AD-752 025

FLOW FIELD MEASUREMENTS AROUND AN OGIVE-CYLINDER AT ANGLES OF ATTACK UP TO 15 DEGREES FOR MACH NUMBERS 3.5 AND 4

William C. Ragsdale

Naval Ordnance Laboratory
White Oak, Maryland

24 August 1972

NOLTR 72-198

AD 752 023

FLOW FIELD MEASUREMENTS AROUND AN OGIVE-CYLINDER AT ANGLES OF ATTACK UP TO 15 DEGREES FOR MACH NUMBERS 3.5 AND 4

By
W. C. Ragsdale

24 AUGUST 1972

NOL

NAVAL ORDNANCE LABORATORY, WHITE OAK, SILVER SPRING, MARYLAND

APPROVED FOR PUBLIC RELEASE;
DISTRIBUTION UNLIMITED

NOLTR 72-198

125

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author) Naval Ordnance Laboratory White Oak, Silver Spring, Maryland 20910	2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED 2b. GROUP

3. REPORT TITLE
FLOW FIELD MEASUREMENTS AROUND AN OGIVE-CYLINDER AT ANGLES OF ATTACK UP TO 15 DEGREES FOR MACH NUMBERS 3.5 AND 4

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)

5. AUTHOR(S) (First name, middle initial, last name)
William C. Ragsdale

6. REPORT DATE 24 August 1972	7a. TOTAL NO. OF PAGES 120	7b. NO. OF REFS 14
8a. CONTRACT OR GRANT NO. b. PROJECT NO. A310-310A/WR02-403-001 c. d.	9a. ORIGINATOR'S REPORT NUMBER(S) NOLTR 72-198 9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)	

10. DISTRIBUTION STATEMENT
APPROVED FOR PUBLIC RELEASE; DISTRIBUTION UNLIMITED

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY Naval Air Systems Command Washington, D. C. 20360

13. ABSTRACT

(U) The flow field was surveyed at one station (X/D = 6.5) on an ogive-cylinder having a tangent ogive nose with a fineness ratio of 4. The surveys were performed with Pitot tubes and cone pressure probes at angles of attack of 0, 5, 10 and 15 degrees for Mach numbers 3.52 and 4.07. Surface static pressures were also measured.

(U) The results of the tests are presented in tabular and plotted form. Comparisons are made with inviscid flow field calculations and with experimental results from other investigations.

Details of illustrations in this document may be better studied on microfiche

DD FORM 1 NOV 65 1473 (PAGE 1)

S/N 0101-807-6801

UNCLASSIFIED
Security Classification

UNCLASSIFIED
Security Classification

14 KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT
Flow Field Boundary Layer Static Pressure Separation Cone Probe						

DD FORM 1 NOV 65 1473 (BACK)
(PAGE 2)

UNCLASSIFIED
Security Classification

FLOW FIELD MEASUREMENTS AROUND AN OGIVE-CYLINDER AT ANGLES OF ATTACK UP TO 15 DEGREES FOR MACH NUMBERS 3.5 AND 4

Prepared by:
W. C. Ragsdale

ABSTRACT: (U) The flow field was surveyed at one station (X/D = 6.5) on an ogive-cylinder having a tangent ogive nose with a fineness ratio of 4. The surveys were performed with Pitot tubes and cone pressure probes at angles of attack of 0, 5, 10 and 15 degrees for Mach numbers 3.52 and 4.07. Surface static pressures were also measured.

(U) The results of the tests are presented in tabular and plotted form. Comparisons are made with inviscid flow field calculations and with experimental results from other investigations.

NAVAL ORDNANCE LABORATORY
WHITE OAK, MARYLAND

NOLTR 72-198 24 August 1972

FLOW FIELD MEASUREMENTS AROUND AN OGIVE-CYLINDER AT ANGLES OF ATTACK UP TO 15 DEGREES FOR MACH NUMBERS 3.5 AND 4

The flow field at one station on an ogive-cylinder was surveyed with Pitot tubes and cone pressure probes at Mach numbers of 3.5 and 4.07.

This project was performed for the Naval Air Systems Command (Code 310) under Airtask Number A3130/292/69R0100402.

The author wishes to acknowledge the support and assistance of the staff of the Aerodynamics Department of the Naval Ordnarce Laboratory.

ROBERT WILLIAMSON II
Captain, USN
Commander

L. H. SCHINDEL
By direction

CONTENTS

	Page
INTRODUCTION	1
TEST FACILITY	1
TEST EQUIPMENT AND INSTRUMENTATION	1
Wind Tunnel Model and Flow Field Survey Equipment	1
Flow Field Survey Instrumentation	2
TEST CONDITIONS AND PROCEDURE	3
DATA AND RESULTS	4
Data Reduction Procedures	4
Tabulated Results	5
Plotted Results	5
DISCUSSION OF RESULTS	7
Comparisons With Calculated Values and Other Experimental Data	7
Experimental Problems and Sources of Error	9
CONCLUDING REMARKS	12
REFERENCES	13
APPENDIX A	A-1
APPENDIX B	B-1

ILLUSTRATIONS

Figure	Title
1	Flow Field Survey Apparatus in Wind Tunnel
2	Pitot Tube Rake
3	Cone Probe Rake
4	Typical Cone Probe Dimensions
5	Pattern of Pressure Measurements for Flow Field Survey Tests
6	Flow Direction Conventions
7	Static Pressure Along Model Surface, $M_\infty=3.52$ and $\alpha=0°$
8	Static Pressure Along Model Surface, $M_\infty=3.52$ and $\alpha=5°$

ILLUSTRATIONS (Cont)

Figure	Title
9	Static Pressure Along Model Surface, M_∞=3.52 and α=10°
10	Static Pressure Along Model Surface, M_∞=3.52 and α=15°
11	Static Pressure Along Model Surface, M_∞=4.07 and α=0°
12	Static Pressure Along Model Surface, M_∞=4.07 and α=5°
13	Static Pressure Along Model Surface, M_∞=4.07 and α=10°
14	Static Pressure Along Model Surface, M_∞=4.07 and α=15°
15	Surface Static Pressure Distribution at X/D=6.5, M_∞=3.52
16	Surface Static Pressure Distribution at X/D=6.5, M_∞=4.07
17	Pitot Pressure Map, M_∞=3.52 and α=5°
18	Pitot Pressure Map, M_∞=3.52 and α=10°
19	Pitot Pressure Map, M_∞=3.52 and α=15°
20	Pitot Pressure Map, M_∞=4.07 and α=5°
21	Pitot Pressure Map, M_∞=4.07 and α=10°
22	Pitot Pressure Map, M_∞=4.07 and α=15°
23	Mach Number Map, M_∞=3.52 and α=5°
24	Mach Number Map, M_∞=3.52 and α=10°
25	Mach Number Map, M_∞=3.52 and α=15°
26	Mach Number Map, M_∞=4.07 and α=5°
27	Mach Number Map, M_∞=4.07 and α=10°
28	Mach Number Map, M_∞=4.07 and α=15°
29	Static Pressure Map, M_∞=3.52 and α=5°
30	Static Pressure Map, M_∞=3.52 and α=10°
31	Static Pressure Map, M_∞=3.52 and α=15°
32	Static Pressure Map, M_∞=4.07 and α=5°
33	Static Pressure Map, M_∞=4.07 and α=10°
34	Static Pressure Map, M_∞=4.07 and α=15°
35	Flow Angle Map, M_∞=3.52 and α=5°
36	Flow Angle Map, M_∞=3.52 and α=10°
37	Flow Angle Map, M_∞=3.52 and α=15°
38	Flow Angle Map, M_∞=4.07 and α=5°
39	Flow Angle Map, M_∞=4.07 and α=10°
40	Flow Angle Map, M_∞=4.07 and α=15°
41	Crossflow Direction Map, M_∞=3.52 and α=5°
42	Crossflow Direction Map, M_∞=3.52 and α=10°
43	Crossflow Direction Map, M_∞=3.52 and α=15°
44	Crossflow Direction Map, M_∞=4.07 and α=5°
45	Crossflow Direction Map, M_∞=4.07 and α=10°
46	Crossflow Direction Map, M_∞=4.07 and α=15°
47	Comparison of Pitot Pressure Data, M_∞=3.5
48	Comparison of Pitot Pressure Data, M_∞=3.5, X/D=6.5, α=5°
49	Comparison of Pitot Pressure Data, M_∞=3.5, X/D=6.5, α=10°
50	Comparison of Flow Angle Data, M_∞=3.5, X/D=6.5, α=5°
51	Comparison of Flow Angle Data, M_∞=3.5, X/D=6.5, α=10°
52	Comparison of Crossflow Direction Data, M_∞=3.5, X/D=6.5, α=5°
53	Comparison of Crossflow Direction Data, M_∞=3.5, X/D=6.5, α=10°

ILLUSTRATIONS (Cont)

Figure	Title
54	Comparison of Mach Number Data, $M_\infty=3.5$
55	Comparison of Pitot Pressure Data From Opposite Sides of Model, $M_\infty=4.07$ and $\alpha=10°$
56	Effect of Base Interference On Surface Static Pressure At Flow Field Survey Station (X/D=6.5), $\alpha=15°$
57	Oil Flow Patterns on Ogive-Cylinder Model, $M_\infty=4.07$ and $\alpha=10°$
58	Oil Flow Patterns on Ogive-Cylinder Model, $M_\infty=4.07$ and $\alpha=15°$
A-1	Cone Probe Calibration Apparatus In Wind Tunnel
A-2	Flow Direction Convention Used in Cone Probe Calibrations
A-3a,b	Correlation of Cone Probe Calibration Data
A-4a,b,c	Maximum Deviation of Cone Probe Calibration Data From Correlation

SYMBOLS

D	model diameter
M	Mach number
P	static pressure
PP	Pitot pressure
q	dynamic pressure
R	radial distance from model axis
RB	body radius
Re_D	Reynolds number based on wind tunnel free stream conditions and model diameter
Re_ℓ	Reynolds number based on local conditions and distance along cone probe from probe tip to static pressure tap
t	time
X	axial distance from model nose tip, for a sharp nose
α	angle of attack
β	circumferential position, measured from windward meridian (see Figure 6)
ϵ	total flow angle (see Figure 6)
ϕ	crossflow direction angle measured from reference plane (see Figure 6)
ϕ'	crossflow direction angle used in cone probe calibrations (see Figure A-2)

SYMBOLS (Cont)

χ	viscous interaction parameter

subscripts

∞	wind tunnel free stream
1,2, 3,4,5	cone probe pressure taps (see Figure A-2)
0	stagnation value

INTRODUCTION

The work reported here was part of an investigation of the leeward side performance of aft-entry inlets for ramjet powered missiles. One of the objectives of this investigation was to correlate leeward side aft-inlet performance with the average flow properties in the local flow approaching the inlet.

The problem of correlating leeward side aft-inlet performance with local flow field properties was approached experimentally, by surveying the flow field at one longitudinal station on a typical ogive-cylinder body and measuring the performance of an aft-inlet operating in this flow field.

The flow field survey data and surface pressure data obtained during the investigation are of more general interest than the inlet performance data, and should be of use to those concerned with flow fields and aerodynamics of axisymmetric bodies. Consequently, these data are being published here separately from the other results of the investigation. The flow field around the ogive-cylinder configuration used in this investigation has been studied in two previous investigations (references 1 and 2). The three investigations generally supplement each other in spite of some overlap. Some of the results of the three investigations are compared in this report.

A number of similar investigations of flow fields around axisymmetric bodies have been reported. Some of these are listed in references 3 through 8.

TEST FACILITY

The experimental work reported here was performed in Naval Ordnance Laboratory (NOL) Supersonic Wind Tunnel No. 2. This tunnel operates in the Mach number range from 1.3 to 5 with either continuous recirculating operation or intermittent blowdown operation, depending on the pressure level desired. Various Mach numbers are obtained by means of interchangeable nozzles. The blowdown mode of operation was used for the tests reported here.

TEST EQUIPMENT AND INSTRUMENTATION

WIND TUNNEL MODEL AND FLOW-FIELD SURVEY EQUIPMENT. The configuration used in the flow field survey tests was an ogive-cylinder

10

having a tangent ogive nose with a fineness ratio of 4. The flow-field surveys were made in a plane 6.5 diameters aft of the theoretical location of a sharp nose - the wind tunnel model nose being slightly blunted. The total length of the model, based on a sharp nose, was 7 diameters and the model base diameter was 3 inches. The wind tunnel model was instrumented with a single longitudinal row of static pressure taps. The first tap was located 0.5 inches aft of the theoretical sharp nose tip, and taps were spaced one inch apart (axially) aft of this location, with the last tap located at the flow field survey plane.

The flow field survey data were obtained with Pitot tubes and cone pressure probes spaced radially on fixed rakes at the aft end of the model. Four cone probes were mounted on one rake and nine Pitot tubes were mounted on a second rake. The two rakes were spaced 90 degrees apart around the periphery of the model. The wind tunnel model and flow survey rakes were mounted on a sting attached to the wind tunnel carriage - this arrangement is shown in Figure 1. Using the wind tunnel carriage, the model could be pitched to various angles of attack with respect to the wind tunnel flow, and the model and flow survey rakes could be rolled together to obtain surface pressure data and flow field data at various circumferential locations. With the rakes spaced 90 degrees apart, it was possible to survey the entire (symmetrical) leeward or windward flow field with both Pitot tubes and cone probes while rolling the model through an angle of 90 degrees.

FLOW FIELD SURVEY INSTRUMENTATION. A photograph of the Pitot tube rake is shown in Figure 2. The nine Pitot tubes were spaced 0.2 inch apart along the rake, and the centerline of the innermost tube was 0.1 inch from the model surface with the rake mounted on the model. The centerline of the outermost tube was 1.7 inches from the model surface.

The ends of the Pitot tubes were internally chamfered, with a chamfer angle of 15 degrees. This was done to reduce the sensitivity of the measured pressures to the angle of the approaching flow. The Pitot tubes had an outside diameter of .032 inch and an inside diameter of .020 inch.

A photograph of the cone pressure probe rake is shown in Figure 3. The cone probes were spaced 0.5 inch apart along the rake and the rake could be mounted in two positions so that the center of the innermost probe was either 0.25 inch or 0.5 inch from the surface of the model.

The cone probes had a Pitot pressure port at the probe tip and four static pressure ports spaced equally around the conical face, as shown in Figure 3. The static pressure ports were aligned with the rake as accurately as possible.

The cone pressure probes were old probes which had been constructed for other flow field investigations, and were refurbished for the present investigation. The probes were not identical in size, but all had a total included cone angle of 30 degrees. While the exact dimensions of the probes were not determined, typical dimensions for probes of this type are shown in Figure 4.

The cone pressure probes were used to determine the local Mach number, static pressure and flow direction and had to be calibrated against known values of these quantities in a uniform stream. The probe calibrations and the correlation of the calibration data are discussed in Appendix A.

TEST CONDITIONS AND PROCEDURE

Flow field surveys were made at Mach numbers of 3.52 and 4.07, and angles of attack of 0, 5, 10, and 15 degrees. The wind tunnel free-stream Reynolds number was approximately 12 million per foot for all tests.

The procedure used to obtain flow field survey data was to pitch the model to the desired angle of attack and then roll the model and probes to a series of roll positions, pausing at each roll position to obtain data from the flow field survey probes and the surface static pressure taps. The response of the pressure taps and lines, particularly those on the cone probes, was too slow to allow continuous rolling of the model and probes.

The reference for determining the roll position of the model and probes was the vertical or pitch plane, as indicated by an accurate clinometer. The roll angle readout potentiometer on the wind tunnel carriage was calibrated by resting the clinometer against the flat side of the cone probe rake and reading both the clinometer and the readout potentiometer at various roll positions. The accuracy of the clinometer was ±1 to ±2 minutes of arc. The angle of attack readout potentiometer was calibrated in similar fashion.

The angle between the cone probe rake and Pitot tube rake was also measured with the clinometer and was found to be 90° 50'.

The strain gage pressure transducers used in the investigation were calibrated with an accurate mercury manometer (±.1 mm) and a dead weight calibration apparatus.

Most of the flow field survey data and surface pressure data were taken on the leeward side of the model. The pattern of measurements in the flow field survey plane is shown in Figure 5. Leeward side data at a given angle of attack and Mach number were usually taken in two wind tunnel runs. In one run, the cone probe rake was mounted in the outer position and data were taken at roll positions 10 degrees apart. In a second run the rake was mounted in the inner position and again data were taken at roll positions 10 degrees apart. The roll positions for the second run were located roughly midway between the roll positions for the first run so that cone probe data, Pitot pressure data and surface pressure data were obtained at roll increments of roughly 5 degrees. Usually during the first run the windward side data indicated in Figure 5 were obtained by reversing the model pitch angle and also, a set of zero angle of attack data were obtained at one roll position. There were two exceptions to this pattern of measurements. In case of the Mach 3.52, 10-degree angle of attack flow field survey, the windward side data were obtained with the cone probe rake in the inner position rather than the outer position. In the case of the Mach 4.07, 5-degree angle of attack survey, leeward side data were only obtained with the cone probe rake in the outer position with roll increments of 10 degrees.

DATA AND RESULTS

DATA REDUCTION PROCEDURES. Most of the data reduction procedures were straightforward, but some of the conventions used in reporting the results require explanation.

In reporting the results, circumferential locations around the body have been denoted by the angle β, which is arbitrarily given a value of 0 degree on the windward meridian and 180 degrees on the leeward meridian. The flow field and surface pressure distribution were assumed to be symmetrical with respect to the angle of attack plane and the results are reported for one side of the body. Only Pitot pressures were measured on both sides of the body.

The radial positions of flow field survey data points are reported in terms of a dimensionless radial coordinate, (R-RB)/RB, where RB is the body radius (1.5 inches).

As mentioned previously, all the flow field survey measurements were made in a plane 6.5 diameters aft of a sharp nose. The axial location of the surface pressure measurements is reported in terms of station numbers, with station 1 located 0.5 inch aft of the theoretical sharp nose, and station 20 located at the flow field survey plane. The stations were spaced 1 inch apart in the axial direction.

The measured surface pressures were converted to pressure ratios, P/P_∞ and pressure coefficients, $(P-P_\infty)/q_\infty$, based on the wind tunnel free stream static and dynamic pressures, P_∞ and q_∞. The results are reported in this form.

The measured Pitot pressures were converted to pressure ratios PP/PP_∞, based on the wind tunnel free stream Pitot pressure and are reported in this form.

The cone probe pressure measurements were used to determine local values of Mach number, static pressure and flow direction. The details of the calibration of the probes and the data reduction technique are discussed in Appendix A. The local static pressure measurements were converted to pressure ratios based on the wind tunnel free stream static pressure, P/P_∞, and are reported in this form.

The direction of the local velocity vector, or local flow direction, has been described by two angles, as follows:

1. a total flow angle, ε, defined as the angle between the local velocity vector and the cone probe (or body) axis;

2. a flow direction angle, ϕ, defined as the angle between a reference plane through the cone probe axis and the plane containing the cone probe axis and the local velocity vector.

Sketches illustrating these conventions are shown in Figure 6. The flow direction angle, ϕ, can also be thought of as the flow direction in the plane of the flow field measurements, or crossflow plane. The reference plane for measuring, ϕ, was taken to be the vertical, or pitch plane.

TABULATED RESULTS. A set of tables listing all the flow field survey and surface pressure results are included in Appendix B. The results listed are as follows:

TABLE I:	Surface Pressure Ratio, P/P_∞ Surface Pressure Coefficient, $(P-P_\infty)/q_\infty$
TABLE II:	Pitot Pressure Ratio, PP/PP_∞
TABLE III:	Mach Number, M Total Flow Angle, ε Flow Direction Angle, ϕ Static Pressure Ratio, P/P_∞

Some of the surface static pressure results have been deleted from Table I. The measurements deleted at stations 1, 2, 4 and 12 were in error due to faulty pressure transducer readings. The measurements deleted at stations 18, 19 and 20 were in error due to a base interference effect which is discussed on page 11.

Some values of Mach number and static pressure ratio have been deleted from Table III. Mach numbers were not computed outside the range 1.5 to 5 as it was felt any values outside these limits would be inaccurate. Some values of Mach number and static pressure were obviously out of line with the rest of the data due to base interference or other effects and were also deleted from the table.

PLOTTED RESULTS. Plots of surface pressure ratio, P/P_∞, versus axial position (X/D) are shown in Figures 7 through 14. Comparisons are made in some of the figures with pressures computed with a method of characteristics computer program. These comparisons are discussed on page 8. Results are shown for only three values of β: 0°; 90°; and 180°. In some cases, several surface pressure readings were made at a given location during the course of several flow field survey tests. These replicate readings are indicated in the Figures. Plots of surface pressure ratio versus circumferential position at the flow field survey plane (X/D = 6.5) are shown in Figures 15 and 16.

In order to present the flow field Pitot pressure data in a concise way and to illustrate the features of the flow field on the leeward side of the body, maps were prepared showing a cross section of the body and contours of constant Pitot pressure ratio at the flow field survey plane. These maps are shown in Figures 17 through 22.

In the construction of the Pitot pressure maps, a computer was used to interpolate within the grid of measured values to determine points of constant Pitot pressure ratio in the flow field survey plane. Contours were drawn through these points by hand and consequently, the results are subject to some judgement and/or bias.

In constructing the Pitot pressure ratio map for the Mach 3.52, 15-degree angle of attack flow field it was reasonably clear what part of the flow field had been affected by base interference. The Pitot pressure ratio contours were extrapolated across this region rather than following the interpolated points. The boundaries of this region have been indicated in Figure 19. No clear indication of the extent of base interference could be detected in the Mach 4.07, 15 degree angle of attack Pitot pressure contours and consequently, this map was not edited. The 5 and 10 degree angle of attack data are thought to be free of any base interference effects.

In the 10 and 15 degree angle of attack flow fields the Pitot pressure data indicated clearly an embedded shock wave in the leeward flow field. The Mach 4.07, 15 degree angle of attack data indicated the presence of two embedded shock waves. The positons of all the embedded shock waves indicated by the data are shown in Figures 18, 19, 21, and 22.

The cone probe results were used to prepare maps similar to the Pitot pressure ratio maps, using the same method of construction. Maps of Mach number, static pressure ratio, total flow angle and flow direction angle are shown in Figures 23 through 46. The flow direction angle has been indicated by small arrows at each measurement point rather than contours.

There was no clear indication of embedded shock waves or of base interference effects in the cone probe results. Consequently, the maps shown in Figures 23 through 46 were not edited and the shock wave positions shown are those obtained from the Pitot pressure data. The second embedded shock indicated by the Mach 4.07, 15 degree angle of attack Pitot pressure data has not been noted on the other maps, as it was not clear how the fairing of the contours would be affected.

It is important to note here that the Pitot pressure ratio maps, Mach number maps and static pressure ratio maps were constructed individually from the experimental data and the fairing of the contours through the interpolated points was done by hand with no cross checking for consistency between the maps. As a result, values of Pitot pressure ratio, Mach number and static pressure ratio read from the maps for the same position in the flow field may not be consistent. The maps are intended primarily to give a qualitative look at the flow fields surveyed. Readers desiring quantitative information should refer to the tabulated data in Appendix B.

DISCUSSION OF RESULTS

COMPARISONS WITH CALCULATED VALUES AND OTHER EXPERIMENTAL DATA. The flow field around the ogive-cylinder configuration used in this investigation has been studied in two previous investigations, reported in references 1 and 2. Some of the data from the three investigations overlap, but substantial portions of the data do not. Thus, the three investigations tend to supplement each other.

A summary of the test conditions for the three investigations is given in the table below:

Investigation	$\frac{X}{D}$ Survey Plane	$\frac{R-RB}{RB}$	M_∞	α deg	$Re_D \times 10^{-6}$	Type of Data
Ref 1	7.5	.39 .59, .79	3.5	0,5 10,15	.5	Cone Probe
Ref 2	5.5 6.5	0-1.2	2.49 3.5 4.3	0,5 10	3-4.5	Cone Probe; Pitot Pressure; Surface Pressure
Present Investigation	6.5	.167- 1.33	3.52 4.07	0,5 10,15	3	Cone Probe; Pitot Pressure; Surface Pressure

In all three investigations the nose tips of the wind tunnel models were essentially sharp, with nose bluntnesses between one and three percent.

Some comparisons have been made of data from the three investigations to determine roughly whether or not the data are consistent. In addition, the inviscid flow field around the ogive-cylinder configuration was computed using a method of characteristics computer program obtained from NASA (reference 9). The inviscid flow field was

16

calculated for a Mach number of 3.5 and angles of attack of 0, 5 and 10 degrees. The calculations should be accurate in all portions of the flow field not affected by boundary layer separation and provide a standard of comparison for the experimental results where applicable.

Surface static pressures computed with the method of characteristics program are compared with the experimental values for Mach 3.52 and 0, 5 and 10 degrees angle of attack in Figures 7, 8 and 9. The agreement between the computed and experimental values is generally quite good. The experimental values for the windward meridian (β=0) at 10 degrees angle of attack are five to ten percent higher than the computed values. It has been found that positive errors of this magnitude can occur when the size of static pressure taps is comparable to the displacement thickness of the boundary layer (reference 10). This would most likely occur on the windward side of the model and may offer an explanation for the observed difference between the calculated and experimental values. The computed values on the leeward meridian at 10 degrees angle of attack are higher than the experimental values toward the end of the body, but in this region the flow field is affected substantially by boundary layer separation.

A comparison of Pitot pressure data from reference 1 and the present investigation is shown in Figure 47. The data from the two investigations are in good agreement, even though the flow field survey stations differed by one body diameter. This result, along with the fact that the axial variation in static pressure toward the end of the body is small, indicates that the flow field develops quite slowly in the axial direction at this distance from the nose (6.5 to 7.5 diameters). The difference in Reynolds number by a factor of five between the two investigations should not have affected the data in the parts of the flow field unaffected by boundary layer separation. It is surprising, however, that the data are in agreement even in regions of the flow fields affected by separation.

A comparison of Pitot pressure data from the present investigation and reference 2 with computed Pitot pressures for Mach 3.5 and angles of attack of 5 and 10 degrees is shown in Figures 48 and 49. This comparison indicates that the experimental data and computed values agree to within ten percent except in the boundary layer and regions of the flow field affected by boundary layer separation. In the outer part of the flow field at β=135 and β=180 degrees and 10 degrees angle of attack good agreement is obtained with the computed values even in the presence of boundary layer separation. The variation of Pitot pressure within the flow fields at 5 and 10 degrees angle of attack appears fairly small except in the attached and separated boundary layer flow.

A comparison of total flow angle and flow direction angle measurements from all three investigations with computed values from the method of characteristics program is shown in Figures 50 through 53.

The measured and computed total flow angles generally agree within 2 degrees in the flow field outside the boundary layer and not affected by separation. At β=135 degrees and 10 degrees angle of attack where an effect of flow separation is expected the computed and experimental values differ by 3 to 4 degrees, but appear to follow the same trend in the radial direction. At β=180 degrees the trends are different.

The measured and computed flow direction angles agree to within 10 to 15 degrees in the regions where comparisons are valid. The experimental values on the leeward meridian at 10 degrees angle of attack were greatly affected by the strong flow divergence in the separated boundary layer flow. The effect of the embedded shock on the flow direction appears fairly substantial.

Finally, measured Mach numbers from reference 1 and the present investigation are compared in Figure 54. The agreement is generally good despite the fact that the measurements were made at different axial and radial locations. The comparison should still be valid as the measurements indicated only a small variation of Mach number in the radial direction in the regions unaffected by separation, and it should be safe to assume small variations in the axial direction also. Computed values of Mach number are shown for the 5 and 10 degree angle of attack flow fields and are in good agreement with the measured values where a comparison is valid.

In summary, the experimental data from the three experimental investigations are in reasonably good agreement and are consistent with computed values for the inviscid flow field in all parts of the flow field where a valid comparison can be made. It should be possible to use the data from all three investigations together in comparisons with theory or in empirical analyses of the flow field.

<u>EXPERIMENTAL PROBLEMS AND SOURCES OF ERROR.</u> The accuracy of the cone probe calibrations is discussed in some detail in Appendix A. A general statement concerning the accuracy of the calibrations is as follows:

1. Mach numbers are accurate to about ±5 percent,

2. total flow angles are accurate to about ±2 degrees,

3. flow direction angles are accurate to about ±7.5 degrees.

The comparisons with other data and with theoretical inviscid values discussed above indicate that these accuracies were achieved in most regions of the flow fields surveyed where there was no effect of boundary layer separation. The comparisons also indicate the measured Pitot pressures were quite accurate.

Since the Pitot rake and cone probe rake surveyed the flow field on opposite sides of the body, the symmetry of the flow field is of some concern. A comparison of Pitot pressure data from the cone probe rake with corresponding data from the Pitot rake is shown in

Figure 55. The pressures compared are in good agreement, indicating the flow field was symmetrical to within the accuracy of the data. Comparisons similar to the one shown were made for all the flow fields surveyed and in all cases the Pitot pressures from opposite sides of the body were in good agreement.

Two sources of error could have affected the experimental measurements to a greater extent in the regions of separated flow than in other parts of the flow field. These are: (1) viscous effects; and (2) the effect of Mach number and pressure gradients.

Viscous effects on the cone probe and Pitot pressure readings are thought to be negligible. An estimate of the viscous interaction parameter $\chi = M^3/\sqrt{Re_\ell}$ was made for the cone pressure probe at the point of minimum Reynolds number in the Mach 4.07, 15 degree angle of attack flow field. Assuming a total flow angle of zero, a value of χ less than 0.1 was obtained. It was concluded that viscous effects on the cone pressure readings were probably negligible (reference 11). A similar estimate was made of the minimum Reynolds number based on Pitot tube diameter and the resulting value was found to be greater than 1000. Accordingly, viscous effects on the Pitot pressure readings should have been negligible (reference 12).

Since the diameter of the Pitot tubes was quite small (.032 inch) compared to the size of the flow field surveyed the effect of Mach number and pressure gradients on the Pitot pressure measurements should have been negligible. This is probably not the case for the cone probes, however, which were much larger in diameter (about .19 inch).

Unfortunately, no accepted method for correcting cone probe readings for the effect of Mach number and pressure gradients is available. Consequently, no attempt has been made to correct the cone probe measurements for this effect.

Two experimental problems were encountered which may have affected some of the experimental measurements in the region of separated flow.

In some cases the pressure in the tubes connecting the cone probes with the pressure transducers had not steadied out during the period when the pressure data were recorded. Most of the unsteady pressure data recorded occurred in the separated flow regions, where pressures were lowest. Where unsteady readings were encountered, an effort was made to estimate steady values of pressure by curve fitting the following type equation to several successive pressure readings (a number of readings were recorded at each survey point):

$$P = a + be^{-ct}$$

Where: a, b, c = constants determined during the curve fitting process
t = time

19

The estimated steady pressure reading is given by the constant a. The accuracy of the estimated steady values appeared to be good in some cases and poor in others. In some cases the equation above did not appear to describe the trend of the data and could not be used, in which case the final value recorded was used. At any rate, the Mach numbers and flow angles computed from the cone pressure data were related to correlation parameters involving four pressure readings and should not have been highly sensitive to errors in a single reading.

The second experimental problem encountered was a base interference effect which affected some of the surface pressure data and flow field data at 15 degrees angle of attack. The base interference was due to an overly large connecting nut which was used on the two piece sting support used in the tests. Unfortunately, the interference effect was not identified until after the flow field tests had been completed.

The effect of base interference on the surface static pressure at the flow field survey station (X/D = 6.5) is shown in Figure 56. According to these measurements the flow field at the model surface was affected from $\beta \cong 125°$ to $\beta \cong 155°$, for $M = 3.52$ and $\beta \cong 125°$ to $\beta \cong 165°$ for $M = 4.07$. At 10 degrees angle of attack, the surface static pressures were free of any interference effect.

Oil flow photographs were taken after the flow field survey tests to study the location of boundary layer separation along the model. These photographs were taken at Mach 4.07 and 10 and 15 degrees angle of attack and illustrate clearly the extent of the base interference effect on the model surface. The two photographs are shown in Figures 57 and 58, and confirm that the interference did not quite reach the flow field survey plane at 10 degrees angle of attack, but reached a point well ahead of the flow field survey plane at 15 degrees angle of attack.

As mentioned previously, the effect of the base interference was apparent in the Pitot pressure contours obtained from the $M = 3.52$ 15 degree angle of attack Pitot pressure data, and the Pitot pressure map for this case was corrected by extrapolating the data across the region of base interference. The effect of interference was not apparent in any of the other contour plots and no further corrections were made. Individual data points which appeared to be obviously incorrect due to the base interference or otherwise have been deleted from the tabulated data given in Appendix B.

Comparison of the surface static pressure data with static pressures measured in the flow field near the surface indicates agreement is not too good, particularly in the 5 degree angle of attack cases. This should not be too surprising since the static pressure ratios in the flow field were computed from the measured Mach number and Pitot pressure, and the error in static pressure will range from two to seven times the error in the Mach number depending upon the Mach number. It is hoped that the flow field static pressure results at least indicate the correct trends.

CONCLUDING REMARKS

The flow field at one station (X/D = 6.5) on an ogive cylinder of fineness ratio 4 was surveyed at Mach 3.52 and 4.07 and angles of attack of 0, 5, 10 and 15 degrees.

The experimental results have been compared with those of two previous investigations and with theoretical values for the inviscid flow field calculated by the method of characteristics. The experimental results from all three investigations are reasonably consistent and in fairly good agreement with the theoretical results in regions of the flow fields where comparisons are valid.

REFERENCES

1. Lankford, J. L., "Preliminary Results of Flow Surveys About an Inclined Body of Revolution at Mach Number 3.5 (Phase 1 of Aft-Entry Program)," NAVORD Report 6708, Jan 1960.

2. Karanian, A. J., Gadbois, S. E., and Carlson, P. R., "Investigation of Inlet-Vehicle Installation Interactions for an Air-Launched Advanced Ramjet Missile (ALARM) (U)," Final Report, Vol. II, Contract N00019-68-C-0507, United Aircraft Research Lab Report H910656-22, Nov 1969, Confidential.

3. Raney, D. J., "Measurement of the Cross-Flow Around an Inclined Body at a Mach Number of 1.91," RAE TN Aero 2357, Jan 1955.

4. Jorgensen, L. H. and Perkins, E. W., "Investigation of Some Wake Vortex Characteristics of an Inclined Ogive-Cylinder Body at Mach Number 2," NACA Report 1371, May 1955.

5. Mello, H. F., "Investigation of Normal Force Distributions and Wake Vortex Characteristics of Bodies of Revolution at Supersonic Speeds," APL/JHU Report CM867, McDonnell Aircraft Corp., Apr 1956.

6. Tinling, B. E. and Allen, C. Q., "An Investigation of Normal-Force and Vortex Wake Characteristics of an Ogive-Cylinder Body at Subsonic Speeds," NASA TN D-1297, 1962.

7. Grosche, F. R., "Wind Tunnel Investigation of the Vortex System Near an Inclined Body of Revolution With and Without Wings," AGARD Conference Proceedings No. 71, presented at a Specialists' Meeting of the Fluid Dyanmics Panel of AGARD held at NOL, Silver Spring, Maryland, 28-30 Sep 1970.

8. Rainbird, W. J., "The External Flow Field About Yawed Circular Cones," AGARD Conference Proceedings No. 30, presented at a Specialists' Meeting of the Fluid Dynamics Panel of AGARD held at the Royal Aeronautical Society, London, England, 1-3 May 1968.

9. Rakich, J. V., "A Method of Characteristics for Steady Three-Dimensional Supersonic Flow with Application to Inclined Bodies of Revolution," NASA TN D-5341, Oct 1969.

10. Rainbird, W. J., "Errors in Measurement of Mean Static Pressure of a Moving Fluid Due to Pressure Holes," Quart. Bulletin, Div. of Mech. Engr. and Natl. Aero. Estab., Canada, Report No. DME/NAE, 1967.

22

11. Talbot, L., et al, "Hypersonic Viscous Flow Over Slender Cones," NACA TN-4327, 1957.

12. Schaaf, S. A., "The Pitot Probe in Low-Density Flow," AGARD Report 525, Jan 1966.

13. Jones, D. J., "Tables of Inviscid Supersonic Flow About Circular Cones at Incidence $\gamma = 1.4$," AGARDOGRAPH 137, Nov 1969.

14. Karanian, A. J., et al, "Investigation of Air Induction System Technology for an Air-Launched Advanced Ramjet Missile (ALARM)(U)," Test Data Summary Report, Contract N00123-70-C-0693, NWC TP 5184, Dec 1971, Confidential.

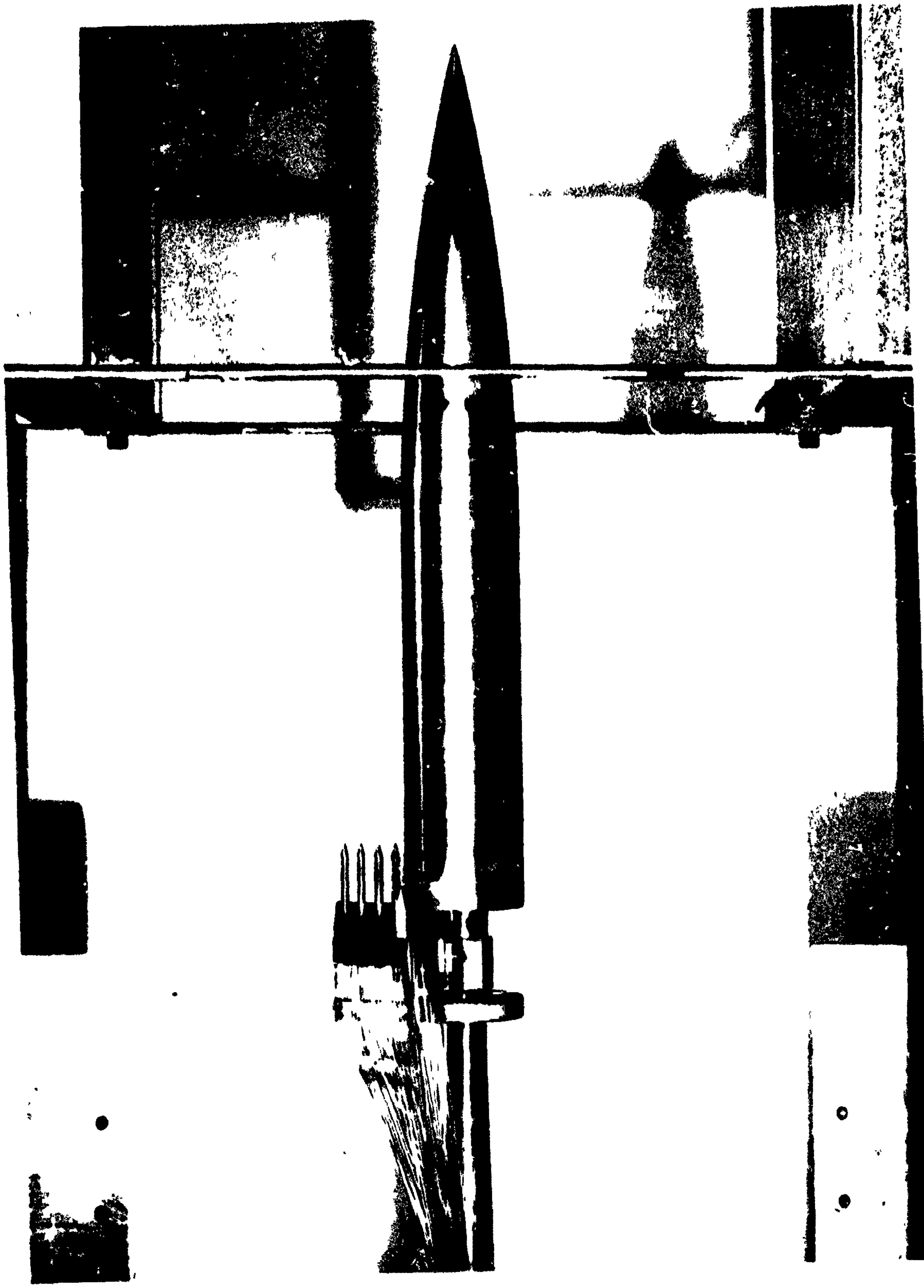


FIG. 1 FLOW FIELD SURVEY APPARATUS IN WIND TUNNEL

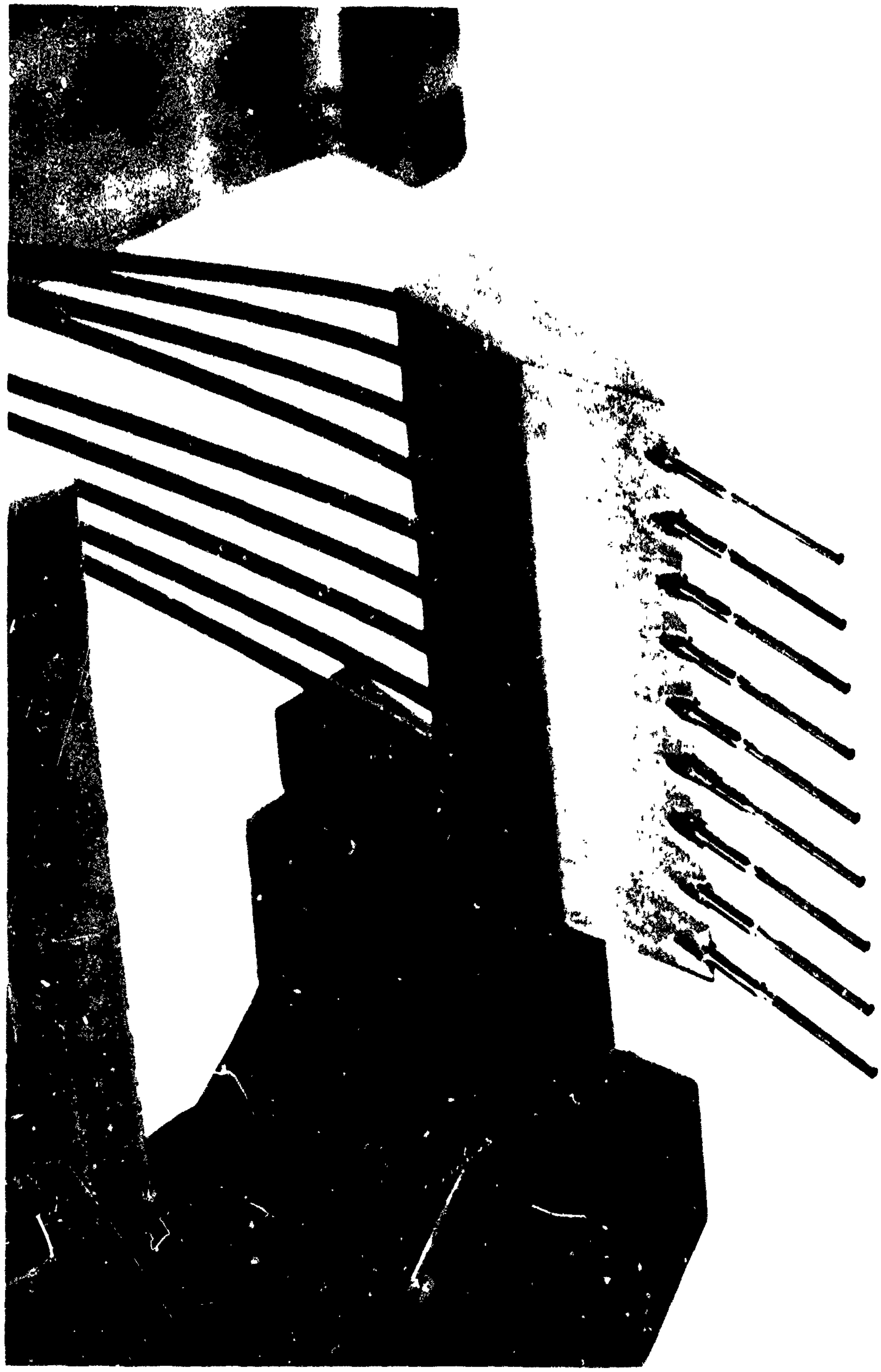


FIG. 2 PITOT TUBE RAKE

FIG. 3 CONE PROBE RAKE

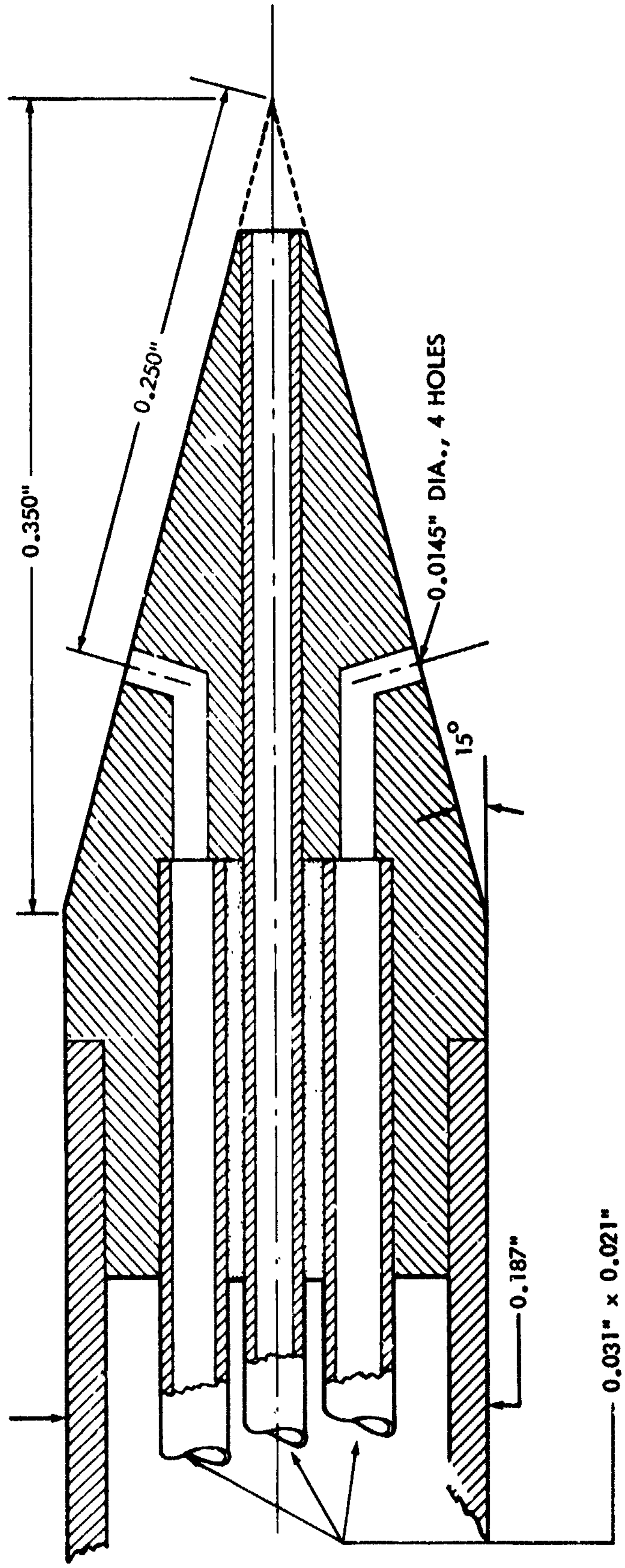


FIG. 4 TYPICAL CONE PROBE DIMENSIONS

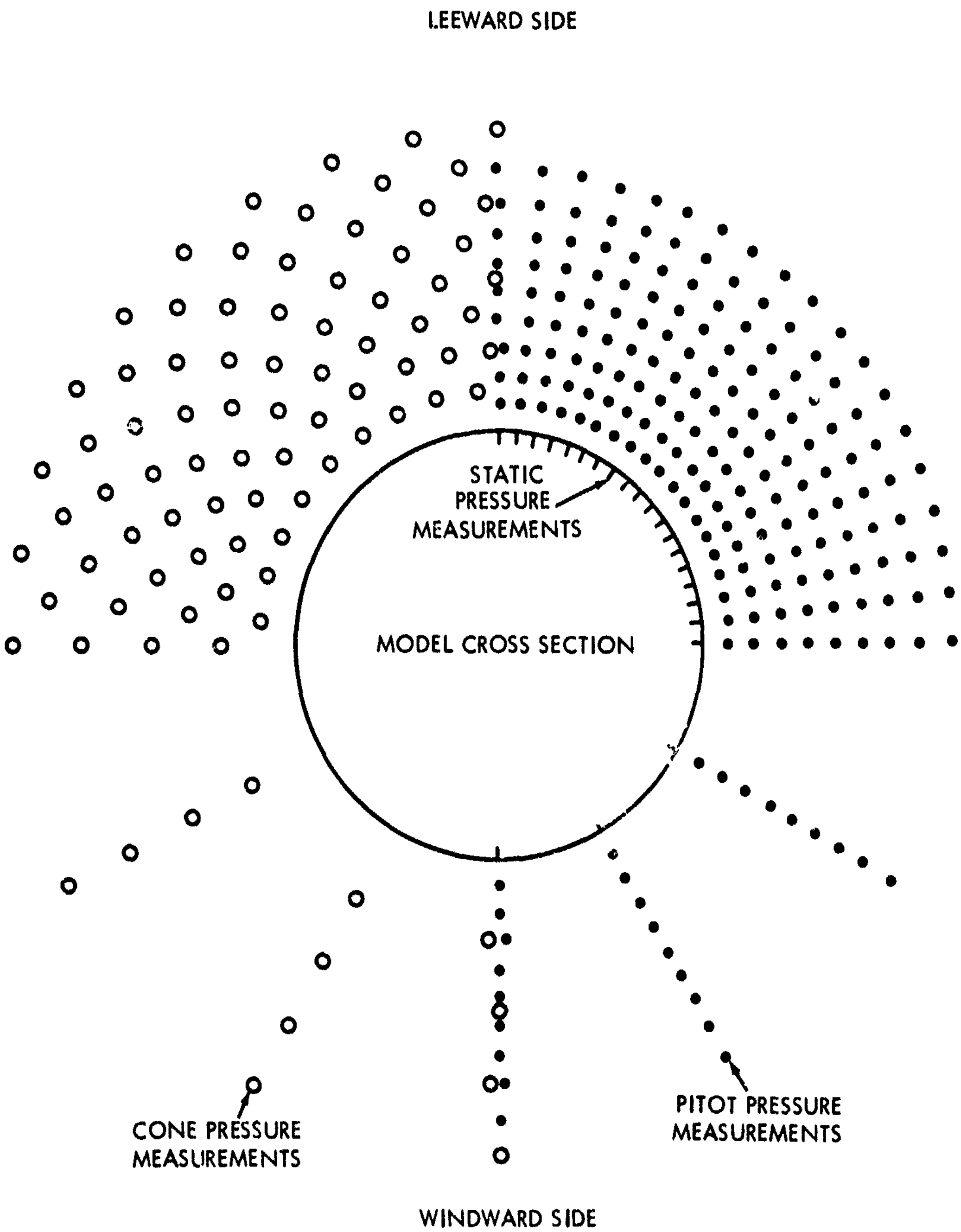
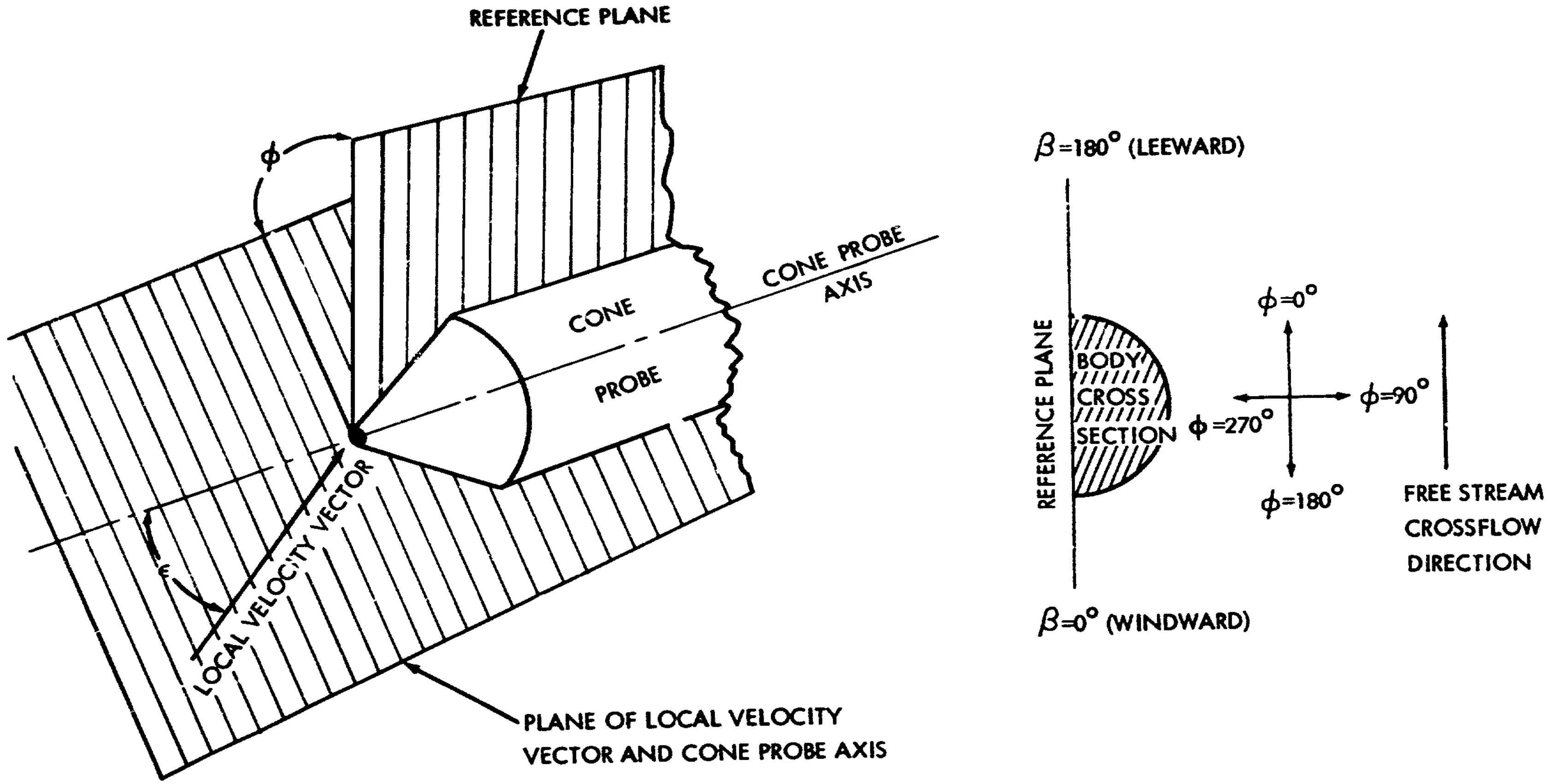


