THE EFFECT OF EXIT CONDITIONS ON THE DEVELOPMENT OF AN AXISYMMETRIC TURBULENT FREE JET

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ABSTRACT

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by

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The mean flow in the near field ($0 \lesssim x/D \lesssim 10$) of a submerged axisymmetric jet emitting from a plane wall constitutes the boundary value problem of interest. The solution ($U(x,y)$, $V(x,y)$, $u'(x,y)$, $v'(x,y)$, $\overline{uv}(x,y)$, etc.) is dependent upon the boundary conditions and Reynolds number. For sufficiently large Reynolds numbers, the present case, the solution is Reynolds number independent. The boundary conditions are: the exit plane pressure ($P(0,y)$) and statistical measures of the velocity at $(0,y)$ and (x,∞), the latter being zero. A postulate of the study is that measures of the first two moments are sufficient to specify the exit plane velocity boundary conditions. An experimental configuration to provide a nearly uniform mean velocity profile with a core of homogeneous turbulence of variable intensity and scale was developed. Eight cases with intensity values of $0.004 \lesssim u'/U \lesssim 0.035$ and integral scales up to $L_x/R = 0.28$ were investigated using conditional sampling techniques. For each case seven radial traverses were recorded in the range $0 \lesssim x/D \lesssim 10$. At each data point zone averages of U, V, u', v', $\overline{uv}$, γ and the number of interface crossings were recorded for the vortical and non-vortical modes. The integral continuity and momentum equations were used to characterize $U(x,r)$. Centerline variations of $U(x,0)$ and $u'(x,0)$, and a width measure based upon the superlayer interface mean position were used to characterize the detailed structure.

It was found that the jet exhibits an increasing momentum flux in the near field. This result, although contrary to expectation and the accepted assumption of ambient static pressure in a turbulent jet, seems to be conclusive and borne out by comparison with published data. Both integral measures, mass and momentum flux ratios, are insensitive to exit turbulence variations, but, the detailed structure (including centerline velocity) variations with exit conditions are systematic and explainable.

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NOMENCLATURE

a, D	jet exit dimension
b	radius at which $U/U_c = 0.5$
C	number of mode switches
E	voltage signal
f	normalized longitudinal correlation function $\frac{1}{T}\int_0^T \{ \overline{u(x)\, u(x+\Delta x)} / \overline{u}^2 \}\ dt$
g	normalized lateral correlation function
$\tilde{p}$, p	instantaneous and mean pressure
R	pipe flow facility radius, (3.25 in.)
r	radial coordinate in pipe flow facility
t	time
T	total time of sample
u_τ	skin friction velocity $(\tau_w/\rho)^{1/2}$
$\tilde{U}$, U, u, u'	instantaneous, mean, fluctuating and root-mean-square streamwise velocity components
$\tilde{V}$, V, v, v'	instantaneous, mean, fluctuating and root-mean-square radial velocity components
$\tilde{W}$, W, w, w'	instantaneous, mean, fluctuating and root-mean-square azmuthal velocity components
x, y, ϕ	streamwise, radial and azmuthal coordinates
z	vertical direction
γ	intermittancy factor
λ	micro scale of turbulence
μ	dynamic viscosity
ν	kinematic viscosity
Λ	integral scale of turbulence
ω	vorticity
ρ	density
τ	shear stress
θ	orientation of velocity vector in horizontal mid-plane; $\theta \equiv \tan^{-1} V/u$

Subscripts

atm	atmospheric conditions
c	centerline
e	at the exit ($x = 0$)
n.v.	denotes the non-vortical condition
v	denotes the vortical condition
w	at the wall ($r = R$)
x	streamwise component
y	lateral component

1. INTRODUCTION

At sufficiently large downstream distances, axisymmetric jets, as well as other free shear flows, develop a self-preserving structure which has been described by Townsend (1956) as a state of the flow. . . "in which the conditions at the initiation of the flow are mostly irrelevant, and the flow is geometrically similar." The dependence of the self-similar region upon upstream conditions appears as a shift in the apparent origin of the jet. From a comparison of previous studies in the self-similar region, it was believed that the shift in the apparent origin would be evidenced by a difference in the rate of entrainment in the initial region, see Foss and Kleis (1971). The results of the comparison also indicated that the exit trubulence structure had possibly more influence on the shift of the apparent origin than non-uniformity of the exit mean velocity profile. The purpose of the present investigation is to provide a systematic study of the influence of various exit turbulence structures on the development of an axisymmetric turbulent free jet in the initial region ($0 \lesssim x/D \lesssim 10$).

A new technique utilizing conditional sampling to orient the sampling probe into the mean direction of the velocity vector of the condition being taken was developed and used to increase the accuracy of measurements. The increased accuracy over conventional methods was deemed necessary for the accurate determination of the mass flux given the large velocity gradients of the initial region.

The traditional measures of mass and momentum flux and, also, statistical measures of the velocity distribution were made with somewhat unexpected results.

1.1. Formulation of the problem

The axisymmetric turbulent free jet is but one of a general class termed "free turbulent shear flows". This class of flows contains the general groups of jets, wakes, and free shear layers.

The outer region of a turbulent boundary layer also exhibits the characteristics of a free turbulent shear flow; however, the near wall region of a boundary layer is dominated by the large production of turbulence kinetic energy associated with the steep velocity gradients resulting from the no-slip condition. Turbulent shear flows are characterized by the production and decay of turbulent kinetic energy due to a gradient of the mean velocity profile with boundaries unrestrained by the presence of a solid surface. Turbulent flows are governed by the conservation of mass (continuity) and momentum equations (the latter become the familiar Navier-Stokes equations if a Newtonian fluid is under investigation). For the instantaneous equations, these represent a system of four equations for the four unknowns $\tilde{U}$, $\tilde{V}$, $\tilde{W}$, and $\tilde{P}$. The solution of the instantaneous equations requires the specification of the initial velocity and pressure fields at every point of the flow field (i.e. the initial conditions) as well as the boundary conditions of the particular problem. The complete description of the flow field would require the simultaneous solution of three non-linear and one linear partial differential equations and a forward stepping procedure with respect to time. The instantaneous velocity and pressure fields are, therefore, most difficult to obtain. Also, such a solution would constitute such a vast amount of information that it would have to be suitably compressed for utilization in the solution of a technological problem or the description of a natural event. An alternate approach is to represent the instantaneous velocity as a mean plus fluctuating component and time average the equations of motion. The averaged equations in cylindrical coordinates are:

$$\rho\left(\frac{dV}{dt} - \frac{W^2}{y}\right) = -\frac{\partial p}{\partial y} + \mu\left(\nabla^2 V - \frac{V}{y^2} - 2\frac{\partial W}{y^2 \partial \phi}\right) - \frac{\rho}{y}\frac{\partial (y\overline{v'^2})}{\partial y} - \frac{\rho}{y}\frac{\partial \overline{vw}}{\partial \phi} - \rho\frac{\partial \overline{uv}}{\partial x} + \rho\frac{\overline{w'^2}}{y}$$

$$\rho\left(\frac{dW}{dt} + \frac{VW}{y}\right) = -\frac{\partial p}{y\partial \phi} + \mu\left(\nabla^2 W - \frac{W}{y^2} + \frac{2}{y^2}\frac{\partial V}{\partial \phi}\right) - \frac{\rho}{y}\frac{\partial (\overline{w'^2})}{\partial \phi} - \rho\frac{\partial \overline{wv}}{\partial y} - \rho\frac{\partial \overline{uw}}{\partial x} - 2\frac{\rho}{y}\overline{vw} \tag{2}$$

$$\rho\left(\frac{dU}{dt}\right) = -\frac{\partial p}{\partial x} + \mu\nabla^2 U - \rho\frac{\partial (\overline{u'^2})}{\partial x} - \frac{\rho}{y}\frac{\partial}{\partial y}(y\overline{uv}) - \frac{\rho}{y}\frac{\partial \overline{uw}}{\partial \phi}$$

where

$$\frac{d}{dt} = \frac{\partial}{\partial t} + V\frac{\partial}{\partial y} + \frac{W\partial}{y\partial \phi} + U\frac{\partial}{\partial x}$$

and

$$\nabla^2 = \frac{\partial^2}{\partial y^2} + \frac{1}{y}\frac{\partial}{\partial y} + \frac{1}{y^2}\frac{\partial^2}{\partial \phi^2} + \frac{\partial^2}{\partial x^2}$$

The time averaging process introduces six additional unknowns (u', v', w', $\overline{uv}$, $\overline{uw}$, and $\overline{vw}$), a group of terms commonly referred to as the components of the (negative kinematic) Reynolds stress tensor. Even for the special case in which the mean velocity gradient is zero, the correlations $\overline{u_i u_i}$ are non-zero and the indeterminancy remains; it is a fundamental aspect of the mathematical description of a turbulent motion. The solution of the time averaged equations requires the specification of statistical measures of the velocity field as boundary conditions for the particular problem. A complete specification of the boundary conditions for the instantaneous motion in terms of time averaged flow variables involves not only point wise averages of the velocity field but an infinite set of correlations between the velocities at each point in the exit plane. It is a major premise of the present research that the statistical effect of the boundary conditions on the development of the mean velocity field can be satisfactorily represented by specifying i) the character of the mean streamwise velocity profile and ii) the scales and intensity of the fluctuating velocity components. A condition of spatial homogeneity precludes the necessity for identifying the values of lateral or longitudinal derivatives of these functions of the velocity field.

1.2. An axisymmetric jet, the subject flow

The axisymmetric turbulent free jet was selected as the flow field to be investigated because it has only two independent variables (thus reducing the number of unknowns to seven) and it is of great technological importance. A few of the technological problems which are supported by this investigation are described in a following section.

The axisymmetric free turbulent jet is often described in terms of three regions: the region containing the potential core, the developing region and the fully developed or self-preserving region. The potential core contains fluid which is bounded by intense shear layers but is characterized by the absence of the shear layer influence upon the mean velocity in the central portion of the jet. This region extends from the jet exit to approximately five diameters downstream. The developing region extends from the end of the potential core to the fully developed region and is simply a region of transition in the sense that the jet loses all identity with the exit conditions with the possible exception of a shift in the apparent origin between various jets. The fully developed or self-preserving region extends downstream from about 40 diameters. This region is characterized by self-similarity of the velocity profiles. That is, if the velocity profiles (mean and fluctuating) are normalized by the centerline value and the transverse coordinate is normalized by a properly chosen width measure (a function of streamwise distance), the resulting profiles are independent of the streamwise coordinate.

Townsend (1956) provides a comprehensive discussion of the nature of self-preservation and the implied interrelationship between the velocity (U_0) and length (l_0) scales for various shear flows. Specifically, let U_0 (x) and l_0 (x) be the centerline velocity and a radial distance such that $U(x,y)/U(x,0) = 0.5$ respectively; then $U(x,y)/U(x,0) = f(y/l_0)$ if

$$l_0 = ax + b \tag{3}$$

and $(l_0/U_0)\, dU_0/dx$ = constant. A negligible streamwise pressure gradient and the global conservation of momentum equation can be combined to show that U_0 satisfies the condition

$$U_0 = (ax + b)^{-1} \tag{4}$$

The velocity field is then specified by the normalized functions and the functional dependence of the normalizing parameters on the streamwise coordinate.

Numerous studies have quite adequately documented the self-preserving region of the jet and several investigations of the regions involving the potential core and transition zone. The present work is exclusively concerned with the near field $0 \lesssim x/D \lesssim 10$ and with the effects of the exit plane turbulence structure on this region. The remaining sub-sections of the Introduction are to place this investigation in its proper context by considering the appropriate literature base re free shear flows (1.3), the technological problems supported by this research (1.4) and the scope of the present investigation (1.5).

