00136	0.00152	61.1	0.00146
30.03	21.366	0.326	2.008	1696.8	297.3	0.00603	510.6	435.2	0.460	0.609E 05	0.193E 04	0.00146	0.00134	0.00150	60.9	0.00144
30.53	21.337	0.322	2.009	1697.2	297.2	0.00602	510.6	435.2	0.452	0.608E 05	0.192E 04	0.00144	0.00132	0.00148	60.6	0.00143
31.03	21.308	0.317	2.010	1697.6	297.1	0.00602	510.6	435.2	0.443	0.608E 05	0.190E 04	0.00143	0.00130	0.00146	60.2	0.00141
31.53	21.228	0.312	2.012	1698.8	296.8	0.00600	510.6	435.0	0.435	0.608E 05	0.189E 04	0.00141	0.00128	0.00144	59.9	0.00140
32.03	21.233	0.307	2.012	1698.7	296.8	0.00600	510.6	435.0	0.425	0.608E 05	0.187E 04	0.00139	0.00125	0.00142	59.4	0.00138
32.53	21.239	0.301	2.012	1698.6	296.8	0.00601	510.6	435.0	0.413	0.608E 05	0.185E 04	0.00137	0.00123	0.00139	58.8	0.00136
INS.	PSIA	PSIA		FT/SEC	°R	SLUGS/ CU.FT.	°R	°R							FT/SEC	

TABLE 4: SKIN FRICTION CORRELATIONS IN RING PRESSURE GRADIENT FLOW

C_F CALCULATED FROM CORRELATIONS BY FENTER & STALMACH, HOPKINS & KEENER, AND SIGALLA;
HOPKINS & KEENER CORRELATION WITH (1): ADIABATIC WALL RECOVERY TEMPERATURE, T_R, AND (2): INTERMEDIATE TEMPERATURE, T', AS INPUT
STATIC PRESSURES CORRECTED FOR HOLE ERROR GIVEN BY FRANKLIN & WALLACE
P_0 = 120.7 PSIA; T_0 = 537.0 °R

X	P_W	ΔP F&W	M_E	u_E	T_E	ρ_E	T_R	T'	C_{PP}	F_D	$\frac{u_{\tau W} d_S}{\nu_W}$	C_F F&S	C_F HKTR	C_F HKT'	$u_{\tau W}$	C_F SIG
11.53	1.044	0.007	3.798	2188.6	138.2	0.00063	493.1	367.7	0.224	0.177E 05	0.167E 03	0.00106	0.00139	0.00121	101.5	0.00124
12.03	1.123	0.008	3.745	2180.6	141.1	0.00067	493.5	369.0	0.218	0.181E 05	0.175E 03	0.00104	0.00133	0.00117	98.7	0.00121
12.53	1.173	0.008	3.713	2175.7	142.9	0.00069	493.6	369.7	0.206	0.184E 05	0.177E 03	0.00101	0.00126	0.00112	95.6	0.00118
13.03	1.212	0.008	3.689	2172.0	144.3	0.00071	493.8	370.3	0.194	0.186E 05	0.177E 03	0.00097	0.00119	0.00107	92.8	0.00114
13.53	1.240	0.007	3.673	2169.5	145.2	0.00072	493.9	370.7	0.185	0.188E 05	0.177E 03	0.00094	0.00113	0.00103	90.7	0.00111
14.03	1.260	0.007	3.662	2167.6	145.9	0.00072	494.0	371.0	0.180	0.189E 05	0.177E 03	0.00093	0.00110	0.00101	89.4	0.00109
14.53	1.278	0.007	3.651	2165.9	146.5	0.00073	494.0	371.2	0.179	0.190E 05	0.179E 03	0.00092	0.00109	0.00100	88.8	0.00108
15.03	1.304	0.008	3.637	2163.6	147.3	0.00074	494.1	371.6	0.179	0.191E 05	0.181E 03	0.00092	0.00109	0.00099	88.4	0.00108
15.53	1.313	0.008	3.632	2162.8	147.6	0.00075	494.2	371.7	0.181	0.192E 05	0.183E 03	0.00093	0.00110	0.00100	88.7	0.00109
16.03	1.325	0.008	3.626	2161.7	148.0	0.00075	494.2	371.9	0.182	0.192E 05	0.185E 03	0.00093	0.00110	0.00101	88.6	0.00109
16.53	1.332	0.008	3.622	2161.1	148.2	0.00075	494.2	371.9	0.184	0.193E 05	0.186E 03	0.00093	0.00111	0.00101	88.8	0.00109
17.03	1.343	0.008	3.616	2160.1	148.6	0.00076	494.3	372.1	0.183	0.193E 05	0.187E 03	0.00093	0.00110	0.00101	88.5	0.00109
17.53	1.353	0.008	3.611	2159.2	148.9	0.00076	494.3	372.2	0.183	0.194E 05	0.188E 03	0.00093	0.00110	0.00101	88.3	0.00109
18.03	1.358	0.008	3.608	2158.8	149.0	0.00076	494.3	372.3	0.182	0.194E 05	0.188E 03	0.00093	0.00109	0.00100	88.1	0.00109
18.53	1.362	0.009	3.606	2158.5	149.1	0.00077	494.3	372.3	0.183	0.194E 05	0.189E 03	0.00093	0.00110	0.00101	88.2	0.00109
19.03	1.360	0.009	3.607	2158.6	149.1	0.00077	494.3	372.3	0.183	0.194E 05	0.189E 03	0.00093	0.00110	0.00101	88.3	0.00109
19.53	1.358	0.009	3.608	2158.8	149.0	0.00076	494.3	372.3	0.183	0.194E 05	0.189E 03	0.00093	0.00110	0.00101	88.3	0.00109
20.03	1.358	0.009	3.609	2158.8	149.0	0.00076	494.3	372.3	0.183	0.194E 05	0.189E 03	0.00093	0.00110	0.00101	88.3	0.00109
20.53	1.358	0.009	3.608	2158.8	149.0	0.00076	494.3	372.3	0.183	0.194E 05	0.189E 03	0.00093	0.00110	0.00101	88.3	0.00109
21.03	1.358	0.009	3.608	2158.8	149.0	0.00076	494.3	372.3	0.183	0.194E 05	0.189E 03	0.00093	0.00110	0.00101	88.3	0.00109
21.53	1.350	0.008	3.612	2159.5	148.8	0.00076	494.3	372.2	0.185	0.194E 05	0.188E 03	0.00094	0.00111	0.00102	88.7	0.00110
22.03	1.345	0.008	3.615	2160.0	148.6	0.00076	494.3	372.1	0.186	0.193E 05	0.188E 03	0.00094	0.00111	0.00102	88.9	0.00110
22.53	1.338	0.008	3.619	2160.6	148.4	0.00076	494.3	372.0	0.187	0.193E 05	0.188E 03	0.00094	0.00112	0.00102	89.2	0.00110
23.03	1.337	0.008	3.620	2160.7	148.3	0.00076	494.2	372.0	0.186	0.193E 05	0.187E 03	0.00094	0.00112	0.00102	89.1	0.00110
23.53	1.337	0.008	3.620	2160.7	148.3	0.00076	494.2	372.0	0.186	0.193E 05	0.187E 03	0.00094	0.00112	0.00102	89.1	0.00110
24.03	1.337	0.008	3.619	2160.7	148.3	0.00076	494.2	372.0	0.183	0.193E 05	0.186E 03	0.00093	0.00110	0.00101	88.6	0.00109
24.53	1.330	0.008	3.623	2161.3	148.1	0.00075	494.2	371.9	0.183	0.193E 05	0.185E 03	0.00093	0.00110	0.00101	88.6	0.00109
25.03	1.328	0.008	3.624	2161.4	148.1	0.00075	494.2	371.9	0.183	0.193E 05	0.185E 03	0.00093	0.00110	0.00101	88.7	0.00109
25.53	1.330	0.008	3.623	2161.3	148.1	0.00075	494.2	371.9	0.184	0.193E 05	0.186E 03	0.00093	0.00111	0.00101	88.9	0.00109
26.03	1.337	0.008	3.619	2160.7	148.3	0.00076	494.2	372.0	0.183	0.193E 05	0.186E 03	0.00093	0.00110	0.00101	88.6	0.00109
26.53	1.342	0.008	3.617	2160.3	148.5	0.00076	494.3	372.1	0.183	0.193E 05	0.187E 03	0.00093	0.00110	0.00101	88.6	0.00109
27.03	1.351	0.009	3.612	2159.4	148.8	0.00076	494.3	372.2	0.187	0.194E 05	0.189E 03	0.00094	0.00112	0.00103	89.1	0.00110
27.53	1.363	0.009	3.606	2158.4	149.2	0.00077	494.3	372.4	0.192	0.194E 05	0.192E 03	0.00096	0.00115	0.00104	89.8	0.00112
28.03	1.377	0.010	3.598	2157.1	149.6	0.00077	494.4	372.6	0.198	0.195E 05	0.196E 03	0.00097	0.00117	0.00107	90.5	0.00113
28.53	1.390	0.010	3.591	2156.0	150.0	0.00078	494.4	372.7	0.211	0.196E 05	0.202E 03	0.00101	0.00123	0.00111	92.4	0.00117
29.03	1.467	0.012	3.553	2149.5	152.3	0.00081	494.7	373.7	0.225	0.199E 05	0.215E 03	0.00105	0.00129	0.00116	93.4	0.00121
29.53	2.548	0.017	3.171	2075.6	178.4	0.00120	497.5	384.8	0.150	0.242E 05	0.278E 03	0.00080	0.00081	0.00082	70.3	0.00092
30.03	2.580	0.023	3.162	2073.7	179.0	0.00121	497.6	385.0	0.192	0.243E 05	0.306E 03	0.00093	0.00099	0.00098	76.4	0.00106
30.53	2.565	0.025	3.166	2074.6	178.7	0.00120	497.6	384.9	0.204	0.243E 05	0.312E 03	0.00097	0.00105	0.00102	78.3	0.00110
31.03	2.529	0.026	3.176	2076.7	178.0	0.00119	497.5	384.6	0.213	0.241E 05	0.313E 03	0.00099	0.00109	0.00105	79.7	0.00112
31.53	2.475	0.026	3.190	2079.8	176.9	0.00117	497.4	384.1	0.217	0.240E 05	0.311E 03	0.00101	0.00112	0.00107	80.8	0.00114
32.03	2.320	0.025	3.234	2089.1	173.7	0.00112	497.0	382.8	0.231	0.234E 05	0.303E 03	0.00104	0.00119	0.00113	83.9	0.00118
32.53	2.296	0.025	3.242	2090.7	173.1	0.00111	497.0	382.5	0.229	0.233E 05	0.300E 03	0.00104	0.00119	0.00112	83.9	0.00118
INS.	PSIA	PSIA		FT/SEC	°R	SLUGS/ CU.FT.	°R	°R							FT/SEC	

M : 6.5
R THETA X 10^{-3} : 0.5 - 5.5
TW/TR : 1.0

7103

ZPG - AW

Axially-symmetric blow-down tunnel, contoured nozzle. Running time 50 s. D = 0.56 m.
3.5 < PO < 21 MN/m^2. TO : 350 K. Helium. 6 < RE/m X 10^{-6} < 25.

FISCHER M.C. and MADDALON D.V., 1971. Experimental laminar, transitional and turbulent boundary layer profiles on a wedge at local Mach number 6.5 and comparisons with theory. NASA TN D-6462.
And Fischer M.C., private communication.

1 The test boundary layer was formed on the lower surface of a 5^o half-angle wedge the test surface being
at 10^o incidence to the M = 20 free stream. Two wedges (L = 0.406, W = 0.279 m) were used, the leading
edges (X = 0) being 51 μm thick. One was fitted with wall static tappings, and had a local surface
depression, of maximum depth 0.38 mm, extending from X = 0.305 to X = 0.381 m. The other, used for profile
measurements, could be fitted with a rear extension which increased the length to 0.610 m. The last four
of the seven survey stations were on the extension surface. Measurements of the model surface "indicated
2 excellent surface uniformity". The surface was not actively cooled. A detailed survey of the M = 20 free
stream was made by Arrington et al. (1964) and showed transverse Mach number variations of ± 0.3. Heat
3 transfer studies showed that the boundary layer did not become fully turbulent on the basic wedge models,
5 and prompted the construction of the extension to X = 0.61 m. Chamfered swept end plates were used to help
maintain two dimensional flow in the test region.

6 The pressure instrumented wedge had 12 static holes (d = 1.02 mm) mounted along the centre-line from
X = 0.105 to 0.376 m. The model used for profile studies had numerous thermocouples along the centre line
at intervals of about 12.5 mm for the same range of X. Thermocouples were also fitted to the extension.

7 Pitot profiles were obtained with two CPP. For the three upstream stations, d_1 = 1.02, d_2 = 0.51, l = 20 mm
while for the four downstream stations, on the model extension, d_1 = 2.29, d_2 = 1.78, l = 20 mm. All
8 measurements were made on the model centre line, the profiles at X values of 99.1, 180.3, 228.6, 431.8,
482.6, 533.4 and 599.4 mm.

9 The authors compared the measured PW values to both the inviscid calculated values and values calculated
using a laminar viscous interaction correction following Bertram 1966. The initial values agreed well with
the pressure predicted by Bertram, but further downstream departures were noted. These were attributed to
the surface depression remarked in § 1 above. The wall pressure values used in data reduction are
extrapolations of the initial measured values guided by the trends predicted by Bertram's analysis. Static
pressure was assumed constant through the boundary layer. Wall temperatures changed by less than 4 K during
a run, and average values were used.

10 Viscous interaction and rarefaction effects in the Pitot measurements were assessed following Beckwith et al.
(CAT 7105) and estimated at less than 2 %. Real gas effects were estimated as less than 1 % following
Erikson (1960). These possible corrections were therefore ignored. Probe wall-interference effects were
assessed by recalculating the integral thicknesses with the low y-values replaced by a curve faired in to
the wall static value. Changes in D1 and D2 were negligible. The Pitot pressure displayed an "overshoot"
in the outer part of the layer for the lowest values of X. This was attributed to the relatively large
size of the Pitot (d/D1 up to 0.5). These overshoots were replaced by a faired curve, following Monaghan
11 (1966) for the affected profiles (0101, 0201/2, 0301/2, 0401/2). Viscosity values for helium took account
of quantum effects, after Maddalon and Jackson (1970).

12 The editors have presented all the data available, incorporating the authors' assumptions and procedures.
We have however calculated viscosity as discussed in the introduction. The 'D' state is the authors' based
13 on the experimental position at which PT2 was either a maximum, or became effectively constant. The data

consists of four sets of six or seven successive profiles, each at a different unit Reynolds number. They range from laminar to fully turbulent.

§ DATA: 7103 0101-0407. Pitot profiles. NX = 6 or 7.

15 Editors' comments

The measurements are made in a Mach number range for which there are no really satisfying data. They overlap the studies by Danberg - CAT 6702 and Adcock et al. - CAT 6601, but have more in common with the measurements, at higher Mach number, of Watson et al. - CAT 7305. Both 7103 and 7305 provide a number of profile sequences spanning the transition region.

This is an adiabatic layer, so that the absence of TO profiles is not crucial, though regrettable at these high Mach numbers. More of a pity is the lack of CF measurements. In these respects the study is superseded by Watson et al. (CAT 7305).

CAT 7103 FISCHER BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR*	PED2W	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD*	PED2D	CQ	H32	H32K	TW	TD
Rℓ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
71030101	6.1000	1.0000	8.8629"+01	NM	36.1020	2.4447	6.7300"+02	6.7300"+02
9.9100"-02	4.4975"+05	1.0000	4.3774"+02	NM	1.5683	1.4866	3.0672"+02	2.5980"+01
INFINITE	3.4500"+02	0.0000	7.9483"-05	0.0000"+00	0.1740	6.2277"-04	1.8264"+03	3.0672"+02
71030102	6.1000	1.0000	1.4344"+02	NM	33.4072	2.3906	6.6200"+02	6.6200"+02
1.8030"-01	4.4240"+05	1.0000	7.0846"+02	NM	1.6645	1.5480	3.0672"+02	2.5980"+01
INFINITE	3.4500"+02	0.0000	1.3078"-04	0.0000"+00	0.1847	8.4356"-04	1.8264"+03	3.0672"+02
71030103	6.2000	1.0000	1.5452"+02	NM	35.6291	2.4729	6.5900"+02	6.5900"+02
2.2860"-01	4.7504"+05	1.0000	7.7804"+02	NM	1.6341	1.5156	3.0663"+02	2.5210"+01
INFINITE	3.4500"+02	0.0000	1.3713"-04	0.0000"+00	0.1818	9.6421"-04	1.8286"+03	3.0663"+02
71030104	6.2000	1.0000	2.2297"+02	NM	30.1898	2.0588	6.2200"+02	6.2200"+02
4.3180"-01	4.4837"+05	1.0000	1.1227"+03	NM	1.7745	1.6586	3.0663"+02	2.5210"+01
INFINITE	3.4500"+02	0.0000	2.0964"-04	0.0000"+00	0.1974	1.0570"-03	1.8286"+03	3.0663"+02
71030105	6.4000	1.0000	2.7961"+02	NM	30.7855	1.9379	6.1800"+02	6.1800"+02
4.8260"-01	5.1674"+05	1.0000	1.4622"+03	NM	1.8060	1.6957	3.0645"+02	2.3766"+01
INFINITE	3.4500"+02	0.0000	2.4880"-04	0.0000"+00	0.2018	1.1944"-03	1.8327"+03	3.0645"+02
71030106	6.3000	1.0000	2.9158"+02	NM	28.9406	1.8864	6.1700"+02	6.1700"+02
5.3340"-01	4.7926"+05	1.0000	1.4964"+03	NM	1.8362	1.7187	3.0654"+02	2.4472"+01
INFINITE	3.4500"+02	0.0000	2.6793"-04	0.0000"+00	0.2047	1.1045"-03	1.8307"+03	3.0654"+02
71030107	6.4000	1.0000	3.3185"+02	NM	29.2235	1.8101	6.1600"+02	6.1600"+02
5.9940"-01	5.1507"+05	1.0000	1.7353"+03	NM	1.8496	1.7343	3.0645"+02	2.3766"+01
INFINITE	3.4500"+02	0.0000	2.9623"-04	0.0000"+00	0.2067	1.1821"-03	1.8327"+03	3.0645"+02
71030201	6.3000	1.0000	1.2011"+02	NM	37.2507	2.5938	1.0720"+03	1.0720"+03
9.9100"-02	8.3268"+05	1.0000	6.1639"+02	NM	1.6440	1.5213	3.1364"+02	2.5040"+01
INFINITE	3.5300"+02	0.0000	6.5215"-05	0.0000"+00	0.1833	4.6016"-04	1.8518"+03	3.1364"+02
71030202	6.4000	1.0000	1.6841"+02	NM	35.2723	2.5428	1.0480"+03	1.0480"+03
1.8030"-01	8.7628"+05	1.0000	8.8063"+02	NM	1.7366	1.5799	3.1356"+02	2.4317"+01
INFINITE	3.5300"+02	0.0000	9.0717"-05	0.0000"+00	0.1940	5.2142"-04	1.8539"+03	3.1356"+02
71030203	6.3000	1.0000	1.7151"+02	NM	35.4134	2.5279	1.0400"+03	1.0400"+03
2.2860"-01	8.0782"+05	1.0000	8.8019"+02	NM	1.7092	1.5978	3.1364"+02	2.5040"+01
INFINITE	3.5300"+02	0.0000	9.5990"-05	0.0000"+00	0.1906	5.9669"-04	1.8518"+03	3.1364"+02
71030204	6.6000	1.0000	3.1838"+02	NM	31.4993	1.9097	9.8600"+02	9.8600"+02
4.3180"-01	9.5254"+05	1.0000	1.7273"+03	NM	1.8471	1.7342	3.1340"+02	2.2960"+01
INFINITE	3.5300"+02	0.0000	1.7170"-04	0.0000"+00	0.2072	7.3129"-04	1.8577"+03	3.1340"+02
71030205	6.7000	1.0000	4.0554"+02	NM	31.8785	1.8442	9.7900"+02	9.7900"+02
4.8260"-01	1.0152"+06	1.0000	2.2403"+03	NM	1.8623	1.7774	3.1332"+02	2.2322"+01
INFINITE	3.5300"+02	0.0000	2.1392"-04	0.0000"+00	0.2093	8.8181"-04	1.8595"+03	3.1332"+02
71030206	6.7000	1.0000	4.4044"+02	NM	30.9994	1.7183	9.7700"+02	9.7700"+02
5.3340"-01	1.0131"+06	1.0000	2.4331"+03	NM	1.8769	1.7897	3.1332"+02	2.2322"+01
INFINITE	3.5300"+02	0.0000	2.3281"-04	0.0000"+00	0.2110	8.8509"-04	1.8595"+03	3.1332"+02
71030207	6.7000	1.0000	4.8853"+02	NM	30.9597	1.6970	9.7400"+02	9.7400"+02
5.9940"-01	1.0100"+06	1.0000	2.6987"+03	NM	1.8737	1.7801	3.1332"+02	2.2322"+01
INFINITE	3.5300"+02	0.0000	2.5902"-04	0.0000"+00	0.2106	9.9727"-04	1.8595"+03	3.1332"+02

CAT 7103 FISCHER BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF	H12	H12K	PW*	PD*
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOO*	SW *	D2	PI2*	H42	D2K	UD	TR
71030301	6.5000	1.0000	1.6691"+02	NM	40.9361	2.5079	1.4780"+03	1.4780"+03
9.9100"-02	1.2947"+06	1.0000	9.0689"+02	NM	1.6284	1.5483	3.1420"+02	2.2965"+01
INFINITE	3.4800"+02	0.0000	6.0899"-05	0.0000"+00	0.1582	4.9257"-04	1.8353"+03	3.1420"+02
71030302	6.5000	1.0000	1.8175"+02	NM	37.7308	2.5808	1.4200"+03	1.4200"+03
1.8030"-01	1.2439"+06	1.0000	9.8754"+02	NM	1.7527	1.6396	3.1420"+02	2.2965"+01
INFINITE	3.4800"+02	0.0000	6.9023"-05	0.0000"+00	0.1703	4.1463"-04	1.8353"+03	3.1420"+02
71030303	6.5000	1.0000	1.8253"+02	NM	37.0351	2.4879	1.4050"+03	1.4050"+03
2.2860"-01	1.2307"+06	1.0000	9.9181"+02	NM	1.7465	1.6174	3.1420"+02	2.2965"+01
INFINITE	3.4800"+02	0.0000	7.0061"-05	0.0000"+00	0.1696	4.1922"-04	1.8353"+03	3.1420"+02
71030304	6.8000	1.0000	4.3629"+02	NM	33.5703	1.9109	1.3500"+03	1.3500"+03
4.3180"-01	1.4599"+06	1.0000	2.5028"+03	NM	1.8769	1.7688	3.1400"+02	2.1103"+01
INFINITE	3.4800"+02	0.0000	1.5963"-04	0.0000"+00	0.1834	6.2817"-04	1.8405"+03	3.1400"+02
71030305	6.9000	1.0000	5.6175"+02	NM	33.9156	1.8370	1.3380"+03	1.3380"+03
4.8260"-01	1.5494"+06	1.0000	3.2799"+03	NM	1.8943	1.8351	3.1394"+02	2.0532"+01
INFINITE	3.4800"+02	0.0000	2.0156"-04	0.0000"+00	0.1854	7.5100"-04	1.8421"+03	3.1394"+02
71030306	6.8000	1.0000	5.6617"+02	NM	32.3727	1.6112	1.3350"+03	1.3350"+03
5.3340"-01	1.4437"+06	1.0000	3.2480"+03	NM	1.8846	1.8159	3.1400"+02	2.1103"+01
INFINITE	3.4800"+02	0.0000	2.0949"-04	0.0000"+00	0.1841	8.0821"-04	1.8405"+03	3.1400"+02
71030401	6.6000	1.0000	2.1587"+02	NM	44.6265	3.1624	2.5640"+03	2.5640"+03
9.9100"-02	2.4770"+06	1.0000	1.1712"+03	NM	1.6478	1.5090	3.1428"+02	2.3025"+01
INFINITE	3.5400"+02	0.0000	4.4915"-05	0.0000"+00	0.1849	3.3777"-04	1.8603"+03	3.1428"+02
71030402	6.5000	1.0000	3.1340"+02	NM	33.8068	2.1325	2.4830"+03	2.4830"+03
1.8030"-01	2.2327"+06	1.0000	1.6695"+03	NM	1.7626	1.6548	3.1436"+02	2.3691"+01
INFINITE	3.5400"+02	0.0000	6.9364"-05	0.0000"+00	0.1974	3.9618"-04	1.8584"+03	3.1436"+02
71030403	6.5000	1.0000	2.8206"+02	NM	33.6431	2.7753	2.4750"+03	2.4750"+03
2.2860"-01	2.2255"+06	1.0000	1.5025"+03	NM	1.8702	1.8165	3.1436"+02	2.3691"+01
INFINITE	3.5400"+02	0.0000	6.2630"-05	0.0000"+00	0.2094	2.4139"-04	1.8584"+03	3.1436"+02
71030404	6.6000	1.0000	7.1518"+02	NM	31.0356	1.8315	2.4200"+03	2.4200"+03
4.3180"-01	2.3379"+06	1.0000	3.8801"+03	NM	1.8592	1.7779	3.1428"+02	2.3025"+01
INFINITE	3.5400"+02	0.0000	1.5766"-04	0.0000"+00	0.2086	6.4704"-04	1.8603"+03	3.1428"+02
71030405	6.8000	1.0000	9.0475"+02	NM	32.7169	1.8551	2.4060"+03	2.4060"+03
4.8260"-01	2.6754"+06	1.0000	5.0879"+03	NM	1.8696	1.8013	3.1413"+02	2.1772"+01
INFINITE	3.5400"+02	0.0000	1.8928"-04	0.0000"+00	0.2106	7.7661"-04	1.8638"+03	3.1413"+02
71030406	6.7000	1.0000	9.4384"+02	NM	31.4399	1.7125	2.3990"+03	2.3990"+03
5.3340"-01	2.4876"+06	1.0000	5.2139"+03	NM	1.8609	1.7908	3.1421"+02	2.2386"+01
INFINITF	3.5400"+02	0.0000	2.0384"-04	0.0000"+00	0.2092	8.5472"-04	1.8621"+03	3.1421"+02

TRAPEZOIDAL RULE FOR 0203,0302,0401,0403

71030201 FISCHER PROFILE TABULATION 28 POINTS, DELTA AT POINT 28

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88851	0.00000	0.00000	12.52598	0.00000
2	5.6430"-04	1.3708"+00	NM	0.90126	0.10100	0.33813	11.20816	0.03017
3	6.4510"-04	1.4211"+00	NM	0.90264	0.10700	0.35590	11.06573	0.03217
4	1.2042"-03	1.5757"+00	NM	0.90650	0.12300	0.40170	10.66607	0.03766
5	1.5903"-03	2.1532"+00	NM	0.91745	0.16500	0.50948	9.53420	0.05344
6	1.7955"-03	3.4456"+00	NM	0.93316	0.22500	0.63282	7.91030	0.08000
7	2.0007"-03	4.8764"+00	NM	0.94494	0.27500	0.71142	6.69247	0.10630
8	2.0520"-03	5.7398"+00	NM	0.95040	0.30100	0.74508	6.12737	0.12160
9	2.1789"-03	7.6255"+00	NM	0.95961	0.35100	0.79855	5.17600	0.15428
10	2.3085"-03	9.9984"+00	NM	0.96748	0.40300	0.84164	4.36153	0.19297
11	2.4624"-03	1.3022"+01	NM	0.97498	0.46500	0.88066	3.58684	0.24553
12	2.5137"-03	1.5158"+01	NM	0.97673	0.50300	0.89959	3.19852	0.28125
13	2.5650"-03	1.7399"+01	NM	0.98189	0.54000	0.91518	2.87229	0.31862
14	2.6406"-03	2.0819"+01	NM	0.98563	0.59200	0.93333	2.48559	0.37550
15	2.7189"-03	2.3811"+01	NM	0.98816	0.63400	0.94543	2.22370	0.42516
16	2.7945"-03	2.7165"+01	NM	0.99044	0.67800	0.95614	1.98878	0.48077
17	2.9241"-03	3.4728"+01	NM	0.99414	0.76800	0.97335	1.60625	0.60598
18	2.9997"-03	3.7923"+01	NM	0.99530	0.80300	0.97871	1.48552	0.65883
19	3.1023"-03	4.1164"+01	NM	0.99632	0.83700	0.98336	1.38031	0.71242
20	3.1536"-03	4.5352"+01	NM	0.99744	0.87900	0.98846	1.26456	0.78166
21	3.2319"-03	4.9106"+01	NM	0.99830	0.91500	0.99233	1.17617	0.84370
22	3.3075"-03	5.2349"+01	NM	0.99894	0.94500	0.99525	1.10918	0.89728
23	3.3831"-03	5.4794"+01	NM	0.99939	0.96700	0.99724	1.06352	0.93768
24	3.5370"-03	5.6151"+01	NM	0.99962	0.97900	0.99827	1.03976	0.96010
25	3.7692"-03	5.7295"+01	NM	0.99980	0.98900	0.99911	1.02055	0.97899
26	3.9987"-03	5.7755"+01	NM	0.99987	0.99300	0.99944	1.01300	0.98661
27	4.2309"-03	5.8102"+01	NM	0.99993	0.99600	0.99968	1.00740	0.99233
D 28	5.2920"-03	5.8566"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

71030207 FISCHER PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88759	0.00000	0.00000	14.03606	0.00000
2	1.1280"-03	2.6611"+00	NM	0.92353	0.18000	0.56544	9.86609	0.05730
3	1.7680"-03	4.0599"+00	NM	0.93775	0.23300	0.66799	8.21921	0.08127
4	2.1440"-03	6.2305"+00	NM	0.95212	0.29600	0.75768	6.55227	0.11564
5	2.4800"-03	8.4233"+00	NM	0.96169	0.34800	0.81189	5.44304	0.14916
6	2.9440"-03	1.0975"+01	NM	0.96940	0.40000	0.85310	4.54864	0.18755
7	3.3760"-03	1.3181"+01	NM	0.97429	0.44000	0.87815	3.98324	0.22046
8	3.9600"-03	1.5851"+01	NM	0.97877	0.48400	0.90061	3.46247	0.26011
9	4.5520"-03	1.8226"+01	NM	0.98187	0.52000	0.91584	3.10193	0.29525
10	5.3440"-03	2.0407"+01	NM	0.98421	0.55100	0.92711	2.83113	0.32747
11	6.2640"-03	2.3331"+01	NM	0.98677	0.59000	0.93930	2.53457	0.37060
12	7.1120"-03	2.6788"+01	NM	0.98917	0.63300	0.95063	2.25537	0.42150
13	7.7200"-03	2.9430"+01	NM	0.99069	0.66400	0.95767	2.08017	0.46038
14	8.3840"-03	3.2382"+01	NM	0.99212	0.69700	0.96430	1.91409	0.50379
15	8.8720"-03	3.5381"+01	NM	0.99336	0.72900	0.97000	1.77046	0.54788
16	9.4050"-03	3.7719"+01	NM	0.99420	0.75300	0.97386	1.67264	0.58223
17	1.0104"-02	4.1161"+01	NM	0.99528	0.78700	0.97880	1.54682	0.63278
18	1.0736"-02	4.4754"+01	NM	0.99626	0.82100	0.98321	1.43418	0.68555
19	1.1456"-02	4.9177"+01	NM	0.99727	0.86100	0.98780	1.31622	0.75048
20	1.2168"-02	5.2866"+01	NM	0.99800	0.89300	0.99107	1.23171	0.80463
21	1.3088"-02	5.7178"+01	NM	0.99874	0.92900	0.99439	1.14574	0.86791
22	1.4040"-02	5.9772"+01	NM	0.99914	0.95000	0.99617	1.09957	0.90597
23	1.5344"-02	6.3192"+01	NM	0.99962	0.97700	0.99831	1.04409	0.95615
24	1.6696"-02	6.4742"+01	NM	0.99982	0.98900	0.99920	1.02074	0.97890
25	1.8312"-02	6.5525"+01	NM	0.99992	0.99500	0.99964	1.00935	0.99038
D 26	2.0352"-02	6.6181"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

71030401 FISCHER PROFILE TABULATION 25 POINTS, DELTA AT POINT 25

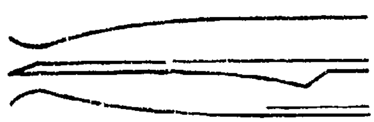
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88780	0.00000	0.00000	13.64982	0.00000
2	5.8000"-04	1.2893"+00	NM	0.89816	0.08600	0.30384	12.48203	0.02434
3	8.0600"-04	1.3040"+00	NM	0.89861	0.08800	0.31028	12.43198	0.02496
4	9.8200"-04	1.5823"+00	NM	0.90594	0.11800	0.40199	11.60565	0.03464
5	1.1080"-03	1.9587"+00	NM	0.91352	0.14600	0.47871	10.75091	0.04453
6	1.2600"-03	2.5368"+00	NM	0.92217	0.17700	0.55341	9.77567	0.05661
7	1.3600"-03	3.3984"+00	NM	0.93195	0.21300	0.62727	8.67256	0.07233
8	1.4620"-03	4.9933"+00	NM	0.94498	0.26600	0.71390	7.20288	0.09911
9	1.5620"-03	6.8377"+00	NM	0.95538	0.31600	0.77606	6.03131	0.12867
10	1.6880"-03	9.9631"+00	NM	0.96690	0.38600	0.83964	4.73168	0.17745
11	1.7380"-03	1.3776"+01	NM	0.97563	0.45700	0.88474	3.74799	0.23606
12	1.8140"-03	1.6082"+01	NM	0.97934	0.49500	0.90324	3.32961	0.27127
13	1.8640"-03	1.9536"+01	NM	0.98357	0.54700	0.92387	2.85266	0.32386
14	1.9400"-03	2.3184"+01	NM	0.98689	0.59700	0.93977	2.47795	0.37925
15	1.9640"-03	2.6657"+01	NM	0.98934	0.64100	0.95129	2.20245	0.43192
16	2.0160"-03	3.0466"+01	NM	0.99146	0.68600	0.96118	1.96317	0.48960
17	2.0900"-03	3.4907"+01	NM	0.99342	0.73500	0.97021	1.74244	0.55681
18	2.1660"-03	3.7290"+01	NM	0.99429	0.76000	0.97424	1.64326	0.59287
19	2.2160"-03	4.1168"+01	NM	0.99553	0.79900	0.97988	1.50400	0.65151
20	2.3420"-03	4.6641"+01	NM	0.99695	0.85100	0.98634	1.34335	0.73423
21	2.4440"-03	5.3152"+01	NM	0.99830	0.90900	0.99239	1.19188	0.83262
22	2.5440"-03	5.9355"+01	NM	0.99932	0.96100	0.99698	1.07628	0.92632
23	2.6460"-03	6.1797"+01	NM	0.99966	0.98000	0.99849	1.03810	0.96185
24	2.6960"-03	6.2712"+01	NM	0.99980	0.98800	0.99911	1.02261	0.97702
D 25	2.9720"-03	6.4233"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST

71030406 FISCHER PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88759	0.00000	0.00000	14.03606	0.00000
2	1.1392"-03	3.8231"+00	NM	0.93571	0.22500	0.65427	8.45571	0.07738
3	1.8944"-03	5.2696"+00	NM	0.94656	0.27000	0.72432	7.19677	0.10065
4	2.4512"-03	7.7539"+00	NM	0.95913	0.33300	0.79777	5.73941	0.13900
5	3.0784"-03	1.0922"+01	NM	0.96927	0.39900	0.85241	4.56405	0.18677
6	3.5840"-03	1.3647"+01	NM	0.97515	0.44800	0.88260	3.88124	0.22740
7	4.0640"-03	1.6494"+01	NM	0.97968	0.49400	0.90510	3.35689	0.26962
8	4.6976"-03	1.9477"+01	NM	0.98327	0.53800	0.92257	2.94059	0.31374
9	5.2544"-03	2.2183"+01	NM	0.98583	0.57500	0.93485	2.64330	0.35367
10	5.7856"-03	2.5150"+01	NM	0.98810	0.61300	0.94561	2.37956	0.39738
11	6.2912"-03	2.8478"+01	NM	0.99017	0.65300	0.95527	2.14007	0.44637
12	6.6944"-03	3.1382"+01	NM	0.99166	0.68600	0.96218	1.96729	0.48909
13	7.1744"-03	3.5094"+01	NM	0.99325	0.72600	0.96949	1.78326	0.54366
14	7.5008"-03	3.7917"+01	NM	0.99427	0.75500	0.97417	1.66484	0.58514
15	7.9296"-03	4.1057"+01	NM	0.99525	0.78600	0.97866	1.55032	0.63126
16	8.3328"-03	4.4109"+01	NM	0.99609	0.81500	0.98246	1.45318	0.67608
17	8.7360"-03	4.7717"+01	NM	0.99696	0.84800	0.98637	1.35297	0.72904
18	9.0944"-03	5.1005"+01	NM	0.99765	0.87700	0.98948	1.27295	0.77731
19	9.4976"-03	5.3810"+01	NM	0.99817	0.90100	0.99184	1.21181	0.81848
20	9.9008"-03	5.6448"+01	NM	0.99863	0.92300	0.99387	1.15945	0.85719
21	1.0355"-02	5.9398"+01	NM	0.99909	0.94700	0.99593	1.10600	0.90048
22	1.0912"-02	6.1660"+01	NM	0.99941	0.96500	0.99738	1.06823	0.93367
23	1.1565"-02	6.3836"+01	NM	0.99970	0.98200	0.99868	1.03427	0.96559
24	1.2454"-02	6.5133"+01	NM	0.99987	0.99200	0.99942	1.01502	0.98463
25	1.3414"-02	6.5918"+01	NM	0.99997	0.99800	0.99986	1.00373	0.99615
D 26	1.4445"-02	6.6181"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD ASSUME P=PD AND VAN DRIEST



M : 2.4 falling to 1.9
R THETA X 10^{-3} : 20 - 40
TW/TR : 1.05

7104

APG - AW

Fixed symmetrical nozzle blow down wind tunnel, running time 15 sec., W = H = 0.229 m.
PO : 0.35 MN/m^2. TO : 289 K. Air. RE/m X 10^{-6} : 4.

WALTRUP P.J. and SCHETZ J.A., 1971. An experimental investigation of a compressible turbulent boundary layer subjected to a systematic variation of adverse pressure gradients. Virginia Poly. Inst. VPI-E-71-18.
<u>And</u> Waltrup P.J., Schetz J.A., private communications.
<u>Also</u> Waltrup & Schetz (1973).

1 The test boundary layer was formed on the bottom nozzle block and test section wall of the wind tunnel.
The highly polished instrumental section started at the end of the nozzle block (X = 0) and extended 0.23 m
downstream. Pressure gradients could be imposed by three ramps of the full tunnel width. These were mounted
in the centre of the tunnel as an extension of a plate running through the nozzle into the settling chamber
so as to eliminate leading edge disturbances. The resulting reflected wave pressure histories are listed
4 with the wall temperature histories in section D. The test layer had undergone a largely two dimensional
2 expansion in the nozzle, and all three imposed pressure gradients commenced at X = 22.2 mm. Weak disturbances
were generated by the nozzle / wall junction (X = 0) and several small machining slope-discontinuities on the
3 ramps. It was believed that the effect was small, probably less than 1 % in Mach number. Spark schlieren
photographs clearly established that the boundary layer was turbulent. Changes of static pressure across
5 the test-surface were less than 1 % in the central 100 mm.

6 Static pressure was measured at up to 38 tappings of 0.78 mm diameter, and wall temperature by means of 0.25 mm copper-constantan thermocouples press-fitted into the test-surface at up to 15 stations. Wall shear stress could be determined at three stations using a FEB copied from the NOL balance of Bruno, Yanta and Risher (1969). The element was rectangular (ΔX = 12.7, ΔZ = 25.4 mm) set across the centre line.

7 The Pitot probe used was a FPP made by flattening 3.2 mm diameter tubing to give a rectangular probe tip for
which h_1 = 0.66, h_2 = 0.254, b_1 = 3.58, b_2 = 3.2 mm. Total temperature was found with a STP (d_1 = 1.57,
d_2 = 0.97 mm) containing a copper-constantan thermocouple bead 0.13 mm in diameter about 2.5 mm back from
the opening. The cone static probe was a 10^o semi-angle cone with a base diameter of 1.6 mm and four static
holes (D = 0.33 mm) drilled in the conical surface about 3/4 of the way back from the tip. This was directly
calibrated and its sensitivity to angle of attack found in the wind tunnel. The total temperature probe was
calibrated directly for M between 1.95 and 2.36, results for lower Mach numbers being taken from an extra-
polation of the data of Hottel & Kalitinsky (1945). The various probes deflected under aerodynamic loading,
10 and a correction, found from photographs to be constant for each particular probe, was applied to allow for
this. Traverses were taken with a DISA type 55 F 31 boundary layer probe and associated commercial hot-wire
anemometer electronics at the X = 22.2 and 178 mm stations using ramp 2. The probe wire was of platinum
plated tungsten (d = 5 μm, l/d = 250).

8 The detailed disposition of all the wall measurement positions is to be found in figure 2 of Waltrup and Schetz (1973). The four stations are at X = 22.2, 76.2, 127 and 178 mm. At the last three, provision for inserting the FEB was made on the centre line. Profiles could be obtained at all four X-values at points 12.7 mm off the centre line. Rows of 6-7 static pressure tappings and 3-4 thermocouples were arranged at each station. Data from other X-values is presented in section D.

9 Pitot, static pressure and total temperature profiles were taken on separate occasions. The authors have interpolated the TO and P data to the Y values of the Pitot measurements. A polynominal approximation and the Rayleigh-Pitot formula (Volluz 1961) were used to allow Mach number determination without iteration. The recovery factor used was 0.89.

12 The tables computed by the editors incorporate the varied calibration and data reduction procedures of the

13 authors. The profiles presented consist of three sets for four successive X-stations. The first profile in each set is very nearly the same, the X = 22.2 mm station being upstream of the start of the imposed pressure gradient. The three succeeding stations of a set describe the development of the layer under an

14 adverse pressure gradient on a straight wall, the pressure history of each set being different. The wall pressure and temperature data is presented in section D, together with the measured shear stress. Also presented are the author's reduced hot-wire measurements.

§ DATA: 7104 0101-0304. Pitot, TO and P profiles measured separately. NX = 4. CF from FEB. Some hot-wire measurements.

15 Editors' comments

The entry describes three APG flows of varied severity. Similar examples of nominally planar straight-wall compressions are Zwarts - CAT 7007 and Thomas - CAT 7401. Axisymmetric examples are Peake et al. - CAT 7102 and Lewis et al. - CAT 7201. As with all nominally planar cases, cross flow effects cannot be eliminated with confidence.

The Mach number is low, and the flow near-adiabatic so that the rather simple approach to TO probe calibrations is probably adequate. All TO profiles show an outer region overshoot. The static pressure profiles show a dip of 10 % in the outer part of the layer. In a straight wall flow at these low Mach numbers, streamline curvature, streamline divergence, and normal turbulent stresses are unlikely to produce a dip of this magnitude. The location of the pressure drop suggests that it may be caused by turbulence effects on the calibration of the static probe used, which is not of a common type for this Mach number range.

The three test cases are intended to be distinguished by -ve, zero and +ve values of $\delta^2 p/\delta x^2$. On a transformed log-law plot we find that the outer regions of the profile do not differ very much from ZPG profiles, but that there are sometimes peculiarities in the inner regions. The calculated PO values for the profiles suggest that the D-state should be taken further out towards the free stream, and that measurements for profiles 0101/3, 0203 should have been continued to higher values of Y. Measurements do not extend within the momentum deficit peak for 0101, 0102 and series 03.

CAT 7104 WALTRUP BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN / X * / RZ	MD * / POD / TOD	TW/TR / PW/PD / SW *	RED2W / RED2D / D2	CF * / CQ / PI2	H12 / H32 / H42	H12K / H32K / D2K	PW* / TW* / UD	PD* / TD* / TR
71040101	2.3610	1.0437	1.5030"+04	NM	1.7794	1.4673	2.6717"+04	2.5959"+04
2.2225"-02	3.5709"+05	1.0292	2.8009"+04	NM	1.8006	1.8007	2.8568"+02	1.3693"+02
INFINITE	2.8960"+02	0.0000	7.3280"-04	NC	0.8603	7.4989"-04	5.5394"+02	2.7372"+02
71040102	2.0980	1.0391	1.7391"+04	1.3432"-03	3.5453	1.6069	4.0128"+04	3.7818"+04
7.6200"-02	3.4475"+05	1.0611	2.9193"+04	NM	1.7413	1.7244	2.8620"+02	1.5398"+02
INFINITE	2.8953"+02	0.0000	6.9553"-04	NC	-0.0296	9.1750"-04	5.2197"+02	2.7543"+02
71040103	1.9340	1.0367	2.1823"+04	1.3136"-03	3.4991	1.5753	4.8298"+04	4.7712"+04
1.2700"-01	3.3696"+05	1.0123	3.4403"+04	NM	1.7414	1.7283	2.8617"+02	1.6527"+02
INFINITE	2.8891"+02	0.0000	7.7742"-04	NC	-0.0165	1.0244"-03	4.9850"+02	2.7605"+02
71040104	1.8820	0.9800	2.6107"+04	1.4036"-03	3.2447	1.5425	5.5469"+04	5.4090"+04
1.7780"-01	3.5250"+05	1.0255	3.8638"+04	NM	1.7359	1.7250	2.7121"+02	1.6929"+02
INFINITE	2.8921"+02	0.0000	8.1806"-04	NC	-0.0157	1.0580"-03	4.9096"+02	2.7674"+02
71040201	2.3760	1.0446	1.1865"+04	NM	3.9479	1.4479	2.6959"+04	2.5580"+04
2.2225"-02	3.6022"+05	1.0539	2.2253"+04	NM	1.8076	1.7937	2.8591"+02	1.3607"+02
INFINITE	2.8970"+02	0.0000	5.8186"-04	NC	-0.0161	7.7572"-04	5.5569"+02	2.7372"+02
71040202	2.2780	1.0453	1.2090"+04	1.4693"-03	4.1336	1.4687	2.8855"+04	2.8510"+04
7.6200"-02	3.4443"+05	1.0121	2.1847"+04	NM	1.7989	1.7827	2.8614"+02	1.4184"+02
INFINITE	2.8906"+02	0.0000	5.6687"-04	NC	-0.0328	7.6978"-04	5.4396"+02	2.7375"+02
71040203	2.1080	1.0400	1.6805"+04	1.3539"-03	3.8223	1.4902	3.7404"+04	3.7163"+04
1.2700"-01	3.4412"+05	1.0065	2.8340"+04	NM	1.7789	1.7637	2.8603"+02	1.5311"+02
INFINITE	2.8919"+02	0.0000	6.7847"-04	NC	-0.0279	9.0883"-04	5.2298"+02	2.7503"+02
71040204	1.9500	1.0365	2.1577"+04	1.3439"-03	3.3490	1.5433	4.8884"+04	4.7609"+04
1.7780"-01	3.4468"+05	1.0268	3.4213"+04	NM	1.7458	1.7321	2.8597"+02	1.6409"+02
INFINITE	2.8888"+02	0.0000	7.6086"-04	NC	-0.0517	9.8796"-04	5.0082"+02	2.7590"+02
71040301	2.3720	1.0496	1.1186"+04	NM	4.4248	1.4652	2.6717"+04	2.6062"+04
2.2225"-02	3.6473"+05	1.0251	2.1036"+04	NM	1.8117	1.7977	2.8620"+02	1.3578"+02
INFINITE	2.8857"+02	0.0000	5.3915"-04	NC	-0.0636	7.3380"-04	5.5416"+02	2.7268"+02
71040302	2.2970	1.0477	1.2274"+04	1.5686"-03	3.7779	1.4593	2.8613"+04	2.7372"+04
7.6200"-02	3.4067"+05	1.0453	2.2388"+04	NM	1.8033	1.7880	2.8617"+02	1.4040"+02
INFINITE	2.8856"+02	0.0000	5.9148"-04	NC	-0.0284	7.8145"-04	5.4570"+02	2.7315"+02
71040303	2.2200	1.0431	1.4625"+04	1.5069"-03	3.3980	1.4177	3.1716"+04	3.0372"+04
1.2700"-01	3.3508"+05	1.0443	2.5800"+04	NM	1.8023	1.7904	2.8600"+02	1.4560"+02
INFINITE	2.8912"+02	0.0000	6.6893"-04	NC	0.0309	8.6308"-04	5.3709"+02	2.7419"+02
71040304	2.1240	1.0412	1.8470"+04	1.4067"-03	3.5375	1.4802	3.7680"+04	3.6784"+04
1.7780"-01	3.4923"+05	1.0244	3.1366"+04	NM	1.7769	1.7626	2.8612"+02	1.5196"+02
INFINITE	2.8906"+02	0.0000	7.4504"-04	NC	-0.0274	9.8428"-04	5.2496"+02	2.7480"+02

INPUT TAUW NOT CF

71040101 WALTRUP PROFILE TABULATION 27 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.02922	0.89681	0.00000	0.00000	1.89662	0.00000
2	4.2672E-04	3.1158E+00	1.02922	0.70363	0.60097	0.61900	1.06091	0.60051
3	6.5852E-04	3.6339E+00	1.02922	0.73982	0.65954	0.67700	1.05364	0.66131
4	1.0541E-03	4.1066E+00	1.02922	0.77228	0.70845	0.72500	1.04727	0.71250
5	1.4554E-03	4.5553E+00	1.02789	0.80231	0.75178	0.76700	1.04091	0.75741
6	1.6764E-03	4.9646E+00	1.02656	0.82952	0.78913	0.80300	1.03545	0.79610
7	1.9837E-03	5.2388E+00	1.02390	0.84755	0.81316	0.82600	1.03182	0.81966
8	2.3597E-03	5.4712E+00	1.02125	0.86300	0.83297	0.84500	1.02909	0.83856
9	2.9464E-03	5.7507E+00	1.00797	0.88114	0.85617	0.86700	1.02545	0.85222
10	3.6068E-03	6.0939E+00	0.99203	0.90311	0.88381	0.89300	1.02091	0.86774
11	4.1910E-03	6.3931E+00	0.98008	0.92236	0.90720	0.91500	1.01727	0.88155
12	4.8768E-03	6.6882E+00	0.97477	0.94113	0.92968	0.93600	1.01364	0.90011
13	5.6388E-03	7.0384E+00	0.96680	0.96297	0.95567	0.96000	1.00909	0.91977
14	6.2484E-03	7.2010E+00	0.96946	0.97331	0.96749	0.97100	1.00727	0.93454
15	6.8834E-03	7.3861E+00	0.97078	0.98438	0.98077	0.98300	1.00455	0.94996
16	7.5946E-03	7.4908E+00	0.97875	0.99123	0.98820	0.99000	1.00364	0.96545
17	8.3058E-03	7.5459E+00	0.98938	0.99351	0.99210	0.99300	1.00182	0.98067
18	8.9662E-03	7.6235E+00	0.99602	0.99832	0.99755	0.99800	1.00091	0.99312
D 19	9.6774E-03	7.6586E+00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
20	1.0389E-02	7.6586E+00	1.01726	1.00000	1.00000	1.00000	1.00000	1.01726
21	1.1125E-02	7.5950E+00	1.03586	0.99622	0.99555	0.99600	1.00091	1.03078
22	1.1735E-02	7.5808E+00	1.04117	0.99517	0.99455	0.99500	1.00091	1.03502
23	1.2344E-02	7.5808E+00	1.04648	0.99517	0.99455	0.99500	1.00091	1.04030
24	1.3030E-02	7.5523E+00	1.05445	0.99308	0.99255	0.99300	1.00091	1.04612
25	1.3691E-02	7.5459E+00	1.05710	0.99351	0.99210	0.99300	1.00182	1.04780
26	1.4300E-02	7.5459E+00	1.06242	0.99351	0.99210	0.99300	1.00182	1.05307
27	1.4935E-02	7.5808E+00	1.05578	0.99517	0.99455	0.99500	1.00091	1.04954

INPUT VARIABLES Y,U/UD,T/TD,P/P0

71040102 WALTRUP PROFILE TABULATION 27 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.06108	0.98753	0.00000	0.00000	1.85687	0.00000
2	4.6482E-04	1.5563E+00	1.06108	0.98990	0.39117	0.50100	1.64036	0.32407
3	7.8994E-04	1.6667E+00	1.06016	0.99042	0.42251	0.53600	1.60939	0.35308
4	1.0338E-03	1.7992E+00	1.05925	0.99156	0.45557	0.57200	1.57642	0.38435
5	1.2852E-03	2.0282E+00	1.05834	0.99300	0.50441	0.62300	1.52547	0.43222
6	1.5215E-03	2.2694E+00	1.05743	0.99460	0.54854	0.66700	1.47852	0.47703
7	1.7399E-03	2.4134E+00	1.05652	0.99711	0.57295	0.69100	1.45455	0.50191
8	2.0752E-03	2.7029E+00	1.05469	0.99961	0.61804	0.73300	1.40659	0.54962
9	2.3876E-03	2.8960E+00	1.04923	1.00112	0.64604	0.75800	1.37662	0.57773
10	2.6670E-03	3.1931E+00	1.04740	1.00135	0.68658	0.79200	1.33067	0.62340
11	2.9972E-03	3.3609E+00	1.03737	1.00263	0.70832	0.81000	1.30769	0.64256
12	3.6322E-03	3.8237E+00	1.02461	1.00450	0.76483	0.85400	1.24675	0.70184
13	4.2418E-03	4.2315E+00	1.01732	1.00430	0.81114	0.88700	1.19580	0.75461
14	4.9022E-03	4.7020E+00	1.00456	1.00738	0.86132	0.92200	1.14585	0.80831
15	5.6134E-03	5.0489E+00	1.00000	1.00694	0.89645	0.94400	1.10889	0.85130
16	6.2484E-03	5.3399E+00	0.99362	1.00866	0.92486	0.96200	1.08192	0.88349
17	6.8580E-03	5.7554E+00	0.98997	1.00547	0.96393	0.98300	1.03996	0.93575
18	7.5946E-03	6.0370E+00	0.98724	1.00317	0.98959	0.99600	1.01299	0.97068
19	8.2804E-03	6.1154E+00	0.99818	1.00172	0.99651	0.99900	1.00500	0.99222
D 20	8.8900E-03	6.1546E+00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
21	9.6012E-03	6.1153E+00	1.00912	0.99972	0.99651	0.99800	1.00300	1.00409
22	1.0008E-02	6.1153E+00	1.01185	0.99972	0.99651	0.99800	1.00300	1.00681
23	1.0973E-02	6.0763E+00	1.01823	0.99945	0.99303	0.99600	1.00599	1.00812
24	1.1659E-02	6.0430E+00	1.02461	0.99865	0.99005	0.99400	1.00799	1.01039
25	1.2243E-02	6.0210E+00	1.02917	0.99878	0.98808	0.99300	1.00999	1.01186
26	1.2827E-02	6.0155E+00	1.03099	0.99931	0.98759	0.99300	1.01099	1.01265
27	1.3411E-02	6.0321E+00	1.03099	0.99971	0.98907	0.99400	1.00999	1.01467

INPUT VARIABLES Y,U/UD,T/TD,P/P0

71040103 WALTRUP PROFILE TABULATION 27 POINTS, DELTA AT POINT 22

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.01228	0.99043	0.00000	0.00000	1.73134	0.00000
2	5.1054"-04	1.5764"+00	1.01228	0.99025	0.43087	0.53120	1.51995	0.35378
3	7.8994"-04	1.6572"+00	1.01228	0.99214	0.45558	0.55820	1.50125	0.37639
4	1.0046"-03	1.7854"+00	1.01228	0.99330	0.49069	0.59520	1.47135	0.40949
5	1.2751"-03	1.9426"+00	1.01228	0.99411	0.52847	0.63360	1.43746	0.44619
6	1.4732"-03	2.0794"+00	1.01228	0.99418	0.55791	0.66240	1.40966	0.47567
7	1.8059"-03	2.2551"+00	1.01228	0.99770	0.59254	0.69640	1.38126	0.51037
8	2.2504"-03	2.4136"+00	1.01156	0.99994	0.62155	0.72380	1.35606	0.53992
9	2.5400"-03	2.6062"+00	1.01012	1.00064	0.65462	0.75340	1.32457	0.57454
10	2.9972"-03	2.7719"+00	1.00361	1.00018	0.68150	0.77630	1.29757	0.60043
11	3.6322"-03	3.0597"+00	0.99639	1.00111	0.72544	0.81290	1.25567	0.64504
12	3.9878"-03	3.3053"+00	0.99061	1.00170	0.76067	0.84090	1.22208	0.68163
13	4.2926"-03	3.4898"+00	0.98483	1.00395	0.78598	0.86110	1.20028	0.70653
14	4.5974"-03	3.7126"+00	0.98338	1.00401	0.81542	0.88280	1.17208	0.74067
15	4.9784"-03	3.9118"+00	0.97977	1.00674	0.84082	0.90210	1.15108	0.76784
16	5.6642"-03	4.2503"+00	0.97543	1.00808	0.88216	0.93100	1.11379	0.81535
17	6.4262"-03	4.5337"+00	0.97616	1.00546	0.91528	0.95140	1.08049	0.85953
18	7.0612"-03	4.8649"+00	0.98121	1.00290	0.95301	0.97370	1.04390	0.91523
19	7.6962"-03	5.0890"+00	0.98338	1.00300	0.97678	0.98800	1.02310	0.94965
20	8.4328"-03	5.2444"+00	0.98555	1.00173	0.99328	0.99700	1.00750	0.97528
21	9.1186"-03	5.2888"+00	0.99566	1.00035	0.99795	0.99900	1.00210	0.99258
D 22	9.8298"-03	5.3084"+00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
23	1.0516"-02	5.3055"+00	1.00361	1.00034	0.99970	1.00000	1.00060	1.00301
24	1.1227"-02	5.2988"+00	1.00867	1.00034	0.99900	0.99960	1.00120	1.00706
25	1.1862"-02	5.2941"+00	1.01084	1.00032	0.99850	0.99930	1.00160	1.00852
26	1.2497"-02	5.2594"+00	1.01662	1.00030	0.99487	0.99720	1.00470	1.00903
27	1.3157"-02	5.2698"+00	1.01806	0.99944	0.99596	0.99740	1.00290	1.01248

INPUT VARIABLES Y,U/UD,T/TD,P/PO

71040104 WALTRUP PROFILE TABULATION 27 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.02549	0.93776	0.00000	0.00000	1.60205	0.00000
2	3.8862"-04	1.5682"+00	1.02486	0.98383	0.44006	0.53500	1.47800	0.37097
3	6.9850"-04	1.6178"+00	1.02358	0.98388	0.45606	0.55200	1.46500	0.38568
4	1.0109"-03	1.7269"+00	1.02231	0.98529	0.48833	0.58600	1.44000	0.41602
5	1.2649"-03	1.8654"+00	1.02103	0.98628	0.52466	0.62300	1.41000	0.45114
6	1.5773"-03	2.0314"+00	1.01912	0.99704	0.56299	0.66400	1.39100	0.48648
7	1.9710"-03	2.2130"+00	1.01721	1.00100	0.60066	0.70100	1.36200	0.52354
8	2.6924"-03	2.4025"+00	1.01402	1.00132	0.63670	0.73400	1.32900	0.56004
9	3.2512"-03	2.6543"+00	1.01020	1.00228	0.68085	0.77300	1.28900	0.60581
10	3.5306"-03	2.8727"+00	1.00765	1.00257	0.71651	0.80300	1.25600	0.64422
11	3.8100"-03	2.9729"+00	1.00446	1.00310	0.73220	0.81600	1.24200	0.65994
12	4.3688"-03	3.2566"+00	1.00191	1.00435	0.77465	0.85000	1.20400	0.70733
13	5.0038"-03	3.5322"+00	0.99873	1.00596	0.81356	0.88000	1.17000	0.75118
14	5.5880"-03	3.9101"+00	0.99299	1.00392	0.86382	0.91500	1.12200	0.80979
15	6.2230"-03	4.2355"+00	0.98853	1.00891	0.90473	0.94500	1.09100	0.85624
16	6.6548"-03	4.4940"+00	0.98789	1.00639	0.93588	0.96400	1.06100	0.89757
17	6.9342"-03	4.5853"+00	0.98725	1.00476	0.94662	0.97000	1.05000	0.91203
18	7.4930"-03	4.8564"+00	0.98789	1.00439	0.97782	0.98900	1.02300	0.95506
19	8.2042"-03	4.9610"+00	0.98853	1.00230	0.98957	0.99500	1.01100	0.97288
20	8.7630"-03	5.0503"+00	0.99490	1.00059	0.99950	1.00000	1.00100	0.99391
D 21	9.3980"-03	5.0548"+00	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
22	9.7536"-03	4.9608"+00	1.00637	1.00031	0.98956	0.99400	1.00900	0.99141
23	1.0058"-02	4.9432"+00	1.01083	1.00065	0.98758	0.99300	1.01100	0.99284
24	1.0897"-02	4.9256"+00	1.01530	1.00100	0.98561	0.99200	1.01300	0.99425
25	1.1455"-02	4.9125"+00	1.01721	1.00076	0.98413	0.99100	1.01400	0.99414
26	1.2065"-02	4.8993"+00	1.02167	1.00053	0.98266	0.99000	1.01500	0.99651
27	1.2725"-02	4.8819"+00	1.02304	1.00088	0.98070	0.98900	1.01700	0.99974

INPUT VARIABLES Y,U/UD,T/TD,P/PO

SECTION D - ADDITIONAL DATA

NB FACSIMILE FROM SOURCE PAPER: AUTHORS' SYMBOLS AND UNITS

TABLE B-I

WALL PRESSURE, TEMPERATURE, AND SHEAR FOR RAMP 1

CAT 7104
0101-0104

x(in.)	Station	$\frac{P_w}{P_o}$	$\frac{T_w}{T_o}$	$\frac{T_w - T_{aw}}{T_{aw}}$	τ_w (lb/in²)
0.00					
0.875	1	0.0775	0.9889	0.0495	
1.50		0.0759	0.9905		
2.00		0.0896	0.9908		
2.50		0.1078	0.9901		
3.00	2	0.1164	0.9907	0.0434	0.0227
3.50		0.1222	0.9909		
4.00		0.1286	0.9905		
4.50		0.1350	0.9907		
5.00	3	0.1401	0.9906	0.0391	0.0236
5.50		0.1443	0.9903		
6.00		0.1491	0.9897		
6.50		0.1555	0.9900		
7.00	4	0.1609	0.9388	0.0353	0.0273
7.50		0.1668	0.9899		
8.00		0.1727	0.9901		
8.50		0.1819	0.9890		
9.00		0.1871	0.9908		

TABLE B-VI

WALL PRESSURE, TEMPERATURE, AND SHEAR FOR RAMP 2

CAT 7104
0201-0204

x (in.)	Station	$\frac{P_w}{P_o}$	$\frac{T_w}{T_o}$	$\frac{T_w - T_{aw}}{T_{aw}}$	τ_w (lb/in²)
0.00					
0.875	1	0.0782	0.9897	0.0494	
1.50		0.0779	0.9902		
2.00		0.0757	0.9907		
2.50		0.0762	0.9901		
3.00	2	0.0837	0.9905	0.0468	.02207
3.50		0.0945	0.9908		
4.00		0.0983	0.9910		
4.50		0.1077	0.9902		
5.00	3	0.1085	0.9901	0.0415	.02270
5.50		0.1143	0.9898		
6.00		0.1216	0.9889		
6.50		0.1331	0.9900		
7.00	4	0.1418	0.9899	0.0393	.0247
7.50		0.1489	0.9904		
8.00		0.1530	0.9895		
8.50		0.1572	0.9901		
9.00		0.1662	0.9902		

SECTION D (CONT.) - ADDITIONAL DATA

NB FACSIMILE FROM SOURCE PAPER: AUTHORS' SYMBOLS AND UNITS

TABLE D-XI

WALL PRESSURE, TEMPERATURE, AND SHEAR FOR RAMP 3

CAT 7104
0301-0304

x (in.)	Station	$\frac{P_w}{P_o}$	$\frac{T_w}{T_o}$	$\frac{T_w - T_{aw}}{T_{aw}}$	$\frac{\tau_w}{(lb./in.^2)}$
0.00					
0.875	1	0.0775	0.9907	0.0514	
1.50		0.0763	0.9911		
2.00		0.0773	0.9901		
2.50		0.0803	0.9904		
3.00	2	0.0830	0.9906	0.0492	0.0230
3.50		0.0875	0.9903		
4.00		0.0898	0.9907		
4.50		0.0908	0.9906		
5.00	3	0.0920	0.9900	0.0472	0.0229
5.50		0.0945	0.9911		
6.00		0.0988	0.9908		
6.50		0.1053	0.9905		
7.00	4	0.1093	0.9904	0.0413	0.0237
7.50		0.1171	0.9901		
8.00		0.1204	0.9905		
8.50		0.1325	0.9899		
9.00		0.1418	0.9902		

SECTION D - ADDITIONAL DATA

NB FACSIMILE FROM SOURCE PAPER: AUTHORS' SYMBOLS AND UNITS

7104
0201

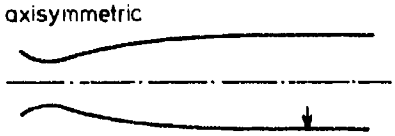
TABLE D-XVI

HOT WIRE MEASUREMENTS

7104
0204

RAMP 2, STATION 1			RAMP 2, STATION 4		
y	$\rho u/\rho_e U_e$	$\sqrt{\overline{U'^2}}/U$	y	$\rho u/\rho_e U_e$	$\sqrt{\overline{U'^2}}/U$
.0886	.609	.0524	.0787	.521	.0679
.116	.676	.0495	.111	.601	.0715
.150	.738	.0468	.141	.668	.0726
.189	.801	.0428	.169	.729	.0677
.213	.841	.0370	.204	.805	.0585
.221	.896	.0312	.218	.848	.0476
.276	.933	.0252	.267	.936	.0370
.311	.962	.0150	.300	.976	.0317
.339	.980	.0103	.330	.992	.0211
.378	1.000	.00625	.342	.997	.0136
.419	1.011	.00445	.367	1.000	.00885

axisymmetric



M : 19.5
R THETA X 10^{-3} : 2 - 4
TW/TR : 0.2

7105

FPG - SHT

Axially symmetric blow down tunnel. Effectively continuous. D = 0.406 m.
29 < PO < 55 MN/m^2. TO : 1780 K. Nitrogen. 2 < RE/m X 10^{-6} < 3.

BECKWITH I.E., HARVEY W.D. and CLARK F.L. 1971. Comparisons of turbulent boundary layer measurements at Mach number 19.5 with theory and an assessment of probe errors. NASA TN D-6192.
And Harvey W.D., private communications, Harvey & Clark (1972).

1 The test boundary layer was formed on the wall of a contoured axi symmetric nozzle approximately 2.25 m
long from throat to exit. Profiles were measured at a single station near the nozzle exit and 2.083 m
axially from the throat (X=0) at which the wall was inclined to the axis at 3.5°. The nozzle wall was
finished to 0.4 μm and was actively cooled. Some disturbances in the flow originate from the nozzle wall
in the neighbourhood of the contour point of inflection. There was a mean axial decrease in Mach number
in the vicinity of the survey station of about 1.64 /m, where the radius of curvature in the longitudinal
3 direction was about 32 m. Transition occurred naturally, and the boundary layer was believed to be turbulent
over the full nozzle length except possibly in the immediate throat region,where calculations indicated
4 that laminarisation could have occurred (PC and source, figure 12). The available wall pressure history
is given in table 1 below. The wall temperature was kept nearly constant in the cooled part of the nozzle
extending from X = 0.145 m downstream of the throat, at about 0.17 TO (330-300 K) but the high heat trans-
fer rates in the throat region caused the wall temperature to reach an estimated value of about 0.8 TO.
5 Limited Pitot surveys were made on the opposite side of the nozzle at the 2.083 m station, and the results
confirmed the axisymmetric nature of the flow.

6 Wall static pressure was measured at the stations listed in table 1 with holes 2.3 mm in diameter. Thermocouples used to monitor TW were placed at 0.305 m intervals along the nozzle, embedded 2.4 mm from the test surface.

7 The profile data as presented was all obtained with a single TPP (FPP) and a single TTP (FWP). Other probes were used however in assessing the correction procedures and all are discussed here. The FPP (h_1 = 0.28, h_2 = 0.13, b_1 = 3.81, b_2 = 3.66, 1 = 31.8 mm) was mounted on a rake which also carried 2 CPP (d_1 = 3.18, d_2 = 2.3, 1 (E) = 45 and 60 mm) separated in the Y-direction by 25.4 mm. The FPP could be replaced by the FWP (d = 0.25, b = 6.35, 1 (E) = 10 mm). The FWP was an unshielded 0.25 mm chromel-alumel thermocouple wire placed perpendicular to the flow and the profile normal. In addition to the central junction, two subsidiary junctions were established at the ends of the crossflow wire to allow a proper conduction and radiation correction procedure (Appendix A, source), which was applied to all observations. Static pressure profiles were obtained with a CCP (α= 17.5° semi angle, d = 3.18, l_1 = 50.8, 1 (E) = 100 mm) with four static holes (d = 0.78 mm) aligned on the diameters normal to and parallel to the wall.

8 All profile measurements were made normal to the wall at an axial distance of 2.083 m from the throat.
The static holes in the CCP were on the same normal, as was the relevant static hole. The TO and PT2 profiles
9 were taken on separate occasions and with a great many data points. All readings were normalized with the
instantaneous tunnel reservoir conditions, which varied by up to 9 % during a two hour run. The profiles
presented are obtained from faired curves through the corrected profile data, at greater Y-intervals than
the original readings.

10 A major topic of the source paper is probe correction procedures. In the wall region, the viscous and rarefaction effects on the Pitot data involve correction factors of up to 2.14 as assessed by the authors. These completely outweigh the other possible corrections so that no adjustments have been made for wall proximity, shear displacement, thermal diffusion or turbulence effects. The corrections applied exceed 10 % for y/δ less than 0.4 - 0.5. Corrections to the TO data would be more properly described as a calib-

ration procedure. They may be summarised as amounting to finding a probe recovery factor of about 0.7 to 0.75 when the probe and its support are in a flow region where the total temperature is reasonably uniform. Conduction and radiation corrections were applied to all data however, and close to the wall where the probe was at a markedly lower temperature than the support, these were large and resulted in an effective recovery factor near one. The authors found large differences between the static pressure found at the wall and that calculated from PT2 measurements in the inviscid core. This was investigated with the CCP, the readings being corrected for bluntness and viscous-induced pressure effects after Bertram & Blackstock (1961). The surface temperature of the probe was estimated, assuming a linear variation of probe temperature with distance from 0.2 TO at the wall to 0.6 TO at the boundary layer edge. The resultant profile matches closely the static pressure values outside the boundary layer as predicted by a characteristics solution starting from the axial Mach number distribution. Both however lie about 20 % below the value found from Pitot measurements. A better match was found by using only the first order correction of Behrens (1963) (Source, fig. 7). Because of the very large correction factors involved (greater than 2) these static pressure distributions were not used in the profiles as presented by the authors, who instead assumed that P falls linearly with distance to PD. The authors present Mach number profiles computed on this basis with, for comparison, a profile with an alternative artificial static pressure distribution which represents the data
11 in the wall region more exactly (Source figure 8a). The viscosity of Nitrogen was computed from equation 44
of Ahtye and Peng (1962).

12 The editors have first presented the profiles in the authors' final, corrected form, with the linear static
pressure distribution. The edge stagnation state has been arbitrarily set to the nominal tunnel reservoir
conditions. We have also reconstructed the authors' corrected static pressure distribution by scaling the
data from figure 7 of the source paper. This, together with the authors' corrected TO data, was interpolated
13 to the Y stations of the original Pitot measurements, and the revised profile 0201 is presented as 0201 P.
The interpolation procedure introduces no additional uncertainty or error at greater than 2 %, except in
those regions where the original data are themselves uncertain. 0201 P therefore reports all the original,
14 unsmoothed, Pitot data, in conjunction with smoothed P and TO data. The authors originally determined a CF
value from the Mach number gradient at the wall. A later paper (Harvey & Clark 1972) describes shear stress
8 measurements made at X = 2.28 m, that is 0.117 m downstream of the profile station. The balance used was
6 an FEB for which the element diameter was 12.7 mm, with a peripheral gap of 0.076 mm, as described by
12 Paros (1970). The editors have interpolated these measurements on the basis of the authors' R THETA values
so as to give CF data in association with the profiles. For profiles 0201, 0301 the values are similar to
the profile-derived values, but there is marked disagreement for profile 0101. The authors remark on the
possibility that this arises from the large Pitot tube errors involved (see § 10 above). The CQ value
presented with the profiles is that derived by the authors from the limiting slope of the corrected
TO profile.

§ DATA: 7105 0101-0301, 0201 P. Pitot, TO and P profiles separately. NX = 1. CF from FEB in later experiment.

15 Editors' comments

The measurements presented here, with the addition of the later shear stress measurements, provide the only functionally complete description of the mean flow in a hypersonic boundary layer subject to substantial normal pressure gradients. The extent to which probe measurements required correction is such that a user should not refine too much upon any precise numerical value, but the qualitative picture is probably complete.

Attention is drawn to figure 7 of the source paper in particular. Here the problems of static pressure measurement in hypersonic conditions are graphically displayed. The profile tables for 0201 P assume that the final adjusted static pressure variation is correct, but since the adjustments are so large, with calibration factors of up to 2, the accuracy is not high. A variation of this kind is, however, easily explained by a combination of the effects of streamline curvature and the separate contributions to normal stress of mean static pressure and normal Reynolds stress. A very similar variation is reported by Fischer et al. - CAT 7001 and comparison should be made between 71050201 P and 70010104. Kemp & Owen - CAT 7206 made no static pressure measurements, and also assumed a linear variation of P from PW to PO. Their data should show, even more markedly, a pressure variation like to that of 0201 P as their range extends to even higher Mach numbers.

For many purposes the assumed static pressure variation used by the authors and retained for the data tables of 0101-0301 will not introduce too great a level of inaccuracy. It is unfortunately not possible to make a direct comparison with 0201P, for which the measured static profile was used, as the static pressure values in the free stream differ quite markedly. We have chosen to prepare 0201P assuming that the reported PT2 and P values are correct. As a consequence, the POD value which is calculated from them on the assumption that the D-point is outside the boundary layer is much higher than the measured tunnel reservoir pressure. (The appropriate small difference normal shock equation for very high Mach number is

$$\frac{dp_o}{p_o} = \left(\frac{\gamma}{\gamma-1}\right)\frac{dp_{t2}}{p_{t2}} - \left(\frac{1}{\gamma-1}\right)\frac{dp}{p}$$

so that a relatively modest underestimate of the value of PD results in a noticeably high value of POD).

The profiles 0101-0301 with assumed P(Y) are from smoothed curves, 0201 P has all original data points and will show scatter despite interpolated P and TO values. Using van Driest coordinates no log-law region exists and the profiles show - at least in the inner region - a transitional behaviour.

TABLE 1: WALL AND FREE STREAM STATIC PRESSURE

POR - Reservoir pressure

P INF - 'Free stream' static pressure at x = 2.057 m from Pitot measurements.

7105 x (m)	-RZ (mm)	0101 PW (N/m²)	0201 PW (N/m²)	0301 PW (N/m²)
0.610	96.9	68.6	91.4	120.0
0.991	133.4	32.4	41.0	55.5
1.219	150.8	22.4	31.0	40.3
1.524	170.1	17.6	23.4	31.4
1.702	179.7	15.5	20.0	27.2
1.969	192.3	13.1	16.9	22.4
2.057	196.0	15.2	17.2	22.1
POR (MN/m²)		29.65	43.09	55.50
P INF (N/m²)		7.93	10.69	13.45

NB : NORMALISED VALUES

CAT 7105 BECKWITH BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD* TOD*	TW/TR PW/PD SW *	RED2W RED2D D2	CF * CQ * PI2*	H12 H32 H42	H12K H32K D2K	PW* TW* UD	PD* TD TR
71050101	19.2600	0.1990	2.1370"+02	4.9000"-04	37.9916	2.3995	1.1613"+01	7.9893"+00
2.0830"+00	2.9700"+07	1.4535	2.3444"+03	3.1400"-04	1.8099	1.6327	3.0000"+02	2.2344"+01
-1.9750"-01	1.6800"+03	1.0000	1.7085"-03	-4.6629"+01	1.4420	1.0160"-02	1.8548"+03	1.5076"+03
71050201	19.4200	0.1878	3.5633"+02	4.6000"-04	25.1921	2.3201	1.6766"+01	1.1034"+01
2.0830"+00	4.3100"+07	1.5195	3.7699"+03	2.0600"-04	1.8187	1.6581	3.0000"+02	2.3290"+01
-1.9750"-01	1.7800"+03	1.0000	2.0887"-03	-6.7667"+01	1.5567	9.2971"-03	1.9095"+03	1.5973"+03
71050301	19.6500	0.1822	3.2319"+02	4.6000"-04	31.2883	2.2886	2.1645"+01	1.3098"+01
2.0830"+00	5.5500"+07	1.6525	3.3977"+03	1.6700"-04	1.8377	1.6783	3.0000"+02	2.3458"+01
-1.9750"-01	1.8350"+03	1.0000	1.5828"-03	-8.7135"+01	1.4735	7.7165"-03	1.9390"+03	1.6466"+03
71050201P	21.7700	0.1973	2.4621"+02	4.3595"-04	41.0455	2.3512	1.6760"+01	8.7893"+00
2.0830"+00	7.5600"+07	1.9069	3.2713"+03	2.0600"-04	1.8211	1.6621	3.0000"+02	1.7696"+01
-1.9750"-01	1.6950"+03	1.0000	1.4087"-03	-1.1869"+02	1.5436	8.5711"-03	1.8658"+03	1.5206"+03

POD IS INPUT FOR 0101-0301. PD IS INPUT FOR 0201P.

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
71050101	1.7037"-03	51.8254	1.8094	1.4461	2.3131"+03	2.0602"+02	6.7573"-02
	1.3016"-03	47.7740	1.8092	1.4444	2.3124"+03	2.0596"+02	
71050201	2.0813"-03	35.1465	1.8180	1.5622	3.7168"+03	3.4332"+02	5.5355"-02
	1.5439"-03	32.8767	1.8175	1.5597	3.7149"+03	3.4314"+02	
71050301	1.5755"-03	46.3993	1.8369	1.4804	3.3456"+03	3.1101"+02	5.2460"-02
	1.1007"-03	42.9650	1.8369	1.4781	3.3448"+03	3.1094"+02	
71050201P	1.4093"-03	51.4188	1.8211	1.5430	3.2407"+03	2.3813"+02	5.7265"-02
	8.8941"-04	46.9629	1.8211	1.5402	3.2399"+03	2.3806"+02	

71050101 BECKWITH PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.45353	0.17857	0.00000	0.00000	13.42670	0.00000
2	2.0160"-03	1.4113"+00	1.44537	0.22160	0.03734	0.14510	15.10000	0.01389
3	7.1680"-03	1.6274"+00	1.42451	0.32328	0.04486	0.20630	21.15000	0.01389
4	1.2208"-02	2.1771"+00	1.40410	0.40050	0.05799	0.28470	24.10000	0.01659
5	1.7248"-02	3.5931"+00	1.38369	0.48609	0.08031	0.39930	24.72000	0.02235
6	2.2400"-02	6.1420"+00	1.36283	0.59406	0.10881	0.53060	23.78000	0.03041
7	2.7440"-02	1.0175"+01	1.34242	0.70108	0.14250	0.65350	21.03000	0.04172
8	3.2592"-02	1.5994"+01	1.32155	0.77039	0.18029	0.74290	16.98000	0.05782
9	3.7632"-02	2.4722"+01	1.30114	0.82243	0.22536	0.81160	12.97000	0.08142
10	4.2784"-02	3.5801"+01	1.28028	0.84059	0.27201	0.84890	9.74000	0.11158
11	4.7824"-02	5.2142"+01	1.25987	0.83515	0.32910	0.86760	6.95000	0.15728
12	5.2976"-02	7.9411"+01	1.23901	0.82378	0.40657	0.87860	4.67000	0.23310
13	5.8016"-02	1.1391"+02	1.21860	0.82722	0.48737	0.89070	3.34000	0.32497
14	6.3168"-02	1.4876"+02	1.19774	0.84713	0.55723	0.90710	2.65000	0.40999
15	6.8208"-02	1.8802"+02	1.17733	0.86569	0.62666	0.92100	2.16000	0.50200
16	7.3248"-02	2.3105"+02	1.15692	0.88630	0.69483	0.93480	1.81000	0.59751
17	7.8400"-02	2.7418"+02	1.13606	0.89711	0.75703	0.94250	1.55000	0.69080
18	8.3440"-02	3.1371"+02	1.11565	0.91801	0.80985	0.95480	1.39000	0.76635
19	8.8592"-02	3.5687"+02	1.09479	0.93699	0.86384	0.96580	1.25000	0.84588
20	9.3632"-02	3.9792"+02	1.07438	0.95122	0.91223	0.97400	1.14000	0.91793
21	9.8784"-02	4.3928"+02	1.05352	0.96585	0.95853	0.98220	1.05000	0.98549
22	1.0382"-01	4.6123"+02	1.03311	0.97484	0.98220	0.98710	1.01000	1.00968
23	1.0886"-01	4.7636"+02	1.01270	0.98649	0.99820	0.99320	0.99000	1.01597
D 24	1.1200"-01	4.7808"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD P/PD=PW/PD+(1-PW/PD)*Y

71050201 BECKWITH PROFILE TABULATION 21 POINTS, DELTA AT POINT 21

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.51953	0.16854	0.00000	0.00000	12.88100	0.00000
2	2.0022"-03	1.1647"+00	1.50847	0.24231	0.02430	0.10230	17.73000	0.00870
3	6.3074"-03	1.5597"+00	1.48467	0.30633	0.04237	0.19240	20.62000	0.01385
4	1.1383"-02	2.7901"+00	1.45662	0.41698	0.06816	0.33110	23.60000	0.02044
5	1.6450"-02	5.3733"+00	1.42861	0.55420	0.10026	0.49210	24.09000	0.02918
6	2.1526"-02	9.7238"+00	1.40056	0.65097	0.13800	0.62360	20.42000	0.04277
7	2.6583"-02	2.1220"+01	1.37261	0.69798	0.20673	0.73470	12.63000	0.07985
8	3.1659"-02	3.4221"+01	1.34455	0.73768	0.26366	0.79230	9.03000	0.11797
9	3.6716"-02	5.4790"+01	1.31660	0.74224	0.33448	0.82000	6.01000	0.17964
10	4.1783"-02	8.2507"+01	1.28860	0.75531	0.41105	0.84240	4.20000	0.25846
11	4.6840"-02	1.1764"+02	1.26065	0.77883	0.49123	0.86490	3.10000	0.35172
12	5.1888"-02	1.5912"+02	1.23275	0.76840	0.57161	0.86500	2.29000	0.46565
13	5.6983"-02	2.0112"+02	1.20459	0.78284	0.64283	0.87670	1.86000	0.56778
14	6.2040"-02	2.4347"+02	1.17664	0.84668	0.70743	0.91420	1.67000	0.64412
15	6.7116"-02	2.8500"+02	1.14859	0.86933	0.76548	0.92810	1.47000	0.72517
16	7.2192"-02	3.2927"+02	1.12053	0.91983	0.82288	0.95610	1.35000	0.79359
17	7.7268"-02	3.7720"+02	1.09248	0.94232	0.88082	0.96890	1.21000	0.87479
18	8.2156"-02	4.2735"+02	1.06546	0.95997	0.93762	0.97890	1.09000	0.95686
19	8.7420"-02	4.6550"+02	1.03637	0.99658	0.97862	0.99800	1.04000	0.99451
20	9.2496"-02	4.8028"+02	1.00831	0.99816	0.99404	0.99900	1.01000	0.49733
D 21	9.4000"-02	4.8605"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,T/TD P/PD=PW/PD+(1-PW/PD)*Y

71050301 BECKWITH PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.65254	0.16349	0.00000	0.00000	12.78875	0.00000
2	2.0241"-03	1.1625"+00	1.63727	0.22608	0.02386	0.09820	16.94000	0.00949
3	7.1103"-03	1.8155"+00	1.59890	0.38351	0.04905	0.24670	25.30000	0.01559
4	9.6534"-03	2.9006"+00	1.57972	0.49602	0.06905	0.36770	28.36000	0.02048
5	1.4740"-02	6.1919"+00	1.54135	0.64282	0.10712	0.55310	26.66000	0.03198
6	1.9826"-02	1.3836"+01	1.50298	0.76208	0.16396	0.72180	19.38000	0.05598
7	2.4921"-02	2.5835"+01	1.46454	0.78760	0.22589	0.79770	12.47000	0.09369
8	3.0007"-02	4.2065"+01	1.42618	0.79654	0.28928	0.83590	8.35000	0.14277
9	3.5093"-02	6.5029"+01	1.38781	0.80650	0.36038	0.86190	5.72000	0.20912
10	4.0179"-02	9.5150"+01	1.34944	0.82131	0.43642	0.88260	4.09000	0.29120
11	4.5265"-02	1.3377"+02	1.31107	0.83250	0.51783	0.89690	3.00000	0.39197
12	5.0360"-02	1.7454"+02	1.27263	0.85671	0.59173	0.91480	2.39000	0.48711
13	5.5446"-02	2.1868"+02	1.23426	0.87884	0.66253	0.92990	1.97000	0.58261
14	6.0533"-02	2.6581"+02	1.19589	0.90128	0.73057	0.94410	1.67000	0.67607
15	6.5628"-02	3.1599"+02	1.15746	0.92703	0.79666	0.95930	1.45000	0.76576
16	7.0714"-02	3.6495"+02	1.11909	0.95016	0.85624	0.97250	1.29000	0.84365
17	7.5800"-02	4.1611"+02	1.08072	0.97226	0.91436	0.98480	1.16000	0.91749
18	8.0886"-02	4.6079"+02	1.04235	0.98249	0.96225	0.99070	1.06000	0.97420
19	8.5972"-02	4.8592"+02	1.00398	0.99631	0.98817	0.99800	1.02000	0.98233
D 20	8.6500"-02	4.9762"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

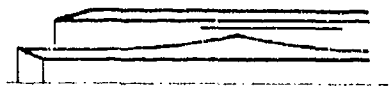
INPUT VARIABLES Y/DELTA,U/UD,T/TD P/PD=PW/PD+(1-PW/PD)*Y

71050201P BECKWITH PROFILE TABULATION 44 POINTS, DELTA AT POINT 43

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.90686	0.17699	0.00000	0.00000	16.95338	0.00000
2	2.7430"-03	1.2066"+00	1.90686	0.26200	0.02412	0.11761	23.78494	0.00943
3	5.2830"-03	1.4150"+00	1.89216	0.30600	0.03316	0.17087	26.54337	0.01218
4	7.8230"-03	1.7794"+00	1.86275	0.35300	0.04336	0.23229	28.69791	0.01508
5	1.0363"-02	2.5082"+00	1.81373	0.41000	0.05668	0.31101	30.10422	0.01874
6	1.2903"-02	3.3794"+00	1.71569	0.47300	0.06849	0.38355	31.36269	0.02098
7	1.5443"-02	5.0741"+00	1.60784	0.55000	0.08663	0.48066	30.78336	0.02511
8	1.7983"-02	7.8109"+00	1.43627	0.62200	0.10960	0.57849	27.85901	0.02982
9	2.0523"-02	1.0969"+01	1.34804	0.67600	0.13114	0.65070	24.61851	0.03563
10	2.3063"-02	1.3557"+01	1.27451	0.71100	0.14644	0.69396	22.45687	0.03938
11	2.5603"-02	1.9099"+01	1.21569	0.74200	0.17474	0.74651	18.25170	0.04972
12	2.8143"-02	2.5620"+01	1.16176	0.76100	0.20303	0.78251	14.85417	0.06120
13	3.0683"-02	3.4587"+01	1.10784	0.77600	0.23647	0.81223	11.79776	0.07627
14	3.3223"-02	4.7280"+01	1.06863	0.78100	0.27699	0.83296	9.04348	0.09843
15	3.5763"-02	6.2261"+01	1.02941	0.78500	0.31824	0.84761	7.09401	0.12300
16	3.8303"-02	7.4577"+01	0.99510	0.78800	0.34851	0.85596	6.03235	0.14120
17	4.0843"-02	8.9440"+01	0.96564	0.79200	0.38186	0.86392	5.11855	0.16299
18	4.3383"-02	1.0701"+02	0.94608	0.80000	0.41787	0.87314	4.36607	0.18920
19	4.5923"-02	1.3574"+02	0.93137	0.80900	0.47083	0.88340	3.52033	0.23372
20	4.8463"-02	1.6779"+02	0.91667	0.81400	0.52366	0.89001	2.88864	0.28243
21	5.1003"-02	2.0423"+02	0.90686	0.81900	0.57786	0.89571	2.40264	0.33808
22	5.3543"-02	2.3235"+02	0.90686	0.82400	0.61644	0.90011	2.13208	0.38285
23	5.6083"-02	2.5717"+02	0.90196	0.83800	0.64860	0.90891	1.96378	0.41746
24	5.8623"-02	2.9900"+02	0.90686	0.85100	0.68764	0.91717	1.77901	0.46754
25	6.1163"-02	3.1020"+02	0.91667	0.87100	0.71245	0.92858	1.69877	0.50107
26	6.3703"-02	3.4634"+02	0.92157	0.88800	0.75287	0.93860	1.55425	0.55653
27	6.6243"-02	3.6820"+02	0.93627	0.90100	0.77630	0.94596	1.48487	0.59647
28	6.8783"-02	3.9163"+02	0.95098	0.91000	0.80064	0.95116	1.41134	0.64091
29	7.1323"-02	4.1485"+02	0.96569	0.92400	0.82407	0.95889	1.35396	0.68391
30	7.3863"-02	4.3922"+02	0.98039	0.93600	0.84796	0.96550	1.29647	0.73012
31	7.6403"-02	4.5650"+02	0.99510	0.94800	0.86449	0.97194	1.26403	0.76515
32	7.8943"-02	5.0626"+02	1.00000	0.95400	0.91043	0.97568	1.14848	0.84954
33	8.1483"-02	5.1189"+02	1.00980	0.96300	0.91548	0.98034	1.14671	0.86329
34	8.4023"-02	5.3314"+02	1.01471	0.97000	0.93431	0.98414	1.10950	0.90006
35	8.6563"-02	5.6990"+02	1.01961	0.97800	0.96601	0.98857	1.04726	0.96247
36	8.9103"-02	5.8352"+02	1.01961	0.98300	0.97749	0.99122	1.02829	0.98289
37	9.1643"-02	5.9121"+02	1.01961	0.99000	0.98392	0.99482	1.02227	0.99223
38	9.4183"-02	6.0174"+02	1.01471	0.99600	0.99265	0.99792	1.01065	1.00193
39	9.6723"-02	6.0508"+02	1.00980	1.00000	0.99541	0.99995	1.00915	1.00060
40	9.9263"-02	6.0341"+02	1.00980	1.00000	0.99403	0.99994	1.01192	0.99784
41	1.0180"-01	6.0508"+02	1.00980	1.00000	0.99541	0.99995	1.00915	1.00060
42	1.0434"-01	6.1630"+02	1.00490	1.00000	1.00459	1.00005	0.99097	1.01411
D 43	1.0942"-01	6.1068"+02	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
44	1.1450"-01	6.0443"+02	0.99020	1.00000	0.99495	0.99995	1.01008	0.98027

INPUT VARIABLES Y,P/POD,M,TO/TOD

axisymmetric



M : 4, falling to 2.4
then rising to 3.7 (Series 01).
: 4, ZPG (Series 02).
R THETA X 10^{-3} : 4 - 14.
TW / TR : 1.

7201

ZPG - APG - FPG
(ZPG)
AW

Continuous tunnel with symmetrical flexible nozzle, W = H = 1 m, L = 5 m.
PO : 496 (± 3.5) KN/m^2. TO : 318 (± 1) K. Air: Dew point 239-247 K. RE/m X 10^{-6} : 20 at M = 4.

LEWIS J.E., GRAN R.L. and KUBOTA T., 1972. An experiment on the adiabatic compressible turbulent boundary layer in adverse and favourable pressure gradients. J. Fluid Mech. 51, 657-672.
And Gran R.L., private communications.

1 The tests were performed on the inner surface of a cylinder (D = 0.508, L = 1.3 m) mounted on the centre line of the windtunnel. A pressure gradient could be imposed by a centre-body, itself hollow, causing the streamwise pressure variation tabulated in section 8. The leading edge of the cylinder (X = 0) was chamfered on the outside at 11° with a nose radius of 0.05 mm. The profiles were measured in the range 0.29 <X <0.88 m. Maximum deviation from a straight generator was less than 5 x 10^{-4} m/m in the test-area with no local slope exceeding 0.06°. Surface roughness was less than 2.5 μm. The test-surface was not cooled, the greatest departure of TW from TR being 2.5 % at the pressure maximum (X = 0.47 m). Tunnel
2 calibration tests gave the empty-tunnel Mach number as 4.026 (+ 0.022, - 0.026).

3 The boundary layer was tripped 3 mm back from the leading edge using 0.15 mm thick fibre-glass tape with a serrated upstream edge. Transition is believed to have been complete upstream of X = 0.204 m, the
5 upstream limit for measurements. Static pressure and heat-transfer measurements made at three streamwise stations showed the flow to be uniform round the circumference, and good agreement was reached in a streamwise momentum balance.

6 Static holes (diameter 0.51 mm) were drilled along one generator from X = 50.8 to 1016 mm at 12.7 mm
8 intervals, with additional holes at 6.35 mm intervals between X = 356 and 635 mm. Additional tappings were also distributed circumferentially at 45° intervals for X = 63.5, 444 and 673 mm. Wall temperature was found from the heat-flux gauges (see below) and checked using four thermocouples. Stanton tubes were mounted on generators 8.6° to either side of the PW generator at nominal 25.4 mm intervals from X = 51 to X = 965 mm. The tubes were formed by placing a 4.8 mm square piece of thin metal, with a sharp leading edge chamfered at 6° on the underside, approximately 0.51 mm ahead of the centre-line of a 0.51 mm diameter static hole. The side and back edges of the thin plate were sealed. The Stanton tube heights were within the range 0.12< h< 0.21 mm. Steady state heat-flux meters after Gardon (1960) were mounted on a generator 6° from the PW generator. Gauges of 6.35 mm diameter were placed at nominal 25.4 mm intervals from X = 50.8 to 1016 mm except between X = 356 and 661 mm where gauges of 3.18 mm diameter were placed at 12.7 mm intervals.

7 Traverses were made with Pitot, TO and P-probes. The transducer attached to the latter failed so that P-traverse measurements were not used. The TTP (d_1 = 1.52 mm, l = 29 mm) was of STP type, inclined at 10° to the wall. The TPP was an FPP (h_1 = 0.46 mm, b_1 = 2.1 mm, l = 15.2 mm) formed by flattening a 1.6 mm
8 diameter tube, and inclined at 6° to the wall. All traverses for a given X-value were made simultaneously, with the PO traverse over the PW generator and the TO and P traverses slightly to either side. The X-value
9 was the same for all three within 0.5 mm. The TO data points were interpolated to the Y values of the PO measurements. The PW (X) data were fitted to analytic expressions for interpolation where necessary.
10 No corrections were applied to the probe-data. Sutherland's viscosity law was used.
11 The authors state that within experimental accuracy the data satisfied the relation (TO - TW) / (TOD - TW)
12 = U/UD and this has been used together with the assumption P = PW to construct the tables below. The total conditions at the layer edge have been set arbitrarily equal to the nominal reservoir conditions. The wall temperature has been set constant at 293 K following the authors' statement that (TOD - TW) / TOD was nearly constant at 0.08. No heat transfer data is presented, the authors stating that Q was zero within experimental accuracy.

13 The data presented consists of two profile sequences. The first, 0101 - 0119 consists of ZPG (01-05) followed by APG (06-14) and FPG (15-19). Duplicate profiles were obtained for 01 11/12/14/16, but since they had relatively few data points, they are not presented here. The second set, 0201 - 0209, provides,
14 for comparison, ZPG data in the downstream portion ($X < 495$ mm), obtained with no centrebody. The CF values presented are the authors', obtained by the curve-fitting procedure of Coles & Hirst (1969) applied to equivalent incompressible velocity profiles transformed as suggested by Van Driest (1951). The resultant calibration function for the Stanton tubes was presented (source, figure 3) as evidence of consistency.

§ DATA: 7201 0101 to 0209. PT2 and TO simultaneously. NX = 19 and 9. CF from profiles (curve fitting). Confirmatory Stanton tube observations.

15 Editors' comments

The axi-symmetric configuration chosen results in a flow free of significant end effects. Axial symmetry corrections were small as $\delta/RZ < 0.07$. The pressure gradient was applied as a reflected wave on a straight surface so that little or no normal pressure gradient is to be expected except at the changes from ZPG to APG and APG to FPG. The authors state that static pressure measurements showed the pressure to be constant within 10 % across the layer. There are very small intervals between successive profiles, so that the layer development can be followed in detail.

The authors give a full discussion of the profiles in relation to the "wall law" and "wake law" in the source paper. The values of CF given here assume that this is a valid and complete description, so that they should be used with caution in the FPG region.

Comparisons should be made with the similar flow observed by Peake et al. - CAT 7102, series 02 - though there is little detail in the compression region and the study is more concerned with the constant-pressure relaxation which follows. Nominally planar APG flows of the same type are studied in some detail by Zwarts - CAT 7007, Thomas - CAT 7401 and with fewer stations by Waltrup and Schetz - CAT 7104. The FPG case is covered by Michel - CAT 6902 and Voisinet et al. - CAT 7304. The authors have repeated the investigation with a strongly cooled wall (Gran et al. 1974) but the numerical data is not at present available.