FIG. 5 PATTERN OF PRESSURE MEASUREMENTS FOR FLOW-FIELD SURVEY TESTS



ϵ = TOTAL FLOW ANGLE

ϕ = FLOW DIRECTION ANGLE

FIG. 6 FLOW DIRECTION CONVENTIONS

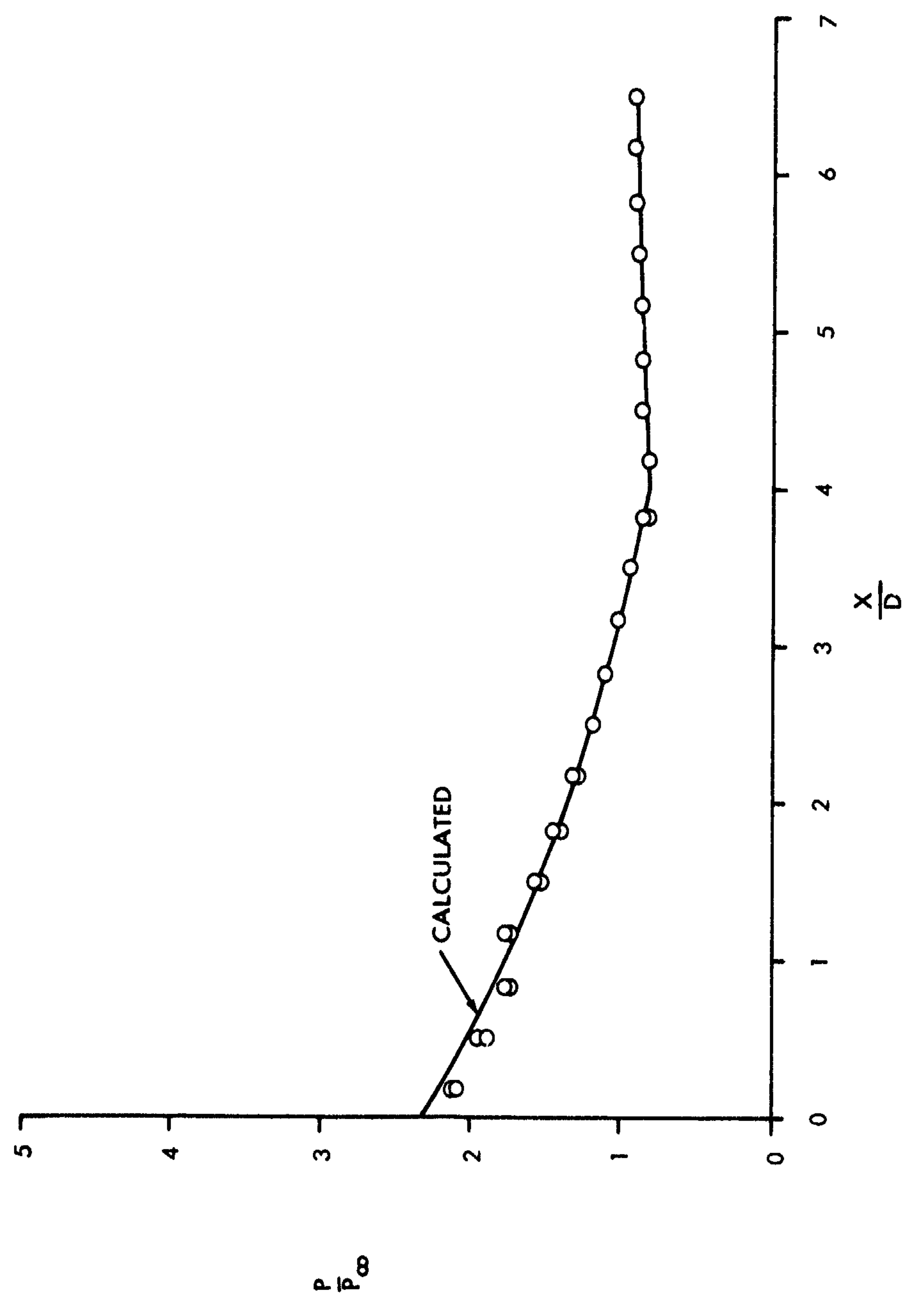


FIG. 7 STATIC PRESSURE ALONG MODEL SURFACE, M_∞=3.52 AND $\alpha = 0°$

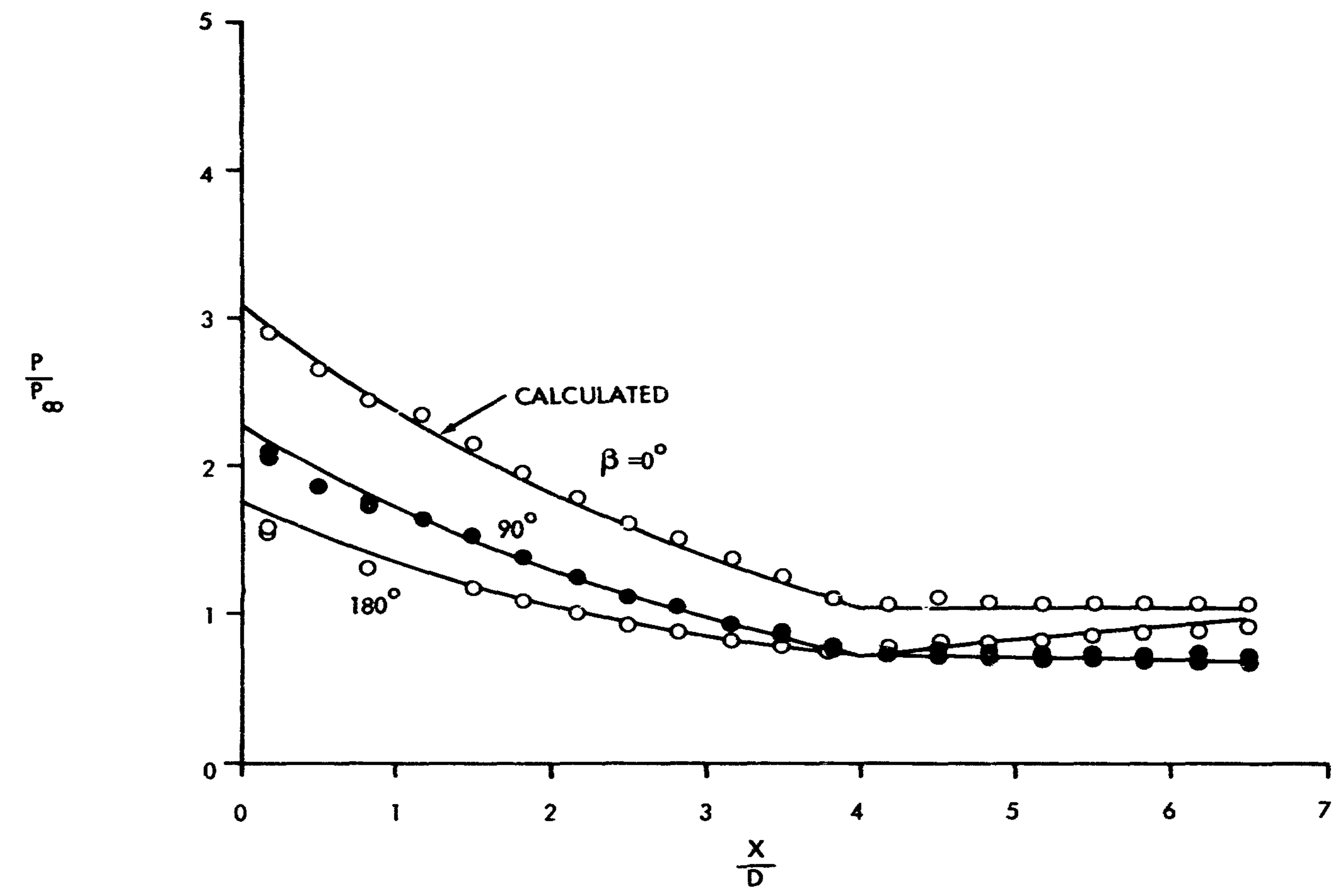


FIG. 8 STATIC PRESSURE ALONG MODEL SURFACE, $M_\infty = 3.52$ AND $\alpha = 5°$

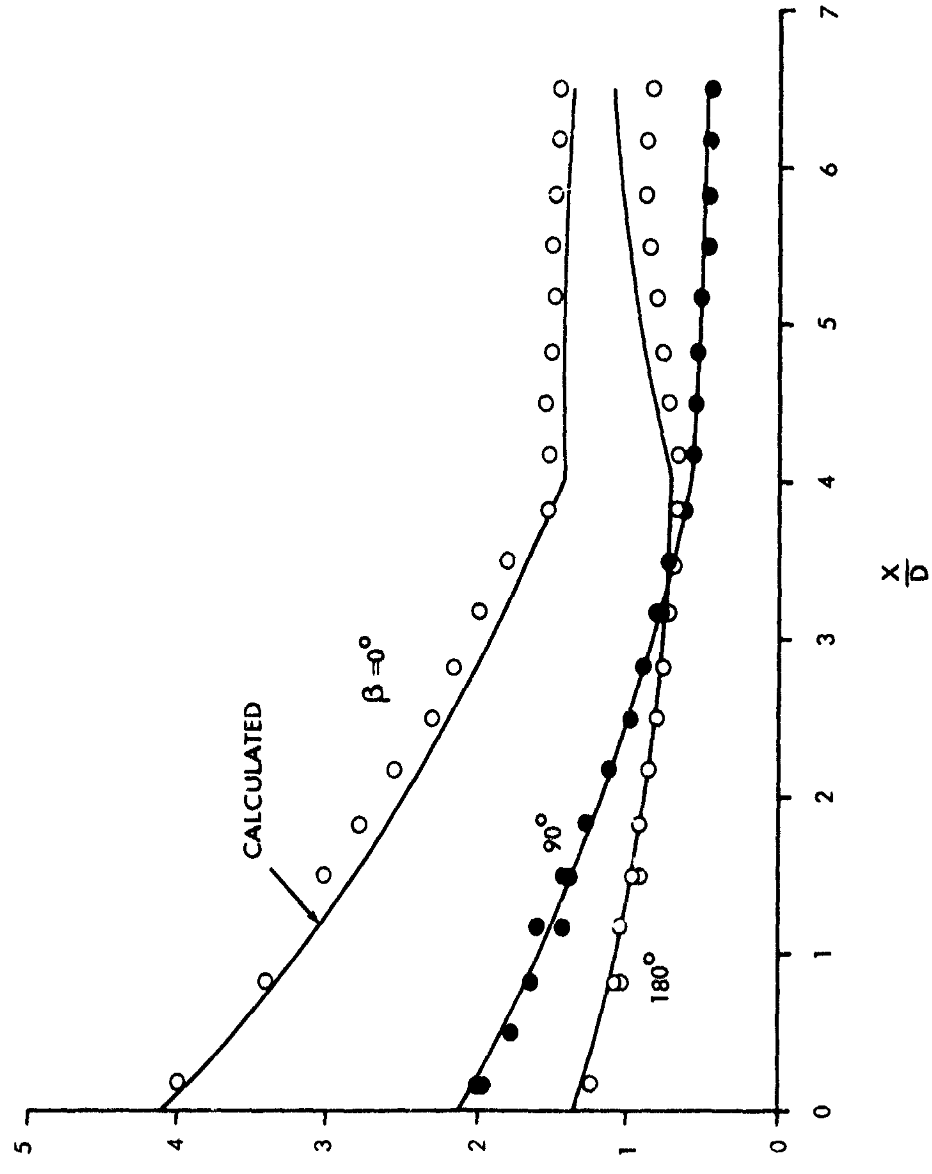


FIG. 9 STATIC PRESSURE ALONG MODEL SURFACE, $M_\infty = 3.52$ AND $\alpha = 10°$

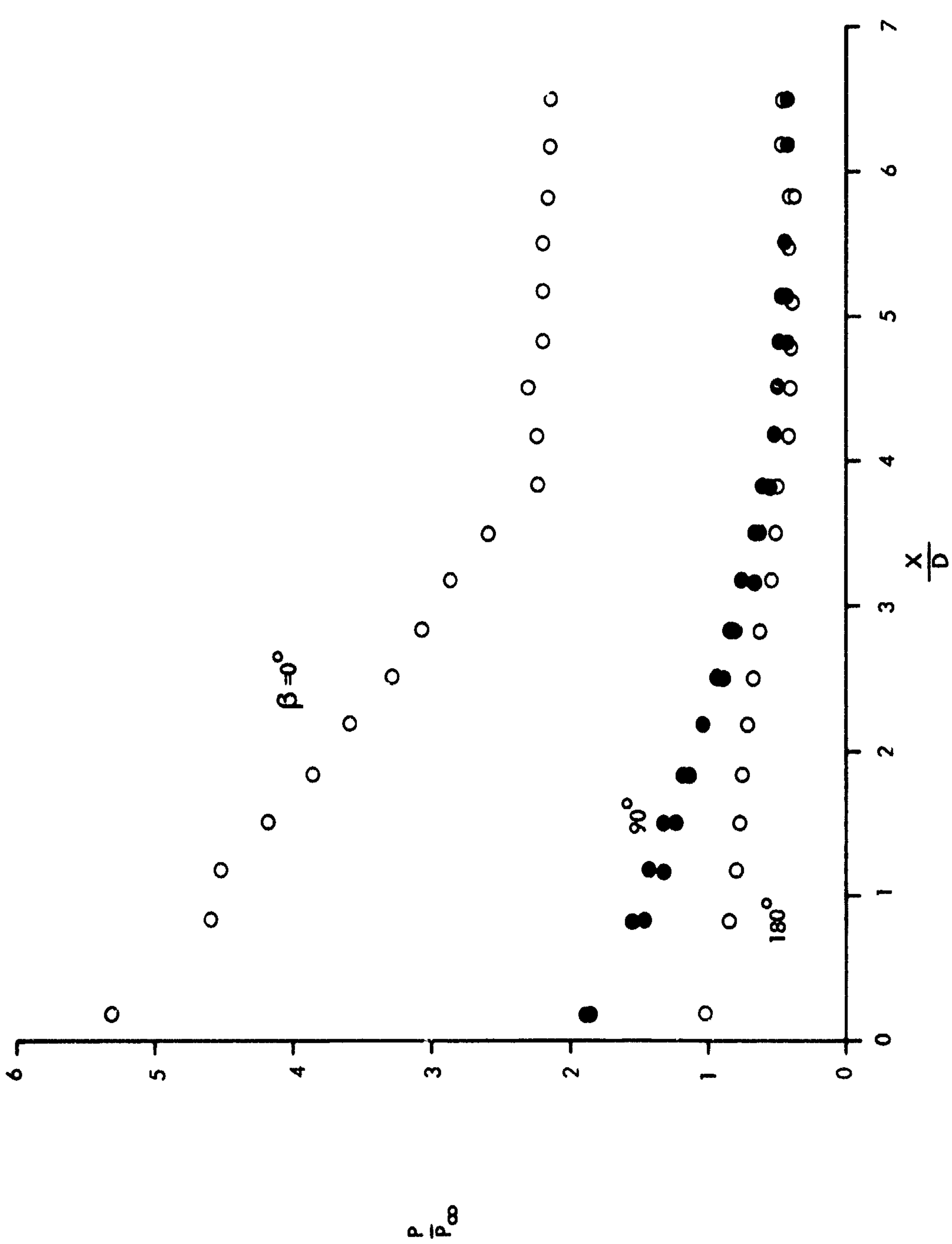


FIG. 10 STATIC PRESSURE ALONG MODEL SURFACE, $M_\infty = 3.52$ AND $\alpha = 15°$

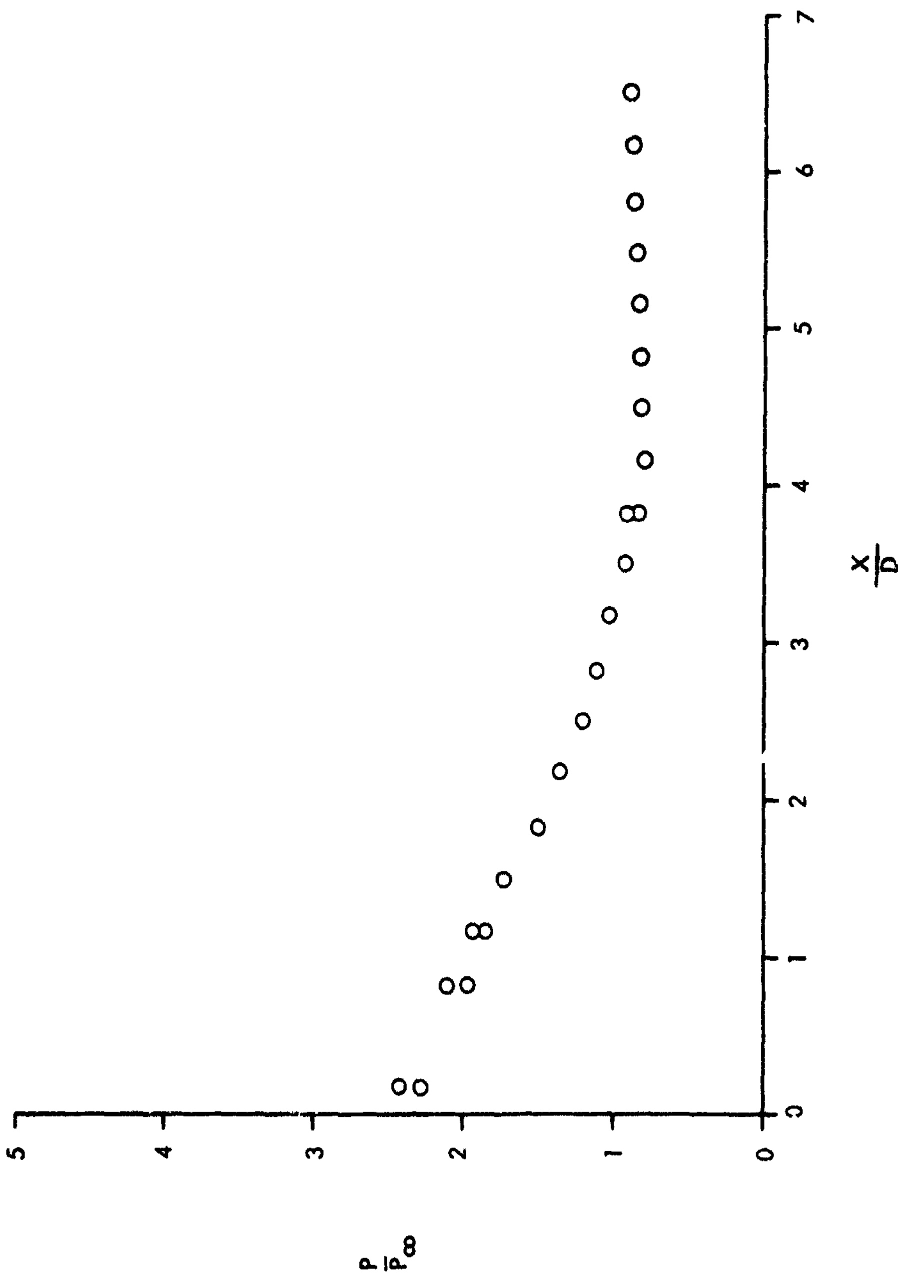


FIG. 11 STATIC PRESSURE ALONG MODEL SURFACE, $M_\infty = 4.07$ AND $\alpha = 0°$

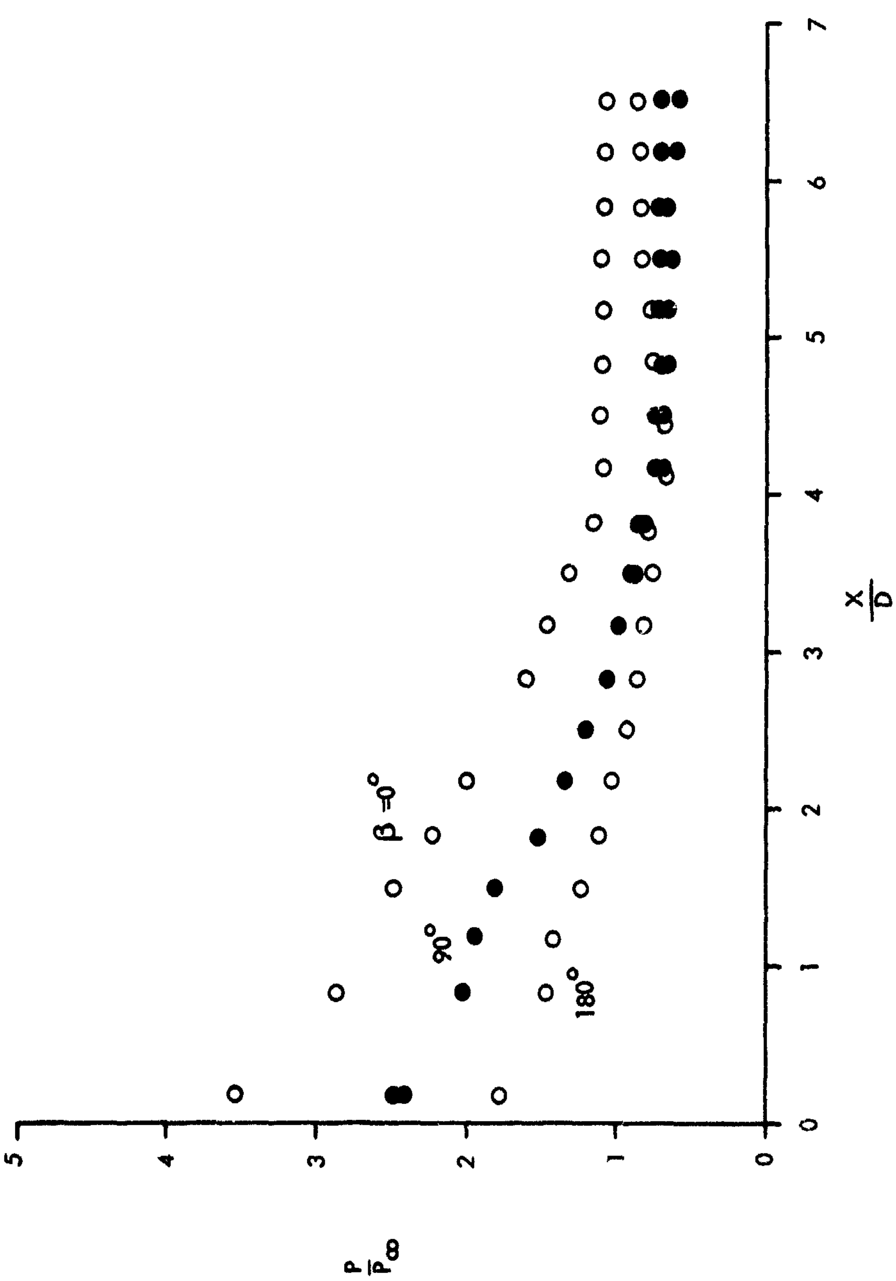


FIG. 12 STATIC PRESSURE ALONG MODEL SURFACE, $M_\infty = 4.07$ AND $\alpha = 5^\circ$

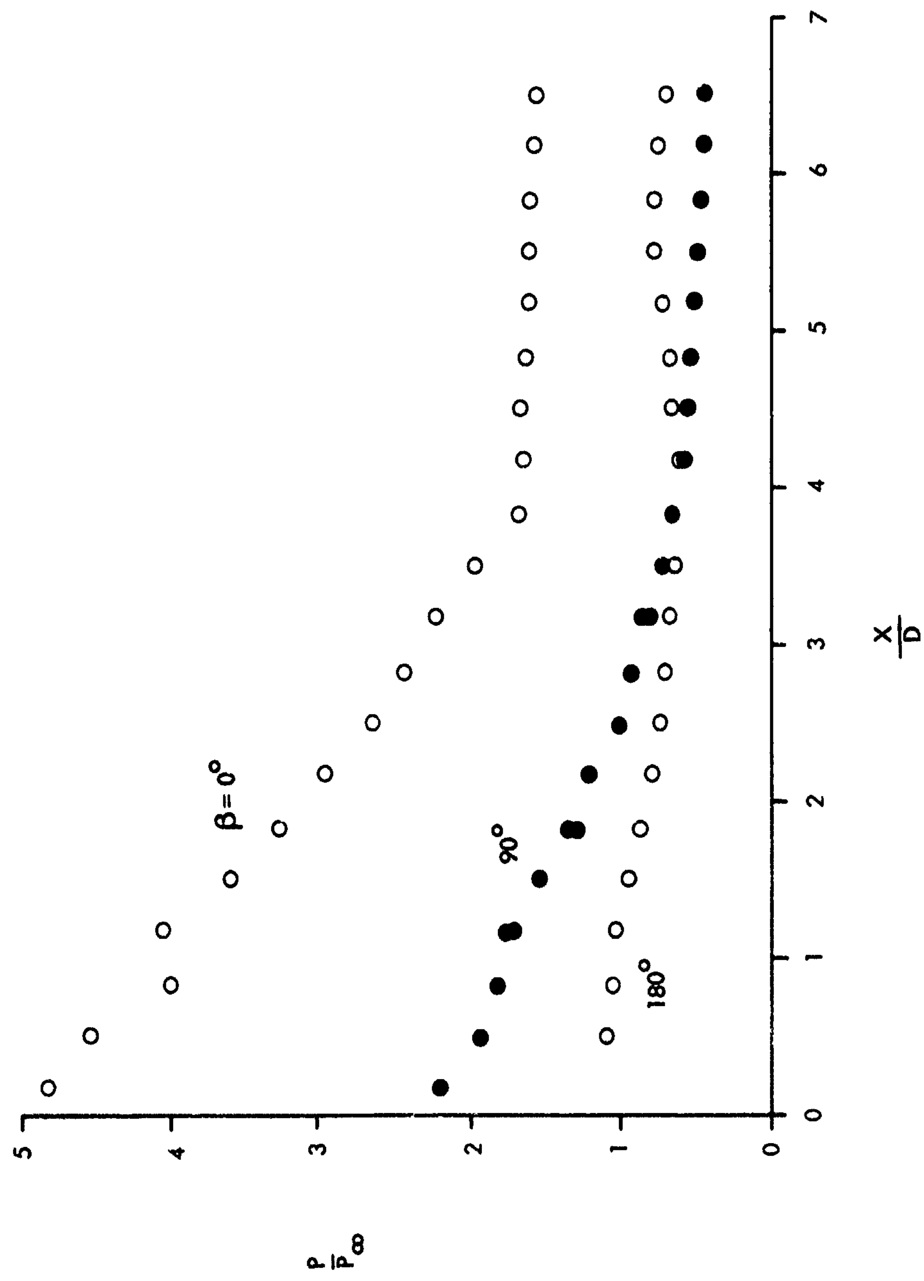


FIG. 13 STATIC PRESSURE ALONG MODEL SURFACE, $M_\infty = 4.07$ AND $\alpha = 10^\circ$