1.3 Literature Survey

This section is a review of the literature which provides information related to free turbulent shear flows in general and axisymmetric free jets in particular. This section is presented in the context of the objectives of the present investigation. Some general characteristics of free shear flows are first discussed; pertinent characteristics of the axisymmetric jet are then considered.

1.3.1 Free Turbulent Shear Flows

1.3.1.1. General characteristics

The important common characteristics of free turbulent shear flows, including jets, wakes and the free shear layer between two streams of uniform mean velocity, are: i) a sheared region where the turbulence energy and Reynolds stresses are produced, ii) an insensitivity of the mean flow and energy bearing eddies to the Reynolds number (if the latter is sufficiently large) since the direct effect of viscous stresses (i.e. $\mu \nabla^2 U$) are not important in the absence of a solid boundary and iii) a thin, contorted and three-dimensional layer bounding the fluid in fluctuating vortical motion. The layer of (iii) is termed the viscous or laminar super-layer and it is responsible for the diffusion of vorticity into the non-vortical ambient fluid. In a strict sense, entrainment into the shear flow can be defined as this vorticity diffusion process. Alternate definitions, which may result in a quantitatively different entrainment magnitude, have also been employed and are described below. The existence of the super layer was first identified by Corrsin (1943), the flow field characteristics related to it were first measured by Townsend (1949) and its detailed characteristics and the attendant statistical behavior of this turbulent-non-turbulent interface (superlayer) has been studied by Corrsin and Kistler (1955). As pointed out by Corrsin and Kistler, the distinctive characteristic between the fluid interior and exterior to the interface is the existence of high frequency vorticity fluctuations of the interior fluid. The gradient of vorticity is maintained at a large value due to the stretching of vortex filaments in the vicinity of the superlayer. It is the diffusion of vorticity by direct viscous action at the superlayer interface which is considered to be one of the important features of free turbulent shear layers.

The intermittent region of a turbulent boundary layer, which exhibits the characteristics of a free shear flow, has been studied by

Kaplan and Laufer (1968), Kibens and Kovasznay (1969) and by Kovasznay, Kibens, and Blackwelder (1970). The results of these studies indicate the possibility of a much more orderly structure of the flow behavior than had been previously revealed by long term average values of the velocity. Similar studies are continuing on turbulent boundary layers and also on turbulent axisymmetric jets; the latter are discussed below.

In addition, theoretical studies of the properties of the superlayer have been conducted by Townsend (1970) and Phillips (1972). From these theoretical studies, undertaken to provide some correlation of the many experimental observations, it is suggested that the area of the superlayer over which the diffusion of vorticity occurs is not only a function of the large scale fluctuation resulting in the observed bulges and indentations, but also smaller corrugations corresponding to all scales of the turbulence. These smaller corrugations, although not so readily observable, can result in large differences in the superlayer surface area.

1.3.1.2. Entrainment

The recognition of the intermittent nature of the detailed structure in turbulent shear flows raises an interesting question as to what one means by the word "entrainment". Historically, entrainment has meant the process of a jet of fluid somehow "capturing" essentially quiescient ambient fluid and imparting to it a streamwise mean velocity. The rate at which entrainment takes place has been taken to be the rate of increase of mass flux across planes of constant streamwise distance (x) with increasing streamwise distance. To evaluate the mass flux across a plane, it is mathematically necessary to integrate over the entire plane (i.e. to infinity). This is not possible experimentally and requires an assumption of when the mass flux becomes negligible for larger radii. However, if one takes the presence of vorticity fluctuations as a property of the fluid belonging to the jet, entrainment can be defined in terms of the rate of diffusion of vorticity from the jet into the ambient fluid. Then, the rate of entrainment is the rate of increase of mass flux of vortical fluid across planes of constant x with increasing x. There are two contributions to the total mass flux, the mass flux of vortical fluid and the mass flux of potential (non-vortical) fluid. Although both quantities are measured and reported, the historic meaning of entrainment will be used unless otherwise noted in order to compare with other investigations.

A study of entrainment in axisymmetric jets was made by Ricou and Spalding (1961). They used a porous cylinder surrounding the jet for many diameters downstream and forced fluid through the porous cylinder at such a rate that the pressure inside was that which would have existed for the free jet. The volume flux through the porous cylinder was measured and provided a direct measurement of the entrainment rate. Based upon the results of Ricou and Spalding, the entrainment rate in the self-similar region of an axisymmetric jet is 0.32, specifically

$$\frac{d\dot{M}}{dx} = 0.32 \; \frac{\dot{M}(x=0)}{d} \qquad \dot{M} = 2\pi\int_0^\infty yU\,dy \tag{5}$$

1.3.2. Turbulent Free Jets

A relatively large amount of data exists for both axisymmetric and plane jets. Most of the experiments were conducted in the fully developed region of the jet where the velocity field exhibits a self-preserving character.

As shown by Wygnanski and Fiedler (1969) and Heskastad (1965), jets may not exhibit true similarity for as much as 60 diameters (slot widths for plane) downstream for the mean velocity profiles and up to 120 diameters for similarity of the turbulence structure. This asymptotic approach to the fully developed state could conceivably result in very significant differences in the determined virtual origins with different initial conditions. That is, small changes in the slope of the spread measure or centerline velocity as functions of streamwise distance at 40 or 60 diameters downstream would result in large changes in the virtual origin.

An important aspect of the behavior of turbulent free jets in the fully developed region is the determination of the exit properties which influence the value of the virtual origin. This requires detailed measurements in the near field region.

1.3.2.1. The Near Field

Measurements of the pressure and velocity distributions in the near field (from the exit to the fully developed region) have been made by relatively few investigators. Most of the available studies were concerned with jet noise generation, specifically, Ko and Davies (1971), Laurence

(1956), Bradshaw et al (1964), Davies et al (1963) and Maestrello (1973). Consequently, their measurements are concentrated in the intense shear layer between (or near) the potential cone and the ambient fluid and are primarily concerned with the turbulence intensities, shear stresses and correlation functions insofar as they relate to acoustic noise generation. The results of these and the present study overlap and comparisons that contribute to the present motivation are discussed. It should be noted that the turbulence data presented for documentation purposes could be used to investigate the effect of the exit conditions on the turbulence characteristics related to noise generation, see Appendix D.

The region of an axisymmetric jet nearest the exit plane is essentially the flow field described as a free shear layer where the bounding streams are the high velocity potential core and the low (or zero) velocity ambient flow. As such, the independent studies of the free shear layer problem contribute to the description of a jet flow. The phenomena of the shear layer instability and the asymptotic shear layer structure are well understood, see e.g. Freymuth (1966) and Wygnanski and Fiedler (1970). These phenomena are present in the jet flow of interest but are not explicitly pertinent in terms of the larger scale phenomena that develop in response to the axisymmetric structure of the jet.

Several investigations have resulted in velocity profiles in the near field of an axisymmetric jet. Foss and Kleis (1971) made use of these to evaluate the mass flux (by numerical integration schemes); similarly, they also evaluated the momentum flux and used the degree to which it was constant as a check on the data (and the integration process). These results, and the significantly different entrainment rates which were evidenced by them were a principal motivation for the present investigation. On the basis of the results reported herein, it has become evident that this motivation was ill conceived. Specifically, the momentum flux is a monotonically increasing function in the near field and rises to approximately 125 percent of its exit plane value at $x/D = 10$. Secondly, the accurate calculation of the mass flux is a most delicate matter requiring a knowledge of the mean flow direction. The procedure used herein, to determine the separate mean flow directions for the vortical and non-vortical conditions and executing separate mass flux calculations, is considered to be a practical necessity. That is, this scheme alleviates the yaw induced errors when a single time average is attempted in the presence of a velocity vector shift of the order 130 degrees and it accurately accounts for the direction of the time average velocity vector which is an important factor in the accurate evaluation of the mass flux integral.

Recognizing the difficulty of accurately determining the mass flux by integrating a measured velocity distribution, Hill (1971) has employed an extension of the Ricou and Spaulding technique which ostensibly allows a local measurement of the entrainment rate. Hill exercised considerable care in his investigation to calibrate his device in the self-preserving region and to examine the optimum radius of the device which introduced (and hence monitored) the entrainment flow. However, streamwise gradients and streamline curvature effects in the region near the nozzle cannot be accounted for in the calibration scheme. The results of the Hill study show that the asymptotic entrainment rate of 0.32 was attained at approximately five diameters.

Sami (1967) and Sami et. al. (1967) have examined the near field of an axisymmetric jet; their motivation and their results are similar to and hence quite pertinent to those of the present study. Their jet was formed by pressurizing the room below their laboratory and using a 1.0 ft. diameter hole in the floor as the jet exit. Measurements were made of mean and fluctuating velocity and mean and fluctuating pressure. The mean pressure was measured with a static tube and micromanometer combination. Although the micromanometer was capable of measurements to .001 in. alcohol, the necessary instability of the readings due to the large pressure fluctuations raises questions about the accuracies necessary to measure the small mean pressures involved (on the order of 0.007 in. water).

1.3.2.2. Exit Condition Effects on Jet Development

An investigation of the effect of exit conditions on the development of a plane jet was conducted by Oseberg and Kline (1971). The variation of initial conditions for their study was confined to controlling the boundary layer growth in the contraction by the use of suction and blowing. Their study was performed in water and the hydrogen bubble technique was used for visualizing these effects in the resulting jet flow. Their plane geometry and their variation of the mean velocity as well as the turbulence structure restricts the use of their study as a reference source for the present investigation.

Flora and Goldschmidt (1969) provide a comparison of several investigations which show significant variation in the computed virtual origin. They also conducted experiments using various nozzle configurations (different boundary layer growth) and varied the turbulence structure with the use of screens and grids in the plenum. They conclude that the calculated virtual origins are not influenced by different nozzle designs but are a function of initial turbulence structure. All of their tests were conducted on a plane jet and, thus, are not directly comparable to the present study.

The present investigation is complementary to the recent study by Crow and Champagne (1970). Their investigation was to determine the response of an axisymmetric jet to the introduction of single frequencies of excitation at the exit plane. The flow field investigated by Crow and Champagne was basically the same as the present study subject to different variations in exit (or boundary) conditions. Their exit conditions were generated by a loudspeaker in the plenum chamber adjusted such that the operating frequencies corresponded to the resonant frequencies of the chamber. The results of their investigation indicate that at certain "preferred modes" of excitation the jet exhibits an increase in mass flux and more rapid centerline velocity decay than without excitation. A more complete description of their results and a comparison with the present investigation are included in the results section.

1.4. Technological Problems Supported by this Research

1.4.1. General Numeric Solutions

As shown in the formulation of the problem, the introduction of mean plus fluctuating velocity components and time averaging the governing equations results in an indeterminate system of equations. This mathematical indeterminancy plus the need for engineering calculations of the behavior of turbulent shear flows have resulted in the development of phenomenological theories to effect a closure of the equations. A vast literature exists for such closure schemes; the earliest of these was the Boussinesq (1877) eddy viscosity model. The Prandtl (1925) mixing-length model is characteristic of the models predicated upon some physical notion of the behavior of the shear flow. More recent models have attempted to exploit the dual role of the Reynolds stress as a significant part of the momentum equation and as a factor in the production of turbulence kinetic energy. A conference to compare the ability of various models to predict the behavior of free turbulent shear flows was recently sponsored by the NASA Langely Research Center; the conference report provides a comprehensive description of these models and their relative success in the calculation of selected test cases, see Birch, et. al. (1972). Included within the structure of the conference were committees to recommend "critical experiments in free shear flows" and a second committee to summarize the status of free shear flow computations. A recommendation of the former committee was that systematic investigations of the effect of the initial conditions (e. g. the jet exit plane conditions) be conducted and both committees urged that the initial conditions and the original data be documented for each investigation in order to provide reliable test cases for evaluation of the prediction schemes. The documentation in this report fully complies with these suggestions.