CAT 7201 LEWIS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	PED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ *	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
72010101	3.9800	1.0005	1.4803"+03	1.5154"-03	7.9198	1.4601	3.3551"+03	3.3551"+03
2.9159"-01	4.9600"+05	1.0000	4.9214"+03	NM	1.8339	1.8099	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.5217"-04	0.0000"+00	0.1444	4.6448"-04	6.9701"+02	2.9286"+02
72010102	3.9800	1.0005	1.3601"+03	1.6150"-03	7.7991	1.4026	3.3551"+03	3.3551"+03
3.0455"-01	4.9600"+05	1.0000	4.5217"+03	NM	1.8344	1.8054	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.3169"-04	0.0000"+00	0.1445	4.2450"-04	6.9701"+02	2.9286"+02
72010103	3.9800	1.0005	1.5468"+03	1.5501"-03	7.7648	1.3919	3.3551"+03	3.3551"+03
3.1674"-01	4.9600"+05	1.0000	5.1425"+03	NM	1.8416	1.8169	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.6350"-04	0.0000"+00	0.1450	4.7561"-04	6.9701"+02	2.9286"+02
72010104	3.9800	1.0005	1.6522"+03	1.4531"-03	7.8327	1.4013	3.3551"+03	3.3551"+03
3.2969"-01	4.9600"+05	1.0000	5.4930"+03	NM	1.8241	1.7917	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.8146"-04	0.0000"+00	0.1436	5.2785"-04	6.9701"+02	2.9286"+02
72010105	3.9800	1.0005	1.5143"+03	1.4530"-03	7.8375	1.4032	3.3551"+03	3.3551"+03
3.4265"-01	4.9600"+05	1.0000	5.0346"+03	NM	1.8239	1.7927	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.5797"-04	0.0000"+00	0.1436	4.8452"-04	6.9701"+02	2.9286"+02
72010106	3.8329	0.9989	1.7003"+03	1.4466"-03	7.3983	1.4061	4.0919"+03	4.0919"+03
3.5509"-01	4.9600"+05	1.0000	5.3443"+03	NM	1.8156	1.7880	2.9300"+02	8.0747"+01
-2.5400"-01	3.1800"+02	0.0000	2.5369"-04	3.0310"-01	0.1418	4.6959"-04	6.9056"+02	2.9333"+02
72010107	3.5295	0.9952	2.2417"+03	1.3768"-03	6.5996	1.4481	6.2366"+03	6.2366"+03
3.8049"-01	4.9600"+05	1.0000	6.2620"+03	NM	1.7943	1.7674	2.9300"+02	9.1079"+01
-2.5400"-01	3.1800"+02	0.0000	2.5311"-04	3.8798"-01	0.1375	4.5352"-04	6.7536"+02	2.9440"+02
72010108	3.3775	0.9932	2.8211"+03	1.2666"-03	6.3806	1.5758	7.7487"+03	7.7487"+03
3.9319"-01	4.9600"+05	1.0000	7.4206"+03	NM	1.7926	1.7655	2.9300"+02	9.6907"+01
-2.5400"-01	3.1800"+02	0.0000	2.7635"-04	5.1195"-01	0.1358	4.7740"-04	6.6663"+02	2.9501"+02
72010109	3.2267	0.9910	2.9751"+03	1.2688"-03	5.8675	1.4972	9.6474"+03	9.6474"+03
4.0589"-01	4.9600"+05	1.0000	7.3685"+03	NM	1.7727	1.7483	2.9300"+02	1.0317"+02
-2.5400"-01	3.1800"+02	0.0000	2.5281"-04	5.2098"-01	0.1328	4.3478"-04	6.5712"+02	2.9566"+02
72010110	3.0747	0.9886	3.5624"+03	1.1742"-03	5.6828	1.6260	1.2077"+04	1.2077"+04
4.1859"-01	4.9600"+05	1.0000	8.3002"+03	NM	1.7680	1.7464	2.9300"+02	1.1001"+02
-2.5400"-01	3.1800"+02	0.0000	2.6205"-04	6.5298"-01	0.1308	4.3643"-04	6.4658"+02	2.9637"+02
72010111	2.9209	0.9860	4.1226"+03	1.2271"-03	5.1226	1.5220	1.5211"+04	1.5211"+04
4.3129"-01	4.9600"+05	1.0000	9.0268"+03	NM	1.7594	1.7373	2.9300"+02	1.1750"+02
-2.5400"-01	3.1800"+02	0.0000	2.6195"-04	7.0225"-01	0.1283	4.2337"-04	6.3482"+02	2.9715"+02
72010112	2.7713	0.9833	4.4661"+03	1.1809"-03	5.0278	1.7057	1.9096"+04	1.9096"+04
4.4400"-01	4.9600"+05	1.0000	9.2038"+03	NM	1.7662	1.7479	2.9300"+02	1.2539"+02
-2.5400"-01	3.1800"+02	0.0000	2.4610"-04	7.7118"-01	0.1268	3.7944"-04	6.2220"+02	2.9797"+02
72010113	2.6169	0.9803	5.7028"+03	1.5257"-03	4.2220	1.4395	2.4216"+04	2.4216"+04
4.5669"-01	4.9600"+05	1.0000	1.1040"+04	NM	1.7956	1.7806	2.9300"+02	1.3420"+02
-2.5400"-01	3.1800"+02	0.0000	2.7150"-04	7.4629"-01	0.1263	3.8797"-04	6.0781"+02	2.9888"+02
72010114	2.4661	0.9772	6.7840"+03	1.7262"-03	3.8493	1.4210	3.0603"+04	3.0603"+04
4.6939"-01	4.9600"+05	1.0000	1.2357"+04	NM	1.8182	1.8086	2.9300"+02	1.4348"+02
-2.5400"-01	3.1800"+02	0.0000	2.8041"-04	7.7286"-01	0.1252	3.7717"-04	5.9227"+02	2.9985"+02
72010115	2.5545	0.9790	6.7071"+03	1.8069"-03	3.9027	1.3067	2.6673"+04	2.6673"+04
4.8209"-01	4.9600"+05	1.0000	1.2661"+04	NM	1.8399	1.8298	2.9300"+02	1.3796"+02
-2.5400"-01	3.1800"+02	0.0000	3.0110"-04	-4.6879"-01	0.1280	4.0063"-04	6.0157"+02	2.9928"+02
72010116	2.6504	0.9810	6.3462"+03	1.9101"-03	4.0313	1.3146	2.2995"+04	2.2995"+04
4.9479"-01	4.9600"+05	1.0000	1.2453"+04	NM	1.8614	1.851[illegible]	2.9300"+02	1.3223"+02
-2.5400"-01	3.1800"+02	0.0000	3.1183"-04	-4.0969"-01	0.1308	4.093[illegible]"-04	6.1106"+02	2.9860"+02
72010117	2.9977	0.9874	5.4645"+03	1.9004"-03	4.6944	1.2617	1.3550"+04	1.3550"+04
5.4559"-01	4.9600"+05	1.0000	1.2342"+04	NM	1.8886	1.8762	2.9300"+02	1.1368"+02
-2.5400"-01	3.1800"+02	0.0000	3.7357"-04	-3.2206"-01	0.1378	4.9625"-04	6.4084"+02	2.9675"+02
72010118	3.5347	0.9953	4.7450"+03	1.6705"-03	6.0271	1.2326	6.1909"+03	6.1909"+03
6.4719"-01	4.9600"+05	1.0000	1.3282"+04	NM	1.8930	1.8737	2.9300"+02	9.0888"+01
-2.5400"-01	3.1800"+02	0.0000	5.3835"-04	-2.4024"-01	0.1447	7.7625"-04	6.7564"+02	2.9438"+02
72010119	3.6361	0.9966	4.4744"+03	1.6387"-03	6.3213	1.2365	5.3685"+03	5.3685"+03
6.7259"-01	4.9600"+05	1.0000	1.3032"+04	NM	1.8922	1.8710	2.9300"+02	8.7261"+01
-2.5400"-01	3.1800"+02	0.0000	5.5762"-04	-2.0772"-01	0.1457	8.2026"-04	6.8101"+02	2.9400"+02

CAT 7201 LEWIS BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	PED2W	CF *	H12	H12K	PW	PD
X *	MOD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ *	TOD*	SW *	F2	PI2*	H42	D2K	UD	TR
72010201	3.9800	1.0005	2.2878"+03	1.3574"-03	7.8179	1.3900	3.3551"+03	3.3551"+03
4.9479"-01	4.9600"+05	1.0000	7.6062"+03	NM	1.8294	1.8044	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	3.8973"-04	0.0000"+00	0.1440	7.2586"-04	6.9701"+02	2.9286"+02
72010202	3.9800	1.0005	2.4727"+03	1.3542"-03	7.8492	1.4161	3.3551"+03	3.3551"+03
5.4559"-01	4.9600"+05	1.0000	8.2209"+03	NM	1.8368	1.8152	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	4.2123"-04	0.0000"+00	0.1446	7.7220"-04	6.9701"+02	2.9286"+02
72010203	3.9800	1.0005	2.6543"+03	1.3289"-03	7.7639	1.3601	3.3551"+03	3.3551"+03
5.9665"-01	4.9600"+05	1.0000	8.8247"+03	NM	1.8298	1.8035	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	4.5217"-04	0.0000"+00	0.1440	8.4055"-04	6.9701"+02	2.9286"+02
72010204	3.9800	1.0005	2.6314"+03	1.3531"-03	7.7436	1.3574	3.3551"+03	3.3551"+03
5.9690"-01	4.9600"+05	1.0000	8.7482"+03	NM	1.8352	1.8108	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	4.4825"-04	0.0000"+00	0.1444	8.2342"-04	6.9701"+02	2.9286"+02
72010205	3.9800	1.0005	2.8840"+03	1.3043"-03	7.7463	1.3475	3.3551"+03	3.3551"+03
6.4719"-01	4.9600"+05	1.0000	9.5883"+03	NM	1.8299	1.8045	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	4.9129"-04	0.0000"+00	0.1440	9.1418"-04	6.9701"+02	2.9286"+02
72010206	3.9800	1.0005	2.9769"+03	1.2999"-03	7.7040	1.3285	3.3551"+03	3.3551"+03
6.7259"-01	4.9600"+05	1.0000	9.8971"+03	NM	1.8330	1.8086	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	5.0712"-04	0.0000"+00	0.1442	9.3727"-04	6.9701"+02	2.9286"+02
72010207	3.9800	1.0005	3.2951"+03	1.2367"-03	7.8520	1.3950	3.3551"+03	3.3551"+03
7.7368"-01	4.9600"+05	1.0000	1.0955"+04	NM	1.8261	1.7979	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	5.6132"-04	0.0000"+00	0.1436	1.0529"-03	6.9701"+02	2.9286"+02
72010208	3.9800	1.0005	3.7273"+03	1.2117"-03	7.7980	1.3690	3.3551"+03	3.3551"+03
8.7478"-01	4.9600"+05	1.0000	1.2392"+04	NM	1.8315	1.8068	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	6.3494"-04	0.0000"+00	0.1440	1.1786"-03	6.9701"+02	2.9286"+02
72010209	3.9800	1.0005	3.6475"+03	1.2263"-03	7.7222	1.3229	3.3551"+03	3.3551"+03
8.7579"-01	4.9600"+05	1.0000	1.2127"+04	NM	1.8295	1.8081	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	6.2135"-04	0.0000"+00	0.1439	1.1617"-03	6.9701"+02	2.9286"+02

CAT 7201 LEWIS BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	PED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ *	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
72010101	3.9800	1.0005	1.4803"+03	1.5154"-03	7.9198	1.4601	3.3551"+03	3.3551"+03
2.9159"-01	4.9600"+05	1.0000	4.9214"+03	NM	1.8339	1.8099	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.5217"-04	0.0000"+00	0.1444	4.6448"-04	6.9701"+02	2.9286"+02
72010102	3.9800	1.0005	1.3601"+03	1.6150"-03	7.7991	1.4026	3.3551"+03	3.3551"+03
3.0455"-01	4.9600"+05	1.0000	4.5217"+03	NM	1.8344	1.8054	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.3169"-04	0.0000"+00	0.1445	4.2450"-04	6.9701"+02	2.9286"+02
72010103	3.9800	1.0005	1.5468"+03	1.5501"-03	7.7648	1.3919	3.3551"+03	3.3551"+03
3.1674"-01	4.9600"+05	1.0000	5.1425"+03	NM	1.8416	1.8169	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.6350"-04	0.0000"+00	0.1450	4.7561"-04	6.9701"+02	2.9286"+02
72010104	3.9800	1.0005	1.6522"+03	1.8531"-03	7.8327	1.4013	3.3551"+03	3.3551"+03
3.2969"-01	4.9600"+05	1.0000	5.4930"+03	NM	1.8241	1.7917	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.8146"-04	0.0000"+00	0.1436	5.2785"-04	6.9701"+02	2.9286"+02
72010105	3.9800	1.0005	1.5143"+03	1.4930"-03	7.8375	1.4032	3.3551"+03	3.3551"+03
3.4265"-01	4.9600"+05	1.0000	5.0346"+03	NM	1.8239	1.7927	2.9300"+02	7.6294"+01
-2.5400"-01	3.1800"+02	0.0000	2.5797"-04	0.0000"+00	0.1436	4.8452"-04	6.9701"+02	2.9286"+02
72010106	3.8329	0.9989	1.7003"+03	1.4466"-03	7.3983	1.4061	4.0919"+03	4.0919"+03
3.5509"-01	4.9600"+05	1.0000	5.3443"+03	NM	1.8156	1.7880	2.9300"+02	8.0747"+01
-2.5400"-01	3.1800"+02	0.0000	2.8369"-04	3.0310"-01	0.1418	4.6959"-04	6.9056"+02	2.9333"+02
72010107	3.5295	0.9952	2.2417"+03	1.3768"-03	6.5996	1.4481	6.2366"+03	6.2366"+03
3.8049"-01	4.9600"+05	1.0000	6.2620"+03	NM	1.7943	1.7674	2.9300"+02	9.1079"+01
-2.5400"-01	3.1800"+02	0.0000	2.5311"-04	3.8798"-01	0.1375	4.5352"-04	6.7536"+02	2.9440"+02
72010108	3.3775	0.9932	2.8211"+03	1.2666"-03	6.3806	1.5758	7.7487"+03	7.7487"+03
3.9319"-01	4.9600"+05	1.0000	7.4206"+03	NM	1.7926	1.7655	2.9300"+02	9.6907"+01
-2.5400"-01	3.1800"+02	0.0000	2.7635"-04	5.1195"-01	0.1356	4.7740"-04	6.6663"+02	2.9501"+02
72010109	3.2267	0.9910	2.9751"+03	1.2688"-03	5.8675	1.4972	9.6474"+03	9.6474"+03
4.0589"-01	4.9600"+05	1.0000	7.3685"+03	NM	1.7727	1.7483	2.9300"+02	1.0317"+02
-2.5400"-01	3.1800"+02	0.0000	2.5281"-04	5.2098"-01	0.1328	4.3478"-04	6.5712"+02	2.9566"+02
72010110	3.0747	0.9886	3.5624"+03	1.1742"-03	5.6828	1.6260	1.2077"+04	1.2077"+04
4.1859"-01	4.9600"+05	1.0000	8.3002"+03	NM	1.7680	1.7464	2.9300"+02	1.1001"+02
-2.5400"-01	3.1800"+02	0.0000	2.6205"-04	6.5298"-01	0.1308	4.3643"-04	6.4658"+02	2.9637"+02
72010111	2.9209	0.9860	4.1226"+03	1.2271"-03	5.1226	1.5220	1.5211"+04	1.5211"+04
4.3129"-01	4.9600"+05	1.0000	9.0268"+03	NM	1.7594	1.7373	2.9300"+02	1.1750"+02
-2.5400"-01	3.1800"+02	0.0000	2.6195"-04	7.0225"-01	0.1262	4.2337"-04	6.3482"+02	2.9715"+02
72010112	2.7713	0.9833	4.4661"+03	1.1809"-03	5.0278	1.7057	1.9096"+04	1.9096"+04
4.4400"-01	4.9600"+05	1.0000	9.2038"+03	NM	1.7662	1.7479	2.9300"+02	1.2939"+02
-2.5400"-01	3.1800"+02	0.0000	2.4610"-04	7.7118"-01	0.1268	3.7944"-04	6.2220"+02	2.9797"+02
72010113	2.6169	0.9803	5.7028"+03	1.5257"-03	4.2220	1.4395	2.4216"+04	2.4216"+04
4.5669"-01	4.9600"+05	1.0000	1.1040"+04	NM	1.7956	1.7808	2.9300"+02	1.3420"+02
-2.5400"-01	3.1800"+02	0.0000	2.7150"-04	7.4629"-01	0.1263	3.8797"-04	6.0781"+02	2.9888"+02
72010114	2.4661	0.9772	6.7840"+03	1.7262"-03	3.8493	1.4210	3.0603"+04	3.0603"+04
4.6939"-01	4.9600"+05	1.0000	1.2357"+04	NM	1.8182	1.8086	2.9300"+02	1.4348"+02
-2.5400"-01	3.1800"+02	0.0000	2.8041"-04	7.7286"-01	0.1252	3.7717"-04	5.9227"+02	2.9985"+02
72010115	2.5545	0.9790	6.7071"+03	1.8069"-03	3.9027	1.3467	2.6673"+04	2.6673"+04
4.8209"-01	4.9600"+05	1.0000	1.2661"+04	NM	1.8399	1.8298	2.9300"+02	1.3796"+02
-2.5400"-01	3.1800"+02	0.0000	3.0110"-04	-4.6879"-01	0.1280	4.0063"-04	6.0157"+02	2.9928"+02
72010116	2.6504	0.9810	6.3462"+03	1.9101"-03	4.0313	1.3145	2.2995"+04	2.2995"+04
4.9479"-01	4.9600"+05	1.0000	1.2453"+04	NM	1.8614	1.8514	2.9300"+02	1.3223"+02
-2.5400"-01	3.1800"+02	0.0000	3.1183"-04	-4.0969"-01	0.1308	4.0938"-04	6.1106"+02	2.9868"+02
72010117	2.9977	0.9874	5.4645"+03	1.9004"-03	4.6944	1.2617	1.3550"+04	1.3550"+04
5.4559"-01	4.9600"+05	1.0000	1.2342"+04	NM	1.8886	1.8762	2.9300"+02	1.1368"+02
-2.5400"-01	3.1800"+02	0.0000	3.7357"-04	-3.2206"-01	0.1378	4.9625"-04	6.4084"+02	2.9675"+02
72010118	3.5347	0.9953	4.7450"+03	1.6705"-03	6.0271	1.2326	6.1909"+03	6.1909"+03
6.4719"-01	4.9600"+05	1.0000	1.3282"+04	NM	1.8930	1.8737	2.9300"+02	9.0888"+01
-2.5400"-01	3.1800"+02	0.0000	5.3835"-04	-2.4024"-01	0.1447	7.7625"-04	6.7564"+02	2.9438"+02
72010119	3.6361	0.9966	4.4744"+03	1.6387"-03	6.3213	1.2365	5.3685"+03	5.3685"+03
6.7259"-01	4.9600"+05	1.0000	1.3032"+04	NM	1.8922	1.8710	2.9300"+02	8.7261"+01
-2.5400"-01	3.1800"+02	0.0000	5.5762"-04	-2.0772"-01	0.1457	8.2026"-04	6.8101"+02	2.9400"+02

72010101 LEWIS PROFILE TABULATION 21 POINTS, DELTA AT POINT 15

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	3.84040	0.00000
2	3.5326"-04	3.4595"+00	NM	0.95219	0.37994	0.62700	2.72334	0.23023
3	4.1041"-04	3.4465"+00	NM	0.95209	0.37909	0.62600	2.72689	0.22957
4	6.2341"-04	4.6355"+00	NM	0.96015	0.45039	0.70300	2.43627	0.28856
5	8.6238"-04	6.1482"+00	NM	0.96816	0.52684	0.77200	2.14725	0.35953
6	1.2780"-03	7.5520"+00	NM	0.97405	0.58878	0.81900	1.93490	0.42328
7	1.6988"-03	8.7200"+00	NM	0.97813	0.63568	0.85000	1.78798	0.47540
8	2.2079"-03	1.0470"+01	NM	0.98319	0.70004	0.88700	1.60548	0.55248
9	2.7170"-03	1.2286"+01	NM	0.98746	0.76105	0.91700	1.45180	0.63163
10	3.2157"-03	1.4354"+01	NM	0.99142	0.82505	0.94400	1.30912	0.72109
11	3.7612"-03	1.6465"+01	NM	0.99473	0.88560	0.96600	1.18980	0.81190
12	4.2911"-03	1.8454"+01	NM	0.99734	0.93908	0.98300	1.09572	0.89712
13	4.7431"-03	1.9669"+01	NM	0.99874	0.97029	0.99200	1.04525	0.94905
14	5.2678"-03	2.0553"+01	NM	0.99968	0.99239	0.99800	1.01135	0.98680
D 15	5.8133"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
16	6.3224"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
17	6.8990"-03	2.0707"+01	NM	0.99984	0.99618	0.99900	1.00568	0.99336
18	7.3926"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
19	7.7458"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
20	8.4160"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
21	8.9563"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010103 LEWIS PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	3.84040	0.00000
2	2.2441"-04	3.5118"+00	NM	0.95259	0.38337	0.63100	2.70904	0.23292
3	3.5577"-04	3.4208"+00	NM	0.95189	0.37739	0.62400	2.73399	0.22824
4	5.1998"-04	4.9410"+00	NM	0.96194	0.46688	0.71900	2.37166	0.30316
5	7.9365"-04	6.3344"+00	NM	0.96902	0.53547	0.77900	2.11642	0.36807
6	1.3082"-03	7.(207"+00	NM	0.97431	0.59165	0.82100	1.92559	0.42636
7	1.7351"-03	8.8458"+00	NM	0.97853	0.64053	0.85300	1.77347	0.48098
8	2.2879"-03	1.0633"+01	NM	0.98361	0.70574	0.89000	1.59034	0.55963
9	2.8079"-03	1.2493"+01	NM	0.98789	0.76769	0.92000	1.43615	0.64060
10	3.2129"-03	1.4268"+01	NM	0.99127	0.82250	0.94300	1.31448	0.71739
11	3.8588"-03	1.6359"+01	NM	0.99458	0.88266	0.96500	1.19529	0.80734
12	4.4116"-03	1.8076"+01	NM	0.99688	0.92915	0.98000	1.11244	0.88094
13	4.8549"-03	1.9528"+01	NM	0.99859	0.96671	0.99100	1.05088	0.94302
14	5.3749"-03	2.0402"+01	NM	0.99953	0.98863	0.99700	1.01701	0.98032
15	5.8402"-03	2.0553"+01	NM	0.99968	0.99239	0.99800	1.01135	0.98680
16	6.3656"-03	2.0553"+01	NM	0.99968	0.99239	0.99800	1.01135	0.98680
17	6.8528"-03	2.0553"+01	NM	0.99968	0.99239	0.99800	1.01135	0.98680
D 18	7.8051"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010105 LEWIS PROFILE TABULATION 18 POINTS, DELTA AT POINT 17

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	3.84040	0.00000
2	1.5075"-04	2.5754"+00	NM	0.94471	0.31559	0.54600	2.99319	0.18241
3	3.0151"-04	3.4725"+00	NM	0.95229	0.38080	0.62800	2.71977	0.23090
4	4.5226"-04	4.2353"+00	NM	0.95764	0.42780	0.68000	2.52661	0 26914
5	7.1218"-04	5.5605"+00	NM	0.96529	0.49857	0.74800	2.25085	0.33232
6	1.0189"-03	6.5562"+00	NM	0.97000	0.54558	0.78700	2.08084	0.37821
7	1.6323"-03	8.3178"+00	NM	0.97680	0.61904	0.84000	1.83597	0.45752
8	2.1417"-03	1.0154"+01	NM	0.98236	0.68887	0.88100	1.63560	0.53864
9	2.7395"-03	1.2286"+01	NM	0.98746	0.76105	0.91700	1.45180	0.63163
10	3.3010"-03	1.4528"+01	NM	0.99172	0.83021	0.94600	1.29839	0.72860
11	3.8572"-03	1.6901"+01	NM	0.99534	0.89760	0.97000	1.16782	0.83061
12	4.4550"-03	1.8979"+01	NM	0.99796	0.95268	0.98700	1.07335	0.91955
13	4.9177"-03	2.0252"+01	NM	0.99937	0.98490	0.99600	1.02267	0.97392
14	5.5986"-03	2.0553"+01	NM	0.99968	0.99239	0.99800	1.01135	0.98680
15	6.2224"-03	2.0707"+01	NM	0.99984	0.99618	0.99900	1.00568	0.99336
16	6.6955"-03	2.0707"+01	NM	0.99984	0.99618	0.99900	1.00568	0.99336
D 17	7.3089"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
18	7.8599"-03	2.0863"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010106 LEWIS PROFILE TABULATION 20 POINTS, DELTA AT POINT 15

	I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
	1	0.0000E+00	1.0000E+00	NM	0.92138	0.00000	0.00000	3.62862	0.00000
	2	1.5039E-04	2.7897E+00	NM	0.94754	0.34529	0.57400	2.76354	0.20770
	3	2.7652E-04	3.1192E+00	NM	0.95040	0.37043	0.60500	2.66744	0.22681
	4	4.0750E-04	3.8686E+00	NM	0.95617	0.42151	0.66300	2.47406	0.26798
	5	6.5490E-04	5.1396E+00	NM	0.96417	0.49559	0.73600	2.20549	0.33371
	6	9.7508E-04	6.0035E+00	NM	0.96866	0.53998	0.77400	2.05456	0.37672
	7	1.6882E-03	8.1502E+00	NM	0.97752	0.63679	0.84400	1.75669	0.48045
	8	2.1588E-03	9.7650E+00	NM	0.98265	0.70076	0.88200	1.58417	0.55676
	9	2.7506E-03	1.2005E+01	NM	0.98829	0.78081	0.92200	1.39436	0.66123
	10	3.3230E-03	1.4480E+01	NM	0.99313	0.86060	0.95500	1.23143	0.77552
	11	3.9488E-03	1.7145E+01	NM	0.99721	0.93893	0.98200	1.09385	0.89775
	12	4.3854E-03	1.8847E+01	NM	0.99938	0.98570	0.99600	1.02100	0.97551
	13	5.0452E-03	1.9383E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	14	5.5934E-03	1.9522E+01	NM	1.00016	1.00365	1.00100	0.99474	1.00630
D	15	6.1852E-03	1.9383E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	16	6.7722E-03	1.9247E+01	NM	0.99984	0.99638	0.99900	1.00526	0.99377
	17	7.3107E-03	1.9383E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	18	7.8734E-03	1.9383E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	19	8.4604E-03	1.9522E+01	NM	1.00016	1.00365	1.00100	0.99474	1.00630
	20	9.0862E-03	1.9661E+01	NM	1.00031	1.00732	1.00200	0.98947	1.01267

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010107 LEWIS PROFILE TABULATION 19 POINTS, DELTA AT POINT 12

	I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
	1	0.0000E+00	1.0000E+00	NM	0.92138	0.00000	0.00000	3.21694	0.00000
	2	1.5377E-04	2.3725E+00	NM	0.94540	0.33656	0.54000	2.57433	0.20976
	3	2.4775E-04	2.9651E+00	NM	0.95121	0.38978	0.60500	2.40919	0.25112
	4	3.3017E-04	3.5074E+00	NM	0.95580	0.43198	0.65200	2.27803	0.28621
	5	6.8344E-04	4.4131E+00	NM	0.96236	0.49389	0.71400	2.08992	0.34164
	6	9.5255E-04	5.1676E+00	NM	0.9670	0.53982	0.75500	1.95609	0.38597
	7	1.5078E-03	6.7808E+00	NM	0.97515	0.62654	0.82200	1.72125	0.47756
	8	2.0888E-03	8.7091E+00	NM	0.98259	0.71634	0.87900	1.50569	0.58379
	9	2.6625E-03	1.1085E+01	NM	0.98952	0.81333	0.92900	1.30465	0.71207
	10	3.2720E-03	1.3501E+01	NM	0.99489	0.90131	0.96600	1.14870	0.84095
	11	3.8273E-03	1.5713E+01	NM	0.99878	0.97487	0.99200	1.03545	0.95804
D	12	4.4167E-03	1.6509E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	13	4.9655E-03	1.6931E+01	NM	1.00061	1.01307	1.00400	0.98217	1.02223
	14	5.5231E-03	1.6613E+01	NM	1.00015	1.00324	1.00100	0.99555	1.00548
	15	6.0912E-03	1.6509E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	16	6.6636E-03	1.6509E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	17	7.2231E-03	1.6509E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	18	7.8083E-03	1.6509E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	19	8.4234E-03	1.6406E+01	NM	0.99985	0.99679	0.99900	1.00445	0.99458

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010109 LEWIS PROFILE TABULATION 18 POINTS, DELTA AT POINT 11

	I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
	1	0.0000E+00	1.0000E+00	NM	0.92138	0.00000	0.00000	2.64000	0.00000
	2	1.5058E-04	2.2140E+00	NM	0.94588	0.35046	0.53400	2.32172	0.23000
	3	3.2751E-04	2.8500E+00	NM	0.95272	0.41581	0.61100	2.15921	0.28297
	4	4.6680E-04	3.2132E+00	NM	0.95610	0.44813	0.64600	2.07803	0.31087
	5	7.3408E-04	3.9430E+00	NM	0.96209	0.50630	0.70400	1.93343	0.36412
	6	1.0616E-03	4.7697E+00	NM	0.96786	0.56457	0.75600	1.79312	0.42161
	7	1.5924E-03	6.2453E+00	NM	0.97622	0.65541	0.82600	1.58831	0.52005
	8	2.1759E-03	8.3992E+00	NM	0.98541	0.76863	0.89700	1.36190	0.65864
	9	2.7067E-03	1.0670E+01	NM	0.99259	0.87210	0.94900	1.18414	0.80143
	10	3.2751E-03	1.2935E+01	NM	0.99808	0.96420	0.98700	1.04786	0.94192
D	11	3.8737E-03	1.3877E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	12	4.4120E-03	1.4109E+01	NM	1.00045	1.00863	1.00300	0.98687	1.01429
	13	4.9973E-03	1.4031E+01	NM	1.00030	1.00574	1.00200	0.99258	1.00949
	14	5.5790E-03	1.3877E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	15	6.1512E-03	1.3801E+01	NM	0.99985	0.99716	0.99900	1.00370	0.99531
	16	6.6444E-03	1.3877E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	17	7.2957E-03	1.3877E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
	18	7.8566E-03	1.3877E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010111 LEWIS PROFILE TABULATION 26 POINTS, DELTA AT POINT 15

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	2.09357	0.00000
2	1.5257"-04	2.0576"+00	NM	0.94663	0.36641	0.52900	2.08440	0.25379
3	3.1555"-04	2.5591"+00	NM	0.95282	0.42810	0.60000	1.96436	0.30544
4	4.9240"-04	2.9204"+00	NM	0.95669	0.46650	0.64100	1.88801	0.33951
5	7.0046"-04	3.4491"+00	NM	0.96171	0.51677	0.69100	1.78796	0.38647
6	1.0160"-03	4.0800"+00	NM	0.96694	0.57050	0.74000	1.68248	0.43983
7	1.1547"-03	4.8702"+00	NM	0.97261	0.63103	0.79000	1.56729	0.50405
8	1.6540"-03	5.7893"+00	NM	0.97824	0.69460	0.83700	1.45204	0.57643
9	1.9488"-03	6.8563"+00	NM	0.98377	0.76163	0.88100	1.33802	0.65844
10	2.2297"-03	7.8952"+00	NM	0.98835	0.82157	0.91600	1.24310	0.73687
11	2.5036"-03	8.9230"+00	NM	0.99227	0.87680	0.94500	1.16161	0.81353
12	2.7567"-03	9.7866"+00	NM	0.99517	0.92063	0.96600	1.10100	0.87739
13	3.0688"-03	1.0724"+01	NM	0.99799	0.96592	0.98600	1.04201	0.94624
14	3.3254"-03	1.1135"+01	NM	0.99914	0.98513	0.99400	1.01808	0.97635
D 15	3.6237"-03	1.1459"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
16	3.9253"-03	1.1514"+01	NM	1.00014	1.00252	1.00100	0.99698	1.00404
17	4.2305"-03	1.1404"+01	NM	0.99986	0.99749	0.99900	1.00302	0.99599
18	4.4906"-03	1.1295"+01	NM	0.99957	0.99252	0.99700	1.00905	0.98805
19	4.7610"-03	1.1241"+01	NM	0.99942	0.99005	0.99600	1.01207	0.98413
20	5.0835"-03	1.1295"+01	NM	0.99957	0.99252	0.99700	1.00905	0.98805
21	5.7285"-03	1.1295"+01	NM	0.99957	0.99252	0.99700	1.00905	0.98805
22	6.2764"-03	1.1295"+01	NM	0.99957	0.99252	0.99700	1.00905	0.98805
23	6.8416"-03	1.1295"+01	NM	0.99957	0.99252	0.99700	1.00905	0.98805
24	7.4311"-03	1.1188"+01	NM	0.99928	0.98758	0.99500	1.01507	0.98022
25	7.9790"-03	1.0920"+01	NM	0.99856	0.97544	0.99000	1.03007	0.96110
26	8.5268"-03	1.0774"+01	NM	0.99814	0.96828	0.98700	1.03903	0.94992

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010113 LEWIS PROFILE TABULATION 22 POINTS, DELTA AT POINT 12

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	2.18334	0.00000
2	1.5406"-04	2.3181"+00	NM	0.95368	0.44660	0.59500	1.77498	0.33522
3	2.9686"-04	2.8579"+00	NM	0.96017	0.51360	0.66400	1.67139	0.39727
4	4.2086"-04	3.2004"+00	NM	0.96379	0.55121	0.70000	1.61271	0.43405
5	8.1166"-04	3.8471"+00	NM	0.96984	0.61537	0.75700	1.51329	0.50023
6	1.0146"-03	4.2488"+00	NM	0.97318	0.65182	0.78700	1.45777	0.53987
7	1.6233"-03	5.3803"+00	NM	0.98127	0.74458	0.85600	1.32167	0.64767
8	2.1757"-03	6.6572"+00	NM	0.98864	0.83666	0.91500	1.19603	0.76503
9	2.7393"-03	7.9993"+00	NM	0.99495	0.92344	0.96300	1.08751	0.88551
10	3.3143"-03	8.8810"+00	NM	0.99848	0.97621	0.98900	1.02637	0.96359
11	3.8967"-03	9.2559"+00	NM	0.99986	0.99780	0.99900	1.00241	0.99660
D 12	4.4453"-03	9.2946"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
13	5.0127"-03	9.2946"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
14	5.5914"-03	9.2946"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
15	6.2114"-03	9.2946"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
16	6.7488"-03	9.2174"+00	NM	0.99972	0.99561	0.99800	1.00482	0.99322
17	7.3575"-03	9.1792"+00	NM	0.99958	0.99342	0.99700	1.00722	0.98985
18	7.8648"-03	9.0657"+00	NM	0.99917	0.98691	0.99400	1.01442	0.97987
19	8.4585"-03	8.9912"+00	NM	0.99889	0.98261	0.99200	1.01921	0.97331
20	9.0147"-03	8.8447"+00	NM	0.99834	0.97410	0.98800	1.02875	0.96039
21	9.5407"-03	8.7369"+00	NM	0.99793	0.96779	0.98500	1.03588	0.95088
22	1.0172"-02	8.5268"+00	NM	0.99711	0.95537	0.97900	1.05008	0.93231

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010114 LEWIS PROFILE TABULATION 21 POINTS, DELTA AT POINT 10

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	2.04209	0.00000
2	1.8590"-04	2.7872"+00	NM	0.96183	0.53634	0.67400	1.57918	0.42680
3	3.9715"-04	3.2068"+00	NM	0.96648	0.58564	0.72000	1.51150	0.47635
4	7.0558"-04	3.7702"+00	NM	0.97203	0.64571	0.77200	1.42742	0.54008
5	1.0225"-03	4.1819"+00	NM	0.97560	0.68541	0.80400	1.37599	0.58431
6	1.6055"-03	4.9293"+00	NM	0.98141	0.75248	0.85400	1.28803	0.66303
7	2.1167"-03	5.8865"+00	NM	0.98775	0.83026	0.90600	1.19077	0.76085
8	2.6829"-03	6.9365"+00	NM	0.99362	0.90777	0.95200	1.09982	0.86560
9	3.2448"-03	7.7850"+00	NM	0.99771	0.96580	0.98300	1.03593	0.94891
D 10	3.8532"-03	8.3099"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
11	4.4574"-03	8.2777"+00	NM	0.99986	0.99794	0.99900	1.00213	0.99688
12	4.9982"-03	8.2457"+00	NM	0.99973	0.99588	0.99800	1.00426	0.99377
13	5.5686"-03	8.0881"+00	NM	0.99905	0.98570	0.99300	1.01487	0.97845
14	6.1094"-03	8.0571"+00	NM	0.99892	0.98368	0.99200	1.01699	0.97543
15	6.7009"-03	7.9650"+00	NM	0.99851	0.97767	0.98900	1.02332	0.96646
16	7.2755"-03	7.8743"+00	NM	0.99811	0.97171	0.98600	1.02963	0.95762
17	7.8386"-03	7.8146"+00	NM	0.99784	0.96777	0.98400	1.03383	0.95180
18	8.3402"-03	7.7850"+00	NM	0.99771	0.96580	0.98300	1.03593	0.94891
19	9.0120"-03	7.7262"+00	NM	0.99744	0.96190	0.98100	1.04011	0.94317
20	9.5782"-03	7.6680"+00	NM	0.99718	0.95801	0.97900	1.04429	0.93748
21	1.0153"-02	7.6104"+00	NM	0.99691	0.95416	0.97700	1.04846	0.93184

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010115 LEWIS PROFILE TABULATION 23 POINTS, DELTA AT POINT 14

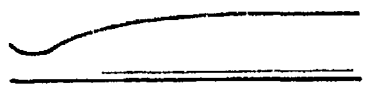
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	2.12388	0.00000
2	1.5417"-04	2.8037"+00	NM	0.96055	0.51975	0.66500	1.63700	0.40623
3	2.8708"-04	3.0954"+00	NM	0.96374	0.55319	0.69700	1.58749	0.43906
4	4.3061"-04	3.7938"+00	NM	0.97050	0.62527	0.76100	1.48129	0.51374
5	7.1769"-04	4.4116"+00	NM	0.97566	0.68227	0.80700	1.39904	0.57683
6	9.8350"-04	4.5920"+00	NM	0.97704	0.69800	0.81900	1.37677	0.59487
7	1.2918"-03	4.8796"+00	NM	0.97915	0.72232	0.83700	1.34273	0.62336
8	1.8394"-03	5.5623"+00	NM	0.98373	0.77693	0.87500	1.26838	0.68985
9	2.3923"-03	6.3915"+00	NM	0.98861	0.83837	0.91400	1.18857	0.76899
10	2.9452"-03	7.1937"+00	NM	0.99275	0.89372	0.94600	1.12043	0.84432
11	3.5831"-03	8.0709"+00	NM	0.99673	0.95051	0.97600	1.05436	0.92568
12	4.1094"-03	8.5299"+00	NM	0.99863	0.97890	0.99000	1.02282	0.96792
13	4.6464"-03	8.8084"+00	NM	0.99973	0.99572	0.99800	1.00456	0.99345
D 14	5.3003"-03	8.8800"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
15	5.9276"-03	8.8800"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
16	6.4433"-03	8.8441"+00	NM	0.99986	0.99786	0.99900	1.00229	0.99672
17	7.0068"-03	8.8441"+00	NM	0.99986	0.99786	0.99900	1.00229	0.99672
18	7.5543"-03	8.7729"+00	NM	0.99959	0.99359	0.99700	1.00687	0.99020
19	8.1179"-03	8.7729"+00	NM	0.99959	0.99359	0.99700	1.00687	0.99020
20	8.7186"-03	8.7025"+00	NM	0.99931	0.98936	0.99500	1.01144	0.98375
21	9.1705"-03	8.5984"+00	NM	0.99890	0.98306	0.99200	1.01827	0.97420
22	9.8297"-03	8.5299"+00	NM	0.99863	0.97890	0.99000	1.02282	0.96792
23	1.0420"-02	8.4286"+00	NM	0.99822	0.97270	0.98700	1.02961	0.95861

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST

72010119 LEWIS PROFILE TABULATION 32 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92138	0.00000	0.00000	3.35775	0.00000
2	1.6122"-04	2.9892"+00	NM	0.95063	0.34028	0.60200	2.50604	0.24022
3	3.0454"-04	3.5554"+00	NM	0.95532	0.42274	0.65000	2.36421	0.27493
4	4.6576"-04	4.6801"+00	NM	0.96311	0.49567	0.72300	2.12759	0.33982
5	7.7030"-04	6.1649"+00	NM	0.97122	0.57752	0.79200	1.88071	0.42112
6	1.0032"-03	6.9061"+00	NM	0.97458	0.61422	0.81900	1.77797	0.46064
7	1.7914"-03	8.1989"+00	NM	0.97961	0.67339	0.85800	1.62346	0.52850
8	2.7229"-03	9.5644"+00	NM	0.98410	0.73065	0.89100	1.48709	0.59916
9	3.5469"-03	1.0822"+01	NM	0.98759	0.77965	0.91600	1.38035	0.66360
10	4.4426"-03	1.1512"+01	NM	0.98930	0.80527	0.92800	1.32806	0.69876
11	5.3562"-03	1.2269"+01	NM	0.99103	0.83245	0.94000	1.27509	0.73720
12	6.1445"-03	1.2816"+01	NM	0.99219	0.85154	0.94800	1.23940	0.76489
13	7.0581"-03	1.3325"+01	NM	0.99322	0.86893	0.95500	1.20792	0.79062
14	7.9179"-03	1.3786"+01	NM	0.99411	0.88439	0.96100	1.18075	0.81389
15	8.7420"-03	1.4189"+01	NM	0.99485	0.89769	0.96600	1.15798	0.83421
16	9.6018"-03	1.4697"+01	NM	0.99574	0.91418	0.97200	1.13050	0.85980
17	1.0408"-02	1.5182"+01	NM	0.99650	0.92839	0.97700	1.10747	0.88219
18	1.1304"-02	1.5609"+01	NM	0.99725	0.94305	0.98200	1.08432	0.90564
19	1.2164"-02	1.5999"+01	NM	0.99786	0.95512	0.98600	1.06571	0.92520
20	1.3059"-02	1.6404"+01	NM	0.99847	0.96751	0.99000	1.04703	0.94553
21	1.3973"-02	1.6719"+01	NM	0.99893	0.97702	0.99300	1.03297	0.96130
22	1.4833"-02	1.7265"+01	NM	0.99969	0.99332	0.99800	1.00944	0.98866
D 23	1.5531"-02	1.7492"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
24	1.6517"-02	1.7723"+01	NM	1.00031	1.00678	1.00200	0.99054	1.01157
25	1.7412"-02	1.8079"+01	NM	1.00077	1.01712	1.00500	0.97631	1.02939
26	1.8093"-02	1.8323"+01	NM	1.00108	1.02415	1.00700	0.96679	1.04159
27	1.9186"-02	1.8447"+01	NM	1.00124	1.02779	1.00800	0.96203	1.04778
28	1.9956"-02	1.9221"+01	NM	1.00217	1.04958	1.01400	0.93336	1.08640
29	2.0726"-02	1.9996"+01	NM	1.00295	1.06859	1.01900	0.90933	1.12060
30	2.1658"-02	2.0935"+01	NM	1.00406	1.09653	1.02600	0.87550	1.17191
31	2.2392"-02	2.2055"+01	NM	1.00517	1.12614	1.03300	0.84143	1.22767
32	2.3843"-02	2.2741"+01	NM	1.00580	1.14386	1.03700	0.82186	1.26178

INPUT VARIABLES Y/DELTA,U/UD ASSUME P=PD AND VAN DRIEST



M : 4.9
R THETA X 10^{-3} : 7 - 58.
TW/TR : 1.0, 0.8, 0.25.

7202

ZPG
AW - MHT - SHT

Boundary-layer channel. Effectively continuous. W = 0.33 H = 0.272 m.
0.1 < PO < 1.1 MN/m^2. 320 < TO < 461 K. Air, dew point 215-233 K. 1.7 < RE/m X 10^{-6} < 25.

VOISINET R.L.P. and LEE R.E., 1972. Measurements of a Mach 4.9 zero-pressure-gradient turbulent boundary-layer with heat transfer. Part I-Data compilation. NOL TR 72-232.
And Voisinet R.L.P., private communications, Lee et al (1966).
Also Lee, Yanta and Leonas (1968) (1969), Gates (1973) (CAT 7301)

1 The test boundary layer was formed on a flat copper surface opposite the flexible half-nozzle. The plate was 2.69 m long and extended upstream of the nozzle throat (X = 0). The plate increased in width from 305 mm at the throat to 343 mm at the channel exit. The nozzle contours are presented in table 1 of section A and the height of the parallel section, as operated, was 272 mm. The plate could be actively cooled with water or liquid nitrogen, and the specification called for a surface finish with roughness below 0.8 μm r.m.s. and waviness less than 5 X 10^{-3} m/m. The zero pressure gradient region started at X = 1.397 m and instrumentation could be attached to or inserted through five removable ports downstream
2 of this point. (A full description of the basic facility is given by Lee et al., 1966). Axial Pitot surveys
5 showed the flow to be shock free with less than 1 % variation of Mach number in the test zone. In a central region along the test plate, about 150 mm wide, the flow did not exhibit any effects due to cross-flow.
3 Skin friction coefficients measured at a point 0.254 m downstream of the nozzle throat were very close to turbulent values at high PO. Low pressure tests (PO = 0.05 MN/m^2 - PC) gave data which appeared to deviate from turbulent flow prediction. The authors therefore present only data for PO = 0.1 MN/m^2 or
4 above, which is believed to represent fully turbulent flow. The test boundary layer passed through the strong reflected-wave expansion of the nozzle, the pressure distribution being given in table 2 of section A. The wall temperature histories are given in table 3 of section A. Substantial heat-transfer from the flow occurred in the nozzle region.

6 Measurements were made at the five instrumentation ports centred on X = 1.624, 1.778, 1.981, 2.134, 2.286 m.
7 Skin friction and heat flux measurements were made at these stations while traverses were made 76.2 mm upstream. The relative positions of the various measurements, taking a local zero on the centre line at the X-value of the Pitot-probe tip are:

8

	PT2	TAUW	Q	PW (a)	PW (b,c)	TW	TO	
X :	0	+ 76.2	+ 76.2	0	76.2	0 (E)	0	mm
Z :	+ 12.7	0	0	0	± 76.2	- 50.8 (E)	- 12.7	mm

The static hole diameter was 0.79 mm, and wall temperature was measured by thermocouples attached to the underside of the copper plate. Temperature differences over the thickness of the plate were less than 1^{o}K. Wall shear stress was measured using two FEB. For the AW and some MHT tests a Kistler balance (model 322 M 107) was used (Paros 1970). For the SHT and some MHT tests, a NOL design intended to operate in strongly cooled-wall and pressure-gradient conditions was employed. This was a modification of the design of Bruno et al. (1969). The floating element cooling system did not function, so that the temperature of the element was higher than that of the surrounding wall. In the SHT case, this difference could be as much as 100^{o}K which, the authors suggest, could result in the balance recording a value as much as 20 % below the true wall stress. The heat-flux was measured with a thermo-pile gauge attached to the centre of each port, using the manufacturers calibration. (RdF Corp. Hudson, New Hampshire, Model 20463-3.)
7 Pitot, TO and P profiles were measured, however only Pitot and TO results, measured simultaneously, are presented (but see § 9 below). Two TTP were used, one an ECP (Danberg 1961) for which $\alpha = 5^{o}$, d = 1.27, l = 12.7 mm, and the other an FWP (Yanta, 1970) with a chromel / alumel junction, for which d = 0.0254, b = 3.56 , l = 20 (E) mm. The TPP was an FPP for which h_1 = 0.127, h_2 = 0.076, b_1 = 2.54, l = 20 (E) mm.

9 Any small differences in Y between the TTP and the TPP were eliminated by the authors who normalised the TO data to the Y values of the PT2 probe. The values for Y less than 0.635 mm were obtained by extrapolating the profile to meet the wall temperature. The static pressure distribution presented is an interpolation giving zero normal pressure gradient at the wall, agreeing with the measured value of PW, and with the values and trend of the static pressure in the free stream as determined from PT2 and the tunnel reservoir pressure (Voisinet et al. 1971). Substantial pressure variation is only observed at the first station, where the profile normal in the outer part of the boundary layer intercepts the last part of the nozzle expansion,

10 here reflected as a simple wave. Corrections were applied to the Pitot data for viscous and molecular effects, and also for probe-wall interference. Both corrections were based on calibration experiments.

11 (Source, Appendix A). Sutherland's viscosity relation was used.

12 The editors have accepted the interpolations and corrections made by the authors. The edge reservoir state has been calculated from the static pressure and temperature data with the Mach number distribution as presented. The authors present their wall shear stress and heat transfer data as measured on separate occasions at the centre of the ports - that is, 76.2 mm downstream of the profiles. The wall temperature histories for these runs were not exactly as for the profile measurements. The CF and CQ values presented with the profiles have been interpolated by the editors on the basis of the author's R THETA values alone. No adjustment has been made for the small X-difference, introducing a systematic error which is, however, very small as compared to the scatter of the data. Following the author's stated preference, the CF values presented for the MHT case are those measured with the NOL balance where possible. For the AW and SHT, data is only available from the Kistler and NOL balances respectively. Where comparison is possible, the Kistler balance appears to read systematically about 3 % higher. (Skin friction values for profiles 0601, 0701, 0801, 0901 and 1001 were measured with a Kistler balance. The authors state that the two balances agreed to within 5 % in comparative measurements.) We present revised data for profile 1201 (private communication).

13 The profile sets presented are distinguished by total pressure (Reynolds number), by the heat transfer on

14 the experimental wall, and by the TTP used. The data sets are:

CODE 7202	HT	NX	TTP	FEB	POD MN/m^2	TOD K	TW K
0101-5	AW	5	ECP	Kistler	0.1	355	300
0201-5	AW	5	ECP	Kistler	0.5	355	295
0301-5	AW	5	ECP	Kistler	1.0	355	295
0401-4	AW	4	FWP	Kistler	0.1	355	295
0501-5	AW	5	FWP	Kistler	0.5	350	295
0601-5	MHT	5	ECP	NOL	0.1	415	300
0701-5	MHT	5	ECP	NOL	0.5	415	300
0801-5	MHT	5	ECP	NOL	1.0	415	300
0901-5	MHT	5	FWP	NOL	0.1	425	295
1001-5	MHT	5	FWP	NOL	0.5	420	295
1101-3	SHT	3	ECP	NOL	0.1	425	85
1201-3	SHT	3	ECP	NOL	0.5	425	90
1301-3	SHT	3	ECP	NOL	1.0	425	100
1401-2	SHT	2	FWP	NOL	0.1	425	85
1501-2	SHT	2	FWP	NOL	0.5	425	90

15 Data: 7202 0101-1502. Pitot and TO profiles simultaneously. NX = 2 to 5. CF from FEB, CQ from thermopiles, measured separately and with slightly different thermal histories.

16 Editors' comments

This entry describes the ZPG case which forms part of a comprehensive study using the same facility and the same instrumentation. The FPG case is described in CAT 7304, and the APG case in Voisinet et al. 1971. Taken together, the three data-sets cover a very wide range of systematically varied governing parameters. They provide the only fully documented case with a wide range of TW/TR values. These data supersede the earlier comparable tests in the same facility reported by Lee et al. (1968, 1969 - ZPG), Brott et al. (1969, 1970 - FPG). Tabular data for the APG (1971) case are not at present available.

In many cases substantial heat transfer took place in the nozzle region, so that there is a downstream heat-transfer history effect in addition to any downstream effect of the nozzle pressure-gradient. Thus, in the AW case, the zero-heat-transfer wall temperature is the TW value given in section B or table 3, and was determined by adjusting the wall cooling rate so as to have no measurable heat flux at the measuring ports. This adiabatic wall temperature, TAW, differs noticeably from the "flat plate recovery temperature" TR. Further tests to assess the effect of upstream heat transfer are reported by Gates (CAT 7301). On a transformed wall-law plot many of the profiles show inner region characteristics which could be described as transitional.

Static pressure variations normal to the test surface were generally small, except for the first station, where the profile normal extends into the last, simple wave, part of the nozzle expansion. The reduced data of section B have been prepared both with a fixed reference state (the D-state) and also with a varying pressure-based reference state, the tables for which follow the normal section B.

There are no truly comparable experiments, but the same Mach number and Reynolds number ranges are covered in part for the adiabatic wall case by Gates (CAT 7301), Allen (CAT 7303) and Mabey et al. (CAT 7402), with various geometries.

TABLE 1

NOZZLE CONTOUR COORDINATES

x (m)	y (m)
0.0000	0.01077
0.2794	0.02959
0.3810	0.04598
0.5588	0.08738
0.7366	0.12970
0.9144	0.16475
1.0668	0.18952
1.2446	0.21296
1.4224	0.23107
1.6002	0.24485
1.7780	0.25518
1.9558	0.26264
2.1591	0.26838
2.3368	0.27162

TABLE 2

NOZZLE WALL PRESSURE DISTRIBUTION

x (meters)	$P_{sw}/P_0 \times 10^3$ Design	Experiment
0.000	528.30	-
0.127	194.04	-
0.257	70.02	-
0.385	29.24	-
0.559	11.47	10.68
0.635	8.25	8.00
0.711	6.22	6.04
0.787	5.22	4.68
0.864	3.97	3.95
0.940	3.32	3.44
1.067	2.66	2.67
1.143	2.41	2.43
1.194	2.31	2.29
1.270	2.20	2.10
1.448	2.12	1.99
1.624	2.12	1.99
1.702	2.12	2.04
1.778	2.12	2.09
1.905	2.12	2.04
1.981	2.12	2.02
2.057	2.12	2.03
2.134	2.12	2.05
2.210	2.12	2.11
2.286	2.12	2.14

TABLE 3

NOZZLE WALL TEMPERATURE DISTRIBUTION

CAT 7202 SERIES		Code	P_0 atm	T_0 °K	0.000	0.279	0.457	0.711	0.864	1.067	1.194	1.448	1.702	1.905	2.057	2.210
					Average T_W (°K)											
03	ZPG-AW	TD1	10.	348.	307.	306.	303.	297.	297.	297.	297.	297.	297.	297.	297.	297.
02		TD2	5.	348.	296.	297.	299.	298.	298.	298.	298.	298.	298.	298.	298.	298.
01		TD3	1.	348.	275.	283.	294.	298.	298.	298.	298.	298.	298.	298.	298.	298.
05		TD4	5.	348.	300.	294.	294.	296.	296.	296.	296.	296.	296.	296.	296.	296.
04		TD5	1.	348.	281.	284.	290.	296.	296.	296.	296.	296.	296.	296.	296.	296.
08	ZPG-MHT	TD6	10.	423.	338.	300.	298.	298.	298.	298.	-	-	-	300.	299.	299.
07		TD7	5.	423.	327.	301.	299.	299.	299.	299.	297.	-	-	302.	301.	301.
06		TD8	1.	423.	288.	301.	299.	299.	299.	299.	299.	299.	300.	301.	301.	301.
10		TD9	5.	423.	342.	333.	319.	300.	299.	299.	299.	299.	299.	299.	299.	299.
09		TD10	1.	423.	300.	302.	303.	299.	299.	299.	299.	299.	299.	299.	299.	299.
13	ZPG-CW	TD11	10.	423.	332.	311.	288.	178.	124.	97.	-	87.	91.	91.	97.	-
12,15		TD12	5.	423.	320.	-	275.	142.	94.	88.	-	86.	86.	87.	89.	-
11,14		TD13	1.	423.	[illegible]	257.	160.	88.	85.	84.	-	84.	84.	85.	85.	-

CAT 7202 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2	H42	D2K	UD	TR
72020101	4.7553	0.9249	1.5563"+03	8.9000"-04	9.1155	1.4493	2.3360"+02	2.5577"+02
1.4480"+00	1.0124"+05	0.9133	6.2612"+03	NM	1.8320	1.7768	2.9980"+02	6.4157"+01
INFINITE	3.5431"+02	0.0000	2.7169"-03	0.0000"+00	0.6266	5.6121"-03	7.6368"+02	3.2414"+02
72020102	4.7662	0.9211	1.7524"+03	8.7000"-04	8.1573	1.4693	2.4960"+02	2.5105"+02
1.7020"+00	1.0068"+05	0.9942	7.0625"+03	NM	1.8135	1.7583	2.9700"+02	6.3585"+01
INFINITE	3.5247"+02	0.0000	3.0735"-03	0.0000"+00	0.5728	6.3039"-03	7.6201"+02	3.2243"+02
72020103	4.7879	0.9250	1.7791"+03	8.4000"-04	8.4273	1.4528	2.4410"+02	2.4613"+02
1.9050"+00	1.0132"+05	0.9918	7.2225"+03	NM	1.8163	1.7614	3.0240"+02	6.4004"+01
INFINITE	3.5745"+02	0.0000	3.2230"-03	0.0000"+00	0.5428	6.6964"-03	7.6800"+02	3.2693"+02
72020104	4.7910	0.9124	1.9555"+03	8.3000"-04	8.0701	1.4732	2.5460"+02	2.4676"+02
2.0570"+00	1.0196"+05	1.0318	7.8659"+03	NM	1.7996	1.7476	2.9800"+02	6.3872"+01
INFINITE	3.5709"+02	0.0000	3.4881"-03	0.0000"+00	0.5182	7.2663"-03	7.6770"+02	3.2660"+02
72020105	4.8041	0.9195	2.1045"+03	8.2000"-04	8.0043	1.4545	2.5210"+02	2.4671"+02
2.2100"+00	1.0355"+05	1.0219	8.5751"+03	NM	1.8005	1.7496	2.4700"+02	6.2894"+01
INFINITE	3.5321"+02	0.0000	3.7060"-03	0.0000"+00	0.5382	7.7278"-03	7.6388"+02	3.2301"+02
72020201	4.7804	0.9149	5.1742"+03	7.2000"-04	9.8480	1.3470	1.0820"+03	1.1949"+03
1.4480"+00	4.8745"+05	0.9056	2.0828"+04	NM	1.8442	1.7939	2.9600"+02	6.3496"+01
INFINITE	3.5370"+02	0.0000	1.8947"-03	0.0000"+00	0.5249	3.9409"-03	7.6374"+02	3.2352"+02
72020202	4.8117	0.9204	5.9030"+03	6.5500"-04	8.5729	1.3910	1.1580"+03	1.1614"+03
1.7020"+00	4.9190"+05	0.9971	2.4164"+04	NM	1.8250	1.7722	2.9570"+02	6.2393"+01
INFINITE	3.5130"+02	0.0000	2.1885"-03	0.0000"+00	0.4935	4.4849"-03	7.6204"+02	3.2126"+02
72020203	4.8546	0.9079	6.6989"+03	6.4000"-04	8.3388	1.3870	1.1710"+03	1.1615"+03
1.9050"+00	5.1780"+05	1.0082	2.7453"+04	NM	1.8211	1.7690	2.9510"+02	6.2229"+01
INFINITE	3.5554"+02	0.0000	2.4542"-03	0.0000"+00	0.5140	5.0172"-03	7.6782"+02	3.2503"+02
72020204	4.8092	0.9153	6.8013"+03	6.3000"-04	9.1178	1.4059	1.1810"+03	1.2181"+03
2.0570"+00	5.1439"+05	0.9696	2.7638"+04	NM	1.8136	1.7624	2.9680"+02	6.3031"+01
INFINITE	3.5459"+02	0.0000	2.4246"-03	0.0000"+00	0.4767	5.2234"-03	7.6553"+02	3.2427"+02
72020205	4.8232	0.9277	6.9625"+03	6.2000"-04	8.6262	1.3975	1.1920"+03	1.1765"+03
2.2100"+00	5.0521"+05	1.0132	2.8764"+04	NM	1.8075	1.7587	2.9900"+02	6.2357"+01
INFINITE	3.5248"+02	0.0000	2.5631"-03	0.0000"+00	0.4474	5.4606"-03	7.6364"+02	3.2231"+02
72020301	4.8042	0.9272	9.5304"+03	6.3000"-04	10.1926	1.3118	2.2260"+03	2.3958"+03
1.4480"+00	1.0057"+06	0.9291	3.9008"+04	NM	1.8496	1.8038	3.0200"+02	6.3420"+01
INFINITE	3.5617"+02	0.0000	1.7578"-03	0.0000"+00	0.4137	3.6081"-03	7.6709"+02	3.2573"+02
72020302	4.8160	0.9165	1.1919"+04	5.7000"-04	8.3082	1.3382	2.3430"+03	2.3430"+03
1.7020"+00	9.9751"+05	1.0000	4.8707"+04	NM	1.8423	1.7907	2.9430"+02	6.2274"+01
INFINITE	3.5115"+02	0.0000	2.1782"-03	0.0000"+00	0.5042	4.2405"-03	7.6199"+02	3.2111"+02
72020303	4.8645	0.9124	1.0371"+04	5.8000"-04	10.0107	1.3489	2.2020"+03	2.3934"+03
1.9050"+00	1.0796"+06	0.9451	4.2808"+04	NM	1.8266	1.7808	2.9650"+02	6.2012"+01
INFINITE	3.5550"+02	0.0000	1.8437"-03	0.0000"+00	0.4713	3.9889"-03	7.6805"+02	3.2497"+02
72020304	4.8200	0.9207	1.1506"+04	5.6500"-04	10.0475	1.3579	2.2810"+03	2.4288"+03
2.0570"+00	1.0390"+06	0.9391	4.7013"+04	NM	1.8262	1.7781	3.0210"+02	6.3546"+01
INFINITE	3.5881"+02	0.0000	2.0892"-03	0.0000"+00	0.5009	4.5131"-03	7.7038"+02	3.2811"+02
72020305	4.8016	0.9131	1.3252"+04	5.5500"-04	8.5063	1.3745	2.3950"+03	2.3950"+03
2.2100"+00	1.0022"+06	1.0000	5.3799"+04	NM	1.8196	1.7707	2.9180"+02	6.2273"+01
INFINITE	3.4942"+02	0.0000	2.3608"-03	0.0000"+00	0.4871	4.8934"-03	7.5971"+02	3.1956"+02

CAT 7202 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	PED2W	CF *	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2	H42	D2K	UD	TR
72020401	4.7417	0.9118	1.6627"+03	8.8000"-04	8.7507	1.4401	2.3560"+02	2.6371"+02
1.4480"+00	1.0268"+05	0.8934	6.5885"+03	NM	1.8368	1.7798	2.9500"+02	6.4330"+01
INFINITE	3.5361"+02	0.0000	2.7921"-03	0.0000"+00	0.7551	5.6349"-03	7.6252"+02	3.2352"+02
72020402	4.7889	0.9092	1.9554"+03	8.2000"-04	7.9236	1.4601	2.4410"+02	2.4735"+02
1.9050"+00	1.0194"+05	0.9869	7.8576"+03	NM	1.8172	1.7618	2.9370"+02	6.3222"+01
INFINITE	3.5321"+02	0.0000	3.4246"-03	0.0000"+00	0.6440	6.8993"-03	7.6345"+02	3.2305"+02
72020403	4.8253	0.9066	2.1020"+03	8.1000"-04	7.6275	1.4562	2.4450"+02	2.4450"+02
2.0570"+00	1.0526"+05	1.0000	8.5234"+03	NM	1.8143	1.7584	2.9420"+02	6.2741"+01
INFINITE	3.5491"+02	0.0000	3.6870"-03	0.0000"+00	0.6627	7.4124"-03	7.6632"+02	3.2452"+02
72020404	4.7951	0.9045	2.0581"+03	8.1500"-04	8.1837	1.4656	2.4370"+02	2.4743"+02
2.2100"+00	1.0274"+05	0.9849	8.2597"+03	NM	1.8054	1.7516	2.9140"+02	6.2922"+01
INFINITE	3.5228"+02	0.0000	3.5683"-03	0.0000"+00	0.6128	7.4723"-03	7.6262"+02	3.2218"+02
72020501	4.8684	0.9278	5.0612"+03	7.2000"-04	10.2367	1.3482	1.0620"+03	1.1505"+03
1.4480"+00	5.2136"+05	0.9231	2.1289"+04	NM	1.8481	1.7972	2.9550"+02	6.0699"+01
INFINITE	3.4843"+02	0.0000	1.8455"-03	0.0000"+00	0.5250	3.8644"-03	7.6048"+02	3.1850"+02
72020502	4.8770	0.9258	5.8531"+03	6.5000"-04	9.4066	1.3896	1.0890"+03	1.1215"+03
1.7020"+00	5.1342"+05	0.9711	2.4681"+04	NM	1.8292	1.7751	2.9330"+02	6.0202"+01
INFINITE	3.4659"+02	0.0000	2.1641"-03	0.0000"+00	0.4862	4.6129"-03	7.5870"+02	3.1680"+02
72020503	4.8610	0.9246	5.9597"+03	6.5000"-04	9.2694	1.3945	1.0990"+03	1.1056"+03
1.9050"+00	4.9664"+05	0.9940	2.4912"+04	NM	1.8226	1.7701	2.9590"+02	6.1141"+01
INFINITE	3.5009"+02	0.0000	2.2754"-03	0.0000"+00	0.4312	4.8749"-03	7.6208"+02	3.2004"+02
72020504	4.8902	0.9224	6.4075"+03	6.3500"-04	9.3105	1.3837	1.0910"+03	1.1110"+03
2.0570"+00	5.1664"+05	0.9820	2.6997"+04	NM	1.8251	1.7723	2.9520"+02	6.0551"+01
INFINITE	3.5016"+02	0.0000	2.4039"-03	0.0000"+00	0.4797	5.1613"-03	7.6295"+02	3.2004"+02
72020505	4.9018	0.9248	6.6369"+03	6.1500"-04	9.1184	1.3866	1.1090"+03	1.1088"+03
2.2100"+00	5.2275"+05	1.0002	2.8122"+04	NM	1.8206	1.7685	2.9630"+02	6.0383"+01
INFINITE	3.5056"+02	0.0000	2.4927"-03	0.0000"+00	0.4512	5.3806"-03	7.6370"+02	3.2038"+02
72020601	4.7747	0.7845	1.8649"+03	1.0550"-03	6.8257	1.4442	2.3350"+02	2.4746"+02
1.4480"+00	1.0027"+05	0.9436	6.4159"+03	7.0100"-05	1.8247	1.7733	2.9790"+02	7.4667"+01
INFINITE	4.1512"+02	0.0000	3.5977"-03	0.0000"+00	0.8668	6.5603"-03	8.2722"+02	3.7971"+02
72020602	4.8182	0.7888	1.9743"+03	1.0350"-03	6.3306	1.4471	2.3880"+02	2.3964"+02
1.7020"+00	1.0229"+05	0.9965	6.9301"+03	6.7800"-05	1.8152	1.7628	2.9760"+02	7.3117"+01
INFINITE	4.1260"+02	0.0000	3.8539"-03	0.0000"+00	0.8434	6.9861"-03	8.2604"+02	3.7729"+02
72020603	4.8303	0.7939	1.9620"+03	1.0250"-03	6.7650	1.4461	2.3370"+02	2.3896"+02
1.9050"+00	1.0349"+05	0.9780	6.9317"+03	6.5800"-05	1.8130	1.7613	3.0300"+02	7.3660"+01
INFINITE	4.1738"+02	0.0000	3.8989"-03	0.0000"+00	0.8410	7.3032"-03	8.3119"+02	3.8164"+02
72020604	4.8128	0.7988	2.0609"+03	1.0100"-03	6.6339	1.4549	2.4130"+02	2.4219"+02
2.0570"+00	1.0272"+05	0.9963	7.2784"+03	6.3700"-05	1.8038	1.7531	3.0380"+02	7.3840"+01
INFINITE	4.1591"+02	0.0000	4.0688"-03	0.0000"+00	0.8021	7.6801"-03	8.2919"+02	3.8034"+02
72020605	4.8114	0.7965	1.9739"+03	1.0320"-03	7.2503	1.4642	2.3830"+02	2.4490"+02
2.2100"+00	1.0369"+05	0.9730	6.9588"+03	6.5800"-05	1.7938	1.7462	3.0180"+02	7.3595"+01
INFINITE	4.1434"+02	0.0000	3.8292"-03	0.0000"+00	0.7803	7.6203"-03	8.2757"+02	3.7890"+02
72020701	4.8228	0.7890	5.7897"+03	8.0500"-04	8.9558	1.3463	1.0240"+03	1.1927"+03
1.4480"+00	5.1190"+05	0.8586	2.0346"+04	5.1000"-05	1.8421	1.7938	2.9840"+02	7.3184"+01
INFINITE	4.1363"+02	0.0000	2.2744"-03	0.0000"+00	0.8117	4.5215"-03	8.2721"+02	3.7822"+02
72020702	4.8632	0.7905	6.4523"+03	7.1000"-04	7.5705	1.3707	1.0790"+03	1.1221"+03
1.7020"+00	5.0535"+05	0.9616	2.3006"+04	4.6600"-05	1.8280	1.7786	2.9950"+02	7.2333"+01
INFINITE	4.1448"+02	0.0000	2.6638"-03	0.0000"+00	0.7654	5.0798"-03	8.2928"+02	3.7889"+02
72020703	4.9358	0.7921	6.3813"+03	7.1000"-04	7.1484	1.3973	1.0600"+03	1.0587"+03
1.9050"+00	5.1957"+05	1.0012	2.3297"+04	4.6600"-05	1.8205	1.7703	3.0260"+02	7.1202"+01
INFINITE	4.1813"+02	0.0000	2.7511"-03	0.0000"+00	0.7422	5.2627"-03	8.3505"+02	3.8205"+02
72020704	4.8892	0.7934	7.0974"+03	6.8500"-04	7.3385	1.3874	1.0860"+03	1.1054"+03
2.0570"+00	5.1346"+05	0.9824	2.5604"+04	4.5800"-05	1.8191	1.7697	3.0020"+02	7.1616"+01
INFINITE	4.1400"+02	0.0000	2.9489"-03	0.0000"+00	0.7453	5.6819"-03	8.2957"+02	3.7839"+02
72020705	4.8904	0.7915	7.0273"+03	6.9000"-04	7.4664	1.4087	1.1160"+03	1.1173"+03
2.2100"+00	5.1973"+05	0.9988	2.5298"+04	4.6200"-05	1.8039	1.7564	3.0050"+02	7.1823"+01
INFINITE	4.1537"+02	0.0000	2.8944"-03	0.0000"+00	0.6890	5.7761"-03	8.3097"+02	3.7964"+02

CAT 7202 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD TOD	TW/TR PW/PD SW *	PED2W RED2D D2	CF * CQ * PI2	H12 H32 H42	H12K H32K D2K	PW* TW* UD	PD* TD* TR
72020801	4.8067	0.7986	1.2025"+04	6.7000"-04	7.5164	1.3264	2.3610"+03	2.3900"+03
1.4480"+00	1.0063"+06	0.9578	4.2388"+04	4.1200"-05	1.8429	1.7984	3.0330"+02	7.3887"+01
INFINITE	4.1531"+02	0.0000	2.4065"-03	0.0000"+00	0.6568	4.3725"-03	8.2840"+02	3.7980"+02
72020802	4.8851	0.7892	1.2551"+04	5.9000"-04	7.4224	1.3336	2.2260"+03	2.2414"+03
1.7020"+00	1.0360"+06	0.9931	4.4893"+04	4.3700"-05	1.8394	1.7918	3.0270"+02	7.2695"+01
INFINITE	4.1965"+02	0.0000	2.6101"-03	0.0000"+00	0.6873	4.7915"-03	8.3509"+02	3.8357"+02
72020803	4.9188	0.8009	1.0954"+04	6.1000"-04	7.6779	1.3591	2.1510"+03	2.1510"+03
1.9050"+00	1.0347"+06	1.0000	4.0146"+04	4.1200"-05	1.8249	1.7775	3.0480"+02	7.1323"+01
INFINITE	4.3645"+02	0.0000	2.3475"-03	0.0000"+00	0.6503	4.5673"-03	8.3288"+02	3.8056"+02
72020804	4.8760	0.8035	1.2100"+04	5.9500"-04	8.0828	1.3604	2.2700"+03	2.2648"+03
2.0570"+00	1.0356"+06	1.0023	4.4032"+04	4.0500"-05	1.8245	1.7774	2.9980"+02	7.0925"+01
INFINITE	4.0818"+02	0.0000	2.4462"-03	0.0000"+00	0.5608	4.8303"-03	8.2333"+02	3.7310"+02
72020805	4.8558	0.7965	1.2724"+04	5.9000"-04	7.7016	1.3739	2.2930"+03	2.2930"+03
2.2100"+00	1.0237"+06	1.0000	4.5414"+04	4.2200"-05	1.8132	1.7678	3.0500"+02	7.3280"+01
INFINITE	4.1885"+02	0.0000	2.6277"-03	0.0000"+00	0.6256	5.2151"-03	8.3342"+02	3.8291"+02
72020901	4.7175	0.7592	1.9254"+03	1.0500"-03	6.7291	1.4120	2.2940"+02	2.6298"+02
1.4480"+00	9.9446"+04	0.8723	6.2887"+03	7.8400"-05	1.8296	1.7788	2.9820"+02	7.8747"+01
INFINITE	4.2925"+02	0.0000	3.6357"-03	0.0000"+00	1.1256	6.5239"-03	8.3934"+02	3.9280"+02
72020902	4.7856	0.7617	2.1836"+03	9.9000"-04	5.8837	1.4499	2.3580"+02	2.4674"+02
1.7020"+00	1.0129"+05	0.9557	7.3248"+03	7.3800"-05	1.8164	1.7623	2.9730"+02	7.6474"+01
INFINITE	4.2675"+02	0.0000	4.2592"-03	0.0000"+00	1.0181	7.4885"-03	8.3908"+02	3.9033"+02
72020903	4.8212	0.7606	2.3677"+03	9.6500"-04	5.7833	1.4396	2.3900"+02	2.4581"+02
1.9050"+00	1.0530"+05	0.9560	8.0275"+03	7.2600"-05	1.8146	1.7618	2.9700"+02	7.5598"+01
INFINITE	4.2703"+02	0.0000	4.5716"-03	0.0000"+00	1.0380	8.0127"-03	8.4046"+02	3.9049"+02
72020904	4.8076	0.7602	2.4769"+03	9.5500"-04	5.6144	1.4547	2.4320"+02	2.4320"+02
2.0570"+00	1.0250"+05	1.0000	8.3614"+03	7.2000"-05	1.8057	1.7545	2.9600"+02	7.5729"+01
INFINITE	4.2579"+02	0.0000	4.8390"-03	0.0000"+00	0.9397	8.4862"-03	8.3882"+02	3.8938"+02
72020905	4.8361	0.7569	2.5657"+03	9.5000"-04	5.5601	1.4551	2.4150"+02	2.4150"+02
2.2100"+00	1.0531"+05	1.0000	8.7287"+03	6.6300"-05	1.8029	1.7507	2.9250"+02	7.4446"+01
INFINITE	4.2267"+02	0.0000	4.9298"-03	0.0000"+00	0.9547	8.6981"-03	8.3662"+02	3.8646"+02
72021001	4.9029	0.7674	6.0830"+03	8.0000"-04	7.3705	1.3357	1.0140"+03	1.1007"+03
1.4480"+00	5.1961"+05	0.9212	2.1413"+04	5.5800"-05	1.8457	1.7986	2.9480"+02	7.2376"+01
INFINITE	4.2033"+02	0.0000	2.5092"-03	0.0000"+00	0.9328	4.5748"-03	8.3629"+02	3.8415"+02
72021002	4.9068	0.7713	6.5377"+03	7.0000"-04	7.3743	1.3701	1.0300"+03	1.0922"+03
1.7020"+00	5.1799"+05	0.9430	2.3124"+04	5.0700"-05	1.8301	1.7794	2.9680"+02	7.2408"+01
INFINITE	4.2108"+02	0.0000	2.7304"-03	0.0000"+00	0.8634	5.1751"-03	8.3715"+02	3.8481"+02
72021003	4.8955	0.7685	7.5390"+03	6.8500"-04	6.6925	1.3860	1.1020"+03	1.1020"+03
1.9050"+00	5.1569"+05	1.0000	2.6489"+04	5.0300"-05	1.8229	1.7722	2.9590"+02	7.2722"+01
INFINITE	4.2129"+02	0.0000	3.1273"-03	0.0000"+00	0.7945	5.7705"-03	8.3703"+02	3.8504"+02
72021004	4.9817	0.7670	7.9489"+03	6.7000"-04	6.3561	1.3753	1.0530"+03	1.0530"+03
2.0570"+00	5.4535"+05	1.0000	2.8674"+04	5.0500"-05	1.8264	1.7745	2.9600"+02	7.0844"+01
INFINITE	4.2248"+02	0.0000	3.3478"-03	0.0000"+00	0.8749	6.1056"-03	8.4070"+02	3.8591"+02
72021005	4.9055	0.7754	7.5623"+03	6.8000"-04	6.6535	1.3837	1.0800"+03	1.0800"+03
2.2100"+00	5.1141"+05	1.0000	2.6816"+04	4.9300"-05	1.8174	1.7675	2.9990"+02	7.2807"+01
INFINITE	4.2321"+02	0.0000	3.2295"-03	0.0000"+00	0.8081	6.0775"-03	8.3923"+02	3.8677"+02
72021101	4.8224	0.2191	7.9050"+03	1.6500"-03	3.8377	1.4027	2.3390"+02	2.3390"+02
1.9050"+00	1.0035"+05	1.0000	8.9355"+03	4.2500"-04	1.7845	1.7579	8.5430"+01	7.5455"+01
INFINITE	4.2640"+02	0.0000	5.3315"-03	0.0000"+00	1.1440	7.6100"-03	8.3988"+02	3.8990"+02
72021102	4.8357	0.2168	8.2024"+03	1.8500"-03	4.0450	1.4080	2.3500"+02	2.3500"+02
2.0570"+00	1.0243"+05	1.0000	9.2166"+03	3.9600"-04	1.7796	1.7531	8.3910"+01	7.4573"+01
INFINITE	4.2334"+02	0.0000	5.3635"-03	0.0000"+00	1.1161	7.8395"-03	8.3726"+02	3.8707"+02
72021103	4.8220	0.2163	0.7199"+03	1.6200"-03	3.8978	1.4138	2.4510"+02	2.3883"+02
2.2100"+00	1.0241"+05	1.0263	9.7327"+03	4.0100"-04	1.7741	1.7475	8.4340"+01	7.5459"+01
INFINITE	4.2637"+02	0.0000	5.6882"-03	0.0000"+00	1.0994	8.2556"-03	8.3983"+02	3.8987"+02

CAT 7202 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X * RZ	MD * POD TOD	TW/TR PW/PD SW *	RED2W RED2D D2	CF * CQ * PI2	H12 H32 H42	H12K H32K D2K	PW* TW* UD	PD* TD* TR
72021201 1.9050"+00 INFINITE	4.9151 5.2921"+05 4.2479"+02	0.2237 1.0000 0.0000	2.3652"+04 2.8139"+04 3.3081"-03	1.1550"-03 NM 0.0000"+00	5.5707 1.8011 0.9182	1.3604 1.7713 5.4065"-03	1.1050"+03 8.6850"+01 8.4107"+02	1.1050"+03 7.2842"+01 3.8819"+02
72021202 2.0570"+00 INFINITE	4.9030 5.1597"+05 4.2610"+02	0.2414 0.9590 0.0000	2.3004"+04 2.9354"+04 3.5354"-03	1.2000"-03 2.4800"-04 0.0000"+00	5.4713 1.8021 1.0194	1.3577 1.7719 5.7217"-03	1.0480"+03 9.4010"+01 8.4201"+02	1.0929"+03 7.3305"+01 3.8941"+02
72021203 2.2100"+00 INFINITE	4.8574 5.1411"+05 4.2211"+02	0.2279 1.0344 0.0000	3.3764"+04 4.0140"+04 4.6820"-03	1.1100"-03 2.5400"-04 0.0000"+00	3.9594 1.8231 1.0771	1.3378 1.7862 6.9945"-03	1.1890"+03 8.7960"+01 8.3671"+02	1.1494"+03 7.3811"+01 3.8589"+02
72021301 1.9050"+00 INFINITE	4.8910 1.0338"+06 4.2853"+02	0.2365 1.0000 0.0000	3.8033"+04 4.7373"+04 2.8557"-03	9.9500"-04 2.2200"-04 0.0000"+00	5.8639 1.8145 0.8657	1.3284 1.7841 4.7075"-03	2.2210"+03 9.2620"+01 8.4405"+02	2.2210"+03 7.4084"+01 3.9167"+02
72021302 2.0570"+00 INFINITE	4.8578 1.0191"+06 4.2508"+02	0.2684 0.9678 0.0000	3.3669"+04 4.6874"+04 2.7877"-03	1.0350"-03 2.1400"-04 0.0000"+00	6.4238 1.8093 0.8572	1.3377 1.7788 4.8000"-03	2.2040"+03 1.0430"+02 8.3966"+02	2.2774"+03 7.4320"+01 3.8860"+02
72021303 2.2100"+00 INFINITE	4.8903 1.0491"+06 4.1906"+02	0.2604 0.9713 0.0000	3.6276"+04 4.9617"+04 2.8497"-03	9.7000"-04 2.1500"-04 0.0000"+00	6.4718 1.8029 0.8437	1.3477 1.7742 4.9312"-03	2.1910"+03 9.9740"+01 8.3466"+02	2.2556"+03 7.2464"+01 3.8302"+02
72021401 1.4480"+00 INFINITE	4.7916 1.0134"+05 4.2620"+02	0.2107 0.9229 0.0000	6.9631"+03 7.4976"+03 4.3618"-03	1.7200"-03 4.3700"-04 0.0000"+00	4.2533 1.7894 1.2249	1.3808 1.7658 6.2735"-03	2.2620"+02 8.2140"+01 8.3872"+02	2.4509"+02 7.6218"+01 3.8980"+02
72021402 1.7020"+00 INFINITE	4.8206 1.0174"+05 4.2973"+02	0.2208 0.9471 0.0000	7.7693"+03 8.8442"+03 5.2607"-03	1.7000"-03 3.9900"-04 0.0000"+00	3.7397 1.7837 1.2552	1.3984 1.7581 7.3688"-03	2.2510"+02 8.6780"+01 8.4309"+02	2.3766"+02 7.6089"+01 3.9295"+02
72021501 1.4480"+00 INFINITE	4.9286 5.3365"+05 4.2008"+02	0.2242 0.9001 0.0000	2.1288"+04 2.5494"+04 2.9417"-03	1.3000"-03 2.8300"-04 0.0000"+00	6.1920 1.8106 1.0384	1.3368 1.7834 4.7990"-03	9.8710"+02 8.6050"+01 8.3679"+02	1.0967"+03 7.1708"+01 3.8385"+02
72021502 1.7020"+00 INFINITE	4.9186 5.1806"+05 4.2659"+02	0.2283 0.9793 0.0000	2.5476"+04 3.0948"+04 3.7463"-03	1.2100"-03 2.5900"-04 0.0000"+00	4.6625 1.7961 1.0912	1.3727 1.7660 5.7415"-03	1.0550"+03 8.9000"+01 8.4296"+02	1.0773"+03 7.3065"+01 3.8982"+02

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
72020101	2.7904E-03	7.8417	1.8365	0.6101	6.4383E+03	1.6003E+03	2.3230E-02
	2.9603E-03	7.8638	1.8313	0.6118	6.4202E+03	1.5958E+03	
72020201	1.9545E-03	8.3511	1.8490	0.5089	2.1511E+04	5.3439E+03	1.7415E-02
	2.0953E-03	8.3766	1.8434	0.5104	2.1446E+04	5.3276E+03	
72020301	1.8043E-03	8.9484	1.8535	0.4030	4.0087E+04	9.7938E+03	1.6938E-02
	1.8930E-03	8.9685	1.8494	0.4039	3.9997E+04	9.7719E+03	
72020302	2.1784E-03	8.3076	1.8423	0.5042	4.8768E+04	1.1934E+04	1.8097E-02
	2.1784E-03	8.3076	1.8423	0.5042	4.8768E+04	1.1934E+04	
72020303	1.8885E-03	8.8951	1.8307	0.4601	4.3901E+04	1.0636E+04	1.7451E-02
	1.9597E-03	8.9101	1.8276	0.4609	4.3827E+04	1.0618E+04	
72020304	2.1567E-03	8.6413	1.8317	0.4853	4.8592E+04	1.1892E+04	1.9453E-02
	2.2471E-03	8.6577	1.8282	0.4862	4.8499E+04	1.1870E+04	
72020305	2.3606E-03	8.5064	1.8196	0.4872	5.3860E+04	1.3267E+04	2.0080E-02
	2.3606E-03	8.5064	1.8196	0.4872	5.3860E+04	1.3267E+04	
72020401	2.8997E-03	7.0728	1.8429	0.7271	6.8507E+03	1.7289E+03	2.2120E-02
	3.1209E-03	7.0978	1.8365	0.7297	6.8267E+03	1.7228E+03	
72020501	1.9107E-03	8.6345	1.8534	0.5071	2.2068E+04	5.2464E+03	1.7418E-02
	2.0136E-03	8.6551	1.8490	0.5083	2.2016E+04	5.2339E+03	
72020601	3.6530E-03	6.1602	1.8274	0.8537	6.5224E+03	1.8958E+03	2.3389E-02
	3.7939E-03	6.1714	1.8241	0.8552	6.5106E+03	1.8924E+03	
72020701	2.3859E-03	6.7776	1.8496	0.7738	2.1370E+04	6.0810E+03	1.7897E-02
	2.6363E-03	6.8086	1.8412	0.7773	2.1273E+04	6.0533E+03	
72020801	2.4232E-03	7.2531	1.8440	0.6523	4.2732E+04	1.2123E+04	1.7723E-02
	2.4425E-03	7.2559	1.8433	0.6526	4.2716E+04	1.2118E+04	
72020901	3.8383E-03	4.7203	1.8308	1.0661	6.6470E+03	2.0351E+03	1.9890E-02
	4.1956E-03	4.7406	1.8310	1.0707	6.6186E+03	2.0264E+03	
72021001	2.5938E-03	6.0154	1.8508	0.9024	2.2161E+04	6.2956E+03	1.6505E-02
	2.7371E-03	6.0299	1.8464	0.9046	2.2108E+04	6.2805E+03	
72021101	5.3312E-03	3.8382	1.7845	1.1440	8.9458E+03	7.9141E+03	2.0462E-02
	5.3311E-03	3.8382	1.7845	1.1440	8.9458E+03	7.9141E+03	
72021201	3.3083E-03	5.5702	1.8011	0.9182	2.8175E+04	2.3682E+04	1.8428E-02
	3.3083E-03	5.5703	1.8011	0.9182	2.8175E+04	2.3682E+04	
72021301	2.8559E-03	5.8634	1.8146	0.8656	4.7433E+04	3.8081E+04	1.6745E-02
	2.8559E-03	5.8634	1.8146	0.8656	4.7433E+04	3.8081E+04	
72021401	4.4612E-03	3.4434	1.7941	1.1976	7.6778E+03	7.1305E+03	1.6227E-02
	4.7010E-03	3.4519	1.7897	1.2006	7.6589E+03	7.1139E+03	
72021501	3.0264E-03	5.0047	1.8160	1.0094	2.6261E+04	2.1928E+04	1.6265E-02
	3.2430E-03	5.0199	1.8105	1.0124	2.6181E+04	2.1862E+04	

72020201 VOISINET PROFILE TABULATION 55 POINTS, DELTA AT POINT 42

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.90555	0.83686	0.00000	0.00000	4.66170	0.00000
2	6.3000"-05	1.0176"+00	0.90555	0.83889	0.03307	0.07130	4.64975	0.01384
3	1.4500"-04	1.0917"+00	0.90555	0.84350	0.07451	0.15950	4.58240	0.03152
4	2.6900"-04	1.2758"+00	0.90555	0.85179	0.12558	0.26420	4.42580	0.05406
5	3.9400"-04	1.5578"+00	0.90555	0.86144	0.17187	0.35340	4.22780	0.07569
6	5.1800"-04	1.9422"+00	0.90555	0.87160	0.21376	0.42840	4.01640	0.09659
7	7.4400"-04	2.6581"+00	0.90555	0.88554	0.26830	0.51690	3.71170	0.12611
8	9.7000"-04	3.1294"+00	0.90555	0.89260	0.29761	0.55990	3.53940	0.14325
9	1.2400"-03	3.5703"+00	0.90555	0.89487	0.32234	0.59260	3.37980	0.15878
10	1.6310"-03	3.9217"+00	0.90555	0.89392	0.34067	0.61450	3.25370	0.17102
11	1.9410"-03	4.1935"+00	0.90555	0.89317	0.35415	0.62980	3.16250	0.18034
12	2.5980"-03	4.6175"+00	0.90555	0.89254	0.37416	0.65150	3.03190	0.19459
13	3.1340"-03	4.9644"+00	0.90555	0.89403	0.38974	0.66820	2.93950	0.20585
14	3.7310"-03	5.3251"+00	0.90555	0.89627	0.40528	0.68440	2.85180	0.21732
15	4.3540"-03	5.7201"+00	0.90555	0.89919	0.42162	0.70090	2.76360	0.22966
16	4.8030"-03	6.0171"+00	0.90555	0.90125	0.43349	0.71240	2.70080	0.23886
17	5.3490"-03	6.3343"+00	0.90582	0.90354	0.44581	0.72400	2.63740	0.24866
18	6.6220"-03	7.1518"+00	0.90691	0.90972	0.47608	0.75110	2.48910	0.27367
19	7.7240"-03	7.8978"+00	0.90791	0.91484	0.50208	0.77260	2.36790	0.29623
20	8.9150"-03	8.7610"+00	0.90899	0.92047	0.53056	0.79450	2.24240	0.32206
21	9.9310"-03	9.5024"+00	0.90990	0.92479	0.55385	0.81110	2.14470	0.34411
22	1.1153"-02	1.0446"+01	0.91098	0.92995	0.58213	0.82990	2.03240	0.37199
23	1.3444"-02	1.2254"+01	0.91298	0.93842	0.63278	0.86000	1.84710	0.42508
24	1.4816"-02	1.3380"+01	0.91424	0.94299	0.66235	0.87570	1.74800	0.45801
25	1.4790"-02	1.3325"+01	0.91424	0.94261	0.66093	0.87490	1.75230	0.45647
26	1.6325"-02	1.4573"+01	0.91624	0.94765	0.69231	0.89050	1.65450	0.49315
27	1.8049"-02	1.6002"+01	0.91877	0.95219	0.72657	0.90580	1.55420	0.53547
28	2.0157"-02	1.7595"+01	0.92194	0.95654	0.76294	0.92050	1.45570	0.58298
29	2.3033"-02	1.9622"+01	0.92620	0.96206	0.80684	0.93680	1.34810	0.64362
30	2.5817"-02	2.1370"+01	0.93027	0.96650	0.84286	0.94900	1.26770	0.69640
31	2.8143"-02	2.2919"+01	0.93380	0.97074	0.87353	0.95890	1.20500	0.74309
32	3.1051"-02	2.4188"+01	0.93860	0.97463	0.89789	0.96660	1.15890	0.78286
33	3.3282"-02	2.5126"+01	0.94367	0.97755	0.91548	0.97200	1.12730	0.81367
34	3.5994"-02	2.6085"+01	0.94992	0.98118	0.93312	0.97760	1.09760	0.84607
35	3.9754"-02	2.7232"+01	0.95862	0.98451	0.95378	0.98350	1.06330	0.88667
36	4.3574"-02	2.8145"+01	0.96740	0.98818	0.96991	0.98850	1.03870	0.92065
37	4.6533"-02	2.8531"+01	0.97428	0.99081	0.97665	0.99110	1.02480	0.93767
38	4.9301"-02	2.9122"+01	0.98062	0.99358	0.98686	0.99440	1.01530	0.96044
39	5.2548"-02	2.9602"+01	0.98814	0.99637	0.99511	0.99730	1.00440	0.98115
40	5.5126"-02	2.9743"+01	0.99411	0.99806	0.99760	0.99860	1.00200	0.99074
41	5.7800"-02	2.9883"+01	1.00027	1.00004	0.99990	1.00000	1.00020	1.00007
D 42	5.7706"-02	2.9889"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
43	6.0952"-02	3.0289"+01	1.00752	1.00238	1.00679	1.00240	0.99130	1.01880
44	6.3434"-02	3.0223"+01	1.01385	1.00338	1.00567	1.00270	0.99410	1.02263
45	6.6243"-02	3.0226"+01	1.01385	1.00456	1.00572	1.00330	0.99520	1.02211
46	6.8181"-02	3.0130"+01	1.02345	1.00554	1.00410	1.00350	0.99880	1.02827
47	7.0508"-02	3.0033"+01	1.03305	1.00633	1.00245	1.00360	1.00230	1.03439
48	7.2738"-02	3.0000"+01	1.03622	1.00613	1.00190	1.00340	1.00300	1.03664
49	7.5453"-02	3.0033"+01	1.03296	1.00513	1.00245	1.00300	1.00110	1.03492
50	8.0145"-02	2.9874"+01	1.04899	1.00630	0.99976	1.00310	1.00670	1.04324
51	8.3487"-02	2.9810"+01	1.05542	1.00649	0.99867	1.00300	1.00870	1.04946
52	8.6733"-02	2.9656"+01	1.07172	1.00644	0.99605	1.00250	1.01300	1.06061
53	8.8834"-02	2.9628"+01	1.07498	1.00642	0.99555	1.00240	1.01380	1.06289
54	8.9886"-02	2.9596"+01	1.07824	1.00642	0.99501	1.00230	1.01470	1.06506
55	9.0744"-02	2.9538"+01	1.08476	1.00638	0.99403	1.00210	1.01630	1.06960

INPUT VARIABLES Y,U/UD,T/TD,P/PW
AT I=2 DATA WERE AVERAGED

72020202 VOISINET PROFILE TABULATION 48 POINTS, DELTA AT POINT 40

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.99711	0.84172	0.00000	0.00000	4.73930	0.00000
2	6.3000"-05	1.0112"+00	0.99711	0.84366	0.02624	0.05710	4.73510	0.01202
3	1.0400"-04	1.0326"+00	0.99711	0.84586	0.04456	0.09680	4.71920	0.02045
4	2.6200"-04	1.1508"+00	0.99711	0.85325	0.09403	0.20200	4.61530	0.04364
5	3.5800"-04	1.3101"+00	0.99711	0.86019	0.13162	0.27870	4.48360	0.06198
6	5.3600"-04	1.8326"+00	0.99711	0.87626	0.20200	0.41150	4.14970	0.09888
7	8.3300"-04	2.4702"+00	0.99711	0.88906	0.25382	0.49840	3.85560	0.12889
8	1.1480"-03	2.9522"+00	0.99711	0.89349	0.28513	0.54510	3.65490	0.14871
9	1.7700"-03	3.4536"+00	0.99711	0.89228	0.31395	0.58310	3.44960	0.16855
10	2.3320"-03	3.7647"+00	0.99711	0.89130	0.33045	0.60330	3.33310	0.18048
11	3.3830"-03	4.2701"+00	0.99711	0.89283	0.35952	0.63310	3.17110	0.19907
12	4.4550"-03	4.7949"+00	0.99711	0.89669	0.37972	0.66070	3.02750	0.21760
13	5.6390"-03	5.3370"+00	0.99711	0.90076	0.40314	0.68580	2.89390	0.23630
14	6.8960"-03	6.1096"+00	0.99711	0.90666	0.43428	0.71690	2.72510	0.26231
15	8.0060"-03	6.7085"+00	0.99711	0.91148	0.45692	0.73810	2.60940	0.28204
16	9.2080"-03	7.3528"+00	0.99711	0.91625	0.48008	0.75840	2.49560	0.30302
17	1.0312"-02	7.9936"+00	0.99711	0.92051	0.50203	0.77640	2.39170	0.32368
18	1.1460"-02	8.7335"+00	0.99711	0.92536	0.52623	0.79510	2.28290	0.34728
19	1.2426"-02	9.4725"+00	0.99711	0.92938	0.54933	0.81160	2.18280	0.37074
20	1.5198"-02	1.1382"+01	0.99711	0.93908	0.60492	0.84740	1.96240	0.43057
21	1.7506"-02	1.3619"+01	0.99711	0.94719	0.66412	0.87930	1.75300	0.50015
22	1.9901"-02	1.5372"+01	0.99711	0.95285	0.70704	0.89950	1.61850	0.55415
23	2.2299"-02	1.7256"+01	0.97711	0.95800	0.75042	0.91760	1.49520	0.61192
24	2.4407"-02	1.9070"+01	0.99711	0.96199	0.78994	0.93280	1.39260	0.66746
25	2.6617"-02	2.0820"+01	0.99721	0.96570	0.82629	0.94450	1.30660	0.72085
26	2.9022"-02	2.2503"+01	0.99741	0.96958	0.85977	0.95520	1.23430	0.77187
27	3.1427"-02	2.3731"+01	0.99761	0.97250	0.88342	0.96240	1.18680	0.80898
28	3.3543"-02	2.4832"+01	0.99771	0.97541	0.90409	0.96860	1.14780	0.84194
29	3.5756"-02	2.5731"+01	0.99791	0.97818	0.92062	0.97360	1.11840	0.86871
30	3.7681"-02	2.6445"+01	0.99801	0.98053	0.93354	0.97750	1.09640	0.88978
31	3.9959"-02	2.7217"+01	0.99821	0.98291	0.94730	0.98150	1.07350	0.91266
32	4.2426"-02	2.7862"+01	0.99840	0.98560	0.95867	0.98510	1.05590	0.93146
33	4.4699"-02	2.8369"+01	0.99860	0.98759	0.96750	0.98780	1.04240	0.94630
34	4.7353"-02	2.9016"+01	0.99880	0.99017	0.97866	0.99120	1.02580	0.96511
35	4.9342"-02	2.9334"+01	0.99890	0.99176	0.98409	0.99300	1.01820	0.97418
36	5.1351"-02	2.9524"+01	0.99910	0.99317	0.98731	0.99430	1.01420	0.97950
37	5.4087"-02	2.9779"+01	0.99930	0.99500	0.99165	0.99600	1.00880	0.98662
38	5.6528"-02	2.9902"+01	0.99950	0.99644	0.99373	0.99710	1.00680	0.98987
39	5.9949"-02	3.0150"+01	0.99980	0.99855	0.99790	0.99890	1.00200	0.99671
D 40	6.2682"-02	3.0275"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
41	6.5565"-02	3.0335"+01	1.00020	1.00085	1.00100	1.00060	0.99920	1.00160
42	6.9195"-02	3.0581"+01	1.00050	1.00199	1.00512	1.00190	0.99360	1.00886
43	7.2060"-02	3.0769"+01	1.00070	1.00289	1.00826	1.00290	0.98940	1.01435
44	7.5400"-02	3.0635"+01	1.01356	1.00287	1.00603	1.00250	0.99300	1.02326
45	7.9411"-02	3.0635"+01	1.01356	1.00368	1.00602	1.00290	0.99380	1.02284
46	8.2659"-02	3.0502"+01	1.02642	1.00345	1.00381	1.00240	0.99720	1.03178
47	8.6096"-02	3.0376"+01	1.03929	1.00340	1.00170	1.00200	1.00060	1.04074
48	8.9532"-02	3.0361"+01	1.04028	1.00369	1.00145	1.00210	1.00130	1.04111

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72020203 VOISINET PROFILE TABULATION 46 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00817	0.83001	0.00000	0.00000	4.74220	0.00000
2	6.3000"-05	1.0172"+00	1.00817	0.83170	0.03224	0.07010	4.72870	0.01495
3	1.4200"-04	1.0654"+00	1.00817	0.83607	0.06224	0.13480	4.69120	0.02897
4	2.6200"-04	1.2048"+00	1.00817	0.84318	0.10771	0.23020	4.56770	0.05081
5	3.5800"-04	1.3925"+00	1.00817	0.84797	0.14509	0.30460	4.40750	0.06967
6	6.3500"-04	2.0504"+00	1.00817	0.86387	0.21986	0.44080	4.01980	0.11055
7	9.9100"-04	2.7405"+00	1.00817	0.87870	0.26951	0.52120	3.74000	0.14050
8	1.2850"-03	3.0942"+00	1.00817	0.88236	0.29102	0.55240	3.60300	0.15457
9	1.8190"-03	3.4471"+00	1.00817	0.88024	0.31082	0.57780	3.45560	0.16857
10	2.4100"-03	3.7328"+00	1.00817	0.88020	0.32589	0.59660	3.35130	0.17947
11	3.0400"-03	4.0303"+00	1.00817	0.88132	0.34083	0.61480	3.25380	0.19049
12	4.1170"-03	4.4922"+00	1.00817	0.88498	0.36274	0.64080	3.12080	0.20701
13	5.2170"-03	4.9542"+00	1.00817	0.88914	0.38334	0.66410	3.00130	0.22308
14	6.2840"-03	5.4149"+00	1.00817	0.89302	0.40280	0.68490	2.89120	0.23883
15	7.4090"-03	5.9213"+00	1.00817	0.89719	0.42313	0.70550	2.78000	0.25585
16	8.7430"-03	6.5510"+00	1.00817	0.90276	0.44709	0.72860	2.65570	0.27659
17	9.8120"-03	7.0839"+00	1.00817	0.90665	0.46640	0.74590	2.55770	0.29401
18	1.0988"-02	7.7027"+00	1.00817	0.91128	0.48784	0.76420	2.45390	0.31397
19	1.2167"-02	8.3778"+00	1.00817	0.91591	0.51020	0.78210	2.34990	0.33554
20	1.3866"-02	9.4888"+00	1.00817	0.92266	0.54497	0.80770	2.19660	0.37071
21	1.6645"-02	1.1335"+01	1.00817	0.93267	0.59827	0.84250	1.98310	0.42831
22	1.9713"-02	1.3519"+01	1.00817	0.94218	0.65574	0.87450	1.77850	0.49572
23	2.2685"-02	1.5781"+01	1.00817	0.94982	0.71035	0.90030	1.60630	0.56506
24	2.5403"-02	1.8132"+01	1.00817	0.95668	0.76297	0.92190	1.46000	0.63659
25	2.8158"-02	2.0324"+01	1.00766	0.96200	0.80894	0.93840	1.34570	0.70268
26	3.1333"-02	2.2456"+01	1.00716	0.96698	0.85127	0.95220	1.25120	0.76648
27	3.3929"-02	2.3980"+01	1.00675	0.97007	0.88028	0.96080	1.19130	0.81196
28	3.7104"-02	2.5383"+01	1.00625	0.97435	0.90617	0.96880	1.14300	0.85289
29	3.9977"-02	2.6590"+01	1.00575	0.97770	0.92787	0.97510	1.10440	0.88800
30	4.2939"-02	2.7661"+01	1.00524	0.98106	0.94670	0.98060	1.07290	0.91876
31	4.5804"-02	2.8475"+01	1.00474	0.98458	0.96076	0.98510	1.05130	0.94147
32	4.8666"-02	2.9029"+01	1.00434	0.98739	0.97023	0.98830	1.03760	0.95662
33	5.1234"-02	2.9385"+01	1.00383	0.98915	0.97625	0.99030	1.02900	0.96608
34	5.4292"-02	2.9736"+01	1.00333	0.99238	0.98216	0.99300	1.02220	0.97467
35	5.6982"-02	2.9999"+01	1.00292	0.99538	0.98656	0.99530	1.01780	0.98075
36	6.0135"-02	3.0278"+01	1.00242	0.99711	0.99122	0.99700	1.01170	0.98785
37	6.2636"-02	3.0424"+01	1.00202	0.99824	0.99364	0.99800	1.00880	0.99129
38	6.5532"-02	3.0511"+01	1.00151	0.99873	0.99507	0.99850	1.00690	0.99316
39	6.8486"-02	3.0592"+01	1.00101	0.99926	0.99641	0.99900	1.00520	0.99483
40	7.1735"-02	3.0727"+01	1.00050	0.99787	0.99865	0.99970	1.00210	0.99811
D 41	7.4689"-02	3.0809"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
42	7.7211"-02	3.0836"+01	0.99738	0.99984	1.00045	1.00000	0.99910	0.99828
43	8.0434"-02	3.0821"+01	0.99869	1.00213	1.00020	1.00110	1.00180	0.99799
44	8.3373"-02	3.0830"+01	0.99808	1.00288	1.00035	1.00150	1.00230	0.99729
45	8.6121"-02	3.0803"+01	1.00060	1.00344	0.99990	1.00170	1.00360	0.99871
46	8.9248"-02	3.0770"+01	1.00393	1.00343	0.99935	1.00160	1.00450	1.00103

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72020204 VOISINET PROFILE TABULATION 49 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	0.96956	0.83702	0.00000	0.00000	4.70880	0.00000
2	6.3000E-05	1.0131E+00	0.96956	0.83776	0.02843	0.06160	4.69540	0.01272
3	1.2200E-04	1.0350E+00	0.96956	0.83827	0.04623	0.09990	4.66970	0.02074
4	2.0100E-04	1.0706E+00	0.96956	0.83998	0.06522	0.14040	4.63430	0.02937
5	3.2000E-04	1.1935E+00	0.96956	0.84541	0.10566	0.22510	4.52160	0.04827
6	4.3900E-04	1.3811E+00	0.96956	0.85215	0.14454	0.30220	4.37150	0.06703
7	7.9200E-04	2.2231E+00	0.96956	0.87255	0.23584	0.46600	3.90420	0.11572
8	5.7700E-04	1.7135E+00	0.96956	0.86170	0.18963	0.38660	4.15630	0.09018
9	1.1280E-03	2.7804E+00	0.96956	0.88140	0.27460	0.52650	3.67620	0.13886
10	1.7600E-03	3.2498E+00	0.96956	0.88090	0.30276	0.56480	3.48010	0.15735
11	2.2910E-03	3.5295E+00	0.96956	0.88059	0.31823	0.58450	3.37360	0.16798
12	3.1010E-03	3.8702E+00	0.96956	0.88155	0.33602	0.60650	3.25780	0.18050
13	4.0060E-03	4.2491E+00	0.96956	0.88458	0.35470	0.62910	3.14570	0.19390
14	5.1050E-03	4.6935E+00	0.96956	0.88856	0.37537	0.65300	3.02630	0.20921
15	6.2810E-03	5.1481E+00	0.96956	0.89281	0.39535	0.67500	2.91510	0.22450
16	7.4370E-03	5.6264E+00	0.96956	0.89653	0.41530	0.69560	2.80540	0.24040
17	8.5780E-03	6.1256E+00	0.96956	0.90057	0.43512	0.71510	2.70090	0.25670
18	9.7740E-03	6.6056E+00	0.96956	0.90425	0.45335	0.73210	2.60780	0.27219
19	1.1041E-02	7.1727E+00	0.96985	0.90930	0.47397	0.75070	2.50860	0.29023
20	1.2535E-02	7.9113E+00	0.97043	0.91532	0.49953	0.77230	2.39030	0.31354
21	1.4041E-02	8.7754E+00	0.97101	0.92383	0.52784	0.79540	2.27070	0.34013
22	1.5761E-02	9.8199E+00	0.97169	0.92971	0.56015	0.81820	2.13360	0.37263
23	1.8626E-02	1.1644E+01	0.97276	0.93931	0.61246	0.85130	1.93200	0.42863
24	2.1011E-02	1.3252E+01	0.97392	0.94620	0.65512	0.87480	1.78310	0.47781
25	2.3208E-02	1.5029E+01	0.97537	0.95222	0.69920	0.89610	1.64250	0.53214
26	2.5690E-02	1.6786E+01	0.97702	0.95728	0.74023	0.91370	1.52360	0.58592
27	2.7600E-02	1.8433E+01	0.97828	0.96144	0.77671	0.92780	1.42690	0.63610
28	2.9987E-02	2.0131E+01	0.97993	0.96522	0.81259	0.94040	1.33930	0.68807
29	3.2565E-02	2.1686E+01	0.98158	0.96823	0.84413	0.95050	1.26790	0.73585
30	3.4666E-02	2.2863E+01	0.98303	0.97114	0.86722	0.95780	1.21980	0.77189
31	3.7722E-02	2.4361E+01	0.98507	0.97582	0.89578	0.96690	1.16510	0.81749
32	4.0109E-02	2.5368E+01	0.98662	0.97828	0.91446	0.97230	1.13050	0.84855
33	4.2019E-02	2.6033E+01	0.98798	0.98047	0.92659	0.97600	1.10950	0.86910
34	4.4310E-02	2.6880E+01	0.98943	0.98355	0.94181	0.98070	1.08430	0.89490
35	4.6698E-02	2.7738E+01	0.99108	0.98627	0.95699	0.98510	1.05960	0.92140
36	4.9182E-02	2.8532E+01	0.99273	0.98873	0.97082	0.98900	1.03780	0.94605
37	5.2428E-02	2.9261E+01	0.99476	0.99163	0.98336	0.99280	1.01930	0.96890
38	5.5293E-02	2.9673E+01	0.99661	0.99337	0.98952	0.99480	1.01070	0.98093
39	5.7678E-02	3.0051E+01	0.99806	0.99536	0.99675	0.99710	1.00070	0.99447
40	6.0830E-02	3.0244E+01	1.00000	0.99820	1.00000	0.99910	0.99820	1.00090
D 41	6.3693E-02	3.0244E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
42	6.6916E-02	3.0274E+01	0.99690	1.00162	1.00050	1.00090	1.00080	0.99700
43	6.9571E-02	3.0307E+01	0.99370	1.00223	1.00105	1.00130	1.00050	0.99449
44	7.2507E-02	3.0339E+01	0.99060	1.00303	1.00160	1.00180	1.00040	0.99198
45	7.5352E-02	3.0387E+01	0.98604	1.00395	1.00240	1.00240	1.00000	0.98840
46	7.7828E-02	3.0426E+01	0.98284	1.00472	1.00305	1.00290	0.99970	0.98598
47	8.1265E-02	3.0405E+01	0.98429	1.00585	1.00270	1.00340	1.00140	0.98626
48	8.4607E-02	3.0441E+01	0.98119	1.00524	1.00330	1.00320	0.99980	0.98453
49	8.9573E-02	3.0625E+01	0.96422	1.00535	1.00637	1.00380	0.99490	0.97285

