

AD-A123 824

VORTEX ASYMMETRY DEVELOPMENT ON A TANGENT DGIVE(U)

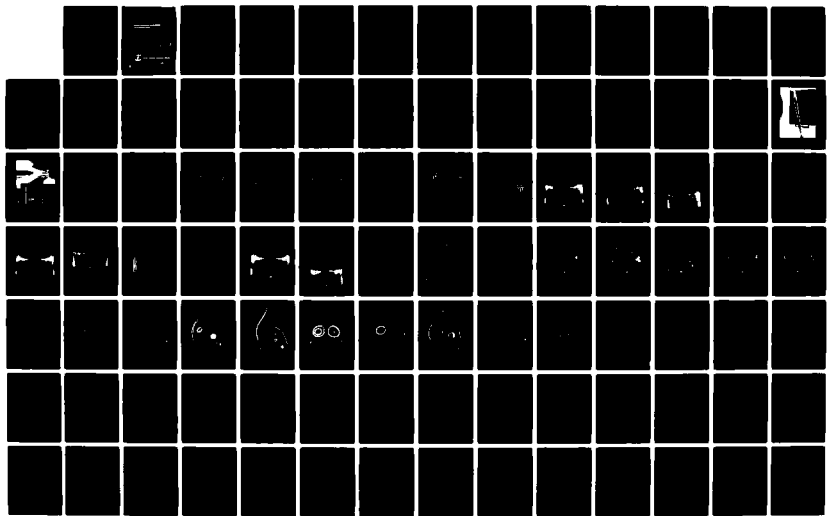
1/2

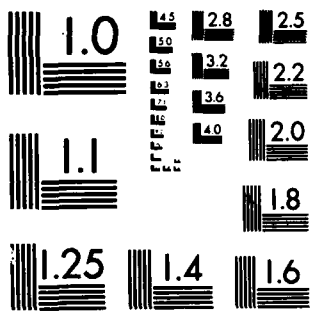
NAVAL SURFACE WEAPONS CENTER SILVER SPRING MD
W J YANTA ET AL. OCT 82 NSWC/TR-82-394 SBI-AD-F500 119

UNCLASSIFIED

F/G 20/4

NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

ADA 123924

**VORTEX ASYMMETRY DEVELOPMENT
ON A TANGENT OGIVE**

BY WILLIAM J. YANTA, ANDREW B. WARDLAW, JR.
DANIEL STERNKLAR

RESEARCH AND TECHNOLOGY DEPARTMENT

OCTOBER 1982

Approved for public release, distribution unlimited.

DTIC
S ELECTRIC D
JAN 28 1983
A

DTIC FILE COPY



NAVAL SURFACE WEAPONS CENTER

Dahlgren, Virginia 22448 • Silver Spring, Maryland 20910

88 01 28 056

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER NSWC TR 82-394	2. GOVT ACCESSION NO. AD-A123 924	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) VORTEX ASYMMETRY DEVELOPMENT ON A TANGENT OGIVE	5. TYPE OF REPORT & PERIOD COVERED	
	6. PERFORMING ORG. REPORT NUMBER	
7. AUTHOR(s) William J. Yanta Andrew B. Wardlaw, Jr. Daniel Sternklar	8. CONTRACT OR GRANT NUMBER(s)	
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Surface Weapons Center (Code K24) White Oak Silver Spring, MD 20910	10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS 61153N; WR02302; WR02302; R44AA	
11. CONTROLLING OFFICE NAME AND ADDRESS	12. REPORT DATE October 1982	
	13. NUMBER OF PAGES 137	
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)	15. SECURITY CLASS. (of this report) UNCLASSIFIED	
	15a. DECLASSIFICATION/DOWNGRADING SCHEDULE	
16. DISTRIBUTION STATEMENT (of this Report) Approved for public release, distribution unlimited.		
17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)		
18. SUPPLEMENTARY NOTES		
19. KEY WORDS (Continue on reverse side if necessary and identify by block number) High Angle of Attack Vortex Shedding Side Force Separated Flow		
20. ABSTRACT (Continue on reverse side if necessary and identify by block number) <p>A rigidly supported tangent ogive model has been tested in low turbulent, incompressible flow at an incidence of 45°. A constant streamwise Reynolds number of 1.5 (10⁵) was maintained which produced laminar boundary layer separation. The sharp nose tip was replaced in some tests with a 10% spherically blunted one. In the sharp nose experiments it was found necessary to stabilize the flow field by adding a small trip. Both unsteady surface pressures and flow field velocities in the crossflow plane were</p>		

DD FORM 1 JAN 73 1473

EDITION OF 1 NOV 65 IS OBSOLETE
S/N 0102-014-6601

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE (When Data Entered)

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

measured, the latter with a two component Laser Doppler Velocimeter. The flow field in the vicinity of the leeside of the model surface, including the primary separation region was examined in detail. Results indicate that the flow field generally features two secondary structures on each side of the model which contain vorticity of opposite sign. Asymmetry starts with the windward crossflow plane streamline from the primary saddle point, which detaches from the body. It appears to be completed when the crossflow plane focus of the shed vortex combines with the primary saddle point. The introduction of nose bluntness is not found to fundamentally change the leeward flow field, although it does significantly reduce the level of asymmetry and the side force magnitude.

UNCLASSIFIED

SECURITY CLASSIFICATION OF THIS PAGE(When Data Entered)

FOREWORD

A rigidly supported tangent ogive model has been tested in low turbulent, incompressible flow at an incidence of 45°. A constant streamwise Reynolds number of $1.5(10^5)$ was maintained which produced laminar boundary layer separation. The sharp nose tip was replaced in some tests with a 10% spherically blunted one. In the sharp nose experiments it was found necessary to stabilize the flow field by adding a small trip. Both unsteady surface pressures and flow field velocities in the crossflow plane were measured, the latter with a two component Laser Doppler Velocimeter. The flow field in the vicinity of the leeside of the model surface, including the primary separation region was examined in detail. Results indicate that the flow field generally features two secondary structures on each side of the model which contain vorticity of opposite sign. Asymmetry starts with the windward crossflow plane streamline from the primary saddle point, which detaches from the body. It appears to be completed when the crossflow plane focus of the shed vortex combines with the primary saddle point. The introduction of nose bluntness is not found to fundamentally change the leeward flow field, although it does significantly reduce the level of asymmetry and the side force magnitude.

Ira M. Blatstein

IRA M. BLATSTEIN
By direction

Accession For	
NSIS GRA&I	<input checked="" type="checkbox"/>
TAB	<input checked="" type="checkbox"/>
Announced	<input type="checkbox"/>
Classification	

BTIC
COPY
INSPECTED
2

A

CONTENTS

<u>Chapter</u>		<u>Page</u>
1	INTRODUCTION.	7
2	NOMENCLATURE	8
3	DESCRIPTION OF THE MODEL INSTRUMENTATION AND EXPERIMENT . .	9
4	INFLUENCE OF THE NOSE TRIP.	11
5	PRESSURE AND FLOW FIELD MEASUREMENTS.	12
6	DISCUSSION OF RESULTS	15
	6.1 TOPOLOGICAL NOTIONS.	15
	6.2 FLOW FIELD DEVELOPMENT ON THE SHARP TRIPPED MODEL. . .	16
	6.3 FLOW FIELD DEVELOPMENT ON THE SHARP UNTRIPPED MODEL. .	18
	6.4 FLOW FIELD DEVELOPMENT ON THE BLUNTED MODEL.	19
7	ASYMMETRY FORMATION	20
8	SUMMARY AND CONCLUSIONS	22
9	REFERENCES.	68
Appendix A	VELOCITY MEASUREMENTS	A-1
Appendix B	SURFACE PRESSURE MEASUREMENTS	B-1

ILLUSTRATIONS

<u>Figure</u>		<u>Page</u>
1	TANGENT OGIVE PRESSURE MODEL AND SUPPORT	24
2	SCHEMATIC OF THE LASER DOPPLER VELOCIMETER	25
3	PRESSURE MODEL MOUNTED IN THE WIND TUNNEL.	26
4	NOSE TRIP MADE FROM .45mm GRIT	27
5	$C_{y_{peak}}$ AS A FUNCTION OF MODEL ROLL ANGLE	28
6	AXIAL LOCATION OF $C_{y_{peak}}$ AND $C_y = 0$ AS A FUNCTION OF $C_{y_{peak}}$	29
7	CIRCUMFERENTIAL PRESSURE DISTRIBUTIONS ON THE SHARP, TRIPPED MODEL	30
8	CIRCUMFERENTIAL PRESSURE DISTRIBUTIONS ON THE BLUNT MODEL.	31
9	CIRCUMFERENTIAL PRESSURE DISTRIBUTION ON THE SHARP, UNTRIPPED MODEL.	32
10	MEASURED CROSSFLOW PLANE VELOCITY VECTORS ON THE SHARP, TRIPPED MODEL	34
11	MEASURED CROSSFLOW PLANE VELOCITY VECTORS ON THE SHARP, UNTRIPPED MODEL.	41
12	MEASURED CROSSFLOW PLANE VELOCITY VECTORS ON THE BLUNT MODEL	45
13	ISOVORTICITY CONTOURS AND AREAS OF HIGH VELOCITY FLUCTUATIONS ON THE SHARP TRIPPED MODEL	49
14	ISOVORTICITY CONTOURS AND AREAS OF HIGH VELOCITY FLUCTUATIONS ON THE SHARP, UNTRIPPED MODEL	53
15	ISOVORTICITY CONTOURS AND AREAS OF HIGH VELOCITY FLUCTUATIONS ON THE SHARP, UNTRIPPED MODEL	54
16	STREAMLINES ON THE TRIPPED MODEL	56
17	STREAMLINES ON THE SHARP UNTRIPPED MODEL	60
18	STREAMLINES ON THE BLUNT MODEL	61
19	TOPOLOGICAL SKETCH OF ASYMMETRIC FLOW DEVELOPMENT	63

TABLES

<u>Table</u>		<u>Page</u>
1	WIND TUNNEL TESTS IN WHICH LDV DATA WAS TAKEN	65
2	CIRCULATION CONTAINED IN REGIONS P, S1 AND S2	66
3	SIDE FORCE VARIATION	67

CHAPTER 1

INTRODUCTION

At incidences greater than a few degrees, the flow on the leeside of a slender configuration separates and rolls up to form a pair of symmetric vortices. With increasing angle of attack, the pattern becomes asymmetric, even on axisymmetric bodies. In subsonic and transonic flow these vortices have a dominant and nonlinear influence on vehicle aerodynamics.

The asymmetric vortex pattern which develops on a circular body at high angles of attack has been extensively studied.¹⁻¹² In the subsonic flow regime this flow produces a large side force which has been found difficult to repeat experimentally. Even on axisymmetric bodies, the side force varies with changes in the model roll orientation.^{13,14} The non-repeatability appears to be primarily due to the occurrence of a multiplicity of stable vortex patterns. Such patterns have been documented by the authors in Ref. 12. The different patterns are most likely triggered by model irregularities on the order of the machining tolerance which occur in the vicinity of the nose tip. Unsteadiness can also contribute to the lack of repeatability problem. Free stream turbulence causes the vortex pattern to jump from one stable configuration to another.¹³

In the present study, crossflow plane velocities and surface pressures have been measured on sharp and slightly blunted tangent ogive models at an incidence of 45° , under the condition of laminar separation. The sharp model was tested with and without a nose trip, which was designed to stabilize the flow field. Results obtained on all runs are presented in this report. This includes a listing of the measured velocities and surface pressures which are tabulated in Appendices A and B respectively, and an analysis of the data which is discussed in the main body of the report.

The data presented in this report differs from previously available information in that it probes in detail the secondary flow regions near the model surface as well as outer or primary areas of the crossflow plane. The resulting measurements allow the presence of secondary vortices and shear layers to be determined. Further analysis is carried out by integrating the crossflow plane velocities to determine the crossflow plane streamlines. The resulting streamline patterns are interpreted in light of topological considerations. From this point of view it is possible to gain an alternate perspective on the onset of asymmetry and the process of vortex shedding.

CHAPTER 2

NOMENCLATURE

\bar{C}_p	average value of $(p-p_\infty)/(q\sin^2\alpha)$ for 100 data points taken at each visit to a pressure tap
C_y	$F_y/(Dq\sin^2\alpha)$
$C_{y\text{peak}}$	maximum C_y value.
D	model diameter (5.715 cm)
F_y	side force per unit length
q	free stream dynamic pressure
Re_s	Reynolds number based on freestream properties and $D/\sin\alpha$
U_∞	freestream velocity
v, w	velocity components in y, z directions
x, y, z	cartesian coordinates (see Figure 1)
α	angle of attack
Γ	circulation (m^2/sec)
λ	$\Gamma/(\pi D U_\infty \sin\alpha)$ (sec^{-1})
ϕ	circumferential angle (windward is $\phi = 180^\circ$)
σ_{C_p}	standard deviation of C_p
σ_{v_c}	$\sqrt{\sigma_v^2 + \sigma_w^2}$, where σ_v and σ_w are the standard deviations of v and w respectively.
Φ	model roll orientation
ω	$[\Gamma/\text{unit area}] D/(\pi U_\infty \sin\alpha)$

CHAPTER 3

DESCRIPTION OF THE MODEL, INSTRUMENTATION AND EXPERIMENT

The experimental model shown in Figure 1 was a 5.715 cm in diameter tangent ogive with a nose fineness of 3 and an afterbody length of 9.6 calibers. The sharp nose tip could be unscrewed and replaced with a 10% blunted (spherical) nose tip. Six cross sectional stations were each instrumented with 24 pressure taps located circumferentially at intervals of 15° . Pressures were monitored using three internally mounted $\pm .1$ psi Setra differential pressure transducers. Each of these devices was connected to a 48 port internally mounted Scanivalve allowing all 144 pressure taps to be sampled. In order to maximize the response of the pressure measuring system the lengths of the tubes connecting pressure taps to Scanivalves were minimized. Pretest calibrations indicated that pressure fluctuations on the order of 500 Hz could be measured.

The crossflow planes were surveyed using a two dimensional, two color backscatter LDV system shown schematically in Figure 2. In order to adequately survey the entire leeward flow field, the model was mounted on the tunnel wall opposite the window through which the LDV measurements were made. The refraction resulting from the oblique passage of the laser beams through the glass was compensated for by optically alligning the focal volumes of the two different components inside the tunnel. Off-axis collecting optics were used to minimize the focal volume size which was estimated to have a diameter of .37mm and a length of 1.47mm. Directional ambiguity for both components were removed with the aid of Bragg cells. A coincident circuit was used to insure that both components of velocity were measured within a pre-selected time window. In general most of the optical and electrical components for the LDV system were manufactured by TSI (Thermo-Systems Inc.). This included beam splitters, color separators, photomultiplier tubes, Bragg cells and counter type signal processors. Scattering particules consisted of olive oil atomized to a 1.5 micron diameter by a Laskin nozzle. The aerosol was injected upstream of the turbulence damping screens to minimize flow disturbance.

Experiments were conducted in the Naval Academy 1m by 1.3m subsonic tunnel which has a nominal free-stream turbulence level of 0.1%. Tests were restricted to an incidence of 45° and free-stream velocity of 24m/sec which produced an Re_S of $1.5(10^5)$. As discussed in Ref. 15, this resulted in a laminar boundary layer separation. The wind tunnel model was mounted on the side of the wind tunnel wall illustrated in Figure 3. To increase the rigidness of the mounting, four support wires were attached to the model at a distance of 12.6 calibers from the nose tip.

Pressure alone tests were initially made on the sharp untripped model at the twelve roll angles; 0° , 30° , 60° ... 330° . Measurements were integrated to determine the magnitude of the normal and side forces. The model was then positioned to a roll orientation featuring a maximum side force and detailed flow

surveys were initiated. Unfortunately, the flow field exhibited a tendency to change levels of asymmetry during a test and side force levels were also not repeatable from test to test. Accordingly, a trip was added to the model nose tip to stabilize the flow field. The trip, shown in Figure 4 consisted of 0.45mm grit glued to the model surface near the nose in a strip 5mm long and 1mm wide. Pressure alone tests were then repeated to determine a roll orientation which produced high side force levels and flow field surveys were then conducted at this roll angle. A final series of tests were also made on the blunted model using a roll orientation which produced the highest observed blunt model side force. An outline of tests in which LDV data was taken is provided in Table 1.

The surface pressure data were acquired three ports at a time using the internally mounted Scanivalves and transducer arrangement. At each pressure port 100 samples were taken which allowed both pressure mean and standard deviation values to be determined. The LDV velocity data were measured by focusing the system on a specific point in the flow field. Velocity measurements were acquired whenever both v and w components were measured within a 100 μ sec. window. Here 100 samples were also taken at each point in the flow field allowing both the mean and standard deviation values to be calculated. In the secondary flow region near the leeside of the model surface, measurements were taken with a y, z spacing which varied from .76mm near the model nose tip to 1.27mm on the afterbody crossflow planes. This spacing was increased by a factor of 3 to 4 in the outer portions of the flow field. Pressure alone tests could be completed in about 10 minutes while the LDV surveys which measured velocities at as many as 950 points in a crossflow plane lasted up to three hours.

CHAPTER 4
INFLUENCE OF THE NOSE TRIP

During the long experiments in which crossflow plane velocities were measured, the flow field occasionally changed level of asymmetry. This was determined by monitoring the surface pressures throughout the tests. Measured variations in the side force during the two sharp, untripped model tests are shown in Table 1. The level of variation was felt to be unacceptably large, hence the previously described trip was added to the model nose. Trips applied near the model nose have been successfully used by other investigators to stabilize the flow field¹⁶. The magnitude of the peak local side force, $C_{y_{peak}}$, with and without the trip in place is illustrated in Figure 5. The addition of the trip usually increased $C_{y_{peak}}$, particularly at roll orientations which featured low side force peaks in the untripped case. The grit trip also was found to produce a side force which was repeatable throughout long experiments. In successive experiments the repeatability degraded somewhat as can be seen in Appendix B, however $C_{y_{peak}}$ was still well reproduced. Application of a tape trip with a similar planform was found to produce a more drastic effect which included reversal of the side force direction. This is more in keeping with the results of Ref. 16 where a tape trip was found to control the side force direction except at roll orientations which placed the trip near the windward plane.

Although addition of the trip stabilizes the flow field, it is relevant to ask whether the presence of the trip alters the fundamental character of the flow field. It was noted in Ref. 12 that a side force characteristic which appears repeatable from test to test and facility to facility is the relation between the axial location at which $C_{y_{peak}}$ or $C_y = 0$ occur and the magnitude of $C_{y_{peak}}$. If the character of the flow field is unchanged by the addition of the trip, the tripped data should reproduce the previously observed relationship. As is shown in Figure 6, data taken on the untripped model from both this study and Ref. 12 are in reasonable agreement with the tripped results. This suggests that the trip locks the flow field into a pattern typical of the untripped model and does not fundamentally alter its character.

CHAPTER 5

PRESSURE AND FLOW FIELD MEASUREMENTS

Pressure coefficient and standard deviation data taken on the sharp tripped and blunt models are illustrated in Figures 7 and 8 respectively. During these experiments, results repeated reasonably well during each test and from run to run. The data provided in these two figures is representative of the sharp tripped and blunt model pressure measurements respectively. During the sharp, untripped model tests, the level of asymmetry was low and the measured side force changed during each run. In Figures 9a and 9b are illustrated the circumferential \bar{C}_p distribution corresponding to the lowest and highest side force levels encountered during runs 1 and 2.

The measured crossflow plane velocity vectors taken in the tests on the sharp untripped, sharp tripped and blunt model are illustrated in Figures 10, 11 and 12 respectively. Clearly visible in these figures are points located adjacent to the model surface where the velocity component parallel to the surface reverses direction. These locations are interpreted as attachment and separation points and are marked by an S'_a and S'_s respectively. Also marked by S'_s are the windward separation points on each side of the body whose locations are estimated using both velocity and pressure data. Evident in Figures 7 and 9 are locations where maximum values of σ_{C_p} occur. Such points are marked by P in Figures 10 to 12. Similarly, regions on the leeward side of the body exhibiting large pressure gradients in Figures 7 to 9 are marked in Figures 10 to 12 by a G.

As is evident in Figures 10, 11 and 12, the crossflow plane surveys consisted of closely spaced measurements taken near the model surface and measurements taken farther from the model surface which are located a greater distance apart. Along the interface between the finely and coarsely spaced data occur points which have been probed twice; once as part of the finely spaced measurements and once as part of the coarsely spaced measurements. In Figures 10, 11 and 12 both sets of data have been plotted which provides a measure of the repeatability of the results. Near the outer edges of the crossflow plane coincident velocity measurements are generally indistinguishable, but in the vicinity of vortices a difference can often be seen (e.g. Figure 10b).

The vorticity throughout each crossflow plane is calculated by dividing the surveyed area into quadrilateral elements with corners located at points where flow field velocities are measured. The circulation associated with each element is determined from:

$$\Gamma = \oint \bar{v} \cdot d\bar{s} = 1/2 [\bar{n}_{12} \cdot (\bar{v}_1 + \bar{v}_2) + \bar{n}_{23} \cdot (\bar{v}_2 + \bar{v}_3) + \bar{n}_{34} \cdot (\bar{v}_3 + \bar{v}_4) + \bar{n}_{41} \cdot (\bar{v}_4 + \bar{v}_1)] \quad (1)$$

Here \bar{n}_{ij} is the vector connecting element corners i and j while \bar{v}_i is the velocity at corner i . The computed circulation is assigned the location of the element centroid. Isovorticity contours resulting from this calculation are displayed for the sharp tripped, sharp untripped and blunt models in Figures 13, 14 and 15 respectively. Also indicated in these figures are regions of high velocity fluctuations in which the standard deviation of the crossflow velocity, σ_{V_c} , exceeds $.3U_\infty$.

A convenient method of characterizing the crossflow plane is to divide it into the regions shown in Table 2 which contain vorticity of the same sign. The circulation computed at each element in the crossflow plane is assigned to one of these regions allowing the total circulation in each region to be calculated. The few elements which do not possess a symmetric counter part with respect to the pitch plane are excluded from the summation. The outer portion of the crossflow plane is divided into two primary regions, designated by a P, which contain circulation of opposite sign. Secondary flow structure often is visible near the model surface. On each side of the model the secondary crossflow plane areas are divided into two regions, S1 and S2 which contain circulation of opposite sign. The boundaries between all three regions are somewhat subjective. Most easily determined is the dividing line between regions containing circulation of opposite sign where the zero vorticity contour provides a convenient demarcation line. The boundary between the primary and secondary regions with circulation of the same sign is taken to be the contour with the minimum vorticity value. The calculated circulation of the primary and secondary regions are provided in Table 2.

In two of the cases listed in Table 2, the strength of one of the secondary region, λ_{S1} , is marked with an asterisk. Here the surveyed portion of the flow field clearly omits areas of high vorticity and the calculated strengths is unreasonably low. These tabulated values are estimated using the known ratio of λ_{S1} left to λ_{S1} right from nearby crossflow planes and the measured value of λ_{S1} right.

It is important to note that the circulation contained in each region cannot necessarily be associated with a vortex since not all regions contain vortices. Also, in region S1, there often exists both a strong shear layer which springs from the separation point and a vortex. Here the circulation attributable to each structure cannot be determined.

Additional information concerning the structure of the flow field can be obtained by constructing the crossflow plane streamlines. A streamline can be generated by integrating the equations:

$$\frac{dy}{dt} = v \quad \frac{dz}{dt} = w \quad (2)$$

from a starting point. The starting points are selected by trial and error to highlight regions near the vortices and separation points. To evaluate Equations (2) a description of v and w throughout the surveyed portion of the crossflow plane is necessary. Such a description is constructed using a bilinear interpolating function of the form $a + by + cz + dz^2$ to specify each velocity component within an element. Here a , b , c and d are constants evaluated using the measured velocities at the corners of the element. This provides a continuous description

of the velocity throughout the crossflow plane. As is noted in Refs. 18 and 19 the crossflow plane streamlines are not the projection of the three dimensional streamlines into the crossflow planes, but are instead the streamlines produced by the crossflow velocity vector field.

The streamlines determined by the above integration procedure are shown in Figures 17, 18 and 19, for the sharp tripped, sharp untripped and blunt models respectively. These figures illustrate two notable characteristics. First, streamlines originating near the estimated primary separation points do not feed into vortices but instead skirt the recirculation flow region. Second, streamlines near vortex cores often have a pronounced inwards or outwards spiral. Using the velocity measurements of Figures 10 to 12 it is possible to resolve the direction of spiral. Pronounced inwards or outwards spirals tend to occur in flow fields featuring high asymmetry. In such cases primary vortices which are clearly resolvable on adjacent crossflow planes usually retain the same direction of spiral. The more symmetric flow patterns feature vortices with poorly defined directions of spiral. Limit cycles are often observed with the direction of spiral changing across the limit cycle. In these cases it is conceivable that the presence of a spiral rather than a set of closed streamlines is a result of experimental error.

CHAPTER 6

6.1 TOPOLOGICAL NOTIONS

It has recently been suggested that the crossflow plane structure can be conveniently characterized in terms of singularities, or points where the crossflow velocity is zero.^{17,18} Several types of singularities occur in the flow fields illustrated in Figures 10, 11 and 12. Saddle singularities occur on the model surface as attachment or separation points. Also classed as saddle singularities are crossflow plane stagnation points interior to the flow field which are formed by the intersection of four streamlines, two directed towards the singularity and two directed away from it. Nodal singularities only occur off the body surface as stagnation points about which the streamlines spiral or circle. This structure is reminiscent of a vortex and in this report, the term vortex and nodal singularity will be used interchangeably. For a more complete discussion of singularities, the reader is referred to references 17 and 18.

These topological notions are useful in analyzing the structure of the crossflow plane for two reasons. First such notions provide a concrete definition of several types of flow field structures. A vortex, for example, must contain a singular point. Thus the left secondary flow region depicted in Figures 10c and 16d is seen to contain a vortex and a shear layer rather than two vortices. Secondly, assuming that the crossflow plane is a continuous vector field and that singularities are limited to points, it can be proved that the following relation must exist between the number of nodes and saddles:¹⁸

$$N_v - N_s - \frac{1}{2}(N'_s) = -1 \quad (3)$$

Here N_v is the number of nodes or vortices while N'_s and N_s represent the number of saddles on and off the body surface respectively. This rule does not define crossflow plane structure but precludes certain structures. It may also point to the existence of certain flow field features which are not resolvable with the available experimental data.

The streamline integration patterns shown in Figures 16, 17 and 18 illustrate the existence of both vortices and saddle singularities throughout the surveyed crossflow planes. The primary region generally contains two vortices and a saddle point. This saddle point, which is usually located in between these vortices, is an important landmark and will be referred to as the primary saddle point. The secondary region on each side of the body often contains two vortices and a saddle point. The saddle is not always clearly visible, however satisfaction of Equation (3) mandates its existence. In other instances, only a single secondary vortex is present in this secondary region. A number of saddle points occur on the model surface. In all cases an attachment saddle is visible near the center of the model on the leeward side. Also, on each side of the model a separation saddle can be seen marking the windward extent of the separation region. These attachment and separation saddles will be referred to as the rear attachment and

primary separation points respectively. When secondary vortices occur, an additional separation and attachment saddle occur on each side of the model. Not visible in the flow field surveys is a saddle of attachment which must occur on the windward side of the body, often termed the crossflow plane stagnation point.

Using the results from the streamline integrations, it is possible to construct crossflow plane topologies which contain the correct number of nodes and saddles to satisfy Equation (3). As an example, sketches of the crossflow plane topology for the sharp, tripped model are exhibited in Figure 19. The left primary vortex and primary saddle are shown as combined in Figure 19c. Inclusion of these two structures would also satisfy Equation (3).

6.2 FLOW FIELD DEVELOPMENT ON THE SHARP TRIPPED MODEL

The tabulated circulations on the surveyed crossflow planes are shown in Table 2. On each plane a net negative circulation occurs which increases in magnitude with increasing distance from the model nose. The magnitude of the net circulation increases in rough proportion to the size of the local side force coefficient. Also indicated in this table are the circulation strengths of the primary and secondary regions P, S1 and S2 associated with each side of the model. As expected, the largest circulation occurs in P. The circulation contained in S1 is about half as large as that in P while that in S2 is on the order of a tenth of that in P.

At the forward most crossflow plane probed, which is at $X/D = .75$, the outer edges of two primary vortices can be seen. In this crossflow plane which is illustrated in Figure 10a, the primary saddle is not fully visible, but is likely offset to the left.

The crossflow plane velocity field at an axial station of $X/D = 1.3$ is shown in Figure 10b and features two primary vortices but no secondary vortex structure. The vortices and primary saddle point appear to be symmetrically located; however, the rear attachment point, marked by an S_a' is offset slightly to the right. Also the velocities between the two vortices, second row behind the model are all pointing to the left. As is shown in Figure 16a, the resulting streamline pattern is highly skewed. The left and right vortices both spiral outwards and the windward streamline from the primary saddle point does not attach to the model surface, but moves around the left vortex and then out the leeward side of the visible flow field. A topological sketch of this crossflow plane which satisfies Equation (3) is provided in Figure 19a.

At an axial station of $X/D = 2.6$, both primary and secondary vortices are visible in Figures 10c and 16b. The left primary vortex has moved away from the model surface while the right primary vortex has rotated towards the leeward side. The primary saddle point has moved away from the model and to the left. The windward streamline from the primary saddle point feeds into the left vortex which has reversed its direction of spiral when compared to the axial station at $X/D = 1.3$ and now spirals inwards. The right primary vortex retains the outwards spiral visible at $X/D = 1.3$. Streamlines originating in the vicinity of the right primary separation point pass between the two primary vortices and leave the visible flow field from the left side. The streamlines originating near the left primary separation point also leave the visible flow field from the left side.

As can be seen in Figures 10d and 16c, the same flow field structure which exists at $X/D = 2.6$, persists at $X/D = 3.6$. The left primary vortex has moved farther from the model surface, but it still spirals inward and is fed by a streamline from the primary saddle point. The right vortex continues to spiral outwards, except very near to the vortex core where a limit cycle occurs. The topology sketched in Figure 19b which satisfies Equation (3) is representative of the crossflow plane structure at $X/D = 2.6$ and 3.6 .

The maximum measured side force coefficient occurs at $X/D = 4.7$ and the accompanying flow field structure differs from that at $X/D = 2.6$ and 3.6 . In Figure 10e only the right primary vortex is clearly visible. The distance between the left primary vortex and primary saddle point has decreased suggesting that these two structures have combined. The term combined is applied since both structures must disappear simultaneously in order to satisfy Equation (3). A careful construction of streamlines in the vicinity of the left primary vortex and adjacent saddle which is shown in Figure 16d indicates that the process of combination is not complete. The right primary vortex retains the outwards spiral visible at upstream stations and has moved leeward to a position nearly behind the model. The secondary region has become highly skewed with the rear attachment points and secondary separation points rotated in a counter-clockwise direction. On the right side of the model, two counter-rotating secondary vortices are present while on the left side only one secondary vortex which rotates in a counter-clockwise manner can be seen. The clockwise rotating vortex and adjacent saddle point visible on this side of the model at $X/D = 2.6$ and 3.6 have combined to leave a strong shear region. An examination of the flow field adjacent to the left primary separation point indicates the formation of a region of counter-clockwise rotation. Although this is not particularly evident in Fig. 10e, the circulation of a number of adjacent elements in this region is positive suggesting the formation of a new secondary vortex. The calculated strength of this new vortex is given in Table 1. A plausible topology for this crossflow plane which satisfies Equation (3) is shown in Figure 19c. Here the left primary vortex and saddle are taken to be combined and are therefore not shown. Inclusion of these two structures would also satisfy Equation (3).

Circumferential pressure profiles measured at the axial stations of $X/D = 2.6$, 3.6 and 4.7 are shown in Figure 7. It can be seen that flow field asymmetry produces differing levels of pressure on each side of the model. Lowest pressures occur on the side of the model with the closest primary vortex. The differing pressure levels occurring on each side of the model are bridged by sharp pressure gradients on the leeward side of the model. These gradients extend from below each primary vortex core to the rear attachment point and are indicated by a G in Figure 10e. At an X/D of 2.6 , both primary vortices are located fairly close to the model surface and two pressure gradients of opposite sign occur. A single sharp pressure gradient exists beneath the right primary vortex at $X/D = 3.6$ and 4.7 . Also indicated by a P in Figure 10 are points on the model surface where the pressure standard deviation reaches peak value. These peak values are located in the vicinity of the large pressure gradients and are likely caused by an unsteady circumferential motion of the vortex pattern. Such unsteadiness moves the position of the surface pressure gradients and produces large pressure fluctuations at fixed points on the model which are located nearby.

A comparison of Figures 7 and 10 indicates that secondary vortices have little discernable effect on the measured surface pressures. This is probably attributable to the small circulation strengths of these structures. Table 2 indicates that the circulation contained in the S2 region is typically small. The strength of the vortices in the S1 region cannot be determined since this region contains both a strong shear layer and a vortex.

6.3 FLOW FIELD DEVELOPMENT ON THE SHARP UNTRIPPED MODEL

On the sharp untripped model, surveys were carried out at X/D values of 2.6 and 5.7 with the latter survey covering only the secondary region. From Appendix B it is evident that the side force levels on the untripped model are much lower than those measured on the tripped model. As was previously mentioned, fluctuations in the surface pressures were noted in tests involving the untripped sharp model. The level of variation is indicated in Table 3 where samples of side force data spanning runs 1 and 2 are shown. The crossflow planes at X/D of 2.6 and 5.7 were probed in runs 1 and 2 respectively. It can be seen from Table 2 that side force levels in both of these runs were fairly steady at the axial locations where the velocity measurements were made.

At the axial station of $X/D = 2.6$ little asymmetry is visible in the crossflow velocity vector plots and streamline contours of Figures 11a and 17 respectively. As is shown in Table 2, the net circulation is nearly zero and the side force coefficient, although fluctuating slightly, is also small. The crossflow plane clearly contains two primary vortices and on each side of the model two secondary vortices. The streamlines originating near the estimated primary separation points do not roll up into the primary vortices but skirt the recirculatory region and pass out of the surveyed portion of the flow field on the side of the model from which they originated. This is in contrast to the asymmetric case shown in Figure 16b where the streamlines originating near the right primary separation point pass between the two primary vortices and out of the visible portion of the flow field from the left side. Another notable aspect of the streamline pattern is the windward streamline from the primary saddle point. As in the asymmetric case this streamline does not attach to the body but circles around the left vortex. Neither of the primary vortices has a well defined direction of spiral and limit cycles occur near each vortex.

At an axial station of 5.7, only the secondary portion of the flow field was surveyed. The primary vortices appear to have moved to the right since the rear attachment point is on the right side of the model. On the left side of the model two counter rotating vortices are visible in the secondary region shown in Figures 11b while on the right hand side only one vortex appears to exist. The second vortex has presumably combined with the adjacent saddle in a similar manner to that observed on the right hand of the sharp, tripped model at $X/D = 4.7$ (see Figure 16e).

The pressure distributions on the sharp untripped model are presented in Figure 9 and display the same general features which occur in the asymmetric case. In low side force cases where the flow field is relatively symmetric, a sharp pressure gradient occurs beneath each primary vortex. A single pressure gradient occurs when a larger side force is present (e.g. Figure 9b) and is likely located below the closer of the two primary vortices. As in the case of the tripped model, the secondary vortices do not induce a discernable effect on the circumferential pressure distribution.

6.4 FLOW FIELD DEVELOPMENT ON THE BLUNTED MODEL

The blunt model was tested at a roll orientation producing a $C_{y\text{peak}}$ of .95, which is one of the highest values observed for this model. The velocity data was measured at axial stations with X/D values of 2.6 and 5.7.

Crossflow plane velocities and streamlines at X/D = 2.6 are shown in Figures 12a and 18a respectively. This crossflow plane contains two primary vortices and two secondary vortices of opposite rotation on the left side of the model. On the right side of the model only a secondary vortex of clockwise rotation is partially visible. The primary vortex pattern is slightly offset to the left side of the model. As is shown in Table 2, the net circulation is positive as is the local side force. This is in contrast to the sharp tripped model case where a net negative circulation is associated with a positive side force. The streamlines in the vicinity of the right primary vortices show a pronounced outwards spiral while those near the left primary vortex feature a limit cycle with an outwards spiral inside of the cycle and an inwards spiral outside of it. Streamlines originating near the primary separation points skirt the recirculatory flow region and leave the flow field from the same side on which they started. The windward streamline from the primary stagnation point does not attach to the body surface, but instead circles around the right vortex. When compared to the sharp untripped model streamline pattern, a strong similarity is evident. In the blunt model case, though, the primary vortices appear to have a more defined direction of spiral.

The blunt model achieves its maximum side force at X/D = 5.7. The measured flow field at this axial station is displayed in Figures 12b, 18b and shows significant asymmetry. The primary vortex pattern is offset to the left. Unlike the tripped, sharp model flow field, the left hand vortex has not moved away from the model. The secondary flow field region has two counter rotating vortices and a saddle on each side of the model but these areas are clearly not symmetric in structure or location. The attachment and separation points noted in Figure 12b are offset in a counter-clockwise direction. On the left side of the body the secondary vortex of clockwise rotation has moved away from the body surface. The net circulation over the surveyed portion of the flow field is slightly positive as indicated in Table 1. The streamline pattern which is shown in Figure 18b features primary vortices which have a well defined outwards spiral. This structure is reminiscent of that visible on the sharp tripped model at X/D = 1.3 (see Figure 16a). As in the sharp, tripped model case, streamlines originating near the right primary separation point appear to pass between the two primary vortices and then out of the surveyed portion of the flow field from the left side. An unusual aspect of the blunt model flow field can be seen by considering Figures 8 and 15b which indicate that both the velocity and surface pressures show very high levels of fluctuation.

The pressure profiles on the blunted model are very similar to those on the sharp model. The different pressure levels which form on each side of the model when a side force occurs are bridged by sharp pressure gradients which occur beneath the vortex nearest to the model surface. The symmetric primary vortex pattern, which occurs at X/D = 2.6 features pressure gradients beneath each primary vortex.

CHAPTER 7

DEVELOPMENT OF FLOW FIELD ASYMMETRIES

It has been suggested that flow field asymmetry is a manifestation of a hydrodynamic instability which develops when primary vortices are crowded together.¹⁹ Peake, et al.¹¹ form the hypothesis, based on Nishioka and Sato's²⁰ incompressible cylinder data, that amplification of perturbations in the flow field near the primary saddle point results in the development of the asymmetric flow field. Irregularities in the model geometry serve only to determine the extent and direction of the flow field asymmetries. The results from the current study support the hypothesis that the flow field near the primary saddle point plays a principal role in the formation of the asymmetric flow field. Many of the crossflow planes surveyed appear to be symmetric both with respect to vortex location and strength. However, in all cases the windward streamline from the primary saddle point does not attach to the body surface but instead circles about one of the primary vortices as is indicated in Figures 16 to 18. It thus seems to be this streamline which first reflects flow field asymmetry and presumably only small perturbations in the vicinity of the saddle point are sufficient to cause this streamline to detach from the model surface.

Using the streamline traces of Figures 16 to 18 it is possible to construct a description of vortex shedding in terms of saddle and nodal singularities. Small perturbations near the primary saddle point leads to a detachment of the windward primary saddle streamline from the body surface, as is shown in Figures 17 and 18a. This streamline initially appears to roll up into one of the two primary vortices, neither of which have a well defined spiral direction. Figures 16a and 18b suggest that as the asymmetry in the crossflow plane grows, both vortices tend to develop a well defined outwards spiral. The windward streamline from the primary saddle now circles one of the vortices and then passes out the leeward side of the surveyed flow field. This topology is illustrated in Figure 19a and still features primary vortices which are relatively symmetrically located. As the crossflow plane asymmetry increases, one of the vortices moves away from the model and reverses its direction of spiral to inwards as illustrated in Figures 16b and 16c. The windward streamline from the primary saddle now feeds into this vortex and the resulting crossflow plane topology is illustrated in Figure 19b. Further asymmetry development leads to a combination of a primary vortex and the primary saddle. Figure 16d suggests that such a combination occurs while Figure 19c illustrates the resulting topology. Clearly, in order to satisfy Equation (3), the vortex and primary saddle must simultaneously disappear from the flow field.

It is of interest to compare the topological description of asymmetry development with the more conventional view of this process. Traditionally the crossflow plane has been visualized as containing both shed and attached primary vortices. Each attached vortex is connected to a primary separation point by a feeding sheet. As asymmetry develops and a vortex starts to move away from the body surface, the feeding sheet is torn and the vortex is shed. In the current

study the calculated crossflow plane streamlines which originate near the primary separation points do not feed into vortices. Hence the current data does not define a feeding sheet and an analog to the tearing of the feeding sheet is not evident. The clearest topological landmark visible in the asymmetry development process is the combining of the primary saddle and a primary vortex. This occurrence provides a convenient definition of vortex shedding in the current study. However, the present study is limited in scope and it is not clear whether such a combination process takes place as subsequent vortices are shed or under different test conditions. Thus, the general applicability of this definition of vortex shedding remains to be demonstrated.

The blunt model experiences, in general, a much lower level of side force than does the sharp model. Not only are maximum side loads lower, but average values taken over many different roll angles are significantly less. The maximum local side force occurs on the blunt model at $X/D = 5.7$. The resulting velocity and streamline data at this axial station are shown in Figures 12b and 18b respectively, and represent a roll orientation with the highest observed side force. From these figures it is evident that the maximum degree of flow field asymmetry which occurs on the blunt model is much less than that observed on the sharp model (see Figures 10 and 16). In fact, the degree of asymmetry is sufficiently low on the blunt model to suggest that vortex shedding does not take place. The reason for the difference in asymmetry levels observed on the sharp and blunt models remains unclear. A comparison of the blunt measurements taken at $X/D = 2.6$ with those at the same axial station on the sharp and sharp, tripped models indicates that the general flow field structure is qualitatively the same. Quantitatively some differences are detectable which include a 10% to 15% reduction in primary vortex strength in the case of the blunt model. An interpolation of the measured velocities along the pitch plane indicates that the primary saddle point is closer to the body surface on the blunt model than on the sharp model. Also, on the blunt model asymmetries in vortex strengths are principally confined to secondary vortices. However, it is difficult to construct an explanation for the apparent increased stability of the blunt flow field from any of these observed differences and the best hypothesis appears to concern the absence of a sharp nose tip. Near the tip of a sharp nose the local diameter is small and local irregularities may amount to extremely large local perturbations. A similar perturbing mechanism does not exist on the blunt model.

CHAPTER 8

SUMMARY AND CONCLUSIONS

A tangent ogive model with nose fineness of three has been tested in incompressible flow at an incidence of 45° and with a Reynolds number producing laminar separation. The model was rigidly supported in the wind tunnel which had a streamwise turbulence level of .1%. The model's sharp nose tip was interchanged in some tests with a 10% spherically blunted one. In tests on the sharp model, a strip of grit placed near the nose was often used to stabilize the flow field. Both surface pressures and crossflow velocities were measured on several crossflow planes. A two component LDV system was used to probe the flow field near the primary separation points as well as further out from the model. Axial stations upstream of the location at which the maximum side force occurred were investigated. Based on the data taken in this study the following conclusions can be drawn:

1. Use of a grit trip near the model nose stabilizes the flow field without changing its basic side force characteristics.
2. In addition to two primary vortices and a primary saddle, the flow field generally contains two counter-rotating secondary vortices and a saddle point on each side of the model.
3. The development of the asymmetric flow field on the sharp tripped model up to the point of maximum side force can be characterized by the following three steps:
 - a. Flow field asymmetries seem to originate with instabilities at the primary saddle point. The windward streamline leaving this point detaches itself from the body surface, circles about one of the vortices and then moves out into the leeward flow field.
 - b. The vortex circled by this primary saddle point streamline moves away from the model.
 - c. The primary saddle and a primary vortex appear to combine on the crossflow plane at which the peak side force occurs. The point of combination appears to offer a convenient definition of vortex shedding.
4. Blunting the model nose by 10% drastically reduces side force and the degree of flow field asymmetry. The windward primary saddle point streamline detaches from the model and circles a primary vortex as in the sharp model case. However, at the axial station featuring maximum C_y , neither primary vortex appears to be in the process of shedding. The increased stability of the blunted model flow field is hypothesized to be related to the absence of a slender nose tip on which model irregularities become large perturbations.

ACKNOWLEDGMENTS

This project was supported by William C. Volz of the Naval Air Systems Command. The authors wish to thank Commander Paul Schlein and his staff at the U. S. Naval Academy for making the wind tunnel testing facilities available.