1. 4. 2. STOL Aircraft

In the design of short takeoff or landing (STOL) aircraft it is necessary to create a large lift at relatively low forward speeds. To achieve such a condition several engine/wing-flap geometries have been considered. One such geometry consists of having the exhaust of the turbofan engine impinge at some relative angle onto the underside of the wing. One possible benefit of this geometry is the use of the strong streamwise vorticity produced by the impingement as a boundary layer control mechanism. That is, the streamwise vorticity would be ducted through the flap-gap and onto the upper surface of the flap assembly. The flow field generated by such a geometry has been studied by Foss and Kleis (1971). A second geometry which has been proposed is to exhaust the turbofan directly onto the flap assembly. This problem is similar to the previous one with the exception that larger included angles are involved. The large angle oblique impingement problem is currently being studied by Foss.

In both of the geometries it is necessary to determine the flow field associated with a free turbulent axisymmetric jet in the initial region (from the exit to ten diameters downstream). It has been shown by Foss and Kleis (1971) that the flow field resulting from the oblique impingement case is not measurably different than a free jet up to the streamwise location where contact is made with the plate. Thus the free jet behavior is important for two reasons. First, the free jet influences the ambient fluid due to the entrainment process. The result of this influence is to change the circulation and thus the lift of the wing section. The second reason for studying the initial region of a free jet is that characteristics of the free jet at the streamwise location at which impingement occurs become the initial conditions for the oblique impingement problem.

Since different turbofan engines generate different exit conditions, it is important to determine what effect different exit conditions have on the development of an axisymmetric free jet. Because experimental data indicate that the exhaust of a turbofan engine has a relatively uniform mean velocity profile, the present investigation, restricted to uniform mean velocity profiles, is quite relevant.

1.5. Scope of Investigation

The present study is an experimental investigation of the effects of different turbulent kinetic energy and integral scale on the development of an axisymmetric turbulent free jet. The region of interest for the present investigation is from the jet exit to 10 diameters downstream. The range of Reynolds number is from 65,000 to 100,000. The root mean square (RMS) of the axial velocity fluctuation (an indication of turbulent kinetic energy) was varied from 1 to 3 percent of the exit mean velocity and the integral scale, calculated from time auto correlations at the exit plane of the axial velocity component, ranged from 0.15 to 0.3 inches. The documentation of the exit plane conditions is given in Appendix C. All measurements were made on a 2.0 inch diameter jet using a thermal anemometer with an x-wire sensing element.

Conditional sampling techniques were used to rotate the sensor into the mean direction of the velocity vector for both the vortical and potential condition readings in order to minimize sensor errors. Zone averages were made of the velocity field for both the vortical and potential conditions. The quantities measured were the mean velocity magnitude and direction, the RMS of the axial and radial velocity components, the product of the axial and radial fluctuating components $(\overline{uv})$, the fraction of time in the zone condition and the number of condition changes during the average.

The mass flux at various streamwise locations and the entrainment rate which can be inferred from these measurements was a factor of principal interest. Measures of the turbulence structure and their relationship to the entrainment rate were also of specific interest. Unexpectedly, but quite significantly, i) the mass flux increase trends are independent of the exit plane turbulence conditions except for a streamwise change in the initiation of the asymptotic-increase-rate location; ii) the momentum flux is not a constant in the near field but its variation is independent of the exit plane conditions; iii) the turbulence structure parameters do reflect the state of the exit plane turbulence structure conditions.

2. EXPERIMENTAL FACILITY

This section describes the experimental facilities used to obtain the quantitative data from the present investigation. Included are descriptions of the flow facility, traversing system, transducers, and signal processing equipment. The discriminator circuit, which is a signal processing piece of equipment, is described in a separate section because it is of central importance to the data processing.

2.1. Flow System

The flow system used for the present investigation is a minor modification to that used by Holdeman (1970), Holdeman and Foss (1970), and Foss and Kleis (1971). A detailed description of the flow system with modifications is included because these reports are not of general circulation. A schematic of the flow system is shown in Figure 1.

The blower is a Buffalo Forge model 37 V volume fan powered by a 15 horsepower D.C. motor with a $\pm$ 1 percent positive feedback variable speed control. On the inlet side to the blower is a fully developed pipe flow system for comparing the results from the data acquisition system against the known results of Laufer (1954).

Filters and a 36:1 octagonal contraction are located at the inlet to the fully developed pipe flow system. The pipe is 7.5 in. I.D. extruded aluminium with a length to diameter ratio of 105. The pipe is fitted with static pressure taps at every 2 ft. along the length and a traversing probe support. Connection is made to the blower by means of a removable section containing a screened diffuser and flow straighteners to minimize the upstream propagation of effects from the blower.

The main plenum chamber is connected to the blower through a diffuser and turning vanes. The diffuser has been fitted with 30 mesh screens for separation control. The turning vanes are of constant radius. The flow in the plenum then passes through flow straighteners to decrease the large scale motions and a filter to remove foreign material and further decrease the turbulence.

As shown in Figure 2 the flow then proceeds through a toroidal contraction to a 3.25 in. I.D. pipe mounted such that it can be positioned axially. At the downstream end of this 13 in. pipe, the central portion of the flow is separated from the boundary layer portion by a concentric

2 in. I. D. copper pipe. The copper pipe is 2 in. long and is mounted in the exit plate. The upstream end of the copper pipe is ground to a 15 degree bevel from the outside to minimize flow separation. The excess boundary layer fluid is pulled off through a secondary plenum-blower arrangement. It was found that the best adjustment of the secondary plenum pressure level, to minimize separation on the 2 in. exit pipe, was obtained with the axial movement of the 13 in. long pipe relative to the exit plate.

The variable turbulence initial conditions were generated by arrays of 0.020 in O. D. tubes as shown in Figure 2. The jet tube arrays were placed at the throat of the toroidal contraction and air was supplied from a central high pressure (90-95 psi) compressor. The pressure was reduced through two filter-regulators which removed nearly all of the pressure variation. Three different grids were used with center to center spacing of 0.3, 0.4, and 0.5 in. Extensive testing showed that the scales of turbulence at the exit varied with the mean velocity at the exit and the intensity could be varied by using different grids.

2.2. Traversing System

Because of the nature of the data, with the requirements of using an x-wire hot-wire probe and taking measurements in regions of high velocity gradients, it was necessary to construct a probe traversing system which could be positioned accurately in the three spatial coordinates and also rotate the x-wire array in the plane of the wires as shown in Figure 3. To meet these requirements, a lathe bed was used as the basic traversing mechanism. The lathe allowed 30 in. travel in the streamwise (x) direction and the lathe cross-feed was used to give 12 in. of travel in the y direction. The cross-feed screw was removed and the cross-feed was driven by means of a stepping (1.8 degree per step) motor geared down and connected to an anti-backlash translation screw. On top of the compound feed, which was used for fine positioning in x, was mounted a dual worm gear drive which moved the probe support vertically (z) and in Θ, the angle in the horizontal plane. The Θ and z movements were also driven by stepping motors (1.8 degree per step). The worm gear drive allowed z variations of 10 in. and Θ variations of 360 degrees. It was necessary to correct in z after a change was made in Θ.

The x-wire hot-wire probe was mounted on a support which allowed the wires to pivot about the axis of the worm gear drive assembly. A Disa type 55A38 x-wire probe was slightly modified to give a probe separation of 1/16 in. to lessen the probe wake interference effects reported by Guitton and Patel (1969). The sensing elements were 5 μm diameter Pt-plated tungsten wire, each 1.2 mm in length.

The entire traversing system was levelled and aligned with the physical centerline of the flow system using an optical cathetometer.

The stepping motors for the Θ and z drives are Slo-Syn type HS50 and the y drive a Slo-Syn type HS50L manufactured by Superior Electric. One stepping motor drive unit was used for all three motors by selecting the motor to be driven with a solenoid actuated rotary switch driven by a square wave from the on-line computer. The stepping motor drive unit accepts input pulses and energizes the proper field coils in the stepping motors to rotate the motor one step (1.8 degrees) per input pulse. This pulse was also generated by the on-line computer, thus giving control of the probe positioning in y, z, and Θ to the computer.

2.3. Data Acquisition Equipment

Two flow variables were measured in the present investigation, pressure and velocity. The transducers necessary to produce an analog voltage proportional to the two measured variables and the equipment used to process the resulting signals are described in this section.

2.3.1. Transducers

A two-channel Thermo Systems Inc. model 1054A thermal anemometer was used to produce linearized response from the modified Disa type 55A38 x-wire probe described earlier. The signal from each channel was passed through a Thermo Systems model 1057 signal conditioners for low pass filtering to eliminate aliasing errors. The x-wire probe was calibrated with the probe axis aligned with the flow direction; the velocity was calculated from pressure readings.

The pressure was measured using a Decker Corp. type 308 variable capacitance pressure transducer. Two transducer units were used with ranges of 3.0 in H_2O = 10 volts and 0.3 in H_2O = 10 volts. The three-inch transducer was used for the calibration of the hot wire unit and monitoring the plenum pressure turning the data acquisition. The three-tenths transducer was used for calibrating the hot wire and measuring the pressure gradient in the fully developed pipe flow field.

2.3.2. Signal processing equipment

The analog voltage from the thermal anemometer was processed in several ways both by analog and digital methods.

A simple sum and difference network was set up to produce a signal proportional to either the axial or transverse velocity component relative to the x-wire probe axis. As shown in Figure 5, this signal was then fed into a Thermo Systems Inc. RMS meter for comparison with the fluctuating velocity components measured and calculated with the digital data acquisition system. The sum and difference of the anemometer signals were also fed into a Princeton Applied Research model 101A correlation function computer to produce autocorrelations of the axial and radial velocity fluctuations in order to document the various initial conditions used for the present investigation. The output of the PAR correlator was read with the IBM 1800 computer and punched on cards for later processing.

In addition to the commercially available equipment for signal processing, a circuit was constructed to produce an analog signal which could be level discriminated by the digital computer to indicate whether the flow was vortical or nonvortical. This circuit is described in a separate section because it is not commercially available and it is of central importance to the conditionally sampled data acquisition.

2.3.3. Analog-digital interface

The analog outputs of the thermal anemometers, pressure transducers and discriminator circuit were fed through individual buffer amplifiers with variable gain. The gain on each of the amplifiers was set so that the maximum voltages would be below but near the 10 volt maximum of the analog to digital converters on both the IBM 1800 and TI 960A computers.

The actual gains of the amplifiers was determined by applying a 1.00 volt D.C. signal to the input of each of the buffer amplifiers.

The outputs were then read and the inverses of the values obtained were used to convert the indicated voltages measured by the computers to the actual values input to the buffer amplifiers. This provided the most accuracy with the limited resolution of the 12 bit analog to digital converters.

2.3.4. Digital data acquisition and control systems

Two general purpose digital computer facilities were used in the present investigation, an IBM 1800 system, available in the College of Engineering and used for previous investigations in the fluid mechanics research laboratory, did not have fast enough instruction execution times to make it useful for data acquisition for the present investigation. In order to meet the increased speed requirements for the present investigation, a TI 960A "mini-computer" was obtained.

The TI computer facility consisted of a multi-channel analog to digital converter, real time clock, Silent 700 data terminal, card reader, digital to analog converter and digital interface cards for communication with the IBM 1800 computer. The four analog signals (two thermal anemometer channels, one pressure transducer and the discriminator circuit output) were in turn interrogated by the computer and the signals processed.

The real time clock was used to time the data taking at a point for the specified time interval (usually 15 seconds per reading).

The Silent 700 data terminal was necessary for communication with the computer. The initial positions, type of traverse, starting and ending points for a traverse, coefficients for two fourth order polynomial fits to the two wire calibrations, number of data points and the time for averaging at a point were entered at the beginning of each traverse. This information was used during the automatic "process control" by the computer. The data terminal also provided listings of the unprocessed data as a permanent record.