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72020205 VOISINET PROFILE TABULATION 41 POINTS, DELTA AT POINT 34

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.01317	0.84827	0.00000	0.00000	4.79500	0.00000
2	6.3000"-05	1.0251"+00	1.01317	0.84952	0.03911	0.08540	4.76810	0.01815
3	2.0100"-04	1.1503"+00	1.01317	0.85458	0.09367	0.20180	4.64120	0.04405
4	3.4000"-04	1.3506"+00	1.01317	0.86165	0.13882	0.29350	4.46980	0.06653
5	4.3900"-04	1.5887"+00	1.01317	0.86873	0.17433	0.36160	4.30230	0.08516
6	6.9300"-04	2.1325"+00	1.01317	0.88088	0.22804	0.45660	4.00930	0.11539
7	1.0290"-03	2.7063"+00	1.01317	0.88913	0.26906	0.52170	3.75960	0.14059
8	1.6030"-03	3.1438"+00	1.01317	0.88769	0.29561	0.55860	3.56600	0.15871
9	2.1540"-03	3.4132"+00	1.01317	0.88669	0.31099	0.57820	3.45670	0.16947
10	3.3550"-03	3.8914"+00	1.01317	0.88864	0.33612	0.60990	3.29250	0.18768
11	4.4580"-03	4.3187"+00	1.01317	0.89165	0.35698	0.63500	3.16410	0.20333
12	5.5780"-03	4.7386"+00	1.01317	0.89509	0.37631	0.65720	3.05010	0.21831
13	6.7970"-03	5.2005"+00	1.01317	0.89900	0.39643	0.67920	2.93540	0.23443
14	7.8610"-03	5.6591"+00	1.01317	0.90279	0.41542	0.69890	2.83050	0.25017
15	9.0750"-03	6.0796"+00	1.01317	0.90623	0.43208	0.71540	2.74140	0.26440
16	1.0282"-02	6.5938"+00	1.01317	0.91054	0.45160	0.73390	2.64100	0.28155
17	1.1377"-02	7.0568"+00	1.01317	0.91374	0.46847	0.74890	2.55560	0.29690
18	1.3655"-02	7.9986"+00	1.01317	0.92053	0.50100	0.77620	2.40030	0.32764
19	1.6998"-02	9.7586"+00	1.01317	0.93045	0.55668	0.81700	2.15390	0.38431
20	1.9576"-02	1.1235"+01	1.01317	0.93840	0.59940	0.84460	1.98550	0.43099
21	2.2154"-02	1.3021"+01	1.01317	0.94606	0.64728	0.87160	1.81320	0.48703
22	2.5400"-02	1.5366"+01	1.01317	0.95378	0.70521	0.89950	1.62690	0.56017
23	2.8456"-02	1.7869"+01	1.01317	0.96065	0.76219	0.92300	1.46650	0.63768
24	3.1130"-02	1.9925"+01	1.01317	0.96504	0.80597	0.93860	1.35620	0.70120
25	3.4282"-02	2.2127"+01	1.01317	0.97094	0.85038	0.95360	1.25750	0.76832
26	3.7816"-02	2.4380"+01	1.01236	0.97525	0.89352	0.96620	1.16930	0.83652
27	4.0965"-02	2.5874"+01	1.01125	0.97970	0.92102	0.97450	1.11950	0.88027
28	4.4498"-02	2.7229"+01	1.01003	0.98445	0.94527	0.98190	1.07900	0.91914
29	4.8222"-02	2.8230"+01	1.00871	0.98875	0.96278	0.98750	1.05200	0.94687
30	5.1852"-02	2.9037"+01	1.00740	0.99208	0.97668	0.99180	1.03120	0.96891
31	5.3952"-02	2.9442"+01	1.00669	0.99392	0.98358	0.99400	1.02130	0.97978
32	5.8059"-02	2.9938"+01	1.00517	0.99707	0.99196	0.99710	1.01040	0.99194
33	6.1877"-02	3.0159"+01	1.00223	0.99874	0.99567	0.99860	1.00590	0.99496
D 34	6.4544"-02	3.0418"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
35	6.8049"-02	3.0574"+01	0.99706	1.00188	1.00260	1.00140	0.99760	1.00086
36	7.1463"-02	3.0686"+01	0.99433	1.00243	1.00446	1.00200	0.99510	1.00122
37	7.5443"-02	3.0755"+01	0.98784	1.00342	1.00562	1.00270	0.99420	0.99629
38	7.9065"-02	3.0801"+01	0.98328	1.00396	1.00638	1.00310	0.99350	0.99278
39	8.1836"-02	3.0804"+01	0.98328	1.00434	1.00642	1.00330	0.99380	0.99268
40	8.6228"-02	3.0864"+01	0.97781	1.00560	1.00743	1.00410	0.99340	0.98834
41	9.0429"-02	3.0840"+01	0.98014	1.00594	1.00702	1.00420	0.99440	0.98980

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72021201 VOISINET PROFILE TABULATION 35 POINTS, DELTA AT POINT 30

I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.20445	0.00000	0.00000	1.19230	0.00000
2	6.3000"-05	1.2759"+00	1.00000	0.31703	0.12214	0.16040	1.72450	0.09301
3	1.4000"-04	1.6579"+00	1.00000	0.38161	0.17934	0.24890	1.92610	0.12922
4	3.9400"-04	3.6232"+00	1.00000	0.54512	0.31626	0.46300	2.14320	0.21603
5	6.4800"-04	4.4390"+00	1.00000	0.59043	0.35585	0.52010	2.13620	0.24347
6	9.0200"-04	4.7084"+00	1.00000	0.60419	0.36794	0.53700	2.13010	0.25210
7	1.1300"-03	4.8437"+00	1.00000	0.61096	0.37385	0.54520	2.12670	0.25636
8	1.3590"-03	4.9632"+00	1.00000	0.61709	0.37901	0.55240	2.12430	0.26004
9	1.6380"-03	5.1292"+00	1.00000	0.62712	0.38604	0.56290	2.12620	0.26474
10	1.9150"-03	5.2696"+00	1.00000	0.63641	0.39188	0.57200	2.13050	0.26848
11	2.1440"-03	5.4150"+00	1.00000	0.64294	0.39785	0.57990	2.12460	0.27295
12	4.9120"-03	6.0398"+00	1.00000	0.69862	0.45199	0.64720	2.05030	0.31566
13	7.4240"-03	8.1355"+00	1.00000	0.74013	0.49611	0.69660	1.97160	0.35332
14	9.9360"-03	9.4924"+00	1.00000	0.77578	0.53837	0.73910	1.88470	0.39216
15	1.2118"-02	1.0711"+01	1.00000	0.80538	0.57366	0.77250	1.81340	0.42600
16	1.4989"-02	1.2362"+01	1.00000	0.83897	0.61825	0.81050	1.71660	0.47160
17	1.7501"-02	1.3937"+01	1.00000	0.86533	0.65796	0.84060	1.63220	0.51501
18	1.9886"-02	1.5490"+01	1.00000	0.88747	0.69490	0.86590	1.55270	0.55767
19	2.2652"-02	1.7426"+01	1.00000	0.90930	0.73834	0.89190	1.45920	0.61123
20	2.4938"-02	1.9015"+01	1.00000	0.92303	0.77218	0.90940	1.38700	0.65566
21	3.0190"-02	2.2436"+01	1.00000	0.94339	0.84041	0.93840	1.24680	0.75265
22	3.5065"-02	2.4868"+01	1.00000	0.95435	0.88573	0.95470	1.16180	0.82174
23	4.0267"-02	2.7333"+01	1.00000	0.96376	0.92938	0.96870	1.08640	0.89166
24	4.5344"-02	2.9278"+01	1.00000	0.97350	0.96245	0.98000	1.03680	0.94522
25	5.0089"-02	2.9841"+01	1.00000	0.98121	0.97180	0.98560	1.02860	0.95820
26	5.5446"-02	3.0554"+01	1.00000	0.98657	0.98354	0.99040	1.01400	0.97673
27	6.0546"-02	3.0887"+01	1.00000	0.99025	0.98896	0.99320	1.00860	0.98473
28	6.5674"-02	3.1177"+01	1.00000	0.99479	0.99367	0.99630	1.00530	0.99105
29	7.0800"-02	3.1301"+01	1.00000	0.99849	0.99567	0.99850	1.00570	0.99284
D 30	7.5801"-02	3.1570"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
31	8.0978"-02	3.1514"+01	1.00000	1.00151	0.99910	1.00060	1.00300	0.99761
32	8.5954"-02	3.1128"+01	1.00000	1.00207	0.99287	0.99980	1.01400	0.98600
33	9.1029"-02	3.1397"+01	1.00000	1.00276	0.99722	1.00090	1.00740	0.99355
34	9.5496"-02	3.1744"+01	1.00000	1.00364	1.00280	1.00230	0.99400	1.00330
35	1.0309"-01	3.1632"+01	1.00000	1.00526	1.00100	1.00280	1.00360	0.99920

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72021202 VOISINET PROFILE TABULATION 36 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.95896	0.22063	0.00000	0.00000	1.28140	0.00000
2	6.3000"-05	1.2719"+00	0.95896	0.32211	0.12164	0.16075	1.74655	0.08826
3	1.1400"-04	1.4317"+00	0.95896	0.35075	0.14986	0.20320	1.83660	0.10598
4	1.6500"-04	1.8166"+00	0.95896	0.40099	0.19667	0.27560	1.96370	0.13459
5	2.4100"-04	2.3446"+00	0.95896	0.44930	0.24028	0.34340	2.04250	0.16123
6	4.1900"-04	3.8482"+00	0.95896	0.54886	0.32850	0.47590	2.09880	0.21744
7	7.2400"-04	4.5497"+00	0.95896	0.58541	0.36176	0.52260	2.08690	0.24014
8	1.1300"-03	4.9233"+00	0.95896	0.60338	0.37823	0.54500	2.07630	0.25171
9	1.5370"-03	5.1432"+00	0.95896	0.61332	0.38758	0.55740	2.06630	0.25844
10	1.7650"-03	5.2926"+00	0.95896	0.62044	0.39380	0.56580	2.06430	0.26284
11	2.0190"-03	5.4412"+00	0.95896	0.62727	0.39989	0.57390	2.05960	0.26721
12	2.4000"-03	5.7020"+00	0.95896	0.63734	0.41036	0.58690	2.04550	0.27515
13	4.6090"-03	6.8951"+00	0.95896	0.67723	0.45512	0.63890	1.97070	0.31089
14	7.4790"-03	8.3317"+00	0.95896	0.71871	0.50368	0.69070	1.88050	0.35222
15	9.8630"-03	9.6426"+00	0.95896	0.75078	0.54419	0.72990	1.79900	0.38907
16	1.2022"-02	1.0825"+01	0.95896	0.77759	0.57828	0.76100	1.73180	0.42139
17	1.5067"-02	1.2523"+01	0.95896	0.81143	0.62396	0.79930	1.64100	0.46709
18	1.7658"-02	1.4138"+01	0.95896	0.83830	0.66450	0.82970	1.55900	0.51036
19	2.0119"-02	1.5774"+01	0.95896	0.86153	0.70317	0.85590	1.48160	0.55398
20	2.2609"-02	1.7416"+01	0.95896	0.88237	0.73996	0.87890	1.41080	0.59741
21	2.5197"-02	1.9167"+01	0.95896	0.90200	0.77725	0.90030	1.34170	0.64347
22	3.0249"-02	2.2590"+01	0.96250	0.92871	0.84543	0.93220	1.21580	0.73799
23	3.5377"-02	2.5319"+01	0.96634	0.94400	0.89608	0.95170	1.12600	0.81531
24	4.0455"-02	2.7158"+01	0.97008	0.95661	0.92865	0.96490	1.07960	0.86702
25	4.5583"-02	2.8574"+01	0.97392	0.96461	0.95296	0.97370	1.04400	0.90834
26	5.0609"-02	2.9695"+01	0.97766	0.97292	0.97178	0.98140	1.01990	0.94075
27	5.5687"-02	3.0501"+01	0.98140	0.98045	0.98509	0.98760	1.00510	0.96431
28	6.0510"-02	3.0945"+01	0.98494	0.98629	0.99235	0.99180	0.99890	0.97794
29	6.5816"-02	3.1013"+01	0.98888	0.99148	0.99346	0.99460	1.00230	0.98128
30	7.0976"-02	3.1087"+01	0.99271	0.99465	0.99466	0.99640	1.00350	0.98569
31	7.6225"-02	3.1541"+01	0.99664	0.99871	1.00201	0.99970	0.99540	1.00095
D 32	8.0769"-02	3.1417"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
33	8.5794"-02	3.1370"+01	1.00451	1.00026	0.99925	1.00000	1.00150	1.00300
34	9.1382"-02	3.1309"+01	1.01016	1.00120	0.99826	1.00030	1.00410	1.00634
35	9.5951"-02	3.1312"+01	1.00949	1.00239	0.99831	1.00090	1.00520	1.00516
36	1.0166"-01	3.1315"+01	1.00969	1.00297	0.99836	1.00120	1.00570	1.00517

INPUT VARIABLES Y,U/UD,T/TD,P/PW
AT I=2 DATA WERE AVERAGED

72021203 VOISINET PROFILE TABULATION 34 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.03445	0.20838	0.00000	0.00000	1.19170	0.00000
2	6.3000E-05	1.2322E+00	1.03445	0.31544	0.11414	0.14880	1.69950	0.09057
3	1.9100E-04	2.0209E+00	1.03445	0.43535	0.21725	0.31000	2.03620	0.15749
4	5.7200E-04	3.9178E+00	1.03445	0.57604	0.33507	0.49170	2.15340	0.23620
5	7.7500E-04	4.2236E+00	1.03445	0.59310	0.34997	0.51310	2.14950	0.24693
6	1.0540E-03	4.4072E+00	1.03445	0.60268	0.35860	0.52520	2.14500	0.25328
7	1.3340E-03	4.5338E+00	1.03445	0.60891	0.36443	0.53320	2.14070	0.25766
8	1.5620E-03	4.6826E+00	1.03445	0.61551	0.37115	0.54210	2.13330	0.26287
9	1.7400E-03	4.7513E+00	1.03445	0.62049	0.37422	0.54700	2.13060	0.26483
10	2.1720E-03	4.9615E+00	1.03445	0.63310	0.38343	0.56060	2.13760	0.27129
11	4.5570E-03	6.0784E+00	1.03445	0.67584	0.42899	0.61700	2.06860	0.30854
12	7.2240E-03	7.2104E+00	1.03445	0.71493	0.47059	0.66540	1.99430	0.34428
13	9.7610E-03	8.2676E+00	1.03445	0.74849	0.50632	0.70470	1.93710	0.37632
14	1.2301E-02	9.3822E+00	1.03445	0.77934	0.54142	0.74040	1.87010	0.40955
15	1.4991E-02	1.0650E+01	1.03445	0.80953	0.57875	0.77470	1.79180	0.44725
16	1.7429E-02	1.1903E+01	1.03445	0.83442	0.61340	0.80430	1.71930	0.48392
17	1.9967E-02	1.3323E+01	1.03445	0.85917	0.65041	0.83290	1.63990	0.52539
18	2.2431E-02	1.4796E+01	1.03445	0.87980	0.68671	0.85770	1.56000	0.56875
19	2.5121E-02	1.6423E+01	1.03445	0.89908	0.72468	0.88110	1.47830	0.61655
20	3.0223E-02	1.9922E+01	1.03134	0.92810	0.80024	0.91930	1.31970	0.71843
21	3.5123E-02	2.3117E+01	1.02814	0.94611	0.86347	0.94490	1.19750	0.81126
22	4.0251E-02	2.5232E+01	1.02483	0.95772	0.90290	0.95980	1.13000	0.87047
23	4.5380E-02	2.7105E+01	1.02141	0.96618	0.93644	0.97110	1.07540	0.92235
24	5.5458E-02	2.9455E+01	1.01490	0.98333	0.97686	0.98750	1.02190	0.98073
25	5.0279E-02	2.8398E+01	1.01831	0.97471	0.95888	0.97980	1.04410	0.95560
26	6.0663E-02	3.0093E+01	1.01148	0.98783	0.98756	0.99170	1.00840	0.99473
27	6.5740E-02	3.0574E+01	1.00817	0.99397	0.99555	0.99620	1.00130	1.00304
28	7.0869E-02	3.0801E+01	1.00486	0.99745	0.99930	0.99860	0.99860	1.00486
D 29	7.5565E-02	3.0844E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
30	8.1023E-02	3.0811E+01	1.00559	1.00099	0.99945	1.00040	1.00190	1.00406
31	8.5923E-02	3.0802E+01	1.00455	1.00225	0.99930	1.00100	1.00340	1.00215
32	9.1128E-02	3.0826E+01	1.00217	1.00331	0.99970	1.00160	1.00380	0.99998
33	9.6383E-02	3.0868E+01	0.99772	1.00366	1.00040	1.00190	1.00300	0.99663
34	1.0278E-01	3.1063E+01	0.97683	1.00475	1.00360	1.00300	0.99880	0.98094

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72021501 VOISINET PROFILE TABULATION 45 POINTS, DELTA AT POINT 38

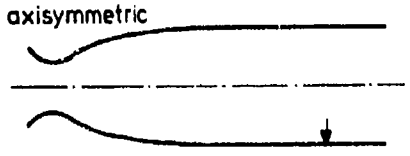
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	0.90009	0.20484	0.00000	0.00000	1.20000	0.00000
2	6.3000E-05	1.3808E+00	0.90009	0.31846	0.14099	0.18390	1.70130	0.09729
3	1.1400E-04	1.9298E+00	0.90009	0.38482	0.20624	0.28190	1.86830	0.13581
4	1.6500E-04	2.2371E+00	0.90009	0.41172	0.23118	0.31990	1.91480	0.15038
5	1.9100E-04	2.6458E+00	0.90009	0.44321	0.25944	0.36290	1.95660	0.16694
6	2.6700E-04	3.3652E+00	0.90009	0.49255	0.30176	0.42680	2.00050	0.19203
7	2.9200E-04	3.6417E+00	0.90009	0.50109	0.31635	0.44460	1.97520	0.20260
8	3.6800E-04	4.1143E+00	0.90009	0.51553	0.33975	0.47260	1.93500	0.21984
9	3.9400E-04	4.2325E+00	0.90009	0.51978	0.34533	0.47950	1.92800	0.22386
10	4.7000E-04	4.5826E+00	0.90009	0.53010	0.36135	0.49810	1.90010	0.23595
11	5.2100E-04	4.6759E+00	0.90009	0.53333	0.36550	0.50310	1.89470	0.23900
12	5.4600E-04	4.7880E+00	0.90009	0.53634	0.37041	0.50860	1.88530	0.24282
13	6.4800E-04	5.0260E+00	0.90009	0.54680	0.38063	0.52190	1.88000	0.24987
14	8.5100E-04	5.3650E+00	0.90009	0.56338	0.39472	0.54100	1.87850	0.25922
15	1.1300E-03	5.5634E+00	0.90009	0.57796	0.40273	0.55420	1.89370	0.26342
16	1.4100E-03	5.7257E+00	0.90009	0.59044	0.40916	0.56510	1.90750	0.26665
17	1.6380E-03	5.8940E+00	0.90009	0.59825	0.41572	0.57380	1.90510	0.27110
18	1.9180E-03	6.1194E+00	0.90009	0.60822	0.42435	0.58500	1.90050	0.27706
19	2.1970E-03	6.3603E+00	0.90009	0.61722	0.43337	0.59590	1.89070	0.28369
20	2.4260E-03	6.5665E+00	0.90009	0.62654	0.44095	0.60580	1.88750	0.28889
21	2.7050E-03	6.7664E+00	0.90009	0.63697	0.44817	0.61590	1.88860	0.29353
22	5.1690E-03	8.6246E+00	0.90009	0.69524	0.51034	0.68430	1.79790	0.34258
23	7.9370E-03	1.0582E+01	0.90009	0.74541	0.56845	0.74100	1.69920	0.39252
24	1.0503E-02	1.2359E+01	0.90036	0.78240	0.61648	0.78230	1.61030	0.43740
25	1.2891E-02	1.3929E+01	0.90252	0.81374	0.65597	0.81470	1.54250	0.47668
26	1.5431E-02	1.5656E+01	0.90477	0.84276	0.69683	0.84480	1.46980	0.52004
27	1.7920E-02	1.7480E+01	0.90693	0.86883	0.73749	0.87180	1.39740	0.56581
28	2.0561E-02	1.9481E+01	0.90927	0.89280	0.77968	0.89680	1.32300	0.61635
29	2.2771E-02	2.1044E+01	0.91125	0.90835	0.81112	0.91340	1.26810	0.65637
30	2.5743E-02	2.3058E+01	0.91413	0.92881	0.84989	0.93360	1.20670	0.70725
31	3.0721E-02	2.5567E+01	0.92142	0.94556	0.89585	0.95260	1.13070	0.77629
32	3.5674E-02	2.7105E+01	0.92880	0.95969	0.92291	0.96540	1.09420	0.81947
33	4.0881E-02	2.8411E+01	0.93663	0.96996	0.94527	0.97500	1.06390	0.85837
34	4.6037E-02	2.9492E+01	0.94896	0.97807	0.96337	0.98250	1.04010	0.89641
35	5.1219E-02	3.0556E+01	0.96148	0.98629	0.98087	0.98980	1.01830	0.93457
36	5.6147E-02	3.0723E+01	0.97399	0.99131	0.98360	0.99280	1.01880	0.94913
37	6.1074E-02	3.1136E+01	0.98641	0.99675	0.99028	0.99670	1.01300	0.97054
D 38	6.6434E-02	3.1741E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
39	7.1158E-02	3.1281E+01	1.01197	1.00174	0.99263	0.99960	1.01410	0.99750
40	7.6543E-02	3.1198E+01	1.02304	1.00304	0.99063	0.99990	1.01880	1.00406
41	8.1267E-02	3.0780E+01	1.06403	1.00541	0.98452	1.00000	1.03174	1.03191
42	8.6474E-02	3.0558E+01	1.08335	1.00389	0.98091	0.99860	1.03640	1.04384
43	9.1681E-02	3.0458E+01	1.09392	1.00509	0.97927	0.99890	1.04050	1.04980
44	9.6761E-02	3.0256E+01	1.11620	1.00327	0.97597	0.99740	1.04440	1.06597
45	1.0174E-01	3.0122E+01	1.12988	1.00368	0.97377	0.99720	1.04870	1.07440

INPUT VARIABLES Y,U/UD,T/TD,P/PW

72021502 VOISINET PROFILE TABULATION 46 POINTS, DELTA AT POINT 40

I	Y	PT2/P	P/PO	TO/TOD	H/HD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.97934	0.20863	0.00000	0.00000	1.21810	0.00000
2	6.3000"-05	1.4053"+00	0.97934	0.31050	0.14526	0.18630	1.64490	0.11092
3	1.1400"-04	1.6604"+00	0.97934	0.34106	0.17950	0.23560	1.72270	0.13394
4	1.4000"-04	1.9072"+00	0.97934	0.36317	0.20462	0.27170	1.76320	0.15091
5	1.9100"-04	2.1902"+00	0.97934	0.39397	0.22809	0.30920	1.83760	0.16479
6	2.4100"-04	2.6941"+00	0.97934	0.42815	0.26307	0.36000	1.87270	0.18826
7	2.9200"-04	2.9523"+00	0.97934	0.44820	0.27894	0.38460	1.90110	0.19812
8	3.4300"-04	3.4211"+00	0.97934	0.47307	0.30539	0.42130	1.90320	0.21679
9	4.1900"-04	3.7440"+00	0.97934	0.49122	0.32222	0.44520	1.90900	0.22839
10	4.4400"-04	3.8836"+00	0.97934	0.49676	0.32921	0.45410	1.90260	0.23374
11	5.2100"-04	4.0649"+00	0.97934	0.50605	0.33807	0.46630	1.90250	0.24003
12	5.4600"-04	4.1259"+00	0.97934	0.50955	0.34099	0.47050	1.90390	0.24202
13	8.2500"-04	4.5993"+00	0.97934	0.53563	0.36283	0.50150	1.91040	0.25709
14	1.0800"-03	4.7937"+00	0.97934	0.55209	0.37141	0.51640	1.93310	0.26162
15	1.3080"-03	4.9486"+00	0.97934	0.56331	0.37811	0.52720	1.94410	0.26558
16	1.5880"-03	5.1054"+00	0.97934	0.57346	0.38476	0.53740	1.95080	0.26978
17	1.8160"-03	5.2728"+00	0.97934	0.58234	0.39174	0.54720	1.95120	0.27465
18	2.0960"-03	5.4720"+00	0.97934	0.59092	0.39987	0.55770	1.94520	0.28078
19	2.3490"-03	5.6202"+00	0.97934	0.59803	0.40581	0.56570	1.94320	0.28510
20	2.6800"-03	5.8166"+00	0.97934	0.60656	0.41356	0.57570	1.93780	0.29095
21	5.2450"-03	7.2868"+00	0.97934	0.66102	0.46737	0.64020	1.87630	0.33415
22	7.8870"-03	8.7571"+00	0.97934	0.70585	0.51553	0.69220	1.80280	0.37602
23	1.0401"-02	1.0152"+01	0.97934	0.74150	0.55735	0.73300	1.72960	0.41504
24	1.2891"-02	1.1630"+01	0.97934	0.77388	0.59846	0.76950	1.65330	0.45582
25	1.5354"-02	1.3206"+01	0.97934	0.80392	0.63938	0.80270	1.57610	0.49877
26	1.7970"-02	1.4960"+01	0.97934	0.83293	0.68203	0.83420	1.49600	0.54610
27	2.0460"-02	1.6711"+01	0.97934	0.85747	0.72209	0.86080	1.42110	0.59321
28	2.3076"-02	1.8620"+01	0.97934	0.88028	0.76336	0.88550	1.34560	0.64447
29	2.5819"-02	2.0643"+01	0.97953	0.90246	0.80480	0.90860	1.27460	0.69826
30	3.0924"-02	2.4105"+01	0.98169	0.92654	0.87114	0.93740	1.15790	0.79474
31	3.5776"-02	2.6412"+01	0.98374	0.93999	0.91268	0.95330	1.09100	0.85958
32	4.0831"-02	2.8130"+01	0.98590	0.95348	0.94241	0.96610	1.05090	0.90634
33	4.5657"-02	2.9284"+01	0.98795	0.96221	0.96187	0.97420	1.02580	0.93826
34	5.0635"-02	3.0140"+01	0.99001	0.97115	0.97604	0.98130	1.01080	0.96112
35	5.5994"-02	3.0981"+01	0.99236	0.97922	0.98978	0.98780	0.99600	0.98419
36	6.1024"-02	3.1034"+01	0.99442	0.98388	0.99065	0.99030	0.99930	0.98546
37	6.6154"-02	3.1646"+01	0.99667	0.99085	1.00052	0.99550	0.99000	1.00221
38	7.1387"-02	3.1637"+01	0.99736	0.99209	1.00036	0.99610	0.99150	1.00198
39	7.6035"-02	3.1642"+01	0.99667	0.99625	1.00045	0.99820	0.99550	0.99437
D 40	8.1445"-02	3.1614"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
41	8.6500"-02	3.1564"+01	1.00470	0.99967	0.99920	0.99970	1.00100	1.00340
42	9.1681"-02	3.1398"+01	1.02419	1.00220	0.99652	1.00050	1.00800	1.01657
43	9.3891"-02	3.1300"+01	1.03349	1.00375	0.99495	1.00100	1.01220	1.02206
44	9.6787"-02	3.1294"+01	1.02429	1.00378	0.99485	1.00100	1.01240	1.01275
45	9.8361"-02	3.1377"+01	1.01743	1.00412	0.99618	1.00140	1.01090	1.00827
46	1.0288"-01	3.1343"+01	1.02869	1.00391	0.99564	1.00120	1.01120	1.01852

INPUT VARIABLES Y,U/UD,T/TD,P/PW



M : 7.4

R THETA X 10^{-3} : 20 - 60

TW / TR : 0.32 - 0.47

7203

ZPG (FPG) - SHT

Axi-symmetric contoured nozzle. Running time 2-3 minutes. D = 1.07, L = 10 m.
1.2 < PO < 5.7 MN/m^2. 700 < TO < 1050 K. Air, dewpoint 205 K. 1.5 < RE/m X 10^{-6} < 14.

HOPKINS E.J. and KEENER E.R. 1972 Pressure gradient effects on hypersonic turbulent skin friction and boundary layer profiles. AIAA J. 10, 1141-1142.
And private communications. Also Keener & Hopkins (1969, 1973)

1 The test boundary layer was formed on the wall of an axisymmetric tunnel fed by a contoured nozzle. A selection from the full nozzle contour geometrical data is given in Table 1, from which it may be seen that the test section is slightly divergent. The test station was 10.13 m downstream of the throat,
2 which was uncooled. The surface finish was smooth to 0.8 µm. The test section flow was surveyed with
3 Pitot rakes and 'was not entirely uniform but relatively so for this type of facility'. No observations
4 were made to determine position of natural transition. The tests were made under ZPG or near ZPG conditions 2.7 m downstream of the start of the test section, after the nozzle expansion, predominately simple wave, was complete. (The downstream part of the throat was probably actively cooled, keeping the wall temperature in the region of 300 - 350 K.)
6 An instrumentation panel about 0.3 m long carried all the measuring equipment. A row of static holes
8 was drilled at 25.4 mm intervals on the centre line and an FEB (Kistler, diameter 12.7 mm) 30.2 mm to one
7 side. The panel and balance conformed to the tunnel wall curvature. Profile measurements were made with
8 rakes mounted 47.8 mm to either side of the static holes and 54 mm behind the centre of the FEB. The pitot rake had 10 CPP of 1.016 mm diameter in the inner 50 mm and 11 CPP of 3.175 mm diameter between y = 50 and 355 mm. The precise positions appear as the y values in section C. The total temperature rake had 5 triply-shielded STP of 6.35 mm diameter, the innermost at y = 25.4 mm and the outermost at y = 357 mm.

9 Temperatures needed for the Y values of the Pitot tubes were interpolated from a free-hand fairing of the measured temperatures. In the region between the innermost STP and the wall, total temperatures were taken from the empirical relation

$$(TO-TW) / (TOD-TW) = (U/UD)^{1.66}$$

10 which had been found to fit the data further out. Real gas corrections for a calorically imperfect
11 thermally perfect diatomic gas were applied to all calculated values. Keyes' viscosity law was used.

12 The editors have accepted the authors U/UD and M/MD data together with the stated values of MD, TD, TW, PD and CF. Some of the MD values represent revised data which differ from the published tabulation. The other values presented in the tables of sections B and C are calculated assuming a diatomic perfect gas. No attempt has been made to allow for real gas effects. Resulting error in static properties stated is negligible, but the tabulated TO and PT2 values may be up to 3 % in error. The static pressure has been assumed constant through the boundary layer. The boundary layer thickness is such that integrals cannot be evaluated using the axisymmetric correction as in the source paper. They must be found using a full axisymmetric treatment and this has been done here. (See also Kemp & Owen 1972.)

13 The fifteen individual profiles presented cover a range of TW/TR values, obtained by varying TOD, and
14 Reynolds numbers, as a result of the TOD variation and four POD levels. The CF values have not been adjusted to allow fur the small difference in X.

§ DATA 72030101 - 72031501. PO and TO (interpolated) profiles. NX = 1. CF from an FEB.

15 Editors' comments

Apart from its value as an addition to the data available, this experiment is of interest in that it shows upstream history effects. The next entry, CAT 7204, provides a comparison case performed in the same facility and by the same authors, where there are no history effects. It is unfortunate that the thermal history, especially, is not recorded.
The boundary layer was relatively thick, but even so there were no observations closer to the wall than the momentum deficit peak, so that integral values should be treated with some reserve. The T0 profile used is based on measurements at only five points.

The only comparable investigation is that of Jones & Feller (CAT 7002), since other nozzle boundary layer studies such as Fischer et al. (7001) and Beckwith et al. (7105) describe tests which were made in a simple wave cancellation region, where there are normal pressure gradients.

Table 1 Coordinates for the Ames 3.5 Ft. W.T. Nozzle (M_∞ = 7.4)

x (m)	y (m)	x (m)	y (m)	x (m)	y (m)
0	0.041602	0.801289	0.153375	6.328562	0.520294
0.030480	0.042824	1.001451	0.182392	7.566172	0.533400
0.060960	0.046147	1.219200	0.213970	8.074162	0.541812
0.091440	0.040475	1.524000	0.257343	8.582162	0.547207
0.161209	0.060564	1.905000	0.306294	9.090172	0.552602
0.234361	0.071171	2.539990	0.372862	9.598182	0.557967
0.353233	0.088422	3.301990	0.430621	10.106223	0.563362
0.453817	0.102992	3.810000	0.458175	10.252222*	0.568757
0.609265	0.125517	4.825990	0.494721		

* - centre of balance element.

CAT 7203 HOPKINS/KEENER BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2K	CF *	H12	H12K	PW	PD*
X *	POD	PW/PD*	RED2D	CO	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	PT2*	H42	D2K	UD	TP
72030101	7.4200	0.3492	6.3273"+03	9.1200"-04	7.6382	1.3457	2.3300"+02	2.3300"+02
1.0130"+01	1.3993"+06	1.0000	2.0578"+04	NM	1.8631	1.8436	3.0700"+02	8.0900"+01
-5.3500"-01	9.7171"+02	0.0000	8.8867"-03	0.0000"+00	1.3034	1.6473"-02	1.3381"+03	8.7907"+02
72030201	7.4400	0.3325	1.0201"+04	8.4300"-04	7.8601	1.3377	4.4500"+02	4.4500"+02
1.0130"+01	2.7191"+06	1.0000	3.1759"+04	NM	1.8721	1.8543	3.1300"+02	6.6200"+01
-5.3500"-01	1.0405"+03	0.0000	7.8686"-03	0.0000"+00	1.2901	1.4314"-02	1.3850"+03	9.4125"+02
72030301	7.4600	0.3136	1.4504"+04	8.1300"-04	7.9989	1.3339	6.4700"+02	6.4700"+02
1.0130"+01	4.0221"+06	1.0000	4.2759"+04	NM	1.8749	1.9574	3.1000"+02	9.0100"+01
-5.3500"-01	1.0929"+03	0.0000	7.7577"-03	0.0000"+00	1.2644	1.4117"-02	1.4197"+03	9.8865"+02
72030401	7.5500	0.3656	4.7640"+03	8.8600"-04	10.7005	1.3634	2.0700"+02	2.0700"+02
1.0130"+01	1.3900"+06	1.0000	1.6777"+04	NM	1.8547	1.8362	3.0300"+02	7.3900"+01
-5.3500"-01	9.1640"+02	0.0000	7.0034"-03	0.0000"+00	1.1220	1.5094"-02	1.3013"+03	8.2878"+02
72030501	7.4000	0.4098	4.7825"+03	8.0800"-04	12.4602	1.3651	2.4100"+02	2.4100"+02
1.0130"+01	1.4225"+06	1.0000	1.8131"+04	NM	1.8579	1.8390	3.0800"+02	6.9500"+01
-5.3500"-01	8.3066"+02	0.0000	6.0505"-03	0.0000"+00	0.9775	1.3837"-02	1.2369"+03	7.5150"+02
72030601	7.5900	0.3829	7.8340"+03	7.8200"-04	12.2072	1.3548	4.1200"+02	4.1200"+02
1.0130"+01	2.8623"+06	1.0000	2.9014"+04	NM	1.8665	1.8494	3.1000"+02	7.1500"+01
-5.3500"-01	8.9530"+02	0.0000	5.7616"-03	0.0000"+00	1.0299	1.2707"-02	1.2868"+03	8.0962"+02
72030701	7.4700	0.3550	8.8087"+03	7.9700"-04	9.9050	1.3497	4.3600"+02	4.3600"+02
1.0130"+01	2.7339"+06	1.0000	2.9363"+04	NM	1.8666	1.8499	3.1200"+02	7.9900"+01
-5.3500"-01	9.7160"+02	0.0000	6.6077"-03	0.0000"+00	1.1560	1.3266"-02	1.3388"+03	8.7886"+02
72030801	7.4700	0.4283	1.1745"+04	6.7000"-04	12.7354	1.3560	6.6100"+02	6.6100"+02
1.0130"+01	4.1447"+06	1.0000	4.7266"+04	NM	1.8709	1.8537	3.1000"+02	6.5800"+01
-5.3500"-01	8.0014"+02	0.0000	5.2478"-03	0.0000"+00	0.9693	1.1718"-02	1.2149"+03	7.2377"+02
72030901	7.4900	0.4323	1.2622"+04	6.8400"-04	12.3232	1.3492	6.7000"+02	6.7000"+02
1.0130"+01	4.2739"+06	1.0000	5.1844"+04	NM	1.8748	1.8587	3.0200"+02	6.3200"+01
-5.3500"-01	7.7231"+02	0.0000	5.3305"-03	0.0000"+00	1.0002	1.1580"-02	1.1939"+03	6.9856"+02
72031001	7.4700	0.3625	1.5467"+04	7.3300"-04	8.4755	1.3368	6.5200"+02	6.5200"+02
1.0130"+01	4.0883"+06	1.0000	5.2744"+04	NM	1.8731	1.8544	3.0900"+02	7.7500"+01
-5.3500"-01	9.4241"+02	0.0000	7.5848"-03	0.0000"+00	1.2568	1.4365"-02	1.3165"+03	8.5246"+02
72031101	7.4900	0.3895	1.4605"+04	7.1200"-04	11.5854	1.3531	8.5400"+02	8.5400"+02
1.0130"+01	5.4477"+06	1.0000	5.3472"+04	NM	1.8746	1.8577	3.1600"+02	7.3400"+01
-5.3500"-01	8.9695"+02	0.0000	5.3988"-03	0.0000"+00	1.0473	1.1352"-02	1.2866"+03	8.1130"+02
72031201	7.3900	0.4635	4.5329"+03	7.1400"-04	15.2925	1.3600	2.4600"+02	2.4600"+02
1.0130"+01	1.4395"+06	1.0000	1.9486"+04	NM	1.8642	1.8457	3.0200"+02	6.0400"+01
-5.3500"-01	7.2011"+02	0.0000	5.1659"-03	0.0000"+00	0.7878	1.2906"-02	1.1515"+03	6.5150"+02
72031301	7.5400	0.4498	7.3040"+03	7.2600"-04	14.1666	1.3604	4.2900"+02	4.2900"+02
1.0130"+01	2.8562"+06	1.0000	3.1283"+04	NM	1.8682	1.8514	3.1500"+02	6.2600"+01
-5.3500"-01	7.7438"+02	0.0000	4.9189"-03	0.0000"+00	0.8912	1.1614"-02	1.1961"+03	7.0036"+02
72031401	7.5000	0.4476	1.3135"+04	6.5000"-04	15.3739	1.3637	8.6800"+02	8.6800"+02
1.0130"+01	5.5847"+06	1.0000	5.9748"+04	NM	1.8709	1.8574	3.0800"+02	6.2100"+01
-5.3500"-01	7.6072"+02	0.0000	4.3033"-03	0.0000"+00	0.7458	1.0396"-02	1.1850"+03	6.8807"+02
72031501	7.4800	0.4637	1.4077"+04	6.3000"-04	13.5947	1.3580	8.7000"+02	8.7000"+02
1.0130"+01	5.5023"+06	1.0000	6.1222"+04	NM	1.8769	1.8588	3.1600"+02	6.1800"+01
-5.3500"-01	7.5335"+02	0.0000	4.6932"-03	0.0000"+00	0.9148	1.0725"-02	1.1790"+03	6.8143"+02

72030301 HOPKINS/KEENER PROFILE TABULATION 19 POINTS, DELTA AT POINT 19

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.28364	0.00000	0.00000	3.44062	0.00000
2	4.9500"-03	1.1206"+01	NM	0.65506	0.38700	0.66800	2.97941	0.22421
3	9.6500"-03	1.3720"+01	NM	0.59701	0.43000	0.71500	2.76487	0.25860
4	1.4990"-02	1.6231"+01	NM	0.73472	0.46900	0.75400	2.58462	0.29173
5	2.0070"-02	1.8382"+01	NM	0.76081	0.50000	0.78100	2.43984	0.32010
6	2.5400"-02	2.0444"+01	NM	0.78428	0.52800	0.80400	2.31870	0.34675
7	3.0480"-02	2.2221"+01	NM	0.78983	0.55100	0.81500	2.18782	0.37252
8	3.5560"-02	2.4075"+01	NM	0.80061	0.57400	0.82800	2.08083	0.39792
9	4.0640"-02	2.5409"+01	NM	0.80873	0.59000	0.83700	2.01255	0.41589
10	4.5470"-02	2.7041"+01	NM	0.81773	0.60900	0.84700	1.93434	0.43788
11	5.0550"-02	2.8815"+01	NM	0.82501	0.62900	0.85600	1.85202	0.46220
12	6.3250"-02	3.3015"+01	NM	0.84916	0.67400	0.87900	1.70082	0.51681
13	8.8650"-02	4.2727"+01	NM	0.88522	0.76800	0.91500	1.41945	0.64462
14	1.1405"-01	5.2355"+01	NM	0.92106	0.85100	0.94500	1.23312	0.76635
15	1.3945"-01	6.0807"+01	NM	0.94948	0.91800	0.96700	1.10960	0.87148
16	1.6485"-01	6.9300"+01	NM	0.97077	0.97300	0.98300	1.02066	0.96310
17	1.9025"-01	7.1545"+01	NM	0.98273	0.99600	0.99100	0.98999	1.00103
18	2.1565"-01	7.1687"+01	NM	0.99450	0.99700	0.99700	1.00000	0.99700
D 19	2.4105"-01	7.2117"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

72030501 HOPKINS/KEENER PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.37079	0.00000	0.00000	4.43165	0.00000
2	4.9500"-03	9.5815"+00	NM	0.69048	0.33900	0.64800	3.65385	0.17735
3	9.6500"-03	1.0710"+01	NM	0.73352	0.38100	0.70100	3.38521	0.20708
4	1.4990"-02	1.2210"+01	NM	0.75823	0.40800	0.73100	3.21007	0.22772
5	2.0070"-02	1.3997"+01	NM	0.78324	0.43800	0.76100	3.01671	0.25209
6	2.5400"-02	1.5454"+01	NM	0.80111	0.46100	0.78200	2.87748	0.27177
7	3.0480"-02	1.7054"+01	NM	0.81613	0.48500	0.80100	2.72761	0.29366
8	3.5560"-02	1.8449"+01	NM	0.82657	0.50500	0.81500	2.60455	0.31291
9	4.0640"-02	1.9827"+01	NM	0.83713	0.52400	0.82800	2.49688	0.33161
10	4.5470"-02	2.1179"+01	NM	0.84551	0.54200	0.83900	2.39621	0.35014
11	5.0550"-02	2.2736"+01	NM	0.85545	0.56200	0.85100	2.29291	0.37114
12	6.3250"-02	2.6873"+01	NM	0.87654	0.61200	0.87700	2.05351	0.42707
13	8.8650"-02	3.5012"+01	NM	0.91611	0.70000	0.91900	1.72359	0.53319
14	1.1405"-01	4.5025"+01	NM	0.95245	0.79500	0.95300	1.43698	0.66320
15	1.3945"-01	5.8082"+01	NM	0.97837	0.90700	0.98000	1.17521	0.83389
16	1.6485"-01	6.3693"+01	NM	0.98954	0.94700	0.99000	1.09287	0.90587
17	1.9025"-01	6.9426"+01	NM	0.99387	0.98900	0.99600	1.01421	0.98205
D 18	2.1565"-01	7.0969"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

72031401 HOPKINS/KEENER PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.40488	0.00000	0.00000	4.95974	0.00000
2	4.9500"-03	1.0072"+01	NM	0.74546	0.36400	0.69700	3.66659	0.19009
3	9.6500"-03	1.2588"+01	NM	0.78687	0.40900	0.74800	3.34470	0.22364
4	1.4990"-02	1.4941"+01	NM	0.81560	0.44700	0.78400	3.07622	0.25486
5	2.0070"-02	1.6879"+01	NM	0.83686	0.47600	0.80900	2.88857	0.28007
6	2.5400"-02	1.8742"+01	NM	0.85493	0.50300	0.83000	2.72283	0.30483
7	3.0480"-02	2.0582"+01	NM	0.86152	0.52700	0.84300	2.55879	0.32945
8	3.5560"-02	2.2216"+01	NM	0.87210	0.54800	0.85600	2.43998	0.35082
9	4.0640"-02	2.3832"+01	NM	0.88052	0.56800	0.86700	2.32992	0.37212
10	4.5470"-02	2.5506"+01	NM	0.88794	0.58800	0.87700	2.22456	0.39423
11	5.0550"-02	2.7503"+01	NM	0.89862	0.61100	0.88900	2.11700	0.41993
12	6.3250"-02	2.3098"+01	NP	0.97683	0.55900	0.91000	2.65008	0.34339
13	8.8650"-02	4.3293"+01	NM	0.95140	0.76900	0.94900	1.52291	0.62314
14	1.1405"-01	5.5660"+01	NM	0.98085	0.87300	0.97800	1.25502	0.77927
15	1.3945"-01	6.6793"+01	NM	1.00146	0.95700	0.99700	1.08534	0.91860
D 16	1.6485"-01	7.2887"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,M/MD ASSUME P=PD

M : 6.2 - 6.5
R THETA X 10^{-3} : 2 - 7
TW / TR : 0.32 - 0.51

7204

ZPG - MHT - SHT

Axisymmetric blow down tunnel. Running time 2-3 minutes. D = 1.07 m.
3.8 < PO < 6.7 MN/m^2. 680 < TO < 1100 K. Air, dew point 205 K. 5 < RE/m X 10^{-6} < 14.

KEENER E.R. and HOPKINS E.J. 1972 Turbulent boundary layer velocity profiles on a non-adiabatic flat plate at Mach number 6.5 NASA TN D-6907.
And Hopkins, Keener and Louie (1970), Keener and Hopkins (1969), private communications.

1 The test boundary layer was formed on a flat plate (W = 0.457, L = 1.22 m) mounted on a sting at 3° negative incidence in the wind tunnel used for CAT 7203. The leading edge (X = 0) was chamfered at 23° with an average edge thickness of 0.13 mm . The surface of the plate was smooth to 0.8 μm. A row of boundary layer trip elements 1.65 mm high could be mounted at 19 mm (typical) intervals on the line X = 100 mm. In plan view these were symmetrical pentagons with a triangular front and rectangular back, 7.1 mm long overall and 6.4 mm wide. The triangular portion was 4.8 mm long. Surveys were made at a single test station with X = 965 to 996 mm. The plate cooling system maintained
2 the surface temperature constant to within 30 K in the central region. Surface pressures were "not as uniform as expected for a flat plate", varying by about 10 % which corresponds to 1.5 % in MD at this
3 Mach number. The sublimation technique was used to detect transition, which in all cases is complete upstream of the measuring station (figure 5, source). There were noticeable differences between boundary layers with forced and with natural transition.

6 Surface pressures were measured at close intervals (20 mm, E) along the centre line, surface temperature
8 at a single point, 16 mm off the centre line at X = 989 mm, and surface shear stress, 45.7 mm off at X = 965 mm, by a FEB (Kistler, diameter of element 9.4 mm). A cooling system was provided to keep the
7 electrical components of the balance below 370 K. The boundary layer profiles were surveyed simultaneously by a FPP, a flattened STP and a CCP mounted on a single traverse gear giving a profile normal at X = 996 mm.
8 The three probes registered at, respectively, 19.0, 24.7 and 29.8 mm off the centre line. The TTP was constructed from platinum tubing (1.02 mm OD with wall thickness 0.1 mm) flattened to give an opening with h_2 = 0.15 mm and ground so that h_1 = 0.25 mm. A platinum / platinum-rhodium thermocouple was mounted about 5 mm back from the opening with a 0.25 mm diameter vent hole 5.6 mm back on the top surface. The FPP was formed in the same manner from tube 0.76 mm in diameter, again with h_1 = 0.25, h_2 = 0.15 mm. The CCP was 1.02 mm in diameter, but was not used. The TTP and TPP were bent down so as to be able to come close to the plate surface.

9 Total temperature profiles were taken for three of the cases presented (0101, 0201, 0401). The values fitted the relationship.

$$U/UD = (TO - TW) / (TOD - TW)$$

within the margin of experimental error, and this relationship was used for all profiles in reduction.
10 The air was treated as a calorically imperfect, thermally perfect, diatomic gas and Keyes' viscosity law
11 was used.

12 The editors have reduced the data using the same assumptions and simplifications as for CAT 7203. The
13 profiles presented form three pairs, each specified by a TW/TR value. In each pair, one profile (0201,
14 0401, 0601) was obtained with the boundary layer trips on, and the other with natural transition. No adjustment has been made for the small X difference of the CF value obtained from the FEB balance.

5 DATA. 72040101-0601. PO and (3) TO profiles. NX = 1. CF from balance.

15 Editors' comments

This experiment provides a reference case, with no upstream history, for comparison with the previous entry (CAT 7203). The authors compare the temperature velocity correlations obtained, and find the marked difference displayed by the two equations quoted in § 9 for each case.

The profiles were relatively "short" and the measurements did not extend within the momentum-deficit peak, so that it is not advisable to place too great a reliance on values of the integral parameters. (The authors suggest a tolerance of 8 %). Comparisons may be made with the results of Danberg (CAT 6702), Samuels et al. (6701), and with possible small history effects, Horstman & Owen (CAT 7205).

CAT 7204 KEENER/HOPKINS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD*
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
72040101	6.2100	0.3330	1.0662"+03	1.5600"-03	11.6676	1.9071	1.1600"+03	1.1600"+03
9.9600"-01	2.2647"+06	1.0000	2.4161"+03	NM	1.9035	1.8892	3.2400"+02	1.2300"+02
INFINITE	1.0717"+03	0.0000	4.6174"-04	0.0000"+00	0.7330	8.1643"-04	1.3809"+03	9.7301"+02
72040201	6.3900	0.3136	2.2811"+03	1.2200"-03	11.6544	1.6167	1.8600"+03	1.8600"+03
9.9600"-01	4.3372"+06	1.0000	5.1160"+03	NM	1.8641	1.8423	3.2600"+02	1.2500"+02
INFINITE	1.1458"+03	0.0000	6.0639"-04	0.0000"+00	0.7559	1.2605"-03	1.4324"+03	1.0396"+03
72040301	6.4200	0.4377	1.4209"+03	1.2300"-03	13.4564	1.8011	1.1400"+03	1.1400"+03
9.9600"-01	2.7371"+06	1.0000	4.4565"+03	NM	1.8876	1.8690	3.1200"+02	8.5000"+01
INFINITE	7.8568"+02	0.0000	4.8922"-04	0.0000"+00	0.6289	1.0076"-03	1.1867"+03	7.1281"+02
72040401	6.4200	0.4194	1.2470"+03	1.2500"-03	12.9200	1.6096	6.9000"+02	6.9000"+02
9.9600"-01	1.6567"+06	1.0000	3.7665"+03	NM	1.8807	1.8593	3.0600"+02	8.7000"+01
INFINITE	8.0417"+02	0.0000	7.0706"-04	0.0000"+00	0.6445	1.4824"-03	1.2006"+03	7.2958"+02
72040501	6.5000	0.5082	1.7931"+03	1.0600"-03	14.1756	1.6019	1.3300"+03	1.3300"+03
9.9600"-01	3.4503"+06	1.0000	6.6326"+03	NM	1.8743	1.8504	3.1800"+02	7.3000"+01
INFINITE	6.8985"+02	0.0000	4.9145"-04	0.0000"+00	0.5616	1.1182"-03	1.1135"+03	6.2570"+02
72040601	6.5000	0.5014	2.3441"+03	1.0000"-03	13.8981	1.4829	1.3300"+03	1.3300"+03
9.9600"-01	3.4503"+06	1.0000	8.5540"+03	NM	1.8552	1.8258	3.1800"+02	7.4000"+01
INFINITE	6.9930"+02	0.0000	6.4680"-04	0.0000"+00	0.5689	1.5691"-03	1.1211"+03	6.3427"+02

72040201 KEENER/HOPKINS PROFILE TABULATION 18 POINTS, DELTA AT POINT 18

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.28452	0.00000	0.00000	2.60000	0.00000
2	1.7000"-03	1.1147"+01	NM	0.81739	0.45057	0.75650	2.81900	0.26836
3	2.8000"-03	1.3983"+01	NM	0.85326	0.50695	0.80540	2.52400	0.31910
4	4.0000"-03	1.6251"+01	NM	0.87581	0.54789	0.83560	2.32600	0.35924
5	4.7000"-03	1.8885"+01	NM	0.89629	0.59187	0.86340	2.12800	0.40573
6	5.2000"-03	2.0170"+01	NM	0.90498	0.61217	0.87500	2.04300	0.42829
7	6.4000"-03	2.3503"+01	NM	0.92453	0.66196	0.90060	1.85100	0.48655
8	6.8000"-03	2.4721"+01	NM	0.93050	0.67923	0.90850	1.78900	0.50783
9	7.7000"-03	2.7314"+01	NM	0.94200	0.71463	0.92350	1.67000	0.55299
10	9.1000"-03	3.1044"+01	NM	0.95537	0.76266	0.94120	1.52300	0.61799
11	9.4000"-03	3.2359"+01	NM	0.95943	0.77889	0.94660	1.47700	0.64089
12	1.0100"-02	3.4102"+01	NM	0.96461	0.80036	0.95340	1.41900	0.67188
13	1.0600"-02	3.6105"+01	NM	0.96977	0.82336	0.96020	1.36000	0.70603
14	1.1200"-02	3.8243"+01	NM	0.97484	0.84770	0.96690	1.30100	0.74320
15	1.2500"-02	4.2966"+01	NM	0.98442	0.89913	0.97960	1.18700	0.82527
16	1.3000"-02	4.4269"+01	NM	0.98679	0.91281	0.98270	1.15900	0.84789
17	1.4600"-02	4.8417"+01	NM	0.99360	0.95505	0.99160	1.07800	0.91985
D 18	1.7800"-02	5.3036"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72040501 KEENER/HOPKINS PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

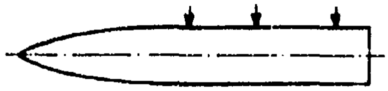
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.46095	0.00000	0.00000	4.35600	0.00000
2	1.4000"-03	1.0107"+01	NM	0.86715	0.42077	0.76240	3.28300	0.23223
3	2.8000"-03	1.3116"+01	NM	0.89612	0.48211	0.81490	2.85700	0.28523
4	4.0000"-03	1.5645"+01	NM	0.91407	0.52816	0.84720	2.57300	0.32927
5	5.5000"-03	2.0507"+01	NM	0.93876	0.60694	0.89140	2.15700	0.41326
6	6.4000"-03	2.3183"+01	NM	0.94886	0.64621	0.90930	1.98000	0.45924
7	7.6000"-03	2.7214"+01	NM	0.96116	0.70122	0.93080	1.76200	0.52826
8	8.9000"-03	3.2030"+01	NM	0.97199	0.76175	0.95020	1.55600	0.61067
9	1.0200"-02	3.6845"+01	NM	0.98044	0.81779	0.96520	1.39300	0.69289
10	1.1600"-02	4.2844"+01	NM	0.98862	0.88265	0.97970	1.23200	0.79521
11	1.2500"-02	4.6299"+01	NM	0.99242	0.91792	0.98650	1.15500	0.85411
12	1.4100"-02	5.0186"+01	NM	0.99606	0.95605	0.99310	1.07900	0.92039
13	1.5500"-02	5.2465"+01	NM	0.99806	0.97772	0.99660	1.03900	0.95919
14	1.6300"-02	5.3677"+01	NM	0.99915	0.98905	0.99840	1.01900	0.97978
15	1.6800"-02	5.3982"+01	NM	0.99934	0.99188	0.99880	1.01400	0.98501
D 16	1.9500"-02	5.4862"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72040601 KEENER/HOPKINS PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45471	0.00000	0.00000	4.29700	0.00000
2	1.2000"-03	7.9100"+00	NM	0.83472	0.36956	0.70720	3.66200	0.19312
3	2.5000"-03	1.0030"+01	NM	0.86404	0.41908	0.75980	3.28700	0.23115
4	3.6000"-03	1.1415"+01	NM	0.87901	0.44848	0.78670	3.07700	0.25567
5	5.1000"-03	1.4839"+01	NM	0.90733	0.51394	0.83710	2.65300	0.31553
6	6.0000"-03	1.6757"+01	NM	0.91930	0.54718	0.85840	2.46100	0.34880
7	7.4000"-03	1.9621"+01	NM	0.93384	0.59337	0.88410	2.22000	0.39824
8	8.6000"-03	2.2779"+01	NM	0.94658	0.64044	0.90640	2.00300	0.45252
9	9.8000"-03	2.6529"+01	NM	0.95840	0.69217	0.92710	1.79400	0.51678
10	1.1300"-02	3.0930"+01	NM	0.96932	0.74835	0.94600	1.59800	0.59199
11	1.2600"-02	3.5761"+01	NM	0.97824	0.80551	0.96190	1.42600	0.67454
12	1.3700"-02	3.9368"+01	NM	0.98379	0.84567	0.97160	1.32000	0.73606
13	1.4900"-02	4.3516"+01	NM	0.98920	0.88962	0.98100	1.21600	0.80674
14	1.7600"-02	5.1077"+01	NM	0.99686	0.96458	0.99450	1.06300	0.93556
15	2.2500"-02	5.4291"+01	NM	0.99952	0.99473	0.99920	1.00900	0.99029
D 16	2.5200"-02	5.4862"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

axisymmetric		7205
	M : 7.2 R THETA X 10^{-3} : 6 - 13 TW / TR : 0.5	ZPG - SHT

Blow-down axisymmetric wind tunnel. Useful running time 2 minutes. D = 1.07 m.
PO : 3.5 MN/m^2. TO : 667 K. Air, dew point 205 K. RE/m X 10^{-6} : 11.

HORSTMAN C.C. and OWEN F.K. 1972 Turbulent properties of a compressible boundary layer. AIAA Jour. 10. 1418-1424.
And Horstman, C.C., private communications, Owen & Horstman (197 (1974), Owen et al. (1975).

1 The test boundary layer was formed on a 10^0 semi-apex angle cone-o cylinder 3.30 m long and 203 mm in diameter with a shoulder fairing radius of 810 mm. The model was on the centre-line of the tunnel used for CAT 7203/7204. All measurements were made on the parallel po stream of the tangent point at X = 647 mm (X = 0 at the nose). The model surface was finished to 1. t actively cooled, the wall temperature in the test zone rising by 10 K during a run, which was a ss than a minute,
2 while the temperature of the nose-cone rose by about 40 K. The wind tunnel Mach number and total temperature were uniform to within ± 0.05 and ± 3 % respectively over a 0.9 m core, in which the stream angles had a maximum deflection of 0.5^0.

3 Natural transition was detected by a hot wire close to the model surface, following Owen (1970), starting
4 and finishing at X = 370 and 800 mm respectively. The development of the flow over the surface of the model is presented in table 1. The pressure gradient in the test zone (1/p)dp/dx was - 4 %/m. Model alignment was
5 checked by surface pressure and heat transfer measurements at 90^0 intervals round the model, and skin friction measurements 180^0 apart. Circumferential variations were within the accuracy of measurement.

6 The surface pressure, wall shear stress and heat transfer were obtained along the cylindrical portion of the model from X = 0.85 to 2.37 m. The wall shear stress was measured directly using a contoured floating-element balance. Direct calibrations using weights hung from the sensing element were performed before and after each test series. These calibrations were repeatable to within 5 %. The heat transfer rate was measured using the thin-wall transient technique. Lateral and radial conduction errors were computed and found to be
7 less than 5 % of the convective heat transfer. Pitot pressure and total temperature profiles were obtained
8 at X = 1.15, 1.76 and 2.37 m. To provide reliable mean flow profiles extra care was taken to use flow field instrumentation which required little or no experimental correction. Single probes were traversed through the boundary layer, stopping every few seconds to ensure no time lag in pressure or temperature. Pitot
7 pressure was measured with an FPP (h_1 = 0.75, h_2 = 0.65, b_1 = 1.9, b_2 = 1.8 mm). Independent calibrations in a free-jet facility, matching Mach number, velocity and density with the present test conditio
10 indicated that rarefaction effects were less than 0.5 %. The minimum local probe Reynolds number based on conditions behind the normal shock and probe height was 60. The Pitot probe height was less than 4.5 % of the smallest boundary-layer thickness traversed.

7 Total temperature profiles were obtained using two types of probes; a single shielded chromel-alumel probe 1.4 mm in diameter was used in the outer 90 % of the boundary layer and an unshielded butt-welded chromel-alumel wire 3 mm long by 0.07 mm thick was used close to the wall. Independent calibrations of these probes in a free-jet facility, matching test conditions, indicated a maximum total temperature error of 2 % for
10 the shielded probe and 5 % for the unshielded probe. Corrections were only applied to the unshielded probe. For portions of the boundary layer where measurements with both probes were taken the corrected data agreed to within 2 %. The shielded probe diameter was less than 8 % of the smallest boundary-layer thickness traversed. The caloric imperfections of air were taken into account in data reduction.

7 The fluctuating properties of the layer were measured with a constant temperature HWP and the results presented in Owen & Hartmann (1972). A comparison between these observations and later surveys made using a constant current HWP is made in Owen & Horstman 1974) and Owen et al. (1975). The CC-HWP data

were taken at slightly differenct free stream conditions. The data was reduced assuming that the signal was not affected by pressure fluctuations. A sample profile is given in section D. The mean turbulent shear flow was analysed in Horstman & Owen 1972. A tabulation of certain of these quantities is given in
9 section D. The three total temperature profiles, scaled on δ (table 1) were indistinguishable and the mean TO profile has been used for all three profiles presented. The static pressure has been assumed constant through the layer. The CF value for X = 1.15 m is an interpolation of values measured at X = 0.85 and 1.46 m. The CF values presented are averaged from the measurements on either side of the
12 model at each X station. The editors have accepted the data as presented by the authors.

§ DATA: 7205 0101-0103. Pitot and TO profiles separately. NX = 3 CF from a number of FEB and CQ by the transient technique separately. Hot wire measurements.

15 Editors' comments

This experiment is very fully and accessibly reported. We suggest that recourse should be had to the original papers, particularly for a treatment of the turbulence quantities which we have not discussed in any detail here.

The experimental range is small, but the coverage of that range is exceptionally complete. This is the only case we have found in which, for one set of conditions, the mean flow profile information is complete, both wall shear stress and heat flux have been measured, and significant information on the fluctuating quantities is provided. Additionally there is a high probability that there are not significant history effects.

The same model and test conditions were used by Mikulla & Horstman (1975) for pioneer Reynolds stress measurements using fine wires mounted on the leading edges of thin ceramic wedges.

Data for boundary layers in broadly the same experimental range may be found in Keener & Hopkins - CAT 7204, Danberg - CAT 6702, and Samuels et al. - CAT 6701.

TABLE 1: BOUNDARY LAYER HISTORY

X (m)	UD/UR	MD/MR	RHOD/RHOR	(RED/m)/(RER/m)	δ (mm)
0.00	0.975	0.795	2.39	1.54	-
0.20	0.975	0.795	2.39	1.54	-
0.40	0.975	0.795	2.39	1.54	-
0.60	0.995	0.945	1.12	0.96	-
0.80	1.00	1.017	0.79	0.81	-
1.00	1.00	1.005	0.85	0.85	15.0
1.20	1.00	1.000	0.83	0.825	17.6
1.40	1.00	1.000	0.83	0.815	20.2
1.60	1.00	0.995	0.82	0.805	22.8
1.80	1.00	0.990	0.81	0.80	25.5
2.00	1.00	0.985	0.795	0.78	28.2
2.20	1.00	0.980	0.78	0.76	30.8
2.40	1.00	0.975	0.765	0.74	33.5

REFERENCE VALUES:

MR = 7.2 TOR = 667 K TW = 310 K UR = 1110 m/s RER/m = 10.9

The boundary layer edge, δ, is defined as that point at which PO/POR = 0.99.

CAT 7205 HORSTMAN BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ *	MD * POD TOD	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ * PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD* TD* TR
72050101 1.1500"+00 1.0150"-01	7.2000 3.3777"+06 6.7071"+02	0.5035 1.0000 0.0000	1.3951"+03 6.1983"+03 5.8730"-04	9.0000"-04 2.2328"-04 -2.6755"-06	14.3126 1.8191 0.7473	1.5630 1.7505 1.6545"-03	6.8192"+02 3.0570"+02 1.1088"+03	6.8192"+02 5.9000"+01 6.0709"+02
72050102 1.7600"+00 1.0150"-01	7.2000 3.3777"+06 6.7071"+02	0.4984 1.0000 0.0000	2.1011"+03 9.2612"+03 8.7751"-04	8.5000"-04 2.0139"-04 -4.2327"-06	14.0416 1.8282 0.7078	1.4345 1.7802 2.3232"-03	6.8192"+02 3.0256"+02 1.1088"+03	6.8192"+02 5.9000"+01 6.0709"+02
72050103 2.3700"+00 1.0150"-01	7.2000 3.3777"+06 6.7071"+02	0.4764 1.0000 0.0000	3.0423"+03 1.2950"+04 1.2271"-03	8.0000"-04 2.1015"-04 -6.2887"-06	12.2653 1.8303 0.8326	1.3941 1.7755 3.0195"-03	6.8192"+02 2.6922"+02 1.1088"+03	6.8192"+02 5.9000"+01 6.0709"+02

TW CHANGED TO BE CONSISTENT WITH RHOW/RHOD

72050101 HURSTMAN PROFILE TABULATION 16 POINTS, DELTA AT POINT 16

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45578	0.00000	0.00000	5.18135	0.00000
2	1.2070"-03	5.0023"+00	NM	0.77091	0.25987	0.59000	5.15464	0.11446
3	1.4960"-03	7.7709"+00	NM	0.78484	0.33048	0.67600	4.18410	0.16156
4	2.0910"-03	1.0301"+01	NM	0.80226	0.38368	0.72900	3.61011	0.20193
5	3.0940"-03	1.2772"+01	NM	0.82591	0.42927	0.77100	3.22581	0.23901
6	4.7940"-03	1.5847"+01	NM	0.86152	0.47999	0.81600	2.89017	0.28234
7	5.7800"-03	1.9091"+01	NM	0.88256	0.52822	0.84800	2.57732	0.32902
8	7.4800"-03	2.3887"+01	NM	0.91274	0.59236	0.88600	2.23714	0.39604
9	8.5000"-03	2.8366"+01	NM	0.92544	0.64653	0.90800	1.97239	0.46036
10	9.8090"-03	3.3770"+01	NM	0.94941	0.70639	0.93400	1.74825	0.53425
11	1.1186"-02	4.2988"+01	NM	0.97384	0.79819	0.96300	1.45560	0.66158
12	1.2597"-02	5.2025"+01	NM	0.98327	0.87892	0.97900	1.24069	0.78907
13	1.3906"-02	5.9697"+01	NM	0.99705	0.94204	0.99300	1.11111	0.89370
14	1.5011"-02	6.4359"+01	NM	0.99591	0.97841	0.99600	1.03627	0.96114
15	1.6524"-02	6.6608"+01	NM	1.00080	0.99549	1.00000	1.00908	0.99100
D 16	1.7000"-02	6.7209"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,RHO/RHOD ASSUME P=PD

72050102 HORSTMAN PROFILE TABULATION 14 POINTS, DELTA AT POINT 14

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45111	0.00000	0.00000	5.12821	0.00000
2	1.2000"-03	5.5314"+00	NM	0.75768	0.27480	0.60400	4.83092	0.12503
3	1.9000"-03	9.2021"+00	NM	0.77887	0.36154	0.70100	3.75940	0.18647
4	3.1000"-03	1.1241"+01	NM	0.80236	0.40164	0.74200	3.41297	0.21741
5	5.8000"-03	1.5017"+01	NM	0.84834	0.46685	0.80300	2.95858	0.27141
6	8.5000"-03	1.9416"+01	NM	0.88490	0.53281	0.85100	2.55102	0.33359
7	1.1200"-02	2.5541"+01	NM	0.91812	0.61293	0.89500	2.13220	0.41975
8	1.3900"-02	3.2631"+01	NM	0.94873	0.69420	0.93100	1.79856	0.51764
9	1.6525"-02	4.1665"+01	NM	0.97592	0.78567	0.96200	1.49925	0.64165
10	1.9200"-02	5.2311"+01	NM	0.99677	0.88135	0.98600	1.25156	0.78781
11	2.1925"-02	6.2422"+01	NM	1.00277	0.96347	0.99800	1.07296	0.93014
12	2.2600"-02	6.3672"+01	NM	1.00492	0.97314	1.00000	1.05597	0.94700
13	2.4625"-02	6.6608"+01	NM	1.00080	0.99549	1.00000	1.00908	0.99100
D 14	2.5000"-02	6.7209"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,RHO/RHOD ASSUME P=PD

72050103 HORSTMAN PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.43121	0.00000	0.00000	4.90196	0.00000
2	1.0890"-03	4.3474"+00	NM	0.72433	0.24005	0.54500	5.15464	0.10573
3	1.6830"-03	7.8821"+00	NM	0.75640	0.33300	0.66600	4.00000	0.16650
4	2.6070"-03	1.0052"+01	NM	0.77318	0.37877	0.71200	3.53357	0.20150
5	3.1020"-03	1.0818"+01	NM	0.77992	0.39365	0.72600	3.40136	0.21344
6	4.3890"-03	1.2212"+01	NM	0.79861	0.41937	0.75200	3.21543	0.23387
7	5.7090"-03	1.3919"+01	NM	0.81842	0.44886	0.77900	3.01205	0.25863
8	6.9960"-03	1.5673"+01	NM	0.83295	0.47725	0.80100	2.81690	0.28435
9	8.3160"-03	1.7434"+01	NM	0.84597	0.50415	0.82000	2.64550	0.30996
10	9.5040"-03	1.9083"+01	NM	0.85581	0.52810	0.83500	2.50000	0.33400
11	1.1121"-02	2.1547"+01	NM	0.87646	0.56197	0.85800	2.33100	0.36808
12	1.2408"-02	2.3669"+01	NM	0.89406	0.58959	0.87600	2.20751	0.39683
13	1.362[illegible]"-02	2.6367"+01	NM	0.89996	0.62293	0.88900	2.03666	0.43650
14	1.5213"-02	2.9229"+01	NM	0.91618	0.65646	0.90600	1.90476	0.47565
15	1.6302"-02	3.1920"+01	NM	0.92791	0.68649	0.91900	1.79211	0.51280
16	1.7622"-02	3.4787"+01	NM	0.94081	0.71710	0.93200	1.68919	0.55174
17	1.8909"-02	3.8812"+01	NM	0.95321	0.75798	0.94600	1.55763	0.60733
18	2.0328"-02	4.2399"+01	NM	0.96352	0.79264	0.95700	1.45773	0.65650
19	2.1516"-02	4.6213"+01	NM	0.97284	0.82790	0.96700	1.36426	0.70881
20	2.2935"-02	4.9457"+01	NM	0.98495	0.85676	0.97700	1.30039	0.75131
21	2.4123"-02	5.3630"+01	NM	0.99202	0.89250	0.98500	1.21803	0.80869
22	2.6829"-02	6.0442"+01	NM	0.99183	0.94795	0.99100	1.09290	0.90676
23	2.9205"-02	6.3966"+01	NM	0.99447	0.97540	0.99500	1.04058	0.95620
24	3.0723"-02	6.6078"+01	NM	0.99751	0.99149	0.99800	1.01317	0.98503
25	3.1944"-02	6.6942"+01	NM	1.00035	0.99800	1.00000	1.00402	0.99600
D 26	3.5000"-02	6.7209"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,U/UD,RHO/RHOD ASSUME P=PD

SECTION D: SUPPLEMENTARY DATA

D 1. CONSTANT CURRENT HOT WIRE DATA (Owen et al., 1975, figures 8-11)

AUTHORS' SYMBOLS AND UNITS

X = 224 cm. $R_{e\theta}$ = 8500 T_o = 667 K T_w = 310 K δ = 3.3 cm θ = 0.134 cm

ρ_e = 0.0294 kg/m^3 u_e = 1100 m/s u_τ/u_e = 0.0416

y/δ	u/u_e	M/M_e	ρ/ρ_e	$\frac{\langle(\rho u)'\rangle}{\rho u}$	$\frac{\langle T_o'\rangle}{T_o}$	$R_{(\rho u)T_o}$	$\frac{\langle\rho'\rangle}{\rho}$	$\frac{\langle u'\rangle}{u_\tau}(\frac{\rho}{\rho_w})^{1/2}$	$\frac{\langle u'\rangle}{u_\tau}$
0	0	0	0.24	-	-	-	-	-	-
0.04	0.64	0.32	0.26	13.0	4.3	0.6	7.0	1.12	1.06
0.04	0.64	0.32	0.26	15.0	4.8	0.75	7.6	1.31	1.25
0.12	0.74	0.41	0.31	14.0	3.0	0.5	9.5	1.04	0.89
0.22	0.81	0.49	0.36	12.0	3.6	0.4	8.2	0.91	0.72
0.23	0.81	0.49	0.37	13.5	4.2	0.5	9.7	1.13	0.90
0.41	0.89	0.62	0.48	11.6	3.3	0.35	9.6	0.88	0.60
0.43	0.90	0.64	0.50	12.0	2.5	0.4	10.0	0.79	0.54
0.56	0.94	0.74	0.62	11.5	2.5	0.5	10.0	0.77	0.46
0.63	0.96	0.80	0.69	10.0	3.3	0.5	8.8	0.89	0.51
0.81	0.99	0.93	0.88	8.0	2.3	0.0	7.8	0.60	0.31
0.96	1.0	0.99	0.99	6.5	2.2	- 0.4	6.7	0.54	0.26
1.1	1.0	1.0	1.0	1.5	1.4	- 0.5	1.9	0.36	0.17
				%	%		%		

D 2. TURBULENCE QUANTITIES DEDUCED FROM MEAN FLOW MEASUREMENTS

(Horstman & Owen, 1972, figures 6-14)

AUTHORS' SYMBOLS AND UNITS

7205 0101

X = 1.15 m

y/δ	$\frac{d(u/u_e)}{d(y/\delta)}$	$\frac{d(H/H_e)}{d\ y/\delta}$	$\frac{\tau_T}{\rho_e u_e^2}10^4$	$\frac{q_T}{\rho_e u_e H_e}10^4$	$\frac{q_t}{\rho_e u_e H_e}10^4$	$\frac{\epsilon}{u_e \delta_i^*}$	$\frac{\lambda}{\delta}$	P_{r_T}	P_{r_t}
0.071	4.0	0.49	3.25	2.69	- 0.80	0.00278	0.0102	0.15	3.82
0.088	2.5	0.49	3.74	2.50	- 2.12	0.00416	0.0158	0.29	1.83
0.123	1.0	0.47	4.07	2.29	- 3.10	0.00976	0.0383	0.83	1.12
0.182	0.62	0.41	4.03	2.18	- 3.47	0.0139	0.0581	1.22	0.86
0.282	0.47	0.34	3.79	1.96	- 3.67	0.0155	0.0704	1.39	0.79
0.340	0.45	0.31	3.54	1.81	- 3.64	0.0135	0.0671	1.35	0.83
0.440	0.41	0.29	3.10	1.48	- 3.52	0.0112	0.0642	1.48	0.80
0.500	0.38	0.26	2.77	1.21	- 3.36	0.00955	0.0615	1.67	0.75
0.577	0.34	0.27	2.28	0.82	- 3.05	0.00777	0.0587	2.22	0.67
0.658	0.27	0.23	1.59	0.31	- 2.46	0.00568	0.0563	4.29	0.58
0.741	0.18	0.14	1.10	- 0.017	- 2.11	0.00502	0.0648	- 4.99	0.52
0.818	0.11	0.07	0.56	- 0.040	- 1.40	0.00375	0.0716	- 0.89	0.47
0.883	0.07	0.04	0.42	- 0.040	- 1.15	0.00409	0.0938	- 0.59	0.45
0.972	0.027	0.015	0.19	- 0.039	- 0.74	0.00466	0.1612	- 0.26	0.32
1.0	0.020	0.01	0.19	- 0.039	- 0.74	0.00616	0.2153	- 0.23	0.34

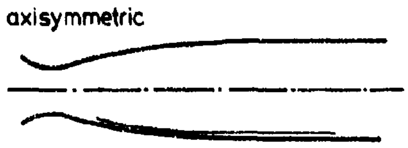
TABLE D 2 CONT.

7205 0102 X = 1.76 m

y/δ	$\frac{d(u/u_e)}{d(y/\delta)}$	$\frac{d(H/H_e)}{d(y/\delta)}$	$\frac{\tau_T}{\rho_e u_e^2}\ 10^4$	$\frac{q_T}{\rho_e u_e H_e}\ 10^4$	$\frac{q_t}{\rho_e u_e H_e}\ 10^4$	$\frac{\epsilon}{u_e \delta_1^*}$	$\frac{l}{\delta}$	P_{r_T}	P_{r_t}
0.048	6.0	0.50	2.99	2.49	- 0.81	0.00173	0.0063	0.10	3.75
0.076	2.5	0.49	3.70	2.18	- 2.54	0.00400	0.0149	0.33	1.67
0.124	0.68	0.47	3.90	1.98	- 3.29	0.01409	0.0537	1.36	0.78
0.232	0.50	0.37	3.63	1.78	- 3.50	0.0155	0.0656	1.51	0.74
0.340	0.42	0.31	3.24	1.49	- 3.50	0.0141	0.0684	1.60	0.75
0.448	0.37	0.28	2.69	1.12	- 3.26	0.0111	0.0647	1.82	0.72
0.556	0.33	0.28	2.05	0.60	- 2.89	0.00804	0.0582	2.91	0.60
0.661	0.26	0.22	1.31	- 0.05	- 2.34	0.00544	0.0539	-23.48	0.51
0.768	0.16	0.11	0.55	- 0.57	- 1.55	0.00308	0.0517	- 0.66	0.39
0.877	0.08	0.04	0.04	- 0.68	- 0.75	0.00038	0.0256	- 0.03	0.07
0.904	0.06	0.03	- 0.06	- 0.68	- 0.57	-0.00077	-	0.04	- 0.14
0.985	0.02	0.01	- 0.07	- 0.67	- 0.55	-0.00241	-	0.05	- 0.16
1.0	0.02	0.01	- 0.07	- 0.67	- 0.54	-0.00244	-	0.05	- 0.16

7205 0103 X = 2.37 m

y/δ	$\frac{d(u/u_e)}{d(y/\delta)}$	$\frac{d(H/H_e)}{d(y/\delta)}$	$\frac{\tau_T}{\rho_e u_e^2}\ 10^4$	$\frac{q_T}{\rho_e u_e H_e}\ 10^4$	$\frac{q_t}{\rho_e u_e H_e}\ 10^4$	$\frac{\epsilon}{u_e \delta_1^*}$	$\frac{l}{\delta}$	P_{r_T}	P_{r_t}
0.033	9.0	1.2	2.39	2.70	+ 0.34	0.00104	0.0039	0.12	- 6.50
0.051	4.0	0.50	3.32	2.38	- 1.65	0.00253	0.0091	0.17	2.18
0.079	1.0	0.49	3.69	2.16	- 2.63	0.00994	0.0361	0.84	1.13
0.094	0.82	0.49	3.68	2.13	- 2.75	0.0116	0.0432	1.04	0.97
0.133	0.65	0.47	3.61	2.06	- 2.90	0.0136	0.0524	1.27	0.81
0.173	0.56	0.42	3.50	1.98	- 2.98	0.0143	0.0580	1.33	0.78
0.212	0.50	0.38	3.38	1.89	- 3.03	0.0145	0.0617	1.36	0.78
0.252	0.47	0.36	3.24	1.80	- 3.04	0.0139	0.0623	1.38	0.78
0.288	0.45	0.33	3.11	1.73	- 3.00	0.0132	0.0620	1.32	0.82
0.337	0.43	0.31	2.88	1.54	- 2.96	0.0119	0.0603	1.35	0.82
0.376	0.41	0.30	2.67	1.42	- 2.85	0.0110	0.0592	1.38	0.81
0.413	0.40	0.29	2.49	1.27	- 2.76	0.00966	0.0563	1.42	0.81
0.461	0.38	0.28	2.23	1.05	- 2.62	0.00850	0.0542	1.56	0.78
0.494	0.37	0.28	2.00	0.90	- 2.44	0.00738	0.0512	1.68	0.75
0.534	0.34	0.28	1.74	0.71	- 2.24	0.00660	0.0505	2.02	0.68
0.573	0.31	0.27	1.44	0.48	- 2.00	0.00551	0.0483	2.61	0.61
0.616	0.27	0.25	1.16	0.17	- 1.85	0.00479	0.0482	6.32	0.51
0.662	0.24	0.23	0.89	- 0.07	- 1.62	0.00385	0.0459	-12.51	0.44
0.695	0.20	0.19	0.58	- 0.33	- 1.36	0.00288	0.0434	- 1.65	0.35
0.731	0.16	0.16	0.31	- 0.53	- 1.08	0.00179	0.0383	- 0.58	0.23
0.813	0.10	0.08	0.06	- 0.75	- 0.86	0.00054	0.0265	- 0.07	0.07
0.886	0.06	0.04	- 0.13	- 0.79	- 0.55	- 0.00174	-	0.11	- 0.28
0.931	0.04	0.025	- 0.30	- 0.78	- 0.25	- 0.00573	-	0.24	- 1.61
0.968	0.03	0.015	- 0.42	- 0.77	- 0.02	- 0.0106	-	0.27	-
1.0	0.02	0.01	- 0.42	- 0.76	0	- 0.0159	-	0.27	-



M : 19 to 45
R THETA X 10^{-3} : 1 - 8
TW/TR : 0.35 - 0.85

7206

FPG - SHT

Blow-down tunnel with axisymmetric contoured nozzle. Test time up to 20 minutes. Open test section: 6.6 < PO < 28 MN/m^2 315 < TO < 988 K Helium. 2 < RE/m X 10^{-6} < 35. D = 0.77 m.

KEMP J.H., OWEN F.K. 1972. Experimental study of nozzle wall boundary layers at Mach numbers 20 to 47. NASA TN D-6965.
And Kemp J.H., private communications, Kemp & Sreekanth (1969)

1 The tests were conducted on the wall of the axisymmetric contoured nozzle designed to give a Mach number 50 core and equipped with an alternative throat section intended to give a Mach 40 core. The throat sections were furnished with heating coils around the outside to provide a more uniform temperature distribution in the nozzle wall (Kemp, 1970). Radii of the nozzle contour are given in section C for the measuring stations. The nozzle was about 3.60 m long and 0.72 m in diameter at the exit. The profiles were measured in the range 0.50 < X < 3.5 m, (X = 0 at the nozzle throat) where X is measured along the nozzle axis. The nozzle was equipped with an injector at the end but no difference was found, in these tests, between

2 data obtained with or without the injector, so long as the boundary layer remained attached. The Mach 40 throat was found to provide an inviscid test core approximately 0.10 m in diameter in which the pitot pressure variation was less than ± 5 % and the Mach number variation was less than ± 1.8 %. A reasonably sized uniform core was obtained for 10 < PO < 14 MN/m^2 (Kemp 1970). "The uniform Mach core is very much dependent on the reservoir conditions so that care must be exercised in judging the uniform flow conditions."

4 The nozzle throat was heated to very nearly the recovery temperature. The temperature dropped off rapidly with distance down the nozzle where the wall temperature was nearly room temperature for all test stations X>1.5 m. Coordinates for the nozzle are given in table 1.

6 There were 10 static holes (d = 6.35 mm) along one generator from X = 0.508 to 3.56 m, at the 5 profile measuring stations, and distributed between these stations. No corrections were made for rarefaction effects on the wall pressure measurements. Wall temperature was measured at the 5 profile measuring stations using chromel-alumel thermocouples. Skin friction was measured at the last 4 survey stations using a floating element, magnetically nulling balance (Spangler 1963). At each station the elements were contoured to the local nozzle surface. The diameter of the floating element was 12.7 mm and the centre line of the floating element was aligned with the profile measuring station. Wall heat transfer was determined from the steady-state heat conduction in thin-skin gauges contoured to the nozzle wall and positioned at the last four survey stations.

7 Traverses were made with Pitot and TO-probes at five survey stations and with hot-wire probes at the last two survey stations. TO was measured with a single shielded thermocouple probe (d_1 = 1.78 mm) designed to have low conduction losses in very low density flow conditions and calibrated in a free-jet facility in the relevant Mach number range (the calibration curve is given). Pitot pressure was measured with a CPP (d_1 = 4.76 mm) at survey stations 1.067 m to 3.56 m and with a CPP (d_1 = 1.59 mm) at X = 0.508 m. Fluctuation measurements at X = 3.56 m were obtained with a water-cooled platinum film probe (McCroskey 1966). Mass flow and temperature fluctuation intensities were measured at X = 2.793 m using a HWP (CT) with a "Platinum 10 % Iridium" wire (d_1 = 0.0063 mm, l_1 = 3.17 mm). A preliminary probe calibration was made in a free-jet facility.

8 Pitot and TO profiles were taken at a station corresponding to the centre of the balance.

9 The TO and PT2 profiles were obtained on separate occasions, and the TO data were interpolated to the Y-values of the Pitot values. The tunnel reservoir conditions differed for each run and the profiles are presented as having the reservoir pressure of the pressure run and the reservoir temperature of the temperature run. The TO data showed some "hysteresis effects due to variations in support temperature"

and the data were faired giving "velocity values that vary as much as 5 % from the value given by unweighted fairing". The fairing was weighted toward high temperature values in the outer part of the layer, and towards low values in the inner part. The static pressure at the wall differed greatly from that near the boundary layer edge, by a factor of up to three. The authors reduced data assuming a linear static
10 pressure variation from the wall to the free stream. The recovery factor used was 0.8. The temperature and Pitot data were corrected for real gas effects (Erikson, 1963) and raw data are tabulated in the source
11 paper. The viscosity law assumed was Akin's (1950).

12 The editors have taken values from the authors' final, adjusted profile tabulations, so incorporating all the authors assumptions and calibration procedures. The edge state reservoir values given in section B are calculated from the static properties at the D-state profile point, assuming that helium can be treated as a perfect gas. Ignoring typographical error, random differences between the calculated edge state and the
13 tabulated reservoir conditions are found at the 10 % level. With the exception of four profiles, all the data obtained are presented, giving seven sets of runs for different ranges of Mach number, Reynolds
14 number and heat transfer. CF data are not available for the first station.

§ DATA: 7206 0101-0705. Pitot and T0 profiles obtained separately. NX = 5. CF from FEB,CQ from steady state film gauges. Some hot wire data.

15 Editors' comments

These measurements were made in a Mach number range unmatched by any other reported experiment. The instrumental and conceptual difficulties are such that no great emphasis should be placed on any precise numerical value. Unfortunately, the experiment is not very clearly reported, and it has not proved possible to decide exactly what was done in every particular.
The editors have inadvertently introduced some scatter in the outer region of the profiles by using the authors' T/T0 data as an input for the profiles. These are tabulated in rounded form, to one decimal place, so that for the outermost profile points the pressures may be up to 5 % in error from this cause. The effect of the scatter on evaluated data will however be small. Large differences between our Reynolds number values and those of the original arise from our choosing a different viscosity law for helium at low temperatures, as stated in the introduction.

The velocity profiles cannot be related directly to any correlation based on adiabatic flat plate data. There are strong thermal and pressure history effects, and, for the Mach number, the Reynolds number is so low that the profiles should be considered transitional. (In transformed coordinates the maximum value of yu_τ/ν is of order 40 and the H12K value is appropriate to a laminar layer.) There are also strong, and inadequately described, normal pressure gradient effects which will only very approximately be accounted for by the linear static pressure variation assumed. The probable shape of the static pressure variation can be seen in Beckwith et al. - CAT 7105 P and, approximately, in Fischer et al. - CAT 7001. The normal stress gradient required to turn the flow is provided by a static pressure gradient with a normal Reynolds stress component superimposed on it which is of the same order.