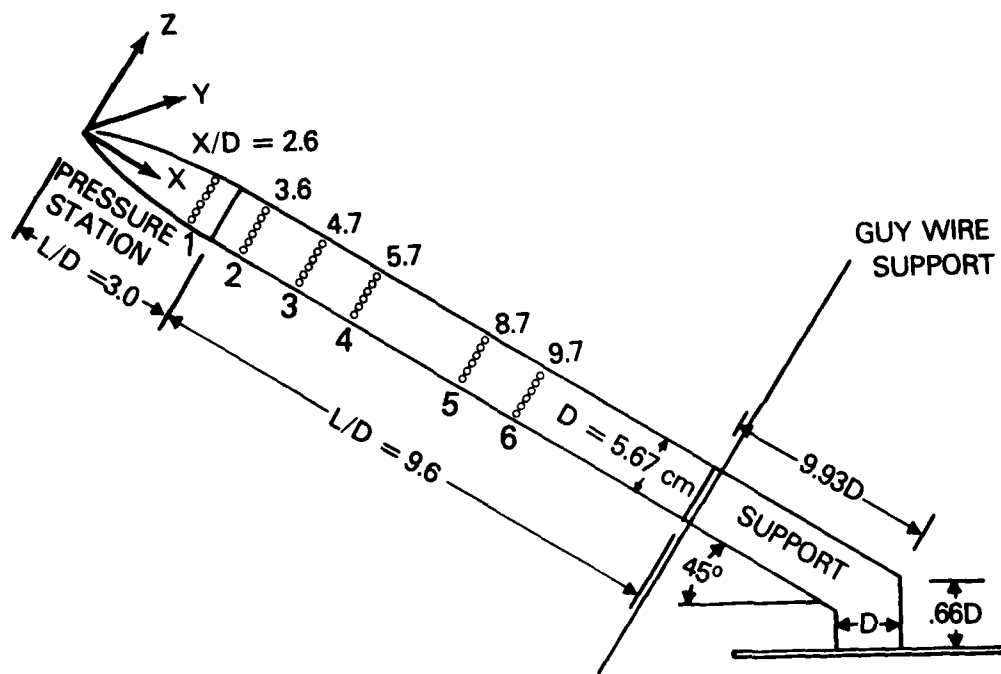


Figure 1. Tangent ogive pressure model and support

2-D BACKSCATTER LDV

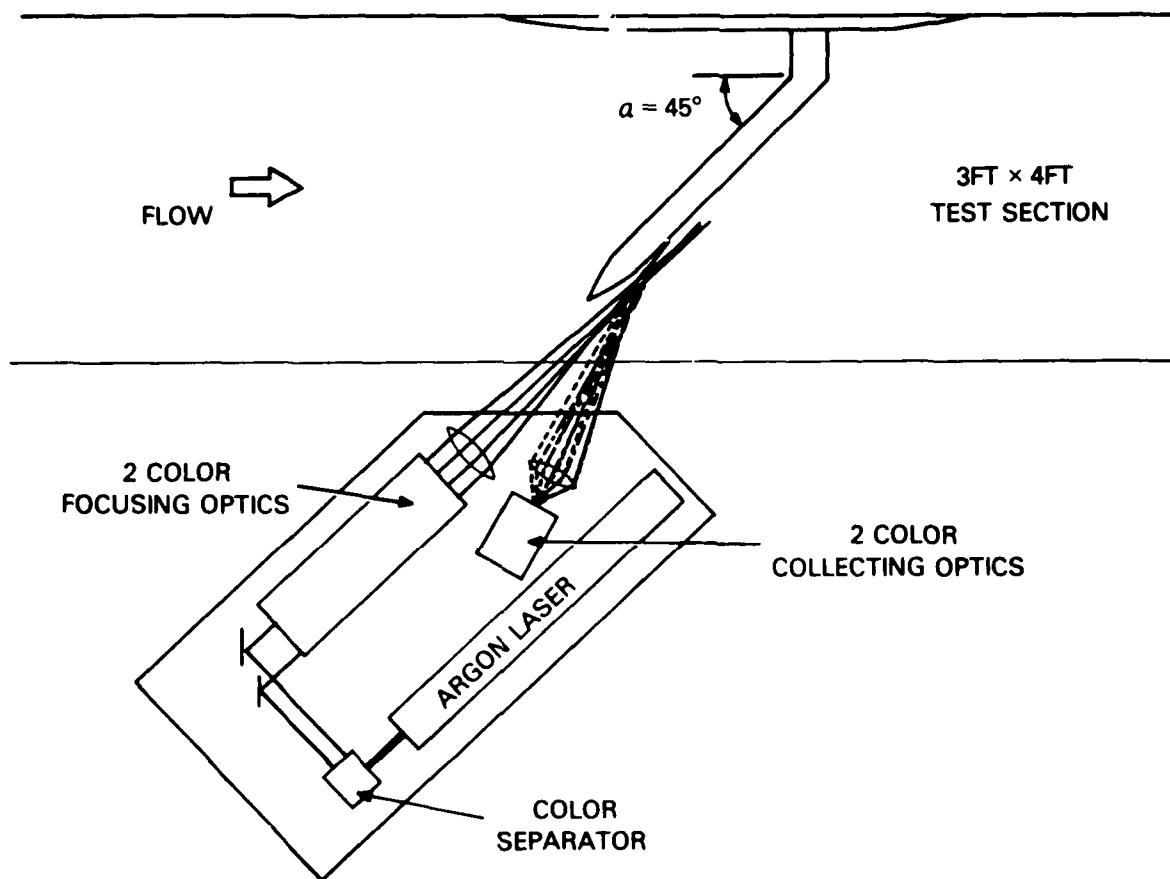


Figure 2. Schematic of the laser doppler velocimeter

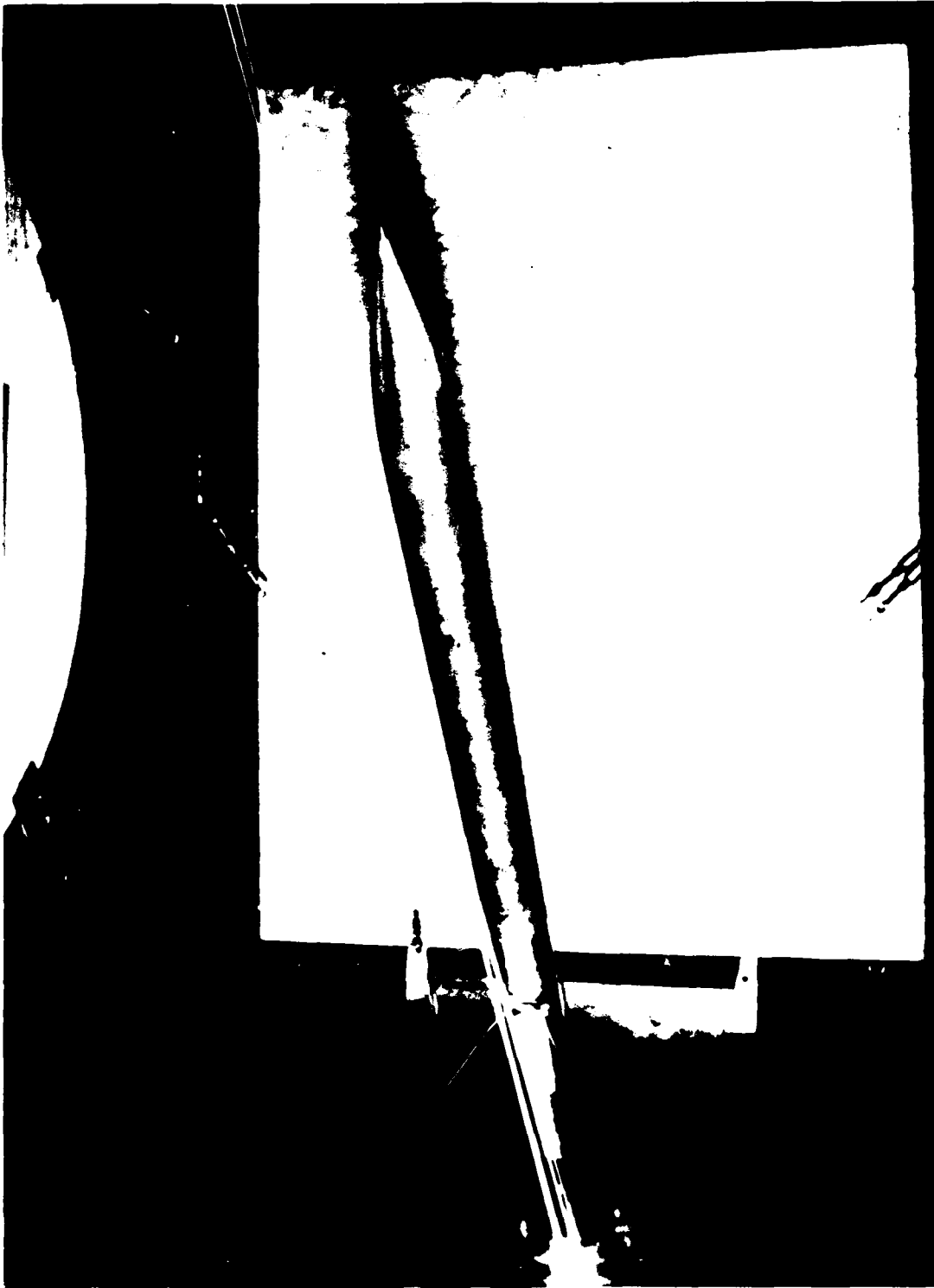


Figure 1. Pressure model mounted in the wind tunnel

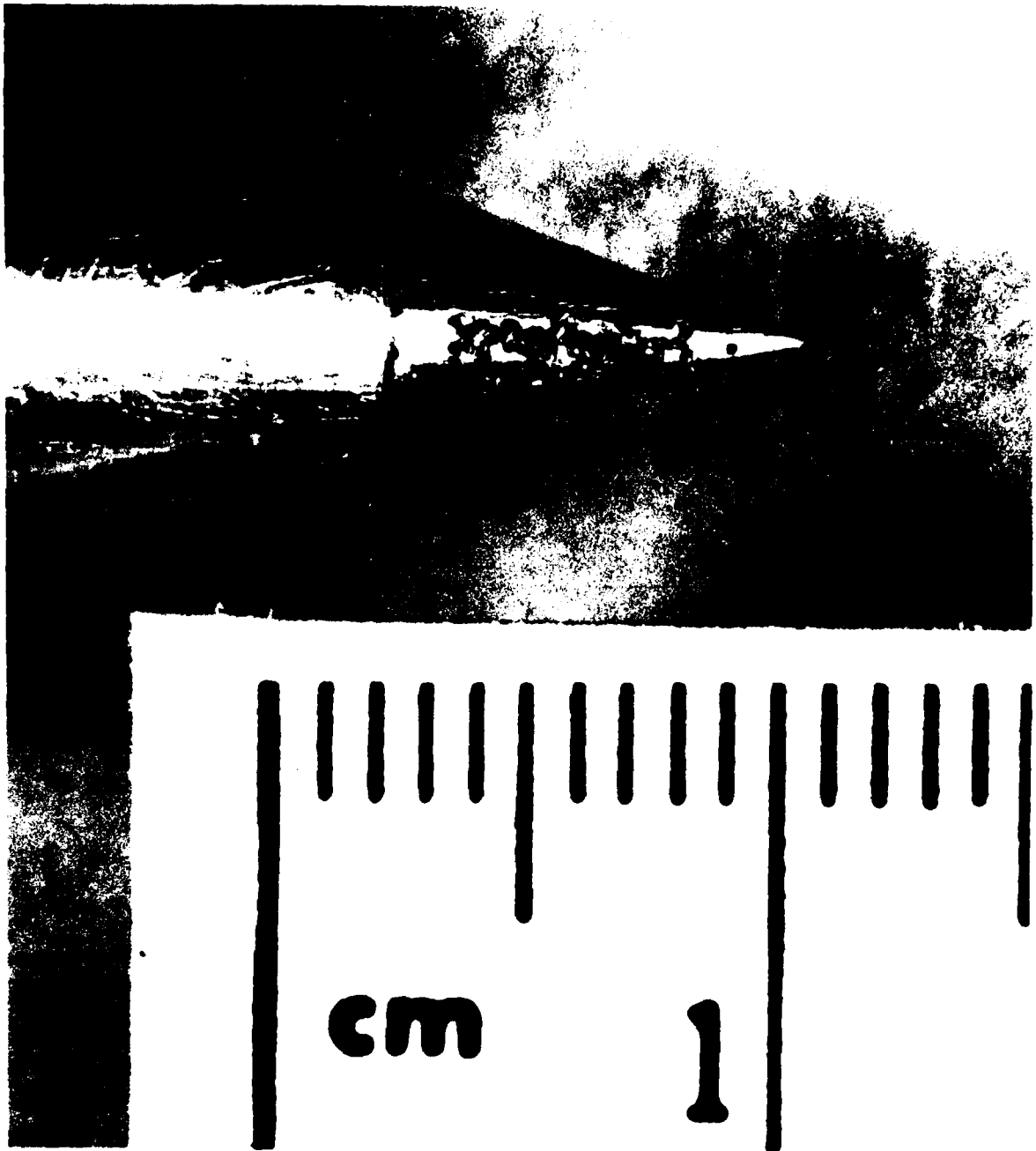


Figure 4. Nose trip made from thin wire.

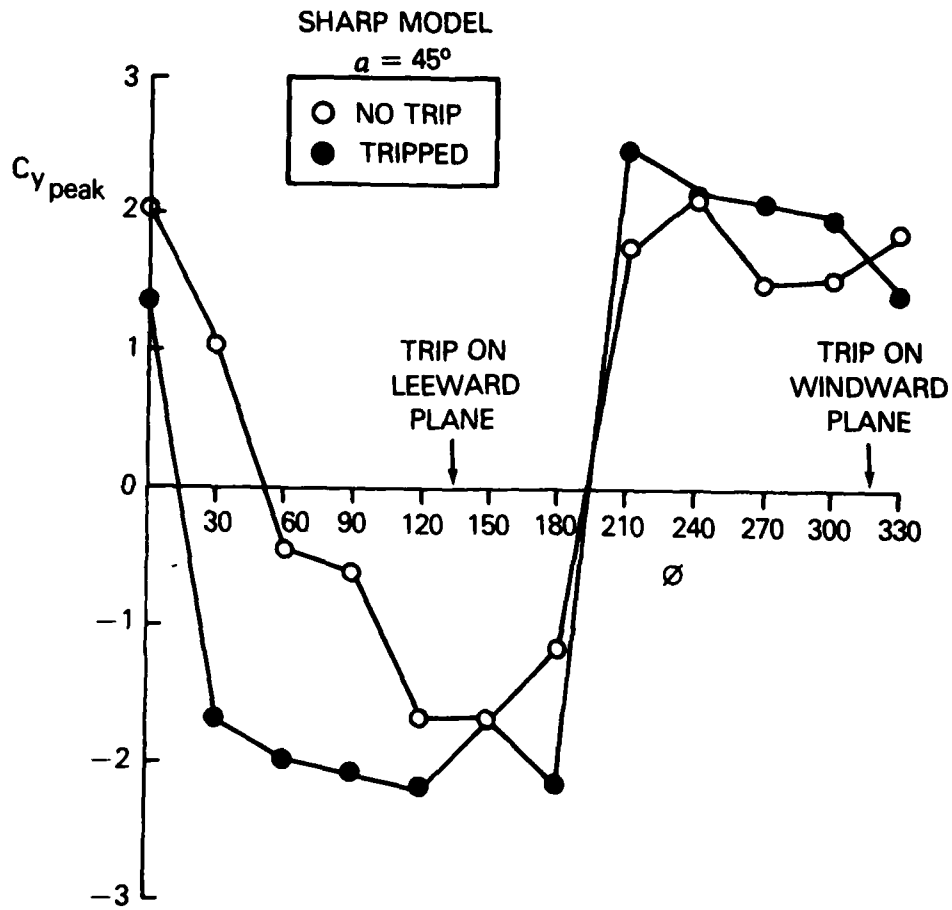


Figure 5. $C_{y \text{ peak}}$ as a function of model roll angle

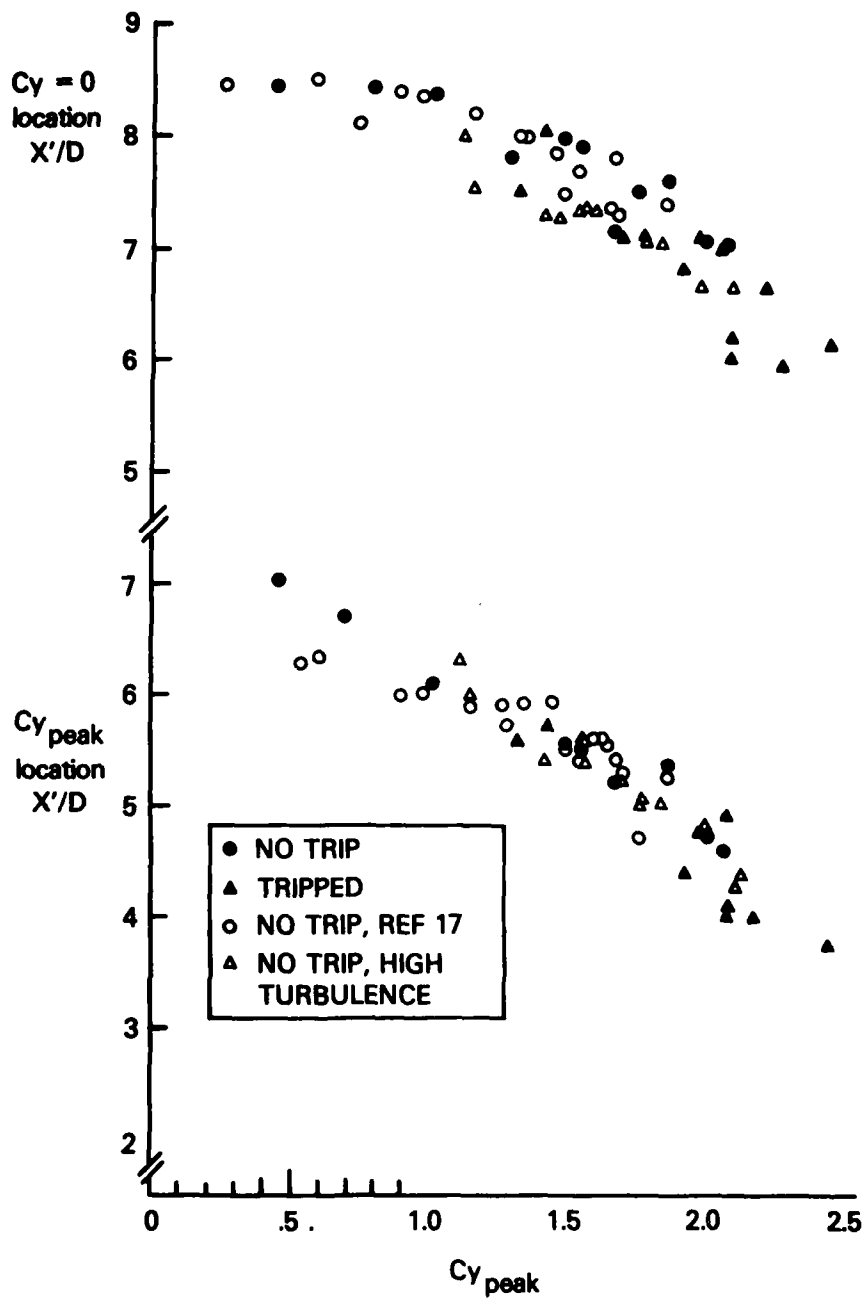


Figure 6. Axial location of $C_{y\ peak}$ and $C_y = 0$ as a function of $C_{y\ peak}$

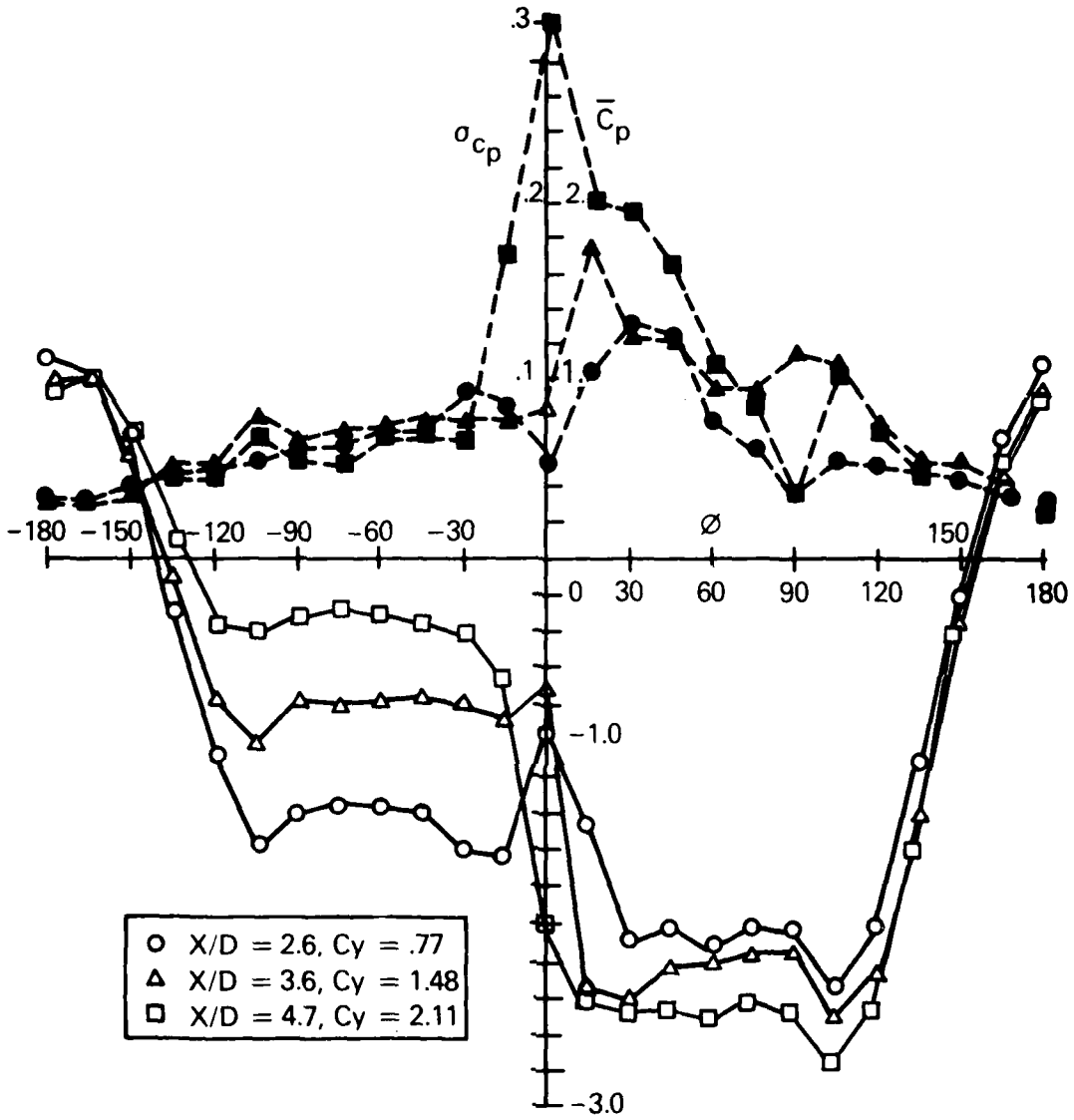


Figure 7. Circumferential pressure distributions on the sharp, tripped model. Open Symbols are \bar{C}_p and solid ones are σ_{C_p}

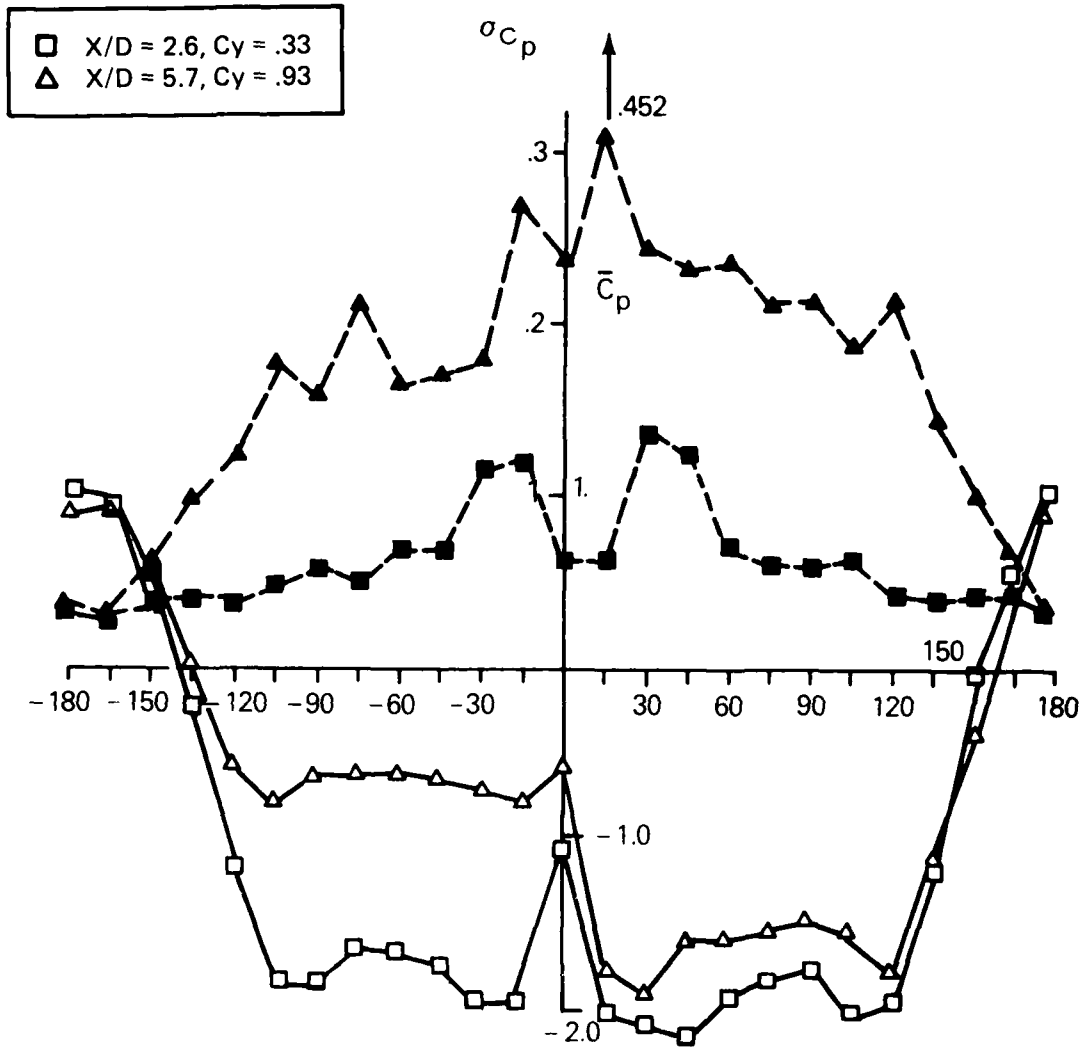


Figure 8. Circumferential pressure distributions on the blunt model. Open symbols are \bar{C}_p and solid ones are σ_{C_p}

A) Highest side force case.

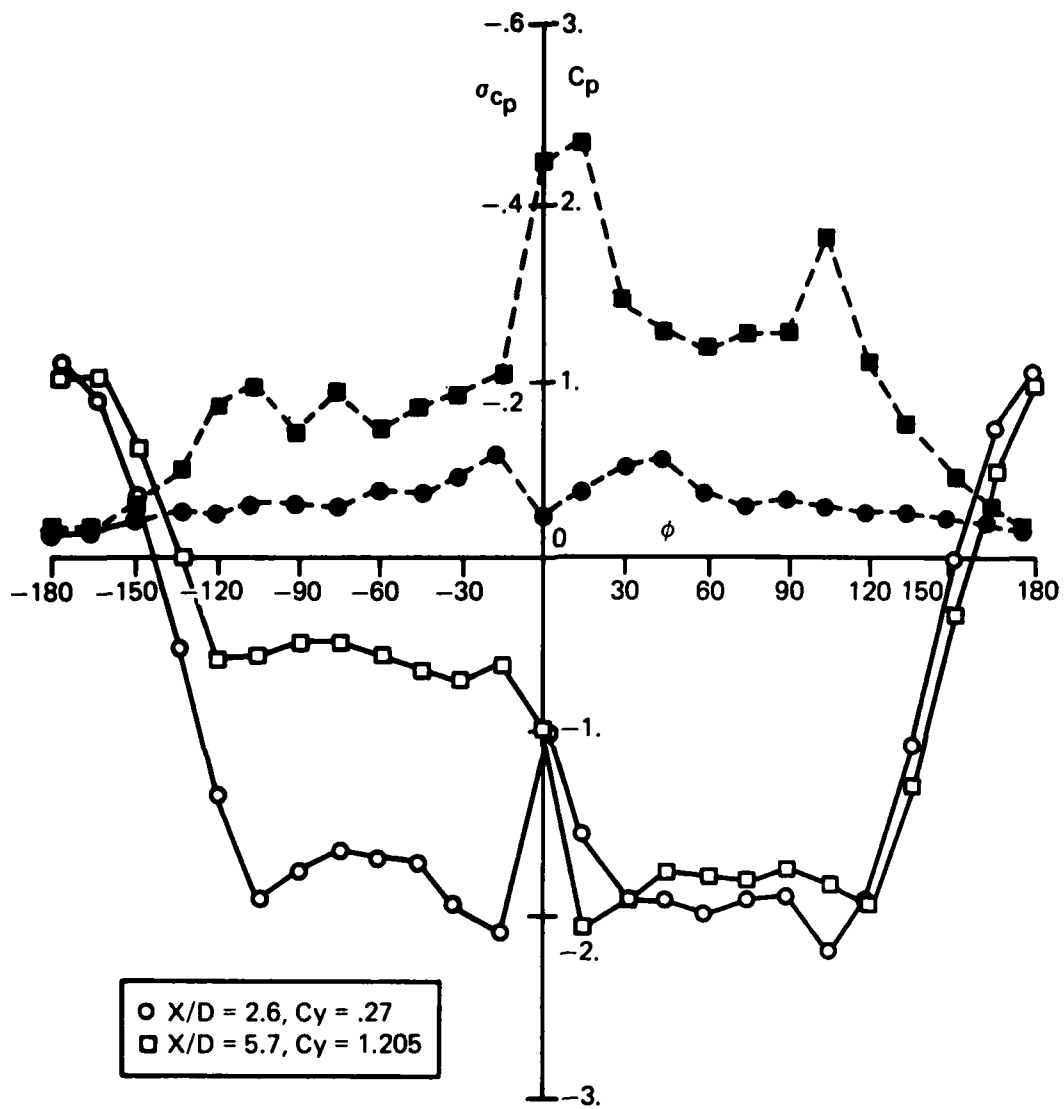


Figure 9. Circumferential pressure distribution on the sharp, untripped model. Open symbols are C_p and solid symbols are σ_{C_p}

B) Lowest side force case

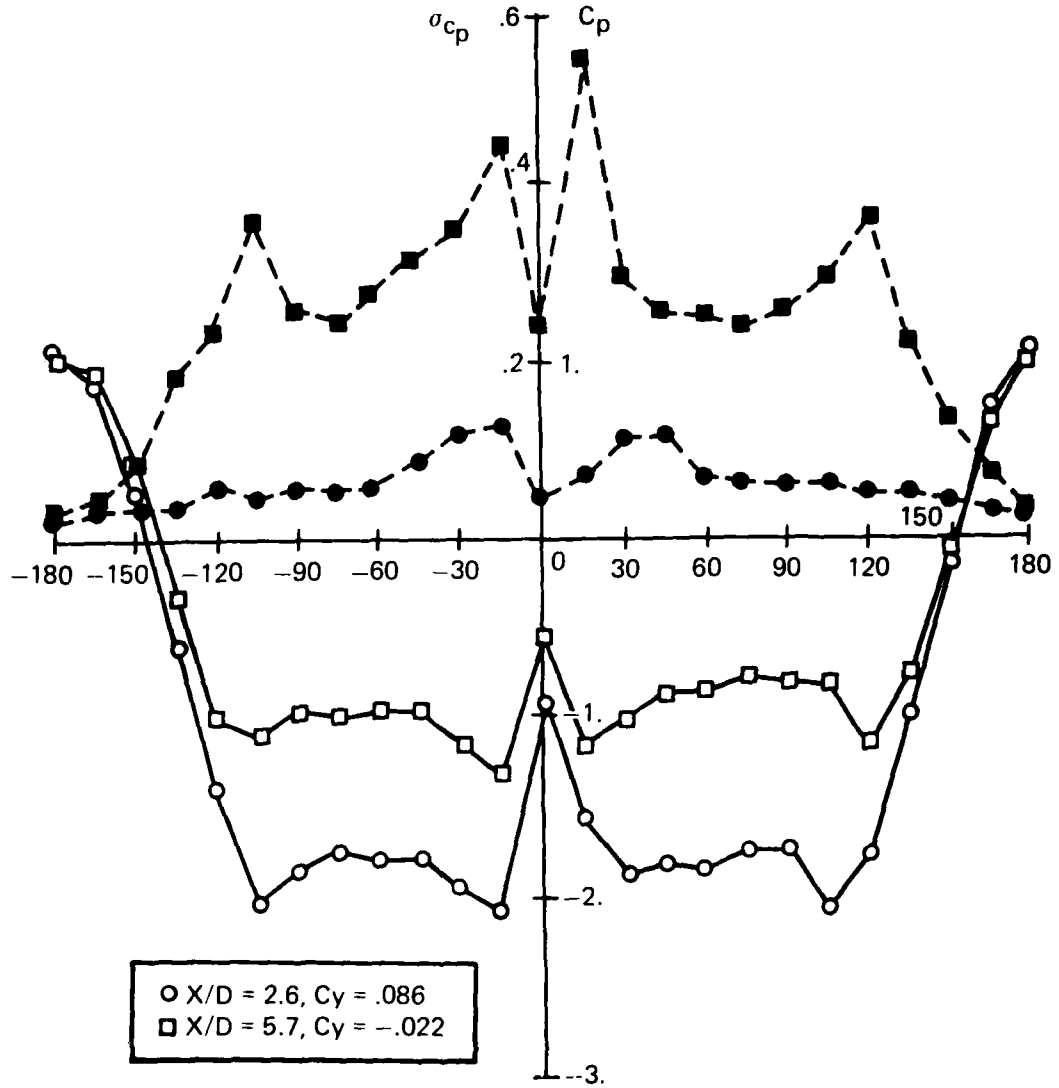


Figure 9. (Continued)

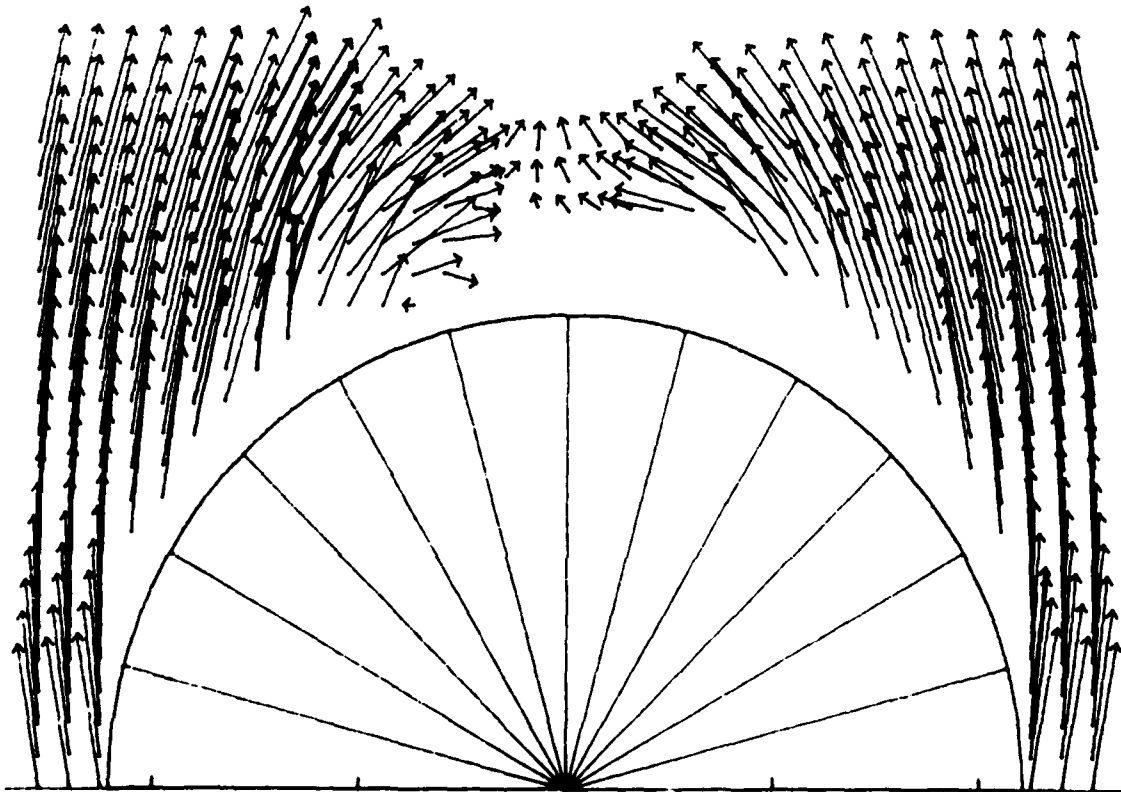
A) $x/D = .75$ 

Figure 10. Measured crossflow plane velocity vectors on the sharp, tripped model. S'_a and S'_s are attachment and separation points respectively. The P represents peak σ_c locations while the G indicates regions of sharp pressure gradients.

B) $X/D = 1.3$

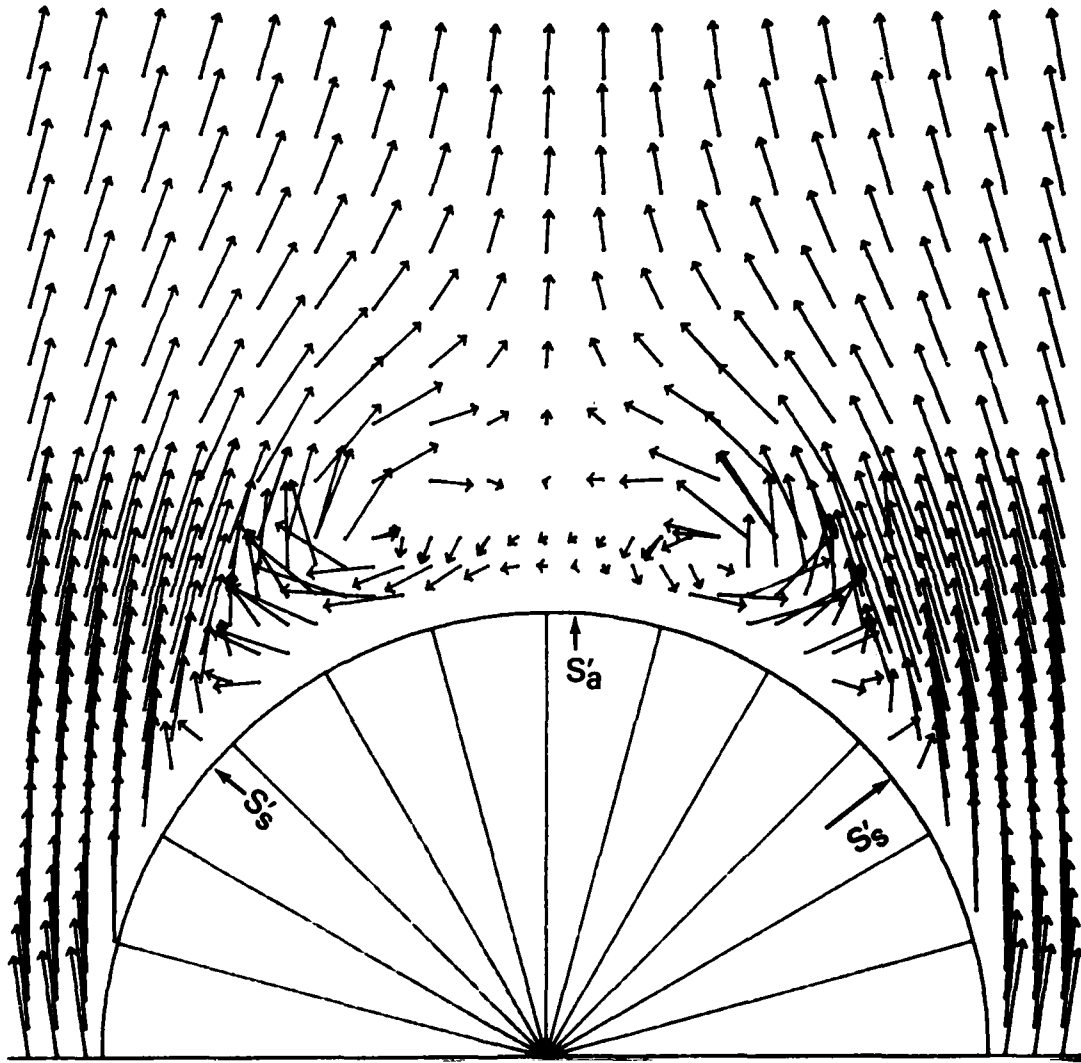


Figure 10. (Continued)

c) $x/D = 2.6$

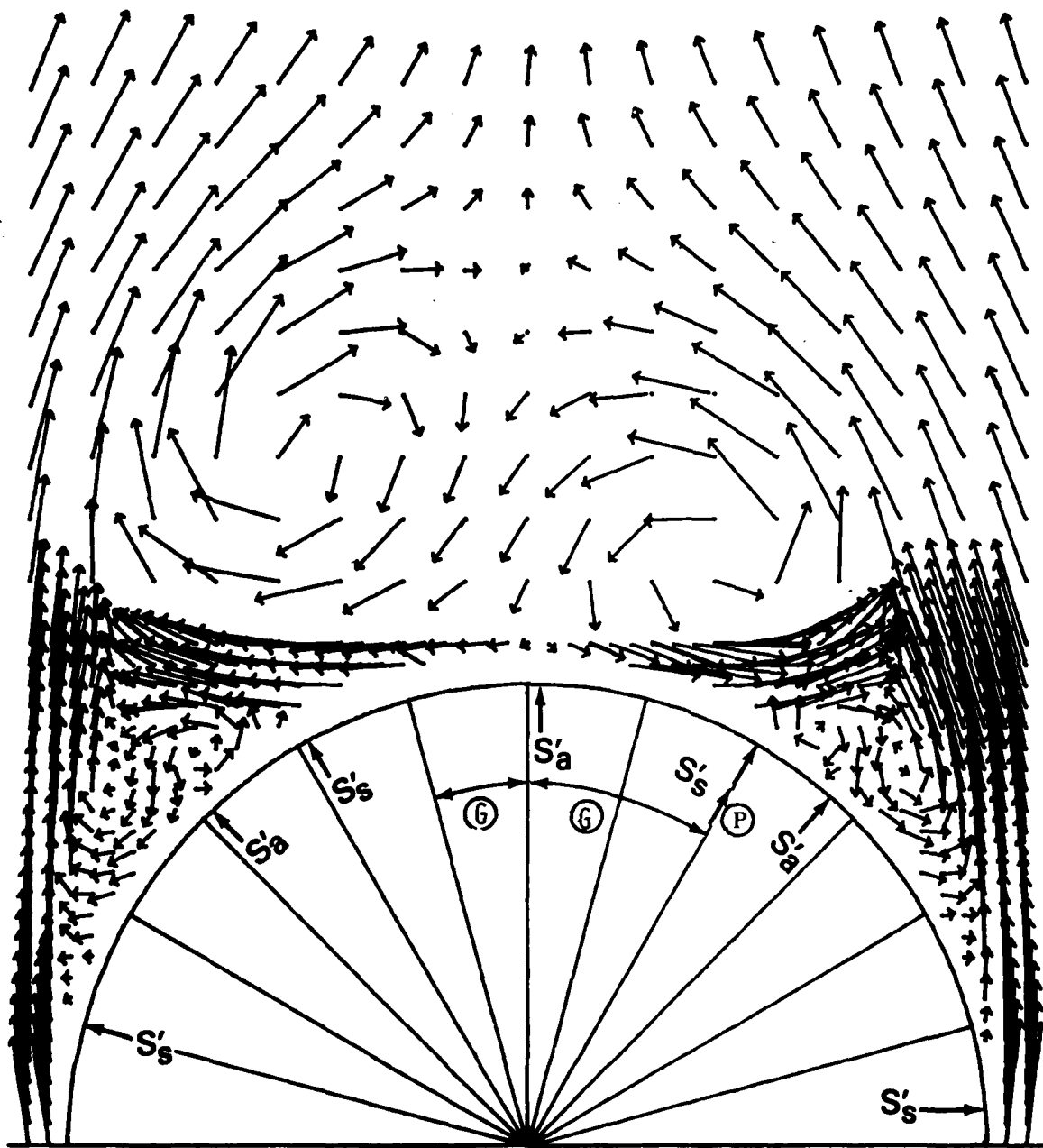


Figure 10. (Continued)

D) $X/D = 3.6$

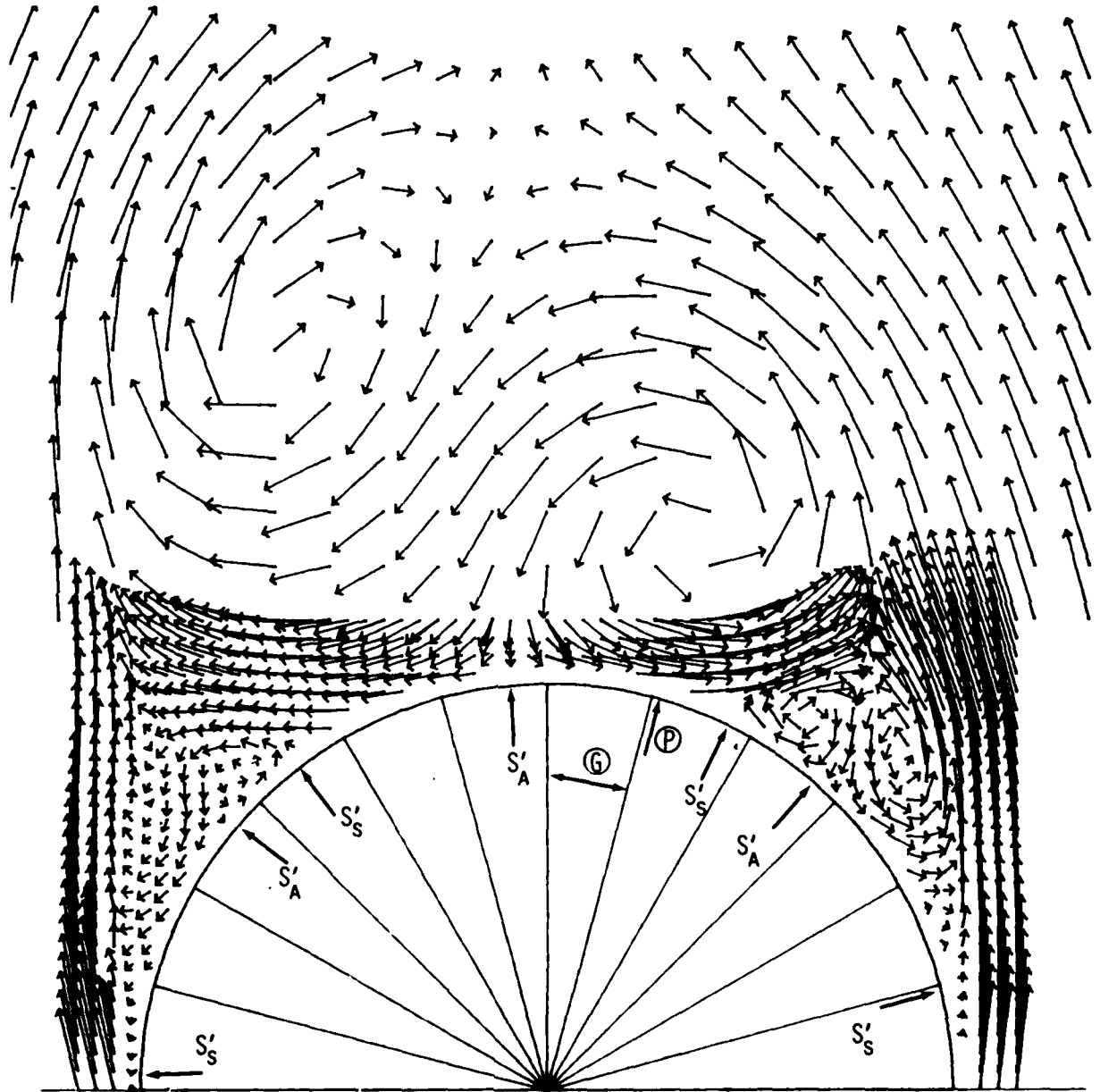


Figure 10. (Continued)

E) $X/D = 4.7$

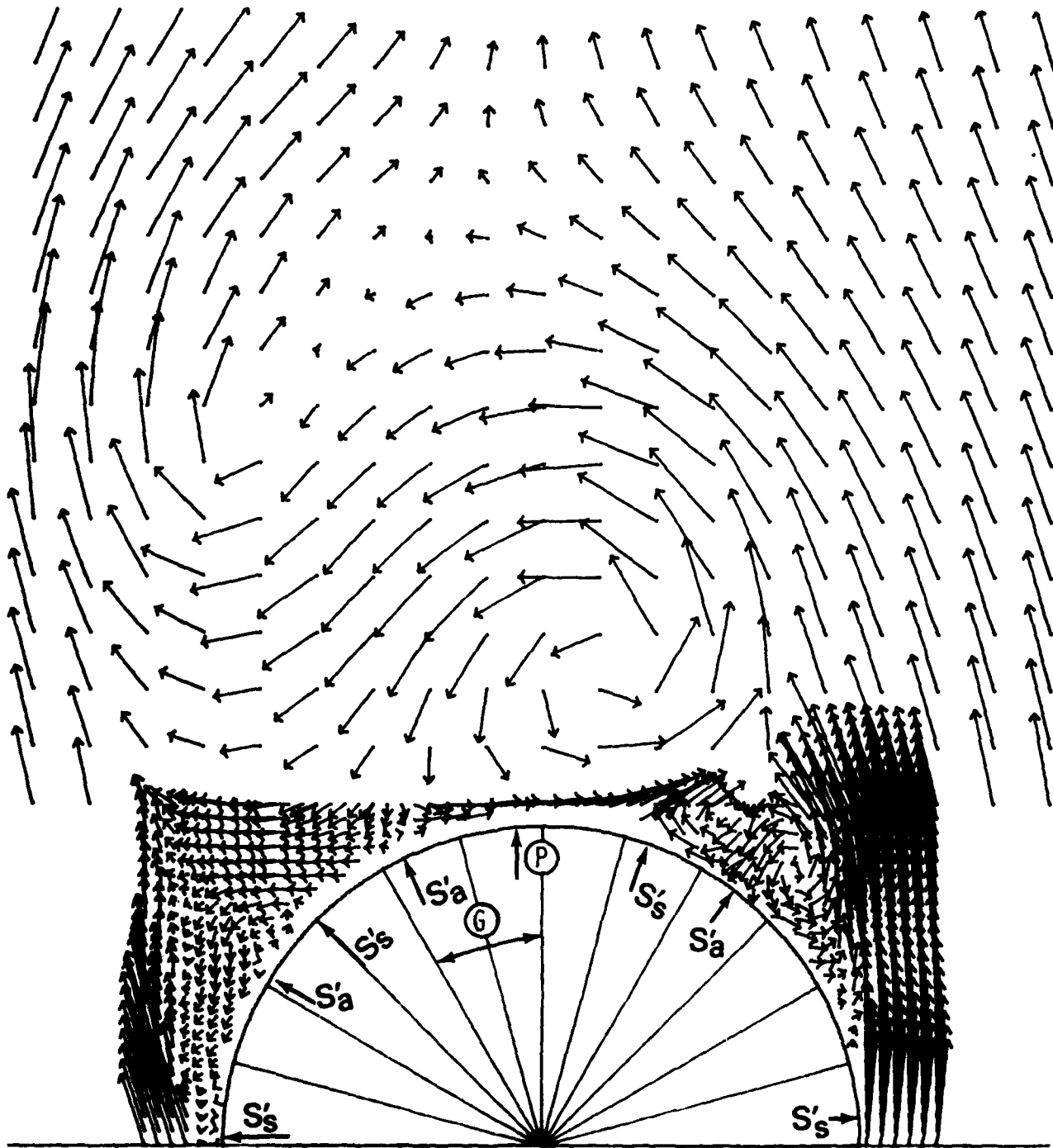


Figure 10. (Continued)

E) (Continued) Enlargement of left secondary region.