The digital to analog converter provided the square wave outputs used to select and drive the three stepping motors for probe positioning. They were also used to drive an x-y plotter for plotting some of the results of the data acquisition.

A digital interface card provided two way communication between the TI and the IBM 1800. The card had 16 input and 16 output connections which allowed the transmission of one sixteen-bit word at a time. This was done with an answer-back system such that each computer could send or receive from the other at a maximum rate with the minimum possibility of error. The communication was necessary because of the lack of a peripheral device such as a card punch for the TI system. Thus the TI system was operated in a satellite mode from the IBM 1800. That is, the TI was used for the actual data acquisition (typically 8 hours) and then the stored results were transmitted to the IBM 1800 for punched card output for later processing.

In addition to providing punched card output of the information transmitted from the TI, the IBM 1800 was also used for two phases of the data acquisition process. The routines used, which were developed for the earlier investigations, were to calibrate up to four thermal anemometer channels and to read the analog output of the PAR Correlation Function Computer from which the routine produced listings and punched card output.

The IBM 1800 was also utilized for the processing of the data due to the convenience of writing processing routines in FORTRAN and the inconvenience of using TI's version of FORTRAN on the 960A computer.

2.3.5. Discriminator circuit

In any conditional sampling of data, the signal upon which the decision is made as to whether or not to include the reading in the sample is of primary importance. For the present investigation it was desired to produce a signal based upon the outputs of the thermal anemometers which would indicate if the flow past the sensors was turbulent. The property of turbulence which is desirable to use to produce the analog signal, which is eventually level discriminated, is the presence of vorticity fluctuations. Unfortunately, it is very difficult to measure any of the actual vorticity fluctuations. Kovasznay, Kibbens and Blackwelder (1970) measured a part of the instantaneous vorticity ω_z, where

$$\omega_z = \left(\frac{\partial \tilde{V}}{\partial x} - \frac{\partial \tilde{U}}{\partial y}\right) \tag{2.1}$$

for the discrimination. That is, it is possible to construct a probe consisting of two parallel wires which are normal to the flow such that when the difference is taken one gets a signal proportional to approximately $\partial\tilde{U}/\partial y$. This signal is then processed by analog circuitry to produce a signal with a definite on-off character.

Since an x-wire probe was used for the data acquisition of the present investigation, the alternate approach was taken of using $\frac{\partial\tilde{V}}{\partial x}$ as the signal to indicate the presence of ω_z. Using Taylor's hypothesis we can write the approximate relations

$$\frac{\partial\tilde{V}}{\partial x} \simeq -\frac{1}{U}\frac{\partial\tilde{V}}{\partial t} \tag{2.2}$$

which can be obtained from the two channels of the thermal anemometer by taking the difference of the time derivatives of the linearized signals

$$\frac{\partial\tilde{V}}{\partial t} \sim \frac{\partial E_1}{\partial t} - A\frac{\partial E_2}{\partial t} \tag{2.3}$$

where A is chosen to compensate for the difference in the gains of the two signals.

It was found by analyzing the Fourier Transform of several samples of data taken in the intermittent flow region of the jet at a typical velocity (100 ft/sec) that the greatest percentage difference in energy content at a given frequency occurred between 1 KHz and 3 KHz. Therefore, the difference of the time derivatives was band pass filtered at these frequencies before it was processed further. This essentially eliminated the low frequency components associated with potential fluctuations (caused by pressure gradients in the non-vortical fluid).

As is shown in Figure 4, this signal was then processed in two ways. First, it was full-wave rectified to eliminate the zero-crossings. Also, the time derivative was taken and then full-wave rectified. This was done because the zero-crossing of a signal such as this are points at which its time derivatives are nonzero. Thus, if the resulting full wave rectified signals are added together there results a signal which should be zero only when the original signal has sufficiently small amplitude ($\frac{\partial\tilde{V}}{\partial t} \simeq 0$ and $\frac{\partial^2\tilde{V}}{\partial t^2} \simeq 0$).

The final signal was then read by the computer which made a decision as to whether the data point was vortical or not by comparing the signal to a specified level entered at the beginning of the traverse. In addition to the level discrimination, the computer acted as a digital filter by saving the previous two data points and requiring that there be three consecutive readings in a new mode before it considered a mode change to have taken place. That is, if vortical fluid has been passing the x-wire probe and a non-vortical reading is made, then there must be two more consecutive readings indicating non-vortical fluid before the computer recognizes the switch from vortical to non-vortical. The same procedure holds on making the switch from the non-vortical to the vortical mode.

3. ACCURACY

Several factors must be considered in the estimation of the overall bounds which can be placed on the accuracy of the results. Some of the factors for which error bounds can be estimated are sensor positioning, alignment of flow field and traversing system, analog to digital conversion and integration scheme. In addition, several checks have been made which indicate overall performance of the data acquisition facility and validity of assumptions made in the data processing.

Accurate probe positioning is especially important in any axisymmetric flow field. The evaluation of the mass, momentum and energy flux integrals weight the measured values by the radius. This means that the points measured in the steepest velocity gradient are weighted more heavily than the high velocity small gradient fluid near the center. The position of the probe is then important in the accurate determination of the function of the velocity multiplied by the weighting parameter. For these reasons the traversing mechanism for the present investigation was built upon a lathe bed and cross-feed. The streamwise position (x) was selected manually with an estimated accuracy of 0.02 in. This was deemed adequate since the gradients in the streamwise direction are relatively small. The lathe cross-feed was driven with the antibacklash screws stepping motor drive system to position in the (y) direction. The estimated accuracy for the transverse (y) direction is 0.001 in. The vertical and rotational drives were also driven by stepping motors, and the accuracies are estimated at 0.001 in. for the vertical and 0.5 degrees for the rotation.

Alignment of the sensor traversing system with the physical centerline of the flow field was accomplished using the optical cathetometer at approximately 60 diameters downstream. The initial alignment of the cathetometer was achieved by passing a laser beam through the supply tube for the jet tube array, through the jet exit and onto the opposite wall of the laboratory. The resulting accuracy of the alignment is estimated to be $\pm$ 0.05 in. at 10 diameters from the exit. These accuracies agree with the measured centerline of the flow field as determined from the half velocity points.

The finite length of the sensor element and the unavoidable interference of the supports for the sensor element cause the response of the x-wire sensor to be somewhat different than a simple cosine (normal component) cooling law. To minimize the error which would occur if such a response were assumed, the scheme of conditional sampling the velocity field based on the output of the discriminator circuit, which indicated the presence or absence of high frequency vorticity fluctuations, was used to rotate the sensor until it was aligned with the mean velocity vector for the condition. Short term time averages (0.3 sec.) were taken for the two wires. The velocity components along and normal to the x-wire sensor were calculated from the two polynomials representing the wire calibration curves. The angle of the mean velocity vector relative to the probe axis was calculated assuming a cosine cooling law and the probe was rotated to align with the measured mean velocity vector direction. Since the cooling law response is somewhat different than a simple cosine law, the procedure was repeated if the indicated rotation was more than one degree for a maximum of four corrections. With the x-array aligned with the direction of the mean velocity, the probe was being used at the orientation at which it was calibrated. The part of the flow field for which this procedure would provide significantly better results is in the low velocity, high relative intensity region in the outer part of the jet. The velocity measurements in this region make significant contributions to the mass flux integration used in determining entrainment rates. Conventional methods of using sensors which are not rotated into the mean velocity direction encounter significant errors because the relative angle of the mean velocity directions between the vortical and non-vortical fluid is as large as 130 degrees. In addition to the errors associated with support interference, the indicated mean velocity differs from the true value due to second and higher order turbulence quantities as shown by Champagne (1965). Those contributions become large in the outer region of the jet for the non-vortical fluid where the mean velocity is nearly radially inward and the potential fluctuations are relatively large. Since the x-array was essentially aligned with the mean velocity, the conditions of the measurement approximate those of the calibration. Therefore, even though the x-array still has errors associated with relatively high turbulence intensities, the contributions of the errors to the flux quantities are minimized when the measured velocities are rotated back into

laboratory coordinates. As a result of these considerations it is believed that the scheme of aligning the sensor axis with the mean velocity vector direction yields significantly better accuracy in determining the measured quantities (U, V, u', v', $\overline{uv}$) than conventional methods.

The errors associated with the data acquisition facility include the resolution capability of the A/D converter and the round-off errors of the computer during the time averaging. The A/D converter was a 12 bit converter with an input range of ± 10 volts. This means that the resolution capability was 0.005 volts. Full advantage of this resolution may be made for the time average of the voltage signals; however, if this signal is squared (needed for fluctuating quantities) the resultant quantity may contain up to 24 bits of information. This then must be truncated to 16 bits in order to avoid overflow. The result would be a mean square fluctuating quantity accurate to 0.04 volts, which is adequate for mean values on the order of 10 volts. The voltages encountered in the present investigation ranged from about 8 volts in the center of the jet to about .5 volts in the outer portions. This would represent about a 10 percent error bound at the lower voltages. To overcome this problem, software was developed to make a short-term average (.25 sec) to determine the approximate mean value. The signal was then scaled up by shifting the quantities (suppressing leading zeros) allowing for a factor of 8 overvoltage. The result was an overall accuracy estimated to be 0.05 percent for mean quantities and 0.4 percent for the fluctuating quantities.

The overall performance of the thermal anemometer and data acquisition facility was checked by making measurements in the fully developed pipe flow facility described earlier. The calculation of $\overline{uv}$ from the individual wire voltages tests all aspects of the x-wire system and this quantity may be established by the independent measurement of the pressure gradient in the fully developed pipe flow. This evaluation is described in Appendix A; it was found that the measured values from the data acquisition facility agreed with those calculated from the measured pressure gradient to within about 2 percent. This was considered to be quite acceptable.

Although the accuracy of 2 percent for the calculation of $\overline{uv}$ is an indication of reliable data acquisition, there are two additional types of errors which affect the accuracy of the behavioral measures of the jet. The first type of errors are those associated with converting the time-averaged voltages into the desired velocity quantities. The measured voltages were first corrected for the second order turbulence terms as indicated by Champagne (1965). The resulting response characteristics of the wires should then be accurate to the third order turbulence quantities. The resulting cumulative error due to this effect is estimated to be on the order of 0.1 percent over most of the jet. The corrected voltages were then converted to the desired velocity measures (U, V, u', v', $\overline{uv}$) using the polynomials which were fit to the calibration tables. The accuracy of the polynomial fit is shown in Appendix B. Linearizers were used on both thermal anemometers so that the voltage output was approximately proportional to the instantaneous velocity. It was only assumed, however, that the response was linear over the range of excursion of the velocity fluctuations about the mean value. The fluctuating voltage quantities were converted to velocity using the local slope of the calibration curve at the mean velocity point. After being converted, the velocity profiles may be plotted or measures of the behavior of the jet computed. Some of the behavorial measures which are commonly used are the mass flux, momentum flux and turbulent kinetic energy flux across a plane normal to the axis of the jet. To evaluate these flux quantities it is necessary to evaluate integrals of the velocity, velocity squared and velocity cubed. If the assumption could be made that the flow field were axisymmetric, it would be permissible to make the measurements along a radial traverse and then integrate in cylindrical coordinates. Two special tests were run to examine the axisymmetric character of the flow. Traverses covering the exit plane ($x = 0$) at all operating conditions verified that the exit condition was uniform, and a horizontal and vertical traverse through the centerline of the jet at 10 diameters downstream verified that the jet was axisymmetric at 10 diameters. The integrals were evaluated using a modified Simpson's rule. A parabola was fitted to each set of three points. The parabola was then integrated with the weighting function

$$\Delta I = \int_{y - \delta/2}^{y + \delta/2} p(y)\, y\, dy \qquad (3.1)$$

The accuracy of this method was checked using several different known profiles, and the results were good.