TABLE 1 NOZZLE COORDINATES: AUTHORS' UNITS (INCHES)

x (Inches)	r (Radius-Inches)	x (Inches)	r (Radius-Inches)	x (Inches)	r (Radius-Inches)
- 0.50	0.231	8.000	1.4640	60.000	6.4240
- 0.100	0.1007	10.000	1.7320	64.000 (03)	6.7280
0	0.0954	15.000	2.3250	68.000	7.0270
0.150	0.1140	20.000 (01)	2.8790	80.000	7.8680
0.350	0.1508	25.000	3.4000	90.000	8.5530
0.600	0.1975	30.000	3.8820	100.000	9.2130
1.000	0.2732	35.000	4.3380	110.000 (04)	9.8360
2.000	0.4700	39.000	4.6950	120.000	10.4240
3.000	0.6620	42.000 (02)	4.9590	130.000	10.9760
4.000	0.8430	45.000	5.2170	140.000 (05)	11.5140
6.000	1.1720	50.000	5.6280		

(Figures from NASA Ames)

CAT 7206 KEMP BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ *	TOD	SW *	D2	PI2	H42	D2K	UD	TR
72060101	19.4000	0.8098	7.5360"+01	NM	91.0592	2.3489	5.3297"+01	3.7896"+01
5.0800"-01	6.7979"+06	1.4122	1.6971"+03	NM	1.9071	1.6268	3.6200"+02	3.9400"+00
-7.3127"-02	9.9847"+02	1.0000	1.6328"-04	NC	1.2692	1.8040"-03	2.2668"+03	4.4704"+02
72060102	27.3000	0.7006	5.4270"+01	3.6200"-04	156.3718	2.6490	1.4692"+01	6.9304"+00
1.0670"+00	6.7704"+06	2.1182	2.3499"+03	2.1410"-05	1.8654	1.5665	3.1500"+02	2.0100"+00
-1.2596"-01	5.0160"+02	1.0000	2.9909"-04	NC	1.2405	5.6321"-03	2.2784"+03	4.4965"+02
72060103	30.9000	0.6571	6.7521"+01	2.6600"-04	143.2889	2.5437	7.0725"+00	3.7693"+00
1.6260"+00	6.8441"+06	1.8917	3.3561"+03	1.6190"-05	1.8848	1.5736	3.0100"+02	1.6000"+00
-1.7089"-01	5.1109"+02	1.0000	5.2217"-04	NC	1.5031	9.6920"-03	2.3008"+03	4.5810"+02
72060201	19.2000	0.5444	6.4465"+01	NM	84.6881	2.3830	5.3297"+01	3.9821"+01
5.0800"-01	6.7855"+06	1.3552	9.6382"+02	NM	1.8668	1.6042	3.9700"+02	6.5600"+00
-7.3127"-02	8.1306"+02	1.0000	1.8394"-04	NC	1.3258	2.2272"-03	2.8448"+03	7.2918"+02
72060202	26.4000	0.4375	4.8990"+01	3.8000"-04	130.3095	2.6730	1.4692"+01	7.9439"+00
1.0670"+00	6.5868"+06	1.8483	1.1037"+03	5.6860"-05	1.8207	1.5627	3.5800"+02	3.9100"+00
-1.2596"-01	9.1274"+02	1.0000	3.6797"-04	NC	1.3609	6.3685"-03	3.0730"+03	8.1822"+02
72060203	30.6000	0.4127	5.7165"+01	3.0000"-04	132.4749	2.7784	7.0725"+00	3.8402"+00
1.6260"+00	6.6421"+06	1.8892	1.7579"+03	4.2350"-05	1.8177	1.5442	3.2100"+02	2.7700"+00
-1.7089"-01	8.6777"+02	1.0000	6.0103"-04	NC	1.5037	1.0831"-02	2.9960"+03	7.7781"+02
72060301	19.8000	0.4581	1.0826"+02	NM	61.1823	2.5443	8.7241"+01	5.5830"+01
5.0800"-01	1.1082"+07	1.5905	1.4757"+03	NM	1.8691	1.6032	4.0000"+02	7.3900"+00
-7.3127"-02	9.7360"+02	1.0000	2.2787"-04	NC	1.4438	1.9617"-03	3.1685"+03	8.7311"+02
72060302	27.4000	0.4032	9.1289"+01	3.2200"-04	100.1961	2.8510	2.0670"+01	1.1348"+01
1.0670"+00	1.1323"+07	1.8271	2.1111"+03	5.3300"-05	1.8619	1.5529	3.2800"+02	3.6100"+00
-1.2596"-01	9.0748"+02	1.0000	4.1990"-04	NC	1.5139	5.4217"-03	3.0646"+03	8.1347"+02
72060303	32.5000	0.4053	7.0156"+01	2.6800"-04	146.3628	2.7491	1.0538"+01	4.7724"+00
1.6260"+00	1.1145"+07	2.2563	2.4476"+03	4.0420"-05	1.8240	1.5534	3.1700"+02	2.4700"+00
-1.7089"-01	8.7255"+02	1.0000	5.2345"-04	NC	1.4400	9.6592"-03	3.0068"+03	7.8206"+02
72060304	37.9000	0.3558	4.9990"+01	1.9000"-04	248.7335	2.8250	4.0023"+00	2.2697"+00
2.7930"+00	1.1407"+07	1.7595	2.1464"+03	3.2100"-05	1.7847	1.5438	3.0000"+02	1.9600"+00
-2.4983"-01	9.4088"+02	1.0000	5.7810"-04	NC	1.4393	1.7703"-02	3.1235"+03	8.4324"+02
72060401	20.1000	0.7610	1.7867"+02	NM	85.6343	2.2555	1.3578"+02	9.7576"+01
5.0800"-01	2.0869"+07	1.3983	4.0995"+03	NM	1.9395	1.7156	3.5200"+02	3.8000"+00
-7.3127"-02	5.1580"+02	1.0000	1.3993"-04	NC	1.2950	1.1509"-03	2.3065"+03	4.6255"+02
72060402	29.4000	0.6650	1.3098"+02	2.7300"-04	115.9050	2.9224	3.1613"+01	1.4084"+01
1.0670"+00	1.9958"+07	2.2386	6.1453"+03	2.3220"-05	1.9194	1.5869	3.1900"+02	1.8500"+00
-1.2596"-01	5.3514"+02	1.0000	3.1809"-04	NC	1.4038	4.0443"-03	2.3540"+03	4.7968"+02
72060403	34.5000	0.6607	1.1424"+02	1.9600"-04	157.0778	2.4637	1.4692"+01	6.6368"+00
1.6260"+00	2.0873"+07	2.2062	6.1540"+03	1.4340"-05	1.9121	1.5957	3.0400"+02	1.2900"+00
-1.7089"-01	5.1335"+02	1.0000	4.0612"-04	NC	1.4635	7.0988"-03	2.3067"+03	4.6010"+02
72060404	42.2000	0.6712	6.2783"+01	1.4700"-04	325.9712	2.6176	5.6033"+00	2.4521"+00
2.7930"+00	2.1066"+07	2.2790	3.6102"+03	8.3900"-06	1.8844	1.5787	2.9700"+02	8.3000"-01
-2.4983"-01	4.9378"+02	1.0000	3.9022"-04	NC	1.3401	1.3367"-02	2.2632"+03	4.4251"+02
72060405	43.8000	0.6231	6.5332"+01	9.2000"-05	368.8574	3.0953	5.1068"+00	2.0569"+00
3.5560"+00	2.1277"+07	2.5255	3.7568"+03	NM	1.8510	1.5335	2.9700"+02	8.3000"-01
-2.9246"-01	5.3186"+02	1.0000	4.6639"-04	NC	1.3475	1.8451"-02	2.3490"+03	4.7664"+02

CAT 7206 KEMP BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN / X * / RZ *	MD * / POD / TOD	TW/TR / PW/PD / SW *	RED2W / RED2D / D2	CF * / CQ / PI2	H12 / H32 / H42	H12K / H32K / D2K	PW* / TW* / UD	PD* / TD* / TR
72060501	20.0000	0.4806	1.9515"+02	NM	56.0666	2.1539	1.3578"+02	9.8589"+01
5.0600"-01	2.0570"+07	1.3920	2.8071"+03	NM	1.9230	1.6570	4.0200"+02	6.9400"+00
-7.3127"-02	9.3274"+02	1.0000	2.2388"-04	NC	1.5160	1.5740"-03	3.1015"+03	8.3645"+02
72060502	29.0000	0.4464	1.1353"+02	3.0100"-04	108.8460	2.6738	3.1613"+01	1.4996"+01
1.0670"+00	1.9449"+07	2.0850	3.2390"+03	4.0890"-05	1.8942	1.5821	3.4800"+02	3.0900"+00
-1.2596"-01	8.6975"+02	1.0000	3.5894"-04	NC	1.4660	4.3614"-03	3.0009"+03	7.7962"+02
72060503	34.9000	0.4091	1.1048"+02	2.4500"-04	120.4938	2.5938	1.4692"+01	6.2619"+00
1.6260"+00	2.0859"+07	2.3904	4.5304"+03	3.9680"-05	1.8797	1.5833	3.2100"+02	2.1500"+00
-1.7089"-01	8.7549"+02	1.0000	5.5029"-04	NC	1.5450	8.0650"-03	3.0124"+03	7.8467"+02
72060504	42.1000	0.3578	4.9863"+01	1.7900"-04	319.6740	2.7960	5.6033"+00	2.4723"+00
2.7930"+00	2.0990"+07	2.3358	2.4888"+03	2.7180"-05	1.7887	1.5475	3.0000"+02	1.5800"+00
-2.4983"-01	9.3552"+02	1.0000	4.2787"-04	NC	1.3063	1.5005"-02	3.1151"+03	8.3839"+02
72060601	20.3000	0.7018	2.9953"+02	NM	72.2043	2.1649	1.8340"+02	1.2970"+02
5.0800"-01	2.9135"+07	1.4165	6.7110"+03	NM	1.9406	1.6800	3.1800"+02	3.6500"+00
-7.3127"-02	5.0528"+02	1.0000	1.6037"-04	NC	1.4026	1.1771"-03	2.2830"+03	4.5311"+02
72060602	29.9000	0.7059	1.4880"+02	2.0300"-04	135.3709	2.6128	3.9111"+01	1.8846"+01
1.0670"+00	2.9047"+07	2.0623	7.4560"+03	1.6430"-05	1.9406	1.6420	3.1800"+02	1.6800"+00
-1.2596"-01	5.0258"+02	1.0000	2.5254"-04	NC	1.3696	3.0454"-03	2.2814"+03	4.5048"+02
72060603	35.8000	0.6554	1.4814"+02	1.8800"-04	133.2784	2.5434	1.9049"+01	7.5183"+00
1.6260"+00	2.8434"+07	2.5482	8.0499"+03	1.7210"-05	1.9250	1.6031	3.0200"+02	1.2000"+00
-1.7089"-01	5.1411"+02	1.0000	4.3025"-04	NC	1.4873	6.1451"-03	2.3086"+03	4.6077"+02
72060604	43.6000	0.6460	8.1181"+01	1.4400"-04	259.9784	2.6995	6.6672"+00	2.5433"+00
2.7930"+00	2.8795"+07	2.6399	4.7992"+03	1.1170"-05	1.9088	1.5811	3.0000"+02	7.8000"-01
-2.4983"-01	5.1822"+02	1.0000	4.4912"-04	NC	1.4384	1.2222"-02	2.3187"+03	4.6441"+02
72060605	45.9000	0.6452	8.2696"+01	5.6000"-05	328.6326	2.9451	6.5355"+00	2.2089"+00
3.5560"+00	2.8866"+07	2.9926	4.9947"+03	NM	1.8629	1.5460	2.9700"+02	7.3000"-01
-2.9246"-01	5.1344"+02	1.0000	4.9196"-04	NC	1.3525	1.7568"-02	2.3086"+03	4.6030"+02
72060701	20.2000	0.4589	2.4250"+02	NM	63.3799	2.3482	1.8441"+02	1.2767"+02
5.0800"-01	2.7985"+07	1.4504	3.4814"+03	NM	1.9291	1.6379	3.6100"+02	6.4000"+00
-7.3127"-02	8.7732"+02	1.0000	1.9053"-04	NC	1.4740	1.3847"-03	3.0082"+03	7.8674"+02
72060702	29.6000	0.4358	1.3589"+02	2.5800"-04	115.1301	2.7134	3.9010"+01	1.9150"+01
1.0670"+00	2.8070"+07	1.9774	4.0054"+03	4.1800"-05	1.8975	1.6040	3.3900"+02	2.9600"+00
-1.2596"-01	8.6787"+02	1.0000	3.1717"-04	NC	1.4435	3.9100"-03	2.9978"+03	7.7792"+02
72060703	35.1000	0.3975	1.3074"+02	2.1700"-04	127.8709	2.6741	1.8948"+01	8.0452"+00
1.6260"+00	2.7573"+07	2.4124	5.3107"+03	3.4570"-05	1.8838	1.5817	3.1400"+02	2.1400"+00
-1.7089"-01	8.8141"+02	1.0000	4.9567"-04	NC	1.5219	7.3718"-03	3.0226"+03	7.8997"+02
72060704	43.5000	0.3692	6.6167"+01	1.6500"-04	289.7081	2.8746	6.6672"+00	2.8472"+00
2.7930"+00	2.8460"+07	2.3967	3.4251"+03	3.0970"-05	1.7977	1.5310	2.9700"+02	1.4200"+00
-2.4983"-01	8.9753"+02	1.0000	4.4941"-04	NC	1.3615	1.4208"-02	3.0514"+03	8.0434"+02
72060705	45.1000	0.3782	9.1399"+01	6.1000"-05	247.4689	3.0527	6.5355"+00	2.3609"+00
3.5560"+00	2.8260"+07	2.8194	4.8499"+03	NM	1.8258	1.5427	2.9700"+02	1.2900"+00
-2.9246"-01	8.7635"+02	1.0000	6.8827"-04	NC	1.4844	1.9658"-02	3.0154"+03	7.8535"+02

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
72060101	1,6532"-04	112,2894	1,9075	1,2887	1,7183"+03	7,6312"+01	1,5555"-02
	1,3486"-04	109,2512	1,9083	1,2879	1,7190"+03	7,6341"+01	
72060102	2,9560"-04	292,5824	1,8638	1,2551	2,3225"+03	5,3637"+01	5,0030"-02
	1,8820"-04	232,4460	1,8644	1,2541	2,3231"+03	5,3653"+01	
72060103	5,1921"-04	265,4817	1,8841	1,5116	3,3370"+03	6,7138"+01	7,9675"-02
	3,5609"-04	200,1613	1,8841	1,5106	3,3369"+03	6,7135"+01	
72060201	1,8240"-04	104,6585	1,8656	1,3369	9,5577"+02	6,3926"+01	1,6305"-02
	1,5326"-04	101,8386	1,8662	1,3362	9,5605"+02	6,3945"+01	
72060202	3,6551"-04	211,8333	1,8194	1,3700	1,0964"+03	4,8663"+01	5,0360"-02
	2,5294"-04	178,8039	1,8199	1,3690	1,0965"+03	4,8670"+01	
72060203	5,9808"-04	266,6124	1,8167	1,5111	1,7492"+03	5,6885"+01	8,3741"-02
	4,1478"-04	182,7825	1,8168	1,5100	1,7491"+03	5,6880"+01	
72060301	2,2580"-04	83,7323	1,8678	1,4571	1,4623"+03	1,0728"+02	1,4825"-02
	1,7294"-04	80,5531	1,8686	1,4557	1,4628"+03	1,0732"+02	
72060302	4,1692"-04	159,7140	1,8608	1,5247	2,0961"+03	9,0637"+01	4,4797"-02
	2,9111"-04	140,8107	1,8610	1,5235	2,0962"+03	9,0641"+01	
72060303	5,1972"-04	NOT REAL	1,8227	1,4504	2,4302"+03	6,9656"+01	8,1808"-02
	3,2330"-04	222,0764	1,8228	1,4492	2,4301"+03	6,9654"+01	
72060304	5,7538"-04	NOT REAL	1,7837	1,4460	2,1364"+03	4,9756"+01	1,5070"-01
	4,0952"-04	333,7050	1,7837	1,4454	2,1363"+03	4,9754"+01	
72060401	1,3825"-04	109,8360	1,9388	1,3107	4,0501"+03	1,7652"+02	1,2709"-02
	1,1309"-04	106,3875	1,9395	1,3099	4,0515"+03	1,7650"+02	
72060402	3,1362"-04	220,3895	1,9182	1,4258	6,0591"+03	1,2914"+02	4,1015"-02
	1,9326"-04	186,6027	1,9186	1,4226	6,0603"+03	1,2916"+02	
72060403	4,0200"-04	318,6338	1,9112	1,4786	6,0918"+03	1,1308"+02	6,8913"-02
	2,4970"-04	241,9913	1,9113	1,4775	6,0931"+03	1,1309"+02	
72060404	3,8705"-04	NOT REAL	1,8834	1,3512	3,5810"+03	6,2274"+01	1,3651"-01
	2,3584"-04	494,4936	1,8835	1,3506	3,5811"+03	6,2276"+01	
72060405	4,6311"-04	NOT REAL	1,8499	1,3570	3,7304"+03	6,4873"+01	1,8329"-01
	2,6849"-04	574,4069	1,8500	1,3564	3,7305"+03	6,4874"+01	
72060501	2,2216"-04	71,5308	1,9223	1,5277	2,7854"+03	1,9364"+02	1,3380"-02
	1,8347"-04	69,8677	1,9228	1,5267	2,7861"+03	1,9369"+02	
72060502	3,5497"-04	196,5228	1,8929	1,4823	3,2032"+03	1,1228"+02	4,2722"-02
	2,2711"-04	167,3242	1,8933	1,4810	3,2037"+03	1,1229"+02	
72060503	5,4638"-04	NOT REAL	1,8788	1,5561	4,4982"+03	1,0970"+02	7,2305"-02
	3,2769"-04	193,4044	1,8787	1,5548	4,4975"+03	1,0968"+02	
72060504	4,2565"-04	NOT REAL	1,7876	1,3130	2,4758"+03	4,9602"+01	1,4523"-01
	2,6062"-04	480,8302	1,7877	1,3125	2,4758"+03	4,9602"+01	
72060601	1,5896"-04	91,7923	1,9400	1,4151	6,6522"+03	2,9691"+02	1,2237"-02
	1,2925"-04	89,7212	1,9406	1,4142	6,6544"+03	2,9700"+02	
72060602	2,4937"-04	231,0715	1,9397	1,3868	7,3623"+03	1,4693"+02	3,7047"-02
	1,6106"-04	205,0608	1,9402	1,3858	7,3640"+03	1,469[illegible]02	
72060603	4,2487"-04	321,2168	1,9240	1,5061	7,9453"+03	1,462[illegible]02	6,4505"-02
	2,4338"-04	230,9244	1,9241	1,5049	7,9494"+03	1,4629"+02	
72060604	4,4559"-04	NOT REAL	1,9080	1,4498	4,7615"+03	8,0543"+01	1,2853"-01
	2,5003"-04	439,0560	1,9080	1,4491	4,7612"+03	8,0539"+01	
72060605	4,8751"-04	NOT REAL	1,8616	1,3649	4,9497"+03	8,1951"+01	1,7564"-01
	2,5443"-04	567,4926	1,8618	1,3641	4,9497"+03	8,1951"+01	
72060701	1,8895"-04	81,6771	1,9284	1,4863	3,4525"+03	2,4049"+02	1,2755"-02
	1,5169"-04	79,6075	1,9291	1,4853	3,4536"+03	2,4057"+02	
72060702	3,1394"-04	199,6752	1,8964	1,4585	3,9644"+03	1,3450"+02	3,9911"-02
	2,0501"-04	174,8504	1,8967	1,4574	3,9649"+03	1,3452"+02	
72060703	4,9164"-04	297,1975	1,8828	1,5344	5,2675"+03	1,2968"+02	6,9387"-02
	2,9421"-04	207,0648	1,8828	1,5332	5,2671"+03	1,2967"+02	
72060704	4,4648"-04	NOT REAL	1,7964	1,3704	3,4028"+03	6,5735"+01	1,3989"-01
	2,6507"-04	451,0117	1,7964	1,3698	3,4026"+03	6,5733"+01	
72060705	6,8464"-04	NOT REAL	1,8248	1,4923	4,8245"+03	9,0920"+01	1,8272"-01
	3,7179"-04	409,5137	1,8247	1,4914	4,8238"+03	9,0906"+01	

72060103 KEMP PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.89173	0.58636	0.00000	0.00000	187.30000	0.00000
2	6.3498"-03	1.2628"+00	1.84380	0.60353	0.01753	0.23230	175.60000	0.00244
3	1.2700"-02	1.7200"+00	1.79872	0.62461	0.02759	0.34960	160.60000	0.00392
4	1.9063"-02	2.3623"+00	1.76358	0.65476	0.03594	0.43750	148.20000	0.00521
5	2.5413"-02	3.3280"+00	1.72160	0.69082	0.04485	0.52020	134.50000	0.00666
6	3.1763"-02	4.7073"+00	1.67912	0.74089	0.05488	0.60320	120.80000	0.00838
7	3.8112"-02	6.9200"+00	1.63332	0.80859	0.06787	0.69450	104.70000	0.01083
8	4.4462"-02	1.1736"+01	1.59767	0.90407	0.08968	0.80760	81.10000	0.01591
9	5.0825"-02	2.8609"+01	1.55168	0.96283	0.14169	0.91390	41.60000	0.03409
10	5.7175"-02	1.1880"+02	1.50960	0.96845	0.29049	0.96780	11.10000	0.13162
11	6.3525"-02	2.9162"+02	1.47976	0.96269	0.42317	0.97420	5.30000	0.27200
12	6.9875"-02	3.8166"+02	1.41400	0.95919	0.52132	0.97530	3.50000	0.39402
13	7.6225"-02	5.1436"+02	1.36396	0.95773	0.60529	0.97600	2.60000	0.51201
14	8.2575"-02	6.3698"+02	1.33875	0.95656	0.67364	0.97620	2.10000	0.62233
15	8.8938"-02	7.4398"+02	1.33470	0.95679	0.72806	0.97680	1.80000	0.72430
16	9.5288"-02	8.9671"+02	1.24980	0.96014	0.79935	0.97900	1.50000	0.81570
17	1.0164"-01	1.0409"+03	1.18430	0.96498	0.86110	0.98180	1.30000	0.89442
18	1.0799"-01	1.1336"+03	1.17120	0.97016	0.89881	0.98460	1.20000	0.96097
19	1.1434"-01	1.2465"+03	1.11991	0.97752	0.94250	0.98850	1.10000	1.00639
20	1.2070"-01	1.2566"+03	1.14389	0.98542	0.94631	0.99250	1.10000	1.03210
21	1.2323"-01	1.3852"+03	1.04540	0.98728	0.99360	0.99360	1.00000	1.03871
22	1.2958"-01	1.3933"+03	1.02630	0.99303	0.99650	0.99650	1.00000	1.02271
D 23	1.3340"-01	1.4031"+03	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD,RHO/RHOD

72060405 KEMP PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	2.52547	0.55509	0.00000	0.00000	355.70000	0.00000
2	1.2731"-02	1.0948"+00	2.42692	0.57752	0.00760	0.14350	356.90000	0.00098
3	2.5433"-02	1.3008"+00	2.39020	0.60940	0.01317	0.24690	351.50000	0.00168
4	3.8164"-02	1.6867"+00	2.30112	0.65096	0.01907	0.35080	338.40000	0.00239
5	5.0866"-02	2.2811"+00	2.22939	0.70149	0.02473	0.44450	323.10000	0.00307
6	6.3597"-02	3.2774"+00	2.18892	0.75189	0.03135	0.53920	295.80000	0.00399
7	7.6328"-02	4.7890"+00	2.11815	0.80714	0.03909	0.63220	261.50000	0.00512
8	8.9030"-02	7.3975"+00	2.05200	0.86754	0.04960	0.72890	216.00000	0.00692
9	1.0176"-01	1.3427"+01	1.98264	0.92471	0.06785	0.83150	150.20000	0.01098
10	1.1446"-01	4.0275"+01	1.91556	0.95906	0.11888	0.93000	61.20000	0.02911
11	1.2719"-01	1.1484"+02	1.84920	0.96798	0.20147	0.96620	23.00000	0.07768
12	1.3993"-01	2.4167"+02	1.78640	0.97462	0.29256	0.97910	11.20000	0.15617
13	1.5263"-01	4.1822"+02	1.71860	0.97218	0.38502	0.98160	6.50000	0.25954
14	1.6536"-01	6.4859"+02	1.65690	0.97094	0.47956	0.98280	4.20000	0.38771
15	1.7806"-01	9.0989"+02	1.57740	0.97123	0.56805	0.98390	3.00000	0.51733
16	1.9079"-01	1.1903"+03	1.50719	0.97309	0.64975	0.98540	2.30000	0.64573
17	2.0352"-01	1.4452"+03	1.44780	0.97542	0.71597	0.98690	1.90000	0.75202
18	2.1622"-01	1.7192"+03	1.34976	0.97672	0.78092	0.98780	1.60000	0.83331
19	2.2895"-01	1.8412"+03	1.34895	0.98052	0.80817	0.98980	1.50000	0.89013
20	2.4166"-01	2.1313"+03	1.22018	0.98337	0.86952	0.99140	1.30000	0.93053
21	2.5439"-01	2.3186"+03	1.17012	0.98737	0.90694	0.99350	1.20000	0.96876
22	2.6712"-01	2.5401"+03	1.10099	0.99139	0.94927	0.99560	1.10000	0.99650
23	2.7727"-01	2.5488"+03	1.11078	0.99477	0.95089	0.99730	1.10000	1.00707
D 24	2.9000"-01	2.8188"+03	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

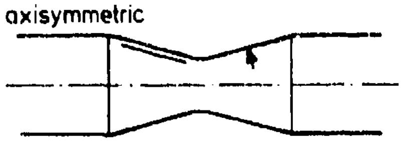
INPUT VARIABLES Y,U/UD,T/TD,RHO/RHOD

72060705 KEMP PROFILE TABULATION 23 POINTS, DELTA AT POINT 23

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	2.81942	0.34018	0.00000	0.00000	231.10000	0.00000
2	1.2714"-02	1.1601"+00	2.74804	0.37006	0.00950	0.14620	236.90000	0.00170
3	2.5401"-02	1.4853"+00	2.65440	0.40871	0.01590	0.24480	237.00000	0.00274
4	3.8115"-02	2.0049"+00	2.58112	0.46043	0.02175	0.33470	236.80000	0.00365
5	5.0830"-02	2.8242"+00	2.48940	0.51653	0.02775	0.42130	230.50000	0.00455
6	6.3544"-02	4.1265"+00	2.42368	0.58153	0.03489	0.51320	216.40000	0.00575
7	7.6230"-02	6.2341"+00	2.33046	0.65445	0.04392	0.60950	192.60000	0.00737
8	8.8945"-02	9.6919"+00	2.25260	0.73328	0.05559	0.70510	160.90000	0.00987
9	1.0166"-01	1.7540"+01	2.16960	0.81164	0.07562	0.80390	113.00000	0.01543
10	1.1435"-01	3.5059"+01	2.08884	0.88140	0.10763	0.88490	67.60000	0.02734
11	1.2706"-01	9.4390"+01	2.00160	0.91367	0.17731	0.93490	27.80000	0.06731
12	1.3977"-01	1.9962"+02	1.91526	0.93199	0.25818	0.95560	13.70000	0.13359
13	1.5249"-01	3.6642"+02	1.82704	0.94066	0.34997	0.96480	7.60000	0.23194
14	1.6518"-01	6.1114"+02	1.77054	0.94551	0.45208	0.96960	4.60000	0.37320
15	1.7789"-01	9.1470"+02	1.64641	0.95165	0.55314	0.97390	3.10000	0.51724
16	1.9060"-01	1.2441"+03	1.55388	0.95924	0.64514	0.97840	2.30000	0.66101
17	2.0329"-01	1.6019"+03	1.46952	0.96595	0.73209	0.98220	1.80000	0.80187
18	2.2238"-01	1.9438"+03	1.42545	0.97632	0.80645	0.98770	1.50000	0.93861
19	2.4143"-01	2.4618"+03	1.20888	0.98875	0.90758	0.99420	1.20000	1.00156
20	2.5337"-01	2.6975"+03	1.13385	0.99317	0.95013	0.99650	1.10000	1.02689
21	2.6049"-01	2.7034"+03	1.13553	0.99516	0.95108	0.99750	1.10000	1.02972
22	2.6683"-01	2.7088"+03	1.12717	0.99715	0.95203	0.99850	1.10000	1.02316
D 23	2.7700"-01	2.9886"+03	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD,RHO/RHOD

axisymmetric	M : 0.06 to 3.6 R THETA X 10^{-3} : 6 - 26 TW/TR : About 0.5 and 1.1	**7207** FPG-MHT-SHT



Special purpose rig: continuous running. D (inlet) 127 mm. PO : 1 MN/m^2. TO : 830 and 290 K.
Air and a small quantity of the combustion products of Methanol. RE/m X 10^{-6} at inlet about 30 and 100.

BACK L.H. and CUFFEL R.F., 1972. Turbulent-boundary-layer measurements along a supersonic nozzle with and without wall cooling. Heat Transfer. Trans. Am. Soc. Mech.Engrg. 94, 242-243.
And Back & Cuffel (1971) and private communications.
Also Back, Cuffel and Massier (1970). Many associated papers. See References.

1 The test boundary layer was formed on the inside surface of a circular duct finishing in a convergent-
divergent nozzle. The air supply is compressed and then heated by the combustion of methanol before entering
a large settling chamber containing baffles and screens (Back, Massier & Cuffel, 1967). From this it passes
through an area contraction of 11.6:1 and enters the duct which has the dimensions listed in Table 1. These
may be summarised as describing a conical convergent-divergent nozzle of closely 10° semi vertex angle fed
by a cooled-wall approach duct about 1 m long and 127 mm in diameter. The throat (diameter 40.4 mm) and the
junctions of duct and nozzle are faired in section with circular arcs. There are five traverse stations
8 upstream of the throat and one downstream. The first station, in the approach duct, has been selected as the
X = 0 point. The surface was finished to 0.8 µm and could be actively cooled by small circumferential coolant
3 passages, of which there were 36 in the nozzle and 31 in the approach section. The boundary layer was tripped
by a 1.5 mm square step mounted inside the duct at the outlet from the settling chamber contraction
(X = - 1.110 m). The velocity profile at the first traverse station was typical of a fully developed turbulent
4 layer. The cooled approach duct allowed the thermal layer to form with approximately the same wall temperature
as in the nozzle, and from a point just downstream of the boundary layer trip.

6 There were some 45 static pressure taps (d = 0.51 mm) in the nozzle and 9 in the cooled approach duct.
Thermocouples were fixed in the coolant passages, and the "gas-side" wall temperatures were calculated from
these "water-side" measurements and the heat-flux, which was determined calorimetrically. The technique is
described by Back, Massier and Cuffel (1967).

8 The 6 profile traverse stations were at X (axial) = 0, 90.50, 147.57, 185.67, 223.80 and 528.04 mm (the
7 throat is at 313.06 mm - see table 1). The Pitot tube was an FPP (h_1 = 0.127, b_1 = 1.65, 1 = 12.7 mm) and
two types of TTP were used. In the subsonic region an exposed thermocouple 0.1 mm thick in the direction
normal to the wall was mounted on a support for which h_1 = 0.25, b_1 = 6.86, 1 = 12.7 mm. At the supersonic
8 station, an SIP was used for which h_1 = 0.25 mm. The Pitot probe was always located 90° circumferentially
from the TTP at the same X-station. Only one pair of probes was in use at any one time.

9 The authors have interpolated the static pressure measurements to the nominal X-values of the heat-flux
measurements. These values are presented together in section D. The heat flux measurements are the average
of at least 5 runs. The authors' CF values, quoted for the profiles, are based on a momentum balance for
the four stations in the converging cone, on a form of Reynolds analogy in the approach duct, and in the
supersonic diverging flow, on the velocity profile in the sublayer. Very close to the wall the TTP gave
readings below those indicated by an extrapolation of the TO profile to meet the TW value, and the values
11 were adjusted to fit the extrapolation. Transport properties were taken as for air, from Hilsenrath et al.
(1955).

12 The heat flux and pressure values are given separately in section D for the 01 series with strong wall
cooling. The authors state that, for the 02 series (heat transfer to the gas but near adiabatic), the
temperature differences were too small to allow of meaningful distributed values, and suggest that the
wall temperature be taken as constant at 1.10 TOD. The editors have accepted this, and the presumption
that the pressure distribution is effectively the same in the two cases. Boundary conditions for the

profiles are thus taken from the authors' interpolations. It has been assumed that P = PD through the boundary layer.

13 The two sets of six profiles describe the development of the boundary layer through a nozzle expansion. The low velocity history is fully described (profiles 1-5) but there is only one supersonic profile. The
14 two cases are firstly (Series 01) a flow with strongly cooled wall in which the wall heat-flux and
14 temperature are given in detail. The second series (02) describes a near-adiabatic set, and is without a detailed temperature history. The CF values are as estimated by the authors.

§ DATA: 7207 0101-0206. Pitot and TO profiles measured simultaneously. NX = 6. Heat flux by calorimetry.

15 Editors' comments

This entry is included principally as a challenge for calculation methods. In both series, the state of the boundary layer upstream of the throat is very fully described, and a fully developed calculation scheme should be able to predict the subsequent heat transfer distribution and the final velocity profile from the full wall pressure and temperature data given. The heat transfer case (series 01) is similar to the "cooled inlet" series of Boldman et al. - CAT 6901, series 02 - for which, however, the emphasis in measurement lay on the supersonic side of the throat.

The authors' CF values appear quite reasonable when the profiles are plotted out in comparison with the wall law, though the values for the supersonic profiles, 0106, 0206 are probably too high. In general measurements do not extend within the momentum-deficit peak.

The measurements described here form only part of an extended project described in about ten frequently overlapping papers.

TABLE 1 GEOMETRY OF DUCT - DIMENSIONS in mm

	X (Axial)	X (Contour)	- RZ
End of contraction (E)	- 1110.00	- 1110.00	63.50
Start of cooled approach	- 1053.85	- 1053.85	63.50
First profile station	0	0	63.50
End of parallel approach	+ 59.95	+ 59.95	63.50
Circular arc fairing with radius 40.64			
Start of conical contraction	67.01	-	59.61
Second profile station	90.50	90.91	58.67
Third profile station	147.57	148.89	48.51
Fourth profile station	185.67	187.55	41.88
Fifth profile station	223.80	226.26	35.16
End of conical contraction	304.29	-	20.96
Circular arc fairing with radius 50.47			
Throat	313.06	317.07	20.19
Start of conical expansion	321.84	-	20.96
Sixth profile station	528.04	535.08	57.76
End of conical expansion	556.87	-	63.06

CAT 7207 BACK/CUFFEL BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ *	H32	H32K	TW*	TD
RZ *	TOD*	SW *	D2	P12	H42	D2K	UD	TR
72070101	0.0637	0.4627	1.7644"+04	3.2000"-03	0.5627	1.3644	1.0285"+06	1.0285"+06
0.0000"+00	1.0315"+06	1.0000	1.0512"+04	1.0500"-03	1.7922	1.7982	3.8556"+02	8.3266"+02
-6.3500"-02	8.3333"+02	0.0000	2.4872"-03	NC	0.6063	2.1549"-03	3.6854"+01	8.3326"+02
72070102	0.0723	0.4545	1.6106"+04	5.0000"-03	0.3536	1.2397	1.0311"+06	1.0311"+06
9.0907"-02	1.0349"+06	1.0000	9.4763"+03	8.9000"-04	1.8481	1.8514	3.8000"+02	8.3524"+02
-5.8674"-02	8.3611"+02	0.0000	1.9774"-03	NC	0.7208	1.7260"-03	4.1894"+01	8.3602"+02
72070103	0.1038	0.4759	1.3303"+04	5.2000"-03	-0.0469	1.1548	1.0299"+06	1.0299"+06
1.4884"-01	1.0377"+06	1.0000	8.0969"+03	8.9000"-04	1.9041	1.9033	3.9778"+02	8.3431"+02
-4.8514"-02	8.3611"+02	0.0000	1.1768"-03	NC	1.0634	1.0327"-03	6.0113"+01	9.3592"+02
72070104	0.1367	0.4910	1.2926"+04	4.0000"-03	-0.3372	1.1576	1.0228"+06	1.0228"+06
1.8755"-01	1.0363"+06	1.0000	8.0337"+03	8.5000"-04	1.9054	1.9110	3.9944"+02	8.1086"+02
-4.1885"-02	8.1389"+02	0.0000	8.6448"-04	NC	1.3511	7.4842"-04	7.8046"+01	8.1357"+02
72070105	0.1944	0.4997	1.4951"+04	4.6000"-03	-0.2625	1.1591	1.0046"+06	1.0046"+06
2.2626"-01	1.0315"+06	1.0000	9.4510"+03	7.5000"-04	1.9085	1.9144	4.1611"+02	8.2708"+02
-3.5154"-02	8.3333"+02	0.0000	7.4453"-04	NC	1.2860	6.4975"-04	1.1209"+02	8.3268"+02
72070106	3.3663	0.4613	1.0570"+04	1.7600"-03	-0.3221	1.2399	1.6464"+04	1.6464"+04
5.3508"-01	1.0370"+06	1.0000	1.3681"+04	3.3000"-04	1.8840	1.8692	3.5667"+02	2.5512"+02
-5.7760"-02	8.3333"+02	0.0000	9.2080"-04	NC	1.7826	9.0831"-04	1.0780"+03	7.7320"+02
72070201	0.0650	1.1087	2.4142"+04	1.7600"-03	1.4542	1.3290	1.0339"+06	1.0339"+06
0.0000"+00	1.0370"+06	1.0000	2.6144"+04	NM	1.8203	1.8189	3.2333"+02	2.7142"+02
-6.3500"-02	2.9167"+02	0.0000	1.7223"-03	NC	-0.0944	1.7550"-03	2.2248"+01	2.9164"+02
72070202	0.0740	1.0246	2.2065"+04	3.3600"-03	1.2195	1.1785	1.0289"+06	1.0289"+06
9.0907"-02	1.0328"+06	1.0000	2.2498"+04	NM	1.8859	1.8857	3.0278"+02	2.9523"+02
-5.8674"-02	2.9556"+02	0.0000	1.3301"-03	NC	-0.0317	1.3371"-03	2.5493"+01	2.9552"+02
72070203	0.1030	1.0245	1.3560"+04	3.5400"-03	1.1911	1.1128	1.0266"+06	1.0266"+06
1.4884"-01	1.0342"+06	1.0000	1.3836"+04	NM	1.9425	1.9422	3.0500"+02	2.9715"+02
-4.8514"-02	2.9778"+02	0.0000	5.9383"-04	NC	-0.0674	5.9683"-04	3.5599"+01	2.9771"+02
72070204	0.1380	1.0807	5.7686"+03	3.4400"-03	1.8703	1.1968	1.0253"+06	1.0253"+06
1.8755"-01	1.0390"+06	1.0000	6.1400"+03	NM	1.9281	1.9267	3.1389"+02	2.8945"+02
-4.1885"-02	2.9056"+02	0.0000	1.9046"-04	NC	-0.6319	1.9467"-04	4.7074"+01	2.9044"+02
72070205	0.1970	1.0940	7.0765"+03	3.9400"-03	1.8389	1.1821	1.0093"+06	1.0093"+06
2.2626"-01	1.0370"+06	1.0000	7.6228"+03	NM	1.9453	1.9441	3.1944"+02	2.8997"+02
-3.5154"-02	2.9222"+02	0.0000	1.6865"-04	NC	-0.6053	1.7239"-04	6.7260"+01	2.9199"+02
72070206	3.6140	1.1682	2.6698"+03	1.3600"-03	8.1010	1.3604	1.1599"+04	1.1599"+04
5.3508"-01	1.0390"+06	1.0000	8.8815"+03	NM	1.8362	1.8071	3.1389"+02	8.0437"+01
-5.7760"-02	2.9056"+02	0.0000	1.5684"-04	NC	-0.2268	2.7857"-04	6.4987"+02	2.6870"+02

TRAPEZOIDAL RULE FOR RUN 0106

72070101 BACK/CUFFEL PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.46163	0.00000	0.00000	0.46200	0.00000
2	1.7780"-04	1.0009"+00	NM	0.71290	0.54963	0.46420	0.71330	0.65078
3	2.0320"-04	1.0009"+00	NM	0.72160	0.56490	0.48000	0.72200	0.66482
4	2.5400"-04	1.0010"+00	NM	0.73611	0.58716	0.50390	0.73650	0.68418
5	3.0480"-04	1.0010"+00	NM	0.74322	0.60152	0.51870	0.74360	0.69755
6	3.5560"-04	1.0011"+00	NM	0.74952	0.61272	0.53060	0.74990	0.70756
7	4.3180"-04	1.0011"+00	NM	0.75653	0.62655	0.54510	0.75690	0.72017
8	4.9530"-04	1.0011"+00	NM	0.76173	0.63598	0.55520	0.76210	0.72851
9	5.5880"-04	1.0012"+00	NM	0.76754	0.64396	0.56430	0.76790	0.73486
10	6.8580"-04	1.0012"+00	NM	0.77574	0.65837	0.58000	0.77610	0.74733
11	8.1280"-04	1.0013"+00	NM	0.78256	0.67630	0.59840	0.78290	0.76434
12	9.3980"-04	1.0013"+00	NM	0.78896	0.68132	0.60530	0.78930	0.76688
13	1.1938"-03	1.0014"+00	NM	0.79997	0.69741	0.62390	0.80030	0.77958
14	1.4478"-03	1.0015"+00	NM	0.80858	0.71549	0.64350	0.80890	0.79552
15	1.8288"-03	1.0015"+00	NM	0.81839	0.73208	0.66240	0.81870	0.80909
16	2.2098"-03	1.0016"+00	NM	0.82880	0.74812	0.68120	0.82910	0.82161
17	2.7178"-03	1.0017"+00	NM	0.83852	0.76846	0.70380	0.83880	0.83906
18	3.3528"-03	1.0018"+00	NM	0.85004	0.78819	0.72680	0.85030	0.85476
19	3.9878"-03	1.0018"+00	NM	0.85975	0.80314	0.74480	0.86000	0.86605
20	5.2578"-03	1.0020"+00	NM	0.87638	0.83235	0.77930	0.87660	0.88900
21	6.5278"-03	1.0021"+00	NM	0.89181	0.85764	0.81000	0.89200	0.90807
22	7.7978"-03	1.0022"+00	NM	0.90603	0.88020	0.83790	0.90620	0.92463
23	9.0678"-03	1.0023"+00	NM	0.91776	0.90129	0.86350	0.91790	0.94073
24	1.0338"-02	1.0024"+00	NM	0.92908	0.92007	0.88690	0.92920	0.95448
25	1.2878"-02	1.0026"+00	NM	0.94752	0.94920	0.92400	0.94760	0.97509
26	1.5418"-02	1.0027"+00	NM	0.96025	0.97056	0.95110	0.96030	0.99042
27	1.7958"-02	1.0028"+00	NM	0.97038	0.98458	0.96990	0.97040	0.99948
28	2.0498"-02	1.0028"+00	NM	0.97839	0.99318	0.98240	0.97840	1.00409
29	2.5578"-02	1.0028"+00	NM	0.98920	0.99831	0.99290	0.98920	1.00374
30	3.0658"-02	1.0028"+00	NM	0.99540	1.00000	0.99770	0.99540	1.00231
D 31	3.5738"-02	1.0028"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72070102 BACK/CUFFEL PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.45652	0.00000	0.00000	0.45700	0.00000
2	6.3500"-05	1.0013"+00	NM	0.67595	0.60066	0.49400	0.67640	0.73034
3	8.3820"-05	1.0016"+00	NM	0.68909	0.65682	0.54540	0.68950	0.79101
4	1.0922"-04	1.0018"+00	NM	0.71521	0.69308	0.58630	0.71560	0.81931
5	1.3462"-04	1.0019"+00	NM	0.73252	0.71406	0.61130	0.73290	0.83400
6	1.7272"-04	1.0020"+00	NM	0.74694	0.73572	0.63600	0.74730	0.85106
7	2.2352"-04	1.0021"+00	NM	0.75846	0.75147	0.65460	0.75880	0.86268
8	2.9972"-04	1.0022"+00	NM	0.77287	0.76957	0.67670	0.77320	0.87519
9	4.2672"-04	1.0023"+00	NM	0.78149	0.78716	0.69600	0.78180	0.89025
10	6.8072"-04	1.0024"+00	NM	0.79441	0.80441	0.71710	0.79470	0.90235
11	9.3472"-04	1.0024"+00	NM	0.80442	0.81411	0.73030	0.80470	0.90754
12	1.4427"-03	1.0025"+00	NM	0.82003	0.82610	0.74820	0.82030	0.91211
13	1.9507"-03	1.0026"+00	NM	0.83294	0.83786	0.76480	0.83320	0.91791
14	2.4587"-03	1.0026"+00	NM	0.84295	0.84486	0.77580	0.84320	0.92007
15	3.7287"-03	1.0027"+00	NM	0.86417	0.86326	0.80260	0.86440	0.92851
16	4.9987"-03	1.0028"+00	NM	0.88409	0.88114	0.82860	0.88430	0.93701
17	7.5387"-03	1.0031"+00	NM	0.90954	0.91394	0.87170	0.90970	0.95823
18	1.0079"-02	1.0032"+00	NM	0.93379	0.93938	0.90780	0.93390	0.97205
19	1.2619"-02	1.0034"+00	NM	0.95212	0.95798	0.93480	0.95220	0.98173
20	1.5159"-02	1.0035"+00	NM	0.96605	0.97426	0.95760	0.96610	0.99120
21	1.7699"-02	1.0036"+00	NM	0.97737	0.98621	0.97500	0.97740	0.99754
22	2.0239"-02	1.0036"+00	NM	0.98439	0.99610	0.98830	0.98440	1.00396
23	2.5319"-02	1.0037"+00	NM	0.99580	1.00000	0.99790	0.99580	1.00211
D 24	3.0399"-02	1.0037"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72070103 BACK/CUFFEL PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.47597	0.00000	0.00000	0.47700	0.00000
2	6.3500"-05	1.0038"+00	NM	0.68816	0.70663	0.58650	0.68890	0.85136
3	7.6200"-05	1.0043"+00	NM	0.69386	0.75801	0.63170	0.69450	0.90958
4	1.0160"-04	1.0047"+00	NM	0.71231	0.78523	0.66300	0.71290	0.93000
5	1.2700"-04	1.0048"+00	NM	0.72832	0.79461	0.67840	0.72890	0.93072
6	1.6510"-04	1.0050"+00	NM	0.73357	0.81420	0.69760	0.73410	0.95028
7	2.1590"-04	1.0052"+00	NM	0.74711	0.83353	0.72070	0.74760	0.96402
8	2.9210"-04	1.0055"+00	NM	0.76356	0.85577	0.74800	0.76400	0.97906
9	3.6830"-04	1.0057"+00	NM	0.77360	0.87170	0.76690	0.77400	0.99083
10	4.9530"-04	1.0061"+00	NM	0.78497	0.89621	0.79420	0.78530	1.01133
11	7.4930"-04	1.0064"+00	NM	0.80274	0.92010	0.82450	0.80300	1.02677
12	1.0033"-03	1.0066"+00	NM	0.81817	0.93185	0.84300	0.81840	1.03006
13	1.5113"-03	1.0067"+00	NM	0.83910	0.94189	0.86290	0.83930	1.02812
14	2.5273"-03	1.0068"+00	NM	0.86451	0.94721	0.88080	0.86470	1.01862
15	3.7973"-03	1.0069"+00	NM	0.88213	0.95411	0.89620	0.88230	1.01575
16	5.0673"-03	1.0070"+00	NM	0.89885	0.95934	0.90960	0.89900	1.01179
17	6.3373"-03	1.0070"+00	NM	0.91026	0.96390	0.91970	0.91040	1.01022
18	7.6073"-03	1.0071"+00	NM	0.92678	0.96837	0.93230	0.92690	1.00583
19	1.0147"-02	1.0072"+00	NM	0.95011	0.97663	0.95200	0.95020	1.00189
20	1.2687"-02	1.0073"+00	NM	0.96813	0.98326	0.96750	0.96820	0.99928
21	1.5227"-02	1.0074"+00	NM	0.97915	0.98803	0.97770	0.97920	0.99847
22	2.0307"-02	1.0075"+00	NM	0.99248	0.99424	0.99050	0.99250	0.99798
23	2.5387"-02	1.0075"+00	NM	0.99849	0.99785	0.99710	0.99850	0.99860
D 24	3.0467"-02	1.0076"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72070104 HACK/CUFFEL PROFILE TABULATION 27 POINTS, DELTA AT POINT 27

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.48021	0.00000	0.00000	0.48200	0.00000
2	6.3500"-05	1.0065"+00	NM	0.68022	0.70391	0.58110	0.68150	0.85268
3	8.8900"-05	1.0073"+00	NM	0.69785	0.74743	0.62490	0.69900	0.89399
4	1.1430"-04	1.0080"+00	NM	0.71226	0.77980	0.65860	0.71330	0.92331
5	1.3970"-04	1.0083"+00	NM	0.72082	0.79639	0.67660	0.72180	0.93738
6	1.6510"-04	1.0086"+00	NM	0.72657	0.80932	0.69030	0.72750	0.94887
7	2.1590"-04	1.0090"+00	NM	0.73804	0.82853	0.71220	0.73890	0.96387
8	2.6670"-04	1.0093"+00	NM	0.74670	0.84365	0.72940	0.74750	0.97579
9	3.1750"-04	1.0096"+00	NM	0.75466	0.85740	0.74520	0.75540	0.98650
10	3.9370"-04	1.0102"+00	NM	0.76386	0.88030	0.76970	0.76450	1.00680
11	5.2070"-04	1.0108"+00	NM	0.77829	0.90845	0.80170	0.77880	1.02940
12	6.4770"-04	1.0113"+00	NM	0.79248	0.92616	0.82470	0.79290	1.04011
13	7.7470"-04	1.0117"+00	NM	0.80526	0.94201	0.84550	0.80560	1.04953
14	1.0287"-03	1.0121"+00	NM	0.82655	0.95811	0.87120	0.82680	1.05370
15	1.2827"-03	1.0123"+00	NM	0.83920	0.96705	0.88600	0.83940	1.05552
16	1.5367"-03	1.0124"+00	NM	0.84913	0.97257	0.89630	0.84930	1.05534
17	2.0447"-03	1.0125"+00	NM	0.86316	0.97725	0.90800	0.86330	1.05178
18	2.8067"-03	1.0126"+00	NM	0.87446	0.97861	0.91520	0.87460	1.04642
19	3.8227"-03	1.0126"+00	NM	0.88687	0.98003	0.92300	0.88700	1.04059
20	5.0927"-03	1.0127"+00	NM	0.90228	0.98184	0.93270	0.90240	1.03358
21	6.3627"-03	1.0127"+00	NM	0.91669	0.98319	0.94140	0.91680	1.02683
22	7.6327"-03	1.0128"+00	NM	0.93041	0.98639	0.95150	0.93050	1.02257
23	1.0173"-02	1.0129"+00	NM	0.95684	0.99099	0.96940	0.95690	1.01306
24	1.2713"-02	1.0130"+00	NM	0.97476	0.99461	0.98200	0.97480	1.00739
25	1.5253"-02	1.0131"+00	NM	0.98598	0.99690	0.98990	0.98600	1.00396
26	2.0333"-02	1.0131"+00	NM	0.99440	1.00000	0.99720	0.99440	1.00282
D 27	2.5413"-02	1.0131"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72070105 BACK/CUFFEL PROFILE TABULATION 33 POINTS, DELTA AT POINT 33

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.49923	0.00000	0.00000	0.50300	0.00000
2	6.3500"-05	1.0129"+00	NM	0.68713	0.69593	0.57800	0.68980	0.83792
3	8.1280"-05	1.0150"+00	NM	0.69920	0.75004	0.62820	0.70150	0.89551
4	9.3980"-05	1.0159"+00	NM	0.706[illegible]6	0.77330	0.65100	0.70870	0.91858
5	1.[illegible]938"-04	1.0168"+00	NM	0.71990	0.79468	0.67520	0.72190	0.93531
6	1.3208"-04	1.0170"+00	NM	0.72422	0.79819	0.68020	0.72620	0.93666
7	1.4478"-04	1.0175"+00	NM	0.72871	0.80983	0.69220	0.73060	0.94744
8	1.7018"-04	1.0179"+00	NM	0.73887	0.81893	0.70480	0.74070	0.95153
9	1.9558"-04	1.0183"+00	NM	0.74624	0.82799	0.71610	0.74800	0.95735
10	2.4638"-04	1.0192"+00	NM	0.75800	0.84803	0.73910	0.75960	0.97301
11	2.9718"-04	1.0202"+00	NM	0.76840	0.87077	0.76400	0.76980	0.99247
12	3.4798"-04	1.0210"+00	NM	0.77857	0.88839	0.78450	0.77980	1.00603
13	3.9878"-04	1.0217"+00	NM	0.786[illegible]1	0.90268	0.80090	0.78720	1.01740
14	4.4958"-04	1.0223"+00	NM	0.79142	0.91415	0.81400	0.79290	1.02661
15	5.5118"-04	1.0231"+00	NM	0.80220	0.93137	0.83460	0.80300	1.03935
16	6.7818"-04	1.0240"+00	NM	0.81168	0.94826	0.85580	0.81450	1.05071
17	8.0518"-04	1.0246"+00	NM	0.82551	0.95935	0.87190	0.82600	1.05557
18	9.3218"-04	1.0249"+00	NM	0.83418	0.96556	0.88210	0.83460	1.05691
19	1.0592"-03	1.0252"+00	NM	0.84144	0.97090	0.89080	0.84180	1.05821
20	1.3132"-03	1.0254"+00	NM	0.85160	0.97629	0.90110	0.85190	1.05775
21	1.8212"-03	1.0256"+00	NM	0.86594	0.98012	0.91220	0.86620	1.05311
22	2.3292"-03	1.0257"+00	NM	0.87685	0.98085	0.91860	0.87710	1.04732
23	3.0912"-03	1.0257"+00	NM	0.88595	0.98122	0.92370	0.88620	1.04232
24	3.8532"-03	1.0257"+00	NM	0.89726	0.98167	0.93000	0.89750	1.03621
25	5.1232"-[illegible]	1.0258"+00	NM	0.91476	0.98217	0.93930	0.91460	1.02701
26	6.39[illegible]-03	1.0259"+00	NM	0.93178	0.98405	0.95000	0.93200	1.01931
27	[illegible].0632"-03	1.0259"+00	NM	0.94589	0.985[illegible]3	0.95850	0.94610	1.01311
[illegible]	8.9332"-03	1.0260"+00	NM	0.96001	0.98653	0.96670	0.96020	1.00677
29	1.0203"-02	1.0261"+00	NM	0.97143	0.98823	0.97410	0.97160	1.00257
30	1.2743"-02	1.0263"+00	NM	0.98559	0.99222	0.98510	0.98570	0.99939
31	1.5283"-02	1.0264"+00	NM	0.99412	0.99479	0.99190	0.99420	0.99769
32	2.0363"-02	1.0267"+00	NM	0.99999	0.99930	0.99930	1.00000	0.99930
D 33	2.2903"-02	1.0267"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

72070106 BACK/CUFFEL PROFILE TABULATION 41 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.42616	0.00000	0.00000	1.39200	0.00000
2	6.3500"-05	1.9728"+00	NM	0.55208	0.30747	0.37470	1.48510	0.25231
3	8.8900"-05	2.4442"+00	NM	0.58982	0.36020	0.43950	1.48880	0.29520
4	1.1430"-04	3.0130"+00	NM	0.61964	0.41280	0.49880	1.46010	0.34162
5	1.3970"-04	3.4947"+00	NM	0.64533	0.45194	0.54250	1.44090	0.37650
6	1.6510"-04	3.9373"+00	NM	0.65601	0.48489	0.57330	1.39790	0.41012
7	2.1590"-04	4.7107"+00	NM	0.67057	0.53737	0.61830	1.32390	0.46703
8	2.6670"-04	5.4130"+00	NM	0.67998	0.58077	0.65160	1.25880	0.51764
9	3.1750"-04	6.0058"+00	NM	0.68600	0.61496	0.67550	1.20660	0.55984
10	3.9370"-04	6.6684"+00	NM	0.69654	0.65100	0.70130	1.16050	0.60431
11	4.69[illegible]0"-04	7.0873"+00	NM	0.70678	0.67277	0.71820	1.13960	0.63022
12	5.7150"-04	7.3484"+00	NM	0.71782	0.68599	0.73070	1.13460	0.64402
13	6.9850"-04	7.4971"+00	NM	0.72843	0.69341	0.73990	1.13860	0.64983
14	8.2550"-04	7.7982"+00	NM	0.73792	0.70623	0.75120	1.13140	0.66396
15	1.0795"-03	8.5641"+00	NM	0.76040	0.74441	0.78110	1.10100	0.70945
16	1.3335"-03	9.2745"+00	NM	0.77364	0.77651	0.80240	1.06780	0.75145
17	1.5875"-03	1.0035"+01	NM	0.78694	0.80932	0.82320	1.03460	0.79567
18	1.8415"-03	1.0679"+01	NM	0.80131	0.83629	0.84150	1.01250	0.83111
19	2.0955"-03	1.1271"+01	NM	0.81117	0.86024	0.85580	0.98970	0.86471
20	2.6035"-03	1.2345"+01	NM	0.82905	0.90207	0.88020	0.95210	0.92448
21	3.1115"-03	1.3324"+01	NM	0.84523	0.93854	0.90090	0.92140	0.97775
22	3.6195"-03	1.4[illegible]51"+01	NM	0.85949	0.96473	0.91670	0.90290	1.01528
23	4.1275"-03	1.4453"+01	NM	0.86739	0.97895	0.92520	0.89320	1.03583
24	5.1435"-03	1.4905"+01	NM	0.88577	0.99463	0.93960	0.89240	1.05289
25	6.4135"-03	1.5219"+01	NM	0.89197	1.00542	0.94600	0.88530	1.06856
26	7.0835"-03	1.5416"+01	NM	0.90405	1.01212	0.95430	0.88900	1.07345
27	1.0224"-02	1.5614"+01	NM	0.92348	1.01879	0.96640	0.89980	1.07402
28	1.2002"-02	1.5733"+01	NM	0.93703	1.02278	0.97460	0.90800	1.07335
29	1.2764"-02	1.6174"+01	NM	0.94338	1.03748	0.98200	0.89590	1.09610
30	1.3780"-02	1.5813"+01	NM	0.95178	1.02546	0.98300	0.91890	1.06976
31	1.5304"-02	1.5826"+01	NM	0.96086	1.02590	0.98780	0.92710	1.06547
32	1.6828"-02	1.5946"+01	NM	0.96701	1.02992	0.99210	0.92790	1.06919
33	1.8606"-02	1.5804"+01	NM	0.97572	1.02516	0.99520	0.94240	1.05603
34	2.2415"-02	1.5791"+01	NM	0.98383	1.02473	0.99920	0.95080	1.05090
35	2.4955"-02	1.5561"+01	NM	0.99301	1.01702	1.00160	0.96990	1.03268
36	2.6987"-02	1.5645"+01	NM	0.99593	1.01983	1.00390	0.96930	1.03602
37	2.8512"-02	1.5195"+01	NM	0.99601	1.00459	0.99940	0.98970	1.00980
38	2.9762"-02	1.5164"+01	NM	0.99686	1.00352	0.99950	0.99200	1.00756
39	3.0797"-02	1.4824"+01	NM	0.99703	0.99184	0.99600	1.00840	0.98770
40	3.2830"-02	1.4739"+01	NM	0.99847	0.98890	0.99580	1.01400	0.98205
D 41	3.5115"-02	1.5061"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

SECTION D: ADDITIONAL DATA
WALL TEMPERATURE, PRESSURE, AND HEAT FLUX
AUTHORS UNITS

X, RZ - inches.   TW - ^{o}R   Q/A - BTU/in^{2}sec.   PO = 150.0 psia   TO = 1500^{o}R

Normalised average data, five runs. Brackets mark an interpolated value.

X AXIAL in	-RZ in	TW ^{o}R	PW/PO -	MD -	Q/A BTU/in^{2}sec.
- 39.97	2.500	710	.99740	.06100	.1370
- 38.95	2.500	706	.99740	.06098	.1258
- 38.00	2.500	707	.99740	.06096	.1180
- 37.05	2.500	709	.99740	.06095	.1121
- 36.09	2.500	708	.99740	.06095	.1179
- 35.11	2.500	705	.99741	.06093	.1199
- 33.85	2.500	705	.99741	.06091	.1167
- 32.33	2.500	704	.99741	.06089	.1070
- 30.85	2.500	703	.99741	.06088	.1021
- 29.39	2.500	702	.99739	.06114	.1004
- 27.93	2.500	701	.99737	.06141	.1009
- 26.47	2.500	705	.99734	.06167	.0965
- 24.99	2.500	706	.99732	.06193	.1027
- 23.50	2.500	705	.99730	.06219	.0985
- 21.73	2.500	696	.99727	.06250	.0946
- 19.71	2.500	698	.99724	.06284	.0888
- 17.73	2.500	699	.99724	.06289	.0888
- 15.76	2.500	697	.99723	.06295	.0879
- 13.80	2.500	697	.99723	.06301	.0898
- 11.83	2.500	699	.99722	.06306	.0897
- 9.86	2.500	698	.99722	.06312	.0903
- 7.88	2.500	702	.99721	.06318	.0944
- 5.89	2.500	699	.99720	.06326	.0927
- 4.35	2.500	691	.99720	.06328	.0993
- 3.32	2.500	691	.99720	.06331	.0885
- 2.36	2.500	691	.99720	.06336	.0903
- 1.41	2.500	692	.99719	.06338	.0844
- 0.46	2.500	691	.99719	.06344	.0860
0.00	2.500	(691)	.9972	.06346	(.0904)
0.564	2.500	692	.9972	.06349	.0946
1.625	2.500	690	.9972	.06335	.0964
2.309	2.497	683	.9973	.06194	.1073
2.612	2.477	676	.9973	.06180	.0762
2.885	2.429	692	.9971	.06443	.0882
3.161	2.380	688	.9969	.06715	.0810
3.436	2.332	690	.9965	.07052	.0894
3.563	2.310	(691)			(.0945)
3.943	2.242	692	.9959	.07693	.0996
4.692	2.110	698	.9947	.08731	.1129
5.441	1.978	703	.9933	.09825	.1219
5.810	1.910	(707)			(.1335)
6.189	1.846	711	.9912	.11263	.1451
6.937	1.714	718	.9884	.12917	.1640
7.310	1.649	(724)			(.1694)
7.681	1.583	730	.9838	.15290	.1749
8.426	1.452	739	.9773	.18126	.1928
8.811	1.384	(743)			(.2129)
9.176	1.320	747	.9674	.21818	.2330
9.923	1.188	760	.9491	.2741	.2591
10.667	1.056	789	.9215	.3438	.3001

SECTION D (CONT.): ADDITIONAL DATA

WALL TEMPERATURE, PRESSURE, AND HEAT FLUX

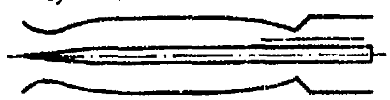
AUTHORS UNITS

X, RZ - inches. TW - ^oR Q/A - $BTU/in^2sec.$ PO = 150.0 psia TO = 1500^oR

Normalised average data, five runs. Brackets mark an interpolated value.

X AXIAL in	- RZ in	TW ^oR	PW/PO -	MO -	Q/A $BTU/in^2sec.$
11.189	0.966	812	.8780	.4351	.3088
11.465	0.916	834	.8403	.5048	.3309
11.741	0.867	842	.7897	.5907	.3469
12.032	0.816	810	.6605	.7931	.3732
12.336	0.795	806	.4807	1.0789	.3353
12.646	0.821	780	.2984	1.4366	.2996
12.933	0.872	783	.2554	1.5442	.2716
13.450	0.963	776	.1783	1.784	.2076
14.196	1.095	741	.1161	2.062	.1660
14.931	1.225	730	.0731	2.357	.1217
15.657	1.353	720	.0501	2.600	.0984
16.393	1.483	707	.0364	2.808	.0715
17.130	1.614	693	.0276	2.990	.0642
17.865	1.744	665	.0250	3.057	.0586
18.560	1.866	672	.0211	3.171	.0484
19.015	1.949	666	.0187	3.254	
19.316	2.004	660	.0171	3.316	.0472
19.752	2.084	658	.0152	3.395	.0428
20.294	2.184	655	.0144	3.435	.0380
20.789	2.274	(649)			(.0352)
20.830	2.282	649	.0120	3.563	.0352
21.369	2.380	647	.0104	3.662	.0316

axisymmetric



M : 6 falling to 4.6

R THETA X 10^{-3} : 96 - 140

TW/TR : 0.7

7208

APG - MHT

Blow-down axisymmetrical tunnel with contoured nozzle. D = 0.3048 m.
PO : 13.4 MN/m^2. TO : 460 K. Air. RE/m X 10^{-6} : 124.

ZAKKAY V. and WANG C.-R., 1972. Turbulent boundary layer in an adverse pressure gradient without effect of wall curvature. NASA CR 11-2247.

1 The test boundary layer was formed on an axi-symmetric centre body. This started with a small diameter section passing through the throat and having a streamlined nose. The nose section was faired into a parallel sided section 116.5 mm in diameter. The test region started at 0.1554 m downstream of the throat. (X = 0). A contoured compression sleeve was fitted inside the tunnel test section, and formed a compression
4 which was focused onto the centre body. The static pressure then increased approximately linearly from X = 0 to X = 120 mm, then rather more rapidly before reaching a maximum at about X = 190 mm, and then
6 falling. The pressure increased, overall, by a factor of about seven. The cylindrical portion of the model was equipped with pressure taps and thermocouples at approximately 10 mm [E] intervals. Heat transfer was determined using the transient thin-wall technique.

7 A combined, triple, probe was used to measure Pitot, TO and static pressure profiles. The FPP was made from flattened 1 mm tube so that at the tip [E] h_1 = 0.35, h_2 = 0.05 mm. The TTP was an "unshielded" open tip chromel-alumel thermocouple about [E] 1 mm in diameter. The SPP "had a conical tip faired into" a 1 mm diameter tube. The available sketch suggests that [E] the effective slender length of the probes was of
8 the order of 10 mm. The SPP was mounted in the centre, with the FPP and the TTP 3.2 mm to either side.

9 No details are given of reduction or interpolation procedures. The integral data, presented graphically,
10 uses a pressure-based reference flow. No profile corrections are reported, nor is the viscosity law used.
11

12 The editors present the eight profiles measured. These are given in the source directly as measured by the SPP, the TPP and the TTP. We have reduced the data assuming the test gas to be air. The heat transfer data given has been scaled from the original graphical presentation. We have selected a D-state on the basis of the computed PO values.

13 The eight profiles form a sequence, with the first five showing the development from a near-constant-pressure region through the compression, and the last three describing a region in which, again, the flow
14 is not varying rapidly. Heat transfer values appropriate to the profiles have been interpolated by the editors.

§ DATA 7208 0101-0108. Pitot, TO and P profiles obtained simultaneously. NX = 8. Heat transfer data from the transient technique.

15 <u>Editors' comments</u>

The experiment describes a very interesting and difficult flow case. Unfortunately the data is not of particularly good quality, and is very badly reported. Much of the description above has required considerable imagination on the part of the editors. New and more careful data of this type would be valuable.

The flow undergoes a very strong reflected-wave compression, and streamline curvature is quite marked at relatively small distances from the straight wall, so that there are large normal pressure gradients. Hence SW has been arbitrarily set at 0.5. There will also be a "focusing" of the compression wave as the waves approach the axis, in contrast to the other reflected wave compression experiments (Peake et al. - CAT 7102, Lewis et al. - CAT 7201) in which the compression is radiated out from a centrebody. Effects of transverse curvature are likely to be significant, as δ/RZ is of order 0.2.

There are relatively few data points in each profile, and, in half the cases, measurements do not extend within the momentum deficit peak.

CAT 7208 ZAKKAY BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X RZ *	MD * POD TOD*	TW/TR PW/PD SH *	RED2W RED2D D2	CF CQ * PI2	H12 H32 H42	H12K H32K D2K	PW* TW* UD	PD* TD TR
72080101	6.0000	0.7190	1.7962"+04	NM	14.7096	1.4747	9.2000"+03	8.6000"+03
NM	1.3578"+07	1.0698	5.3303"+04	6.8649"-05	1.8608	1.8154	2.9400"+02	5.4878"+01
5.8250"-02	4.5000"+02	0.5000	6.7335"-04	NC	0.1121	1.6047"-03	8.9117"+02	4.0891"+02
72080102	5.6000	0.7098	2.5829"+04	NM	8.1243	1.5046	1.6500"+04	1.1700"+04
3.8100"-02	1.2133"+07	1.4103	1.0497"+05	9.5661"-05	1.8356	1.7918	2.9400"+02	6.2569"+01
5.8250"-02	4.5500"+02	0.5000	8.1423"-04	NC	0.2789	1.6332"-03	8.8813"+02	4.1419"+02
72080103	5.3500	0.7152	2.6774"+04	NM	9.9820	1.5606	2.2000"+04	1.5800"+04
6.9800"-02	1.2459"+07	1.3924	1.0148"+05	9.5510"-06	1.8088	1.7760	2.9400"+02	6.7068"+01
5.8250"-02	4.5100"+02	0.5000	6.7731"-04	NC	0.2921	1.4522"-03	8.7846"+02	4.1107"+02
72080104	4.9000	0.7008	3.2724"+04	NM	5.2605	1.5712	2.9300"+04	1.7900"+04
1.0160"-01	8.4212"+06	1.6369	1.0523"+05	1.2562"-05	1.8138	1.7717	2.9400"+02	7.9111"+01
5.8250"-02	4.5900"+02	0.5000	8.6648"-04	NC	0.2861	1.4841"-03	8.7382"+02	4.1949"+02
72080105	4.8000	0.7019	3.3385"+04	NM	3.6632	1.5659	3.3800"+04	1.9300"+04
1.3340"-01	8.0609"+06	1.7513	1.0404"+05	1.5601"-05	1.8363	1.7987	2.9400"+02	8.1669"+01
5.8250"-02	4.5800"+02	0.5000	8.5037"-04	NC	0.2674	1.2998"-03	8.6972"+02	4.1886"+02
72080106	4.6000	0.6933	3.4761"+04	NM	2.4959	1.6375	4.2000"+04	2.6800"+04
1.6260"-01	8.7795"+06	1.5672	1.0013"+05	1.3904"-05	1.8467	1.8215	2.9400"+02	8.8494"+01
5.8250"-02	4.6300"+02	0.5000	6.9260"-04	NC	0.3661	9.8589"-04	8.6761"+02	4.2405"+02
72080107	4.6000	0.7133	4.4774"+04	NM	3.7044	1.6421	5.4100"+04	3.1700"+04
1.9050"-01	1.0385"+07	1.7066	1.3261"+05	1.2588"-05	1.8144	1.7922	2.9400"+02	8.6009"+01
5.8250"-02	4.5000"+02	0.5000	7.4355"-04	NC	0.3009	1.0850"-03	8.5534"+02	4.1214"+02
72080108	4.6000	0.7009	4.3718"+04	NM	0.2292	1.8183	4.8300"+04	2.6800"+04
2.1840"-01	8.7795"+06	1.8022	1.2727"+05	NM	1.8691	1.8548	2.9400"+02	8.7538"+01
5.8250"-02	4.5800"+02	0.5000	8.6636"-04	NC	0.3645	9.6095"-04	8.6291"+02	4.1947"+02

TRAPEZOIDAL RULE FOR RUN 0108

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
72080101	6.6177"-04	14.8432	1.8616	0.1110	8.1970"+04	1.7675"+04	9.8464"-03
	6.3523"-04	14.8609	1.8649	0.1104	9.2121"+04	1.7707"+04	
72080102	7.0596"-04	14.3541	1.8531	0.2583	9.1119"+04	2.2422"+04	9.8387"-03
	5.4382"-04	14.5084	1.8660	0.2565	9.1776"+04	2.2583"+04	
72080103	5.7562"-04	13.9947	1.8259	0.2688	8.6352"+04	2.2782"+04	7.8799"-03
	4.5156"-04	14.0832	1.8397	0.2668	8.7027"+04	2.2960"+04	
72080104	7.9804"-04	15.1817	1.8687	0.2058	9.7037"+04	3.0175"+04	1.0558"-02
	4.9360"-04	15.6152	1.8805	0.2045	9.7691"+04	3.0378"+04	
72080105	8.0536"-04	13.5154	1.8968	0.1723	9.8652"+04	3.1656"+04	9.4067"-03
	4.6963"-04	13.9729	1.8986	0.1721	9.8774"+04	3.1695"+04	
72080106	5.8997"-04	13.4655	1.8792	0.2952	8.5392"+04	2.9645"+04	6.9530"-03
	3.8067"-04	13.6579	1.8940	0.2930	8.6088"+04	2.9887"+04	
72080107	7.0716"-04	9.2566	1.8769	0.2082	1.2627"+05	4.2634"+04	6.0996"-03
	4.5879"-04	9.3974	1.8825	0.2076	1.2668"+05	4.2772"+04	
72080108	6.1007"-04	13.8990	1.8910	0.3150	8.9729"+04	3.0822"+04	7.4022"-03
	3.5986"-04	14.0533	1.9223	0.3102	9.1243"+04	3.1342"+04	

72080102 ZAKKAY PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.41026	0.64615	0.00000	0.00000	5.41236	0.00000
2	1.3000E-03	5.0461E+00	1.41026	0.88132	0.33575	0.67406	4.03065	0.23584
3	2.6000E-03	6.2182E+00	1.38462	0.89890	0.37675	0.72256	3.67830	0.27199
4	3.9000E-03	8.5667E+00	1.29060	0.92308	0.44755	0.79065	3.12086	0.32696
5	5.2000E-03	1.0653E+01	1.08547	0.94066	0.50206	0.83343	2.75566	0.32829
6	6.5000E-03	1.4198E+01	1.05983	0.95165	0.58307	0.87897	2.27248	0.40993
7	7.8000E-03	1.5434E+01	1.23932	0.96484	0.60876	0.89565	2.16461	0.51279
8	9.1000E-03	1.9079E+01	1.23932	0.98022	0.67891	0.92743	1.86612	0.61592
9	1.0400E-02	2.2509E+01	1.21368	0.98901	0.73884	0.94851	1.64806	0.69850
10	1.1700E-02	2.8110E+01	1.17949	1.00000	0.82743	0.97359	1.38446	0.82944
11	1.3000E-02	3.4151E+01	1.14530	1.00000	0.91339	0.98835	1.17088	0.96676
12	1.4300E-02	3.5302E+01	1.17949	1.00000	0.92887	0.99064	1.13743	1.02727
13	1.5600E-02	3.6359E+01	1.14530	1.00000	0.94286	0.99263	1.10835	1.02572
14	1.6900E-02	3.5302E+01	1.17949	1.00000	0.92887	0.99064	1.13743	1.02727
15	1.8200E-02	3.5549E+01	1.17949	1.00000	0.93216	0.99111	1.13049	1.03407
16	1.9500E-02	3.5822E+01	1.20513	1.00000	0.93578	0.99163	1.12293	1.06422
17	2.0800E-02	3.6234E+01	1.17949	1.00000	0.94122	0.99240	1.11172	1.05289
18	2.2100E-02	3.7905E+01	1.08547	1.00000	0.96295	0.99535	1.06843	1.01123
19	2.3400E-02	3.9601E+01	1.02564	1.00000	0.98452	0.99811	1.02780	0.99602
D 20	2.4700E-02	4.0841E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,P,TO,M

72080104 ZAKKAY PROFILE TABULATION 20 POINTS, DELTA AT POINT 20

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.63687	0.64052	0.00000	0.00000	4.99167	0.00000
2	1.3000E-03	3.8151E+00	1.63687	0.87146	0.32704	0.64852	3.93346	0.26992
3	2.6000E-03	5.0450E+00	1.61453	0.89760	0.38357	0.71753	3.49767	0.33121
4	3.9000E-03	6.5205E+00	1.53631	0.92375	0.44183	0.77727	3.09479	0.38585
5	5.2000E-03	9.3200E+00	1.42458	0.93900	0.53483	0.84333	2.48637	0.48319
6	6.5000E-03	1.1591E+01	1.42458	0.96078	0.59969	0.88436	2.17470	0.57932
7	7.8000E-03	1.5303E+01	1.36313	0.97821	0.69269	0.92669	1.78974	0.70580
8	9.1000E-03	1.9261E+01	1.36313	0.99129	0.77968	0.95683	1.50601	0.86605
9	1.0400E-02	2.3531E+01	1.40782	1.00000	0.86376	0.97885	1.28425	1.07304
10	1.1700E-02	2.5648E+01	1.38547	1.00000	0.90254	0.98571	1.19279	1.14494
11	1.3000E-02	2.6546E+01	1.32961	1.00000	0.91850	0.98832	1.15781	1.13497
12	1.4300E-02	2.7144E+01	1.22905	1.00000	0.92896	0.98997	1.13565	1.07139
13	1.5600E-02	2.8379E+01	1.11732	1.00000	0.95024	0.99318	1.09241	1.01582
14	1.6900E-02	2.8876E+01	1.11732	1.00000	0.95865	0.99439	1.07596	1.03261
15	1.8200E-02	2.8886E+01	1.07821	1.00000	0.95882	0.99442	1.07563	0.99680
16	1.9500E-02	2.9448E+01	1.03911	1.00000	0.96826	0.99575	1.05760	0.97834
17	2.0800E-02	3.0307E+01	1.00000	1.00000	0.98250	0.99770	1.03119	0.96753
18	2.2100E-02	3.1093E+01	0.98324	1.00000	0.99537	0.99940	1.00812	0.97473
19	2.3400E-02	3.1421E+01	0.98324	1.00000	1.00069	1.00009	0.99880	0.98450
D 20	2.4700E-02	3.1379E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,P,TO,M

72080108 ZAKKAY PROFILE TABULATION 20 POINTS, DELTA AT POINT 15

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	1.80224	0.64192	0.00000	0.00000	3.92902	0.00000
2	1.3000E-03	7.6085E+00	1.72388	0.91266	0.51146	0.79032	2.38771	0.57060
3	2.6000E-03	8.1740E+00	1.78731	0.92576	0.53142	0.80882	2.31644	0.62407
4	3.9000E-03	1.1589E+01	1.60821	0.93450	0.63874	0.86914	1.85157	0.75491
5	5.2000E-03	1.4048E+01	1.56716	0.95652	0.70593	0.90727	1.65177	0.86080
6	6.5000E-03	1.6340E+01	1.55597	0.96725	0.76324	0.93052	1.48638	0.97409
7	7.8000E-03	1.9661E+01	1.54104	0.98908	0.83933	0.96210	1.31395	1.12839
8	9.1000E-03	2.2187E+01	1.51866	0.99782	0.89308	0.97882	1.20123	1.23746
9	1.0400E-02	2.3693E+01	1.49254	1.00000	0.92332	0.98616	1.14075	1.29027
10	1.1700E-02	2.3972E+01	1.44030	1.00000	0.92885	0.98725	1.12970	1.25869
11	1.3000E-02	2.4627E+01	1.35075	1.00000	0.94170	0.98973	1.10461	1.21027
12	1.4300E-02	2.5239E+01	1.23507	1.00000	0.95356	0.99195	1.08214	1.13214
13	1.5600E-02	2.6203E+01	1.13060	1.00000	0.97194	0.99525	1.04855	1.07313
14	1.6900E-02	2.6560E+01	1.06716	1.00000	0.97866	0.99642	1.03663	1.02577
D 15	1.8200E-02	2.7710E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
16	1.9500E-02	2.7764E+01	0.95149	1.00000	1.00099	1.00016	0.99835	0.95322
17	2.0800E-02	2.8556E+01	0.88806	1.00000	1.01542	1.00247	0.97467	0.91339
18	2.2100E-02	2.9349E+01	0.82090	1.00000	1.02964	1.00467	0.95208	0.86624
19	2.3400E-02	3.0007E+01	0.74627	1.00000	1.04130	1.00641	0.93411	0.80403
20	2.4700E-02	2.9962E+01	0.68284	1.00000	1.04051	1.00630	0.93531	0.73466

INPUT VARIABLES Y,P,TO,M

M : 7.5 - 7.8
R THETA X 10^{-3} : 6 - 10
TW/TR : 0.8

7209

ZPG
(Recovery)
MHT

Blow-down tunnel with axi-symmetric contoured nozzle. D = 0.53 m.
Air, PO : 14 MN/m^2, TO : 840 K, RE/m X 10^{-6} : 20.

STONE D.R. and CARY A.M. 1972. Discrete sonic jets used as boundary-layer trips at Mach number of 6 and 8.5. NASA TN D 6802.
And Morrisette, Stone and Cary, (1968), Stone, (1971), Morrisette E.L., private communication.

1 The test boundary layer was formed on the surface of a flat-plate model (L = 0.521, W = 0.279 m) with a leading edge (X = 0) 0.03 mm thick and chamfered at 15^0 on the underside. From X = 38 mm back the working surface consisted of a removable plate. Two were used, one for heat transfer studies, and the other for
3 the profile studies reported here. At X = 25 mm, a row of 17 jet orifices was drilled. These were spaced symmetrically about the centreline at intervals of 6.4 mm, and converged from a supply pipe diameter of 2.3 mm to a parallel sided outlet 0.8 mm long and 0.4 mm in diameter at the test surface. (A second such row at X = 76 mm could be employed on the heat transfer model.) When employed, the discharge through the jets was at a constant value, 2.5, of a "mass flow parameter" λ where $\lambda = p_{0j}\,\gamma_j \,/\, p_\infty M_\infty^2\,\gamma_\infty$
The boundary layer could also be tripped by spherical balls of 1.5 mm diameter at X = 12.7 mm, or of 3.0 mm diameter at X = 25.4 mm. The balls were distributed symmetrically at intervals of 50.8 and 12.0 mm respectively, and spanned the full width of the plate. The test plates were provided with sharp, swept side plates. Surface oil flow patterns were observed, but two-dimensionality in the region of profile measurements is not reported. An oil pattern published by Morrisette et al. (1968) in a not dissimilar case shows strong three dimensional effects in the immediate vicinity of the trips, but little or no large-scale divergence far downstream.

6 The central 19 mm of the heat transfer plate was reduced in thickness from 3.18 mm to 0.8 mm and instrumented with 95 thermocouples to allow heat-flux determination by the thin wall transient technique. These
3 measurements showed that the mass flow, at X = 1.0 was sufficient to cause transition as defined by a local peak heat flux, at X = 127 mm. The mass flow was such that any further increase would not cause transition to move further forward. (For these tests, however, TW/TR was about 0.45).

6 The pressure plate, also used for profile measurements, had three rows of static holes (d = 2.3 mm) in the central 40 mm of the plate. The total number was 36, the greater number providing a very close grid for X less than 200 mm. The largest interval downstream was less than 50 mm. The plate also had three thermocouples mounted 18 mm off the centre line at X = 168, 280 and 485 mm.

7 Pitot and TO profiles were measured at two stations for which X = 0.279 and 0.455 mm. The Pitot probe was
8 an FPP for which h_1 = 0.25, h_2 = 0.18, b_1 = 2.03, b_2 = 1.42 mm. The TO probe was an STP with a constant d_1 of 1.9 mm. The interior of the probe tip was chamfered so as to give a sharp leading edge. The thermocouple was mounted 0.8 mm back from the probe face and there were two vent-holes (d = 0.04 mm) 3.6 mm back. The probe was calibrated over a wide range of Reynolds number at M = 3.6 and 8.5, and found to have a probe recovery factor near to one, which value was assumed for all subsequent work.

9 The authors have interpolated TO profile measurements to the Y values of the Pitot profiles, and extrapolated the TO profile at low values of Y so as to match the wall temperature. Static pressure has been assumed
10 constant through the layer. No probe corrections have been applied, and Sutherland's viscosity law was used.
11
12 All profiles tabulated by the authors have been presented, incorporating the authors' procedures. While a
13 great deal of heat transfer data was obtained, it is only presented as small scale graphs and is not
14 reproduced here. The profiles consist of a single reference profile taken with natural transition, and three pairs for the jet trip (0201/2), the small ball trip (0301/2) and the large ball trip (0401/2).

§ DATA: 7209 0101 0402. Pitot and TO profiles obtained separately. NX = 2.

16 Editors' comments

The interest of this experiment lies in the effect of the relatively brutal tripping devices used. The reference case, 0101, is turbulent but still markedly transitional, while the downstream tripped profiles are relatively well developed and fully turbulent in character. We find less distortion introduced by the trips than is reported by the authors, and in general the interesting result is that the trips, at least at the downstream station of the two, do not seem to leave any special mark on the mean profile characteristics. On a transformed log-law plot, no effect can be seen which could not be accounted for by the general experimental scatter. Tests in the same range with no trip, or modest trips, are described by Danberg - CAT 6702 and Keener & Hopkins - CAT 7204. Abruptly disturbed flows, but in different experimental ranges, are the step flow of Moore - CAT 5805 and the flow over a rectangular cross-section protrusion described by Peake et al. - CAT 7102.

CAT 7209 STONE BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
72090101 4.5500"-01 INFINITE	7.8200 1.3510"+07 8.3300"+02	0.8054 1.0000 0.0000	9.6805"+02 6.5609"+03 2.6839"-04	NM NM 0.0000"+00	14.9431 1.8907 0.8873	1.4544 1.8040 6.5647"-04	1.6038"+03 6.0642"+02 1.2441"+03	1.6038"+03 6.2961"+01 7.5292"+02
72090201 2.7900"-01 INFINITE	7.7400 1.3790"+07 8.4400"+02	0.7489 1.0000 0.0000	1.1046"+03 6.9671"+03 2.7702"-04	NM NM 0.0000"+00	14.4141 1.8744 0.8967	1.3864 1.8068 7.1863"-04	1.7495"+03 5.7139"+02 1.2513"+03	1.7495"+03 6.5015"+01 7.6299"+02
72090202 4.5500"-01 INFINITE	7.7800 1.3720"+07 8.3300"+02	0.7666 1.0000 0.0000	1.5120"+03 9.8229"+03 3.9026"-04	NM NM 0.0000"+00	16.5466 1.8712 0.7528	1.3593 1.8067 1.0798"-03	1.6836"+03 5.7727"+02 1.2436"+03	1.6836"+03 6.3560"+01 7.5298"+02
72090301 2.7900"-01 INFINITE	7.5500 1.3790"+07 8.3300"+02	0.7740 1.0000 0.0000	1.3079"+03 8.0926"+03 2.9516"-04	NM NM 0.0000"+00	17.0201 1.8601 0.6801	1.4268 1.7924 8.7867"-04	2.0537"+03 5.8310"+02 1.2407"+03	2.0537"+03 6.7175"+01 7.5335"+02
72090302 4.5500"-01 INFINITE	7.8000 1.3820"+07 8.3600"+02	0.8076 1.0000 0.0000	1.4368"+03 9.6973"+03 3.8722"-04	NM NM 0.0000"+00	17.9876 1.8694 0.6714	1.3880 1.8021 1.1387"-03	1.6680"+03 6.1028"+02 1.2461"+03	1.6680"+03 6.3487"+01 7.5566"+02
72090401 2.7900"-01 INFINITE	7.5400 1.3790"+07 8.3300"+02	0.7740 1.0000 0.0000	1.4433"+03 8.9087"+03 3.2377"-04	NM NM 0.0000"+00	21.1472 1.8558 0.3657	1.4433 1.7872 1.0250"-03	2.0712"+03 5.8310"+02 1.2405"+03	2.0712"+03 6.7339"+01 7.5337"+02
72090402 4.5500"-01 INFINITE	7.8700 1.3750"+07 8.4000"+02	0.7967 1.0000 0.0000	1.3245"+03 8.9920"+03 3.7233"-04	NM NM 0.0000"+00	20.2526 1.8493 0.5865	1.5305 1.7560 1.2641"-03	1.5663"+03 6.0480"+02 1.2499"+03	1.5663"+03 6.2746"+01 7.5917"+02

72090101 STONE PROFILE TABULATION 25 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.72800	0.00000	0.00000	9.63179	0.00000
2	1.8000"-04	2.3747"+00	NM	0.81972	0.15200	0.44200	8.45585	0.05227
3	1.9000"-04	2.6570"+00	NM	0.81797	0.16400	0.46800	8.14337	0.05747
4	2.0000"-04	2.7836"+00	NM	0.83994	0.16900	0.48500	8.23586	0.05889
5	3.8000"-04	5.7307"+00	NM	0.85963	0.25800	0.64600	6.26939	0.10304
6	7.7000"-04	1.2757"+01	NM	0.89491	0.39500	0.77700	4.07120	0.19577
7	1.1200"-03	1.6698"+01	NM	0.90885	0.45400	0.83900	3.41517	0.24567
8	1.5200"-03	1.9142"+01	NM	0.91300	0.40700	0.85700	3.09673	0.27674
9	1.8800"-03	2.1350"+01	NM	0.91539	0.51500	0.87000	2.85380	0.30486
10	2.4000"-03	2.5246"+01	NM	0.92039	0.56100	0.88900	2.51118	0.35402
11	3.0500"-03	2.9190"+01	NM	0.92476	0.60400	0.90400	2.24008	0.40356
12	3.4700"-03	3.2816"+01	NM	0.92796	0.64100	0.91500	2.03763	0.44905
13	4.1000"-03	3.7625"+01	NM	0.93401	0.68700	0.92800	1.82466	0.50859
14	4.5000"-03	4.0829"+01	NM	0.93704	0.71600	0.93500	1.70529	0.54830
15	5.0800"-03	4.5584"+01	NM	0.94331	0.75700	0.94500	1.55837	0.60640
16	5.5600"-03	5.0981"+01	NM	0.94854	0.80100	0.95400	1.41851	0.67254
17	6.2200"-03	5.7216"+01	NM	0.95650	0.84900	0.96400	1.28925	0.74772
18	6.9900"-03	6.4098"+01	NM	0.96969	0.89900	0.97400	1.17381	0.82978
19	7.5100"-03	6.8416"+01	NM	0.97390	0.92900	0.98100	1.11508	0.87976
20	8.1700"-03	7.2724"+01	NM	0.98276	0.95800	0.98800	1.06361	0.92891
21	8.6700"-03	7.5465"+01	NM	0.98777	0.97600	0.99200	1.03306	0.96026
22	9.1300"-03	7.6855"+01	NM	0.99432	0.98500	0.99600	1.02246	0.97412
23	9.8900"-03	7.8414"+01	NM	0.99676	0.99500	0.99800	1.00604	0.99201
24	1.0550"-02	7.9042"+01	NM	0.99815	0.99900	0.99900	1.00000	0.99900
D 25	1.1100"-02	7.9199"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD,U/UD ASSUME P=PD

72090202 STONE PROFILE TABULATION 27 POINTS, DELTA AT POINT 27

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.69300	0.00000	0.00000	9.08224	0.00000
2	1.8000"-04	1.9010"+00	NM	0.79549	0.12900	0.38000	8.67736	0.04379
3	2.8000"-04	2.4247"+00	NM	0.81915	0.15500	0.44700	8.31671	0.05375
4	6.8000"-04	5.8387"+00	NM	0.85726	0.26200	0.64900	6.13602	0.10577
5	1.0200"-03	9.5389"+00	NM	0.86983	0.34100	0.74200	4.73477	0.15671
6	1.5200"-03	1.1846"+01	NM	0.88236	0.38200	0.78100	4.17999	0.18684
7	2.0600"-03	1.3700"+01	NM	0.88546	0.41200	0.80300	3.79871	0.21139
8	2.5400"-03	1.5353"+01	NM	0.89628	0.43700	0.82300	3.54680	0.23204
9	3.2500"-03	1.8574"+01	NM	0.90679	0.48200	0.85100	3.11720	0.27300
10	4.0600"-03	2.1703"+01	NM	0.91950	0.52200	0.87400	2.80338	0.31177
11	4.6700"-03	2.5169"+01	NM	0.92857	0.56300	0.89300	2.51586	0.35495
12	5.2600"-03	2.8428"+01	NM	0.93276	0.59900	0.90600	2.28772	0.39603
13	5.7700"-03	3.1495"+01	NM	0.93787	0.63100	0.91700	2.11193	0.43420
14	6.5500"-03	3.6078"+01	NM	0.94332	0.67600	0.93000	1.89266	0.49137
15	7.1400"-03	3.9972"+01	NM	0.94716	0.71200	0.93900	1.73929	0.53988
16	7.5900"-03	4.2795"+01	NM	0.95033	0.73700	0.94500	1.64410	0.57478
17	8.3800"-03	4.8121"+01	NM	0.95423	0.78200	0.95400	1.48828	0.64101
18	9.1700"-03	5.3893"+01	NM	0.95982	0.82800	0.96300	1.35267	0.71193
19	9.7800"-03	5.8102"+01	NM	0.96618	0.86000	0.97000	1.27217	0.76247
20	1.0390"-02	6.2471"+01	NM	0.97323	0.89200	0.97700	1.19966	0.81440
21	1.0800"-02	6.5425"+01	NM	0.97702	0.91300	0.98100	1.15451	0.84971
22	1.1180"-02	6.7433"+01	NM	0.98035	0.92700	0.98400	1.12676	0.87330
23	1.1660"-02	7.0059"+01	NM	0.98507	0.94500	0.98800	1.09308	0.90387
24	1.2140"-02	7.2286"+01	NM	0.99045	0.96000	0.99200	1.06778	0.92903
25	1.2500"-02	7.3337"+01	NM	0.99327	0.96700	0.99400	1.05662	0.94073
26	1.4930"-02	7.6537"+01	NM	0.99986	0.98800	0.99900	1.02239	0.97712
D 27	1.7400"-02	7.8396"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD,U/UD ASSUME P=PD

72090401 STONE PROFILE TABULATION 31 POINTS, DELTA AT POINT 31

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.70000	0.00000	0.00000	8.65922	0.00000
2	1.8000"-04	1.4373"+00	NM	0.81250	0.09800	0.29500	9.06133	0.03256
3	4.1000"-04	2.0587"+00	NM	0.85696	0.14200	0.41700	8.62374	0.04835
4	7.1000"-04	5.1788"+00	NM	0.89099	0.25300	0.63900	6.37912	0.10017
5	9.4000"-04	6.8974"+00	NM	0.90249	0.29600	0.70000	5.59259	0.12517
6	1.2400"-03	9.0895"+00	NM	0.91077	0.34300	0.75300	4.81950	0.15624
7	1.5500"-03	1.0334"+01	NM	0.91492	0.36700	0.77600	4.47086	0.17357
8	1.9800"-03	1.1550"+01	NM	0.92099	0.38900	0.79600	4.18723	0.19010
9	2.2100"-03	1.2185"+01	NM	0.92305	0.40000	0.80500	4.05016	0.19876
10	2.5400"-03	1.3323"+01	NM	0.92540	0.41900	0.81900	3.82067	0.21436
11	2.6900"-03	1.4069"+01	NM	0.92627	0.43100	0.82700	3.68177	0.22462
12	2.9700"-03	1.4706"+01	NM	0.93067	0.44100	0.83500	3.58505	0.23291
13	3.3000"-03	1.5891"+01	NM	0.93248	0.45900	0.84600	3.39715	0.24903
14	3.5800"-03	1.7124"+01	NM	0.93384	0.47700	0.85600	3.22041	0.26580
15	3.7800"-03	1.8115"+01	NM	0.93646	0.49100	0.86400	3.09645	0.27903
16	4.0400"-03	1.9136"+01	NM	0.93779	0.50500	0.87100	2.97477	0.29280
17	4.2900"-03	2.0720"+01	NM	0.94019	0.52600	0.88100	2.80531	0.31405
18	4.6500"-03	2.2529"+01	NM	0.94263	0.54900	0.89100	2.63397	0.33827
19	5.2100"-03	2.5688"+01	NM	0.94706	0.58700	0.90600	2.38221	0.38032
20	5.4600"-03	2.7614"+01	NM	0.94995	0.60900	0.91400	2.25246	0.40578
21	5.7200"-03	2.8422"+01	NM	0.95090	0.61800	0.91700	2.20172	0.41649
22	6.2000"-03	3.2544"+01	NM	0.95658	0.66200	0.93100	1.97780	0.47072
23	6.8600"-03	3.4611"+01	NM	0.97765	0.68300	0.94600	1.91841	0.49312
24	7.3400"-03	3.6743"+01	NM	0.98912	0.70400	0.95600	1.84404	0.51843
25	7.8700"-03	4.0873"+01	NM	0.98001	0.74300	0.95900	1.66594	0.57565
26	8.2000"-03	4.2189"+01	NM	1.00239	0.75500	0.97200	1.65744	0.58645
27	9.7500"-03	4.7077"+01	NM	1.00263	0.79800	0.97900	1.50508	0.65046
28	1.0310"-02	5.2236"+01	NM	1.00269	0.84100	0.98500	1.37177	0.71805
29	1.0790"-02	5.6506"+01	NM	1.00435	0.87500	0.99000	1.28013	0.77336
30	1.2800"-02	6.9336"+01	NM	0.99705	0.97000	0.99600	1.05433	0.94468
D 31	1.4000"-02	7.3662"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD,U/UD ASSUME P=PD

72090402 STONE PROFILE TABULATION 24 POINTS, DELTA AT POINT 24

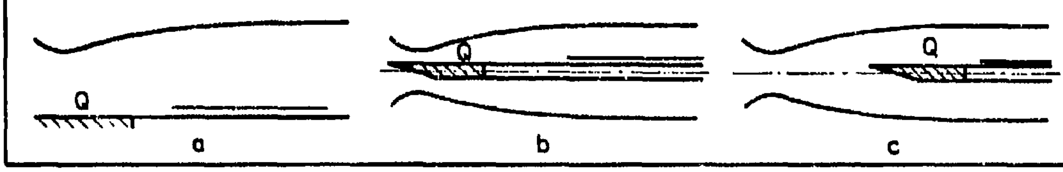
I	Y	PT2/P	P/PD	T0/T	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.72000	0.00000	0.00000	9.63891	0.00000
2	1.8000"-04	1.4075"+00	NM	0.75762	0.09100	0.27600	9.19889	0.03000
3	6.8000"-04	2.1375"+00	NM	0.87169	0.14000	0.42900	9.38985	0.04569
4	8.9000"-04	3.9894"+00	NM	0.89266	0.20900	0.58200	7.75449	0.07505
5	1.7000"-03	9.0572"+00	NM	0.91590	0.32800	0.75200	5.25640	0.14306
6	1.8300"-03	1.0300"+01	NM	0.91755	0.35100	0.77400	4.86259	0.15917
7	2.3400"-03	1.1215"+01	NM	0.91693	0.36700	0.78800	4.61021	0.17093
8	3.0000"-03	1.3231"+01	NM	0.90440	0.40000	0.80600	4.06023	0.19851
9	3.3800"-03	1.3877"+01	NM	0.92546	0.41000	0.82200	4.01954	0.20450
10	4.2400"-03	1.8010"+01	NM	0.93117	0.46900	0.85800	3.34679	0.25636
11	4.8000"-03	1.8765"+01	NM	0.93377	0.47900	0.86400	3.25354	0.26556
12	5.4600"-03	2.3292"+01	NM	0.94176	0.53500	0.89100	2.77363	0.32124
13	6.4000"-03	2.6649"+01	NM	0.95045	0.57300	0.90800	2.51109	0.36160
14	6.8100"-03	3.1120"+01	NM	0.94971	0.62000	0.92100	2.20666	0.41737
15	7.6700"-03	3.3951"+01	NM	0.95826	0.64800	0.93200	2.06863	0.45054
16	8.0500"-03	3.9095"+01	NM	0.95791	0.69600	0.94200	1.83182	0.51424
17	9.3200"-03	5.0992"+01	NM	0.96542	0.79600	0.96200	1.46058	0.65864
18	1.0390"-02	6.0269"+01	NM	0.97230	0.86600	0.97400	1.26498	0.76998
19	1.1630"-02	6.7521"+01	NM	0.98194	0.91700	0.98400	1.15147	0.85456
20	1.2880"-02	7.2889"+01	NM	0.99149	0.95300	0.99200	1.08352	0.91553
21	1.4300"-02	7.6427"+01	NM	0.99371	0.97600	0.99500	1.03931	0.95736
22	1.5370"-02	7.7678"+01	NM	0.99445	0.98400	0.99600	1.02454	0.97214
23	1.6760"-02	7.9255"+01	NM	0.99890	0.99400	0.99900	1.01009	0.98903
D 24	1.7960"-02	8.0209"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M/MD,U/UD ASSUME P=PD

Three confinurations tested See diagrams below	M : a) 4.9 b, c) 4.0 R THETA X 10^{-3} : 8 - 30 TW/TR : 0.85 - 1.0	7301 ZPG (HISTORY) AW - MHT

Windtunnels: (a) as for CAT 7202 (b, c) effectively continuous, fixed nozzle, W = H = 0.4 m.
PO : (a) 0.61 (b) 0.21 (c) 0.43 MN/m^2 TO: (a) 305-375, (b) 350, (c) 330 K.
Dry air, dew point 215-233 K. RE/m x 10^{-6} : a) 10-16 b) 6.5 c) 15

GATES D.F. 1973. Measurements of upstream history effects in compressible turbulent boundary layers. NOLTR 73-152.
And Gates D.F., private communications, Voisinet & Lee CAT 7202.



1 The test boundary layers were all formed on flat surfaces, and in the region of study were at constant
4 pressure. The emphasis of the tests was on a controlled variation of the upstream history of the layers. In each case, upstream of the test zone, a part of the flat surface could be made to transfer heat to or from the flow (the sketches in the heading indicate this region with the symbol Q). The pressure history and origin of the boundary layer is different in each case. The combinations are listed in table 1.

1a a) Series 01-06. The test layer was formed on the flat wall of the boundary layer channel described in
4a CAT 7202, and experienced the pressure history given in table 2 of that entry. The plate cooling system was arranged so that near the throat (X = 0), from X = - 165 to + 457 mm, the wall temperature could be controlled to give heating, cooling, or near-adiabatic conditions independently of the controlled cooling in the test zone.

1b b, c) Series 07-10: The basic structure for these tests consisted of a rectangular cross section channel
1c constructed as an extension of the tunnel nozzle 3.66 m long and closed on the plane of symmetry by the test plate. A long (b, series 07-08) or short (c, series 09-10) leading edge section could be attached, which ran into the normal tunnel test section on the centre plane. The cross section of the channel was W = 411, H = 222 mm at entry, increasing to W = 436, H = 274 mm at exit, to allow for boundary layer growth (there is also a slight divergence in the tunnel proper). The test surface was fitted with removable plugs (D = 47.6 mm) at intervals along the centre-line which could be replaced by instrumented units. Test surface roughness was held to 0.8 μm rms, and all other flow surfaces to 1.6 μm rms.

1b b) Series 07-08: The test plate in the channel was extended upstream by a plate of similar construction 1.83 m long on which was mounted a leading edge section 0.23 m long. The leading edge was formed by a half-wedge of 19° included angle and was 153 mm upstream of the throat (X = 0). The leading edge section
4b could be cooled by liquid nitrogen giving the temperature histories shown in table II, columns 2 and 3. A limited amount of pressure history is available and is given as a Mach number distribution at the foot of columns 1 and 2.

1c c) Series 09-10: The short leading edge section was 0.686 m long. The leading edge (X = 0) was formed by a half-wedge of 10° included angle and was thus 1.219 m downstream of the throat and in the constant pressure region. The leading edge section did not contain instrumentation ports and could be cooled by
4c liquid nitrogen in passages between X = 76 and 533 mm. Sample temperature distributions are given in table II columns 5 and 6.

2 "Pitot pressure profiles, oil streak tests and several sets of schlieren photographs all indicate uniformity of the pressure-velocity field" and the (PC) wall pressure distributions in the uniform flow region (not

3 presented) show the Mach number constant within limits of ± 0.04 for (b) and ± 0.02 for (c). Transition was
natural with no information as to the precise location. Flow angularity as shown by oil streak observations
5 ranged from immeasurable at the centre line to a few degrees near the corners.

6 The instrumentation of the channel is described in CAT 7202. The plates in the windtunnel tests were drilled
with up to 26 static tappings of 0.79 mm diameter at intervals of 305 or 153 mm along the centre line.
Copper-constantan thermocouples were mounted at 305 mm intervals 76.2 mm from the centre line. Additional
thermocouples were mounted on the centre line of the cooled leading edge sections, 3 for the long plate (b)
and 5 for the short (c) as indicated by table II. Thermopiles (RdF corporation, Hudson, New Hampshire, model
7 no 20463-3) could be mounted at the centre of the ports. The probes employed were identical to those used
8 for CAT 7202. The results presented were obtained with the FPP and the ECP. The relative positions of
measuring stations were the same as in CAT 7202 except that there were no static holes to the sides of each
port in the plates. The X values for which measurements were made are given in table I.

9 The author has interpolated his TO data to the Y stations of the PT2 values and applied the same probe
10 corrections as in CAT 7202. In the region adjacent to the wall (y < 0.6 - 1.0 mm) temperature values were
11 again obtained by extrapolating the profiles to meet the wall temperature. Sutherland's viscosity law was
12 assumed. The editors have presented the data as prepared by the author.

13 The 26 ZPG profiles presented have varied upstream histories as listed in table I. PO and TO were measured
14 simultaneously. A limited amount of wall data is presented, and no attempt has been made to adjust the
values to take account of the slight differences in X value.

§ DATA. 7301 0101-1003 ZPG PT2 and TO simultaneously. NX = 2 to 4. CQ from Thermopiles.

15 <u>Editors' comments</u>

The experiments constitute a systematic attempt to identify the influence of pressure and temperature history effects. Configuration c) (series 09, 10) involves no pressure history, so that any differences observed between the cooled and uncooled leading edge cases can be ascribed to the temperature history alone. Configurations a) and b) both involve a predominately reflected-wave expansion in the nozzle region, with differing initial boundary-layer thicknesses. Tests on configuration a) include both relative heating and cooling in the nozzle region, coupled with differing test-region thermal conditions. Configuration b) provided a stronger throat-region cooling effect, but was associated only with a near-adiabatic test-region wall.

An obvious gross effect of upstream heating is to modify the downstream adiabatic wall temperature. For example, tests on the short flat plate, configuration c), gave an "experimental recovery factor", in the absence of any leading-edge cooling, of about 0.88. The corresponding value with a cool leading edge was 0.78 at the first measuring station (X = 0.914 m) relaxing to 0.86 at the most downstream station (X = 2.743 m). Similar effects are observed in the other cases, and reported at length also by Voisinet & Lee (CAT 7202).

The profiles are specified by a fairly large number of data points and in every case the measurements extend within the momentum deficit maximum. In most cases the measurements extend well out into the free stream, as indicated by the PO deficit. By the same criterion, the D-state should in general be taken at a larger value of Y. It is a pity that in an investigation on this large scale no CF information was obtained.

Comparisons, on the basis of Mach number and Reynolds number in the test-zone, may be made with the adiabatic flat plate studies of Hastings & Sawyer (CAT 7006) and Mabey et al. (CAT 7402). Corresponding cases where the layer was produced on a flat wall facing a contoured half-nozzle are Voisinet & Lee (CAT 7202) and, at lower Mach number, Meier (CAT 7003) and Jeromin (CAT 6602).

TABLE I GROSS THERMAL HISTORY OF TEST BOUNDARY LAYERS

Run. IDENT 7301-	Reservoir TOD K	Throat or leading edge condition	Nominal temperature K	Wall condition	Nominal temperature K	PORT X m	PROFILE X m	
0101	347	COOL	308	ADIAB.	301	1.778	1.702	Boundary layer channel
0102	348	"	311	"	296	2.286	2.210	MD = 4.9
0201	373	"	328	COOL	270	1.778	1.702	PO = 515 KN/m^2
0202	374	"	332	"	279	2.286	2.210	
0301	338	ADIAB.	325	ADIAB.	304	1.778	1.702	
0302	324	"	319	"	296	2.286	2.210	
0401	333	"	327	COOL	265	1.778	1.702	
0402	333	"	317	"	267	2.286	2.210	
0501	311	HOT	323	ADIAB.	294	1.778	1.702	
0502	311	"	332	"	293	2.286	2.210	
0601	311	"	323	COOL	269	1.778	1.702	
0602	311	"	339	"	262	2.286	2.210	
0701	340	UNCOOLED	304	ISOTHERMAL	298	1.524	1.448	Long flat plate
0702	341	"	306	IN	298	2.134	2.057	MD = 4.0
0703	344	"	308	TEST	297	2.743	2.667	PO = 215 KN/m^2
0704	343	"	301	REGION	294	3.962	3.886	
0801	341	COOLED	249	AND	297	1.524	1.448	
0802	343	"	256	NEARLY	298	2.134	2.057	
0803	343	"	252	ADIABATIC	298	2.743	2.667	
0804	343	"	257		298	3.962	3.886	
0901	332	UNCOOLED	301	NEARLY	300	0.914	0.838	Short flat plate
0902	327	"	299	ADIABATIC	301	1.524	1.448	MD = 4.0
0903	327	"	301	SLIGHT HEAT	298	2.743	2.667	PO = 430 KN/m^2
1001	333	COOLED	129	TRANSFER TO	298	0.914	0.838	
1002	331	"	112	OR FROM THE	296	1.524	1.448	
1003	333	"	104	PLATE	298	2.743	2.667	

TABLE II TEMPERATURE HISTORY FOR FLAT PLATE TESTS

LONG PLATE			SHORT PLATE		
1) X/m from M = 1	2) T/K LE COOLED	3) T/K LE ADIAB	4) X/m from LE	5) T/K LE COOLED	6) T/K LE ADIAB
- 0.076	277	-	0.000	283 +	-
- 0.015	251	-	0.003	269 +	-
+ 0.061	262	321	0.015	243 +	-
0.305	299	306	0.030	216 +	-
0.533	299	302	0.046	190 +	-
0.838	298	300	0.061	161 +	-
1.143	298	298	0.091	104	301
1.448	299	300	0.183	93	300
1.763	298	299	0.305	92	299
2.057	298	299	0.427	91	298
2.362	298	-	0.610	101	298
2.667	297	298	0.701	132 +	-
2.972	298	299	0.701	253 +	-
3.277	299	300	0.838	272	299
3.581	300	301	1.143	289	299
3.886	301	301	1.448	296	301
4.191	302	302	1.763	298	300
4.496	304	305	2.057	298	299
4.801	308	310	2.362	298	300
X/m	MD		2.667	299	300
0.305	3.22		3.277	300	301
0.457	3.53				
0.610	3.81				
0.762	3.96				

+ Calculated from fin Bessel function.

Sample sets. Typical except for column 5, for which values were in general 0 - 15 K higher.

Long plate: X=0 at throat, Cooled leading edge X =-153 to + 76 mm, Leading edge extension X = + 76 mm to 1905 mm
Short plate: Cooled leading edge X = 0 to 686 mm, Cooling passages X = 76 to 533 mm.