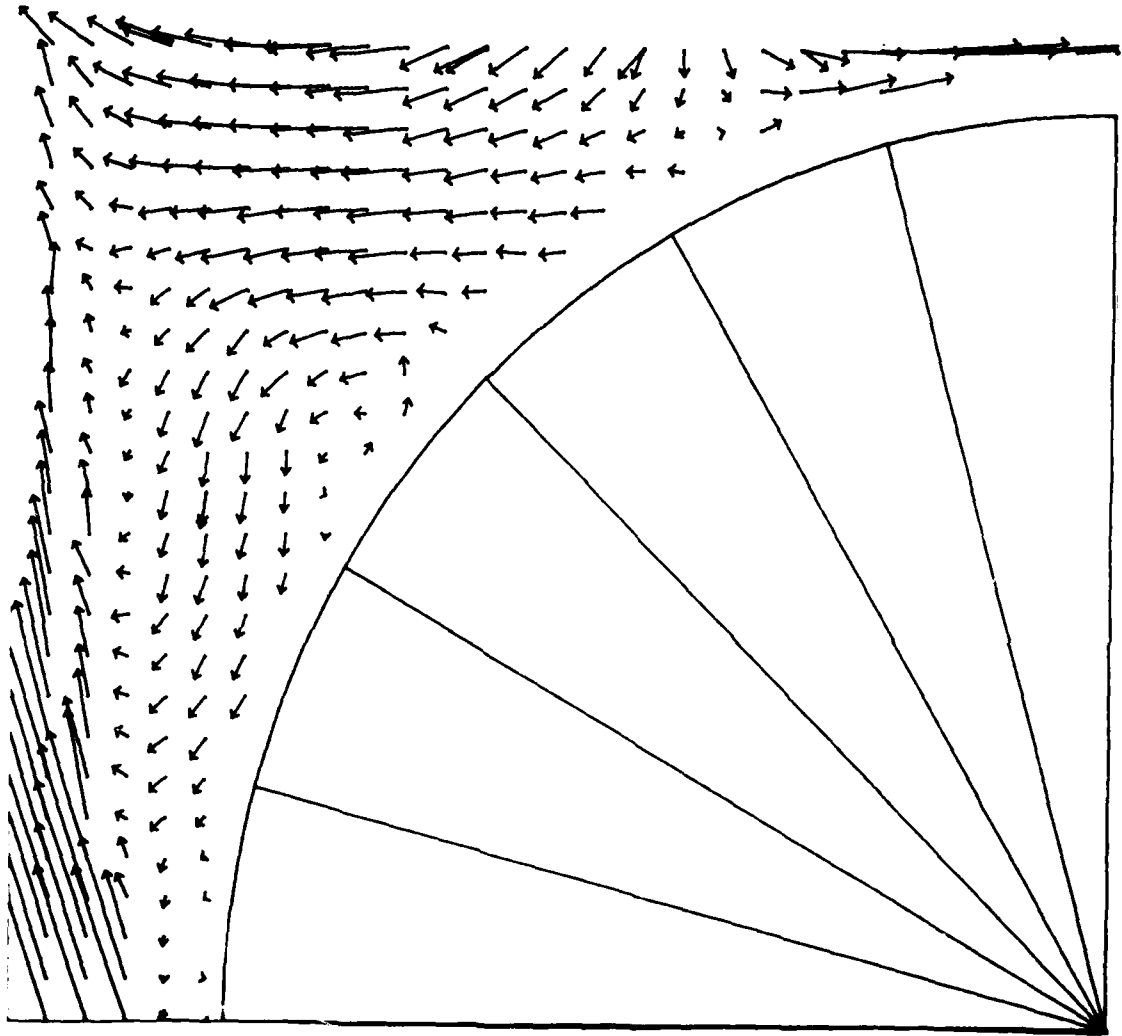


Figure 10. (Continued)

E) (Continued) Enlargement of right secondary region.

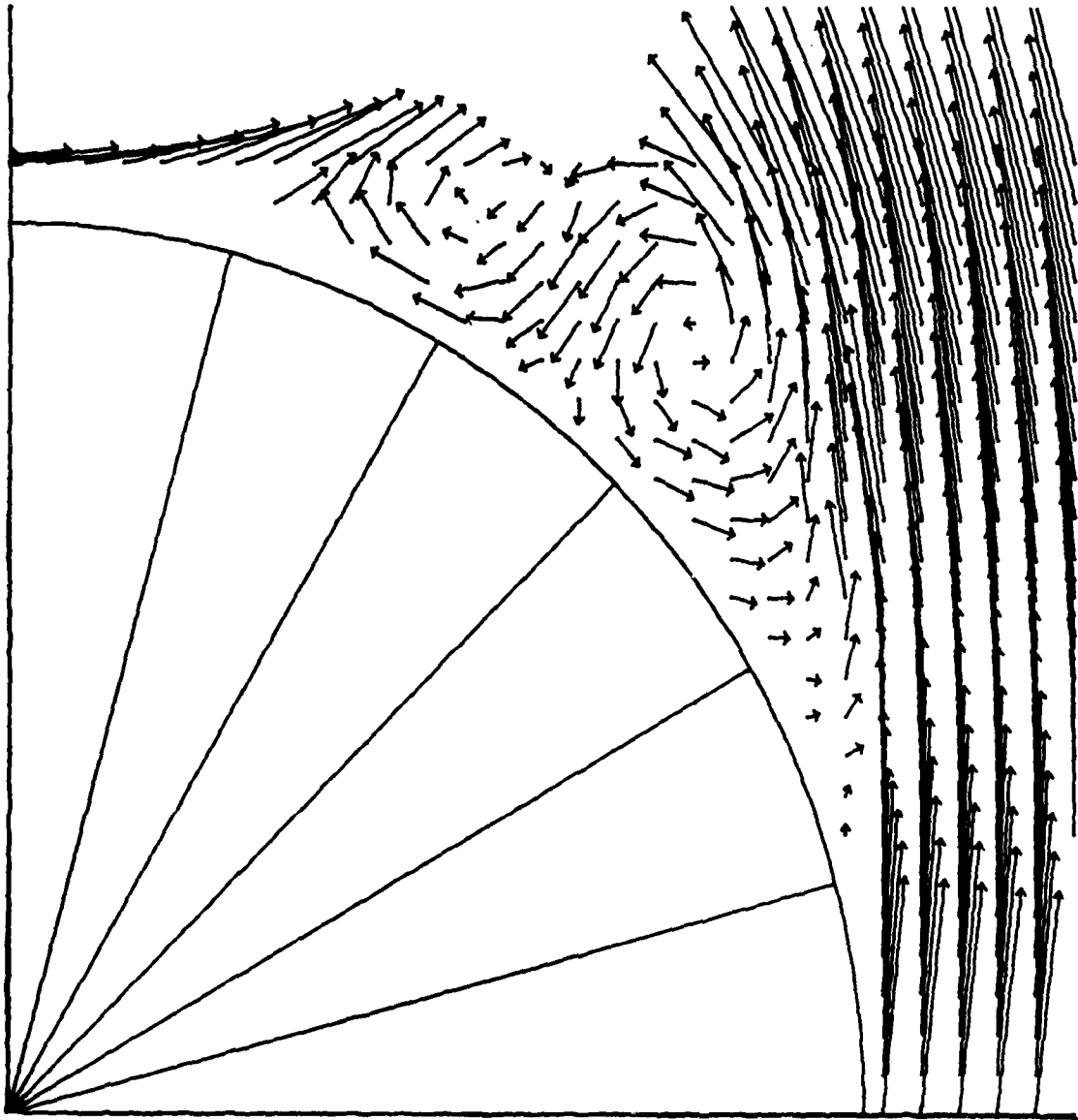


Figure 10. (Continued)

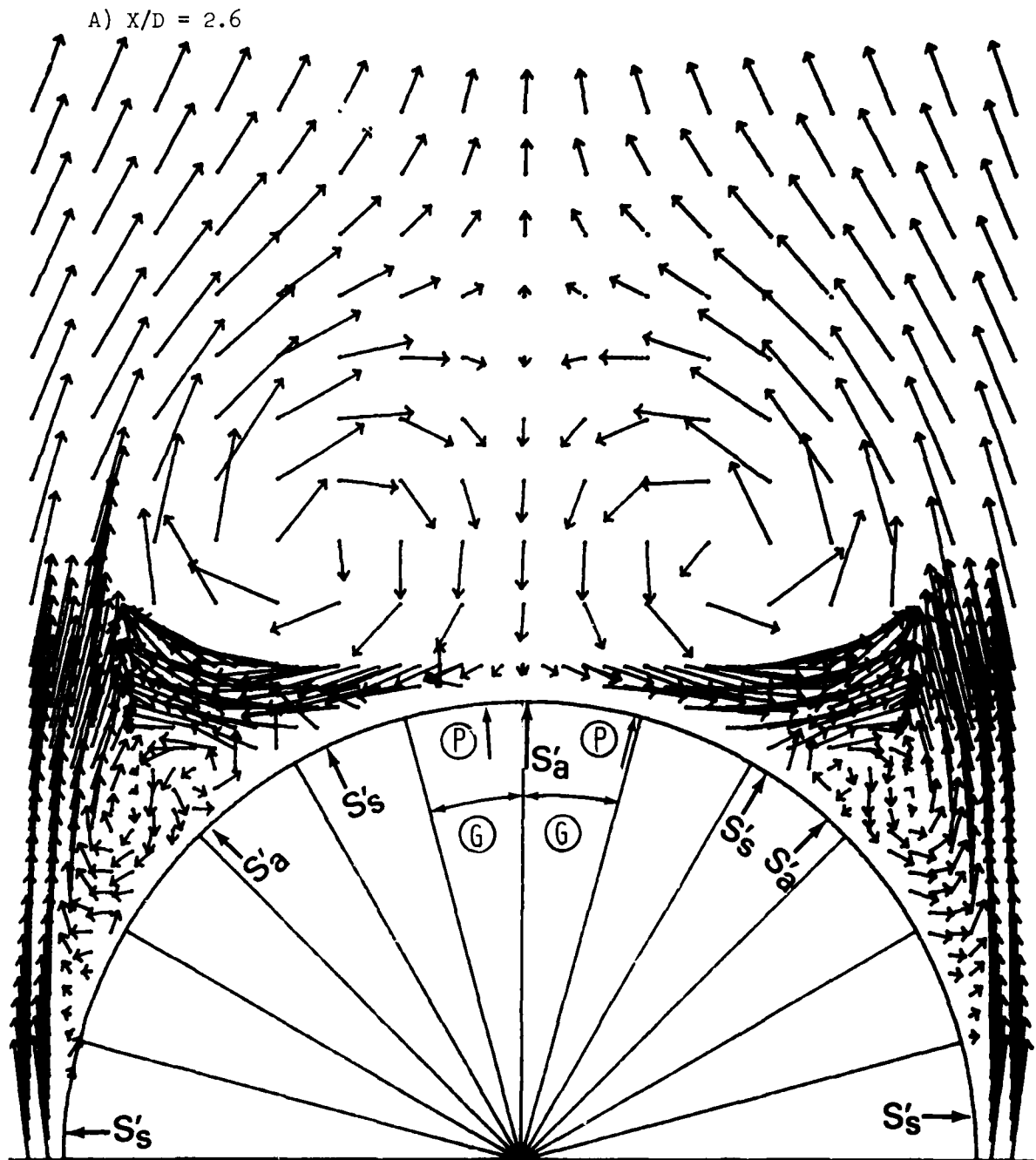


Figure 11. Measured crossflow plane velocity vectors on the sharp, untripped model. S'_a and S'_s are the attachment and separation points respectively. The P represents peak σ_{C_p} locations while the G indicates regions of sharp pressure gradients.

B) $X/D = 5.7$

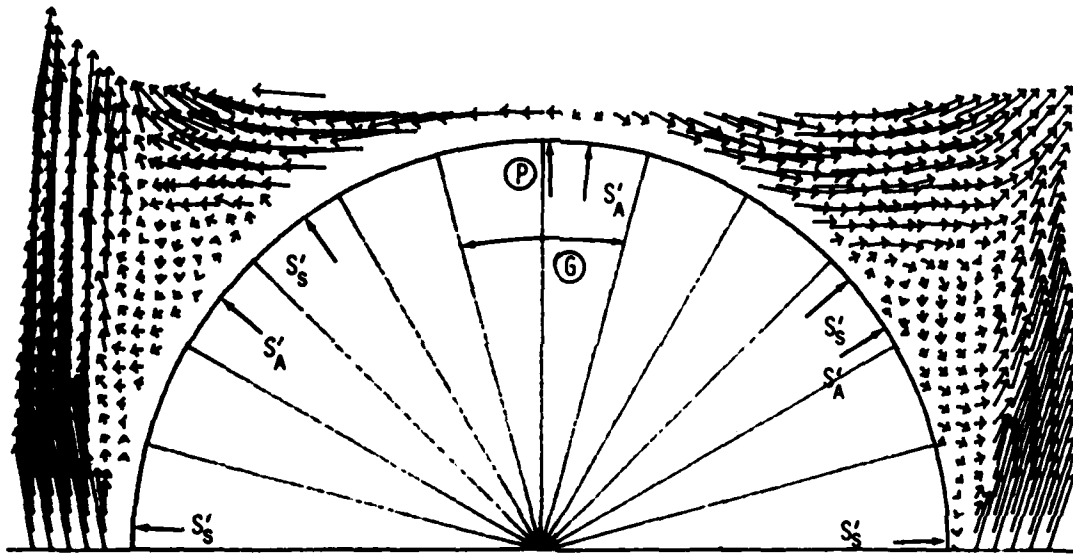


Figure 11. (Continued)

B) (Continued) Enlargement of left secondary region.

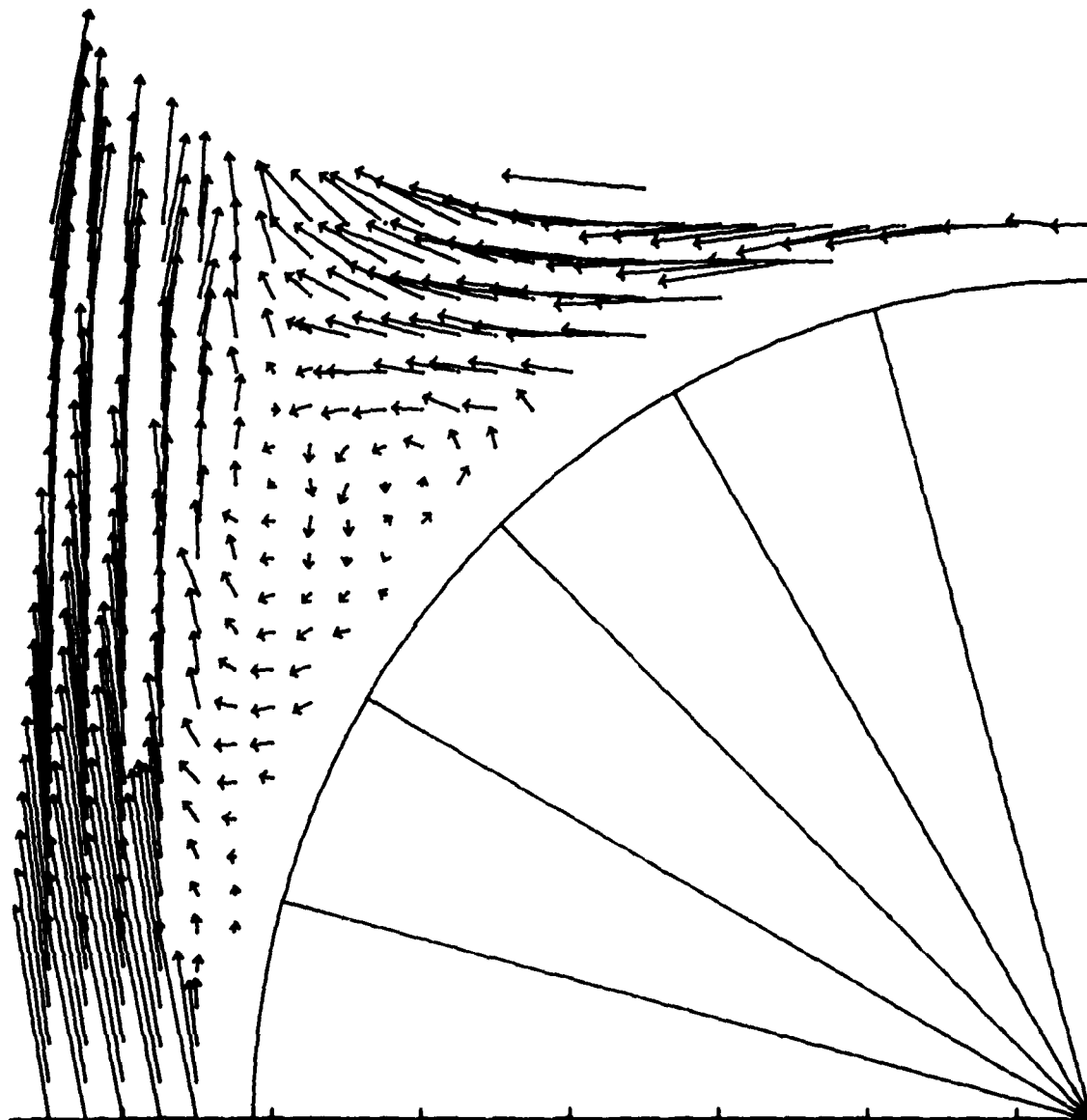


Figure 11. (Continued)

B) (Continued) Enlargement of right secondary region.

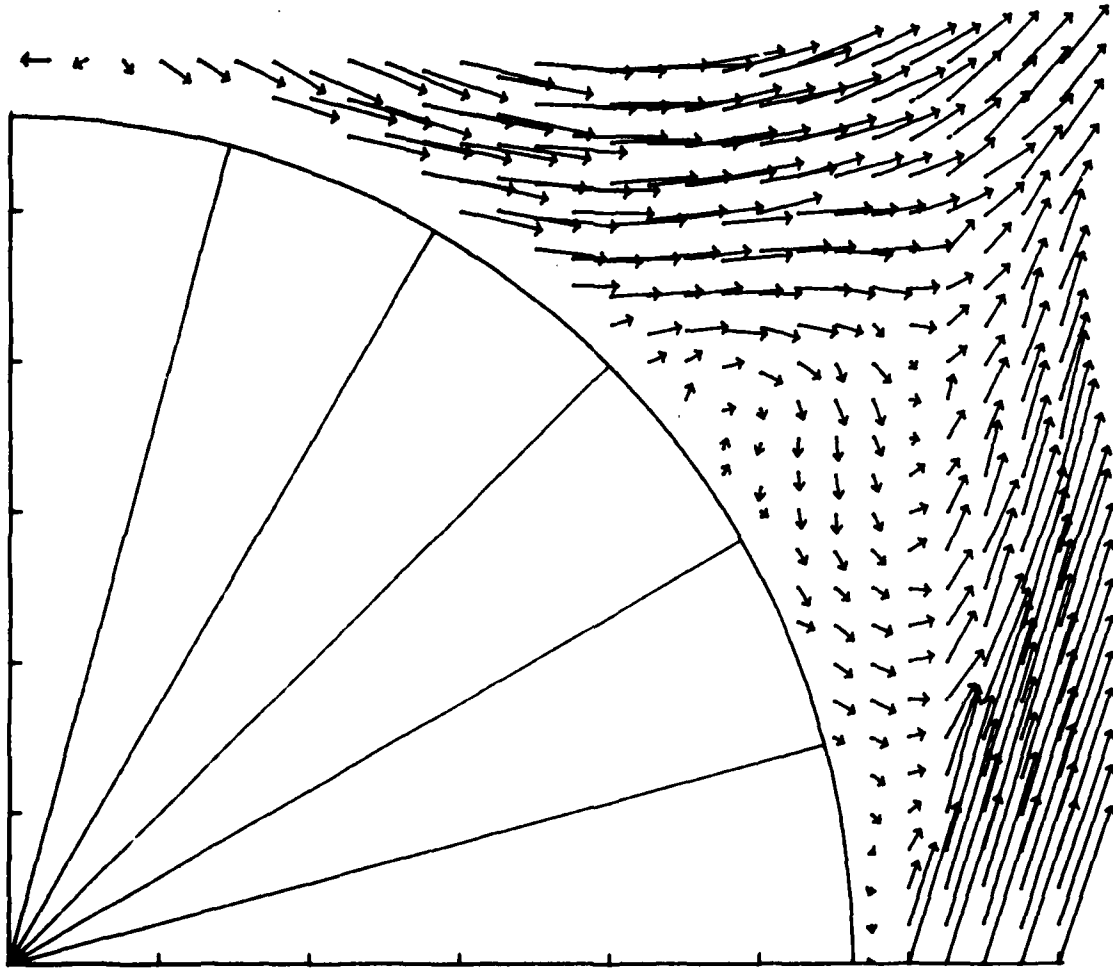


Figure 11. (Continued)

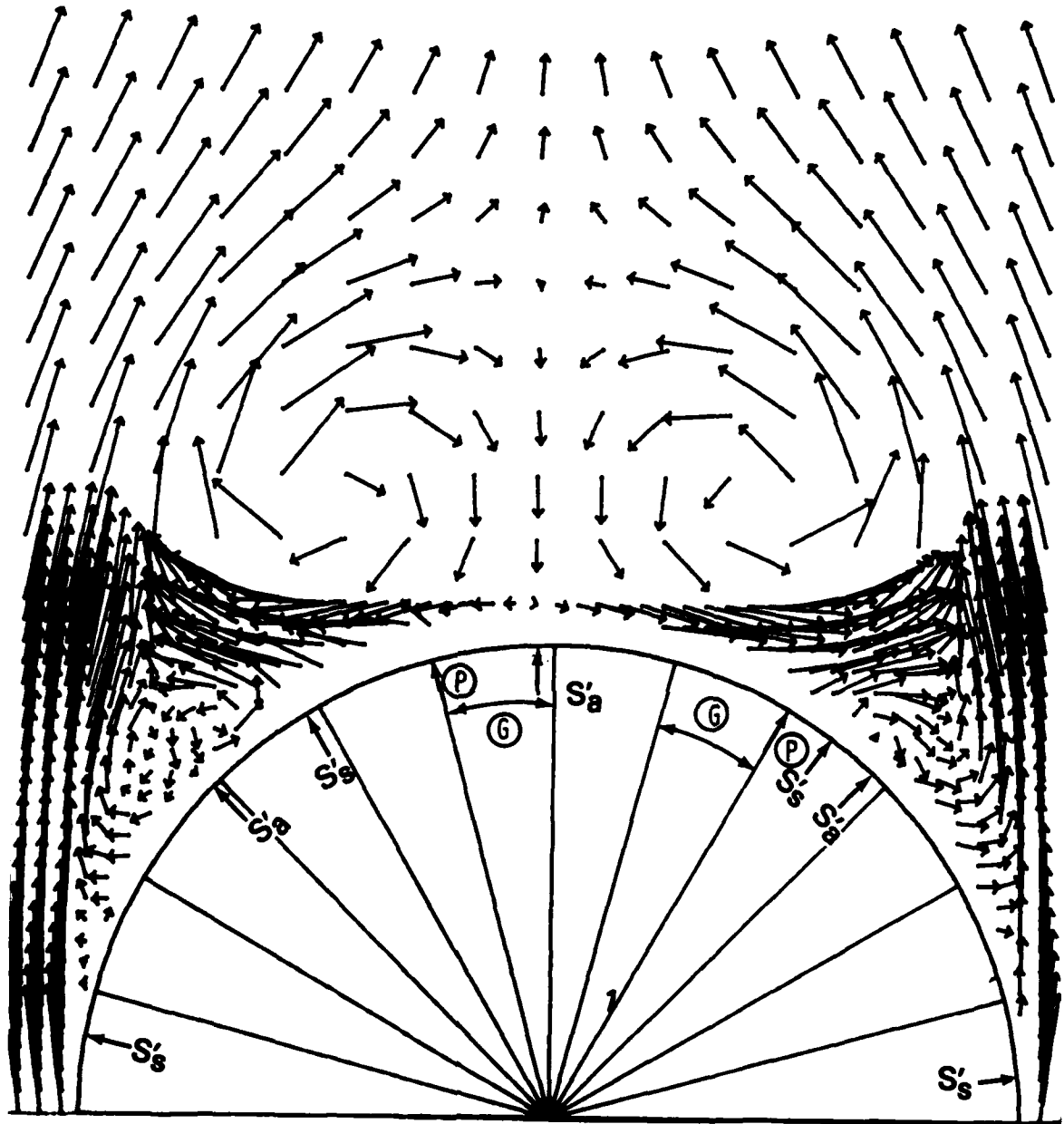
A) $X/D = 2.6$ 

Figure 12. Measured Crossflow plane velocity vectors on the blunt model. S'_a and S'_s are attachment and separation points respectively. The P represents peak σ_c locations while the G indicates regions of sharp pressure gradients.

B) $X/D = 5.7$

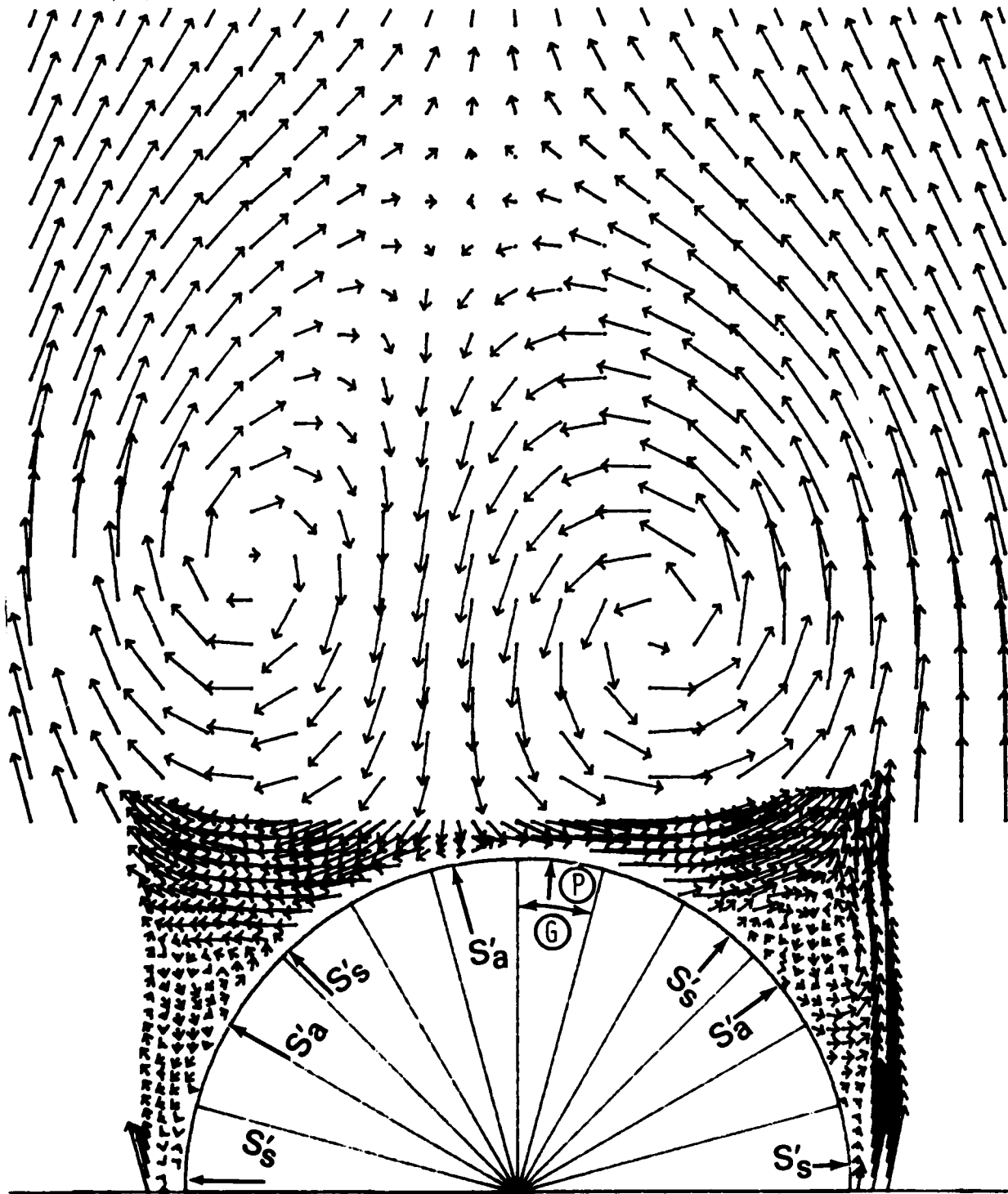


Figure 12.(Continued)

B) (Continued) Enlargement of the left secondary region.

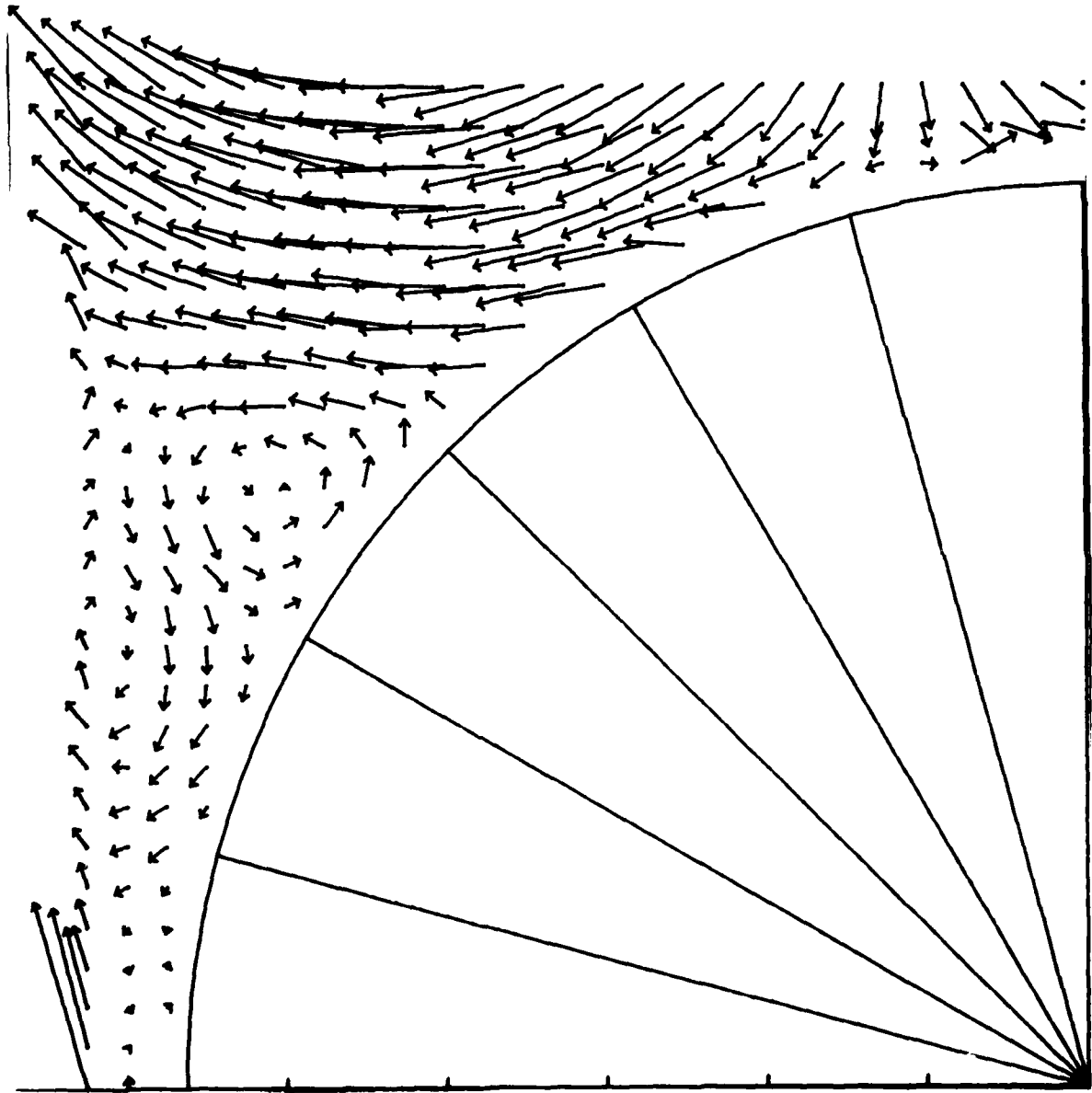


Figure 12. (Continued)

B)(Continued) Enlargement of right secondary region.

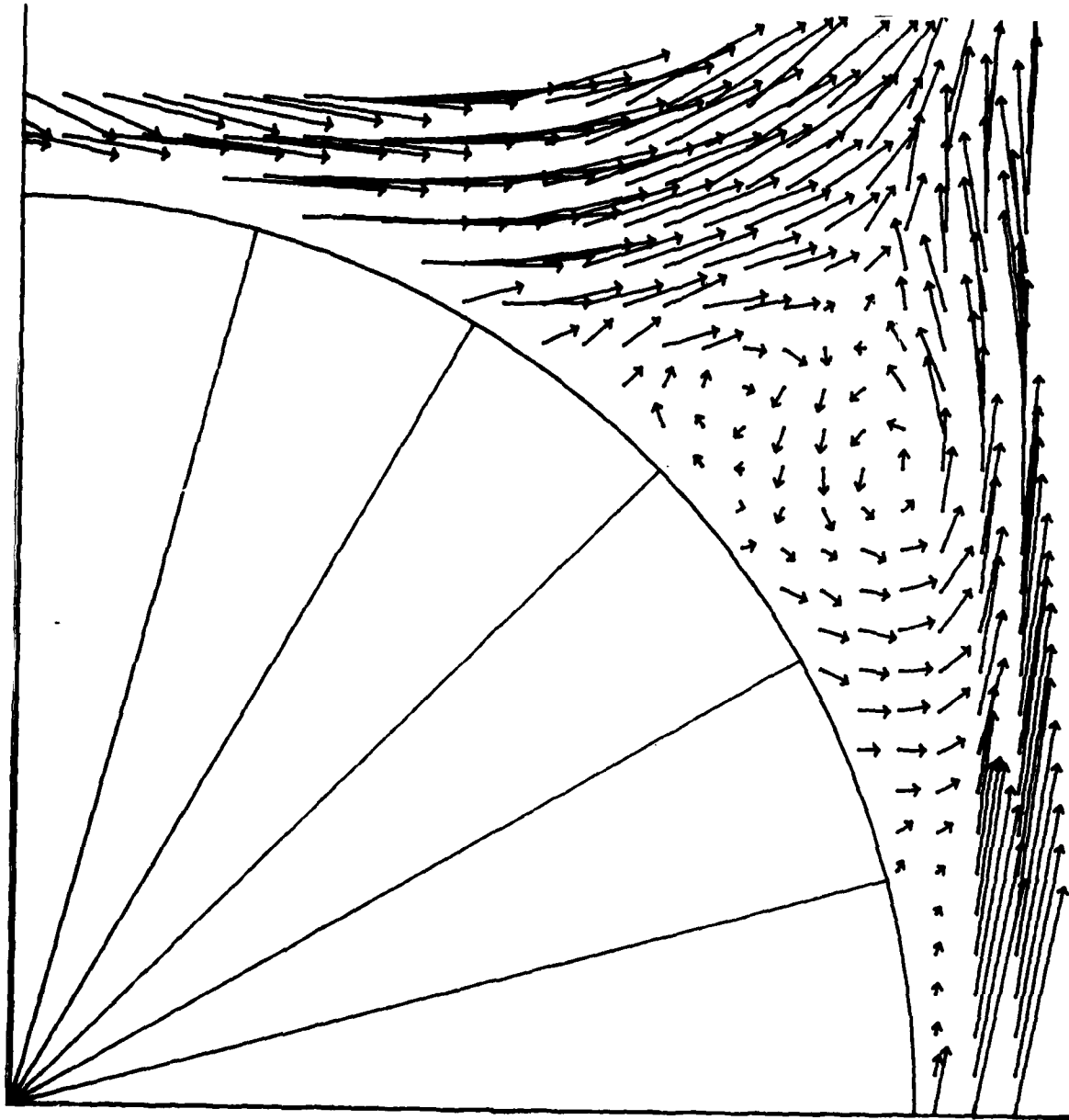


Figure 12. (Continued)

A) $X/D = 1.3$

SHARP, TRIPPED MODEL
 $X/D = 1.3$

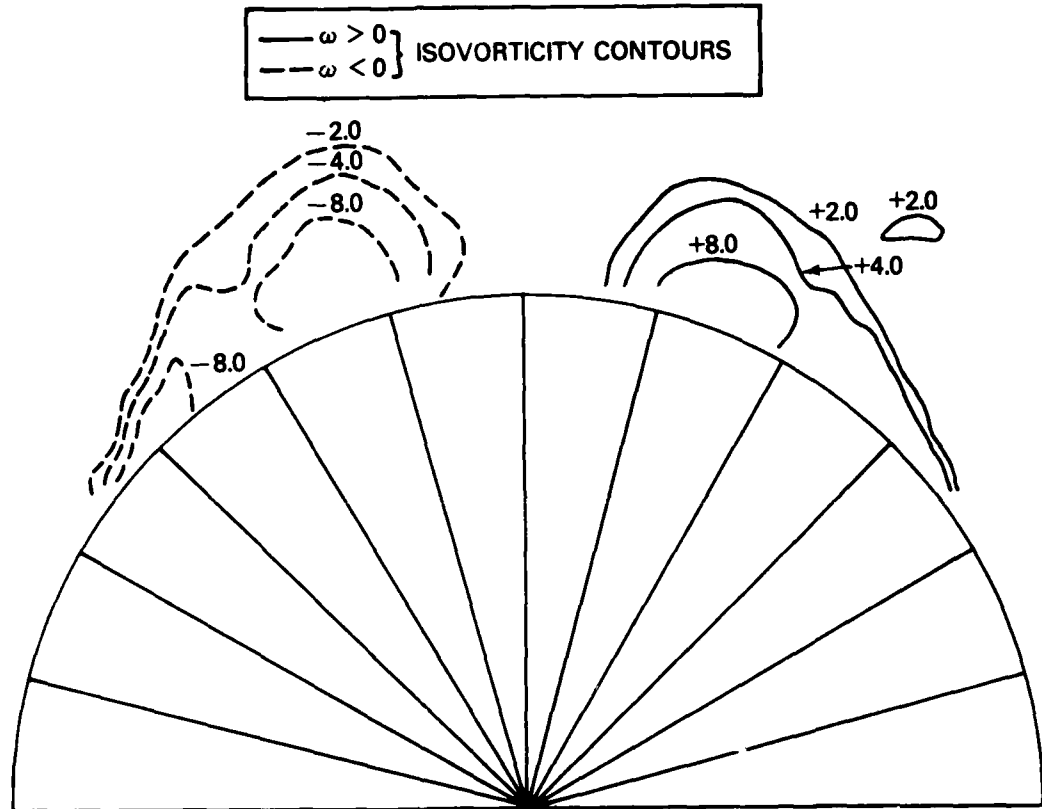


Figure 13. Isovorticity contours and areas of high velocity fluctuations on the sharp tripped model. — $\omega > 0$; --- $\omega \leq 0$;
 ### $\sigma_{V_c} / U_\infty > .3$