As a result of these effects it is believed that the overall best estimate cumulative accuracies are 2 percent for the mass flux, 5 percent for the momentum flux and 8 percent for the turbulent kinetic energy flux values.

4. RESULTS AND DISCUSSION

The principal results of this investigation are comprised of integrated functions of the velocity (mass and momentum flux distributions) and other functions of the velocity field which characterize its detailed structure. The format of this section follows this natural division of the results. Additional results which are predicated upon the turbulence quantities are presented in Appendix D, "Additional Results". Characteristic exit plane velocity profiles are shown in Figures 6 and 7. These are to indicate the relative uniformity of both the velocity and the intensity of the fluctuations.

4.1. Mass Flux Distributions

The mass flux values for eight distinct exit conditions and for seven x/D locations in the near field of the axisymmetric jet ($0 \leq x/D \leq 10$) are presented in Figure 8. These data demonstrate the negligible importance of the exit plane conditions over the range investigated for the determination of this aspect of the jet flow behavior. This is an unexpected result, but it appears to be conclusive since each data point on the graph is supported by a radial traverse encompassing 31 individual velocity measurements and 7 mass flux values are used to establish the streamwise distribution.

Since the largest intensity (3.6 percent) and largest scale ($\Lambda/D = 0.13$) case were obtained by creating a jet solely with the flow induced by the jet tube array, and since it is unlikely that these conditions can be made more extreme without sacrificing the longitudinal homogeneity utilized in the definition of the exit plane conditions, the present results are inferred to be representative of all such jet flows. The effects of a stronger disturbance condition and the attendant longitudinal inhomogeneity and, perhaps more significantly, the effect of a nonuniform mean velocity profile at the exit plane cannot be assessed from these results. An investigation of these effects is suggested as a logical extension of the present investigation.

The slope of the mass flux distribution for $x/D \geq 6$ is nominally 0.31;[1] this is considered to be a most significant result. For an

[1] This slope is primarily based upon the data at x/D = 6 and 10. The data at x/D = 8 is adversely affected by the outer limit used for the radial traverse which is considered to have truncated the flux of non-vortical fluid. This judgement is supported by the measured flux of vortical fluid at x/D = 8 as discussed below.

isothermal submerged jet (the present problem), Ricou and Spalding (1961) have established an "entrainment rate" of 0.32, i.e.,

$$\frac{d(\dot{M}/\dot{M}_e)}{d(x/D)} = 0.32, \tag{4.1}$$

using a procedure which is independent of detailed measurements within the jet field. Consequently, the agreement between the present result of 0.31 as a conglomerate value established by eight separate sets of measurements and the value of 0.32 from Ricou and Spalding supports the following conclusions:

1) The overall accuracy of the velocity measurement and the integration procedure is approximately $\pm$ 2 percent as revealed by the dispersion of the data points about their mean value.

2) The asymptotic rate at which ambient fluid is caused to move across a plane normal to the streaming direction is established at approximately 6 diameters from the exit. (Recall that the detailed structure of the velocity field is not self-preserving before approximately 60 diameters, see Wygnanski and Fiedler (1969).)

Attaining the asymptotic mass-flux-increase rate at six diameters downstream is compatible with the results of two previous investigations, specifically, Hill (1971) and Crow and Champagne (1970). The study by Hill was an extension of the Ricou and Spalding technique in which a determination of the local value of the mass-flux-increase rate was attempted. Although the measurements are undoubtably influenced by the finite width of the device used to introduce the entrained air and although the streamline curvature of the entrained flow may affect the detailed results, the results of Hill provide substantial support for the present data. Crow and Champagne (1970) found it necessary to replace the entrained flow contribution to their hot-wire signal by an assumed smooth variation from the edge of the jet to a zero forward velocity condition since their instrumentation was not configured to provide for flow direction measurements. (Such a refinement was not required for the purpose of their study.) However, they similarly conclude that the asymptotic mass-flux-increase-rate attains its asymptotic value at $x/D = 6$.

The present results suggest a mass-flux-increase rate of approximately 0.21 in the region closer to the nozzle; however, the experimental accuracy in this region is insufficient to obtain more than an approximate value, and it is insufficient to judge whether this rate is essentially constant up to $x/D = 6$ or whether a continuous variation more accurately describes the physical phenomena. Based upon the present results, the increase rate of 0.136 for $0 \leq x/D \leq 2$ quoted by Crow and Champagne appears low. Similarly, the continuous variation in the quantity reported by Hill is not supported by the present results.

The mass flux of vortical fluid across a plane of constant x, normalized on the exit mass flux, is shown in Figure 9 as a function of x/D. As in the total mass flux, there appears to be little if any significant deviation between the various cases. Although there appears to be a decrease in the rate of diffusion of vorticity (rate of increase in the flux of vortical fluid) for the highest intensity largest scale cases, it is believed that this is a result of the failure of the interface detection circuity to respond to the lower frequencies resulting from the lower mean velocities. This error would most probably be largest in the outer edges of the low velocity puffs or bulges of vortical fluid. Note that the total mass flux will not incur any error due to such a failure of the detection circuitry since the mass flux not included in the vortical zone averages will be included in the non-vortical zone averages. Thus the total is still essentially correct. (The improper zone discrimination will be associated with a yaw error in the thermal anemometer response.)

The streamwise distribution of the non-vortical mass flux provides for an instructive comparison with respect to the total mass flux distribution. Specifically, the rate of increase in this curve is relatively constant; there is no pronounced increase in the slope at $x/D \approx 6$. Consequently, the latter response in the total mass flux distribution must be caused by the enhanced movement of non-vortical fluid. This is a principal reason why the word "entrainment" is used with caution in the non-self-preserving region. It is probably significant that this change in the mass-flux-increase rate occurs in the neighborhood of the termination of the unsheared core of fluid. The constant rate of increase in the vortical mass flux implies that the diffusion of vorticity phenomenon is independent of the agents causing the increase in the total mass flux.

It is important to note that the increase in the movement of non-vortical fluid must be associated with a significant pressure gradient in the streamwise direction since this is the only accelerating agent for an irrotational field. The existence of a streamwise pressure gradient is consistent with a momentum flux which, as will be shown, has a significant streamwise variation starting at approximately $x/D = 6$.

4.2. Momentum Flux

If the static pressure in the jet interior is only negligibly different from the atmospheric value, then the momentum flux past any x location is a constant and equal to that at the exit plane of the jet (see equation 4.2). This assumption is commonly made, e.g., see Townsend (1956), and the constancy of the momentum flux is often used as a measure of the accuracy of experimental data, see Sami, et al. (1967), Mons and Sforza (1971), and Foss and Kleis (1971).

$$\left.\int_0^R p\cdot y\,dy\right]_{x=o} - \left.\int_0^R p\cdot y\,dy\right]_{x=x} = \rho\left.\int_0^R (U^2+u'^2)\,y\,dy\right]_{x=x} - \rho\left.\int_0^R (U^2+u'^2)\,y\,dy\right]_{x=o} \qquad (4.2)$$

The results of the present investigation indicate that the momentum flux is not a constant in the initial region. Figure 10 shows a plot of the momentum flux, normalized on the momentum flux at $x/D = 0.5$, as a function of x/D. The results show a definite rise in the momentum flux to a value between 20 to 30 percent over the initial momentum flux value. Since the present study concentrated upon the near field of the jet ($0 \lesssim x/D \lesssim 10$), the downstream behavior of the momentum flux distribution is not revealed by the data of this investigation. However, it is expected that the momentum flux would approach a constant value at least in the region ($x/D \gtrsim 40$) where the mean velocity profiles attain self-similarity. Note that a condition of self-preservation, see Townsend (1956), would guarantee this result. Referring to Figure 10, the momentum flux appears to be leveling off slightly from 8 to 10 diameters downstream. It would be most interesting to have measurements in the developing region ($10 \lesssim x/D \lesssim 40$) to examine the behavior of the normalized momentum flux.

The direct measurement of the mean velocity vector (magnitude and direction) and the turbulence intensities in the vortical and non-vortical zones of the jet and the utilization of these values in the construction of the mean momentum flux value, see (1), implies that a nonconstant momentum flux value must be balanced by the integral of the mean static pressure. The mechanism for the reduced static pressure is revealed by the radial component of the Reynolds equation (see Hinze, page 23.). For an incompressible steady flow of the axisymmetric jet, the radial component of the Reynolds equation for large Reynolds number can be written in the following approximate form,

$$\frac{1}{\rho}\frac{\partial p}{\partial y} = -\frac{1}{2}\frac{\partial(V^2 + v'^2)}{\partial y} - \frac{1}{y}(v'^2 - w'^2) - \frac{\partial(\overline{uv})}{\partial x} - \frac{1}{2}\frac{\partial v'^2}{\partial y} \qquad (4.3)$$

If the streamwise variation of $\overline{uv}$ is neglected, a conservative estimate, then this equation may be integrated from outside the jet to an arbitrary radius (y). Thus, the radial component momentum equation requires that there must be a radial pressure gradient due to the turbulence quantities. An attempt was made to compute the pressure from the radial momentum equation by assuming that the azimuthal component (w') is equal to the radial component (v') within the vortical fluid and equal to (u') for the non-vortical fluid. These assumptions were checked at x/D = 10 for one case; the agreement was sufficient for the purpose of the calculation (10 percent and 15 percent respectively). The resulting equation, in the vortical region, is

$$p\,(y) = \rho V^2/2 + \rho v'^2 \qquad (4.4)$$

The mean pressure values computed by this technique were integrated over the area of the velocity distribution. This integral value was approximately one-half as large as the excess momentum flux, and since the estimate of the pressure value is approximate and conservative, it appears feasible that the reduced pressure effect can be of sufficient magnitude to balance the increase in the momentum flux.

Sami, et al. (1967) present data for the region $0 \leq x/D \leq 20$, from which they demonstrate a balance between the mean velocity, the turbulent intensity and the static pressure. The static pressure effect, at the x/D = 10 station of the present evaluation, was a negative 8 percent of the exit momentum flux; this is similar to the values noted above. Their turbulence intensity contribution at $x/D = 10$ is approximately + 9.4 percent of the exit momentum flux and this compares with the nominal values of 7 percent for the present study.

The essential differences between the two studies are the value of $\int_0^\infty U^2 dA$, ≃ 1.0 and 1.18 of the exit plane value for Sami, et al., and the present study, respectively, and the magnitude of the pressure force, approximately -0.08 and -0.25 of the exit plane value, respectively. Since the results of Sami, et al., were in agreement with the author's a priori understanding of the jet behavior, considerable effort was expended to establish the credulity of the increasing momentum flux result. The most significant factor in assessing the accuracy of the mean velocity values is the agreement with the Ricou and Spalding result for the mass flux. The author integrated the Sami, et al., data with these results: 1) agreement with the published momentum flux value and 2) a mass-flux-increase rate of 0.173 for $0 \leq x/D \leq 10$. It is inferred that the uncertainty of the flow direction and the ambiguity of identifying the velocity magnitude at large radius values is responsible for the differences between the results using conventional techniques and the results with the present data acquisition system. It is also inferred that the indicated result of a negative pressure force equal to approximately 25 percent of the initial momentum flux can be used as an indication of the extreme difficulty of executing accurate static pressure measurements in a jet flow. Although this magnitude cannot be used to infer the detailed pressure distributions in the jet, it would provide an integral value to assess the accuracy of the corrected probe response.

Additional measurements which support this inferred behavior of the jet momentum flux are provided by two studies of a plane jet.