CAT 7301 GATES BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW	PD*
X *	POD	PW/PD*	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
73010101	4.9307	0.9659	5.7592"+03	NM	8.8708	1.3863	1.0459"+03	1.0459"+03
1.7018"+00	5.1022"+05	1.0000	2.5595"+04	0.0000"+00	1.8315	1.7767	3.0356"+02	5.8667"+01
INFINITE	3.4393"+02	0.0000	2.2892"-03	0.0000"+00	0.4965	4.7488"-03	7.5721"+02	3.1426"+02
73010102	4.8633	0.9488	6.5279"+03	NM	9.6147	1.3947	1.1487"+03	1.1487"+03
2.2098"+00	5.1740"+05	1.0000	2.8056"+04	0.0000"+00	1.8161	1.7663	2.9461"+02	5.9278"+01
INFINITE	3.3968"+02	0.0000	2.3530"-03	0.0000"+00	0.3587	5.1945"-03	7.5074"+02	3.1052"+02
73010201	4.9343	0.7936	6.4884"+03	NM	8.2150	1.3742	1.0425"+03	1.0425"+03
1.7018"+00	5.1070"+05	1.0000	2.4315"+04	0.0000"+00	1.8307	1.7791	2.7072"+02	6.3611"+01
INFINITE	3.7336"+02	0.0000	2.4628"-03	0.0000"+00	0.5834	4.8837"-03	7.8905"+02	3.4115"+02
73010202	4.8539	0.8335	6.9989"+03	NM	8.8172	1.3900	1.1521"+03	1.1521"+03
2.2098"+00	5.1318"+05	1.0000	2.6589"+04	NC	1.8142	1.7662	2.8194"+02	6.4778"+01
INFINITE	3.7002"+02	0.0000	2.5459"-03	0.0000"+00	0.4661	5.3689"-03	7.8327"+02	3.3827"+02
73010301	4.9651	0.9881	4.6022"+03	NM	11.1257	1.3967	1.0211"+03	1.0211"+03
1.7018"+00	5.1866"+05	1.0000	2.1145"+04	0.0000"+00	1.8241	1.7721	3.0483"+02	5.6944"+01
INFINITE	3.3771"+02	0.0000	1.8392"-03	0.0000"+00	0.1833	4.2396"-03	7.5121"+02	3.0851"+02
73010302	4.8499	1.0022	5.6063"+03	NM	11.3321	1.3955	1.1500"+03	1.1500"+03
2.2098"+00	5.0983"+05	1.0000	2.5241"+04	0.0000"+00	1.8105	1.7638	2.9994"+02	5.7389"+01
INFINITE	3.2736"+02	0.0000	2.0192"-03	0.0000"+00	0.0908	4.8226"-03	7.3664"+02	2.9929"+02
73010401	4.9329	0.8707	4.8841"+03	NM	11.3511	1.3983	1.0170"+03	1.0170"+03
1.7018"+00	4.9738"+05	1.0000	2.0199"+04	0.0000"+00	1.8172	1.7697	2.6372"+02	5.6500"+01
INFINITE	3.3147"+02	0.0000	1.7548"-03	0.0000"+00	0.1217	4.0426"-03	7.4342"+02	3.0287"+02
73010402	4.8632	0.8848	6.8751"+03	NM	9.9055	1.3857	1.1356"+03	1.1356"+03
2.2098"+00	5.1144"+05	1.0000	2.8168"+04	NC	1.8182	1.7703	2.6650"+02	5.7500"+01
INFINITE	3.2948"+02	0.0000	2.2825"-03	0.0000"+00	0.3123	5.0977"-03	7.3938"+02	3.0120"+02
73010501	4.7424	1.0212	3.7895"+03	NM	11.2671	1.4121	1.0142"+03	1.0142"+03
1.7018"+00	3.9525"+05	1.0000	1.6878"+04	0.0000"+00	1.8131	1.7664	2.9167"+02	5.6778"+01
INFINITE	3.1217"+02	0.0000	1.5406"-03	0.0000"+00	0.0387	3.6275"-03	7.1647"+02	2.8561"+02
73010502	4.8687	1.0462	3.8730"+03	NM	17.4113	1.4240	1.1438"+03	1.1438"+03
2.2098"+00	5.1854"+05	1.0000	1.8429"+04	0.0000"+00	1.7772	1.7505	2.9278"+02	5.3328"+01
INFINITE	3.0615"+02	0.0000	1.3218"-03	0.0000"+00	-0.8314	3.9106"-03	7.1285"+02	2.7985"+02
73010601	4.7510	0.9222	4.2406"+03	NM	10.8335	1.3959	1.0128"+03	1.0128"+03
1.7018"+00	3.9883"+05	1.0000	1.7488"+04	0.0000"+00	1.8120	1.7684	2.6311"+02	5.6556"+01
INFINITE	3.1187"+02	0.0000	1.5862"-03	0.0000"+00	0.1001	3.6420"-03	7.1636"+02	2.8532"+02
73010602	4.8856	0.9350	4.2170"+03	NM	16.9525	1.4344	1.1107"+03	1.1107"+03
2.2098"+00	5.1373"+05	1.0000	1.8481"+04	NC	1.7686	1.7464	2.6139"+02	5.2972"+01
INFINITE	3.0585"+02	0.0000	1.3467"-03	0.0000"+00	-0.7524	3.9106"-03	7.1294"+02	2.7955"+02

CAT 7301 GATES BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF	H12	H12K	PW	PD*
X *	POD	PW/PD*	RED2D	CO *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
73010701	3.9566	0.9136	2.7655"+03	NM	7.5927	1.3335	1.2776"+03	1.2776"+03
1.4478"+00	1.8395"+05	1.0000	8.3145"+03	NC	1.8116	1.7845	2.9628"+02	8.5222"+01
INFINITE	3.5205"+02	0.0000	1.3266"-03	0.0000"+00	0.1401	2.4666"-03	7.3233"+02	3.2430"+02
73010702	4.0148	0.9215	3.4346"+03	NM	7.8998	1.3334	1.2424"+03	1.2424"+03
2.0574"+00	1.9240"+05	1.0000	1.0603"+04	NC	1.8119	1.7855	3.0078"+02	8.3944"+01
INFINITE	3.5456"+02	0.0000	1.6765"-03	0.0000"+00	0.1155	3.2018"-03	7.3751"+02	3.2641"+02
73010703	3.9557	0.9191	4.6940"+03	NM	7.7931	1.3323	1.3079"+03	1.3079"+03
2.6670"+00	1.8717"+05	1.0000	1.4177"+04	NC	1.8103	1.7851	2.9778"+02	8.5167"+01
INFINITE	3.5170"+02	0.0000	2.2079"-03	0.0000"+00	0.0984	4.1995"-03	7.3193"+02	3.2398"+02
73010704	3.9284	0.9364	5.6507"+03	NM	7.8416	1.3141	1.2597"+03	1.2597"+03
3.8862"+00	1.7377"+05	1.0000	1.7211"+04	NC	1.8192	1.7945	2.9756"+02	8.4389"+01
INFINITE	3.4485"+02	0.0000	2.7646"-03	0.0000"+00	0.0584	5.1868"-03	7.2355"+02	3.1776"+02
73010801	4.0269	0.9329	3.0578"+03	NM	7.5276	1.3384	1.2597"+03	1.2597"+03
1.4478"+00	1.9823"+05	1.0000	9.6177"+03	NC	1.8112	1.7809	2.9778"+02	8.1722"+01
INFINITE	3.4676"+02	0.0000	1.4370"-03	0.0000"+00	0.2050	2.7095"-03	7.2988"+02	3.1920"+02
73010802	4.0506	0.9381	4.0815"+03	NM	7.6374	1.3235	1.1969"+03	1.1969"+03
2.0574"+00	1.9438"+05	1.0000	1.3016"+04	NC	1.8206	1.7905	2.9817"+02	8.0667"+01
INFINITE	3.4537"+02	0.0000	1.9959"-03	0.0000"+00	0.1887	3.7263"-03	7.2942"+02	3.1784"+02
73010803	4.0472	0.9391	5.0559"+03	NM	7.8179	1.3304	1.2417"+03	1.2417"+03
2.6670"+00	2.0075"+05	1.0000	1.6120"+04	NC	1.8147	1.7859	2.9833"+02	8.0722"+01
INFINITE	3.4517"+02	0.0000	2.3870"-03	0.0000"+00	0.1539	4.5417"-03	7.2906"+02	3.1766"+02
73010804	3.9879	0.9262	6.3177"+03	NM	7.4346	1.3264	1.2197"+03	1.2197"+03
3.8862"+00	1.8222"+05	1.0000	1.9445"+04	NC	1.8133	1.7872	2.9833"+02	8.3667"+01
INFINITE	3.4978"+02	0.0000	3.1375"-03	0.0000"+00	0.1897	5.8192"-03	7.3136"+02	3.2211"+02
73010901	4.0640	1.0224	2.6492"+03	NM	8.1951	1.3759	2.4621"+03	2.4621"+03
8.3820"-01	4.0699"+05	1.0000	9.1490"+03	0.0000"+00	1.8167	1.7835	3.1239"+02	7.7167"+01
INFINITE	3.3207"+02	0.0000	6.3630"-04	0.0000"+00	0.1086	1.2309"-03	7.1578"+02	3.0556"+02
73010902	4.0851	0.9880	4.4124"+03	NM	8.1445	1.3476	2.4152"+03	2.4152"+03
1.4478"+00	4.1052"+05	1.0000	1.4959"+04	0.0000"+00	1.8141	1.7843	3.0183"+02	7.6556"+01
INFINITE	3.3207"+02	0.0000	1.0427"-03	0.0000"+00	0.1204	2.0209"-03	7.1664"+02	3.0549"+02
73010903	4.1103	0.9814	6.7779"+03	NM	8.3574	1.3275	2.3421"+03	2.3421"+03
2.6670"+00	4.1153"+05	1.0000	2.3121"+04	0.0000"+00	1.8273	1.7972	2.9689"+02	7.5111"+01
INFINITE	3.2891"+02	0.0000	1.6054"-03	0.0000"+00	0.0865	3.0982"-03	7.1423"+02	3.0251"+02
73011001	4.0528	0.9796	2.5653"+03	NM	6.5354	1.4063	2.5014"+03	2.5014"+03
8.3820"-01	4.0741"+05	1.0000	8.5408"+03	NC	1.8120	1.7783	2.9894"+02	7.7389"+01
INFINITE	3.3161"+02	0.0000	5.8880"-04	0.0000"+00	0.4364	1.0270"-03	7.1483"+02	3.0517"+02
73011002	4.0847	0.9717	4.3409"+03	NM	7.1894	1.3893	2.4401"+03	2.4401"+03
1.4478"+00	4.1452"+05	1.0000	1.4537"+04	NC	1.8043	1.7724	2.9594"+02	7.6333"+01
INFINITE	3.3105"+02	0.0000	9.9867"-04	0.0000"+00	0.3235	1.8483"-03	7.1553"+02	3.0456"+02
73011003	4.1069	0.9597	7.1399"+03	NM	7.4812	1.3841	2.3325"+03	2.3325"+03
2.6670"+00	4.0800"+05	1.0000	2.3820"+04	0.0000"+00	1.8176	1.7811	2.9533"+02	7.6500"+01
INFINITE	3.3456"+02	0.0000	1.7082"-03	0.0000"+00	0.2817	3.1863"-03	7.2020"+02	3.0772"+02

73010101 GATES PROFILE TABULATION 48 POINTS, DELTA AT POINT 43

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88249	0.00000	0.00000	5.17350	0.00000
2	6.3500"-05	1.0102"+00	NM	0.88142	0.02441	0.05540	5.15230	0.01075
3	2.1590"-04	1.0807"+00	NM	0.87245	0.06792	0.15190	5.00240	0.03037
4	3.6830"-04	1.2798"+00	NM	0.87199	0.12256	0.26750	4.76400	0.05615
5	5.9690"-04	1.7288"+00	NM	0.88613	0.18660	0.39330	4.44270	0.08853
6	8.5090"-04	2.3185"+00	NM	0.89526	0.23706	0.48130	4.12200	0.11676
7	1.1811"-03	2.8832"+00	NM	0.89280	0.27412	0.53670	3.83330	0.14001
8	1.5621"-03	3.2518"+00	NM	0.90074	0.29541	0.56880	3.70730	0.15343
9	2.1209"-03	3.6012"+00	NM	0.90261	0.31412	0.59400	3.57580	0.16612
10	2.6289"-03	3.8915"+00	NM	0.90607	0.32879	0.61350	3.48160	0.17621
11	3.3655"-03	4.2503"+00	NM	0.90150	0.34602	0.63240	3.34030	0.18932
12	4.1783"-03	4.6580"+00	NM	0.89906	0.36455	0.65230	3.20170	0.20374
13	5.1435"-03	5.1341"+00	NM	0.90379	0.38502	0.67560	3.07900	0.21942
14	6.2103"-03	5.6961"+00	NM	0.91157	0.40782	0.70100	2.95460	0.23726
15	7.2517"-03	6.2268"+00	NM	0.91857	0.42821	0.72250	2.84680	0.25379
16	8.2169"-03	6.7634"+00	NM	0.92685	0.44787	0.74280	2.75070	0.27004
17	9.2075"-03	7.2530"+00	NM	0.92676	0.46507	0.75680	2.64810	0.28579
18	1.0224"-02	7.8786"+00	NM	0.92688	0.48614	0.77300	2.52830	0.30574
19	1.0884"-02	8.2728"+00	NM	0.92549	0.49896	0.78170	2.45440	0.31849
20	1.2814"-02	9.4703"+00	NM	0.92958	0.53601	0.80820	2.27350	0.35549
21	1.4008"-02	1.0262"+01	NM	0.93181	0.55913	0.82320	2.16760	0.37977
22	1.5354"-02	1.1208"+01	NM	0.93870	0.58558	0.84110	2.06310	0.40769
23	1.6472"-02	1.2118"+01	NM	0.94440	0.60992	0.85630	1.97110	0.43443
24	1.7945"-02	1.3295"+01	NM	0.95123	0.64003	0.87380	1.86390	0.46880
25	1.8961"-02	1.4106"+01	NM	0.95634	0.65999	0.88500	1.79810	0.49219
26	2.0409"-02	1.5321"+01	NM	0.95516	0.68879	0.89630	1.69330	0.52932
27	2.1679"-02	1.6316"+01	NM	0.95656	0.71151	0.90560	1.62000	0.55901
28	2.2847"-02	1.7572"+01	NM	0.95016	0.73917	0.91230	1.52330	0.59890
29	2.4244"-02	1.8335"+01	NM	0.95768	0.75549	0.92130	1.48710	0.61953
30	2.5514"-02	1.9350"+01	NM	0.96153	0.77667	0.92980	1.43320	0.64876
31	2.7826"-02	2.1139"+01	NM	0.96521	0.81264	0.94200	1.34370	0.70105
32	3.0493"-02	2.2979"+01	NM	0.96992	0.84805	0.95360	1.26440	0.75419
33	3.2855"-02	2.4314"+01	NM	0.97500	0.87283	0.96210	1.21500	0.79185
34	3.5039"-02	2.5313"+01	NM	0.97633	0.89093	0.96690	1.17780	0.82094
35	3.8189"-02	2.6593"+01	NM	0.97832	0.91360	0.97280	1.13380	0.85800
36	4.0780"-02	2.7524"+01	NM	0.97967	0.92974	0.97680	1.10380	0.88494
37	4.3142"-02	2.8263"+01	NM	0.98025	0.94236	0.97960	1.08060	0.90653
38	4.5860"-02	2.9021"+01	NM	0.98275	0.95511	0.98330	1.05990	0.92773
39	4.7917"-02	2.9554"+01	NM	0.98521	0.96399	0.98620	1.04660	0.94229
40	5.0356"-02	3.0210"+01	NM	0.98826	0.97480	0.98970	1.03080	0.96013
41	5.4242"-02	3.0824"+01	NM	0.99168	0.98482	0.99320	1.01710	0.97650
42	5.8788"-02	3.1367"+01	NM	0.99521	0.99357	0.99650	1.00590	0.99066
D 43	6.3970"-02	3.1768"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
44	6.8212"-02	3.1646"+01	NM	1.00027	0.99805	0.99980	1.00350	0.99631
45	7.3266"-02	3.1606"+01	NM	1.00109	0.99741	1.00010	1.00540	0.99473
46	7.8346"-02	3.1500"+01	NM	1.00087	0.99573	0.99970	1.00800	0.99177
47	8.4036"-02	3.1375"+01	NM	1.00217	0.99371	1.00000	1.01270	0.98746
48	8.8633"-02	3.1317"+01	NM	1.00229	0.99278	0.99990	1.01440	0.98571

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

73010501 GATES PROFILE TABULATION 48 POINTS, DELTA AT POINT 36

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93447	0.00000	0.00000	5.13780	0.00000
2	6.3500"-05	1.0126"+00	NM	0.93520	0.02819	0.06380	5.12350	0.01245
3	1.6510"-04	1.0557"+00	NM	0.93084	0.05889	0.13220	5.03920	0.02623
4	3.6830"-04	1.2631"+00	NM	0.93841	0.12386	0.27210	4.82640	0.05638
5	5.4610"-04	1.6893"+00	NM	0.94516	0.18954	0.40090	4.47360	0.08961
6	7.7970"-04	2.2525"+00	NM	0.94323	0.24144	0.48940	4.10860	0.11912
7	1.1303"-03	2.8512"+00	NM	0.95159	0.28299	0.55500	3.84640	0.14429
8	1.5113"-03	3.2950"+00	NM	0.96422	0.30962	0.59590	3.70410	0.16086
9	2.0701"-03	3.6347"+00	NM	0.95503	0.32840	0.61750	3.53570	0.17465
10	2.4765"-03	3.8485"+00	NM	0.95051	0.33964	0.63000	3.44070	0.18310
11	3.3401"-03	4.2763"+00	NM	0.95289	0.36102	0.65610	3.30280	0.19865
12	4.2037"-03	4.7077"+00	NM	0.96154	0.38130	0.68170	3.19630	0.21328
13	5.0419"-03	5.1381"+00	NM	0.96834	0.40048	0.70430	3.09280	0.22772
14	6.0579"-03	5.6893"+00	NM	0.96699	0.42373	0.72670	2.94120	0.24708
15	7.1755"-03	6.2307"+00	NM	0.96715	0.44537	0.74660	2.81020	0.26568
16	8.1153"-03	6.7940"+00	NM	0.97617	0.46679	0.76850	2.71050	0.28353
17	9.1821"-03	7.4870"+00	NM	0.98852	0.49184	0.79350	2.60280	0.30486
18	1.0274"-02	8.1276"+00	NM	0.98667	0.51390	0.80920	2.47940	0.32637
19	1.1443"-02	8.8032"+00	NM	0.98648	0.53618	0.82460	2.36520	0.34864
20	1.2738"-02	9.6792"+00	NM	0.98694	0.56374	0.84250	2.23350	0.37721
21	1.3983"-02	1.0467"+01	NM	0.98663	0.58740	0.85640	2.12560	0.40290
22	1.5354"-02	1.1544"+01	NM	0.99652	0.61830	0.87760	2.01460	0.43562
23	1.6396"-02	1.2466"+01	NM	1.00574	0.64357	0.89440	1.93140	0.46308
24	1.7869"-02	1.3781"+01	NM	1.00585	0.67795	0.91030	1.80290	0.50491
25	1.8961"-02	1.4672"+01	NM	1.00460	0.70031	0.91920	1.72280	0.53355
26	2.0307"-02	1.5749"+01	NM	1.00054	0.72640	0.92760	1.63070	0.56884
27	2.1577"-02	1.6837"+01	NM	1.00186	0.75183	0.93750	1.55490	0.60293
28	2.2974"-02	1.8164"+01	NM	1.00676	0.78171	0.94990	1.47660	0.64330
29	2.4143"-02	1.9349"+01	NM	1.01001	0.80747	0.95950	1.41200	0.67953
30	2.5336"-02	2.0381"+01	NM	1.00878	0.82926	0.96530	1.35500	0.71240
31	2.7978"-02	2.2484"+01	NM	1.00595	0.87197	0.97540	1.25130	0.77951
32	3.0620"-02	2.4274"+01	NM	1.00226	0.90674	0.98200	1.17290	0.83724
33	3.2830"-02	2.5587"+01	NM	1.00021	0.93141	0.98650	1.12180	0.87939
34	3.5649"-02	2.6975"+01	NM	0.99616	0.95679	0.98980	1.07020	0.92487
35	3.8240"-02	2.8244"+01	NM	0.99686	0.97944	0.99460	1.03120	0.96451
D 36	4.0526"-02	2.9423"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
37	4.3167"-02	3.0325"+01	NM	0.99709	1.01546	1.00130	0.97230	1.02983
38	4.5656"-02	3.0944"+01	NM	0.99429	1.02594	1.00170	0.95330	1.05077
39	4.8450"-02	3.1475"+01	NM	0.99092	1.03484	1.00150	0.93660	1.06929
40	5.1016"-02	3.1880"+01	NM	0.98656	1.04157	1.00040	0.92250	1.08444
41	5.4191"-02	3.2198"+01	NM	0.98232	1.04682	0.99910	0.91090	1.09683
42	5.7899"-02	3.2171"+01	NM	0.97991	1.04638	0.99780	0.90930	1.09733
43	6.3792"-02	3.2174"+01	NM	0.97871	1.04644	0.99720	0.90810	1.09812
44	6.8466"-02	3.2086"+01	NM	0.97976	1.04498	0.99750	0.91120	1.09471
45	7.4079"-02	3.1961"+01	NM	0.97944	1.04291	0.99700	0.91390	1.09093
46	7.8727"-02	3.1772"+01	NM	0.98064	1.03977	0.99710	0.91960	1.08428
47	8.3858"-02	3.1530"+01	NM	0.98071	1.03589	0.99650	0.92540	1.07683
48	8.9040"-02	3.1336"+01	NM	0.98103	1.03252	0.99610	0.93070	1.07027

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

73011001 GATES PROFILE TABULATION 37 POINTS, DELTA AT POINT 23

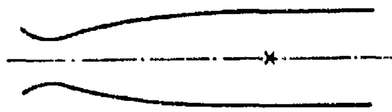
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.90139	0.00000	0.00000	3.86250	0.00000
2	6.3500"-05	1.1111"+00	NM	0.87364	0.09644	0.18380	3.63260	0.05060
3	1.1450"-04	1.1912"+00	NM	0.86985	0.12491	0.23520	3.54560	0.06634
4	4.1910"-04	3.3390"+00	NM	0.87913	0.36523	0.59110	2.61930	0.22567
5	6.2230"-04	4.3553"+00	NM	0.88771	0.42690	0.65850	2.37940	0.27675
6	8.2550"-04	4.9979"+00	NM	0.89427	0.46144	0.69290	2.25480	0.30730
7	1.1557"-03	5.5473"+00	NM	0.88767	0.48897	0.71370	2.13040	0.33501
8	1.5367"-03	6.1415"+00	NM	0.89078	0.51706	0.73710	2.03220	0.36271
9	1.8161"-03	6.6431"+00	NM	0.89361	0.53961	0.75490	1.95710	0.38572
10	2.2479"-03	7.2369"+00	NM	0.89841	0.56513	0.77460	1.87870	0.41231
11	2.7305"-03	7.9783"+00	NM	0.90713	0.59543	0.79790	1.79570	0.44434
12	3.1115"-03	8.6906"+00	NM	0.91109	0.62314	0.81620	1.71560	0.47575
13	3.4163"-03	9.2013"+00	NM	0.91499	0.64227	0.82870	1.66480	0.49778
14	4.6355"-03	1.1455"+01	NM	0.94257	0.72060	0.88040	1.49270	0.58980
15	5.4737"-03	1.3068"+01	NM	0.95553	0.77174	0.90820	1.38490	0.65579
16	6.6167"-03	1.5548"+01	NM	0.97651	0.84438	0.94480	1.25200	0.75463
17	7.6581"-03	1.7708"+01	NM	0.98987	0.90286	0.96960	1.15330	0.84072
18	8.6995"-03	1.9536"+01	NM	0.99412	0.94954	0.98460	1.07520	0.91574
19	9.7155"-03	2.0728"+01	NM	0.99734	0.97879	0.99360	1.03050	0.96419
20	1.1214"-02	2.1395"+01	NM	0.99805	0.99477	0.99780	1.00610	0.99175
21	1.2230"-02	2.1546"+01	NM	0.99717	0.99835	0.99820	0.99970	0.99850
22	1.3830"-02	2.1567"+01	NM	0.99854	0.99885	0.99900	1.00030	0.99870
D 23	1.4922"-02	2.1615"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
24	1.6345"-02	2.1620"+01	NM	0.99895	1.00010	0.99950	0.99880	1.00070
25	1.7158"-02	2.1634"+01	NM	1.00059	1.00045	1.00040	0.99990	1.00050
26	1.8478"-02	2.1620"+01	NM	1.00235	1.00010	1.00120	1.00220	0.99900
27	2.0841"-02	2.1582"+01	NM	1.00117	0.99920	1.00040	1.00240	0.99800
28	2.3152"-02	2.1584"+01	NM	1.00235	0.99925	1.00100	1.00350	0.99751
29	2.4016"-02	2.1567"+01	NM	1.00331	0.99891	1.00140	1.00500	0.99642
30	2.6556"-02	2.1563"+01	NM	1.00258	0.99876	1.00100	1.00450	0.99652
31	2.8918"-02	2.1563"+01	NM	1.00098	0.99875	1.00020	1.00290	0.99731
32	3.1229"-02	2.1520"+01	NM	0.99526	0.99775	0.99710	0.99870	0.99840
33	3.3947"-02	2.1482"+01	NM	0.98711	0.99685	0.99280	0.99190	1.00091
34	3.6766"-02	2.1917"+01	NM	0.99094	1.00712	0.99710	0.98020	1.01724
35	3.8951"-02	2.1500"+01	NM	1.00028	0.99726	0.99950	1.00450	0.99502
36	4.1719"-02	2.1169"+01	NM	0.99681	0.98939	0.99590	1.01320	0.98293
37	4.4437"-02	2.0698"+01	NM	0.99488	0.97807	0.99220	1.02910	0.96414

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

73011003 GATES PROFILE TABULATION 39 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88246	0.00000	0.00000	3.85930	0.00000
2	6.3500"-05	1.0757"+00	NM	0.87763	0.07902	0.15320	3.75900	0.04076
3	3.4290"-04	1.2689"+00	NM	0.88176	0.14446	0.27420	3.60260	0.07611
4	1.0287"-03	2.5429"+00	NM	0.91024	0.30326	0.52860	3.03820	0.17398
5	1.4097"-03	3.0857"+00	NM	0.92369	0.34342	0.58380	2.88990	0.20201
6	1.9431"-03	3.9630"+00	NM	0.92653	0.39096	0.64780	2.63650	0.24570
7	2.7305"-03	4.6944"+00	NM	0.92437	0.43961	0.68770	2.44720	0.28102
8	3.3655"-03	5.1572"+00	NM	0.92480	0.46341	0.70970	2.34540	0.30259
9	3.9243"-03	5.5186"+00	NM	0.92433	0.48115	0.72490	2.26980	0.31937
10	4.6101"-03	5.9628"+00	NM	0.92956	0.50208	0.74420	2.19700	0.33873
11	5.6515"-03	6.5409"+00	NM	0.93571	0.52805	0.76680	2.10870	0.36364
12	6.7437"-03	7.0648"+00	NM	0.93978	0.55051	0.78480	2.03230	0.38616
13	7.5819"-03	7.4870"+00	NM	0.94544	0.56795	0.79920	1.98010	0.40362
14	8.3185"-03	7.9010"+00	NM	0.95121	0.58454	0.81260	1.93250	0.42049
15	9.8425"-03	8.6775"+00	NM	0.96192	0.61444	0.83580	1.85030	0.45171
16	1.1367"-02	9.4506"+00	NM	0.96658	0.64282	0.85420	1.76580	0.48375
17	1.3195"-02	1.0354"+01	NM	0.96874	0.67445	0.87200	1.67160	0.52166
18	1.4973"-02	1.1289"+01	NM	0.97116	0.70570	0.88840	1.58480	0.56058
19	1.6396"-02	1.2077"+01	NM	0.97378	0.73098	0.90110	1.51960	0.59298
20	1.8275"-02	1.3128"+01	NM	0.97556	0.76340	0.91560	1.43850	0.63650
21	1.9520"-02	1.3910"+01	NM	0.97824	0.78667	0.92600	1.38560	0.66830
22	2.1146"-02	1.5343"+01	NM	0.98073	0.82756	0.94200	1.29570	0.72702
23	2.2542"-02	1.6471"+01	NM	0.98238	0.85838	0.95300	1.23260	0.77316
24	2.5286"-02	1.8598"+01	NM	0.98977	0.91368	0.97310	1.13430	0.85789
25	2.7140"-02	1.9909"+01	NM	0.99336	0.94616	0.98360	1.08070	0.91015
26	2.9654"-02	2.1095"+01	NM	0.99514	0.97460	0.99160	1.03520	0.95788
27	3.2423"-02	2.1843"+01	NM	0.99483	0.99213	0.99560	1.00700	0.98868
28	3.4684"-02	2.2062"+01	NM	0.99649	0.99720	0.99760	1.00080	0.99680
D 29	3.7929"-02	2.2184"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
30	4.0373"-02	2.2220"+01	NM	1.00081	1.00085	1.00060	0.99950	1.00110
31	4.3269"-02	2.2236"+01	NM	0.99885	1.00120	0.99970	0.99700	1.00271
32	4.6063"-02	2.2281"+01	NM	0.99001	1.00224	0.99550	0.98660	1.00902
33	4.8654"-02	2.2306"+01	NM	0.98577	1.00282	0.99350	0.98150	1.01223
34	5.0863"-02	2.2318"+01	NM	0.98288	1.00309	0.99210	0.97820	1.01421
35	5.2464"-02	2.2298"+01	NM	0.98189	1.00264	0.99150	0.97790	1.01392
36	5.5893"-02	2.2323"+01	NM	0.98025	1.00322	0.99080	0.97540	1.01579
37	5.8407"-02	2.2323"+01	NM	0.97630	1.00320	0.98890	0.97170	1.01770
38	6.0846"-02	2.2311"+01	NM	0.97741	1.00293	0.98930	0.97300	1.01675
39	6.3055"-02	2.2325"+01	NM	0.98301	1.00325	0.99220	0.97810	1.01442

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD



M : 0.2 to 2.8
R THETA X 10^{-3} : 10 - 160
TW/TR : Approx 1

7302

ZPG - AW

Continuous running windtunnel with variable nozzle: W = H : 2.4 m. L : 10 m.
0.01 < PO < 0.4 MN/m^2. TO : 284 - 294 K. Air, dew point below 243 K. 1.5 < RE/m × 10^{-6} < 18.

WINTER K.G. and GAUDET L., 1973. Turbulent boundary-layer studies at high Reynolds numbers at Mach numbers between 0.2 and 2.8. ARC (London) R & M 3712.
And Winter K.G. private communications. Also: Winter & Gaudet (1970) (1968) and Winter, Smith & Gaudet (1965).

1 The tests were performed at a single station approximately 10.7 m downstream of the throat on the centre
line of the plane side wall of a closed-circuit wind-tunnel with a flexible roof and floor. The Mach number
at the test station was set to nominal values in steps of 0.2, from 0.2 to 0.8 and from 1.4 to 2.8. All the
walls in the nozzle and test-section were coated with a thin layer of epoxy resin providing some thermal
2 insulation and giving a good surface finish (typically 6-13 μm). Localised disturbances in the test-area
3 caused Mach number perturbations less than 0.006 in the supersonic test cases. Transition occured naturally
and no experimental observations are available. The design is such that the final Mach number is approached
4 asymptotically, and has a value within 1 % of its final value for the last 25 % of the effective run. The
pressure history is presented graphically in figure 6 of the source, and the temperature history probably
5 corresponds to a very slight heat transfer to the flow. No systematic investigation of possible flow
convergence was made, but accidental hydraulic leaks showed approximately parallel streak-patterns.

6 The instruments were attached to replaceable plugs inserted just upstream of the main tunnel windows. At
subsonic speeds the wall static pressure was measured with tappings 3.2 mm in diameter, and corrected for
hole size after Gaudet (1965), whilst at supersonic speeds it was assumed constant through the boundary
layer and computed from the tunnel reservoir pressure and the pitot pressure just outside the boundary
layer. Some measurements of TW were made on the balance plate and the rake mounting plate, the values being
closely adiabatic. The wall shear stress was measured using a floating element balance (diameter 368.3 mm),
the force on the plate being found by strain gauge techniques. Corrections to the measurements were made
to allow for the effects of temperature differences between the back plate and the floating plate.

7 Profile surveys were made using rakes mounted so that the profile normal passed through the X-value of the
8 balance centre. Thirteen TTP were mounted on a strut. These were STP's with a thermistor bead in a vented
stainless steel tube for which d_1 = 2, d_2 = 1.6 and l = 25.4 mm. These were calibrated in the flow near
the centre line of the tunnel over a range of Mach number (0.8<M<2.8) and Reynolds number, by comparison
with an ECP. On separate runs the same strut carried 49 CPP mounted in five columns, so as to avoid mutual
interference in an array of densely packed tubes. For the tubes near the wall, d_1 = 0.50 mm, d_2 = 0.25 mm,
while further out d_1 = 1.00 mm and d_2 = 0.60 mm. Static pressure probes were also mounted but not used.

9 Profile TO measurements were interpolated to the Y-values of the PO measurements, and correlation of profile
measurements and CF measurements on different occasions was made by interpolation of the data on the basis
10 of unit Reynolds number. No corrections were applied to the profile data. Sutherland's viscosity law was
11 used.

12 The editors have presented the data using the measured temperature distribution - the profiles resulting
from a Crocco / Van Driest-relation with recovery factors of 0.89 and 1.0 (isoenergetic) are also tabulated
by the authors. The boundary conditions are calculated from the authors' unit Reynolds number values, MD
13 and TOD. TW has been taken as TR with a recovery factor of 0.896. The profiles in the tables below include
some of the wide range of measurements made at subsonic Mach numbers. Those whose serial numbers are/
14 followed by a star form a set for all of which the unit Reynolds number was close to 7 × 10^6/m. The CF
values presented with the profiles are as interpolated by the authors. The full Mach number range is covered,
from 0.2 to 2.8, with a range of Reynolds number covered at M = 0.8, 1.4, 2.2 and 2.8.

§ DATA: 730101 to 1203 Pitot and TO profiles. NX = 1. CF from balance.

15 Editors' comments

The exceptional size of the floating element balance made it possible for the peripheral gap to be fully pressure plotted. Thus aerodynamically induced errors could be eliminated, and the reading of the balance itself is unusually trustworthy. The scale is such however that a substantial variation of CF could occur over the width of the element (Fernholz 1964) so that the recorded value might not be appropriate to the profile recorded at the centre of the plate. The profiles are described in fine detail, but in spite of the large physical scale of the experiment, measurements do not extend within the momentum-deficit peak in about half the cases. Integral values, therefore, should be treated with caution. Log-law plots indicate that substantial probe corrections could reasonably be applied to the data-points closest to the wall. The TO readings in this region are interpolated, but any error introduced in this way will be negligible for an AW case at these relatively low Mach numbers.

The Reynolds number and Mach number ranges are unusually wide and systematically varied and of particular interest since the whole range from M = 0.2 to M = 2.8 was covered with the same instrumentation. Comparisons should be made with the data of Allen - CAT 7303 and Jackson et al. - CAT 6505 with broadly the same geometry and Reynolds number range. Hopkins & Keener - CAT 6601 whose Reynolds number fell in the range of CAT 7302, give measurements made not on the flat side wall, but on the wall which, upstream, was curved to form the nozzle. Similar tests were made at ultra-high Reynolds number by Moore & Harkness - CAT 6502 and Thomke - CAT 6903. Further high Reynolds number experiments at higher Mach numbers and with varied geometries and boundary layer histories are those of Voisinet & Lee - CAT 7202, Gates - CAT 7301, Jones & Feller - CAT 7002 and Hopkins & Keener - CAT 7203.

CAT 7302 WINTER/GAUDET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TH/TR*	RED2W	CF *	H12	H12K	PW	PD*
X	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD*
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD*	TR
73020101*	0.2007	1.0000	9.5756"+04	1.7700"-03	1.2609	1.2451	1.4282"+05	1.4282"+05
NM	1.4688"+05	1.0000	9.6292"+04	NM	1.8201	1.8200	2.8370"+02	2.8168"+02
INFINITE	2.8395"+02	0.0000	1.4240"-02	0.0000"+00	0.0017	1.4272"-02	6.7536"+01	2.8370"+02
73020102*	0.2013	1.0000	9.4304"+04	1.8300"-03	1.2607	1.2446	1.3787"+05	1.3787"+05
NM	1.4182"+05	1.0000	9.4834"+04	NM	1.8233	1.8231	2.8520"+02	2.8316"+02
INFINITE	2.8545"+02	0.0000	1.4582"-02	0.0000"+00	0.0015	1.4615"-02	6.7915"+01	2.8520"+02
73020201*	0.3978	1.0000	8.4937"+04	1.7800"-03	1.2898	1.2364	6.8472"+04	6.8472"+04
NM	7.6362"+04	1.0000	8.6803"+04	NM	1.8265	1.8261	2.8469"+02	2.7689"+02
INFINITE	2.8565"+02	0.0000	1.3214"-02	0.0000"+00	0.0136	1.3317"-02	1.3272"+02	2.8469"+02
73020301*	0.5952	1.0000	8.1145"+04	1.7600"-03	1.3896	1.2375	4.4336"+04	4.4336"+04
NM	5.6339"+04	1.0000	8.5141"+04	NM	1.8264	1.8255	2.8337"+02	2.6656"+02
INFINITE	2.8545"+02	0.0000	1.2739"-02	0.0000"+00	0.0023	1.2998"-02	1.9484"+02	2.8337"+02
73020401*	0.7904	1.0000	7.2951"+04	1.7400"-03	1.5286	1.2371	3.1465"+04	3.1465"+04
NM	4.7510"+04	1.0000	7.9288"+04	NM	1.8274	1.8258	2.8393"+02	2.5552"+02
INFINITE	2.8745"+02	0.0000	1.1916"-02	0.0000"+00	-0.0150	1.2362"-02	2.5332"+02	2.8393"+02
73020402	0.7930	1.0000	1.0879"+05	1.6500"-03	1.5227	1.2360	4.7015"+04	4.7015"+04
NM	7.1172"+04	1.0000	1.1831"+05	NM	1.8278	1.8262	2.8293"+02	2.5445"+02
INFINITE	2.8645"+02	0.0000	1.1797"-02	0.0000"+00	-0.0096	1.2236"-02	2.5362"+02	2.8293"+02
73020403	0.7933	1.0000	1.4182"+05	1.5800"-03	1.5201	1.2329	6.2479"+04	6.2479"+04
NM	9.4610"+04	1.0000	1.5422"+05	NM	1.8292	1.8277	2.8391"+02	2.5531"+02
INFINITE	2.8745"+02	0.0000	1.1618"-02	0.0000"+00	-0.0102	1.2047 -02	2.5415"+02	2.8391"+02
73020501	1.3943	1.0000	1.3702"+04	1.9700"-03	2.1014	1.2597	3.4812"+03	3.4812"+03
NM	1.0990"+04	1.0000	1.7425"+04	NM	1.8166	1.8118	2.8170"+02	2.0928"+02
INFINITE	2.9065"+02	0.0000	1.0315"-02	0.0000"+00	0.0090	1.1526"-02	4.0442"+02	2.8170"+02
73020502	1.3951	1.0000	2.9589"+04	1.7600"-03	2.1556	1.2649	8.3239"+03	8.3239"+03
NM	2.6307"+04	1.0000	3.7634"+04	NM	1.8157	1.8108	2.8227"+02	2.0964"+02
INFINITE	2.9125"+02	0.0000	9.3327"-03	0.0000"+00	-0.0236	1.0447"-02	4.0500"+02	2.8227"+02
73020503*	1.4003	1.0000	4.5658"+04	1.6500"-03	2.1097	1.2477	1.3723"+04	1.3723"+04
NM	4.3688"+04	1.0000	5.8160"+04	NM	1.8255	1.8207	2.8272"+02	2.0957"+02
INFINITE	2.9175"+02	0.0000	8.7123"-03	0.0000"+00	-0.0029	9.7046"-03	4.0643"+02	2.8272"+02
73020504	1.3999	1.0000	8.7352"+04	1.5000"-03	2.0688	1.2410	2.6523"+04	2.6523"+04
NM	8.4393"+04	1.0000	1.1134"+05	NM	1.8292	1.8245	2.7903"+02	2.0687"+02
INFINITE	2.8795"+02	0.0000	8.4831"-03	0.0000"+00	0.0181	9.4136"-03	4.0370"+02	2.7903"+02
73020505	1.4003	1.0000	9.6076"+04	1.4800"-03	2.1302	1.2401	3.0134"+04	3.0134"+04
NM	9.5936"+04	1.0000	1.2245"+05	NM	1.8292	1.8248	2.7990"+02	2.0748"+02
INFINITE	2.8885"+02	0.0000	8.2420"-03	0.0000"+00	-0.0240	9.1681"-03	4.0441"+02	2.7990"+02
73020601*	1.5970	1.0000	4.0241"+04	1.5900"-03	2.3395	1.2456	1.0699"+04	1.0699"+04
NM	4.5274"+04	1.0000	5.4625"+04	NM	1.8283	1.8223	2.8091"+02	1.9320"+02
INFINITE	2.9175"+02	0.0000	8.2501"-03	0.0000"+00	0.0113	9.4320"-03	4.4506"+02	2.8091"+02
73020701*	1.8002	1.0000	3.5558"+04	1.5300"-03	2.6196	1.2416	8.5372"+03	8.5372"+03
NM	4.9068"+04	1.0000	5.1780"+04	NM	1.8305	1.8235	2.7894"+02	1.7690"+02
INFINITE	2.9155"+02	0.0000	7.7130"-03	0.0000"+00	0.0202	9.1102"-03	4.8005"+02	2.7894"+02
73020801*	2.0002	1.0000	3.1338"+04	1.4600"-03	2.8926	1.2456	6.6819"+03	6.6819"+03
NM	5.2299"+04	1.0000	4.9070"+04	NM	1.8310	1.8223	2.7728"+02	1.6195"+02
INFINITE	2.9135"+02	0.0000	7.4463"-03	0.0000"+00	0.0501	9.0729"-03	5.1019"+02	2.7728"+02

CAT 7302 WINTER/GAUDET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X RZ	MD * POD* TOO*	TW/TR* PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2*	H12 H32 H42	H12K H32K D2K	PW TW UD*	PD* TD* TR
73020901*	2.1865	1.0000	8.3321"+03	1.7000"-03	3.2648	1.2573	1.3975"+03	1.3975"+03
NM	1.4630"+04	1.0000	1.3993"+04	NM	1.8211	1.8118	2.7578"+02	1.4899"+02
INFINITE	2.9145"+02	0.0000	8.2677"-03	0.0000"+00	0.0420	1.0559"-02	5.3511"+02	2.7578"+02
73020902	2.1972	1.0000	1.7468"+04	1.4900"-03	3.2783	1.2521	3.2427"+03	3.2427"+03
NM	3.4522"+04	1.0000	2.9453"+04	NM	1.8289	1.8180	2.7589"+02	1.4838"+02
INFINITE	2.9165"+02	0.0000	7.4206"-03	0.0000"+00	0.0424	9.4579"-03	5.3662"+02	2.7589"+02
73020903	2.2014	1.0000	2.7113"+04	1.3800"-03	3.2913	1.2457	5.4045"+03	5.4045"+03
NM	5.7915"+04	1.0000	4.5791"+04	NM	1.8326	1.8225	2.7576"+02	1.4805"+02
INFINITE	2.9155"+02	0.0000	6.8874"-03	0.0000"+00	0.0322	8.7266"-03	5.3705"+02	2.7576"+02
73020904	2.2064	1.0000	4.9459"+04	1.2800"-03	3.3165	1.2348	1.0458"+04	1.0458"+04
NM	1.1295"+05	1.0000	8.3762"+04	NM	1.8381	1.8287	2.7365"+02	1.4661"+02
INFINITE	2.8935"+02	0.0000	6.4078"-03	0.0000"+00	0.0141	8.0676"-03	5.3564"+02	2.7365"+02
73020905	2.1984	1.0000	1.0864"+04	1.6100"-03	3.5115	1.2888	1.9162"+03	1.9162"+03
NM	2.0438"+04	1.0000	1.8353"+04	NM	1.8132	1.8013	2.7247"+02	1.4647"+02
INFINITE	2.8805"+02	0.0000	7.6800"-03	0.0000"+00	-0.0392	1.0022"-02	5.3345"+02	2.7247"+02
73020906	2.1992	1.0000	1.4142"+04	1.5400"-03	3.3233	1.2722	2.5471"+03	2.5471"+03
NM	2.7201"+04	1.0000	2.3879"+04	NM	1.8207	1.8096	2.7428"+02	1.4739"+02
INFINITE	2.8995"+02	0.0000	7.5812"-03	0.0000"+00	0.0343	9.7108"-03	5.3530"+02	2.7428"+02
73020907	2.2005	1.0000	1.6653"+04	1.4900"-03	3.4495	1.2694	3.1937"+03	3.1937"+03
NM	3.4176"+04	1.0000	2.8123"+04	NM	1.8223	1.8116	2.7521"+02	1.4781"+02
INFINITE	2.9095"+02	0.0000	7.1449"-03	0.0000"+00	-0.0256	9.1992"-03	5.3639"+02	2.7521"+02
73020908	2.2012	1.0000	1.8926"+04	1.4600"-03	3.5084	1.2620	3.8033"+03	3.8033"+03
NM	4.0744"+04	1.0000	3.1955"+04	NM	1.8253	1.8153	2.7633"+02	1.4837"+02
INFINITE	2.9215"+02	0.0000	6.8511"-03	0.0000"+00	-0.0581	8.8231"-03	5.3758"+02	2.7633"+02
73020909	2.2025	1.0000	2.1892"+04	1.4300"-03	3.4343	1.2568	4.4345"+03	4.4345"+03
NM	4.7603"+04	1.0000	3.6971"+04	NM	1.8285	1.8184	2.7699"+02	1.4864"+02
INFINITE	2.9285"+02	0.0000	6.8116"-03	0.0000"+00	-0.0263	8.7171"-03	5.3839"+02	2.7699"+02
73020910*	2.2040	1.0000	2.5495"+04	1.3900"-03	3.4721	1.2533	5.3465"+03	5.3465"+03
NM	5.7527"+04	1.0000	4.3074"+04	NM	1.8307	1.8207	2.7726"+02	1.4869"+02
INFINITE	2.9315"+02	0.0000	6.5808"-03	0.0000"+00	-0.0446	8.4304"-03	5.3885"+02	2.7726"+02
73020911	2.2054	1.0000	2.9789"+04	1.3700"-03	3.3878	1.2510	6.2876"+03	6.2876"+03
NM	6.7802"+04	1.0000	5.0351"+04	NM	1.8316	1.8219	2.7744"+02	1.4870"+02
INFINITE	2.9335"+02	0.0000	6.5379"-03	0.0000"+00	-0.0082	8.3099"-03	5.3920"+02	2.7744"+02
73020912	2.2064	1.0000	3.5004"+04	1.3300"-03	3.4064	1.2463	7.5204"+03	7.5204"+03
NM	8.1223"+04	1.0000	5.9189"+04	NM	1.8341	1.8245	2.7742"+02	1.4863"+02
INFINITE	2.9335"+02	0.0000	6.4183"-03	0.0000"+00	-0.0179	8.1642"-03	5.3933"+02	2.7742"+02
73020913	2.2071	1.0000	4.0203"+04	1.3100"-03	3.4179	1.2431	8.8038"+03	8.8038"+03
NM	9.5188"+04	1.0000	6.7996"+04	NM	1.8357	1.8264	2.7743"+02	1.4859"+02
INFINITE	2.9335"+02	0.0000	6.2945"-03	0.0000"+00	-0.0254	7.9974"-03	5.3941"+02	2.7743"+02
73020914	2.2082	1.0000	4.6532"+04	1.2900"-03	3.3832	1.2415	1.0272"+04	1.0272"+04
NM	1.1125"+05	1.0000	7.8719"+04	NM	1.8362	1.8271	2.7799"+02	1.4882"+02
INFINITE	2.9395"+02	0.0000	6.2557"-03	0.0000"+00	-0.0101	7.9241"-03	5.4010"+02	2.7799"+02
73021001*	2.4020	1.0000	2.1827"+04	1.3500"-03	3.7448	1.2481	4.2027"+03	4.2027"+03
NM	6.1636"+04	1.0000	3.9815"+04	NM	1.8330	1.8214	2.7502"+02	1.3568"+02
INFINITE	2.9225"+02	0.0000	6.2427"-03	0.0000"+00	0.0085	8.2434"-03	5.6098"+02	2.7502"+02
73021101*	2.5993	1.0000	2.0262"+04	1.2900"-03	4.0346	1.2491	3.4311"+03	3.4311"+03
NM	6.8389"+04	1.0000	3.9907"+04	NM	1.8344	1.8208	2.7462"+02	1.2468"+02
INFINITE	2.9315"+02	0.0000	6.2808"-03	0.0000"+00	0.0633	8.5716"-03	5.8192"+02	2.7462"+02
73021201	2.7894	1.0000	5.4382"+03	1.5300"-03	4.5242	1.2555	7.1397"+02	7.1397"+02
NM	1.9065"+04	1.0000	1.1563"+04	NM	1.8262	1.8127	2.7072"+02	1.1351"+02
INFINITE	2.9015"+02	0.0000	7.1222"-03	0.0000"+00	0.0526	1.0306"-02	5.9585"+02	2.7072"+02
73021202	2.7972	1.0000	1.1064"+04	1.3200"-03	4.5486	1.2605	1.6936"+03	1.6936"+03
NM	4.5766"+04	1.0000	2.3561"+04	NM	1.8277	1.8130	2.7347"+02	1.1429"+02
INFINITE	2.9315"+02	0.0000	6.1612"-03	0.0000"+00	0.0484	8.8605"-03	5.9958"+02	2.7347"+02
73021203*	2.7996	1.0000	1.7532"+04	1.2100"-03	4.5447	1.2446	2.8189"+03	2.8189"+03
NM	7.6454"+04	1.0000	3.7394"+04	NM	1.8410	1.8251	2.7225"+02	1.1367"+02
INFINITE	2.9185"+02	0.0000	5.8242"-03	0.0000"+00	0.0374	8.2116"-03	5.9845"+02	2.7225"+02

73020402 WINTER/GAUDET PROFILE TABULATION 39 POINTS, DELTA AT POINT 39

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.98761	0.00000	0.00000	1.11182	0.00000
2	3.0480"-04	1.1129"+00	NM	0.99206	0.49684	0.51710	1.08320	0.47738
3	3.5560"-04	1.1098"+00	NM	0.99200	0.49003	0.51020	1.08402	0.47066
4	8.3820"-04	1.1367"+00	NM	0.99323	0.54458	0.56540	1.07794	0.52452
5	1.1938"-03	1.1492"+00	NM	0.99353	0.56762	0.58850	1.07493	0.54748
6	1.4478"-03	1.1590"+00	NM	0.99414	0.58513	0.60610	1.07297	0.56488
7	1.6002"-03	1.1617"+00	NM	0.99427	0.58982	0.61080	1.07239	0.56957
8	2.1844"-03	1.1700"+00	NM	0.99438	0.60402	0.62490	1.07033	0.58384
9	2.5400"-03	1.1789"+00	NM	0.99473	0.61879	0.63960	1.06836	0.59866
10	3.0988"-03	1.1911"+00	NM	0.99520	0.63825	0.65890	1.06576	0.61824
11	3.4544"-03	1.1937"+00	NM	0.99507	0.64226	0.66280	1.06497	0.62237
12	4.2672"-03	1.2053"+00	NM	0.99550	0.66009	0.68040	1.06248	0.64039
13	5.0546"-03	1.2082"+00	NM	0.99534	0.66445	0.68460	1.06158	0.64489
14	6.4770"-03	1.2212"+00	NM	0.99627	0.68352	0.70350	1.05933	0.66410
15	7.4930"-03	1.2367"+00	NM	0.99669	0.70533	0.72480	1.05597	0.68638
16	8.8900"-03	1.2435"+00	NM	0.99667	0.71465	0.73380	1.05430	0.69601
17	1.1252"-02	1.2539"+00	NM	0.99717	0.72869	0.74750	1.05230	0.71035
18	1.2294"-02	1.2616"+00	NM	0.99691	0.73878	0.75710	1.05020	0.72091
19	1.5037"-02	1.2688"+00	NM	0.99748	0.74805	0.76620	1.04910	0.73034
20	1.7501"-02	1.2815"+00	NM	0.99792	0.76411	0.78170	1.04658	0.74691
21	2.2606"-02	1.2971"+00	NM	0.99855	0.78320	0.80010	1.04363	0.76665
22	2.5197"-02	1.3080"+00	NM	0.99855	0.79619	0.81240	1.04113	0.78031
23	3.0226"-02	1.3203"+00	NM	0.99864	0.81057	0.82600	1.03843	0.79543
24	3.5560"-02	1.3344"+00	NM	0.99908	0.82656	0.84120	1.03574	0.81218
25	4.0564"-02	1.3452"+00	NM	0.99909	0.83842	0.85230	1.03338	0.82477
26	4.5491"-02	1.3571"+00	NM	0.99935	1.85139	0.86450	1.03104	0.83848
27	5.0724"-02	1.3689"+00	NM	0.99966	0.86394	0.87630	1.02881	0.85176
28	5.5677"-02	1.3795"+00	NM	1.00032	0.87497	0.88680	1.02722	0.86330
29	6.1214"-02	1.3919"+00	NM	1.00082	0.88762	0.89870	1.02512	0.87668
30	6.6192"-02	1.4004"+00	NM	1.00072	0.89615	0.90650	1.02323	0.88592
31	7.0764"-02	1.4106"+00	NM	1.00156	0.90620	0.91610	1.02197	0.89640
32	7.6022"-02	1.4218"+00	NM	1.00126	0.91706	0.92590	1.01937	0.90831
33	8.8722"-02	1.4455"+00	NM	1.00192	0.93947	0.94660	1.01523	0.93240
34	1.0140"-01	1.4686"+00	NM	1.00271	0.96063	0.96610	1.01143	0.95518
35	1.1410"-01	1.4853"+00	NM	1.00261	0.97547	0.97940	1.00807	0.97156
36	1.2677"-01	1.4997"+00	NM	1.00284	0.98797	0.99070	1.00553	0.98525
37	1.3955"-01	1.5080"+00	NM	1.00191	0.99510	0.99660	1.00301	0.99361
38	1.5217"-01	1.5129"+00	NM	1.00073	0.99925	0.99970	1.00090	0.99880
D 39	1.6490"-01	1.5138"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD

7302C505 WINTER/GAUDET PROFILE TABULATION 38 POINTS, DELTA AT POINT 38

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.96892	0.00000	0.00000	1.34889	0.00000
2	3.0480"-04	1.3432"+00	NM	0.97994	0.47357	0.53030	1.25395	0.42290
3	3.5560"-04	1.3390"+00	NM	0.97981	0.47098	0.52760	1.25489	0.42043
4	8.3820"-04	1.4224"+00	NM	0.98196	0.51969	0.57780	1.23612	0.46743
5	1.1938"-03	1.4633"+00	NM	0.98265	0.54130	0.59960	1.22702	0.48866
6	1.4478"-03	1.5014"+00	NM	0.98386	0.56034	0.61880	1.21954	0.50740
7	1.6002"-03	1.5060"+00	NM	0.98399	0.56254	0.62100	1.21865	0.50958
8	2.1844"-03	1.5620"+00	NM	0.98531	0.58867	0.64690	1.20761	0.53569
9	2.5400"-03	1.5918"+00	NM	0.98600	0.60182	0.65980	1.20195	0.54894
10	3.0988"-03	1.6312"+00	NM	0.98663	0.61856	0.67600	1.19434	0.56600
11	3.4544"-03	1.6396"+00	NM	0.98725	0.62202	0.67950	1.19334	0.56941
12	4.2672"-03	1.6855"+00	NM	0.98705	0.64044	0.69680	1.18373	0.58865
13	5.0546"-03	1.7194"+00	NM	0.98824	0.65349	0.70940	1.17843	0.60199
14	6.4770"-03	1.7618"+00	NM	0.98886	0.66924	0.72420	1.17098	0.61846
15	7.4930"-03	1.8206"+00	NM	0.99028	0.68999	0.74370	1.16173	0.64017
16	8.8900"-03	1.8474"+00	NM	0.99020	0.69919	0.75200	1.15676	0.65009
17	1.0211"-02	1.8723"+00	NM	0.99052	0.70739	0.75950	1.15276	0.65886
18	1.1252"-02	1.9100"+00	NM	0.99127	0.71960	0.77070	1.14707	0.67189
19	1.2294"-02	1.9361"+00	NM	0.99148	0.72784	0.77810	1.14287	0.68083
20	1.5037"-02	1.9665"+00	NM	0.99251	0.73724	0.78680	1.13897	0.69080
21	2.2606"-02	2.1132"+00	NM	0.99467	0.78007	0.82490	1.11796	0.73777
22	2.5197"-02	2.1567"+00	NM	0.99484	0.79211	0.83510	1.11149	0.75133
23	3.0226"-02	2.2240"+00	NM	0.99611	0.81074	0.85130	1.10255	0.77212
24	3.5560"-02	2.3040"+00	NM	0.99701	0.83104	0.86850	1.09219	0.79519
25	4.0564"-02	2.3699"+00	NM	0.99796	0.84766	0.88250	1.08390	0.81419
26	4.5491"-02	2.4386"+00	NM	0.99899	0.86455	0.89660	1.07551	0.83365
27	5.0724"-02	2.5096"+00	NM	0.99972	0.88158	0.91050	1.06667	0.85359
28	5.5677"-02	2.5692"+00	NM	1.00079	0.89557	0.92200	1.05984	0.86990
29	6.1214"-02	2.6373"+00	NM	1.00190	0.91122	0.93470	1.05219	0.88833
30	6.6192"-02	2.6947"+00	NM	1.00219	0.92416	0.94480	1.04516	0.90398
31	7.0764"-02	2.7458"+00	NM	1.00295	0.93550	0.95380	1.03951	0.91755
32	7.6022"-02	2.8032"+00	NM	1.00403	0.94806	0.96380	1.03349	0.93257
33	8.8722"-02	2.9198"+00	NM	1.00600	0.97297	0.98330	1.02135	0.96275
34	1.0140"-01	3.0054"+00	NM	1.00713	0.99080	0.99690	1.01235	0.98474
35	1.1410"-01	3.0363"+00	NM	1.00594	0.99714	1.00090	1.00796	0.99339
36	1.2677"-01	3.0451"+00	NM	1.00392	0.99894	1.00120	1.00452	0.99669
37	1.3955"-01	3.0481"+00	NM	1.00225	0.99955	1.00080	1.00251	0.99830
D 38	1.5217"-01	3.0503"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD

73020908 WINTER/GAUDET PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94586	0.00000	0.00000	1.86246	0.00000
2	3.0480"-04	1.5886"+00	NM	0.96289	0.38197	0.49230	1.66113	0.29636
3	9.6520"-04	1.9025"+00	NM	0.96913	0.45626	0.57495	1.58793	0.36207
4	1.2192"-03	1.9680"+00	NM	0.96971	0.46930	0.58870	1.57356	0.37412
5	1.4478"-03	2.0310"+00	NM	0.97164	0.48128	0.60160	1.56250	0.38502
6	1.5748"-03	2.0580"+00	NM	0.97232	0.48623	0.60690	1.55763	0.38963
7	2.6416"-03	2.2454"+00	NM	0.97506	0.51900	0.64040	1.52253	0.42061
8	3.0480"-03	2.3448"+00	NM	0.97644	0.53524	0.65660	1.50489	0.43631
9	3.6068"-03	2.4467"+00	NM	0.97726	0.55124	0.67210	1.48655	0.45212
10	4.7244"-03	2.5871"+00	NM	0.98004	0.57235	0.69270	1.46477	0.47291
11	4.9530"-03	2.5750"+00	NM	0.97950	0.57057	0.69090	1.46628	0.47119
12	6.2738"-03	2.7490"+00	NM	0.98190	0.59557	0.71440	1.43885	0.49651
13	7.4168"-03	2.8760"+00	NM	0.98343	0.61306	0.73040	1.41945	0.51457
14	8.8900"-03	2.9835"+00	NM	0.98469	0.62742	0.74330	1.40351	0.52960
15	9.9314"-03	3.0560"+00	NM	0.98605	0.63690	0.75190	1.39373	0.53949
16	1.0693"-02	3.1175"+00	NM	0.98613	0.64481	0.75860	1.38408	0.54809
17	1.2294"-02	3.2104"+00	NM	0.98671	0.65656	0.76860	1.37043	0.56085
18	1.4961"-02	3.3798"+00	NM	0.99483	0.67740	0.78880	1.35593	0.58174
19	1.7272"-02	3.4905"+00	NM	0.99015	0.69066	0.79750	1.33333	0.59812
20	1.9634"-02	3.5910"+00	NM	0.99103	0.70246	0.80710	1.32013	0.61138
21	2.2403"-02	3.7265"+00	NM	0.99230	0.71803	0.81960	1.30293	0.62904
22	3.0277"-02	4.0957"+00	NM	0.99579	0.75871	0.85120	1.25865	0.67628
23	3.5560"-02	4.3276"+00	NM	0.99813	0.78313	0.86950	1.23274	0.70534
24	4.0183"-02	4.5247"+00	NM	0.99989	0.80327	0.88410	1.21139	0.72982
25	4.5618"-02	4.7628"+00	NM	1.00223	0.82692	0.90090	1.18694	0.75901
26	5.0851"-02	4.9836"+00	NM	1.00343	0.84823	0.91520	1.16414	0.78616
27	5.5626"-02	5.1783"+00	NM	1.00450	0.86657	0.92720	1.14482	0.80991
28	6.1062"-02	5.4048"+00	NM	1.00724	0.88743	0.94120	1.12486	0.83673
29	6.6192"-02	5.6095"+00	NM	1.00739	0.90584	0.95220	1.10497	0.86174
30	7.0815"-02	5.7898"+00	NM	1.00926	0.92175	0.96230	1.08992	0.88291
31	7.6098"-02	5.9876"+00	NM	1.01094	0.93889	0.97280	1.07354	0.90616
32	8.8773"-02	6.3852"+00	NM	1.01324	0.97241	0.99220	1.04112	0.95301
33	1.0140"-01	6.6261"+00	NM	1.01514	0.99215	1.00350	1.02302	0.98092
34	1.1417"-01	6.7108"+00	NM	1.00302	0.99900	1.00100	1.00402	0.99700
D 35	1.2687"-01	6.7233"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
AT I=3 DATA WERE AVERAGED

73020910* WINTER/GAUDET PROFILE TABULATION 35 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94579	0.00000	0.00000	1.86466	0.00000
2	3.0480"-04	1.6259"+00	NM	0.96728	0.39160	0.50450	1.65975	0.30396
3	9.6520"-04	1.9394"+00	NM	0.97402	0.46310	0.58380	1.58919	0.36736
4	1.2192"-03	2.0097"+00	NM	0.97511	0.47669	0.59820	1.57480	0.37986
5	1.4478"-03	2.0713"+00	NM	0.97596	0.48808	0.61010	1.56250	0.39046
6	1.5748"-03	2.1088"+00	NM	0.97649	0.49484	0.61710	1.55521	0.39680
7	2.6416"-03	2.3122"+00	NM	0.97845	0.52932	0.65180	1.51630	0.42986
8	3.0480"-03	2.4211"+00	NM	0.98043	0.54658	0.66900	1.49813	0.44656
9	3.6068"-03	2.5319"+00	NM	0.98175	0.56345	0.68530	1.47929	0.46326
10	4.7244"-03	2.6694"+00	NM	0.98329	0.58355	0.70430	1.45666	0.48350
11	4.9530"-03	2.6427"+00	NM	0.98438	0.57971	0.70120	1.46306	0.47927
12	6.2738"-03	2.8469"+00	NM	0.98512	0.60834	0.72710	1.42857	0.50897
13	7.4168"-03	2.9624"+00	NM	0.98728	0.62383	0.74140	1.41243	0.52491
14	8.8900"-03	3.0763"+00	NM	0.98780	0.63871	0.75430	1.39470	0.54083
15	9.9314"-03	3.1473"+00	NM	0.98824	0.64778	0.76210	1.38408	0.55062
16	1.0693"-02	3.2035"+00	NM	0.98905	0.65486	0.76830	1.37646	0.55817
17	1.2294"-02	3.3011"+00	NM	0.98969	0.66697	0.77850	1.36240	0.57142
18	1.4961"-02	3.4752"+00	NM	0.99150	0.68797	0.79610	1.33905	0.59453
19	1.7272"-02	3.5962"+00	NM	0.99164	0.70217	0.80730	1.32188	0.61072
20	1.9634"-02	3.6897"+00	NM	0.99238	0.71292	0.81590	1.30976	0.62294
21	2.2403"-02	3.8208"+00	NM	0.99377	0.72772	0.82770	1.29366	0.63981
22	3.0277"-02	4.2008"+00	NM	0.99596	0.76891	0.85870	1.24719	0.68851
23	3.5560"-02	4.4361"+00	NM	0.99917	0.79328	0.87710	1.22249	0.71747
24	4.0183"-02	4.6367"+00	NM	0.99975	0.81345	0.89100	1.19976	0.74265
25	4.5618"-02	4.8755"+00	NM	1.00150	0.83680	0.90710	1.17509	0.77194
26	5.0851"-02	5.0947"+00	NM	1.00312	0.85766	0.92110	1.15340	0.79859
27	5.5626"-02	5.2945"+00	NM	1.00404	0.87623	0.93300	1.13379	0.82291
28	6.1062"-02	5.5184"+00	NM	1.00592	0.89655	0.94610	1.11354	0.84960
29	6.6192"-02	5.7289"+00	NM	1.00713	0.91525	0.95760	1.09469	0.87477
30	7.0815"-02	5.9035"+00	NM	1.00738	0.93046	0.96640	1.07875	0.89585
31	7.6098"-02	6.0961"+00	NM	1.00926	0.94695	0.97650	1.06338	0.91830
32	8.8773"-02	6.4701"+00	NM	1.01107	0.97816	0.99420	1.03306	0.96239
33	1.0140"-01	6.6702"+00	NM	1.00970	0.99446	1.00200	1.01523	0.98697
34	1.1417"-01	6.7328"+00	NM	1.00251	0.99950	1.00100	1.00301	0.99800
D 35	1.2687"-01	6.7391"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
AT I=3 DATA WERE AVERAGED

73021101* WINTER/GAUDET PROFILE TABULATION 38 POINTS, DELTA AT POINT 38

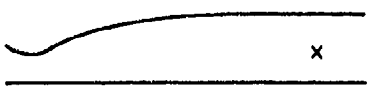
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93678	0.00000	0.00000	2.20263	0.00000
2	3.0480"-04	1.7260"+00	NM	0.95445	0.35340	0.48970	1.92012	0.25504
3	3.5560"-04	1.6864"+00	NM	0.95271	0.34521	0.47950	1.92938	0.24852
4	8.3820"-04	2.1468"+00	NM	0.96050	0.42526	0.57290	1.81488	0.31567
5	1.1938"-03	2.2623"+00	NM	0.96244	0.44199	0.59130	1.79051	0.33024
6	1.4478"-03	2.3660"+00	NM	0.97160	0.45613	0.60910	1.78317	0.34158
7	1.6002"-03	2.3937"+00	NM	0.96322	0.45984	0.61030	1.76149	0.34647
8	2.1844"-03	2.6192"+00	NM	0.96490	0.48867	0.64000	1.71527	0.37312
9	2.5400"-03	2.7006"+00	NM	0.96626	0.49858	0.65020	1.70068	0.38232
10	3.0988"-03	2.8526"+00	NM	0.96675	0.51647	0.66760	1.67084	0.39956
11	3.4544"-03	2.9380"+00	NM	0.95966	0.52621	0.67430	1.64204	0.41065
12	4.2672"-03	3.0632"+00	NM	0.97018	0.54014	0.69090	1.63613	0.42228
13	5.0546"-03	3.2253"+00	NM	0.97133	0.55758	0.70710	1.60823	0.43967
14	6.4770"-03	3.4127"+00	NM	0.97294	0.57702	0.72480	1.57778	0.45938
15	7.4930"-03	3.5638"+00	NM	0.97380	0.59218	0.73810	1.55352	0.47511
16	8.8900"-03	3.6814"+00	NM	0.97550	0.60370	0.74840	1.53681	0.48698
17	1.0211"-02	3.8471"+00	NM	0.97683	0.61953	0.76190	1.51240	0.50377
18	1.1252"-02	3.9484"+00	NM	0.97706	0.62900	0.76960	1.49701	0.51409
19	1.2294"-02	4.0220"+00	NM	0.97888	0.63579	0.77570	1.48854	0.52112
20	1.5037"-02	4.2391"+00	NM	0.98010	0.65538	0.79140	1.45815	0.54274
21	1.7501"-02	4.4112"+00	NM	0.98085	0.67040	0.80310	1.43472	0.55976
22	1.9837"-02	4.5626"+00	NM	0.98309	0.68347	0.81360	1.41703	0.57416
23	2.2606"-02	4.7877"+00	NM	0.98442	0.70233	0.82770	1.38889	0.59594
24	2.5197"-02	4.9329"+00	NM	0.98554	0.71422	0.83650	1.37174	0.60981
25	3.0226"-02	5.3016"+00	NM	0.98804	0.74352	0.85740	1.32979	0.64476
26	3.5560"-02	5.6667"+00	NM	0.99082	0.77141	0.87660	1.29132	0.67884
27	4.0564"-02	5.9838"+00	NM	0.99227	0.79481	0.89170	1.25865	0.70846
28	4.5491"-02	6.3187"+00	NM	0.99398	0.81880	0.90670	1.22624	0.73941
29	5.0724"-02	6.6714"+00	NM	0.99606	0.84330	0.92160	1.19432	0.77166
30	5.5677"-02	6.9924"+00	NM	0.99743	0.86499	0.93410	1.16618	0.80099
31	6.1214"-02	7.3462"+00	NM	0.99858	0.88827	0.94690	1.13636	0.83327
32	6.6192"-02	7.6543"+00	NM	1.00019	0.90805	0.95770	1.11235	0.86097
33	7.0764"-02	7.9357"+00	NM	1.00166	0.92574	0.96710	1.09135	0.88615
34	7.6022"-02	8.2414"+00	NM	1.00253	0.94458	0.97650	1.06872	0.91371
35	8.8722"-02	8.8192"+00	NM	1.00446	0.97920	0.99320	1.02881	0.96539
36	1.1410"-01	9.1610"+00	NM	0.97897	0.99910	0.99910	1.00000	0.99910
37	1.2677"-01	9.1801"+00	NM	1.00023	1.00020	1.00020	1.00000	1.00020
D 38	1.3955"-01	9.1766"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD

73021203* WINTER/GAUDET PROFILE TABULATION 38 POINTS, DELTA AT POINT 38

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*
1	0.0000"+00	1.0000"+00	NM	0.93284	0.00000	0.00000	2.39512	0.00000
2	3.0480"-04	1.7792"+00	NM	0.95165	0.33786	0.48640	2.07254	0.23469
3	3.5560"-04	1.7929"+00	NM	0.95176	0.34030	0.48940	2.06825	0.23662
4	8.3820"-04	2.2948"+00	NM	0.95806	0.41448	0.57700	1.93798	0.29773
5	1.1938"-03	2.4304"+00	NM	0.96014	0.43143	0.59600	1.90840	0.31230
6	1.4478"-03	2.5466"+00	NM	0.96147	0.44531	0.61110	1.88324	0.32449
7	1.6002"-03	2.5929"+00	NM	0.96302	0.45068	0.61720	1.87547	0.32909
8	2.1844"-03	2.8369"+00	NM	0.96423	0.47784	0.64520	1.82315	0.35389
9	2.5400"-03	2.9208"+00	NM	0.96449	0.48677	0.65410	1.80571	0.36224
10	3.0988"-03	3.0840"+00	NM	0.96716	0.50361	0.67130	1.77683	0.37781
11	3.4544"-03	3.2008"+00	NM	0.96768	0.51528	0.68250	1.75439	0.38902
12	4.2672"-03	3.3418"+00	NM	0.96857	0.52899	0.69550	1.72861	0.40235
13	5.0546"-03	3.5180"+00	NM	0.97062	0.54559	0.71120	1.69924	0.41854
14	6.4770"-03	3.7674"+00	NM	0.97357	0.56818	0.73200	1.65975	0.44103
15	7.4930"-03	3.9251"+00	NM	0.97366	0.58199	0.74370	1.63292	0.45544
16	8.8900"-03	4.0712"+00	NM	0.97493	0.59448	0.75450	1.61082	0.46839
17	1.0211"-02	4.2497"+00	NM	0.97621	0.60937	0.76700	1.58428	0.48413
18	1.1252"-02	4.3612"+00	NM	0.97726	0.61847	0.77460	1.56863	0.49381
19	1.2294"-02	4.4642"+00	NM	0.97840	0.62676	0.78150	1.55473	0.50266
20	1.5037"-02	4.7272"+00	NM	0.97903	0.64742	0.79740	1.51699	0.52565
21	1.7501"-02	4.9307"+00	NM	0.98077	0.66295	0.80950	1.49098	0.54293
22	1.9837"-02	5.1260"+00	NM	0.99690	0.67751	0.82660	1.48854	0.55531
23	2.2606"-02	5.3867"+00	NM	0.98435	0.69645	0.83450	1.43575	0.58123
24	2.5197"-02	5.5823"+00	NM	0.98547	0.71032	0.84430	1.41283	0.59760
25	3.0226"-02	6.0240"+00	NM	0.98826	0.74066	0.86510	1.36426	0.63412
26	3.5560"-02	6.4741"+00	NM	0.99112	0.77033	0.88450	1.31839	0.67089
27	4.0564"-02	6.8673"+00	NM	0.99239	0.79532	0.89960	1.27943	0.70313
28	4.5491"-02	7.2983"+00	NM	0.99481	0.82182	0.91540	1.24069	0.73781
29	5.0724"-02	7.7297"+00	NM	0.99723	0.84751	0.93010	1.20438	0.77226
30	5.5677"-02	8.1233"+00	NM	0.99870	0.87029	0.94230	1.17233	0.80378
31	6.1214"-02	8.5607"+00	NM	1.00161	0.89490	0.95560	1.14025	0.83806
32	6.6192"-02	8.9690"+00	NM	1.00353	0.91728	0.96690	1.11111	0.87021
33	7.0764"-02	9.2917"+00	NM	1.00571	0.93459	0.97570	1.08992	0.89520
34	7.6022"-02	9.6631"+00	NM	1.00827	0.95411	0.98540	1.06667	0.92381
35	8.8722"-02	9.6659"+00	NM	1.00834	0.95426	0.98530	1.06655	0.92400
36	1.1410"-01	1.0542"+01	NM	0.99854	0.99880	0.99880	1.00000	0.99880
37	1.2677"-01	1.0562"+01	NM	0.99976	0.99980	0.99980	1.00000	0.99980
D 38	1.3955"-01	1.0567"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD

	M : a) 2.0 b) 2.3, 4.6 R THETA X 10^{-3} : 10 - 80 TW/TR : 1.0	7303 ZPG - AW

Windtunnels a) symmetrical flexible nozzle, b) asymmetric block nozzle. Both: W = H = 1.22 m, continuous, 30 minutes settling time. a) PO : 0.07 MN/m^2 TO : 314 K. b) 0.02 < PO < 0.62 MN/m^2. 339 < TO < 352 Dried air, dew point 244 K. 2 < RE/m X 10^{-6} < 17.

ALLEN J.M. 1973a. Evaluation of compressible-flow Preston tube calibrations. NASA TN D-7190. And Allen (1972), and private communications.

1 The test boundary layers were formed on the flat side walls of the two wind-tunnels by expansion through two-dimensional nozzles. For a) the test station was "about 5 m from the throat" on the centre line of the test section wall, while for b) it was "midway of the test section" which was 2.13 m long. The test section walls were not cooled and were allowed to reach equilibrium temperature. The surfaces were smooth to 0.8 μm.

6 Wall shear stress was measured using a commercial balance (Kistler, d = 9.27 mm) as described by Paros (1970), and a wide range of Preston tubes (d_1 from 1.3 to 48 mm) were used as the principal aim of the investigation was to calibrate these. For case a) the static pressure was measured at orifices on the tunnel sidewall about 1.6 m upstream of the test station.

7 Pitot pressure profiles were taken using an asymmetric FPP for which h_1 = 0.26, h_2 = 0.08, b_1 = 0.88 (E) mm.
8 The wall thickness next to the tunnel wall was 0.13 mm. The profile normal was "a few cm" upstream of the balance centre, no adjustment to the values being made as it was estimated that the difference would be
9 below 0.03 % in CF. The static pressure was assumed to be constant through the layer and equal to the
10 value calculated from Pitot measurements at the boundary layer edge. No Pitot corrections were applied
11 and Sutherland's viscosity law was assumed. The author tabulates profiles of M and U/UD calculated on the
12 basis of iso-energetic flow. The editors have replaced this assumption with the van Driest / Crocco temperature-velocity correlation assuming an adiabatic wall. The edge total state has been arbitrarily set at the tunnel stagnation conditions.

13 The profiles presented here are for three different Mach numbers, the sets for M = 2.3 (02) and M = 4.6 (03)
14 covering a range of Reynolds number. The CF values associated with the profiles are those measured with the balance. The value for 0301 is the author's extrapolation from other measurements at that Mach number, no balance measurement having been taken. The Preston tube results are not presented here but are fully tabulated in the source. The results are summarized in Allen (1973b).

§ DATA: 7303 0101-0306. Pitot profiles NX = 1. CF from Balance.

15 Editors' comments

This experiment provides, together with Hopkins & Keener - CAT 6601, the principal body of calibration data for Preston tubes at high Reynolds numbers and moderate Mach number. There is no information relating to symmetry or cross flow in the tunnel wall boundary layers - all profiles except 0101 are taken in an asymmetric configuration - and whether from this cause or another, the profile characteristics do not match typical zero-pressure-gradient data in the outer region. In the inner region, transformed wall law plots show that the balance readings vary by at least ± 15 % from the mean. The balance is very small for an experiment on this scale, and correspondingly very difficult to use (d = 0.3 mm; cf. CAT 6601, d = 50.8 mm; CAT 7302, d = 368.3 mm).

Experiments comparable in range are Jackson et al. - CAT 6505, Hopkins & Keener - CAT 6601 and Winter & Gaudet - CAT 7302. Mabey et al. - CAT 7402 provide flat plate data for comparison and contrast.
Note added in proof. The author has recently obtained fresh CF data using two more Kistler balances, giving values about 10% higher.
See also J.M. Allen (1976) NASA TN4D-8291) for tests with a much larger balance.

CAT 7303 ALLEN BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
73030101	1.9830	1.0000	2.6469"+04	1.7600"-03	2.8385	1.2734	9.1747"+03	9.1747"+03
NM	6.9914"+04	1.0000	4.0975"+04	NM	1.8212	1.8110	2.9962"+02	1.7577"+02
INFINITE	3.1400"+02	0.0000	5.1107"-03	0.0000"+00	0.0834	6.2415"-03	5.2711"+02	2.9962"+02
73030201	2.3250	1.0000	9.0391"+03	1.8240"-03	3.3693	1.2412	1.7143"+03	1.7143"+03
NM	2.2292"+04	1.0000	1.5754"+04	NM	1.8305	1.8246	3.2068"+02	1.6289"+02
INFINITE	3.3900"+02	0.0000	8.0781"-03	0.0000"+00	0.0992	1.0351"-02	5.9495"+02	3.2068"+02
73030202	2.3190	1.0000	1.4131"+04	1.7600"-03	3.3437	1.2329	2.8317"+03	2.8317"+03
NM	3.6477"+04	1.0000	2.4574"+04	NM	1.8409	1.8295	3.2073"+02	1.6333"+02
INFINITE	3.3900"+02	0.0000	7.6766"-03	0.0000"+00	0.0992	9.7729"-03	5.9422"+02	3.2073"+02
73030203	2.3180	1.0060	2.6212"+04	1.6260"-03	3.3207	1.2205	5.6723"+03	5.6723"+03
NM	7.2954"+04	1.0000	4.5564"+04	NM	1.8473	1.8367	3.2074"+02	1.6340"+02
INFINITE	3.3900"+02	0.0000	7.1132"-03	0.0000"+00	0.0995	8.9874"-03	5.9409"+02	3.2074"+02
73030204	2.3170	1.0000	3.8242"+04	1.5360"-03	3.2998	1.2099	8.6007"+03	8.6007"+03
NM	1.1044"+05	1.0000	6.6450"+04	NM	1.8535	1.8434	3.2075"+02	1.6348"+02
INFINITE	3.3900"+02	0.0000	6.8489"-03	0.0000"+00	0.0998	8.5858"-03	5.9397"+02	3.2075"+02
73030205	2.3210	1.0000	4.8315"+04	1.4690"-03	3.3001	1.2058	1.1370"+04	1.1370"+04
NM	1.4692"+05	1.0000	8.4080"+04	NM	1.8556	1.8458	3.2072"+02	1.6318"+02
INFINITE	3.3900"+02	0.0000	6.5279"-03	0.0000"+00	0.1001	8.1680"-03	5.9446"+02	3.2072"+02
73030301	4.6220	1.0000	2.6742"+03	1.0290"-03	9.5638	1.2453	2.2278"+02	2.2278"+02
NM	7.4981"+04	1.0000	1.0927"+04	NM	1.8586	1.8267	3.2234"+02	6.6761"+01
INFINITE	3.5200"+02	0.0000	5.9457"-03	0.0000"+00	0.1566	1.1691"-02	7.5718"+02	3.2234"+02
73030302	4.6000	1.0000	4.2603"+03	9.8900"-04	9.4688	1.2427	3.8044"+02	3.8044"+02
NM	1.2463"+05	1.0000	1.7276"+04	NM	1.8611	1.8288	3.2239"+02	6.7278"+01
INFINITE	3.5200"+02	0.0000	5.5954"-03	0.0000"+00	0.1566	1.0859"-02	7.5649"+02	3.2239"+02
73030303	4.6120	1.0000	7.8086"+03	5.0400"-04	9.4461	1.2225	7.4973"+02	7.4973"+02
NM	2.4926"+05	1.0000	3.1796"+04	NM	1.8687	1.8389	3.2236"+02	6.6995"+01
INFINITE	3.5200"+02	0.0000	5.1793"-03	0.0000"+00	0.1574	9.8431"-03	7.5687"+02	3.2236"+02
73030304	4.6190	1.0000	1.1106"+04	8.8300"-04	9.4259	1.2087	1.1150"+03	1.1150"+03
NM	3.7389"+05	1.0000	4.5332"+04	NM	1.8741	1.8464	3.2234"+02	6.6831"+01
INFINITE	3.5200"+02	0.0000	4.9396"-03	0.0000"+00	0.1579	9.2386"-03	7.5709"+02	3.2234"+02
73030305	4.6220	1.0000	1.4243"+04	8.6100"-04	9.4120	1.2007	1.4812"+03	1.4812"+03
NM	4.9852"+05	1.0000	5.8198"+04	NM	1.8771	1.8508	3.2234"+02	6.6761"+01
INFINITE	3.5200"+02	0.0000	4.7630"-03	0.0000"+00	0.1582	8.8313"-03	7.5718"+02	3.2234"+02
73030306	4.6400	1.0000	1.6996"+04	8.4000"-04	9.4507	1.1932	1.8110"+03	1.8110"+03
NM	6.2315"+05	1.0000	6.9877"+04	NM	1.8803	1.8553	3.2229"+02	6.6341"+01
INFINITE	3.5200"+02	0.0000	4.6151"-03	0.0000"+00	0.1587	8.4950"-03	7.5774"+02	3.2229"+02

73030201 ALLEN PROFILE TABULATION 27 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94597	0.00000	0.00000	1.96869	0.00000
2	1.8000"-04	1.7976"+00	NM	0.96140	0.41075	0.53432	1.69213	0.31576
3	6.4000"-04	1.7895"+00	NM	0.96129	0.40903	0.53239	1.69412	0.31426
4	1.1900"-03	2.0645"+00	NM	0.96475	0.46151	0.58957	1.63198	0.36126
5	5.0800"-03	2.7784"+00	NM	0.97210	0.56774	0.69540	1.50025	0.46352
6	8.8900"-03	3.1448"+00	NM	0.97533	0.61376	0.73712	1.44236	0.51105
7	1.2700"-02	3.4322"+00	NM	0.97767	0.64731	0.76600	1.40031	0.54702
8	1.6510"-02	3.6806"+00	NM	0.97958	0.67484	0.78874	1.36606	0.57739
9	2.0320"-02	3.8784"+00	NM	0.98104	0.69591	0.80559	1.34003	0.60117
10	2.4130"-02	4.0404"+00	NM	0.98218	0.71269	0.81865	1.31948	0.62044
11	3.3020"-02	4.4746"+00	NM	0.98508	0.75570	0.85079	1.26751	0.67123
12	4.0640"-02	4.7991"+00	NM	0.98710	0.78624	0.87245	1.23134	0.70854
13	4.8260"-02	5.0885"+00	NM	0.98880	0.81247	0.89033	1.20083	0.74143
14	5.5880"-02	5.4629"+00	NM	0.99088	0.84516	0.91167	1.16357	0.78351
15	6.3500"-02	5.7433"+00	NM	0.99235	0.86882	0.92649	1.13718	0.81473
16	7.1120"-02	6.1010"+00	NM	0.99413	0.89806	0.94413	1.10522	0.85425
17	7.8740"-02	6.3389"+00	NM	0.99526	0.91699	0.95515	1.08495	0.88036
18	8.6360"-02	6.6434"+00	NM	0.99665	0.94065	0.96849	1.06008	0.91360
19	9.3980"-02	6.8526"+00	NM	0.99757	0.95656	0.97721	1.04365	0.93634
20	1.0160"-01	7.0481"+00	NM	0.99840	0.97118	0.98505	1.02875	0.95751
21	1.0922"-01	7.1586"+00	NM	0.99886	0.97935	0.98935	1.02052	0.96946
22	1.1684"-01	7.2465"+00	NM	0.99922	0.98581	0.99271	1.01406	0.97895
23	1.2446"-01	7.3647"+00	NM	0.99969	0.99441	0.99715	1.00552	0.99168
24	1.3208"-01	7.3825"+00	NM	0.99976	0.99570	0.99781	1.00424	0.99359
D 25	1.3970"-01	7.4420"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.4732"-01	7.4420"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
27	1.5240"-01	7.4420"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

73030205 ALLEN PROFILE TABULATION 26 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94606	0.00000	0.00000	1.96536	0.00000
2	1.8000"-04	2.1149"+00	NM	0.96543	0.47092	0.59916	1.61880	0.37012
3	6.4000"-04	2.1693"+00	NM	0.96604	0.47997	0.60859	1.60780	0.37852
4	1.1900"-03	2.4192"+00	NM	0.96871	0.51874	0.64793	1.56009	0.41531
5	5.0800"-03	3.2241"+00	NM	0.97608	0.62430	0.74605	1.42805	0.52242
6	8.8900"-03	3.6214"+00	NM	0.97923	0.66954	0.78417	1.37174	0.57166
7	1.2700"-02	3.8416"+00	NM	0.98086	0.69324	0.80323	1.34252	0.59830
8	1.6510"-02	4.0531"+00	NM	0.98236	0.71521	0.82036	1.31567	0.62353
9	2.0320"-02	4.2585"+00	NM	0.98376	0.73589	0.83602	1.29064	0.64775
10	2.4130"-02	4.4836"+00	NM	0.98523	0.75786	0.85216	1.26434	0.67400
11	3.3020"-02	4.9402"+00	NM	0.98803	0.80052	0.88210	1.21421	0.72648
12	4.0640"-02	5.3084"+00	NM	0.99013	0.83326	0.90388	1.17667	0.76816
13	4.8260"-02	5.6047"+00	NM	0.99172	0.85868	0.92008	1.14813	0.80138
14	5.5880"-02	5.9206"+00	NM	0.99334	0.88496	0.93622	1.11921	0.83651
15	6.3500"-02	6.2789"+00	NM	0.99508	0.91383	0.95325	1.08814	0.87604
16	7.1120"-02	6.5651"+00	NM	0.99639	0.93623	0.96598	1.06456	0.90740
17	7.8740"-02	6.8014"+00	NM	0.99744	0.95433	0.97590	1.04585	0.93318
18	8.6360"-02	6.9615"+00	NM	0.99813	0.96639	0.98247	1.03355	0.95058
19	9.3980"-02	7.1178"+00	NM	0.99878	0.97803	0.98864	1.02181	0.96753
20	1.0160"-01	7.2465"+00	NM	0.99931	0.98751	0.99350	1.01239	0.98146
21	1.0922"-01	7.3173"+00	NM	0.99960	0.99268	0.99625	1.00722	0.98911
22	1.1684"-01	7.3351"+00	NM	0.99967	0.99397	0.99692	1.00594	0.99103
23	1.2446"-01	7.3944"+00	NM	0.99991	0.99828	0.99912	1.00169	0.99743
24	1.3208"-01	7.4122"+00	NM	0.99998	0.99957	0.99978	1.00042	0.99936
D 25	1.3970"-01	7.4182"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000
26	1.4732"-01	7.4182"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

73030301 ALLEN PROFILE TABULATION 28 POINTS, DELTA AT POINT 27

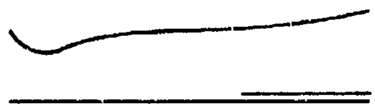
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.91572	0.00000	0.00000	4.82823	0.00000
2	1.8000"-04	2.1719"+00	NM	0.93509	0.24124	0.47936	3.94855	0.12140
3	6.4000"-04	2.1746"+00	NM	0.93512	0.24145	0.47971	3.94726	0.12153
4	1.1900"-03	2.3700"+00	NM	0.93715	0.25682	0.50423	3.85491	0.13080
5	5.0800"-03	4.8505"+00	NM	0.95583	0.39788	0.68987	3.00629	0.22948
6	8.8900"-03	5.7900"+00	NM	0.96085	0.43899	0.73174	2.77846	0.26336
7	1.2700"-02	6.4542"+00	NM	0.96395	0.46582	0.75649	2.63742	0.28683
8	1.6510"-02	7.1236"+00	NM	0.96678	0.49135	0.77851	2.50920	0.31018
9	2.0320"-02	7.7498"+00	NM	0.96918	0.51406	0.79641	2.40013	0.33182
10	2.4130"-02	8.3728"+00	NM	0.97137	0.53570	0.81255	2.30069	0.35318
11	3.3020"-02	9.8277"+00	NM	0.97583	0.58308	0.84453	2.09783	0.40257
12	4.0640"-02	1.1117"+01	NM	0.97918	0.62203	0.86770	1.94592	0.44591
13	4.8260"-02	1.2380"+01	NM	0.98201	0.65794	0.88689	1.81705	0.48809
14	5.5880"-02	1.3590"+01	NM	0.98440	0.69061	0.90272	1.70860	0.52834
15	6.3500"-02	1.4885"+01	NM	0.98666	0.72393	0.91744	1.60605	0.57124
16	7.1120"-02	1.6027"+01	NM	0.98843	0.75206	0.92885	1.52541	0.60891
17	7.8740"-02	1.7276"+01	NM	0.99018	0.78170	0.93996	1.44591	0.65008
18	8.6360"-02	1.8459"+01	NM	0.99168	0.80874	0.94935	1.37796	0.68896
19	9.3980"-02	1.9553"+01	NM	0.99294	0.83297	0.95722	1.32056	0.72486
20	1.0160"-01	2.0883"+01	NM	0.99435	0.86153	0.96587	1.25688	0.76847
21	1.0922"-01	2.2058"+01	NM	0.99548	0.88598	0.97278	1.20555	0.80692
22	1.1684"-01	2.3039"+01	NM	0.99635	0.90588	0.97811	1.16580	0.83900
23	1.2446"-01	2.4606"+01	NM	0.99763	0.93682	0.98587	1.10744	0.89022
24	1.3208"-01	2.5586"+01	NM	0.99837	0.95565	0.99031	1.07385	0.92220
25	1.3970"-01	2.6492"+01	NM	0.99902	0.97274	0.99417	1.04454	0.95177
26	1.4732"-01	2.7309"+01	NM	0.99957	0.98788	0.99745	1.01947	0.97841
D 27	1.5494"-01	2.7971"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
28	1.5621"-01	2.7983"+01	NM	1.00001	1.00022	1.00004	0.99966	1.00039

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST

73030306 ALLEN PROFILE TABULATION 28 POINTS, DELTA AT POINT 27

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.91560	0.00000	0.00000	4.85810	0.00000
2	1.8000"-04	3.2168"+00	NM	0.94460	0.31185	0.58614	3.53263	0.16592
3	6.4000"-04	3.4436"+00	NM	0.94637	0.32500	0.60380	3.45155	0.17493
4	1.1900"-03	4.0404"+00	NM	0.95065	0.35711	0.64439	3.25606	0.19791
5	5.0800"-03	6.1654"+00	NM	0.96251	0.45259	0.74555	2.71361	0.27474
6	8.8900"-03	7.2819"+00	NM	0.96727	0.49526	0.78245	2.49605	0.31348
7	1.2700"-02	8.2777"+00	NM	0.97091	0.53039	0.80954	2.32966	0.34749
8	1.6510"-02	9.2751"+00	NM	0.97410	0.56336	0.83254	2.18394	0.38121
9	2.0320"-02	1.0079"+01	NM	0.97639	0.58858	0.84869	2.07919	0.40818
10	2.4130"-02	1.0874"+01	NM	0.97845	0.61250	0.86295	1.98501	0.43473
11	3.3020"-02	1.2576"+01	NM	0.98229	0.66078	0.88890	1.80966	0.49120
12	4.0460"-02	1.3946"+01	NM	0.98492	0.69720	0.90624	1.68956	0.53638
13	4.8260"-02	1.5325"+01	NM	0.98723	0.73211	0.92128	1.58353	0.58179
14	5.5880"-02	1.6833"+01	NM	0.98945	0.76832	0.93541	1.48226	0.63107
15	6.3500"-02	1.8124"+01	NM	0.99114	0.79806	0.94603	1.40520	0.67323
16	7.1120"-02	1.9543"+01	NM	0.99280	0.82953	0.95638	1.32923	0.71950
17	7.8740"-02	2.0771"+01	NM	0.99410	0.85582	0.96440	1.26983	0.75947
18	8.6360"-02	2.1974"+01	NM	0.99526	0.88082	0.97153	1.21657	0.79858
19	9.3980"-02	2.3461"+01	NM	0.99657	0.91078	0.97950	1.15660	0.84688
20	1.0160"-01	2.4684"+01	NM	0.99756	0.93470	0.98544	1.11152	0.88657
21	1.0922"-01	2.5734"+01	NM	0.99835	0.95474	0.99016	1.07557	0.92059
22	1.1684"-01	2.6794"+01	NM	0.99909	0.97457	0.99460	1.04154	0.95494
23	1.2446"-01	2.7462"+01	NM	0.99954	0.98685	0.99725	1.02118	0.97656
24	1.3208"-01	2.7900"+01	NM	0.99982	0.99483	0.99893	1.00826	0.99074
25	1.3970"-01	2.8055"+01	NM	0.99992	0.99763	0.99951	1.00378	0.99575
26	1.4732"-01	2.8150"+01	NM	0.99998	0.99935	0.99987	1.00103	0.99884
D 27	1.5494"-01	2.8186"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
28	1.5621"-01	2.8186"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M ASSUME P=PD AND VAN DRIEST



M : 3.8 rising to 4.5

R THETA X 10^{-3} : 6 - 50

TW/TR : 1.0, 0.8, 0.25

7304

FPG

AW-MHT-SHT

Boundary layer channel. Effectively continuous. W = 0.33 H = 0.272 m.
0.1 < PO < 1.1 MN/m^2. TO : 336, 423 K. Air, dew point 215-233 K. 2 < RE/m X 10^{-6} < 40.

VOISINET R.L.P. and LEE R.E., 1973. Measurements of a supersonic favourable pressure-gradient turbulent boundary layer with heat transfer - Part I, Data compilation. NOLTR 73-224.
And Voisinet and Lee (1972) CAT 7202 with associated references, Brott et al. (1969)

1- The tests were performed in the purpose-built channel used for CAT 7202 and described in that entry.
11 The flexible wall was set to give a monotonically accelerating flow, the coordinates being given in table 1, and the resulting pressure history in table 2. The plate surface temperature history is given in table 3. (Tables 2 and 3 are facsimiles of the authors' tables 2&3.) The instrumentation employed was also as for CAT 7202.

8 The relative positions of profiles and wall measurements at any one station were again as for CAT 7202, but profiles and wall measurements were made at an additional upstream station (X = 1.194 m for profiles, 1.270 m for wall measurements). The positions at which differing measurements were made are given in
6 table 4. The heat transfer measurements in the AW condition were made to ensure that the wall temperature had been adjusted to a practical zero heat transfer condition, taking into account the effect of nozzle region heat transfer.

12 The editors have accepted the interpolations and corrections made by the authors. In several cases, differing repeated data for a single Y-value have been averaged. The edge state has been calculated from the static pressure and temperature data with the Mach number as presented. The authors interpolated the CF data to agree with the boundary conditions for the measured profiles, and these are the values given here. The editors have interpolated the CQ data in their original form, as Stanton numbers, to match the profiles on the basis of the authors' R THETA values alone. No heat transfer data are presented for the SHT condition, as the only measurements were at a station not associated with a profile.

13 The profiles presented and their associated instrumentation are listed in table 5. CF data is given for
14 all while CQ is not given for the SHT case since it was not effectively measured.

§ DATA: 7304 0101-1503. Pitot and TO profiles measured simultaneously. NX up to 5. CF from FEB, CQ from thermopiles measured separately.

15 Editors' comments

The remarks made in the first three paragraphs of § 15 CAT 7202 apply equally here, except that in this case the measurements were all made in a fully reflected-wave flow-region. Static pressure variation along a normal is therefore found to be small. There are no properly comparable experiments, but similar pressure histories were studied by Michel (CAT 6902) and Thomas (CAT 7401) at lower Mach numbers and without heat-transfer.

Many of the profiles display characteristics which could be interpreted as transitional characteristics were it not for the high Reynolds numbers.

TABLE 1 NOZZLE CONTOUR COORDINATES

x (meters)	y (meters)	x (meters)	y (meters)	x (meters)	y (meters)
0.0000	0.01016	0.9144	0.08534	1.8034	0.18263
0.2794	0.02128	1.0668	0.10312	1.9812	0.19939
0.3810	0.02784	1.2446	0.12319	2.1591	0.21768
0.5588	0.04597	1.4224	0.14275	2.3368	0.23952
0.7366	0.06591	1.6002	0.16154		

Facsimile from source paper

TABLE 2

AVERAGE NOZZLE WALL-PRESSURE AND PRESSURE-GRADIENT DISTRIBUTIONS

x (meters)	P_{sw}/P_o	$\frac{1}{P_o}\frac{dP_{sw}}{dx}\left(\frac{1}{meters}\right)$
1.016	.9895E-02	-.1649E-01
1.041	.9488E-02	-.1557E-01
1.067	.9103E-02	-.1470E-01
1.092	.8740E-02	-.1387E-01
1.118	.8398E-02	-.1308E-01
1.143	.8076E-02	-.1233E-01
1.168	.7772E-02	-.1162E-01
1.194	.7485E-02	-.1095E-01
1.219	.7215E-02	-.1031E-01
1.245	.6961E-02	-.9709E-02
1.270	.6722E-02	-.9142E-02
1.295	.6496E-02	-.8607E-02
1.321	.6284E-02	-.8104E-02
1.346	.6084E-02	-.7632E-02
1.372	.5896E-02	-.7188E-02
1.397	.5719E-02	-.6773E-02
1.422	.5552E-02	-.6385E-02
1.448	.5394E-02	-.6022E-02
1.473	.5246E-02	-.5683E-02
1.499	.5106E-02	-.5368E-02
1.524	.4973E-02	-.5075E-02
1.549	.4848E-02	-.4803E-02
1.575	.4729E-02	-.4550E-02
1.600	.4616E-02	-.4316E-02
1.626	.4509E-02	-.4099E-02
1.651	.4408E-02	-.3898E-02
1.676	.4311E-02	-.3712E-02
1.702	.4219E-02	-.3539E-02
1.727	.4131E-02	-.3379E-02
1.753	.4048E-02	-.3231E-02
1.778	.3967E-02	-.3092E-02
1.803	.3890E-02	-.2963E-02
1.829	.3817E-02	-.2841E-02
1.854	.3746E-02	-.2725E-02
1.880	.3678E-02	-.2615E-02
1.905	.3613E-02	-.2509E-02
1.930	.3551E-02	-.2406E-02
1.956	.3491E-02	-.2305E-02
1.981	.3434E-02	-.2204E-02
2.007	.3379E-02	-.2103E-02
2.032	.3327E-02	-.1999E-02
2.057	.3277E-02	-.1893E-02
2.083	.3231E-02	-.1783E-02
2.108	.3187E-02	-.1667E-02
2.134	.3146E-02	-.1544E-02
2.159	.3108E-02	-.1413E-02
2.184	.3074E-02	-.1274E-02
2.210	.3044E-02	-.1124E-02
2.235	.3017E-02	-.9630E-03
2.261	.2995E-02	-.7893E-03
2.286	.2977E-02	-.6018E-03

Facsimile from source paper

TABLE 3

NOZZLE WALL-TEMPERATURE DISTRIBUTION

7304 SERIES	Flow	Code	P_o atm	T_o °K	x (meters) 0.000	0.279	0.457	0.711	0.864	1.067	1.194	1.448	1.702	1.905	2.057	2.210
					Average Wall Temperature °K											
03	FPG-AW	TD14	10	336.	323.	311.	305.	295.	294.	294.	294.	294.	294.	294.	294.	294.
02, 05		TD15	5	336.	321.	310.	303.	292.	291.	291.	291.	291.	291.	291.	291.	291.
01, 04		TD16	1	336.	314.	306.	300.	292.	291.	291.	251.	291.	291.	291.	291.	291.
08	FPG-MHT	TD17	10	423.	355.	352.	342.	304.	300.	302.	299.	299.	298.	298.	298.	298.
07, 10		TD18	5	423.	341.	341.	332.	298.	296.	296.	295.	295.	295.	295.	295.	295.
06, 09		TD19	1	423.	301.	306.	306.	293.	293.	293.	293.	293.	293.	293.	293.	293.
13	FPG-CW	TD20	10	423.	359.	357.	351.	300.	291.	202.	160.	119.	99.	116.	117.	118.
12, 15		TD21	5	423.	348.	346.	334.	267.	202.	125.	103.	97.	98.	100.	97.	101.
11, 14		TD22	1	423.	308.	303.	288.	193.	144.	94.	89.	88.	88.	89.	87.	88.

TABLE 4
LOCATION OF MEASUREMENTS

	Wall condition		
X-Station: m	AW	MHT	SHT
1.194 (P)	P	P	
1.270 (W)	K K K	K Q	N Q
1.448 (P)	P	P	P
1.524 (W)	K K K, Q	K K, Q	
1.702 (P)	P	P	P
1.778 (W)	K Q	K Q	N
1.905 (P)	P	P	P
1.981 (W)	K K, Q	K Q	N
2.057 (P)	P	P	P
2.134 (W)	K Q	K Q	N
2.286 (W)	Q		

KEY: P - profile, W - wall measurement, K - CF using Kistler FEB, N - CF using NOL FEB, Q - CQ using thermopile.