B) $X/D = 2.6$, $C_y = .77$

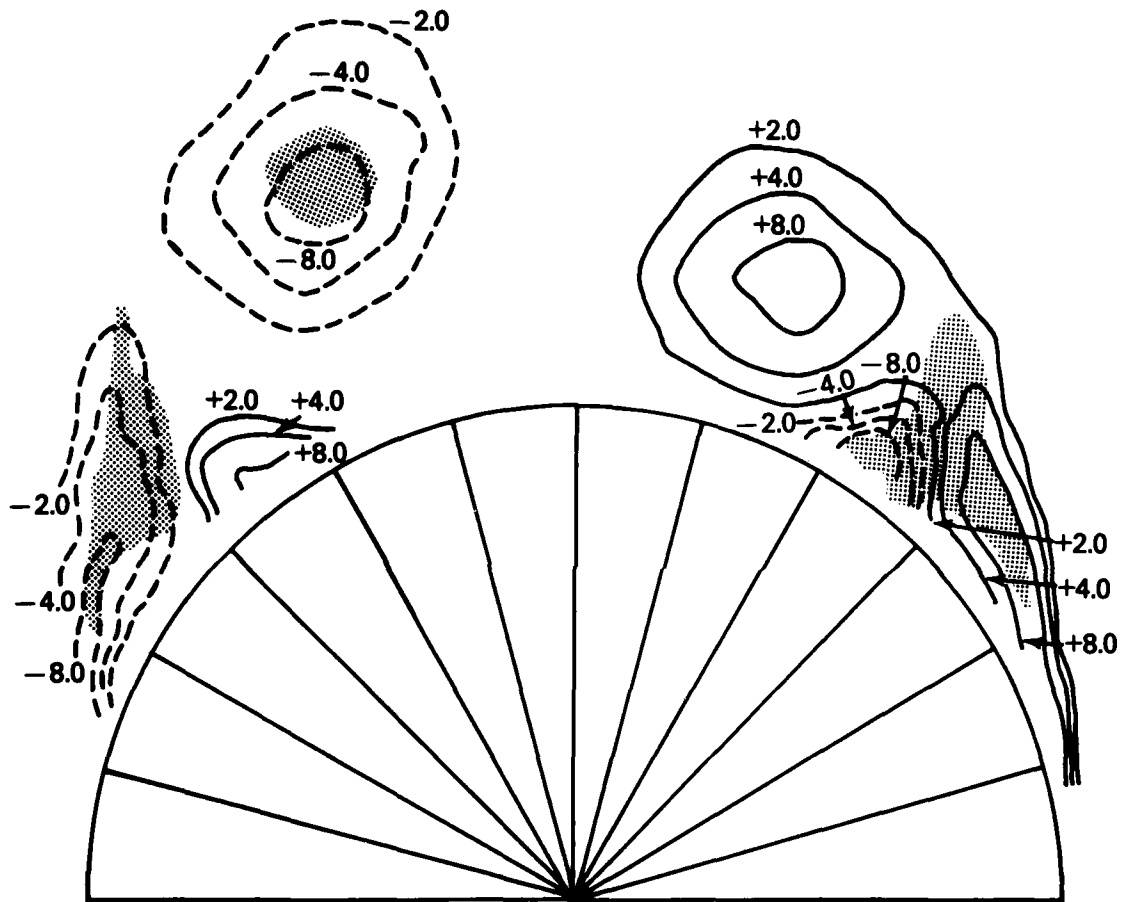


Figure 13. (Continued)

c) $X/D = 3.6$, $C_y = 1.52$

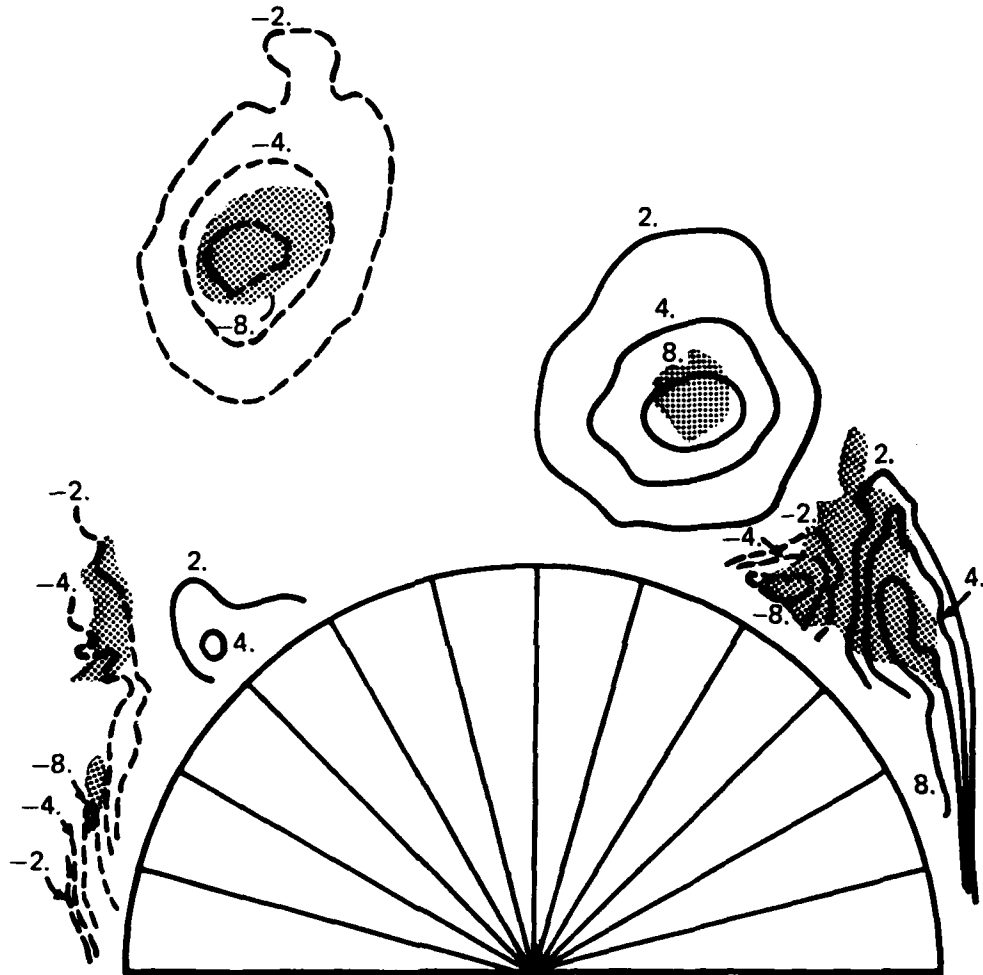


Figure 13. (Continued)

D) $X/D = 4.7$, $C_y = 2.11$

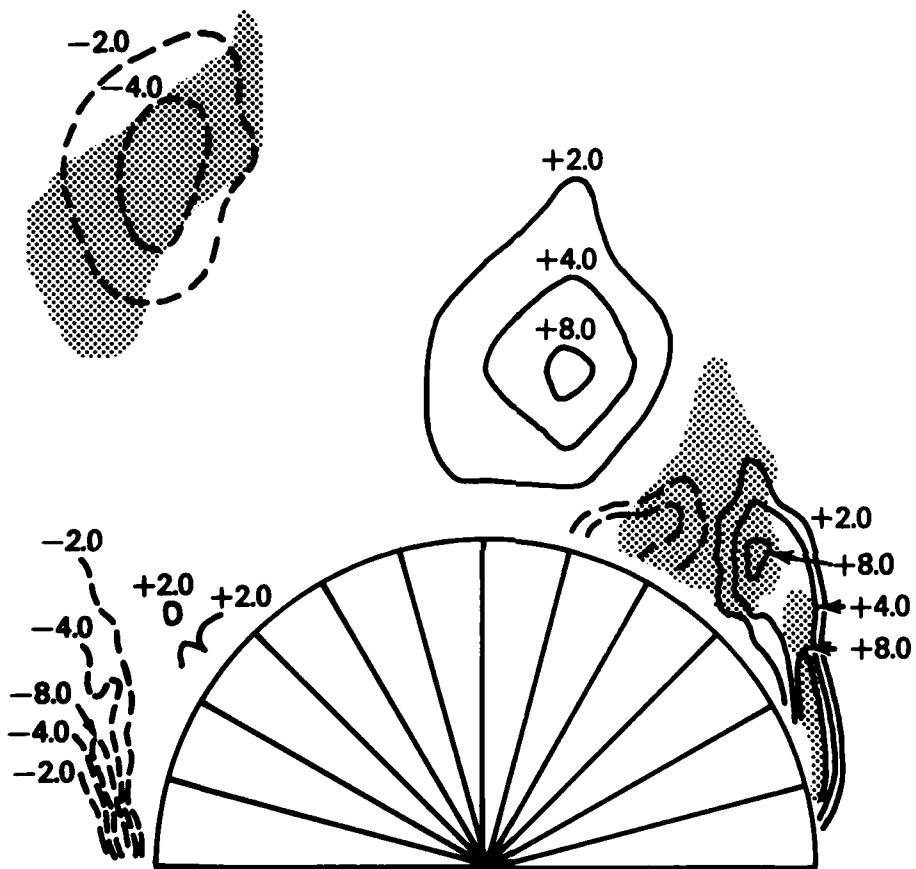


Figure 13. (Continued)

$x/D = 2.6$, $c_y = .09$

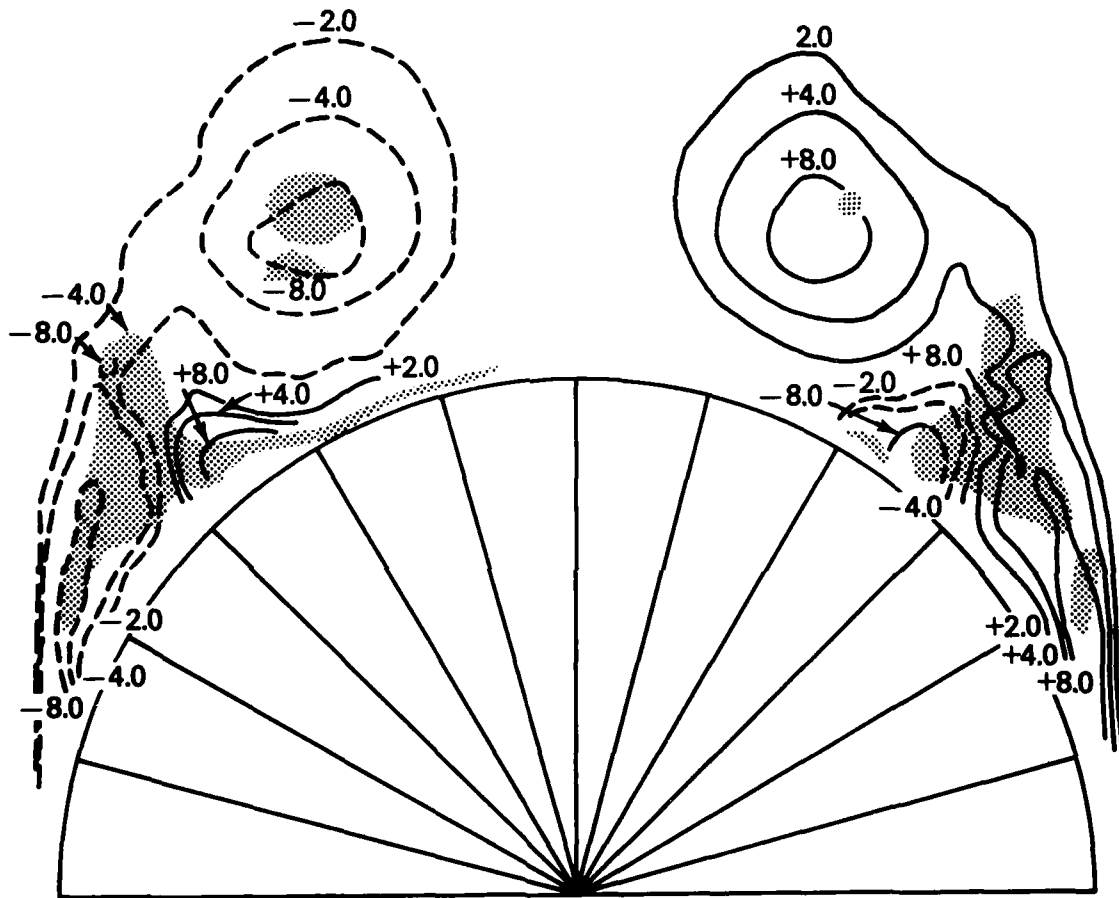


Figure 14. Isovorticity contours and areas of high velocity fluctuations on the sharp, untripped model. — $\omega > 0$; ---- $\omega \leq 0$;
 # # # # $\sigma_{v_c} / U_\infty \geq .3$

A) $X/D = 2.6$; $C_y = .33$

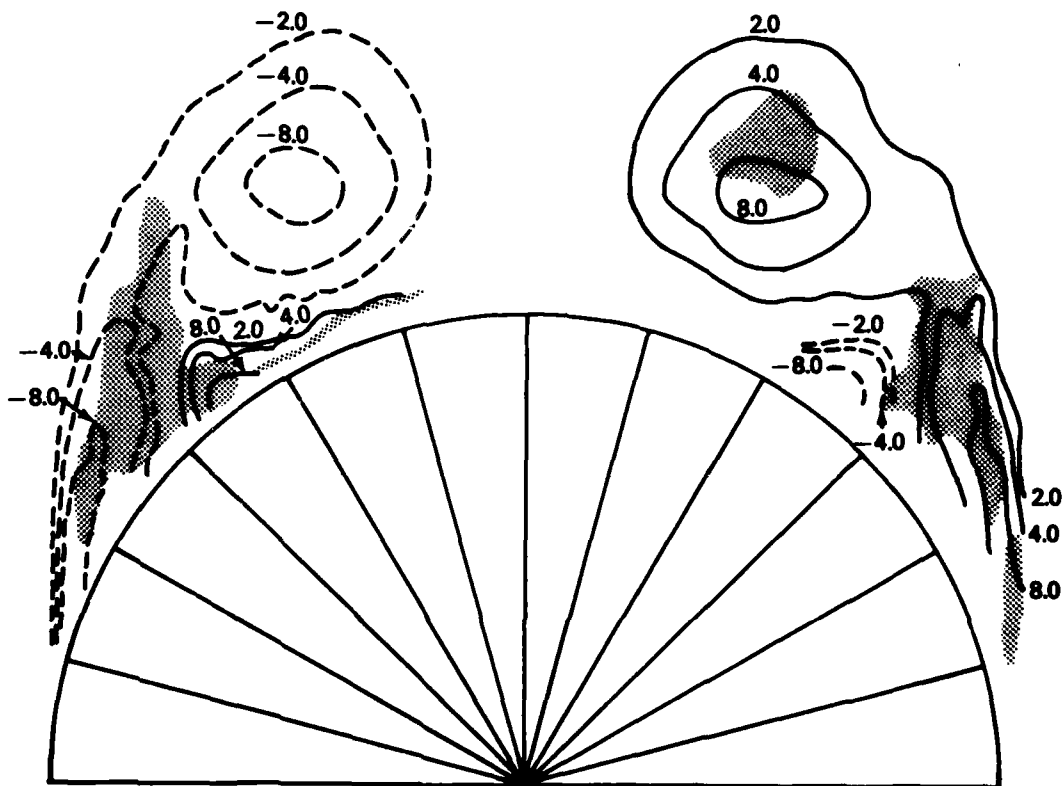


Figure 15. Isovorticity contours and areas of high velocity fluctuations on the sharp, untripped model. — $\omega > 0$; ---- $\omega \leq 0$;
 $\sigma_{v_c} / U_\infty > .3$

B) $X/D = 5.7, C_y = .93$

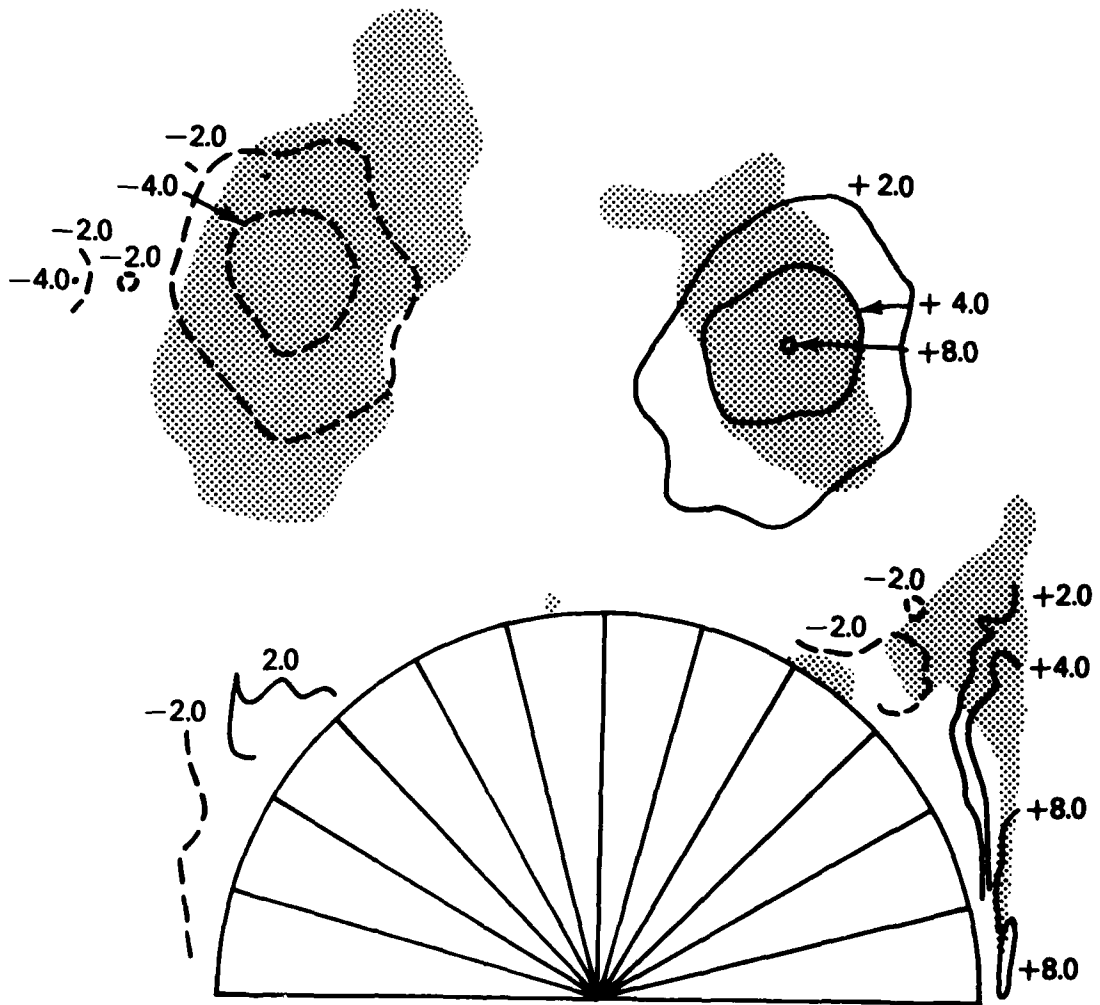


Figure 15.(Continued)

A) $X/D = 1.3$

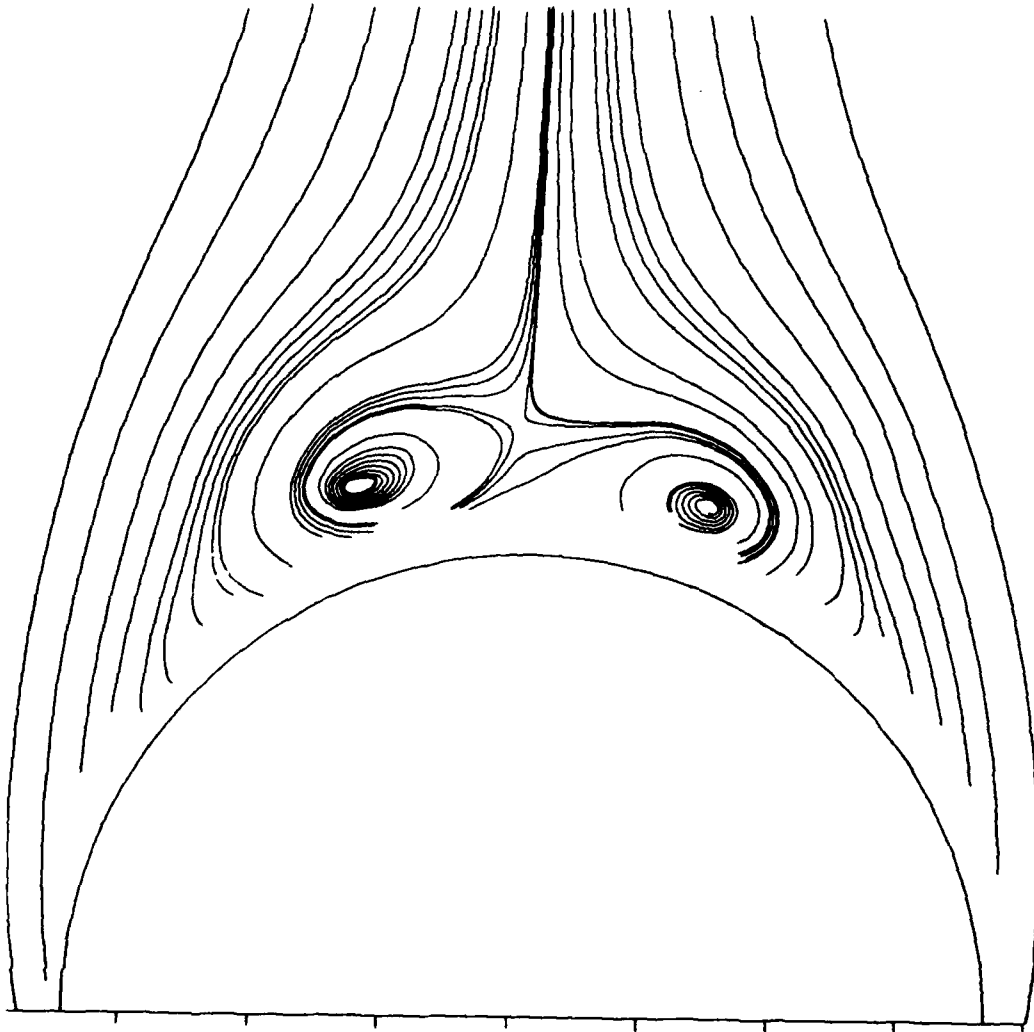


Figure 16. Streamlines on the tripped model.

B) $X/D = 2.6$

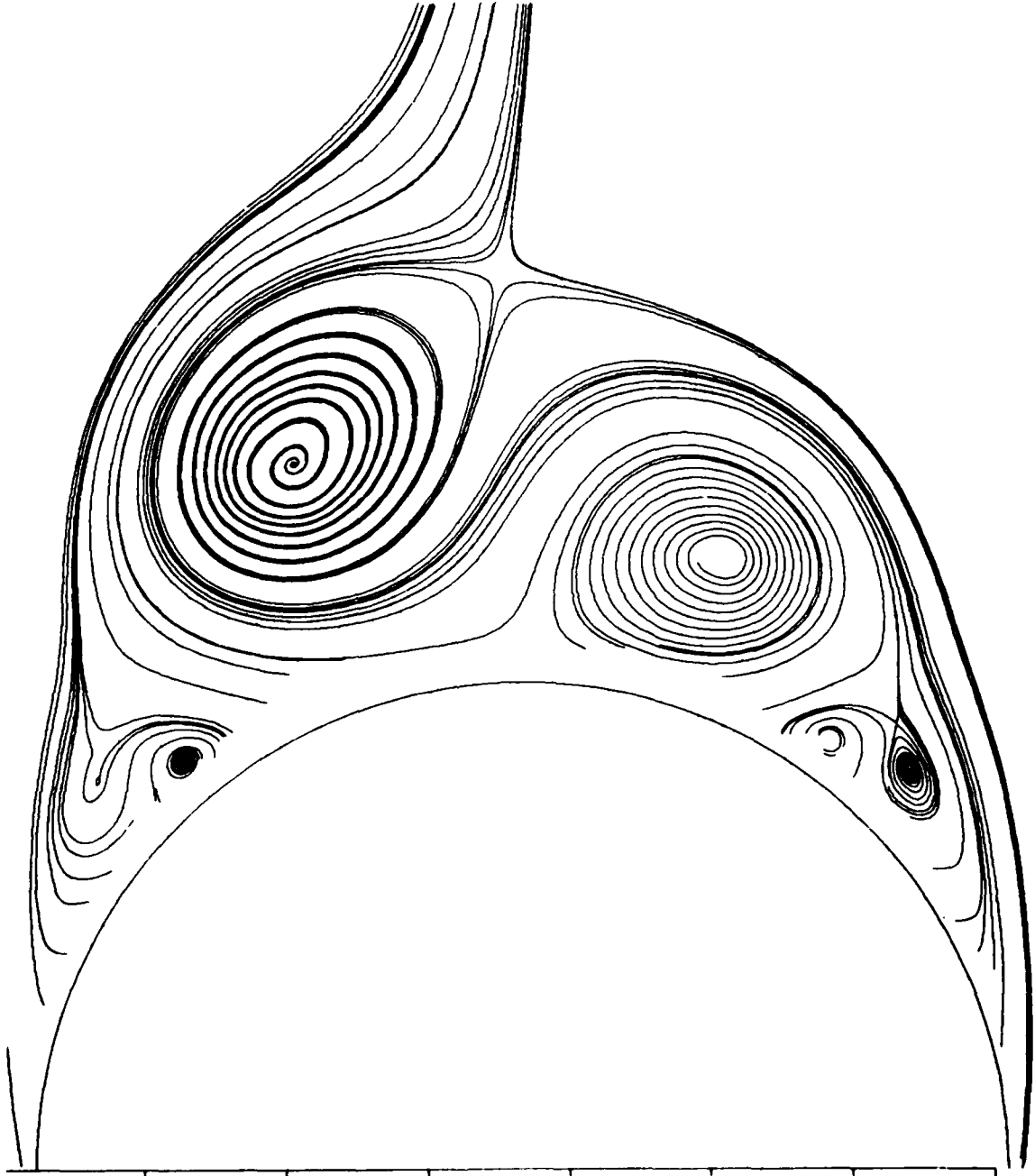


Figure 16. (Continued)

c) $x/D = 3.6$

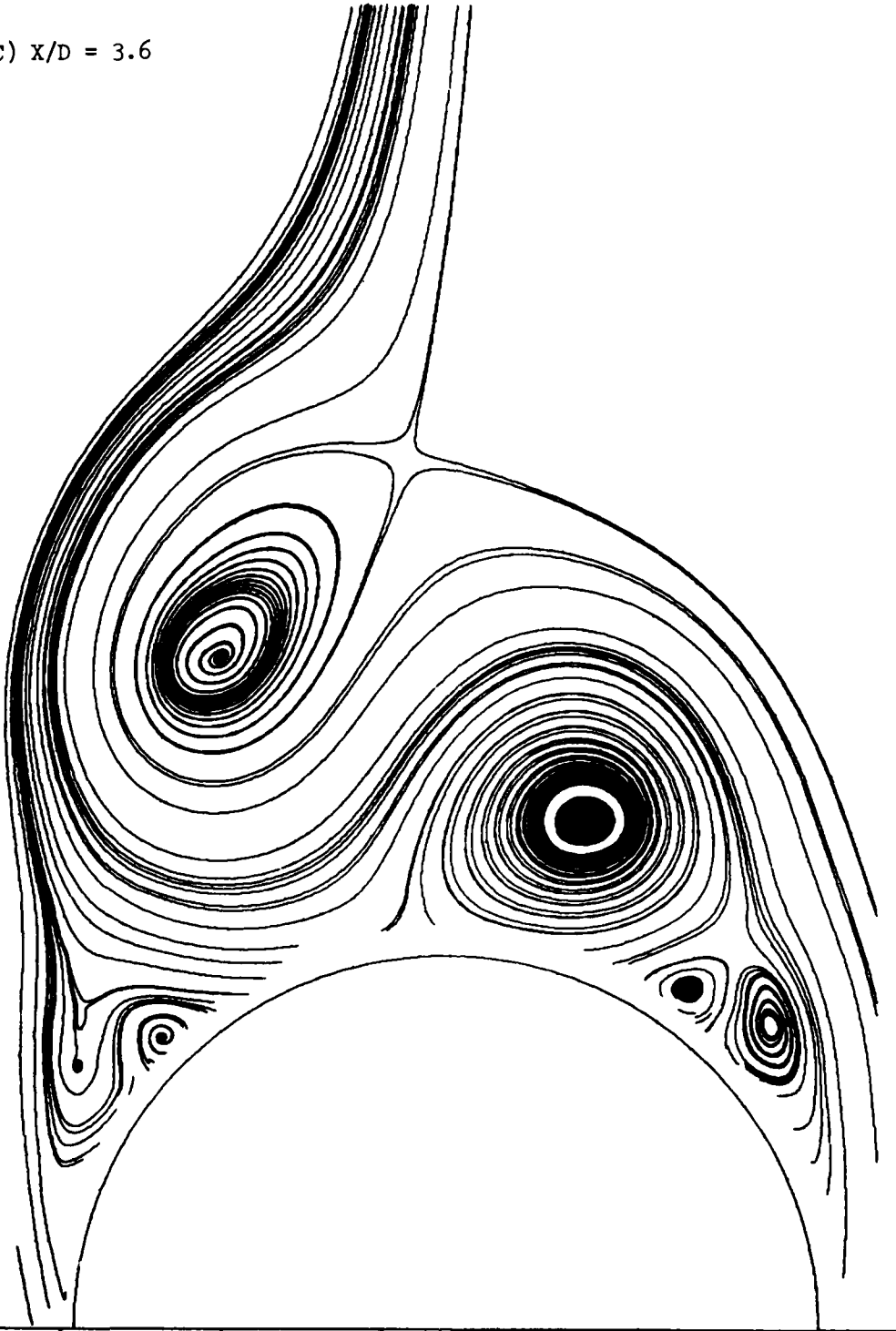


Figure 16. (Continued)

D) $X/D = 4.7$

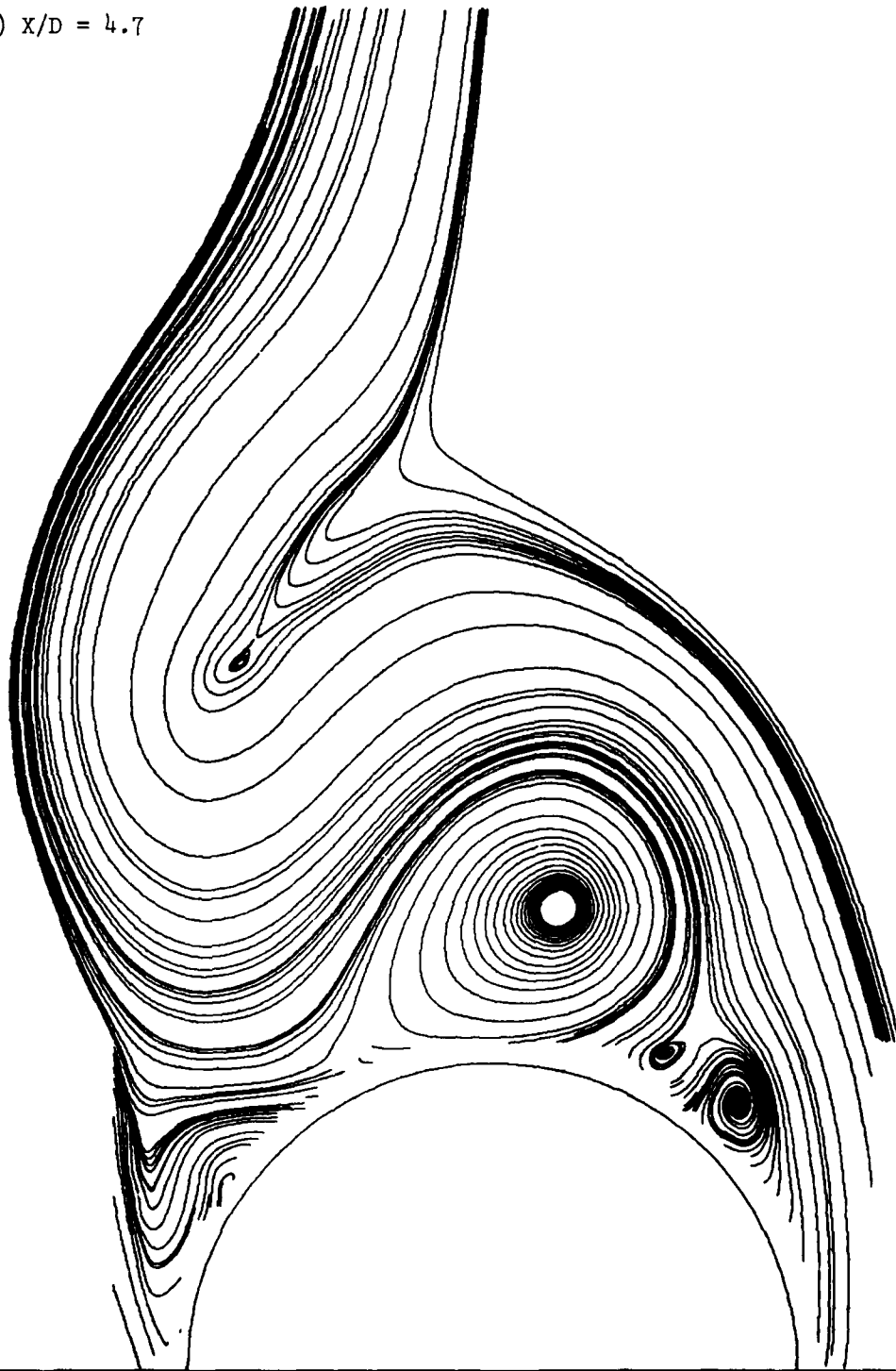


Figure 16.(Continued)

$X/D = 2.6$

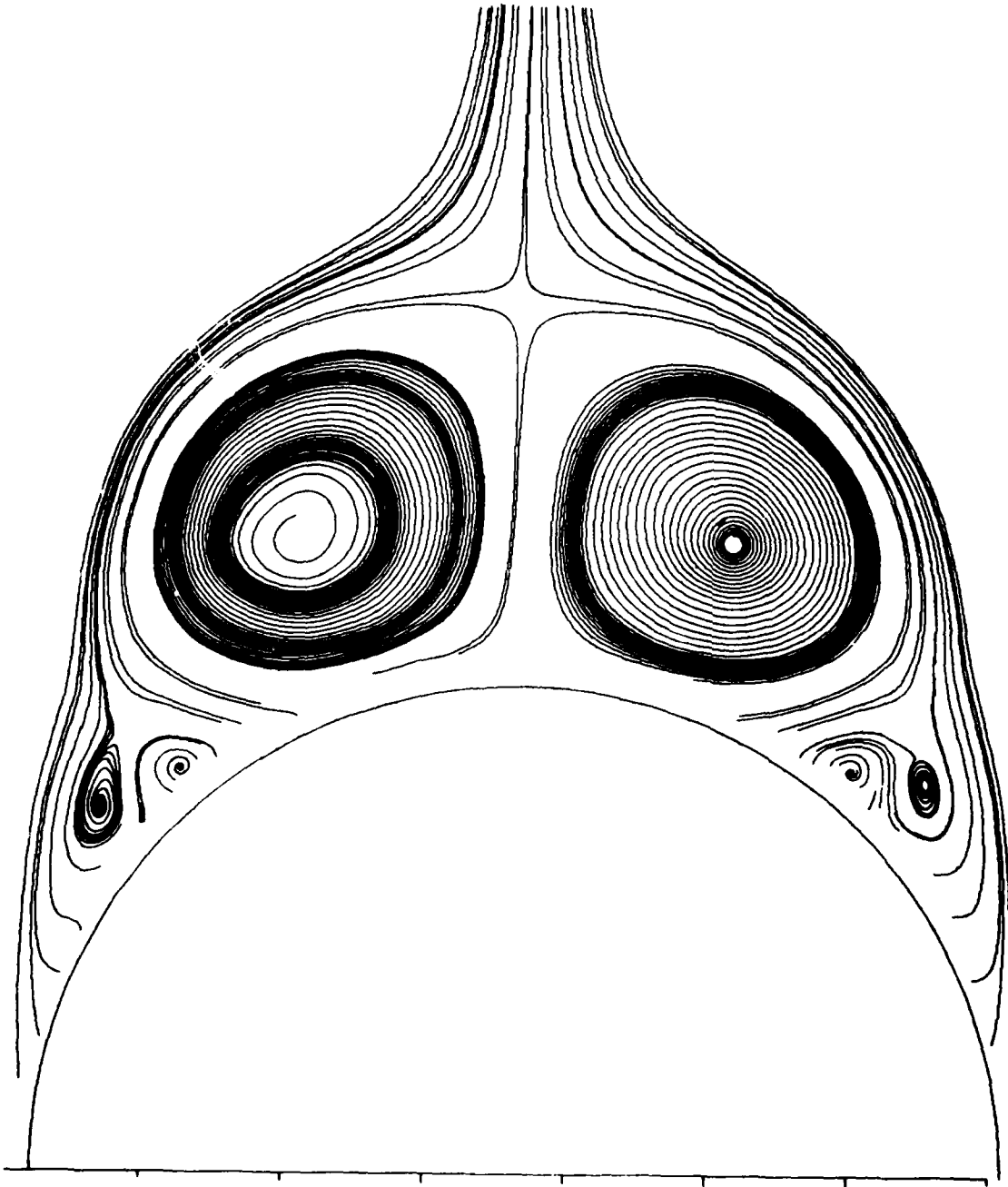


Figure 17. Streamlines on the sharp untripped model.

A) $X/D = 2.6$

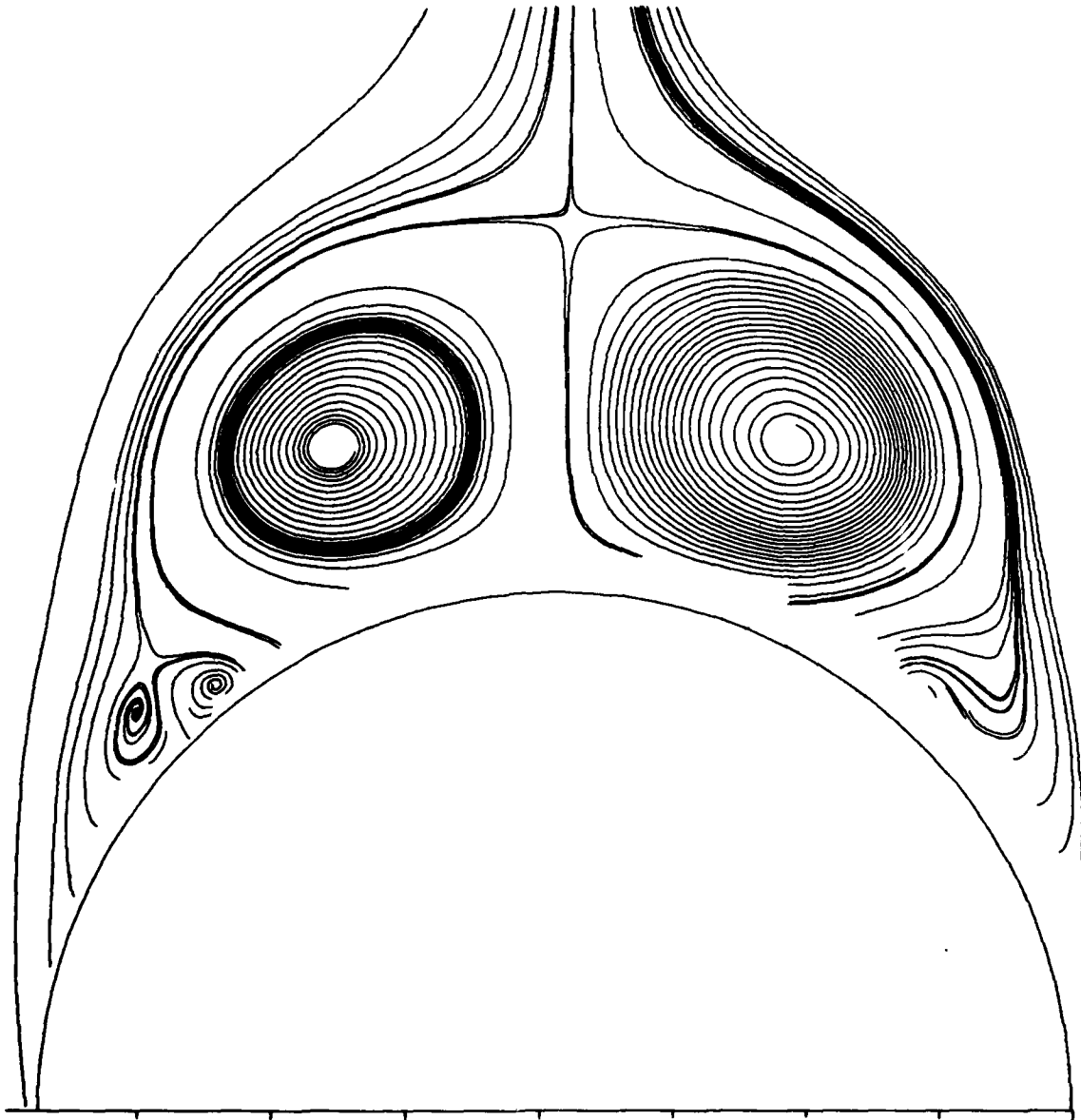


Figure 18. Streamlines on the blunt model.

B) $X/D = 5.7$

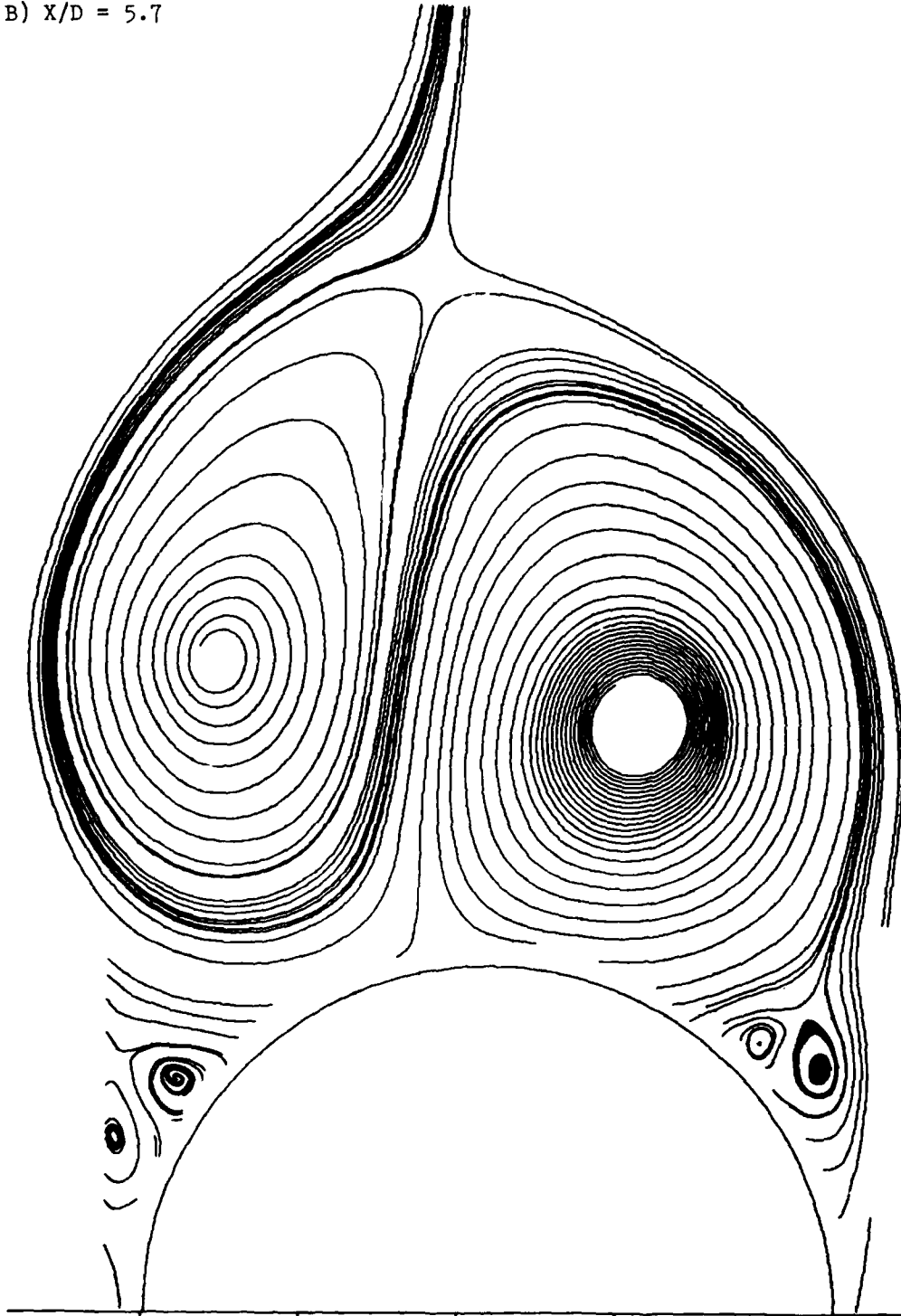


Figure 18. (Continued)

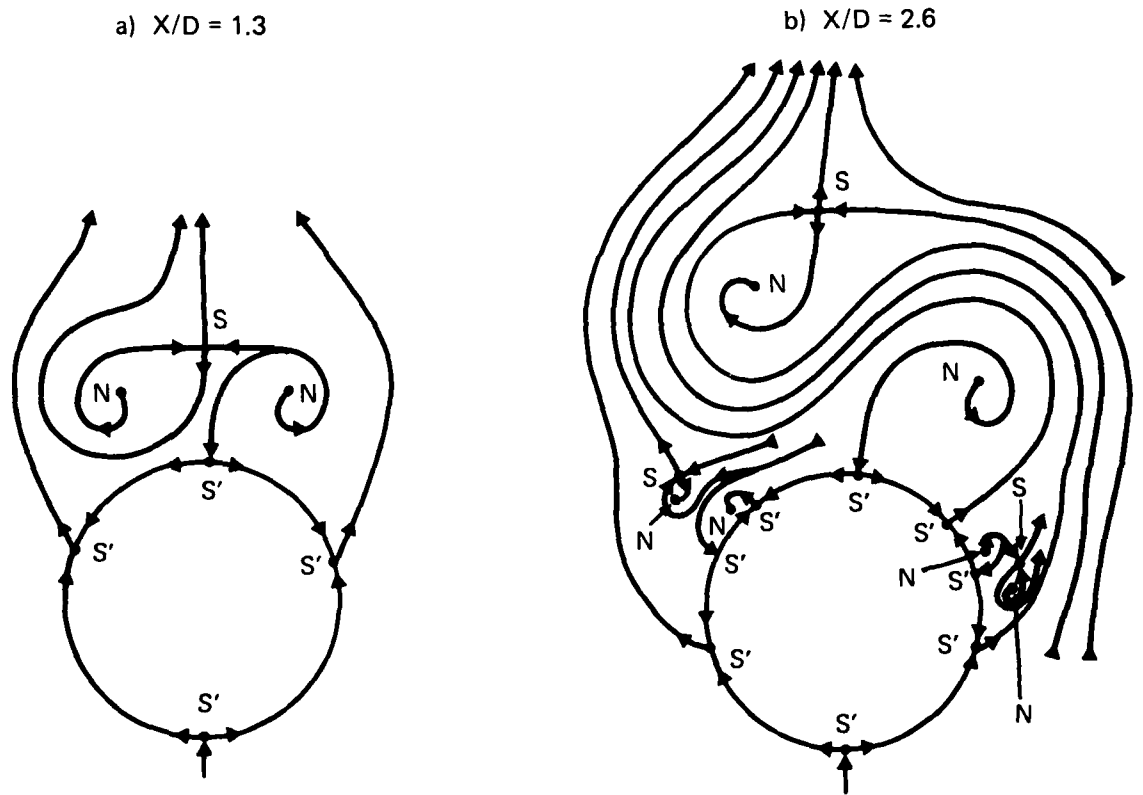


Figure 19. Topological sketch of asymmetric flow development.

c) $X/D = 4.7$

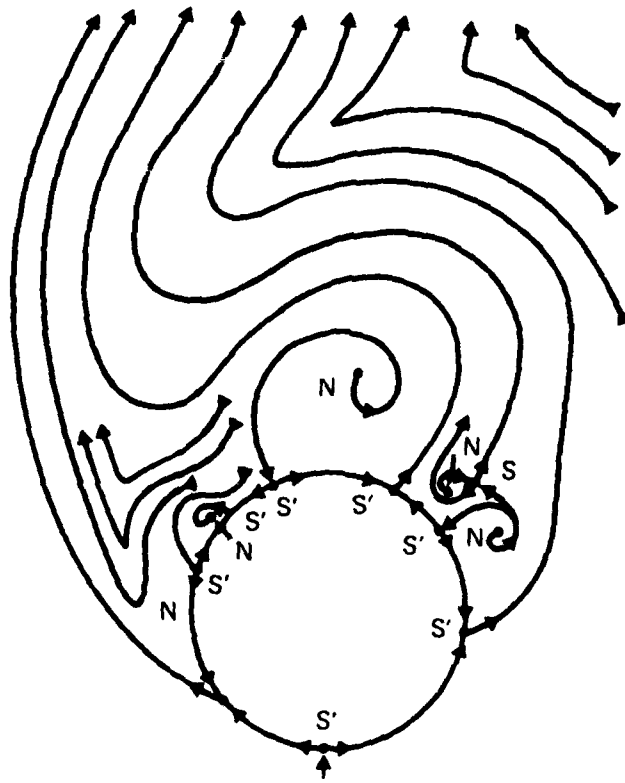


Figure 19. (Continued)

TABLE 1

WIND TUNNEL TESTS IN WHICH LDV DATA WAS TAKEN

Run No.	Model	Crosssectional Plane Surveyed (X/D)	Comments	Test No.
1	Sharp, no trip	2.6	Flow field unsteadiness occured	81061602
2	Sharp, no trip	5.7	Only secondary region surveyed	81061701
3	Sharp, tripped	.75	Vortices not clearly resolved.	81070702
4	Sharp, tripped	1.3		81070701
5	Sharp, tripped	2.6		81070802
6	Sharp, tripped	3.6		81070803
7	Sharp, tripped	4.7		81062502
8	Blunt	2.6		81071515
9	Blunt	5.7		81071601

TABLE 2
CIRCULATION CONTAINED IN REGIONS P, S1 and S2

X/D	Left Hand Side			Right Hand Side			$\sum \lambda$	C_y
	Secondary λ_{s1}	λ_{s2}	Primary λ_p	Secondary λ_{s1}	λ_{s2}	Primary λ_p		
SHARP, TRIPPED MODEL								
.75			-.019			.010	-.009	
1.30			-.218			.198	-.020	
2.60	-.218	.053	-.403	.209	-.046	.360	-.044	.77
3.60	-.265	.048	-.581	.245	-.070	.578	-.095	1.475
4.70 ⁺	-.332*	.031	-.755	.297	-.064	.665	-.158	2.1
SHARP, UNTRIPPED MODEL								
2.60	-.203	.068	-.412	.204	-.047	.388	-.003	0 ~ .2
5.70		.037			-.039			-.6 ~ -8
BLUNT, TRIPPED MODEL								
2.60	-.203	.048	-.346	.216	-.030	.340	.026	.33
5.70	-.188*	.046	-.837	.201	-.048	.869	.043	.93

* Estimated

+ Second vortex with a $\lambda = .0023$ starts to form on left hand side of model.