Measurements by Miller and Comings (1957) for a plane jet show a constant momentum flux in the fully developed region of very nearly 1.40 times the exit momentum flux. This is calculated using the fact that their normalized velocity profiles (U/U_c versus y/b) are very closely fitted with a gaussian profile

$$U/U_c = \exp\left(-\pi/8\,(y/b)^2\right). \qquad (4.5)$$

This gives a momentum flux

$$\dot{m} = U_c^2 b \int_{\infty}^{\infty} \rho \exp(-\pi/4\ (y/b)^2)\ dy/b = 2\rho\, U_c^2 b. \qquad (4.6)$$

When normalized on the exit momentum flux this becomes

$$\dot{m}/\dot{m} = (2U_c^2/U_e^2)\ (b/a) \qquad (4.7)$$

The values of U_c^2/U_e^2 and b/a presented by the authors were used to evaluate this ratio; a nominal value of 1.4 was obtained.

Similar results have been obtained by Clark (1974). A gradual increase in the momentum flux ratio from 1.0 to approximately 1.3 was observed in the region $0 \leq x/a \leq 15$.

The corresponding value for the axisymmetric jet of Wygnanski and Fiedler (1969) is 1.24. This value assumes a "top-hat" exit profile, a conservative estimate, and would be larger if u'^2 were included.

4.3. Centerline Velocity Decay

After considering the momentum and mass flux behavior as a function of initial turbulence structure it would appear that there is no significant difference in the development due to various initial turbulence structures. It should be remembered, however, that the momentum and mass fluxes are integral quantities and therefore cannot reveal differences in the detailed structure of the flow. As will be shown by considering the centerline velocity decay and spread of the jet as a function of x/D, the mean velocity profiles spread faster (and decay faster) for the higher intensity larger scale initial condition cases.

Figure 11 is a plot of $(U_c/U_e)^{-1}$ versus x/D for all of the initial conditions investigated. The inverse function was selected because in the region of the jet where similarity of the velocity field holds ($x/D \gtrsim 40$), the centerline velocity should be proportional to $(x/D)^{-1}$. That is, the slope of this curve in the fully developed region should be 0.167 as reported by Flora and Goldschmidt (1969) for the axisymmetric jets of Miller and Comings (1957) and Van der Hegge Zijnen (1958). The results of Wygnanski and Fiedler (1965) show that the value is more nearly 0.20 based upon data further downstream. As is indicated in Figure 11, the slopes of the curves vary from 0.125 for the low intensity small scale cases to 0.147 for the largest intensity largest scale case in the $0 \leq x/D \leq 10$ region.

In addition to the cases shown, a case was run with no jet grid present giving an intensity of 0.4 percent and the centerline velocity decay was the same as that for the minimum scale and intensity case. This indicates that a lower asymptotic value for the centerline velocity decay exists for zero initial intensity and is near the value reported for the lowest intensity cases.

The observation that the curves are diverging and the fact that they will eventually attain a slope equal to that of the fully developed jet indicates the possibility of a considerable difference in the measured virtual origins. The virtual origins are measured from data in the fully developed region and determined from

$$(U_c/U_e)^{-1} = K\,(x/D - C) \tag{4.8}$$

where K is the slope of the curve (about 0.167) and C is the virtual origin. The notation is that of Flora and Goldschmidt (1969), who have compiled K and C values from numerous experiments. Therefore, there are significant differences in the measured centerline velocities in the initial region and an indication of even larger differences in this quantity in the fully developed region at a given x/D location as a function of initial turbulence structure at the exit plane.

4.4. Centerline RMS

A similar influence of the exit plane condition is indicated by the variation of the root mean square axial velocity fluctuation as a function of x/D. Figure 12 shows the RMS velocity fluctuation normalized by the exit velocity versus x/D. As the centerline velocity data indicated, the higher intensity larger scale cases tend to develop sooner than the lower intensity smaller scale cases. This is seen as a more rapid rise and decay of the centerline RMS for the higher intensity and larger scales.

It was originally thought that this more rapid rise could possibly be due to the difference in Reynolds number between the cases (6.5×10^4 for highest intensity largest scale to 1.0×10^5 for lowest intensity smallest scale). To determine the effect of this Reynolds number range, one additional case was run at the lower Reynolds number with no jet grid (0.4 percent intensity), and it was found that the centerline behavior agreed very well with the no jet grid case run at the highest Reynolds number. In addition, both of the no jet grid cases were in good agreement with the results of Crow and Champagne (1970) for their no forcing condition.

The velocity fluctuation intensity results and their implication of an upstream shift in the initiation of significant dynamic processes in the jet are in excellent agreement with the results of Crow and Champagne who found that an axisymmetric jet responds to certain preferred modes of forcing. The two experiments are complementary; they introduced single frequencies into the jet and studied the resulting behavior. The present study involves the introducing of a wide distribution of turbulence scales and the determination of the resultant behavior of the jet. The results of the present investigation substantiate the results of Crow and Champagne in that the higher intensity cases contain more energy at the preferred modes (and harmonics) and thus should and do show a more rapid increase in centerline intensity distribution.

4.5. Jet Spread

It is difficult to define a meaningful measure of the jet spread. In the region where the flow is self-preserving, the most common measure of jet spread is to use the radius at which the axial velocity component is one-half of the centerline value. (The half-velocity point is a good indication of the relative width of the mean velocity profile only if the velocity profiles are similar.) The half-velocity point can be used as a normalizing factor for the radial coordinate along with the centerline velocity as the normalizing factor for the velocity to reduce the velocity profiles to a single curve. This is not true for the present case because the mean velocity profiles are not self-similar in the initial region.

The purpose of defining any measure of jet spread is to indicate the rate at which the jet is growing in the radial direction as it proceeds downstream. Possibly a more direct measure of radial growth would be obtained by plotting the locus of positions of constant probability that the fluid passing that location will be vortical at that instant. In fact, if the probability of one-half is chosen, then the locus of points will indicate the mean radial position of the vortical-non-vortical interface. Figure 13 shows a plot of such positions as a function of x/D for the cases investigated. This figure indicates that there is no measurable difference in the mean position of the viscous superlayer for the range of conditions investigated. This is not surprising if one considers that the mass and momentum flux distributions were independent of the exit plane conditions. A similar behavior of the flux quantities indicates a similarity of the pressure effects which would dictate the curvature of streamlines or mean spread of the vortical flow.

However, as shown by Figure 14, there is a measurable difference in the excursions of the viscous superlayer. Differences in the measured superlayer excursions could be associated with two quite different physical phenomena. Either the jet could be increasing in width instantaneously followed by a narrowing of the jet, or the jet could be whipping, i. e. , maintaining a constant width and simply moving back and forth. Figure 14 is a plot of the radial separation between the positions of an intermittency factor of 95 percent to that of 5 percent. As the figure indicates, the higher intensity larger scale cases have a wider intermittent zone than the lower intensity smaller scale cases. The fact that the curves are essentially parallel is significant. These results are consistant with the flow visualization studies of Crow and Champagne (1970) and their major conclusions which is summarized by them as:

> "...a forced axisymmetric wave amplifies owing to the linear instability of a top-hot jet column, saturates under the non-linear action of a harmonic, and finally decays owing to an essentially linear process, either mean-field changes or eddy damping."

Consequently, the parallel character of the curves is interpreted as an indication of a more rapid amplification due to the presence of more energy at the preferred modes for the higher intensity larger scale cases.

Note also that these results are consistant with the centerline velocity decay and more rapid increase and subsequent decay of the centerline RMS for higher intensity cases. That is, there is an increased excursion of the superlayer interface resulting in a quicker penetration of the so-called potential core and the resultant increase in centerline RMS and velocity decay.

The total rate of vorticity diffusion in a given region of the jet flow is related to but not controlled by the excursions of the superlayer as revealed by the ($R_{\gamma = 0.95} - R_{\gamma = 0.05}$) plots discussed above. The local rate is related to the instantaneous Laplacian of the vorticity evaluated at the location of the superlayer as shown by the vorticity transport equation, viz.,

$$\frac{D\breve{\omega}_i}{Dt} = \breve{\omega}_j \frac{\partial \breve{U}_i}{\partial x_j} + \nu \frac{\partial^2 \breve{\omega}_i}{\partial x_j \partial x_j} \tag{4.9}$$

The area of the interface in a given region of the jet is a function of the corrugations of the superlayer, as discussed extensively by Phillips (1972), and these corrugations are influenced by all scales of the turbulent motion. It is instructive to note that the vortical mass flux is insensitive to the exit plane conditions, whereas the excursion of the superlayer shows a definite dependence upon these conditions.

5. CONCLUSIONS

The following conclusions are supported by the results of this study. These conclusions are based upon the investigation of eight discrete exit plane conditions involving an essentially uniform mean velocity profile (nozzle boundary layer/diameter $\lesssim 0.02$) and turbulence structure conditions described by $0.004 \leq u'(o,r)/U(o) \leq 0.036$ and $.075 \leq \Lambda/D \leq 0.13$.

1.) The mass-flux-increase rate is negligibly influenced by the exit plane turbulence conditions.

2.) The mass-flux-increase rate attains its asymptotic value of ≈ 0.32 at approximately $x/D = 6$.

3.) Separate measurement of the vortical mass flux demonstrates that the total mass flux involves a significant fraction ($\approx$ 20 percent) of non-vortical fluid at $x/D = 10$. This suggests that the word "entrainment" should not be used without further definition or qualification in order to distinguish between the movement of fluid across a plane of constant x and the diffusion of vorticity into the external fluid.

4.) Contrary to our a priori expectation, the momentum flux (the integral over a plane of the average of the squared longitudinal velocity, $U^2 + u'^2$) increases to approximately 125 percent of its exit plane value at $x/D = 10$. This behavior is apparently not influenced by the exit plane turbulence conditions. It is presumed that the asymptotic value is of this order.

5.) The increased momentum flux value must be balanced by a net static pressure force acting differentially between the exit plane ("zero" force resulting from $p(0,r) \approx p_{atm}$) and the x location of the increased momentum flux. (No detailed pressure measurements were attempted.)

6.) The influence of the exit plane conditions are revealed by measures of the structure of the jet; specifically,

i) The centerline mean velocity and turbulence intensity values exhibit an upstream shift in their characteristic variation as the intensity and/or scale of the turbulence is increased.

ii) A width measure, based upon the radial distance between the 0.05 and 0.95 intermittency values, increases linearly with x/D for all exit plane conditions but is an increasing function of the scale and intensity at a given x/D location.

7.) The turbulence structure effects identified in 6.i and 6.ii indicate that the exit plane conditions influence the initiation of, but not the mechanics of, the controlling processes of the jet flow in the initial region.

APPENDICES

APPENDIX A

FULLY DEVELOPED PIPE FLOW

As stated in the accuracies section, the overall accuracy of the measurements of turbulence quantities was checked by making measurements in a fully developed pipe flow facility. The measured values of u' and v' can be compared with the published results of Laufer (1954). Also, the total shear stress at any radius can be computed from a measure of the pressure gradient along the pipe. If the flow in the pipe is fully developed, i. e. there are no changes in the velocity field with streamwise location, then a simple force balance between the wall shear stress (τ_w) and the pressure drop between two x - locations (x_1 and x_2) gives

$$(p_2 - p_1)\,\pi r^2 = \tau_w\,(x_2 - x_1)\cdot 2\pi r$$

or

$$\tau_w = \frac{r\,(p_2 - p_1)}{2\,(x_2 - x_1)}$$

Because the velocity field is fully developed, the wall shear stress can not vary with x, therefore the pressure gradient must be a constant. Also, since the flow is fully developed, the radial pressure gradient is zero (no streamline curvature), thus, the total shear stress varies linearly with radius. In a turbulent pipe flow, the total shear stress is the sum of the viscous shear and Reynolds shear stresses. The viscous shear stress is dominant at and very near the wall but becomes insignificant in comparison to the Reynolds shear stress in the central part of the flow field. Thus, from a measure of the pressure drop along the pipe, the Reynolds shear stress ($\overline{u\,v}$) can be computed. This value can then be compared with the measured value to evaluate the accuracy of the data acquisition facility.