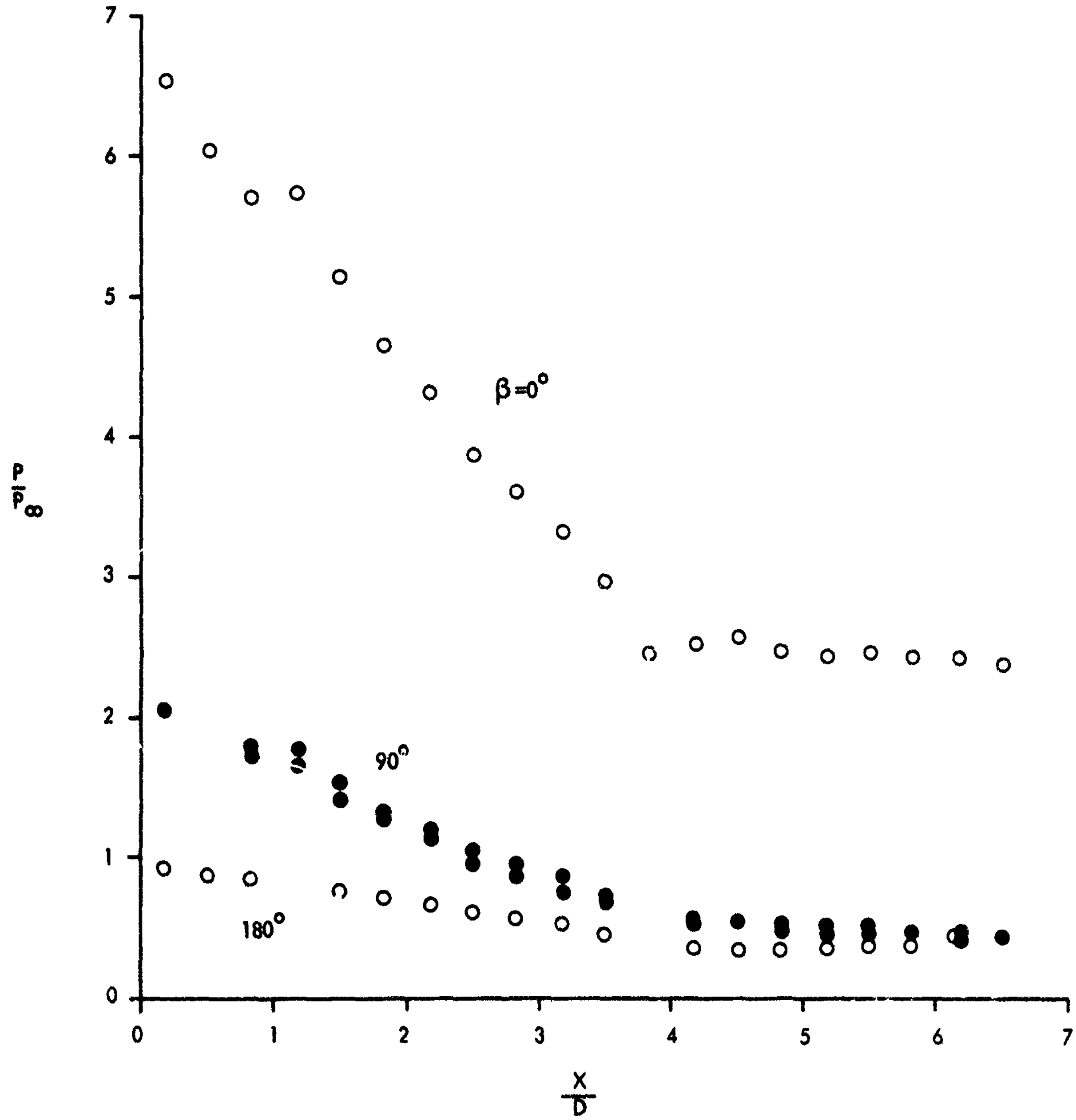


FIG. 14 STATIC PRESSURE ALONG MODEL SURFACE, M_{∞} = 4.07 AND α=15°

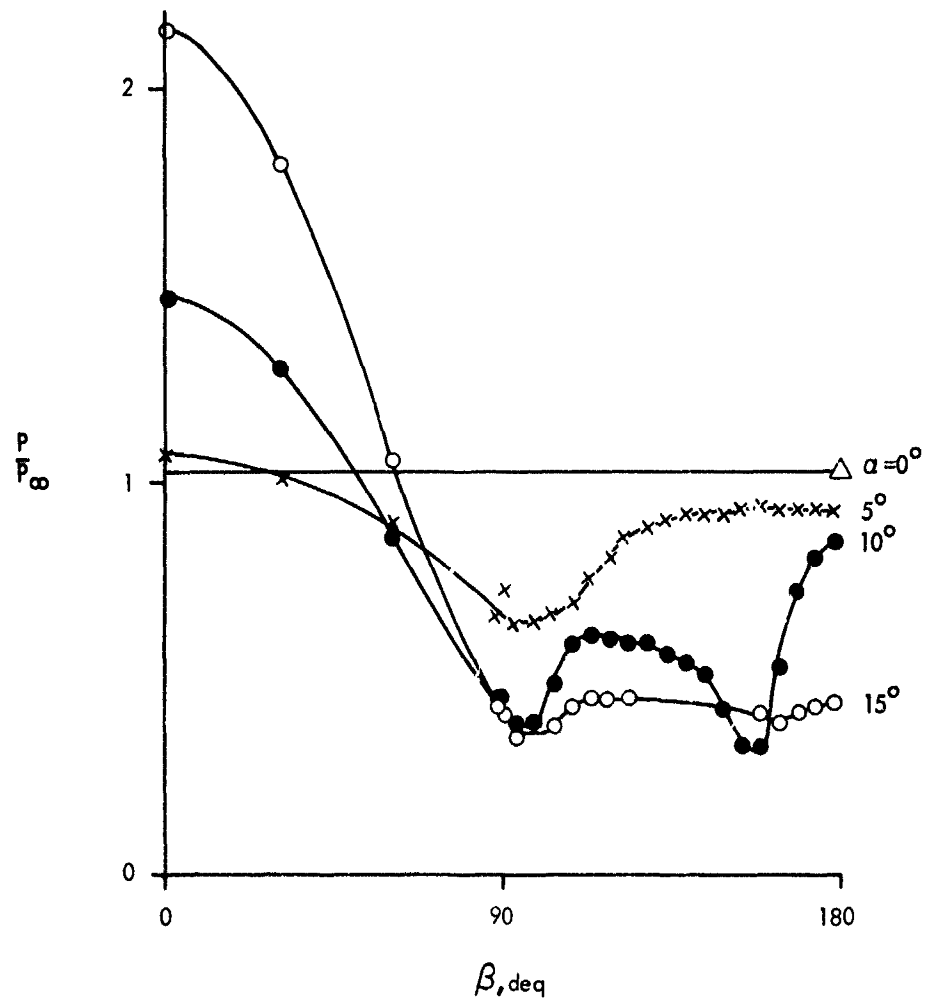


FIG. 15 SURFACE STATIC PRESSURE DISTRIBUTION AT $\frac{X}{D}$ = 6.5, M_∞ = 3.52

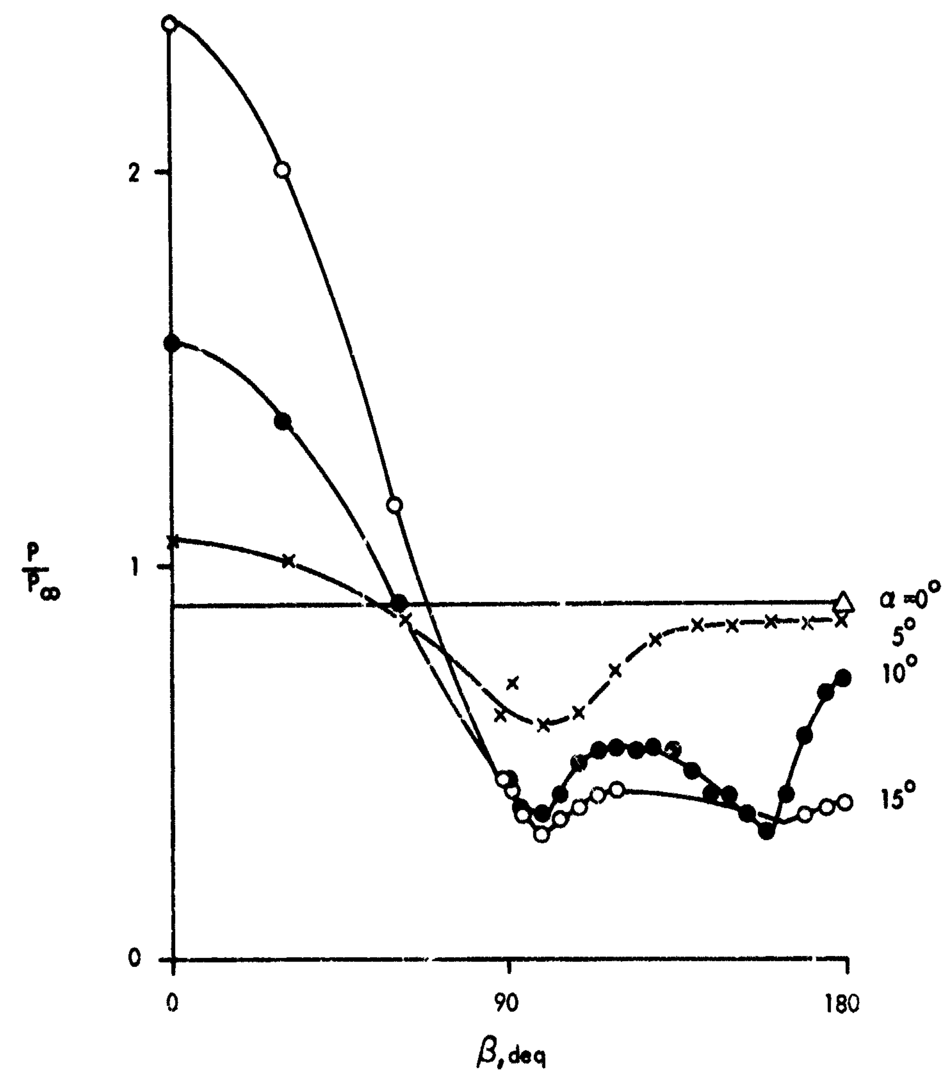


FIG. 16 SURFACE STATIC PRESSURE DISTRIBUTION AT $\frac{X}{D}$ =6.5, M_{∞}= 4.07

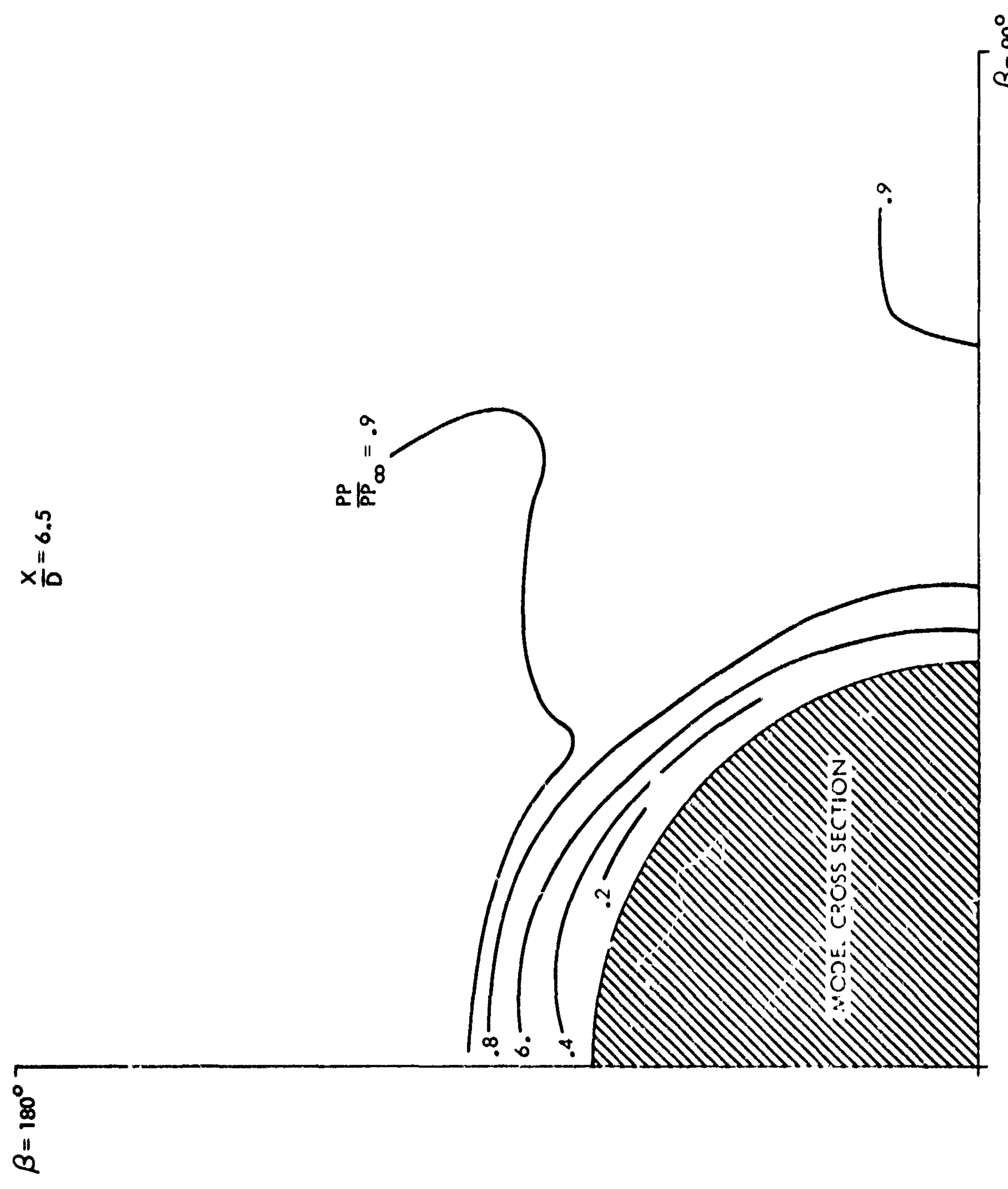


FIG. 17 PITOT PRESSURE MAP, $M_\infty = 3.52$ AT 1D $\alpha = 5°$

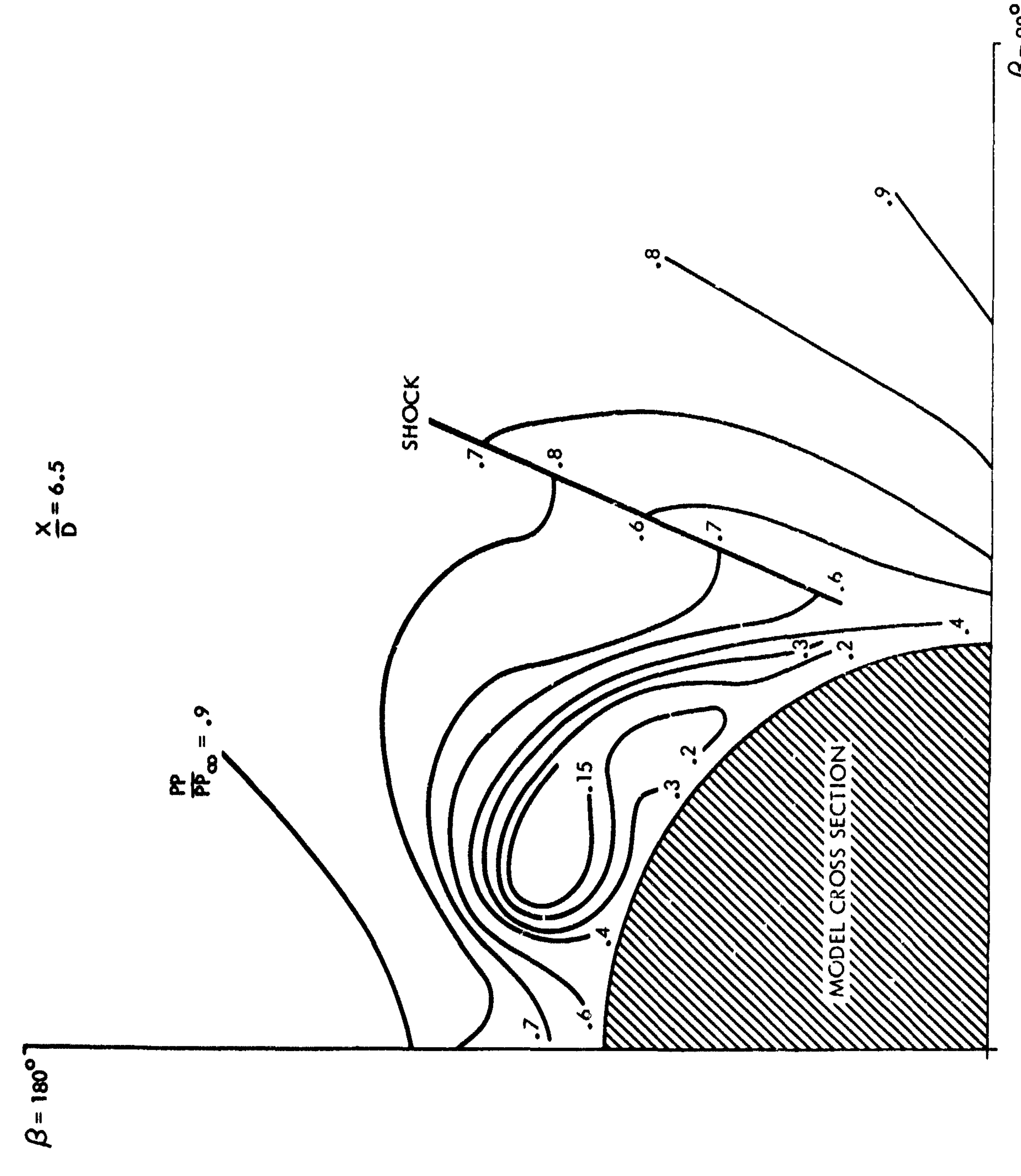


FIG. 18 PITOT PRESSURE MAP, $M_\infty = 3.52$ AND $\alpha = 10°$

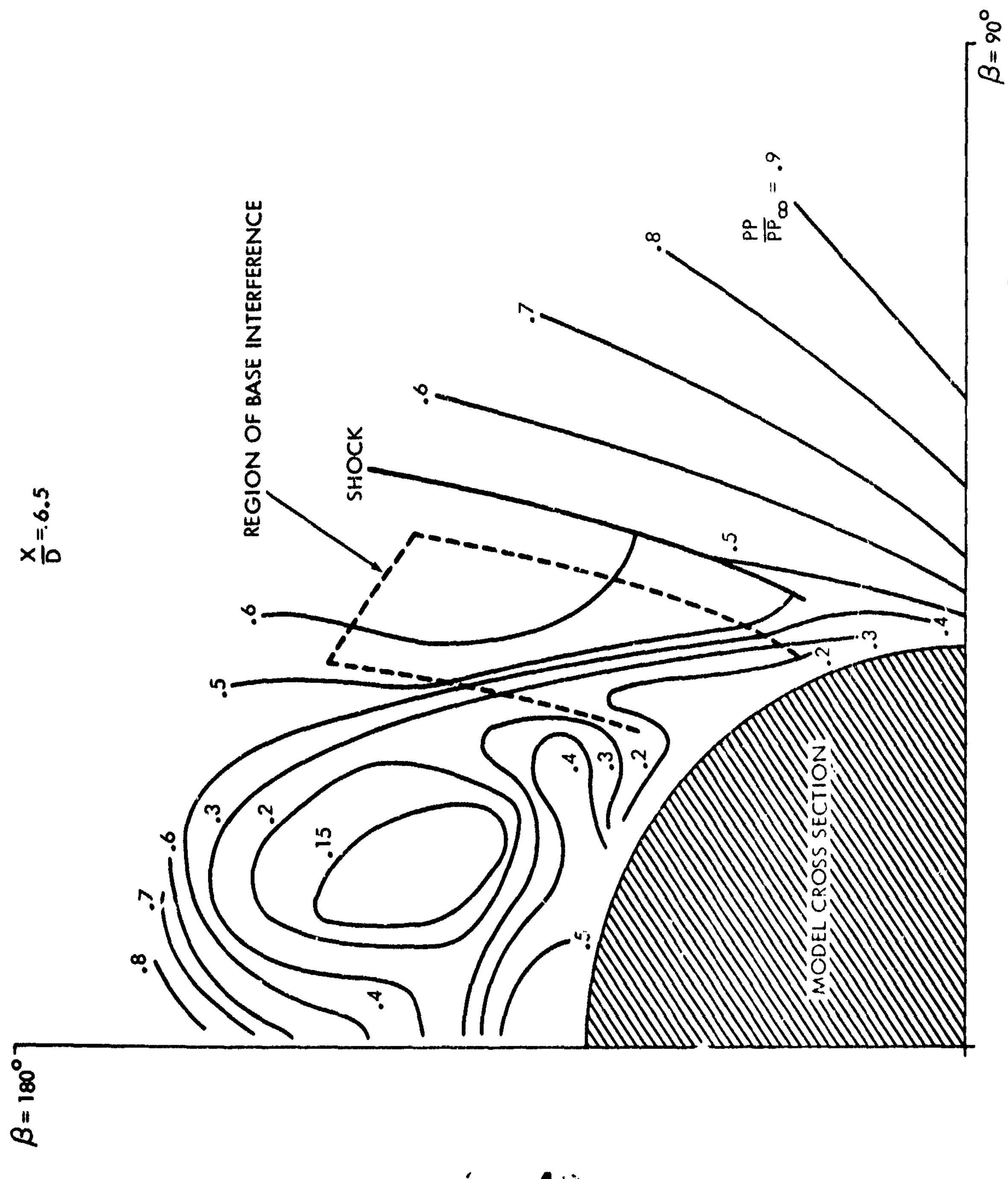


FIG. 19 PITOT PRESSURE MAP, $M_\infty = 3.52$ AND $\alpha = 15°$

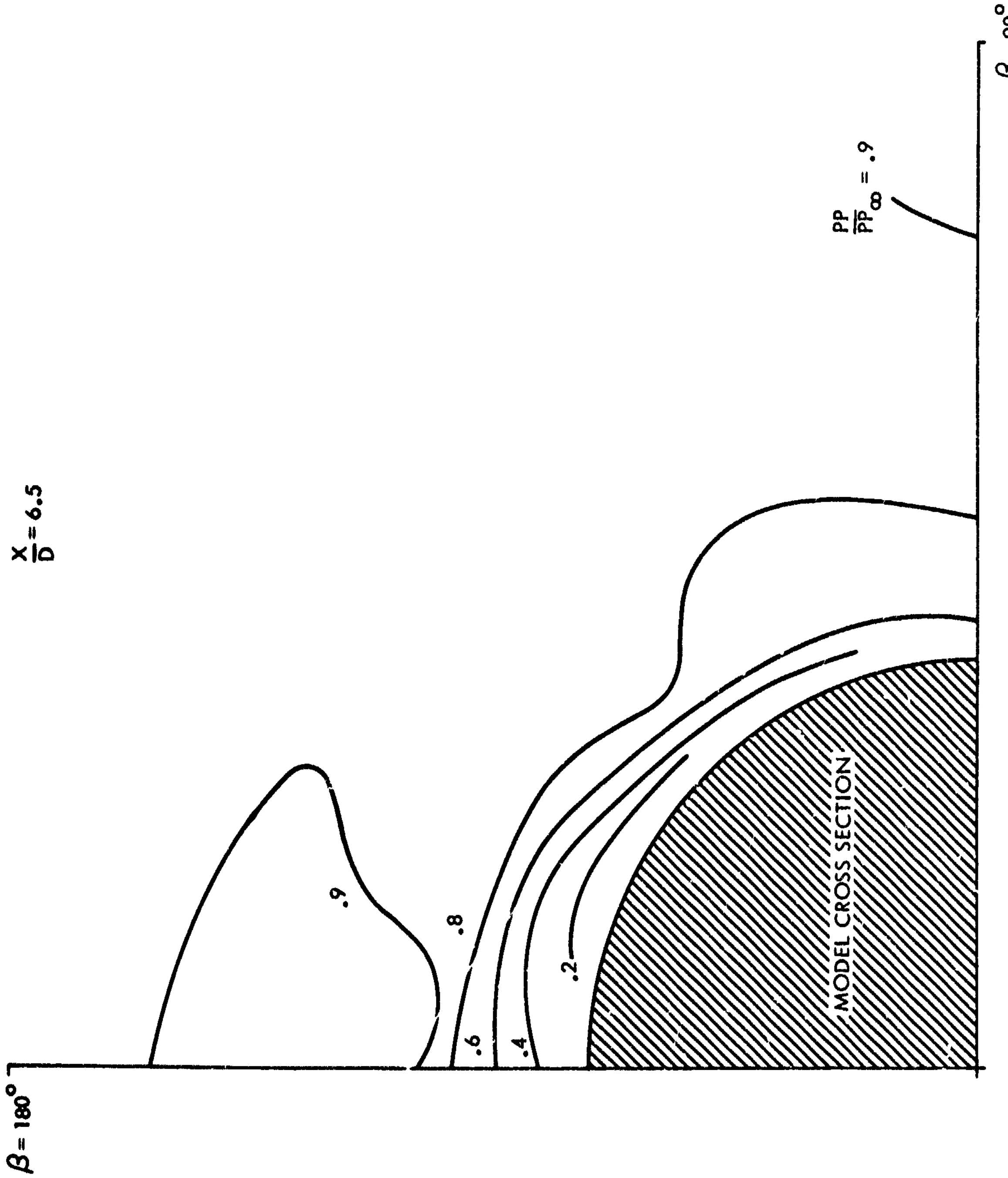


FIG. 20 PITOT PRESSURE MAP, $M_\infty = 4.07$ AND $\alpha = 5^\circ$

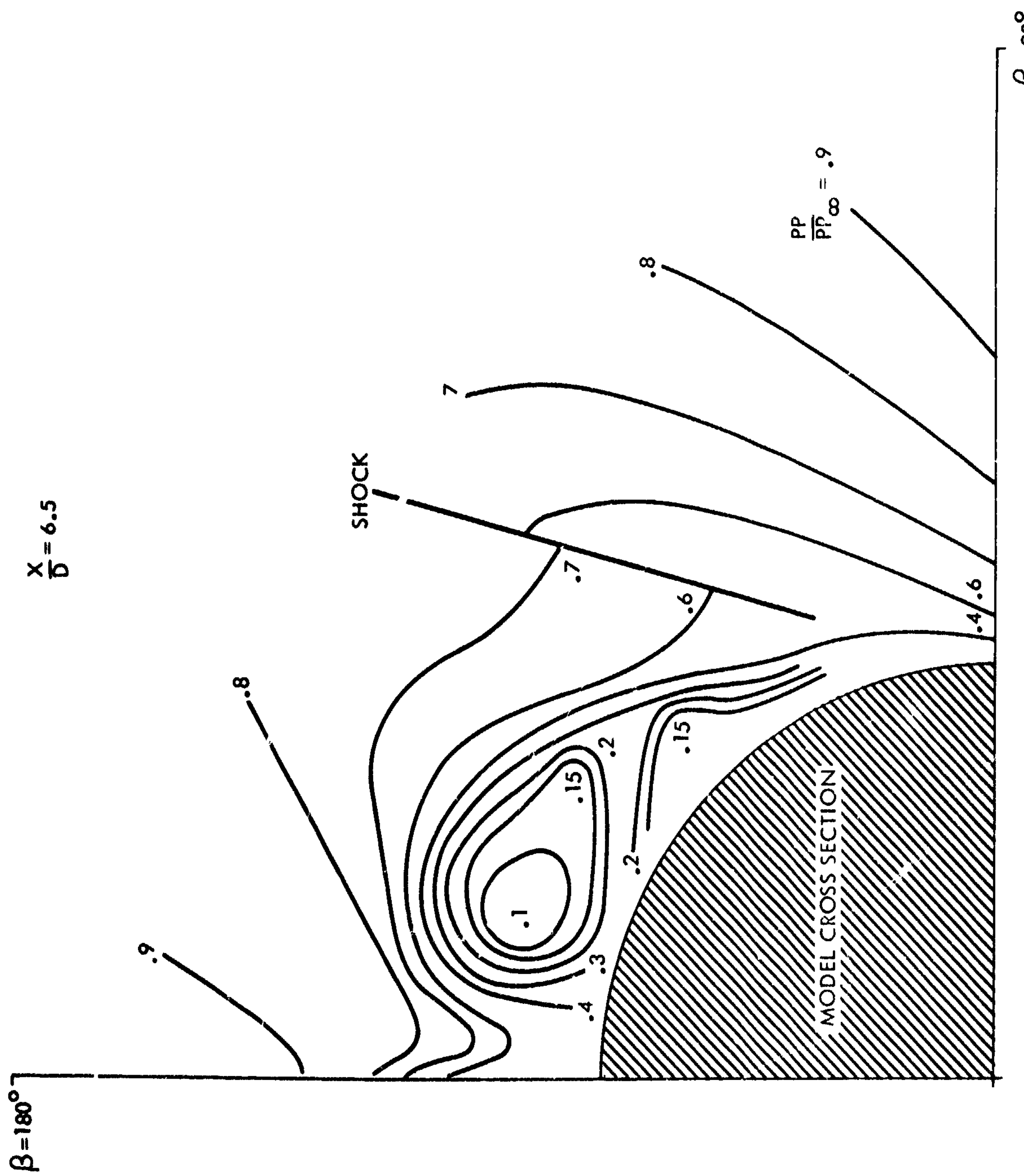


FIG. 21 PITOT PRESSURE MAP, $M_\infty = 4.07$ AND $\alpha = 10°$

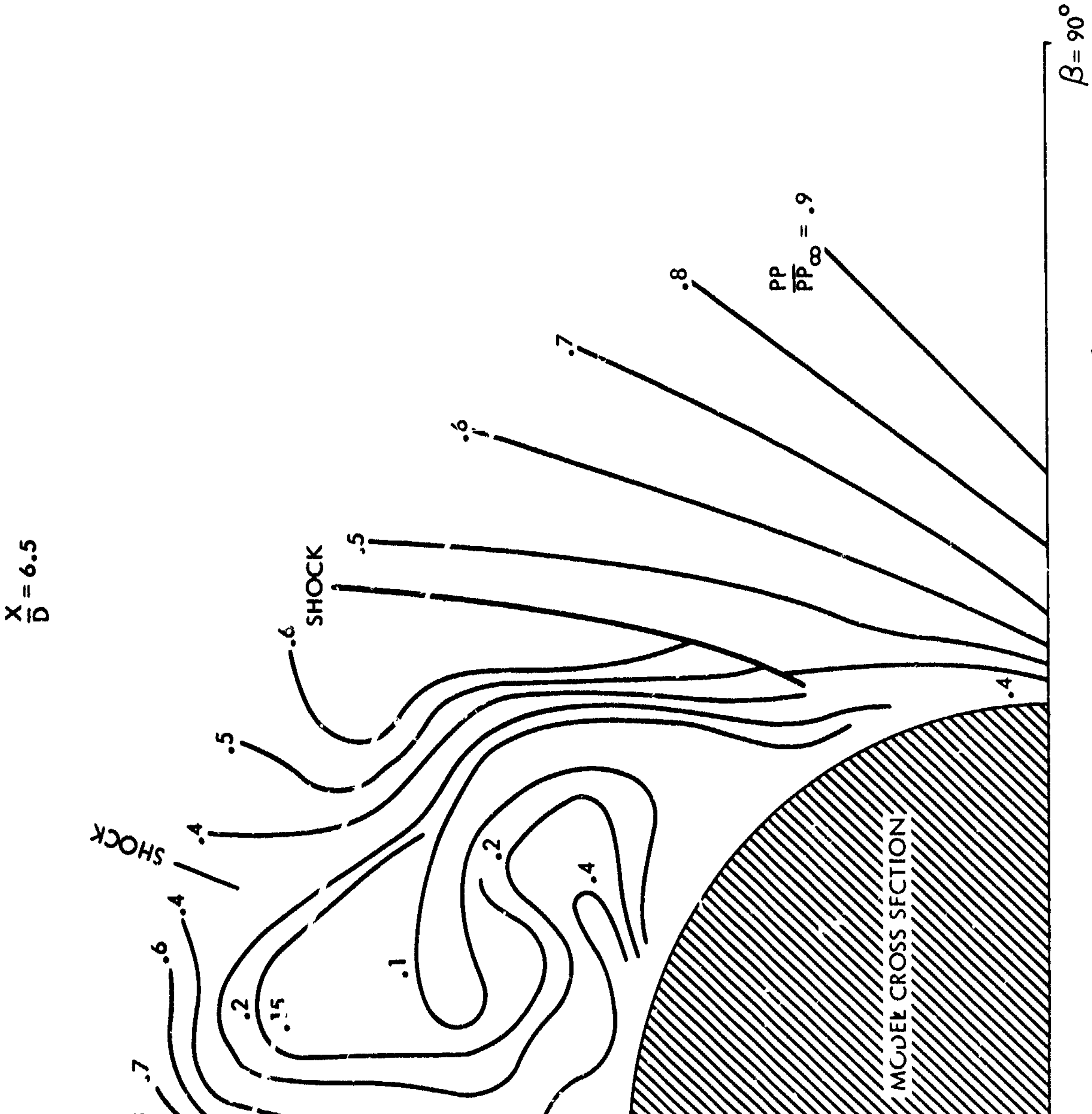


FIG. 22 PITOT PRESSURE MAP, $M_\infty = 4.07$ AND $\alpha = 15°$

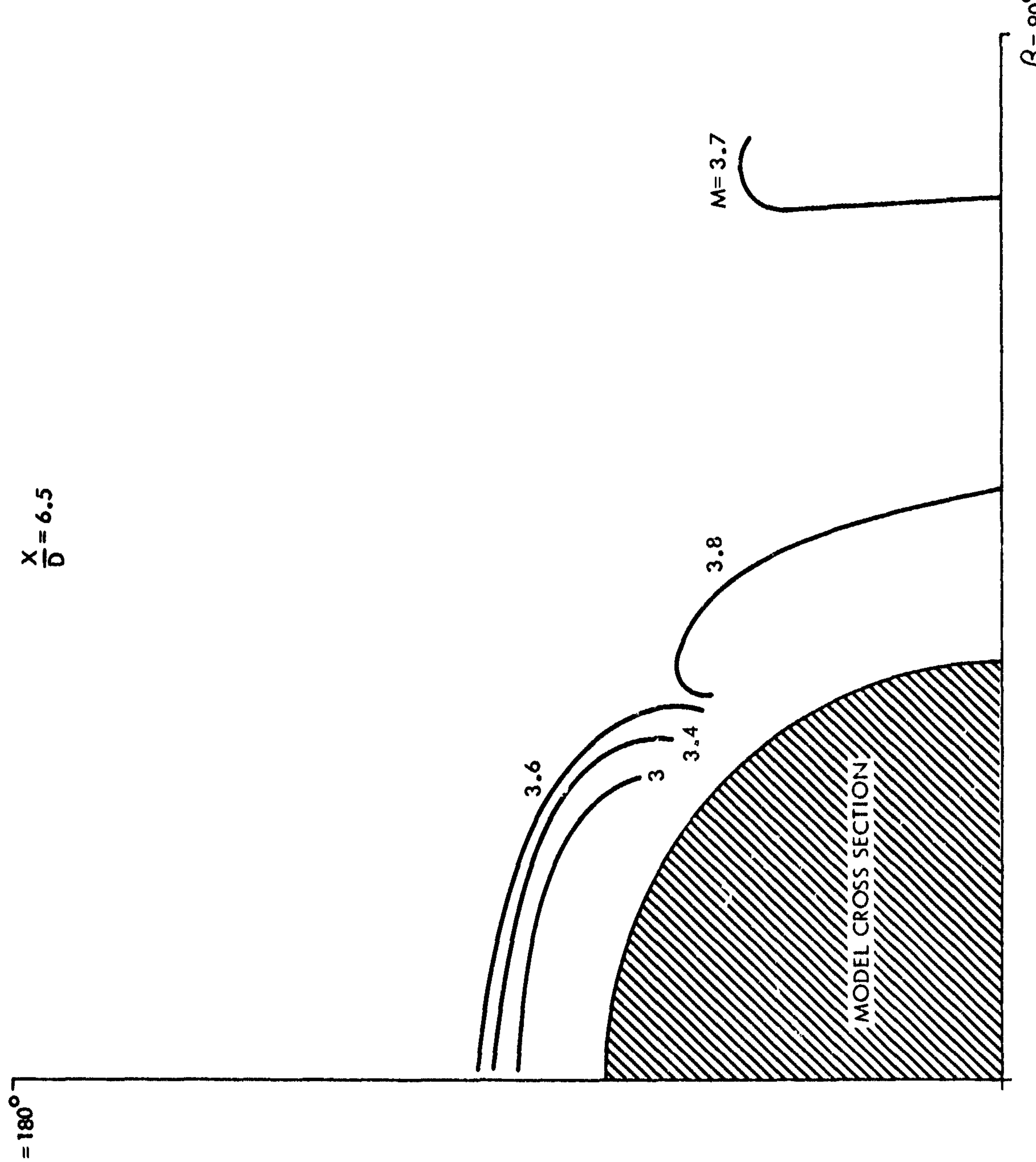


FIG. 23 MACH NUMBER MAP, $M_\infty = 3.52$ AND $\alpha = 5°$

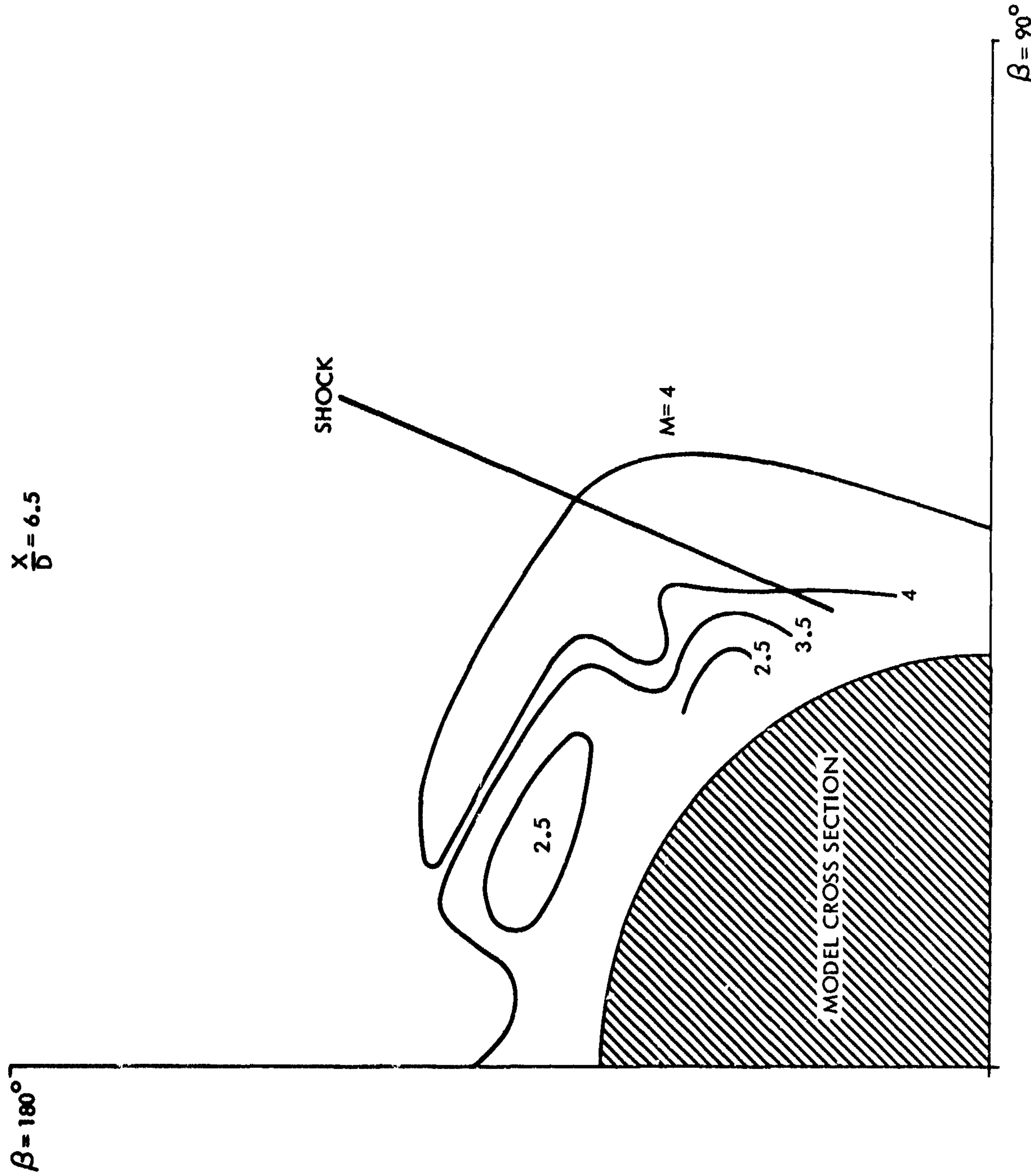


FIG. 24 MACH NUMBER MAP, $M_\infty = 3.52$ AND $\alpha = 10°$

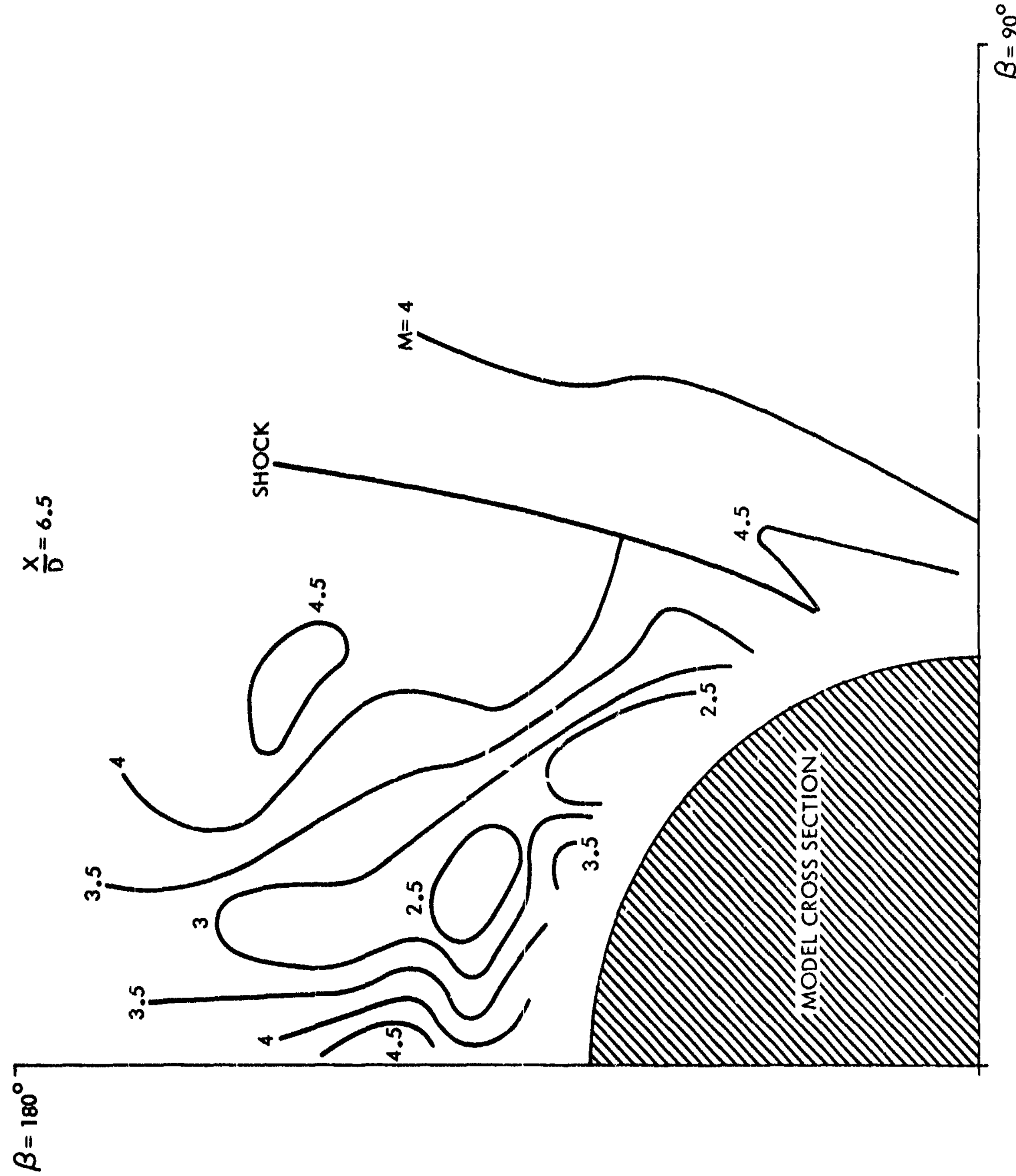


FIG. 25 MACH NUMBER MAP, $M_\infty = 3.52$ AND $\alpha = 15°$

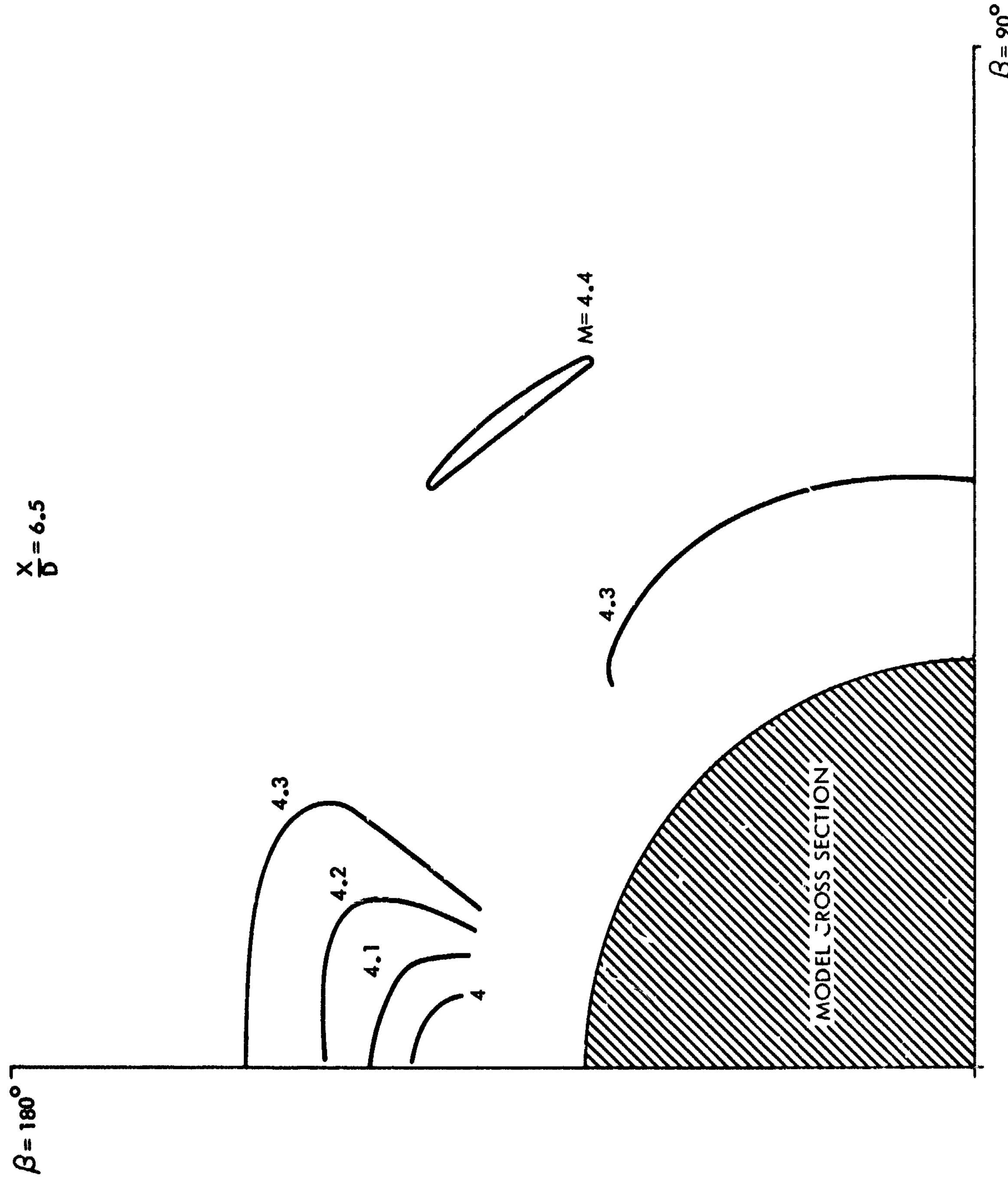


FIG. 26 MACH NUMBER MAP, $M_\infty = 4.07$ AND $\alpha = 5°$

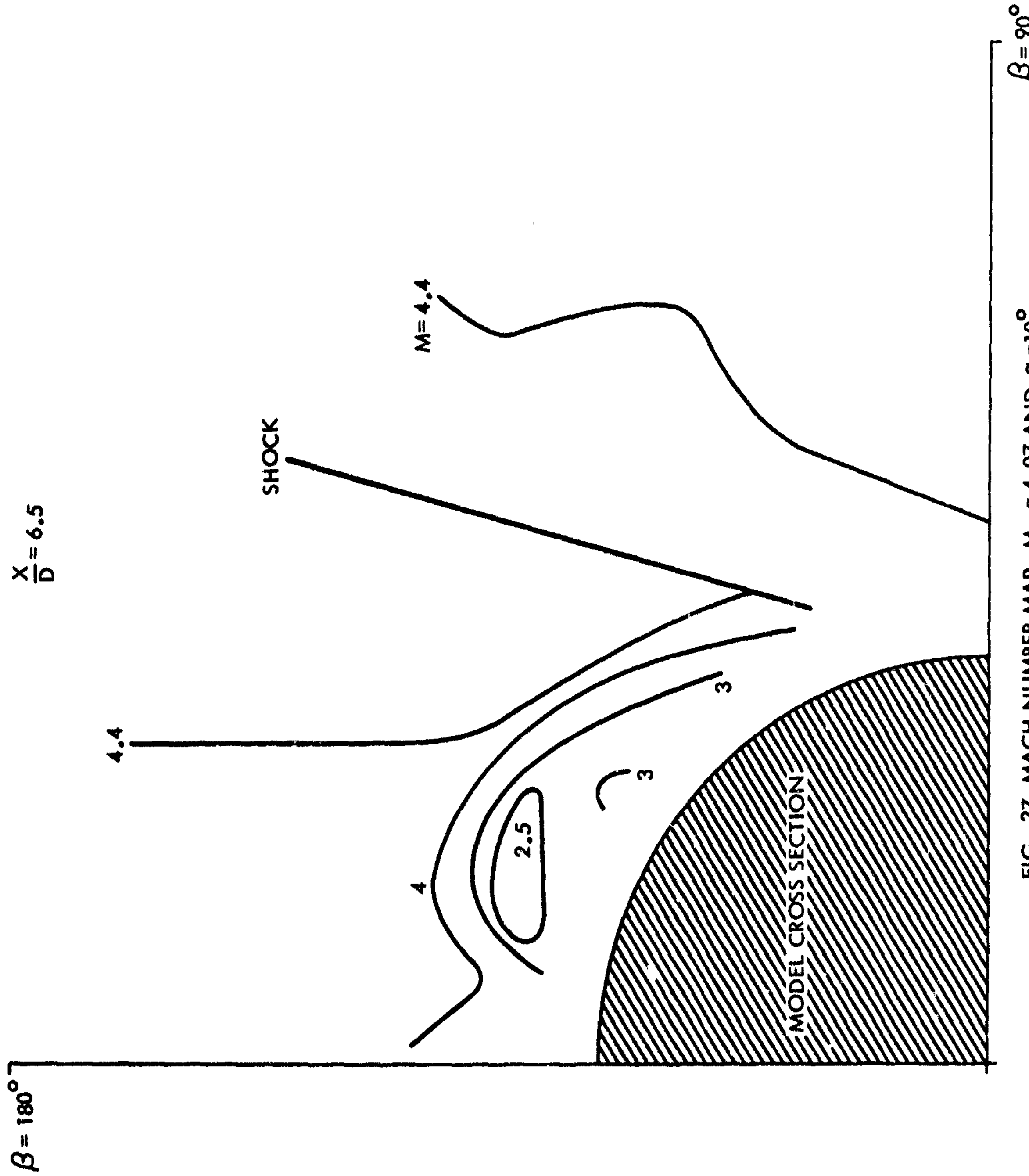


FIG. 27 MACH NUMBER MAP, $M_\infty = 4.07$ AND $\alpha = 10°$

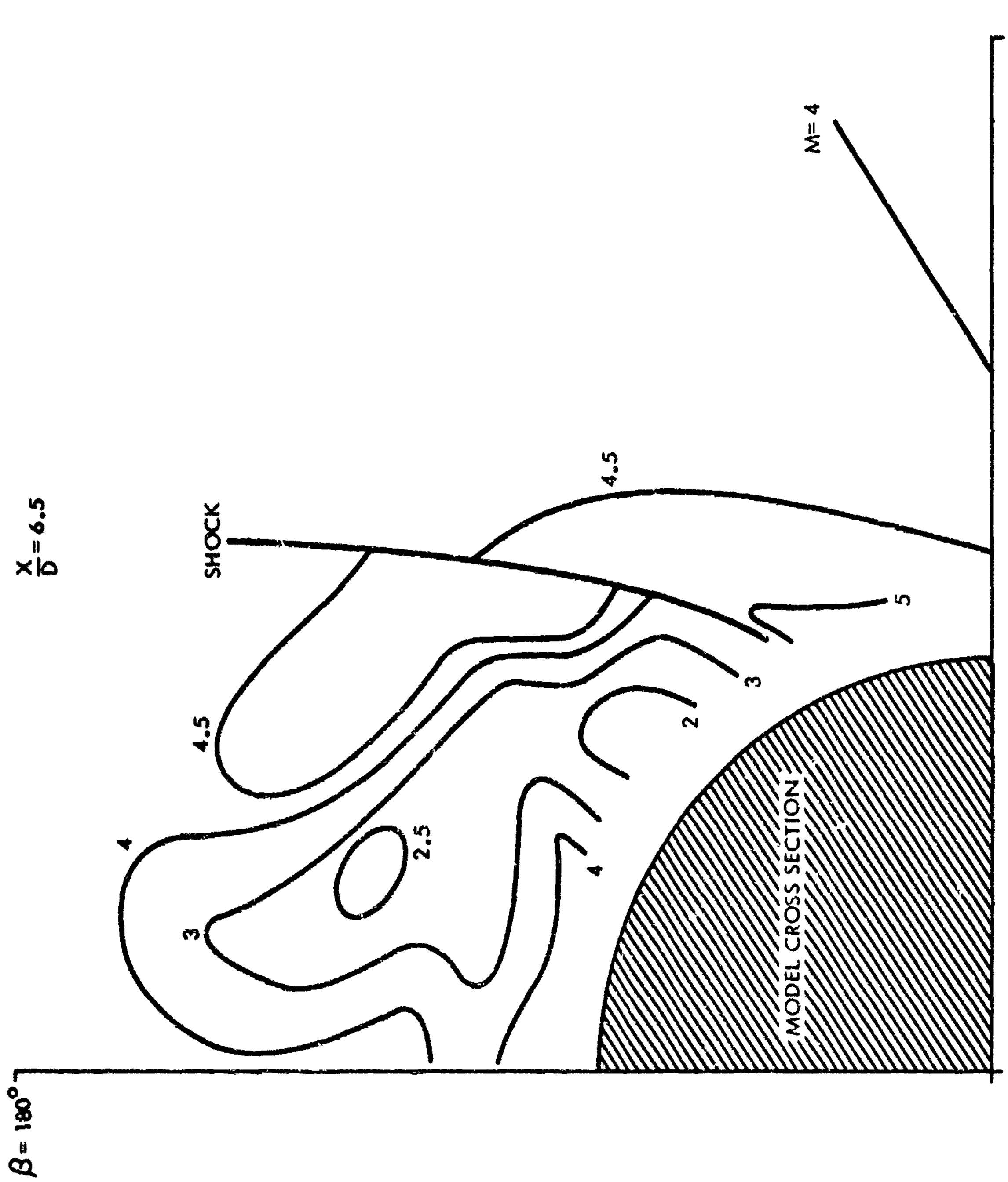


FIG. 28 MACH NUMBER MAP, $M_\infty = 4.07$ AND $\alpha = 15^\circ$

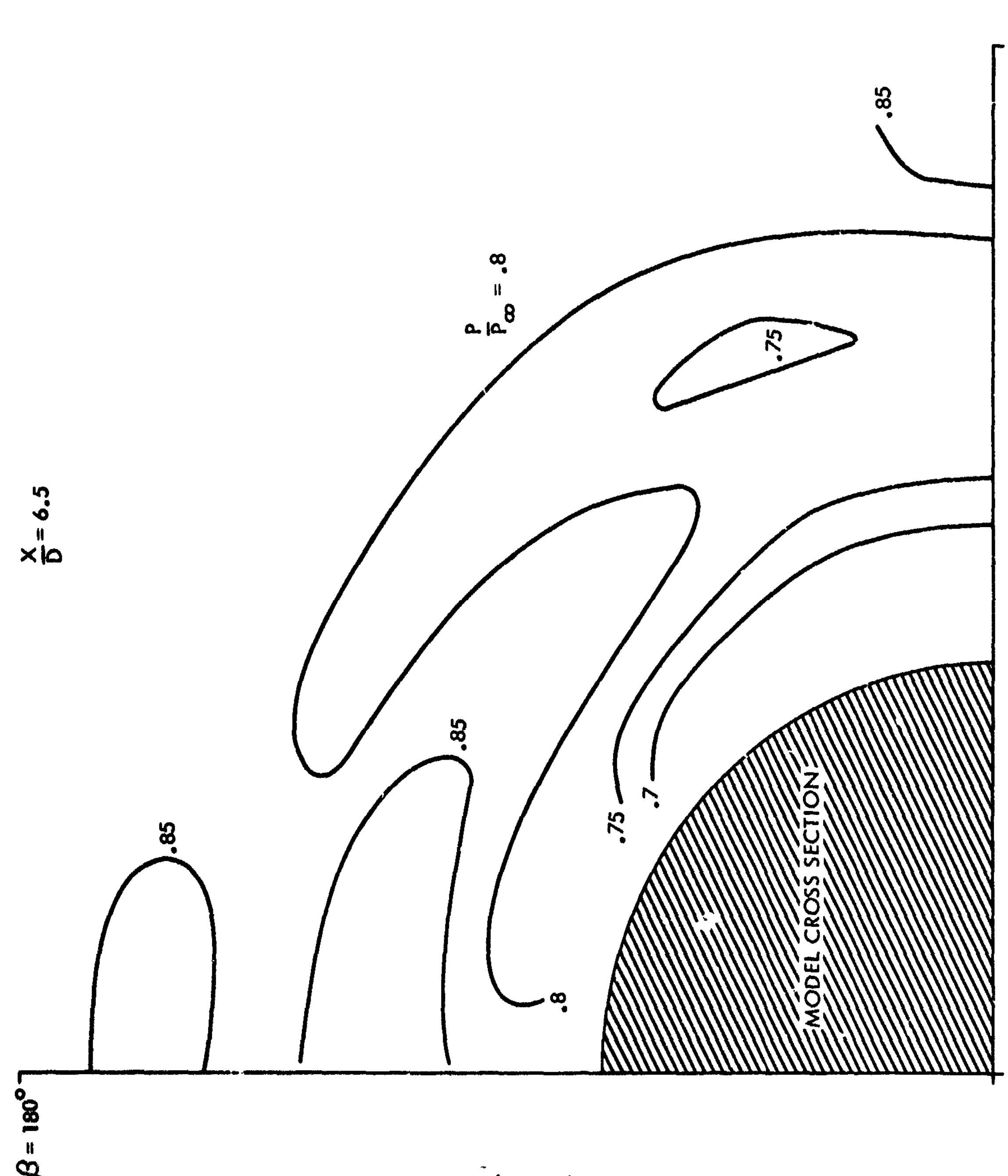


FIG. 29 STATIC PRESSURE MAP, $M_\infty = 3.52$ AND $\alpha = 5°$

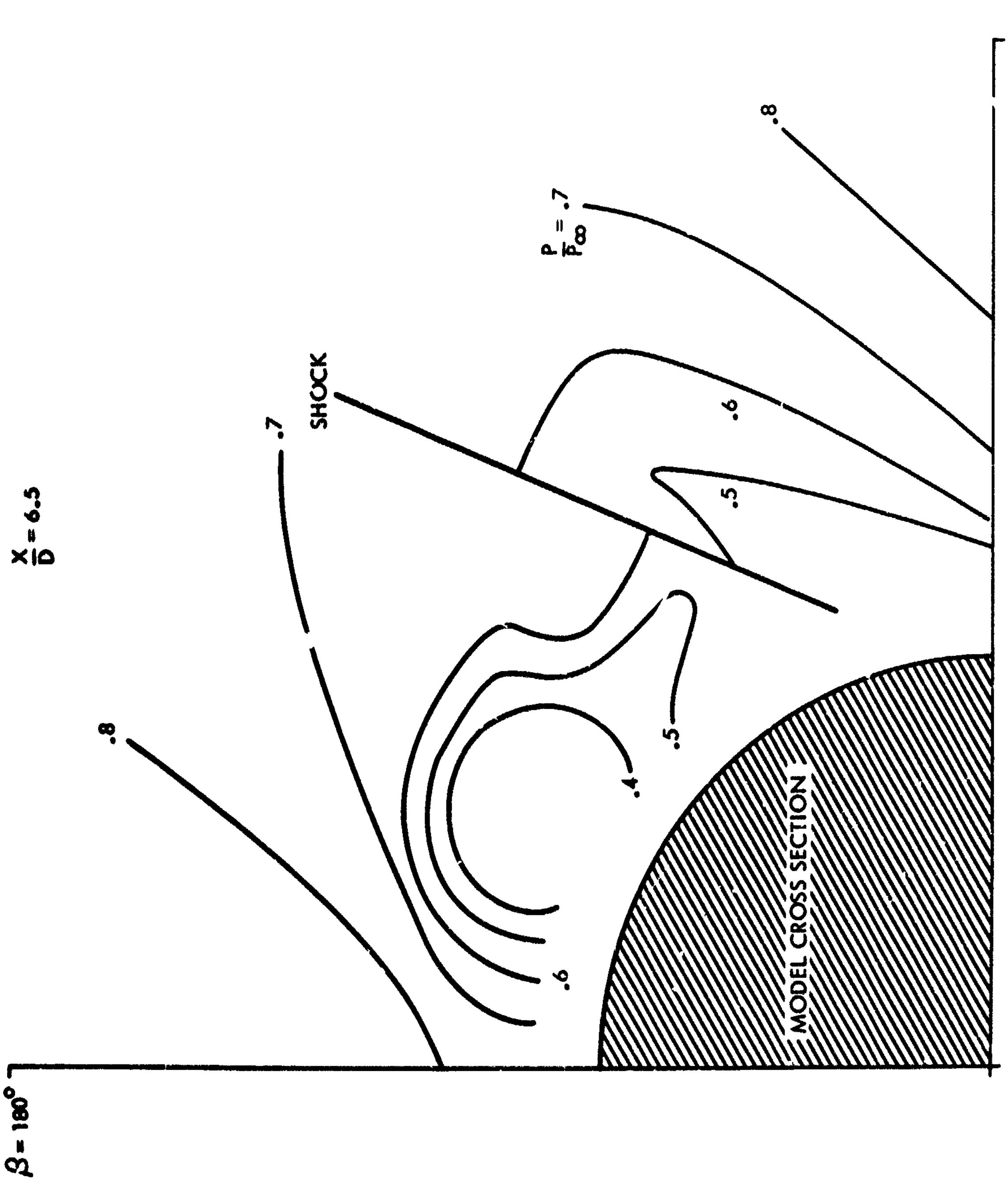


FIG. 30 STATIC PRESSURE MAP, $M_\infty = 3.52$ AND $\alpha = 10°$

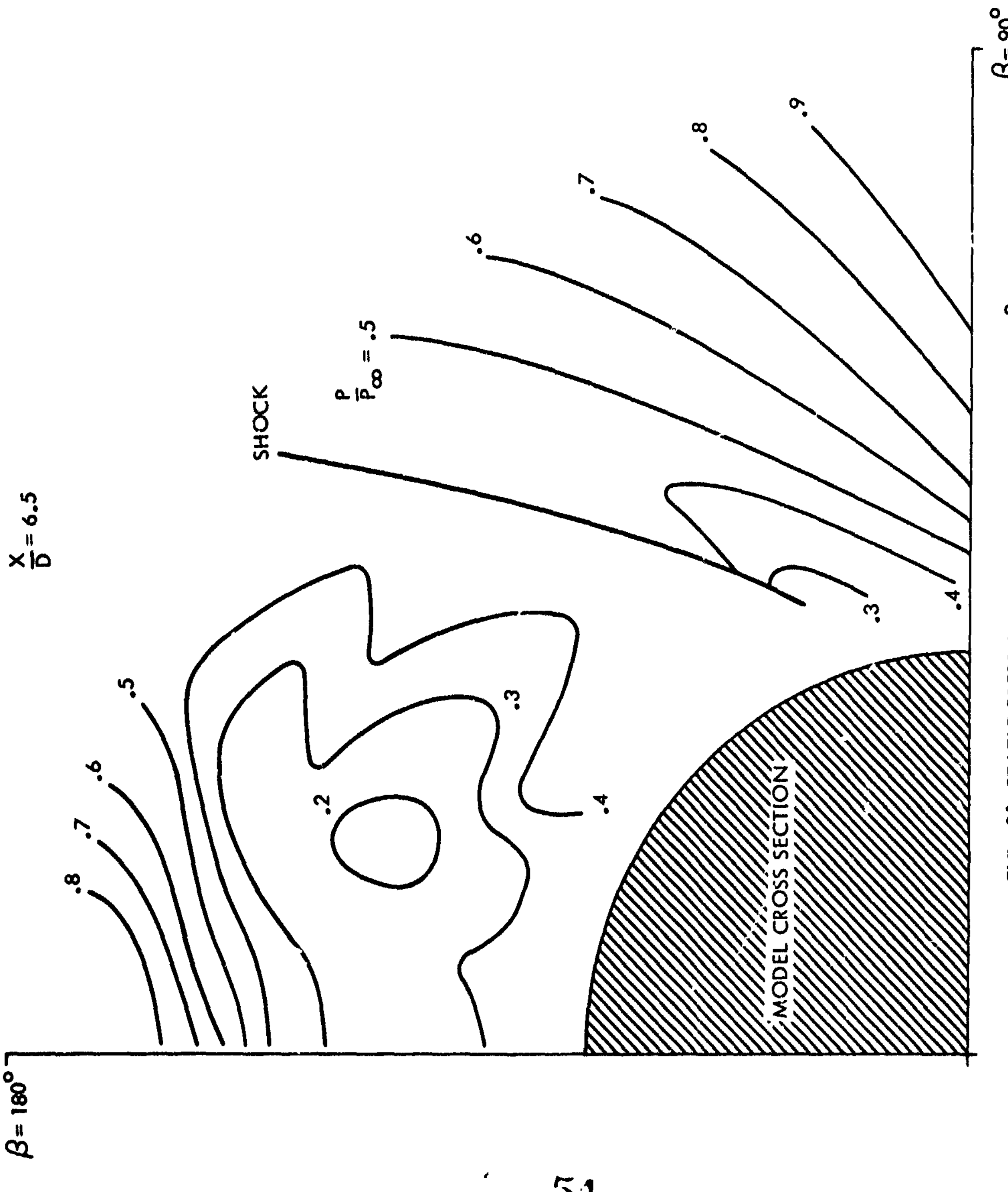


FIG. 31 STATIC PRESSURE MAP, $M_\infty = 3.52$ AND $\alpha = 15°$

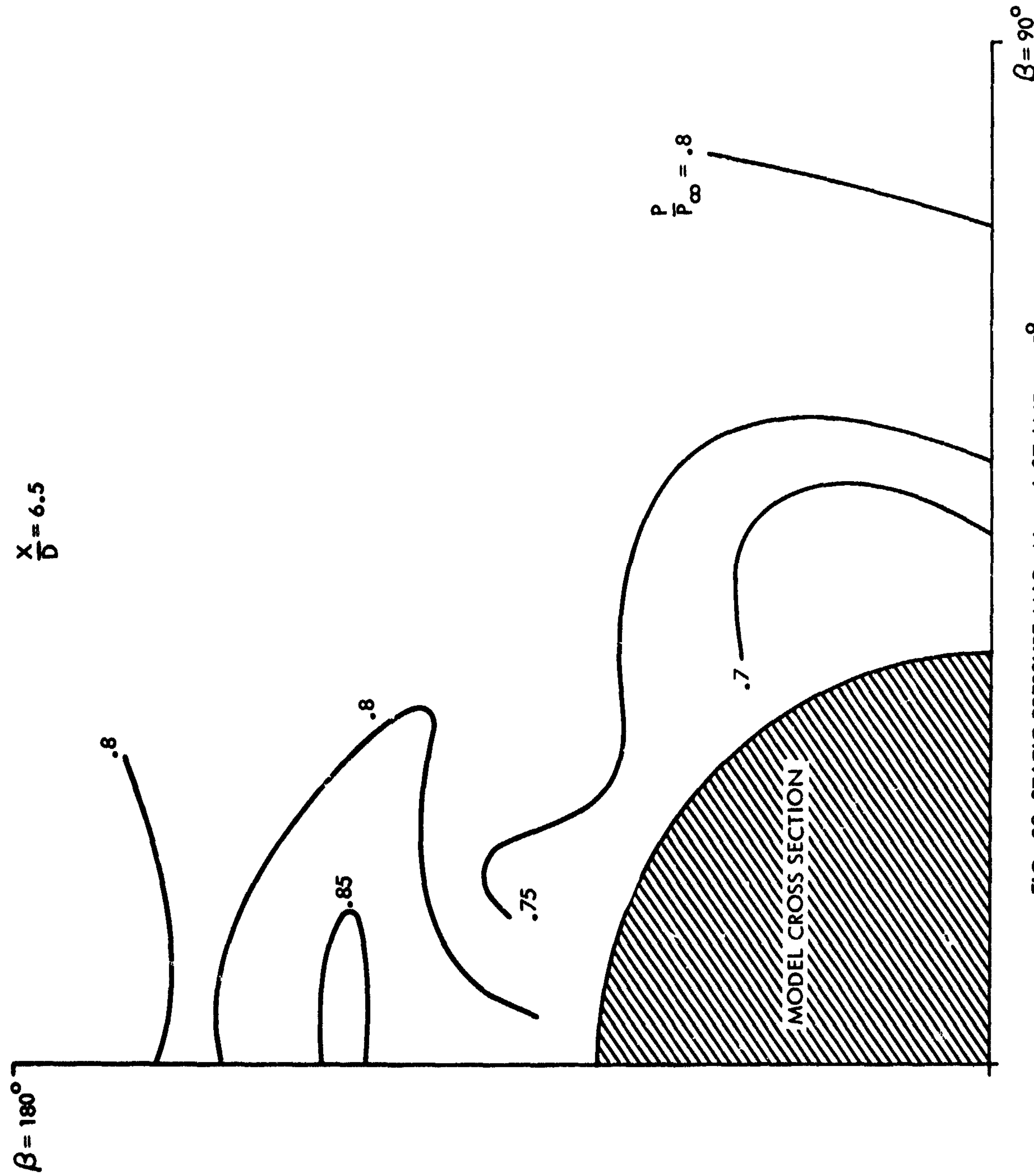


FIG. 32 STATIC PRESSURE MAP, $M_\infty = 4.07$ AND $\alpha = 5^\circ$