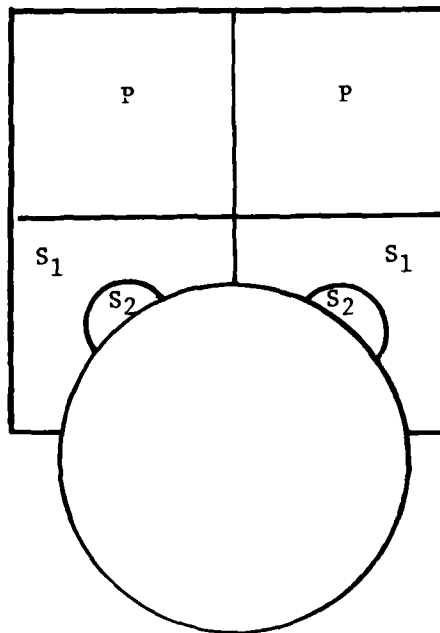


TABLE 3
SIDE FORCE VARIATION

Run 1

X/D	Sample			
	1	2	3	4
2.6	.093	-.018	0.86	.270
3.6	.038	-.18	.059	.520
4.7	.013	-.47	.013	.909
5.7	-.075	-.723	-.022	1.205

Run 2

X/D	Sample			
	1	2	3	4
2.6	-.005	-.019	-.043	-.058
3.6	-.161	-.137	-.205	-.231
4.7	-.442	-.412	-.523	-.578
5.7	-.656	-.620	-.779	-.845

CHAPTER 9

REFERENCES

1. Gowens, F. E. and Perkins, E. W., "Study of the Effects of Body Shape on the Vortex Wakes of Inclined Bodies at $M = 2.$," NACA, 1953, RM A53117.
2. Fiechter, M., "Über Wirbelsysteme an Schlanken Rotationskörpern und Ihren Einfluss auf die Aerodynamischen Beiwerte," Deutsch-Französisches Forschungsinstitut, Saint-Louis, 1966, Bericht 10/66.
3. Thomson, K. D. and Morrison, D. F., "The Spacing, Position and Strength of Vortices in the Wake of Slender Cylindrical Bodies at Large Incidence," Journal of Fluid Mechanics, 50, 4, 1971, pp. 751-783.
4. Clark, W. H. and Nelson, R. D., "Body Vortex Formation on Missiles at High Angles of Attack," AIAA Paper 76-65, 1976.
5. Clark, W. H., "Body Vortex Formation on Missiles in Incompressible Flows," AIAA Paper No. 77-1154, 1977.
6. Fidler, J. E., Schwind, R. G. and Nielsen, J. N., "Investigation of Slender-Body Vortices," AIAA Journal, 15, 12, Dec 1977, pp. 1736-1741.
7. Yanta, W. J. and Wardlaw, A. B., "Laser Doppler Velocimeter Measurements of Leeward Flowfields on Slender Bodies at Large Angle-of-Attack," AIAA Paper 77-660, 1977.
8. Schwind, R. G. and Mullen, J., "Laser Velocimeter Measurements of Slender Body Wake Vortices," AIAA Paper 79-0302, 1979.
9. Owen, F. K. and Johnson, D. A., "Wake Vortex Measurements of an Ogive Cylinder at $\alpha = 36$ Degrees," Journal of Aircraft, Sep 1979, pp. 577-583.
10. Wardlaw, A. B. and Yanta, W. J., "Flow Field About and Forces on Slender Bodies at High Incidence," AIAA Journal, 19, 3, Mar 1981, pp. 296-302.
11. Peake, D. J., Owen, F. K., and Johnson, D. A., "Control of Forebody Vortex Orientation to Alleviate Side Forces," AIAA Paper 80-0183, 1980.
12. Yanta, W. J. and Wardlaw, A. B., "Multi-Stable Vortex Patterns on Slender, Circular Bodies at High Incidence," AIAA Journal, 20, 4 Apr 1982, pp 509-515.
13. Lamont, P. J. and Hunt, B. L., "Pressure and Force Distributions on a Sharp-Nosed Circular Cylinder at Large Angles of Inclination to a Uniform Subsonic Stream," Journal of Fluid Mechanics, 76, 3, 1976, pp. 519-559.

14. Wardlaw, A. B. and Morrison, A. M., "Induced Side Forces at High Angles of Attack," Journal of Space Craft and Rockets, 13, 10, 1976, pp. 589-593.
15. Wardlaw, A. B. and Yanta, W. J., "The Flow Field About and Forces on Slender Bodies at High Incidence," AIAA Paper 80-0184, 1980.
16. Canning, T. N. and Nielson, J. N., "Experimental Study of the Influence of Supports on the Aerodynamic Loads of an Ogive Cylinder at High Angles of Attack," AIAA Paper 81-0007, 1981.
17. Hunt, J. C. R., Abell, C. J., Peterka, J. A., and Woo, H., "Kinematical Studies of the Flows Around Free or Surface-Mounted Obstacles; Applying Topology to Flow Visualization," Journal of Fluid Mechanics, 86, 1, 1978, pp. 179-200.
18. Tobak, M. and Peake, D. J., "Topology of Two-Dimensional and Three Dimensional Separated Flows," AIAA Paper 79-1480.
19. Keener, E. R. and Chapman, G. T., "Similarities in Vortex Asymmetries Over Slender Bodies and Wings," AIAA Journal, 15, 9, 1977, pp. 1370-1372.
20. Nishioka, M. and Sato, H., "Mechanism of the Determination of the Shedding Frequency of Vortices Behind a Cylinder at Low Reynolds Number," Journal of Fluid Mechanics, 89, 1, 1978, pp. 49-60.

APPENDIX A

This appendix provides a listing of the measured crossflow plane velocities and standard deviations. The symbols using in the listing are defined as follows:

X,Y,Z - x,y,z coordinate (see Figure 1)

V,W - v and w velocity components

VS,WS - standard deviation of the v and w velocity components.

In some cases the standard deviation values are not available. In these instances the listed value is 0.0000. A tape containing the information provided in this appendix is available on request.

TEST NUMBER 81061602 RUN NUMBER 1 X/D = 2.60

NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS																																																																																																																																																																																																																																																																																																																																																																					
331	1.100	.804	-2.5997	21.5244	2.0374	6.0689	386	1.200	1.051	-5.2080	24.0241	.7565	6.0795	387	1.200	1.010	-5.1010	23.7147	.9455	6.2069	388	1.200	1.150	-5.3373	23.6303	.8083	6.2069	389	1.200	1.150	-5.2586	23.3053	.8850	4.1229	390	-1.200	1.200	-5.2586	23.8037	1.0888	4.1189	391	-1.200	1.200	4.4595	23.1147	1.0877	2.3394	392	-1.200	1.501	6.2587	23.7013	1.0077	2.3394	393	-1.200	1.651	6.6907	23.8118	.8545	2.3394	394	-1.200	1.800	7.9793	23.8118	.7298	2.3394	395	-1.200	1.950	8.7371	21.3350	.8857	2.3394	396	-1.200	2.100	8.7371	19.6756	.7887	2.3394	397	-1.200	2.252	8.4120	18.3249	.7589	2.3394	398	-1.200	2.400	7.7063	17.2970	.7531	2.3394	399	-1.200	2.550	6.9927	16.5218	.7445	2.3394	400	-1.200	2.702	6.1669	16.0730	.7347	2.3394	401	-1.050	1.200	5.2219	15.6371	.5914	2.3394	402	-1.050	1.352	2.2895	18.0024	6.8013	2.3394	403	-1.050	1.503	4.0576	22.9120	4.9280	2.3394	404	-1.050	1.653	6.8619	22.9120	3.1945	2.3394	405	-1.050	1.803	6.8619	23.8239	1.4324	2.3394	406	-1.050	1.953	11.4135	21.6269	.9144	2.3394	407	-1.050	2.104	10.9288	19.0641	.8555	2.3394	408	-1.050	2.254	10.0931	17.3095	.7510	2.3394	409	-1.050	2.404	8.7274	16.3649	.7417	2.3394	410	-1.050	2.554	6.7249	15.5591	.8098	2.3394	411	-1.050	2.704	5.5177	15.0140	.6714	2.3394	412	-1.050	2.854	4.6164	14.8164	.4448	2.3394	413	-1.050	3.004	-7.4865	11.5568	4.6164	2.3394	414	-1.050	3.154	-2.5304	26.1790	4.6347	2.3394	415	-1.050	3.304	5.1726	23.0402	4.8498	2.3394	416	-1.050	3.454	9.5861	22.7230	4.3493	2.3394	417	-1.050	3.604	14.6317	21.1568	2.1559	2.3394	418	-1.050	3.754	13.7903	18.1164	1.8791	2.3394	419	-1.050	3.904	11.8367	15.9528	.8317	2.3394	420	-1.050	4.054	9.8149	14.8781	.7836	2.3394	421	-1.050	4.204	8.0380	14.3745	.7292	2.3394	422	-1.050	4.354	6.6856	14.2349	.5365	2.3394	423	-1.050	4.504	5.7188	16.1666	.7918	2.3394	424	-1.050	4.654	-17.4885	10.5252	2.0120	2.3394	425	-1.050	4.804	-10.9691	18.6270	3.8962	2.3394	426	-1.050	4.954	4.0311	23.9767	3.3687	2.3394	427	-1.050	5.104	14.1965	21.7621	4.1494	2.3394	428	-1.050	5.254	17.4765	17.6468	3.9392	2.3394	429	-1.050	5.404	16.6668	15.0578	1.2631	2.3394	430	-1.050	5.554	13.1097	13.2215	1.0545	2.3394	431	-1.050	5.704	10.2318	12.8156	.8312	2.3394	432	-1.050	5.854	8.1322	12.6824	.9999	2.3394	433	-1.050	6.004	6.5321	12.9647	.6533	2.3394	434	-1.050	6.154	5.4150	13.1996	.5014	2.3394	435	-1.050	6.304	-22.1485	4.1622	2.1670	2.3394	436	-1.050	6.454	-19.1161	8.1360	3.6316	2.3394	437	-1.050	6.604	-10.5542	13.1203	5.6841	2.3394	438	-1.050	6.754	18.5734	11.8318	4.3388	2.3394	439	-1.050	6.904	17.8967	10.1941	4.4823	2.3394	440	-1.050	7.054	17.5621	9.5560	1.8997	2.3394	441	-1.050	7.204	13.2873	9.7746	.8806	2.3394

TEST NUMBER 81061602 RUN NUMBER 1 X/D = 2.60

NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS
551	.900	2.254	-8.6507	14.6960	.6502	.5871	564	1.050	2.553	-5.8609	15.0583	.5612	.5802
552	.900	2.403	-7.1826	14.0985	.5910	.5615	565	1.050	2.704	-5.0108	14.7199	.5664	.5661
553	.900	2.554	-6.0402	14.0156	.6687	.5391	566	1.200	1.203	-4.9726	23.3411	.9107	.8938
554	.900	2.704	-4.9339	14.0873	.5826	.5438	567	1.200	1.352	-5.8583	23.2921	.8766	.7903
555	1.050	1.204	-3.3785	20.0514	3.1418	6.3054	568	1.200	1.504	-6.7300	23.0181	1.8269	.7726
556	1.050	1.352	-4.9918	23.4650	2.3980	3.7574	569	1.200	1.654	-7.7371	21.8834	.7220	.6777
557	1.050	1.504	-7.8985	23.9815	1.6994	1.1911	570	1.200	1.804	-8.4591	20.4634	.6750	.6285
558	1.050	1.654	-9.7925	22.7187	.9851	1.0587	571	1.200	1.953	-8.4181	19.0656	.5898	.5692
559	1.050	1.804	-10.5584	20.5884	.9912	.9131	572	1.200	2.104	-7.8405	17.6739	.5511	.5867
560	1.050	1.952	-10.1550	18.5986	.6681	.6710	573	1.200	2.254	-7.0509	16.8414	.8921	.8733
561	1.050	2.104	-9.1826	16.9645	.6410	.6310	574	1.200	2.404	-6.2589	16.2548	.4765	.5231
562	1.050	2.254	-7.8062	15.9164	.5812	.6433	575	1.200	2.553	-5.5181	15.6473	.5883	.4844
563	1.050	2.404	-6.8778	15.3162	.5126	.5911	576	1.200	2.704	-4.8572	15.5879	.4633	.5864

TEST NUMMR 01070701 RUN NUMBER 4 K/D = 1.30

NO.	Y	Z	V	M	VS	NO.	Y	Z	V	M	VS
1	-0.899	0.000	-3.8231	25.0865	.4966	56	-0.799	.851	5.7150	22.9716	.6946
2	-0.899	.052	-2.9478	25.3114	.4993	57	-0.799	.900	6.0165	22.5485	.6561
3	-0.899	.102	-2.2742	25.3745	.6094	58	-0.750	.202	-3.693	27.1415	.6275
4	-0.899	.150	-1.5870	25.3773	.6275	59	-0.750	.252	-2.006	26.9307	.7312
5	-0.899	.201	-0.8854	25.2932	.5884	60	-0.750	.302	-1.7446	26.8116	.5082
6	-0.899	.252	-0.3601	25.2337	.6640	61	-0.750	.350	1.5256	26.4889	.6213
7	-0.899	.302	.3621	25.1368	.5629	62	-0.750	.402	2.1115	26.2957	.6644
8	-0.899	.351	.8855	24.8838	.6013	63	-0.750	.452	2.7585	26.0112	.7057
9	-0.899	.401	1.3867	24.7400	.6374	64	-0.750	.501	3.1238	25.8104	.7172
10	-0.899	.452	1.7696	24.5038	.5890	65	-0.750	.550	3.6116	25.5723	.7403
11	-0.899	.502	2.3689	24.3018	.6238	66	-0.750	.602	4.3975	25.2897	.8857
12	-0.899	.551	2.6399	24.2607	.6356	67	-0.750	.652	4.8065	24.8096	.6688
13	-0.899	.601	3.0644	23.9195	.4747	68	-0.750	.700	5.2492	24.3178	.6310
14	-0.899	.652	3.4885	23.6461	.6122	69	-0.750	.750	5.5930	23.9161	.7064
15	-0.899	.702	3.9307	23.5160	.6595	70	-0.750	.802	5.8888	23.6420	.6482
16	-0.899	.751	4.2342	23.1294	.6023	71	-0.750	.852	6.2238	23.2898	.6406
17	-0.899	.801	4.5356	22.7562	.5449	72	-0.750	.901	6.5356	22.8671	.5431
18	-0.899	.852	4.8248	22.5180	.6662	73	-0.699	.402	2.6615	26.7143	.8004
19	-0.899	.902	4.9324	22.1527	.5655	74	-0.699	.452	3.0915	26.4034	.8230
20	-0.849	.002	-3.8907	25.9901	.5780	75	-0.699	.502	3.6961	26.4143	.9063
21	-0.849	.300	-2.9683	26.2339	.5491	76	-0.699	.551	4.1445	25.7392	.8756
22	-0.849	.102	-2.0662	26.0343	.5896	77	-0.699	.602	4.8749	25.7463	.9175
23	-0.849	.150	-1.4553	26.0365	.5642	78	-0.699	.653	5.4930	25.3886	.9084
24	-0.849	.201	-0.8994	25.8774	.5919	79	-0.699	.702	5.8487	24.5405	.8388
25	-0.849	.251	-0.1530	25.7506	.6448	80	-0.699	.751	6.0013	24.1149	.9154
26	-0.849	.300	.4423	25.6190	.6383	81	-0.699	.802	6.3494	23.7807	.7531
27	-0.849	.350	1.1019	25.5467	.5882	82	-0.699	.853	6.7606	23.5767	.6572
28	-0.849	.401	1.4117	25.3047	.5981	83	-0.699	.902	7.1352	23.1479	.6581
29	-0.849	.451	2.1146	24.9680	.5739	84	-0.650	.501	-1.7829	11.2824	7.5650
30	-0.849	.500	2.5334	24.9208	.5923	85	-0.650	.551	3.0380	20.2034	7.4475
31	-0.849	.550	2.9280	24.6585	.6106	86	-0.650	.600	4.8922	24.2197	3.8371
32	-0.849	.601	3.4807	24.1826	.5283	87	-0.650	.650	6.3307	24.9853	2.4374
33	-0.849	.651	3.8723	23.9626	.5500	88	-0.650	.701	6.5773	24.5168	1.5886
34	-0.849	.700	4.3027	23.7395	.5861	89	-0.650	.751	6.5450	24.5078	1.2672
35	-0.849	.750	4.6066	23.4321	.6098	90	-0.650	.800	6.7283	24.0728	1.1522
36	-0.849	.801	4.9701	23.0928	.5196	91	-0.650	.850	7.0941	23.8113	.9389
37	-0.849	.851	5.2788	22.6971	.5728	92	-0.650	.901	7.7189	23.5771	.7464
38	-0.849	.900	5.4866	22.3725	.7049	93	-0.600	.550	-5.3505	4.5823	7.5775
39	-0.799	.001	-3.9271	26.9023	.7002	94	-0.600	.600	-1.6853	9.4499	9.6513
40	-0.799	.051	-2.9466	26.8463	.5737	95	-0.600	.650	2.2138	13.9999	9.6534
41	-0.799	.100	-2.1571	26.7398	.5999	96	-0.600	.700	5.3118	19.4863	9.5530
42	-0.799	.150	-1.3563	26.6643	.5446	97	-0.600	.751	6.3410	22.2595	3.8442
43	-0.799	.201	-0.5034	26.4628	.5444	98	-0.600	.800	7.2071	23.6901	2.2547
44	-0.799	.251	-0.0033	26.4007	.5915	99	-0.600	.850	7.6230	24.3691	1.7069
45	-0.799	.300	.6264	26.2563	.5520	100	-0.600	.900	8.3763	24.1937	1.4023
46	-0.799	.350	1.2501	26.0964	.5319	101	-0.550	.651	-5.6810	2.2974	6.8956
47	-0.799	.401	1.7310	25.9116	.6581	102	-0.550	.700	-2.2543	8.1558	8.5252
48	-0.799	.451	2.1718	25.6715	.6140	103	-0.550	.759	.6177	13.8074	7.9942
49	-0.799	.500	2.8803	25.1847	.7402	104	-0.550	.800	2.6230	18.1758	7.7253
50	-0.799	.550	3.4060	25.1234	.6871	105	-0.550	.851	5.5786	21.3004	6.0977
51	-0.799	.601	3.8706	24.7619	.7267	106	-0.550	.900	9.1437	24.0437	3.1684
52	-0.799	.651	4.3113	24.3626	.7092	107	-0.500	.649	-11.1188	-4.8504	3.9089
53	-0.799	.700	4.6638	24.0053	.5855	108	-0.500	.700	-11.2766	-3.1455	3.9089
54	-0.799	.750	5.0780	23.6938	.5408	109	-0.500	.751	-7.5273	10.8374	5.0529
55	-0.799	.801	5.3585	23.4154	.6219	110	-0.500	.800	-2.7747	16.1453	5.3282

TEST NUMBER 81070701 RUN NUMBER 4 X/D = 1.30											
NO.	Y	Z	V	W	VS	WS	NO.	Y	Z	V	W
111	-.500	.849	2.2621	19.3205	5.4641	6.0204	166	.450	.851	-4.3027	22.6100
112	-.500	.900	7.4629	22.5912	4.9710	4.7187	167	.450	.900	-10.8472	22.8041
113	-.450	.700	-16.7011	5.7921	1.8921	3.0123	168	.500	.650	7.6446	2.7446
114	-.450	.750	-14.9875	10.5619	2.7188	3.1598	169	.500	.701	10.9068	4.7704
115	-.450	.800	-9.7530	16.3505	4.1157	3.9153	170	.500	.752	5.9877	11.7797
116	-.450	.849	-3.577	21.0018	4.9724	5.4201	171	.500	.801	-7.424	18.3166
117	-.450	.900	6.5831	23.2289	4.9416	5.8444	172	.500	.850	-5.6637	21.1156
118	-.400	.750	-20.5891	9.3851	2.4243	2.0870	173	.500	.901	-9.9530	22.4197
119	-.400	.803	-17.2406	14.2541	3.7552	3.6651	174	.550	.851	4.8776	.9919
120	-.400	.854	-6.0873	20.7759	5.4101	5.4043	175	.550	.702	1.8099	8.7434
121	-.400	.903	8.8091	21.7155	4.9903	5.0123	176	.550	.751	-3.6176	15.7186
122	-.350	.799	-22.4447	7.7177	3.2584	3.7053	177	.550	.800	-6.5453	20.8230
123	-.350	.849	-16.9622	11.0025	7.5401	4.8682	178	.550	.851	-7.7449	22.8939
124	-.350	.899	11.3257	17.3775	4.6470	6.2228	179	.550	.902	-9.6870	23.1616
125	-.300	.799	-22.6643	1.3848	2.7467	3.0108	180	.599	.551	6.9852	4.6855
126	-.300	.850	-16.3423	-1.6781	3.3601	6.1613	181	.599	.600	-6.298	9.8241
127	-.300	.901	5.5836	1.0429	7.8130	4.8987	182	.599	.652	-6.3230	18.5736
128	-.250	.801	-19.4342	-2.8424	2.5546	3.0123	183	.599	.702	-7.9476	21.2490
129	-.250	.851	-12.1471	-4.6798	3.8252	4.2774	184	.599	.751	-8.1118	22.6279
130	-.250	.900	-5.5576	-4.2370	6.1177	4.9633	185	.600	.800	-8.0854	22.9210
131	-.200	.850	-10.9777	-5.7533	2.6848	3.1352	186	.600	.852	-8.2810	23.3101
132	-.200	.901	-2.0789	-5.6856	4.3370	3.4095	187	.600	.902	-6.9866	20.6765
133	-.150	.851	-8.0979	-5.4708	1.9096	2.5060	188	.650	.501	3.3237	7.9838
134	-.150	.901	-2.8220	-5.8697	2.8291	2.8033	189	.650	.550	-7.4492	19.8520
135	-.100	.850	-5.8353	-2.7281	9.9364	1.5976	190	.650	.601	-7.4410	25.8293
136	-.100	.901	-2.4919	-3.6773	1.4585	1.5007	191	.650	.652	-7.7492	25.5738
137	-.050	.851	-3.8218	-7.087	7.517	9.104	192	.650	.701	-8.1446	24.5249
138	-.050	.902	-1.9932	-1.7362	8.013	8.518	193	.650	.750	-8.0529	23.8250
139	0.000	.851	-2.0970	1.1921	7.024	7.531	194	.650	.801	-7.9440	23.1662
140	0.000	.900	-1.7132	-6.6977	5.851	6.145	195	.650	.852	-7.7265	22.8208
141	0.050	.850	-5.5544	-1.258	7.541	7.048	196	.650	.901	-8.3078	22.3049
142	0.050	.901	-1.4098	-9.9560	6.056	6.519	197	.700	.401	-2.5441	25.5937
143	0.100	.850	-1.7549	-1.6110	1.1799	9.821	198	.700	.450	-4.0573	27.1901
144	0.100	.900	-1.2742	-2.1569	5.9473	1.2103	199	.700	.501	-4.4743	26.9765
145	0.150	.852	-1.5711	-4.3366	2.2407	2.0678	200	.700	.552	-5.3182	26.6447
146	0.150	.900	-2.3083	-4.6640	1.8194	2.4669	201	.700	.601	-6.0797	26.1067
147	0.200	.850	3.4977	-6.0881	3.1278	2.8722	202	.700	.650	-6.5946	25.3298
148	0.200	.901	-4.6297	-4.7657	2.9766	4.2959	203	.700	.701	-7.0725	24.4216
149	0.250	.801	13.6542	-2.9249	3.9014	3.3553	204	.700	.752	-7.2191	23.6834
150	0.250	.852	2.4706	-5.4072	4.9123	4.7587	205	.700	.801	-7.2950	23.0170
151	0.250	.901	-6.6823	-2.9053	3.8857	5.5436	206	.700	.850	-7.3822	22.7261
152	0.300	.800	16.8656	-1.90513	5.1364	3.2601	207	.700	.901	-7.6366	22.1470
153	0.300	.851	3.5407	-1.7147	6.3966	7.4862	208	.750	.252	-6.901	28.0277
154	0.300	.902	-13.2012	3.1216	4.2065	5.4866	209	.750	.302	-1.2973	27.6794
155	0.350	.750	23.7376	6.4421	3.5971	2.1311	210	.750	.350	-1.9496	27.0617
156	0.350	.801	20.2390	8.4887	4.3472	3.7499	211	.750	.401	-2.7344	27.0691
157	0.350	.852	3.3336	12.3738	9.5334	9.5290	212	.750	.452	-3.3930	26.5892
158	0.350	.900	-17.2935	13.7821	4.4745	5.3701	213	.750	.502	-4.0784	26.5354
159	0.400	.751	20.8354	11.2171	3.1338	2.6745	214	.750	.550	-4.6685	26.0363
160	0.400	.800	15.0889	16.1463	4.7489	4.1749	215	.750	.600	-5.3396	25.5043
161	0.400	.851	-1.8847	22.2338	5.9007	6.1063	216	.750	.652	-6.0030	24.9012
162	0.400	.902	-13.6699	21.0346	5.3495	4.8465	217	.750	.702	-6.3416	24.2888
163	0.450	.700	17.6542	7.8869	3.5909	3.0095	218	.750	.750	-6.5026	23.6076
164	0.450	.751	14.8793	13.4987	3.6832	2.8754	219	.750	.801	-6.6097	22.9235
165	0.450	.802	6.0411	19.5706	4.8005	5.9737	220	.750	.852	-6.8637	22.6118

TEST NUMBER 81070701 RUN NUMBER 4 X/D = 1.30

NO.	Y	Z	V	M	VS	WS	NO.	Y	Z	V	M	VS	WS
221	.750	.902	-6.9741	21.9476	.5066	.7631	276	.900	.800	-4.9273	22.6745	.4535	.8205
222	.800	.800	4.2107	28.4048	.6579	.6818	277	.900	.852	-5.1141	22.0438	.4437	.8068
223	.800	.052	3.0004	28.2751	.5752	.6106	278	.900	.902	-5.3666	21.7254	.4959	.5743
224	.800	.100	1.9858	28.1014	.6232	.5842	279	-.898	.900	5.0118	22.0542	.4941	.4745
225	.800	.150	1.0761	27.7966	.6193	.5804	280	-.898	.900	4.9980	22.1776	.4654	.6876
226	.800	.202	-.3339	27.6789	.5524	.6250	281	-.898	1.001	5.3839	21.4194	.4901	.5341
227	.800	.252	-.3537	27.3356	.4659	.6332	282	-.898	1.101	5.4860	28.6377	.4469	.5846
228	.800	.300	-1.0051	27.1550	.5180	.5116	283	-.898	1.202	5.6173	19.7775	.5098	.5559
229	.800	.351	-1.7770	26.8697	.5842	.5808	284	-.898	1.301	5.3918	19.1849	.5144	.5250
230	.800	.402	-2.5066	26.6967	.4869	.6742	285	-.898	1.401	5.2355	18.5157	.5273	.5442
231	.800	.452	-3.1687	26.3205	.5453	.6816	286	-.898	1.500	4.7945	18.9540	.4864	.5680
232	.800	.500	-3.6729	25.9381	.5060	.6860	287	-.898	1.601	4.4204	17.7176	.4948	.4375
233	.800	.551	-4.2443	25.4013	.5394	.6572	288	-.898	1.700	3.9573	17.3458	.4524	.5915
234	.800	.602	-4.7084	24.9572	.5185	.7104	289	-.799	.901	5.9213	22.5688	.5623	.5049
235	.800	.652	-5.1349	24.5001	.5288	.7036	290	-.799	1.001	6.4895	21.7888	.5163	.5598
236	.800	.700	-5.4358	23.9569	.4918	.7196	291	-.799	1.101	6.9907	20.7507	.5372	.4711
237	.800	.751	-5.7430	23.4171	.4968	.6376	292	-.799	1.201	6.5529	19.8579	.5426	.4858
238	.800	.802	-5.9419	22.8587	.4875	.6104	293	-.799	1.301	6.2507	18.8573	.5760	.4652
239	.800	.852	-6.3549	22.3310	.4066	.6080	294	-.799	1.401	5.7169	18.1527	.5922	.4612
240	.800	.900	-6.2765	21.8787	.4775	.5764	295	-.799	1.501	5.3369	17.6602	.4143	.5281
241	.850	.001	4.1543	27.2838	.5192	.5997	296	-.799	1.601	4.7124	17.2697	.4699	.4969
242	.850	.050	3.1842	27.2837	.6299	.6633	297	-.799	1.701	4.1660	16.9036	.5041	.4084
243	.850	.101	2.1002	27.3476	.5779	.6223	298	-.699	.902	7.0375	23.2545	.5743	.6182
244	.850	.152	1.3381	27.0977	.5724	.6215	299	-.699	1.002	7.9092	22.1909	.5264	.6262
245	.850	.201	.5302	26.8622	.5187	.6871	300	-.699	1.102	8.1692	20.6896	.5495	.5014
246	.850	.250	-.0948	26.7872	.4499	.6374	301	-.699	1.201	7.8258	19.4149	.4899	.5300
247	.850	.302	-.7795	26.4828	.4864	.6452	302	-.699	1.303	7.1367	18.2830	.4639	.4782
248	.850	.352	-1.4570	26.2854	.5677	.6827	303	-.699	1.401	6.7445	17.4585	.4869	.5807
249	.850	.401	-2.0044	26.0552	.4667	.6094	304	-.699	1.503	5.6118	17.0599	.4233	.5150
250	.850	.450	-2.6024	25.7212	.4775	.7242	305	-.699	1.602	5.8372	16.6591	.5192	.5690
251	.850	.502	-3.0680	25.3281	.5297	.6207	306	-.699	1.703	4.4502	16.4791	.5078	.5394
252	.850	.552	-3.5845	24.8944	.5799	.6919	307	-.600	.902	8.6712	24.2760	.9454	1.1166
253	.850	.601	-4.0839	24.5710	.5445	.5927	308	-.600	1.002	10.8669	22.6731	.7118	.7598
254	.850	.650	-4.7282	24.1137	.4931	.6205	309	-.600	1.102	10.4423	20.4594	.7277	.6098
255	.850	.702	-4.9168	23.6330	.5178	.6418	310	-.600	1.202	9.3340	18.5905	.5515	.5209
256	.850	.752	-5.2491	23.1389	.5118	.5929	311	-.600	1.302	8.1027	17.3984	.5568	.5166
257	.850	.801	-5.4036	22.6461	.4238	.5798	312	-.600	1.402	7.0426	16.4478	.5634	.5334
258	.850	.850	-5.6684	22.1843	.4202	.5989	313	-.600	1.502	5.9526	16.2330	.8000	.8000
259	.850	.901	-5.7828	21.7749	.4943	.5802	314	-.600	1.602	5.0465	16.0660	.8000	.8000
260	.900	.000	3.9962	26.3195	.5813	.5541	315	-.600	1.700	4.4057	15.8953	.8000	.8000
261	.900	.052	2.9188	26.4665	.5313	.6482	316	-.600	.900	7.5275	22.4507	.8000	.8000
262	.900	.102	2.2330	26.5960	.6035	.5531	317	-.600	1.000	13.1975	23.0656	.8000	.8000
263	.900	.151	1.5483	26.4927	.5954	.6503	318	-.600	1.100	13.2639	19.4748	.8000	.8000
264	.900	.200	.7868	26.3383	.6488	.5798	319	-.600	1.200	11.0614	17.1544	.8000	.8000
265	.900	.252	-.0155	26.0576	.5668	.5632	320	-.600	1.300	9.0725	16.0514	.8000	.8000
266	.900	.302	-.5294	26.0432	.4768	.6474	321	-.600	1.400	7.4077	15.5212	.8000	.8000
267	.900	.352	-1.1225	25.7689	.5605	.6318	322	-.600	1.500	6.0494	15.2120	.8000	.8000
268	.900	.400	-1.7435	25.6534	.4801	.6782	323	-.600	1.600	5.2252	15.1719	.8000	.8000
269	.900	.452	-2.3380	25.2176	.4512	.6277	324	-.600	1.700	4.2759	15.3240	.8000	.8000
270	.900	.502	-2.7807	24.8462	.5360	.6236	325	-.600	.901	6.6275	22.4840	.8000	.8000
271	.900	.551	-3.2767	24.5319	.5714	.6100	326	-.600	.999	15.8149	19.0079	.8000	.8000
272	.900	.600	-3.7086	24.1150	.4678	.6230	327	-.600	1.101	16.4463	16.1622	.8000	.8000
273	.900	.652	-4.1444	23.6596	.4355	.5319	328	-.600	1.199	12.3958	14.3988	.8000	.8000
274	.900	.702	-4.4380	23.5559	.5164	.7102	329	-.600	1.301	9.3790	13.9644	.8000	.8000
275	.900	.752	-4.7365	22.8629	.5295	.6171	330	-.600	1.399	7.1412	13.8875	.8000	.8000

AD-A123 924

VORTEX ASYMMETRY DEVELOPMENT ON A TANGENT OGIVE(U)
NAVAL SURFACE WEAPONS CENTER SILVER SPRING MD

22

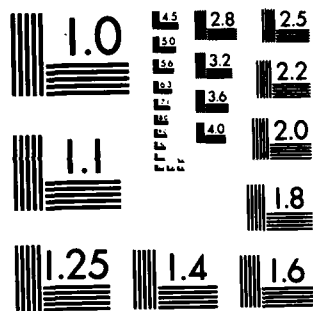
UNCLASSIFIED

W J YANTA ET AL. OCT 82 NSWC/TR-82-384 SBI-AD-F500 119

F/G 20/4

NL

													END DATE FILMED JUN-83 DTIC



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

TEST NUMBER 81062502 RUN NUMBER 7 X/D = 4.70

NO.	Y	Z	V	M	MS	NO.	Y	Z	V	M	MS
441	1.200	.649	-3.5063	29.0231	1.1703	496	1.300	.699	-4.0449	27.7934	.8036
442	1.200	.700	-3.4262	28.6025	1.3111	497	1.300	.949	-5.4856	27.6151	.6939
443	1.200	.750	-3.7215	28.3890	1.0310	498	1.300	1.000	-5.9531	27.4438	.7845
444	1.200	.799	-3.6729	28.3539	1.0372	499	1.300	1.000	-5.9822	27.3720	.7013
445	1.200	.849	-4.0754	28.4891	1.1496	500	1.300	1.050	-6.4658	27.1477	.7255
446	1.200	.899	-5.2325	28.6060	1.2036	501	1.300	1.099	-6.9559	26.5990	.7207
447	1.200	.950	-6.0292	28.8310	1.1909	502	1.300	1.149	-7.4252	26.2681	.7883
448	1.200	.999	-6.7198	28.5146	1.1856	503	1.300	1.200	-7.7672	25.8738	.7251
449	1.200	1.049	-7.4072	28.2128	1.0921	504	1.350	.001	3.0108	27.7426	.5220
450	1.200	1.100	-8.0276	27.6603	1.2638	505	1.350	.050	2.3959	27.7893	.5489
451	1.200	1.150	-8.6109	27.0151	1.2638	506	1.350	.098	2.0432	27.9012	.4386
452	1.200	1.199	-9.2042	26.2956	1.0456	507	1.350	.150	1.5432	27.9647	.4899
453	1.250	.001	3.0427	28.7381	.5206	508	1.350	.200	1.1131	27.9646	.5495
454	1.250	.051	2.5819	28.8435	.5493	509	1.350	.250	.6798	28.0102	.5464
455	1.250	.100	1.9529	28.8087	.5231	510	1.350	.300	.0698	27.9772	.4884
456	1.250	.149	1.5783	28.8260	.5224	511	1.350	.350	-.0820	27.9229	.5586
457	1.250	.200	1.1028	28.8190	.5269	512	1.350	.400	-.7366	28.0224	.4452
458	1.250	.250	.6329	28.7612	.5161	513	1.350	.450	-.9252	27.9940	.5012
459	1.250	.300	.1337	28.6859	.5638	514	1.350	.498	-1.4411	28.0217	.5493
460	1.250	.349	-.1974	28.5637	.4936	515	1.350	.550	-1.7401	27.8460	.5082
461	1.250	.400	-.6142	28.7580	.5213	516	1.350	.600	-2.1899	27.8221	.5168
462	1.250	.450	-1.0501	28.5969	.4936	517	1.350	.649	-2.7138	27.8036	.5798
463	1.250	.500	-1.5395	28.6736	.5455	518	1.350	.698	-3.2052	27.8063	.5535
464	1.250	.549	-2.0393	28.7293	.6318	519	1.350	.750	-3.5370	27.7280	.5840
465	1.250	.600	-2.5648	28.6971	.6655	520	1.350	.800	-3.6965	27.5061	.6501
466	1.250	.650	-3.0507	28.5913	.6702	521	1.350	.849	-4.3171	27.5589	.6601
467	1.250	.700	-3.4823	28.3724	.6332	522	1.350	.898	-4.8033	27.3130	.6553
468	1.250	.749	-3.6647	28.3320	.6149	523	1.350	.950	-5.1495	27.1670	.6716
469	1.250	.800	-3.7652	28.2817	1.1223	524	1.350	1.000	-5.6881	26.8666	.6486
470	1.250	.850	-4.4464	28.4800	1.0321	525	1.350	1.049	-5.8149	26.7404	.7347
471	1.250	.900	-4.9901	28.3786	1.0252	526	1.350	1.098	-6.3662	26.2620	.6309
472	1.250	.949	-5.6727	28.1256	.8314	527	1.350	1.150	-6.9041	25.9927	.6704
473	1.250	1.000	-6.4631	27.9904	.7247	528	1.350	1.200	-7.1238	25.5209	.6994
474	1.250	1.050	-6.6776	27.6237	1.0377	529	1.400	0.000	2.9124	27.3647	.4640
475	1.250	1.100	-7.5641	27.2321	.8192	530	1.400	.052	2.4617	27.2546	.5524
476	1.250	1.149	-8.1079	26.4592	.8046	531	1.400	.101	2.0381	27.4985	.4813
477	1.250	1.200	-8.3055	25.7327	.8870	532	1.400	.152	1.4559	27.5954	.5540
478	1.300	0.000	3.1073	28.1907	.6254	533	1.400	.203	1.0093	27.5202	.4523
479	1.300	.052	2.4356	28.1778	.5125	534	1.400	.252	.6331	27.5785	.6493
480	1.300	.101	1.9401	28.3021	.4894	535	1.400	.301	.3536	27.6219	.4821
481	1.300	.151	1.5890	28.4095	.5590	536	1.400	.352	-.2011	27.7130	.5324
482	1.300	.202	1.0167	28.5203	.5102	537	1.400	.403	-.5908	27.6211	.5257
483	1.300	.252	.5499	28.3707	.5058	538	1.400	.452	-.8018	27.4951	.5433
484	1.300	.299	.1597	28.5563	.5104	539	1.400	.501	-1.4220	27.5778	.6003
485	1.300	.349	-.2078	28.3578	.5203	540	1.400	.552	-1.8793	27.5103	.4590
486	1.300	.400	-.7025	28.3155	.5248	541	1.400	.603	-2.0113	27.3202	.4563
487	1.300	.450	-1.1445	28.3187	.5152	542	1.400	.652	-2.6341	27.3053	.5370
488	1.300	.499	-1.4068	28.2612	.5741	543	1.400	.701	-2.8236	27.3847	.6412
489	1.300	.549	-2.0501	28.3900	.5907	544	1.400	.752	-3.3963	27.2913	.5227
490	1.300	.600	-2.3867	28.2880	.6209	545	1.400	.802	-3.8185	27.2011	.5455
491	1.300	.650	-2.7650	28.2596	.6283	546	1.400	.852	-4.2292	27.1325	.5821
492	1.300	.699	-3.0747	28.0336	.5662	547	1.400	.901	-.5133	26.9160	.6522
493	1.300	.749	-3.4170	28.0538	.5493	548	1.400	.952	-.8911	26.7844	.6092
494	1.300	.800	-3.9401	27.8136	.7059	549	1.400	1.002	-5.3046	26.5352	.5749
495	1.300	.850	-4.2591	27.7855	.7028	550	1.400	1.052	-5.6719	26.2266	.5782