TABLE 5
PROFILE SERIES PRESENTED

CODE 7304	HT	NX	TTP	FEB	POD MN/m^2	TOD K	TW K
0101-5	AW	5	ECP	Kistler	0.1	336	291
0201-5	AW	5	ECP	Kistler	0.5	336	291
0301-5	AW	5	ECP	Kistler	1.0	336	294
0401-5	AW	5	FWP	Kistler	0.1	336	291
0501-5	AW	5	FWP	Kistler	0.5	336	291
0601-4	MHT	4	ECP	Kistler	0.1	423	293
0701-4	MHT	4	ECP	Kistler	0.5	423	295
0801-4	MHT	4	ECP	Kistler	1.0	423	299
0901-5	MHT	5	FWP	Kistler	0.1	423	293
1001-5	MHT	3	FWP	Kistler	0.5	423	295
1101-2	SHT	2	ECP	NOL	0.1	423	90
1201-4	SHT	4	ECP	NOL	0.5	423	100
1301-4	SHT	4	ECP	NOL	1.0	423	120
1401-3	SHT	3	FWP	NOL	0.1	423	90
1501-3	SHT	3	FWP	NOL	0.5	423	100

(Nominal values)

CAT 7304 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	PED2W	CF *	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
73040101	3.8501	0.9371	2.2846"+03	1.2400"-03	6.1913	1.3554	8.4060"+02	8.3379"+02
1.1940"+00	1.0346"+05	1.0130	6.7783"+03	0.0000"+00	1.8277	1.7916	2.9480"+02	8.6043"+01
INFINITE	3.4113"+02	0.0000	1.7274"-03	-1.7879"-01	0.3328	2.9001"-03	7.1604"+02	3.1460"+02
73040102	4.0862	0.9460	2.1197"+03	1.2200"-03	7.5115	1.3831	5.9880"+02	5.9958"+02
1.4480"+00	1.0206"+05	0.9987	6.9228"+03	0.0000"+00	1.8248	1.7876	2.9470"+02	7.8031"+01
INFINITE	3.3861"+02	0.0000	1.9993"-03	-1.4544"-01	0.2575	3.6425"-03	7.2371"+02	3.1151"+02
73040103	4.2954	0.9415	2.0112"+03	1.1100"-03	7.9558	1.3720	4.6730"+02	4.6305"+02
1.7020"+00	1.0346"+05	1.0092	7.0463"+03	0.0000"+00	1.8269	1.7880	2.9490"+02	7.2739"+01
INFINITE	3.4115"+02	0.0000	2.2572"-03	-1.2041"-01	0.2664	4.2474"-03	7.3451"+02	3.1324"+02
73040104	4.3873	0.9502	2.0073"+03	1.0600"-03	8.6077	1.3863	4.0160"+02	4.0614"+02
1.9050"+00	1.0202"+05	0.9880	7.3275"+03	0.0000"+00	1.8265	1.7857	2.9580"+02	6.9969"+01
INFINITE	3.3933"+02	0.0000	2.4721"-03	-1.1636"-01	0.2648	4.8512"-03	7.3580"+02	3.1131"+02
73040105	4.4796	0.9521	1.9997"+03	1.0400"-03	8.4224	1.4029	3.6750"+02	3.5589"+02
2.0570"+00	1.0041"+05	1.0326	7.5585"+03	0.0000"+00	1.8206	1.7793	2.9530"+02	6.7485"+01
INFINITE	3.3833"+02	0.0000	2.6998"-03	-9.4350"-02	0.2513	5.3114"-03	7.3782"+02	3.1016"+02
73040201	3.8838	0.9299	8.0606"+03	8.6200"-04	6.5726	1.2899	3.9510"+03	3.9297"+03
1.1940"+00	5.1042"+05	1.0054	2.4138"+04	0.0000"+00	1.8412	1.8113	2.8860"+02	8.3813"+01
INFINITE	3.3666"+02	0.0000	1.2445"-03	-1.9444"-01	0.2643	2.0817"-03	7.1289"+02	3.1036"+02
73040202	4.1149	0.9495	7.5158"+03	8.3800"-04	7.9016	1.3052	2.7810"+03	2.8502"+03
1.4480"+00	5.0384"+05	0.9757	2.5229"+04	0.0000"+00	1.8418	1.8080	2.9440"+02	7.6855"+01
INFINITE	3.3712"+02	0.0000	1.4880"-03	-1.6486"-01	0.2342	2.6939"-03	7.2328"+02	3.1005"+02
73040203	4.3125	0.9423	7.3908"+03	8.1000"-04	8.1481	1.3038	2.2170"+03	2.2064"+03
1.7020"+00	5.0387"+05	1.0048	2.6155"+04	0.0000"+00	1.8395	1.8054	2.9080"+02	7.1231"+01
INFINITE	3.3618"+02	0.0000	1.6973"-03	-1.3123"-01	0.2205	3.1439"-03	7.2975"+02	3.0862"+02
73040204	4.4378	0.9454	7.3047"+03	7.7900"-04	8.9909	1.3051	1.8640"+03	1.9074"+03
1.9050"+00	5.1066"+05	0.9772	2.7045"+04	0.0000"+00	1.8423	1.8059	2.9400"+02	6.8661"+01
INFINITE	3.3910"+02	0.0000	1.8671"-03	-1.2003"-01	0.2304	3.6173"-03	7.3728"+02	3.1098"+02
73040205	4.5237	0.9512	7.2875"+03	7.7200"-04	8.7977	1.3190	1.7130"+03	1.7008"+03
2.0570"+00	5.0699"+05	1.0072	2.7957"+04	0.0000"+00	1.8383	1.8009	2.9490"+02	6.6425"+01
INFINITE	3.3829"+02	0.0000	2.0204"-03	-1.0396"-01	0.2339	3.9276"-03	7.3921"+02	3.1001"+02
73040301	3.9022	0.9426	1.4099"+04	6.6500"-04	6.4477	1.2606	7.7550"+03	7.6177"+03
1.1940"+00	1.0144"+06	1.0180	4.2980"+04	0.0000"+00	1.8526	1.8253	2.9190"+02	8.3049"+01
INFINITE	3.3597"+02	0.0000	1.1224"-03	-2.2854"-01	0.2454	1.8245"-03	7.1299"+02	3.0966"+02
73040302	4.0996	0.9434	1.3838"+04	6.8500"-04	7.7956	1.2673	5.6200"+03	5.7526"+03
1.4480"+00	9.9664"+05	0.9769	4.5374"+04	0.0000"+00	1.8522	1.8219	2.9210"+02	7.7179"+01
INFINITE	3.3660"+02	0.0000	1.3392"-03	-1.3267"-01	0.2277	2.3613"-03	7.2211"+02	3.0962"+02
73040303	4.3062	0.9455	1.3416"+04	6.7500"-04	7.9648	1.2709	4.4570"+03	4.4120"+03
1.7020"+00	9.9949"+05	1.0102	4.7481"+04	0.0000"+00	1.8507	1.8193	2.9230"+02	7.1511"+01
INFINITE	3.3672"+02	0.0000	1.5522"-03	-1.4383"-01	0.2136	2.7886"-03	7.3011"+02	3.0914"+02
73040304	4.4370	0.9458	1.3046"+04	6.6500"-04	9.0537	1.2683	3.6950"+03	3.8077"+03
1.9050"+00	1.0184"+06	0.9704	4.8284"+04	0.0000"+00	1.8549	1.8211	2.9460"+02	6.8795"+01
INFINITE	3.3967"+02	0.0000	1.6750"-03	-1.2634"-01	0.2213	3.1682"-03	7.3787"+02	3.1150"+02
73040305	4.5339	0.9460	1.2895"+04	6.5800"-04	9.0376	1.2791	3.3610"+03	3.3731"+03
2.0570"+00	1.0183"+06	0.9964	4.9413"+04	0.0000"+00	1.8509	1.8165	2.9370"+02	6.6289"+01
INFINITE	3.3882"+02	0.0000	1.7911"-03	-1.0922"-01	0.2101	3.4234"-03	7.4012"+02	3.1048"+02
73040401	3.8630	0.9287	2.0201"+03	1.2400"-03	6.8128	1.3784	8.0850"+02	7.9742"+02
1.1940"+00	1.0070"+05	1.0139	5.9870"+03	0.0000"+00	1.0224	1.7884	2.9060"+02	8.5165"+01
INFINITE	3.3934"+02	0.0000	1.5660"-03	-1.6715"-01	0.2158	2.7072"-03	7.1477"+02	3.1291"+02
73040402	4.0987	0.9259	1.9422"+03	1.2200"-03	7.6004	1.3822	5.5930"+02	5.6075"+02
1.4480"+00	9.7035"+04	0.9974	6.2665"+03	0.0000"+00	1.8242	1.7881	2.8840"+02	7.7669"+01
INFINITE	3.3863"+02	0.0000	1.9158"-03	-1.3908"-01	0.2488	3.5000"-03	7.2423"+02	3.1149"+02
73040403	4.2888	0.9250	1.9938"+03	1.1100"-03	7.8228	1.3867	4.5480"+02	4.4934"+02
1.7020"+00	9.9549"+04	1.0121	6.8801"+03	0.0000"+00	1.8250	1.7862	2.8860"+02	7.2626"+01
INFINITE	3.3980"+02	0.0000	2.2693"-03	-1.2562"-01	0.2862	4.2409"-03	7.3281"+02	3.1201"+02
73040404	4.4001	0.9327	2.0052"+03	1.0600"-03	8.5580	1.3957	3.9350"+02	3.9803"+02
1.9050"+00	1.0161"+05	0.9886	7.2514"+03	0.0000"+00	1.8259	1.7848	2.8980"+02	6.9518"+01
INFINITE	3.3870"+02	0.0000	2.4651"-03	-1.0920"-01	0.2855	4.8225"-03	7.3557"+02	3.1071"+02
73040405	4.4756	0.9251	1.9749"+03	1.0400"-03	8.3438	1.3972	3.5820"+02	3.4907"+02
2.0570"+00	9.7991"+04	1.0262	7.2908"+03	0.0000"+00	1.8195	1.7795	2.8680"+02	6.7549"+01
INFINITE	3.3816"+02	0.0000	2.6612"-03	-9.6710"-02	0.2771	5.2069"-03	7.3752"+02	3.1002"+02

CAT 7304 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN X * RZ	MD * POD TOD	TW/TR PW/PD SW *	RED2W RED2D D2	CF * CQ * PI2*	H12 H32 H42	H12K H32K D2K	PW* TW* UD	PD* TD* TF
73040501	3.8912	0.9334	7.3633"+03	8.6200"-04	6.7211	1.2945	3.8270"+03	3.7734"+03
1.1940"+00	4.9506"+05	1.0142	2.2132"+04	0.0000"+00	1.8410	1.8115	2.9250"+02	8.4389"+01
INFINITE	3.3994"+02	0.0000	1.1981"-03	-1.8640"-01	0.2026	2.0175"-03	7.1670"+02	3.1336"+02
73040502	4.1561	0.9303	7.4249"+03	8.3800"-04	7.9587	1.3048	2.7010"+03	2.7223"+03
1.4480"+00	5.0791"+05	0.9922	2.4586"+04	0.0000"+00	1.8434	1.8109	2.8780"+02	7.5536"+01
INFINITE	3.3649"+02	0.0000	1.4648"-03	-1.6381"-01	0.1951	2.6509"-03	7.2422"+02	3.0935"+02
73040503	4.3301	0.9316	7.2355"+03	8.1000"-04	8.2050	1.3104	2.1600"+03	2.1440"+03
1.7020"+00	5.0077"+05	1.0075	2.5525"+04	0.0000"+00	1.8426	1.8067	2.8830"+02	7.0977"+01
INFINITE	3.3714"+02	0.0000	1.6886"-03	-1.3308"-01	0.2171	3.1333"-03	7.3142"+02	3.0946"+02
73040504	4.4555	0.9376	7.3190"+03	7.7900"-04	9.0274	1.2453	1.8340"+03	1.8806"+03
1.9050"+00	5.1479"+05	0.9752	2.7156"+04	0.0000"+00	1.8551	1.8313	2.8860"+02	6.7537"+01
INFINITE	3.3568"+02	0.0000	1.8477"-03	-1.1849"-01	0.2144	3.5163"-03	7.3414"+02	3.0779"+02
73040505	4.4962	0.9349	6.9313"+03	7.7200"-04	8.7853	1.3007	1.6490"+03	1.6286"+03
2.0570"+00	4.6910"+05	1.0126	2.6015"+04	0.0000"+00	1.8425	1.8063	2.8840"+02	6.6730"+01
INFINITE	3.3653"+02	0.0000	1.9892"-03	-1.0274"-01	0.1990	3.8250"-03	7.3640"+02	3.0847"+02
73040601	3.8656	0.7557	2.8969"+03	1.4100"-03	4.0252	1.3603	8.2730"+02	8.0612"+02
1.1940"+00	1.0216"+05	1.0263	7.0218"+03	1.0687"-04	1.8168	1.7860	2.9460"+02	1.0599"+02
INFINITE	4.2277"+02	0.0000	2.5031"-03	-2.3243"-01	0.7849	3.6063"-03	7.9794"+02	3.8982"+02
73040602	4.1071	0.7586	2.8622"+03	1.2700"-03	4.8162	1.3644	5.8720"+02	5.9530"+02
1.4480"+00	1.0416"+05	0.9864	7.5881"+03	8.5240"-05	1.8217	1.7870	2.9460"+02	9.6543"+01
INFINITE	4.2224"+02	0.0000	3.0082"-03	-2.1150"-01	0.8143	4.6366"-03	8.0910"+02	3.8837"+02
73040603	4.2792	0.7576	2.8336"+03	1.1700"-03	4.9708	1.3697	4.7160"+02	4.7202"+02
1.7020"+00	1.0329"+05	0.9991	7.9752"+03	8.1380"-05	1.8236	1.7862	2.9370"+02	9.0548"+01
INFINITE	4.2216"+02	0.0000	3.4829"-03	-1.8256"-01	0.8299	5.4727"-03	8.1641"+02	3.8767"+02
73040604	4.5035	0.7646	2.7559"+03	1.1300"-03	5.1585	1.3887	3.7040"+02	3.5425"+02
2.0570"+00	1.0297"+05	1.0456	8.4326"+03	7.5180"-05	1.8159	1.7768	2.9800"+02	8.4093"+01
INFINITE	4.2520"+02	0.0000	4.1797"-03	-1.3643"-01	0.8192	6.7671"-03	8.2802"+02	3.6972"+02
73040701	3.9016	0.7636	9.5017"+03	9.3500"-04	4.6772	1.2947	3.9090"+03	3.8620"+03
1.1940"+00	5.1397"+05	1.0119	2.3731"+04	7.8230"-05	1.8352	1.8075	2.9660"+02	1.0419"+02
INFINITE	4.2141"+02	0.0000	1.7061"-03	-2.4392"-01	0.6627	2.5377"-03	7.9850"+02	3.8842"+02
73040702	4.1372	0.7652	9.1942"+03	9.0000"-04	5.8435	1.2996	2.7450"+03	2.8375"+03
1.4480"+00	5.1647"+05	0.9674	2.4802"+04	6.9300"-05	1.8367	1.8059	2.9720"+02	9.5492"+01
INFINITE	4.2239"+02	0.0000	2.0152"-03	-2.0841"-01	0.6605	3.2566"-03	8.1059"+02	3.8839"+02
73040703	4.3245	0.7644	9.1791"+03	8.5500"-04	5.7946	1.3114	2.2080"+03	2.2157"+03
1.7020"+00	5.1384"+05	0.9965	2.6438"+04	6.4680"-05	1.8366	1.8026	2.9580"+02	8.8930"+01
INFINITE	4.2155"+02	0.0000	2.3700"-03	-1.7642"-01	0.6876	3.8668"-03	8.1766"+02	3.8696"+02
73040704	4.5584	0.7693	8.9414"+03	8.3000"-04	6.1979	1.3154	1.6810"+03	1.6637"+03
2.0570"+00	5.1774"+05	1.0104	2.8059"+04	6.0770"-05	1.8345	1.7989	2.9720"+02	8.1788"+01
INFINITE	4.2168"+02	0.0000	2.8076"-03	-1.3343"-01	0.6830	4.7654"-03	8.2654"+02	3.8633"+02
73040801	3.9245	0.7778	1.6470"+04	7.6800"-04	4.8932	1.2629	7.6740"+03	7.5090"+03
1.1940"+00	1.0304"+06	1.0220	4.1870"+04	6.6070"-05	1.8481	1.8222	2.9630"+02	1.0131"+02
INFINITE	4.1338"+02	0.0000	1.4777"-03	-2.5788"-01	0.5727	2.1963"-03	7.9199"+02	3.8092"+02
73040802	4.1488	0.7749	1.6616"+04	7.6000"-04	6.1938	1.2619	5.5360"+03	5.6768"+03
1.4480"+00	1.0494"+06	0.9748	4.5629"+04	6.2820"-05	1.8501	1.8218	2.9490"+02	9.3169"+01
INFINITE	4.1391"+02	0.0000	1.7817"-03	-2.1579"-01	0.5744	2.8637"-03	8.0291"+02	3.8055"+02
73040803	4.3478	0.7805	1.6031"+04	7.4100"-04	6.0149	1.2701	4.3680"+03	4.3361"+03
1.7020"+00	1.0359"+06	1.0074	4.7534"+04	5.4960"-05	1.8496	1.8186	2.9500"+02	8.6144"+01
INFINITE	4.1183"+02	0.0000	2.0662"-03	-1.7344"-01	0.6132	3.3529"-03	8.0908"+02	3.7796"+02
73040804	4.5727	0.8093	1.4856"+04	7.1800"-04	6.8210	1.2781	3.2950"+03	3.2953"+03
2.0570"+00	1.0438"+06	0.9999	4.9025"+04	4.7130"-05	1.8487	1.8152	3.0360"+02	7.9025"+01
INFINITE	4.0950"+02	0.0000	2.3458"-03	-1.3025"-01	0.5993	4.0273"-03	8.1502"+02	3.7513"+02

CAT 7304 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
73040901	3.8686	0.7404	3.0272"+03	1.4100"-03	3.8273	1.3604	8.2690"+02	8.1185"+02
1.1940"+00	1.0330"+05	1.0185	7.2190"+03	1.1275"-04	1.8181	1.7875	2.9110"+02	1.0678"+02
INFINITE	4.2639"+02	0.0000	2.5808"-03	-2.4286"-01	0.8443	3.6508"-03	8.0150"+02	3.9315"+02
73040902	4.1164	0.7429	2.9291"+03	1.2700"-03	4.6060	1.3691	5.7860"+02	5.8653"+02
1.4480"+00	1.0388"+05	0.9865	7.6622"+03	9.0320"-05	1.8219	1.7875	2.8930"+02	9.6472"+01
INFINITE	4.2341"+02	0.0000	3.0727"-03	-2.2058"-01	0.8589	4.6550"-03	8.1064"+02	3.8941"+02
73040903	4.3173	0.7531	2.8904"+03	1.1700"-03	4.5778	1.3766	4.6170"+02	4.5154"+02
1.7020"+00	1.0376"+05	1.0225	8.2058"+03	8.2210"-05	1.8196	1.7830	2.9200"+02	8.9332"+01
INFINITE	4.2235"+02	0.0000	3.6398"-03	-1.9116"-01	0.8686	5.5671"-03	8.1814"+02	3.8771"+02
73040904	4.4122	0.7519	2.9231"+03	1.1400"-03	4.9297	1.3791	3.9470"+02	3.9900"+02
1.9050"+00	1.0343"+05	0.9892	8.5569"+03	8.2960"-05	1.8222	1.7831	2.9290"+02	8.6788"+01
INFINITE	4.2470"+02	0.0000	4.0273"-03	-1.7132"-01	0.9047	6.3778"-03	8.2413"+02	3.8955"+02
73040905	4.5108	0.7496	2.8738"+03	1.1300"-03	5.0134	1.3852	3.6770"+02	3.5454"+02
2.0570"+00	1.0400"+05	1.0371	8.6932"+03	7.9880"-05	1.8161	1.7779	2.9010"+02	8.3297"+01
INFINITE	4.2227"+02	0.0000	4.2383"-03	-1.4368"-01	0.8374	6.7831"-03	8.2543"+02	3.8702"+02
73041001	3.9226	0.7494	9.8746"+03	9.3500"-04	4.5004	1.2892	3.8090"+03	3.7728"+03
1.1940"+00	5.1641"+05	1.0096	2.4267"+04	8.3170"-05	1.8373	1.8099	2.9230"+02	1.0381"+02
INFINITE	4.2327"+02	0.0000	1.7672"-03	-2.5797"-01	0.7293	2.5935"-03	8.0132"+02	3.9005"+02
73041002	4.1721	0.7530	9.4149"+03	9.0000"-04	5.5726	1.2954	2.6920"+03	2.7442"+03
1.4480"+00	5.2279"+05	0.9810	2.5409"+04	7.2930"-05	1.8374	1.8075	2.9160"+02	9.4007"+01
INFINITE	4.2127"+02	0.0000	2.0687"-03	-2.1668"-01	0.6933	3.2837"-03	8.1104"+02	3.8724"+02
73041003	4.3595	0.7527	9.4683"+03	8.5500"-04	5.5849	1.2949	2.1280"+03	2.1333"+03
1.7020"+00	5.1729"+05	0.9975	2.7273"+04	6.7850"-05	1.8408	1.8078	2.9140"+02	8.7872"+01
INFINITE	4.2188"+02	0.0000	2.4748"-03	-1.8478"-01	0.7360	3.9684"-03	8.1935"+02	3.8714"+02
73041004	4.4628	0.7555	9.2389"+03	8.4000"-04	6.2408	1.3025	1.7940"+03	1.8672"+03
1.9050"+00	5.1583"+05	0.9608	2.7651"+04	6.6960"-05	1.8404	1.8056	2.9280"+02	8.4825"+01
INFINITE	4.2271"+02	0.0000	2.6579"-03	-1.6040"-01	0.7667	4.4630"-03	8.2410"+02	3.8757"+02
73041005	4.6027	0.7523	8.8996"+03	8.3000"-04	6.1769	1.3002	1.6350"+03	1.6092"+03
2.0570"+00	5.2891"+05	1.0161	2.7874"+04	6.5490"-05	1.8366	1.8023	2.9020"+02	8.0430"+01
INFINITE	4.2121"+02	0.0000	2.7856"-03	-1.3735"-01	0.6911	4.7057"-03	8.2762"+02	3.8577"+02

CAT 7304 VOISINET BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW*	PD*
X *	POD	PW/PD	RED2D	CQ *	H32	H32K	TW*	TD*
RZ	TOD	SW *	D2	PI2*	H42	D2K	UD	TR
73041101	4.1051	0.2337	3.7632"+03	2.1000"-03	4.0198	1.3376	5.7160"+02	5.9561"+02
1.4460"+00	1.0394"+05	0.9597	8.2470"+03	NM	1.8057	1.7894	9.0910"+01	9.6785"+01
INFINITE	4.2299"+02	0.0000	3.2814"-03	-1.4340"-01	1.0038	4.5104"-03	8.0972"+02	3.8906"+02
73041102	4.3312	0.2378	8.3288"+03	1.8600"-03	3.7073	1.3628	4.6090"+02	4.5039"+02
1.7020"+00	1.0534"+05	1.0233	8.6302"+03	NM	1.7957	1.7792	9.2770"+01	8.9443"+01
I[illegible]E	4.2502"+02	0.0000	3.8325"-03	-1.2507"-01	0.9828	5.1988"-03	8.2128"+02	3.9012"+02
73041201	4.1241	0.2330	2.7443"+04	1.4350"-03	5.1203	1.2898	2.6930"+03	2.8282"+03
1.4460"+00	5.0601"+05	0.9522	2.5929"+04	NM	1.822[illegible]	1.8051	9.0560"+01	9.6014"+01
INFINITE	4.2262"+02	0.0000	2.1375"-03	-2.6020"-01	0.8446	3.1631"-03	8.1022"+02	3.8865"+02
73041202	4.3881	0.2429	2.6339"+04	1.3500"-03	4.3236	1.3165	2.1410"+03	2.0605"+03
1.7020"+00	5.1809"+05	1.0391	2.8414"+04	NM	1.8143	1.7950	9.4240"+01	8.7179"+01
INFINITE	4.2291"+02	0.0000	2.6211"-03	-1.2213"-01	0.8441	3.7649"-03	8.2147"+02	3.8799"+02
73041203	4.5018	0.2321	2.8058"+04	1.3400"-03	5.0707	1.3067	1.8640"+03	1.8560"+03
1.9050"+00	5.3836"+05	1.0043	3.0123"+04	NM	1.8178	1.7979	8.9650"+01	8.3380"+01
INFINITE	4.2134"+02	0.0000	2.8151"-03	-1.0236"-01	0.8323	4.2343"-03	8.2419"+02	3.8619"+02
73041204	4.6116	0.2326	2.8328"+04	1.3500"-03	5.1300	1.3056	1.6480"+03	1.6309"+03
2.0570"+00	5.4194"+05	1.0105	3.1633"+04	NM	1.8198	1.7992	8.9530"+01	8.0009"+01
INFINITE	4.2032"+02	0.0000	3.0890"-03	-8.9960"-02	0.8403	4.6326"-03	8.2705"+02	3.8492"+02
73041301	4.1393	0.3236	3.7482"+04	1.1930"-03	4.9158	1.2592	5.5750"+03	5.5750"+03
1.4460"+00	1.0175"+06	1.0000	4.8658"+04	NM	1.8415	1.8207	1.2630"+02	9.5885"+01
INFINITE	4.2446"+02	0.0000	2.0234"-03	-1.5229"-01	0.7335	2.9765"-03	8.1267"+02	3.9029"+02
73041302	4.3817	0.2558	4.4527"+04	1.1220"-03	4.5542	1.2832	4.2360"+03	4.1076"+03
1.70[illegible]0"+00	1.0245"+06	1.0312	5.0400"+04	NM	1.8301	1.8101	9.6620"+01	8.5075"+01
INFINITE	4.1175"+02	0.0000	2.2528"-03	-1.2734"-01	0.8090	3.2630"-03	8.1032"+02	3.7778"+02
73041303	4.5095	0.2407	4.7571"+04	1.1100"-03	5.5929	1.2779	3.7200"+03	3.7200"+03
1.9050"+00	1.0894"+06	1.0000	5.3026"+04	NM	1.8360	1.8143	9.4310"+01	8.4379"+01
INFINITE	4.2756"+02	0.0000	2.5122"-03	-1.1048"-01	0.7556	3.8424"-03	8.3053"+02	3.9187"+02
73041304	[illegible].5081	0.2586	4.1822"+04	1.1200"-03	5.5874	1.2705	3.2940"+03	3.3586"+03
2.0570"+00	[illegible].8188"+05	0.9808	4.9960"+04	NM	1.8371	1.8152	1.0010"+02	8.3375"+01
INFINITE	4.2226"+02	0.0000	2.5763"-03	-9.4430"-02	0.8209	3.9578"-03	8.2532"+02	3.8702"+02
73041401	4.3171	0.2211	9.7940"+03	1.8600"-03	3.1033	1.3605	4.5870"+02	4.4604"+02
1.7020"+00	1.0246"+05	1.0284	9.4064"+03	NM	1.7967	1.7795	8.6440"+01	9.0089"+01
INFINITE	4.2589"+02	0.0000	4.2769"-03	-1.4624"-01	1.0725	5.4981"-03	8.2156"+02	3.9097"+02
73041402	4.4549	0.2249	9.1819"+03	1.8000"-03	3.4719	1.3817	3.7140"+02	3.7556"+02
1.9050"+00	1.0273"+05	0.9889	9.4038"+03	NM	1.7836	1.7679	8.7930"+01	8.5810"+01
INFINITE	4.2641"+02	0.0000	4.5797"-03	-1.2265"-01	1.1194	6.0996"-03	8.2740"+02	3.9099"+02
73041403	4.5527	0.2181	9.7557"+03	1.8100"-03	3.2560	1.3689	3.5530"+02	3.4176"+02
2.0570"+00	1.0561"+05	1.0396	1.0024"+04	NM	1.7859	1.7691	8.5140"+01	8.2821"+01
INFINITE	4.2615"+02	0.0000	4.9805"-03	-1.0987"-01	1.0926	6.5655"-03	8.3071"+02	3.9044"+02
73041501	4.3708	0.2286	2.9503"+04	1.3500"-03	4.2674	1.3252	2.1520"+03	2.1016"+03
1.7020"+00	5.1697"+05	1.0240	3.1095"+04	NM	1.8077	1.7898	9.1430"+01	8.6639"+01
INFINITE	4.1767"+02	0.0000	2.7976"-03	-1.3084"-01	0.8848	3.9854"-03	8.1569"+02	3.8324"+02
73041502	4.5118	0.2882	2.1995"+04	1.3400"-03	5.2479	1.3336	1.6980"+03	1.7690"+03
1.9050"+00	5.1955"+05	0.9599	2.9174"+04	NM	1.8079	1.7882	1.1120"+02	8.3004"+01
INFINITE	4.2093"+02	0.0000	2.8351"-03	-1.1347"-01	0.9508	4.3180"-03	8.2415"+02	3.8579"+02
73041503	4.6183	0.2529	2.5870"+04	1.3500"-03	4.8191	1.3158	1.5800"+03	1.5800"+03
2.0570"+00	5.2938"+05	1.0000	3.1395"+04	NM	1.8101	1.7917	9.8070"+01	8.0425"+01
INFINITE	4.2350"+02	0.0000	3.1843"-03	-9.6480"-02	0.9203	4.7036"-03	8.3040"+02	3.8782"+02

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
73040301	1.1130"-03	6.6935	1.8513	0.2474	4.2671"+04	1.3998"+04	7.3629"-03
	1.1007"-03	6.6879	1.8529	0.2472	4.2707"+04	1.4009"+04	
73040302	1.3518"-03	7.4733	1.8536	0.2256	4.5853"+04	1.3984"+04	1.0256"-02
	1.3718"-03	7.4806	1.8518	0.2258	4.5809"+04	1.3970"+04	
73040303	1.5461"-03	8.1147	1.8502	0.2195	4.7351"+04	1.3379"+04	1.2461"-02
	1.5361"-03	8.1115	1.8509	0.2194	4.7369"+04	1.3384"+04	
73040304	1.6928"-03	8.6177	1.8565	0.2190	4.8855"+04	1.3200"+04	1.4867"-02
	1.7258"-03	8.6271	1.8544	0.2192	4.8802"+04	1.3186"+04	
73040305	1.7935"-03	8.9811	1.8511	0.2098	4.9539"+04	1.2928"+04	1.6146"-02
	1.7977"-03	8.9822	1.8508	0.2099	4.9532"+04	1.2926"+04	
73041301	2.0231"-03	4.9161	1.8415	0.7336	4.8710"+04	3.7522"+04	9.9458"-03
	2.0231"-03	4.9161	1.8415	0.7336	4.8710"+04	3.7522"+04	
73041302	2.2246"-03	4.9342	1.8280	0.8192	4.9829"+04	4.4023"+04	1.0750"-02
	2.1812"-03	4.9284	1.8301	0.8183	4.9867"+04	4.4074"+04	
73041303	2.5122"-03	5.5925	1.8360	0.7556	5.3090"+04	4.7629"+04	1.4050"-02
	2.5122"-03	5.5925	1.8360	0.7556	5.3090"+04	4.7629"+04	
73041304	2.5998"-03	5.2924	1.8386	0.8135	5.0475"+04	4.2254"+04	1.3942"-02
	2.5325"-03	5.2960	1.8374	0.8140	5.0441"+04	4.2225"+04	

73040301 VOISINET PROFILE TABULATION 35 POINTS, DELTA AT POINT 25

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.01802	0.86883	0.00000	0.00000	3.51480	0.00000
2	6.3000"-05	1.3595"+00	1.01802	0.87969	0.17353	0.31330	3.25980	0.09784
3	1.4000"-04	1.8224"+00	1.01802	0.89117	0.24783	0.43190	3.03710	0.14477
4	2.1600"-04	2.4187"+00	1.01802	0.89926	0.30850	0.51810	2.82040	0.18701
5	2.9200"-04	3.0844"+00	1.01802	0.90989	0.36134	0.58640	2.63370	0.22666
6	5.2100"-04	3.8669"+00	1.01802	0.92109	0.41392	0.64770	2.44860	0.26928
7	6.9800"-04	4.3458"+00	1.01802	0.92662	0.44282	0.67840	2.34700	0.29426
8	9.7800"-04	4.7626"+00	1.01802	0.93062	0.46644	0.70190	2.26440	0.31556
9	1.2070"-03	5.0144"+00	1.01802	0.93382	0.48013	0.71530	2.21950	0.32809
10	1.4630"-03	5.2718"+00	1.01802	0.93797	0.49372	0.72860	2.17780	0.34059
11	1.7170"-03	5.5458"+00	1.01802	0.93977	0.50777	0.74100	2.12960	0.35422
12	1.9960"-03	5.8184"+00	1.01802	0.93974	0.52136	0.75190	2.07990	0.36802
13	2.2760"-03	6.0817"+00	1.01802	0.94411	0.53416	0.76360	2.04360	0.38079
14	2.4280"-03	6.2111"+00	1.01802	0.94120	0.54033	0.76710	2.01550	0.38746
15	5.1230"-03	8.5416"+00	1.01802	0.96055	0.64128	0.84230	1.72520	0.49703
16	7.7420"-03	1.0774"+01	1.01629	0.97273	0.72479	0.89170	1.51360	0.59872
17	1.0030"-02	1.2623"+01	1.01476	0.97924	0.78723	0.92210	1.37200	0.68201
18	1.2624"-02	1.4442"+01	1.01303	0.98559	0.84416	0.94670	1.25770	0.76253
19	1.5420"-02	1.6012"+01	1.01110	0.99160	0.89037	0.96510	1.17490	0.83055
20	1.7988"-02	1.7330"+01	1.00937	0.99498	0.92736	0.97800	1.11220	0.88757
21	2.0480"-02	1.8417"+01	1.00764	0.99640	0.95681	0.98700	1.06410	0.93463
22	2.2718"-02	1.9150"+01	1.00529	0.99810	0.97616	0.99300	1.03480	0.96469
23	2.3073"-02	1.9236"+01	1.00499	1.00035	0.97840	0.99470	1.03360	0.96717
24	2.5489"-02	1.9792"+01	1.00244	0.99899	0.99280	0.99770	1.00990	0.99033
D 25	2.7854"-02	2.0073"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
26	3.0549"-02	2.0170"+01	0.99715	0.99739	1.00246	0.99930	0.99370	1.00277
27	3.2990"-02	2.0249"+01	0.99460	0.99880	1.00448	1.00050	0.99210	1.00303
28	3.5303"-02	2.0263"+01	0.99277	0.99983	1.00482	1.00110	0.99260	1.00127
29	3.8227"-02	2.0285"+01	0.99033	0.99996	1.00538	1.00130	0.99190	0.99971
30	4.0795"-02	2.0317"+01	0.98615	0.99996	1.00619	1.00150	0.99070	0.99691
31	4.3261"-02	2.0339"+01	0.98319	1.00089	1.00674	1.00210	0.99080	0.99431
32	4.6007"-02	2.0314"+01	0.98615	1.00199	1.00613	1.00250	0.99280	0.99579
33	4.8397"-02	2.0314"+01	0.98636	1.00179	1.00613	1.00240	0.99260	0.99610
34	5.0305"-02	2.0344"+01	0.98208	1.00142	1.00689	1.00240	0.99110	0.99328
35	5.2746"-02	2.0408"+01	0.97414	1.00203	1.00851	1.00310	0.98930	0.98773

INPUT VARIABLES Y,U/UD,T/TD,P/PW

73040302 VOISINET PROFILE TABULATION 57 POINTS, DELTA AT POINT 42

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	0.97694	0.86778	0.00000	0.00000	3.78470	0.00000
2	6.3000E-05	1.2438E+00	0.97694	0.87136	0.13834	0.26140	3.57060	0.07152
3	1.4000E-04	1.5739E+00	0.97694	0.88083	0.20288	0.37270	3.37470	0.10789
4	2.1600E-04	2.0264E+00	0.97694	0.89146	0.25795	0.45980	3.17730	0.14138
5	3.4300E-04	2.8480E+00	0.97694	0.90582	0.32712	0.55760	2.90550	0.10749
6	4.9500E-04	3.3573E+00	0.97694	0.91373	0.36225	0.60240	2.76530	0.21282
7	5.7200E-04	3.7283E+00	0.97694	0.91870	0.38564	0.63030	2.67140	0.23050
8	7.4900E-04	4.0775E+00	0.97694	0.92364	0.40633	0.65400	2.59060	0.24663
9	1.0540E-03	4.5121E+00	0.97694	0.92868	0.43062	0.68020	2.49510	0.26633
10	1.2830E-03	4.7673E+00	0.97694	0.93080	0.44423	0.69400	2.44060	0.27780
11	1.5620E-03	5.0072E+00	0.97694	0.93300	0.45665	0.70630	2.39230	0.28843
12	2.0960E-03	5.5090E+00	0.97694	0.93764	0.48155	0.73000	2.29810	0.31033
13	2.6030E-03	5.9303E+00	0.97694	0.94035	0.50147	0.74760	2.22250	0.32862
14	3.0350E-03	6.3095E+00	0.97694	0.94178	0.51874	0.76180	2.15670	0.34508
15	3.6200E-03	6.7531E+00	0.97694	0.94632	0.53822	0.77830	2.09110	0.36362
16	4.1270E-03	7.1258E+00	0.97694	0.94861	0.55405	0.79060	2.03620	0.37932
17	4.6860E-03	7.5397E+00	0.97694	0.95239	0.57110	0.80390	1.98140	0.39637
18	5.0670E-03	7.8393E+00	0.97694	0.95439	0.58314	0.81270	1.94230	0.40877
19	5.7020E-03	8.2730E+00	0.97733	0.95649	0.60012	0.82440	1.88710	0.42696
20	6.1340E-03	8.5984E+00	0.97763	0.95788	0.61255	0.83260	1.84750	0.44058
21	6.7180E-03	9.0007E+00	0.97802	0.96028	0.62758	0.84250	1.80220	0.45721
22	7.1760E-03	9.3668E+00	0.97831	0.95964	0.64094	0.84980	1.75790	0.47293
23	7.7850E-03	9.7943E+00	0.97870	0.96182	0.65020	0.85910	1.71400	0.49055
24	8.7250E-03	1.0480E+01	0.97929	0.96321	0.67996	0.87430	1.65330	0.51787
25	9.5380E-03	1.1058E+01	0.97978	0.97082	0.69935	0.88500	1.60140	0.54147
26	1.0223E-02	1.1553E+01	0.98027	0.97280	0.71556	0.89350	1.55920	0.56174
27	1.1468E-02	1.2409E+01	0.98105	0.97705	0.74271	0.90750	1.49300	0.59632
28	1.2891E-02	1.3332E+01	0.98193	0.98059	0.77090	0.92080	1.42670	0.63374
29	1.4033E-02	1.4019E+01	0.98271	0.98314	0.79124	0.92990	1.38120	0.66161
30	1.5431E-02	1.4861E+01	0.98359	0.98627	0.81550	0.94030	1.32950	0.69565
31	1.6396E-02	1.5477E+01	0.98417	0.98832	0.83276	0.94730	1.29400	0.72048
32	1.7844E-02	1.6321E+01	0.98515	0.99107	0.85589	0.95630	1.24840	0.75465
33	1.8885E-02	1.6878E+01	0.98583	0.99247	0.87079	0.96170	1.21970	0.77730
34	2.0460E-02	1.7729E+01	0.98681	0.99461	0.89310	0.96950	1.17840	0.81188
35	2.1425E-02	1.8182E+01	0.98759	0.99463	0.90476	0.97290	1.15630	0.83095
36	2.2847E-02	1.8857E+01	0.98877	0.99484	0.92184	0.97780	1.12510	0.85931
37	2.4346E-02	1.9481E+01	0.99004	0.99730	0.93736	0.98320	1.10020	0.88475
38	2.5540E-02	1.9902E+01	0.99101	0.99830	0.94767	0.98640	1.08340	0.90228
39	2.7927E-02	2.0593E+01	0.99297	0.99963	0.96438	0.99130	1.05660	0.93160
40	3.1280E-02	2.1390E+01	0.99570	1.00001	0.98330	0.99610	1.02620	0.96650
41	3.3922E-02	2.1851E+01	0.99785	1.00033	0.99409	0.99880	1.00950	0.98727
D 42	3.6487E-02	2.2106E+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
43	4.0526E-02	2.2305E+01	1.00332	0.99991	1.00457	1.00100	0.99290	1.01151
44	4.3472E-02	2.2340E+01	1.00567	0.99995	1.00538	1.00120	0.99170	1.01530
45	4.5936E-02	2.2377E+01	1.00772	0.99936	1.00625	1.00110	0.98980	1.01922
46	4.7943E-02	2.2401E+01	1.00488	1.00111	1.00679	1.00210	0.99070	1.01645
47	5.0711E-02	2.2381E+01	1.00723	1.00131	1.00634	1.00210	0.99160	1.01789
48	5.2870E-02	2.2335E+01	1.01290	1.00180	1.00527	1.00210	0.99370	1.02146
49	5.5766E-02	2.2313E+01	1.01544	1.00223	1.00477	1.00220	0.99490	1.02289
50	5.7721E-02	2.2304E+01	1.01671	1.00232	1.00456	1.00220	0.99530	1.02375
51	6.1049E-02	2.2322E+01	1.01456	1.00273	1.00497	1.00250	0.99510	1.02210
52	6.3411E-02	2.2335E+01	1.01270	1.00340	1.00527	1.00290	0.99530	1.02043
53	6.6154E-02	2.2278E+01	1.01973	1.00359	1.00396	1.00270	0.99750	1.02505
54	6.8604E-02	2.2289E+01	1.01876	1.00368	1.00421	1.00280	0.99720	1.02448
55	7.0777E-02	2.2252E+01	1.02325	1.00387	1.00335	1.00270	0.99870	1.02735
56	7.3851E-02	2.2213E+01	1.02614	1.00448	1.00245	1.00280	1.00070	1.03029
57	7.6365E-02	2.2197E+01	1.03048	1.00380	1.00210	1.00240	1.00060	1.03233

INPUT VARIABLES Y,U/UD,T/TD,P/PW

73040303 VOISINET PROFILE TABULATION 55 POINTS, DELTA AT POINT 37

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.01020	0.86809	0.00000	0.00000	4.08750	0.00000
2	6.3000"-05	1.1562"+00	1.01020	0.87089	0.10683	0.21190	3.93420	0.05441
3	1.4000"-04	1.5100"+00	1.01020	0.88054	0.18356	0.35240	3.68560	0.09659
4	2.1600"-04	2.0700"+00	1.01020	0.89248	0.24969	0.46130	3.41320	0.13653
5	3.5800"-04	2.9154"+00	1.01020	0.90610	0.31609	0.55770	3.11300	0.18098
6	5.7200"-04	3.5748"+00	1.01020	0.91557	0.35811	0.61210	2.92160	0.21165
7	8.2500"-04	4.0581"+00	1.01020	0.92195	0.38577	0.64520	2.79730	0.23300
8	1.0800"-03	4.3456"+00	1.01020	0.92294	0.40126	0.66190	2.72100	0.24574
9	1.4600"-03	4.7162"+00	1.01020	0.92619	0.42036	0.68230	2.63460	0.26162
10	2.0450"-03	5.2204"+00	1.01020	0.92957	0.44497	0.70690	2.52380	0.28295
11	2.4770"-03	5.5887"+00	1.01020	0.93342	0.46209	0.72370	2.45260	0.29806
12	3.1880"-03	6.1509"+00	1.01020	0.93782	0.48705	0.74650	2.34920	0.32101
13	4.0010"-03	6.7152"+00	1.01020	0.94138	0.51084	0.76670	2.25260	0.34383
14	4.4580"-03	7.0357"+00	1.01020	0.94417	0.52387	0.77760	2.20330	0.35653
15	5.0670"-03	7.4391"+00	1.01020	0.94690	0.53980	0.79020	2.14290	0.37252
16	6.0580"-03	8.0858"+00	1.01020	0.95158	0.56441	0.80890	2.05400	0.39784
17	7.0490"-03	8.7987"+00	1.01020	0.95594	0.59033	0.82720	1.96350	0.42559
18	8.0140"-03	9.4782"+00	1.01020	0.96027	0.61401	0.84310	1.88540	0.45174
19	9.1820"-03	1.0280"+01	1.01020	0.96457	0.64082	0.85980	1.80020	0.48249
20	1.0223"-02	1.0978"+01	1.01020	0.96819	0.66327	0.87300	1.73240	0.50907
21	1.1417"-02	1.1746"+01	1.00980	0.97225	0.68713	0.88640	1.66410	0.53788
22	1.2789"-02	1.2630"+01	1.00939	0.97580	0.71359	0.90000	1.59070	0.57110
23	1.3957"-02	1.3351"+01	1.00899	0.97912	0.73446	0.91040	1.53650	0.59784
24	1.5354"-02	1.4221"+01	1.00859	0.98239	0.75889	0.92170	1.47510	0.63020
25	1.6294"-02	1.4804"+01	1.00828	0.98399	0.77483	0.92850	1.43600	0.65194
26	1.7691"-02	1.5649"+01	1.00788	0.98626	0.79736	0.93770	1.38300	0.68336
27	1.8783"-02	1.6321"+01	1.00748	0.98736	0.81481	0.94420	1.34280	0.70841
28	2.0434"-02	1.7329"+01	1.00697	0.99054	0.84034	0.95400	1.28180	0.74538
29	2.3025"-02	1.8764"+01	1.00616	0.99380	0.87538	0.96610	1.21800	0.79307
30	2.5413"-02	1.9840"+01	1.00546	0.99612	0.90078	0.97430	1.16490	0.83735
31	2.7927"-02	2.0886"+01	1.00465	0.99777	0.92478	0.98140	1.12620	0.87548
32	3.0391"-02	2.1789"+01	1.00394	0.99854	0.94501	0.98680	1.09040	0.90855
33	3.2880"-02	2.2591"+01	1.00313	0.99960	0.96262	0.99150	1.06090	0.93751
34	3.5522"-02	2.3294"+01	1.00232	1.00045	0.97781	0.99540	1.03630	0.96276
35	3.7503"-02	2.3716"+01	1.00172	1.00070	0.98680	0.99750	1.02180	0.97789
36	4.0323"-02	2.4112"+01	1.00081	1.00086	0.99518	0.99940	1.00850	0.99178
D 37	4.2862"-02	2.4342"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
38	4.5885"-02	2.4590"+01	0.99909	1.00041	1.00518	1.00130	0.99230	1.00815
39	4.8247"-02	2.4633"+01	0.99838	1.00043	1.00607	1.00150	0.99090	1.00906
40	5.0838"-02	2.4685"+01	0.99758	0.99979	1.00716	1.00140	0.98860	1.01049
41	5.3200"-02	2.4704"+01	0.99545	1.00122	1.00755	1.00220	0.98940	1.00833
42	5.5308"-02	2.4711"+01	0.99444	1.00115	1.00771	1.00220	0.98910	1.00761
43	5.8458"-02	2.4731"+01	0.99232	1.00139	1.00811	1.00240	0.98870	1.00607
44	6.0388"-02	2.4748"+01	0.99050	1.00164	1.00847	1.00260	0.98840	1.00473
45	6.3589"-02	2.4703"+01	0.99535	1.00222	1.00755	1.00270	0.99040	1.00771
46	6.6027"-02	2.4704"+01	0.99535	1.00082	1.00756	1.00200	0.98900	1.00844
47	6.8466"-02	2.4694"+01	0.99646	1.00170	1.00735	1.00240	0.99020	1.00874
48	7.0930"-02	2.4703"+01	0.99586	1.00423	1.00754	1.00370	0.99240	1.00720
49	7.3215"-02	2.4693"+01	0.99677	1.00331	1.00734	1.00320	0.99180	1.00822
50	7.7940"-02	2.4611"+01	1.00616	1.00383	1.00562	1.00310	0.99500	1.01435
51	8.2436"-02	2.4546"+01	1.01394	1.00349	1.00426	1.00260	0.99670	1.01994
52	8.6677"-02	2.4543"+01	1.01424	1.00442	1.00421	1.00310	0.99780	1.01963
53	9.2113"-02	2.4519"+01	1.01647	1.00544	1.00370	1.00350	0.99960	1.02043
54	9.6914"-02	2.4404"+01	1.03041	1.00586	1.00130	1.00320	1.00380	1.02979
55	1.0194"-01	2.4356"+01	1.03596	1.00488	1.00030	1.00250	1.00440	1.03400

INPUT VARIABLES Y,U/UD,T/TD,P/PW

73040304 VOISINET PROFILE TABULATION 56 POINTS, DELTA AT POINT 43

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.97040	0.86732	0.00000	0.00000	4.28230	0.00000
2	6.3000"-05	1.1404"+00	0.97040	0.87354	0.09857	0.20090	4.15410	0.04693
3	8.9000"-05	1.2455"+00	0.97040	0.87854	0.12822	0.25880	4.07400	0.06164
4	2.4100"-04	1.9508"+00	0.97040	0.89349	0.23115	0.44130	3.64470	0.11750
5	3.4300"-04	2.5357"+00	0.97040	0.90214	0.28017	0.51680	3.40260	0.14739
6	4.4400"-04	2.9691"+00	0.97040	0.90835	0.31032	0.55960	3.25190	0.16699
7	5.2100"-04	3.2871"+00	0.97040	0.91327	0.33045	0.58680	3.15340	0.18058
8	6.7300"-04	3.7109"+00	0.97040	0.91841	0.35533	0.61840	3.02880	0.19813
9	8.5100"-04	3.9948"+00	0.97040	0.92241	0.37100	0.63760	2.95360	0.20948
10	1.0030"-03	4.2213"+00	0.97040	0.92252	0.38301	0.65080	2.88720	0.21874
11	1.2570"-03	4.4407"+00	0.97040	0.92212	0.39428	0.66260	2.82420	0.22767
12	1.6130"-03	4.8039"+00	0.97040	0.92666	0.41222	0.68250	2.74120	0.24161
13	2.0190"-03	5.1467"+00	0.97040	0.93166	0.42845	0.70010	2.67010	0.25444
14	2.4260"-03	5.4533"+00	0.97040	0.93480	0.44244	0.71430	2.60650	0.26593
15	2.8320"-03	5.7362"+00	0.97040	0.93711	0.45495	0.72640	2.54930	0.27651
16	3.3910"-03	6.1525"+00	0.97040	0.94026	0.47275	0.74290	2.46940	0.29194
17	4.0010"-03	6.5403"+00	0.97040	0.94108	0.48874	0.75660	2.39650	0.30637
18	4.6860"-03	7.0070"+00	0.97040	0.94137	0.50730	0.77080	2.30860	0.32400
19	5.4230"-03	7.4573"+00	0.97060	0.94592	0.52458	0.78540	2.24160	0.34007
20	6.3630"-03	8.0670"+00	0.97118	0.95031	0.54709	0.80290	2.15380	0.36204
21	7.4040"-03	8.7131"+00	0.97186	0.95496	0.56997	0.81980	2.06880	0.38512
22	8.3440"-03	9.3311"+00	0.97244	0.95799	0.59101	0.83400	1.99130	0.40728
23	9.3600"-03	1.0000"+01	0.97312	0.96176	0.61297	0.84830	1.91520	0.43102
24	1.0376"-02	1.0621"+01	0.97370	0.96246	0.63268	0.85930	1.84470	0.45357
25	1.1621"-02	1.1435"+01	0.97448	0.96694	0.65759	0.87400	1.76650	0.48214
26	1.2492"-02	1.2243"+01	0.97535	0.97102	0.68143	0.88720	1.69510	0.51049
27	1.4211"-02	1.2970"+01	0.97613	0.97455	0.70218	0.89810	1.63590	0.53589
28	1.5405"-02	1.3677"+01	0.97690	0.97713	0.72180	0.90760	1.58110	0.56077
29	1.6700"-02	1.4428"+01	0.97768	0.98031	0.74205	0.91720	1.52780	0.58694
30	1.8351"-02	1.5408"+01	0.97875	0.98486	0.76766	0.92900	1.46450	0.62087
31	2.0358"-02	1.6586"+01	0.98001	0.98821	0.79737	0.94100	1.39270	0.66216
32	2.3178"-02	1.8142"+01	0.98176	0.99182	0.83501	0.95480	1.30750	0.71693
33	2.5768"-02	1.9400"+01	0.98341	0.99411	0.86423	0.96450	1.24550	0.76154
34	2.8232"-02	2.0521"+01	0.98496	0.99571	0.88946	0.97220	1.19470	0.80152
35	3.0518"-02	2.1518"+01	0.98632	0.99583	0.91130	0.97790	1.15150	0.83762
36	3.3105"-02	2.2525"+01	0.98806	0.99690	0.93285	0.98370	1.11200	0.87406
37	3.5877"-02	2.3301"+01	0.98971	0.99892	0.94912	0.98850	1.08470	0.90194
38	3.8189"-02	2.3819"+01	0.99117	1.00069	0.95984	0.99180	1.06770	0.92071
39	4.0907"-02	2.4414"+01	0.99292	1.00175	0.97199	0.99500	1.04790	0.94279
40	4.3294"-02	2.4968"+01	0.99437	1.00016	0.98317	0.99660	1.02750	0.96447
41	4.6012"-02	2.5534"+01	0.99612	0.99645	0.99447	0.99710	1.00530	0.98799
42	4.8628"-02	2.5733"+01	0.99777	1.00025	0.99840	0.99980	1.00280	0.99476
D 43	5.2261"-02	2.5814"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
44	5.6147"-02	2.5839"+01	1.00243	1.00020	1.00050	1.00020	0.99940	1.00323
45	5.9830"-02	2.5918"+01	1.00475	1.00017	1.00205	1.00050	0.99690	1.00838
46	6.3665"-02	2.5888"+01	1.00825	1.00061	1.00145	1.00060	0.99830	1.01057
47	6.7475"-02	2.5880"+01	1.00873	1.00127	1.00130	1.00090	0.99920	1.01045
48	7.1488"-02	2.5867"+01	1.01058	1.00178	1.00105	1.00110	1.00010	1.01159
49	7.5298"-02	2.5852"+01	1.01184	1.00250	1.00075	1.00140	1.00130	1.01194
50	7.9032"-02	2.5870"+01	1.01019	1.00256	1.00110	1.00150	1.00080	1.01090
51	8.3071"-02	2.5941"+01	1.00243	1.00339	1.00250	1.00220	0.99940	1.00523
52	8.6652"-02	2.5982"+01	0.99767	1.00307	1.00330	1.00220	0.99780	1.00207
53	9.0589"-02	2.5862"+01	1.01077	1.00342	1.00095	1.00190	1.00190	1.01077
54	9.4298"-02	2.5799"+01	1.01776	1.00412	0.99970	1.00200	1.00460	1.01512
55	9.7904"-02	2.5961"+01	0.99981	1.00463	1.00290	1.00290	1.00000	1.00271
56	1.0189"-01	2.6068"+01	0.98845	1.00539	1.00501	1.00370	0.99740	0.99470

INPUT VARIABLES Y,U/UD,T/TD,P/PW

73040305 VOISINET PROFILE TABULATION 43 POINTS, DELTA AT POINT 35

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	0.99641	0.86683	0.00000	0.00000	4.43060	0.00000
2	6.3000"-05	1.0953"+00	0.99641	0.86640	0.08006	0.16630	4.31470	0.03840
3	1.4000"-04	1.3006"+00	0.99641	0.87242	0.13772	0.28010	4.13660	0.06747
4	1.9100"-04	1.5762"+00	0.99641	0.87953	0.18376	0.36510	3.94750	0.09216
5	2.4100"-04	1.7206"+00	0.99641	0.88311	0.20197	0.39710	3.86550	0.10236
6	2.6700"-04	1.9364"+00	0.99641	0.88785	0.22483	0.43580	3.75720	0.11557
7	3.4300"-04	2.4460"+00	0.99641	0.89703	0.26757	0.50360	3.54230	0.14166
8	4.1900"-04	2.6628"+00	0.99601	0.90082	0.28321	0.52700	3.46250	0.15166
9	4.9500"-04	2.9540"+00	0.99641	0.90606	0.30272	0.55520	3.36380	0.16446
10	5.2100"-04	3.1169"+00	0.99641	0.90881	0.31302	0.56960	3.31130	0.17140
11	5.7200"-04	3.2244"+00	0.99641	0.90984	0.31961	0.57840	3.27500	0.17598
12	6.9800"-04	3.5903"+00	0.99641	0.91600	0.34100	0.60690	3.16760	0.19091
13	8.2500"-04	3.8491"+00	0.99641	0.92022	0.35529	0.62520	3.09650	0.20118
14	1.1050"-03	4.1432"+00	0.99641	0.92370	0.37081	0.64400	3.01620	0.21275
15	1.3080"-03	4.3157"+00	0.99641	0.92305	0.37961	0.65340	2.96270	0.21975
16	1.5880"-03	4.5933"+00	0.99641	0.92544	0.39333	0.66880	2.89120	0.23049
17	1.8670"-03	4.8323"+00	0.99641	0.92768	0.40475	0.68130	2.83330	0.23960
18	2.1460"-03	5.0659"+00	0.99641	0.92893	0.41560	0.69250	2.77640	0.24853
19	2.3750"-03	5.2068"+00	0.99641	0.92925	0.42201	0.69880	2.74200	0.25394
20	3.9500"-03	6.2861"+00	0.99641	0.93721	0.46810	0.74310	2.52010	0.29381
21	5.2200"-03	7.0792"+00	0.99641	0.94335	0.49921	0.77040	2.38160	0.32232
22	8.1410"-03	8.8531"+00	0.99641	0.95426	0.56252	0.81900	2.11980	0.38497
23	1.0223"-02	1.0142"+01	0.99641	0.96157	0.60435	0.84710	1.96470	0.42961
24	1.2891"-02	1.1688"+01	0.99661	0.96937	0.65092	0.87500	1.80700	0.48259
25	1.4922"-02	1.2886"+01	0.99681	0.97451	0.68485	0.89320	1.70100	0.52343
26	1.8199"-02	1.4815"+01	0.99701	0.98078	0.73619	0.91740	1.55290	0.58900
27	2.0942"-02	1.6461"+01	0.99731	0.98478	0.77732	0.93430	1.44470	0.64497
28	2.3508"-02	1.7946"+01	0.99751	0.98873	0.81261	0.94780	1.36040	0.69497
29	2.6759"-02	1.9598"+01	0.99771	0.99303	0.85016	0.96110	1.27800	0.75031
30	3.2220"-02	2.2133"+01	0.99821	0.99714	0.90476	0.97750	1.16750	0.83584
31	3.6614"-02	2.3818"+01	0.99851	0.99939	0.93931	0.98690	1.10390	0.89268
32	4.0551"-02	2.4960"+01	0.99880	1.00058	0.96201	0.99250	1.06440	0.93134
33	4.7262"-02	2.6311"+01	0.99940	1.00110	0.98817	0.99820	1.02040	0.97766
34	5.1448"-02	2.6765"+01	0.99970	1.00065	0.99601	0.99970	1.00580	0.99364
D 35	5.5359"-02	2.6933"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
36	6.1532"-02	2.7079"+01	1.00050	1.00032	1.00276	1.00070	0.99590	1.00532
37	6.7069"-02	2.7119"+01	0.99631	1.00143	1.00351	1.00140	0.99580	1.00192
38	7.1920"-02	2.7103"+01	0.99791	1.00175	1.00321	1.00150	0.99660	1.00281
39	7.9750"-02	2.7202"+01	0.98725	1.00243	1.00507	1.00220	0.99430	0.99509
40	8.2613"-02	2.7244"+01	0.98336	1.00412	1.00587	1.00320	0.99470	0.99176
41	8.9421"-02	2.7193"+01	0.98834	1.00429	1.00491	1.00310	0.99640	0.99499
42	9.5059"-02	2.7204"+01	0.98725	1.00542	1.00511	1.00370	0.99720	0.99368
43	1.0194"-01	2.7174"+01	0.99004	1.00543	1.00455	1.00360	0.99810	0.99549

INPUT VARIABLES Y,U/UD,T/TD,P/PH

73041301 VOISINET PROFILE TABULATION 33 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.29702	0.00000	0.00000	1.31483	0.00000
2	6.3000"-05	1.8168"+00	1.00000	0.51498	0.23299	0.32302	1.92214	0.16805
3	1.4000"-04	2.7647"+00	1.00000	0.60117	0.31788	0.44693	1.97674	.22609
4	2.4100"-04	3.6130"+00	1.00000	0.65611	0.37491	0.52491	1.96027	0.26778
5	3.1700"-04	4.1983"+00	1.00000	0.68713	0.40927	0.56895	1.93252	0.29441
6	3.9400"-04	4.5521"+00	1.00000	0.70438	0.42863	0.59291	1.91346	0.30986
7	4.7000"-04	4.6956"+00	1.00000	0.71121	0.43623	0.60220	1.90567	0.31600
8	5.7200"-04	4.9381"+00	1.00000	0.72212	0.44876	0.61717	1.89140	0.32631
9	6.4800"-04	5.0282"+00	1.00000	0.72562	0.45333	0.62237	1.88481	0.33020
10	8.2500"-04	5.2426"+00	1.00000	0.73348	0.46400	0.63425	1.86844	0.33945
11	1.1300"-03	5.4615"+00	1.00000	0.75237	0.47465	0.65072	1.87952	0.34622
12	1.3570"-03	5.7163"+00	1.00000	0.76560	0.48674	0.66570	1.87053	0.35589
13	1.6640"-03	5.9896"+00	1.00000	0.77950	0.49938	0.68118	1.86065	0.36610
14	1.8670"-03	6.2213"+00	1.00000	0.78699	0.50984	0.69206	1.84258	0.37559
15	2.1720"-03	6.4603"+00	1.00000	0.79604	0.52040	0.70354	1.82771	0.38493
16	2.4510"-03	6.6634"+00	1.00000	0.80364	0.52921	0.71303	1.81533	0.39278
17	2.5780"-03	6.7771"+00	1.00000	0.80762	0.53408	0.71812	1.80795	0.39720
18	5.5250"-03	8.7539"+00	1.00000	0.85920	0.61247	0.79011	1.66420	0.47477
19	7.9120"-03	1.0339"+01	1.00000	0.89144	0.66868	0.83475	1.55839	0.53565
20	1.0401"-02	1.1967"+01	1.00000	0.91533	0.72182	0.87059	1.45468	0.59848
21	1.2992"-02	1.3503"+01	1.00000	0.93315	0.76857	0.89825	1.36594	0.65761
22	1.5558"-02	1.4922"+01	1.00000	0.94671	0.80936	0.91982	1.29158	0.71217
23	1.8047"-02	1.6280"+01	1.00000	0.95657	0.84657	0.93709	1.22529	0.76479
24	2.0637"-02	1.7611"+01	1.00000	0.96437	0.88152	0.95167	1.16550	0.81653
25	2.3050"-02	1.8618"+01	1.00000	0.97000	0.90705	0.96176	1.12428	0.85545
26	2.5489"-02	1.9418"+01	1.00000	0.97488	0.92682	0.96955	1.09433	0.88597
27	3.0696"-02	2.0867"+01	1.00000	0.98372	0.96161	0.98283	1.04462	0.94085
28	3.5649"-02	2.1776"+01	1.00000	0.98974	0.98280	0.99091	1.01657	0.97476
29	4.0602"-02	2.2393"+01	1.00000	0.99320	0.99695	0.99591	0.99790	0.99800
30	4.5885"-02	2.2723"+01	1.00000	0.99642	1.00443	0.99920	0.98962	1.00968
31	5.0965"-02	2.2501"+01	1.00000	0.99728	0.99940	0.99850	0.99820	1.00030
D 32	5.6195"-02	2.2527"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
33	6.1430"-02	2.2616"+01	1.00000	1.00150	1.00200	1.00120	0.99840	1.00280

INPUT VARIABLES Y,U/UD,T/TD,P/PW

7304-C-7

73041302 VOISINET PROFILE TABULATION 53 POINTS, DELTA AT POINT 50

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.03125	0.23466	0.00000	0.00000	1.13570	0.00000
2	6.3000"-05	1.6257"+00	1.03125	0.42528	0.19694	0.26360	1.79150	0.15174
3	8.9000"-05	1.7333"+00	1.03125	0.44064	0.21052	0.28420	1.82250	0.16081
4	1.1400"-04	1.8212"+00	1.03125	0.45150	0.22057	0.29930	1.84120	0.16764
5	1.4000"-04	2.2048"+00	1.03125	0.49304	0.25730	0.35490	1.90260	0.19236
6	1.9100"-04	2.6135"+00	1.03125	0.52959	0.28947	0.40310	1.93920	0.21436
7	2.1600"-04	3.0598"+00	1.03125	0.56320	0.32020	0.44780	1.95580	0.23611
8	2.6700"-04	3.4847"+00	1.03125	0.59213	0.34662	0.48540	1.96110	0.25525
9	3.1700"-04	3.8549"+00	1.03125	0.61424	0.36795	0.51460	1.95600	0.27131
10	3.9400"-04	4.4498"+00	1.03125	0.64712	0.39972	0.55690	1.94110	0.29586
11	4.9500"-04	4.8460"+00	1.03125	0.66624	0.41948	0.58190	1.92430	0.31184
12	5.2100"-04	4.9936"+00	1.03125	0.67276	0.42660	0.59060	1.91670	0.31776
13	6.2200"-04	5.1652"+00	1.03125	0.68080	0.43472	0.60070	1.90940	0.32443
14	6.9800"-04	5.3440"+00	1.03125	0.68829	0.44302	0.61060	1.89960	0.33148
15	1.2570"-03	5.9791"+00	1.03125	0.71042	0.46696	0.63880	1.87140	0.35201
16	1.6890"-03	6.3506"+00	1.03125	0.73248	0.48706	0.66340	1.85520	0.36876
17	2.0960"-03	6.7501"+00	1.03125	0.74819	0.50345	0.68200	1.83510	0.38325
18	2.2220"-03	6.8549"+00	1.03125	0.75175	0.50766	0.68650	1.82870	0.38713
19	2.4000"-03	6.9796"+00	1.03125	0.75731	0.51262	0.69240	1.82440	0.39138
20	2.6290"-03	7.1530"+00	1.03125	0.76376	0.51944	0.69990	1.81550	0.39756
21	2.7300"-03	7.2681"+00	1.03125	0.76671	0.52392	0.70420	1.80660	0.40197
22	2.9080"-03	7.3780"+00	1.03125	0.77050	0.52816	0.70870	1.80050	0.40591
23	3.1620"-03	7.6042"+00	1.03125	0.77652	0.53678	0.71700	1.78420	0.41442
24	3.4670"-03	7.7957"+00	1.03125	0.78253	0.54397	0.72430	1.77290	0.42131
25	3.7210"-03	7.9773"+00	1.03125	0.78779	0.55070	0.73090	1.76150	0.42790
26	4.0770"-03	8.[illegible]451"+00	1.03125	0.79457	0.55903	0.73910	1.74800	0.43604
27	4.3310"-03	[illegible].4161"+00	1.03125	0.79890	0.56656	0.74560	1.73190	0.44396
28	5.6260"-03	[illegible].2761"+00	1.03125	0.82170	0.59667	0.77340	1.68010	0.47471
29	6.7690"-03	1.[illegible]"+01	1.03125	0.84167	0.62107	0.79580	1.64180	0.49986
30	8.0390"-03	1.0[illegible]"+01	1.03125	0.85997	0.64815	0.81800	1.59280	0.52961
31	8.9790"-03	1.1441"+01	1.03125	0.87242	0.66607	0.83240	1.56180	0.54963
32	1.0859"-02	1.2616"+01	1.03125	0.89348	0.70089	0.85790	1.49820	0.59051
33	1.2154"-02	1.3361"+01	1.03125	0.90501	0.72209	0.87220	1.45900	0.61649
34	1.2992"-02	1.3875"+01	1.03125	0.91072	0.73637	0.88060	1.43010	0.63500
35	1.3830"-02	1.4396"+01	1.03125	0.91795	0.75053	0.88950	1.40460	0.65306
36	1.5024"-02	1.5090"+01	1.03125	0.92665	0.76904	0.90050	1.37110	0.67729
37	1.7081"-02	1.6308"+01	1.03001	0.93831	0.80045	0.91700	1.31240	0.71969
38	1.8834"-02	1.7425"+01	1.02877	0.94754	0.82821	0.93040	1.26200	0.75845
39	2.0155"-02	1.8272"+01	1.02795	0.95291	0.84864	0.93920	1.22480	0.78825
40	2.2517"-02	1.9676"+01	1.02630	0.96145	0.88149	0.95270	1.16810	0.83705
41	2.4930"-02	2.0862"+01	1.02465	0.96780	0.90832	0.96290	1.12380	0.87794
42	2.8207"-02	2.2172"+01	1.02248	0.97431	0.93703	0.97320	1.07870	0.92248
43	3.1001"-02	2.3064"+01	1.02032	0.98024	0.95610	0.98060	1.05190	0.95116
44	3.4760"-02	2.3899"+01	1.01598	0.98563	0.97362	0.98720	1.02810	0.97557
45	3.7173"-02	2.4311"+01	1.01320	0.98893	0.98214	0.99070	1.01750	0.98651
46	3.9611"-02	2.4586"+01	1.01042	0.99132	0.98778	0.99310	1.01080	0.99272
47	4.1440"-02	2.4794"+01	1.00835	0.99333	0.99203	0.99500	1.00600	0.99733
48	4.4183"-02	2.5028"+01	1.00516	0.99653	0.99680	0.99760	1.00160	1.00114
49	4.6723"-02	2.5110"+01	1.00227	0.99884	0.99845	0.99910	1.00130	1.00007
D 50	4.8654"-02	2.5180"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
51	5.1194"-02	2.5303"+01	0.99711	1.00243	1.00235	1.00170	0.99870	1.00011
52	5.3556"-02	2.5325"+01	0.99484	1.00405	1.00280	1.00260	0.99960	0.99783
53	5.6401"-02	2.5322"+01	0.99577	1.00527	1.00275	1.00320	1.00090	0.99806

INPUT VARIABLES Y,U/UD,T/TD,P/PW

73041303 VOISINET PROFILE TABULATION 52 POINTS, DELTA AT POINT 44

I	Y	PT2/P	P/PD	TO/TOD	M/MO	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.00000	0.22058	0.00000	0.00000	1.11770	0.00000
2	6.3000"-05	1.4222"+00	1.00000	0.38614	0.16134	0.21460	1.76930	0.12129
3	1.1000"-04	1.5534"+00	1.00000	0.41077	0.18159	0.24600	1.83530	0.13404
4	1.9100"-04	2.1567"+00	1.00000	0.48887	0.24596	0.34680	1.98800	0.17445
5	2.4100"-04	2.7638"+00	1.00000	0.54489	0.29173	0.41780	2.05110	0.20370
6	3.1700"-04	3.6426"+00	1.00000	0.60787	0.34580	0.49780	2.07230	0.24022
7	4.1900"-04	4.2679"+00	1.00000	0.64481	0.37923	0.54450	2.06150	0.26413
8	4.9500"-04	4.6378"+00	1.00000	0.66400	0.39762	0.56900	2.04780	0.27786
9	5.9700"-04	4.8469"+00	1.00000	0.67464	0.40763	0.58220	2.03990	0.28541
10	7.2400"-04	5.1466"+00	1.00000	0.68806	0.42155	0.59970	2.02380	0.29632
11	9.0200"-04	5.3952"+00	1.00000	0.70390	0.43275	0.61580	2.02490	0.30411
12	1.1560"-03	5.5930"+00	1.00000	0.71617	0.44145	0.62810	2.02440	0.31026
13	1.3360"-03	5.8295"+00	1.00000	0.72259	0.45162	0.63890	2.00130	0.31924
14	1.6410"-03	6.1383"+00	1.00000	0.72949	0.46457	0.65180	1.96850	0.33112
15	1.8690"-03	6.4064"+00	1.00000	0.73537	0.47551	0.66250	1.94110	0.34130
16	2.1490"-03	6.6456"+00	1.00000	0.74101	0.48507	0.67190	1.91870	0.35019
17	2.3770"-03	6.8533"+00	1.00000	0.74629	0.49321	0.68000	1.90090	0.35773
18	3.4700"-03	7.5925"+00	1.00000	0.77332	0.52114	0.71110	1.86190	0.38192
19	4.6150"-03	8.3649"+00	1.00000	0.79685	0.54879	0.73930	1.81480	0.40737
20	5.8600"-03	9.1431"+00	1.00000	0.81742	0.57529	0.76440	1.76540	0.43297
21	7.2850"-03	9.9847"+00	1.00000	0.83944	0.60263	0.78970	1.71720	0.45988
22	8.5290"-03	1.0712"+01	1.00000	0.85629	0.62530	0.80930	1.67510	0.48314
23	1.0284"-02	1.1687"+01	1.00000	0.87502	0.65442	0.83220	1.61710	0.51462
24	1.1735"-02	1.2539"+01	1.00000	0.88911	0.67886	0.84990	1.56740	0.54224
25	1.3310"-02	1.3351"+01	1.00000	0.90263	0.70135	0.86590	1.52430	0.56806
26	1.5065"-02	1.4370"+01	1.00000	0.91484	0.72860	0.88260	1.46740	0.60147
27	1.6360"-02	1.5078"+01	1.00000	0.92423	0.74692	0.89400	1.43260	0.62404
28	1.8141"-02	1.6004"+01	1.00000	0.93435	0.77025	0.90720	1.38720	0.65398
29	1.9997"-02	1.7075"+01	1.00000	0.94293	0.79639	0.92010	1.33480	0.68932
30	2.1293"-02	1.7715"+01	1.00000	0.94885	0.81158	0.92780	1.30690	0.70992
31	2.3200"-02	1.8716"+01	1.00000	0.95515	0.83482	0.93790	1.26220	0.74307
32	2.5540"-02	1.9936"+01	1.00000	0.96292	0.86229	0.94950	1.21250	0.78309
33	2.7295"-02	2.0614"+01	1.00000	0.96717	0.87718	0.95560	1.18680	0.80519
34	2.9863"-02	2.1585"+01	1.00000	0.97187	0.89809	0.96330	1.15050	0.83729
35	3.2355"-02	2.2390"+01	1.00000	0.97557	0.91504	0.96930	1.12210	0.86383
36	3.4770"-02	2.2966"+01	1.00000	0.97853	0.92699	0.97360	1.10310	0.88260
37	3.7846"-02	2.3618"+01	1.00000	0.98180	0.94033	0.97830	1.08240	0.90382
38	4.0617"-02	2.4300"+01	1.00000	0.98589	0.95408	0.98340	1.06240	0.92564
39	4.2906"-02	2.4496"+01	1.00000	0.98899	0.95799	0.98590	1.05890	0.93097
40	4.4737"-02	2.4875"+01	1.00000	0.99015	0.96552	0.98800	1.04710	0.94356
41	4.7584"-02	2.5306"+01	1.00000	0.99477	0.97401	0.99210	1.03750	0.95624
42	4.9720"-02	2.5481"+01	1.00000	0.99553	0.97744	0.99320	1.03250	0.96194
43	5.2339"-02	2.6404"+01	1.00000	0.99846	0.99532	0.99830	1.00600	0.99235
D 44	5.4755"-02	2.6649"+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
45	5.7374"-02	2.6412"+01	1.00000	1.00020	0.99547	0.99920	1.00750	0.99176
46	5.9789"-02	2.6297"+01	1.00000	1.00188	0.99326	0.99960	1.01280	0.98697
47	6.2408"-02	2.6244"+01	1.00000	1.00230	0.99224	0.99960	1.01490	0.98492
48	6.5001"-02	2.6249"+01	1.00000	1.00246	0.99233	0.99970	1.01490	0.98502
49	6.7874"-02	2.6285"+01	1.00000	1.00195	0.99302	0.99960	1.01330	0.98648
50	7.1204"-02	2.6380"+01	1.00000	1.00365	0.99485	1.00080	1.01200	0.98893
51	7.4102"-02	2.6352"+01	1.00000	1.00447	0.99431	1.00110	1.01370	0.98797
52	7.6899"-02	2.6267"+01	1.00000	1.00312	0.99268	1.00010	1.01560	0.98532

INPUT VARIABLES Y,U/UD,T/TD,P/PN

7304-C-9

73041304 VOISINET PROFILE TABULATION 55 POINTS, DELTA AT POINT 44

I	Y	PT2/P	P/PD	TO/TOD	U/UD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000*+00	1.0000*+00	0.98078	0.23706	0.00000	0.00000	1.20060	0.00000
2	6.3000*-05	1.5271*+00	0.98078	0.40610	0.17786	0.24010	1.82240	0.12922
3	1.4000*-04	2.3248*+00	0.98078	0.49889	0.25978	0.36580	1.98280	0.18094
4	1.6500*-04	2.7305*+00	0.98078	0.53292	0.28953	0.41080	2.01310	0.20014
5	2.4100*-04	3.4836*+00	0.98078	0.58514	0.33683	0.47970	2.02820	0.23197
6	3.1700*-04	3.9958*+00	0.98078	0.61519	0.36520	0.51910	2.02040	0.25199
7	3.6800*-04	4.4776*+00	0.98078	0.64078	0.38989	0.55220	2.00590	0.27000
8	4.7000*-04	4.7982*+00	0.98078	0.65580	0.40545	0.57210	1.99100	0.28182
9	6.7300*-04	5.2801*+00	0.98078	0.67676	0.42774	0.59970	1.96570	0.29922
10	1.0030*-03	5.5985*+00	0.98078	0.68946	0.44182	0.61650	1.9670[illegible]	0.31055
11	1.2320*-03	5.7561*+00	0.98078	0.70051	0.44863	0.62670	1.95140	0.31498
12	1.4600*-03	5.9749*+00	0.98078	0.71265	0.45791	0.63920	1.94860	0.32172
13	1.6890*-03	6.1751*+00	0.98078	0.72308	0.46623	0.65010	1.94430	0.32793
14	1.9690*-03	6.4370*+00	0.98078	0.73304	0.47692	0.66240	1.92910	0.33677
15	2.1970*-03	6.6545*+00	0.98078	0.73993	0.48557	0.67170	1.91360	0.34427
16	4.1020*-03	8.0263*+00	0.98078	0.78305	0.53701	0.72580	1.82670	0.38967
17	5.0420*-03	8.6198*+00	0.98078	0.80132	0.55778	0.74670	1.79210	0.40865
18	6.3120*-03	9.3980*+00	0.98078	0.82134	0.58389	0.77100	1.74360	0.43369
19	7.8100*-03	1.0217*+01	0.98078	0.84118	0.61014	0.79440	1.69520	0.45961
20	9.7920*-03	1.1367*+01	0.98078	0.86357	0.64522	0.82240	1.62460	0.49649
21	1.1087*-02	1.2069*+01	0.98078	0.87627	0.66569	0.83790	1.58430	0.51871
22	1.2662*-02	1.2977*+01	0.98078	0.88996	0.69131	0.85560	1.53180	0.54782
23	1.4186*-02	1.3840*+01	0.98078	0.90162	0.71475	0.87080	1.48420	0.57543
24	1.6167*-02	1.4923*+01	0.98078	0.91372	0.74318	0.88750	1.42610	0.61036
25	1.7970*-02	1.5858*+01	0.98078	0.92387	0.76687	0.90090	1.38010	0.64023
26	2.0256*-02	1.7053*+01	0.98078	0.93458	0.79610	0.91590	1.32360	0.67867
27	2.1933*-02	1.7978*+01	0.98078	0.94220	0.81802	0.92650	1.28280	0.70836
28	2.3609*-02	1.8786*+01	0.98078	0.94839	0.83668	0.93510	1.24910	0.73423
29	2.6454*-02	2.0206*+01	0.98117	0.95690	0.86852	0.94820	1.19190	0.78056
30	2.8867*-02	2.1245*+01	0.98225	0.96436	0.89110	0.95780	1.15530	0.81433
31	3.1255*-02	2.2325*+01	0.98323	0.96948	0.91397	0.96600	1.11710	0.85024
32	3.3642*-02	2.3095*+01	0.98421	0.97345	0.92994	0.97200	1.09250	0.87565
33	3.6385*-02	2.3725*+01	0.98529	0.97810	0.94278	0.97700	1.07390	0.89638
34	3.9510*-02	2.4532*+01	0.98666	0.98195	0.95900	0.98250	1.04960	0.92359
35	4.1643*-02	2.4915*+01	0.98754	0.98388	0.96682	0.98510	1.03860	0.93667
36	4.3929*-02	2.5362*+01	0.98843	0.98718	0.97543	0.98860	1.02720	0.95128
37	4.6419*-02	2.5767*+01	0.98951	0.98991	0.98333	0.99160	1.01690	0.96489
38	4.9695*-02	2.6084*+01	0.99088	0.99281	0.98946	0.99430	1.00980	0.97567
39	5.2083*-02	2.6195*+01	0.99186	0.99475	0.99159	0.99570	1.00630	0.47946
40	5.4674*-02	2.6246*+01	0.99294	0.99445	0.99258	0.99600	1.00690	0.98219
41	5.6883*-02	2.6316*+01	0.99382	0.99642	0.99392	0.99700	1.00620	0.98473
42	5.9423*-02	2.6367*+01	0.99490	0.99722	0.99492	0.99760	1.00540	0.98718
43	6.1938*-02	2.6638*+01	0.99588	0.99836	1.00010	0.99920	0.99820	0.99688
D 44	7.1844*-02	2.6633*+01	1.00000	1.00000	1.00000	1.00000	1.00000	1.00000
45	7.4689'-02	2.6651*+01	0.99784	1.00066	1.00035	1.00040	1.00010	0.99814
46	7.7152*-02	2.6646*+01	0.99853	1.00110	1.00025	1.00060	1.00070	0.99843
47	7.9607*-02	2.6630*+01	0.99980	1.00196	1.00010	1.00100	1.00180	0.99901
48	8.2604*-02	2.6664*+01	0.99578	1.00216	1.00065	1.00120	1.00120	0.99578
49	8.4620*-02	2.6659*+01	0.99735	1.00260	1.00050	1.00140	1.00180	0.99695
50	8.7135*-02	2.6586*+01	1.00588	1.00256	0.99910	1.00110	1.00400	1.00298
51	8.9344*-02	2.6674*+01	0.99353	1.00329	1.00080	1.00180	1.00200	0.99333
52	9.1707*-02	2.6724*+01	0.98931	1.00371	1.00175	1.00220	1.00090	0.99054
53	9.6253*-02	2.6703*+01	0.99235	1.00427	1.00135	1.00240	1.00210	0.99265
54	1.0034*-01	2.6745*+01	0.98745	1.00516	1.00215	1.00300	1.00170	0.98873
55	1.0303*-01	2.6787*+01	0.98284	1.00605	1.00295	1.00360	1.00130	0.98509

INPUT VARIABLES Y,U/UD,T/TD,P/PW

M : 9 - 10
R THETA X 10^{-3} : 1 - 12
TW / TR : 1.0

7305

ZPG - AW

Axially symmetric blow down tunnel. Running time 5 s. D = 1.52 m.
2.8 < PO < 13.8 MN/m^2. TO : 300 K. Helium. 0.9 < RE/m X 10^{-6} < 5.

WATSON R.D., HARRIS J.E. and ANDERS J.B., 1973. Measurements in a transitional / turbulent Mach 10 boundary layer at high Reynolds numbers. AIAA P 73-165.
<u>And</u> Watson R.D., private communications.

1 The test boundary layer was formed on a flat plate (L = 2.36, W = 1.016 m) placed at 5° negative incidence in the working section of the Mach 20 wind tunnel described in Watson and Bushnell (1971). The leading edge (X = 0) was 0.13 mm thick and chamfered so that the under side was at 17° to the free stream flow. It was positioned 0.127 m below the tunnel centre line, 0.425 m downstream of the end of the nozzle. The test zone extended from X = 0.74 to X = 2.11 m. End-plates were mounted on the surface 0.305 m to either side of the centre line. The surface consisted of steel plates 4.76 mm thick finished to 0.8 µm r.m.s. forming interchangeable instrument sections 153 mm (E) wide along the centre line. The surface was not actively
3 cooled. The transition zone was located from heat transfer measurements. In all cases transition commenced at about X = 0.61 m and extended over the first three measuring stations to between X = 1.4 and 2.0 m. The flow was fully turbulent at the last station (X = 2.11 m) though by no means in equilibrum even for
5 the highest RE/m case. No trip was used. Preliminary oil-flow tests showed that, with the end-plates fitted, no discernable surface-flow divergence was present over the central 0.15 m wide instrumented strip.

6 Wall static pressure was measured at static tappings of diameter 2.29 mm. The wall temperature was obtained by thermocouples. Heat transfer rates were found using the transient technique from the rate of change of wall temperature. Floating element balances (Kistler model 322, serial 121) were installed at each profile
7 location to measure the wall shear stress. Profile traverses were made with Pitot, static and total temperature probes. The FPP (h_1 = 1 b_1 = 3.02 1 = 50.8 mm) was formed from flattened 1.52 mm tube. The SPP was a CPP (α = 42.5°, d = 3.2, l_s = 12.2, l = 50.8$^+$ mm) and because of wall interference effects could only be used in the outer part of the layer. Pitot-static values gave an edge Mach number which matched that calculated using the wall pressure and values from an exterior flow field calculation so that it was assumed that P = PW = PD. The TTP was an STP with a resistive temperature sensor (h_1 = 1.6 b_1 = 4.35 l = 10.2 mm) and was used only at the last (X = 2.11 m) station (see Weinstein 1971). All sets of profile measurements were made on a common normal.

9 The authors have reduced the profile data on the assumption of no normal pressure gradient and with the linear Crocco total temperature distribution. The static pressure at a profile normal was measured with the probe well clear of the surface. When this was not possible, due to instrument failure or the presence of a skin-friction gauge, the value was determined from the tunnel stagnation pressure and the results of earlier measurements. The heat transfer measurements showed that the model temperature did not change significantly during a run, so that the wall temperature measured at a single station at the start of the run was taken to apply to all stations. The authors found, particularly in the transitional zone, that probe interference effects were evidently large, the wall static pressure rising by as much as 80 % as a
10 probe approached the wall. In the absence of a rational correction procedure, no profile corrections
11 were applied. Viscosity values were determined from the power law $\mu = 5.0277 \times 10^{-7}\ T^{0.647}$ kg/ms.

12 The editors have presented the profile data replacing the authors' temperature velocity correlation by the Crocco - Van Driest relationship. The edge Mach number has been interpolated on the basis of tunnel reservoir pressure for each station. Adjustments from neighbouring measured points were less than 0.5 % except for profile 0502 where it was necessary to extrapolate, the resulting adjustment being 1.5 %. The edge point is that selected by the authors, and the edge stagnation pressure (the source paper tabulates tunnel values)

has been calculated using the authors' D2 and RED2D values, with the authors' viscosity law. We have then replaced this with the helium viscosity law used throughout the catalogue. The different viscosity value causes the differences that can be observed between their RED2D values and ours. We have interpolated the CF values for each station, also on the basis of tunnel reservoir pressure. The biggest adjustment was 3 % for run 0504.

13 The five sets of four profiles are distinguished by increasing values of unit Reynolds number. Measured
14 TO profiles corresponding to runs at station 4 for series 02-05 are given in section D. Interpolated CF values are associated with the profiles. Heat transfer measurements were made, but with the small temperature differences involved the heat flux values are not very accurate. We have therefore regarded the flow as adiabatic.

§ DATA 7305 0101-0504. Pitot profiles. NX = 4. CF from FEB. Some additional TO profiles. CQ measured but not presented (near zero).

16 Editors' comments

The entry gives a very clear description of the development of a layer through the transition region. The development is free of history effects, and transition is unforced. In this respect it can be regarded as an extension of the data of Fischer et al. - CAT 7103 to higher Mach numbers. The value of the measurements is greatly enhanced by the provision for direct wall shear stress measurements.

Measurements extend within the momentum-deficit peak, and the profile is described at close intervals. Values near the wall should not be given too great emphasis as no corrections were applied, and it is far from certain how they should be.

CAT 7305 WATSON BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR*	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
73050101	9.5800	1.0000	1.6983"+02	1.9900"-04	74.0466	2.3571	2.0341"+02	2.0341"+02
7.4200"-01	1.1395"+06	1.0000	1.4911"+03	NM	1.7547	1.5983	2.6979"+02	9.4914"+00
INFINITE	3.0000"+02	0.0000	1.7811"-04	0.0000"+00	0.1988	2.0118"-03	1.7374"+03	2.6979"+02
73050102	8.9500	1.0000	2.3371"+02	2.2300"-04	65.3323	2.1673	2.2917"+02	2.2917"+02
9.9600"-01	9.2435"+05	1.0000	1.8771"+03	NM	1.7296	1.5838	2.6993"+02	1.0825"+01
INFINITE	3.0000"+02	0.0000	2.4878"-04	0.0000"+00	0.1736	2.7477"-03	1.7334"+03	2.6993"+02
73050103	9.7000	1.0000	2.4149"+02	2.6200"-04	65.6644	1.5072	2.0083"+02	2.0083"+02
1.2500"+00	1.1949"+06	1.0000	2.1562"+03	NM	1.8173	1.7136	2.6976"+02	9.2653"+00
INFINITE	3.0000"+02	0.0000	2.5031"-04	0.0000"+00	0.1839	2.4239"-03	1.7381"+03	2.6976"+02
73050104	9.2000	1.0000	4.1494"+02	4.3400"-04	64.4725	2.5962	2.5386"+02	2.5386"+02
2.1100"+00	1.1694"+06	1.0000	3.4534"+03	NM	1.8477	1.6022	2.6987"+02	1.0264"+01
INFINITE	3.0000"+02	0.0000	3.7767"-04	0.0000"+00	0.1842	2.5749"-03	1.7351"+03	2.6987"+02
73050201	9.7900	1.0000	2.2749"+02	1.4800"-04	86.7190	2.1385	4.0103"+02	4.0103"+02
7.4200"-01	2.4954"+06	1.0000	2.0569"+03	NM	1.6044	1.6371	2.6975"+02	9.1008"+00
INFINITE	3.0000"+02	0.0000	1.1595"-04	0.0000"+00	0.1656	2.2174"-03	1.7386"+03	2.6975"+02
73050202	9.5100	1.0000	3.1272"+02	2.3000"-04	66.4819	1.9147	4.0664"+02	4.0664"+02
9.9600"-01	2.1986"+06	1.0000	2.7188"+03	NM	1.8097	1.6608	2.6980"+02	9.6272"+00
INFINITE	3.0000"+02	0.0000	1.6645"-04	0.0000"+00	0.1900	1.5492"-03	1.7370"+03	2.6980"+02
73050203	9.6800	1.0000	3.0568"+02	3.4700"-04	83.8491	7.3594	3.9484"+02	3.9484"+02
1.2500"+00	2.3260"+06	1.0000	2.7217"+03	NM	1.9433	1.9263	2.6977"+02	9.3024"+00
INFINITE	3.0000"+02	0.0000	1.6181"-04	0.0000"+00	0.2039	6.5300"-04	1.7380"+03	2.6977"+02
73050204	9.7400	1.0000	6.6240"+02	3.3700"-04	78.7582	4.4223	4.5832"+02	4.5832"+02
2.1100"+00	2.7820"+06	1.0000	5.9475"+03	NM	1.8497	1.2727	2.6976"+02	9.1916"+00
INFINITE	3.0000"+02	0.0000	2.9841"-04	0.0000"+00	0.1840	1.7707"-03	1.7383"+03	2.6976"+02
73050301	9.8500	1.0000	3.5236"+02	1.3500"-04	75.9805	2.3869	5.6932"+02	5.6932"+02
7.4200"-01	3.6491"+06	1.0000	3.2129"+03	NM	1.7998	1.6181	2.6974"+02	8.9936"+00
INFINITE	3.0000"+02	0.0000	1.2499"-04	0.0000"+00	0.1849	1.2522"-03	1.7339"+03	2.6974"+02
73050302	9.7300	1.0000	2.7034"+02	2.6800"-04	72.7464	2.1827	5.4453"+02	5.4453"+02
9.9600"-01	3.2888"+06	1.0000	2.4239"+03	NM	1.8030	1.6932	2.6976"+02	9.2100"+00
INFINITE	3.0000"+02	0.0000	1.0272"-04	0.0000"+00	0.2011	1.0526"-03	1.7382"+03	2.6976"+02
73050303	9.8000	1.0000	4.4400"+02	3.7800"-04	63.4262	1.5419	5.4297"+02	5.4297"+02
1.2500"+00	3.3954"+06	1.0000	4.0202"+03	NM	1.9140	1.8531	2.6974"+02	9.0828"+00
INFINITE	3.0000"+02	0.0000	1.6681"-04	0.0000"+00	0.1937	9.2138"-04	1.7386"+03	2.6974"+02
73050304	9.8300	1.0000	1.0786"+03	3.0400"-04	62.4785	1.4429	6.3969"+02	6.3969"+02
2.1100"+00	4.0599"+06	1.0000	9.8070"+03	NM	1.9222	1.8800	2.6974"+02	9.0291"+00
INFINITE	3.0000"+02	0.0000	3.4188"-04	0.0000"+00	0.2080	1.7636"-03	1.7380"+03	2.6974"+02
73050401	9.9400	1.0000	3.7077"+02	1.2800"-04	77.3138	2.2998	7.0838"+02	7.0838"+02
7.4200"-01	4.7452"+06	1.0000	3.4234"+03	NM	1.7884	1.6145	2.6972"+02	8.8363"+00
INFINITE	3.0000"+02	0.0000	1.0382"-04	0.0000"+00	0.1865	1.1158"-03	1.7394"+03	2.6972"+02
73050402	9.6800	1.0000	3.7548"+02	3.0000"-0[illegible]	70.3553	2.0422	7.1593"+02	7.1593"+02
9.9600"-01	4.2175"+06	1.0000	3.3432"+03	NM	1.8260	1.7834	2.6977"+02	9.3024"+00
INFINITE	3.0000"+02	0.0000	1.0962"-04	0.0000"+00	0.1940	1.0508"-03	1.7380"+03	2.6977"+02
73050403	10.0200	1.0000	5.4825"+02	3.6000"-04	67.7094	1.8090	7.0237"+02	7.0237"+02
1.2500"+00	4.8915"+06	1.0000	5.1191"+03	NM	1.9145	1.8608	2.6970"+02	8.6998"+00
INFINITE	3.0000"+02	0.0000	1.5240"-04	0.0000"+00	0.1960	8.7302"-04	1.7398"+03	2.6970"+02
73050404	10.0200	1.0000	1.3019"+03	2.7300"-04	65.8399	1.5704	8.0237"+02	8.0237"+02
2.1100"+00	5.5879"+06	1.0000	1.2147"+04	NM	1.9150	1.8594	2.6970"+02	8.6998"+00
INFINITE	3.0000"+02	0.0000	3.1656"-04	0.0000"+00	0.2078	1.7908"-03	1.7398"+03	2.6970"+02
73050501	10.1600	1.0000	4.6204"+02	1.2200"-04	77.1491	2.0302	8.3036"+02	8.3036"+02
7.4200"-01	6.1859"+06	1.0000	4.3994"+03	NM	1.8063	1.6520	2.6968"+02	8.4684"+00
INFINITE	3.0000"+02	0.0000	1.0570"-04	0.0000"+00	0.1844	1.1194"-03	1.7405"+03	2.6968"+02
73050502	9.8400	1.0000	5.2842"+02	3.0900"-04	75.6685	3.1489	8.5348"+02	8.5348"+02
9.9600"-01	5.4435"+06	1.0000	4.8114"+03	NM	1.8702	1.7039	2.6974"+02	9.0114"+00
INFINITE	3.0000"+02	0.0000	1.2529"-04	0.0000"+00	0.1958	8.6721"-04	1.7388"+03	2.6974"+02
73050503	10.3100	1.0000	6.7762"+02	3.2800"-04	69.0221	1.5806	8.3678"+02	8.3678"+02
1.2500"+00	6.6939"+06	1.0000	6.5889"+03	NM	1.9250	1.8854	2.6966"+02	8.2305"+00
INFINITE	3.0000"+02	0.0000	1.4944"-04	0.0000"+00	0.2133	8.0894"-04	1.7412"+03	2.6966"+02
73050504	10.3100	1.0000	1.5502"+03	2.4000"-04	70.2460	1.5612	9.4475"+02	9.4475"+02
2.1100"+00	7.5576"+06	1.0000	1.5074"+04	NM	1.9045	1.8184	2.6966"+02	8.2305"+00
INFINITE	3.0000"+02	0.0000	3.0280"-04	0.0000"+00	0.1999	1.9432"-03	1.7412"+03	2.6966"+02

PD,POD CALCULATED WITH AUTHOR'S MUE-LAW FROM RED2,DELTA2 (AUTHOR) - TRAPEZOIDAL RULE FOR RUN 0203

73050101 WATSON PROFILE TABULATION 33 POINTS, DELTA AT POINT 33

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88673	0.00000	0.00000	28.02710	0.00000
2	1.0222"-03	1.0441"+00	NM	0.88851	0.02386	0.12536	27.60236	0.00454
3	1.7870"-03	1.1981"+00	NM	0.89402	0.04951	0.25381	26.28598	0.00966
4	3.1327"-03	1.9547"+00	NM	0.91181	0.10024	0.47062	22.04094	0.02135
5	4.1685"-03	2.1555"+00	NM	0.91505	0.10842	0.50003	21.26964	0.02351
6	5.0314"-03	2.8062"+00	NM	0.92360	0.13010	0.57053	19.22975	0.02967
7	6.4005"-03	4.0918"+00	NM	0.93905	0.17239	0.67965	15.54267	0.04373
8	7.2342"-03	5.6326"+00	NM	0.94644	0.19560	0.72607	13.77914	0.05269
9	7.9131"-03	8.2055"+00	NM	0.95816	0.23964	0.79415	10.98181	0.07231
10	8.7579"-03	1.0305"+01	NM	0.96469	0.27026	0.82965	9.42386	0.08804
11	9.4968"-03	1.5338"+01	NM	0.97471	0.33228	0.88131	7.03493	0.12528
12	1.0104"-02	2.1801"+01	NM	0.98195	0.39796	0.91685	5.30783	0.17273
13	1.0934"-02	2.7792"+01	NM	0.98607	0.45035	0.93649	4.32409	0.21657
14	1.1450"-02	3.4727"+01	NM	0.98927	0.50425	0.95146	3.56034	0.26724
15	1.2005"-02	4.2176"+01	NM	0.99165	0.55634	0.96243	2.99262	0.32160
16	1.2147"-02	5.2471"+01	NM	0.99391	0.62120	0.97276	2.45221	0.39669
17	1.2545"-02	5.8893"+01	NM	0.99495	0.65841	0.97747	2.20399	0.44350
18	1.3033"-02	6.5819"+01	NM	0.99586	0.69634	0.98157	1.98704	0.49399
19	1.3167"-02	7.1708"+01	NM	0.99651	0.72702	0.98446	1.83357	0.53691
20	1.3532"-02	8.0083"+01	NM	0.99727	0.76856	0.98786	1.65211	0.59794
21	1.4066"-02	8.8003"+01	NM	0.99786	0.80587	0.99051	1.51072	0.65565
22	1.4670"-02	9.4938"+01	NM	0.99830	0.83718	0.99247	1.40541	0.70618
23	1.5243"-02	1.0088"+02	NM	0.99863	0.86308	0.99395	1.32624	0.74945
24	1.5930"-02	1.0636"+02	NM	0.99891	0.88634	0.99517	1.26063	0.78942
25	1.6465"-02	1.1185"+02	NM	0.99916	0.90901	0.99627	1.20122	0.82939
26	1.6992"-02	1.1587"+02	NM	0.99932	0.92526	0.99702	1.16111	0.85867
27	1.7868"-02	1.1991"+02	NM	0.99948	0.94134	0.99772	1.12337	0.88815
28	1.8745"-02	1.2347"+02	NM	0.99961	0.95525	0.99829	1.09216	0.91406
29	2.0051"-02	1.2661"+02	NM	0.99972	0.96736	0.99878	1.06601	0.93693
30	2.1259"-02	1.3026"+02	NM	0.99984	0.98124	0.99931	1.03717	0.96350
31	2.2068"-02	1.3285"+02	NM	0.99993	0.99100	0.99967	1.01759	0.98239
32	2.3505"-02	1.3458"+02	NM	0.99998	0.99743	0.99991	1.00498	0.99495
D 33	2.4596"-02	1.3527"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050102 WATSON PROFILE TABULATION 41 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.89964	0.00000	0.00000	24.93289	0.00000
2	2.9187"-03	1.8967"+00	NM	0.92132	0.10453	0.46473	19.76409	0.02351
3	4.1413"-03	2.1317"+00	NM	0.92480	0.11507	0.50070	18.93280	0.02645
4	5.1901"-03	2.1856"+00	NM	0.92553	0.11727	0.50793	18.75850	0.02708
5	6.0008"-03	3.0873"+00	NM	0.93557	0.14790	0.59832	16.36513	0.03656
6	6.7542"-03	3.8138"+00	NM	0.94177	0.16794	0.64793	14.88557	0.04353
7	8.1921"-03	5.5986"+00	NM	0.95300	0.20867	0.72914	12.20925	0.05972
8	9.3981"-03	7.0244"+00	NM	0.95939	0.23606	0.77160	10.68389	0.07222
9	1.0479"-02	8.9658"+00	NM	0.96589	0.26884	0.81250	9.13362	0.08896
10	1.1354"-02	1.0555"+01	NM	0.96996	0.29293	0.83703	8.16506	0.10251
11	1.1721"-02	1.2463"+01	NM	0.97382	0.31945	0.85973	7.24305	0.11870
12	1.2024"-02	1.4541"+01	NM	0.97714	0.34601	0.87878	6.45052	0.13623
13	1.2326"-02	1.6618"+01	NM	0.97981	0.37066	0.89378	5.81448	0.15372
14	1.3484"-02	2.6475"+01	NM	0.98758	0.47030	0.93608	3.96171	0.23628
15	1.2692"-02	1.8699"+01	NM	0.98200	0.39380	0.90591	5.29201	0.17118
16	1.2918"-02	2.0945"+01	NM	0.98396	0.41734	0.91663	4.82403	0.19001
17	1.3141"-02	2.3707"+01	NM	0.98595	0.44458	0.72735	4.35099	0.21314
18	1.4057"-02	3.0802"+01	NM	0.98962	0.50789	0.94687	3.47564	0.27243
19	1.4276"-02	3.4251"+01	NM	0.99092	0.53598	0.95368	3.16598	0.30123
20	1.4493"-02	3.8044"+01	NM	0.99210	0.56525	0.95984	2.88348	0.33288
21	1.4944"-02	4.2709"+01	NM	0.99330	0.59929	0.96603	2.59838	0.37178
22	1.5211"-02	4.8052"+01	NM	0.99441	0.63605	0.97173	2.33404	0.41633
23	1.5481"-02	5.3051"+01	NM	0.99526	0.66861	0.97608	2.13118	0.45800
24	1.5577"-02	5.7009"+01	NM	0.99583	0.69331	0.97901	1.99398	0.49098
25	1.6155"-02	6.0477"+01	NM	0.99628	0.71425	0.98128	1.88751	0.51988
26	1.6363"-02	6.7020"+01	NM	0.99700	0.75217	0.98495	1.71474	0.57440
27	1.6720"-02	7.2710"+01	NM	0.99753	0.78365	0.98763	1.58834	0.62180
28	1.7089"-02	7.6509"+01	NM	0.99785	0.80399	0.98921	1.51383	0.65345
29	1.7651"-02	8.1004"+01	NM	0.99818	0.82740	0.99089	1.43421	0.69089
30	1.8155"-02	8.4294"+01	NM	0.99840	0.84413	0.99201	1.38105	0.71830
31	1.8454"-02	8.8778"+01	NM	0.99868	0.86640	0.99340	1.31466	0.75564
32	1.8961"-02	9.1552"+01	NM	0.99884	0.87990	0.99420	1.27667	0.77875
33	1.9339"-02	9.4664"+01	NM	0.99901	0.89480	0.99504	1.23660	0.80466
34	1.9829"-02	9.7441"+01	NM	0.99915	0.90789	0.99575	1.20291	0.82779
35	2.0635"-02	1.0213"+02	NM	0.99937	0.92956	0.99686	1.15004	0.86681
36	2.1502"-02	1.0578"+02	NM	0.99953	0.94613	0.99766	1.11189	0.89727
37	2.2544"-02	1.0927"+02	NM	0.99967	0.96168	0.99837	1.07776	0.92634
38	2.4026"-02	1.1209"+02	NM	0.99978	0.97404	0.99892	1.05173	0.94979
39	2.5349"-02	1.1422"+02	NM	0.99986	0.98327	0.99931	1.03289	0.96759
40	2.6831"-02	1.1651"+02	NM	0.99994	0.99315	0.99972	1.01328	0.98662
C 41	2.7940"-02	1.1812"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050103 WATSON PROFILE TABULATION 26 POINTS, DELTA AT POINT 26

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.89878	0.00000	0.00000	29.10169	0.00000
2	3.3455"-04	2.1515"+00	NM	0.92427	0.10693	0.50182	22.02493	0.02278
3	9.2471"-04	2.2058"+00	NM	0.92500	0.10895	0.50895	21.82243	0.02332
4	2.2756"-03	3.1173"+00	NM	0.93508	0.13728	0.59881	19.02530	0.03147
5	3.4293"-03	3.2011"+00	NM	0.93585	0.13954	0.60520	18.80908	0.03218
6	5.2243"-03	4.9598"+00	NM	0.94875	0.18003	0.70258	15.23008	0.04613
7	7.8748"-03	8.4080"+00	NM	0.96352	0.23976	0.79977	11.12681	0.07188
8	9.7017"-03	1.2198"+01	NM	0.97266	0.29148	0.85433	8.57089	0.09945
9	1.1457"-02	1.8016"+01	NM	0.98067	0.35648	0.89946	6.36638	0.14128
10	1.2594"-02	2.3179"+01	NM	0.98495	0.40552	0.92269	5.17715	0.17822
11	1.3518"-02	2.8937"+01	NM	0.98817	0.45400	0.93974	4.28460	0.21933
12	1.4478"-02	3.4497"+01	NM	0.99037	0.49633	0.95125	3.67319	0.25897
13	1.5131"-02	4.3084"+01	NM	0.99276	0.55541	0.96358	3.00987	0.32014
14	1.5921"-02	5.0870"+01	NM	0.99429	0.60399	0.97136	2.58643	0.37556
15	1.6364"-02	6.1271"+01	NM	0.99576	0.66337	0.97885	2.17722	0.44958
16	1.7065"-02	6.9458"+01	NM	0.99663	0.70660	0.98320	1.93613	0.50782
17	1.7750"-02	7.6623"+01	NM	0.99724	0.74238	0.98629	1.76506	0.55879
18	1.8475"-02	8.6638"+01	NM	0.99794	0.78967	0.98979	1.57104	0.63002
19	1.9192"-02	9.4007"+01	NM	0.99837	0.82274	0.99190	1.45349	0.68242
20	2.0033"-02	1.0362"+02	NM	0.99883	0.86397	0.99421	1.32422	0.75079
21	2.1364"-02	1.1388"+02	NM	0.99925	0.90590	0.99627	1.20945	0.82373
22	2.2450"-02	1.1965"+02	NM	0.99945	0.92864	0.99727	1.15326	0.86474
23	2.3964"-02	1.2666"+02	NM	0.99967	0.95558	0.99837	1.09156	0.91463
24	2.5665"-02	1.3206"+02	NM	0.99983	0.97582	0.99914	1.04837	0.95304
25	2.7816"-02	1.3587"+02	NM	0.99993	0.98982	0.99965	1.01994	0.98010
D 26	2.9963"-02	1.3867"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050104 WATSON PROFILE TABULATION 52 POINTS, DELTA AT POINT 52