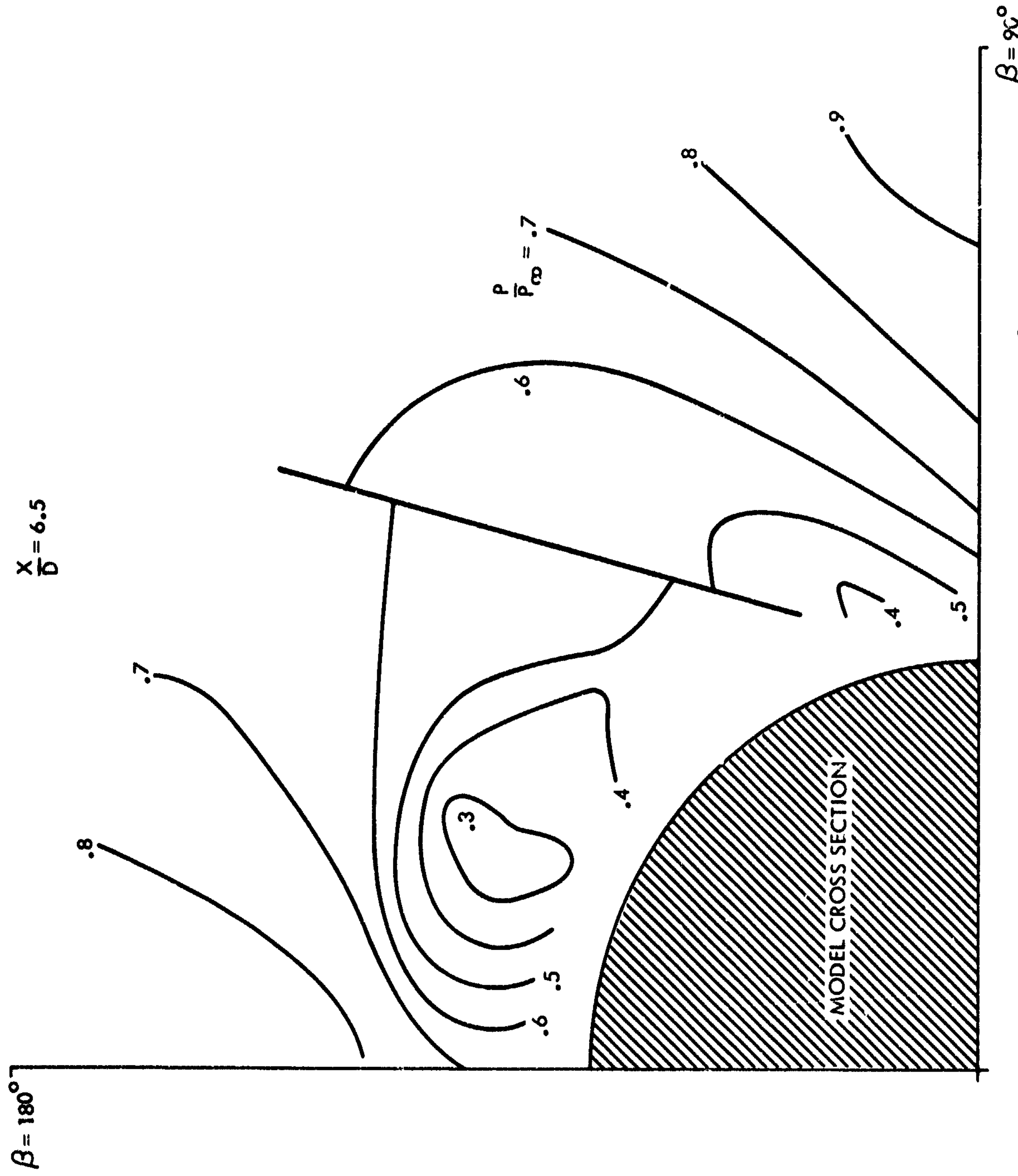


FIG. 33 STATIC PRESSURE MAP, $M_\infty = 4.07$ AND $\alpha = 10°$

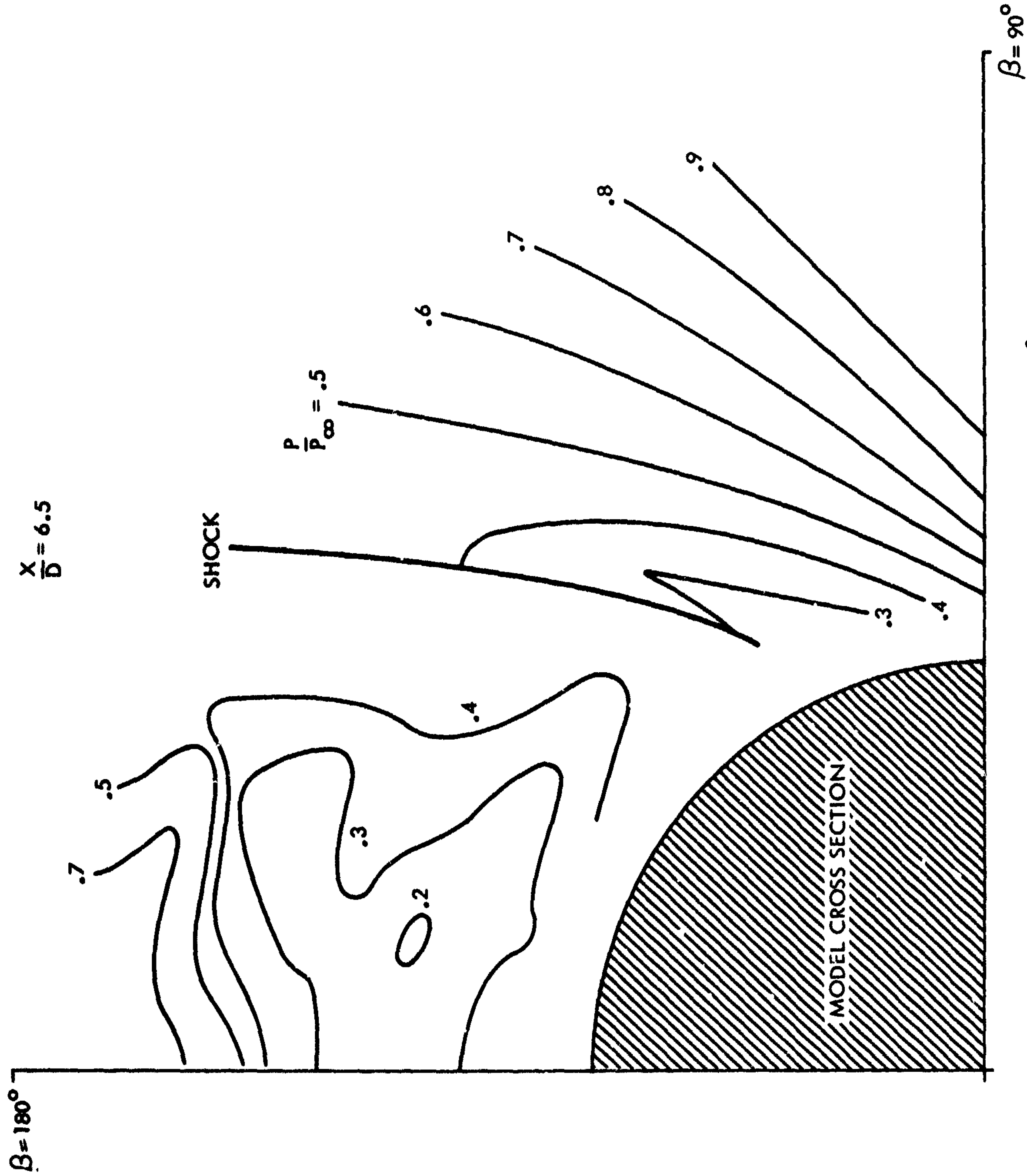


FIG. 34 STATIC PRESSURE MAP, $M_{\infty} = 4.07$ AND $\alpha = 15^{\circ}$

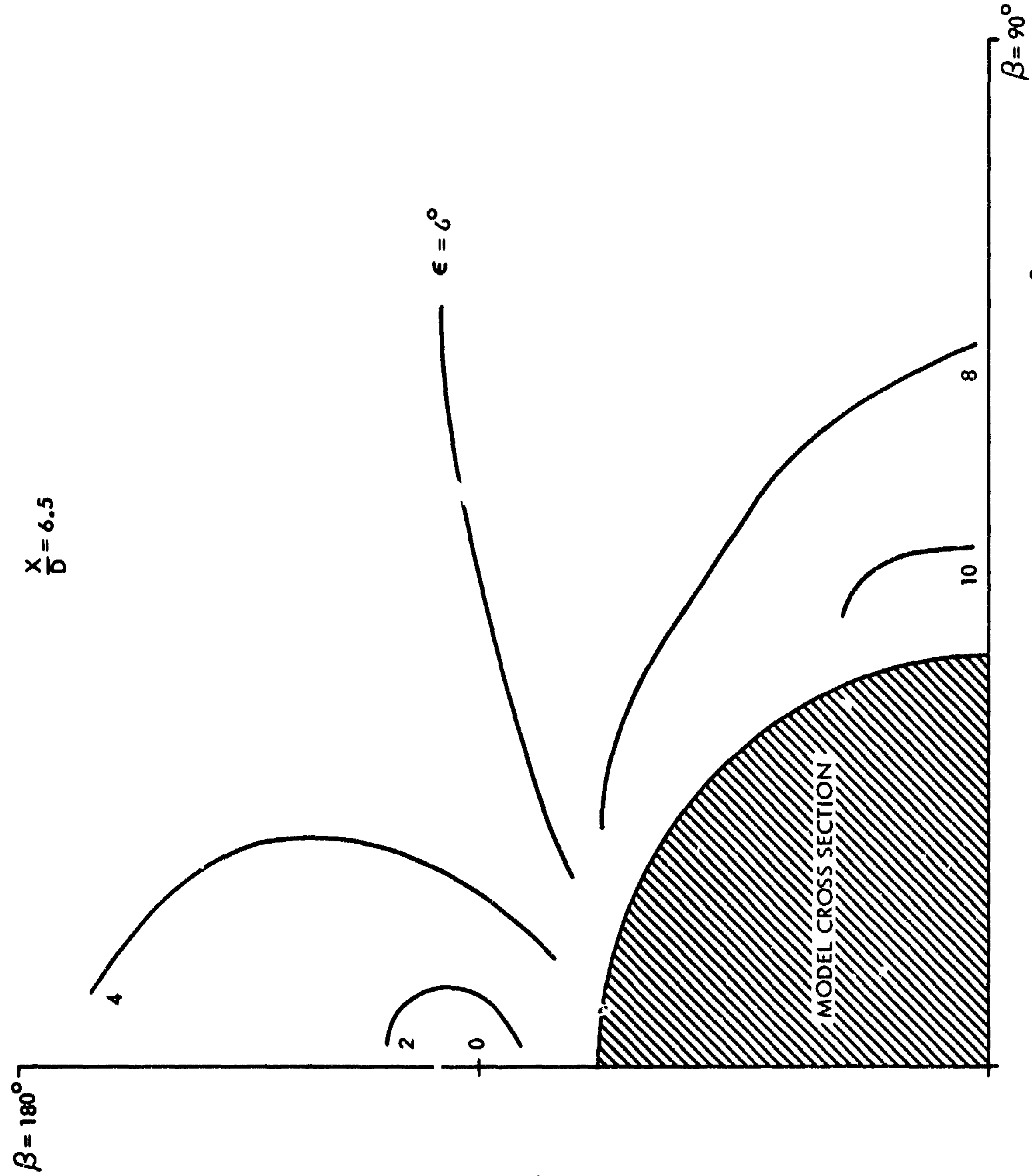


FIG. 35 FLOW ANGLE MAP, $M_\infty = 3.52$ AND $\alpha = 5^\circ$

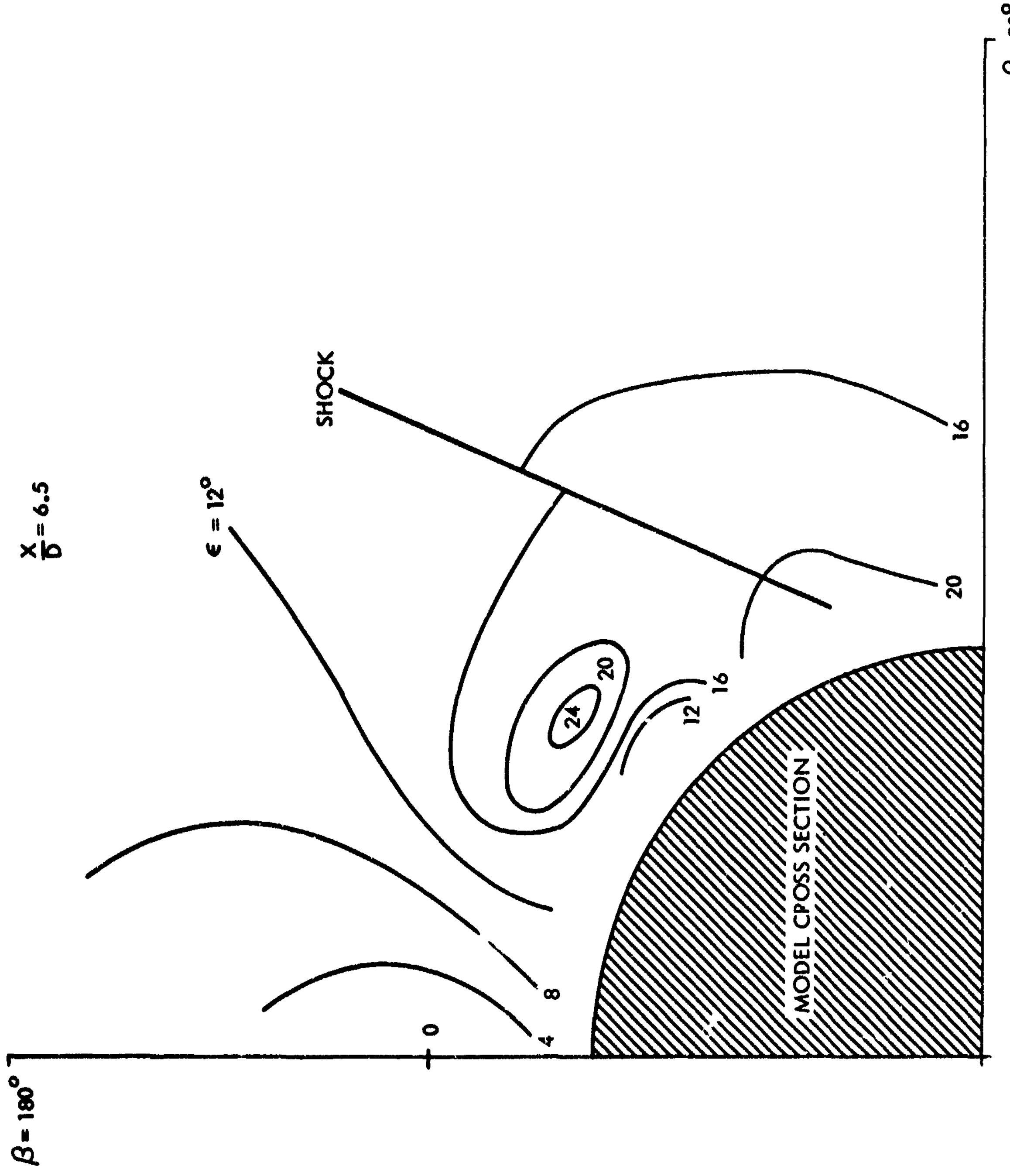


FIG. 36 FLOW ANGLE MAP, $M_{\infty} = 3.52$ AND $\alpha = 10°$

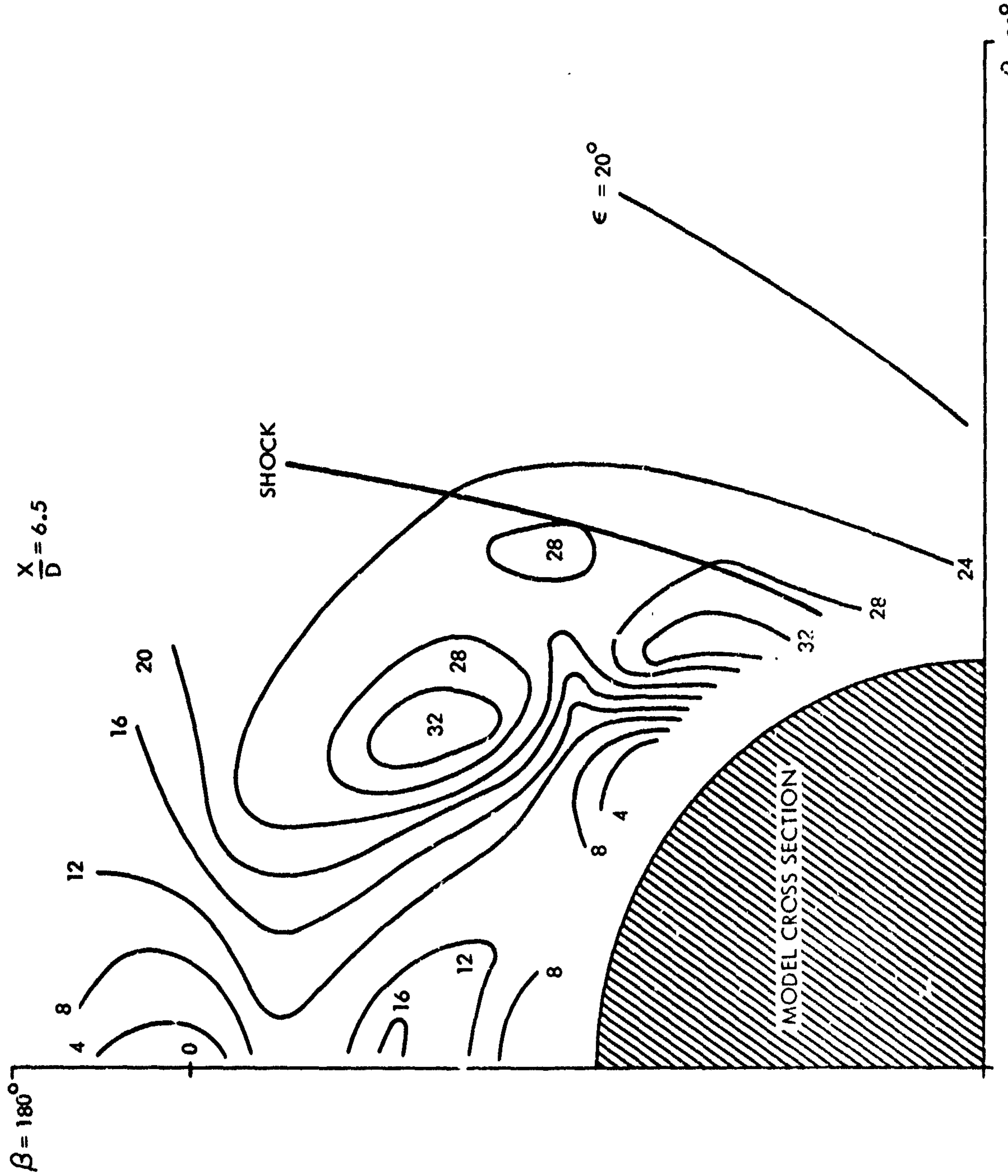


FIG. 37 FLOW ANGLE MAP, $M_\infty = 3.52$ AND $\alpha = 15°$

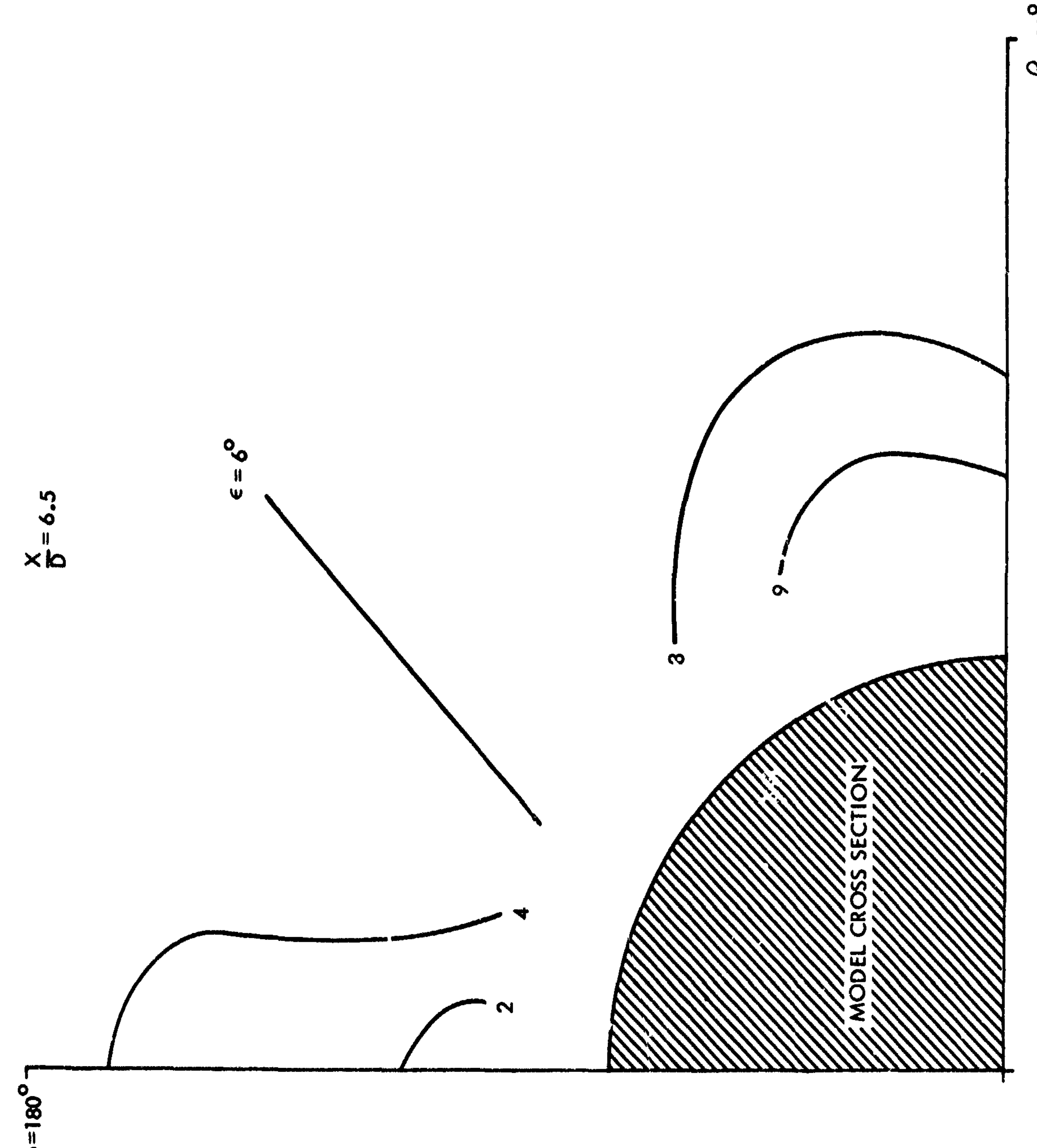


FIG. 38 FLOW ANGLE MAP, $M_\infty = 4.07$ AND $\alpha = 5°$

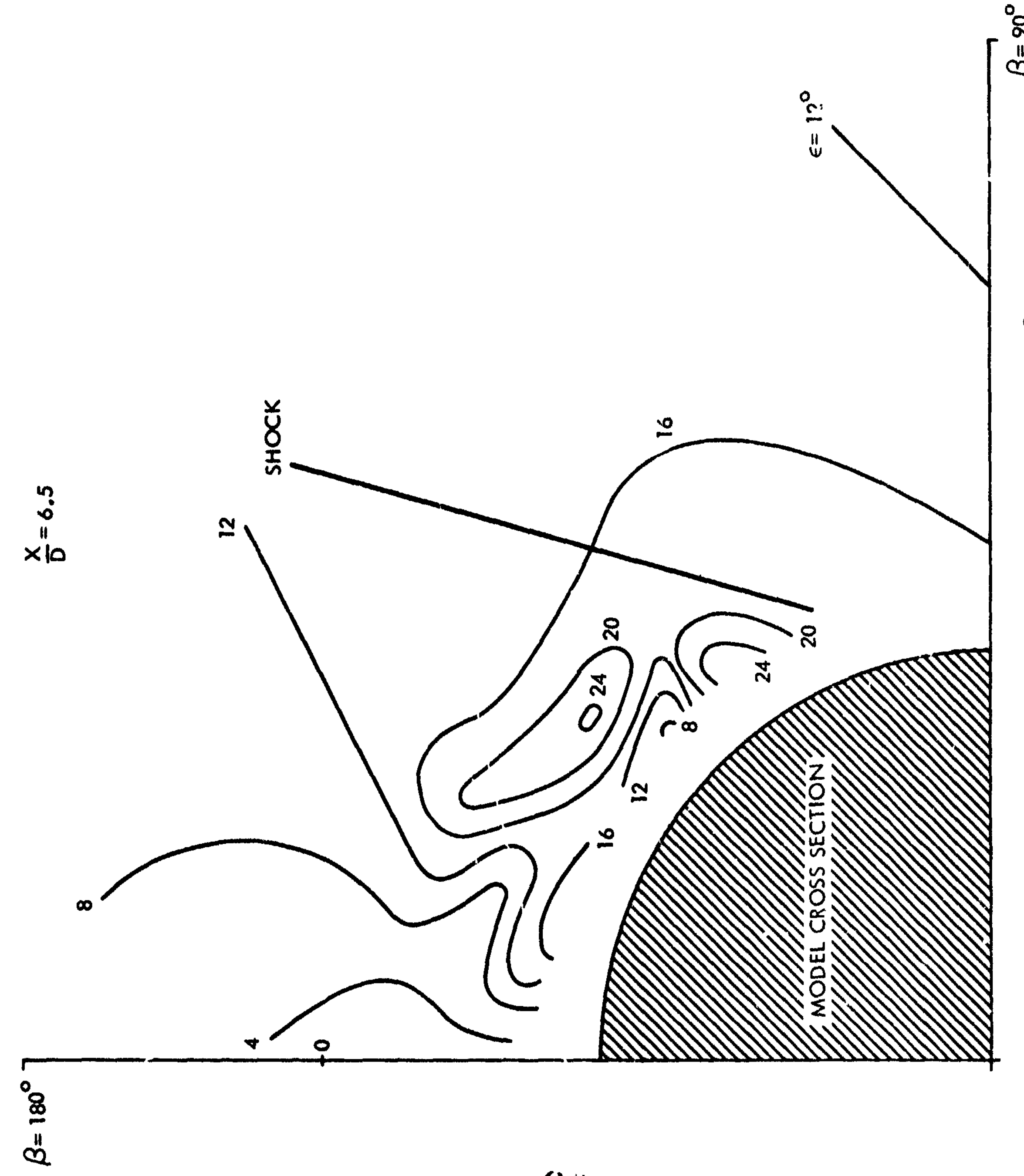


FIG. 39 FLOW ANGLE MAP, $M_\infty = 4.07$ AND $\alpha = 10^\circ$

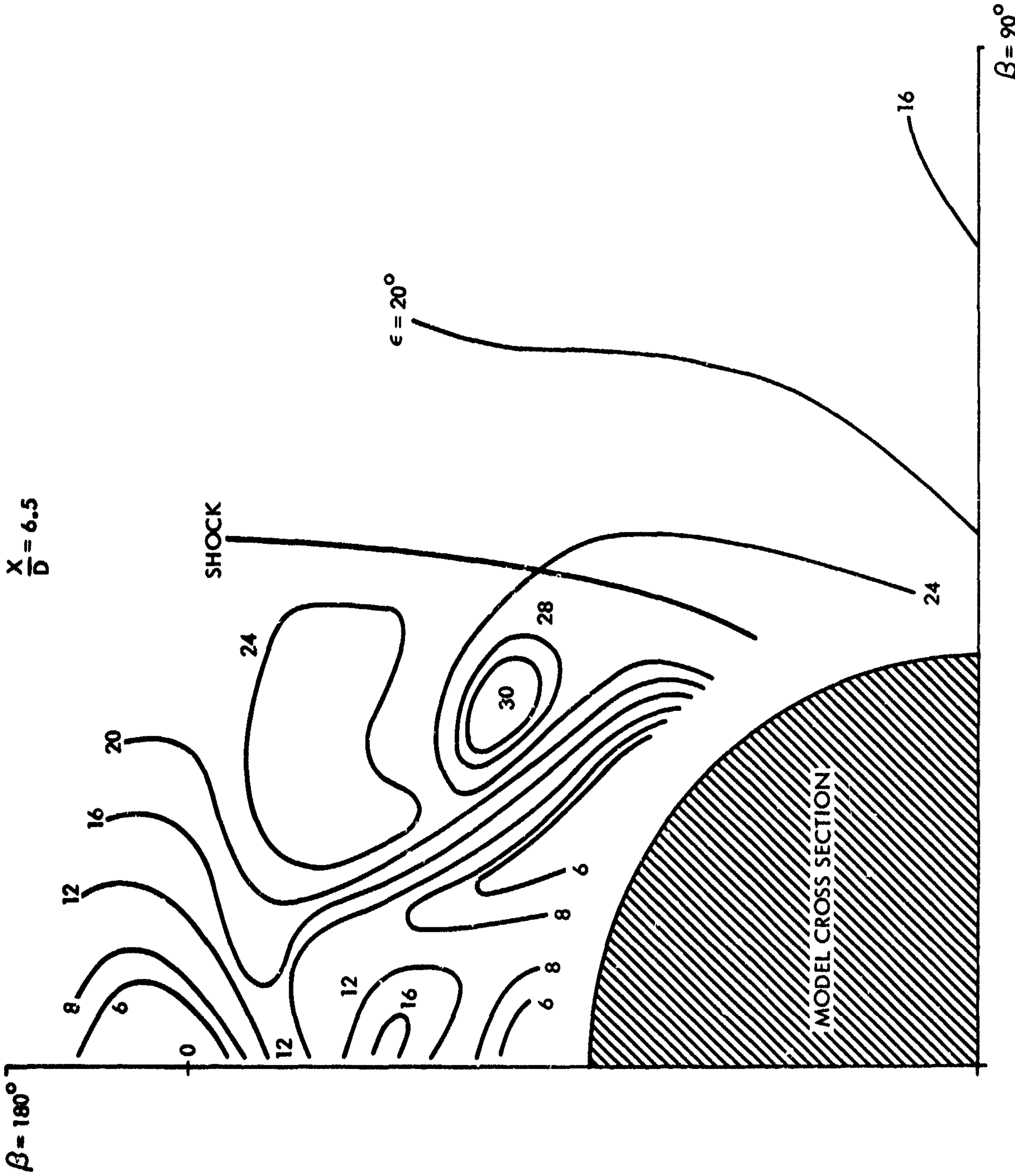


FIG. 40 FLOW ANGLE MAP, $M_\infty = 4.07$ AND $\alpha = 15°$

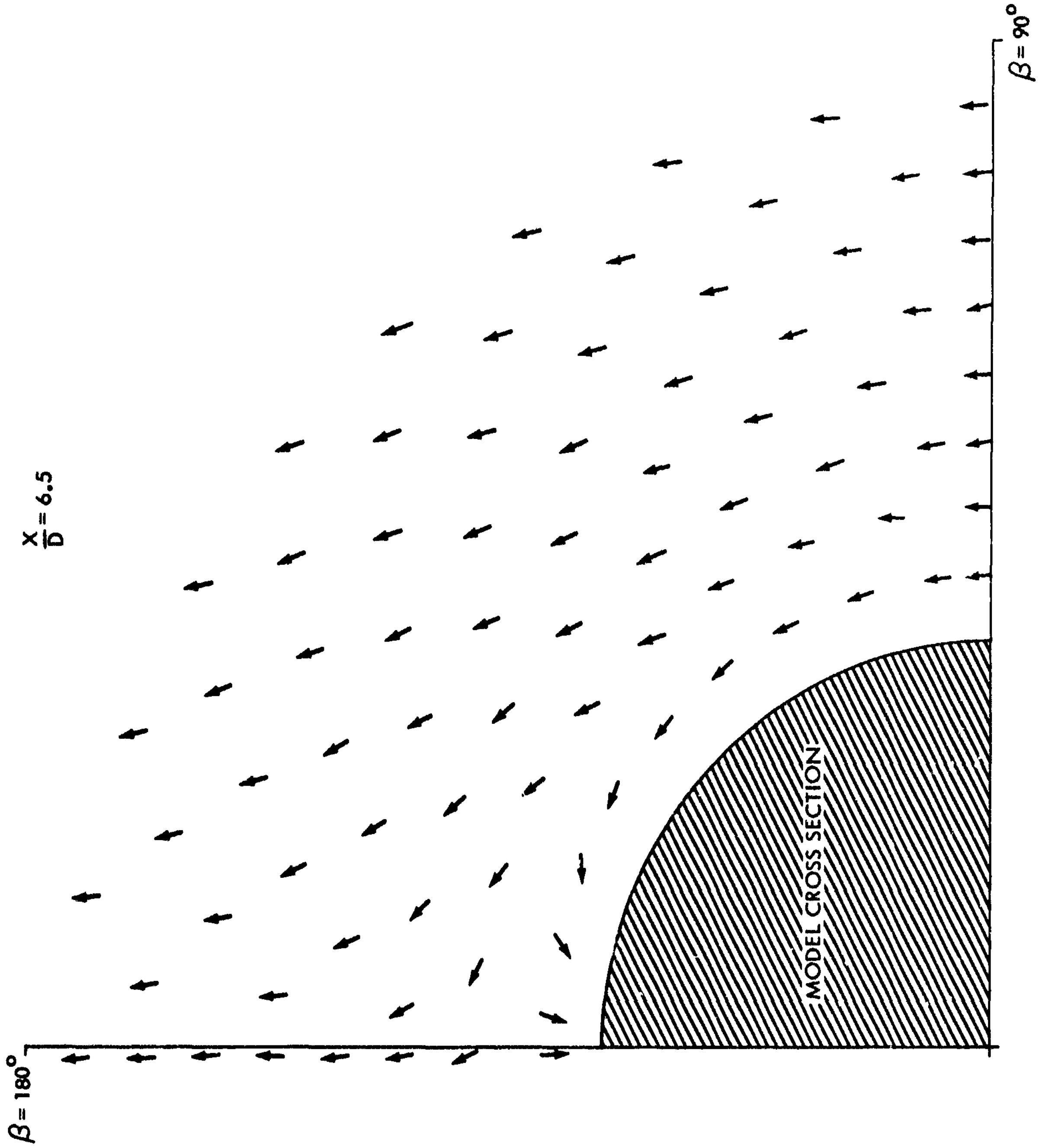


FIG. 41 CROSSFLOW DIRECTION MAP, $M_\infty = 3.52$ AND $\alpha = 5°$

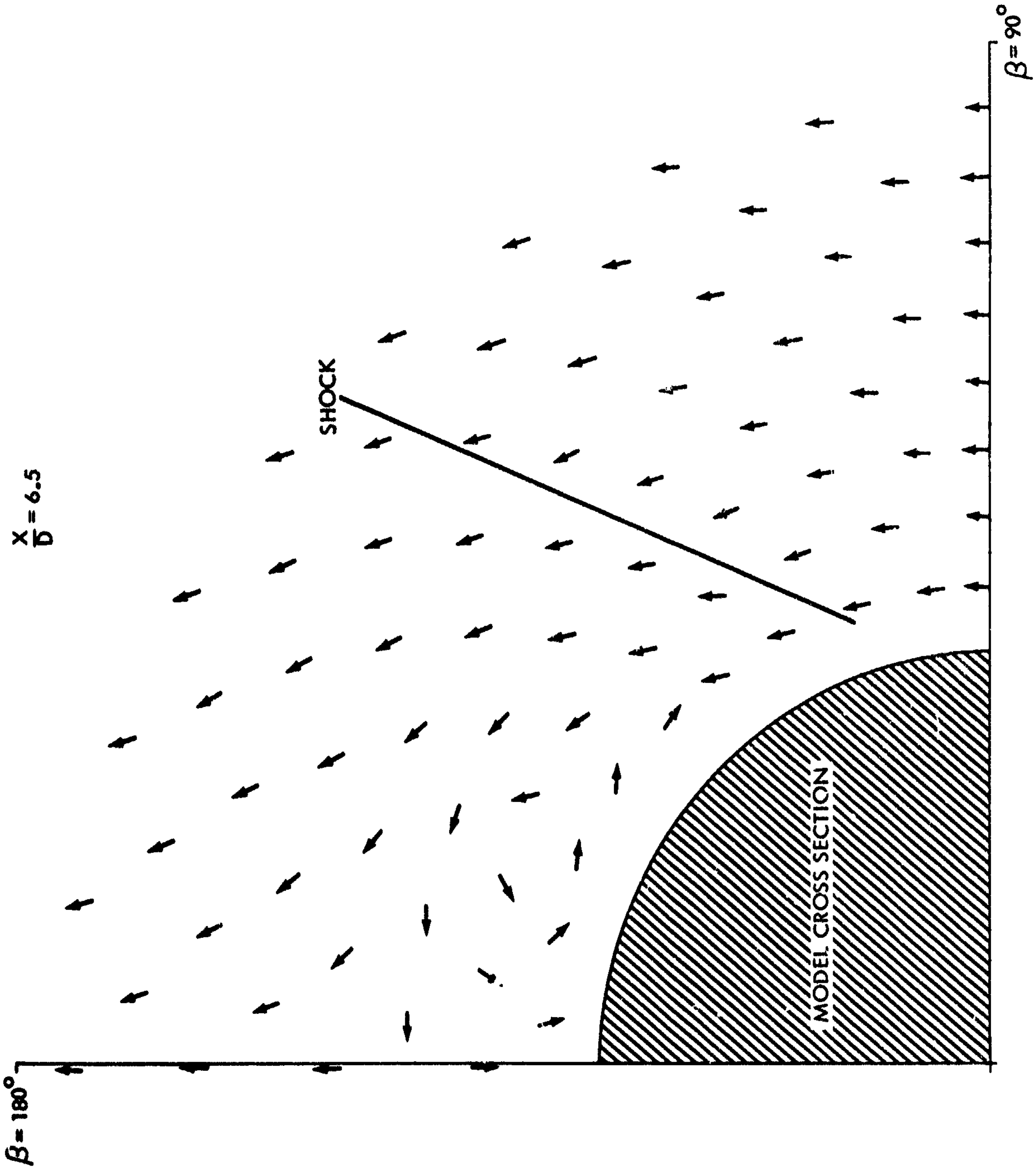


FIG. 42 CROSSFLOW DIRECTION MAP, $M_\infty = 3.52$ AND $\alpha = 10°$

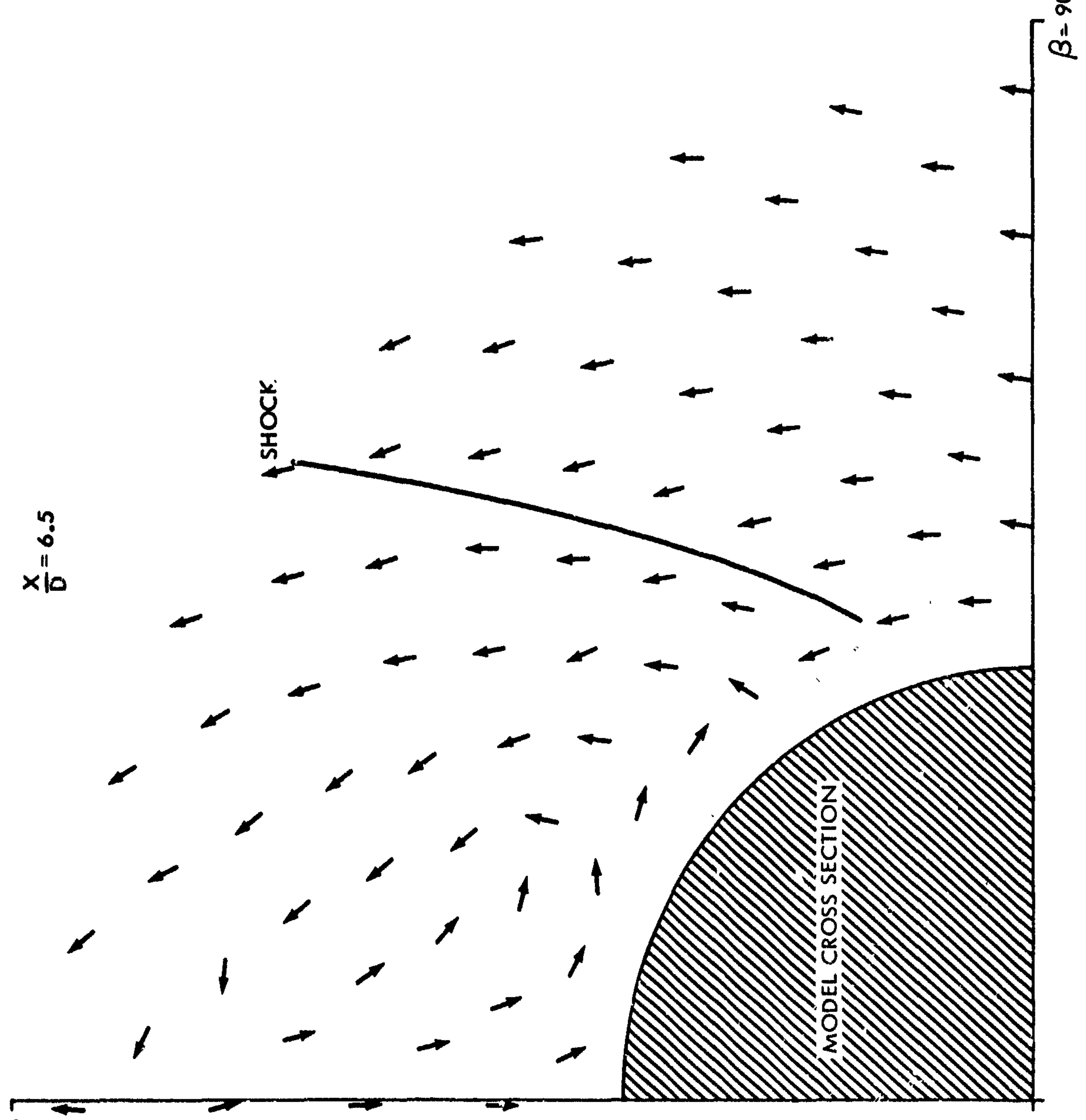


FIG. 43 CROSSFLOW DIRECTION MAP, $M_\infty = 3.52$ AND $\alpha = 15^\circ$

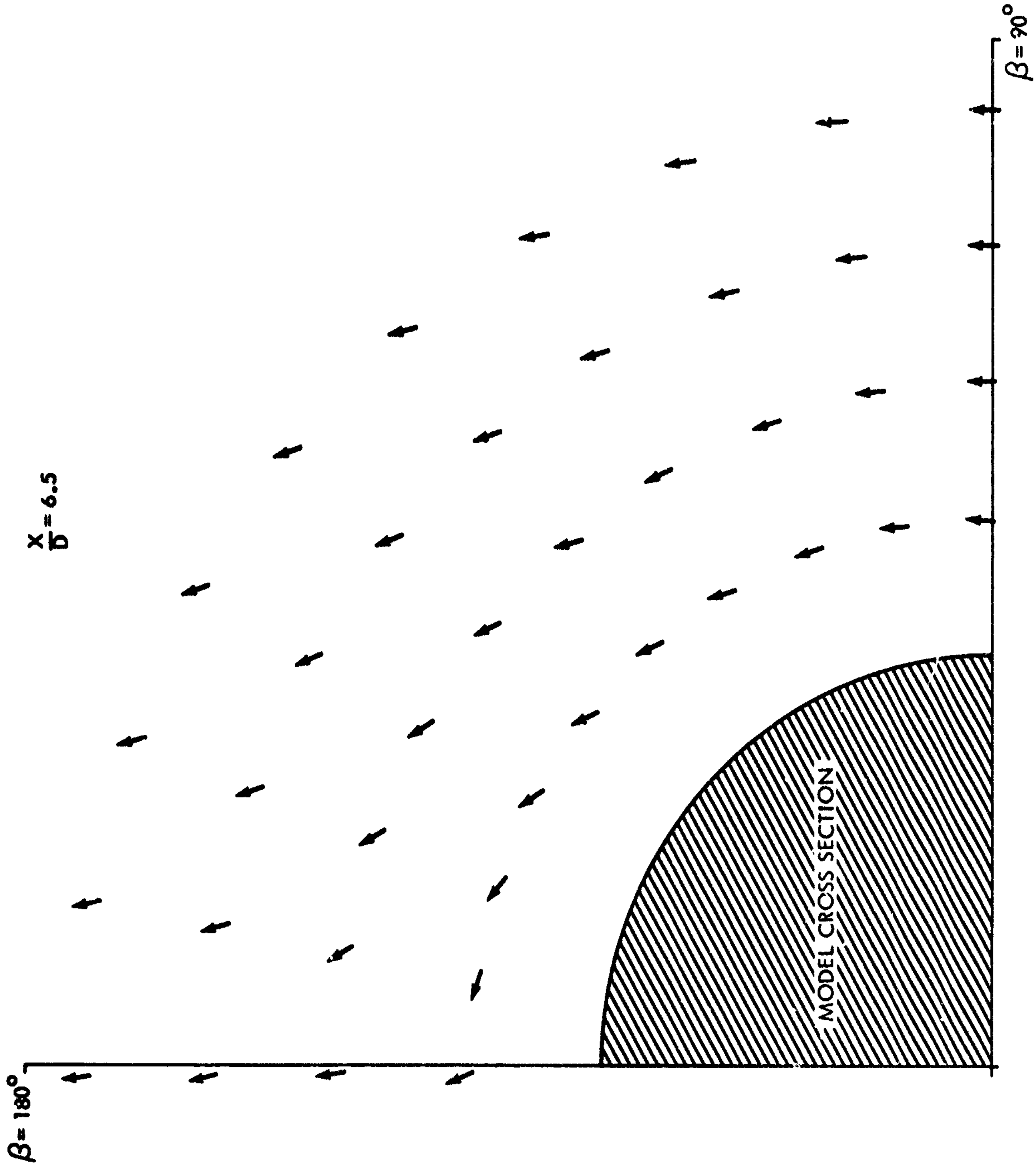


FIG. 44 CROSSFLOW DIRECTION MAP, $M_\infty = 4.07$ AND $\alpha = 5°$

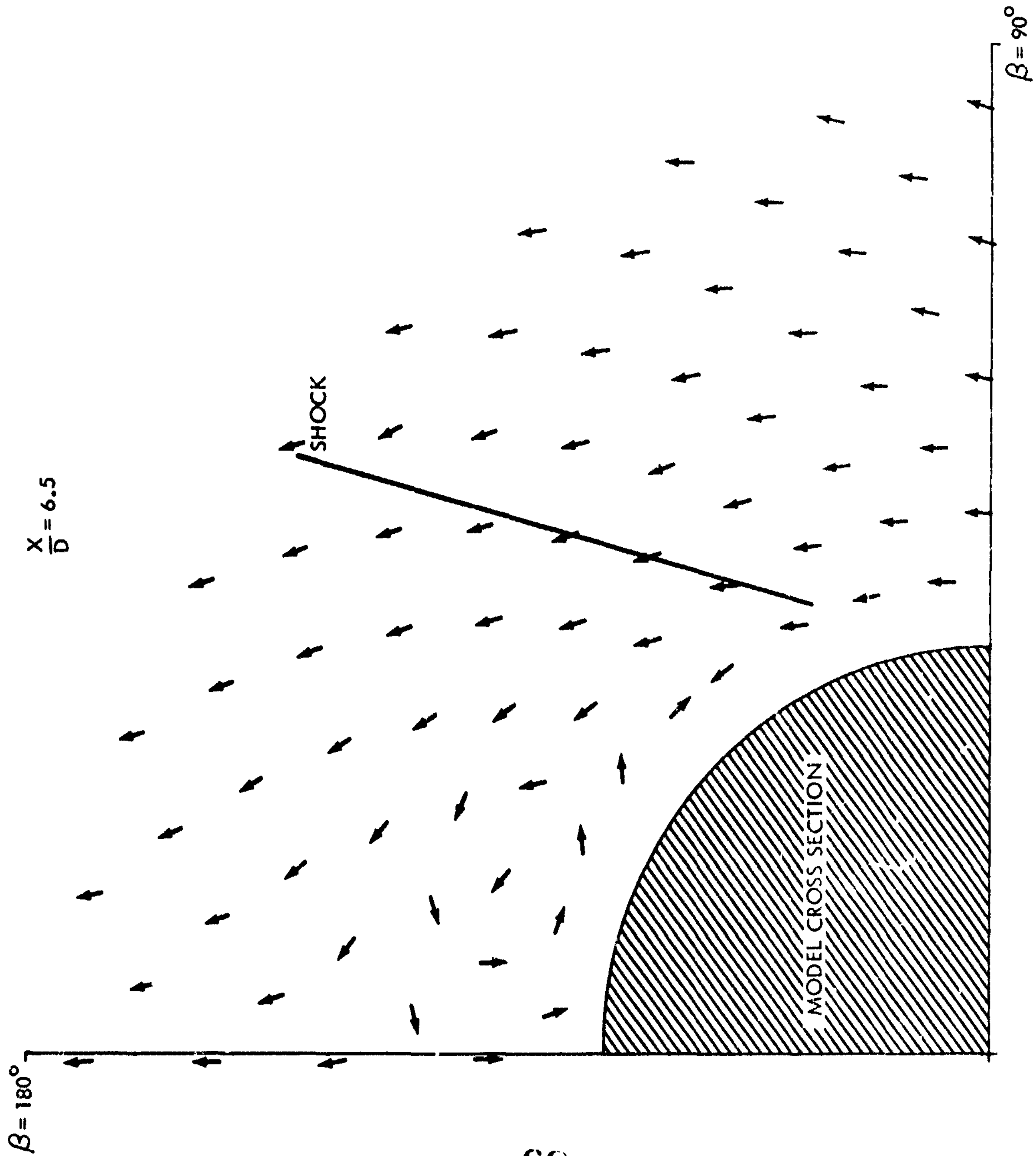


FIG. 45 CROSSFLOW DIRECTION MAP, $M_\infty = 4.07$ AND $\alpha = 10^\circ$

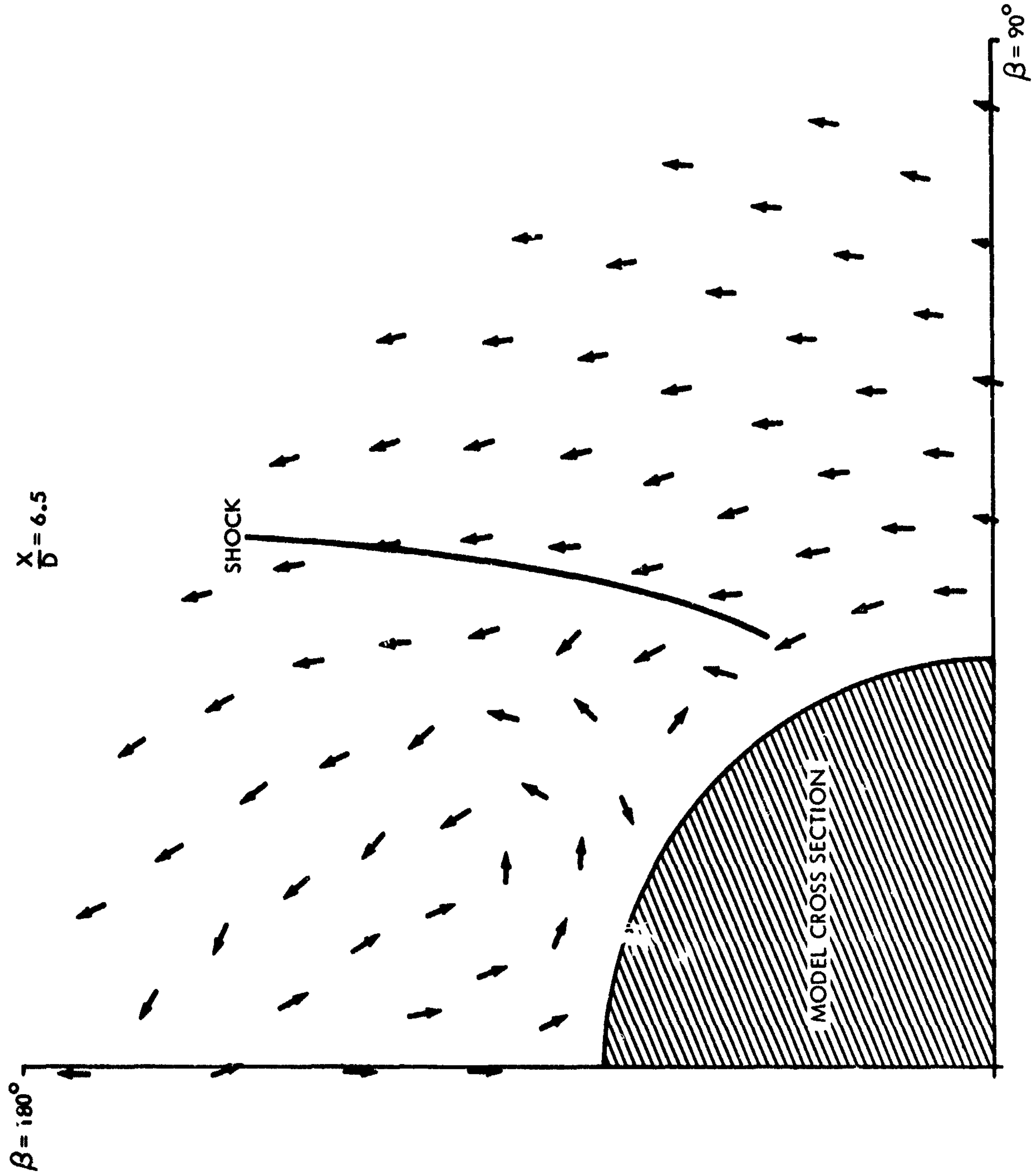


FIG. 46 CROSSFLOW DIRECTION MAP, $M_\infty = 4.07$ AND $\alpha = 15°$

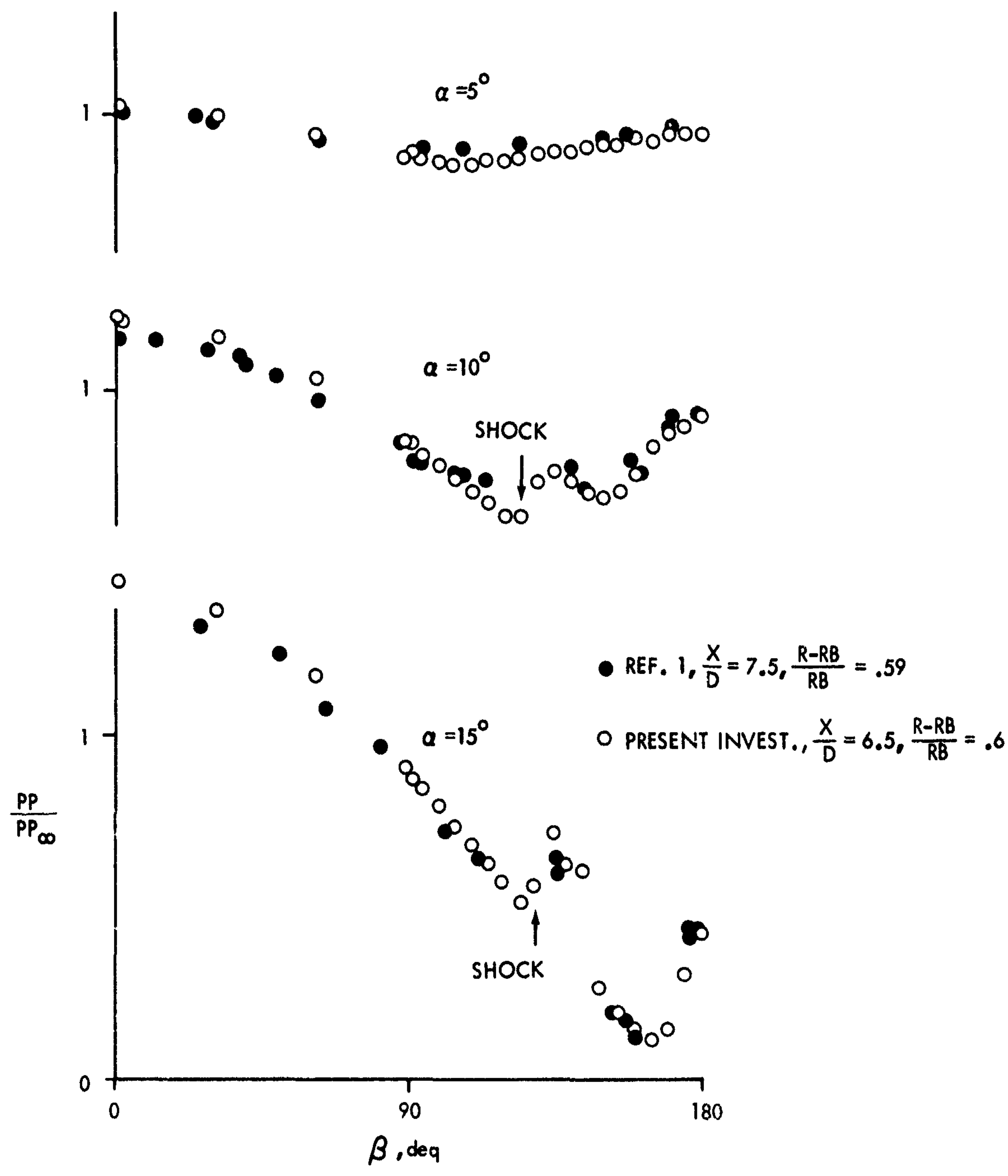


FIG. 47 COMPARISON OF PITOT PRESSURE DATA, $M_\infty = 3.5$

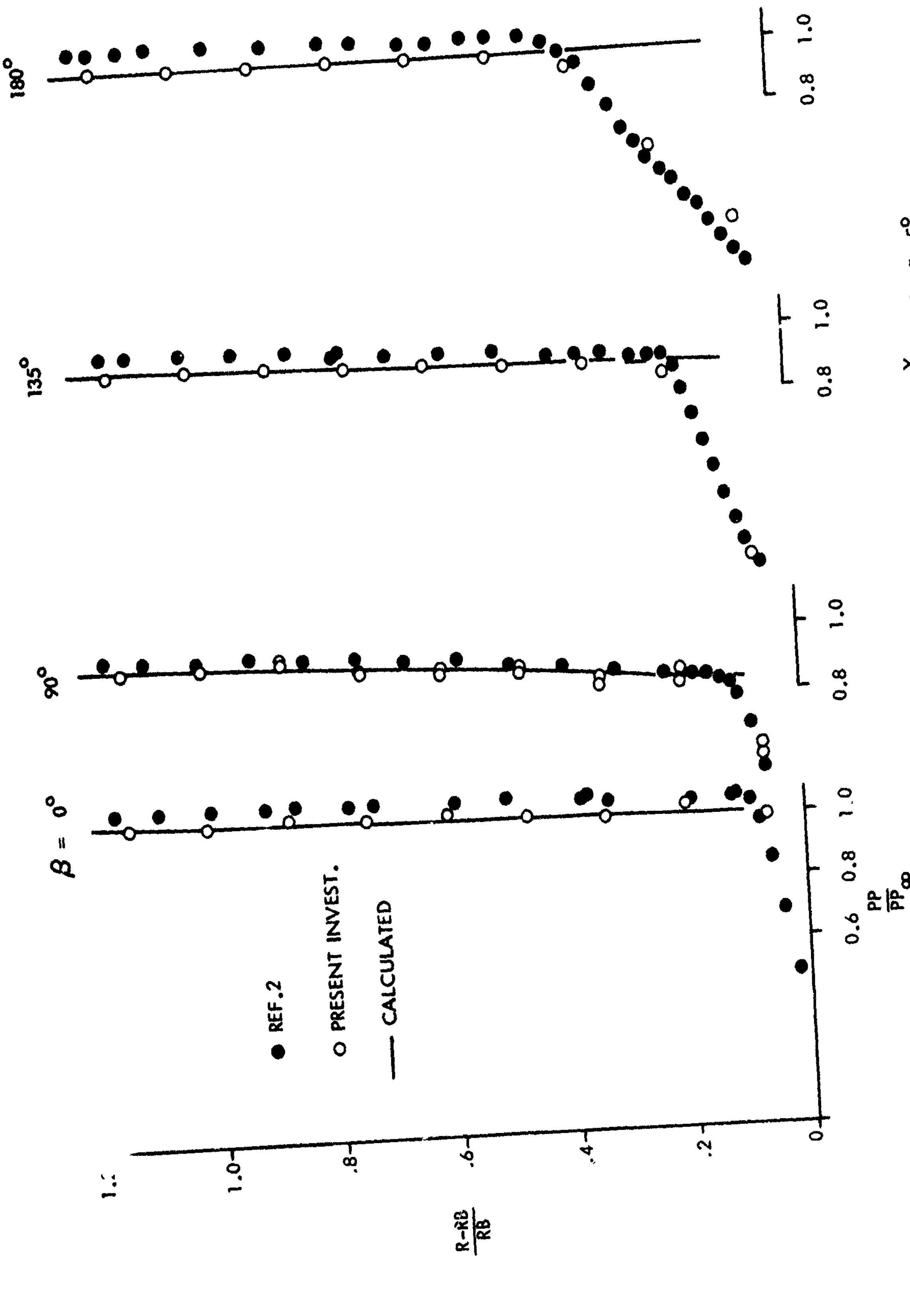


FIG. 48 COMPARISON OF PITOT PRESSURE DATA, $M_\infty = 3.5, \frac{X}{D} = 6.5, \alpha = 5^\circ$

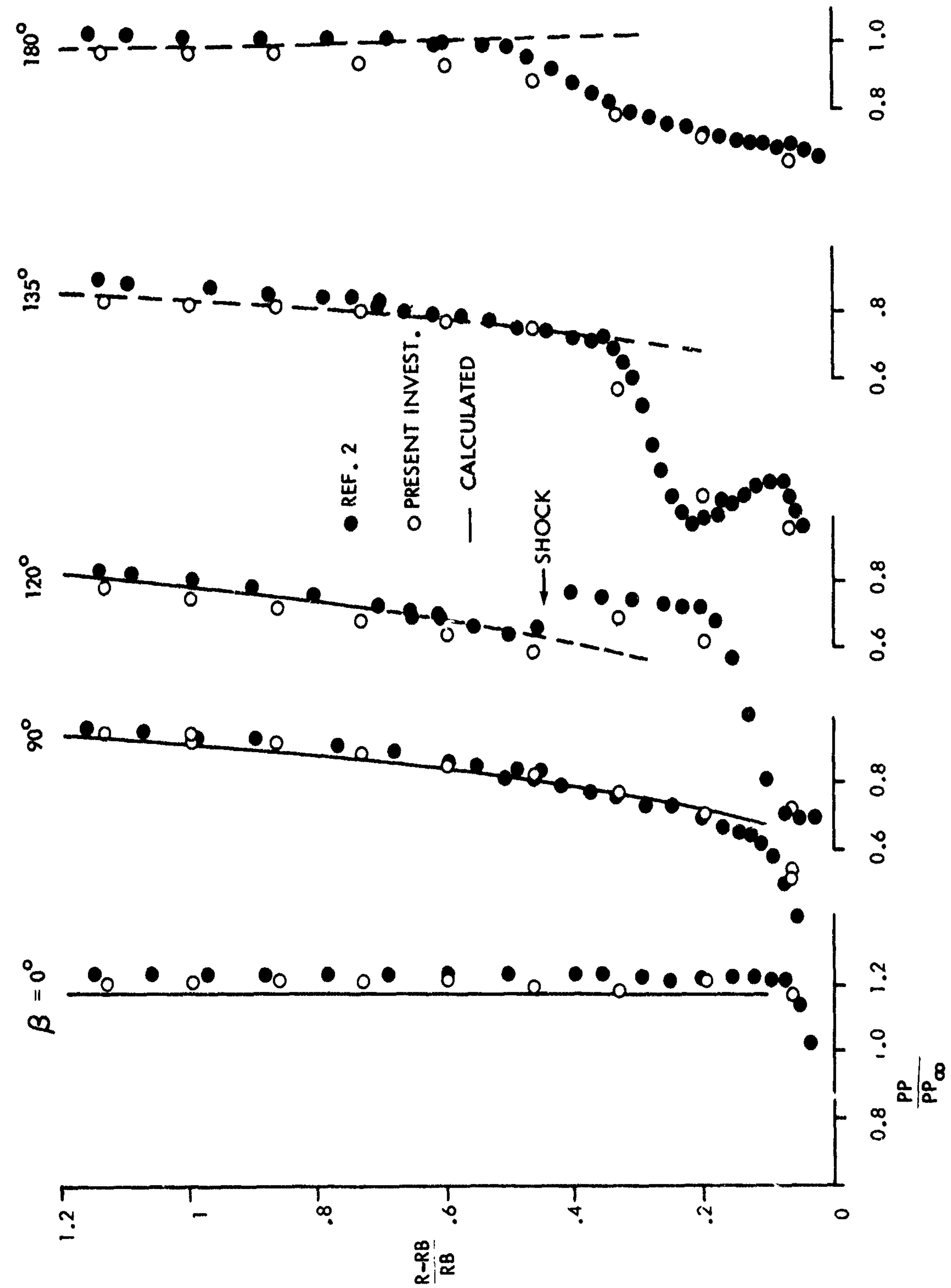


FIG. 49 COMPARISON OF PITOT PRESSURE DATA, $M_\infty = 3.5$, $\frac{X}{D} = 6.5$, $\alpha = 10°$

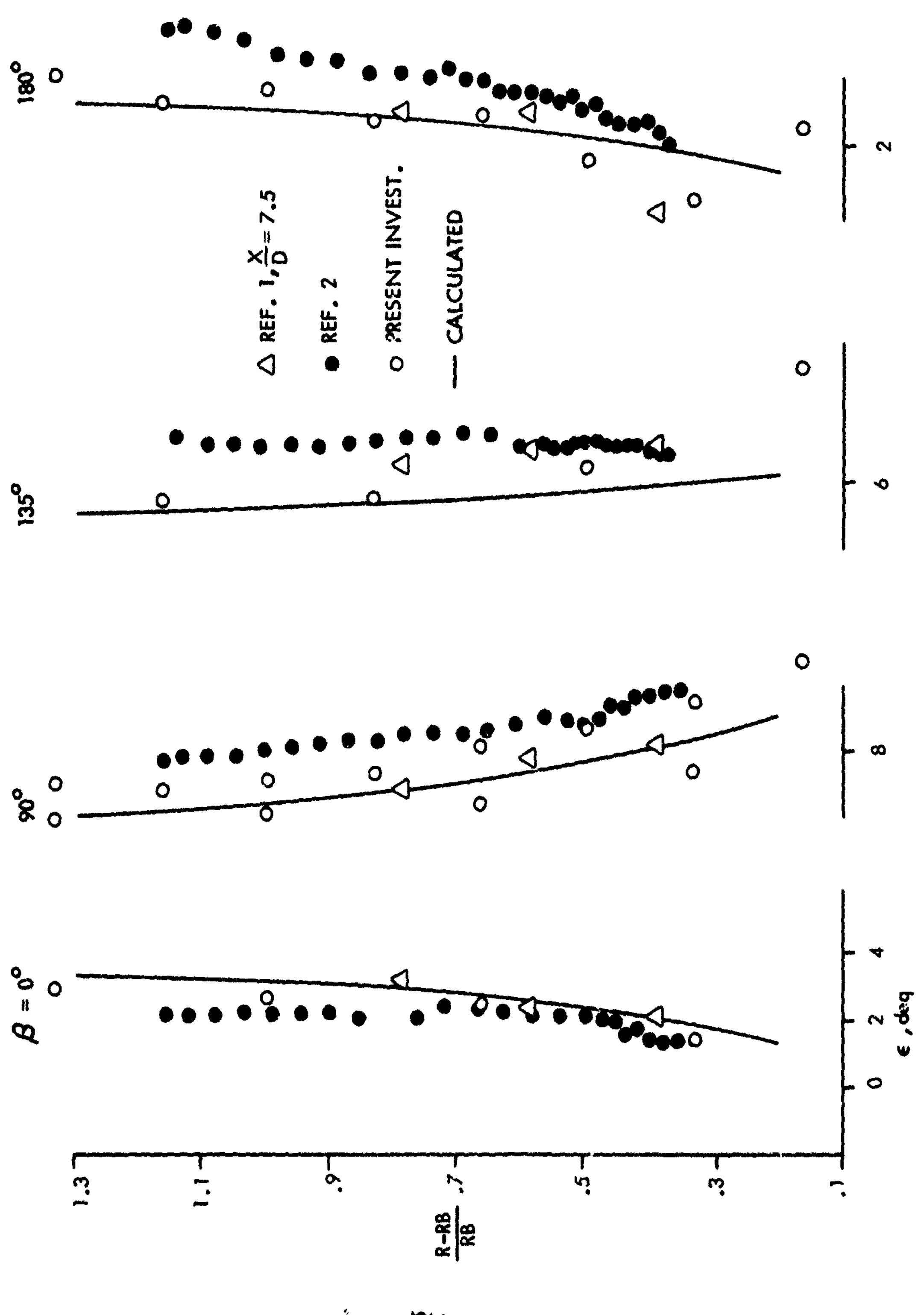


FIG. 50 COMPARISON OF FLOW ANGLE DATA, $M_\infty = 3.5$, $\frac{X}{D} = 6.5$, $\alpha = 5^\circ$