TEST NUMBER 81062502 RUN NUMBER 7 X/D = 4.70

NO.	Y	Z	V	W	VS	MS	NO.	Y	Z	V	W	VS	MS
771	.001	4.199	-5.779	10.6288	.6246	.4885	826	.600	3.200	-9.1911	10.2309	.3871	.6007
772	.001	4.399	.7712	11.4430	.5814	.4662	827	.600	3.400	-7.4154	10.4308	.4194	.5522
773	.001	4.599	.9308	12.2665	.5077	.4581	828	.600	3.600	-8.8232	11.7308	.4963	.5282
774	.001	4.799	.8472	12.9969	.4768	.4865	829	.600	3.800	-4.3685	11.1638	.3607	.5198
775	.001	4.999	.8736	13.4296	.4457	.5183	830	.600	4.000	-3.4418	11.5841	.4556	.3910
776	.001	1.200	20.5415	3.5453	2.1471	2.8072	831	.600	4.200	-2.4684	12.0975	.4866	.4905
777	.001	1.400	17.0143	1.4158	4.3237	3.0634	832	.600	4.400	-1.9373	12.6246	.4959	.4634
778	.001	1.600	18.4114	-3.4536	6.5763	4.8119	833	.600	4.600	-1.4176	12.9983	.4065	.3792
779	.001	1.800	-12.5333	-5.1095	4.1286	8.0820	834	.600	4.800	-1.1900	13.4567	.4884	.4527
780	.001	2.000	-21.4015	.0332	3.4455	5.0625	835	.600	5.000	-0.7681	13.7580	.4074	.4249
781	.001	2.200	-21.5959	-.4925	3.7101	6.1624	836	.800	1.202	-0.0486	-2.7989	7.2278	8.1071
782	.001	2.400	-21.2220	-1.9588	2.8537	4.4291	837	.800	1.402	-0.9337	10.6744	7.9645	7.0348
783	.001	2.599	-18.6881	.7135	.9566	2.4224	838	.800	1.602	-1.7738	19.3466	6.5497	6.2175
784	.001	2.800	-14.2169	2.7294	.6640	1.5193	839	.800	1.802	-1.0278	19.3466	5.3266	4.6104
785	.001	2.999	-10.8610	4.3818	.5128	1.1349	840	.800	2.002	-10.1447	22.8363	4.2529	4.5445
786	.001	3.199	-8.0095	5.5046	.5927	.8283	841	.800	2.201	-12.4895	21.0461	3.7563	3.6892
787	.001	3.399	-5.8288	6.7042	.7252	.7252	842	.800	2.401	-15.4873	18.3617	2.5143	2.2784
788	.001	3.599	-4.1293	7.8851	.7377	.7365	843	.800	2.600	-15.5871	15.4628	1.2333	.9784
789	.001	3.799	-2.4775	8.8854	.6293	.5329	844	.800	2.800	-13.0913	13.6211	.6219	.5090
790	.001	3.999	-1.5241	9.9675	.6078	.5023	845	.800	3.000	-10.9239	12.6042	.4141	.5453
791	.001	4.198	-1.7322	10.8739	.5260	.5607	846	.800	3.200	-9.1279	12.0822	.3795	.5022
792	.001	4.398	-2.2554	11.6643	.4216	.4549	847	.800	3.400	-7.4275	11.9073	.3530	.4845
793	.001	4.598	-.0389	12.4204	.4876	.4780	848	.800	3.600	-5.8011	11.8947	.4285	.5780
794	.001	4.800	.11961	13.0034	.4440	.4858	849	.800	3.800	-0.9514	12.3088	.4232	.4494
795	.001	5.000	.2700	13.4180	.4848	.3642	850	.800	4.000	-0.9518	12.5175	.3688	.4391
796	.001	1.201	18.2145	8.5059	2.8886	4.0068	851	.800	4.200	-3.0914	12.6891	.4731	.4665
797	.001	1.400	17.5845	12.3136	4.6288	4.6288	852	.800	4.400	-2.4726	13.0675	.4366	.4078
798	.001	1.600	10.6579	19.2288	4.9516	4.9576	853	.800	4.600	-1.6823	13.4006	.4404	.5080
799	.001	1.800	-11.6595	20.3530	6.7183	3.5925	854	.800	4.800	-1.6302	13.6744	.3475	.4528
800	.001	2.001	-19.9791	4.0796	4.0796	3.7285	855	.800	5.000	-1.2287	13.9644	.4230	.4439
801	.001	2.201	-20.4564	12.1736	4.0096	3.9101	856	1.000	1.201	-12.2571	18.4754	4.8318	5.1471
802	.001	2.400	-20.2956	7.9368	3.8532	4.4887	857	1.000	1.401	-9.3835	19.6037	2.6655	6.5737
803	.001	2.600	-19.9147	7.3078	1.5989	2.3539	858	1.000	1.601	-7.3388	22.0212	2.5557	4.2842
804	.001	2.800	-15.5338	7.3743	.5942	.8876	859	1.000	1.801	-7.7276	23.3376	2.6439	4.1299
805	.001	3.000	-11.7231	7.4810	.4582	.8463	860	1.000	2.001	-9.3701	23.2995	2.6333	3.1685
806	.001	3.200	-9.0309	8.0438	.3692	.8351	861	1.000	2.200	-12.4451	21.7569	1.7916	2.8851
807	.001	3.400	-6.7935	8.6268	.4718	.6657	862	1.000	2.400	-13.1831	19.3343	1.8325	.9788
808	.001	3.600	-5.1302	9.3392	.4810	.5648	863	1.000	2.600	-12.7557	17.0679	.7285	.7097
809	.001	3.799	-3.7289	10.0998	.3162	.4907	864	1.000	2.800	-11.5384	15.2932	.4388	.5993
810	.001	3.999	-2.5781	10.7851	.4876	.4469	865	1.000	3.000	-10.0221	14.2221	.4285	.4672
811	.001	4.199	-1.6996	11.4763	.4713	.5112	866	1.000	3.200	-8.5829	13.6348	.3769	.5153
812	.001	4.399	-1.2484	12.0783	.4342	.4342	867	1.000	3.400	-7.2435	13.2662	.4275	.4156
813	.001	4.599	-.7535	12.6722	.3815	.4756	868	1.000	3.600	-6.0394	13.1024	.3515	.5387
814	.001	4.800	-.4718	13.1403	.5003	.4597	869	1.000	3.800	-5.0281	13.0182	.4145	.5811
815	.001	4.999	-.2819	13.5037	.4370	.4596	870	1.000	3.999	-4.1889	13.1902	.4484	.4899
816	.000	1.202	8.3382	6.0202	7.3347	6.5464	871	1.000	4.200	-3.4186	13.4221	.4868	.5248
817	.000	1.402	12.6102	15.3324	4.8821	4.4007	872	1.000	4.400	-2.9095	13.6899	.4217	.4658
818	.000	1.602	4.6623	23.0108	3.5929	3.0964	873	1.000	4.600	-2.3716	13.6899	.4442	.4754
819	.000	1.802	-7.1751	24.8954	4.3554	2.8534	874	1.000	4.800	-1.9155	13.9955	.4085	.4722
820	.000	2.002	-14.7695	22.8818	4.6352	4.3052	875	1.000	5.000	-1.5965	14.3133	.3995	.4234
821	.000	2.202	-16.5166	18.7045	4.0658	3.3590	876	1.200	1.201	-0.9954	26.4515	1.0981	1.0253
822	.000	2.402	-17.9995	14.7429	3.2593	3.3843	877	1.200	1.400	-0.8453	23.2290	.9568	1.3934
823	.000	2.601	-18.0526	12.3067	1.7931	1.6158	878	1.200	1.600	-0.7456	23.3377	1.0814	1.5351
824	.000	2.801	-14.6342	10.9963	.6508	.7031	879	1.200	1.800	-0.5081	23.3544	1.0717	1.0785
825	.000	3.000	-11.7051	10.3281	.5121	.6593	880	1.200	2.001	-0.6425	22.5186	1.0921	.8599

TEST NUMBER H1062502 RUN NUMBER 7 X/Y = 4.70

NU.	Y	Z	V	M	VS	WS	NO.	Y	Z	V	M	VS	WS
881	1.200	2.200	-10.5673	21.2042	.8904	.7907	917	1.600	1.402	-5.9728	23.8281	.6921	.6921
882	1.200	2.400	-11.0657	19.3491	.6530	.6215	918	1.600	1.602	-6.6354	22.9242	.5350	.5350
883	1.200	2.600	-10.7888	17.8318	.4590	.5840	919	1.600	1.802	-7.2272	22.2827	.6044	.6044
884	1.200	2.800	-9.9253	16.4203	.4090	.5431	920	1.600	2.002	-7.6010	21.4407	.5187	.5187
885	1.200	3.000	-8.8882	15.3487	.4485	.6090	921	1.600	2.202	-7.9383	20.4836	.5541	.5541
886	1.200	3.200	-7.9815	14.6627	.3812	.5085	922	1.600	2.401	-8.1723	19.4082	.5029	.5029
887	1.200	3.399	-6.8852	14.2584	.3966	.4856	923	1.600	2.600	-8.0501	18.4311	.4477	.4477
888	1.200	3.599	-5.9113	14.0638	.4064	.5056	924	1.600	2.801	-7.7394	17.5871	.4057	.4057
889	1.200	3.794	-5.0372	13.8650	.3999	.5411	925	1.600	3.001	-7.3221	16.8603	.3414	.3414
890	1.200	3.999	-4.3332	13.8827	.3056	.4154	926	1.600	3.200	-6.6367	16.0803	.4354	.4354
891	1.200	4.199	-3.7468	14.0286	.3722	.4891	927	1.600	3.400	-5.9966	15.6667	.3468	.3468
892	1.200	4.399	-3.1753	14.1755	.3498	.4992	928	1.600	3.600	-5.3668	15.4658	.3848	.3848
893	1.200	4.599	-2.6522	14.2637	.3484	.5099	929	1.600	3.800	-4.8093	15.2451	.4254	.4254
894	1.200	4.799	-2.2249	14.4564	.4687	.4886	930	1.600	4.000	-4.2717	15.0759	.3878	.3878
895	1.200	5.000	-1.7562	14.5041	.4082	.4482	931	1.600	4.200	-3.7203	14.9910	.3864	.3864
896	1.400	1.202	-6.6377	25.3086	.5804	.7092	932	1.600	4.400	-3.2995	14.9658	.3890	.3890
897	1.400	1.401	-7.0648	24.2619	.6875	.7856	933	1.600	4.600	-2.8598	15.0065	.3910	.3910
898	1.400	1.601	-7.3661	23.3831	.7525	.7792	934	1.600	4.800	-2.5011	15.0802	.4220	.4220
899	1.400	1.801	-7.8950	22.7612	.7214	.8201	935	1.600	5.000	-2.2049	15.1745	.3890	.3890
900	1.400	2.001	-8.5846	21.9784	.6690	.6299	936	1.800	1.202	-4.5040	23.8945	.5097	.5097
901	1.400	2.200	-9.0838	20.7560	.6031	.6505	937	1.800	1.402	-5.3828	23.1822	.6025	.6025
902	1.400	2.400	-9.3851	19.3937	.4818	.6072	938	1.800	1.602	-5.8901	22.4829	.5639	.5639
903	1.400	2.600	-9.2721	18.0725	.4213	.5187	939	1.800	1.802	-6.3249	21.8726	.4821	.4821
904	1.400	2.800	-8.8022	17.0952	.4084	.4948	940	1.800	2.000	-6.6617	21.0880	.4483	.4483
905	1.400	3.000	-8.0159	16.2445	.4149	.5163	941	1.800	2.200	-6.9856	20.2699	.5546	.5546
906	1.400	3.200	-7.2782	15.5936	.4187	.4582	942	1.800	2.401	-7.1813	19.5301	.5491	.5491
907	1.400	3.400	-6.5617	15.0995	.3709	.5006	943	1.800	2.601	-7.1081	18.6289	.3957	.3957
908	1.400	3.600	-5.7077	14.8431	.4189	.4849	944	1.800	2.801	-6.8237	17.9299	.4449	.4449
909	1.400	3.800	-4.9517	14.5831	.4266	.4929	945	1.800	3.000	-6.5213	17.2704	.4334	.4334
910	1.400	3.999	-4.2405	14.6162	.4138	.4704	946	1.800	3.200	-6.0600	16.6844	.3904	.3904
911	1.400	4.199	-3.6853	14.5764	.4584	.5513	947	1.800	3.400	-5.5505	16.2948	.4200	.4200
912	1.400	4.399	-3.2771	14.5770	.4046	.4162	948	1.800	3.600	-5.1136	15.9168	.3954	.3954
913	1.400	4.599	-2.7729	14.6956	.4669	.5476	949	1.800	3.800	-4.6400	15.6877	.4639	.4639
914	1.400	4.799	-2.4099	14.8005	.4460	.4719	950	1.800	4.000	-4.1189	15.5128	.3275	.3275
915	1.400	4.999	-2.0463	14.8753	.4504	.5263	951	1.800	4.200	-3.7256	15.4376	.4766	.4766
916	1.600	1.202	-5.3111	24.5226	.5336	.7126	952	1.800	4.400	-3.2350	15.3263	.3858	.3858

TEST NUMBER 81071515 RUN NUMBER 8 X/D = 2.60

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
1	-1.199	0.000	-3.5856	25.2094	1.0930	.7340	56	-1.100	.250	-1.0700	25.4468	1.2168	1.2115
2	-1.199	.050	-2.9856	25.5339	.9206	.8086	57	-1.100	.302	-.6419	25.5142	1.3122	1.0289
3	-1.199	.100	-2.4389	25.8599	.8179	.6926	58	-1.100	.352	-.1313	25.0190	1.5171	1.5171
4	-1.199	.152	-2.1707	25.3997	.9545	.7743	59	-1.100	.401	1.2659	25.0770	1.6777	1.6727
5	-1.199	.201	-1.7639	25.5099	1.0705	.6748	60	-1.100	.451	1.2620	24.6789	2.0718	2.6466
6	-1.199	.250	-1.6171	25.4615	.9097	.7798	61	-1.100	.502	.9583	24.1628	3.9661	2.3295
7	-1.199	.302	-.8061	25.7074	.9887	.7242	62	-1.100	.552	1.1136	24.3758	3.6212	1.9799
8	-1.199	.352	-.6891	25.3894	2.8258	.6893	63	-1.100	.601	1.2922	23.6056	4.2659	1.8254
9	-1.199	.401	-.2508	25.4916	1.0654	.7233	64	-1.100	.651	1.7340	24.2970	4.5214	2.0728
10	-1.199	.450	-.0285	25.4140	1.8593	.6967	65	-1.100	.702	2.6265	25.0325	2.9771	2.0869
11	-1.199	.502	.4928	25.4346	.9843	.7828	66	-1.100	.752	3.3457	24.8541	2.6525	1.7751
12	-1.199	.552	.6981	25.4060	1.1205	.7583	67	-1.100	.801	4.1962	25.1273	2.1063	2.0959
13	-1.199	.601	1.0980	25.4234	.8801	.7901	68	-1.100	.851	4.3732	25.1738	2.3436	1.6009
14	-1.199	.650	1.6666	25.4492	1.3614	.9368	69	-1.100	.902	4.7580	24.6165	2.4899	1.7154
15	-1.199	.702	2.1320	25.3955	1.0449	.9042	70	-1.100	.952	4.8609	24.7277	1.7563	1.6438
16	-1.199	.752	2.6884	25.3136	1.5798	.8739	71	-1.100	1.001	4.8919	23.9513	1.7690	1.3668
17	-1.199	.801	2.8067	25.1209	1.1903	.8597	72	-1.100	1.051	4.8498	23.5775	2.2514	1.2048
18	-1.199	.850	3.3866	24.9418	1.7214	1.0207	73	-1.100	1.102	4.6828	23.1931	2.5944	1.3009
19	-1.199	.902	3.7359	24.7293	.9463	.9562	74	-1.100	1.152	5.0624	23.7597	2.0340	1.4972
20	-1.199	.952	4.0526	24.4484	1.0393	.9202	75	-1.100	1.201	4.8170	24.0223	1.7518	1.4256
21	-1.199	1.002	4.0338	24.1239	1.1178	.8903	76	-1.049	.382	-.7379	-.0325	1.8574	1.1827
22	-1.199	1.050	4.3656	24.1957	.9107	.9572	77	-1.049	.432	-.7770	-.3176	2.8484	1.8978
23	-1.199	1.102	4.6109	24.0365	1.1103	.9779	78	-1.049	.481	-1.5822	.2647	3.3798	2.1373
24	-1.199	1.152	4.4446	23.6339	1.8614	1.0504	79	-1.049	.531	-1.4026	1.4755	4.6306	2.4411
25	-1.199	1.202	4.7829	23.6128	1.8694	.8665	80	-1.049	.582	-1.4053	3.5165	5.6368	3.2834
26	-1.150	.002	-3.4176	25.7474	.7632	.6495	81	-1.049	.552	-1.7434	5.6351	5.6639	3.0293
27	-1.150	.052	-2.9203	25.7451	.7898	.6871	82	-1.049	.601	-1.0378	8.0985	7.0126	3.7522
28	-1.150	.101	-2.4769	25.6019	.8154	.7876	83	-1.049	.651	-.1479	11.9876	7.3958	3.1327
29	-1.150	.150	-2.1237	25.9115	.8116	.6857	84	-1.049	.702	1.3580	14.4379	7.6063	3.9858
30	-1.150	.202	-1.7112	25.7935	.8779	.7038	85	-1.049	.752	3.1718	16.7834	7.5974	3.7670
31	-1.150	.252	-1.1704	25.8627	.8641	.6755	86	-1.049	.801	3.8488	18.6404	7.2645	3.5745
32	-1.150	.302	-.6748	25.9017	.9143	.7726	87	-1.049	.851	4.8448	19.5290	6.4589	3.4089
33	-1.150	.351	-.4357	25.8676	.7508	.7831	88	-1.049	.902	5.5498	20.7101	5.1157	3.2666
34	-1.150	.402	-.1603	25.8407	1.1844	.7834	89	-1.049	.952	5.8116	21.3305	4.8873	2.5596
35	-1.150	.452	.3374	25.6451	1.1860	.7425	90	-1.049	1.001	5.1585	21.3143	4.6838	2.5664
36	-1.150	.502	.7413	25.7909	.8985	.7864	91	-1.049	1.051	4.0615	20.9139	5.7256	2.8049
37	-1.150	.551	1.1606	25.6920	1.1680	.8407	92	-1.049	1.102	3.9523	21.4550	5.0991	2.1252
38	-1.150	.602	1.3735	25.7654	1.3776	1.0339	93	-1.049	1.152	4.2891	22.2781	4.2732	2.1510
39	-1.150	.652	1.7066	25.7832	1.4009	1.1880	94	-1.049	1.201	4.6383	22.9977	4.0745	1.7194
40	-1.150	.702	2.0679	25.7746	1.1304	1.0709	95	-1.049	.452	.8002	2.2213	7.2589	1.7599
41	-1.150	.751	2.5281	25.7140	1.3788	1.3257	96	-1.049	.502	-3.0382	-.2704	3.6352	1.9823
42	-1.150	.802	3.4625	25.5851	1.2506	1.1989	97	-1.049	.552	-3.5941	-.2517	3.6147	2.2505
43	-1.150	.852	3.6921	25.3057	1.7119	1.2212	98	-1.049	.600	-4.1656	1.2435	4.7103	2.8273
44	-1.150	.902	4.1116	24.9938	1.3768	1.0856	99	-1.049	.652	-3.0849	3.3908	5.5093	2.9389
45	-1.150	.951	4.3864	24.2096	1.5626	1.9513	100	-1.049	.702	-1.9826	5.0702	5.3943	3.4383
46	-1.150	1.002	4.5816	24.2510	1.3014	.9481	101	-1.049	.752	-.7219	7.0317	7.1739	3.2881
47	-1.150	1.052	4.5405	23.7547	1.3805	1.0712	102	-1.049	.799	-.7271	9.1320	8.0100	4.2563
48	-1.150	1.102	4.6322	23.9784	1.4453	1.2004	103	-1.049	.851	3.0812	11.1136	7.8405	4.1923
49	-1.150	1.151	4.9328	23.6238	1.4721	.9497	104	-1.049	.901	4.0739	12.3406	7.7753	3.7790
50	-1.150	1.202	4.6831	23.7536	1.7851	1.1342	105	-1.049	.950	3.6493	13.4658	7.1337	3.3441
51	-1.100	.002	-3.1326	26.3229	.9977	.6699	106	-1.049	1.000	3.2598	14.3706	8.1359	3.8406
52	-1.100	.051	-2.9400	26.1951	.7570	.6193	107	-1.049	1.051	3.3477	16.7176	7.1878	2.9331
53	-1.100	.102	-2.5359	25.9142	.8250	.7374	108	-1.049	1.101	3.7988	18.1948	6.5897	3.1917
54	-1.100	.152	-1.9217	25.7784	.9124	.7402	109	-1.049	1.150	3.2893	17.6750	6.4567	2.8397
55	-1.100	.201	-1.5279	25.6849	.7619	.7566	110	-1.049	1.200	2.7934	19.0477	6.8194	2.6243

TEST NUMBER 81071515 RUN NUMBER 8 X/D = 2.60

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
111	-950	.681	-4.1801	-.2347	4.8295	2.3373	166	-700	1.100	-17.1094	6.7631	2.8149	2.2073
112	-950	.650	-4.4400	-.1311	4.3888	2.8347	167	-700	1.150	-17.1434	9.3489	3.6611	2.2951
113	-950	.700	-4.0570	.4165	5.3165	2.8100	168	-700	1.201	-16.8486	10.9689	2.8253	2.4163
114	-950	.751	-1.3776	.9045	6.5556	4.1808	169	-650	.950	-.0636	6.4527	4.7060	3.6127
115	-950	.799	-.2343	2.2215	7.1780	3.4482	170	-650	1.001	-9.2303	4.8696	5.9085	3.7080
116	-950	.850	.7152	3.5644	7.5091	3.9610	171	-650	1.050	-9.2319	5.7118	4.4102	2.8124
117	-950	.901	3.0773	5.8314	8.5752	3.4644	172	-650	1.100	-17.7348	6.6193	3.7986	1.7945
118	-950	.951	2.9801	9.1117	7.8098	4.1079	173	-650	1.150	-18.7353	8.0374	4.1337	2.3973
119	-950	1.000	2.7191	10.6419	3.2849	3.2849	174	-650	1.201	-18.2215	9.5486	4.3145	2.7420
120	-950	1.050	1.1794	8.9853	8.6225	3.9195	175	-600	1.001	-6.5493	5.8175	7.8099	4.1071
121	-950	1.102	2.2053	12.5299	7.8068	3.4195	176	-600	1.050	-17.6630	5.0037	3.7782	1.5046
122	-950	1.151	.2690	13.2944	8.3341	3.7713	177	-600	1.100	-19.3155	4.9211	3.5108	1.6852
123	-950	1.200	1.2479	15.9102	7.5632	3.7242	178	-600	1.151	-19.1624	6.3266	4.3363	2.1942
124	-900	.701	-3.7739	-1.6869	5.0246	3.1664	179	-600	1.201	-20.0306	6.2161	4.8273	2.5126
125	-900	.751	-2.2367	-1.3988	5.3309	3.9709	180	-550	1.050	-16.6403	4.0391	5.2707	1.2455
126	-900	.800	-1.7922	-2.3823	5.9246	4.5043	181	-550	1.100	-18.8609	3.4130	3.8221	1.6230
127	-900	.850	-.9280	-1.7149	6.9708	4.2343	182	-550	1.150	-19.8116	4.3288	4.9930	1.9387
128	-900	.901	.9231	-1.8575	7.5887	3.9816	183	-550	1.201	-20.0501	3.3887	4.0092	2.8964
129	-900	.951	.6162	3.741	7.9310	4.7373	184	-500	1.050	-13.2611	6.1578	10.0151	1.1318
130	-900	1.000	.3416	3.9997	8.4700	4.4186	185	-500	1.102	-18.3265	1.7954	4.5352	1.4436
131	-900	1.050	-2.1365	4.6945	8.0215	4.6376	186	-500	1.152	-20.0143	1.4879	3.8852	2.0439
132	-900	1.101	-1.1307	8.6071	7.7609	5.1880	187	-500	1.202	-19.6898	.3064	4.2847	2.8911
133	-900	1.151	-1.6509	11.0393	7.8109	4.9188	188	-450	1.100	-13.0779	4.8248	11.0116	1.2594
134	-900	1.200	-2.0659	14.0626	7.3938	4.5492	189	-450	1.152	-19.2985	-4.566	3.9723	1.7535
135	-850	.750	-.9547	-1.4216	6.5328	3.9275	190	-450	1.202	-19.2956	-2.6117	3.4226	3.2886
136	-850	.800	-.0482	-3.0350	5.5630	4.0393	191	-400	1.102	-14.0113	2.3076	8.8647	1.1880
137	-850	.851	1.0310	-3.6773	6.5980	3.9151	192	-400	1.152	-16.5297	-1.2236	6.6581	1.7728
138	-850	.900	-.0862	-3.1622	6.9280	4.3604	193	-400	1.200	-18.1469	-3.9079	7.8766	2.3621
139	-850	.950	-1.7764	-2.5797	7.7952	5.2359	194	-350	1.152	-14.1324	-8.609	7.0879	1.4875
140	-850	1.000	-4.3442	3.9403	7.3761	4.3313	195	-350	1.202	-15.8018	-4.0112	3.8060	2.0091
141	-850	1.051	-6.3527	3.3196	6.2044	4.6503	196	-300	1.152	-10.9282	1.1520	9.8224	1.3115
142	-850	1.101	-4.6883	6.9325	6.7416	4.9487	197	-300	1.200	-13.7219	-4.3265	4.2513	1.5399
143	-850	1.150	-5.7238	9.9960	6.1542	4.9517	198	-250	1.151	-5.5637	4.9392	11.9057	.9801
144	-850	1.200	-5.0599	12.9692	5.5216	4.9038	199	-250	1.202	-11.1067	-3.9668	4.4018	1.1492
145	-800	.800	.7589	-2.3404	5.9246	4.4767	200	-200	1.202	-6.4432	-1.7804	6.7504	1.1009
146	-800	.850	1.7866	-2.3404	5.3336	4.6421	201	-150	1.202	-6.4432	-1.6950	4.3519	.8693
147	-800	.901	.8557	-3.9010	5.7112	4.4043	202	-100	1.202	-3.8185	-.0004	5.8763	.8656
148	-800	.951	-3.2506	-2.5384	6.9485	5.3326	203	-050	1.202	-1.9061	-.0253	4.3315	.9398
149	-800	1.000	-7.1394	-.8852	5.2527	5.7482	204	0.000	1.202	.1563	-.0417	4.0442	.9485
150	-800	1.050	-11.1314	2.6955	4.2200	4.4764	205	.050	1.202	2.0806	-.9166	1.7675	.8711
151	-800	1.101	-9.9285	7.0441	5.2380	4.4863	206	.100	1.202	4.3639	-1.1959	1.3999	.8858
152	-800	1.151	-18.4573	9.3583	3.7390	3.5140	207	.150	1.202	6.9467	-1.7011	1.7494	.9346
153	-800	1.200	-9.3459	12.6234	3.8813	4.0205	208	.200	1.202	9.2938	-2.7924	1.1899	.8340
154	-750	.851	4.8880	2.4308	5.6781	4.4304	209	.250	1.202	11.6773	-3.7292	1.5741	.8844
155	-750	.901	2.2170	-9.058	5.9209	5.2050	210	.300	1.152	15.2601	-1.0207	4.4773	.9864
156	-750	.950	-3.5076	-7.1112	6.7317	5.9934	211	.300	1.200	13.8578	-4.8743	2.1189	1.0891
157	-750	.999	-9.7413	1.8223	6.0531	5.5039	212	.350	1.152	16.9642	-2.9833	1.6743	1.1954
158	-750	1.051	-12.6507	5.7184	5.6444	3.2868	213	.350	1.202	16.3348	-5.1262	1.8890	1.1533
159	-750	1.101	-14.2688	7.0383	2.6578	2.4682	214	.400	1.152	18.8556	-2.9465	1.4536	1.3612
160	-750	1.150	-14.4668	9.7586	3.7286	2.6535	215	.400	1.202	18.4439	-4.6185	2.0974	1.6288
161	-750	1.200	-13.4289	12.1748	3.1594	2.8618	216	.450	1.152	20.2495	-2.4664	2.9518	1.3530
162	-700	.900	5.0563	5.2202	4.5264	4.5264	217	.500	1.200	20.3774	-3.3478	2.3387	1.4305
163	-700	.950	-3.7926	3.2390	6.7798	4.4160	218	.500	1.100	20.5944	.1254	1.9275	1.2529
164	-700	1.001	-11.7260	4.0106	6.5167	3.7420	219	.500	1.152	21.5482	-.8130	1.9191	1.2790
165	-700	1.050	-16.3954	5.5571	4.0850	2.4622	220	.500	1.202	21.4816	-1.4075	3.0677	1.8007

TEST NUMBER 81071515 RUN NUMBER 8 X/D = 2.60

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
221	.550	1.101	20.7369	1.6155	1.3927	1.4167	276	.950	1.150	4.1071	9.2542	4.5724	6.9165
222	.550	1.152	22.2792	1.2546	2.1366	1.5768	277	.950	1.201	4.6544	12.1638	4.7780	6.7405
223	.550	1.202	22.2703	1.4229	3.0323	2.4805	278	1.000	.650	6.4374	-1.3065	1.9188	3.2640
224	.600	1.052	19.5204	2.8051	1.5170	1.6988	279	1.000	.700	6.1216	-	3.2080	3.3835
225	.600	1.101	20.9529	3.0907	1.5360	1.4928	280	1.000	.751	4.8927	.3552	3.9670	4.5320
226	.600	1.151	21.9948	3.7664	2.5087	1.9105	281	1.000	.801	3.8247	1.6565	3.9413	5.3624
227	.600	1.202	22.0491	4.3590	2.9738	2.2438	282	1.000	.850	1.7052	2.0349	3.7441	6.3134
228	.650	1.001	7.3280	3.8966	4.8536	6.7135	283	1.000	.900	.7798	4.3688	4.3045	7.9802
229	.650	1.052	18.2197	4.4213	2.1194	2.8659	284	1.000	.951	1.2679	4.9548	4.5721	8.5910
230	.650	1.102	20.6779	4.8227	1.9904	1.3777	285	1.000	1.001	-1.2095	7.9201	3.5596	9.5832
231	.650	1.152	21.2700	5.7102	1.9972	1.7920	286	1.000	1.050	.6579	9.0929	3.3149	8.4759
232	.650	1.202	21.0637	7.1516	3.2782	2.5117	287	1.000	1.100	-3.647	11.4200	3.9711	8.3738
233	.700	1.000	9.4589	4.3284	3.9178	6.3548	288	1.000	1.152	-1.2459	14.4246	3.8835	8.3420
234	.700	1.052	17.5406	5.2989	2.9664	3.8307	289	1.000	1.201	.1843	15.4766	5.1042	8.5376
235	.700	1.102	19.3356	5.9170	1.9423	1.5910	290	1.050	.550	4.2886	.0060	2.1042	2.7942
236	.700	1.152	19.5400	7.8110	2.8876	2.2459	291	1.050	.600	6.5147	.6513	4.5479	2.9785
237	.700	1.202	18.9281	9.6507	3.5282	2.3988	292	1.050	.651	5.5844	.9192	2.4773	3.5239
238	.750	.951	2.3987	3.3342	4.5463	5.8574	293	1.050	.701	4.9433	2.8682	2.8535	4.1768
239	.750	1.002	10.6626	3.3186	3.3432	5.7607	294	1.050	.750	4.9159	5.6208	3.7032	5.4407
240	.750	1.052	16.7050	4.3115	3.6144	3.1097	295	1.050	.800	2.2824	7.6638	3.8505	5.8444
241	.750	1.102	18.0530	6.3711	2.7204	1.4659	296	1.050	.851	.0319	9.8250	3.8738	8.4938
242	.750	1.151	18.0257	8.6284	2.4079	1.8035	297	1.050	.901	-1.0080	10.5356	3.9940	8.6817
243	.750	1.202	16.3647	10.8034	3.3654	2.1795	298	1.050	.950	-1.8113	12.1133	4.3051	8.3291
244	.800	.901	.3123	-	6.0187	5.6509	299	1.050	1.000	-2.9534	14.0974	3.7354	9.8737
245	.800	.952	4.5260	-1.0781	6.3478	6.3672	300	1.050	1.051	-4.3839	17.0888	3.3781	6.7590
246	.800	1.002	11.1569	-	4.9066	4.4922	301	1.050	1.101	-3.9943	17.5874	3.5987	6.9891
247	.800	1.051	14.8283	2.2481	3.9728	2.5228	302	1.050	1.150	-1.7262	17.7262	3.1390	8.4231
248	.800	1.099	16.2283	5.6438	2.9846	1.7789	303	1.050	1.200	-3.2370	19.5656	3.0912	7.6432
249	.800	1.150	15.1245	8.4700	3.2455	1.7848	304	1.100	.450	2.7437	-	1.8950	2.6782
250	.800	1.200	13.0933	12.1331	2.8934	3.0395	305	1.100	.502	3.5756	.4639	2.6910	2.6135
251	.850	.850	1.8764	-1.1881	5.9563	4.3202	306	1.100	.552	4.5696	1.2641	2.7505	3.6835
252	.850	.899	1.3588	-3.9067	5.0160	5.1622	307	1.100	.600	4.2971	4.1201	3.4765	4.5813
253	.850	.950	5.1209	-3.4588	5.1610	5.2229	308	1.100	.650	2.8914	6.8622	2.8836	7.1450
254	.850	1.000	6.9694	-2.9622	4.1680	3.4972	309	1.100	.702	1.8737	11.4925	3.9957	7.4251
255	.850	1.049	11.7744	.5948	4.3847	2.7447	310	1.100	.751	.6770	14.2528	4.1272	8.4609
256	.850	1.099	12.6447	4.7399	3.6146	2.8646	311	1.100	.800	-1.8663	17.8251	3.7313	7.7255
257	.850	1.150	11.1532	8.3492	3.4509	2.9413	312	1.100	.850	-2.6040	17.8768	3.7448	6.9962
258	.850	1.200	10.5500	11.9008	3.7873	2.7228	313	1.100	.902	-3.8172	20.3014	3.8461	6.3033
259	.900	.799	5.4958	-1.4358	4.7970	3.5168	314	1.100	.951	-4.9068	22.0550	2.9925	4.7021
260	.900	.851	2.0903	-4.1437	4.7166	4.2795	315	1.100	1.000	-5.2038	21.6844	3.8898	4.5873
261	.900	.902	3.6321	-3.7646	5.5495	5.5998	316	1.100	1.050	-4.8602	22.4719	2.0221	3.5458
262	.900	.951	4.3269	-3.2572	5.0000	6.4045	317	1.100	1.100	-4.8122	22.5210	2.3949	3.9887
263	.900	.999	6.0017	-1.2422	4.7764	6.4817	318	1.100	1.152	-5.1116	23.2285	1.9190	3.1279
264	.900	1.051	9.0262	1.5329	4.6482	5.2343	319	1.100	1.200	-5.0468	23.0609	1.8783	3.4638
265	.900	1.102	7.4929	4.6246	4.6845	6.5498	320	1.150	.252	.6516	3.7614	2.9854	2.7941
266	.900	1.151	8.3221	8.2789	4.3961	3.6378	321	1.150	.302	.0459	5.2537	2.9384	4.9764
267	.900	1.200	6.1515	11.2642	5.3990	5.0358	322	1.150	.352	.6694	7.1747	4.8836	6.2778
268	.950	.750	5.0995	-1.6108	3.6380	4.0423	323	1.150	.401	.2515	11.4564	5.8963	6.9640
269	.950	.800	4.8027	-2.0789	4.5026	5.6577	324	1.150	.452	.9517	13.9784	5.3272	7.8584
270	.950	.851	3.6939	-1.1847	4.9729	6.9556	325	1.150	.502	-2.5527	18.0983	5.0951	8.1539
271	.950	.900	2.8298	-2.3397	4.9646	6.1405	326	1.150	.552	-2.6601	20.0362	4.0076	7.3768
272	.950	.950	2.4047	-6.060	4.9001	7.4579	327	1.150	.601	-1.453	20.3324	3.0823	7.2458
273	.950	1.000	3.2052	-7.337	4.2885	7.8609	328	1.150	.652	-1.5607	22.8396	2.3555	5.0328
274	.950	1.051	2.8072	-2.8072	4.2492	7.5235	329	1.150	.702	-2.1348	24.1723	2.2476	4.4801
275	.950	1.101	5.0813	5.7597	4.4979	6.3920	330	1.150	.752	-1.7968	23.6978	2.4231	5.4205

TEST NUMBER 81071515 RUN NUMBER 8 X/D = 2.60

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
331	1.159	.001	-3.2221	25.0836	2.1237	3.1400	386	-9.00	1.650	11.9177	23.0045	4.5365	3.1232
332	1.159	.052	-3.6613	25.2160	2.0520	2.4346	387	-9.00	1.802	14.0060	20.2254	4.4406	1.1557
333	1.159	.092	-4.0144	25.0710	1.7827	2.7422	388	-9.00	1.952	12.4373	17.5514	4.0581	7.257
334	1.159	.092	-4.9610	24.8126	1.6912	1.5765	389	-9.00	2.101	10.5644	16.0076	1.1467	6.350
335	1.159	1.001	-4.5115	24.2983	2.1714	2.5876	390	-9.00	2.251	8.8861	15.0400	0.533	5.333
336	1.159	1.052	-4.0213	24.5643	1.7723	1.4330	391	-9.00	2.400	7.3617	14.6645	0.800	5.341
337	1.159	1.102	-5.1280	23.9334	1.7493	2.2208	392	-7.50	1.200	-13.4732	13.7295	4.3353	2.7117
338	1.159	1.151	-5.0772	24.0073	1.4852	1.3013	393	-7.50	1.350	-4.5316	20.5340	4.7633	4.3724
339	1.159	1.200	-5.0315	23.7054	1.4822	1.7122	394	-7.50	1.502	7.6767	23.6016	4.4275	4.4824
340	1.200	.002	3.8592	26.6135	7.9999	7.1555	395	-7.50	1.652	15.6660	19.7442	4.1975	4.2165
341	1.200	.051	3.3624	26.6730	8.8566	7.035	396	-7.50	1.800	17.2258	17.1812	2.6264	2.0229
342	1.200	.100	2.7516	26.6967	8.185	6.871	397	-7.50	1.950	14.6005	14.9027	1.5808	1.1609
343	1.200	.152	2.4950	26.5864	8.714	7.347	398	-7.50	2.101	11.7547	13.7530	0.883	6.367
344	1.200	.202	1.8050	26.6448	9.245	7.265	399	-7.50	2.250	9.1627	13.2249	0.828	5.709
345	1.200	.251	1.3510	26.6431	9.921	7.329	400	-6.00	2.400	7.4424	13.2899	0.6385	6.259
346	1.200	.300	1.0231	26.4173	7.780	7.742	401	-6.00	1.200	-20.0876	5.9001	3.0063	3.0467
347	1.200	.352	.8131	26.7459	9.850	8.043	402	-6.00	1.353	-14.2666	11.4675	5.1332	3.7859
348	1.200	.402	.2464	26.3947	8.212	8.416	403	-6.00	1.502	12.3989	15.0086	4.7807	5.5891
349	1.200	.452	-3.073	26.4341	8.828	7.794	404	-6.00	1.653	18.6096	13.1399	5.7077	5.8466
350	1.200	.500	-6.295	26.3977	8.246	8.723	405	-6.00	1.800	18.1626	11.6178	3.8846	3.3081
351	1.200	.552	-1.0652	26.2193	1.0233	1.0302	406	-6.00	1.952	15.7802	10.6167	1.5533	1.2187
352	1.200	.602	-1.2690	26.1899	1.1567	1.0260	407	-6.00	2.102	11.7353	10.7737	1.9397	0.8397
353	1.200	.652	-1.6419	26.0385	1.1743	1.3854	408	-6.00	2.252	8.9200	11.2967	0.820	5.132
354	1.200	.700	-2.0979	26.0670	1.2444	1.2250	409	-6.00	2.401	6.9248	11.6150	0.679	5.951
355	1.200	.751	-2.6565	26.0848	1.3824	1.9685	410	-4.50	1.202	-19.1585	-2.0456	3.7611	3.1383
356	1.200	.801	-2.7927	26.0358	1.1606	1.2302	411	-4.50	1.351	-11.2276	-5.1059	4.2531	4.2298
357	1.200	.850	-3.5519	25.7389	1.3856	1.2916	412	-4.50	1.502	7.9903	-4.0613	6.4160	3.6637
358	1.200	.900	-3.8518	25.2303	1.4163	1.3898	413	-4.50	1.652	14.4924	1.8585	4.9487	3.2384
359	1.200	.951	-4.2769	24.8329	1.2216	1.2903	414	-4.50	1.802	17.2585	3.6305	3.5998	2.8371
360	1.200	1.002	-4.6758	24.7446	1.2769	1.0928	415	-4.50	1.951	14.0814	5.4717	1.4783	1.2681
361	1.200	1.051	-4.6329	24.4012	1.2375	1.1204	416	-4.50	2.102	10.2201	7.6748	0.7142	0.826
362	1.200	1.100	-4.7049	24.1367	1.3215	1.0779	417	-4.50	2.252	7.7975	9.1150	0.5902	0.520
363	1.200	1.151	-5.1329	23.6313	1.9094	1.0322	418	-4.50	2.402	5.9336	10.2539	0.761	0.630
364	1.200	1.202	-5.3251	23.9549	1.1948	1.0594	419	-3.00	1.202	-13.4620	-4.3324	4.1184	1.7344
365	-1.200	1.202	4.9626	23.7639	1.0277	0.8086	420	-3.00	1.351	-8.4182	-10.8100	3.0247	3.3189
366	-1.200	1.351	5.6611	23.6429	1.2245	1.0390	421	-3.00	1.502	3.0160	-10.6331	5.5980	2.8524
367	-1.200	1.500	7.0036	23.2254	1.9558	0.8400	422	-3.00	1.652	10.3697	-6.8874	4.0755	2.0864
368	-1.200	1.651	7.9753	22.0881	1.8747	0.6663	423	-3.00	1.802	11.5202	-2.5161	2.4508	1.4892
369	-1.200	1.802	8.6539	20.5268	1.0563	0.7409	424	-3.00	1.951	9.7617	2.1881	1.1480	0.9660
370	-1.200	1.951	8.4844	19.3147	0.8598	0.6286	425	-3.00	2.102	7.6101	5.1229	0.7922	0.8753
371	-1.200	2.100	7.9027	18.2303	0.8068	0.6017	426	-3.00	2.252	5.8025	7.4522	0.6253	0.8084
372	-1.200	2.251	7.0033	17.0548	0.7337	0.4953	427	-3.00	2.402	4.5888	9.0957	0.7036	0.5658
373	-1.200	2.402	6.4635	16.4574	0.7171	0.5673	428	-1.50	1.203	-6.1153	-1.4579	4.7100	1.0673
374	-1.050	1.202	4.4190	23.2987	3.6195	2.0574	429	-1.50	1.353	-3.82297	-8.4641	2.7192	1.3678
375	-1.050	1.350	6.2008	24.7464	2.1793	1.7037	430	-1.50	1.502	-4.286	-10.3918	1.4706	1.2802
376	-1.050	1.500	8.1113	24.2268	3.5692	1.5140	431	-1.50	1.651	4.2856	-7.9022	1.5885	1.0037
377	-1.050	1.652	10.2128	22.9823	0.9871	1.0231	432	-1.50	1.802	5.4493	-3.4586	1.0754	0.8563
378	-1.050	1.802	10.7275	20.7685	1.1303	0.8378	433	-1.50	1.953	4.9434	5.422	0.910	0.768
379	-1.050	1.950	10.1802	18.7007	0.9452	0.7032	434	-1.50	2.102	4.1197	3.6774	0.7653	0.6349
380	-1.050	2.101	9.0489	17.1746	0.9229	0.6294	435	-1.50	2.251	3.2409	6.3080	0.6270	0.6459
381	-1.050	2.252	8.0718	16.2466	0.8934	0.5093	436	-1.50	2.402	2.6007	8.2043	0.6256	0.6256
382	-1.050	2.402	6.8833	15.7139	0.7830	0.5676	437	0.000	1.202	0.9265	-6.013	4.9977	1.0964
383	-9.00	1.202	-1.1418	14.1264	7.2303	4.9905	438	0.000	1.352	0.569	-6.2050	2.2177	0.8300
384	-9.00	1.352	1.6556	20.5460	6.1204	5.0459	439	0.000	1.502	-0.1523	-8.2669	1.0602	0.7486
385	-9.00	1.500	7.6478	23.4017	5.4530	4.2139	440	0.000	1.652	0.5689	-8.5194	1.4324	0.8580

TEST NUMBER 81071515 RUN NUMBER 8 X/D = 2.60

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
441	0.000	1.801	.4617	-3.4640	.8723	.8493	481	.600	2.251	-0.0132	10.4307	.6220	.6615
442	0.000	1.952	.6880	.3052	.7830	.6875	480	.600	2.401	-0.2345	11.1835	.4934	.5457
443	0.000	2.102	.7259	3.3937	.6846	.7710	482	.750	1.201	15.7120	10.6801	3.0035	2.2975
444	0.000	2.252	.5241	5.9098	.5326	.6032	483	.750	1.350	8.3046	19.6175	3.7714	3.6542
445	0.000	2.401	.5791	7.9232	.5306	.6393	484	.750	1.499	-8.3673	22.3928	4.3624	4.6958
446	.150	1.201	6.4437	-1.9908	1.3668	.9313	485	.750	1.650	-13.9622	19.0398	4.1453	4.7305
447	.150	1.352	4.3758	-7.5145	2.9932	1.6011	486	.750	1.801	-16.9439	16.2285	3.0863	1.9134
448	.150	1.502	-0.0680	-9.5944	1.5343	1.3062	487	.750	1.950	-14.2243	13.8036	.9029	.9132
449	.150	1.652	-3.3332	-7.2560	1.1127	1.2434	488	.750	2.099	-10.8357	12.6336	.8157	.8033
450	.150	1.800	-4.2828	-3.4183	1.9049	.9880	489	.750	2.250	-8.5093	12.6616	.6389	.6942
451	.150	1.952	-3.6922	.5870	1.1003	.7937	490	.750	2.401	-8.8400	12.6018	.6093	.6206
452	.150	2.102	-2.7800	3.5494	.7917	.6451	491	.900	1.201	7.4960	11.9685	3.9665	4.7750
453	.150	2.252	-2.0602	6.1731	.5986	.5260	492	.900	1.349	5.917	19.2348	4.8175	5.1200
454	.150	2.401	-1.5663	8.0377	.5511	.5491	493	.900	1.499	-6.1017	21.8677	4.9933	5.8156
455	.300	1.201	14.2540	-4.6579	1.5406	1.8469	494	.900	1.651	-12.6633	22.2349	2.9885	3.4614
456	.300	1.352	9.2845	-9.9742	2.5034	2.1290	495	.900	1.800	-14.0084	19.0165	1.4622	1.2819
457	.300	1.502	-1.1695	-10.6540	3.6889	4.0088	496	.900	1.950	-12.2380	16.4413	.8727	1.0232
458	.300	1.648	-7.7601	-7.1613	3.9963	3.6262	497	.900	2.100	-10.0813	14.9599	.6802	.6128
459	.300	1.800	-9.6700	-2.7408	2.7108	1.7453	498	.900	2.251	-8.2637	14.2663	.5447	.6229
460	.300	1.951	-8.2106	1.7744	.8681	.9776	499	.900	2.400	-6.7543	14.0717	.5318	.6447
461	.300	2.100	-6.1531	4.7658	.8067	.8949	500	1.050	1.200	-3.0232	20.5287	2.7919	7.2706
462	.300	2.249	-4.6996	7.0197	.6049	.6342	501	1.050	1.348	-8.8617	23.2444	3.2031	4.5826
463	.300	2.400	-3.5454	8.6829	.6193	.5834	502	1.050	1.498	-6.3871	24.3136	1.7495	1.7714
464	.450	1.200	20.0718	-3.3993	2.7511	1.7513	503	1.050	1.650	-10.3345	22.3328	1.3078	1.4006
465	.450	1.351	12.7140	-5.8931	4.9555	3.4953	504	1.050	1.800	-10.7680	19.6182	.7578	.9775
466	.450	1.501	-4.7652	-5.8929	4.8414	6.4562	505	1.050	1.949	-10.1887	18.0377	.7435	.7230
467	.450	1.650	-13.6530	-8.7111	3.2191	5.2061	506	1.050	2.100	-8.8795	16.6422	.6281	.6551
468	.450	1.800	-15.4536	2.0219	2.6879	3.4078	507	1.050	2.250	-7.5245	15.6107	.5469	.5981
469	.450	1.951	-12.4763	4.8825	1.3631	1.2161	508	1.050	2.400	-6.5307	15.1939	.4591	.6784
470	.450	2.101	-9.0247	6.8687	.7140	.9753	509	1.200	1.200	-5.0727	23.7551	.9810	1.1450
471	.450	2.250	-6.7186	8.5088	.6500	.7226	510	1.200	1.349	-5.9755	23.6040	1.0527	1.0437
472	.450	2.400	-5.1135	9.6722	.6253	.5186	511	1.200	1.500	-7.2835	22.8621	.8876	.9777
473	.600	1.201	22.1250	4.2241	2.7741	2.2902	512	1.200	1.650	-8.2771	21.8199	.8685	.8453
474	.600	1.350	16.6508	8.9876	4.3831	5.1939	513	1.200	1.800	-8.5616	20.0975	.7770	.6977
475	.600	1.500	-11.2312	11.2026	6.4299	5.9729	514	1.200	1.949	-8.2543	18.6619	.6931	.7775
476	.600	1.650	-15.6385	10.0825	4.8289	6.4385	515	1.200	2.100	-7.6750	17.4869	.6992	.6594
477	.600	1.800	-17.7161	9.6217	3.1870	3.3799	516	1.200	2.250	-6.7100	16.6374	.6693	.6594
478	.600	1.950	-14.5466	9.4685	1.9585	1.2394	517	1.200	2.400	-6.0204	16.1574	.6213	.6749
479	.600	2.100	-10.7101	9.7215	.8462	.8318							