The pressure drop along the fully developed pipe flow facility was measured with an electronic pressure transducer with a full scale sensitivity of 10 volts equal to 0.30 inches of water. The plot of pressure versus streamwise location is shown in Figure 15. The calculated Reynolds stress and the measured values are shown in Figure 16. The agreement is considered to be excellent for this difficult measurement. The data demonstrates a "stairstep function" centered along the mean curve inferred from the pressure measurements. The small velocities required to obtain a Reynolds number of 5×10^4 caused a low level output voltage from the thermal anemometer. The consequent "round-off" error in the analog to digital conversion is considered to be responsible for the "non-smooth" behavior of the $-\overline{uv}/u_2$ curve.

The measured values of u' and v' measured in the pipe at a Reynolds number of 41,000 are shown in Figure 17 with the results of Laufer (1954). The results of Laufer are generally accepted as the most accurate to date for the fully developed pipe flow and are thus used as a standard of comparison.

A direct comparison with known results is important when conducting an experimental investigation in turbulence research due to the nature of the measurement techniques. There are several factors which affect the response of the hot-wire probe and the thermal anemometer. For example, when an x-array is used, as in the present investigation, the relative angle between the wires has a strong influence upon the Reynolds stress measurement. A difference of a few degrees in the included angle can make very large changes in the measured value. Also, it is difficult to accurately measure the relative angle to within the necessary accuracy. But, with a direct comparison with known results (from pressure measurements), the cumulative effect of all such influences can be determined.

The results for the Reynolds stress measurements are considered to be confirmation that the data acquisition facility is quite accurate. The differences between the measured u' and v' distributions and those of Laufer could very well be due to differences in the flow facilities. The present pipe flow facility certainly has a higher relative roughness than the polished brass pipe used by Laufer. This could result in the slightly different trends of the u' and v' data compared with the Laufer study.

APPENDIX B

THERMAL ANEMOMETER CALIBRATION

The calibration of the thermal anemometer used in making turbulence measurements is a critical part of the overall accuracy. When converting a measured voltage output of the thermal anemometers to the corresponding velocity measures ($U, V, u', v', \overline{uv}$), the accuracy of the calibration curves (voltage versus velocity) directly affect the accuracy of the results. The most sensitive measures to calibration errors are the turbulence quantities.

The turbulence quantities are obtained by multiplying the mean of the squared voltage minus the mean voltage squared by the square of the slope of the calibration curve. The slope of the calibration curve was evaluated at the mean voltage point. Thus, "local" linearity of the thermal anemometer was assumed. That is, even though linearizers were used, the curves were only assumed to be linear over the variation of the voltage fluctuations about the mean value of the voltage. The accurate determination of the slope of the calibration curve is, therefore, essential for accuracy in the turbulence quantities. For this reason, a polynomial was fitted to the original calibration points and then the slope was found by taking the derivative of the polynomial. A calibration curve and its corresponding polynomial is shown in Figure 18. This figure demonstrates the excellent fit of a fourth order polynomial. A fourth order curve was chosen by fitting polynomials of order 1 to 13 to a given set of data. The sum of the squared errors was obtained and it was found that the sum of the squared error was very nearly constant for the fourth and higher order polynomials. Thus, because of the computer time required to complete a least square fit, it was decided that the fourth order would be the most appropriate polynomial to use.

APPENDIX C

EXIT CONDITION DOCUMENTATION

The exit conditions for the various cases used in the present investigation are documented in this section. A description of the physical parameters and the corresponding flow field measures are given.

The exit condition generation is described in the text. The quantities varied were the supply pressure to the jet tube array, the spacing of the jet tube array and the main blower speed. These variations resulted in different turbulence structures at the exit plane. There are several measures of turbulence structure which were made at the exit plane.

Both longitudinal and lateral correlation functions were computed. From these both integral (Λ) and micro (λ) scales were computed. The integral scale was calculated directly as the area under the (spatial) correlation function. The micro scales are defined as the separation distance at which the osculation parabola, fit to the correlation curve at zero separation, crosses the separation variable axis. That is, it satisfies the relationship

$$f = 1 - \frac{\Delta x^2}{\lambda_x^2}$$

and

$$g = 1 - \frac{\Delta x^2}{\lambda_y^2}$$

where f is the longitudinal correlation function $\overline{u(x)u(x+\Delta x)}$ and g is the lateral correlation $\overline{v(x)v(x+\Delta x)}$. The micro scales were determined by evaluating

$$\lambda_x \simeq \sqrt{\frac{\Delta x^2}{1-f}}$$

$$\lambda_y \simeq \sqrt{\frac{\Delta x^2}{1-g}}$$

for several values of x and determining the constant values of this function near x = 0. This method minimizes the influence of small variations in the correlation functions near zero separation.

A summary of the physical conditions and resulting exit conditions is shown in Table C.1. The actual correlation functions are given in Figure 19 through 27.

Table C. 1 Exit Conditions

Jet Grid Spacing (in.)	Pressure (psi)	Blower Speed (rpm)	Λ_x/D	Λ_y/D	λ_x/D	λ_y/D	u'/Ue	v'/Ue
.5	25	0	.13	.052	.058	.058	.038	.033
.4	25	0	.14	.093	.085	.065	.037	.020
.3	25	0	.11	.046	.086	.071	.028	.020
.5	15	990	.10	.052	.058	.050	.020	.020
.4	15	990	.10	.052	.083	.070	.015	.011
.3	15	990	.09	.053	.075	.071	.016	.015
.5	5	990	.074	.049	.051	.046	.013	.014
.4	5	990	.083	.057	.060	.050	.012	.010

APPENDIX D

ADDITIONAL RESULTS

This section contains listings of the data obtained in the present investigation. As a result of the general capability of the data acquisition facility, considerably more data than was necessary to meet the direct objectives of this study was obtained. Since this information could be useful to other problems, e.g., aerodynamic noise generation and ejector studies, they are included in the spirit of the Stanford boundary layer conference in 1968 and the Langley Working Conference on Free Turbulent Shear Flows, 1972. This spirit is expressed by the following quote from the report of the Committee to Recommend Critical Experiments of the latter reference.

> "The committee believes that rapid advancement of predictive capability requires more complete reporting of experimental data and also requires arrangements for storage of complete original data in suitable archives (not merely on small published figures)."[1]

The data for each of the exit conditions is subdivided into the vortical and non-vortical averages. Each table contains data for one streamwise location and one of the conditions. The velocity data is presented in a dimensionless form, being normalized by the centerline mean axial velocity. The values of the normalizing factors are included in the captions. The fourth column (Θ) is the angle between the mean velocity for the condition (vortical or non-vortical) and the x-axis. The eighth column (γ_v) is the fraction of time the flow is vortical. The last column (C/T) is the number of mode switches from the vortical to the non-vortical condition divided by the total time giving the number of mode switches per second.

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[1] Free Turbulent Shear Flows, NASA Langley Research Center, NASA SP-321, 1972 p. 659.

TABLE D-1 DATA LISTING

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
0.500	0.130	0.052	0.058	0.058

U_c(fps) =70.190 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.005	0.006	0.366	0.038	0.031	-0.002	0.999	0.333
0.050	1.009	0.010	0.588	0.035	0.030	-0.001	0.999	0.466
0.100	1.031	0.002	0.156	0.038	0.032	-0.001	0.999	0.333
0.150	1.037	0.006	0.340	0.036	0.032	-0.000	0.999	0.200
0.200	1.026	0.004	0.247	0.035	0.031	0.000	0.998	0.933
0.250	1.032	0.007	0.437	0.038	0.032	0.002	0.999	0.400
0.300	1.033	0.006	0.376	0.038	0.032	0.002	0.999	0.866
0.350	1.025	0.007	0.408	0.040	0.034	0.003	0.999	0.466
0.400	1.007	0.008	0.468	0.043	0.044	0.003	0.999	0.266
0.450	0.955	0.021	1.281	0.084	0.084	0.029	0.999	0.066
0.500	0.569	0.047	4.731	0.127	0.125	0.076	1.000	0.000
0.550	0.198	0.033	9.629	0.087	0.074	0.028	0.991	6.733
0.600	0.096	0.035	20.186	0.045	0.023	0.012	0.147	99.933
0.650	0.033	0.009	16.726	0.018	0.012	0.001	0.058	3.200
0.700	0.026	0.006	13.518	0.002	0.001	0.000	0.017	3.400
0.750	0.025	0.007	15.585	0.000	0.000	0.000	0.000	3.000
0.000	1.021	0.001	0.085	0.038	0.032	-0.001	0.999	0.533
-0.050	1.005	0.001	0.079	0.036	0.030	-0.001	0.999	0.333
-0.100	1.001	0.004	0.229	0.039	0.031	-0.002	0.999	0.466
-0.150	0.999	-0.002	-0.129	0.036	0.031	-0.001	0.999	0.200
-0.200	0.993	0.002	0.121	0.035	0.030	-0.001	0.999	0.133
-0.250	0.979	0.005	0.294	0.032	0.029	-0.000	0.999	0.533
-0.300	0.971	0.003	0.223	0.033	0.029	0.000	0.999	0.600
-0.350	0.976	0.004	0.267	0.036	0.030	0.000	0.998	0.800
-0.400	0.974	0.005	0.335	0.048	0.032	0.002	0.998	1.200
-0.450	0.954	-0.003	-0.233	0.082	0.056	-0.012	0.999	0.066
-0.500	0.641	-0.035	-3.129	0.128	0.119	-0.085	1.000	0.000
-0.550	0.267	-0.013	-2.936	0.110	0.078	-0.031	0.999	0.400
-0.600	0.121	-0.005	-2.602	0.059	0.028	-0.001	0.503	187.066
-0.650	0.097	-0.038	-21.803	0.035	0.015	-0.006	0.039	17.266
-0.700	0.024	-0.010	-23.899	0.000	0.000	0.000	0.000	3.000
-0.750	0.024	-0.010	-23.899	0.000	0.000	0.000	0.000	3.000

TABLE D-1 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.130	0.052	0.058	0.058

U_c(fps) = 70.190 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.024	-0.010	-23.899	0.000	0.000	0.000	0.000	3.000
-0.933	0.027	-0.013	-25.385	0.028	0.020	-0.005	0.000	3.133
-0.866	0.071	-0.026	-20.335	0.071	0.048	-0.022	0.003	4.933
-0.800	0.136	-0.082	-30.956	0.081	0.068	-0.079	0.061	30.533
-0.733	0.156	-0.068	-23.561	0.096	0.045	-0.058	0.517	79.266
-0.666	0.240	-0.043	-10.213	0.128	0.054	-0.044	0.789	87.200
-0.600	0.371	-0.023	-3.610	0.141	0.092	-0.052	0.990	7.266
-0.533	0.539	-0.024	-2.609	0.145	0.120	-0.076	0.999	0.133
-0.466	0.710	-0.021	-1.694	0.136	0.121	-0.075	1.000	0.000
-0.400	0.859	-0.007	-0.474	0.112	0.101	-0.049	0.999	0.066
-0.333	0.945	0.001	0.067	0.082	0.068	-0.014	0.999	0.600
-0.266	0.974	0.005	0.346	0.058	0.044	-0.000	0.999	0.866
-0.200	0.977	0.006	0.391	0.044	0.034	0.000	0.998	1.066
-0.133	1.003	-0.001	-0.070	0.043	0.033	-0.001	0.999	0.800
-0.066	1.009	-0.004	-0.235	0.041	0.032	-0.000	0.999	0.533
-0.000	0.996	0.000	0.035	0.038	0.031	0.000	0.999	0.533
0.066	1.018	-0.006	-0.350	0.039	0.033	0.000	0.999	0.533
0.133	1.015	-0.007	-0.446	0.041	0.034	0.002	0.998	1.133
0.199	1.018	-0.003	-0.177	0.042	0.037	0.002	0.999	0.866
0.266	1.003	-0.000	-0.032	0.046	0.045	0.003	0.999	0.466
0.333	0.992	0.005	0.331	0.063	0.065	0.012	0.999	0.400
0.400	0.921	0.015	0.979	0.102	0.091	0.041	1.000	0.000
0.466	0.752	0.030	2.303	0.140	0.112	0.072	1.000	0.000
0.533	0.554	0.042	4.377	0.146	0.116	0.079	0.999	0.133
0.600	0.359	0.043	6.909	0.133	0.099	0.064	0.989	7.466
0.666	0.229	0.037	9.154	0.113	0.034	0.046	0.777	91.266
0.733	0.167	0.047	15.829	0.100	0.088	0.068	0.253	94.000
0.800	0.130	0.041	17.579	0.079	0.087	0.046	0.101	18.333
0.866	0.047	0.012	14.712	0.048	0.037	0.012	0.059	4.133
0.933	0.032	0.006	11.535	0.027	0.021	0.003	0.000	3.266
1.000	0.026	0.004	9.927	0.000	0.000	0.000	0.000	3.000