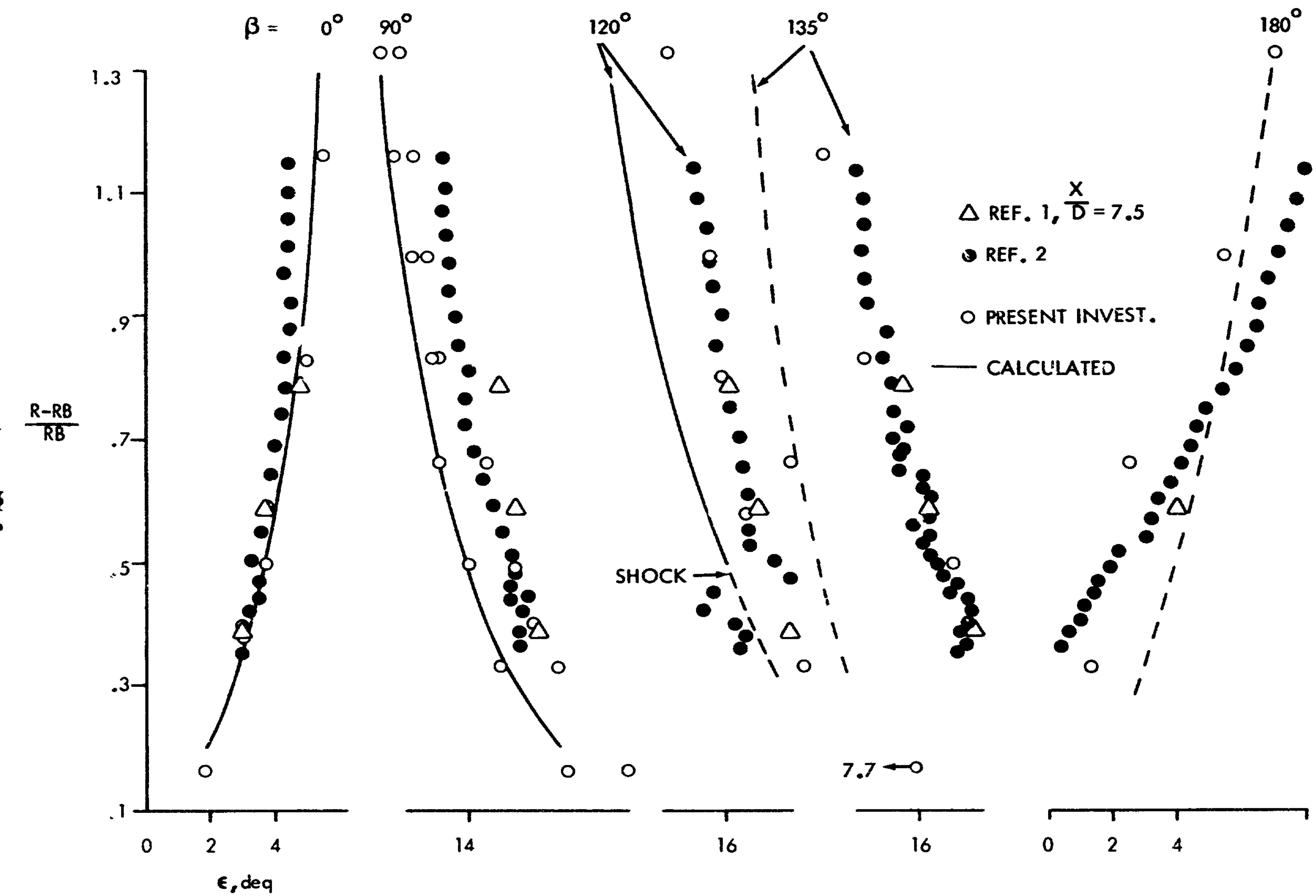


FIG. 51 COMPARISON OF FLOW ANGLE DATA, $M_\infty = 3.5$, $\frac{X}{D} = 6.5$, $\alpha = 10°$

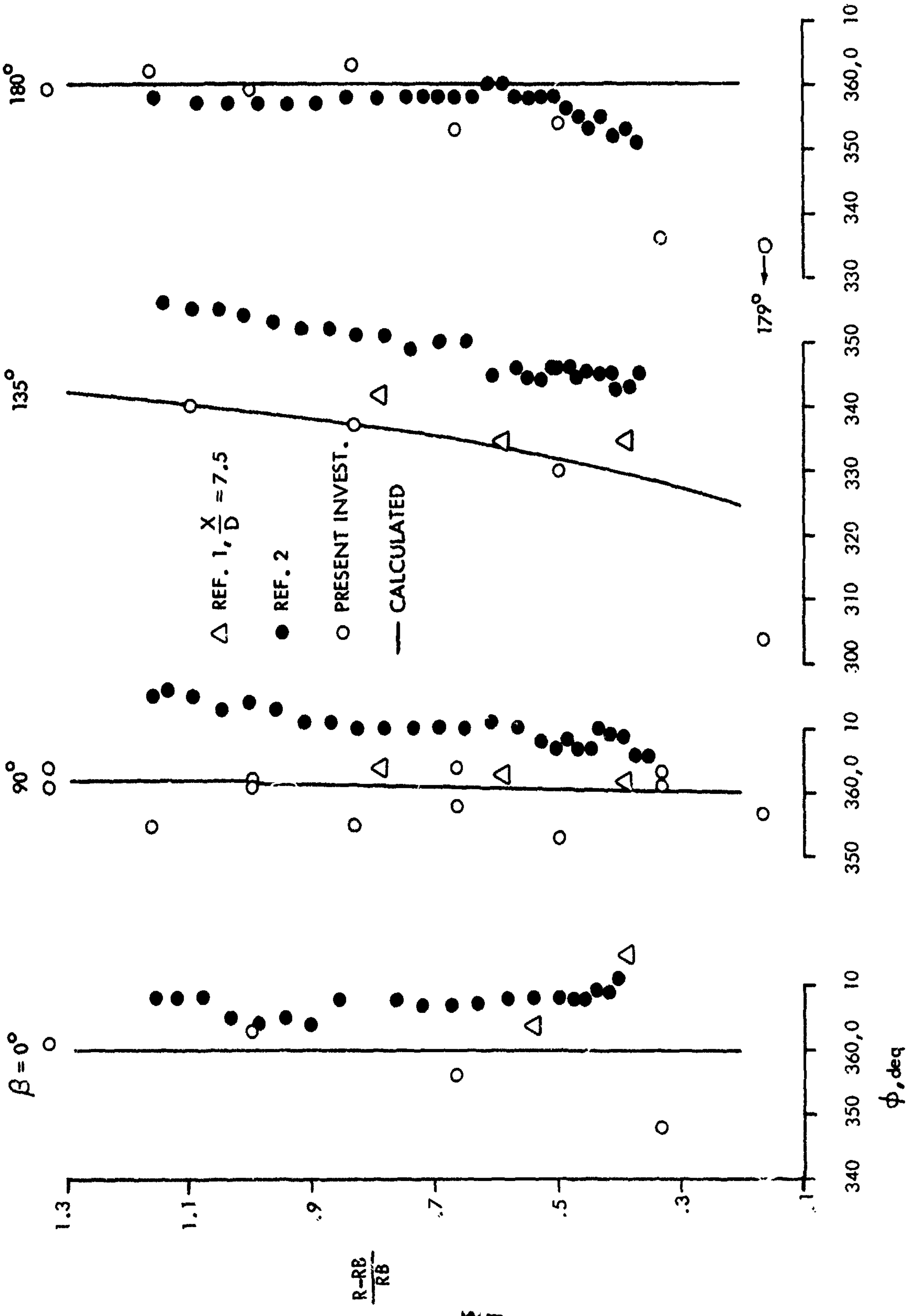


FIG. 52 COMPARISON OF CROSSFLOW DIRECTION DATA, $M_\infty = 3.5$, $\frac{X}{D} = 6.5$, $\alpha = 5°$

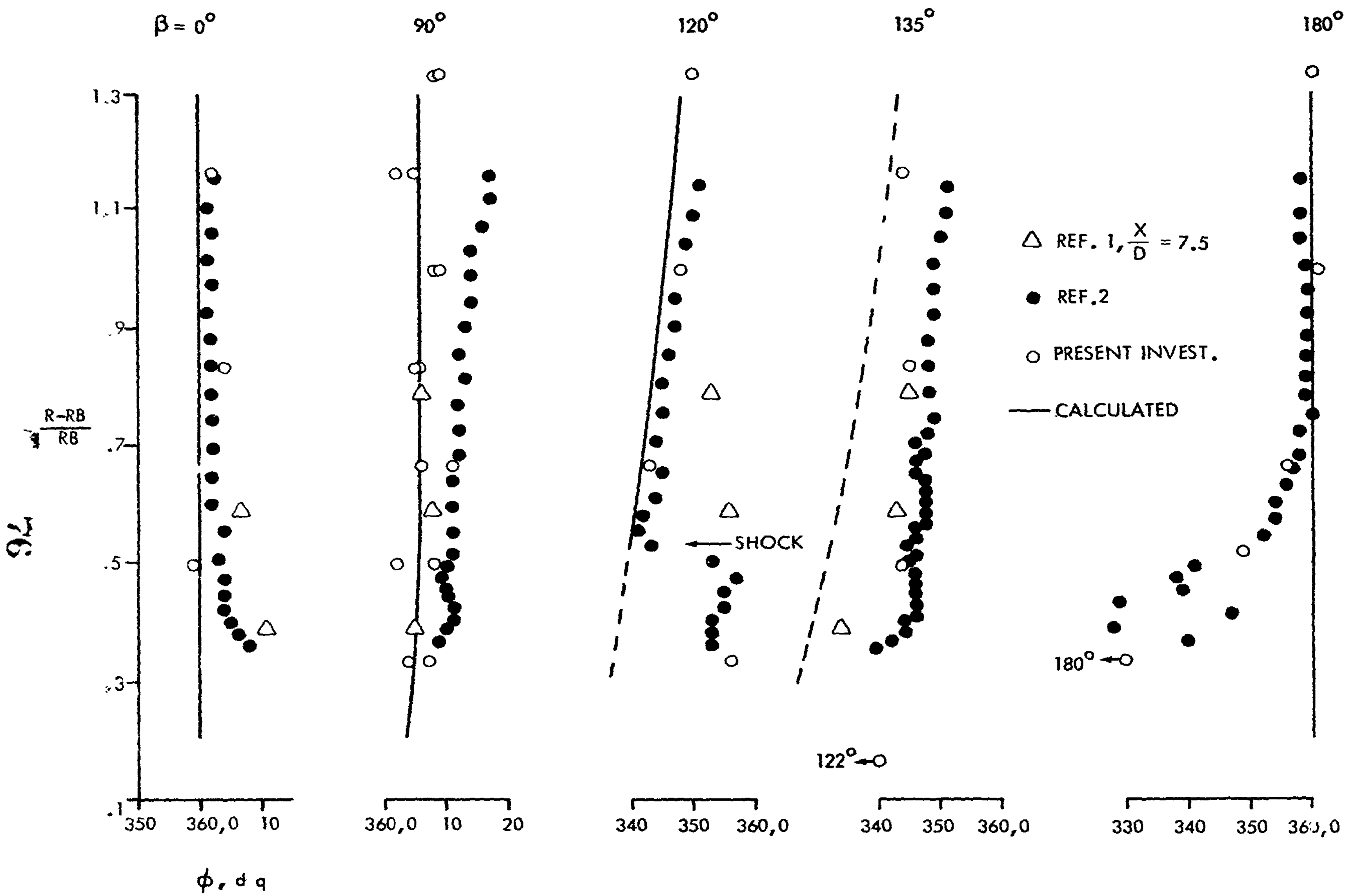


FIG. 53 COMPARISON OF CROSSFLOW DIRECTION DATA, $M_\infty = 3.5, \frac{X}{D} = 6.5, \alpha = 10^\circ$

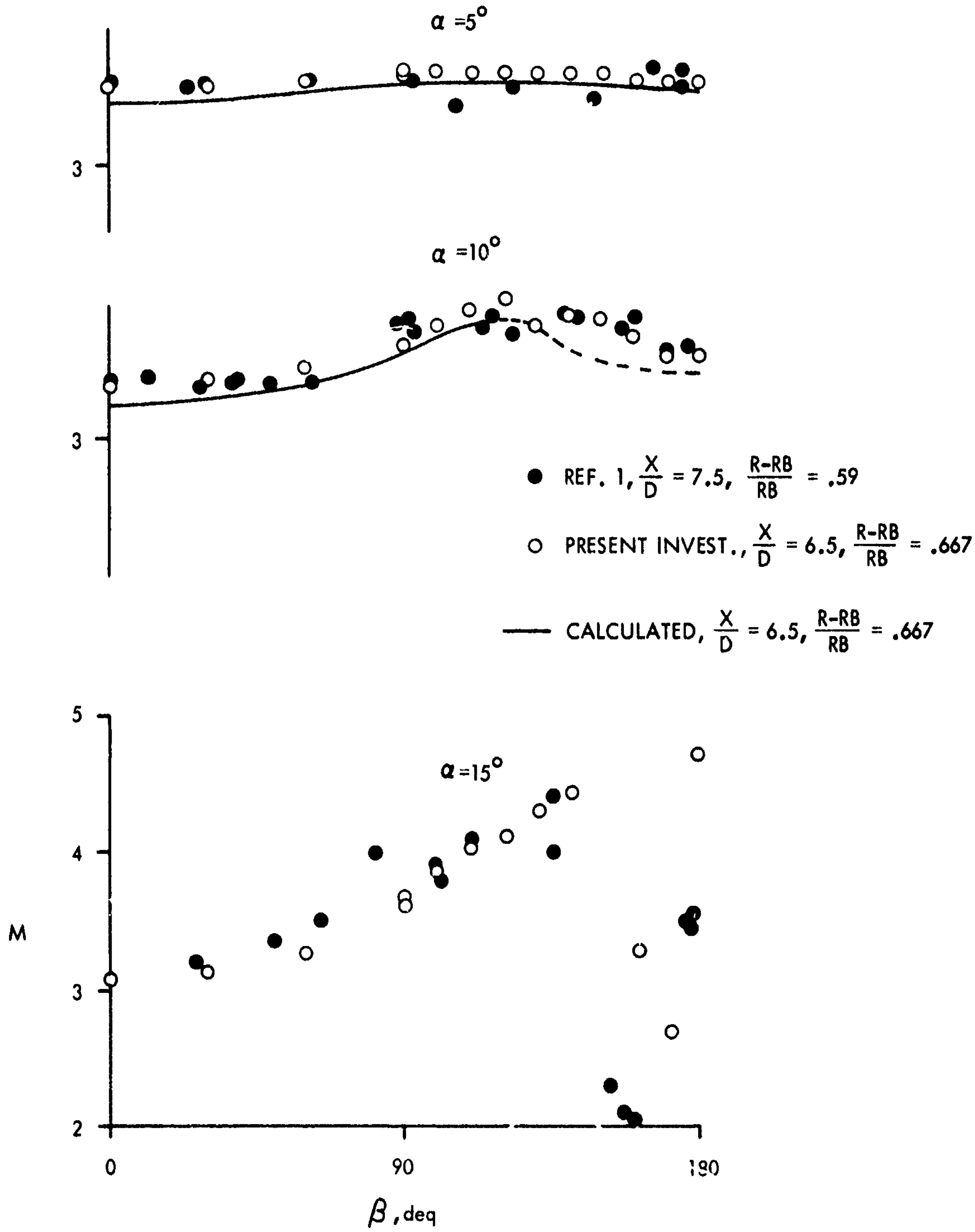


FIG. 54 COMPARISON OF MACH NUMBER DATA, $M_\infty = 3.5$

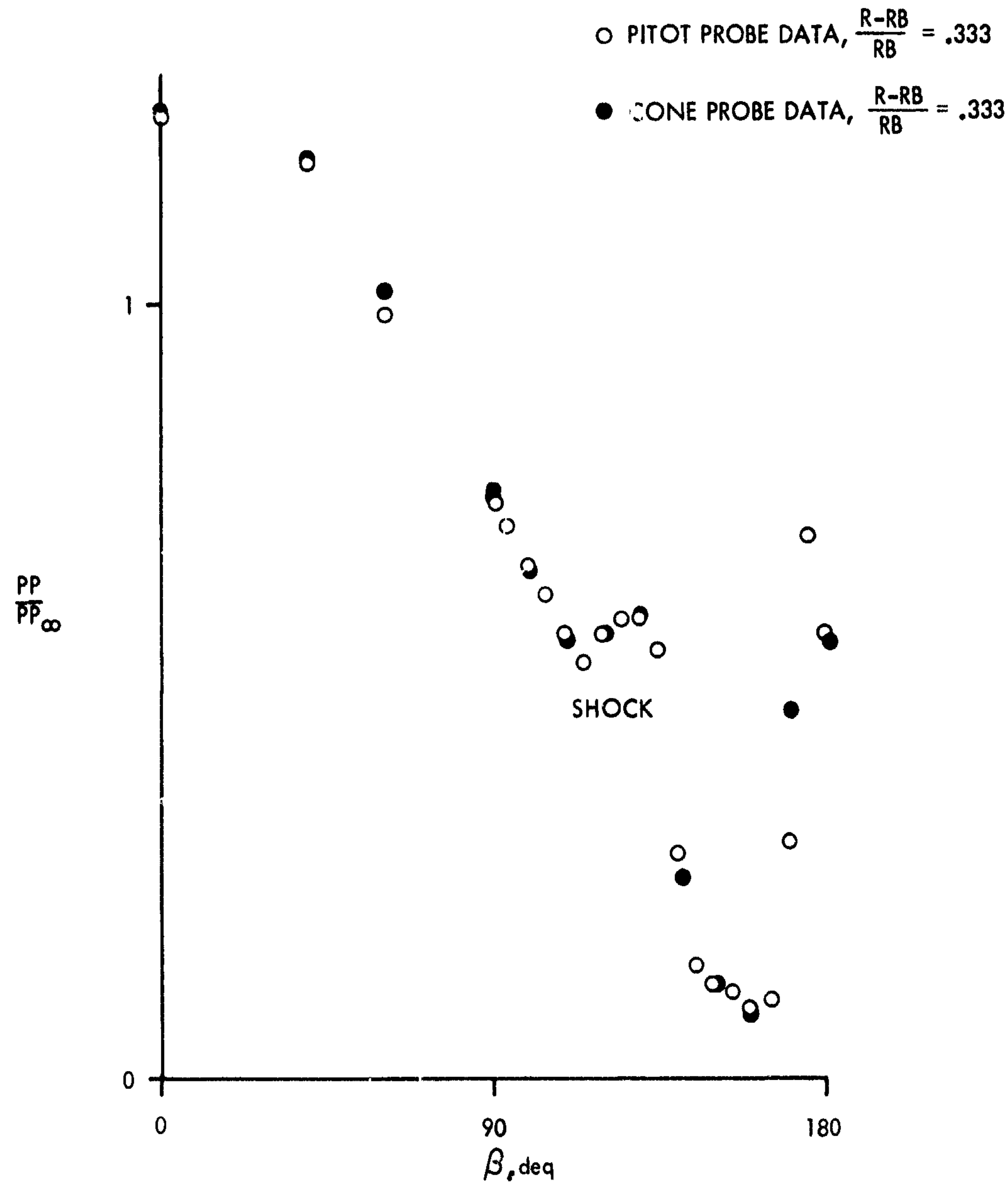


FIG. 55 COMPARISON OF PITOT PRESSURE DATA FROM OPPOSITE SIDES OF MODEL, $M_\infty = 4.07$ AND $\alpha = 10°$

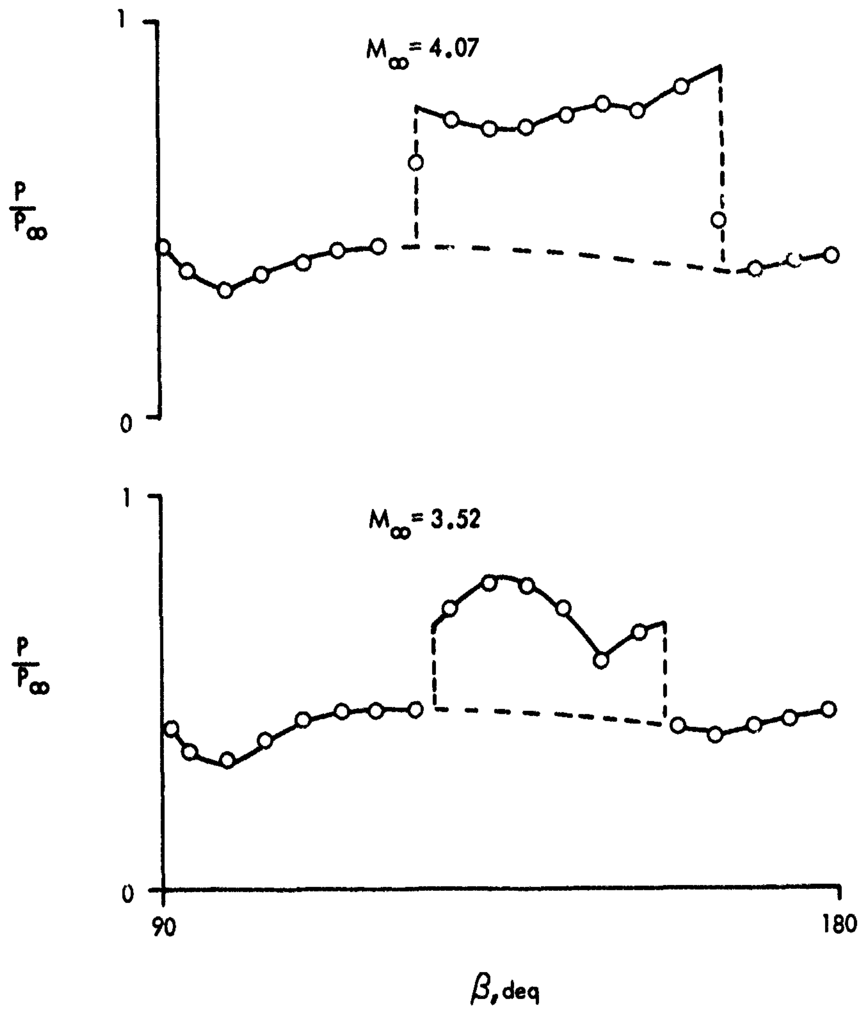


FIG. 56 EFFECT OF BASE INTERFERENCE ON SURFACE STATIC PRESSURE AT FLOW FIELD SURVEY STATION ($\frac{X}{D}$ = 6.5), α = 15°

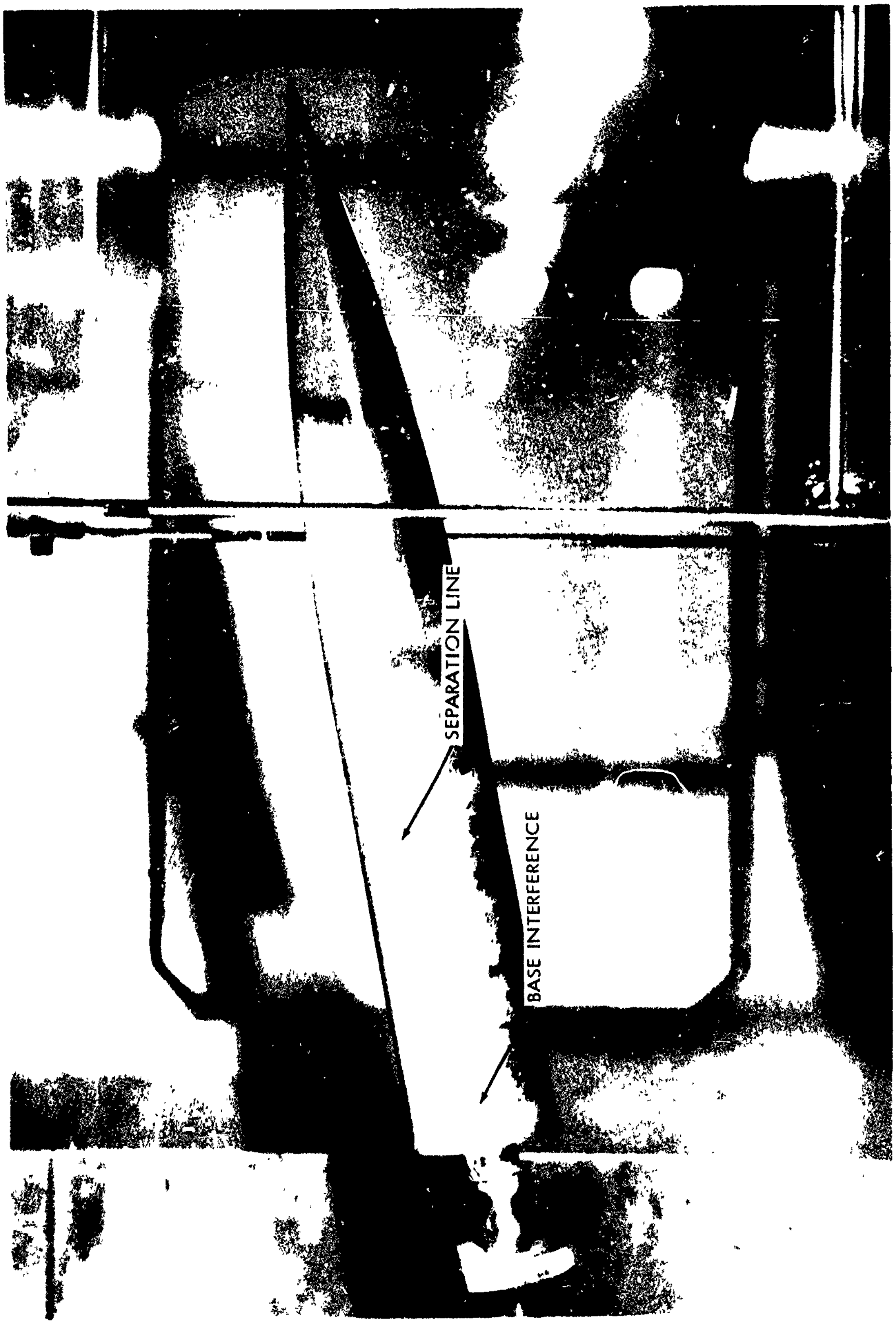


FIG. 57 OIL FLOW PATTERNS ON OGIVE-CYLINDER MODEL, $M = 4.07$ AND $\alpha = 10^{\circ}$

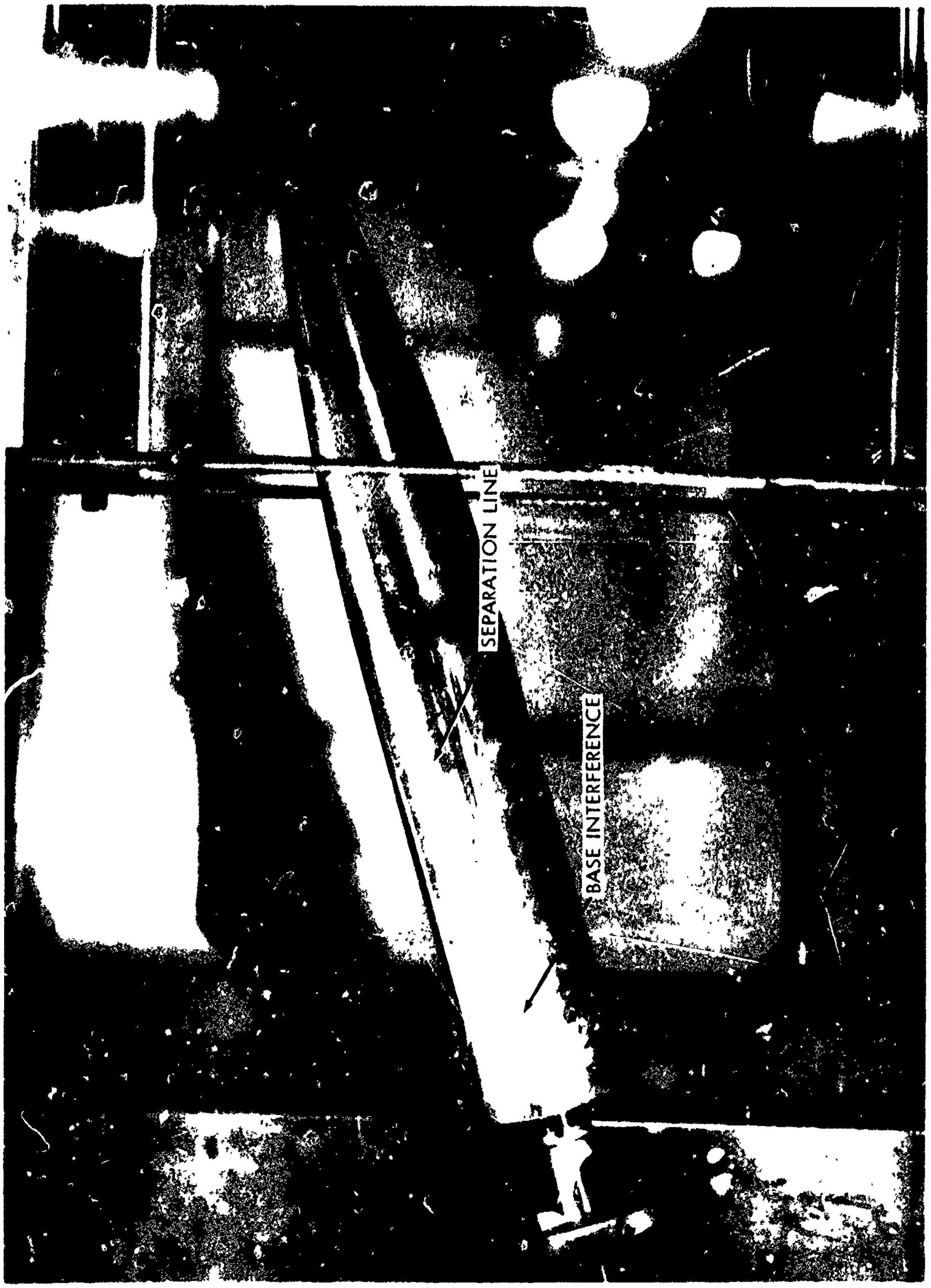


FIG. 58 OIL FLOW PATTERNS ON OGIVE-CYLINDER MODEL, $M = 4.07$ AND $\alpha = 15^{\circ}$

APPENDIX A

CONE PROBE CALIBRATION AND DATA REDUCTION

CALIBRATION PROCEDURE. The cone probes used in the flow field surveys were calibrated by removing the ogive-cylinder model from the sting support and exposing the probes to the uniform wind tunnel flow at various angles of attack and roll positions. The calibration test setup is shown in Figure A-1. Calibration data were taken at Mach numbers of 2.06, 3.05 and 4.08. The calibration test setup allowed the probes to be rolled through an angle of 180 degrees, starting in the pitch plane as shown in Figure A-1 and ending in the pitch plane opposite the position shown. The sting support could be pitched from -12 degrees downward to 22 degrees upward. This range of pitch and roll allowed calibration data to be taken with flow approaching the probes from each quadrant. The probe rake was rolled in the same direction during the calibration tests as in the flow field survey tests.