TEST NUMBER 81071601 RUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
1	-1.250	0.000	-5.9087	20.1720	1.0962	1.2040	56	-1.150	.251	-1.4608	-1.7549	2.5363	1.8765
2	-1.250	.052	-3.9413	14.9640	3.7562	6.3265	57	-1.150	.302	-1.0522	-1.5440	2.2500	1.5603
3	-1.250	.101	-2.3894	8.6655	4.9885	6.6679	58	-1.150	.352	-1.9923	-1.3485	2.1163	1.8005
4	-1.250	.150	-1.5630	4.4952	4.2379	4.3999	59	-1.150	.401	-1.7510	-1.8107	2.5174	2.0058
5	-1.250	.201	-1.0678	2.9755	3.1015	3.0115	60	-1.150	.451	-1.1848	-2.0891	2.3662	3.1169
6	-1.250	.252	-.8581	2.4980	4.0672	2.8855	61	-1.150	.502	-2.3378	-2.3669	3.0308	3.0668
7	-1.250	.301	-1.4963	2.0088	3.8861	2.4530	62	-1.150	.552	-4.556	-2.7805	3.3781	3.3781
8	-1.250	.350	-1.2700	2.1745	3.7744	2.2027	63	-1.150	.601	-.5942	-2.9016	3.6660	3.3607
9	-1.250	.401	-1.8199	2.3143	4.1163	2.6967	64	-1.150	.651	1.3359	-2.6988	4.0394	3.8019
10	-1.250	.452	-2.1214	2.5935	5.4407	3.2071	65	-1.150	.702	1.1519	-2.6762	4.6766	3.8270
11	-1.250	.501	-.8200	2.6965	5.1061	4.2138	66	-1.150	.752	-.5281	-2.2517	5.1429	3.6792
12	-1.250	.550	-.8279	1.8442	4.7614	4.3166	67	-1.150	.801	-0.437	-1.5478	4.5304	4.8562
13	-1.250	.601	-.7490	1.0151	4.4938	4.9300	68	-1.150	.851	-1.4242	-.6859	5.0895	3.5612
14	-1.250	.652	-.7958	1.5506	4.7719	4.1229	69	-1.150	.902	-3.4721	-.2619	5.1965	3.9603
15	-1.250	.701	-.9409	1.7588	5.3589	4.1959	70	-1.150	.952	-5.2624	1.1602	5.0810	3.9985
16	-1.250	.750	-.8732	1.8535	5.5965	4.0067	71	-1.150	1.001	-5.9862	2.6352	4.4406	3.8695
17	-1.250	.801	1.2167	1.9457	6.0945	3.6897	72	-1.150	1.051	-7.3889	3.6533	4.5030	3.0647
18	-1.250	.852	-.7330	2.0532	5.7282	3.7021	73	-1.150	1.101	-0.3482	4.6222	4.7602	2.9187
19	-1.250	.901	-1.4184	1.9600	5.4742	3.2416	74	-1.150	1.152	-8.6029	5.1253	4.7701	3.3433
20	-1.250	.950	-1.8827	3.7991	5.9304	3.2363	75	-1.150	1.201	-9.5334	5.7384	4.9362	2.9004
21	-1.250	1.001	-2.2925	4.6758	6.1234	3.4212	76	-1.150	1.250	-9.8406	7.2624	4.5608	1.4874
22	-1.250	1.052	-6.0928	3.8235	4.7015	3.2382	77	-1.100	.350	-.6290	-1.0478	2.8846	1.6874
23	-1.250	1.101	-5.6639	5.6449	4.2829	3.0112	78	-1.100	.402	-1.7073	-2.0753	2.2366	1.5566
24	-1.250	1.150	-5.9434	6.9662	5.3443	3.1427	79	-1.100	.452	-1.5296	-2.2683	2.0644	2.8550
25	-1.250	1.201	-6.0882	8.1861	5.9854	3.3994	80	-1.100	.502	-.1665	-2.1966	2.2155	2.9961
26	-1.250	1.251	-6.0235	8.8654	4.8457	3.3841	81	-1.100	.550	-.1439	-2.7176	2.4639	3.1534
27	-1.199	.801	-.0919	1.1563	1.4815	2.1221	82	-1.100	.601	-.9333	-2.7388	3.2129	3.1113
28	-1.199	.852	-.1315	1.927	1.7982	1.8411	83	-1.100	.652	2.1927	-2.6408	3.4885	3.6793
29	-1.199	.902	-.3373	-.5455	1.8824	1.8501	84	-1.100	.702	1.6661	-3.3889	4.1126	3.5793
30	-1.199	.951	-.1212	-.5643	2.1034	1.8358	85	-1.100	.750	-2.8225	-1.6273	4.2540	3.8291
31	-1.199	1.000	-.4668	-.5448	2.9014	1.5179	86	-1.100	.801	-1.2303	-1.8283	5.0786	4.2017
32	-1.199	.252	-1.3796	-.7519	2.1920	1.6753	87	-1.100	.852	-2.7834	-.7524	4.7322	4.5683
33	-1.199	.302	-1.8178	-.6832	2.7781	1.7979	88	-1.100	.902	-4.6650	-0.428	4.7047	3.1646
34	-1.199	.351	-1.8562	-.6811	2.5244	2.0829	89	-1.100	.950	-6.1914	1.3157	4.8044	4.1157
35	-1.199	.401	-1.5358	-.6937	2.9404	2.2356	90	-1.100	1.001	-6.9843	2.4226	4.8816	3.8340
36	-1.199	.452	-1.8565	-1.0363	2.7679	3.2461	91	-1.100	1.052	-7.6845	3.4306	4.9555	2.8887
37	-1.199	.502	-1.1366	-.9679	2.8803	3.4847	92	-1.100	1.101	-8.1055	4.6488	5.3768	3.2697
38	-1.199	.551	-.0000	-1.0892	3.8895	4.0979	93	-1.100	1.150	-9.5543	4.3548	4.2243	2.9619
39	-1.199	.601	-.6034	-1.3485	3.8422	3.7265	94	-1.100	1.201	-10.6129	5.2392	4.6839	2.9325
40	-1.199	.652	1.2298	-2.3858	4.2734	3.9291	95	-1.100	1.252	-10.8114	6.2722	5.3478	3.5817
41	-1.199	.703	-.9198	-1.6869	5.0697	3.7396	96	-1.050	.501	-3.3756	-1.4424	2.2875	2.8897
42	-1.199	.751	-.3580	-1.9771	5.6784	3.7710	97	-1.050	.552	-.2951	-1.7301	2.5218	2.6771
43	-1.199	.801	-.3007	-.3768	5.6579	3.6019	98	-1.050	.601	1.1081	-.7888	2.9066	3.1273
44	-1.199	.852	-1.0300	-.2608	5.8190	3.8170	99	-1.050	.650	1.9230	-1.0305	2.7161	3.3203
45	-1.199	.902	-2.0630	-.8969	5.1892	3.9135	100	-1.050	.701	1.4062	-1.4427	3.4572	3.5865
46	-1.199	.951	-4.3160	1.6069	4.5936	3.2717	101	-1.050	.751	-.7964	-.7499	4.0087	3.9968
47	-1.199	1.000	-4.7403	2.5343	5.0676	3.8169	102	-1.050	.801	-1.1711	-.4158	5.1301	3.7110
48	-1.199	1.052	-6.9205	4.7755	5.3173	3.4641	103	-1.050	.850	-3.7588	-.1096	4.0897	3.7243
49	-1.199	1.102	-6.9402	4.9094	4.6454	3.2956	104	-1.050	.901	-4.9431	.6450	4.7345	3.4832
50	-1.199	1.151	-7.5186	6.1872	4.8660	2.9647	105	-1.050	.951	-7.3660	1.8511	4.2188	3.4230
51	-1.199	1.200	-8.4868	6.4167	4.1215	3.9334	106	-1.050	1.001	-6.2279	2.6358	5.0063	3.8534
52	-1.199	1.251	-8.0943	7.4457	5.3769	3.4399	107	-1.050	1.050	-8.2625	2.7428	4.4353	3.4353
53	-1.150	.102	-.3627	-.3345	1.5991	1.4362	108	-1.050	1.101	-9.9888	3.6857	3.5824	2.7979
54	-1.150	.152	-.1704	-.5201	1.5366	1.6194	109	-1.050	1.151	-10.4455	3.8869	4.5170	3.5564
55	-1.150	.201	-.1646	-.6291	2.4965	1.6490	110	-1.050	1.201	-10.6847	4.0342	4.9493	3.2078

TEST NUMBER 81071601 RUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
111	-1.050	1.250	-10.8733	5.3256	5.1138	3.2414	166	-0.800	1.201	-12.0660	-6.306	3.8693	3.4743
112	-1.000	.601	1.4437	.6284	2.1164	2.4465	167	-0.800	1.250	-11.3115	-1.298	5.1476	3.8791
113	-1.000	.652	1.5513	.6315	2.3408	2.9272	168	-0.750	.901	-5.0026	-3.592	5.3426	2.4856
114	-1.000	.701	1.2090	.7486	2.6549	2.6973	169	-0.750	.951	-6.4447	-1.034	4.8172	2.3365
115	-1.000	.750	-0.0053	.3605	3.7716	3.6894	170	-0.750	1.000	-9.2951	-7.266	3.6319	2.5122
116	-1.000	.801	-2.0611	.7866	4.6840	3.5060	171	-0.750	1.050	-10.5916	-1.553	3.5461	2.9488
117	-1.000	.852	-4.7119	-1.319	5.2100	3.5464	172	-0.750	1.101	-9.8692	-7.175	3.7373	3.7373
118	-1.000	.901	-6.5736	.7833	4.8453	3.2556	173	-0.750	1.151	-11.1686	-2.849	4.3585	3.6980
119	-1.000	.950	-7.7715	1.4026	4.2599	2.8853	174	-0.750	1.200	-11.6934	-1.0198	4.0510	3.9561
120	-1.000	1.001	-9.2719	2.0838	4.4310	2.8191	175	-0.750	1.250	-11.3047	-1.4412	4.4225	4.0084
121	-1.000	1.052	-9.8001	2.3056	4.5387	2.6498	176	-0.700	.950	-7.7823	-9.800	2.2252	2.2252
122	-1.000	1.101	-9.9241	3.4863	4.2771	2.8225	177	-0.700	1.001	-9.6706	-7.764	4.6989	2.4652
123	-1.000	1.150	-10.8308	2.9635	4.5140	3.2453	178	-0.700	1.051	-10.5598	-1.8675	3.5661	2.4929
124	-1.000	1.201	-11.5133	2.9764	4.8755	3.3161	179	-0.700	1.100	-10.6000	-1.6247	3.7215	3.2686
125	-1.000	1.251	-11.8371	3.9467	5.0894	2.9990	180	-0.700	1.150	-10.8244	-2.1441	3.8174	3.0947
126	-0.950	.701	1.8759	2.4902	3.0013	2.3898	181	-0.700	1.201	-10.3246	-2.8434	3.7448	3.5993
127	-0.950	.751	.0951	1.9917	3.9663	3.0878	182	-0.700	1.251	-11.5844	-3.0377	3.9034	4.3019
128	-0.950	.801	-2.1609	1.1599	4.5317	2.8371	183	-0.650	1.001	-9.3000	-2.1193	3.3159	2.3909
129	-0.950	.850	-3.6987	.9794	5.2437	3.3130	184	-0.650	1.050	-9.6501	-2.2243	3.1755	2.3211
130	-0.950	.901	-6.6208	1.1502	4.7551	2.9656	185	-0.650	1.100	-10.0081	-2.2022	3.9286	2.9746
131	-0.950	.951	-8.2359	1.6769	5.1469	2.8098	186	-0.650	1.151	-10.1570	-2.3053	3.9895	3.2888
132	-0.950	1.001	-9.5081	1.1494	3.4728	3.0117	187	-0.650	1.201	-10.4611	-3.3272	3.7174	3.6958
133	-0.950	1.050	-10.1362	1.2511	4.1724	3.0358	188	-0.600	1.250	-10.7951	-4.4167	3.9168	3.7971
134	-0.950	1.101	-9.9234	2.3624	4.1530	3.5204	189	-0.600	1.000	-9.5753	-1.5235	4.1773	1.8096
135	-0.950	1.151	-10.5726	3.2678	4.0953	3.1946	190	-0.600	1.051	-10.1988	-2.23027	3.1523	2.6955
136	-0.950	1.201	-11.5816	2.2611	4.8197	3.4907	191	-0.600	1.101	-9.7131	-2.5665	2.9077	2.9077
137	-0.950	1.250	-12.0307	2.6591	5.0013	3.7502	192	-0.600	1.151	-10.3121	-2.6149	3.2995	3.9607
138	-0.900	.752	.5362	3.1033	3.3474	1.9419	193	-0.600	1.200	-10.3318	-2.2413	4.1793	3.6803
139	-0.900	.801	-1.3690	1.8655	4.9511	2.3577	194	-0.600	1.251	-10.4441	-2.2511	3.2312	3.4396
140	-0.900	.850	-4.5573	1.1166	4.6130	2.7144	195	-0.550	1.050	-9.7129	-2.0192	3.9591	2.3508
141	-0.900	.901	-6.3348	1.4873	4.9427	2.5505	196	-0.550	1.101	-8.7682	-2.3869	3.7445	2.7256
142	-0.900	.951	-9.3227	1.4458	4.3611	2.3162	197	-0.550	1.151	-9.1986	-3.7888	3.3787	3.1247
143	-0.900	1.001	-9.9917	.7973	3.5543	2.5001	198	-0.550	1.200	-8.5963	-6.4599	3.5785	3.2818
144	-0.900	1.050	-9.5812	1.0017	3.9884	3.1316	199	-0.550	1.250	-9.2162	-5.1172	3.5250	3.5250
145	-0.900	1.101	-10.4619	1.2932	4.2612	3.0132	200	-0.500	1.051	-6.2534	.4219	7.2918	2.9885
146	-0.900	1.151	-11.6255	2.3869	4.3683	3.4316	201	-0.500	1.101	-9.1086	-3.3857	3.1441	2.6628
147	-0.900	1.201	-11.2943	1.3029	4.5762	3.5188	202	-0.500	1.151	-9.0458	-6.5149	2.8572	2.8300
148	-0.900	1.250	-12.1650	1.4770	5.1887	3.4233	203	-0.500	1.200	-8.1957	-6.7178	4.1470	3.7393
149	-0.850	.801	.0239	2.8321	4.9671	2.1130	204	-0.500	1.251	-8.4969	-6.1910	3.6442	3.6747
150	-0.850	.851	-3.5695	1.1803	5.4576	2.7223	205	-0.450	1.100	-8.3939	-2.1883	3.6455	3.3271
151	-0.850	.901	-6.0877	.9783	5.6161	2.6064	206	-0.450	1.151	-8.3162	-3.7570	3.6436	3.3122
152	-0.850	.950	-8.3650	1.0372	4.6742	2.5163	207	-0.450	1.201	-7.0774	-5.1994	2.8851	3.6081
153	-0.850	1.001	-9.8228	1.3470	5.0386	2.7873	208	-0.450	1.251	-7.5126	-5.0933	4.1726	3.6789
154	-0.850	1.051	-10.4382	.5715	4.4356	2.9742	209	-0.400	1.101	-6.7035	-8.657	5.7084	3.2762
155	-0.850	1.101	-10.7492	1.0684	4.0923	3.0661	210	-0.400	1.149	-7.8129	-3.5300	3.0872	3.2582
156	-0.850	1.150	-11.7216	-1.3027	3.9571	3.4300	211	-0.400	1.201	-5.9100	-4.1560	4.1896	3.5792
157	-0.850	1.201	-11.5914	.9100	4.6223	3.5378	212	-0.400	1.251	-6.2280	-5.9748	3.4449	3.3541
158	-0.850	1.251	-11.1663	-1.288	3.9204	4.1665	213	-0.350	1.151	-5.6771	-2.1650	3.8612	3.1620
159	-0.800	.850	-1.8496	1.6211	5.2922	2.1395	214	-0.350	1.200	-4.7360	-4.3677	3.9378	4.0100
160	-0.800	.901	-7.3396	-1.825	5.3622	2.1441	215	-0.350	1.251	-4.3584	-6.1802	3.7762	3.6183
161	-0.800	.951	-9.0571	-1.3570	4.3220	2.5281	216	-0.300	1.151	-3.2711	-2.499	4.7494	3.5612
162	-0.800	1.001	-9.8916	.1095	3.4667	2.5445	217	-0.300	1.201	-3.6330	-3.7915	3.9541	3.5332
163	-0.800	1.050	-10.6513	.1998	4.0971	2.7782	218	-0.300	1.250	-3.0288	-5.7410	3.7546	3.8254
164	-0.800	1.101	-11.2724	.1140	4.3013	3.1943	219	-0.250	1.151	-1.5990	-5.006	4.9284	4.0417
165	-0.800	1.151	-11.5679	-0.5960	3.7105	3.4745	220	-0.250	1.201	-1.0315	-3.4549	4.9309	3.5987

TEST NUMBER 81071601 MUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	W	VS	MS	MO.	Y	Z	V	W	VS	MS	MO.
331	.950	.700	1.2650	-1.1307	3.2925	2.7317	386	1.100	.851	-1.6269	.0922	5.2709	5.0163	
332	.950	.750	-5.685	-1.3780	4.3664	2.7932	387	1.100	.900	-1.7038	2.5659	4.5676	5.5196	
333	.950	.801	-6.254	-2.0076	4.6068	3.1194	388	1.100	.950	-1.7819	2.9404	4.5853	6.6806	
334	.950	.851	-8.269	-2.5683	4.7666	3.826	389	1.100	1.001	-1.8627	3.2956	4.6792	7.0767	
335	.950	.900	-1.0987	-2.0043	5.4375	4.4478	390	1.100	1.051	-1.2552	5.3105	4.6574	7.6336	
336	.950	.949	2.2801	-1.5503	5.9031	5.1608	391	1.100	1.100	1.6544	5.9391	4.8166	7.3999	
337	.950	1.001	3.5600	5.244	6.7636	5.7027	392	1.100	1.150	1.2087	6.0360	4.5658	7.6684	
338	.950	1.051	5.2910	1.7591	6.6522	5.6804	393	1.100	1.201	3.3017	9.3405	4.2979	7.5028	
339	.950	1.100	7.1067	6.6324	6.6324	5.8101	394	1.100	1.251	3.5656	10.2409	5.1829	6.6507	
340	.950	1.149	7.8615	5.1546	5.9377	5.6146	395	1.150	.001	1.3111	7.2549	6.7368	4.9991	
341	.950	1.201	10.6532	7.5066	3.6393	4.1887	396	1.150	.050	.3686	2.0679	2.0554	1.5208	
342	.950	1.251	10.5378	9.1428	4.5230	4.8102	397	1.150	.101	.2831	1.1346	1.2803	1.1442	
343	1.000	.551	3.0389	-1.3590	1.7216	2.8866	398	1.150	.151	.2036	1.1008	1.3864	1.3793	
344	1.000	.601	2.9727	-.9813	2.1360	2.3823	399	1.150	.201	.4314	1.0827	1.4599	1.5037	
345	1.000	.649	1.9678	-1.4689	3.1563	2.3783	400	1.150	.250	.3794	.6204	1.8137	1.7913	
346	1.000	.699	1.4807	-.8568	3.1154	2.3869	401	1.150	.301	.7794	.5547	1.7503	2.0709	
347	1.000	.751	1.0906	-2.5055	4.4330	4.2845	402	1.150	.351	1.4611	.8217	1.9682	2.8322	
348	1.000	.801	-1.1523	-2.7306	4.6081	3.6909	403	1.150	.401	2.1260	1.2349	1.9361	2.5778	
349	1.000	.849	-3.450	-2.3269	4.2761	4.6029	404	1.150	.450	2.7437	1.4839	2.1415	2.8321	
350	1.000	.899	-.6013	-2.2760	4.8193	4.6059	405	1.150	.501	3.1441	2.4650	2.3414	2.8472	
351	1.000	.951	-.2924	-1.7726	6.0655	4.9626	406	1.150	.551	3.1075	2.5749	2.5749	3.7685	
352	1.000	1.000	.8710	-.4033	5.3529	5.7346	407	1.150	.601	3.1441	4.4774	3.0344	3.5349	
353	1.000	1.049	3.3563	1.7139	6.6779	6.2081	408	1.150	.650	3.2230	4.7554	2.9303	4.6601	
354	1.000	1.099	5.4903	3.7655	6.2162	5.6029	409	1.150	.701	1.9501	4.6822	4.4884	4.5885	
355	1.000	1.151	6.8063	4.9377	5.6848	5.0821	410	1.150	.751	1.0492	6.7988	4.8367	5.5344	
356	1.000	1.201	7.2030	7.8216	5.7195	5.9679	411	1.150	.801	.2549	6.5673	5.3860	6.4214	
357	1.000	1.250	9.2851	9.2640	4.8038	4.5672	412	1.150	.850	-1.8978	7.7970	5.6082	7.0598	
358	1.050	.451	2.1642	-.1047	1.6895	2.9596	413	1.150	.901	-2.7596	6.5596	4.8738	6.1601	
359	1.050	.501	3.2185	-.0815	1.7855	2.6177	414	1.150	.951	-1.9880	7.2253	5.2753	7.6813	
360	1.050	.552	2.9957	-.4981	2.7403	2.8514	415	1.150	1.000	-2.5416	7.9929	4.5391	7.5052	
361	1.050	.601	3.7754	-.8037	2.2932	2.8761	416	1.150	1.049	-.8499	9.3017	3.9714	7.6856	
362	1.050	.650	2.9387	-.4968	3.4207	2.7514	417	1.150	1.100	-1.850	9.6657	3.5333	8.5911	
363	1.050	.701	2.5506	-1.0467	4.1081	3.1751	418	1.150	1.150	-.3895	11.1239	3.4176	7.3620	
364	1.050	.752	1.1428	-1.0456	4.0364	3.7476	419	1.150	1.200	2.1795	10.9540	3.9159	7.5852	
365	1.050	.801	-.4617	-2.1776	3.6942	4.6618	420	1.150	1.249	2.9533	11.8639	4.4729	7.1010	
366	1.050	.850	-1.2589	-1.5435	5.1441	4.8645	421	1.200	.002	5.1286	25.3482	.8924	1.2614	
367	1.050	.901	-1.4188	-1.1670	5.1169	5.7791	422	1.200	.051	4.8337	25.0738	.7659	1.3534	
368	1.050	.951	-.9581	-.0708	5.0746	6.2433	423	1.200	.099	4.3958	24.9010	1.2260	1.5892	
369	1.050	1.001	.6190	1.3154	4.6835	6.6017	424	1.200	.151	3.6424	22.4095	5.5553	4.5263	
370	1.050	1.050	2.3585	2.4057	6.1401	6.7754	425	1.200	.201	2.8278	20.4557	6.7923	5.5871	
371	1.050	1.101	2.7703	4.5009	5.7220	7.4704	426	1.200	.250	2.2569	16.9140	7.5778	6.7020	
372	1.050	1.151	5.1036	6.3400	5.4395	6.3075	427	1.200	.300	1.4365	11.9516	7.0305	6.8466	
373	1.050	1.201	5.5135	7.4238	6.0019	6.2890	428	1.200	.351	1.5297	12.9864	6.2757	7.1620	
374	1.050	1.250	6.7531	9.2636	5.8056	5.6419	429	1.200	.401	1.5506	11.3703	5.2449	6.9081	
375	1.100	.301	.5963	1.0798	1.5717	2.3490	430	1.200	.450	2.5710	10.1093	4.8472	6.9618	
376	1.100	.350	1.4483	1.0437	1.8659	2.2413	431	1.200	.499	2.3468	11.0362	4.4896	7.2995	
377	1.100	.401	2.2701	-.2272	1.6904	2.5798	432	1.200	.551	1.9450	12.3441	3.8441	6.8660	
378	1.100	.452	2.8364	-.0097	1.8664	2.5117	433	1.200	.601	2.3079	11.2412	4.1877	6.5782	
379	1.100	.501	3.1122	-.6092	1.9858	2.6800	434	1.200	.650	1.4846	12.3327	4.6460	6.6840	
380	1.100	.550	3.3732	4.026	2.0846	2.7372	435	1.200	.701	1.8577	11.8161	4.2830	6.6756	
381	1.100	.601	3.5548	1.0737	2.7652	3.2834	436	1.200	.751	1.4546	12.4913	4.9053	6.7066	
382	1.100	.651	3.7186	1.0861	3.5394	3.0715	437	1.200	.801	-.1628	13.3344	5.0657	6.9170	
383	1.100	.701	2.5526	-.6224	4.3558	3.8651	438	1.200	.850	-1.3460	12.7958	5.3760	7.2138	
384	1.100	.750	1.1300	-.9470	4.4506	4.3985	439	1.200	.899	-2.2558	12.5046	5.0850	7.3280	
385	1.100	.801	-.0736	2.0008	4.7838	5.0843	440	1.200	.951	-1.3219	12.5676	4.6967	7.7843	

TEST NUMBER 81071601 RUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	W	VS	WS	NO.	Y	Z	V	W	VS	WS
441	1.001	1.001	-2.6370	14.2247	4.6373	8.0557	496	-1.500	1.551	-5.4070	18.7698	6.2728	2.7974
442	1.200	1.050	-2.7808	14.8155	3.7954	6.8838	497	-1.500	1.252	1.4066	23.8492	4.5551	4.0374
443	1.200	1.099	-4.494	12.1682	4.3067	7.6367	498	-1.500	2.301	4.6208	23.7152	4.2312	3.3494
444	1.200	1.150	-4.297	16.4304	3.1334	8.2056	499	-1.500	4.450	6.7268	22.7885	4.4646	3.9234
445	1.200	1.201	.9864	13.3926	3.5262	7.8624	500	-1.500	2.601	7.7989	22.7099	3.6296	3.0416
446	1.200	1.249	1.7612	14.5950	3.2586	7.6709	501	-1.500	2.752	8.5942	21.1983	4.1094	3.2449
447	1.250	.001	5.1014	24.6779	8.225	1.1721	502	-1.500	2.901	9.8413	20.9211	3.0964	2.8303
448	1.250	.051	4.7177	24.7655	.6662	1.0871	503	-1.500	3.051	10.3044	19.8247	2.2423	2.3130
449	1.250	.100	4.5057	24.8472	.7973	1.3348	504	-1.500	3.201	10.5528	19.3474	1.8697	1.6174
450	1.250	.149	4.1330	25.0764	.7010	1.2890	505	-1.500	3.352	10.1756	18.5184	1.2240	1.3941
451	1.250	.201	3.8536	25.1684	.7816	1.1233	506	-1.500	3.502	9.6402	17.6881	1.2661	1.0072
452	1.250	.251	3.3589	25.4273	.7669	1.3605	507	-1.500	3.651	8.7237	16.9913	1.0535	.7920
453	1.250	.300	3.3722	24.8130	1.4209	1.6803	508	-1.500	3.801	7.9691	16.4955	1.3138	.6947
454	1.250	.349	3.2836	24.9170	1.3893	2.4129	509	-1.500	3.952	7.1694	16.0510	.9459	.7352
455	1.250	.401	2.7635	23.2472	2.8619	3.7740	510	-1.500	4.101	6.4285	15.7893	.9281	.7027
456	1.250	.451	2.9509	21.7241	3.8372	5.6473	511	-1.500	4.251	5.9630	15.6216	.9466	.6644
457	1.250	.500	2.7763	21.5156	3.1144	6.0994	512	-1.350	1.251	-5.7496	10.8770	6.4489	3.3508
458	1.250	.549	2.0969	21.5161	3.3845	5.4435	513	-1.350	1.401	-7.7281	13.3400	4.7731	2.6844
459	1.250	.601	1.6704	20.9343	3.5581	5.4435	514	-1.350	1.552	-7.9485	15.3258	5.2534	3.1317
460	1.250	.651	1.6419	19.9462	3.5903	6.2292	515	-1.349	1.701	-7.5209	18.3002	6.5421	4.0685
461	1.250	.700	1.5618	19.1558	4.1010	7.1864	516	-1.349	1.850	-6.8612	19.7848	6.5932	3.5312
462	1.250	.749	-1.1338	21.0177	3.7503	5.5480	517	-1.349	2.001	-2.9991	22.7740	4.6396	3.8269
463	1.250	.801	.1014	20.6768	4.0012	6.0994	518	-1.349	2.152	.4425	23.0504	5.1802	3.4444
464	1.250	.851	-8.338	20.2635	4.6438	6.0163	519	-1.349	2.301	4.1121	22.5282	4.1418	2.9990
465	1.250	.900	-2.5891	19.4316	4.4002	5.3809	520	-1.349	2.450	7.2761	21.7439	3.9878	3.7393
466	1.250	.949	-2.7373	19.5546	5.1034	5.9579	521	-1.349	2.600	7.9545	19.2497	4.6270	3.6699
467	1.250	1.000	-1.6329	17.3076	4.5637	7.3840	522	-1.349	2.752	9.6224	19.1972	3.7240	3.2747
468	1.250	1.051	-3.1341	18.7139	4.2049	5.6340	523	-1.349	2.902	10.1885	18.7516	4.2959	2.9410
469	1.250	1.099	-1.3605	18.3369	3.2196	6.4373	524	-1.349	3.051	10.2787	17.7786	3.8903	2.9220
470	1.250	1.149	.7737	16.6825	2.8456	7.9163	525	-1.349	3.201	11.3763	17.2551	2.4266	2.3475
471	1.250	1.200	.5403	17.9864	3.2940	7.5334	526	-1.349	3.352	11.0978	17.7897	1.5621	1.7296
472	1.250	1.251	1.1101	17.5157	2.1105	7.3521	527	-1.349	3.501	10.4192	16.6166	1.4133	1.2896
473	1.650	1.251	-5.1755	19.8267	4.1339	1.0000	528	-1.349	3.651	9.5226	16.1497	1.2407	.9290
474	1.650	1.401	-5.1972	20.5331	4.8371	3.0000	529	-1.349	3.801	8.4643	15.6335	1.2767	.8123
475	1.650	1.549	-5.1660	20.2001	5.4335	5.0000	530	-1.349	3.952	7.5878	15.3749	1.0710	.7657
476	1.650	1.700	-5.2235	21.9615	5.8763	3.1518	531	-1.349	4.101	6.7502	15.0789	.9673	.6427
477	1.650	1.851	-2.2869	22.7394	4.8613	3.4683	532	-1.349	4.251	6.0347	15.0663	.9287	.7143
478	1.650	2.001	-1.4573	23.9450	4.1555	3.0529	533	-1.199	1.252	-9.5603	8.2854	4.7417	3.1658
479	1.650	2.150	1.0969	24.7561	4.8340	3.3900	534	-1.199	1.401	-10.1388	10.5260	6.5545	3.2743
480	1.650	2.301	2.4454	24.2453	4.4900	3.5786	535	-1.199	1.551	-11.2065	12.4195	7.4793	3.5443
481	1.650	2.451	5.1572	24.3694	4.1849	3.0055	536	-1.199	1.700	-10.6523	14.0160	7.2809	3.8910
482	1.650	2.601	6.7565	24.0861	3.0138	2.5435	537	-1.199	1.851	-7.7024	16.9539	8.3119	3.7890
483	1.650	2.750	8.5531	22.4603	2.6373	2.1529	538	-1.199	2.002	-4.7370	18.5353	8.0869	5.1338
484	1.650	2.901	9.0291	21.9124	1.7510	1.4710	539	-1.199	2.151	1.6805	21.5452	6.3889	4.6729
485	1.650	3.052	9.1327	21.3056	1.6267	1.6220	540	-1.199	2.301	6.7055	20.2778	4.9476	5.0466
486	1.650	3.201	9.3625	20.0031	1.2483	1.3372	541	-1.199	2.451	9.4632	18.6205	4.6263	3.7469
487	1.650	3.350	9.2180	19.4100	1.1879	1.0088	542	-1.199	2.602	9.8952	15.8627	4.3439	3.3814
488	1.650	3.501	8.5155	18.3895	.7453	.6190	543	-1.199	2.751	8.9244	15.8451	3.4864	3.4864
489	1.650	3.652	8.0470	17.8342	1.0566	.6190	544	-1.199	2.901	10.4036	15.5848	4.8878	3.3560
490	1.650	3.801	7.2836	17.0404	1.2160	.7039	545	-1.199	3.051	11.1928	15.6574	4.5919	3.2329
491	1.650	3.950	6.6585	16.6892	1.0028	.6554	546	-1.199	3.201	11.5576	15.5246	3.5272	2.8633
492	1.650	4.101	6.1642	16.4307	.8456	.5671	547	-1.199	3.351	11.4060	15.2508	2.4823	2.0762
493	1.650	4.252	5.5047	16.2771	.8811	.5716	548	-1.199	3.501	10.8451	14.9570	1.7719	1.1466
494	1.650	4.401	-5.6374	15.9774	6.0971	3.1338	549	-1.199	3.651	10.3237	14.7769	1.4428	1.1446
495	1.650	4.550	-6.4509	15.7298	5.9621	2.8052	550	-1.199	3.801	8.7958	14.5851	1.3805	.9352

TEST NUMBER 81071601 RUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
551	-1.199	3.951	7.7136	14.2831	.9552	.7959	606	-.749	2.749	7.0643	1.9072	7.4553	2.6146
552	-1.199	4.101	6.7085	14.2826	.8790	.7462	607	-.749	2.900	7.5572	3.1577	6.6622	3.1830
553	-1.199	4.251	4.3764	14.2764	.7842	.6802	608	-.749	3.051	7.9602	4.9871	4.9224	3.3408
554	-1.049	1.252	-11.2019	5.6929	5.4421	3.0353	609	-.749	3.200	8.8309	6.0167	3.7400	2.5578
555	-1.049	1.401	-12.2179	5.8356	6.4862	3.8543	610	-.749	3.349	9.7663	7.6093	3.0896	2.2802
556	-1.049	1.551	-12.8115	6.8547	7.6529	4.0339	611	-.749	3.500	9.2785	8.9337	3.1596	1.9472
557	-1.049	1.701	-12.0900	10.2869	8.2458	4.2780	612	-.749	3.651	8.8343	9.7448	2.1853	1.5361
558	-1.049	1.852	-10.0421	11.2083	10.5004	4.8433	613	-.749	3.801	7.8343	10.6823	1.1629	1.0799
559	-1.049	2.002	-6.2129	12.4437	11.2179	6.7932	614	-.749	3.949	6.5765	10.7994	1.4215	1.3902
560	-1.049	2.151	1.7592	13.5065	12.0433	6.9938	615	-.749	4.100	5.8366	11.4302	1.0236	.6940
561	-1.049	2.301	9.2241	12.7452	8.2478	5.7178	616	-.749	4.251	5.2049	11.9159	.9167	.9533
562	-1.049	2.451	10.2436	11.8006	7.3428	4.6437	617	-.600	1.252	-10.2521	4.1785	4.9013	4.2377
563	-1.049	2.602	11.8032	11.8032	4.7506	3.6233	618	-.600	1.400	-10.8830	-7.0585	4.9946	4.6222
564	-1.049	2.751	9.3736	12.1049	5.8450	3.4946	619	-.600	1.551	-8.9976	-9.5262	5.0966	3.9816
565	-1.049	2.901	9.7610	11.9672	5.0378	3.3722	620	-.600	1.701	-9.1803	-11.0375	5.4106	4.7266
566	-1.049	3.051	10.6804	12.6335	5.1855	3.0791	621	-.600	1.851	-6.6849	-13.0866	5.7212	3.5996
567	-1.049	3.201	11.9711	13.1386	3.9202	2.9898	622	-.600	2.000	-4.7242	-15.7018	6.1819	4.8538
568	-1.049	3.351	12.1533	12.9805	2.6597	2.3649	623	-.600	2.151	.5797	-14.0453	7.2370	3.3537
569	-1.049	3.501	11.3196	13.4048	2.1472	1.8452	624	-.600	2.301	3.0073	-10.4790	8.6487	3.4577
570	-1.049	3.651	10.2696	13.3978	1.5179	1.4243	625	-.600	2.451	4.3331	-7.9587	8.5917	2.9661
571	-1.049	3.801	8.6374	13.3489	1.3952	1.1738	626	-.600	2.600	4.6906	-5.4075	7.6366	2.6648
572	-1.049	3.950	7.6432	13.3794	1.0525	1.0250	627	-.600	2.751	4.6533	-2.9339	8.0306	3.1689
573	-1.049	4.101	6.7333	13.3478	.9431	.9545	628	-.600	2.901	5.4030	-.5901	6.5844	3.5873
574	-1.049	4.251	6.0774	13.5405	1.1420	.7976	629	-.600	3.051	6.8142	1.2975	6.0754	2.8612
575	-.900	1.250	-12.3832	1.0881	4.6109	3.5634	630	-.600	3.200	7.4930	3.9031	5.7786	2.4760
576	-.900	1.400	-13.2391	1.1899	6.4028	4.4678	631	-.600	3.350	7.5333	4.5703	4.6393	2.2034
577	-.900	1.551	-12.6699	1.9228	7.1376	4.4678	632	-.600	3.501	7.5148	6.1170	3.6577	1.8566
578	-.900	1.700	-13.3178	.2738	7.4192	4.4923	633	-.600	3.651	7.1396	7.2817	3.1759	1.8229
579	-.900	1.850	-12.4041	.9725	8.7222	7.1592	634	-.600	3.800	6.7408	8.6064	1.9134	1.3455
580	-.900	2.001	-6.7385	-.2457	12.1411	6.5975	635	-.600	3.950	5.8948	9.8413	1.2676	1.0212
581	-.900	2.151	2.3160	.2699	12.9515	6.9148	636	-.600	4.101	5.2588	10.5175	1.0145	1.0607
582	-.900	2.300	9.2272	3.3830	10.5027	5.2357	637	-.600	4.250	4.6180	10.9811	.9640	.9247
583	-.900	2.449	11.5511	5.2265	6.7470	4.0849	638	-.450	1.250	-7.3414	-5.9406	3.5698	3.7875
584	-.900	2.600	9.6473	5.9078	6.5030	3.5805	639	-.450	1.400	-6.9195	-9.7199	4.2287	4.2024
585	-.900	2.751	9.3652	7.7169	5.5061	3.2263	640	-.450	1.551	-5.8258	-17.9377	4.2535	3.6248
586	-.900	2.900	8.4289	7.8923	6.2493	3.0057	641	-.450	1.701	-5.2387	-15.5959	4.5187	3.3605
587	-.900	3.050	9.3654	8.4159	5.2354	3.1287	642	-.450	1.850	-4.7300	-17.9640	4.7654	3.8573
588	-.900	3.200	10.7627	9.3175	4.7645	3.0211	643	-.450	2.001	-3.0289	-17.8117	5.3518	2.9166
589	-.900	3.351	11.5036	9.7068	3.9475	2.1143	644	-.450	2.151	-1.3698	-16.8779	7.0819	3.4360
590	-.900	3.500	10.6786	11.0522	2.2810	2.1960	645	-.450	2.301	-.3920	-14.7529	6.4010	3.1592
591	-.900	3.650	9.6739	11.6083	1.4427	1.6541	646	-.450	2.450	1.2271	-12.5922	7.8498	3.1041
592	-.900	3.800	8.3699	12.0493	1.4332	1.3890	647	-.450	2.601	2.1863	-9.5007	7.1705	3.1804
593	-.900	3.951	7.4289	12.1140	.9894	1.3010	648	-.450	2.751	1.6269	-7.4408	6.3425	3.1351
594	-.900	4.100	6.6020	12.6460	.9009	1.0515	649	-.450	2.901	2.2748	-5.2408	6.3421	3.0379
595	-.900	4.249	5.5954	12.7379	.8259	.8912	650	-.450	3.050	3.8449	-2.5064	6.1505	2.7919
596	-.749	1.252	-11.8451	-1.9454	4.2730	4.0177	651	-.450	3.200	5.0239	-2.0329	5.5189	2.3617
597	-.749	1.401	-11.8534	-3.5741	5.2942	4.1870	652	-.450	3.351	4.6004	.9962	4.3921	2.0491
598	-.749	1.549	-12.7898	-3.6211	5.6046	4.6819	653	-.450	3.501	5.4968	3.5868	3.5273	1.5449
599	-.749	1.700	-11.8954	-6.8931	6.5819	4.7368	654	-.450	3.650	5.1457	5.0793	3.0631	1.2289
600	-.749	1.851	-9.5993	-8.0794	5.8375	5.3190	655	-.450	3.800	5.2238	7.0937	2.0723	1.1981
601	-.749	2.001	-6.2425	-11.1046	7.0847	6.020	656	-.450	3.951	4.3219	8.0748	1.4717	1.0357
602	-.749	2.150	-10.2124	9.8404	9.8404	3.9138	657	-.450	4.101	3.8835	9.6059	.9483	.9298
603	-.749	2.300	5.7735	-6.2490	10.1771	3.3723	658	-.450	4.249	3.5326	10.6387	.8621	.8749
604	-.749	2.451	7.4141	-3.4198	9.3557	3.2882	659	-.450	4.391	3.8053	-6.6205	3.6832	3.2962
605	-.749	2.601	7.6430	-.0571	6.8186	2.9355	660	-.301	1.400	-3.1049	-11.1411	4.0787	3.1335

TEST NUMBER 81071601 RUN NUMBER 9 X/D = 5.70

No.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
661	-301	1.551	-1.8992	-14.9070	4.0452	2.8895	716	0.000	3.501	-2.8743	2.9600	1.4521	1.4834
662	-301	1.701	-3.3341	-17.8272	3.4586	3.0792	717	0.000	3.651	-1.5004	4.6651	1.2482	1.5696
663	-301	1.850	-1.8265	-18.3478	4.8320	3.1536	718	0.000	3.800	-1.1294	6.2923	1.2136	1.1998
664	-301	2.001	-3.0604	-19.2609	4.1341	3.5924	719	0.000	3.949	-7.7022	7.6425	9.772	9.130
665	-301	2.151	-3.4118	-18.9612	4.3548	3.5343	720	0.000	4.100	-2.2108	8.8396	7.658	6.8349
666	-301	2.301	-2.3907	-17.5756	5.4830	3.6873	721	0.000	4.250	-0.0779	9.9191	6.688	7.004
667	-301	2.450	-2.8237	-15.4366	4.6306	3.6720	722	0.150	1.251	14.5340	-3.6287	4.4265	2.7548
668	-301	2.601	-1.9138	-12.4772	5.7027	3.5685	723	0.150	1.401	12.5823	-7.7287	9.1158	3.8080
669	-301	2.751	-2.1077	-10.4647	4.6469	3.5391	724	0.150	1.551	8.9003	-12.1221	4.4735	3.3109
670	-301	2.901	-6.5006	-7.7662	4.3345	3.3149	725	0.150	1.700	4.2494	-14.2361	4.2494	4.1063
671	-301	3.050	-8.1112	-5.3420	4.5781	3.1093	726	0.150	1.851	-1.1690	-16.2671	3.1415	4.6729
672	-301	3.200	1.3798	-2.4763	4.6743	2.7656	727	0.150	2.001	-5.2689	-16.6721	3.0864	6.2255
673	-301	3.351	2.2698	-0.0626	4.5509	2.3015	728	0.150	2.151	-8.4424	-13.6880	3.1083	6.1159
674	-301	3.501	2.7418	2.2922	2.9544	1.5511	729	0.150	2.300	-9.6809	-11.5398	2.9371	6.9689
675	-301	3.650	2.4831	4.2071	2.5853	1.5795	730	0.150	2.450	-10.4160	-10.0415	2.5490	6.9529
676	-301	3.800	2.9056	6.1561	1.9507	1.1256	731	0.150	2.601	-10.5666	-7.8549	2.6477	6.6998
677	-301	3.951	2.3716	7.5738	1.5748	9.9646	732	0.150	2.751	-9.9251	-6.0299	2.6477	6.6998
678	-301	4.100	2.4813	9.0197	1.0906	9.923	733	0.150	2.900	-10.0076	-3.7109	2.2888	4.7622
679	-301	4.249	2.2938	10.0815	1.0638	1.1087	734	0.150	3.051	-9.3676	-1.6216	1.3885	3.8537
680	-150	1.251	3.2572	-5.1399	4.4423	2.9871	735	0.150	3.201	-7.5981	-0.7643	1.6814	3.2889
681	-150	1.401	2.9205	-10.3007	4.4471	3.3391	736	0.150	3.351	-6.3603	2.2720	1.8897	2.2724
682	-150	1.551	1.7928	-15.1182	3.9904	3.0249	737	0.150	3.500	-5.1007	4.0311	1.0153	1.7214
683	-150	1.700	-1.362	-17.7866	3.1332	3.2913	738	0.150	3.650	-3.8071	5.8413	9.107	1.2103
684	-150	1.850	-1.5047	-19.3944	3.4981	3.5891	739	0.150	3.801	-2.6665	7.1171	8.948	1.0606
685	-150	2.001	-3.0928	-19.7295	3.4237	4.5488	740	0.150	3.950	-2.8413	8.2291	9.688	0.8750
686	-150	2.151	-3.7912	-19.3572	3.1645	4.4376	741	0.150	4.099	-1.5854	9.3414	9.750	0.8204
687	-150	2.300	-3.8994	-17.8802	4.9305	4.9305	742	0.150	4.249	-1.1586	10.2426	4.790	0.6472
688	-150	2.450	-5.9447	-15.4673	2.6859	4.9309	743	0.300	1.251	17.3040	-1.6903	4.3787	3.0767
689	-150	2.601	-3.3294	-13.2457	3.4882	3.9948	744	0.300	1.401	16.4955	-3.4759	5.4057	4.2899
690	-150	2.751	-5.2488	-10.6561	3.6620	4.4105	745	0.300	1.551	13.1163	-7.1980	4.9481	4.2267
691	-150	2.900	-2.3464	-6.4744	5.4512	3.7523	746	0.300	1.700	8.9446	-10.2178	5.5375	4.1503
692	-150	3.050	-3.7057	-5.1676	2.5560	3.6227	747	0.300	1.851	2.7144	-13.0023	5.1065	4.9113
693	-150	3.201	-2.5567	-2.4126	2.7762	2.9965	748	0.300	2.001	-6.2493	-14.0752	4.2019	7.7645
694	-150	3.351	-9.9528	-1.071	2.1815	2.2964	749	0.300	2.151	-11.4897	-10.5034	3.9430	7.1915
695	-150	3.500	-5.087	2.0244	2.3282	2.0207	750	0.300	2.300	-13.2412	-6.3718	2.9399	8.0637
696	-150	3.650	3.989	4.2679	1.6964	1.3586	751	0.300	2.450	-12.3650	-4.4760	2.7600	6.3915
697	-150	3.800	9.625	6.0825	1.3400	1.2742	752	0.300	2.601	-12.7214	-2.5829	2.6247	6.7592
698	-150	3.950	1.1636	7.6222	1.2535	1.0231	753	0.300	2.751	-13.4768	-1.0444	2.6280	5.3016
699	-150	4.099	1.1733	8.8402	1.1009	9.246	754	0.300	2.900	-13.2898	0.677	2.0053	3.9851
700	-150	4.249	1.1053	9.8131	1.0419	7.979	755	0.300	3.050	-11.6812	1.9659	1.9903	3.5405
701	0.000	1.252	9.1189	-4.7924	4.2863	2.8056	756	0.300	3.201	-10.0004	3.6353	1.7157	2.6364
702	0.000	1.401	8.2004	-9.45137	4.5148	3.1689	757	0.300	3.350	-8.3414	5.1595	1.3056	2.2184
703	0.000	1.550	5.3167	-13.8627	4.2804	4.4079	758	0.300	3.499	-6.8647	6.0194	1.0309	1.5159
704	0.000	1.701	2.5204	-16.7103	3.4029	4.3000	759	0.300	3.650	-5.3795	6.9095	1.0603	1.3496
705	0.000	1.852	-1.5463	-18.2004	3.2956	5.0187	760	0.300	3.801	-4.1655	8.1105	5.998	0.8577
706	0.000	2.001	-3.9177	-18.1562	2.9529	5.9680	761	0.300	3.950	-3.4485	9.0190	7.261	0.8133
707	0.000	2.151	-5.8895	-17.4200	2.6428	5.8626	762	0.300	4.099	-2.4169	9.7151	6.081	0.6748
708	0.000	2.301	-7.4442	-15.1475	7.3277	7.3277	763	0.300	4.249	-2.0853	10.5471	5.703	0.6443
709	0.000	2.451	-8.1758	-13.4472	3.1466	6.6322	764	0.450	1.251	18.3956	-6.650	4.0340	4.0392
710	0.000	2.601	-7.6326	-11.4322	6.3460	6.3460	765	0.450	1.400	17.8611	-2.2089	4.4790	4.3254
711	0.000	2.750	-6.8073	-9.3305	5.1128	5.1128	766	0.450	1.551	15.6013	9.953	4.8282	4.8478
712	0.000	2.901	-7.2909	-6.1222	2.3975	5.0305	767	0.450	1.701	13.1380	-5.604	6.2282	7.2038
713	0.000	3.051	-5.8856	-3.8007	2.5422	4.5125	768	0.450	1.850	10.9392	-1.9392	10.1347	10.1347
714	0.000	3.200	-5.4960	-1.5244	1.4469	2.8563	769	0.450	2.000	-10.2041	-3.4966	6.5707	10.9596
715	0.000	3.350	-3.4482	0.8291	1.6286	2.1932	770	0.450	2.151	-15.0031	-2.3688	4.4523	9.5288