I	Y	PT2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0009"+00	1.0000"+00	NM	0.90030	0.00000	0.00000	26.31333	0.00000
2	3.8710"-03	1.3749"+00	NM	0.91203	0.07104	0.34314	23.33283	0.01471
3	5.9331"-03	6.0642"+00	NM	0.95547	0.21208	0.74393	12.30430	0.06046
4	7.1343"-03	8.6103"+00	NM	0.96496	0.25600	0.80533	9.89623	0.08138
5	8.5717"-03	1.1581"+01	NM	0.97219	0.29912	0.84918	8.05956	0.10536
6	9.8093"-03	1.3281"+01	NM	0.97524	0.32118	0.86698	7.28636	0.11899
7	1.1242"-02	1.5827"+01	NM	0.97884	0.35165	0.88759	6.37102	0.13932
8	1.2820"-02	1.8374"+01	NM	0.98164	0.37967	0.90327	5.66014	0.15958
9	1.4062"-02	2.1344"+01	NM	0.98421	0.40993	0.91741	5.00850	0.18317
10	1.5038"-02	2.2620"+01	NM	0.98514	0.42227	0.92248	4.77237	0.19330
11	1.6388"-02	2.4743"+01	NM	0.98651	0.44203	0.92988	4.42542	0.21012
12	1.7072"-02	2.8132"+01	NM	0.98832	0.47186	0.93961	3.96520	0.23696
13	1.8172"-02	3.0252"+01	NM	0.98927	0.48959	0.94468	3.72305	0.25374
14	1.9585"-02	3.5334"+01	NM	0.99115	0.52970	0.95457	3.24758	0.29393
15	2.0141"-02	3.8299"+01	NM	0.99203	0.55175	0.95922	3.02240	0.31737
16	2.0495"-02	3.8303"+01	NM	0.99204	0.55178	0.95923	3.02211	0.31740
17	2.0848"-02	3.8306"+01	NM	0.99204	0.55180	0.95923	3.02190	0.31743
18	2.1394"-02	4.0426"+01	NM	0.99260	0.56704	0.96217	2.87918	0.33418
19	2.1874"-02	4.2122"+01	NM	0.99301	0.57894	0.96432	2.77437	0.34758
20	2.3161"-02	4.5937"+01	NM	0.99384	0.60486	0.96861	2.56436	0.37772
21	2.4201"-02	4.9750"+01	NM	0.99455	0.62971	0.97228	2.38400	0.40784
22	2.5506"-02	5.3562"+01	NM	0.99517	0.65359	0.97545	2.22740	0.43794
23	2.6537"-02	5.8644"+01	NM	0.99587	0.68415	0.97908	2.04802	0.47806
24	2.7031"-02	6.2453"+01	NM	0.99633	0.70619	0.98143	1.93144	0.50813
25	2.7230"-02	6.2456"+01	NM	0.99633	0.70620	0.98143	1.93136	0.50815
26	2.7485"-02	6.1190"+01	NM	0.99618	0.69895	0.98068	1.96861	0.49816
27	2.7684"-02	6.3306"+01	NM	0.99643	0.71103	0.98192	1.90712	0.51487
28	2.7798"-02	6.6692"+01	NM	0.99678	0.72992	0.98374	1.81639	0.54159
29	2.8025"-02	6.7963"+01	NM	0.99691	0.73690	0.98438	1.78450	0.55163
30	2.8252"-02	6.6274"+01	NM	0.99674	0.72762	0.98353	1.82711	0.53830
31	2.8536"-02	6.7122"+01	NM	0.99683	0.73229	0.98396	1.80547	0.54499
32	2.9748"-02	7.1359"+01	NM	0.99722	0.75520	0.98598	1.70460	0.57843
33	3.1370"-02	7.6864"+01	NM	0.99768	0.78396	0.98829	1.58920	0.62188
34	3.2497"-02	8.1947"+01	NM	0.99805	0.80962	0.99016	1.49573	0.66199
35	3.3446"-02	8.6606"+01	NM	0.99835	0.83243	0.99168	1.41921	0.69876
36	3.4079"-02	8.7458"+01	NM	0.99840	0.83654	0.99195	1.40666	0.70548
37	3.4450"-02	8.9154"+01	NM	0.99850	0.84465	0.99245	1.38058	0.71887
38	3.4873"-02	9.1272"+01	NM	0.99862	0.85468	0.99306	1.35004	0.73558
39	3.5707"-02	9.4665"+01	NM	0.99880	0.87049	0.99398	1.30384	0.76235
40	3.6634"-02	9.8055"+01	NM	0.99897	0.88602	0.99484	1.26073	0.78910
41	3.8400"-02	1.0314"+02	NM	0.99921	0.90878	0.99602	1.20119	0.82919
42	3.9449"-02	1.0737"+02	NM	0.99939	0.92734	0.99692	1.15570	0.86261
43	4.0174"-02	1.1034"+02	NM	0.99950	0.94013	0.99751	1.12581	0.88604
44	4.0826"-02	1.1204"+02	NM	0.99957	0.94736	0.99784	1.10940	0.89944
45	4.1846"-02	1.1459"+02	NM	0.99966	0.95811	0.99831	1.08568	0.91952
46	4.3963"-02	1.1798"+02	NM	0.99978	0.97223	0.99890	1.05562	0.94627
47	4.5715"-02	1.2052"+02	NM	0.99987	0.98269	0.99933	1.03415	0.96633
48	4.6378"-02	1.2306"+02	NM	0.99995	0.99304	0.99973	1.01353	0.98639
49	4.6802"-02	1.2306"+02	NM	0.99995	0.99305	0.99973	1.01350	0.98642
50	4.7684"-02	1.2392"+02	NM	0.99997	0.99652	0.99987	1.00674	0.99318
51	4.8598"-02	1.2478"+02	NM	1.00000	0.99996	1.00000	1.00007	0.99993
D 52	5.0771"-02	1.2479"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050501 WATSON PROFILE TABULATION 37 POINTS, DELTA AT POINT 37

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.89792	0.00000	0.00000	31.80938	0.00000
2	5.2475"-04	1.1028"+00	NM	0.90155	0.03405	0.18869	30.71239	0.00614
3	1.2774"-03	2.0155"+00	NM	0.92159	0.09697	0.48158	24.66408	0.01953
4	1.9878"-03	2.9187"+00	NM	0.93246	0.12579	0.58169	21.38470	0.02720
5	3.0235"-03	4.7102"+00	NM	0.94662	0.16697	0.69070	17.11133	0.04036
6	3.7590"-03	6.8942"+00	NM	0.95592	0.19933	0.75382	14.30230	0.05271
7	4.2199"-03	8.8984"+00	NM	0.96448	0.23588	0.80751	11.71934	0.06890
8	4.7315"-03	1.0550"+01	NM	0.96876	0.25798	0.83307	10.42772	0.07989
9	5.1859"-03	1.4337"+01	NM	0.97573	0.30258	0.87306	8.32547	0.10487
10	5.5890"-03	1.9001"+01	NM	0.98121	0.34977	0.90331	6.66990	0.13543
11	5.7967"-03	2.5043"+01	NM	0.98574	0.40272	0.92752	5.30432	0.17486
12	5.9654"-03	2.9322"+01	NM	0.98796	0.43637	0.93920	4.63248	0.20274
13	6.2776"-03	3.4612"+01	NM	0.99004	0.47466	0.94997	4.00545	0.23717
14	6.4943"-03	4.0402"+01	NM	0.99175	0.51331	0.95876	3.48866	0.27482
15	6.7115"-03	4.6066"+01	NM	0.99305	0.54849	0.96536	3.09769	0.31164
16	6.8860"-03	5.0472"+01	NM	0.99387	0.57437	0.96952	2.84932	0.34027
17	7.1473"-03	5.7143"+01	NM	0.99489	0.61146	0.97467	2.54083	0.38360
18	7.2501"-03	6.6197"+01	NM	0.99597	0.65848	0.98008	2.21531	0.44241
19	7.5469"-03	7.5635"+01	NM	0.99684	0.70416	0.98439	1.95433	0.50370
20	7.7538"-03	8.3436"+01	NM	0.99741	0.73978	0.98725	1.78091	0.55435
21	7.9594"-03	9.1488"+01	NM	0.99791	0.77484	0.98970	1.63148	0.60663
22	8.2605"-03	1.0005"+02	NM	0.99835	0.81044	0.99189	1.49790	0.66218
23	8.3749"-03	1.0671"+02	NM	0.99865	0.83711	0.99335	1.40812	0.70545
24	8.7343"-03	1.1326"+02	NM	0.99891	0.86252	0.99463	1.32980	0.74796
25	9.1970"-03	1.1830"+02	NM	0.99909	0.88159	0.99552	1.27516	0.78070
26	9.5598"-03	1.2385"+02	NM	0.99927	0.90209	0.99642	1.22009	0.81668
27	1.0370"-02	1.2764"+02	NM	0.99939	0.91586	0.99699	1.18501	0.84134
28	1.1081"-02	1.3169"+02	NM	0.99950	0.93031	0.99757	1.14981	0.86760
29	1.1951"-02	1.3436"+02	NM	0.99958	0.93972	0.99793	1.12772	0.88490
30	1.2631"-02	1.3740"+02	NM	0.99966	0.95033	0.99832	1.10354	0.90465
31	1.3163"-02	1.4031"+02	NM	0.99973	0.96036	0.99868	1.08139	0.92351
32	1.4099"-02	1.4159"+02	NM	0.99976	0.96477	0.99883	1.07187	0.93186
33	1.5186"-02	1.4426"+02	NM	0.99983	0.97385	0.99915	1.05262	0.94920
34	1.5982"-02	1.4592"+02	NM	0.99986	0.97945	0.99933	1.04101	0.95997
35	1.6941"-02	1.4696"+02	NM	0.99989	0.98293	0.99945	1.03390	0.96668
36	1.7743"-02	1.4887"+02	NM	0.99993	0.98932	0.99966	1.02102	0.97908
D 37	2.0239"-02	1.5209"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050502 WATSON PROFILE TABULATION 33 POINTS, DELTA AT POINT 33

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.89531	0.00000	0.00000	29.80610	0.00000
2	1.2051"-03	1.0814"+00	NM	0.89830	0.03138	0.16896	28.98371	0.00583
3	1.5689"-03	1.9687"+00	NM	0.91153	0.07819	0.39361	25.34315	0.01553
4	3.1127"-03	7.0886"+00	NM	0.95736	0.21577	0.76989	12.73184	0.06047
5	3.9869"-03	1.0769"+01	NM	0.96856	0.26925	0.83646	9.65128	0.08667
6	4.7970"-03	1.5065"+01	NM	0.97627	0.32052	0.87942	7.52816	0.11682
7	5.7470"-03	2.1451"+01	NM	0.98301	0.38425	0.91528	5.67393	0.16131
8	6.1337"-03	2.8827"+01	NM	0.98758	0.44667	0.93881	4.41745	0.21252
9	6.5139"-03	3.5834"+01	NM	0.99037	0.49878	0.95290	3.64979	0.26108
10	7.0162"-03	4.3701"+01	NM	0.99254	0.55145	0.96369	3.05396	0.31555
11	7.3961"-03	5.0585"+01	NM	0.99392	0.59372	0.97054	2.67221	0.36320
12	7.8333"-03	5.6730"+01	NM	0.99490	0.62905	0.97533	2.40398	0.40571
13	7.9074"-03	6.1279"+01	NM	0.99550	0.65398	0.97828	2.23771	0.43718
14	8.2889"-03	6.8657"+01	NM	0.99632	0.69250	0.98228	2.01201	0.48821
15	8.6652"-03	7.4434"+01	NM	0.99686	0.72123	0.98488	1.86474	0.52816
16	9.0600"-03	8.2795"+01	NM	0.99751	0.76088	0.98802	1.68614	0.58597
17	9.3322"-03	8.7466"+01	NM	0.99782	0.78216	0.98952	1.60050	0.61826
18	9.6057"-03	9.2506"+01	NM	0.99812	0.80450	0.99098	1.51733	0.65311
19	9.9424"-03	9.7300"+01	NM	0.99838	0.82518	0.99223	1.44587	0.68625
20	1.0151"-02	1.0222"+02	NM	0.99862	0.84587	0.99340	1.37923	0.72025
21	1.0359"-02	1.0677"+02	NM	0.99883	0.86457	0.99438	1.32284	0.75170
22	1.0889"-02	1.1180"+02	NM	0.99903	0.88481	0.99538	1.26554	0.78653
23	1.1287"-02	1.1586"+02	NM	0.99919	0.90078	0.99612	1.22290	0.81456
24	1.1815"-02	1.2041"+02	NM	0.99935	0.91834	0.99690	1.17840	0.84598
25	1.2724"-02	1.2495"+02	NM	0.99950	0.93556	0.99762	1.13706	0.87736
26	1.3169"-02	1.2740"+02	NM	0.99958	0.94473	0.99799	1.11593	0.89431
27	1.3726"-02	1.3035"+02	NM	0.99967	0.95563	0.99841	1.09153	0.91469
28	1.4557"-02	1.3341"+02	NM	0.99976	0.96684	0.99883	1.06727	0.93587
29	1.5497"-02	1.3622"+02	NM	0.99983	0.97701	0.99920	1.04594	0.95532
30	1.6465"-02	1.3806"+02	NM	0.99988	0.98358	0.99944	1.03249	0.96798
31	1.7456"-02	1.3977"+02	NM	0.99993	0.98968	0.99965	1.02025	0.97980
32	1.8513"-02	1.4184"+02	NM	0.99998	0.99703	0.99990	1.00576	0.99417
D 33	1.9960"-02	1.4269"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050505 WATSON PROFILE TABULATION 30 POINTS, DELTA AT POINT 30

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.88918	0.00000	0.00000	32.41026	0.00000
2	1.2882"-03	8.7180"+00	NM	0.96055	0.22995	0.80253	12.18056	0.06589
3	1.6289"-03	9.7912"+00	NM	0.96378	0.24447	0.82049	11.26460	0.07284
4	2.2590"-03	1.3019"+01	NM	0.97111	0.28366	0.85983	9.18825	0.09358
5	2.7719"-03	1.5049"+01	NM	0.97448	0.30574	0.87732	8.23422	0.10655
6	3.8846"-03	1.9109"+01	NM	0.97947	0.34568	0.90264	6.81849	0.13238
7	5.1852"-03	2.4970"+01	NM	0.98425	0.39628	0.92623	5.46308	0.16954
8	6.1720"-03	3.0471"+01	NM	0.98728	0.43849	0.94088	4.60411	0.20436
9	6.7961"-03	3.5980"+01	NM	0.98949	0.47703	0.95142	3.97791	0.23917
10	7.6456"-03	4.1366"+01	NM	0.99114	0.51191	0.95920	3.51101	0.27320
11	8.1598"-03	4.8077"+01	NM	0.99272	0.55230	0.96660	3.06304	0.31557
12	8.6037"-03	5.4430"+01	NM	0.99389	0.58797	0.97202	2.73296	0.35566
13	9.0463"-03	6.0542"+01	NM	0.99479	0.62037	0.97622	2.47624	0.39423
14	9.4908"-03	6.7014"+01	NM	0.99558	0.65292	0.97986	2.25221	0.43507
15	9.9245"-03	7.1686"+01	NM	0.99607	0.67544	0.98210	2.11416	0.46454
16	1.0521"-02	7.6355"+01	NM	0.99650	0.69723	0.98408	1.99210	0.49399
17	1.0994"-02	8.1866"+01	NM	0.99695	0.72209	0.98613	1.86504	0.52875
18	1.1465"-02	8.6898"+01	NM	0.99731	0.74407	0.98779	1.76238	0.56049
19	1.1750"-02	9.3012"+01	NM	0.99770	0.76993	0.98957	1.65191	0.59904
20	1.2230"-02	9.9843"+01	NM	0.99808	0.79783	0.99131	1.54380	0.64212
21	1.2462"-02	1.0824"+02	NM	0.99849	0.83085	0.99315	1.42883	0.69508
22	1.3232"-02	1.1507"+02	NM	0.99877	0.85676	0.99446	1.34728	0.73812
23	1.3562"-02	1.1998"+02	NM	0.99896	0.87494	0.99531	1.29408	0.76912
24	1.4066"-02	1.2886"+02	NM	0.99927	0.90682	0.99668	1.20800	0.82507
25	1.4930"-02	1.3472"+02	NM	0.99945	0.92731	0.99750	1.15711	0.86206
26	1.6029"-02	1.4202"+02	NM	0.99965	0.95219	0.99842	1.09945	0.90810
27	1.7137"-02	1.4824"+02	NM	0.99981	0.97288	0.99913	1.05469	0.94732
28	1.7781"-02	1.5135"+02	NM	0.99988	0.98306	0.99946	1.03366	0.96692
29	1.8733"-02	1.5421"+02	NM	0.99995	0.99233	0.99976	1.01503	0.98496
D 30	1.9431"-02	1.5660"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

73050504 WATSON PROFILE TABULATION 39 POINTS, DELTA AT POINT 39

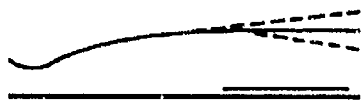
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.89503	0.00000	0.00000	32.62373	0.00000
2	2.2212"-03	4.8861"+00	NM	0.94609	0.16797	0.69744	17.24124	0.04045
3	2.5803"-03	5.9710"+00	NM	0.95209	0.18765	0.73725	15.43520	0.04776
4	3.2110"-03	7.6012"+00	NM	0.95904	0.21378	0.78086	13.34162	0.05853
5	4.0537"-03	9.8725"+00	NM	0.96606	0.24553	0.82260	11.22463	0.07329
6	6.2150"-03	1.3008"+01	NM	0.97275	0.28353	0.86046	9.20984	0.09343
7	7.1909"-03	1.4201"+01	NM	0.97470	0.29671	0.87121	8.62123	0.10105
8	7.9311"-03	1.6043"+01	NM	0.97727	0.31599	0.88515	7.84679	0.11280
9	9.2090"-03	1.8751"+01	NM	0.98031	0.34234	0.90134	6.93207	0.13002
10	1.0130"-02	2.2100"+01	NM	0.98321	0.37236	0.91654	6.05855	0.15128
11	1.1367"-02	2.5773"+01	NM	0.98565	0.40271	0.92914	5.32313	0.17455
12	1.2909"-02	2.9878"+01	NM	0.98776	0.43414	0.93990	4.68708	0.20053
13	1.3880"-02	3.2580"+01	NM	0.98890	0.45363	0.94563	4.34547	0.21761
14	1.4500"-02	3.5606"+01	NM	0.98998	0.47451	0.95110	4.01745	0.23674
15	1.5182"-02	3.9279"+01	NM	0.99110	0.49868	0.95668	3.68035	0.25994
16	1.5905"-02	4.3919"+01	NM	0.99227	0.52764	0.96250	3.32759	0.28925
17	1.7151"-02	4.8125"+01	NM	0.99316	0.55257	0.96686	3.06156	0.31581
18	1.8578"-02	5.3951"+01	NM	0.99417	0.58536	0.97183	2.75636	0.35258
19	1.9377"-02	5.8265"+01	NM	0.99480	0.60850	0.97491	2.56684	0.37980
20	1.9956"-02	6.1503"+01	NM	0.99522	0.62531	0.97695	2.44093	0.40024
21	2.0613"-02	6.6147"+01	NM	0.99575	0.64866	0.97955	2.28045	0.42954
22	2.1166"-02	7.0034"+01	NM	0.99614	0.66757	0.98146	2.16152	0.45406
23	2.2019"-02	7.6829"+01	NM	0.99674	0.69940	0.98437	1.98092	0.49693
24	2.3273"-02	8.4593"+01	NM	0.99732	0.73408	0.98714	1.80828	0.54590
25	2.3690"-02	9.1814"+01	NM	0.99777	0.76493	0.98931	1.67270	0.59144
26	2.4833"-02	9.7745"+01	NM	0.99809	0.78937	0.99086	1.57565	0.62885
27	2.5446"-02	1.0368"+02	NM	0.99838	0.81307	0.99223	1.48926	0.66626
28	2.5838"-02	1.0767"+02	NM	0.99855	0.82865	0.99308	1.43622	0.69145
29	2.6368"-02	1.1188"+02	NM	0.99872	0.84477	0.99391	1.38426	0.71801
30	2.6894"-02	1.1598"+02	NM	0.99888	0.86018	0.99466	1.33712	0.74388
31	2.7617"-02	1.2008"+02	NM	0.99903	0.87531	0.99535	1.29311	0.76974
32	2.9020"-02	1.2806"+02	NM	0.99929	0.90402	0.99659	1.21529	0.82004
33	2.9939"-02	1.3475"+02	NM	0.99948	0.92740	0.99752	1.15693	0.86221
34	3.1004"-02	1.3864"+02	NM	0.99958	0.94073	0.99801	1.12550	0.88673
35	3.1894"-02	1.4447"+02	NM	0.99973	0.96038	0.99871	1.08142	0.92352
36	3.3208"-02	1.4836"+02	NM	0.99982	0.97326	0.99915	1.05390	0.94805
37	3.5392"-02	1.5117"+02	NM	0.99988	0.98247	0.99945	1.03486	0.96578
38	3.6793"-02	1.5355"+02	NM	0.99994	0.99019	0.99970	1.01928	0.98078
D 39	3.9243"-02	1.5660"+02	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y/DELTA,M/MD ASSUME P=PD AND VAN DRIEST

SECTION D, ADDITIONAL DATA, TEMPERATURE PROFILES

	0204	0304	0404	0504
POD	P_o = 5.378 MN/m^2	P_o = 7.929 MN/m^2	P_o = 10.76 MN/m^2	P_o = 13.24 MN/m^2
TOD	T_T = 302 K	T_T = 301 K	T_T = 300 K	T_T = 302 K
TW	T_w = 283 K	T_w = 283 K	T_w = 283 K	T_w = 283 K
δ	δ = 50.80 mm	δ = 40.64 mm	δ = 40.64 mm	δ = 40.64 mm

Y/δ	TO/TOD	Y/δ	TO/TOD	Y/δ	TO/TOD	y/δ	TO/TOD
0.093	0.852	0.117	0.876	0.184	0.903	0.348	0.910
0.108	0.869	0.141	0.887	0.208	0.905	0.375	0.910
0.129	0.883	0.160	0.892	0.222	0.907	0.406	0.912
0.154	0.889	0.189	0.898	0.252	0.906	0.424	0.912
0.187	0.893	0.221	0.902	0.281	0.905	0.437	0.912
0.196	0.896	0.236	0.905	0.313	0.903	0.451	0.911
0.213	0.899	0.249	0.905	0.328	0.903	0.463	0.912
0.236	0.899	0.262	0.906	0.342	0.903	0.482	0.915
0.266	0.897	0.286	0.906	0.355	0.902	0.509	0.921
0.299	0.896	0.308	0.906	0.386	0.901	0.518	0.924
0.316	0.896	0.331	0.905	0.422	0.898	0.543	0.931
0.341	0.895	0.351	0.904	0.448	0.898	0.557	0.934
0.364	0.895	0.358	0.904	0.466	0.900	0.565	0.937
0.390	0.894	0.379	0.903	0.476	0.901	0.577	0.940
0.417	0.895	0.402	0.901	0.488	0.902	0.588	0.945
0.427	0.896	0.426	0.901	0.506	0.905	0.604	0.951
0.447	0.898	0.441	0.900	0.515	0.906	0.635	0.965
0.466	0.900	0.459	0.901	0.538	0.913	0.655	0.973
0.478	0.902	0.475	0.902	0.564	0.921	0.678	[illegible]
0.492	0.904	0.489	0.902	0.582	0.926	0.698	0.988
0.518	0.911	0.501	0.903	0.598	0.930	0.726	0.995
0.535	0.916	0.516	0.904	0.612	0.935	0.774	0.998
0.548	0.913	0.542	0.909	0.622	0.939	0.805	0.998
0.557	0.921	0.570	0.915	0.630	0.943	0.858	0.999
0.566	0.923	0.584	0.919	0.651	0.953	0.912	0.999
0.581	0.929	0.598	0.924	0.671	0.962	0.945	0.999
0.592	0.932	0.613	0.928	0.688	0.969	1.025	1.001
0.602	0.936	0.623	0.931	0.707	0.975		
0.608	0.937	0.836	0.934	0.727	0.982		
0.626	0.942	0.643	0.937	0.749	0.987		
0.646	0.950	0.661	0.944	0.771	0.991		
0.665	0.958	0.684	0.951	0.791	0.995		
0.679	0.963	0.706	0.956	0.829	0.998		
0.692	0.968	0.716	0.959	0.836	0.999		
0.698	0.970	0.730	0.963	0.848	0.999		
0.706	0.973	0.741	0.967	0.862	0.999		
0.719	0.978	0.752	0.970	0.891	0.999		
0.734	0.982	0.759	0.972	0.948	1.000		
0.757	0.987	0.773	0.979	0.962	1.000		
0.768	0.989	0.787	0.984	0.978	1.000		
0.781	0.992	0.816	0.991	1.020	1.000		
0.796	0.994	0.842	0.995				
0.808	0.996	0.855	0.997				
0.816	0.997	0.863	0.999				
0.827	0.997	0.877	1.000				
0.838	0.997	0.888	1.000				
0.853	0.998	0.918	1.000				
0.879	0.999	0.974	1.000				
0.914	1.000						
0.938	1.000						
0.949	1.000						



M : A, 2.56 to 3; B, 2.51 to 2.19; C, 2.57 to 3.24.
R THETA X 10^{-3} : 14 - 24.
TW/TR : 1.05

7401

FPG - APG
AW

Blow-down tunnel with fixed half-nozzle. Running time 50 s, W = 0.114, H = 0.083 m.
Air; 0.3 < PO < 0.6 MN/m^2. TO : 300 K. 3 < RE/m X 10^{-6} < 6.

THOMAS G.D., 1974. Compressible turbulent boundary layers with combined air injection and pressure gradient. ARC (London) R & M 3779. And Ph.D. Thesis, Cambridge (1973), Squire, L.C., private communication.

1 The test boundary layer was formed on a flat surface extending upstream into the settling chamber and facing one of a number of contoured nozzle blocks. For the FPG cases these were cast in Araldite to a design calculated by the method of characteristics. The flow was initially accelerated to give a uniform free stream at M = 2.5 - 2.6. A 5^0 or 10^0 expansion was then produced by a curved surface and reflected from the test surface, where the design pressure gradients were linear. The stronger of the two expansion fields was not completed within the test zone. For the APG tests, the second half of the contoured nozzle was formed of a flexible metal plate. This was rolled to an approxiamte design shape, and then adjusted manually to give a linear APG on the test surface.

Two test surfaces were used, one a solid metal plate, and the other a plate with a sintered section for the injection tests which are not reported here. The plates were 0.1 mm wide and tests extended over a streamwise distance of up to 0.2 m, starting 0.44 m from the tunnel throat.

2 Other than slight disturbances (about 1 % in M) at the start of the pressure gradients, the favourable gradients were "free from disturbance" until the large changes occuring at their ends. "One or two weak disturbances were evident" in the APG case and "these did affect some of the boundary layer parameters".
3 The evidence of earlier tests (Jeromin, 1966, Squire, 1970) was that transition occurred well upstream, and that the velocity profiles were fully developed after experiencing the throat region expansion.

6 Static pressure was measured along the test surface centre line at intervals of 12.7 mm using tappings of 0.30 mm diameter. The plate temperature was monitored by 7 thermocouples mounted 25 mm from the centre line at intervals of 50 mm. The wall shear stress was estimated using the razor-blade technique after Smith, Gaudet and Winter (1964). A section of blade 6.35 mm long and 3.8 mm wide was mounted with its leading edge just over the upstream edge of a static hole. The leading edge was 0.14 mm above the plate surface, and the upper side of the blade had been ground down so that the chamfering of the upper side was about 0.03 mm in height. The sensors were calibrated against the Spalding and Chi (1964) CF correlation for ZPG flow.

7 Pitot, temperature, and static pressure measurements were made. The CCP used has a 2.5^0 semi-angle tip, was of 1 mm diameter and the static holes were 20 mm from the tip. No pressure variation through the boundary layer was observed. The TO profile was measured with an ECP for which d = 1.65 mm, l = 2.5 mm and the semi-angle α was 5^0. The readings had been compared earlier with a long slender ECP, and no difference was found, so that the shorter probe was used as being less fragile. The Pitot probes used were FPP for which, approximately, h_1 = 0.13, h_2 = 0.035, b_1 = 1.5, b_2 = 1.0 mm. (These are representative figures, the source
8 paper giving much more detail.) Profiles, static pressure, and razor blade CF determinations were made on the same normal at streamwise intervals of 12.7 mm. For gradient B, series 02, the interval was 6.35 mm.

9 The readings were recorded continuously on X-Y-plotters, and the tabulated values obtained from values measured from the trace. The author also extrapolated the TO profile to meet the measured wall temperature. The static pressure was taken as constant on the basis of the static pressure traverses made. The author's
10 recovery factor was 0.89. No profile corrections were made and Sutherland's viscosity law was used.

12 The editors have presented only those profiles measured on a solid surface. The author also presents profiles for each pressure gradient at two wall mass flux rates. The boundary layer edge state is that

13 selected by the author. The profiles form three sets, 01 for the FPG "A" case with 15 successive profiles,
14 02 for the APG "B" case with 15 profiles, and 03 for the FPG "C" case with 18 profiles. The CF value is as reduced by the author.

§ DATA 7401 0101-0318. Pitot, TO (and P) profiles measured separately. NX = 15-18. CF from razor blades.

15 Editors' comments

The experiment is one of a series intended to provide comprehensive information on the effects of mass injection. Here we consider only the "solid wall" case, which together with the ZPG experiment of Jeromin - CAT 6602 provides a systematically varied set of pressure gradients observed in a single facility. The principal uncertainty here must be the question of three-dimensionality, as the length/width ratio of the experimental surface is over 5 : 1. A momentum balance for the centre line profile sequence of CAT 6602 showed discrepancies at the 20 - 30 % level.

The profiles are given in fine detail, and at close intervals so that the layer development is easily followed. Comparable tests with broadly similar geometry are those of Michel - CAT 6902 for the FPG case and Zwarts - CAT 7007 in an APG. Lewis et al. - CAT 7201 give profiles at close intervals on an axi-symmetric model.

The author states that no normal pressure gradients were observed, but the frequency at which static pressure profiles were measured is not stated, and normal pressure variations might occur in those regions where the longitudinal pressure gradient is changing rapidly.

CAT 7401 THOMAS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
74010101	2.5600	1.0543	8.2541"+03	1.5300"-03	4.2081	1.3845	2.1968"+04	2.1968"+04
0.0000"+00	4.1200"+05	1.0000	1.6742"+04	NM	1.7913	1.7727	2.8960"+02	1.2632"+02
INFINITE	2.9190"+02	0.0000	4.2574"-04	NC	0.0613	6.1560"-04	5.7689"+02	2.7468"+02
74010102	2.5600	1.0547	8.4568"+03	1.5200"-03	4.2257	1.3675	2.1968"+04	2.1968"+04
1.2700"-02	4.1200"+05	1.0000	1.7157"+04	NM	1.7959	1.7790	2.8970"+02	1.2632"+02
INFINITE	2.9190"+02	0.0000	4.3631"-04	NC	0.0433	6.2911"-04	5.7689"+02	2.7466"+02
74010103	2.5600	1.0550	8.3664"+03	1.5100"-03	4.4007	1.3564	2.1968"+04	2.1968"+04
2.5400"-02	4.1200"+05	1.0000	1.6978"+04	NM	1.8014	1.7850	2.8980"+02	1.2632"+02
INFINITE	2.9190"+02	0.0000	4.3176"-04	NC	-0.0297	6.2738"-04	5.7689"+02	2.7468"+02
74010104	2.5900	1.0561	9.0630"+03	1.5350"-03	4.2581	1.3474	2.0970"+04	2.0970"+04
3.8100"-02	4.1200"+05	1.0000	1.8625"+04	NM	1.8045	1.7880	2.8990"+02	1.2466"+02
INFINITE	2.9190"+02	0.0000	4.8122"-04	NC	0.0395	6.8914"-04	5.7979"+02	2.7451"+02
74010105	2.6300	1.0573	8.6351"+03	1.5650"-03	4.3749	1.3348	1.9712"+04	1.9712"+04
5.0800"-02	4.1200"+05	1.0000	1.8044"+04	NM	1.8117	1.7955	2.9000"+02	1.2247"+02
INFINITE	2.9190"+02	0.0000	4.7624"-04	NC	0.0201	6.8377"-04	5.8356"+02	2.7428"+02
74010106	2.6700	1.0585	8.2509"+03	1.5650"-03	4.4754	1.3423	1.8532"+04	1.8532"+04
6.3500"-02	4.1200"+05	1.0000	1.7532"+04	NM	1.8100	1.7928	2.9010"+02	1.2033"+02
INFINITE	2.9190"+02	0.0000	4.7271"-04	NC	0.0198	6.8416"-04	5.8724"+02	2.7406"+02
74010107	2.7100	1.0597	7.8151"+03	1.5550"-03	4.6449	1.3091	1.7425"+04	1.7425"+04
7.6200"-02	4.1200"+05	1.0000	1.6886"+04	NM	1.8266	1.8102	2.9020"+02	1.1823"+02
INFINITE	2.9190"+02	0.0000	4.6516"-04	NC	-0.0274	6.7310"-04	5.9081"+02	2.7384"+02
74010108	2.7500	1.0606	8.0148"+03	1.5500"-03	4.5364	1.3040	1.6388"+04	1.6388"+04
8.8900"-02	4.1200"+05	1.0000	1.7605"+04	NM	1.8290	1.8126	2.9020"+02	1.1618"+02
INFINITE	2.9190"+02	0.0000	4.9551"-04	NC	0.0386	7.0945"-04	5.9430"+02	2.7363"+02
74010109	2.7900	1.0614	8.0299"+03	1.5500"-03	4.6097	1.2924	1.5415"+04	1.5415"+04
1.0160"-01	4.1200"+05	1.0000	1.7930"+04	NM	1.8337	1.8171	2.9020"+02	1.1417"+02
INFINITE	2.9190"+02	0.0000	5.1567"-04	NC	0.0403	7.4132"-04	5.9770"+02	2.7342"+02
74010110	2.8400	1.0620	7.7609"+03	1.5500"-03	4.7451	1.3015	1.4284"+04	1.4284"+04
1.1430"-01	4.1200"+05	1.0000	1.7685"+04	NM	1.8311	1.8128	2.9010"+02	1.1171"+02
INFINITE	2.9190"+02	0.0000	5.2254"-04	NC	0.0394	7.6046"-04	6.0182"+02	2.7316"+02
74010111	2.8800	1.0624	7.7504"+03	1.5450"-03	4.7735	1.2894	1.3442"+04	1.3442"+04
1.2700"-01	4.1200"+05	1.0000	1.7949"+04	NM	1.8368	1.8187	2.9000"+02	1.0978"+02
INFINITE	2.9190"+02	0.0000	5.4195"-04	NC	0.0551	7.8726"-04	6.0502"+02	2.7296"+02
74010112	2.9000	1.0624	7.6718"+03	1.5350"-03	4.9305	1.2880	1.3040"+04	1.3040"+04
1.3970"-01	4.1200"+05	1.0000	1.7909"+04	NM	1.8370	1.8189	2.8990"+02	1.0884"+02
INFINITE	2.9190"+02	0.0000	5.4663"-04	NC	0.0189	8.0274"-04	6.0659"+02	2.7286"+02
74010113	2.9300	1.0626	7.6564"+03	1.5250"-03	5.0128	1.2838	1.2462"+04	1.2462"+04
1.5240"-01	4.1200"+05	1.0000	1.8089"+04	NM	1.8412	1.8218	2.8980"+02	1.0744"+02
INFINITE	2.9190"+02	0.0000	5.6120"-04	NC	0.0145	8.2663"-04	6.0891"+02	2.7272"+02
74010114	2.9600	1.0628	7.9515"+03	1.5150"-03	4.9022	1.2953	1.1911"+04	1.1911"+04
1.6510"-01	4.1200"+05	1.0000	1.9014"+04	NM	1.8363	1.8156	2.8970"+02	1.0606"+02
INFINITE	2.9190"+02	0.0000	5.9957"-04	NC	0.0796	8.8113"-04	6.1118"+02	2.7257"+02
74010115	3.0000	1.0632	7.3685"+03	1.5050"-03	5.0682	1.2793	1.1216"+04	1.1216"+04
1.7780"-01	4.1200"+05	1.0000	1.7906"+04	NM	1.8430	1.8236	2.8960"+02	1.0425"+02
INFINITE	2.9190"+02	0.0000	5.7704"-04	NC	0.0424	8.5230"-04	6.1414"+02	2.7238"+02

CAT 7401 THOMAS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD* TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
74010201	2.5200	1.0528	7.4141"+03	1.8850"-03	4.0624	1.3718	1.7475"+04	1.7475"+04
0.0000"+00	3.0800"+05	1.0000	1.4770"+04	NM	1.7424	1.7753	2.9160"+02	1.2955"+02
INFINITE	2.9410"+02	0.0000	4.9722"-04	NC	0.0726	7.0708"-04	5.7509"+02	2.7699"+02
74010202	2.5200	1.0528	7.0616"+03	1.5900"-03	4.2791	1.3606	1.7475"+04	1.7475"+04
1.2700"-02	3.0800"+05	1.0000	1.4067"+04	NM	1.7960	1.7797	2.9160"+02	1.2955"+02
INFINITE	2.9410"+02	0.0000	4.7358"-04	NC	-0.0134	6.8488"-04	5.7509"+02	2.7699"+02
74010203	2.5300	1.0533	6.6629"+03	1.6050"-03	4.2456	1.3580	1.7205"+04	1.7205"+04
2.5400"-02	3.0800"+05	1.0000	1.3331"+04	NM	1.7989	1.7829	2.9170"+02	1.2898"+02
INFINITE	2.9410"+02	0.0000	4.5116"-04	NC	0.0028	6.4750"-04	5.7609"+02	2.7693"+02
74010204	2.5200	1.0531	6.8112"+03	1.6200"-03	4.2324	1.3513	1.7475"+04	1.7475"+04
3.8100"-02	3.0800"+05	1.0000	1.3572"+04	NM	1.8005	1.7853	2.9170"+02	1.2955"+02
INFINITE	2.9410"+02	0.0000	4.5691"-04	NC	-0.0053	6.5383"-04	5.7509"+02	2.7699"+02
74010205	2.4800	1.0526	7.0618"+03	1.5850"-03	4.2129	1.3852	1.8596"+04	1.8596"+04
5.0800"-02	3.0800"+05	1.0000	1.3846"+04	NM	1.7831	1.7672	2.9180"+02	1.3188"+02
INFINITE	2.9410"+02	0.0000	4.5646"-04	NC	-0.0080	6.5966"-04	5.7102"+02	2.7723"+02
74010206	2.4500	1.0519	7.4753"+03	1.5500"-03	4.2704	1.3760	1.9486"+04	1.9486"+04
6.3500"-02	3.0800"+05	1.0000	1.4479"+04	NM	1.7866	1.7712	2.9180"+02	1.3365"+02
INFINITE	2.9410"+02	0.0000	4.6492"-04	NC	-0.0610	6.8009"-04	5.6789"+02	2.7741"+02
74010207	2.4400	1.0520	7.9849"+03	1.5150"-03	4.0952	1.3837	1.9792"+04	1.9792"+04
7.6200"-02	3.0800"+05	1.0000	1.5407"+04	NM	1.7823	1.7667	2.9190"+02	1.3425"+02
INFINITE	2.9410"+02	0.0000	4.9745"-04	NC	0.0018	7.1077"-04	5.6683"+02	2.7748"+02
74010208	2.4100	1.0516	8.4707"+03	1.4900"-03	4.0123	1.3833	2.0741"+04	2.0741"+04
8.8900"-02	3.0800"+05	1.0000	1.6150"+04	NM	1.7819	1.7662	2.9200"+02	1.3606"+02
INFINITE	2.9410"+02	0.0000	5.1342"-04	NC	0.0097	7.2868"-04	5.6362"+02	2.7766"+02
74010209	2.3900	1.0508	8.7173"+03	1.4650"-03	3.9743	1.3638	2.1399"+04	2.1399"+04
1.0160"-01	3.0800"+05	1.0000	1.6481"+04	NM	1.7876	1.7737	2.9190"+02	1.3727"+02
INFINITE	2.9410"+02	0.0000	5.1857"-04	NC	-0.0048	7.3079"-04	5.6144"+02	2.7779"+02
74010210	2.3400	1.0492	9.9865"+03	1.4450"-03	3.9143	1.3858	2.3138"+04	2.3138"+04
1.1430"-01	3.0800"+05	1.0000	1.8496"+04	NM	1.7759	1.7618	2.9180"+02	1.4037"+02
INFINITE	2.9410"+02	0.0000	5.6731"-04	NC	-0.0076	7.9982"-04	5.5586"+02	2.7811"+02
74010211	2.3300	1.0490	9.5620"+03	1.4300"-03	4.0616	1.3733	2.3502"+04	2.3502"+04
1.2700"-01	3.0800"+05	1.0000	1.7635"+04	NM	1.7817	1.7682	2.9180"+02	1.4100"+02
INFINITE	2.9410"+02	0.0000	5.3826"-04	NC	-0.0655	7.6380"-04	5.5473"+02	2.7818"+02
74010212	2.3000	1.0479	1.0824"+04	1.4200"-03	3.7444	1.3874	2.4632"+04	2.4632"+04
1.3970"-01	3.0800"+05	1.0000	1.9720"+04	NM	1.7742	1.7605	2.9170"+02	1.4291"+02
INFINITE	2.9410"+02	0.0000	5.9278"-04	NC	0.0266	8.2121"-04	5.5127"+02	2.7838"+02
74010213	2.2800	1.0474	1.1267"+04	1.4100"-03	3.6786	1.3778	2.5415"+04	2.5415"+04
1.5240"-01	3.0800"+05	1.0000	2.0361"+04	NM	1.7779	1.7646	2.9170"+02	1.4419"+02
INFINITE	2.9410"+02	0.0000	6.0594"-04	NC	0.0312	8.3285"-04	5.4892"+02	2.7851"+02
74010214	2.2700	1.0468	1.1530"+04	1.4000"-03	3.6738	1.3683	2.5815"+04	2.5815"+04
1.6510"-01	3.0800"+05	1.0000	2.0748"+04	NM	1.7805	1.7679	2.9160"+02	1.4484"+02
INFINITE	2.9410"+02	0.0000	6.1439"-04	NC	0.0186	8.4268"-04	5.4774"+02	2.7858"+02
74010215	2.2100	1.0452	1.3467"+04	1.3950"-03	3.6765	1.3960	2.8357"+04	2.8357"+04
1.7780"-01	3.0800"+05	1.0000	2.3654"+04	NM	1.7687	1.7546	2.9160"+02	1.4877"+02
INFINITE	2.9410"+02	0.0000	6.8007"-04	NC	-0.0111	9.3061"-04	5.4046"+02	2.7899"+02

CAT 7401 THOMAS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN / X * / RZ	MD * / POD* / TOD*	TW/TR / PW/PD* / SW *	RED2K / RED2D / D2	CF * / CD / PI2	H12 / H32 / H42	H12K / H32K / D2K	PW / TW* / UD	PD / TD / TR
74010301	2.5700	1.0534	7.8294E+03	1.5400E-03	4.2753	1.3585	2.1630E+04	2.1630E+04
0.0000E+00	4.1200E+05	1.0000	1.5946E+04	NM	1.8009	1.7854	2.8760E+02	1.2503E+02
INFINITE	2.9020E+02	0.0000	4.0427E-04	NC	0.0230	5.8024E-04	5.7618E+02	2.7302E+02
74010302	2.6100	1.0546	7.4201E+03	1.5400E-03	4.3007	1.3368	2.0330E+04	2.0330E+04
1.2700E-02	4.1200E+05	1.0000	1.5367E+04	NM	1.8106	1.7965	2.8770E+02	1.2284E+02
INFINITE	2.9020E+02	0.0000	3.9794E-04	NC	0.0310	5.6773E-04	5.7999E+02	2.7279E+02
74010303	2.5800	1.0543	8.4180E+03	1.5600E-03	4.2646	1.3393	2.1297E+04	2.1297E+04
2.5400E-02	4.1200E+05	1.0000	1.7225E+04	NM	1.8081	1.7932	2.8780E+02	1.2448E+02
INFINITE	2.9020E+02	0.0000	4.3901E-04	NC	0.0240	6.2718E-04	5.7714E+02	2.7297E+02
74010304	2.6100	1.0554	7.7180E+03	1.5900E-03	4.3757	1.3365	2.0330E+04	2.0330E+04
3.8100E-02	4.1200E+05	1.0000	1.5993E+04	NM	1.8114	1.7964	2.8790E+02	1.2284E+02
INFINITE	2.9020E+02	0.0000	4.1414E-04	NC	0.0043	5.9432E-04	5.7999E+02	2.7279E+02
74010305	2.6100	1.0557	9.0069E+03	1.6000E-03	4.2318	1.3293	2.0330E+04	2.0330E+04
5.0800E-02	4.1200E+05	1.0000	1.8668E+04	NM	1.8099	1.7954	2.8800E+02	1.2284E+02
INFINITE	2.9020E+02	0.0000	4.8344E-04	NC	0.0533	6.8809E-04	5.7999E+02	2.7279E+02
74010306	2.6700	1.0574	7.7906E+03	1.5950E-03	4.4879	1.3057	1.8532E+04	1.8532E+04
6.3500E-02	4.1200E+05	1.0000	1.6555E+04	NM	1.8265	1.8119	2.8810E+02	1.1963E+02
INFINITE	2.9020E+02	0.0000	4.4265E-04	NC	-0.0085	6.3159E-04	5.8552E+02	2.7246E+02
74010307	2.7200	1.0588	7.5048E+03	1.5850E-03	4.6149	1.2845	1.7160E+04	1.7160E+04
7.6200E-02	4.1200E+05	1.0000	1.6284E+04	NM	1.8365	1.8231	2.8820E+02	1.1703E+02
INFINITE	2.9020E+02	0.0000	4.4722E-04	NC	-0.0256	6.3851E-04	5.8997E+02	2.7219E+02
74010308	2.7700	1.0602	7.7780E+03	1.5800E-03	4.5552	1.2831	1.5894E+04	1.5894E+04
8.8900E-02	4.1200E+05	1.0000	1.7232E+04	NM	1.8362	1.8220	2.8830E+02	1.1450E+02
INFINITE	2.9020E+02	0.0000	4.8617E-04	NC	0.0367	6.9360E-04	5.9427E+02	2.7193E+02
74010309	2.8400	1.0620	7.2846E+03	1.5500E-03	4.7223	1.2689	1.4284E+04	1.4284E+04
1.0160E-01	4.1200E+05	1.0000	1.6615E+04	NM	1.8440	1.8301	2.8840E+02	1.1105E+02
INFINITE	2.9020E+02	0.0000	4.8682E-04	NC	0.0273	6.9792E-04	6.0006E+02	2.7157E+02
74010310	2.9000	1.0635	7.1275E+03	1.5800E-03	4.7929	1.2673	1.3040E+04	1.3040E+04
1.1430E-01	4.1200E+05	1.0000	1.6668E+04	NM	1.8464	1.8315	2.8850E+02	1.0820E+02
INFINITE	2.9020E+02	0.0000	5.0447E-04	NC	0.0493	7.2426E-04	6.0463E+02	2.7127E+02
74010311	2.9600	1.0650	6.9357E+03	1.5800E-03	4.8672	1.2539	1.1911E+04	1.1911E+04
1.2700E-01	4.1200E+05	1.0000	1.6628E+04	NM	1.8536	1.8387	2.8860E+02	1.0544E+02
INFINITE	2.9020E+02	0.0000	5.1992E-04	NC	0.0647	7.4515E-04	6.0940E+02	2.7098E+02
74010312	3.0100	1.0663	6.7756E+03	1.5750E-03	4.9599	1.2510	1.1049E+04	1.1049E+04
1.3970E-01	4.1200E+05	1.0000	1.6585E+04	NM	1.8560	1.8402	2.8870E+02	1.0320E+02
INFINITE	2.9020E+02	0.0000	5.3283E-04	NC	0.0735	7.6814E-04	6.1308E+02	2.7075E+02
74010313	3.0500	1.0674	6.5898E+03	1.5650E-03	5.1620	1.2440	1.0408E+04	1.0408E+04
1.5240E-01	4.1200E+05	1.0000	1.6401E+04	NM	1.8598	1.8441	2.8880E+02	1.0145E+02
INFINITE	2.9020E+02	0.0000	5.3847E-04	NC	0.0362	7.8146E-04	6.1594E+02	2.7057E+02
74010314	3.1000	1.0686	6.6730E+03	1.5500E-03	5.1780	1.2469	9.6609E+03	9.6609E+03
1.6510E-01	4.1200E+05	1.0000	1.6956E+04	NM	1.8584	1.8413	2.8890E+02	9.9316E+01
INFINITE	2.9020E+02	0.0000	5.7199E-04	NC	0.0729	8.3453E-04	6.1941E+02	2.7035E+02
74010315	3.1300	1.0695	6.4931E+03	1.5350E-03	5.5413	1.2485	9.2405E+03	9.2405E+03
1.7780E-01	4.1200E+05	1.0000	1.6706E+04	NM	1.8578	1.8405	2.8900E+02	9.8061E+01
INFINITE	2.9020E+02	0.0000	5.7202E-04	NC	-0.0149	8.5200E-04	6.2144E+02	2.7022E+02
74010316	3.1700	1.0706	6.6873E+03	1.5200E-03	5.0774	1.2436	8.7101E+03	8.7101E+03
1.9050E-01	4.1200E+05	1.0000	1.7493E+04	NM	1.8587	1.8419	2.8910E+02	9.6419E+01
INFINITE	2.9020E+02	0.0000	6.1294E-04	NC	0.1530	8.8840E-04	6.2409E+02	2.7005E+02
74010317	3.2200	1.0718	6.4355E+03	1.5100E-03	5.1767	1.2456	8.0927E+03	8.0927E+03
2.0320E-01	4.1200E+05	1.0000	1.7185E+04	NM	1.8597	1.8413	2.8920E+02	9.4415E+01
INFINITE	2.9020E+02	0.0000	6.1864E-04	NC	0.1618	9.0269E-04	6.2731E+02	2.6984E+02
74010318	3.2400	1.0724	7.5749E+03	1.5000E-03	4.6268	1.2438	7.8590E+03	7.8590E+03
2.1590E-01	4.1200E+05	1.0000	2.0397E+04	NM	1.8559	1.8378	2.8930E+02	9.3627E+01
INFINITE	2.9020E+02	0.0000	7.4228E-04	NC	0.3354	1.0561E-03	6.2857E+02	2.6976E+02

74010101 THOMAS PROFILE TABULATION 29 POINTS, DELTA AT POINT 29

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.99212	0.00000	0.00000	2.29251	0.00000
2	1.0000"-04	1.7555"+00	NM	0.99720	0.36481	0.51100	1.96200	0.26045
3	2.0000"-04	1.9767"+00	NM	0.99112	0.40497	0.55600	1.88500	0.29496
4	3.0000"-04	2.2451"+00	NM	0.98664	0.44622	0.60000	1.80000	0.33186
5	4.0000"-04	2.5069"+00	NM	0.98332	0.48157	0.63600	1.74200	0.36510
6	5.0000"-04	2.7469"+00	NM	0.98135	0.51184	0.66500	1.68800	0.39396
7	6.0000"-04	2.9429"+00	NM	0.97884	0.53486	0.68600	1.64500	0.41702
8	8.0000"-04	3.2008"+00	NM	0.97571	0.56351	0.71100	1.59200	0.44661
9	1.0000"-03	3.4392"+00	NM	0.97855	0.58861	0.73400	1.55500	0.47203
10	1.2000"-03	3.6632"+00	NM	0.98115	0.61117	0.75400	1.52200	0.49540
11	1.4000"-03	3.8805"+00	NM	0.98332	0.63223	0.77200	1.49100	0.51777
12	1.6000"-03	4.1276"+00	NM	0.98545	0.65531	0.79100	1.45700	0.54290
13	1.8000"-03	4.3469"+00	NM	0.98783	0.67508	0.80700	1.42900	0.56473
14	2.0000"-03	4.5997"+00	NM	0.98971	0.69715	0.82400	1.39700	0.58984
15	2.2000"-03	4.8319"+00	NM	0.99218	0.71681	0.83900	1.37000	0.61241
16	2.4000"-03	5.0659"+00	NM	0.99393	0.73606	0.85300	1.34300	0.63515
17	2.6000"-03	5.3453"+00	NM	0.99657	0.75038	0.86900	1.31300	0.60188
18	2.8000"-03	5.5909"+00	NM	0.99823	0.77746	0.88200	1.28700	0.68531
19	3.0000"-03	5.8176"+00	NM	0.99661	0.79466	0.89200	1.26000	0.70794
20	3.3000"-03	6.2099"+00	NM	0.99813	0.82354	0.91000	1.22100	0.74529
21	3.6000"-03	6.6405"+00	NM	0.99724	0.85410	0.92700	1.17800	0.78693
22	3.9000"-03	7.0573"+00	NM	0.99626	0.88265	0.94200	1.13900	0.82704
23	4.2000"-03	7.4927"+00	NM	0.99446	0.91151	0.95600	1.10000	0.86909
24	4.5000"-03	7.9075"+00	NM	0.99634	0.93817	0.97000	1.06900	0.90739
25	4.8000"-03	8.2877"+00	NM	0.99596	0.96195	0.98100	1.04000	0.94327
26	5.2000"-03	8.5947"+00	NM	0.99693	0.98073	0.99000	1.01900	0.97154
27	5.6000"-03	8.7909"+00	NM	0.99850	0.99253	0.99600	1.00700	0.98908
28	6.0000"-03	8.8909"+00	NM	0.99939	0.99850	0.99900	1.00100	0.99800
D 29	6.4000"-03	8.9161"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

74010115 THOMAS PROFILE TABULATION 40 POINTS, DELTA AT POINT 40

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.99212	0.00000	0.00000	2.77794	0.00000
2	1.0000"-04	1.8976"+00	NM	0.99971	0.33404	0.51000	2.33100	0.21879
3	2.0000"-04	2.4882"+00	NM	1.00291	0.40912	0.60100	2.15800	0.27850
4	3.0000"-04	2.9181"+00	NM	1.00375	0.45398	0.65000	2.05000	0.31707
5	4.0000"-04	3.2481"+00	NM	1.00170	0.48519	0.68100	1.97000	0.34569
6	5.0000"-04	3.4928"+00	NM	0.99876	0.50696	0.70100	1.91200	0.36663
7	6.0000"-04	3.7817"+00	NM	0.99711	0.53142	0.72300	1.85100	0.39060
8	8.0000"-04	4.1983"+00	NM	0.99161	0.56469	0.75000	1.76400	0.42517
9	1.0000"-03	4.4226"+00	NM	0.98336	0.58178	0.76100	1.71100	0.44477
10	1.2000"-03	4.7277"+00	NM	0.98125	0.60421	0.77800	1.65800	0.46924
11	1.4000"-03	4.9734"+00	NM	0.98044	0.62166	0.79100	1.61900	0.48857
12	1.6000"-03	5.1840"+00	NM	0.98099	0.63623	0.80200	1.58900	0.50472
13	1.8000"-03	5.3927"+00	NM	0.98065	0.65033	0.81200	1.55900	0.52085
14	2.0000"-03	5.5980"+00	NM	0.98187	0.66390	0.82200	1.53300	0.53620
15	2.2000"-03	5.8120"+00	NM	0.98322	0.67775	0.83200	1.50700	0.55209
16	2.4000"-03	6.0090"+00	NM	0.98253	0.69024	0.84000	1.48100	0.56718
17	2.6000"-03	6.2080"+00	NM	0.98480	0.70264	0.84900	1.46000	0.58151
18	2.8000"-03	6.3827"+00	NM	0.98533	0.71333	0.85600	1.44000	0.59444
19	3.0000"-03	6.5588"+00	NM	0.98628	0.72394	0.86300	1.42100	0.60732
20	3.3000"-03	6.7908"+00	NM	0.98555	0.73771	0.87100	1.39400	0.62482
21	3.6000"-03	7.0580"+00	NM	0.98753	0.75324	0.88100	1.36800	0.64401
22	3.9000"-03	7.3374"+00	NM	0.98964	0.76913	0.89100	1.34200	0.66393
23	4.2000"-03	7.5873"+00	NM	0.99027	0.78307	0.89900	1.31800	0.68209
24	4.5000"-03	7.8639"+00	NM	0.99216	0.79821	0.90800	1.29400	0.70170
25	4.8000"-03	8.1012"+00	NM	0.99286	0.81097	0.91500	1.27300	0.71877
26	5.2000"-03	8.4067"+00	NM	0.99457	0.82711	0.92400	1.24800	0.74038
27	5.6000"-03	8.7264"+00	NM	0.99639	0.84366	0.93300	1.22300	0.76288
28	6.0000"-03	9.0538"+00	NM	0.99866	0.86028	0.94200	1.19900	0.78565
29	6.4000"-03	9.3700"+00	NM	1.00018	0.87603	0.95000	1.17600	0.80782
30	6.8000"-03	9.6380"+00	NM	1.00039	0.88916	0.95600	1.15600	0.82699
31	7.2000"-03	1.0025"+01	NM	1.00222	0.90780	0.96500	1.13000	0.85398
32	7.6000"-03	1.0339"+01	NM	1.00379	0.92258	0.97200	1.11000	0.87568
33	8.0000"-03	1.0586"+01	NM	1.00434	0.93408	0.97700	1.09400	0.89305
34	8.5000"-03	1.1021"+01	NM	1.00443	0.95402	0.98500	1.06600	0.92402
35	9.0000"-03	1.1343"+01	NM	1.00527	0.96850	0.99100	1.04700	0.94651
36	9.5000"-03	1.1612"+01	NM	1.00430	0.98040	0.99500	1.03000	0.96602
37	1.0000"-02	1.1799"+01	NM	1.00222	0.98863	0.99700	1.01700	0.98033
38	1.0500"-02	1.1901"+01	NM	1.00100	0.99305	0.99800	1.01000	0.98812
39	1.1000"-02	1.1980"/01	NM	1.00050	0.99651	0.99900	1.00500	0.99403
D 40	1.1500"-02	1.2061"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIAULES Y,U/UD,T/TD ASSUME P=PD

74010208 THOMAS PROFILE TABULATION 32 POINTS, DELTA AT POINT 32

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.99286	0.00000	0.00000	2.14619	0.00000
2	1.0000"-04	1.7260"+00	NM	0.99864	0.38115	0.51800	1.84700	0.28045
3	2.0000"-04	1.9975"+00	NM	0.99728	0.43382	0.57700	1.76900	0.32617
4	3.0000"-04	2.1488"+00	NM	0.99387	0.45898	0.60300	1.72600	0.34936
5	4.0000"-04	2.2919"+00	NM	0.99081	0.48105	0.62500	1.68800	0.37026
6	5.0000"-04	2.4273"+00	NM	0.98804	0.50075	0.64400	1.65400	0.38936
7	6.0000"-04	2.5120"+00	NM	0.98600	0.51256	0.65500	1.63300	0.40110
8	8.0000"-04	2.7465"+00	NM	0.98374	0.54365	0.68400	1.58300	0.43209
9	1.0000"-03	2.9446"+00	NM	0.98167	0.56836	0.70600	1.54300	0.45755
10	1.2000"-03	3.1112"+00	NM	0.98255	0.58821	0.72400	1.51500	0.47789
11	1.4000"-03	3.3081"+00	NM	0.98398	0.61074	0.74400	1.48400	0.50135
12	1.6000"-03	3.4583"+00	NM	0.98418	0.62733	0.75800	1.46000	0.51918
13	1.8000"-03	3.6295"+00	NM	0.98671	0.64567	0.77400	1.43700	0.53862
14	2.0000"-03	3.7930"+00	NM	0.98782	0.66268	0.78800	1.41400	0.55728
15	2.2000"-03	3.9838"+00	NM	0.99041	0.68194	0.80400	1.39000	0.57842
16	2.4000"-03	4.1500"+00	NM	0.99202	0.69827	0.81700	1.36900	0.59679
17	2.6000"-03	4.3643"+00	NM	0.99190	0.71874	0.83200	1.34000	0.62090
18	2.8000"-03	4.5348"+00	NM	0.99345	0.73461	0.84400	1.32000	0.63939
19	3.0000"-03	4.7417"+00	NM	0.99562	0.75339	0.85800	1.29700	0.66153
20	3.3000"-03	5.0660"+00	NM	0.99762	0.78187	0.87800	1.26100	0.69627
21	3.6000"-03	5.3504"+00	NM	1.00086	0.80601	0.89500	1.23300	0.72587
22	3.9000"-03	5.6648"+00	NM	1.00303	0.83185	0.91200	1.20200	0.75874
23	4.2000"-03	5.9997"+00	NM	1.00551	0.85849	0.92900	1.17100	0.79334
24	4.5000"-03	6.3148"+00	NM	1.00571	0.88281	0.94300	1.14100	0.82647
25	4.8000"-03	6.5966"+00	NM	1.00639	0.90401	0.95500	1.11600	0.85573
26	5.2000"-03	7.0228"+00	NM	1.00340	0.93512	0.97000	1.07600	0.90149
27	5.6000"-03	7.3652"+00	NM	1.00700	0.95937	0.98400	1.05200	0.93536
28	6.0000"-03	7.6758"+00	NM	1.00606	0.98085	0.99400	1.02700	0.96787
29	6.4000"-03	7.8261"+00	NM	1.00233	0.99107	0.99700	1.01200	0.98518
30	6.8000"-03	7.9067"+00	NM	1.00124	0.99651	0.99900	1.00500	0.99403
31	7.2000"-03	7.9512"+00	NM	1.00046	0.99950	1.00000	1.00100	0.99900
D 32	7.6000"-03	7.9587"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

74010215 THOMAS PROFILE TABULATION 36 POINTS, DELTA AT POINT 36

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.99150	0.00000	0.00000	1.96002	0.00000
2	1.0000"-04	1.5212"+00	NM	1.00369	0.36106	0.47900	1.76000	0.27216
3	2.0000"-04	1.7092"+00	NM	1.00347	0.41162	0.53700	1.70200	0.31551
4	3.0000"-04	1.8774"+00	NM	1.00229	0.44929	0.57800	1.65500	0.34924
5	4.0000"-04	1.9996"+00	NM	1.00018	0.47347	0.60300	1.62200	0.37176
6	5.0000"-04	2.0971"+00	NM	0.99842	0.49140	0.62100	1.59700	0.38885
7	6.0000"-04	2.1804"+00	NM	0.99598	0.50598	0.63500	1.57500	0.40317
8	8.0000"-04	2.3186"+00	NM	0.99384	0.52891	0.65700	1.54300	0.42579
9	1.0000"-03	2.4685"+00	NM	0.99218	0.55238	0.67900	1.51100	0.44937
10	1.2000"-03	2.5630"+00	NM	0.99137	0.56653	0.69200	1.49200	0.46381
11	1.4000"-03	2.6560"+00	NM	0.99004	0.58006	0.70400	1.47300	0.47794
12	1.6000"-03	2.7681"+00	NM	0.98925	0.59586	0.71800	1.45200	0.49449
13	1.8000"-03	2.8561"+00	NM	0.99004	0.60792	0.72900	1.43800	0.50695
14	2.0000"-03	2.9631"+00	NM	0.99139	0.62223	0.74200	1.42200	0.52180
15	2.2000"-03	3.0648"+00	NM	0.99041	0.63549	0.75300	1.40400	0.53632
16	2.4000"-03	3.1717"+00	NM	0.99182	0.64910	0.76500	1.38900	0.55076
17	2.6000"-03	3.2914"+00	NM	0.99364	0.66396	0.77800	1.37300	0.56664
18	2.8000"-03	3.4241"+00	NM	0.99360	0.68003	0.79100	1.35300	0.58463
19	3.0000"-03	3.5367"+00	NM	0.99468	0.69334	0.80200	1.33800	0.59940
20	3.3000"-03	3.7103"+00	NM	0.99085	0.71333	0.81800	1.31500	0.62205
21	3.6000"-03	3.9274"+00	NM	0.99773	0.73751	0.83700	1.28800	0.64984
22	3.9000"-03	4.1409"+00	NM	0.99828	0.76050	0.85400	1.26100	0.67724
23	4.2000"-03	4.3697"+00	NM	1.00098	0.78435	0.87200	1.23600	0.70550
24	4.5000"-03	4.5992"+00	NM	1.00363	0.80751	0.88900	1.21200	0.73350
25	4.8000"-03	4.8258"+00	NM	1.00428	0.82974	0.90400	1.18700	0.76158
26	5.2000"-03	5.1422"+00	NM	1.00615	0.85977	0.92400	1.15500	0.80000
27	5.6000"-03	5.4621"+00	NM	1.00851	0.88907	0.94300	1.12500	0.83822
28	6.0000"-03	5.7459"+00	NM	1.00894	0.91425	0.95800	1.09800	0.87250
29	6.4000"-03	6.0240"+00	NM	1.00767	0.93826	0.97100	1.07100	0.90663
30	6.8000"-03	6.3244"+00	NM	1.00607	0.96350	0.98400	1.04300	0.94343
31	7.2000"-03	6.5229"+00	NM	1.00477	0.97983	0.99200	1.02500	0.96780
32	7.6000"-03	6.6129"+00	NM	1.00316	0.98713	0.99500	1.01600	0.97933
33	8.0000"-03	6.6861"+00	NM	1.00169	0.99304	0.99700	1.00800	0.98909
34	8.5000"-03	6.7418"+00	NM	1.00053	0.99750	0.99900	1.00300	0.99601
35	9.0000"-03	6.7668"+00	NM	1.00051	0.99950	1.00000	1.00100	0.99900
D 36	9.5000"-03	6.7730"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

74010306 THOMAS PROFILE TABULATION 33 POINTS, DELTA AT POINT 33

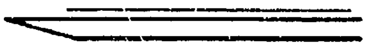
I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.99276	0.00000	0.00000	2.40823	0.00000
2	1.0000"-04	2.0880"+00	NM	0.99885	0.40540	0.56800	1.96300	0.28935
3	2.0000"-04	2.6029"+00	NM	1.00235	0.47377	0.64300	1.84200	0.34908
4	3.0000"-04	2.8434"+00	NM	0.99887	0.50176	0.67000	1.78300	0.37577
5	4.0000"-04	3.1176"+00	NM	0.99706	0.53160	0.69800	1.72400	0.40487
6	5.0000"-04	3.3566"+00	NM	0.99561	0.55615	0.72000	1.67600	0.42959
7	6.0000"-04	3.5489"+00	NM	0.99363	0.57507	0.73600	1.63800	0.44933
8	8.0000"-04	3.8270"+00	NM	0.99021	0.60129	0.75700	1.58500	0.47760
9	1.0000"-03	4.0822"+00	NM	0.98828	0.62431	0.77500	1.54100	0.50292
10	1.2000"-03	4.2767"+00	NM	0.98745	0.64127	0.78800	1.51000	0.52185
11	1.4000"-03	4.4816"+00	NM	0.98681	0.65864	0.80100	1.47900	0.54158
12	1.6000"-03	4.6733"+00	NM	0.98747	0.67446	0.81300	1.45300	0.55953
13	1.8000"-03	4.8543"+00	NM	0.98856	0.68906	0.82400	1.43000	0.57622
14	2.0000"-03	5.0398"+00	NM	0.99023	0.70370	0.83500	1.40600	0.59304
15	2.2000"-03	5.2397"+00	NM	0.99121	0.71912	0.84600	1.38400	0.61127
16	2.4000"-03	5.4520"+00	NM	0.99191	0.73514	0.85700	1.35900	0.63061
17	2.6000"-03	5.6118"+00	NM	0.99259	0.74697	0.86500	1.34100	0.64504
18	2.8000"-03	5.8332"+00	NM	0.99436	0.76304	0.87600	1.31800	0.66464
19	3.0000"-03	6.0181"+00	NM	0.99626	0.77620	0.88500	1.30000	0.68077
20	3.3000"-03	6.3544"+00	NM	0.99839	0.79957	0.90030	1.26700	0.71034
21	3.6000"-03	6.6454"+00	NM	1.00194	0.81924	0.91300	1.24200	0.73510
22	3.9000"-03	6.9669"+00	NM	1.00445	0.84043	0.92600	1.21400	0.76277
23	4.2000"-03	7.2661"+00	NM	1.00578	0.85967	0.93700	1.18800	0.78872
24	4.5000"-03	7.6050"+00	NM	1.00560	0.88096	0.94800	1.15800	0.81865
25	4.8000"-03	7.9533"+00	NM	1.00833	0.90229	0.96000	1.13200	0.84806
26	5.2000"-03	8.3540"+00	NM	1.00722	0.92623	0.97100	1.09900	0.88353
27	5.6000"-03	8.7584"+00	NM	1.00748	0.94978	0.98200	1.06900	0.91862
28	6.0000"-03	9.1203"+00	NM	1.00719	0.97036	0.99100	1.04300	0.95014
29	6.4000"-03	9.3514"+00	NM	1.00403	0.98327	0.99500	1.02400	0.97168
30	6.8000"-03	9.4747"+00	NM	1.00225	0.99009	0.99700	1.01400	0.98323
31	7.2000"-03	9.5735"+00	NM	1.00171	0.99552	0.99900	1.00700	0.99206
32	7.6000"-03	9.6371"+00	NM	1.00082	0.99900	1.00000	1.00200	0.99800
D 33	8.0000"-03	9.6554"+00	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

74010317 THOMAS PROFILE TABULATION 44 POINTS, DELTA AT POINT 44

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.99655	0.00000	0.00000	3.06309	0.00000
2	1.0000"-04	2.4938"+00	NM	0.95451	0.38175	0.57300	2.25300	0.25433
3	2.0000"-04	2.8997"+00	NM	0.95781	0.42128	0.61800	2.15200	0.28717
4	3.0000"-04	3.3171"+00	NM	0.96110	0.45786	0.65700	2.05900	0.31909
5	4.0000"-04	3.7315"+00	NM	0.96311	0.49123	0.69000	1.97300	0.34972
6	5.0000"-04	4.0681"+00	NM	0.96534	0.51663	0.71400	1.91000	0.37382
7	6.0000"-04	4.3306"+00	NM	0.96662	0.53556	0.73100	1.86300	0.39238
8	8.0000"-04	4.7413"+00	NM	0.96791	0.56384	0.75500	1.79300	0.42108
9	1.0000"-03	5.0891"+00	NM	0.96792	0.58668	0.77300	1.73600	0.44528
10	1.2000"-03	5.4150"+00	NM	0.96917	0.60728	0.78900	1.68800	0.46742
11	1.4000"-03	5.7163"+00	NM	0.97086	0.62570	0.80300	1.64700	0.48755
12	1.6000"-03	5.9722"+00	NM	0.97180	0.64093	0.81400	1.61300	0.50465
13	1.8000"-03	6.1956"+00	NM	0.97231	0.65392	0.82300	1.58400	0.51957
14	2.0000"-03	6.4649"+00	NM	0.97452	0.66924	0.83400	1.55300	0.53703
15	2.2000"-03	6.7099"+00	NM	0.97527	0.68287	0.84300	1.52400	0.55315
16	2.4000"-03	6.9421"+00	NM	0.97563	0.69553	0.85100	1.49700	0.56847
17	2.6000"-03	7.1459"+00	NM	0.97654	0.70647	0.85800	1.47500	0.58169
18	2.8000"-03	7.3316"+00	NM	0.97700	0.71628	0.86400	1.45500	0.59381
19	3.0000"-03	7.4828"+00	NM	0.97797	0.72417	0.86900	1.44000	0.60347
20	3.3000"-03	7.7323"+00	NM	0.97958	0.73700	0.87700	1.41600	0.61935
21	3.6000"-03	8.0188"+00	NM	0.97966	0.75146	0.88500	1.38700	0.63807
22	3.9000"-03	8.2670"+00	NM	0.98057	0.76376	0.89200	1.36400	0.65396
23	4.2000"-03	8.5187"+00	NM	0.98187	0.77604	0.89900	1.34200	0.66990
24	4.5000"-03	8.8108"+00	NM	0.98381	0.79004	0.90700	1.31800	0.68816
25	4.8000"-03	9.0575"+00	NM	0.98434	0.80168	0.91300	1.29700	0.70393
26	5.2000"-03	9.2994"+00	NM	0.98558	0.81292	0.91900	1.27800	0.71909
27	5.6000"-03	9.6394"+00	NM	0.98708	0.82847	0.92700	1.25200	0.74042
28	6.0000"-03	9.9010"+00	NM	0.98843	0.84023	0.93300	1.23300	0.75669
29	6.4000"-03	1.0216"+01	NM	0.99012	0.85419	0.94000	1.21100	0.77622
30	6.8000"-03	1.0531"+01	NM	0.99027	0.86793	0.94600	1.18800	0.79630
31	7.2000"-03	1.0833"+01	NM	0.99144	0.88088	0.95200	1.16800	0.81507
32	7.6000"-03	1.1078"+01	NM	0.99300	0.89125	0.95700	1.15300	0.83001
33	8.0000"-03	1.1401"+01	NM	0.99427	0.90471	0.96300	1.13300	0.84996
34	8.5000"-03	1.1800"+01	NM	0.99559	0.92110	0.97000	1.10900	0.87466
35	9.0000"-03	1.2137"+01	NM	0.99532	0.93474	0.97500	1.08800	0.89614
36	9.5000"-03	1.2479"+01	NM	0.99738	0.94837	0.98100	1.07000	0.91682
37	1.0000"-02	1.2809"+01	NM	0.99816	0.96132	0.98600	1.05200	0.93726
38	1.0500"-02	1.3089"+01	NM	0.99861	0.97218	0.99000	1.03700	0.95468
39	1.1000"-02	1.3302"+01	NM	0.99905	0.98034	0.99300	1.02600	0.96784
40	1.1500"-02	1.3493"+01	NM	0.99815	0.98762	0.99500	1.01500	0.98030
41	1.2000"-02	1.3675"+01	NM	0.99758	0.99452	0.99700	1.00500	0.99204
42	1.2500"-02	1.3715"+01	NM	0.99861	0.99601	0.99800	1.00400	0.99402
43	1.3000"-02	1.3794"+01	NM	0.99865	0.99900	0.99900	1.00000	0.99900
D 44	1.3500"-02	1.3821"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,T/TD ASSUME P=PD

	M : 2.5 - 4.5 (6 values) R THETA X 10^{-3} : 5 - 30 TW/TR : 1	7402 ZPG - AW

Continuous wind tunnel with flexible nozzle. W = 0.91, H = 1.22 m.
0.06 < PO < 0.88 MN/m^2. TO : 315 K. Air: Dew point 243 K. 6 < RE/m X 10^{-6} < 30.

MABEY D.G., MEIER H.U. and SAWYER W.G. 1974. Experimental and theoretical studies of the boundary layer on a flat plate at Mach numbers from 2.5 to 4.5. RAE TR 74127.
And Mabey D.G. private communications, Hastings & Sawyer - CAT 7006, Mabey et al. (1971), Mabey & Sawyer (1974).

1 The test boundary layer was formed on a flat plate 1.65 m long and 0.889 m wide. It was mounted on the tunnel centre line with a gap of 13 mm on each side between the plate and the tunnel wall. The leading edge (X = 0) was chamfered at 10° with a 0.25 mm nose thickness. Twenty two removable instrument plugs (diameter 41.3 mm) were arranged in five longitudinal rows in the central 127 mm of the plate, which was a modification of that used by Hastings & Sawyer (CAT 7006). An attempt was made to minimize heat transfer by providing layers of heat insulation on the back surface of the plate and between the plate and its support. Surface roughness was within 0.64 μm except for the transition strip from X = 2.54 to 5.08 mm where
3 Ballotini (small glass spheres) of 0.28 mm diameter were distributed sparsely. All measurements were made in fully turbulent flow. The transition position was derived from surface hot-film measurements.
2 A comprehensive programme of improvements to the tunnel (Mabey & Sawyer 1974) had reduced total temperature fluctuations in the working section to about 0.1 %, and Mach number variations along the plate to about 0.3 %. The spanwise total temperature distribution across the empty tunnel in the plane of the plate was found to
5 be steady and uniform within ± 0.5 K. There was evidence of flow convergence towards the centre line. This was very slight but nevertheless its contribution to the momentum equation was up to 14 % at M = 4.

6 Twenty one static pressure tappings of 1 mm diameter were distributed over the whole plate surface. Surface temperatures were measured using chromel-alumel surface thermocouples. The results agreed well with those derived from the cold resistance of platinum surface hot films installed to detect the beginning and end of transition. Wall shear stress was found using two Kistler type 322 m 102 balances with an element diameter of 9.75 mm. Of the four FEB available, only two were used for the results presented here. These two gave consistent and repeatable readings to within 1 % at the higher stress levels (Mabey & Gaudet, 1975).

7 The profiles were measured with a combined Pitot and TO probe (Meier 1969). The principle on which this operates is described in CAT 7003. For the probe used here, d_1 = 0.61, d_2 = 0.53, l = 20 mm. The first 13 mm of the probe were inclined downwards towards the surface at $3^{\circ}22'$, and this portion was tapered so that at the back end d_1 = 1.2 mm. The probe support was circular (d = 2 mm) and passed through the surface of the instrument plug.

8 All the measurements were made on one row of plugs, on the centre line. The profile normals were at X = 0.368, 0.623, 0.876, 1.130 and 1.384 m. The balance centres were 12 mm downstream of the profile normals.

9 No correction has been made to the CF values to allow for the small systematic x difference, as the appropriate
10 adjustments would have been very much smaller than the likely error of the balance measurements. A probe displacement correction was applied by adding y = 0.15 d_1 to all ordinates.

12 The data were received as a private communication before the catalogue project came in to existence. The profiles are given in great detail - about 50 points each. The experimental scatter was very small, so at that time punched cards were prepared, as a general rule, only for every other data point. To save labour, the editors have chosen to use the existing card-deck, so that only about half the data-points are presented. (e.g. 1801-08)
13 Some profiles which were not included in the original card-deck have been punched in full. The 72 profiles presented form 18 sets of up to five successive stations. For each of six Mach numbers, three different

values of unit Reynolds number are given. There is additionally (0100) one odd profile at a specially low unit Reynolds number providing a check on low Reynolds number effects. The authors present an additional 19 profiles which were influenced by flow from the gap between the tunnel wall and the side of the plate. This effect was eliminated by the addition of fences on the plate, and only those runs with the fences

14 are presented here. The CF value is the authors', obtained by interpolation on the basis of unit Reynolds number.

§ DATA 7402 0100-1805. NX up to 5. PT2 and TO profiles taken with the same probe. CF obtained separately with FEB.

15 Editors' comments

The tests described here provide a very large pool of very carefully observed basic flat plate data. In the earlier tests by Hastings & Sawyer - CAT 7006, an enthalpy deficit was observed in the boundary layer. In these later tests, special efforts were made to eliminate the possibility of heat-transfer. Nevertheless, an enthalpy deficit was still observed. This has been ascribed to various possible instrumental effects, but represents a minor departure from the first law of thermodynamics as compared to many other experiments. Some further measurements have been made using an ECP for the TO profile (private communication). The apparent enthalpy deficit is reduced but not eliminated.*

The profiles were originally described in very fine detail (see § 12 above) and conform in most respects to the behaviour expected of a ZPG layer. On a transformed wall-law plot, series 16 appears non-characteristic, showing a "hump" in the innermost part of the log-law region. Some slight disturbance is also visible in 1301/03/05 and 1001.

The comment above is in no way intended to be adverse, and these must be regarded, for the present, as the basic source for adiabatic flat plate data in this range of Mach and Reynolds number.

*Note added in proof: These studies are described, together with the original experiment, by Mabey and Sawyer (1976) ARC R&M 37.84.

CAT 7402 HABEY BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * PUD TOD*	TW/TR PW/PD* SW *	RED2W RED20 D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
74020100	2.4701	1.0069	3.5148"+03	1.8000"-03	3.8319	1.3819	3.9084"+03	3.9084"+03
8.7600"-01	6.3743"+04	1.0000	6.5823"+03	NM	1.7915	1.7755	2.9526"+02	1.4007"+02
INFINITE	3.1100"+02	0.0000	1.1285"-03	0.0000"+00	0.1169	1.5564"-03	5.8614"+02	2.9322"+02
74020101	2.4929	1.0133	3.0988"+03	1.8500"-03	3.9413	1.4577	7.6903"+03	7.6903"+03
3.6800"-01	1.2995"+05	1.0000	5.8885"+03	NM	1.7925	1.7772	2.9506"+02	1.3777"+02
INFINITE	3.0900"+02	0.0000	4.9677"-04	0.0000"+00	0.1268	6.8081"-04	5.8666"+02	2.9119"+02
74020102	2.4920	1.0050	4.6668"+03	1.7200"-03	3.9023	1.3855	7.6339"+03	7.6339"+03
6.2300"-01	1.2882"+05	1.0000	8.8087"+03	NM	1.8025	1.7887	2.9265"+02	1.3782"+02
INFINITE	3.0900"+02	0.0000	7.4932"-04	0.0000"+00	0.1059	1.0281"-03	5.8657"+02	2.9120"+02
74020103	2.4816	1.0015	6.0672"+03	1.6000"-03	3.9177	1.3445	7.7526"+03	7.7526"+03
8.7600"-01	1.2872"+05	1.0000	1.1370"+04	NM	1.8121	1.7907	2.9265"+02	1.3891"+02
INFINITE	3.1000"+02	0.0000	9.6706"-04	0.0000"+00	0.0700	1.3248"-03	5.8642"+02	2.9221"+02
74020201	2.4947	1.0050	3.9386"+03	1.7200"-03	4.0047	1.4437	1.0170"+04	1.0170"+04
3.6800"-01	1.7234"+05	1.0000	7.4423"+03	NM	1.8012	1.7860	2.9265"+02	1.3766"+02
INFINITE	3.0900"+02	0.0000	4.7389"-04	0.0000"+00	0.1012	6.5317"-04	5.8685"+02	2.9118"+02
74020202	2.4900	1.0017	5.9449"+03	1.6400"-03	3.9029	1.3944	1.0140"+04	1.0140"+04
6.2300"-01	1.7057"+05	1.0000	1.1179"+04	NM	1.8038	1.7887	2.9265"+02	1.3839"+02
INFINITE	3.1000"+02	0.0000	7.2070"-04	0.0000"+00	0.1072	9.8518"-04	5.8731"+02	2.9215"+02
74020203	2.4939	1.0083	7.8437"+03	1.6200"-03	3.9154	1.3490	1.0195"+04	1.0195"+04
8.7600"-01	1.7255"+05	1.0000	1.4861"+04	NM	1.8149	1.8013	2.9265"+02	1.3726"+02
INFINITE	3.0800"+02	0.0000	9.4037"-04	0.0000"+00	0.0836	1.2864"-03	5.8582"+02	2.9024"+02
74020301	2.4957	1.0083	4.7735"+03	1.6700"-03	4.0646	1.4430	1.2656"+04	1.2656"+04
3.6800"-01	2.1479"+05	1.0000	9.0504"+03	NM	1.8036	1.7881	2.9265"+02	1.3715"+02
INFINITE	3.0800"+02	0.0000	4.6052"-04	0.0000"+00	0.0802	6.3763"-04	5.8601"+02	2.9023"+02
74020302	2.4974	1.0019	7.2433"+03	1.6000"-03	3.9122	1.3900	1.2753"+04	1.2753"+04
6.2300"-01	2.1701"+05	1.0000	1.3662"+04	NM	1.8076	1.7926	2.9265"+02	1.3794"+02
INFINITE	3.1000"+02	0.0000	6.9498"-04	0.0000"+00	0.1079	9.4994"-04	5.8808"+02	2.9211"+02
74020303	2.5001	1.0019	9.0948"+03	1.5600"-03	3.8610	1.3446	1.2589"+04	1.2589"+04
8.7600"-01	2.1513"+05	1.0000	1.7172"+04	NM	1.8172	1.8044	2.9265"+02	1.3777"+02
INFINITE	3.1000"+02	0.0000	8.8247"-04	0.0000"+00	0.1039	1.1965"-03	5.8837"+02	2.9209"+02
74020401	2.7820	1.0012	3.8751"+03	1.6300"-03	4.5214	1.3989	5.5606"+03	5.5606"+03
6.2300"-01	1.4681"+05	1.0000	8.1563"+03	NM	1.8019	1.7843	2.9265"+02	1.2245"+02
INFINITE	3.1200"+02	0.0000	7.2124"-04	0.0000"+00	0.1212	1.0523"-03	6.1724"+02	2.9229"+02
74020402	2.7876	0.9981	5.0023"+03	1.5400"-03	4.4843	1.3497	5.5076"+03	5.5076"+03
8.7600"-01	1.4666"+05	1.0000	1.0521"+04	NM	1.8114	1.7959	2.9265"+02	1.2255"+02
INFINITE	3.1300"+02	0.0000	9.3844"-04	0.0000"+00	0.1118	1.3592"-03	6.1871"+02	2.9319"+02
74020501	2.7933	1.0047	3.2220"+03	1.6600"-03	4.6023	1.4444	7.2803"+03	7.2803"+03
3.6800"-01	1.9556"+05	1.0000	6.8333"+03	NM	1.8039	1.7854	2.9265"+02	1.2146"+02
INFINITE	3.1100"+02	0.0000	4.5432"-04	0.0000"+00	0.1295	6.6649"-04	6.1723"+02	2.9129"+02
74020502	2.7884	1.0014	4.9158"+03	1.5300"-03	4.5118	1.3957	7.3505"+03	7.3505"+03
6.2300"-01	1.9598"+05	1.0000	1.0374"+04	NM	1.8058	1.7877	2.9265"+02	1.2211"+02
INFINITE	3.1200"+02	0.0000	6.8958"-04	0.0000"+00	0.1296	1.0053"-03	6.1779"+02	2.9225"+02
74020503	2.7915	0.9982	6.4362"+03	1.4800"-03	4.4999	1.3491	7.3149"+03	7.3149"+03
8.7600"-01	1.9595"+05	1.0000	1.3559"+04	NM	1.8121	1.7974	2.9265"+02	1.2234"+02
INFINITE	3.1300"+02	0.0000	9.0707"-04	0.0000"+00	0.1063	1.3096"-03	6.1905"+02	2.9317"+02
74020601	2.7923	1.0079	3.9257"+03	1.5900"-03	4.6837	1.4441	9.1020"+03	9.1020"+03
3.6800"-01	2.4413"+05	1.0000	8.3474"+03	NM	1.8040	1.7869	2.9265"+02	1.2112"+02
INFINITE	3.1000"+02	0.0000	4.4230"-04	0.0000"+00	0.0950	6.4739"-04	6.1615"+02	2.9036"+02
74020602	2.7898	1.0046	6.0846"+03	1.4800"-03	4.3616	1.3812	9.2160"+03	9.2160"+03
6.1700"-01	2.4624"+05	1.0000	1.2886"+04	NM	1.8125	1.7953	2.9265"+02	1.2165"+02
INFINITE	3.1100"+02	0.0000	6.7912"-04	0.0000"+00	0.1734	9.7532"-04	6.1692"+02	2.9131"+02
74020603	2.7932	0.9983	7.8129"+03	1.4300"-03	4.4375	1.3416	9.0793"+03	9.0793"+03
8.7600"-01	2.4385"+05	1.0000	1.6470"+04	NM	1.8191	1.8032	2.9265"+02	1.2225"+02
INFINITE	3.1300"+02	0.0000	8.0626"-04	0.0000"+00	0.1292	1.2748"-03	6.1920"+02	2.9316"+02

CAT 7402 MABEY BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
74020701	2.9922	1.0026	2.3737"+03	1.6800"-03	4.9490	1.4270	4.5953"+03	4.5953"+03
3.6800"-01	1.6683"+05	1.0000	5.4314"+03	NM	1.8080	1.7888	2.9195"+02	1.1180"+02
INFINITE	3.1200"+02	0.0000	4.7405"-04	0.0000"+00	0.1604	7.1723"-04	6.3434"+02	2.9118"+02
74020702	2.9863	1.0047	3.5460"+03	1.5500"-03	4.9064	1.3763	4.6388"+03	4.6388"+03
6.2300"-01	1.6693"+05	1.0000	8.1124"+03	NM	1.8097	1.7919	2.9165"+02	1.1173"+02
INFINITE	3.1100"+02	0.0000	7.0211"-04	0.0000"+00	0.1451	1.0624"-03	6.3288"+02	2.9028"+02
74020703	2.9857	0.9943	4.5400"+03	1.4600"-03	4.8943	1.3646	4.6286"+03	4.6286"+03
8.7600"-01	1.6641"+05	1.0000	1.0283"+04	NM	1.8113	1.7917	2.9140"+02	1.1283"+02
INFINITE	3.1400"+02	0.0000	9.0493"-04	0.0000"+00	0.1423	1.3666"-03	6.3568"+02	2.9308"+02
74020704	2.9593	1.0058	6.1329"+03	1.4100"-03	4.8899	1.3546	4.9008"+03	4.9008"+03
1.1300"+00	1.6934"+05	1.0000	1.3901"+04	NM	1.8062	1.7870	2.9115"+02	1.1267"+02
INFINITE	3.1000"+02	0.0000	1.1632"-03	0.0000"+00	0.1202	1.7666"-03	6.2979"+02	2.8948"+02
74020801	2.9959	1.0059	2.9995"+03	1.5700"-03	5.0294	1.4339	6.1149"+03	6.1149"+03
3.6800"-01	2.2324"+05	1.0000	6.8944"+03	NM	1.8079	1.7885	2.9195"+02	1.1127"+02
INFINITE	3.1100"+02	0.0000	4.4853"-04	0.0000"+00	0.1429	6.8302"-04	6.3361"+02	2.9023"+02
74020802	2.9910	1.0048	4.5090"+03	1.4700"-03	4.9106	1.3834	6.1826"+03	6.1826"+03
6.2300"-01	2.2406"+05	1.0000	1.0335"+04	NM	1.8113	1.7920	2.9165"+02	1.1150"+02
INFINITE	3.1100"+02	0.0000	6.6813"-04	0.0000"+00	0.1517	1.0109"-03	6.3324"+02	2.9025"+02
74020803	2.9869	0.9975	5.9021"+03	1.3800"-03	4.9115	1.3446	6.2279"+03	6.2279"+03
8.7600"-01	2.2431"+05	1.0000	1.3415"+04	NM	1.8188	1.8006	2.9140"+02	1.1242"+02
INFINITE	3.1300"+02	0.0000	8.7236"-04	0.0000"+00	0.1292	1.3145"-03	6.3496"+02	2.9214"+02
74020804	2.9702	1.0027	7.5206"+03	1.3700"-03	4.8351	1.3346	6.3494"+03	6.3494"+03
1.1300"+00	2.2302"+05	1.0000	1.7071"+04	NM	1.8152	1.7983	2.9115"+02	1.1250"+02
INFINITE	3.1100"+02	0.0000	1.0961"-03	0.0000"+00	0.1324	1.6411"-03	6.3165"+02	2.9036"+02
74020901	2.9982	1.0092	3.5187"+03	1.4900"-03	5.1791	1.4468	7.5789"+03	7.5789"+03
3.6800"-01	2.7764"+05	1.0000	8.1201"+03	NM	1.8064	1.7863	2.9195"+02	1.1060"+02
INFINITE	3.1000"+02	0.0000	4.2331"-04	0.0000"+00	0.1035	6.4988"-04	6.3276"+02	2.8928"+02
74020902	2.9943	1.0081	5.3560"+03	1.4200"-03	4.9723	1.3936	7.6076"+03	7.6076"+03
6.2300"-01	2.7707"+05	1.0000	1.2331"+04	NM	1.8109	1.7911	2.9165"+02	1.1099"+02
INFINITE	3.1000"+02	0.0000	6.4278"-04	0.0000"+00	0.1388	9.7445"-04	6.3247"+02	2.8930"+02
74020903	2.9910	0.9975	7.2296"+03	1.3500"-03	4.8716	1.3645	7.6647"+03	7.6647"+03
8.7600"-01	2.7777"+05	1.0000	1.6460"+04	NM	1.8132	1.7940	2.9140"+02	1.1222"+02
INFINITE	3.1300"+02	0.0000	8.6632"-04	0.0000"+00	0.1514	1.3015"-03	6.3527"+02	2.9212"+02
74020904	2.9732	1.0028	9.1120"+03	1.3400"-03	4.7570	1.3233	7.8836"+03	7.8836"+03
1.1300"+00	2.7816"+05	1.0000	2.0708"+04	NM	1.8214	1.8053	2.9115"+02	1.1236"+02
INFINITE	3.1100"+02	0.0000	1.0679"-03	0.0000"+00	0.1528	1.5813"-03	6.3188"+02	2.9034"+02
74021001	3.4828	1.0098	2.2783"+03	1.4700"-03	6.1576	1.4113	3.8709"+03	3.8709"+03
3.6800"-01	2.8811"+05	1.0000	6.3415"+03	NM	1.8190	1.7975	2.9280"+02	9.1361"+01
INFINITE	3.1300"+02	0.0000	4.2043"-04	0.0000"+00	0.17	7.0026"-04	6.6745"+02	2.8995"+02
74021002	3.4917	1.0052	3.3643"+03	1.3500"-03	6.1663	1.3925	3.8338"+03	3.8338"+03
6.2300"-01	2.8898"+05	1.0000	9.3574"+03	NM	1.8132	1.7884	2.9235"+02	9.1322"+01
INFINITE	3.1400"+02	0.0000	6.2440"-04	0.0000"+00	0.1746	1.0517"-03	6.6991"+02	2.9084"+02
74021003	3.4974	0.9942	4.3758"+03	1.2900"-03	5.7448	1.2819	3.7704"+03	3.7704"+03
8.7600"-01	2.8651"+05	1.0000	1.2071"+04	NM	1.8301	1.8216	2.9190"+02	9.1981"+01
INFINITE	3.1700"+02	0.0000	8.2640"-04	0.0000"+00	0.2279	1.3237"-03	6.7252"+02	2.9360"+02
74021004	3.4888	0.4990	5.4676"+03	1.2300"-03	5.9480	1.3358	3.8628"+03	3.8628"+03
1.1300"+00	2.8997"+05	1.0000	1.5109"+04	NM	1.8205	1.7978	2.9150"+02	9.1721"+01
INFINITE	3.1500"+02	0.0000	1.0079"-03	0.0000"+00	0.2029	1.6499"-03	6.6991"+02	2.9178"+02
74021101	3.4867	1.0067	2.7703"+03	1.3900"-03	6.1832	1.4428	4.8210"+03	4.8210"+03
3.6800"-01	3.6082"+05	1.0000	7.6990"+03	NM	1.8122	1.7867	2.9280"+02	9.1507"+01
INFINITE	3.1400"+02	0.0000	4.1035"-04	0.0000"+00	0.1900	6.9082"-04	6.6873"+02	2.9086"+02
74021102	3.4955	1.0052	4.0028"+03	1.2900"-03	6.1994	1.3817	4.7569"+03	4.7569"+03
6.2300"-01	3.6051"+05	1.0000	1.1150"+04	NM	1.8167	1.7931	2.9235"+02	9.1181"+01
INFINITE	3.1400"+02	0.0000	5.9761"-04	0.0000"+00	0.1642	1.0058"-03	6.6922"+02	2.9083"+02
74021103	3.5012	0.9974	5.2031"+03	1.2300"-03	6.0338	1.3460	4.7053"+03	4.7053"+03
8.7600"-01	3.5950"+05	1.0000	1.4419"+04	NM	1.8220	1.8008	2.9190"+02	9.1550"+01
INFINITE	3.1600"+02	0.0000	7.8469"-04	0.0000"+00	0.1907	1.2972"-03	6.7167"+02	2.9266"+02
74021104	3.4907	1.0055	6.5384"+03	1.1900"-03	6.0056	1.3369	4.8039"+03	4.8039"+03
1.1300"+00	3.6159"+05	1.0000	1.8194"+04	NM	1.8224	1.7999	2.9150"+02	9.1068"+01
INFINITE	3.1300"+02	0.0000	9.6518"-04	0.0000"+00	0.1867	1.5927"-03	6.6789"+02	2.8992"+02

CAT 7402 HABEY BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X * RZ	MD * POD TOD*	TW/TR PW/PD* SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
74021201	3.4888	1.0067	3.2060"+03	1.3300"-03	6.2751	1.4288	5.8184"+03	5.8184"+03
3.6800"-01	4.3677"+05	1.0000	8.9175"+03	NM	1.8149	1.7926	2.9280"+02	9.1429"+01
INFINITE	3.1400"+02	0.0000	3.9308"-04	0.0000"+00	0.1604	6.6248"-04	6.6885"+02	2.9085"+02
74021202	3.4978	1.0085	4.7335"+03	1.2500"-03	6.1010	1.3860	5.7027"+03	5.7027"+03
6.2300"-01	4.3360"+05	1.0000	1.3238"+04	NM	1.8194	1.7944	2.9235"+02	9.0806"+01
INFINITE	3.1300"+02	0.0000	5.8790"-04	0.0000"+00	0.1922	9.8045"-04	6.6828"+02	2.8989"+02
74021203	3.5029	0.9974	6.2503"+03	1.1900"-03	6.0382	1.3721	5.6621"+03	5.6621"+03
8.7600"-01	4.3364"+05	1.0000	1.7333"+04	NM	1.8188	1.7929	2.9190"+02	9.1486"+01
INFINITE	3.1600"+02	0.0000	7.8269"-04	0.0000"+00	0.2048	1.3018"-03	6.7176"+02	2.9265"+02
74021204	3.4962	1.0023	7.6089"+03	1.1700"-03	5.9227	1.3350	5.7147"+03	5.7147"+03
1.1300"+00	4.3353"+05	1.0000	2.1153"+04	NM	1.8260	1.8032	2.9150"+02	9.1155"+01
INFINITE	3.1400"+02	0.0000	9.4314"-04	0.0000"+00	0.2094	1.5401"-03	6.6926"+02	2.9082"+02
74021301	3.9973	1.0084	1.6951"+03	1.4000"-03	7.2268	1.4173	2.4426"+03	2.4426"+03
3.6800"-01	3.6954"+05	1.0000	5.7141"+03	NM	1.8267	1.7976	2.9340"+02	7.5316"+01
INFINITE	3.1600"+02	0.0000	3.9279"-04	0.0000"+00	0.2743	7.0393"-04	6.9553"+02	2.9097"+02
74021302	3.9853	1.0036	2.5602"+03	1.2600"-03	7.3378	1.3510	2.4838"+03	2.4838"+03
6.2300"-01	3.6980"+05	1.0000	8.5608"+03	NM	1.8284	1.8046	2.9205"+02	7.5661"+01
INFINITE	3.1600"+02	0.0000	5.8442"-04	0.0000"+00	0.2231	1.0650"-03	6.9504"+02	2.9100"+02
74021303	3.9840	0.9933	3.2960"+03	1.1800"-03	7.2833	1.3582	2.4629"+03	2.4629"+03
8.7600"-01	3.6605"+05	1.0000	1.0913"+04	NM	1.8186	1.7926	2.9090"+02	7.6178"+01
INFINITE	3.1800"+02	0.0000	7.5928"-04	0.0000"+00	0.2344	1.3914"-03	6.9718"+02	2.9285"+02
74021304	3.9869	0.9985	4.1841"+03	1.1200"-03	7.2528	1.3451	2.4679"+03	2.4679"+03
1.1300"+00	3.6822"+05	1.0000	1.3954"+04	NM	1.8217	1.7932	2.8965"+02	7.5376"+01
INFINITE	3.1500"+02	0.0000	9.5294"-04	0.0000"+00	0.2418	1.7514"-03	6.9400"+02	2.9008"+02
74021305	3.9688	0.9758	4.8600"+03	1.0700"-03	7.1988	1.3168	2.5158"+03	2.5158"+03
1.3840"+00	3.6638"+05	1.0000	1.5750"+04	NM	1.8290	1.8029	2.8850"+02	7.7344"+01
INFINITE	3.2100"+02	0.0000	1.1015"-03	0.0000"+00	0.2295	1.9988"-03	6.9981"+02	2.9566"+02
74021401	4.0034	1.0116	2.0929"+03	1.3000"-03	7.3910	1.4069	3.0175"+03	3.0175"+03
3.6800"-01	4.6025"+05	1.0000	7.0938"+03	NM	1.8246	1.7995	2.9340"+02	7.4903"+01
INFINITE	3.1500"+02	0.0000	3.9090"-04	0.0000"+00	0.2426	7.1203"-04	6.9469"+02	2.9003"+02
74021402	3.9890	1.0036	3.1607"+03	1.1800"-03	7.3775	1.3712	3.0709"+03	3.0709"+03
6.2300"-01	4.5947"+05	1.0000	1.0584"+04	NM	1.8239	1.7926	2.9205"+02	7.5554"+01
INFINITE	3.1600"+02	0.0000	5.8262"-04	0.0000"+00	0.2375	1.0905"-03	6.9519"+02	2.9099"+02
74021403	3.9887	0.9934	4.0408"+03	1.1200"-03	7.2649	1.3340	3.0537"+03	3.0537"+03
8.7600"-01	4.5672"+05	1.0000	1.3403"+04	NM	1.8253	1.8019	2.9090"+02	7.6041"+01
INFINITE	3.1800"+02	0.0000	7.4921"-04	0.0000"+00	0.2339	1.3677"-03	6.9737"+02	2.9284"+02
74021404	3.9871	0.9954	5.0302"+03	1.0700"-03	7.2093	1.3387	3.0598"+03	3.0598"+03
1.1300"+00	4.5665"+05	1.0000	1.6724"+04	NM	1.8241	1.7967	2.8965"+02	7.5609"+01
INFINITE	3.1600"+02	0.0000	9.2541"-04	0.0000"+00	0.2477	1.6901"-03	6.9511"+02	2.9100"+02
74021405	3.9734	0.9789	5.9837"+03	1.0400"-03	7.2217	1.3284	3.1251"+03	3.1251"+03
1.3840"+00	4.5793"+05	1.0000	1.9485"+04	NM	1.8259	1.7987	2.8850"+02	7.6968"+01
INFINITE	3.2000"+02	0.0000	1.0879"-03	0.0000"+00	0.2307	1.9780"-03	6.9892"+02	2.9472"+02
74021501	4.0088	1.0117	2.7857"+03	1.1900"-03	7.5545	1.4417	4.1993"+03	4.1993"+03
3.6800"-01	6.4512"+05	1.0000	9.4613"+03	NM	1.8161	1.7859	2.9340"+02	7.4749"+01
INFINITE	3.1500"+02	0.0000	3.7298"-04	0.0000"+00	0.2299	6.9491"-04	6.9491"+02	2.9001"+02
74021502	3.9951	1.0069	4.0773"+03	1.1100"-03	7.4974	1.4001	4.2486"+03	4.2486"+03
6.2300"-01	6.4089"+05	1.0000	1.3728"+04	NM	1.8166	1.7864	2.9205"+02	7.5140"+01
INFINITE	3.1500"+02	0.0000	5.4091"-04	0.0000"+00	0.2165	1.0068"-03	6.9434"+02	2.9005"+02
74021503	3.9948	0.9935	5.4533"+03	1.0500"-03	7.2031	1.3441	4.2500"+03	4.2500"+03
8.7600"-01	6.4083"+05	1.0000	1.8131"+04	NM	1.8280	1.8017	2.9090"+02	7.5864"+01
INFINITE	3.1800"+02	0.0000	7.2454"-04	0.0000"+00	0.2549	1.3137"-03	6.9763"+02	2.9282"+02
74021504	3.9929	0.9954	6.5636"+03	1.0300"-03	7.2446	1.3286	4.2624"+03	4.2624"+03
1.1300"+00	6.4109"+05	1.0000	2.1870"+04	NM	1.8304	1.8048	2.8965"+02	7.5442"+01
INFINITE	3.1600"+02	0.0000	8.6459"-04	0.0000"+00	0.2357	1.5587"-03	6.9535"+02	2.9098"+02
74021505	3.9810	0.9820	8.0893"+03	1.0000"-03	7.1309	1.3187	4.3384"+03	4.3384"+03
1.3840"+00	6.4223"+05	1.0000	2.6500"+04	NM	1.8325	1.8061	2.8850"+02	7.6505"+01
INFINITE	3.1900"+02	0.0000	1.0541"-03	0.0000"+00	0.2475	1.8821"-03	6.9815"+02	2.9378"+02