In the case of cone probes with four static pressure orifices spaced 90 degrees apart around the cone surface, first order cone flow theory gives the following relations:

$$\left(\frac{P1 + P2 + P3 + P4}{Po}\right) = f_1(M) \tag{A1}$$

$$\sqrt{\left(\frac{P1 - P3}{Po}\right)^2 + \left(\frac{P2 - P4}{Po}\right)^2} = \varepsilon f_2(M) \tag{A2}$$

$$\left(\frac{P1 - P3}{Po}\right) \Big/ \left(\frac{P2 - P4}{Po}\right) = \tan \phi' \tag{A3}$$

Where: P1, P2, P3, and P4 denote the pressures measured at the four orifices

Po = the local total pressure

The functional relationships are not changed if the local Pitot pressure is used rather than the total pressure. Ignoring flow angularity effects, the local Pitot pressure is measured by the fifth orifice located at the tip of the probe. The layout of the cone probe orifices and the definition of the flow direction angle ϕ' is illustrated in Figure A-2.

Examination of the probe calibration data led to the following functional relationships:

$$\left(\frac{P1 + P2 + P3 + P4}{P5}\right) = f_3(\varepsilon, M) \qquad \text{(A4)}$$

$$\sqrt{\left(\frac{P1 - P3}{P5}\right)^2 + \left(\frac{P2 - P4}{P5}\right)^2} = A + B\varepsilon \qquad \text{(A5)}$$

$$\left(\frac{P1 - P3}{P5}\right) \bigg/ \left(\frac{P2 - P4}{P5}\right) = \tan \phi' \qquad \text{(A6)}$$

Where A and B are constants.

Relations (A4) and (A5) were established by curve fitting the experimental calibration data. The range of the calibrations was extended to M=5 by using some previous NOL calibration data for similar probes and some theoretical values from the AGARD cone tables (reference 13). Data from both of these sources were in reasonably good agreement with the M=4.08 calibration data of this investigation. The relationships resulting from curve fitting the data are shown in Figures A-3a and A-3b.

It appeared that no significant improvement in accuracy would be gained by using separate calibrations for each probe. Some influence of ϕ' was noted in Relation (A4) and likewise an influence of both ϕ' and M was noted in Relation (A5). The data indicated, however, that these effects were small and would be very hard to correlate. According to reference 14, some improvement in probe calibration accuracy was achieved in similar probe calibrations by considering the quadrant of the flow direction as an additional parameter. It did not appear that this would significantly improve the accuracy of the calibrations in this investigation.

ACCURACY Accuracy of the probe calibrations was estimated by comparing Relations (A4), (A5) and (A6) with the individual calibration data points. Values of root mean square deviation of the individual data points from the final calibrations are given in the table below:

Mach No.	ΔM (%)	$\Delta \varepsilon$ (deg)	$\Delta \phi'$ (deg)
2.06	±1.1	±1.2	±2.7
3.05	1.8	.7	3.2
4.08	2.0	.6	2.7

The maximum (+) and (-) deviations of the data points from the calibrations are shown in Figures A-4a, A-4b and A-4c as functions of Mach number and total flow angle. The rms deviations are indicated on the graphs. In general, it is seen that the overall spread of the data was about 2 to 3 times the rms deviation. Small trends with respect to Mach number and total flow angle can also be seen.

For a general statement as to the accuracy of the probe calibrations it can be said that:

1. Mach numbers are accurate to about ±5 percent,

2. total flow angles are accurate to about ±2 degrees,

3. flow direction angles are accurate to about ±7.5 degrees.

DATA REDUCTION PROCEDURE. Data reduction using Equations (A4), (A5) and (A6) was straightforward, with no iterations required. The procedure was to compute ϕ' and ε first, using Equations (A6) and (A5) and then compute M, using Equation (A4).

8.1

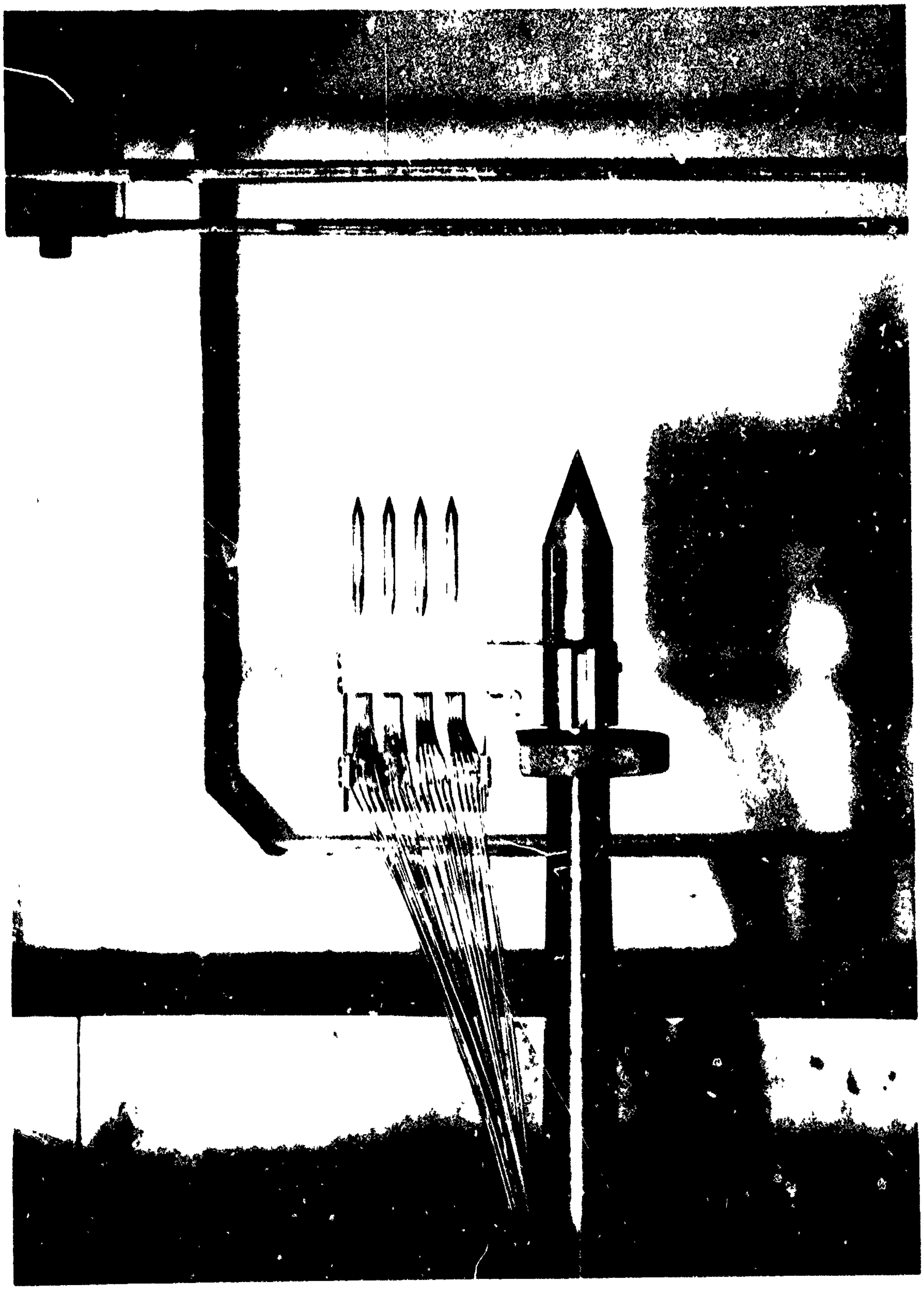
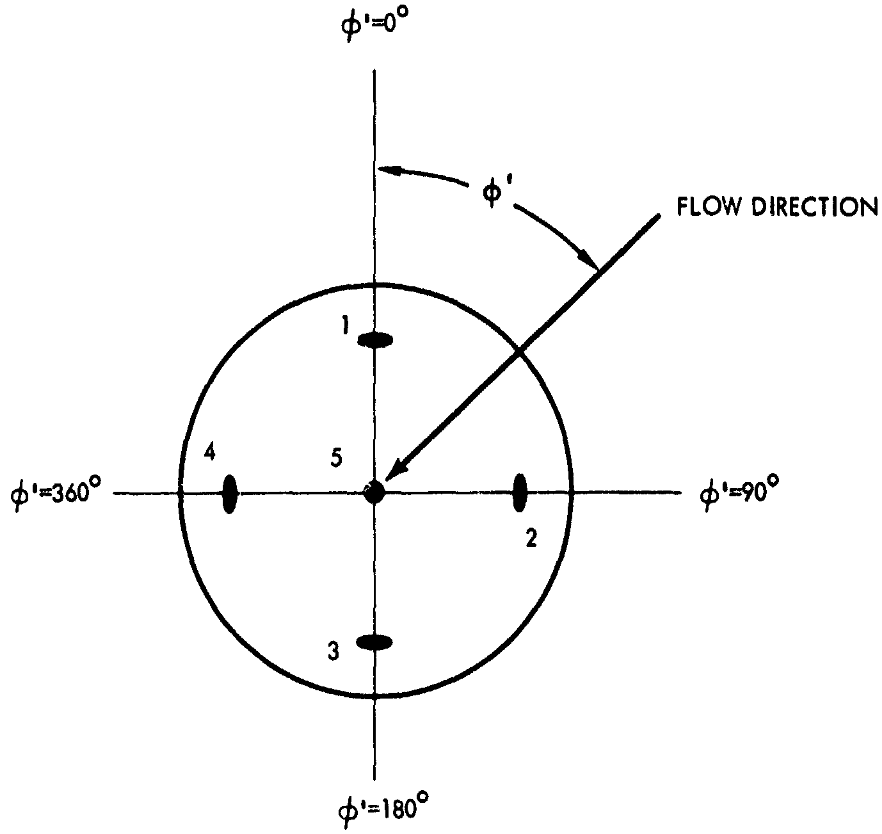


FIG. A-1 CONE PROBE CALIBRATION APPARATUS IN WIND TUNNEL



FRONT VIEW OF CONE PROBE

FIG. A-2 FLOW DIRECTION CONVECTION USED IN CONE PROBE CALIBRATIONS

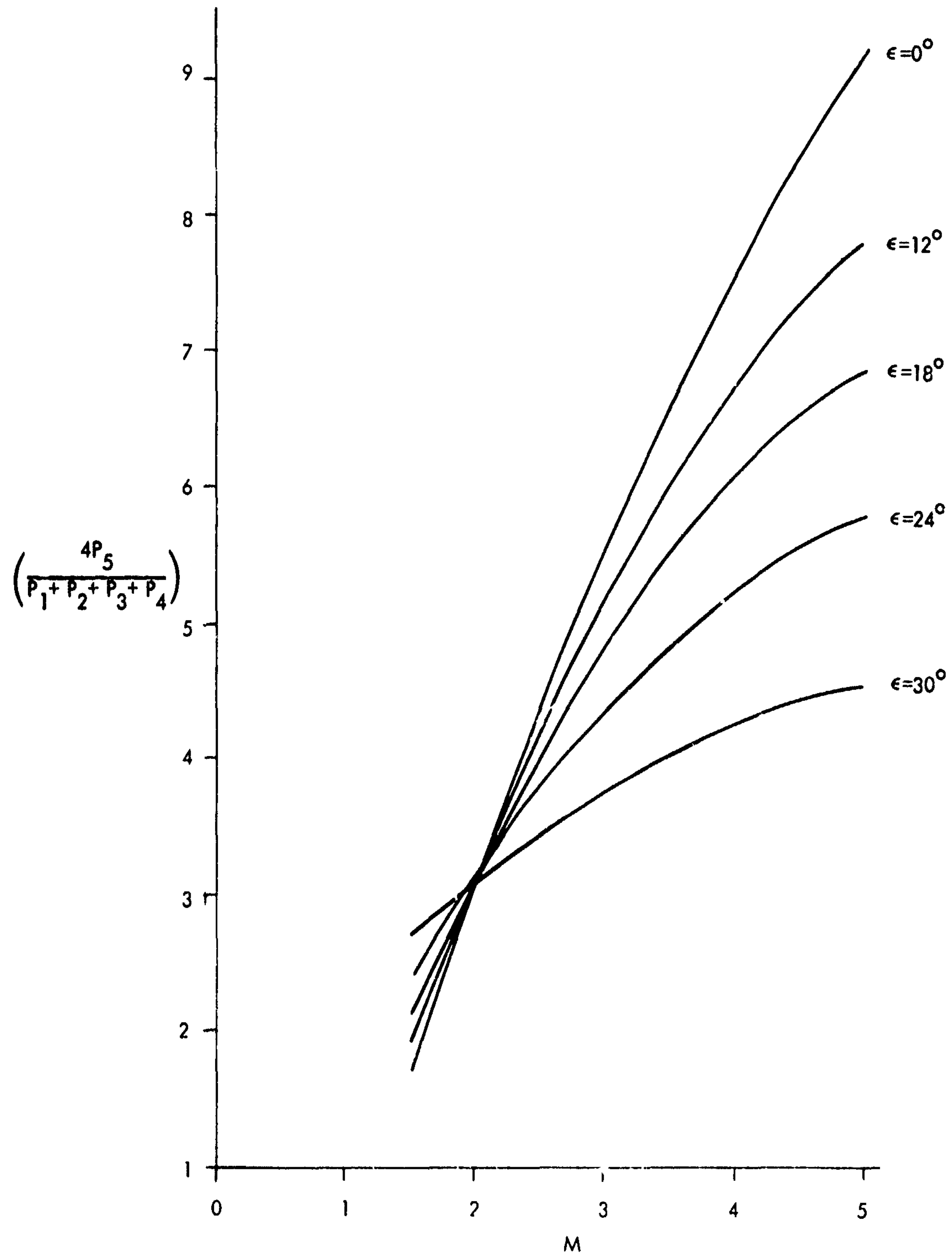


FIG. A-3a CORRELATION OF CONE PROBE CALIBRATION DATA

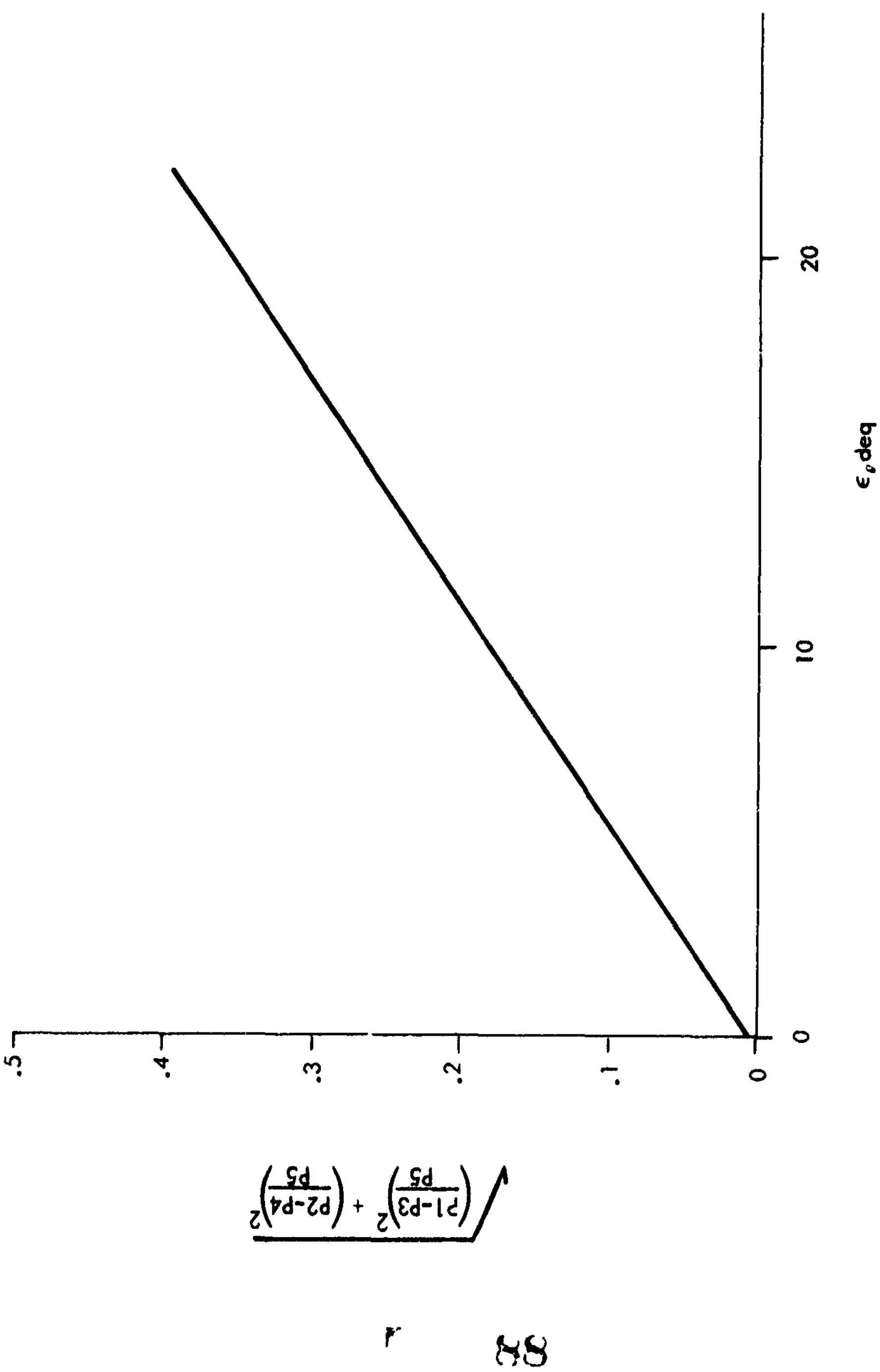


FIG. A-3b CORRELATION OF CONE PROBE CALIBRATION DATA

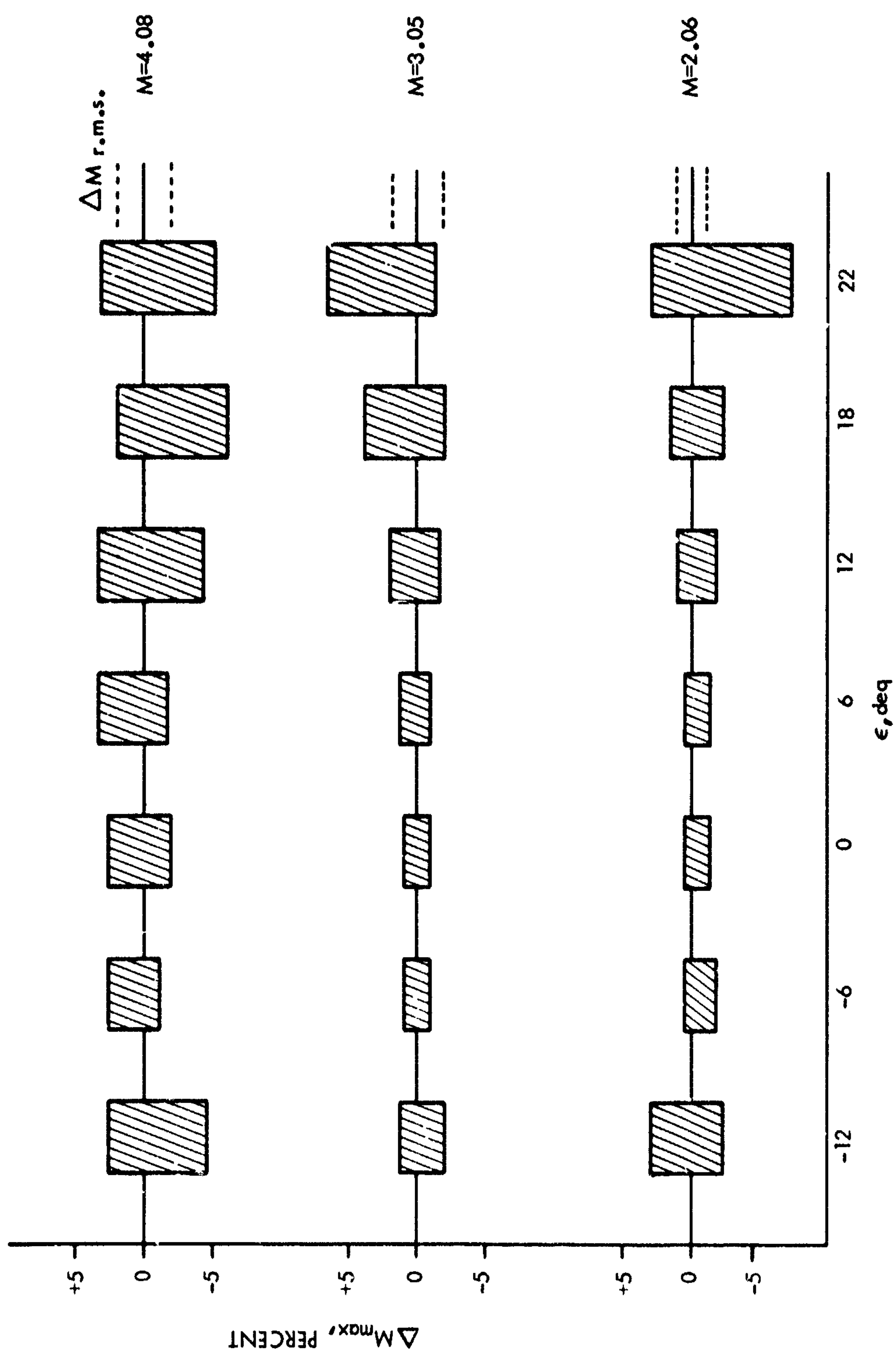


FIG. A-4a MAXIMUM DEVIATION OF CONE PROBE CALIBRATION DATA FROM CORRELATION

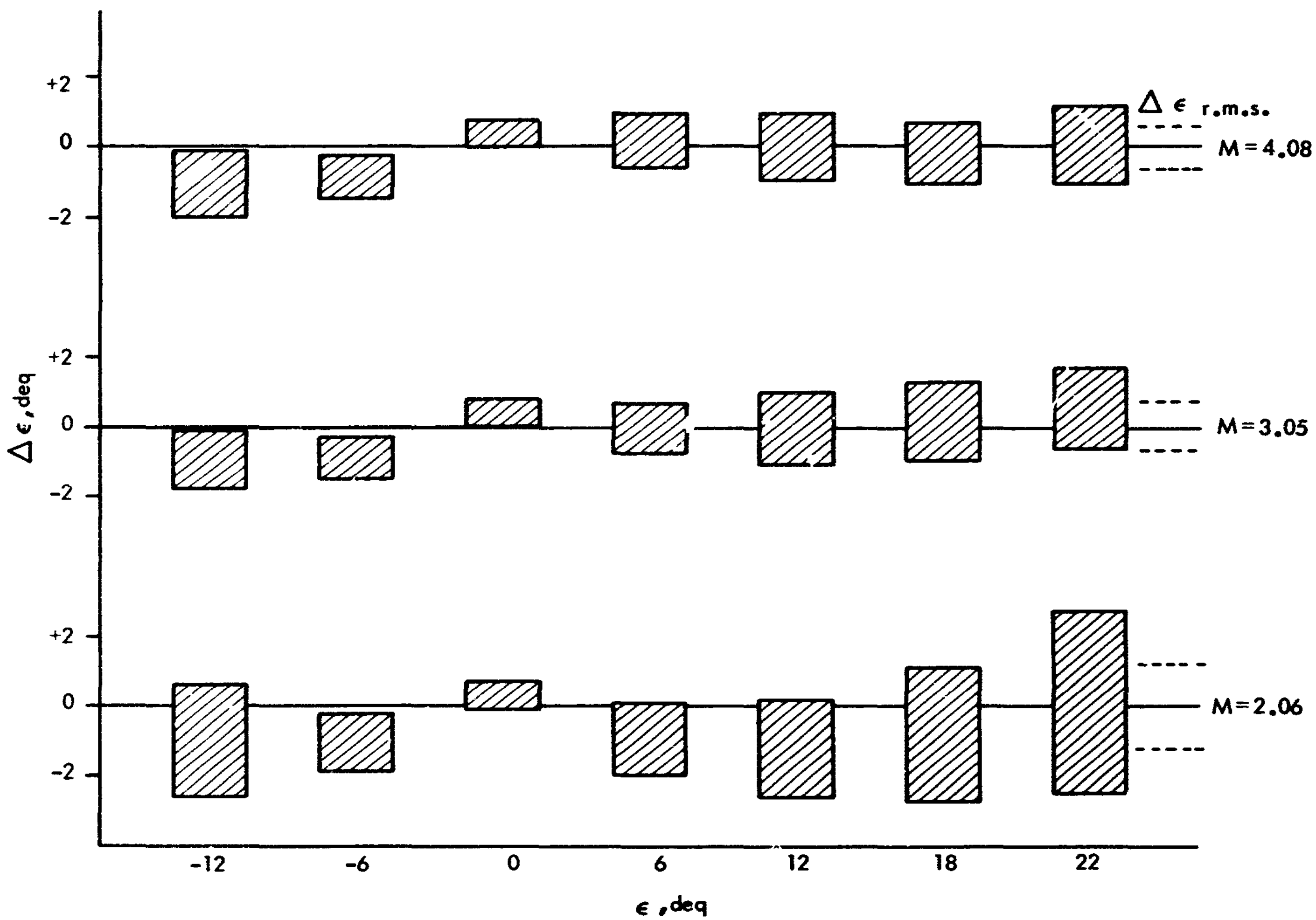


FIG. A-4b MAXIMUM DEVIATION OF CONE PROBE CALIBRATION DATA FROM CORRELATION

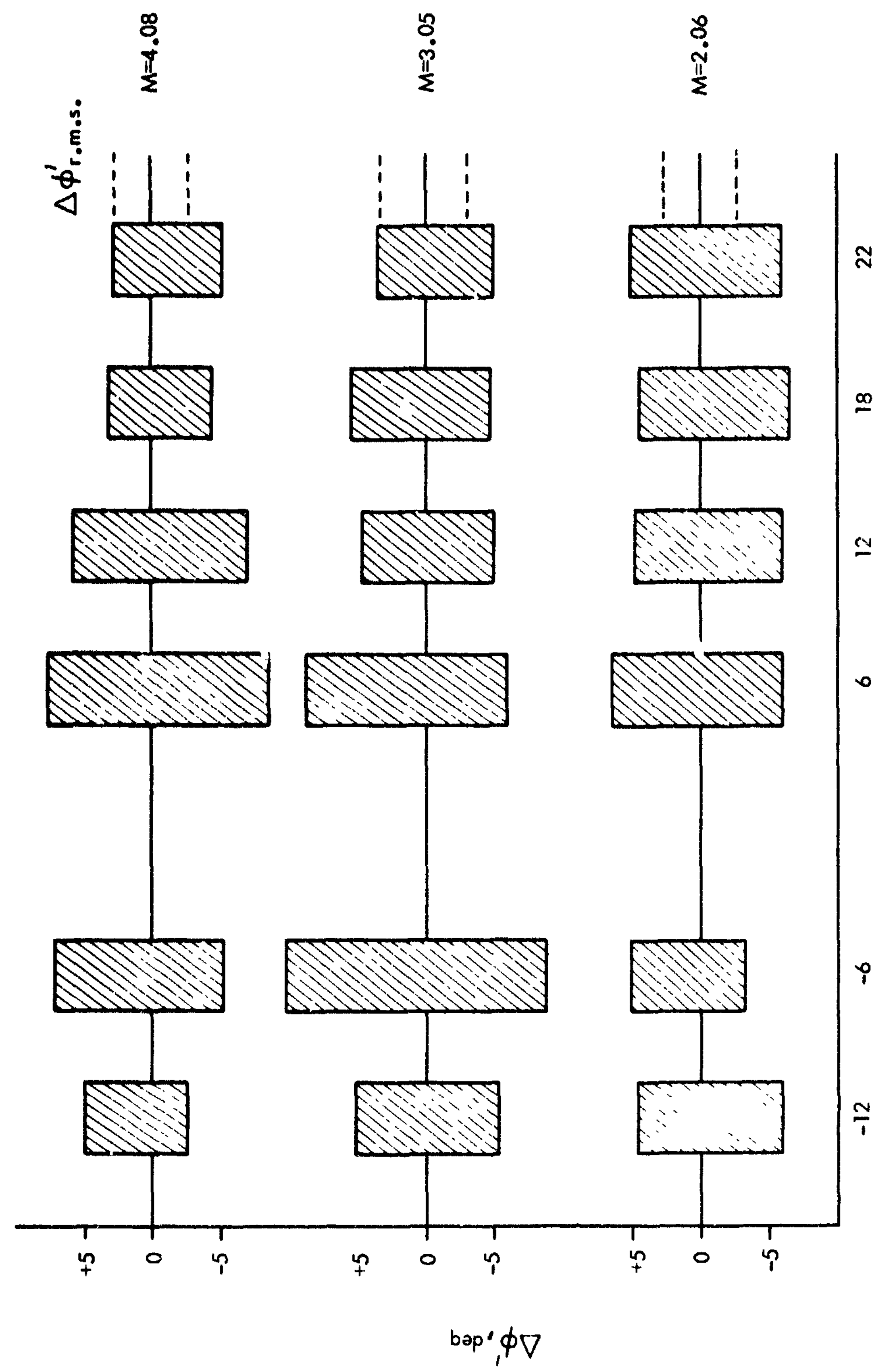


FIG. A-4c MAXIMUM DEVIATION OF CONE PROBE CALIBRATION DATA FROM CORRELATION

APPENDIX B

TABULATED RESULTS

92

TABLE I

SURFACE PRESSURE RATIO

SURFACE PRESSURE COEFFICIENT

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52 ANGLE OF ATTACK = 0 DEGREES

BETA	STATION NUMBER									
DEG	1	2	3	4	5	6	7	8	9	10
179.2	2.1218	1.9193	55	1.7781	1.5733	1.4524	1.3159	1.2013	1.1182	1.0318
	0.1293	0.1060	883	0.0897	0.0661	0.0522	0.0354	0.0232	0.0136	0.0037
178.6	2.0810	1.8997	.7451	1.7443	1.5474	1.4597	1.3049	1.1951	1.1087	1.0334
	0.1246	0.1037	0.0859	0.0858	0.0631	0.0529	0.0352	0.0225	0.0125	0.0039
178.9	2.1280	1.9491	1.7679	1.6870	1.5615	1.4234	1.3055	1.1954	1.1095	1.0240
	0.1301	0.1094	0.0885	0.0792	0.0647	0.0488	0.0353	0.0215	0.0126	0.0028
178.7	2.0990	1.8981	1.7404	1.7365	1.5639	1.4305	1.3065	1.1951	1.1174	1.0279
	0.1267	0.1036	0.0854	0.0849	0.0650	0.0496	0.0353	0.0225	0.0135	0.0032

91

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 0 DEGREES

BETA	STATION NUMBER									
DEG	11	12	13	14	15	16	17	18	19	20
179.2	0.9549	0.8474	0.8420	0.8796	0.8765	0.8857	0.9079	0.9173	0.9281	0.9432
	-0.0052	-0.0176	-0.0182	-0.0139	-0.0142	-0.0131	-0.0106	-0.0095	-0.0083	-0.0066
178.6	0.9495	0.8247	0.8357	0.8757	0.8702	0.8820	0.8992	0.9155	0.9220	0.9369
	-0.0058	-0.0202	-0.0189	-0.0143	-0.0150	-0.0136	-0.0116	-0.0096	-0.0090	-0.0073
178.9	0.9432	0.8467	0.8333	0.8749	0.8718	0.8834	0.9016	0.9097	0.9267	0.9361
	-0.0066	-0.0177	-0.0192	-0.0144	-0.0148	-0.0138	-0.0113	-0.0105	-0.0085	-0.0074
178.7	0.9518	0.8561	0.8404	0.8796	0.8718	0.8851	0.9047	0.9157	0.9251	0.9377
	-0.0056	-0.0166	-0.0184	-0.0139	-0.0148	-0.0132	-0.0110	-0.0097	-0.0086	-0.0072

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 5 DEGREES

BETA DEG	STATION NUMBER 1	2	3	4	5	6	7	8	9	10
1.1	2.9080	2.6608	2.4529	2.3619	2.1728	1.9758	1.8016	1.5358	1.5191	1.3881
	0.2200	0.1915	0.1675	0.1570	0.1352	0.1125	0.0924	0.0734	0.0599	0.0447
31.1	2.7770		2.3415	2.1681	2.0456	1.8733	1.7231	1.5456	1.4336	1.3065
	0.2049		0.1547	0.1347	0.1206	0.1014	0.0834	0.0530	0.0500	0.0353
60.9	2.4749		2.0715		1.8275	1.6612	1.5113	1.3506	1.2547	1.1284
	0.1700		0.1235		0.0954	0.0762	0.0589	0.0416	0.0294	0.0148
90.8	2.0919		1.7773		1.5387	1.3939	1.2743	1.1425	1.0585	0.9400
	0.1259		0.0896		0.0621	0.0451	0.0315	0.0154	0.0067	-0.0069
89.4	2.0708	1.8636	1.7475	1.6494	1.5333	1.3944	1.2596	1.1339	1.0522	0.9651
	0.1235	0.0996	0.0862	0.0749	0.0615	0.0455	0.0298	0.0154	0.0060	-0.0040
88.5	2.0982	1.8746	1.7553		1.5372	1.3855	1.2594	1.1331	1.0507	0.9557
	0.1266	0.1008	0.0871		0.0619	0.0446	0.0299	0.0153	0.0058	-0.0051
93.2	2.0158	1.7781	1.6988	1.5152	1.4799	1.3559	1.2194	1.1025	1.0248	0.9416
	0.1171	0.0897	0.0806	0.0594	0.0553	0.0410	0.0253	0.0118	0.0029	-0.0067
98.5	1.9742	1.7318	1.6666		1.4367	1.3049	1.1794	1.0656	0.9942	0.9039
	0.1123	0.0844	0.0769		0.0504	0.0352	0.0207	0.0076	-0.0007	-0.0111
103.3	1.8918		1.6031		1.4038	1.2751	1.1495	1.0397	0.9667	0.8859
	0.1028		0.0695		0.0466	0.0317	0.0172	0.0046	-0.0038	-0.0132
108.6	1.8636		1.5670	1.4242	1.3528	1.2351	1.1197	1.0099	0.9385	0.8561
	0.0996		0.0654	0.0489	0.0407	0.0271	0.0138	0.0011	-0.0071	-0.0166
113.3	1.7796		1.5168		1.3300	1.2123	1.0954	0.9957	0.9251	0.8490
	0.0899		0.0596		0.0381	0.0245	0.0110	-0.0005	-0.0086	-0.0174
118.5	1.7718		1.4948	1.3747	1.2884	1.1825	1.0725	0.9736	0.9079	0.8310
	0.0890		0.0570	0.0432	0.0333	0.0210	0.0084	-0.0034	-0.0106	-0.0195
123.2	1.6996		1.4579		1.2712	1.1723	1.0577	0.9536	0.8969	0.8294
	0.0807		0.0528		0.0313	0.0199	0.0067	-0.0042	-0.0119	-0.0197
128.6	1.7004		1.4391	1.3120	1.2523	1.1498	1.0444	0.9495	0.8953	0.8192
	0.0808		0.0506	0.0360	0.0291	0.0172	0.0051	-0.0058	-0.0121	-0.0208
133.5	1.6282		1.3983		1.2366	1.1448	1.0325	0.9432	0.8882	0.8216
	0.0724		0.0459		0.0273	0.0157	0.0038	-0.0056	-0.0129	-0.0206
138.6	1.6392		1.3763	1.3175	1.2202	1.1252	1.0271	0.9359	0.8796	0.8153
	0.0737		0.0434	0.0366	0.0254	0.0144	0.0031	-0.0073	-0.0139	-0.0213
143.7	1.5850		1.3520		1.2107	1.1174	1.0177	0.9393	0.8835	0.8255
	0.0675		0.0406		0.0243	0.0135	0.0020	-0.0070	-0.0134	-0.0201
148.7	1.6062		1.3434	1.3410	1.1927	1.1048	1.0139	0.9351	0.8812	0.8200
	0.0699		0.0396	0.0393	0.0222	0.0121	0.0016	-0.0074	[illegible]	-0.0208
153.3	1.5662		1.3292		1.2021	1.1032	1.0130	0.9377	0.8867	0.8325
	0.0653		0.0380		0.0233	0.0114	0.0015	-0.0072	-0.0131	-0.0193
158.5	1.5952		1.3269	1.3167	1.1896	1.1048	1.0146	0.9377	0.8898	0.8318
	0.0686		0.0377	0.0365	0.0219	0.0121	0.0017	-0.0072	-0.0127	-0.0194
163.6	1.5450		1.3151		1.1833	1.0923	1.0114	0.9377	0.8898	0.8396
	0.0628		0.0363		0.0211	0.0106	0.0013	-0.0072	-0.0127	-0.0185
168.9	1.5945		1.3230	1.3206	1.1880	1.1054	1.0185	0.9440	0.8969	0.8420
	0.0685		0.0372	0.0370	0.0217	0.0123	0.0021	-0.0065	-0.0119	-0.0182
173.9	1.5552		1.3237		1.1927	1.1025	1.0177	0.9400	0.8953	0.8482
	0.0640		0.0373		0.0222	0.0118	0.0020	-0.0059	-0.0121	-0.0175
178.7	1.5874		1.3308	1.2931	1.1911	1.1048	1.0201	0.9440	0.8977	0.8427
	0.0677		0.0381	0.0338	0.0220	0.0121	0.0023	-0.0065	-0.0118	-0.0181
179.0	1.5474		1.3135		1.1880	1.0899	1.0185	0.9393	0.8930	0.8459
	0.0631		0.0362		0.0217	0.0104	0.0021	-0.0070	-0.0123	-0.0178

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 5 DEGREES

BETA	STATION NUMBER									
DEG	11	12	13	14	15	16	17	18	19	20
1.1	1.2712	1.1080	1.0828	1.1150	1.0852	1.0836	1.0907	1.0835	1.0781	1.0742
	0.0313	0.0124	0.0096	0.0133	0.0098	0.0096	0.0105	0.0093	0.0090	0.0086
31.1	1.2053	1.0444	1.0232	1.0546	1.0256	1.0177	1.0264	1.0130	1.0146	1.0122
	0.0237	0.0051	0.0027	0.0063	0.0029	0.0020	0.0030	0.0015	0.0017	0.0014
60.9	1.0475	0.9251	0.8937	0.9181	0.8875	0.8812	0.8828	0.8694	0.8694	0.9024
	0.0055	-0.0086	-0.0123	-0.0094	-0.0130	-0.0137	-0.0135	-0.0151	-0.0151	-0.0113
90.8	0.8882	0.7886	0.7556	0.7767	0.7534	0.7455	0.7487	0.7387	0.7527	0.7319
	-0.0129	-0.0244	-0.0282	-0.0257	-0.0284	-0.0292	-0.0290	-0.0301	-0.0285	-0.0309
88.4	0.8663	0.7644	0.7283	0.7358	0.7213	0.7104	0.6977	0.5831	0.6886	0.6610
	-0.0154	-0.0272	-0.0313	-0.0305	-0.0321	-0.0334	-0.0349	-0.0355	-0.0359	-0.0391
88.5	0.8631	0.7672	0.7283	0.7341	0.7192	0.7033	0.5958	0.5835	0.6847	0.6590
	-0.0158	-0.0268	-0.0313	-0.0307	-0.0324	-0.0335	-0.0351	-0.0358	-0.0364	-0.0393
93.2	0.8412	0.7493	0.7096	0.7168	0.7002	0.6913	0.6806	0.5571	0.6659	0.6498
	-0.0183	-0.0289	-0.0335	-0.0327	-0.0346	-0.0356	-0.0358	-0.0384	-0.0385	-0.0404
98.5	0.8176	0.7279	0.6882	0.6940	0.6794	0.5734	0.5653	0.5518	0.6501	0.6461
	-0.0210	-0.0314	-0.0359	-0.0353	-0.0370	-0.0377	-0.0386	-0.0401	-0.0401	-0.0408
103.3	0.7988	0.7133	0.6754	0.6822	0.6693	0.6671	0.5597	0.5505	0.5538	0.6662
	-0.0232	-0.0331	-0.0374	-0.0366	-0.0381	-0.0384	-0.0392	-0.0403	-0.0399	-0.0385
108.6	0.7770	0.6990	0.6594	0.6696	0.6623	0.6609	0.5611	0.5550	0.6660	0.7030
	-0.0257	-0.0347	-0.0393	-0.0381	-0.0389	-0.0391	-0.0391	-0.0397	-0.0385	-0.0342
113.3	0.7665	0.6926	0.6578	0.6725	0.6666	0.5695	0.5719	0.5814	0.7021	0.7578
	-0.0269	-0.0354	-0.0395	-0.0378	-0.0384	-0.0381	-0.0378	-0.0357	-0.0343	-0.0279
118.5	0.7607	0.6926	0.6576	0.6751	0.6736	0.5799	0.5944	0.7134	0.7388	0.8137
	-0.0276	-0.0354	-0.0395	-0.0375	-0.0376	-0.0359	-0.0352	-0.0330	-0.0301	-0.0215
123.2	0.7556	0.6933	0.6650	0.6853	0.6893	0.7013	0.7199	0.7431	0.7731	0.8561
	-0.0282	-0.0354	-0.0386	-0.0363	-0.0358	-0.0344	-0.0323	-0.0296	-0.0262	-0.0166
128.6	0.7577	0.6988	0.6725	0.6993	0.7075	0.7232	0.7520	0.7747	0.8074	0.8945
	-0.0279	-0.0347	-0.0378	-0.0347	-0.0337	-0.0319	-0.0286	-0.0260	-0.0222	-0.0122
133.5	0.7595	0.6971	0.6809	0.7133	0.7244	0.7428	0.7699	0.7917	0.8270	0.9094
	-0.0277	-0.0349	-0.0368	-0.0331	-0.0318	-0.0297	-0.0255	-0.0240	-0.0199	-0.0104
138.6	0.7625	0.7103	0.6884	0.7275	0.7474	0.7596	0.7909	0.8090	0.8380	0.9157
	-0.0274	-0.0334	-0.0359	-0.0314	-0.0297	-0.0277	-0.0241	-0.0220	-0.0187	-0.0097
143.7	0.7673	0.7150	0.7035	0.7431	0.7571	0.7755	0.8051	0.8223	0.8389	0.9212
	-0.0268	-0.0329	-0.0342	-0.0296	-0.0280	-0.0258	-0.0225	-0.0205	-0.0186	-0.0091
149.7	0.7721	0.7244	0.7119	0.7538	0.7686	0.7836	0.8153	0.8294	0.8427	0.9243
	-0.0263	-0.0318	-0.0332	-0.0284	-0.0267	-0.0244	-0.0213	-0.0197	-0.0181	-0.0087
153.3	0.7827	0.7260	0.7210	0.7635	0.7805	0.8004	0.8231	0.8395	0.8514	0.9330
	-0.0251	-0.0316	-0.0322	-0.0273	-0.0253	-0.0230	-0.0204	-0.0185	-0.0171	-0.0077
159.5	0.7902	0.7407	0.7312	0.7790	0.7917	0.8121	0.8404	0.8514	0.8616	0.9408
	-0.0242	-0.0299	-0.0310	-0.0255	-0.0240	-0.0217	-0.0184	-0.0171	-0.0160	-0.0068
153.5	0.7933	0.7375	0.7363	0.7829	0.7980	0.8175	0.8459	0.8592	0.8710	0.9291
	-0.0238	-0.0303	-0.0304	-0.0250	-0.0233	-0.0210	-0.0179	-0.0152	-0.0149	-0.0082
168.9	0.8019	0.7505	0.7464	0.7957	0.8082	0.8310	0.8624	0.8730	0.8882	0.9322
	-0.0228	-0.0288	-0.0292	-0.0236	-0.0221	-0.0195	-0.0159	-0.0141	-0.0129	-0.0078
173.9	0.8035	0.7443	0.7497	0.7941	0.8114	0.8375	0.8671	0.8812	0.8977	0.9259
	-0.0227	-0.0295	-0.0289	-0.0237	-0.0218	-0.0193	-0.0153	-0.0137	-0.0118	-0.0085
178.7	0.8027	0.7526	0.7519	0.8004	0.8145	0.8395	0.8733	0.8838	0.9039	0.9283
	-0.0227	-0.0285	-0.0286	-0.0230	-0.0214	-0.0195	-0.0145	-0.0127	-0.0111	-0.0083
179.0	0.8019	0.7425	0.7490	0.7949	0.8137	0.8349	0.8710	0.8857	0.9024	0.9220
	-0.0228	-0.0297	-0.0289	-0.0237	-0.0215	-0.0190	-0.0149	-0.0131	-0.0113	-0.0090