TEST NUMBER 810/1501 RUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	M	VS	MS	NO.	Y	Z	V	M	VS	MS
771	.950	2.301	-15.3786	-.2744	3.8005	6.6721	826	.750	4.249	-3.8238	12.4017	.4789	.5269
772	.950	2.450	-13.7868	.4030	2.9821	7.3794	827	.900	1.252	12.3513	9.11072	3.5007	4.2888
773	.950	2.600	-14.1728	3.6154	3.1025	5.7185	828	.900	1.401	11.9535	17.4853	3.6146	5.5139
774	.950	2.751	-14.9590	3.6167	3.1025	5.7185	829	.900	1.550	10.6983	13.6921	3.1051	4.9734
775	.950	2.901	-14.3839	3.2354	1.9314	3.5888	830	.900	1.700	7.2832	21.0194	3.0013	5.0013
776	.950	3.050	-13.6237	5.2354	1.9314	3.5734	831	.900	1.851	.6789	23.4376	4.7943	4.9168
777	.950	3.199	-11.4806	6.2434	1.8318	2.0489	832	.900	2.001	-3.8706	22.8789	4.2157	4.4884
778	.950	3.350	-9.5233	7.0808	1.0949	1.4888	833	.900	2.150	-8.3701	21.8775	3.9978	3.6682
779	.950	3.501	-8.0226	8.0221	1.0256	1.1399	834	.900	2.300	-11.5022	18.7650	4.5539	4.8717
780	.950	3.650	-6.3955	8.6609	.9501	.9981	835	.900	2.451	-12.9264	16.4234	3.0176	4.2683
781	.950	3.799	-5.2678	9.1974	.7603	.7184	836	.900	2.601	-13.3269	15.9334	3.5026	4.0442
782	.950	3.950	-4.2419	9.8571	.6574	.5325	837	.900	2.749	-14.9756	15.7359	2.6540	2.8971
783	.950	4.100	-3.3792	10.5515	.5682	.3794	838	.900	2.899	-15.4619	14.5383	2.1233	1.7509
784	.950	4.249	-2.6829	11.0937	.4938	.2658	839	.900	3.051	-13.9480	14.1334	1.4839	1.3711
785	.950	4.400	-2.0829	3.9769	2.8929	4.5686	840	.900	3.200	-12.2438	13.2788	.9615	.8021
786	.950	1.250	17.8040	6.8189	3.8692	5.2857	841	.900	3.349	-10.5248	12.7506	1.0663	.8621
787	.950	1.401	17.4675	6.7516	4.8470	6.3246	842	.900	3.498	-8.8549	12.5401	.7228	.7762
788	.950	1.551	15.1361	6.7516	5.3880	7.6423	843	.900	3.648	-7.5678	12.4071	.6542	.6281
789	.950	1.700	13.1665	6.2494	6.2144	9.4814	844	.900	3.798	-6.5692	12.4755	.5852	.5782
790	.950	1.849	7.3873	11.5898	6.2144	9.4814	845	.900	3.949	-5.4354	12.5921	.5763	.6979
791	.950	2.001	-7.6481	10.4448	7.4668	10.9894	846	.900	4.099	-4.6953	12.7376	.4915	.5725
792	.950	2.151	-15.4739	9.5786	5.7795	6.1452	847	.900	4.250	-4.0264	12.9785	.4640	.5943
793	.950	2.300	-15.8982	7.7134	4.6717	5.7562	848	.900	4.401	5.5737	9.4106	.5146	6.4625
794	.950	2.449	-15.2130	7.2590	3.3414	5.9207	849	.900	4.552	7.3417	14.6446	4.4075	4.1268
795	.950	2.600	-14.5571	7.0438	3.3210	5.1043	850	.900	4.703	7.3417	18.4822	4.3942	4.7396
796	.950	2.751	-14.9996	7.8420	3.1268	4.8520	851	.900	4.854	3.0889	22.1481	4.6070	4.8026
797	.950	2.901	-14.6930	7.3510	2.7185	4.1376	852	.900	5.005	3.0889	23.7875	4.6685	4.1015
798	.950	3.049	-14.3933	8.2425	2.0049	2.3102	853	.900	5.156	1.1395	23.9073	3.8516	3.7259
799	.950	3.200	-12.3474	9.6564	1.8293	1.2953	854	.900	5.307	-3.2272	23.9073	3.8516	3.7259
800	.950	3.351	-10.4668	9.1593	1.4409	.9431	855	.900	5.458	-7.1215	22.8193	4.0436	3.5122
801	.950	3.500	-8.5078	9.6493	1.0680	.6976	856	.900	5.609	-9.8157	21.6756	3.2695	4.1696
802	.950	3.649	-7.0527	9.9675	.6100	.9064	857	.900	5.760	-12.5192	20.3173	3.4568	3.8283
803	.950	3.800	-5.9413	10.4079	.6449	.7008	858	.900	5.911	-12.6583	18.8570	3.0144	3.5302
804	.950	3.950	-4.9444	10.7917	.6350	.6918	859	.900	6.062	-14.5532	18.3114	2.3174	2.2410
805	.950	4.099	-3.9719	11.3069	.5190	.6531	860	.900	6.213	-13.7300	18.6392	1.6735	1.7782
806	.950	4.249	-3.4319	11.7359	.6355	.6352	861	.900	6.364	-12.7441	15.9196	1.2406	1.1666
807	.750	1.250	15.1692	6.8448	3.4267	5.2047	862	.900	6.515	-11.3406	14.7825	.9060	.9873
808	.750	1.400	15.6478	10.7001	3.5740	5.1084	863	.900	6.666	-9.9996	14.0831	.7314	.8394
809	.750	1.551	13.9704	13.8770	3.5389	6.8966	864	.900	6.817	-8.7154	13.7877	.6947	.7527
810	.750	1.701	9.5792	17.6757	4.1954	7.0428	865	.900	6.968	-7.6317	13.6245	.6538	.7769
811	.750	1.849	2.9827	21.1586	4.7845	5.3897	866	.900	7.119	-6.5542	13.4479	.5857	.7706
812	.750	2.000	-4.8461	20.9148	5.0064	5.6602	867	.900	7.270	-5.7014	13.3301	.5743	.6180
813	.750	2.151	-11.9391	17.5883	5.4267	3.8172	868	.900	7.421	-4.9053	13.5809	.4672	.6695
814	.750	2.301	-14.6016	15.4697	3.9411	3.9510	869	.900	7.572	-4.2751	13.4828	.5352	.6207
815	.750	2.449	-14.2401	13.3884	3.6596	4.3070	870	.900	7.723	2.9095	13.0972	4.0174	7.1510
816	.750	2.600	-14.3165	11.9162	3.1982	4.9078	871	.900	7.874	2.8847	17.2244	4.0541	6.9902
817	.750	2.751	-15.7792	11.0853	3.1013	4.6363	872	.900	8.025	4.3921	20.1262	4.0070	6.1683
818	.750	2.901	-15.4616	11.6555	1.8305	3.8208	873	.900	8.176	2.7399	21.6132	3.8537	4.6789
819	.750	3.049	-14.3669	11.4883	1.8685	1.8192	874	.900	8.327	-6.226	23.8711	4.3626	4.9592
820	.750	3.200	-12.2453	11.4424	1.1703	1.0342	875	.900	8.478	-2.7998	24.7737	4.2243	4.2148
821	.750	3.351	-10.6263	10.9537	.9419	1.0758	876	.900	8.629	-5.7673	23.7928	3.2046	3.8664
822	.750	3.500	-8.8358	11.1021	.7259	.6884	877	.900	8.780	-8.0706	22.8418	3.3009	4.5317
823	.750	3.649	-7.5640	11.2250	.6723	.5984	878	.900	8.931	-10.9788	22.1931	2.7440	3.3067
824	.750	3.800	-6.3863	11.5148	.6605	.5870	879	.900	9.082	-11.5998	21.3468	2.0405	2.6897
825	.750	3.950	-5.2571	11.7778	.6247	.5970	880	.900	9.233	-12.4494	19.7530	1.7539	1.9287
825	.750	4.100	-4.4454	12.0802	.6112	.5728			9.384	-12.0170	18.0537	.8407	1.1184

TEST NUMBER 81071601 RUN NUMBER 9 X/D = 5.70

NO.	Y	Z	V	W	VS	WS	NO.	Y	Z	V	M	VS	WS
881	1.200	3.069	-11.3611	17.1185	.6485	1.0854	917	1.500	2.151	-5.8454	25.0357	1.7354	2.4241
882	1.200	3.200	-10.3349	6.1309	.6987	1.0203	918	1.500	2.300	-7.6843	24.6801	1.3471	1.2771
883	1.200	3.350	-9.1509	15.2978	.5835	.8264	919	1.500	2.451	-8.5147	23.5503	1.4514	1.3631
884	1.200	3.500	-8.2417	14.8867	.7201	.6177	920	1.500	2.601	-8.9226	22.2142	1.0797	1.2059
885	1.200	3.649	-7.3302	14.5286	.4798	.7346	921	1.500	2.751	-9.4247	20.7689	.7362	.9229
886	1.200	3.800	-6.5407	14.1855	.5702	.6683	922	1.500	2.900	-9.1397	19.4425	.6354	.8321
887	1.200	3.950	-5.6859	14.1450	.5237	.5791	923	1.500	3.051	-8.8778	18.5569	.6538	1.2081
888	1.200	4.099	-4.9834	14.0556	.4937	.6523	924	1.500	3.201	-8.6877	17.6382	.5522	.8139
889	1.200	4.249	-4.3550	14.0328	.5525	.6029	925	1.500	3.350	-7.7314	16.8001	.4999	.7309
890	1.350	1.251	1.1704	21.8854	1.5951	5.0123	926	1.500	3.499	-7.0350	16.3305	.5277	.6981
891	1.350	1.399	2.1506	21.6726	2.1864	5.9836	927	1.500	3.650	-6.5010	15.7936	.5328	.7234
892	1.350	1.551	2.3081	22.3165	2.6415	6.2300	928	1.500	3.801	-5.9054	15.5433	.5287	.5856
893	1.350	1.701	.9719	23.9360	3.0795	5.0197	929	1.500	3.950	-5.3305	15.2808	.4531	.7613
894	1.350	1.850	-.8776	24.5971	2.4958	5.1541	930	1.500	4.099	-4.7839	15.1831	.5159	.5628
895	1.350	1.999	-3.2035	25.3382	2.8746	3.9206	931	1.500	4.249	-4.2666	15.0171	.6259	.5695
896	1.350	2.151	-5.3529	24.8416	2.9322	4.0411	932	1.650	1.251	-.0925	24.1344	1.0954	1.4478
897	1.350	2.301	-7.5741	24.4530	2.5333	3.8516	933	1.650	1.401	-.5790	24.4552	1.1331	1.3507
898	1.350	2.450	-9.8350	23.4558	2.0307	2.0559	934	1.650	1.552	-.8537	24.7855	1.2862	1.2062
899	1.350	2.599	-10.4420	22.0352	1.3607	1.9605	935	1.650	1.701	-1.7922	25.0402	1.5961	.9892
900	1.350	2.751	-10.8138	20.6402	1.0246	1.3940	936	1.650	1.850	-2.8413	25.2644	1.6367	.9468
901	1.350	2.901	-10.5793	18.9226	.8561	1.1744	937	1.650	2.001	-4.3993	24.7992	1.3518	1.0397
902	1.350	3.050	-10.0160	17.9345	.7173	1.0991	938	1.650	2.152	-5.3703	24.4595	1.2193	.9590
903	1.350	3.199	-9.2937	16.8964	.6570	.9662	939	1.650	2.301	-6.5166	23.6506	1.1897	.9529
904	1.350	3.350	-8.6428	16.2702	.5513	.7759	940	1.650	2.450	-7.2064	22.9139	1.2054	.9513
905	1.350	3.501	-7.7681	15.7019	.5528	.6669	941	1.650	2.601	-7.7935	21.7420	.8060	.9607
906	1.350	3.650	-6.9266	15.2030	.5370	.6765	942	1.650	2.751	-7.9626	20.5593	.7988	.9836
907	1.350	3.799	-6.2048	14.9782	.5407	.7123	943	1.650	2.901	-7.9703	19.7872	.7037	.7269
908	1.350	3.950	-5.6860	14.7662	.5277	.7119	944	1.650	3.050	-7.8430	18.9220	.4688	.9014
909	1.350	4.100	-5.0506	14.5718	.4842	.5501	945	1.650	3.201	-7.4844	17.9221	.5409	.8111
910	1.350	4.249	-4.3457	14.6118	.5148	.6872	946	1.650	3.351	-7.0018	17.2003	.6913	.7542
911	1.500	1.251	.3046	24.1335	1.3727	2.6794	947	1.650	3.501	-6.5629	16.9267	.4763	.6600
912	1.500	1.401	.3452	24.5814	1.6484	1.9573	948	1.650	3.650	-6.1189	16.4322	.4268	.7271
913	1.500	1.551	-.2965	25.1862	1.6205	1.8333	949	1.650	3.800	-5.6872	15.9922	.6130	.6602
914	1.500	1.700	-.4388	25.5023	2.2408	3.1833	950	1.650	3.951	-5.1669	15.8692	.5984	.6150
915	1.500	1.851	-2.2638	25.6280	2.2466	3.3007	951	1.650	4.100	-4.4595	15.6255	.5249	.6849
916	1.500	2.001	-4.4215	25.7554	1.8187	2.1066	952	1.650	4.249	-4.2437	15.4466	.4414	.7107

APPENDIX B

The measured surface pressures are provided in this appendix at pressure stations 1 to 4 (see Figure 1). Due to equipment problems, data at pressure stations 5 and 6 were not acquired in all tests and this information has been omitted from the listed results for all runs. The symbols appearing in the data list are defined as follows:

- PHI - Circumferential angle measured from the leeward plane.
- X/D - x/D (see Figure 1)
- CP - Average pressure coefficient based on a sample of 100 measurements. Here CP is defined as $(p - p_{\infty})/q\sin^2$.
- SCP - Standard deviation of the pressure coefficient using a sample of 100 measurements.
- CN - Local normal force coefficient: $\text{normal force}/(Dq\sin^2)$
- CY - Local side force coefficient: $\text{side force}/(Dq\sin^2)$

In runs 1 and 2, two sets of data are listed. During these tests, substantial fluctuation in the measured pressure was seen and the listed data sets produced the highest and lowest side force values. In the remaining tests, pressures were fairly stable throughout each experiment and the presented data represents a typical set of measurements. A tape containing this information is available on request.

TEST NUMBER R1061602 RUN NUMBER 1

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.079	.028	.991	.028	.986	.032	.976	.030
2	-165.00	.968	.030	.908	.034	.965	.034	.988	.032
3	-150.00	.399	.040	.386	.046	.525	.054	.606	.054
4	-135.00	-.461	.050	-.434	.062	-.161	.090	-.003	.098
5	-120.00	-1.316	.044	-1.187	.074	-.827	.114	-.578	.174
6	-105.00	-1.926	.058	-1.526	.088	-.948	.188	-.556	.196
7	-90.00	-1.758	.060	-1.257	.082	-.767	.150	-.474	.144
8	-75.00	-1.647	.058	-1.248	.104	-.763	.164	-.472	.186
9	-60.00	-1.684	.078	-1.309	.088	-.778	.160	-.546	.146
10	-45.00	-1.701	.078	-1.335	.094	-.865	.138	-.630	.172
11	-30.00	-1.971	.092	-1.486	.112	-.932	.180	-.684	.188
12	-15.00	-2.079	.118	-1.464	.110	-.953	.214	-.599	.208
13	0.00	-.927	.048	-.626	.050	-.506	.148	-.939	.458
14	15.00	-1.572	.074	-1.609	.136	-1.641	.356	-2.056	.488
15	30.00	-1.969	.108	-1.841	.136	-1.833	.186	-1.903	.296
16	45.00	-1.887	.114	-1.950	.124	-1.796	.190	-1.759	.268
17	60.00	-1.961	.078	-1.814	.108	-1.776	.186	-1.758	.242
18	75.00	-1.878	.058	-1.711	.112	-1.677	.202	-1.797	.266
19	90.00	-1.881	.068	-1.677	.104	-1.652	.170	-1.708	.258
20	105.00	-2.212	.054	-1.907	.144	-1.846	.224	-1.813	.370
21	120.00	-1.899	.050	-1.882	.090	-1.896	.140	-1.950	.226
22	135.00	-1.042	.052	-1.126	.070	-1.190	.140	-1.255	.152
23	150.00	-.067	.042	-.200	.060	-.274	.078	-.292	.112
24	165.00	.737	.040	.584	.036	.563	.054	.511	.058
CN		1.760		1.455		1.286		1.191	
CY		.270		.502		.909		1.205	

TEST NUMBER R1061602 RUN NUMBER 1

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.090	.028	1.000	.032	1.019	.026	1.104	.034
2	-165.00	.961	.036	.873	.034	.932	.036	.930	.048
3	-150.00	.355	.040	.298	.046	.379	.076	.424	.098
4	-135.00	-.508	.040	-.564	.080	-.349	.106	-.306	.194
5	-120.00	-1.408	.058	-1.353	.080	-1.165	.176	-.984	.246
6	-105.00	-2.007	.048	-1.723	.112	-1.325	.196	-1.097	.366
7	-90.00	-1.842	.062	-1.446	.092	-1.135	.188	-.961	.266
8	-75.00	-1.734	.058	-1.437	.088	-1.127	.174	-.991	.252
9	-60.00	-1.788	.066	-1.471	.104	-1.132	.184	-.949	.286
10	-45.00	-1.771	.090	-1.474	.104	-1.209	.164	-.951	.318
11	-30.00	-1.951	.122	-1.582	.130	-1.236	.226	-1.130	.356
12	-15.00	-2.067	.132	-1.677	.132	-1.378	.202	-1.304	.428
13	0.00	-.860	.052	-.730	.058	-.521	.156	-.543	.248
14	15.00	-1.543	.074	-1.397	.118	-1.153	.322	-1.151	.558
15	30.00	-1.860	.120	-1.482	.096	-1.132	.164	-1.007	.288
16	45.00	-1.806	.122	-1.524	.112	-1.176	.228	-.855	.260
17	60.00	-1.827	.074	-1.488	.092	-.961	.190	-.842	.256
18	75.00	-1.719	.066	-1.391	.088	-1.028	.182	-.761	.240
19	90.00	-1.725	.066	-1.383	.084	-.999	.182	-.789	.262
20	105.00	-2.063	.068	-1.557	.120	-1.130	.234	-.809	.302
21	120.00	-1.770	.056	-1.613	.116	-1.327	.218	-1.151	.356
22	135.00	-.957	.056	-.941	.080	-.886	.168	-.746	.216
23	150.00	.003	.046	-.107	.062	-.035	.106	-.053	.138
24	165.00	.761	.034	.644	.042	.657	.060	.661	.076
CN		1.748		1.430		1.234		1.042	
CY		.086		.054		.013		-.022	

TEST NUMBER 81061701 RUN NUMBER 2

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.081	.030	.987	.026	1.031	.030	1.022	.024
2	-165.00	.917	.034	.806	.030	.843	.038	.813	.044
3	-150.00	.300	.038	.212	.044	.231	.070	.223	.082
4	-135.00	-.590	.044	-.704	.066	-.647	.086	-.647	.134
5	-120.00	-1.447	.052	-1.513	.076	-1.426	.154	-1.445	.214
6	-105.00	-2.068	.054	-1.939	.088	-1.813	.200	-1.807	.272
7	-90.00	-1.896	.062	-1.641	.112	-1.513	.190	-1.581	.270
8	-75.00	-1.779	.058	-1.633	.096	-1.516	.216	-1.569	.212
9	-60.00	-1.825	.064	-1.679	.102	-1.579	.170	-1.588	.224
10	-45.00	-1.789	.088	-1.713	.098	-1.553	.166	-1.599	.224
11	-30.00	-2.345	.128	-1.748	.112	-1.758	.188	-1.676	.264
12	-15.00	-2.508	.138	-1.803	.144	-1.853	.184	-2.117	.286
13	0.00	-.819	.050	-.769	.066	-.946	.262	-1.530	.614
14	15.00	-1.476	.080	-1.238	.102	-.715	.168	-.505	.194
15	30.00	-1.747	.108	-1.414	.116	-.965	.148	-.758	.284
16	45.00	-1.731	.132	-1.483	.124	-.927	.168	-.607	.178
17	60.00	-1.790	.072	-1.386	.114	-.820	.152	-.665	.226
18	75.00	-1.674	.060	-1.297	.096	-.812	.126	-.586	.202
19	90.00	-1.667	.054	-1.260	.086	-.815	.126	-.521	.176
20	105.00	-2.011	.050	-1.446	.082	-.911	.172	-.527	.170
21	120.00	-1.701	.052	-1.460	.082	-1.068	.136	-.718	.178
22	135.00	-.873	.052	-.803	.068	-.561	.112	-.395	.146
23	150.00	.044	.044	.022	.056	.152	.074	.276	.086
24	165.00	.778	.032	.692	.038	.770	.038	.798	.052
CN		1.811		1.465		1.373		1.310	
CY		-.058		-.231		-.570		-.845	

TEST NUMBER 81061701 RUN NUMBER 2

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.074	.026	.994	.026	.994	.026	.997	.024
2	-165.00	.927	.030	.823	.032	.825	.032	.813	.044
3	-150.00	.320	.038	.215	.044	.235	.068	.207	.086
4	-135.00	-.578	.044	-.687	.064	-.653	.102	-.632	.130
5	-120.00	-1.427	.046	-1.510	.082	-1.450	.136	-1.478	.202
6	-105.00	-2.059	.052	-1.904	.106	-1.789	.224	-1.441	.112
7	-90.00	-1.868	.058	-1.607	.104	-1.385	.094	-1.476	.320
8	-75.00	-1.749	.054	-1.616	.086	-1.476	.190	-1.505	.252
9	-60.00	-1.794	.064	-1.645	.098	-1.527	.186	-1.498	.276
10	-45.00	-1.779	.084	-1.683	.120	-1.509	.160	-1.578	.254
11	-30.00	-2.288	.106	-1.722	.132	-1.688	.172	-1.654	.244
12	-15.00	-2.459	.106	-1.729	.122	-1.780	.198	-1.939	.456
13	0.00	-.823	.056	-.738	.068	-.900	.252	-1.285	.510
14	15.00	-1.761	.024	-1.433	.032	-.798	.182	-.590	.196
15	30.00	-1.768	.122	-1.477	.108	-1.057	.162	-.880	.250
16	45.00	-1.733	.124	-1.531	.106	-1.028	.164	-.676	.170
17	60.00	-1.796	.074	-1.428	.098	-.920	.178	-.697	.214
18	75.00	-1.714	.056	-1.339	.088	-.939	.158	-.706	.206
19	90.00	-1.704	.058	-1.323	.098	-.936	.164	-.683	.198
20	105.00	-2.021	.052	-1.472	.102	-.968	.166	-.628	.224
21	120.00	-1.728	.048	-1.498	.076	-1.167	.174	-.865	.230
22	135.00	-.891	.044	-.829	.070	-.612	.120	-.468	.162
23	150.00	.031	.034	-.013	.044	.099	.086	.174	.110
24	165.00	.782	.026	.693	.032	.792	.046	.755	.054
CN		1.835		1.481		1.344		1.249	
CY		-.005		-.161		-.441		-.659	

TEST NUMBER 81070702 RUN NUMBER 3

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.074	.036	.956	.034	.923	.034	.929	.034
2	-165.00	1.035	.036	.989	.034	.997	.034	.955	.036
3	-150.00	.552	.038	.594	.036	.676	.034	.569	.040
4	-135.00	-.211	.052	-.042	.036	.105	.036	-.078	.052
5	-120.00	-1.007	.056	-.671	.048	-.375	.050	-.697	.084
6	-105.00	-1.489	.052	-.816	.066	-.410	.062	-.884	.138
7	-90.00	-1.280	.054	-.620	.066	-.318	.052	-.762	.138
8	-75.00	-1.231	.062	-.647	.062	-.346	.054	-.825	.140
9	-60.00	-1.278	.078	-.690	.074	-.391	.072	-.941	.144
10	-45.00	-1.247	.078	-.662	.060	-.446	.054	-1.027	.182
11	-30.00	-1.466	.080	-.687	.064	-.546	.088	-1.152	.124
12	-15.00	-1.507	.078	-.758	.058	-1.344	.188	-2.098	.106
13	0.00	-.947	.062	-1.109	.158	-2.419	.242	-2.572	.196
14	15.00	-1.900	.128	-2.837	.198	-2.541	.218	-2.031	.140
15	30.00	-2.519	.172	-2.708	.182	-2.636	.218	-1.898	.122
16	45.00	-2.287	.116	-2.656	.140	-2.867	.170	-1.947	.116
17	60.00	-2.369	.084	-2.625	.084	-2.745	.094	-2.034	.150
18	75.00	-2.295	.066	-2.495	.044	-2.688	.070	-2.062	.128
19	90.00	-2.341	.064	-2.549	.090	-2.697	.082	-2.042	.100
20	105.00	-2.686	.056	-2.975	.098	-3.095	.060	-2.340	.168
21	120.00	-2.253	.052	-2.544	.058	-2.671	.050	-2.212	.082
22	135.00	-1.304	.048	-1.568	.052	-1.713	.048	-1.435	.064
23	150.00	-.264	.040	-.477	.046	-.545	.038	-.436	.046
24	165.00	.601	.040	.449	.040	.360	.038	.430	.040
CN		1.577		1.448		1.678		1.644	
CY		1.038		1.807		2.147		1.144	

TEST NUMBER 81070701 RUN NUMBER 4

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.092	.034	.977	.032	.924	.032	.905	.034
2	-165.00	1.042	.032	1.000	.032	1.004	.030	.977	.032
3	-150.00	.537	.040	.590	.040	.694	.034	.636	.040
4	-135.00	-.245	.038	-.084	.044	.129	.034	.068	.046
5	-120.00	-1.070	.050	-.767	.056	-.356	.044	-.440	.066
6	-105.00	-1.612	.052	-.979	.064	-.372	.054	-.519	.094
7	-90.00	-1.414	.060	-.745	.060	-.284	.054	-.428	.098
8	-75.00	-1.344	.068	-.774	.072	-.307	.050	-.499	.092
9	-60.00	-1.390	.068	-.787	.070	-.351	.068	-.558	.110
10	-45.00	-1.397	.086	-.764	.080	-.393	.074	-.599	.122
11	-30.00	-1.606	.080	-.807	.078	-.444	.062	-.925	.126
12	-15.00	-1.636	.096	-.832	.068	-.847	.160	-2.053	.196
13	0.00	-.970	.064	-.779	.102	-2.381	.326	-2.820	.240
14	15.00	-1.609	.130	-2.524	.190	-2.559	.220	-2.314	.190
15	30.00	-2.214	.126	-2.480	.132	-2.639	.216	-2.291	.168
16	45.00	-2.121	.138	-2.352	.130	-2.654	.170	-2.294	.142
17	60.00	-2.258	.090	-2.410	.090	-2.676	.106	-2.227	.116
18	75.00	-2.131	.068	-2.249	.084	-2.598	.090	-2.206	.108
19	90.00	-2.129	.070	-2.276	.078	-2.606	.098	-2.309	.088
20	105.00	-2.475	.062	-2.621	.106	-2.969	.080	-2.630	.094
21	120.00	-2.110	.048	-2.350	.074	-2.621	.062	-2.445	.058
22	135.00	-1.226	.044	-1.427	.052	-1.717	.048	-1.570	.052
23	150.00	-.189	.040	-.381	.048	-.585	.042	-.512	.046
24	165.00	.647	.034	.478	.034	.368	.036	.366	.034
CN		1.566		1.372		1.522		1.698	
CY		.776		1.477		2.129		1.658	

TEST NUMBER 81070802 RUN NUMBER 5

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.064	.036	.956	.038	.919	.038	.931	.034
2	-165.00	1.041	.036	.992	.030	1.011	.036	.964	.034
3	-150.00	.548	.040	.609	.034	.691	.036	.598	.048
4	-135.00	-.201	.044	-.029	.042	.140	.038	-.004	.058
5	-120.00	-.981	.046	-.662	.050	-.331	.040	-.585	.074
6	-105.00	-1.494	.048	-.813	.066	-.358	.056	-.803	.142
7	-90.00	-1.265	.058	-.611	.062	-.272	.060	-.695	.132
8	-75.00	-1.225	.066	-.638	.060	-.297	.050	-.726	.128
9	-60.00	-1.237	.072	-.668	.072	-.339	.068	-.814	.156
10	-45.00	-1.228	.082	-.634	.068	-.402	.062	-.925	.188
11	-30.00	-1.449	.078	-.688	.064	-.518	.084	-1.043	.130
12	-15.00	-1.499	.092	-.742	.064	-1.169	.188	-2.050	.146
13	0.00	-.931	.052	-1.015	.140	-2.651	.232	-2.522	.180
14	15.00	-1.771	.140	-2.758	.188	-2.458	.190	-2.027	.152
15	30.00	-2.386	.152	-2.626	.164	-2.602	.200	-1.917	.142
16	45.00	-2.172	.130	-2.520	.132	-2.779	.156	-1.895	.108
17	60.00	-2.323	.070	-2.539	.082	-2.682	.086	-1.998	.136
18	75.00	-2.200	.064	-2.433	.098	-2.614	.084	-2.077	.126
19	90.00	-2.253	.070	-2.420	.096	-2.596	.082	-2.050	.118
20	105.00	-2.604	.060	-2.829	.090	-2.994	.066	-2.319	.118
21	120.00	-2.163	.054	-2.447	.064	-2.586	.048	-2.213	.064
22	135.00	-1.271	.052	-1.506	.058	-1.669	.044	-1.398	.058
23	150.00	-.225	.044	-.430	.046	-.550	.042	-.405	.048
24	165.00	.622	.040	.461	.042	.390	.042	.431	.042
CN		1.678		1.543		1.738		1.745	
CY		.972		1.726		2.122		1.218	

TEST NUMBER 81070803 RUN NUMBER 6

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.055	.034	.947	.038	.906	.032	.900	.034
2	-165.00	1.013	.038	.973	.036	.994	.036	.960	.036
3	-150.00	.509	.038	.574	.038	.678	.034	.624	.042
4	-135.00	-.237	.040	-.086	.038	.140	.036	.052	.050
5	-120.00	-1.059	.048	-.738	.052	-.334	.048	-.481	.074
6	-105.00	-1.582	.046	-.938	.068	-.354	.052	-.574	.102
7	-90.00	-1.372	.062	-.727	.072	-.259	.050	-.454	.106
8	-75.00	-1.295	.070	-.739	.066	-.276	.058	-.484	.092
9	-60.00	-1.331	.072	-.754	.072	-.308	.072	-.572	.106
10	-45.00	-1.366	.076	-.735	.066	-.364	.062	-.640	.124
11	-30.00	-1.556	.082	-.816	.082	-.430	.062	-.929	.140
12	-15.00	-1.588	.084	-.833	.066	-.843	.172	-1.995	.202
13	0.00	-.931	.058	-.789	.114	-2.337	.256	-2.629	.178
14	15.00	-1.723	.126	-2.585	.196	-2.431	.188	-2.195	.174
15	30.00	-2.328	.146	-2.492	.144	-2.591	.186	-2.148	.128
16	45.00	-2.136	.116	-2.355	.128	-2.624	.164	-2.142	.140
17	60.00	-2.235	.074	-2.426	.084	-2.621	.106	-2.154	.104
18	75.00	-2.114	.068	-2.277	.090	-2.545	.084	-2.221	.102
19	90.00	-2.144	.058	-2.295	.084	-2.582	.092	-2.214	.086
20	105.00	-2.499	.056	-2.665	.098	-2.960	.076	-2.542	.110
21	120.00	-2.113	.048	-2.347	.060	-2.572	.058	-2.345	.062
22	135.00	-1.220	.054	-1.452	.052	-1.651	.054	-1.512	.050
23	150.00	-.215	.044	-.392	.052	-.562	.046	-.478	.048
24	165.00	.621	.042	.453	.042	.370	.044	.378	.036
CN		1.689		1.490		1.607		1.746	
CY		.821		1.516		2.109		1.552	

TEST NUMBER 81062502 RUN NUMBER 7

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.094	.032	.991	.028	.937	.028	.925	.030
2	-165.00	1.041	.030	.999	.032	1.021	.032	.992	.032
3	-150.00	.532	.038	.578	.034	.706	.032	.670	.036
4	-135.00	-.240	.044	-.094	.048	.152	.040	.122	.050
5	-120.00	-1.061	.050	-.763	.052	-.325	.044	-.359	.066
6	-105.00	-1.604	.052	-1.011	.078	-.349	.066	-.399	.076
7	-90.00	-1.401	.060	-.768	.062	-.249	.056	-.315	.078
8	-75.00	-1.332	.062	-.798	.070	-.266	.050	-.354	.084
9	-60.00	-1.368	.074	-.788	.072	-.287	.066	-.429	.108
10	-45.00	-1.391	.072	-.756	.076	-.348	.068	-.486	.094
11	-30.00	-1.608	.094	-.809	.076	-.391	.062	-.799	.144
12	-15.00	-1.648	.084	-.872	.076	-.667	.152	-1.742	.254
13	0.00	-.908	.054	-.695	.082	-2.021	.300	-2.682	.232
14	15.00	-1.581	.104	-2.306	.174	-2.445	.200	-2.342	.186
15	30.00	-2.117	.132	-2.404	.124	-2.504	.194	-2.224	.158
16	45.00	-2.027	.124	-2.238	.122	-2.484	.162	-2.303	.152
17	60.00	-2.170	.076	-2.252	.096	-2.525	.106	-2.233	.098
18	75.00	-2.032	.060	-2.159	.096	-2.442	.084	-2.266	.096
19	90.00	-2.057	.036	-2.151	.116	-2.489	.034	-2.248	.080
20	105.00	-2.370	.054	-2.507	.110	-2.788	.102	-2.594	.086
21	120.00	-2.038	.050	-2.246	.074	-2.489	.072	-2.362	.054
22	135.00	-1.161	.046	-1.385	.056	-1.603	.046	-1.515	.050
23	150.00	-.155	.042	-.345	.054	-.521	.044	-.495	.044
24	165.00	.640	.032	.529	.036	.388	.034	.394	.036
CN		1.679		1.459		1.544		1.639	
CY		.704		1.363		2.036		1.734	

TEST NUMBER 81071515 RUN NUMBER 8

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.091	.028	1.000	.030	.979	.030	.974	.034
2	-165.00	1.066	.028	1.002	.028	1.014	.030	1.020	.028
3	-150.00	.628	.038	.582	.040	.650	.050	.693	.056
4	-135.00	-.117	.036	-.139	.052	.044	.072	.130	.096
5	-120.00	-1.023	.046	-.921	.060	-.663	.122	-.463	.126
6	-105.00	-1.690	.042	-1.403	.084	-.985	.140	-.713	.196
7	-90.00	-1.715	.054	-1.157	.090	-.767	.124	-.475	.176
8	-75.00	-1.491	.056	-1.122	.090	-.753	.138	-.507	.174
9	-60.00	-1.520	.060	-1.180	.084	-.788	.148	-.583	.182
10	-45.00	-1.587	.084	-1.207	.090	-.807	.134	-.565	.178
11	-30.00	-1.830	.124	-1.302	.106	-.878	.154	-.616	.172
12	-15.00	-1.826	.134	-1.317	.100	-.942	.182	-.680	.250
13	0.00	-.903	.058	-.687	.070	-.444	.154	-.494	.266
14	15.00	-1.046	.066	-.992	.082	-1.118	.302	-1.469	.468
15	30.00	-1.933	.130	-1.559	.118	-1.486	.146	-1.634	.248
16	45.00	-2.001	.122	-1.627	.116	-1.533	.182	-1.405	.240
17	60.00	-1.741	.082	-1.478	.098	-1.365	.166	-1.325	.224
18	75.00	-1.614	.078	-1.482	.084	-1.352	.134	-1.371	.228
19	90.00	-1.625	.067	-1.431	.094	-1.325	.148	-1.321	.218
20	105.00	-1.903	.064	-1.523	.106	-1.371	.188	-1.373	.264
21	120.00	-1.767	.044	-1.650	.082	-1.584	.152	-1.559	.218
22	135.00	-1.044	.044	-1.074	.070	-1.090	.104	-1.008	.140
23	150.00	-.123	.036	-.208	.044	-.743	.084	-.245	.108
24	165.00	.642	.028	.570	.038	.511	.044	.508	.070
CN		1.564		1.223		1.059		1.050	
CY		.308		.411		.661		.867	

TEST NUMBER 81071601 RUN NUMBER 9

PORT	PHI	X/D=2.6		X/D=3.6		X/D=4.7		X/D=5.7	
		CP	SCP	CP	SCP	CP	SCP	CP	SCP
1	-180.00	1.010	.030	.912	.032	.903	.032	.890	.036
2	-165.00	.996	.028	.920	.028	.953	.030	.950	.030
3	-150.00	.545	.038	.488	.038	.584	.046	.627	.052
4	-135.00	-.244	.040	-.272	.056	-.058	.082	.018	.098
5	-120.00	-1.162	.036	-1.054	.060	-.774	.114	-.578	.124
6	-105.00	-1.827	.048	-1.526	.074	-1.107	.150	-.767	.178
7	-90.00	-1.846	.058	-1.298	.084	-.878	.154	-.609	.158
8	-75.00	-1.622	.052	-1.256	.100	-.850	.124	-.629	.212
9	-60.00	-1.659	.072	-1.283	.086	-.870	.146	-.602	.164
10	-45.00	-1.736	.070	-1.339	.092	-.928	.134	-.647	.170
11	-30.00	-1.958	.116	-1.430	.098	-.964	.130	-.718	.178
12	-15.00	-1.937	.120	-1.418	.114	-1.082	.172	-.787	.270
13	0.00	-1.037	.060	-.816	.062	-.565	.150	-.581	.238
14	15.00	-1.175	.064	-1.144	.108	-1.280	.290	-1.762	.532
15	30.00	-2.084	.136	-1.729	.106	-1.620	.148	-1.870	.244
16	45.00	-2.142	.124	-1.776	.120	-1.717	.188	-1.595	.232
17	60.00	-1.885	.072	-1.668	.106	-1.541	.160	-1.570	.236
18	75.00	-1.790	.060	-1.640	.092	-1.527	.146	-1.559	.212
19	90.00	-1.782	.064	-1.562	.086	-1.517	.166	-1.469	.216
20	105.00	-2.046	.064	-1.673	.100	-1.553	.184	-1.526	.184
21	120.00	-1.933	.044	-1.816	.084	-1.767	.140	-1.771	.218
22	135.00	-1.178	.042	-1.217	.066	-1.204	.110	-1.138	.144
23	150.00	-.259	.044	-.350	.048	-.369	.090	-.383	.102
24	165.00	.563	.034	.459	.042	.437	.046	.409	.070
CN		1.723		1.363		1.212		1.096	
CY		.327		.440		.723		.959	

DISTRIBUTION LIST

	<u>Copies</u>
Hughes Aircraft Co. Missile Systems Group Canoga Park, CA 91304 Attn: Mr. Henry August	1
Calspan Field Services, Inc. PWT-4T, MS 600 AEDC (AFSC) Arnold Air Force Station, TN 37389 Attn: Dr. W. B. Baker	1
AEDC/DOFAA Arnold Air Force Station, TN 37389 Attn: Mr. Thomas Best	1
AFATL/DLMA Eglin AFB, FL 32542 Attn: Mr. Carroll B. Butler	1
Naval Weapons Center Code 3246 China Lake, CA 93555 Attn: Dr. William H. Clark	1
Department of Engineering Sciences University of Florida Gainesville, FL 32611 Attn: Dr. Mark H. Clarkson	1
AEDC Arnold Air Force Station, TN 37389 Attn: Mr. Stuart Coulter	1
AFATL-DLB Eglin Air Force Base, FL 32542 Attn: Dr. Donald C. Daniel	1
Commander US Army Missile Command Redstone Arsenal, AL 35898 Attn: Mr. Ray Deep, DRSMI-RDK	1

DISTRIBUTION LIST (Cont.)

	<u>Copies</u>
Department of Aeronautical Engineering University of Bristol Bristol B58 ITR United Kingdom Attn: Mr. Paul Dexter	1
Lockheed Missiles and Space Co. Inc. Dept. 81-10, Bldg. 154, Fac. 1 P.O. Box 504 Sunnyvale, CA 94086 Attn: Dr. Lars E. Ericsson	1
Vought Corporation Advanced Technology Center P. O. Box 226144 Dallas, TX 75266 Attn: Dr. C. H. Haight	1
Nielsen Engineering and Research, Inc. 510 Clyde Avenue Mountain View, CA 94043 Attn: Dr. Michael J. Hensch	1
Rockwell International Missile System Division 4300 East 5th Avenue Columbus, OH 43216 Attn: Mr. Fred Hessman, D-165	1
Northrup Corporation, Aircraft Division Orgn 3813, Zone 82 One Northrop Avenue Hawthorne, CA 90250 Attn: Dr. Brian L. Hunt	1
Department of Mechanics of Fluids University of Manchester Manchester M13 9PL ENGLAND Attn: Dr. Peter Lamont	1
AFWAL/FIGC Department of the Air Force Wright Patterson Air Force Base, OH 45433 Attn: Dr. William H. Lane	1
AFATL/DLJCA Eglin AFB, FL 32542 Attn: Dr. Lawrence E. Lijewski	1

DISTRIBUTION LIST (Cont.)

	<u>Copies</u>
FIMG Air Force Wright Aeronautical Laboratories (AFSC) Wright-Patterson AFB, Ohio 45433 Attn: Capt. Alex J. Malanowski	1
NASA-Ames Research Center Mail Stop 227-8 Moffett Field, CA 94035 Attn: Mr. Gerald N. Malcomm	1
Commander US Army Research Office P. O. Box 12211 Research Triangle Park, NC 27709 Attn: Colonel Duff G. Manges	1
Department of Aerospace and Mechanical Engineering University of Notre Dame Notre Dame, IN 46556 Attn: Dr. Robert C. Nelson	1
Nielsen Engineering and Research 510 Clyde Avenue Mountain View, CA 94043 Attn: Dr. Jack N. Nielsen	1
AEDC/DOFAA, DOT Arnold Air Force Station, TN 37389 Attn: Captain Alvin R. Obal	1
Complere, Inc. P. O. Bcx 1697 Palo Alto, CA 94302 Attn: Dr. F. K. Owen	1
Commander Naval Sea Systems Command SEA 62R41 Washington, DC 20362 Attn: Mr. Lionel Pasiuk	1
Mechanical Engineering Department Clemson University Clemson, SC 29631 Attn: Dr. C. E. G. Prizirembel	1

DISTRIBUTION LIST (Cont.)

	<u>Copies</u>
Director Engineering Sciences Division US Army Research Office P. O. Box 12211 Research Triangle Park, NC 27709 Attn: Dr. Robert E. Singleton	1
Commander U.S. Army Missile Command Redstone Arsenal, AL 35898 Attn: David Washington, DRSMI-RDK	1
USAFA/DFAN USAF Academy, CO 80840 Attn: Captain G. J. Zollars	1
Defense Technical Information Center Cameron Station Alexandria, VA 22314	12
Library of Congress Attn: Gift and Exchange Division Washington, DC 20540	4

LMED

-8