CAT 7402 MABEY BOUNDARY CONDITIONS AND EVALUATED DATA, SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2	H42	D2K	UD	TR
74021601	4.4967	1.0208	1.0792"+03	1.3700"-03	8.4073	1.4254	1.6036"+03	1.6036"+03
3.6800"-01	4.6220"+05	1.0000	4.4028"+03	NM	1.8447	1.8092	2.9475"+02	6.2450"+01
INFINITE	3.1500"+02	0.0000	3.0942"-04	0.0000"+00	0.3512	5.9010"-04	7.1247"+02	2.8873"+02
74021602	4.4898	1.0127	1.7891"+03	1.2400"-03	8.3617	1.3942	1.6106"+03	1.6106"+03
6.2300"-01	4.6022"+05	1.0000	7.2311"+03	NM	1.8324	1.7944	2.9335"+02	6.2802"+01
INFINITE	3.1600"+02	0.0000	5.1109"-04	0.0000"+00	0.3464	9.9601"-04	7.1339"+02	2.8967"+02
74021603	4.4851	1.0027	2.3256"+03	1.1500"-03	8.4056	1.3408	1.6229"+03	1.6229"+03
8.7600"-01	4.6103"+05	1.0000	9.2988"+03	NM	1.8352	1.8046	2.9230"+02	6.3306"+01
INFINITE	3.1800"+02	0.0000	6.6083"-04	0.0000"+00	0.3189	1.2933"-03	7.1549"+02	2.9151"+02
74021604	4.4835	1.0088	3.0658"+03	1.0500"-03	8.5812	1.3558	1.6316"+03	1.6316"+03
1.1300"+00	4.6259"+05	1.0000	1.2335"+04	NM	1.8285	1.7927	2.9130"+02	6.2745"+01
INFINITE	3.1500"+02	0.0000	8.6063"-04	0.0000"+00	0.2956	1.7229"-03	7.1206"+02	2.8877"+02
74021605	4.4719	0.9920	3.5518"+03	1.0100"-03	8.5780	1.3409	1.6510"+03	1.6510"+03
1.3840"+00	4.6134"+05	1.0000	1.4018"+04	NM	1.8305	1.7958	2.8920"+02	6.3605"+01
INFINITE	3.1800"+02	0.0000	9.8910"-04	0.0000"+00	0.2841	1.9748"-03	7.1507"+02	2.9154"+02
74021701	4.5009	1.0209	1.5280"+03	1.3000"-03	8.6529	1.3887	1.9955"+03	1.9955"+03
3.6600"-01	5.7819"+05	1.0000	6.2431"+03	NM	1.8418	1.8126	2.9475"+02	6.2356"+01
INFINITE	3.1500"+02	0.0000	3.5146"-04	0.0000"+00	0.2980	6.8239"-04	7.1261"+02	2.8873"+02
74021702	4.4985	1.0210	2.3095"+03	1.1300"-03	8.0799	1.3455	1.9993"+03	1.9993"+03
8.7600"-01	5.7754"+05	1.0000	9.4294"+03	NM	1.8346	1.8068	2.9480"+02	6.2410"+01
INFINITE	3.1500"+02	0.0000	5.3082"-04	0.0000"+00	0.2822	1.0568"-03	7.1253"+02	2.8873"+02
74021703	4.4956	1.0028	2.9413"+03	1.0600"-03	8.6713	1.3486	2.0139"+03	2.0139"+03
8.7600"-01	5.7967"+05	1.0000	1.1805"+04	NM	1.8295	1.7988	2.9230"+02	6.3069"+01
INFINITE	3.1800"+02	0.0000	6.7064"-04	0.0000"+00	0.2826	1.3431"-03	7.1582"+02	2.9149"+02
74021704	4.4876	1.0024	3.8391"+03	9.9000"-04	8.6390	1.3468	2.0167"+03	2.0167"+03
1.1300"+00	5.7468"+05	1.0000	1.5372"+04	NM	1.8248	1.7925	2.9130"+02	6.3051"+01
INFINITE	3.1700"+02	0.0000	8.7329"-04	0.0000"+00	0.2854	1.7663"-03	7.1444"+02	2.9059"+02
74021705	4.4793	0.9952	4.3197"+03	9.5000"-04	8.8762	1.3210	2.0517"+03	2.0517"+03
1.3840"+00	5.7863"+05	1.0000	1.7148"+04	NM	1.8336	1.8039	2.8920"+02	6.3238"+01
INFINITE	3.1700"+02	0.0000	9.6361"-04	0.0000"+00	0.2260	1.9340"-03	7.1418"+02	2.9061"+02
74021801	4.5169	1.0242	2.3098"+03	1.0800"-03	9.3884	1.428	3.1193"+03	3.1193"+03
3.6800"-01	9.2199"+05	1.0000	9.5222"+03	NM	1.8263	1.790	2.9475"+02	6.1805"+01
INFINITE	3.1400"+02	0.0000	3.3719"-04	0.0000"+00	0.2105	7.0941"-04	7.1197"+02	2.8777"+02
74021802	4.5097	1.0161	3.6569"+03	9.8000"-04	8.6125	1.3872	3.1634"+03	3.1634"+03
6.2300"-01	9.2690"+05	1.0000	1.4935"+04	NM	1.8222	1.7907	2.9335"+02	6.2157"+01
INFINITE	3.1500"+02	0.0000	5.2676"-04	0.0000"+00	0.3133	1.0585"-03	7.1289"+02	2.8870"+02
74021803	4.5098	1.0029	4.5851"+03	9.5000"-04	8.6188	1.3249	3.1603"+03	3.1603"+03
8.7600"-01	9.2588"+05	1.0000	1.8496"+04	NM	1.8358	1.8080	2.9230"+02	6.2751"+01
INFINITE	3.1800"+02	0.0000	6.6244"-04	0.0000"+00	0.2941	1.3207"-03	7.1627"+02	2.9145"+02
74021804	4.5003	1.0057	5.8311"+03	9.1000"-04	8.4562	1.3236	3.1835"+03	3.1835"+03
1.1300"+00	9.2169"+05	1.0000	2.3529"+04	NM	1.8373	1.8052	2.9130"+02	6.2568"+01
INFINITE	3.1600"+02	0.0000	8.3466"-04	0.0000"+00	0.3204	1.6598"-03	7.1372"+02	2.8964"+02
74021805	4.4928	0.9829	6.8131"+03	8.8000"-04	8.5307	1.2853	3.2319"+03	3.2319"+03
1.3840"+00	9.2698"+05	1.0000	2.6837"+04	NM	1.8403	1.8163	2.8920"+02	6.3728"+01
INFINITE	3.2100"+02	0.0000	9.6565"-04	0.0000"+00	0.2820	1.8947"-03	7.1910"+02	2.9424"+02

PD,POD CALCULATED WITH AUTHOR'S MUE-LAW FROM RED2,D2 (AUTHOR)

74021801 MABEY PROFILE TABULATION 41 POINTS, DELTA AT POINT 41

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.94043	0.00000	0.00000	4.77783	0.00000
2	3.6300"-04	3.4114"+00	NM	0.94112	0.33198	0.60290	3.29815	0.18280
3	3.8900"-04	3.5898"+00	NM	0.94086	0.34225	0.61550	3.23415	0.19031
4	4.1400"-04	3.7605"+00	NM	0.93951	0.35179	0.62650	3.17158	0.19754
5	4.3900"-04	3.9211"+00	NM	0.93866	0.36051	0.63640	3.11624	0.20422
6	4.6500"-04	4.0785"+00	NM	0.93780	0.36884	0.64560	3.06373	0.21072
7	4.9000"-04	4.2196"+00	NM	0.93741	0.37615	0.65360	3.01932	0.21647
8	5.1600"-04	4.3462"+00	NM	0.93763	0.38258	0.66070	2.98240	0.22153
9	5.4100"-04	4.4815"+00	NM	0.93505	0.38932	0.66700	2.93513	0.22725
10	5.6600"-04	4.5999"+00	NM	0.93617	0.39513	0.67350	2.90529	0.23182
11	5.9200"-04	4.7133"+00	NM	0.93574	0.40061	0.67900	2.87274	0.23636
12	6.1700"-04	4.8227"+00	NM	0.93602	0.40582	0.68440	2.84414	0.24064
13	6.6800"-04	5.0215"+00	NM	0.43616	0.41512	0.69370	2.79252	0.24841
14	7.1900"-04	5.2015"+00	NM	0.93674	0.42336	0.70190	2.74876	0.25535
15	7.7000"-04	5.3590"+00	NM	0.93567	0.43043	0.70820	2.70709	0.26161
16	8.2000"-04	5.5009"+00	NM	0.93509	0.43670	0.71380	2.67165	0.26718
17	8.7100"-04	5.6457"+00	NM	0.93525	0.44301	0.71960	2.63852	0.27273
18	9.9800"-04	5.9772"+00	NM	0.93766	0.45711	0.73300	2.57136	0.28506
19	1.1250"-03	6.2674"+00	NM	0.94122	0.46910	0.74460	2.51993	0.29553
20	1.2520"-03	6.5486"+00	NM	0.94419	0.48042	0.75510	2.47036	0.30566
21	1.3790"-03	6.8435"+00	NM	0.94760	0.49202	0.76570	2.42189	0.31616
22	1.5060"-03	7.1328"+00	NM	0.94821	0.50313	0.77450	2.36967	0.32684
23	1.6330"-03	7.4354"+00	NM	0.95171	0.51449	0.78440	2.32450	0.33745
24	1.8870"-03	8.0870"+00	NM	0.95404	0.53812	0.80210	2.22173	0.36103
25	2.1410"-03	8.7680"+00	NM	0.95805	0.56175	0.81940	2.12766	0.38512
26	2.3950"-03	9.4807"+00	NM	0.95533	0.58545	0.83280	2.02347	0.41157
27	2.6490"-03	1.0224"+01	NM	0.96261	0.60917	0.84960	1.94515	0.43678
28	2.9030"-03	1.1012"+01	NM	0.96452	0.63335	0.86340	1.85839	0.46460
29	3.4110"-03	1.2622"+01	NM	0.96631	0.68007	0.88680	1.70039	0.52153
30	3.9190"-03	1.4370"+01	NM	0.97722	0.72741	0.91190	1.57159	0.58024
31	4.4270"-03	1.6348"+01	NM	0.98007	0.77748	0.93180	1.43637	0.64872
32	4.9350"-03	1.8567"+01	NM	0.98207	0.83005	0.94970	1.30907	0.72548
33	5.4430"-03	2.0815"+01	NM	0.98681	0.88011	0.96610	1.20496	0.80177
34	6.0780"-03	2.3422"+01	NM	0.99051	0.93481	0.98140	1.10217	0.89042
35	6.7130"-03	2.5243"+01	NM	0.99955	0.97118	0.99390	1.04734	0.94898
36	7.3480"-03	2.6122"+01	NM	1.00209	0.98826	0.99870	1.02124	0.97793
37	7.9830"-03	2.6438"+01	NM	1.00145	0.99434	0.99960	1.01061	0.98910
38	8.6180"-03	2.6588"+01	NM	1.00211	0.99719	1.00050	1.00664	0.99390
39	9.2530"-03	2.6637"+01	NM	1.00274	0.99814	1.00100	1.00573	0.99529
40	9.8880"-03	2.6716"+01	NM	1.00214	0.99965	1.00100	1.00271	0.99830
D 41	1.0520"-02	2.6735"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
ALL MEASURED POINTS

74021802 MABEY PROFILE TABULATION 47 POINTS, DELTA AT POINT 47

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93597	0.00000	0.00000	4.74336	0.00000
2	3.6300"-04	3.0990"+00	NM	0.93442	0.31356	0.57670	3.38261	0.17049
3	3.8900"-04	3.2495"+00	NM	0.93402	0.32284	0.58860	3.32414	0.17707
4	4.1400"-04	3.3979"+00	NM	0.93305	0.33170	0.59950	3.26658	0.18353
5	4.3900"-04	3.5328"+00	NM	0.93403	0.33954	0.60950	3.22237	0.18915
6	4.6500"-04	3.6661"+00	NM	0.93153	0.34709	0.61780	3.16825	0.19500
7	4.9000"-04	3.8149"+00	NM	0.93206	0.35532	0.62770	3.12079	0.20114
8	5.1600"-04	3.9348"+00	NM	0.93178	0.36180	0.63510	3.08136	0.20611
9	5.4100"-04	4.0285"+00	NM	0.93072	0.36678	0.64040	3.04848	0.21007
10	5.6600"-04	4.1449"+00	NM	0.93068	0.37288	0.64720	3.01265	0.21483
11	5.9200"-04	4.2136"+00	NM	0.93122	0.37642	0.65130	2.99371	0.21756
12	6.1700"-04	4.3001"+00	NM	0.93117	0.38084	0.65610	2.96794	0.22106
13	6.6800"-04	4.4785"+00	NM	0.93100	0.38978	0.66560	2.91601	0.22826
14	7.1900"-04	4.6241"+00	NM	0.93112	0.39692	0.67310	2.87575	0.23406
15	7.7000"-04	4.7513"+00	NM	0.93172	0.40305	0.67960	2.84305	0.23904
16	8.2000"-04	4.8585"+00	NM	0.93109	0.40815	0.68450	2.81266	0.24336
17	8.7100"-04	4.9891"+00	NM	0.93092	0.41426	0.69050	2.77827	0.24854
18	9.9800"-04	5.2293"+00	NM	0.93110	0.42527	0.70120	2.71860	0.25793
19	1.1250"-03	5.4339"+00	NM	0.93380	0.43442	0.71080	2.67711	0.26551
20	1.2520"-03	5.6359"+00	NM	0.93644	0.44327	0.71990	2.63756	0.27294
21	1.3790"-03	5.8400"+00	NM	0.93722	0.45203	0.72800	2.59377	0.28067
22	1.5060"-03	6.0440"+00	NM	0.93963	0.46061	0.73640	2.55598	0.28811
23	1.6330"-03	6.2446"+00	NM	0.93958	0.46890	0.74340	2.51357	0.29575
24	1.8870"-03	6.6617"+00	NM	0.94386	0.48566	0.75880	2.44116	0.31084
25	2.1410"-03	7.0854"+00	NM	0.95517	0.50210	0.77620	2.38982	0.32479
26	2.3950"-03	7.5107"+00	NM	0.95516	0.51808	0.78810	2.31405	0.34057
27	2.6490"-03	7.9514"+00	NM	0.95065	0.53412	0.79760	2.22993	0.35768
28	2.9030"-03	8.3975"+00	NM	0.95151	0.54988	0.80860	2.16241	0.37393
29	3.4110"-03	9.3377"+00	NM	0.95588	0.58168	0.83050	2.03853	0.40740
30	3.9190"-03	1.0266"+01	NM	0.96148	0.61145	0.85010	1.93292	0.43980
31	4.4270"-03	1.1274"+01	NM	0.96458	0.64219	0.86770	1.82563	0.47529
32	4.9350"-03	1.2419"+01	NM	0.96811	0.67542	0.88530	1.71804	0.51530
33	5.4430"-03	1.3672"+01	NM	0.97155	0.70998	0.90200	1.61404	0.55884
34	6.0780"-03	1.5316"+01	NM	0.97272	0.75294	0.91940	1.49105	0.61661
35	6.7130"-03	1.7072"+01	NM	0.97736	0.79623	0.93670	1.38394	0.67683
36	7.3480"-03	1.8912"+01	NM	0.98078	0.83921	0.95170	1.28605	0.74002
37	7.9830"-03	2.0840"+01	NM	0.98347	0.88202	0.96490	1.19677	0.80625
38	8.6180"-03	2.2683"+01	NM	0.98739	0.92106	0.97660	1.12424	0.86867
39	9.2530"-03	2.4276"+01	NM	0.99498	0.95352	0.98780	1.07320	0.92043
40	9.8880"-03	2.5382"+01	NM	0.99578	0.97542	0.99290	1.03617	0.95824
41	1.0520"-02	2.5997"+01	NM	0.99946	0.98738	0.99720	1.01999	0.97765
42	1.1158"-02	2.6312"+01	NM	0.99780	0.99345	0.99760	1.00837	0.98932
43	1.1790"-02	2.6455"+01	NM	0.99911	0.99620	0.99880	1.00523	0.99361
44	1.2428"-02	2.6512"+01	NM	0.99867	0.99730	0.99880	1.00301	0.99580
45	1.3060"-02	2.6549"+01	NM	0.99919	0.99800	0.99920	1.00241	0.99680
46	1.4333"-02	2.6625"+01	NM	0.99782	0.99945	0.99880	0.99870	1.00010
D 47	1.5000"-02	2.6653"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
ALL MEASURED POINTS

74021803 MABEY PROFILE TABULATION 47 POINTS, DELTA AT PUI! 47

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93212	0.00000	0.00000	4.72367	0.00000
2	3.6300"-04	2.9609"+00	NM	0.93305	0.30478	0.56460	3.43171	0.16452
3	3.8900"-04	3.0557"+00	NM	0.93245	0.31084	0.57250	3.39213	0.16877
4	4.1400"-04	3.2097"+00	NM	0.93309	0.32042	0.58520	3.33556	0.17544
5	4.3900"-04	3.3528"+00	NM	0.93222	0.32904	0.59590	3.27976	0.18169
6	4.6500"-04	3.4985"+00	NM	0.93070	0.33757	0.60600	3.22269	0.18804
7	4.9000"-04	3.6100"+00	NM	0.93074	0.34439	0.61430	3.18167	0.19307
8	5.1600"-04	3.7358"+00	NM	0.93059	0.35098	0.62210	3.14169	0.19801
9	5.4100"-04	3.8462"+00	NM	0.92914	0.35703	0.62870	3.10078	0.20276
10	5.6600"-04	3.9595"+00	NM	0.92941	0.36313	0.63580	3.06560	0.20740
11	5.9200"-04	4.0623"+00	NM	0.92896	0.36857	0.64180	3.03214	0.21167
12	6.1700"-04	4.1331"+00	NM	0.92803	0.37227	0.64560	3.00752	0.21466
13	6.6800"-04	4.3060"+00	NM	0.92798	0.38115	0.65530	2.95596	0.22169
14	7.1900"-04	4.4380"+00	NM	0.92855	0.38778	0.66260	2.91471	0.22694
15	7.7000"-04	4.5671"+00	NM	0.92884	0.39415	0.66940	2.88434	0.23208
16	8.2000"-04	4.6832"+00	NM	0.92823	0.39979	0.67500	2.85063	0.23679
17	8.7100"-04	4.7811"+00	NM	0.93023	0.40448	0.68050	2.83046	0.24042
18	9.9800"-04	5.0086"+00	NM	0.92988	0.41518	0.69100	2.77008	0.24945
19	1.1250"-03	5.2543"+00	NM	0.93409	0.42641	0.70340	2.72109	0.25850
20	1.2520"-03	5.4165"+00	NM	0.93751	0.43366	0.71150	2.69179	0.26432
21	1.3790"-03	5.5788"+00	NM	0.93761	0.44080	0.71810	2.65393	0.27058
22	1.5060"-03	5.7574"+00	NM	0.93828	0.44851	0.72530	2.61506	0.27735
23	1.8870"-03	6.3090"+00	NM	0.94540	0.47153	0.74790	2.51572	0.29729
24	2.1410"-03	6.6532"+00	NM	0.94775	0.48533	0.76010	2.45278	0.30989
25	2.3950"-03	7.0005"+00	NM	0.94996	0.49886	0.77160	2.39234	0.32253
26	2.6490"-03	7.3538"+00	NM	0.95072	0.51225	0.78200	2.33046	0.33556
27	2.9030"-03	7.6980"+00	NM	0.95166	0.52497	0.79160	2.27376	0.34815
28	3.4110"-03	8.3890"+00	NM	0.95479	0.54959	0.80980	2.17108	0.37299
29	3.9190"-03	9.0637"+00	NM	0.95919	0.57261	0.82640	2.08290	0.39675
30	4.4270"-03	9.7663"+00	NM	0.95976	0.59562	0.84040	1.99084	0.42213
31	4.9350"-03	1.0511"+01	NM	0.96475	0.61907	0.85570	1.91058	0.44787
32	5.4430"-03	1.1308"+01	NM	0.96876	0.64323	0.87010	1.82983	0.47551
33	6.0780"-03	1.2394"+01	NM	0.96313	0.67473	0.88270	1.71145	0.51576
34	6.7130"-03	1.3511"+01	NM	0.97093	0.70566	0.89990	1.62628	0.55335
35	7.3480"-03	1.4707"+01	NM	0.97506	0.73732	0.91460	1.53870	0.59440
36	7.9830"-03	1.5974"+01	NM	0.97447	0.76947	0.92620	1.44886	0.63926
37	8.6180"-03	1.7285"+01	NM	0.97909	0.80135	0.93920	1.37363	0.68374
38	9.2530"-03	1.8634"+01	NM	0.98134	0.83290	0.95010	1.30124	0.73015
39	1.0520"-02	2.1045"+01	NM	0.98354	0.89504	0.96830	1.17041	0.82732
40	1.1158"-02	2.2847"+01	NM	0.98697	0.92447	0.97720	1.11732	0.87459
41	1.1790"-02	2.4061"+01	NM	0.98964	0.94923	0.98420	1.07504	0.91550
42	1.2428"-02	2.5045"+01	NM	0.99375	0.96882	0.99050	1.04526	0.94761
43	1.3060"-02	2.5721"+01	NM	0.99503	0.98205	0.99390	1.02428	0.97034
44	1.4333"-02	2.6370"+01	NM	0.99894	0.99460	0.99840	1.00766	0.99081
45	1.5600"-02	2.6553"+01	NM	0.99915	0.99810	0.99920	1.00220	0.99700
46	1.6873"-02	2.6631"+01	NM	0.99976	0.99960	0.99980	1.00040	0.99940
D 47	1.8140"-02	2.6652"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
ALL MEASURED POINTS

74021804 MABEY PROFILE TABULATION 52 POINTS, DELTA AT POINT 52

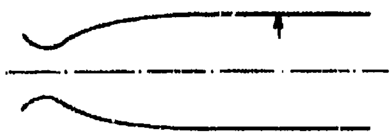
I	Y	PY2/P	P/PD	T0/T0D	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.93264	0.00000	0.00000	4.71032	0.00000
2	3.6300"-04	2.8547"+00	NM	0.92940	0.29845	0.55430	3.44947	0.16069
3	3.8900"-04	3.0002"+00	NM	0.92902	0.30796	0.56700	3.38983	0.16727
4	4.1400"-04	3.1229"+00	NM	0.92927	0.31573	0.57730	3.34336	0.17267
5	4.3900"-04	3.2490"+00	NM	0.92861	0.32349	0.58710	3.29381	0.17824
6	4.6500"-04	3.3822"+00	NM	0.92716	0.33148	0.59670	3.24044	0.18414
7	4.9000"-04	3.4675"+00	NM	0.92595	0.33648	0.60250	3.20616	0.18792
8	5.1600"-04	3.5880"+00	NM	0.92707	0.34342	0.61130	3.16857	0.19293
9	5.4100"-04	3.6906"+00	NM	0.92465	0.34920	0.61740	3.12598	0.19751
10	5.6600"-04	3.7752"+00	NM	0.92369	0.35390	0.62260	3.09502	0.20116
11	5.9200"-04	3.8637"+00	NM	0.92367	0.35873	0.62820	3.06654	0.20486
12	6.1700"-04	3.9212"+00	NM	0.92408	0.36184	0.63190	3.04971	0.20720
13	6.6800"-04	4.0542"+00	NM	0.92322	0.36892	0.63960	3.00571	0.21279
14	7.1900"-04	4.1733"+00	NM	0.92410	0.37514	0.64680	2.97265	0.21758
15	7.7000"-04	4.2882"+00	NM	0.92430	0.38105	0.65330	2.93945	0.22225
16	8.2000"-04	4.3941"+00	NM	0.92421	0.38640	0.65900	2.90867	0.22656
17	8.7100"-04	4.4774"+00	NM	0.92395	0.39056	0.66330	2.88434	0.22997
18	9.9800"-04	4.6792"+00	NM	0.93102	0.40044	0.67610	2.85063	0.23718
19	1.1250"-03	4.8684"+00	NM	0.92741	0.40948	0.68390	2.78940	0.24518
20	1.2520"-03	5.0364"+00	NM	0.92976	0.41734	0.69250	2.75330	0.25152
21	1.3790"-03	5.2021"+00	NM	0.93184	0.42495	0.70060	2.71813	0.25775
22	1.5060"-03	5.3598"+00	NM	0.93370	0.43205	0.70800	2.68528	0.26366
23	1.6330"-03	5.5085"+00	NM	0.93476	0.43865	0.71450	2.65322	0.26930
24	1.8870"-03	5.8263"+00	NM	0.93723	0.45241	0.72780	2.58799	0.28122
25	2.1410"-03	6.1133"+00	NM	0.93716	0.46448	0.73820	2.52589	0.29225
26	2.3950"-03	6.3940"+00	NM	0.94171.	0.47598	0.74960	2.48016	0.30224
27	2.6490"-03	6.6897"+00	NM	0.95232	0.48780	0.76340	2.44918	0.31170
28	2.9030"-03	6.9418"+00	NM	0.94953	0.49765	0.77000	2.39406	0.32163
29	3.4110"-03	7.4707"+00	NM	0.94777	0.51770	0.78430	2.29516	0.34172
30	3.9190"-03	8.0042"+00	NM	0.94937	0.53715	0.79870	2.21092	0.36125
31	4.4270"-03	8.5295"+00	NM	0.95072	0.55563	0.81160	2.13356	0.38040
32	4.9350"-03	9.0690"+00	NM	0.95443	0.57399	0.82480	2.06484	0.39945
33	5.4430"-03	9.6794"+00	NM	0.95672	0.59407	0.83780	1.98886	0.42125
34	6.0780"-03	1.0461"+01	NM	0.95864	0.61881	0.85250	1.89789	0.44918
35	6.7130"-03	1.1263"+01	NM	0.95880	0.64324	0.86530	1.80963	0.47816
36	7.3480"-03	1.2113"+01	NM	0.96260	0.66812	0.87910	1.73130	0.50777
37	7.9830"-03	1.3010"+01	NM	0.96816	0.69340	0.89310	1.65893	0.53836
38	8.6180"-03	1.3916"+01	NM	0.96666	0.71805	0.90280	1.58078	0.57111
39	9.2530"-03	1.4859"+01	NM	0.97081	0.74283	0.91450	1.51561	0.60339
40	9.8880"-03	1.5882"+01	NM	0.97222	0.76878	0.92470	1.44676	0.63915
41	1.0520"-02	1.6910"+01	NM	0.97296	0.79403	0.93370	1.38274	0.67525
42	1.1158"-02	1.8006"+01	NM	0.97808	0.82008	0.94450	1.32644	0.71206
43	1.1790"-02	1.9140"+01	NM	0.97706	0.84619	0.95180	1.26518	0.75830
44	1.2428"-02	2.0291"+01	NM	0.98079	0.87190	0.96080	1.21433	0.79122
45	1.3060"-02	2.1455"+01	NM	0.98079	0.89713	0.96740	1.16279	0.83196
46	1.4333"-02	2.3607"+01	NM	0.98795	0.94202	0.98170	1.08601	0.90395
47	1.5600"-02	2.5172"+01	NM	0.99187	0.97336	0.99050	1.03552	0.95653
48	1.6873"-02	2.5996"+01	NM	0.99362	0.98946	0.99470	1.01061	0.98426
49	1.8140"-02	2.6329"+01	NM	0.99623	0.99590	0.99730	1.00281	0.99491
50	1.9413"-02	2.6446"+01	NM	0.99534	0.99815	0.99730	0.99830	0.99900
51	2.0683"-02	2.6498"+01	NM	0.99774	0.99915	0.99870	0.99910	0.99960
D 52	2.1950"-02	2.6542"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
ALL MEASURED POINTS

74021805 HAREY PROFILE TABULATION 55 POINTS, DELTA AT POINT 55

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	0.92988	0.00000	0.00000	4.68384	0.00000
2	3.6300"-04	2.8355"+00	NM	0.93267	0.29766	0.55370	3.46021	0.16002
3	3.8900"-04	2.9248"+00	NM	0.93221	0.30358	0.56160	3.42231	0.16410
4	4.1400"-04	3.0769"+00	NM	0.93343	0.31336	0.57500	3.36700	0.17077
5	4.3900"-04	3.1887"+00	NM	0.93126	0.32034	0.58340	3.31675	0.17590
6	4.6500"-04	3.3151"+00	NM	0.93093	0.32803	0.59310	3.26904	0.18143
7	4.9000"-04	3.4187"+00	NM	0.93126	0.33419	0.60090	3.23311	0.18586
8	5.1600"-04	3.5105"+00	NM	0.92948	0.33954	0.60690	3.19489	0.18996
9	5.4100"-04	3.6026"+00	NM	0.93041	0.34482	0.61360	3.16656	0.19377
10	5.6600"-04	3.6904"+00	NM	0.92886	0.34978	0.61900	3.13185	0.19765
11	5.9200"-04	3.7618"+00	NM	0.92802	0.35375	0.62340	3.10559	0.20073
12	6.1700"-04	3.8336"+00	NM	0.92923	0.35769	0.62840	3.08642	0.20360
13	6.6800"-04	3.9607"+00	NM	0.92722	0.36457	0.63560	3.03951	0.20911
14	7.1900"-04	4.0699"+00	NM	0.92773	0.37037	0.64230	3.00752	0.21356
15	7.7000"-04	4.1816"+00	NM	0.92400	0.37620	0.64920	2.97796	0.21800
16	8.2000"-04	4.2724"+00	NM	0.92532	0.38087	0.65300	2.93945	0.22215
17	8.7100"-04	4.3566"+00	NM	0.92841	0.38516	0.65870	2.92483	0.22521
18	9.9800"-04	4.5696"+00	NM	0.93015	0.39577	0.67050	2.87026	0.23360
19	1.1250"-03	4.7500"+00	NM	0.93131	0.40453	0.67990	2.82486	0.24068
20	1.2520"-03	4.9153"+00	NM	0.93631	0.41238	0.68960	2.79642	0.24660
21	1.3790"-03	5.0620"+00	NM	0.93572	0.41922	0.69610	2.75710	0.25248
22	1.5060"-03	5.2070"+00	NM	0.93678	0.42588	0.70290	2.72405	0.25803
23	1.6330"-03	5.3598"+00	NM	0.94100	0.43278	0.71100	2.69906	0.26343
24	1.8870"-03	5.6532"+00	NM	0.94368	0.44571	0.72390	2.63783	0.27443
25	2.1410"-03	5.9337"+00	NM	0.94616	0.45773	0.73550	2.58198	0.28486
26	2.3950"-03	6.1939"+00	NM	0.94742	0.46859	0.74530	2.52972	0.29462
27	2.6490"-03	6.4486"+00	NM	0.94961	0.47899	0.75480	2.48324	0.30396
28	2.9030"-03	6.6951"+00	NM	0.95202	0.48883	0.76370	2.44081	0.31289
29	3.4110"-03	7.1514"+00	NM	0.95076	0.50654	0.77690	2.35239	0.33026
30	3.9190"-03	7.6078"+00	NM	0.95544	0.52364	0.79140	2.28415	0.34647
31	4.4270"-03	8.0395"+00	NM	0.95454	0.53931	0.80200	2.21141	0.36266
32	4.9350"-03	8.5023"+00	NM	0.95575	0.55562	0.81340	2.14316	0.37953
33	5.4430"-03	8.9320"+00	NM	0.95974	0.57034	0.82450	2.08986	0.39452
34	6.0780"-03	9.5371"+00	NM	0.96067	0.59044	0.83710	2.01005	0.41646
35	6.7130"-03	1.0181"+01	NM	0.96497	0.61110	0.85080	1.93836	0.43893
36	7.3480"-03	1.0822"+01	NM	0.96247	0.63097	0.86040	1.85943	0.46272
37	7.9830"-03	1.1503"+01	NM	0.96691	0.65145	0.87280	1.79501	0.48624
38	8.6180"-03	1.2182"+01	NM	0.97022	0.67122	0.88380	1.73370	0.50978
39	9.2530"-03	1.2928"+01	NM	0.97467	0.69230	0.89540	1.67280	0.53527
40	9.8880"-03	1.3679"+01	NM	0.97509	0.71287	0.90440	1.60953	0.56190
41	1.0520"-02	1.4457"+01	NM	0.97496	0.73357	0.91270	1.54799	0.58960
42	1.1158"-02	1.5266"+01	NM	0.98048	0.75457	0.92330	1.49723	0.61667
43	1.1790"-02	1.6091"+01	NM	0.97739	0.77528	0.92930	1.43678	0.64679
44	1.2428"-02	1.6939"+01	NM	0.97830	0.79606	0.93680	1.38485	0.67646
45	1.3060"-02	1.7811"+01	NM	0.97894	0.81686	0.94380	1.33494	0.70700
46	1.4333"-02	1.9651"+01	NM	0.98529	0.85913	0.95940	1.24704	0.76934
47	1.5600"-02	2.1557"+01	NM	0.98308	0.90081	0.96940	1.15808	0.83708
48	1.6873"-02	2.3315"+01	NM	0.98984	0.93762	0.98160	1.09601	0.89561
49	1.8140"-02	2.4765"+01	NM	0.99524	0.96693	0.99080	1.04998	0.94364
50	1.9413"-02	2.5659"+01	NM	0.99524	0.98456	0.99450	1.02030	0.97471
51	2.0680"-02	2.6142"+01	NM	0.99722	0.99395	0.99740	1.00695	0.99052
52	2.1953"-02	2.6352"+01	NM	0.99760	0.99800	0.99840	1.00080	0.99760
53	2.3223"-02	2.6432"+01	NM	1.00058	0.99955	1.00020	1.00130	0.99890
54	2.4493"-02	2.6448"+01	NM	1.00006	0.99985	1.00000	1.00030	0.99970
D 55	2.5760"-02	2.6455"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,U/UD,RHO/RHOD ASSUME P=PD
ALL MEASURED POINTS



M : 9.4
R THETA X 10^{-3} : 40
TW/TR : 0.42

7403

ZPG - SHT

Continuous tunnel, with symmetrical flexible nozzle. W = 0.51, H = 0.53 m.
PO : 4.3 MN/m^2. TO : 790 K. Dried air, RE/m X 10^{-6} : 12.7.

LADERMAN A.J. and DEMETRIADES A., 1974. Mean and fluctuating flow measurements in the hypersonic boundary layer over a cooled wall. J. Fluid Mech. 63, 121-144.
And Demetriades, A., Private communications.
Also Laderman & Demetriades (1972), McRonald (1975)

1 The test boundary layer was formed on the upper wall of the contoured flexible nozzle and test section of
4 the tunnel. Measurements were made at a single station on the centre-line 4.064 m downstream of the throat
(X = 0). The test surface was "polished to micro-inch finish" and was actively cooled. Surveys by Laufer
2 et al. (1967) showed that the Mach number on the axis was constant within 0.3 % for nearly 2 m leading up
to and passing through the test zone. Variation across the central 0.25 m of the flow was less than 1 %
5 0.3 m upstream of the test station. Differences in Pitot reading, for a given value of Y, within the central
3 0.3 m of the boundary layer were about 5 %. Transition was "thought to be within a few cm of the throat".
4 Static pressure on the side wall and roof agreed within 3 % but showed greater longitudinal variation than
on the centre line. The pressure at X = 2 m was about 8 % higher than at the test station and fell to a
minimum about 16 % below the test value at X ~ 3.0 m before rising again so that the gradient was about
+ 25 %/m at the test station (Editors' estimate from information supplied in graphical form).

6 Static pressure was measured on both sidewalls and roof of the tunnel at 0.305 m intervals, with a tapping
(d = 1.70 mm) at the test station. The temperature of the wall was measured at X = 4.070 m by a thermocouple
7 mounted in the wall of a recess used for instrumentation. Pitot, hot-wire, static pressure and total
8 temperature probes were mounted on a single traverse gear. The HWP and TTP were mounted 76 mm to either side
5 of the Pitot probe which was on the centre-line. Additional Pitot probes were mounted at Z = ± 152 mm and
7 used to check two-dimensionality. In the outer part of the layer, the Pitot probes were CPP (d_1 or d_2 = 3.17,
1 = 38.1 mm). For measurements near the wall a cranked FPP (h_1 = 0.36, h_2 = 0.2, b_1 = 1.68, b_2 = 1.52,
1 = 38.1 mm) was fitted to the tip of one of the outboard Pitot tubes. The HWP carried a Pt - 10 % Rh wire
(typically d = 0.25, 1 = 76 m). These were mounted slackly (to avoid strain gauge effects) to two sharp-pointed prongs. These, and the initial part of the support body (d = 0.79, 1 = 6.3 mm) were cranked towards
the surface at about 20° and mounted to a slender cylindrical support aligned with the flow (1, overall,
38.1 mm). The wires were operated in the constant-current mode. The TTP was a vented STP (d_1 = 3.2,
d_2 = 2.4, 1 = 38 mm) with the iron-constantan thermocouple mounted 11 mm back from the front face, and
vented by three holes at the same position (d = 0.79 mm). The static pressure probe was "a sharply pointed
1.27 mm diameter tube, aligned in the direction of flow, with three sensing holes (0.38 mm diameter)
8 located 19 mm from its tip". The static probe was mounted with its axis 8 mm further from the tunnel wall
than the line containing the tips of the CPP and STP.

9 The authors have interpolated the profile measurements to the Y value of the Pitot measurements. TO values in the inner part of the layer (y < 1.6 mm) are obtained by fitting a third degree polynomial to the inner-most measured values to meet the wall temperature (see source figure 6 and page 128). The authors obtained a CF value by fitting the transformed velocity profile data to the law of the wall and Coles' (1956) wake function (see source paper p 132 for details).

10 The Pitot probe readings are uncorrected. The authors calculated thermal, viscous, and rarefaction corrections, which were negligible for the large probes. For the small probe, the viscous correction could be up to 10 % but was not applied because of the lack of experimental data on such corrections. The STP was calibrated at M = 9.5 and M = 6 at 800 K, and at M = 4 for TO from 300 to 800 K. The calibration was found to depend on the probe Reynolds Number, being essentially independent of Mach number. Large corrections

for viscous interaction effects were applied to the static pressure readings (up to 60 %). For a discussion of these see the source paper and Beckwith et al. 1971. The calibration and reduction procedures for the hot-wire probes will not be discussed here in detail. The fundamental assumption is that the pressure-entropy and pressure-vorticity correlations are negligible while the entropy / vorticity correlation is - 1.

11 For a full discussion see the source paper and associated references. Viscosity values were taken from NAVORD report 1488 vol. 5 section 15 (1953).

12 The editors have accepted all the corrections and interpolations used by the authors. For the profile tables we have set the D-state at the point for which we computed the highest value of PO and arbitrarily set the D-state reservoir properties to the stated tunnel values. We found it necessary to use a trapezoidal

13 integration rule in calculating the integral values. There is one profile presented, supplemented by the

14 hot wire data in section D. We have presented the CF value obtained by the authors from a curve fit to the transformed profile.

§ DATA 7403 0101. Single profile, Pitot, TO and P measured simultaneously. Turbulence quantities measured with constant current hot-wire probe.

15 Editors' comments

The special value of this entry lies in the provision of hot wire data at M ≈ 10. These are tabulated in section D for two different wires. The difficulty of obtaining such data cannot be overestimated, and the pool of available turbulence information is small. In the catalogue the whole Mach number range from 1.7 to 10 is covered by, successively, Kistler - CAT 5803, Horstman & Owen - CAT 7205 and the present entry. A contrast between ZPG and simple wave APG behaviour is given by Sturek & Danberg - CAT 7101, and a limited observation in a reflected wave APG is given by Waltrup & Schetz - CAT 7104. It is, however, difficult to form these disparate studies into any unified whole as the types of equipment, the assumptions made in data-reduction and the prejudices of each research worker are so varied.

The authors' preferred scaling length is the boundary layer thickness for 50 % intermittency, here 103 mm. At this point PO/POD is about 0.6 and U/UD is about 0.95. Thus δ (intermittency) is here less than most values based on mean flow data, and arguments relying on the relative position of turbulence features should take account of this.

The reported static pressure variation is very difficult to explain. If the mean flow streamlines are straight and parallel, there can be no pressure difference across the boundary layer as a whole. A local dip in the region of intense momentum fluctuations could be observed as a part of the total normal stress would then be supplied by the normal Reynolds stress. The calibration procedure for the static probe requires very large corrections, so that no great emphasis should be placed on the details of the variation reported. The overall difference however can also be inferred from the wall static pressure and a Pitot-derived value in the free stream, and the adjusted static pressure variation given in the profile tables agrees with these two observations.

If the longitudinal pressure gradient of 25 %/m estimated by the editors, and referred to in § 4 above, is assumed to propagate as a simple wave from the wall on which it is measured, the static pressure would fall by about 30 % across the boundary layer, which at this level of argument is quite good agreement with the 40 % reported. The subsequent development of the, necessarily curved, mean flow streamline is, however, difficult to visualise unless the whole phenomenon is an upstream influence of the diffuser. The centre line Pitot data in Laufer et al. (1967) rule out any possibility of a wave structure from upstream having this effect. As a last comment on this puzzling apparent behaviour, McRonald (1975) reports a "balance chamber pressure" at this X-station of about 1.2 PD, and quotes a variety of static pressure determinations by Demetriades and Gupta which show much increased differences between wall and "free stream isentropic" pressures as the tunnel reservoir pressure falls. It is possible that this represents an increasing upstream influence of the diffuser.

The profile is given in great detail, and using the authors' CF value, fits both inner and outer laws well in transformed coordinates. The wake region is rather more pronounced than for low speed ZPG profiles. Measurements extend well within the momentum-deficit peak. There are no available mean flow data which can be directly compared. The cooled tunnel wall measurements of Hopkins & Keener - CAT 7203 were made at M ~ 7, while the M ~ 10 flat plate study by Watson et al. - CAT 7305 was at lower Reynolds number and without heat transfer.

CAT 7403 LADERMAN BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN X RZ	MD * POD* TOD*	TW/TR PW/PD SW *	RED2W RED2D D2	CF * CQ PI2	H12 H32 H42	H12K H32K D2K	PW TW* UD	PD TD TR
74030101 NM INFINITE	9.3730 4.2663"+06 7.9200"+02	0.4257 1.4185 0.0000	6.5232"+03 4.0009"+04 7.8778"-03	4.0600"-04 NM NC	7.2559 1.8135 1.3305	1.4188 1.7449 1.7010"-02	2.1927"+02 3.0400"+02 1.2273"+03	1.5458"+02 4.2648"+01 7.1407"+02

TRAPEZOIDAL RULE FOR ALL INTEGRATIONS

EVALUATED DATA - PRESSURE BASED REFERENCE FLOW

RUN	D2PD D2PW	H12PD H12PW	H32PD H32PW	H42PD H42PW	RED2PDD RED2PWD	RED2PDW RED2PWW	DSTAR
74030101	7.7782"-03 6.0962"-03	10.0290 9.9487	1.8111 1.8166	1.3476 1.3435	3.9551"+04 3.9671"+04	6.4485"+03 6.4681"+03	6.4165"-02

74030101 LADERMAN PROFILE TABULATION 73 POINTS, DELTA AT POINT 71

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	1.41850	0.38307	0.00000	0.00000	7.11388	0.00000
2	2.5400"-04	1.2203"+00	1.40051	0.44261	0.05772	0.16084	7.76509	0.02898
3	3.8100"-04	1.2775"+00	1.40807	0.47047	0.06423	0.18332	8.14645	0.03165
4	4.5720"-04	1.4661"+00	1.42319	0.50785	0.08108	0.23576	8.45446	0.03965
5	5.5880"-04	1.2826"+00	1.37129	0.49146	0.06476	0.18881	8.50032	0.03043
6	7.8740"-04	1.5906"+00	1.42404	0.54613	0.08983	0.26773	8.88249	0.04288
7	9.3980"-04	1.5922"+00	1.42199	0.57802	0.08994	0.27572	9.39836	0.04168
8	1.2446"-03	2.2118"+00	1.42131	0.58828	0.12056	0.35564	8.70226	0.05803
9	1.3716"-03	2.0895"+00	1.41599	0.59839	0.11554	0.34665	9.09101	0.05448
10	1.4478"-03	2.8913"+00	1.41775	0.59164	0.14446	0.40959	8.03932	0.07216
11	1.6002"-03	2.2145"+00	1.41179	0.61078	0.12067	0.36254	9.03186	0.05663
12	1.7780"-03	2.5875"+00	1.41447	0.61443	0.13443	0.39560	8.66041	0.06455
13	1.9050"-03	2.5906"+00	1.40903	0.61990	0.13454	0.39760	8.73424	0.06408
14	2.2352"-03	3.4019"+00	1.40962	0.62334	0.15971	0.45155	7.99323	0.07955
15	2.7940"-03	4.0953"+00	1.40679	0.63318	0.17817	0.48951	7.54829	0.09114
16	3.0988"-03	4.1038"+00	1.39969	0.63738	0.17838	0.49151	7.59183	0.09053
17	4.3688"-03	5.2002"+00	1.39292	0.64472	0.20399	0.53646	6.91611	0.10794
18	5.3086"-03	5.6609"+00	1.38479	0.64828	0.21381	0.55249	6.67642	0.11447
19	5.5626"-03	5.6661"+00	1.38170	0.65027	0.21391	0.55345	6.69391	0.11412
20	5.6388"-03	5.9259"+00	1.38147	0.64903	0.21925	0.56044	6.53418	0.11837
21	6.9342"-03	6.4652"+00	1.36985	0.65738	0.22992	0.57842	6.32924	0.12506
22	7.7978"-03	6.6771"+00	1.36910	0.65912	0.23397	0.58442	6.23912	0.12812
23	8.1788"-03	6.8812"+00	1.36645	0.65948	0.23781	0.58941	6.14289	0.13098
24	8.2296"-03	6.7504"+00	1.36850	0.65966	0.23536	0.58641	6.20804	0.12914
25	9.3980"-03	7.3588"+00	1.36064	0.66038	0.24656	0.60040	5.92977	0.13763
26	1.0338"-02	7.5740"+00	1.35883	0.66153	0.25040	0.60539	5.84532	0.14059
27	1.0719"-02	7.7132"+00	1.35741	0.66195	0.25285	0.60839	5.78931	0.14251
28	1.1989"-02	8.1330"+00	1.34916	0.66401	0.26011	0.61738	5.63376	0.14770
29	1.3233"-02	8.2903"+00	1.34468	0.66642	0.26278	0.62138	5.59166	0.14928
30	1.5850"-02	9.1279"+00	1.33599	0.67040	0.27654	0.63736	5.31203	0.16014
31	1.8339"-02	9.8347"+00	1.32775	0.67339	0.28763	0.64935	5.09655	0.16900
32	2.0523"-02	1.1072"+01	1.32084	0.67325	0.30609	0.66533	4.72472	0.18581
33	2.0701"-02	1.1213"+01	1.32316	0.68001	0.30812	0.67033	4.73304	0.18721
34	2.3190"-02	1.2053"+01	1.31773	0.69544	0.31996	0.68731	4.61438	0.19608
35	2.7026"-02	1.3705"+01	1.31045	0.68973	0.34205	0.70030	4.19178	0.21871
36	3.4595"-02	1.7008"+01	1.30073	0.70675	0.38237	0.73327	3.67744	0.25910
37	3.8481"-02	1.8507"+01	1.30133	0.72648	0.39934	0.75225	3.54846	0.27560
38	4.2215"-02	2.0811"+01	1.29506	0.72747	0.42409	0.76424	3.24741	0.30447
39	4.9835"-02	2.4807"+01	1.29423	0.74895	0.46389	0.79121	2.90911	0.35165
40	5.2222"-02	2.6066"+01	1.29670	0.75464	0.47573	0.79620	2.80111	0.36821
41	5.3696"-02	2.7556"+01	1.29349	0.76865	0.48930	0.81019	2.74077	0.38198
42	5.7607"-02	3.1152"+01	1.28828	0.77375	0.52086	0.82218	2.49169	0.42467
43	6.5075"-02	3.7358"+01	1.28095	0.79751	0.57111	0.84715	2.20032	0.49269
44	6.8885"-02	4.1886"+01	1.27112	0.81255	0.60514	0.86214	2.02973	0.53938
45	7.0129"-02	4.2708"+01	1.27338	0.80480	0.61112	0.85914	1.97642	0.55298
46	7.2746"-02	4.6815"+01	1.26202	0.82148	0.64014	0.87313	1.86041	0.59170
47	7.6505"-02	5.1032"+01	1.25157	0.83184	0.66862	0.88312	1.74451	0.63294
48	7.9146"-02	5.8797"+01	1.22750	0.84549	0.71813	0.89710	1.56057	0.70493
49	8.4023"-02	6.2458"+01	1.22268	0.85180	0.74032	0.90310	1.48810	0.74128
50	8.4099"-02	6.1781"+01	1.22246	0.86214	0.73626	0.90209	1.52122	0.72902
51	8.9103"-02	7.1561"+01	1.18905	0.87159	0.79281	0.91908	1.34391	0.81236
52	9.1745"-02	7.7896"+01	1.16619	0.87889	0.82738	0.92607	1.25281	0.86118
53	9.4183"-02	7.9885"+01	1.16524	0.88099	0.83794	0.92807	1.22670	0.88069
54	9.4285"-02	8.2331"+01	1.14987	0.88851	0.85074	0.93307	1.20290	0.89104
55	9.6799"-02	8.7587"+01	1.13101	0.89410	0.87763	0.93806	1.14246	0.92773
56	9.9314"-02	8.8671"+01	1.12882	0.89906	0.88307	0.94106	1.13565	0.93466
57	9.9339"-02	9.2985"+01	1.11217	0.89811	0.90441	0.94206	1.08500	0.96469
58	1.0193"-01	9.5159"+01	1.10464	0.90630	0.91497	0.94705	1.07136	0.97549
59	1.0198"-01	9.5490"+01	1.09807	0.91185	0.91657	0.95005	1.07439	0.97002
60	1.0432"-01	9.4960"+01	1.11193	0.90260	0.91401	0.94505	1.06909	0.98195
61	1.0450"-01	9.8950"+01	1.08879	0.91173	0.93311	0.95105	1.03893	0.99579
62	1.0705"-01	1.0092"+02	1.08094	0.92215	0.94239	0.95704	1.03134	1.00207
63	1.0945"-01	1.0017"+02	1.08576	0.92064	0.93887	0.95604	1.03693	1.00007
64	1.0970"-01	1.0252"+02	1.07561	0.92513	0.94986	0.95904	1.01943	1.01088
65	1.1217"-01	1.0459"+02	1.06602	0.93175	0.95946	0.96304	1.00747	1.01799
66	1.1453"-01	1.0295"+02	1.07485	0.93262	0.95188	0.96304	1.02357	1.01027
67	1.1455"-01	1.0494"+02	1.06751	0.93157	0.96106	0.96304	1.00412	1.02281
68	1.2222"-01	1.0842"+02	1.04195	0.95312	0.97696	0.97502	0.99605	1.02480
69	1.2982"-01	1.0949"+02	1.03672	0.96827	0.98176	0.98302	1.00257	1.01549
70	1.3721"-01	1.1168"+02	1.02375	0.97904	0.99157	0.98901	0.99484	1.01673
D 71	1.5281"-01	1.1358"+02	1.00100	1.00000	1.00000	1.00000	1.00000	1.00000
72	1.7818"-01	1.1290"+02	0.98702	1.02243	0.99701	1.01099	1.02823	0.96950
73	2.0361"-01	1.1336"+02	0.98731	1.01817	0.99904	1.00899	1.02002	0.97566

INPUT VARIABLES Y,M,U/UD,RHO/RHOD
AT I=2 DATA WERE AVERAGED

SECTION D. ADDITIONAL DATA - TURBULENCE MEASUREMENTS. RESULTS FROM CONSTANT-CURRENT HOT WIRE PROBES

Fluctuation levels relative to local mean value of relevant property.

FACSIMILE FROM TABLE SUPPLIED BY AUTHORS. NB: AUTHORS SYMBOLS AND UNITS

Fluctuation levels (%):

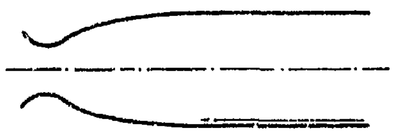
T' - static temperature, u' - velocity, p' - static pressure, ρ' - density, σ' - entropy, τ' - vorticity. Y-distance from wall in inches. L_u, L_T, L_p. Integral scales (x direction) in cm - for velocity, temperature and pressure. SRA - "Strong Reynolds Analogy" = $T'/(\gamma -1) M^2 u'$.

WIRE: A13-1 METHOD: p' ≠ 0

y (inch)	T'(%)	u'(%)	p'(%)	ρ'(%)	SRA	L_u	L_T	L_p	σ'(%)	τ'(%)
.063	4.86	8.69	16.5	11.8	.943	.85	.86	.84	1.18	3.5
.078	6.13	9.60	16.87	12.6	.856	.99	.97	.67	3.78	7.09
.104	6.87	8.41	18.52	13.9	.856	1.12	1.14	1.01	4.39	6.33
.116	6.66	7.56	17.55	13.3	.849	1.23	1.19	.72	4.38	5.81
.26	6.16	4.60	13.48	10.8	.748	1.34	1.24	.63	4.81	4.14
.365	5.30	3.57	12.48	9.73	.722	1.75	1.65	.56	3.92	3.12
.469	5.37	3.22	11.95	9.48	.708	1.96	1.66	.504	4.15	2.88
.562	5.62	3.08	11.47	9.38	.700	1.97	1.85	.479	4.57	2.81
.665	6.24	3.14	11.76	9.91	.685	2.00	1.89	.489	5.26	2.92
.763	6.01	2.90	11.8	9.78	.652	2.06	2.03	.38	4.97	2.70
.861	5.80	2.75	11.05	9.27	.61	2.12	2.16	.47	4.86	2.59
1.462	8.84	2.79	14.4	12.9	.588	1.99	2.10	.51	7.83	2.69
2.011	8.15	2.06	14.3	12.4	.504	1.79	1.81	.36	7.05	1.99
2.513	7.79	1.56	14.8	12.4	.446	2.06	1.96	.55	6.55	1.51
2.716	9.83	1.59	14.5	13.7	.477	2.46	3.27	.66	8.90	1.56
3.263	10.3	1.2	13.9	13.7	.453	1.52	1.37	.18	9.50	1.18
3.413	7.03	.89	11.26	10.2	.376	1.97	1.89	.15	6.25	.88
3.663	7.89	.74	12.36	11.3	.438	1.81	1.65	.84	7.05	.725
3.865	5.46	.525	8.95	8.01	.381	1.81	1.39	.37	4.82	.516
4.062	2.44	.222	6.31	4.8	.372	2.88	4.15	1.86	1.65	.214
4.264	1.59	.160	4.76	3.5	.318	1.85	1.67	1.87	.83	.154
4.464	1.26	.115	3.76	2.76	.342	1.8[illegible]	1.10	1.47	.66	.11
4.613	1.22	.089	3.09	2.36	.420	2.68	.59	1.11	.85	.085
5.54	1.50	.061	3.17	2.56	.709	1.93	1.21	2.50	1.20	.055
6.512	2.11	.037	3.05	2.9	1.61	5.55	4.68	2.28	1.93	.028

WIRE: 6-3 METHOD: p' ≠ 0

y	T'(%)	u'(%)	p'(%)	ρ'(%)	SRA	L_u	L_T	L_p	σ'(%)	τ'(%)
.027	.79	3.12	2.69	1.93	.929	.26	.26	.24	.18	1.33
.047	4.83	10.0	16.8	12.0	.995	.486	.48	.467	.58	1.72
.090	3.07	3.82	8.90	6.58	.932	1.21	1.15	.64	1.73	2.44
.11	3.59	3.78	11.3	8.22	.956	1.31	1.27	.84	1.59	1.95
.128	3.74	3.46	11.56	8.44	.963	1.52	1.45	.57	1.76	1.82
.144	3.65	3.10	10.92	8.02	.947	1.46	1.39	.79	1.89	1.82
.187	3.77	2.78	9.37	7.2	.893	1.48	1.41	.62	2.66	2.15
.212	3.40	2.33	9.10	6.86	.910	1.56	1.45	.59	2.18	1.67
.23	3.46	2.34	9.20	6.94	.885	1.19	1.09	.50	2.25	1.73
1.02	5.24	1.57	11.21	9.01	.849	2.75	2.59	1.03	4.14	1.34
1.318	5.44	1.44	10.85	8.94	.776	3.03	3.23	1.27	4.47	1.29
1.618	6.54	1.42	12.30	10.4	.769	2.95	3.21	1.32	5.52	1.29
2.224	5.80	.875	12.39	9.97	.727	3.3	3.24	1.58	4.50	.784
2.82	6.72	.701	16.29	12.6	.687	3.51	3.40	.45	4.85	.616
3.122	6.58	.614	13.43	11.0	.622	2.92	3.50	2.85	5.35	.572
3.971	2.94	.197	7.36	5.64	.522	2.98	2.64	.59	2.06	.183
5.047	2.08	.081	6.53	4.75	.752	1.19	.52	.38	.92	.060
6.971	3.67	.185	2.41	3.99	.565	.63	.36	.097	3.6	.184



M : 2.96 falling to 2.80

R THETA X 10^{-3} : 23 - 415

TW/TR : 1.05

7601

ZPG - AW

Blow down tunnel with two-dimensional symmetrical fixed nozzle blocks. Minimum running time 20 secs. W = H = 0.232, L = 2.56 m. 0.3 < PO < 3.4 MN/m^2. TO : 275 K. Dry air. 35 < RE/m X 10^{-6} < 300.

VAS I.E., SETTLES G.S. and BOGDONOFF S.M. 1976. An experimental study of the compressible turbulent boundary layer over a wide range of Reynolds number. Princeton University report in preparation. And Settles (1975), Vas & Bogdonoff (1971), Vas I.E., private communications.

1 The test boundary layer was formed on the lower wall of a 0.232 m square constant area test channel, following the contoured nozzle block. There were nine test stations on the centre line, approximately equally distributed in the range X = 0.89 to 3.45, where X = 0 at the tunnel throat. The test surface was
2 machined to 1.7 μm, and was not actively cooled. Pitot surveys showed the free stream "to be even within
3 3 %."No boundary layer trip devices were used, and natural transition was believed to occur upstream of
4 the throat. The test layer experienced a predominately simple wave favourable pressure gradient when passing over the nozzle block, and as a result of boundary layer growth, was subject to a slight adverse
5 pressure gradient in the constant-area test section. Spanwise static pressure surveys and surface flow patterns were frequently repeated, and showed the flow to be'uniform and non-converging'.

6 Wall pressure was measured by static pressure tappings (d = 0.8 mm), and wall temperature by thermocouples,
8 both at the same X-stations as for the profiles. Wall shear stress was determined using Preston tubes (d_2 = 0.6 d_1; d_1 = 1.57, 2.39, 3,18 mm) and the Hopkins & Keener (1966) T/calibration.

7 Pitot profiles were measured with a FPP for which h_1 = 0.178, h_2 = 0.089, b_1 = 0.762, 1 = 2 mm. 20-30 total temperature surveys were made using a FWP consisting of a chromel alumel thermocouple junction
8 at the centre of a fine wire 2.54 mm long, and either 51 or 102 μm in diameter. The profiles were measured at the nine stations listed in section B below, and Preston tube observations were made at the same positions.

9 The TO profile surveys all showed "a roughly linear increase in TO/TOD from 1.0 at the boundary layer edge to 1.05 at the wall. Thus this linear total temperature profile was assumed" in data reduction. The authors comment that a Crocco-Van Driest correlation could have been used, with little consequent material differences in the reduced data. The static pressure was assumed constant through the boundary layer, and given the value obtained from the Pitot measurements at the boundary layer edge. This did not differ significantly
10 from the measured values of PW. No profile corrections were applied and Sutherland's viscosity formula was
11 used.

12 The editors' have accepted all the assumptions of the authors, and adopted the authors' selection of a
13 D-state. The data form four sets of nine successive profile observations at increasing unit Reynolds
14 number. For about 2/3 of the profiles, a Preston tube CF observation is provided. The raw and reduced data are given in table 1 of section D.

§ DATA: 7601 0101-0409. Pitot and TO profiles. NX = 9. CF from Preston tubes measured separately.

15 Editors' comments

The Reynolds number range of this experiment is both very wide and very high. The experimental coverage is relatively complete. Although temperature profiles were not obtained for each and every Pitot profile, a great deal of data was obtained. The reduced data are not very sensitive to small differences in the temperature profile at this relatively modest Mach number and with a near-adiabatic wall, so that the linear variation used to describe the measurements is probably adequate. The value of the data is greatly increased by the inclusion of shear stress measurements and the large number of streamwise stations.

Some of the profiles are extremely long but even so measurements for about half the profiles do not extend within the momentum deficit peak.

The obvious comparison experiments are those of Moore & Harkness - CAT 6502 and Thomke - CAT 6903.

SECTION D, ADDITIONAL DATA, RAW PRESTON TUBE READINGS

DP - Preston tube diameter - inches
PP - Preston tube pressure - psia
CF - As reduced by authors.

CAT 7601	DP in	PP psia	CF X10[3]	CAT 7601	DP in	PP psia	CF X10[3]
0101	0.062	6.012	1.38	0201	0.062	10.57	1.27
0102	-	NM	-	0202	-	NM	-
0103	0.062	5.76	1.21	0203	0.062	9.98	1.10
0104	0.125	7.4	1.31	0204	0.125	12.7	1.18
0105	0.094	6.63	1.23	0205	0.094	11.5	1.13
0106	0.125	7.54	1.26	0206	0.0625	10.52	1.14
0107	0.062	6.19	1.21	0207	0.062	10.62	1.15
0108	-	NM	-	0208	-	NM	-
0109	-	NM	-	0209	0.062	10.58	1.07
0301	0.062	35.48	1.08	0401	-	NM	-
0302	-	NM	-	0402	-	NM	-
0303	0.062	31.65	0.92	0403	0.062	52.97	0.86
0304	0.125	42.5	1.00	0404	-	NM	-
0305	0.094	38.0	0.93	0405	-	NM	-
0306	0.125	42.45	0.95	0406	-	NM	-
0307	0.062	33.60	0.90	0407	-	NM	-
0308	-	NM	-	0408	-	NM	-
0309	0.062	33.15	0.84	0409	0.062	56.76	0.76

CAT 7601 VAS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
76010101	2.9600	1.1245	9.1522E+03	1.3800E-03	5.6106	1.2374	1.1960E+04	1.1960E+04
8.8900E-01	4.1369E+05	1.0000	2.3198E+04	NM	1.8535	1.8390	2.8292E+02	9.7897E+01
INFINITE	2.6944E+02	0.0000	6.4826E-04	0.0000E+00	-0.1713	9.9077E-04	5.8720E+02	2.5160E+02
76010102	2.9200	1.1237	1.2057E+04	NM	5.5008	1.2512	1.2704E+04	1.2704E+04
1.1938E+00	4.1369E+05	1.0000	3.1445E+04	NM	1.8487	1.8318	2.8583E+02	1.0063E+02
INFINITE	2.7222E+02	0.0000	8.7298E-04	0.0000E+00	-0.1684	1.3206E-03	5.8728E+02	2.5438E+02
76010103	2.9000	1.1233	1.4052E+04	1.2100E-03	5.7442	1.2463	1.3094E+04	1.3094E+04
1.4986E+00	4.1369E+05	1.0000	3.4677E+04	NM	1.8485	1.8328	2.8583E+02	1.0150E+02
INFINITE	2.7222E+02	0.0000	9.5241E-04	0.0000E+00	-0.2744	1.4512E-03	5.8579E+02	2.5447E+02
76010104	2.8800	1.1229	1.7315E+04	1.3100E-03	5.5513	1.2412	1.3497E+04	1.3497E+04
1.7907E+00	4.1369E+05	1.0000	4.2376E+04	NM	1.8496	1.8334	2.8583E+02	1.0238E+02
INFINITE	2.7222E+02	0.0000	1.1514E-03	0.0000E+00	-0.2291	1.7383E-03	5.8427E+02	2.5456E+02
76010105	2.8700	1.1227	1.9562E+04	1.2300E-03	5.7958	1.2200	1.3703E+04	1.3703E+04
2.0955E+00	4.1369E+05	1.0000	4.767[illegible]E+04	NM	1.8582	1.8444	2.8583E+02	1.0283E+02
INFINITE	2.7222E+02	0.0000	1.2886E-03	0.0000E+00	-0.3425	1.9308E-03	5.8351E+02	2.5461E+02
76010106	2.8800	1.1229	2.2509E+04	1.2600E-03	5.1555	1.2224	1.3497E+04	1.3497E+04
2.4003E+00	4.1369E+05	1.0000	5.4988E+04	NM	1.8612	1.8433	2.8875E+02	1.0343E+02
INFINITE	2.7500E+02	0.0000	1.5164E-03	0.0000E+00	-0.1098	2.2031E-03	5.8725E+02	2.5716E+02
76010107	2.8700	1.1227	2.3712E+04	1.2100E-03	5.3302	1.2345	1.3703E+04	1.3703E+04
2.6924E+00	4.1369E+05	1.0000	5.7543E+04	NM	1.8555	1.8392	2.9283E+02	1.0535E+02
INFINITE	2.7889E+02	0.0000	1.6109E-03	0.0000E+00	-0.1699	2.3796E-03	5.9061E+02	2.6084E+02
76010108	2.8100	1.1214	2.8761E+04	NM	4.9893	1.2235	1.5013E+04	1.5013E+04
2.9972E+00	4.1369E+05	1.0000	6.8037E+04	NM	1.8582	1.8425	2.9400E+02	1.0856E+02
INFINITE	2.8000E+02	0.0000	1.8548E-03	0.0000E+00	-0.1123	2.6759E-03	5.8702E+02	2.6217E+02
76010201	2.9600	1.1245	1.4722E+04	1.2700E-03	5.4105	1.2971	1.9933E+04	1.9933E+04
8.8900E-01	6.8948E+05	1.0000	3.7245E+04	NM	1.8474	1.8217	2.8583E+02	9.8906E+01
INFINITE	2.7222E+02	0.0000	6.3392E-04	0.0000E+00	-0.0865	9.4582E-04	5.9022E+02	2.5420E+02
76010202	2.9400	1.1241	1.8616E+04	NM	5.7530	1.2492	2.0543E+04	2.0543E+04
1.1938E+00	6.8948E+05	1.0000	4.6710E+04	NM	1.8518	1.8358	2.8583E+02	9.9762E+01
INFINITE	2.7222E+02	0.0000	7.8649E-04	0.0000E+00	-0.2361	1.2009E-03	5.8876E+02	2.5429E+02
76010203	2.9300	1.1239	2.2049E+04	1.1000E-03	5.5334	1.2388	2.0855E+04	2.0855E+04
1.4986E+00	6.8948E+05	1.0000	5.5095E+04	NM	1.8538	1.8386	2.8583E+02	1.0019E+02
INFINITE	2.7222E+02	0.0000	9.2269E-04	0.0000E+00	-0.1794	1.3876E-03	5.8803E+02	2.5433E+02
76010204	2.9200	1.1237	2.6459E+04	1.1800E-03	5.3333	1.2740	2.1173E+04	2.1173E+04
1.7907E+00	6.8948E+05	1.0000	6.5718E+04	NM	1.8437	1.8203	2.8875E+02	1.0165E+02
INFINITE	2.7500E+02	0.0000	1.1110E-03	0.0000E+00	-0.0990	1.6757E-03	5.9027E+02	2.5697E+02
76010205	2.8700	1.1227	3.2356E+04	1.1300E-03	5.2707	1.2504	2.2838E+04	2.2838E+04
2.0955E+00	6.8948E+05	1.0000	7.8861E+04	NM	1.8564	1.8417	2.8583E+02	1.0283E+02
INFINITE	2.7222E+02	0.0000	1.2788E-03	0.0000E+00	-0.1424	1.8773E-03	5.8351E+02	2.5461E+02
76010206	2.8800	1.1229	3.7780E+04	1.1400E-03	5.2857	1.2298	2.2494E+04	2.2494E+04
2.4003E+00	6.8948E+05	1.0000	9.3505E+04	NM	1.8564	1.8391	2.6833E+02	9.6114E+01
INFINITE	2.5556E+02	0.0000	1.3899E-03	0.0000E+00	-0.1471	2.0514E-03	5.6610E+02	2.3897E+02
76010207	2.8500	1.1222	4.0634E+04	1.1500E-03	5.1476	1.2180	2.3543E+04	2.3543E+04
2.6924E+00	6.8948E+05	1.0000	9.8216E+04	NM	1.8632	1.8494	2.8583E+02	1.0372E+02
INFINITE	2.7222E+02	0.0000	1.5756E-03	0.0000E+00	-0.1370	2.2785E-03	5.8196E+02	2.5470E+02
76010208	2.8300	1.1218	4.2019E+04	NM	5.1085	1.2232	2.4270E+04	2.4270E+04
2.9972E+00	6.8948E+05	1.0000	9.9606E+04	NM	1.8605	1.8453	3.0450E+02	1.1146E+02
INFINITE	2.9000E+02	0.0000	1.7328E-03	0.0000E+00	-0.1388	2.5036E-03	5.9905E+02	2.7143E+02
76010209	2.8000	1.1212	4.7141E+04	1.0700E-03	5.0914	1.2095	2.5406E+04	2.5406E+04
3.3147E+00	6.8948E+05	1.0000	1.1160E+05	NM	1.8625	1.8485	2.8583E+02	1.0601E+02
INFINITE	2.7222E+02	0.0000	1.7430E-03	0.0000E+00	-0.1687	2.5043E-03	5.7801E+02	2.5494E+02

CAT 7601 VAS BOUNDARY CONDITIONS AND EVALUATED DATA. SI UNITS.

RUN	MD *	TW/TR	RED2W	CF *	H12	H12K	PW	PD
X *	POD*	PW/PD*	RED2D	CQ	H32	H32K	TW*	TD
RZ	TOD*	SW *	D2	PI2*	H42	D2K	UD	TR
76010301	2.9600	1.1245	3.4141"+04	1.0800"-03	5.7107	1.2327	5.9799"+04	5.9799"+04
8.8900"-01	2.0684"+06	1.0000	8.6376"+04	NM	1.8703	1.8573	2.8583"+02	9.8906"+01
INFINITE	2.7222"+02	0.0000	4.9005"-04	0.0000"+00	-0.2267	7.1927"-04	5.9022"+02	2.5420"+02
76010302	3.0000	[illegible]	[illegible].7092"+04	NM	5.6931	1.2363	5.6310"+04	5.6310"+04
1.1938"+00	2.0684"+06	[illegible]	[illegible].2113"+05	NM	1.8540	1.8371	2.8583"+02	9.7222"+01
INFINITE	2.7222"+02	[illegible]	[illegible].0219"-04	0.0000"+00	-0.1626	1.0795"-03	5.9308"+02	2.5402"+02
76010303	2.9200	1.1237	5.7673"+04	9.2000"-04	5.5719	1.2724	6.3518"+04	6.3518"+04
1.4986"+00	2.0684"+06	1.0000	1.4351"+05	NM	1.8547	1.8381	2.8583"+02	1.0063"+02
INFINITE	2.7222"+02	0.0000	7.9685"-04	0.0000"+00	-0.1655	1.1944"-03	5.8728"+02	2.5438"+02
76010304	2.9300	1.1239	6.6344"+04	1.0000"-03	5.5741	1.1990	6.2566"+04	6.2566"+04
1.7907"+00	2.0684"+06	1.0000	1.6577"+05	NM	1.8730	1.8591	2.8583"+02	1.0019"+02
INFINITE	2.7222"+02	0.0000	9.2543"-04	0.0000"+00	-0.2262	1.3459"-03	5.8803"+02	2.5433"+02
76010305	2.9400	1.1241	6.9094"+04	9.3000"-04	5.7547	1.1918	6.1629"+04	6.1629"+04
2.0955"+00	2.0684"+06	1.0000	1.7336"+05	NM	1.8679	1.8554	2.8583"+02	9.9762"+01
INFINITE	2.7222"+02	0.0000	9.7302"-04	0.0000"+00	-0.2789	1.4406"-03	5.8876"+02	2.5429"+02
76010306	2.8700	1.1227	9.2577"+04	9.5000"-04	5.8050	1.2162	6.8515"+04	6.8515"+04
2.4003"+00	2.0684"+06	1.0000	2.2572"+05	NM	1.8526	1.8406	2.8525"+02	1.0262"+02
INFINITE	2.7167"+02	0.0000	1.2164"-03	0.0000"+00	-0.3516	1.6227"-03	5.8291"+02	2.5409"+02
76010307	2.8900	1.1231	8.7449"+04	9.0000"-04	5.5262	1.2164	6.6468"+04	6.6468"+04
2.6924"+00	2.0684"+06	1.0000	2.1445"+05	NM	1.8683	1.8540	2.8933"+02	1.0319"+02
INFINITE	2.7556"+02	0.0000	1.1926"-03	0.0000"+00	-0.2358	1.7409"-03	5.8860"+02	2.5763"+02
76010308	2.8500	1.1222	1.1113"+05	NM	5.5135	1.2258	7.0628"+04	7.0628"+04
2.9972"+00	2.0684"+06	1.0000	2.6843"+05	NM	1.8576	1.8432	2.8700"+02	1.0415"+02
INFINITE	2.7333"+02	0.0000	1.4439"-03	0.0000"+00	-0.2615	2.1315"-03	5.8315"+02	2.5574"+02
76010309	2.8500	1.1222	1.1875"+05	8.4000"-04	5.4027	1.2196	7.0628"+04	7.0628"+04
3.3147"+00	2.0684"+06	1.0000	2.8591"+05	NM	1.8605	1.8459	2.9225"+02	1.0605"+02
INFINITE	2.7833"+02	0.0000	1.5790"-03	0.0000"+00	-0.2242	2.3198"-03	5.8846"+02	2.6042"+02
76010401	2.9600	1.1245	5.4494"+04	NM	5.3187	1.2112	9.7273"+04	9.7273"+04
8.8900"-01	3.3646"+06	1.0000	1.3787"+05	NM	1.8826	1.8717	2.8583"+02	9.8906"+01
INFINITE	2.7222"+02	0.0000	4.8085"-04	0.0000"+00	-0.1111	6.8048"-04	5.9022"+02	2.5420"+02
76010402	2.9900	1.1250	6.2414"+04	NM	6.2722	1.3177	9.3364"+04	9.3364"+04
1.1938"+00	3.3784"+06	1.0000	1.5988"+05	NM	1.8632	1.8445	2.8583"+02	9.7640"+01
INFINITE	2.7222"+02	0.0000	5.6438"-04	0.0000"+00	-0.3376	8.9640"-04	5.9237"+02	2.5407"+02
76010403	2.9600	1.1245	7.8242"+04	8.6000"-04	5.7942	1.3262	9.7273"+04	9.7273"+04
1.4986"+00	3.3646"+06	1.0000	1.9795"+05	NM	1.8590	1.8398	2.8583"+02	9.8906"+01
INFINITE	2.7222"+02	0.0000	6.9039"-04	0.0000"+00	-0.2006	1.0331"-03	5.9022"+02	2.5420"+02
76010404	2.9700	1.1246	9.4872"+04	NM	5.7095	1.1930	9.6213"+04	9.6213"+04
1.7907"+00	3.3784"+06	1.0000	2.4102"+05	NM	1.8764	1.8644	2.8583"+02	9.8482"+01
INFINITE	2.7222"+02	0.0000	8.4170"-04	0.0000"+00	-0.2393	1.2200"-03	5.9094"+02	2.5415"+02
76010405	2.9500	1.1243	1.0239"+05	9.3000"-04	6.0734	1.2511	9.9154"+04	9.9154"+04
2.0955"+00	3.3784"+06	1.0000	2.5798"+05	NM	1.8616	1.8425	2.8583"+02	9.9333"+01
INFINITE	2.7222"+02	0.0000	8.9129"-04	0.0000"+00	-0.3470	1.3408"-03	5.8949"+02	2.5424"+02
76010406	2.9000	1.1233	1.2167"+05	9.5000"-04	5.6976	1.2170	1.0693"+05	1.0693"+05
2.4003"+00	3.3784"+06	1.0000	3.0025"+05	NM	1.8714	1.8599	2.8583"+02	1.0150"+02
INFINITE	2.7222"+02	0.0000	1.0098"-03	0.0000"+00	-0.2682	1.4744"-03	5.8579"+02	2.5447"+02
76010407	2.9100	1.1235	1.3737"+05	NM	5.3360	1.2091	1.0490"+05	1.0490"+05
2.6924"+00	3.3646"+06	1.0000	3.4042"+05	NM	1.8700	1.8567	2.8583"+02	1.0106"+02
INFINITE	2.7222"+02	0.0000	1.1358"-03	0.0000"+00	-0.1571	1.6687"-03	5.8654"+02	2.5442"+02
76010408	2.9500	1.1243	1.4306"+05	NM	5.3768	1.2048	1.0118"+05	1.0118"+05
2.9972"+00	3.4474"+06	1.0000	3.6112"+05	NM	1.8735	1.8589	2.8292"+02	9.8319"+01
INFINITE	2.6944"+02	0.0000	1.2045"-03	0.0000"+00	-0.1365	1.7414"-03	5.8648"+02	2.5165"+02
76010409	2.9700	1.1246	1.5925"+05	7.6000"-04	5.5902	1.2035	9.7194"+04	9.7194"+04
3.3147"+00	3.4129"+06	1.0000	4.0457"+05	NM	1.8775	1.8622	2.8583"+02	9.8482"+01
INFINITE	2.7222"+02	0.0000	1.3986"-03	0.0000"+00	-0.1966	2.0157"-03	5.9094"+02	2.5415"+02

76010103 VAS PROFILE TABULATION 49 POINTS, DELTA AT POINT 49

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	1.05205	0.00000	0.00000	2.82161	0.00000
2	1.0160"-04	2.0325"+00	NM	1.02221	0.36552	0.54687	2.23852	0.24430
3	3.5560"-04	2.8778"+00	NM	1.02718	0.46552	0.66146	2.01899	0.32762
4	6.0960"-04	3.0144"+00	NM	1.03154	0.47931	0.67708	1.99549	0.33931
5	8.6360"-04	3.4894"+00	NM	1.04004	0.52414	0.72396	1.90781	0.37947
6	1.1176"-03	3.7244"+00	NM	1.03010	0.54483	0.73958	1.84271	0.40136
7	1.3716"-03	3.9693"+00	NM	1.02263	0.56532	0.75521	1.78337	0.42347
8	1.6256"-03	4.0953"+00	NM	1.02570	0.57586	0.76562	1.76765	0.43313
9	1.8796"-03	4.2238"+00	NM	1.03114	0.58621	0.77604	1.75254	0.44281
10	2.1336"-03	4.4880"+00	NM	1.02750	0.60690	0.79167	1.70159	0.46525
11	2.3876"-03	4.6237"+00	NM	1.03307	0.61724	0.80208	1.68861	0.47500
12	2.6416"-03	4.7618"+00	NM	1.03896	0.62759	0.81250	1.67610	0.48476
13	3.2766"-03	4.9973"+00	NM	1.03394	0.64483	0.82292	1.62864	0.50528
14	3.9116"-03	5.3878"+00	NM	1.03355	0.67241	0.84375	1.57454	0.53587
15	4.5466"-03	5.5894"+00	NM	1.02270	0.68621	0.84896	1.53060	0.55466
16	5.1816"-03	5.8473"+00	NM	1.03203	0.70345	0.86458	1.51060	0.57234
17	5.8166"-03	6.1654"+00	NM	1.02455	0.72414	0.87500	1.46007	0.59929
18	6.4516"-03	6.4377"+00	NM	1.02347	0.74138	0.88542	1.42631	0.62077
19	7.0866"-03	6.7730"+00	NM	1.01853	0.76207	0.89583	1.38187	0.64828
20	7.7216"-03	7.0597"+00	NM	1.01928	0.77931	0.90625	1.35231	0.67015
21	8.3566"-03	7.3528"+00	NM	1.02076	0.79655	0.91667	1.32433	0.69218
22	8.9916"-03	7.5319"+00	NM	1.01967	0.80690	0.92187	1.30529	0.70626
23	9.6266"-03	7.8969"+00	NM	1.01826	0.82759	0.93229	1.26905	0.73464
24	1.0262"-02	8.1455"+00	NM	1.02541	0.84138	0.94271	1.25537	0.75094
25	1.0897"-02	8.3386"+00	NM	1.01411	0.85172	0.94271	1.22506	0.76952
26	1.1532"-02	8.8505"+00	NM	1.01885	0.87931	0.95833	1.18782	0.80680
27	1.2167"-02	9.0482"+00	NM	1.01961	0.88966	0.96354	1.17300	0.82143
28	1.2802"-02	9.3155"+00	NM	1.01726	0.90345	0.96875	1.14979	0.84255
29	1.3437"-02	9.5869"+00	NM	1.01530	0.91724	0.97396	1.12749	0.86383
30	1.4072"-02	9.8624"+00	NM	1.01369	0.93103	0.97917	1.10607	0.88527
31	1.4707"-02	1.0072"+01	NM	1.01539	0.94138	0.98438	1.09343	0.90026
32	1.5342"-02	1.0355"+01	NM	1.01435	0.95517	0.98958	1.07335	0.92196
33	1.5977"-02	1.0498"+01	NM	1.00863	0.96207	0.98958	1.05802	0.93532
34	1.6612"-02	1.0642"+01	NM	1.01362	0.96897	0.99479	1.05402	0.94381
35	1.7247"-02	1.0859"+01	NM	1.00537	0.97931	0.99479	1.03187	0.96407
36	1.7882"-02	1.0933"+01	NM	1.01320	0.98276	1.00000	1.03540	0.96581
37	1.8517"-02	1.1080"+01	NM	1.00784	0.98966	1.00000	1.02102	0.97942
38	1.9152"-02	1.1154"+01	NM	1.00520	0.99310	1.00000	1.01394	0.98625
39	1.9787"-02	1.1228"+01	NM	1.00258	0.99655	1.00000	1.00693	0.99312
40	2.0422"-02	1.1228"+01	NM	1.01306	0.99655	1.00521	1.01745	0.98797
41	2.1057"-02	1.1228"+01	NM	1.00258	0.99655	1.00000	1.00693	0.99312
42	2.1692"-02	1.1302"+01	NM	1.01044	1.00000	1.00521	1.01044	0.99482
43	2.2327"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
44	2.2962"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
45	2.3597"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
46	2.4232"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
47	2.4867"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
48	2.5400"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 49	2.6162"-02	1.1302"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U ASSUME P=PD

76010203 VAS PROFILE TABULATION 73 POINTS, DELTA AT POINT 68

I	Y	PT2/P	P/PO	T./TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	1.04200	0.00000	0.00000	2.83109	0.00000
2	8.8900E-05	1.8697E+00	NM	1.02384	0.33767	0.51503	2.32632	0.22139
3	5.1562E-04	3.5482E+00	NM	1.02315	0.52397	0.72021	1.88929	0.38121
4	9.4234E-04	3.9509E+00	NM	1.02339	0.55822	0.75130	1.81139	0.41476
5	1.3716E-03	4.2056E+00	NM	1.03153	0.57877	0.77202	1.77930	0.43389
6	1.7983E-03	4.4701E+00	NM	1.02756	0.59932	0.78756	1.72688	0.45606
7	2.2276E-03	4.6518E+00	NM	1.02594	0.61301	0.79793	1.69428	0.47095
8	2.6416E-03	4.8849E+00	NM	1.01846	0.63014	0.80829	1.64537	0.49125
9	3.0734E-03	5.1247E+00	NM	1.02516	0.64726	0.82383	1.62003	0.50853
10	3.5052E-03	5.2717E+00	NM	1.01938	0.65753	0.82902	1.58960	0.52152
11	3.9370E-03	5.5221E+00	NM	1.01496	0.67466	0.83938	1.54792	0.54226
12	4.3688E-03	5.7792E+00	NM	1.02400	0.69178	0.85492	1.52727	0.55977
13	4.8006E-03	5.8838E+00	NM	1.02535	0.69863	0.86010	1.51568	0.56747
14	5.2070E-03	6.1501E+00	NM	1.01105	0.71575	0.86528	1.46148	0.59206
15	5.6388E-03	6.4229E+00	NM	1.02196	0.73288	0.88083	1.44451	0.60978
16	6.0706E-03	6.5898E+00	NM	1.01925	0.74315	0.88601	1.42142	0.62333
17	6.5024E-03	6.7591E+00	NM	1.01687	0.75342	0.89119	1.39914	0.63695
18	6.9342E-03	6.9884E+00	NM	1.02200	0.76712	0.90155	1.38119	0.65274
19	7.3660E-03	7.1631E+00	NM	1.02028	0.77740	0.90674	1.36043	0.66651
20	7.7724E-03	7.3998E+00	NM	1.01458	0.79110	0.91192	1.32878	0.68628
21	8.2042E-03	7.5197E+00	NM	1.01769	0.79795	0.91710	1.32095	0.69427
22	8.6360E-03	7.8857E+00	NM	1.01617	0.81849	0.92746	1.28399	0.72233
23	9.0678E-03	8.0098E+00	NM	1.00836	0.82534	0.92746	1.26277	0.73447
24	9.4996E-03	8.1979E+00	NM	1.00817	0.83562	0.93264	1.24571	0.74868
25	9.9314E-03	8.3884E+00	NM	1.00821	0.84589	0.93782	1.22918	0.76297
26	1.0338E-02	8.5812E+00	NM	1.00847	0.85616	0.94301	1.21319	0.77732
27	1.0770E-02	8.8420E+00	NM	1.01649	0.86986	0.95337	1.20121	0.79367
28	1.1201E-02	9.1738E+00	NM	1.01048	0.88699	0.95855	1.16787	0.82077
29	1.1633E-02	9.2409E+00	NM	1.00718	0.89041	0.95855	1.15891	0.82712
30	1.2065E-02	9.3083E+00	NM	1.01480	0.89384	0.96373	1.16251	0.82901
31	1.2497E-02	9.4439E+00	NM	1.00832	0.90068	0.96373	1.14489	0.84176
32	1.2903E-02	9.7182E+00	NM	1.00653	0.91438	0.96891	1.12282	0.86292
33	1.3335E-02	9.9267E+00	NM	1.00809	0.92466	0.97409	1.10979	0.87773
34	1.3767E-02	1.0208E+01	NM	1.00688	0.93836	0.97927	1.08911	0.89915
35	1.4199E-02	1.0422E+01	NM	1.00883	0.94863	0.98446	1.07696	0.91411
36	1.4630E-02	1.0639E+01	NM	1.01094	0.95890	0.98964	1.06513	0.92913
37	1.5062E-02	1.0897E+01	NM	1.00267	0.96918	0.98964	1.04267	0.94914
38	1.5494E-02	1.0931E+01	NM	1.01047	0.97260	0.99482	1.04621	0.95088
39	1.5900E-02	1.1070E+01	NM	1.00511	0.97945	0.99482	1.03162	0.96432
40	1.6332E-02	1.1192E+01	NM	1.00247	0.98288	0.99482	1.02445	0.97108
41	1.6764E-02	1.1301E+01	NM	1.00768	0.98973	1.00000	1.02087	0.97956
42	1.7196E-02	1.1301E+01	NM	1.00768	0.98973	1.00000	1.02087	0.97956
43	1.7628E-02	1.1376E+01	NM	1.00509	0.99315	1.00000	1.01384	0.98635
44	1.8059E-02	1.1452E+01	NM	1.00253	0.99658	1.00000	1.00688	0.99316
45	1.8466E-02	1.1452E+01	NM	1.00253	0.99658	1.00000	1.00688	0.99316
46	1.8898E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
47	1.9329E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
48	1.9761E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
49	2.0193E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
50	2.0625E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	2.1031E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
52	2.1463E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
53	2.1895E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
54	2.2327E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
55	2.2758E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
56	2.3190E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
57	2.3597E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
58	2.4028E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
59	2.4460E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
60	2.4892E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
61	2.5324E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
62	2.5654E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
63	2.6162E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
64	2.6670E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
65	2.6924E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
66	2.7432E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
67	2.7940E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 68	2.8194E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
69	2.8702E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
70	2.9210E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
71	2.9718E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
72	2.9972E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
73	3.0480E-02	1.1527E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U ASSUME P=PD

76010303 VAS PROFILE TABULATION 67 POINTS, DELTA AT POINT 67

I	Y	P12/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	1.04651	0.00000	0.00000	2.83109	0.00000
2	1.7526"-04	1.9152"+00	NM	1.03903	0.34589	0.52850	2.33458	0.22638
3	6.0960"-04	3.7244"+00	NM	1.02467	0.51110	0.73575	1.84890	0.39794
4	1.0439"-03	4.1379"+00	NM	1.02734	0.57534	0.76680	1.77646	0.43167
5	1.4783"-03	4.4880"+00	NM	1.02209	0.60274	0.78756	1.70731	0.46129
6	1.9152"-03	4.8084"+00	NM	1.02670	0.62671	0.80829	1.66341	0.48592
7	2.3495"-03	4.9973"+00	NM	1.02659	0.64081	0.81865	1.63411	0.50098
8	2.7940"-03	5.2394"+00	NM	1.02081	0.65753	0.82902	1.58960	0.52152
9	3.2258"-03	5.4881"+00	NM	1.01630	0.67466	0.83938	1.54792	0.54226
10	3.6576"-03	5.5894"+00	NM	1.02982	0.68151	0.84974	1.55465	0.54658
11	4.0894"-03	5.8473"+00	NM	1.02659	0.69863	0.86010	1.51568	0.56747
12	4.5212"-03	6.0583"+00	NM	1.01739	0.71233	0.86528	1.47556	0.58641
13	4.9530"-03	6.3280"+00	NM	1.01599	0.72945	0.87565	1.44100	0.60766
14	5.3848"-03	6.5484"+00	NM	1.02026	0.74315	0.88601	1.42142	0.62333
15	5.8166"-03	6.7730"+00	NM	1.02498	0.75685	0.89637	1.40268	0.63904
16	6.2738"-03	7.0597"+00	NM	1.01391	0.77397	0.90155	1.35685	0.66445
17	6.7056"-03	7.2937"+00	NM	1.01966	0.78767	0.91192	1.34036	0.68035
18	7.1374"-03	7.5319"+00	NM	1.01429	0.80137	0.91710	1.30968	0.70025
19	7.5692"-03	7.6525"+00	NM	1.01752	0.80822	0.92228	1.30217	0.70826
20	8.0010"-03	7.8969"+00	NM	1.01290	0.82192	0.92746	1.27331	0.72839
21	8.4328"-03	8.1455"+00	NM	1.00877	0.83562	0.93264	1.24571	0.74868
22	8.8646"-03	8.5905"+00	NM	1.01650	0.85959	0.94819	1.21676	0.77927
23	9.2964"-03	8.8505"+00	NM	1.01348	0.87329	0.95337	1.19181	0.79993
24	9.7282"-03	9.0482"+00	NM	1.01423	0.88356	0.95855	1.17694	0.81444
25	1.0185"-02	9.3029"+00	NM	1.00866	0.90068	0.96373	1.14489	0.84176
26	1.0617"-02	9.6554"+00	NM	1.00682	0.91438	0.96891	1.12282	0.86292
27	1.1049"-02	9.7931"+00	NM	1.01140	0.92123	0.97409	1.11805	0.87124
28	1.1481"-02	1.0002"+01	NM	1.01303	0.93151	0.97927	1.10519	0.88607
29	1.1913"-02	1.0213"+01	NM	1.00416	0.94178	0.97927	1.08121	0.90572
30	1.2344"-02	1.0355"+01	NM	1.00900	0.94863	0.98446	1.07696	0.91411
31	1.2776"-02	1.0498"+01	NM	1.00332	0.95548	0.98446	1.06157	0.92736
32	1.3208"-02	1.0714"+01	NM	1.00551	0.96575	0.98964	1.05007	0.94245
33	1.3665"-02	1.0933"+01	NM	1.00786	0.97603	0.99482	1.03888	0.95759
34	1.4097"-02	1.1080"+01	NM	1.00252	0.98288	0.99482	1.02445	0.97108
35	1.4529"-02	1.1154"+01	NM	0.99990	0.98630	0.99482	1.01735	0.97786
36	1.4961"-02	1.1154"+01	NM	0.99990	0.98630	0.99482	1.01735	0.97786
37	1.5392"-02	1.1228"+01	NM	1.00771	0.98973	1.00000	1.02087	0.97956
38	1.5824"-02	1.1302"+01	NM	1.00512	0.99315	1.00000	1.01384	0.98635
39	1.6256"-02	1.1302"+01	NM	1.00512	0.99315	1.00000	1.01384	0.98635
40	1.6688"-02	1.1302"+01	NM	1.00512	0.99315	1.00000	1.01384	0.98635
41	1.7120"-02	1.1302"+01	NM	0.99473	0.99315	0.99482	1.00336	0.99149
42	1.7577"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
43	1.8009"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
44	1.8440"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
45	1.8872"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
46	1.9304"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
47	1.9736"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
48	2.0168"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
49	2.0599"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
50	2.1057"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
51	2.1488"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
52	2.3647"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
53	2.4079"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
54	2.4536"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
55	2.4968"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
56	2.5400"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
57	2.5908"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
58	2.2784"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
59	2.3216"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
60	2.1920"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
61	2.2352"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
62	2.6162"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
63	2.6670"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
64	2.7178"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
65	2.7686"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
66	2.7940"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 67	2.8448"-02	1.1452"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U ASSUME P=PD

76010403 VAS PROFILE TABULATION 73 POINTS, DELTA AT POINT 73

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000E+00	1.0000E+00	NM	1.04613	0.00000	0.00000	2.87927	0.00000
2	3.6322E-04	2.3786E+00	NM	1.03135	0.40203	0.59794	2.21209	0.27031
3	6.3246E-04	3.5667E+00	NM	1.03059	0.52027	0.72165	1.92395	0.37509
4	9.0170E-04	4.3108E+00	NM	1.02391	0.58108	0.77320	1.77054	0.43670
5	1.1709E-03	4.5330E+00	NM	1.02800	0.59797	0.78866	1.73947	0.45339
6	1.4376E-03	4.7618E+00	NM	1.01990	0.61486	0.79897	1.68850	0.47318
7	1.7069E-03	4.9023E+00	NM	1.02614	0.62500	0.80928	1.67662	0.48268
8	1.9761E-03	5.0934E+00	NM	1.02629	0.63851	0.81959	1.64760	0.49744
9	2.2454E-03	5.3381E+00	NM	1.02104	0.65541	0.82990	1.60335	0.51760
10	2.5121E-03	5.4378E+00	NM	1.02179	0.66216	0.83505	1.59037	0.52507
11	2.7686E-03	5.5894E+00	NM	1.02945	0.67230	0.84536	1.58111	0.53466
12	3.0480E-03	5.7433E+00	NM	1.02490	0.68243	0.85052	1.55326	0.54757
13	3.3274E-03	5.9523E+00	NM	1.01539	0.69595	0.85567	1.51169	0.56604
14	3.5814E-03	6.1117E+00	NM	1.02397	0.70608	0.86598	1.50420	0.57571
15	3.8608E-03	6.3280E+00	NM	1.01562	0.71959	0.87113	1.46553	0.59442
16	4.1148E-03	6.4929E+00	NM	1.02477	0.72973	0.88144	1.45903	0.60413
17	4.3942E-03	6.7165E+00	NM	1.01746	0.74324	0.88660	1.42296	0.62307
18	4.6482E-03	6.9442E+00	NM	1.02253	0.75676	0.89691	1.40470	0.63851
19	4.9276E-03	7.1762E+00	NM	1.01636	0.77027	0.90206	1.37147	0.65773
20	5.2070E-03	7.2937E+00	NM	1.01929	0.77703	0.90722	1.36317	0.66552
21	5.4610E-03	7.5319E+00	NM	1.01392	0.79054	0.91237	1.33197	0.68498
22	5.7404E-03	7.5920E+00	NM	1.02126	0.79392	0.91753	1.33562	0.68696
23	5.9944E-03	7.7132E+00	NM	1.01310	0.80068	0.91753	1.31318	0.69871
24	6.2738E-03	7.8969E+00	NM	1.01253	0.81081	0.92268	1.29498	0.71250
25	6.5278E-03	8.0207E+00	NM	1.01604	0.81757	0.92784	1.28794	0.72040
26	6.8072E-03	8.2083E+00	NM	1.01584	0.82770	0.93299	1.27059	0.73430
27	7.0866E-03	8.3962E+00	NM	1.01588	0.83784	0.93814	1.25377	0.74826
28	7.3406E-03	8.5261E+00	NM	1.00862	0.84459	0.93814	1.23379	0.76037
29	7.6200E-03	8.7200E+00	NM	1.00905	0.85473	0.94330	1.21798	0.77448
30	7.8740E-03	8.7851E+00	NM	1.01659	0.85811	0.94845	1.22165	0.77637
31	8.1534E-03	8.8505E+00	NM	1.01311	0.86149	0.94845	1.21209	0.78249
32	8.4074E-03	9.1813E+00	NM	1.00720	0.87838	0.95361	1.17863	0.80908
33	8.6868E-03	9.3155E+00	NM	1.01153	0.88514	0.95876	1.17328	0.81716
34	8.9662E-03	9.3155E+00	NM	1.01153	0.88514	0.95876	1.17328	0.81716
35	9.2202E-03	9.5869E+00	NM	1.00958	0.89865	0.96392	1.15054	0.83780
36	9.4996E-03	9.5869E+00	NM	1.00958	0.89865	0.96392	1.15054	0.83780
37	9.7536E-03	9.7931E+00	NM	1.01103	0.90878	0.96907	1.13708	0.85225
38	1.0033E-02	9.8624E+00	NM	1.00798	0.91216	0.96907	1.12867	0.85859
39	1.0287E-02	1.0002E+01	NM	1.01246	0.91892	0.97423	1.12400	0.86675
40	1.0566E-02	1.0213E+01	NM	1.01445	0.92905	0.97938	1.11128	0.88131
41	1.0846E-02	1.0355E+01	NM	1.00864	0.93581	0.97938	1.09524	0.89418
42	1.1100E-02	1.0498E+01	NM	1.00295	0.94257	0.97938	1.07964	0.90714
43	1.1379E-02	1.0642E+01	NM	1.00791	0.94932	0.78454	1.07556	0.91537
44	1.1633E-02	1.0714E+01	NM	1.00515	0.95270	0.98454	1.06794	0.92190
45	1.1913E-02	1.0859E+01	NM	1.01020	0.95946	0.98969	1.06401	0.93015
46	1.2167E-02	1.1006E+01	NM	1.00481	0.96622	0.98969	1.04918	0.94330
47	1.2446E-02	1.1080E+01	NM	1.00216	0.96959	0.98969	1.04188	0.94991
48	1.2725E-02	1.1154E+01	NM	1.00997	0.97297	0.99485	1.04547	0.95158
49	1.2979E-02	1.1228E+01	NM	1.00735	0.97635	0.99485	1.03824	0.95820
50	1.3259E-02	1.1302E+01	NM	1.00475	0.97973	0.99485	1.03109	0.96404
51	1.3513E-02	1.1452E+01	NM	0.99964	0.98649	0.99485	1.01702	0.97820
52	1.3792E-02	1.1452E+01	NM	0.99964	0.98649	0.99485	1.01702	0.97820
53	1.4046E-02	1.1527E+01	NM	1.00748	0.98986	1.00000	1.02658	0.97983
54	1.4326E-02	1.1603E+01	NM	1.00496	0.99324	1.00000	1.01365	0.98653
55	1.4605E-02	1.1603E+01	NM	1.00496	0.99324	1.00000	1.01365	0.98653
56	1.4859E-02	1.1603E+01	NM	1.00496	0.99324	1.00000	1.01365	0.98653
57	1.5138E-02	1.1603E+01	NM	1.00496	0.99324	1.00000	1.01365	0.98653
58	1.5392E-02	1.1603E+01	NM	1.00496	0.99324	1.00000	1.01365	0.98653
59	1.5672E-02	1.1678E+01	NM	1.00247	0.99662	1.00000	1.00679	0.99325
60	1.5951E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
61	1.6205E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
62	1.6485E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
63	1.6739E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
64	1.7018E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
65	1.7272E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
66	1.7551E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
67	1.7831E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
68	1.8085E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
69	1.8364E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
70	1.9050E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
71	2.0320E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
72	2.1590E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 73	2.2860E-02	1.1754E+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U ASSUME P=PD

76010409 VAS PROFILE TABULATION 34 POINTS, DELTA AT POINT 34

I	Y	PT2/P	P/PD	TO/TOD	M/MD	U/UD	T/TD	RHO/RHOD*U/UD
1	0.0000"+00	1.0000"+00	NM	1.04164	0.00000	0.00000	2.87927	0.00000
2	1.0160"-04	2.0168"+00	NM	1.02916	0.35473	0.54124	2.32798	0.23249
3	1.3716"-03	4.6514"+00	NM	1.02555	0.60473	0.79381	1.72312	0.46068
4	2.6416"-03	5.0758"+00	NM	1.01819	0.63514	0.81443	1.64429	0.49531
5	3.9116"-03	5.6237"+00	NM	1.01560	0.67230	0.84021	1.56188	0.53794
6	5.1816"-03	6.0423"+00	NM	1.02110	0.69932	0.86082	1.51521	0.56812
7	6.4516"-03	6.3125"+00	NM	1.01953	0.71622	0.87113	1.47939	0.58885
8	7.7216"-03	6.7585"+00	NM	1.01647	0.74324	0.88660	1.42296	0.62307
9	8.9916"-03	7.1040"+00	NM	1.02432	0.76351	0.90206	1.39585	0.64624
10	1.0262"-02	7.2803"+00	NM	1.02276	0.77365	0.90722	1.37510	0.65975
11	1.1532"-02	7.6400"+00	NM	1.02049	0.79392	0.91753	1.33562	0.68696
12	1.2802"-02	8.0091"+00	NM	1.00796	0.81419	0.92268	1.28426	0.71845
13	1.4072"-02	8.2604"+00	NM	1.01522	0.82770	0.93299	1.27059	0.73430
14	1.5342"-02	8.5805"+00	NM	1.01917	0.84459	0.94330	1.24739	0.75622
15	1.6612"-02	8.9070"+00	NM	1.01263	0.86149	0.94845	1.21209	0.78249
16	1.7882"-02	9.2401"+00	NM	1.00678	0.87838	0.95361	1.17863	0.80908
17	1.9152"-02	9.5113"+00	NM	1.00473	0.89189	0.95876	1.15557	0.82968
18	2.0422"-02	9.8561"+00	NM	1.01072	0.90878	0.96907	1.13708	0.85225
19	2.1692"-02	1.0137"+01	NM	1.00941	0.92230	0.97423	1.11578	0.87314
20	2.2962"-02	1.0421"+01	NM	1.00842	0.93581	0.97938	1.09529	0.89418
21	2.4232"-02	1.0710"+01	NM	1.00775	0.94932	0.98454	1.07556	0.91537
22	2.5400"-02	1.1077"+01	NM	1.00470	0.96622	0.98969	1.04918	0.94330
23	2.6670"-02	1.1300"+01	NM	1.00727	0.97635	0.99485	1.03824	0.95820
24	2.7940"-02	1.1451"+01	NM	1.00213	0.98311	0.99485	1.02402	0.97151
25	2.9210"-02	1.1602"+01	NM	0.99709	0.98986	0.99485	1.01009	0.98491
26	3.0480"-02	1.1678"+01	NM	1.00494	0.99324	1.00000	1.01365	0.98653
27	3.1750"-02	1.1678"+01	NM	1.00494	0.99324	1.00000	1.01365	0.98653
28	3.3020"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
29	3.4290"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
30	3.5560"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
31	3.6830"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
32	3.8100"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
33	3.9370"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000
D 34	4.0640"-02	1.1831"+01	NM	1.00000	1.00000	1.00000	1.00000	1.00000

INPUT VARIABLES Y,M,U ASSUME P=PD

SECTION 9

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9. REFERENCES

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14. Abstract

The compilation provides data obtained in 59 experimental studies of compressible, two-dimensional, turbulent boundary layers. The data are presented in standardised form as tables and microfiche, and are available on magnetic tape. The published descriptions of the experiments have also been standardised, and in many cases supplemented by additional information provided by the original authors, who have also supplied much, as yet, unpublished data.

The entries which describe the experiments are preceded by a general introduction describing the principles and methods applied in the compilation of the data catalogue. There is also an initial discussion of some of the problems of interpretation encountered in this field.

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A CRITICAL COMPILATION OF COMPRESSIBLE TURBULENT BOUNDARY LAYER DATA
by H.H.Fernholz and P.J.Finley
Published July 1977
480 pages

The compilation provides data obtained in 59 experimental studies of compressible, two-dimensional, turbulent boundary layers. The data are presented in standaruised form as tables and microfiche, and are available on magnetic tape. The published descriptions of the experiments have also been standarised, and in many cases supplemented by additional information

P.T.O.

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Turbulent boundary layer
Compressible flow
Experimental data
Tables (data)
Two dimensional flow
Turbulent flow
Boundary layer transition

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