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 10 DEGREES

BETA DEG	STATION NUMBER 1	2	3	4	5	6	7	8	9	10
0.5	4.0003		3.4102		3.0320	2.8013	2.5565	2.3035	2.1555	1.9962
	0.3459		0.2779		0.2343	0.2077	0.1735	0.1509	0.1332	0.1149
1.4	3.9814	3.5742	3.4063	3.2478	3.0343	2.8152	2.5620	2.3101	2.1484	2.0009
	0.3437	0.2968	0.2774	0.2592	0.2346	0.2034	0.1801	0.1510	0.1324	0.1154
30.7	3.6723		3.1120	2.9802	2.7754	2.5541	2.3283	2.0858	1.9248	1.7804
	0.3081		0.2435	0.2283	0.2047	0.1792	0.1532	0.1255	0.1066	0.0900
60.7	2.8688		2.4019	2.3454	2.1249	1.9350	1.7420	1.5442	1.4163	1.2798
	0.2155		0.1616	0.1551	0.1297	0.1078	0.0855	0.0627	0.0480	0.0323
90.3	1.9735		1.6470	1.4312	1.4242	1.2727	1.1315	0.9832	0.8867	0.7828
	0.1122		0.0746	0.0497	0.0489	0.0314	0.0152	-0.0019	-0.0131	-0.0250
88.7	1.9954	1.7741	1.6486	1.6149	1.3897	1.2924	1.1205	1.0028	0.9071	0.8098
	0.1148	0.0893	0.0748	0.0709	0.0449	0.0337	0.0139	0.0003	-0.0107	-0.0219
93.6	1.8581	1.5709	1.5011	1.3551	1.2461	1.1919	1.0249	0.9118	0.8263	0.7499
	0.0989	0.0658	0.0578	0.0409	0.0284	0.022[illegible]	0.0029	-0.0102	-0.0200	-0.0288
98.9	1.7498		1.4312	1.3975	1.1943	1.0970	0.9479	0.8412	0.7611	0.6707
	0.0865		0.0497	0.0458	0.0224	0.0112	-0.0060	-0.0183	-0.0275	-0.0380
103.7	1.6313		1.3065	1.1386	1.0789	1.0255	0.8749	0.7712	0.6977	0.6248
	0.0728		0.0353	0.0160	0.0091	0.0029	-0.0144	-0.0264	-0.0349	-0.0433
109.1	1.5301		1.2476	1.1966	1.0209	0.9314	0.8043	0.7033	0.6289	0.5492
	0.0611		0.0286	0.0227	0.0024	-0.0079	-0.0226	-0.0336	-0.0428	-0.0520
113.7	1.4281		1.1417	1.0114	0.9267	0.8843	0.7450	0.6525	0.5843	0.5191
	0.0494		0.0163	0.0013	-0.0085	-0.0133	-0.0294	-0.0401	-0.0479	-0.0555
118.8	1.3575		1.1080	1.0554	0.9087	0.8270	0.7006	0.6134	0.5407	0.4666
	0.0412		0.0124	0.0064	-0.0105	-0.0199	-0.0345	-0.0446	-0.0530	-0.0615
123.6	1.2947		1.0318	0.9024	0.8380	0.8034	0.5751	0.5938	0.5249	0.4630
	0.0340		0.0037	-0.0113	-0.0187	-0.0230	-0.0375	-0.0472	-0.0548	-0.0619
128.8	1.2508		1.0334	0.9989	0.8514	0.7777	0.6553	0.5981	0.5249	0.4563
	0.0289		0.0039	-0.0001	-0.0171	-0.0256	-0.0385	-0.0475	-0.0548	-0.0627
133.8	1.2178		0.9950	0.8765	0.7862	0.7972	0.6802	0.6073	0.5604	0.5257
	0.0251		-0.0006	-0.0142	-0.0246	-0.0234	-0.0369	-0.0453	-0.0507	-0.0547
139.0	1.2084		1.0185	0.9769	0.8624	0.7894	0.7073	0.6438	0.6098	0.5696
	0.0240		0.0021	-0.0027	-0.0159	-0.0243	-0.0337	-0.0411	-0.0450	-0.0496
143.7	1.1990		0.9769	0.8576	0.8380	0.8338	0.7351	0.6813	0.6528	0.6258
	0.0229		-0.0027	-0.0164	-0.0187	-0.0196	-0.0305	-0.0368	-0.0400	-0.0431
148.5	1.2084		1.0216	0.9957	0.8969	0.8427	0.7680	0.7148	0.6818	0.6394
	0.0240		0.0025	-0.0005	-0.0119	-0.0181	-0.0257	-0.0329	-0.0367	-0.0416
153.7	1.2013		0.9965	0.9479	0.8655	0.8812	0.7917	0.7443	0.7064	0.6725
	0.0232		-0.0004	-0.0060	-0.0155	-0.0137	-0.0240	-0.0295	-0.0338	-0.0378
158.9	1.2304		1.0420	1.0256	0.9330	0.8882	0.8158	0.7556	0.7261	0.6778
	0.0266		0.0048	0.0029	-0.0077	-0.0129	-0.0211	-0.0270	-0.0316	-0.0371
163.7	1.2202		1.0146	1.0114	0.9024	0.9037	0.8253	0.7758	0.7376	0.7001
	0.0254		0.0017	0.0013	-0.0113	-0.0105	-0.0200	-0.0257	-0.0303	-0.0346
169.0	1.2476		1.0593	1.0491	0.9699	0.9102	0.8[illegible]	0.7973	0.7484	0.7011
	0.0286		0.0068	0.0057	-0.0035	-0.0104	-0.0183	[illegible]	-0.0290	-0.0345
173.5	1.2374		1.0350	1.0216	0.9110	0.9345	0.8396	0.77[illegible]	0.7559	0.7232
	0.0274		0.0040	0.0025	-0.0103	-0.0075	-0.0185	-0.023[illegible]	[illegible]	0.0319
179.2	1.2523		1.0774	1.0632	0.9699	0.9191	0.8553	0.8027	0.7648	0.7277
	0.0291		0.0089	0.0073	-0.0035	-0.0094	-0.0157	-0.0227	-0.0269	-0.0314
179.9	1.2406		1.0530	1.0405	0.9322	0.9377	0.8474	0.8027	0.7656	0.7371
	0.0277		0.0061	0.0047	-0.0078	-0.0072	-0.0176	-0.0227	-0.0270	-0.0303

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52 ANGLE OF ATTACK = 10 DEGREES

BETA	STATION NUMBER									
DEG	11	12	13	14	15	16	17	18	19	20
0.5	1.8079	1.5364	1.5411	1.5646	1.5168	1.5034	1.5183	1.4987	1.4846	1.4768
	0.0931	0.0618	0.0624	0.0651	0.0596	0.0580	0.0598	0.0575	0.0559	0.0550
1.4	1.8047	1.4799	1.5403	1.5646	1.5168	1.5056	1.5128	1.4956	1.4807	1.4736
	0.0928	0.0553	0.0623	0.0651	0.0596	0.0584	0.0591	0.0571	0.0554	0.0546
30.7	1.6156	1.3230	1.3716	1.4022	1.3418	1.3235	1.3339	1.3175	1.3080	1.2916
	0.0710	0.0372	0.0428	0.0464	0.0394	0.0379	0.0385	0.0356	0.0355	0.0336
60.7	1.1660	0.9644	0.9738	0.9879	0.9408	0.9157	0.9165	0.8898	0.8828	0.8631
	0.0191	-0.0041	-0.0030	-0.0014	-0.0068	-0.0097	-0.0096	-0.0127	-0.0135	-0.0158
90.3	0.7126	0.6264	0.5770	0.5679	0.5332	0.5086	0.4948	0.4739	0.4576	0.4510
	-0.0331	-0.0431	-0.0488	-0.0498	-0.0538	-0.0557	-0.0582	-0.0607	-0.0625	-0.0633
88.7	0.7245	0.6369	0.5727	0.5531	0.5397	0.5195	0.4902	0.4741	0.4506	0.4457
	-0.0318	-0.0419	-0.0493	-0.0515	-0.0531	-0.0554	-0.0588	-0.0606	-0.0633	-0.0639
93.6	0.6554	0.5915	0.5091	0.4940	0.4761	0.4599	0.4311	0.4159	0.4020	0.3855
	-0.0397	-0.0471	-0.0566	-0.0583	-0.0604	-0.0623	-0.0656	-0.0673	-0.0689	-0.0708
98.9	0.5981	0.5485	0.4620	0.4400	0.4223	0.4045	0.3797	0.3649	0.3602	0.3854
	-0.0463	-0.0521	-0.0620	-0.0646	-0.0666	-0.0637	-0.0715	-0.0732	-0.0738	-0.0709
103.7	0.5413	0.5197	0.4132	0.3931	0.3729	0.3606	0.3331	0.3351	0.3952	0.4854
	-0.0529	-0.0554	-0.0677	-0.0700	-0.0723	-0.0737	-0.0769	-0.0757	-0.0697	-0.0593
109.1	0.4852	0.4663	0.3684	0.3438	0.3265	0.3155	0.3551	0.4158	0.5016	0.5924
	-0.0594	-0.0615	-0.0728	-0.0757	-0.0777	-0.0738	-0.0742	-0.0674	-0.0575	-0.0470
113.7	0.4444	0.4667	0.3288	0.3112	0.3212	0.3691	0.4364	0.4933	0.5393	0.6077
	-0.0641	-0.0615	-0.0774	-0.0794	-0.0783	-0.0729	-0.0650	-0.0589	-0.0531	-0.0452
118.8	0.4068	0.4112	0.3127	0.3473	0.4007	0.4451	0.4832	0.5147	0.5445	0.6026
	-0.0684	-0.0679	-0.0792	-0.0753	-0.0691	-0.0640	-0.0596	-0.0559	-0.0525	-0.0458
123.6	0.3865	0.4504	0.3531	0.4138	0.4549	0.4784	0.4993	0.5228	0.5529	0.5891
	-0.0707	-0.0634	-0.0746	-0.0676	-0.0629	-0.0601	-0.0578	-0.0550	-0.0516	-0.0474
128.8	0.4109	0.4553	0.4254	0.4598	0.4723	0.4878	0.5115	0.5275	0.5537	0.5938
	-0.0679	-0.0628	-0.0663	-0.0623	-0.0608	-0.0591	-0.0553	-0.0545	-0.0515	-0.0468
133.8	0.4894	0.5261	0.4617	0.4779	0.4739	0.4853	0.5030	0.5173	0.5191	0.5635
	-0.0589	-0.0546	-0.0621	-0.0602	-0.0607	-0.0593	-0.0573	-0.0556	-0.0555	-0.0503
139.0	0.5504	0.5473	0.4855	0.4768	0.4753	0.4695	0.4885	0.4755	0.4994	0.5417
	-0.0518	-0.0522	-0.0593	-0.0603	-0.0605	-0.0612	-0.0590	-0.0532	-0.0577	-0.0528
143.7	0.5872	0.5787	0.5104	0.4907	0.4633	0.4563	0.4582	0.4558	0.4628	0.5081
	-0.0476	-0.0486	-0.0565	-0.0587	-0.0619	-0.0629	-0.0625	-0.0626	-0.0619	-0.0567
148.5	0.6098	0.5855	0.5318	0.5089	0.4655	0.4349	0.4267	0.4036	0.4006	0.4158
	-0.0450	-0.0478	-0.0540	-0.0566	-0.0616	-0.0651	-0.0551	-0.0591	-0.0691	-0.0674
153.7	0.6310	0.6051	0.5489	0.5399	0.4924	0.4448	0.4062	0.3738	0.3103	0.3338
	-0.0425	-0.0455	-0.0520	-0.0530	-0.0585	-0.0640	-0.0685	-0.0725	-0.0795	-0.0768
158.9	0.6448	0.6100	0.5683	0.5596	0.5238	0.4835	0.4373	0.3729	0.3289	0.3346
	-0.0410	-0.0450	-0.0498	-0.0508	-0.0549	-0.0599	-0.0649	-0.0723	-0.0774	-0.0767
163.7	0.6576	0.6245	0.5854	0.5872	0.5565	0.5413	0.5128	0.4873	0.4881	0.5261
	-0.0395	-0.0433	-0.0478	-0.0476	-0.0511	-0.0529	-0.0552	-0.0591	-0.0590	-0.0546
169.0	0.6734	0.6379	0.6173	0.6372	0.6260	0.5321	0.5530	0.5539	0.6939	0.7151
	-0.0377	-0.0418	-0.0441	-0.0418	-0.0431	-0.0424	-0.0400	-0.0392	-0.0353	-0.0329
173.5	0.6915	0.6575	0.6557	0.7024	0.7126	0.7539	0.7939	0.8223	0.8325	0.8121
	-0.0356	-0.0395	-0.0397	-0.0343	-0.0331	-0.0287	-0.0241	-0.0205	-0.0193	-0.0217
179.2	0.7083	0.6782	0.6824	0.7445	0.7736	0.8132	0.8653	0.8930	0.8914	0.8467
	-0.0336	-0.0371	-0.0366	-0.0295	-0.0261	-0.0208	-0.0154	-0.0123	-0.0125	-0.0177
179.9	0.7088	0.6743	0.6806	0.7428	0.7708	0.8194	0.8608	0.8930	0.8843	0.8451
	-0.0336	-0.0376	-0.0368	-0.0297	-0.0264	-0.0209	-0.0151	-0.0123	-0.0133	-0.0179

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52 ANGLE OF ATTACK = 15 DEGREES

BETA	STATION NUMBER									
DEG	1	2	3	4	5	6	7	8	9	10
0.9	5.3311		4.6123	4.5260	4.1917	3.8841	3.5111	3.2372	3.0822	2.8695
	0.4994		0.4165	0.4065	0.3680	0.3325	0.3010	0.2549	0.2401	0.2156
30.8	4.7810		4.0497	3.9163	3.6495	3.3936	3.1544	2.8515	2.6593	2.4576
	0.4359		0.3516	0.3362	0.3055	0.2756	0.2484	0.2135	0.1913	0.1681
60.9	3.3529		2.7864	2.6569	2.4309	2.2387	2.0632	1.8448	1.7020	1.5309
	0.2713		0.2060	0.1910	0.1650	0.1428	0.1233	0.0974	0.0809	0.0612
91.1	1.8573		1.4893	1.3434	1.2531	1.1258	1.0326	0.8857	0.8043	0.6873
	0.0988		0.0564	0.0396	0.0292	0.0146	0.0038	-0.0131	-0.0226	-0.0361
88.6	1.9122		1.5466	1.4352	1.[illegible]073	1.1903	1.0431	0.9377	0.8529	0.7662
	0.1052		0.0630	0.0502	0.0354	0.0219	0.0357	-0.0372	-0.0170	-0.0270
93.6	1.7318		1.3700	1.2523	1.1566	1.0420	0.9212	0.8129	0.7390	0.6567
	0.0844		0.0427	0.0291	0.0181	0.0048	-0.0091	-0.0216	-0.0301	-0.0396
98.6	1.5348		1.2186	1.1080	1.0028	0.9118	0.7933	0.7393	0.6415	0.5663
	0.0617		0.0252	0.0124	0.0003	-0.0132	-0.0238	-0.0335	-0.0413	-0.0500
103.6	1.3771		1.0679	0.9722	0.8765	0.7878	0.6882	0.6044	0.5463	0.4779
	0.0435		0.0078	-0.0032	-0.0142	-0.0245	-0.0350	-0.0456	-0.0523	-0.0602
109.6	1.2272		0.9659	0.8678	0.7728	0.6927	0.5955	0.5288	0.4740	0.4149
	0.0262		-0.0039	-0.0152	-0.0262	-0.0354	-0.0466	-0.0543	-0.0606	-0.0675
113.8	1.1119		0.8318	0.7237	0.6659	0.5835	0.5113	0.4438	0.3978	0.3496
	0.0129		-0.0194	-0.0319	-0.0385	-0.0473	-0.0553	-0.0641	-0.0694	-0.0750
119.1	0.9957		0.7596	0.6572	0.5840	0.5255	0.4422	0.3939	0.3433	0.3006
	-0.0305		-0.0277	-0.0395	-0.0480	-0.0547	-0.0643	-0.0702	-0.0757	-0.0806
123.5	0.9259		0.6553	0.5493	0.5013	0.4319	0.3757	0.3250	0.3087	0.3204
	-0.0085		-0.0397	-0.0520	-0.0575	-0.0655	-0.0720	-0.0777	-0.0797	-0.0784
128.2	0.8592		0.5936	0.4876	0.4274	0.3852	0.3482	0.3509	0.3647	0.3644
	-0.0162		-0.0469	-0.0591	-0.0660	-0.0708	-0.0751	-0.0737	-0.0732	-0.0733
133.7	0.8576		0.5371	0.4441	0.4437	0.4237	0.4131	0.3990	0.3981	0.3812
	-0.0164		-0.0534	-0.0641	-0.0641	-0.0654	-0.0677	-0.0693	-0.0694	-0.0713
138.4	0.8600		0.5940	0.5257	0.5141	0.4832	0.4575	0.4293	0.4068	0.3928
	-0.0161		-0.0468	-0.0547	-0.0560	-0.0535	-0.0625	-0.0659	-0.0684	-0.0700
143.4	0.8953		0.6289	0.5524	0.5490	0.5155	0.4800	0.4371	0.4164	0.3992
	-0.0121		-0.0428	-0.0516	-0.0520	-0.0559	-0.0590	-0.0549	-0.0673	-0.0693
148.2	0.8890		0.6790	0.6073	0.5862	0.5329	0.4826	0.4534	0.4197	0.3897
	-0.0128		-0.0370	-0.0453	-0.0477	-0.0539	-0.0597	-0.0534	-0.0669	-0.0704
153.5	0.9094		0.7235	0.6320	0.5846	0.5473	0.4820	0.4357	0.4020	0.3639
	-0.0104		-0.0319	-0.0424	-0.0479	-0.0522	-0.0597	-0.0551	-0.0689	-0.0733
159.7	0.9134		0.7748	0.6717	0.6147	0.5350	0.4655	0.4050	0.3544	0.3173
	-0.0100		-0.0260	-0.0379	-0.0444	-0.0535	-0.0515	-0.0536	-0.0744	-0.0787
163.7	0.9549		0.7964	0.6905	0.6343	0.5657	0.4723	0.3908	0.3316	0.2892
	-0.0052		-0.0235	-0.0357	-0.0422	-0.0531	-0.0608	-0.0732	-0.0771	-0.0819
168.8	0.9730		0.8129	0.7475	0.7006	0.6335	0.5744	0.5132	0.4826	0.4473
	-0.0031		-0.0216	-0.0291	-0.0345	-0.0423	-0.0491	-0.0551	-0.0597	-0.0637
173.8	1.0295		0.8129	0.7541	0.7366	0.7301	0.5894	0.5470	0.6187	0.5581
	0.0034		-0.0216	-0.0284	-0.0304	-0.0311	-0.0359	-0.0407	-0.0440	-0.0510
178.8	1.0310		0.8514	0.8051	0.7894	0.7590	0.7279	0.5781	0.6430	0.5934
	0.0037		-0.0171	-0.0225	-0.0243	-0.0278	-0.0314	-0.0371	-0.0412	-0.0469

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 15 DEGREES

BETA	STATION NUMBER									
DEG	11	12	13	14	15	16	17	18	19	20
0.9	2.6043	2.2512	2.2559	2.3054	2.2120	2.2010	2.2136	2.1936	2.1626	2.1508
	0.1850	0.1443	0.1448	0.1505	0.1397	0.1385	0.1339	0.1351	0.1340	0.1327
30.8	2.2379	1.9319	1.9374	1.9782	1.8911	1.8589	1.8746	1.9448	1.8416	1.8110
	0.1427	0.1074	0.1081	0.1128	0.1027	0.0930	0.1008	0.0974	0.0970	0.0935
60.9	1.4022	1.2053	1.1872	1.2021	1.1425	1.1072	1.1156	1.0428	1.0797	1.0562
	0.0464	0.0237	0.0216	0.0233	0.0164	0.0124	0.0134	0.0096	0.0092	0.0065
91.1	0.6319	0.5790	0.5147	0.5018	0.4636	0.4405	0.4354	0.4119	0.4072	0.4089
	-0.0424	-0.0485	-0.0560	-0.0574	-0.0618	-0.0645	-0.0650	-0.0678	-0.0683	-0.0682
88.6	0.6749	0.6337	0.5330	0.5144	0.5041	0.4856	0.4537	0.4429	0.4338	0.4252
	-0.0375	-0.0422	-0.0538	-0.0560	-0.0573	-0.0593	-0.0623	-0.0642	-0.0653	-0.0663
93.6	0.5792	0.5803	0.4539	0.4338	0.4239	0.4050	0.3843	0.3658	0.3595	0.3491
	-0.0485	-0.0484	-0.0630	-0.0653	-0.0664	-0.0693	-0.0710	-0.0728	-0.0738	-0.0750
99.6	0.4965	0.5076	0.3838	0.3631	0.3532	0.3373	0.3197	0.3052	0.2997	0.3260
	-0.0581	-0.0568	-0.0710	-0.0734	-0.0746	-0.0754	-0.0744	-0.0801	-0.0807	-0.0777
103.6	0.4161		0.3195	0.3019	0.2914	0.2813	0.2833	0.3020	0.3301	0.3774
	-0.0673		-0.0785	-0.0805	-0.0817	-0.0829	-0.0826	-0.0805	-0.0772	-0.0718
108.6	0.3578		0.2757	0.2729	0.2979	0.3150	0.3422	0.3552	0.3789	0.4343
	-0.0740		-0.0835	-0.0838	-0.0809	-0.0790	-0.0758	-0.0742	-0.0716	-0.0652
123.8	0.2941		0.2880	0.3162	0.3405	0.3519	0.3743	0.3932	0.4036	0.4524
	-0.0814		-0.0821	-0.0788	-0.0760	-0.0747	-0.0721	-0.0711	-0.0688	-0.0631
118.3	0.2777		0.3139	0.3353	0.3638	0.3732	0.3872	0.3937	0.4034	0.4486
	-0.0833		-0.0791	-0.0766	-0.0734	-0.0723	-0.0706	-0.0699	-0.0688	-0.0636
123.5	0.3242		0.3380	0.3513	0.3630	0.3757	0.3953	0.4030	0.4133	0.4538
	-0.0779		-0.0763	-0.0748	-0.0734	-0.0719	-0.0695	-0.0688	-0.0676	-0.0630
128.2	0.3492		0.3470	0.3768	0.3700	0.3755	0.4071	0.4059	0.4194	
	-0.0750		-0.0753	-0.0719	-0.0726	-0.0719	-0.0684	-0.0695	-0.0669	
133.7	0.3584		0.3431	0.3701	0.3769	0.3637	0.3935	0.3995		
	-0.0740		-0.0757	-0.0726	-0.0718	-0.0728	-0.0693	-0.0692		
138.4	0.3727		0.3509	0.3712	0.3879	0.3872	0.4073	0.4039	0.4230	
	-0.0723		-0.0748	-0.0725	-0.0706	-0.0707	-0.0683	-0.0687	-0.0665	
143.4	0.3814		0.3486	0.3704	0.3667	0.3792	0.3857	0.3857	0.4023	
	-0.0713		-0.0751	-0.0726	-0.0730	-0.0716	-0.0707	-0.0707	-0.0689	
148.2	0.3573		0.3101	0.3445	0.3524	0.3765	0.3895	0.3943	0.4077	
	-0.0741		-0.0795	-0.0756	-0.0747	-0.0721	-0.0705	-0.0698	-0.0683	
153.5	0.3309		0.31[illegible]	0.3529	0.3529	0.3716	0.3865	0.3993	0.4037	
	-0.0771		-0.0790	-0.0746	-0.0746	-0.0724	-0.0707	-0.0694	-0.0687	
158.7	0.2945		0.2790	0.3227	0.3314	0.3435	0.3597	0.3796	0.3901	0.4099
	-0.0813		-0.0831	-0.0781	-0.0769	-0.0750	-0.0727	-0.0715	-0.0703	-0.0680
163.7	0.2711		0.2685	0.2995	[illegible]	0.3354	0.3493	0.3551	0.3821	0.3891
	-0.0840		-0.0843	-0.0808	[illegible]	-0.0756	-0.0750	-0.0732	-0.0712	-0.0704
168.8	0.4088		0.3539	0.3614	[illegible]	[illegible]	0.3912	0.3794	0.4117	0.4128
	-0.0682		-0.0745	-0.0736	[illegible]	-0.0743	-0.0702	-0.0694	-0.0679	-0.0677
173.8	0.4952	0.5311	0.4114	0.4136	0.4041	0.4047	0.4251	0.4331	0.4352	0.4329
	-0.0582	-0.0541	-0.0679	-0.0676	-0.0687	-0.0636	-0.0653	-0.0654	-0.0651	-0.0654
178.8	0.5236	0.5395	0.4371	0.4373	0.4369	0.4284	0.4520	0.4437	0.4567	0.4469
	-0.0549	-0.0531	-0.0649	-0.0649	-0.0649	-0.0659	-0.0632	-0.0641	-0.0626	-0.0638

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 0 DEGREES

BETA	STATION NUMBER									
DEG	1	2	3	4	5	6	7	8	9	10
179.5	2.4260		2.0011	1.9311	1.7173	1.5232	1.3649	1.2038	1.1185	1.0387
	0.1230		0.0863	0.0803	0.0619	0.0451	0.0315	0.0181	0.0102	0.0033
179.5	2.2910		2.1210	1.8811	1.7228	1.5001	1.3696	1.2066	1.1210	1.0334
	0.1113		0.0967	0.0760	0.0623	0.0431	0.0319	0.0178	0.0104	0.0029
179.5	2.2760		1.9944	1.9094	1.7178	1.5114	1.3609	1.2030	1.1162	1.0365
	0.1100		0.0858	0.0784	0.0619	0.0441	0.0311	0.0180	0.0100	0.0032

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 0 DEGREES

BETA DEG	STATION NUMBER 11	12	13	14	15	16	17	18	19	20
179.5	0.9287	0.8966	0.8043	0.8321	0.8374	0.8522	0.8767	0.8887	0.8894	0.9061
	-0.0061	-0.0089	-0.0169	-0.0145	-0.0140	-0.0127	-0.0106	-0.0096	-0.0095	-0.0081
179.5	0.9254	0.9147	0.8043	0.8331	0.8321	0.8454	0.8696	0.8711	0.8894	0.8969
	-0.0064	-0.0074	-0.0169	-0.0144	-0.0145	-0.0133	-0.0112	-0.0111	-0.0095	-0.0089
179.5	0.9236	0.8702	0.8073	0.8323	0.8324	0.8438	0.8646	0.8732	0.8909	0.8977
	-0.0051	-0.0112	-0.0166	-0.0145	-0.0145	-0.0137	-0.0117	-0.0112	-0.0094	-0.0088

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 5 DEGREES

BETA	STATION NUMBER									
DEG	1	2	3	4	5	6	7	8	9	10
0.6	3.5456		2.8642		2.4926	2.2177	1.9977	1.7528	1.6014	1.4631
	0.2195		0.1608		0.1287	0.1050	0.0863	0.0649	0.0519	0.0399
31.2	3.3557		2.7609	2.6892	2.3576	2.1110	1.8878	1.5643	1.5201	1.3866
	0.2032		0.1519	0.1457	0.1171	0.0958	0.0766	0.0573	0.0448	0.0333
61.5	2.9341		2.4310	2.3426	2.0461	1.8278	1.6284	1.4357	1.3051	1.1845
	0.1668		0.1234	0.1158	0.0902	0.0714	0.0542	0.0377	0.0263	0.0159
91.3	2.4809		2.0477	1.9728	1.7178	1.5335	1.3569	1.2358	1.0943	0.9864
	0.1271		0.0904	0.0839	0.0619	0.0458	0.0308	0.0177	0.0081	-0.0012
88.4	2.4343		2.0311	1.9444	1.6995	1.5192	1.3446	1.1850	1.0772	0.9837
	0.1237		0.0889	0.0814	0.0603	0.0467	0.0297	0.0152	0.0067	-0.0014
99.1	2.3093		1.9061	1.8161	1.5832	1.4139	1.2506	1.1048	1.0052	0.9161
	0.1129		0.0781	0.0704	0.0503	0.0357	0.0216	0.0090	0.0004	-0.0072
109.1	2.1360		1.7895	1.6962	1.4667	1.3239	1.1652	1.0330	0.9384	0.8606
	0.0980		0.0661	0.0600	0.0403	0.0277	0.0142	0.0026	-0.0053	-0.0120
119.2	1.9861		1.6795	1.5859	1.3876	1.2350	1.0960	0.9722	0.8876	0.8168
	0.0850		0.0586	0.0505	0.0354	0.0234	0.0083	-0.0024	-0.0097	-0.0158
129.4	1.8994		1.5672	1.5256	1.3313	1.1728	1.0550	0.9336	0.8609	0.7963
	0.0776		0.0489	0.0453	0.0286	0.0169	0.0049	-0.0053	-0.0120	-0.0176
139.6	1.8428		1.5152	1.4701	1.2840	1.1492	1.0297	0.9211	0.8546	0.7979
	0.0727		0.0444	0.0405	0.0245	0.0128	0.0026	-0.0058	-0.0125	-0.0174
149.6	1.8178		1.4862	1.4229	1.2591	1.1338	1.0174	0.9144	0.8559	0.8058
	0.0705		0.0419	0.0365	0.0273	0.0115	0.0015	-0.0074	-0.0124	-0.0168
159.8	1.7878		1.4821	1.4063	1.2430	1.1122	1.0129	0.9152	0.8571	0.8121
	0.0679		0.0416	0.0350	0.0210	0.0097	0.0011	-0.0072	-0.0123	-0.0162
169.5	1.7928		1.4542	1.4063	1.2356	1.1155	1.0159	0.9222	0.8596	0.8209
	0.0684		0.0392	0.0350	0.0203	0.0100	0.0014	-0.0057	-0.0121	-0.0154
179.3	1.7928		1.4556	1.4121	1.2446	1.1108	1.0172	0.9249	0.8589	0.8201
	0.0684		0.0393	0.0355	0.0211	0.0096	0.0015	-0.0055	-0.0122	-0.0155

101

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 5 DEGREES

BETA DEG	STATION NUMBER 11	12	13	14	15	16	17	18	19	20
0.6	1.3164	1.1545	1.0940	1.1135	1.0912	1.0925	1.1005	1.0835	1.0813	1.0709
	0.0273	0.0133	0.0081	0.0098	0.0079	0.0030	0.0097	0.0072	0.0070	0.0061
31.2	1.2378	1.0868	1.0325	1.0519	1.0265	1.0274	1.0350	1.0149	1.0145	1.0155
	0.0205	0.0075	0.0028	0.0045	0.0023	0.0024	0.0040	0.0013	0.0013	0.0013
61.5	1.0714	0.9556	0.8851	0.9042	0.8769	0.8751	0.8751	0.8631	0.8579	0.8692
	0.0062	-0.0038	-0.0099	-0.0083	-0.0106	-0.0108	-0.0105	-0.0118	-0.0123	-0.0113
91.3	0.8921	0.8416	0.7394	0.7506	0.7310	0.7286	0.7303	0.7258	0.7163	0.7075
	-0.0093	-0.0137	-0.0225	-0.0215	-0.0232	-0.0234	-0.0233	-0.0236	-0.0245	-0.0252
88.4	0.8647	0.7884	0.7050	0.7025	0.6918	0.6830	0.6655	0.6591	0.6338	0.6311
	-0.0117	-0.0182	-0.0254	-0.0257	-0.0266	-0.0273	-0.0287	-0.0294	-0.0316	-0.0318
99.1	0.8079	0.7603	0.6605	0.6566	0.6421	0.6376	0.6266	0.6203	0.5930	0.5980
	-0.0166	-0.0207	-0.0293	-0.0296	-0.0309	-0.0312	-0.0322	-0.0327	-0.0351	-0.0347
109.1	0.7566	0.7320	0.6253	0.6213	0.6142	0.6093	0.6025	0.6052	0.5913	0.6328
	-0.0210	-0.0231	-0.0323	-0.0327	-0.0333	-0.0337	-0.0343	-0.0341	-0.0352	-0.0317
119.2	0.7230	0.7176	0.6102	0.6127	0.6093	0.6153	0.6306	0.5506	0.6620	0.7459
	-0.0239	-0.0244	-0.0336	-0.0334	-0.0337	-0.0331	-0.0319	-0.0301	-0.0292	-0.0219
129.4	0.7153	0.7241	0.6182	0.6331	0.6426	0.5600	0.5913	0.7135	0.7295	0.8218
	-0.0246	-0.0238	-0.0329	-0.0316	-0.0308	-0.0293	-0.0266	-0.0243	-0.0233	-0.0154
139.6	0.7230	0.7496	0.6411	0.6648	0.6786	0.7050	0.7361	0.7596	0.7666	0.8453
	-0.0239	-0.0216	-0.0309	-0.0289	-0.0277	-0.0254	-0.0228	-0.0207	-0.0201	-0.0133
149.6	0.7365	0.7734	0.6660	0.6915	0.7103	0.7336	0.7639	0.7849	0.7839	0.8519
	-0.0227	-0.0195	-0.0288	-0.0266	-0.0250	-0.0230	-0.0204	-0.0195	-0.0186	-0.0128
159.8	0.7548	0.7903	0.6838	0.7168	0.7341	0.7554	0.7896	0.8044	0.8016	0.8562
	-0.0211	-0.0181	-0.0273	-0.0244	-0.0229	-0.0211	-0.0181	-0.0159	-0.0171	-0.0124
169.5	0.7631	0.8031	0.6970	0.7311	0.7516	0.7758	0.8135	0.8271	0.8266	0.8569
	-0.0204	-0.0170	-0.0261	-0.0232	-0.0216	-0.0193	-0.0163	-0.0149	-0.0150	-0.0123
179.3	0.7631	0.8019	0.6990	0.7373	0.7583	0.7853	0.8269	0.8441	0.8498	0.8716
	-0.0204	-0.0171	-0.0260	-0.0227	-0.0208	-0.0133	-0.0149	-0.0134	-0.0130	-0.0111

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 10 DEGREES

BETA	STATION NUMBER									
DEG	1	2	3	4	5	6	7	8	9	10
0.4	4.8352	4.5520	4.0105	4.0571	3.5956	3.2857	2.9841	2.5559	2.4476	2.2377
	0.3308	0.3063	0.2596	0.2637	0.2238	0.1971	0.1711	0.1428	0.1248	0.1067
30.1		3.9288	3.7472	3.6373	3.2357	2.9558	2.6775	2.3693	2.1744	1.9728
		0.2576	0.2369	0.2274	0.1928	0.1687	0.1447	0.1131	0.1013	0.0839
60.5			2.8208	2.7442	2.3810	2.1527	1.9478	1.7128	1.5542	1.3353
			0.1570	0.1504	0.1191	0.0934	0.0617	0.0615	0.0478	0.0332
90.6			1.8245	1.7562	1.5307	1.3174	1.2060	1.0290	0.9271	0.8036
			0.0711	0.0652	0.0458	0.0274	0.0178	0.0025	-0.0063	-0.0169
88.5	2.2310	1.9494	1.8378	1.7895	1.5567	1.3571	1.2186	1.0595	0.9650	0.8686
	0.1062	0.0819	0.0723	0.0681	0.0480	0.0308	0.0189	0.0051	-0.0030	-0.0113
93.7	2.0294	1.7528	1.6552	1.6272	1.3721	1.2575	1.0915	0.9547	0.8722	0.7701
	0.0888	0.0649	0.0565	0.0541	0.0321	0.0222	0.0079	-0.0039	-0.0110	-0.0198
98.9	1.8961	1.6630	1.5645	1.5181	1.2876	1.1452	1.0149	0.8796	0.7979	0.7108
	0.0773	0.0572	0.0487	0.0447	0.0248	0.0125	0.0013	-0.0104	-0.0174	-0.0249
104.0			1.4093	1.3969	1.1715	1.0517	0.9091	0.7956	0.7190	0.6296
			0.0353	0.0342	0.0148	0.0045	-0.0078	-0.0176	-0.0242	-0.0319
109.0	1.5862	1.4286	1.3249	1.2763	1.0637	0.9552	0.8319	0.7183	0.6486	0.5695
	0.0506	0.0370	0.0280	0.0238	0.0055	-0.0038	-0.0145	-0.0243	-0.0303	-0.0371
114.1			1.2425	1.1672	0.9352	0.8811	0.7569	0.6570	0.5860	0.5095
			0.0209	0.0144	-0.0013	-0.0103	-0.0210	-0.0296	-0.0357	-0.0423
119.1	1.3438	1.2546	1.1313	1.1015	0.9064	0.8116	0.6950	0.5998	0.5313	0.4580
	0.0296	0.0220	0.0113	0.0088	-0.0081	-0.0152	-0.0263	-0.0346	-0.0404	-0.0467
124.1	1.2263	1.1713	1.0910	1.0134	0.8747	0.7614	0.6556	0.5628	0.4919	0.4220
	0.0195	0.0148	0.0078	0.0012	-0.0108	-0.0206	-0.0297	-0.0377	-0.0438	-0.0498
129.2	1.1963	1.1515	1.0629	0.9837	0.8453	0.7251	0.6310	0.5437	0.4777	0.4077
	0.0169	0.0131	0.0054	-0.0014	-0.0133	-0.0237	-0.0318	-0.0394	-0.0450	-0.0511
134.2	1.1313	1.1045	1.0878	0.9512	0.8423	0.7221	0.6300	0.5480	0.4904	0.4427
	0.0113	0.0090	0.0076	-0.0042	-0.0136	-0.0240	-0.0319	-0.0390	-0.0440	-0.0481
139.1	1.1330	1.0853	1.0019	0.9780	0.8439	0.7236	0.6551	0.5775	0.5417	0.5025
	0.0115	0.0074	0.0002	-0.0019	-0.0135	-0.0238	-0.0297	-0.0354	-0.0395	-0.0429
144.3	1.1375	1.0664	1.0297	0.9547	0.8614	0.7473	0.6920	0.5236	0.5905	0.5587
	0.0119	0.0057	.0026	-0.0039	-0.0120	-0.0218	-0.0256	-0.0325	-0.0353	-0.0381
149.2		1.0832	1.0000	0.9809	0.8696	0.7659	0.7253	0.5593	0.6301	0.5930
		0.0072	0.0000	-0.0016	-0.0112	-0.0202	-0.0237	-0.0294	-0.0319	-0.0351
154.5	1.161[illegible]	1.0627	1.0010	0.9809	0.9047	0.7948	0.7578	0.5898	0.6538	0.6160
	0.0139	0.0054	0.0001	-0.0016	-0.0082	-0.0177	-0.0209	-0.0258	-0.0299	-0.0331
159.4		1.0863	1.0030	0.9947	0.8996	0.8123	0.7769	0.7073	0.6763	0.6373
		0.0074	0.0003	-0.0005	-0.0087	-0.0152	-0.0192	-0.0252	-0.0279	-0.0313
164.5	1.1763	1.0697	1.0005	1.0109	0.9242	0.8321	0.7893	0.7251	0.6881	0.6485
	0.0152	0.0060	0.0000	0.0009	-0.0065	-0.0145	-0.0182	-0.0237	-0.0269	-0.0303
169.5	1.2213	1.1055	1.0114	1.0214	0.8977	0.8544	0.7898	0.7376	0.7031	0.6616
	0.0191	0.0091	0.0010	0.0018	-0.0088	-0.0125	-0.0181	-0.0226	-0.0256	-0.0292
174.5	1.1913	1.1057	1.0530	1.0412	0.9252	0.8756	0.8018	0.7453	0.7118	0.6745
	0.0165	0.0091	0.0046	0.0036	-0.0064	-0.0106	-0.0171	-0.0220	-0.0249	-0.0281
179.3		1.1045	1.0585	1.0397	0.9516	0.8756	0.8049	0.7539	0.7120	0.6810
		0.0090	0.0050	0.0034	-0.0042	-0.0107	-0.0168	-0.0215	-0.0248	-0.0275

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 10 DEGREES

BETA	STATION NUMBER									
DEG	11	12	13	14	15	16	17	18	19	20
0.4	1.9894	1.6912	1.6597	1.6912	1.6354	1.6235	1.6255	1.5257	1.5947	1.5699
	0.0853	0.0596	0.0569	0.0596	0.0548	0.0538	0.0543	0.0523	0.0513	0.0491
30.1	1.7695	1.4954	1.4734	1.4927	1.4367	1.4156	1.4252	1.3953	1.3916	1.3713
	0.0664	0.0427	0.0408	0.0425	0.0377	0.0358	0.0367	0.0341	0.0338	0.0320
60.5	1.2495	1.0712	1.0245	1.0297	0.9869	0.9557	0.9556	0.9234	0.9196	0.9077
	0.0215	0.0061	0.0021	0.0026	-0.0011	-0.0038	-0.0038	-0.0056	-0.0069	-0.0080
90.6	0.7175	0.6636	0.5760	0.5662	0.5298	0.5054	0.4939	0.4657	0.4622	0.4505
	-0.0244	-0.0290	-0.0366	-0.0374	-0.0405	-0.0427	-0.0437	-0.0450	-0.0464	-0.0474
88.5	0.7423	0.6668	0.5848	0.5630	0.5475	0.5232	0.5045	0.4795	0.4672	0.4552
	-0.0222	-0.0287	-0.0358	-0.0377	-0.0390	-0.0437	-0.0427	-0.0450	-0.0459	-0.0470
93.7	0.6636	0.6155	0.5125	0.4944	0.4742	0.4624	0.4299	0.4125	0.3994	0.3911
	-0.0290	-0.0332	-0.0420	-0.0436	-0.0453	-0.0454	-0.0492	-0.0537	-0.0518	-0.0525
99.9	0.6057	0.5023	0.4637	0.4429	0.4274	0.4120	0.3859	0.3634	0.3544	0.3697
	-0.0340	-0.0360	-0.0463	-0.0480	-0.0494	-0.0537	-0.0530	-0.0569	-0.0557	-0.0544
104.0	0.5422	0.5490	0.4075	0.3887	0.3692	0.3559	0.3291	0.3231	0.3374	0.4240
	-0.0395	-0.0369	-0.0511	-0.0527	-0.05[illegible]	-0.0555	-0.0579	-0.0594	-0.0571	-0.0497
109.0	0.4814	0.5070	0.3604	0.3389	0.3194	0.3124	0.3297	0.3612	0.4050	0.4992
	-0.0447	-0.0425	-0.0552	-0.0570	-0.0587	-0.0593	-0.0579	-0.0551	-0.0513	-0.0432
114.1	0.4337		0.3212	0.3041	0.3101	0.3436	0.3789	0.4135	0.4475	0.5370
	-0.0488		-0.0585	-0.0600	-0.0595	-0.0559	-0.0535	-0.0538	-0.0476	-0.0404
119.1	0.3826		0.3066	0.3357	0.3584	0.3839	0.4165	0.4445	0.4680	0.5368
	-0.0532		-0.0598	-0.0573	-0.0553	-0.0531	-0.0503	-0.0479	-0.0459	-0.0399
124.1	0.3521		0.3367	0.3639	0.3924	0.4154	0.4370	0.4552	0.4775	0.5322
	-0.0559		-0.0572	-0.0549	-0.0524	-0.0504	-0.0485	-0.0470	-0.0451	-0.0403
129.2	0.3586		0.3671	0.3901	0.4097	0.4287	0.4449	0.4525	0.4887	0.5380
	-0.0553		-0.0546	-0.0526	-0.0509	-0.0493	-0.0479	-0.0454	-0.0441	-0.0398
134.2	0.4050		0.3954	0.4149	0.4192	0.4325	0.4594	0.4639	0.4877	0.5307
	-0.0513		-0.0521	-0.0505	-0.0501	-0.0489	-0.0455	-0.0452	-0.0442	-0.0405
139.1	0.4625		0.4080	0.4147	0.4229	0.4279	0.4449	0.4439	0.4609	0.4755
	-0.0464		-0.0511	-0.0505	-0.0498	-0.0493	-0.0479	-0.0490	-0.0465	-0.0452
144.3	0.5113		0.4192	0.4105	0.4145	0.4177	0.4350	0.4235	0.4319	0.4210
	-0.0421		-0.0501	-0.0508	-0.0505	-0.0502	-0.0489	-0.0497	-0.0490	-0.0499
149.2	0.5395		0.4430	0.4139	0.3902	0.3856	0.3944	0.3921	0.3802	0.4160
	-0.0397		-0.0480	-0.0505	-0.0526	-0.0527	-0.0521	-0.0533	-0.0535	-0.0504
154.5	0.5623		0.4699	0.4434	0.3932	0.3637	0.3532	0.3357	0.3382	0.3701
	-0.0377		-0.0457	-0.0480	-0.0523	-0.0549	-0.0551	-0.0572	-0.0571	-0.0541
159.4	0.5803		0.4922	0.4765	0.4204	0.3787	0.3347	0.2957	0.2896	0.3329
	-0.0362		-0.0438	-0.0451	-0.0500	-0.0536	-0.0570	-0.0607	-0.0613	-0.0575
164.5	0.5963		0.5148	0.5082	0.4745	0.4459	0.4202	0.3802	0.3901	0.4229
	-0.0348		-0.0418	-0.0424	-0.0453	-0.0477	-0.0500	-0.0535	-0.0526	-0.0498
169.5	0.6098		0.5450	0.5625	0.5418	0.5420	0.5485	0.5338	0.5600	0.5753
	-0.0336		-0.0392	-0.0377	-0.0395	-0.0395	-0.0389	-0.0397	-0.0379	-0.0366
174.6	0.6346		0.5868	0.6341	0.6380	0.5770	0.7123	0.7193	0.7098	0.6830
	-0.0315		-0.0356	-0.0316	-0.0312	-0.0279	-0.0244	-0.0242	-0.0250	-0.0273
179.3	0.6458		0.6100	0.6593	0.6880	0.7434	0.7853	0.7938	0.7618	0.7076
	-0.0305		-0.0336	-0.0294	-0.0269	-0.0224	-0.0185	-0.0140	-0.0205	-0.0252

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07 ANGLE OF ATTACK = 15 DEGREES

BETA	STATION NUMBER									
DEG	1	2	3	4	5	6	7	8	9	10
0.2	6.5381	6.0399	5.7067	5.7450	5.1502	4.6586	4.3171	3.9772	3.6106	3.1407
	0.4776	0.4346	0.4059	0.4092	0.3579	0.3155	0.2861	0.2481	0.2251	0.2019
30.0	5.7750		5.0019	5.0269	4.4487	4.0471	3.7406	3.3357	3.0858	2.8475
	0.4118		0.3451	0.3473	0.2974	0.2628	0.2363	0.2014	0.1799	0.1585
60.3	3.9238		3.3374	3.2107	2.8775	2.6276	2.3826	2.0964	1.9261	1.7195
	0.2522		0.2016	0.1907	0.1619	0.1434	0.1192	0.0944	0.0799	0.0620
90.6	2.0511		1.7245	1.6745	1.4279	1.2840	1.1327	0.9770	0.8706	0.7478
	0.0906		0.0625	0.0582	0.0369	0.0245	0.0114	-0.0020	-0.0112	-0.0218
88.6			1.8028	1.7745	1.5291	1.3261	1.1906	1.0397	0.9539	0.8654
			0.0692	0.0668	0.0456	0.0280	0.0164	0.0034	-0.0040	-0.0116
93.9	1.8411		1.6014	1.5594	1.3334	1.1605	1.0149	0.8912	0.8081	0.7266
	0.0725		0.0519	0.0482	0.0288	0.0138	0.0013	-0.0094	-0.0165	-0.0236
98.9	1.6812	1.4464	1.3863	1.3246	1.1563	0.9990	0.8847	0.7544	0.6993	0.6295
	0.0587	0.0385	0.0333	0.0280	0.0135	-0.0002	-0.0099	-0.0213	-0.0259	-0.0320
103.6	1.4604	1.2906	1.2303	1.1463	1.0034	0.8729	0.7716	0.6646	0.6040	0.5377
	0.0397	0.0251	0.0199	0.0126	0.0003	-0.0110	-0.0197	-0.0289	-0.0342	-0.0399
109.1	1.2830	1.1980	1.0585	0.8919	0.8696	0.7441	0.6550	0.5612	0.5064	0.4505
	0.0244	0.0171	0.0050	-0.0093	-0.0112	-0.0221	-0.0298	-0.0378	-0.0426	-0.0474
113.8	1.1030	1.0372	0.9389	0.8231	0.7481	0.6565	0.5509	0.4770	0.4260	0.3739
	0.0089	0.0032	-0.0053	-0.0153	-0.0217	-0.0298	-0.0387	-0.0451	-0.0495	-0.0540
119.1	0.9790	0.9517	0.8248	0.6348	0.6233	0.5470	0.4659	0.3974	0.3579	0.3167
	-0.0018	-0.0042	-0.0151	-0.0315	-0.0325	-0.0391	-0.0460	-0.0520	-0.0554	-0.0589
124.0	0.8254	0.8069	0.7355	0.6821	0.5392	0.4580	0.3911	0.3439	0.3211	0.3129
	-0.0151	-0.0167	-0.0228	-0.0274	-0.0397	-0.0457	-0.0525	-0.0556	-0.0586	-0.0593
129.0	0.7981	0.7851	0.6210	0.6132	0.4799	0.4150	0.3599	0.3521	0.3647	0.3546
	-0.0174	-0.0185	-0.0327	-0.0334	-0.0449	-0.0504	-0.0552	-0.0559	-0.0548	-0.0557
134.1	0.7348	0.6761	0.5902	0.6065	0.4859	0.4147	0.4147	0.3946	0.3721	0.3549
	-0.0229	-0.0279	-0.0353	-0.0339	-0.0443	-0.0505	-0.0505	-0.0531	-0.0542	-0.0556
139.0	0.7614	0.7008	0.5585	0.5628	0.5049	0.4794	0.4330	0.3951	0.3777	0.3592
	-0.0206	-0.0258	-0.0381	-0.0377	-0.0427	-0.0450	-0.0489	-0.0522	-0.0537	-0.0553
144.3	0.7664	0.8298	0.6490	0.5665	0.5687	0.4810	0.4457	0.3972	0.3724	0.3612
	-0.0201	-0.0147	-0.0303	-0.0374	-0.0372	-0.0448	-0.0477	-0.0520	-0.0541	-0.0551
149.2	0.7948	0.7631	0.6485	0.5882	0.5405	0.5024	0.4447	0.4092	0.3817	0.3609
	-0.0177	-0.0204	-0.0303	-0.0355	-0.0396	-0.0429	-0.0479	-0.0509	-0.0533	-0.0551
153.9	0.7964	0.7841	0.6786	0.5815	0.5687	0.4932	0.4524	0.4050	0.3654	0.3359
	-0.0176	-0.0186	-0.0277	-0.0361	-0.0372	-0.0437	-0.0472	-0.0513	-0.0547	-0.0573
159.6	0.7981	0.8101	0.7376	0.6560	0.5415	0.5037	0.4235	0.3781	0.3436	0.3179
	-0.0174	-0.0164	-0.0226	-0.0297	-0.0395	-0.0428	-0.0497	-0.0536	-0.0566	-0.0588
164.4	0.8281	0.8581	0.7663	0.7015	0.5687	0.4812	0.4072	0.3454	0.3137	0.2833
	-0.0148	-0.0122	-0.0202	-0.0257	-0.0372	-0.0447	-0.0511	-0.0564	-0.0592	-0.0618
169.2	0.8597	0.8604	0.7973	0.8048	0.6520	0.5920	0.4935	0.4299	0.3969	0.3641
	-0.0121	-0.0120	-0.0175	-0.0168	-0.0300	-0.0352	-0.0437	-0.0492	-0.0520	-0.0548
174.7		0.8343	0.8031		0.7328	0.7033	[illegible]	0.5473	0.5412	0.4819
		-0.0143	-0.0170		-0.0230	-0.0258	-0.0412	-0.0356	-0.0396	-0.0447
179.5	0.9181	0.8819	0.8532		0.7599	0.7215	0.5715	0.6132	0.5637	0.5175
	-0.0071	-0.0102	-0.0127		-0.0207	-0.0240	-0.0293	-0.0334	-0.0376	-0.0416

SURFACE STATIC PRESSURE RATIO AND PRESSURE COEFFICIENT

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 15 DEGREES

BETA	STATION NUMBER									
DEG	11	12	13	14	15	16	17	18	19	20
0.2	2.9825	2.4659	2.5309	2.5759	2.4776	2.4526	2.4759	2.4233	2.4260	2.3843
	0.1710	0.1264	0.1320	0.1359	0.1274	0.1253	0.1273	0.1233	0.1230	0.1194
30.0	2.5459	2.0877	2.1644	2.1944	2.0977	2.0677	2.0911	2.0427	2.0527	2.0111
	0.1333	0.0938	0.1004	0.1030	0.0947	0.0921	0.0941	0.0899	0.0908	0.0872
60.3	1.5542	1.3138	1.3020	1.3076	1.2466	1.2036	1.2108	1.1778	1.1772	1.1567
	0.0478	0.0271	0.0260	0.0265	0.0213	0.0181	0.0182	0.0153	0.0153	0.0135
90.6	0.6801		0.5490	0.5340	0.4887	0.4679	0.4609	0.4450	0.4310	0.4267
	-0.0276		-0.0389	-0.0402	-0.0441	-0.0459	-0.0465	-0.0479	-0.0491	-0.0494
88.6	0.7391		0.5798	0.5562	0.5437	0.5245	0.5009	0.4822	0.4754	0.4579
	-0.0225		-0.0362	-0.0381	-0.0394	-0.0410	-0.0430	-0.0447	-0.0452	-0.0468
93.9	0.6288		0.4872	0.4594	0.4494	0.4277	0.4092	0.3952	0.3847	0.3731
	-0.0320		-0.0442	-0.0466	-0.0475	-0.0494	-0.0509	-0.0522	-0.0531	-0.0541
98.9	0.5343		0.4077	0.3842	0.3717	0.3551	0.3326	0.3242	0.3151	0.3222
	-0.0402		-0.0511	-0.0531	-0.0542	-0.0555	-0.0576	-0.0583	-0.0591	-0.0585
103.6	0.4567		0.3466	0.3232	0.3114	0.2997	0.2869	0.2851	0.2932	0.3599
	-0.0469		-0.0564	-0.0584	-0.0594	-0.0604	-0.0615	-0.0616	-0.0610	-0.0552
109.1	0.3776		0.2821	0.2701	0.2683	0.2889	0.3116	0.3257	0.3394	0.3902
	-0.0537		-0.0619	-0.0629	-0.0631	-0.0613	-0.0594	-0.0581	-0.0570	-0.0526
113.8	0.3201		0.2813	0.2931	0.3121	0.3224	0.3346	0.3484	0.3522	0.4199
	-0.0586		-0.0620	-0.0610	-0.0593	-0.0584	-0.0574	-0.0552	-0.0559	-0.0500
119.1	0.2773		0.2999	0.3117	0.3241	0.3336	0.3434	0.3494	0.3586	0.4339
	-0.0623		-0.0604	-0.0594	-0.0583	-0.0575	-0.0555	-0.0551	-0.0553	-0.0488
124.0	0.3192		0.3107	0.3159	0.3286	0.3391	0.3432	0.3531	0.3574	
	-0.0587		-0.0594	-0.0590	-0.0579	-0.0571	-0.0566	-0.0553	-0.0554	
129.0	0.3321		0.3122	0.3289	0.3246	0.3387	0.3496	0.3539	0.3767	
	-0.0576		-0.0593	-0.0579	-0.0582	-0.0570	-0.0551	-0.0552	-0.0538	
134.1	0.3321		0.3062	0.3317	0.3334	0.3294	0.3549	0.3594		
	-0.0576		-0.0598	-0.0576	-0.0575	-0.0579	-0.0556	-0.0553		
139.0	0.3306		0.3041	0.3302	0.3334	0.3371	0.3477	0.3547		
	-0.0577		-0.0600	-0.0578	-0.0575	-0.0572	-0.0563	-0.0531		
144.3	0.3384		0.3116	0.3371	0.3351	0.3399	0.3464			
	-0.0571		-0.0594	-0.0572	-0.0573	-0.0570	-0.0564			
149.2	0.3382		0.2959	0.3216	0.3126	0.3331	0.3384	0.3551		
	-0.0571		-0.0607	-0.0585	-0.0593	-0.0575	-0.0571	-0.0548		
153.9	0.3089		0.2982	0.3169	0.3147	0.3336	0.3389	0.3502		
	-0.0596		-0.0605	-0.0589	-0.0591	-0.0575	-0.0570	-0.0550		
159.6	0.3021		0.2823	0.3069	0.3021	0.3229	0.3227	0.3341	0.3442	
	-0.0602		-0.0619	-0.0598	-0.0602	-0.0584	-0.0584	-0.0574	-0.0566	
164.4	0.2711		0.2641	0.2914	0.2962	0.3124	0.3279	0.3334	0.3426	
	-0.0629		-0.0635	-0.0611	-0.0607	-0.0593	-0.0580	-0.0571	-0.0567	
169.2	0.3344		0.2946	0.3054	0.3136	0.3282	0.3609	0.3456	0.3649	0.3742
	-0.0574		-0.0608	-0.0599	-0.0592	-0.0579	-0.0551	-0.0546	-0.0548	-0.0540
174.7	0.4242		0.3389	0.3392	0.3449	0.3551	0.3822	0.4009	0.3934	0.3931
	-0.0497		-0.0570	-0.0570	-0.0565	-0.0555	-0.0533	-0.0517	-0.0523	-0.0523
179.5	0.4469		0.3522	0.3524	0.3519	0.3609	0.3855	0.4002	0.4014	0.3980
	-0.0477		-0.0559	-0.0558	-0.0559	-0.0551	-0.0529	-0.0517	-0.0516	-0.0519

TABLE II

PITOT PRESSURE RATIO

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 0 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
179.2	0.5695	0.9484	0.9351	0.9494	0.9499	0.9308	0.9532	0.9441	0.9351
178.6	0.5628	0.9427	0.9427	0.9427	0.9441	0.9241	0.9484	0.9370	0.9284
178.9	0.5533	0.9408	0.9226	0.9408	0.9403	0.9217	0.9408	0.9351	0.9265
178.7	0.5800	0.9480	0.9303	0.9446	0.9470	0.9279	0.9480	0.9408	0.9312

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 5 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
1.1	0.9943	1.0287	0.9962	1.0096	1.0263	1.0206	1.0320	1.0148	1.0230
31.1	0.8987	0.9948	0.9690	0.9943	1.0019	1.0125	1.0129	0.9981	1.0058
60.9	0.7807	0.9293	0.9136	0.9456	0.9537	0.9542	0.9709	0.9680	0.9685
90.8	0.6192	0.8591	0.8519	0.8877	0.8987	0.8997	0.9274	0.9174	0.9183
88.4	0.5929	0.8232	0.8404	0.8667	0.8849	0.8930	0.9212	0.9179	0.9126
88.5	0.5953	0.8228	0.8309	0.8653	0.8844	0.8935	0.9202	0.9193	0.9145
93.2	0.5667	0.8123	0.8290	0.8586	0.8768	0.8834	0.9088	0.9078	0.9059
98.[illegible]	0.5380	0.8008	0.8175	0.8486	0.8658	0.8739	0.8978	0.8978	0.8973
103.3	0.5151	0.8017	0.8275	0.8457	0.8619	0.8705	0.8949	0.8921	0.8925
108.6	0.4936	0.8084	0.8223	0.8395	0.8576	0.8667	0.8892	0.8882	0.8911
113.3	0.4651	0.8223	0.8486	0.8510	0.8662	0.8701	0.8892	0.8887	0.8901
118.5	0.4235	0.8347	0.8610	0.8629	0.8701	0.8753	0.8892	0.8877	0.8949
123.2	0.3780	0.8467	0.8758	0.8744	0.8839	0.8868	0.8935	0.8964	0.8968
128.6	0.3151	0.8510	0.8796	0.8849	0.8916	0.8916	0.9030	0.9021	0.8978
133.5	0.2647	0.8471	0.8944	0.8949	0.8968	0.9007	0.9073	0.9059	0.8992
138.6	0.2217	0.8061	0.8911	0.8973	0.9021	0.9116	0.9116	0.9050	0.9064
143.7	0.1975	0.7353	0.9050	0.9021	0.9126	0.9159	0.9140	0.9107	0.9112
148.7	0.1867	0.6594	0.9097	0.9016	0.9155	0.9198	0.9131	0.9164	0.9155
153.3	0.1974	0.6192	0.9241	0.9140	0.9245	0.9260	0.9188	0.9241	0.9188
158.5	0.2182	0.5824	0.9126	0.9202	0.9437	0.9437	0.9322	0.9346	0.9341
163.6	0.2589	0.5805	0.9265	0.9207	0.9336	0.9355	0.9265	0.9298	0.9298
168.9	0.3063	0.5901	0.9317	0.9365	0.9465	0.9484	0.9351	0.9394	0.9374
173.9	0.3566	0.6106	0.9403	0.9417	0.9460	0.9470	0.9346	0.9379	0.9360
178.7	0.4106	0.6446	0.9265	0.9484	0.9513	0.9527	0.9374	0.9422	0.9389
179.0	0.4125	0.6517	0.9308	0.9441	0.9470	0.9475	0.9346	0.9374	0.9341

112

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 10 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
0.5	1.1744	1.2084	1.1826	1.1926	1.2098	1.2074	1.2088	1.1926	1.1964
1.4	1.1697	1.2055	1.1864	1.1854	1.2041	1.2021	1.2074	1.1878	1.1931
30.7	1.0985	1.1482	1.1333	1.1515	1.1601	1.1582	1.1859	1.1663	1.1701
60.7	0.8696	0.9637	0.9838	1.0244	1.0368	1.0416	1.0817	1.0660	1.0741
90.3	0.5390	0.7076	0.7707	0.8247	0.8505	0.8791	0.9164	0.9164	0.9394
98.7	0.5074	0.7033	0.7707	0.8213	0.8624	0.8935	0.9236	0.9384	0.9527
93.6	0.4375	0.6541	0.7358	0.7769	0.8213	0.8543	0.8863	0.9026	0.9179
98.9	0.3866	0.6168	0.6828	0.7458	0.7917	0.8261	0.8572	0.8777	0.8916
103.7	0.3809	0.5767	0.6555	0.7048	0.7525	0.7879	0.8232	0.8443	0.8600
109.1	0.3013	0.5433	0.5958	0.6637	0.7148	0.7535	0.7884	0.8127	0.8304
113.7	0.1283	0.6613	0.5719	0.6240	0.6775	0.7167	0.7544	0.7812	0.8003
118.8	0.1250	0.6197	0.6885	0.5872	0.6417	0.6842	0.7243	0.7525	0.7779
123.6	0.1809	0.4103	0.6985	0.7134	0.6369	0.6522	0.6985	0.7282	0.7535
128.8	0.2303	0.1977	0.6899	0.7248	0.7401	0.7841	0.6799	0.7129	0.7449
133.8	0.1928	0.2530	0.5667	0.7549	0.7726	0.7989	0.8242	0.8223	0.8323
139.0	0.2306	0.2710	0.2621	0.6962	0.7353	0.7745	0.8080	0.8189	0.8318
143.7	0.3221	0.2198	0.1881	0.6254	0.7048	0.7559	0.8013	0.8218	0.8338
148.5	0.3396	0.1750	0.1483	0.5079	0.6890	0.7616	0.8127	0.8352	0.8490
153.7	0.2425	0.1329	0.1495	0.4260	0.7067	0.7869	0.8409	0.8581	0.8677
158.9	0.2813	0.1119	0.1204	0.4797	0.7640	0.8275	0.8744	0.8863	0.8956
163.7	0.3816	0.1699	0.2294	0.7100	0.8400	0.8734	0.9088	0.9126	0.9169
169.0	0.5117	0.5628	0.6933	0.8395	0.8782	0.9059	0.9322	0.9250	0.9351
173.5	0.5977	0.7148	0.8333	0.8686	0.9035	0.9126	0.9451	0.9403	0.9394
179.2	0.6532	0.7239	0.7769	0.8858	0.9341	0.9446	0.9714	0.9714	0.9709
178.9	0.6493	0.7191	0.7888	0.8830	0.9322	0.9422	0.9699	0.9675	0.9652

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 15 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
0.9	1.3823	1.4238	1.3923	1.4162	1.4458	1.4138	1.4358	1.4004	1.4076
30.8	1.2901	1.3469	1.3369	1.3612	1.3727	1.3665	1.4009	1.3799	1.3789
60.9	0.9757	1.0765	1.1060	1.1658	1.1806	1.2060	1.2394	1.2246	1.2466
91.1	0.5055	0.6909	0.7635	0.9424	0.8849	0.9212	0.9628	0.9824	1.0019
88.6	0.4998	0.7038	0.7768	0.8514	0.9073	0.9460	0.9881	1.0048	1.0263
93.6	0.4170	0.6398	0.7200	0.7931	0.8495	0.8916	0.9331	0.9556	0.9804
98.6	0.3456	0.5786	0.6618	0.7372	0.7960	0.8390	0.8825	0.9064	0.9317
103.6	0.3081	0.5232	0.6030	0.6785	0.7458	0.7826	0.8237	0.8519	0.8796
108.6	0.2793	0.4735	0.5509	0.6288	0.6861	0.7334	0.7759	0.8046	0.8318
113.8	0.1194	0.5117	0.4917	0.5676	0.6250	0.6727	0.7157	0.7478	0.7740
118.1	0.0985	0.5108	0.5074	0.5213	0.5791	0.6273	0.6699	0.7038	0.7296
123.5	0.1664	0.3514	0.5375	0.5542	0.5165	0.5657	0.6082	0.6431	0.6704
128.2	0.2007	0.1039	0.5714	0.5753	0.5691	0.5179	0.5595	0.5949	0.6245
133.7	0.0881	0.1603	0.0860	0.3824	0.7177	0.6699	0.5925	0.5399	0.5695
138.4	0.2518	0.2563	0.1264	0.5456	0.6316	0.5662	0.5781	0.5992	0.6073
143.4	0.2038	0.3759	0.3885	0.1968	0.6144	0.6431	0.6207	0.5987	0.5863
148.2	0.1716	0.4718	0.4018	0.3152	0.2726	0.5342	0.5657	0.5925	0.6183
153.5	0.4656	0.3851	0.1726	0.1791	0.2021	0.2712	0.4424	0.4845	0.5227
158.7	0.4926	0.3257	0.1225	0.1146	0.1528	0.1592	0.2664	0.3818	0.4572
163.7	0.4902	0.3618	0.1583	0.1190	0.1203	0.1592	0.1779	0.2839	0.4176
168.8	0.5155	0.4528	0.2129	0.1685	0.1454	0.1497	0.1914	0.2645	0.6880
173.8	0.5332	0.4983	0.2538	0.2900	0.3068	0.3062	0.3373	0.5638	0.7989
178.8	0.5528	0.5337	0.2675	0.3396	0.4263	0.5509	0.6942	0.8089	0.8782

111

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 0 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
179.5	0.4649	0.9227	0.9005	0.9120	0.9336	0.9151	0.9265	0.9090	0.9097
179.5	0.4747	0.9273	0.8921	0.9151	0.9372	0.9212	0.9204	0.9120	0.9120
179.5	0.4656	0.9227	0.8761	0.9120	0.9342	0.9158	0.9212	0.9097	0.9105

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 5 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
0.6	0.9678	1.0129	1.0114	1.0183	1.0091	1.0167	1.0290	1.0259	1.0290
31.2	0.8317	0.9900	0.9831	0.9986	0.9831	1.0037	1.0175	1.0106	0.9969
61.5	0.6932	0.9097	0.9097	0.9349	0.9288	0.9525	0.9709	0.9602	0.9793
[illegible]1.3	0.5467	0.8264	0.8533	0.8677	0.8715	0.8921	0.9090	0.9005	0.9189
88.6	0.4997	0.7876	0.8050	0.8478	0.8654	0.8860	0.9051	0.8975	0.9151
99.1	0.4329	0.7525	0.7767	0.8218	0.86[illegible]	0.8570	0.8807	0.8746	0.8929
109.1	0.3887	0.7397	0.7586	0.8012	0.8[illegible]	0.8340	0.8616	0.8562	0.8707
119.2	0.3319	0.7736	0.7759	0.8062	0.8187	0.8266	0.8516	0.8447	0.8524
129.4	0.2384	0.7912	0.8195	0.8302	0.8371	0.8386	0.8623	0.8501	0.8447
139.6	0.1616	0.7062	0.8356	0.8539	0.8585	0.8693	0.8707	0.8585	0.8493
149.6	0.1318	0.5321	0.8509	0.8686	0.8707	0.8730	0.8883	0.8766	0.8656
159.8	0.1566	0.4189	0.8616	0.8837	0.8921	0.8990	0.9051	0.8937	0.8845
169.5	0.2342	0.4398	0.8609	0.9036	0.9051	0.9151	0.9181	0.9028	0.8967
179.3	0.3362	0.5286	0.7767	0.9235	0.9128	0.9281	0.9235	0.9067	0.8998

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 10 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
0.4	1.2025	1.2530	1.2461	1.2614	1.2491	1.2569	1.2614	1.2606	1.2736
30.1	1.1146	1.1857	1.1842	1.2056	[illegible]	1.2140	1.2285	1.2285	1.2147
60.5	0.8402	0.9793	0.9877	1.0466	1.0634	1.0909	1.1047	1.1070	1.1307
90.6	0.4679	0.6958	0.7462	0.8203	0.8593	0.8883	0.9151	0.9365	0.9556
88.5	0.4345	0.7026	0.7489	0.8310	0.8692	0.9044	0.9411	0.9579	0.9716
93.7	0.3685	0.6490	0.7149	0.7659	0.8272	0.8623	0.9028	0.9143	0.9342
98.9	0.3209	0.6050	0.6649	0.7454	0.7882	0.8287	0.8661	0.8822	0.9044
104.0	0.2904	0.5562	0.6275	0.6989	0.7444	0.7882	0.8226	0.8424	0.8677
109.0	0.2611	0.5076	0.5776	0.6533	0.7015	0.7468	0.7813	0.8058	0.8317
114.1	0.1374	0.5537	0.5393	0.6121	0.6629	0.7055	0.7437	0.7683	0.7973
119.1	0.0781	0.5535	0.5791	0.5643	0.6187	0.6641	0.6999	0.7316	0.7596
124.1	0.1041	0.4230	0.5974	0.5800	0.5831	0.6292	0.6695	0.6993	0.7305
129.2	0.1570	0.2236	0.5983	0.6315	0.6382	0.5925	0.6352	0.6709	0.7013
134.2	0.1800	0.1336	0.5566	0.6410	0.6487	0.6675	0.6357	0.6510	0.6853
139.1	0.1483	0.2243	0.2936	0.6387	0.6986	0.7243	0.7417	0.7564	0.7612
144.3	0.1230	0.2156	0.1476	0.5913	0.6573	0.6982	0.7273	0.7434	0.7636
149.2	0.2037	0.1564	0.1271	0.3780	0.6169	0.6850	0.7300	0.7595	0.7790
154.5	0.2569	0.1074	0.1151	0.2416	0.5850	0.6904	0.7554	0.7843	0.8019
159.4	0.2041	0.0830	0.0953	0.1828	0.6299	0.7460	0.7981	0.8172	0.8287
164.5	0.2693	0.0983	0.1008	0.2680	0.7294	0.8027	0.8348	0.8531	0.8669
169.5	0.3786	0.3140	0.3080	0.6035	0.8012	0.8440	0.8715	0.8822	0.8868
174.6	0.4413	0.5764	0.7003	0.8004	0.8325	0.8730	0.8921	0.9013	0.9151
179.3	0.4737	0.5219	0.5759	0.6740	0.8371	0.8967	0.9342	0.9414	0.9357

PITOT PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 15 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB								
DEG	0.0667	0.2000	0.3333	0.4667	0.6000	0.7333	0.8667	1.0000	1.1333
0.2	1.4770	1.5456	1.5205	1.5462	1.5236	1.5688	1.5542	1.5366	1.5519
30.0	1.3676	1.4487	1.4227	1.4731	1.4594	1.4999	1.5182	1.4976	1.4777
60.3	1.1068	1.1284	1.1605	1.2615	1.2698	1.2904	1.3279	1.3332	1.3554
90.6	0.6665	0.6975	0.7766	0.8656	0.9128	0.9602	1.0091	1.0282	1.0596
88.6	0.4533	0.7196	0.7996	0.8830	0.9441	0.9946	1.0366	1.0680	1.0924
93.9	0.3628	0.6454	0.7216	0.8111	0.8761	0.9265	0.9724	1.0060	1.0282
98.9	0.2378	0.5813	0.6880	0.7507	0.8149	0.8661	0.9090	0.9479	0.9709
103.6	0.2457	0.5266	0.6126	0.6927	0.7580	0.8103	0.8570	0.8929	0.9143
109.1	0.2296	0.4585	0.5687	0.6273	0.6901	0.7419	0.7889	0.8256	0.8516
113.8	0.1328	0.4066	0.5000	0.5685	0.6311	0.6815	0.7297	0.7633	0.7928
119.1	0.0531	0.4463	0.4366	0.5070	0.5688	0.6175	0.6627	0.6995	0.7299
124.0	0.0893	0.2933	0.6839	0.4496	0.5117	0.5588	0.6064	0.6402	0.6707
129.0	0.0513	0.0774	0.5660	0.5156	0.4585	0.5033	0.5474	0.5844	0.6132
134.1	0.0336	0.0478	0.0698	0.4747	0.6869	0.5281	0.4960	0.5293	0.5605
139.0	0.0369	0.0966	0.0781	0.0583	0.4945	0.6774	0.6061	0.5126	0.5065
144.1	0.0360	0.1251	0.2205	0.0897	0.0790	0.4493	0.6428	0.6603	0.5659
149.2	0.0537	0.1988	0.3597	0.1185	0.0872	0.4506	0.6256	0.6362	0.5436
153.9	0.0791	0.4573	0.2670	0.1876	0.1005	0.3119	0.5111	0.5074	0.5047
158.6	0.3926	0.2039	0.1071	0.1151	0.1383	0.1288	0.3241	0.3824	0.4120
164.6	0.3926	0.2063	0.1173	0.0880	0.1091	0.1268	0.1698	0.2940	0.3394
169.2	0.4352	0.2780	0.1663	0.1038	0.1050	0.1195	0.1400	0.2042	0.6248
174.7	0.4900	0.4939	0.1987	0.1997	0.2012	0.1793	0.1757	0.2625	0.6620
179.5	0.4667	0.4478	0.2218	0.2676	0.3270	0.4196	0.5747	0.7326	0.8241

TABLE III

MACH NUMBER

TOTAL FLOW ANGLE

FLOW DIRECTION ANGLE

STATIC PRESSURE RATIO

MACH NUMBER, FLOW ANGLE, CROSSFLOW DIRECTION AND STATIC PRESSURE RATIO

FREE STREAM MACH NUMBER = 3.52   ANGLE OF ATTACK = 0 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB							
DEG	0.1667	0.3333	0.5000	0.6667	0.8333	1.0000	1.1667	1.3333
89.9		3.72 0.9 13. 0.8488		3.65 0.8 19. 0.8830		3.73 0.3 1. 0.8452		3.67 0.4 354. 0.8675
90.5	3.83 1.6 315. 0.7841		3.65 0.8 347. 0.8768		3.73 0.5 317. 0.8392		3.68 0.6 316. 0.8629	
90.3		3.71 0.9 18. 0.8459		3.65 0.8 21. 0.8754		3.72 0.5 1. 0.8432		3.66 0.6 0. 0.8641
90.4		3.72 0.9 16. 0.8458		3.62 0.7 0. 0.8950		3.74 0.3 3. 0.8378		3.42 0.4 360. 0.9267

[illegible]

[illegible] ANGLE OF ATTACK = 5 DEGREES

[illegible]	[illegible]							
[illegible]	0.[illegible]	0.9[illegible]	0.[illegible]	0.[illegible]	0.[illegible]	1.[illegible]	1.[illegible]	1.[illegible]
0.0		3.04 1.4 348. 0.9272		3.70 2.4 350. 1.00[illegible]		3.65 2.6 3. 0.99[illegible]		3.69 2.9 1. 1.0[illegible]
29.9		3.40 3.3 30. 0.9137		3.[illegible] 3.[illegible] 20. 0.[illegible]		3.[illegible] 3.7 22. 0.[illegible]		[illegible] [illegible] 2[illegible]. [illegible]
50.7		3.73 6.0 22. 0.88[illegible]		3.62 5.3 20. 0.[illegible]		3.70 5.2 10. 0.870[illegible]		3.62 5.[illegible] 10. 0.[illegible]
80.7		3.70 7.4 1. 0.7612		3.65 6.6 4. 0.[illegible]		3.76 6.1 2. 0.8[illegible]		3.65 5.9 [illegible] [illegible]
90.2	3.95 10.7 357. 0.6306		3.70 8.7 353. 0.7045		3.81 7.3 355. 0.7602		3.96 6.8 355. 0.8727	
90.5		3.86 9.5 3. 0.7065		3.60 8.1 350. 0.8130		3.81 7.1 1. 0.7063		3.60 7.0 1. 0.8[illegible]
95.3	3.96 10.7 352. 0.6243		3.72 8.8 350. 0.7726		3.82 7.4 352. 0.7600		3.64 6.8 353. 0.8082	
100.2		3.85 9.6 356. 0.6095		3.70 8.2 352. 0.7927		3.82 7.2 350. 0.7601		3.67 6.8 357. 0.8276
105.5	3.9[illegible] 10.6 34[illegible]. 0.6172		3.70 8.5 345. 0.7600		3.[illegible] 7.5 347. [illegible].7[illegible]		[illegible].60 6.6 340. 0.81[illegible]	
110.7		3.86 9.0 340. 0.7051		3.64 8.8 340. 0.7921		3.83 7.1 351. 0.7547		3.7[illegible] 6.8 353. 0.80[illegible]
115.0	4.00 9.2 332. 0.6376		3.74 7.8 337. 0.7814		3.84 6.8 342. 0.7417		3.7[illegible] 6.6 345. 0.80[illegible]	
120.5		3.80 8.6 345. 0.7305		3.60 7.6 342. 0.7995		3.82 6.8 347. 0.7571		3.75 6.5 349. 0.7876
125.5	3.90 9.0 320. 0.6457		3.67 7.2 334. 0.8111		3.81 6.6 339. 0.7676		3.71 6.0 341. 0.8097	
130.6		3.77 7.7 340. 0.7643		3.68 6.9 339. 0.8213		3.81 6.4 345. 0.770[illegible]		3.76 6.2 347. 0.7876
135.7	3.40 9.6 304. 0.6638		3.67 6.4 330. 0.8207		3.80 5.7 337. 0.7795		3.69 5.4 344. 0.8272	
140.6		3.76 7.0 333. 0.7896		3.67 6.2 335. 0.8426		3.79 5.8 342. 0.7887		3.76 5.7 345. 0.7964
145.9	2.75 8.4 294. 0.7386		3.64 5.6 323. 0.8470		3.80 5.0 335. 0.7800		3.69 4.9 339. 0.8313	
150.6		3.78 5.9 325. 0.7882		3.60 5.3 333. 0.8419		3.78 5.1 341. 0.7978		3.75 5.2 345. 0.8060
155.9	2.44 6.1 272. 0.7675		3.66 4.4 318. 0.8544		3.80 4.1 336. 0.7982		3.75 4.1 342. 0.8179	
160.5		3.78 4.6 314. 0.7953		3.63 4.6 3[illegible] 0.8745		3.78 4.4 344. 0.8081		3.75 4.6 347. 0.8149
165.9	2.51 4.0 237. 0.7855		3.45 3.0 317. 0.8723		3.78 3.3 341. 0.8152		3.69 3.6 344. 0.8505	
170.7		3.79 2.2 302. 0.5032		3.62 3.4 337. 0.8920		3.75 3.9 349. 0.8255		3.74 4.2 352. 0.8230
176.0	2.60 2.5 195. 0.8149		3.63 1.7 334. 0.8916		3.70 2.7 354. 0.8202		3.60 3.2 357. 0.8550	
1[illegible].7		3.60 0.6 336. 0.8306		3.62 2.9 353. 0.8960		3.76 3.6 359. 0.8246		3.76 4.0 350. 0.8276
180.8	2.87 2.5 179. 0.7974		3.62 1.5 3[illegible]. 0.8977		3.70 2.7 3. 0.8219		3.[illegible] 3.2 2. 0.8522	

B-31/32

NOLTR 72-198

MACH NUMBER, FLOW ANGLE, CROSSFLOW POSITION AND STATIC PRESSURE RATIO

FREE STREAM MACH NO. = [illegible]   ANGLE OF ATTACK = 10 DEGREES

PHI DEG	0.1667	0.3000	0.5000	0.6667	0.8330	1.0000	1.1667	1.3333
	DISTANCE FROM BODY SURFACE, IN-[illegible]							
0.0	3.37 1.0 302. 1.3003		3.30 3.7 309. 1.3097		3.43 5.0 0. 1.2539		3.40 5.9 2. 1.3002	
30.1	3.44 6.6 42. 1.1735		3.42 6.2 31. 1.2142		3.47 7.1 22. 1.1009		3.40 7.0 19. 1.1990	
60.1	3.63 12.0 24. 0.8817		3.40 10.0 26. 1.0834		3.58 9.9 16. 1.0408		3.50 9.2 17. 1.0611	
80.6	3.89 17.1 300. 0.5589		3.76 14.0 8. 0.7376		[illegible].96 12.9 0. 0.8353		3.67 11.7 6. 0.8723	
90.3		3.88 15.0 4. 0.6500		3.70 13.1 11. 0.7918		3.60 12.3 9. 0.9640		3.63 11.3 9. 0.8955
90.3	4.06 19.0 1. 0.4063		3.71 15.6 2. 0.7368		3.70 13.1 5. 0.8135		3.63 12.3 5. 0.8967	
90.0		3.90 16.8 7. 0.5900		3.72 14.6 6. 0.7706		3.70 12.7 9. 0.8467		3.62 11.9 9. 0.9105
95.7	4.23 20.0 356. 0.4236		3.86 16.3 359. 0.6518		3.76 13.8 2. 0.7627		3.65 12.8 2. 0.8527	
100.1		4.17 18.4 350. 0.4017		3.84 16.0 350. 0.6463		3.78 13.9 3. 0.7504		3.70 12.9 4. 0.8248
105.6	3.87 21.0 352. 0.4318		3.96 17.5 351. 0.5578		3.83 14.9 356. 0.6726		3.75 13.7 357. 0.7579	
110.2		4.30 19.8 350. 0.3963		3.96 17.1 351. 0.5400		3.86 14.9 354. 0.6648		3.78 13.7 357. 0.7391
115.5	3.71 22.4 351. 0.4840		4.09 18.9 343. 0.4404		3.91 15.9 344. 0.5886		3.83 14.4 350. 0.6762	
120.7		4.63 18.6 356. 0.5300		4.03 18.0 343. 0.4937		3.95 15.5 348. 0.5882		3.85 14.2 350. 0.6796
125.6	1.69 18.9 346. 0.5910		3.88 17.3 349. 0.5874		4.01 14.5 340. 0.5167		3.88 14.5 343. 0.6234	
130.2		4.41 17.6 347. 0.4479		3.85 15.3 349. 0.6666		15.0 348. 0.7043		3.80 13.8 344. 0.6639
135.6	2.01 7.7 122. 0.4901		3.84 17.0 344. 0.6212		3.88 14.3 345. 0.6649		3.83 13.0 344. 0.7095	
140.3		2.50 26.2 331. 0.3900		3.01 16.2 339. 0.6074		3.93 13.0 343. 0.6592		3.89 12.0 345. 0.6961
145.5	2.74 13.7 9[illegible]. 0.3770		4.42 17.7 321. 0.3985		3.90 13.7 335. 0.6383		3.85 12.2 339. 0.7071	
150.4		2.10 22.0 343. 0.3600		3.90 14.5 324. 0.6027		3.87 12.2 336. 0.6984		3.88 11.5 342. 0.7222
155.4	2.59 17.8 95. 0.2796		4.18 [illegible] 290. 0.3639		3.82 10.7 326. 0.7086		3.80 10.2 338. 0.7606	
160.1		2.14 10.2 242. 0.3157		3.77 9.[illegible] 31[illegible]. 0.7220		3.77 9.3 333. 0.7789		3.76 9.6 342. 0.7989
165.5	2.60 15.3 135. 0.5049		3.87 7.5 267. 0.6670		3.72 6.7 324. 0.8046		3.72 7.7 338. 0.8308	
170.3		3.89 4.9 211. 0.6610		3.63 4.9 315. 0.8520		3.70 6.7 340. 0.8456		3.71 7.8 347. 0.8519
175.3	3.34 4.5 171. 0.7258		3.62 1.6 270. 0.8371		3.68 4.0 342. 0.[illegible]541		3.69 6.0 349. 0.8619	
180.4		3.52 1.3 180. 0.7693		3.64 2.5 356. 0.8837		3.71 5.6 1. 0.8709		3.69 7.0 0. 0.8765

MACH NUMBER, FLOW ANGLE, CROSSFLOW VELOCITY, & STATIC PRESSURE RATIO

FREE STREAM MACH NUMBER = 5.52

BETA DEG	0.1667	0.3333	0.5000	0.6667	0.8333	1.0000	1.1667	1.3333
	DISTANCE FROM BODY SURFACE							
-0.3		2.92 3.2 350. 1.9370		3.08 5.2 357. 1.8397		3.13 6.5 348. 1.7761		3.17 7.3 358. 1.7762
29.9		3.09 7.8 39. 1.7057		3.14 7.8 31. 1.7009		3.17 8.9 23. 1.6811		3.19 9.2 21. 1.6667
60.1		3.29 14.0 30. 1.2652		3.27 12.5 31. 1.3739		3.22 12.4 26. 1.4579		3.26 11.9 24. 1.4726
89.9		3.71 20.9 9. 0.6997		3.61 18.4 16. 0.8644		3.48 17.4 14. 1.0054		3.47 16.5 15. 1.0562
90.6		4.01 21.6 10. 0.6034		3.68 19.2 10. 0.8370		3.59 17.5 13. 0.9588		3.52 16.6 14. 1.0516
95.6	4.67 25.8 359. 0.3326		3.84 21.2 3. 0.6659		3.68 18.9 7. 0.8274		3.57 17.9 8. 0.9451	
100.6		4.28 23.7 1. 0.4473		3.86 21.0 3. 0.6676		3.75 19.3 7. 0.7879		3.64 18.2 9. 0.8935
105.6	27.9 349.		4.09 23.0 355. 0.5006		3.85 20.6 0. 0.6634		3.70 19.4 3. 0.7862	
110.6		4.65 25.6 353. 0.3127		4.06 22.8 356. 0.5223		3.88 20.7 0. 0.6667		3.75 19.6 3. 0.7494
115.7	32.0 339.		4.36 24.9 347. 0.3640		4.03 22.0 353. 0.5186		3.84 20.7 356. 0.6371	
121.0		31.8 9.		4.12 24.2 347. 0.4173		3.95 21.8 352. 0.5340		3.88 20.7 355. 0.6197
125.7	25.2 29.		3.83 24.5 354. 0.4675		4.17 23.5 345. 0.6082		3.98 22.0 349. 0.5126	
130.8		32.9 3.		4.31 30.3 0. 0.3968		4.19 23.3 345. 0.4194		4.03 22.1 348. 0.4926
135.5	1.92 3.3 123. 0.4698		2.20 22.8 337. 0.3834		4.20 27.7 359. 0.4834		4.14 23.0 341. 0.4018	
141.0		1.99 12.0 6.		4.44 27.7 355. 0.3880		4.15 23.5 346. 0.4218		4.09 22.1 347. 0.4561
145.6	2.13 2.8 103.		1.97 32.0 340.		4.29 26.6 351. 0.4309		4.17 27.6 349. 0.4521	
151.1		2.71 13.0 11. 0.4076		36.4 324.		4.74 26.8 342. 0.2979		4.13 21.6 343. 0.4821
155.6	3.81 11.6 84. 0.3634		2.77 17.6 320. 0.2106		28.5 322.		4.29 22.0 335. 0.3575	
160.6		2.63 8.9 105.		3.28 20.4 320. 0.1725		4.38 25.5 323. 0.2248		4.13 14.6 329. 0.5087
165.6	3.93 9.2 120. 0.3531		2.60 8.2 136. 0.2061		2.98 19.6 327. 0.2276		3.87 13.4 331. 0.6023	
170.6		2.88 13.1 165. 0.3044		2.69 11.3 142. 0.2501		2.99 10.5 275. 0.4634		3.63 11.0 328. 0.8106
175.6	4.09 5.0 154. 0.3915		4.69 16.1 166. 0.1991		3.73 12.6 167. 0.3476		3.57 5.0 301. 0.8317	
180.5		3.95 17.4 182. 0.2301		4.72 10.9 177. 0.3007		3.89 [illegible] 169. 0.7197		3.65 6.1 [illegible] 0.9127

B-35/36

NOLTR 72-198

MACH NUMBER, FLOW ANGLE, CROSSFLOW DIRECTION AND STATIC PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 0 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB							
DEG	0.1667	0.3333	0.5000	0.6667	0.8333	1.0000	1.1667	1.3333
89.7		4.22		4.14		4.28		4.22
		1.2		1.1		1.0		0.8
		14.		3.		352.		353.
		0.8475		0.8895		0.8320		0.8603
89.6		4.25		4.16		4.32		4.28
		1.0		0.8		0.4		0.5
		11.		12.		351.		341.
		0.8365		0.8826		0.8190		0.8382
89.7		4.27		4.15		4.31		4.26
		1.0		0.9		0.6		0.6
		12.		9.		353.		346.
		0.8295		0.8845		0.8213		0.8445

MACH NUMBER, FLOW ANGLE, CROSSFLOW DIRECTION AND STATIC PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07 ANGLE OF ATTACK = 5 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB							
DEG	0.1667	0.3333	0.5000	0.6667	0.8333	1.0000	1.1667	1.3333
-0.5		4.08 1.0 342. 1.0096		4.04 1.8 353. 1.0347		4.17 2.3 357. 0.9805		4.08 1.9 356. 1.0674
29.3		4.14 2.7 38. 0.9627		4.08 2.7 27. 1.0005		4.18 3.0 18. 0.9628		4.11 2.6 21. 1.0305
59.7		4.17 5.2 23. 0.8814		4.14 4.5 22. 0.9198		4.21 4.2 15. 0.9101		4.17 3.9 17. 0.9543
90.2		4.29 6.8 1. 0.7654		4.20 5.8 6. 0.8310		4.22 5.3 0. 0.8453		4.24 4.8 3. 0.8587
89.8		4.31 9.5 4. 0.7154		4.22 8.0 1. 0.8076		4.34 7.1 2. 0.7920		4.21 6.4 3. 0.8650
99.6		4.37 9.6 356. 0.6690		4.23 8.4 354. 0.7783		4.36 7.4 356. 0.7682		4.25 6.8 357. 0.8274
109.4		4.37 9.5 349. 0.6585		4.25 8.4 348. 0.7508		4.39 7.5 351. 0.7342		4.27 6.9 354. 0.7961
119.6		4.31 8.7 345. 0.6997		4.25 7.9 343. 0.7487		4.40 7.3 345. 0.7218		4.28 6.8 349. 0.7752
129.5		4.32 8.0 341. 0.7333		4.25 7.4 340. 0.7712		4.41 7.0 341. 0.7257		4.25 6. 345. 0.7754
139.8		4.28 7.4 335. 0.7606		4.26 6.8 337. 0.7865		4.39 6.4 338. 0.741		4.28 6.2 342. 0.7717
150.0		4.30 6.4 326. 0.7681		4.26 6.0 334. 0.8019		4.40 5.5 338. 0.7552		4.29 5.6 342. 0.7827
160.0		4.40 4.6 308. 0.7342		4.22 4.9 332. 0.8304		4.37 4.8 339. 0.7781		4.27 5.0 343. 0.7982
170.1		4.03 2.6 287. 0.7942		4.19 3.9 336. 0.8580		4.35 4.0 344. 0.7932		4.25 4.3 349. 0.8126
180.8		3.89 0.0 338. 0.8265		4.20 3.2 351. 0.8561		4.36 3.5 353. 0.7896		4.25 4.1 354. 0.8161

MACH NUMBER, FLOW ANGLE, CROSSFLOW DIRECTION AND STATIC PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 10 DEGREES

BETA	DISTANCE FROM BODY SURFACE, (R-RB)/RB							
DEG	0.1667	0.3333	0.5000	0.6667	0.8333	1.0000	1.1667	1.3333
0.2		3.84 2.2 347. 1.4029		3.81 3.5 356. 1.4280		3.92 4.3 2. 1.3616		3.86 4.2 359. 1.4462
30.3		3.90 5.2 37. 1.2938		3.87 5.3 30. 1.3337		3.96 6.0 23. 1.2961		3.96 5.7 21. 1.3530
60.7		4.03 9.5 26. 1.0389		3.95 8.6 20. 1.1465		4.03 8.5 21. 1.1457		4.03 8.0 19. 1.1699
80.5		4.25 13.7 5. 0.7052		4.13 12.1 12. 0.8499		4.14 11.4 10. 0.9072		4.10 10.9 1. 0.9491
89.8		4.38 15.4 7. 0.6562		4.16 13.3 8. 0.8466		4.18 11.8 11. 0.8983		4.08 11.1 11. 0.9091
94.6	4.58 17.7 359. 0.4017		4.26 14.6 2. 0.7261		4.22 12.5 7. 0.8218		4.11 11.7 6. 0.9225	
99.6		4.53 16.8 360. 0.5339		4.25 14.6 1. 0.7311		4.26 12.8 5. 0.8012		4.15 12.1 5. 0.8904
104.6	4.76 19.1 349. 0.3735		4.40 15.8 354. 0.5914		4.29 13.7 359. 0.7213		4.22 12.5 0. 0.8097	
109.7		4.64 17.9 351. 0.4384		4.39 15.7 353. 0.6075		4.35 13.8 358. 0.6941		4.26 13.1 359. 0.7816
114.6	4.24 18.6 352. 0.4858		4.48 16.8 346. 0.4995		4.43 14.6 352. 0.6090		4.31 13.3 354. 0.7059	
120.0		4.40 16.8 356. 0.4972		4.45 16.4 349. 0.5232		4.44 14.5 350. 0.5944		4.38 13.6 352. 0.6861
124.9	2.84 20.9 320. 0.3888		4.29 15.9 349. 0.5406		4.47 15.1 344. 0.5347		4.39 13.8 346. 0.6248	
130.1		4.63 17.3 348. 0.4692		4.31 15.6 347. 0.5572		4.52 14.9 342. 0.5384		4.45 13.7 345. 0.6158
134.9	2.54 7.5 131. 0.5068		4.36 16.4 346. 0.5555		4.37 14.2 345. 0.5922		4.41 13.[illegible] 339. 0.5893	
140.0		3.53 24.7 325. 0.3476		4.41 15.4 342. 0.5987		4.52 13.5 344. 0.4111		4.47 12.7 345. 0.6368
145.1	3.14 12.8 95. 0.3704		4.86 16.2 328. 0.4159		4.53 13.6 339. 0.5815		4.47 12.1 340. 0.6393	
150.1		2.50 19.8 349. 0.3209		4.44 15.2 329. 0.5417		4.50 12.5 338. 0.6226		4.53 11.6 341. 0.6682
155.1	2.67 16.7 86. 0.2859		4.15 20.1 295. 0.2838		4.40 11.5 329. 0.6457		4.41 10.3 337. 0.6996	
160.2		2.27 8.0 300. 0.2655		4.30 10.5 314. 0.6574		4.36 9.7 334. 0.7315		4.41 9.9 340. 0.7323
165.2	2.54 17.4 113. 0.4193		4.22 10.0 291. 0.6566		4.30 7.3 325. 0.7558		4.27 8.0 339. 0.7989	
170.2		4.03 8.5 180. 0.4733		4.17 5.6 313. 0.8026		4.27 6.9 335. 0.8100		4.29 7.9 345. 0.8171
175.5	3.48 5.7 166. 0.6186		4.20 2.0 256. 0.7612		4.24 4.3 341. 0.8185		4.21 6.1 347. 0.8572	
180.6		3.62 1.7 175. 0.7172		4.15 2.1 356. 0.8411		4.30 5.3 360. 0.8381		4.25 6.9 358. 0.8505

MACH NUMBER, FLOW ANGLE, CROSSFLOW DIRECTION AND STATIC PRESSURE RATIO

FREE STREAM MACH NUMBER = 4.07   ANGLE OF ATTACK = 15 DEGREES

BETA DEG	0.1667	0.3333	0.5000	0.6667	0.8333	1.0000	1.1667	1.3333
	DISTANCE FROM BODY SURFACE, (R-RB)/RB							
0.2		3.50 9.0 352. 2.0640		3.52 6.8 357. 2.0569		3.60 6.0 1. 1.9630		3.58 6.2 359. 2.0530
30.5		3.60 7.0 30. 1.8502		3.57 7.2 30. 1.9141		3.66 8.2 23. 1.8537		3.71 8.2 22. 1.8624
60.8		3.75 12.6 29. 1.3059		3.60 11.3 31. 1.5512		3.71 11.4 25. 1.5965		3.69 11.0 25. 1.6640
90.6		4.15 18.6 8. 0.7726		4.00 18.3 16. 0.9816		3.91 15.6 14. 1.1220		3.94 14.9 15. 1.1762
89.6		4.32 19.9 10. 0.7101		4.00 17.5 12. 0.9783		3.95 16.0 15. 1.1096		3.88 15.4 16. 1.2238
94.9	4.79 25.2 359. 0.4278		4.13 19.3 4. 0.7889		4.02 17.1 9. 0.9657		3.95 16.1 11. 1.0861	
99.9		4.51 21.7 2. 0.5340		4.15 19.3 4. 0.7459		4.09 17.5 9. 0.9116		4.00 16.7 10. 1.0289
104.7	25.5 349.		4.34 21.2 357. 0.5918		4.17 18.7 2. 0.7771		4.07 17.5 5. 0.8998	
109.6		4.75 23.3 354. 0.3923		4.29 20.9 357. 0.6211		4.21 19.0 2. 0.7498		4.13 17.9 4. 0.8588
115.3	28.2 337.		4.56 22.7 348. 0.4163		4.31 20.1 359. 0.6066		4.19 18.9 358. 0.7251	
120.0		3.93 24.6 6. 0.4514		4.45 22.2 349. 0.4719		4.35 20.1 356. 0.5937		4.26 19.2 357. 0.6928
124.9	25.7 20.		4.08 25.1 349. 0.4389		4.39 21.2 347. 0.4873		4.35 19.9 351. 0.5737	
130.2		2.53 26.9 334. 0.4045		3.94 27.5 357. 0.4825		4.44 21.8 344. 0.4706		4.36 20.2 350. 0.5543
135.1	6.6 128.		4.73 25.3 325.		4.13 24.7 358. 0.5623		4.40 20.8 344. 0.4666	
140.2		1.71 21.8 41.		4.79 24.0 349. 0.4411		4.29 23.0 349. 0.4748		4.45 21.1 342. 0.4456
145.2	2.30 1.3 243. 0.4781		36.2 11.		4.53 26.8 353. 0.5113		4.28 22.7 347. 0.4788	
150.1		3.62 15.2 30.		3.97 19.9 319.		4.62 23.5 349. 0.4558		4.36 22.0 346. 0.4526
155.3	4.51 5.8 95. 0.3661		2.99 21.6 327. 0.3205		4.77 27.2 333. 0.2765		4.48 22.2 339. 0.3965	
160.0		2.55 5.8 92. 0.2240		2.31 27.4 316. 0.3424		4.57 24.0 351. 0.2771		4.46 20.3 333. 0.4080
165.6	3.96 9.3 113. 0.3198		2.67 6.9 160. 0.1960		2.85 23.3 322. 0.2692		2.72 14.2 327. 0.7656	
170.3		2.91 11.4 162. 0.2884		2.59 6.2 148. 0.2556		2.84 14.3 307. 0.3922		4.08 11.2 333. 0.7882
175.3	4.54 4.9 152. 0.3516		4.21 16.3 167. 0.2049		3.20 14.7 156. 0.3530		4.01 4.9 305. 0.7806	
180.5		3.50 9.3 183. 0.3034		11.1 181.		4.44 1.2 180. 0.6594		4.11 6.3 1. 1.4008