TABLE D-1 Continued

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
3.000	0.130	0.052	0.058	0.058

U_c(fps) = 70.310 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.030	0.007	13.852	0.018	0.013	0.001	0.000	3.133
1.166	0.055	0.006	6.630	0.047	0.041	0.004	0.136	3.333
1.083	0.109	0.018	9.605	0.064	0.071	0.010	0.011	8.266
1.000	0.139	0.085	31.390	0.056	0.079	0.088	0.082	30.400
0.916	0.191	0.064	18.545	0.092	0.068	0.066	0.299	74.666
0.833	0.233	0.047	11.464	0.111	0.015	0.049	0.720	67.133
0.750	0.296	0.043	8.369	0.115	0.075	0.048	0.912	37.466
0.666	0.390	0.043	6.321	0.135	0.094	0.064	0.986	8.266
0.583	0.504	0.043	4.890	0.145	0.105	0.073	0.999	0.400
0.500	0.643	0.038	3.381	0.147	0.110	0.074	1.000	0.000
0.416	0.783	0.029	2.181	0.139	0.105	0.064	1.000	0.000
0.333	0.895	0.020	1.332	0.113	0.090	0.044	1.000	0.000
0.250	0.985	0.016	0.958	0.080	0.072	0.023	0.999	0.400
0.166	1.012	0.010	0.613	0.056	0.055	0.007	0.998	1.000
0.083	1.007	0.008	0.506	0.048	0.044	0.002	0.998	1.600
0.000	1.004	0.011	0.664	0.048	0.041	-0.000	0.999	0.866
-0.083	0.988	0.012	0.730	0.053	0.043	-0.002	0.998	1.266
-0.166	0.967	0.009	0.538	0.069	0.056	-0.008	0.999	0.600
-0.249	0.914	0.006	0.393	0.093	0.074	-0.023	0.999	0.333
-0.333	0.831	-0.000	-0.057	0.121	0.095	-0.044	1.000	0.000
-0.416	0.724	-0.009	-0.782	0.138	0.105	-0.061	0.999	0.066
-0.499	0.604	-0.010	-0.996	0.146	0.108	-0.069	1.000	0.000
-0.583	0.491	-0.014	-1.733	0.147	0.098	-0.061	0.999	0.533
-0.666	0.382	-0.014	-2.232	0.144	0.067	-0.044	0.982	10.266
-0.750	0.293	-0.015	-3.056	0.140	0.057	-0.026	0.864	50.866
-0.833	0.238	-0.033	-8.070	0.125	0.078	-0.030	0.597	89.800
-0.916	0.197	-0.038	-10.990	0.118	0.109	-0.038	0.280	70.733
-0.999	0.167	-0.006	-2.193	0.113	0.118	0.013	0.107	35.933
-1.083	0.119	-0.002	-1.433	0.090	0.095	0.009	0.027	13.866
-1.166	0.068	-0.002	-1.806	0.070	0.053	0.005	0.003	4.866
-1.250	0.031	-0.001	-3.044	0.027	0.021	0.000	0.000	3.200

TABLE D-1 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.130	0.052	0.058	0.058

U_c(fps) = 70.574 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.037	-0.000	-0.163	0.031	0.026	0.001	0.001	3.533
-1.400	0.068	0.001	1.352	0.068	0.060	0.005	0.003	4.533
-1.300	0.144	-0.000	-0.140	0.107	0.114	0.020	0.027	13.733
-1.200	0.140	-0.057	-22.271	0.072	0.078	-0.064	0.157	23.733
-1.100	0.191	-0.040	-11.974	0.104	0.110	-0.048	0.204	55.533
-1.000	0.237	-0.039	-9.342	0.119	0.084	-0.034	0.491	79.400
-0.900	0.270	-0.023	-4.927	0.126	0.066	-0.029	0.720	72.733
-0.800	0.327	-0.012	-2.220	0.144	0.052	-0.026	0.907	35.266
-0.700	0.405	-0.009	-1.403	0.150	0.063	-0.047	0.978	11.000
-0.600	0.497	-0.011	-1.324	0.164	0.060	-0.061	0.998	1.333
-0.500	0.600	-0.014	-1.363	0.148	0.105	-0.068	0.999	0.266
-0.400	0.711	-0.014	-1.160	0.146	0.106	-0.068	1.000	0.000
-0.300	0.817	-0.012	-0.893	0.134	0.100	-0.052	1.000	0.000
-0.200	0.907	-0.007	-0.501	0.115	0.087	-0.033	0.999	0.333
-0.100	0.979	-0.004	-0.257	0.090	0.074	-0.014	0.999	0.800
-0.000	1.012	0.002	0.156	0.074	0.068	0.000	0.999	0.800
0.099	1.005	0.002	0.125	0.085	0.073	0.018	0.999	0.733
0.199	0.970	0.007	0.457	0.111	0.085	0.039	0.999	0.333
0.299	0.874	0.014	0.953	0.138	0.097	0.056	0.999	0.200
0.399	0.756	0.024	1.879	0.152	0.105	0.070	1.000	0.000
0.499	0.647	0.032	2.913	0.157	0.107	0.076	1.000	0.000
0.599	0.522	0.036	3.989	0.155	0.102	0.079	0.998	0.800
0.699	0.428	0.036	4.894	0.147	0.079	0.071	0.985	8.200
0.800	0.342	0.038	6.433	0.126	0.084	0.054	0.922	32.200
0.900	0.297	0.048	9.251	0.127	0.009	0.062	0.829	55.066
0.999	0.246	0.048	11.109	0.110	0.041	0.052	0.582	75.866
1.100	0.201	0.060	16.631	0.088	0.065	0.053	0.269	66.333
1.200	0.170	0.071	22.766	0.087	0.094	0.088	0.088	29.733
1.300	0.114	0.071	31.737	0.047	0.069	0.062	0.033	15.266
1.399	0.061	0.055	42.210	0.037	0.029	0.045	0.004	5.933
1.500	0.033	0.026	38.204	0.017	0.010	0.009	0.001	3.733

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.130	0.052	0.058	0.058

U_c(fps) =68.407 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.032	0.023	36.137	0.014	0.006	0.006	0.001	3.666
1.633	0.044	0.064	55.299	0.030	0.043	0.043	0.006	5.666
1.516	0.062	0.106	59.873	0.059	0.048	0.053	0.016	9.266
1.400	0.080	0.145	61.094	0.099	0.080	0.123	0.054	18.733
1.283	0.201	0.099	26.244	0.090	0.082	0.142	0.175	49.600
1.166	0.260	0.067	14.586	0.118	0.080	0.087	0.430	75.533
1.050	0.303	0.047	8.903	0.128	0.051	0.065	0.688	72.066
0.933	0.345	0.044	7.297	0.132	0.070	0.061	0.837	48.200
0.816	0.433	0.039	5.241	0.146	0.098	0.072	0.966	15.133
0.700	0.510	0.037	4.214	0.158	0.104	0.083	0.991	5.200
0.583	0.631	0.041	3.797	0.167	0.112	0.092	0.999	0.533
0.466	0.723	0.033	2.630	0.170	0.114	0.086	1.000	0.000
0.350	0.852	0.027	1.818	0.166	0.113	0.079	1.000	0.000
0.233	0.945	0.016	1.027	0.154	0.109	0.058	1.000	0.000
0.116	0.996	0.005	0.336	0.140	0.104	0.033	0.999	0.066
0.000	1.011	-0.000	-0.016	0.133	0.104	-0.002	0.999	0.466
-0.116	0.975	-0.009	-0.573	0.141	0.108	-0.030	0.999	0.066
-0.233	0.888	-0.012	-0.836	0.156	0.112	-0.060	0.999	0.066
-0.349	0.763	-0.011	-0.896	0.161	0.115	-0.077	1.000	0.000
-0.466	0.677	-0.016	-1.356	0.169	0.100	-0.080	0.999	0.066
-0.583	0.579	-0.012	-1.198	0.175	0.074	-0.073	0.997	1.666
-0.699	0.487	-0.010	-1.176	0.159	0.078	-0.058	0.989	5.933
-0.816	0.401	-0.017	-2.478	0.147	0.063	-0.044	0.943	23.133
-0.933	0.337	-0.025	-4.330	0.131	0.041	-0.032	0.828	54.533
-1.050	0.292	-0.038	-7.422	0.144	0.104	-0.044	0.629	73.800
-1.166	0.256	-0.049	-10.828	0.146	0.130	-0.051	0.395	75.400
-1.283	0.220	-0.046	-11.944	0.130	0.129	-0.053	0.199	50.000
-1.399	0.195	-0.014	-4.351	0.148	0.149	0.024	0.079	28.600
-1.516	0.135	-0.008	-3.731	0.111	0.111	-0.000	0.022	11.533
-1.633	0.090	0.019	12.366	0.071	0.061	0.020	0.007	5.866
-1.750	0.038	0.005	8.439	0.023	0.016	0.002	0.002	4.066

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.130	0.052	0.058	0.058

U_c(fps) = 62.270   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.000	0.067	0.014	12.150	0.071	0.060	0.020	0.003	4.333
-1.866	0.121	0.017	8.005	0.126	0.116	0.061	0.007	6.466
-1.733	0.178	0.017	5.541	0.132	0.138	0.088	0.035	15.933
-1.600	0.164	0.077	25.160	0.095	0.091	0.169	0.414	18.333
-1.466	0.267	-0.046	-9.811	0.176	0.180	-0.060	0.161	45.200
-1.333	0.306	-0.059	-11.025	0.144	0.111	-0.059	0.361	72.600
-1.200	0.348	-0.047	-7.763	0.162	0.119	-0.048	0.570	71.800
-1.066	0.385	-0.039	-5.816	0.174	0.097	-0.048	0.720	67.466
-0.933	0.440	-0.025	-3.268	0.176	0.047	-0.048	0.882	40.800
-0.800	0.531	-0.020	-2.212	0.185	0.070	-0.069	0.966	16.000
-0.666	0.621	-0.017	-1.640	0.190	0.094	-0.089	0.992	4.400
-0.533	0.716	-0.017	-1.372	0.203	0.095	-0.103	0.999	0.666
-0.400	0.816	-0.020	-1.426	0.208	0.092	-0.098	0.999	0.200
-0.266	0.906	-0.018	-1.186	0.182	0.134	-0.076	1.000	0.000
-0.133	0.982	-0.013	-0.798	0.182	0.135	-0.044	1.000	0.000
-0.000	1.007	-0.003	-0.193	0.179	0.134	-0.002	1.000	0.000
0.133	0.990	0.005	0.311	0.185	0.130	0.042	1.000	0.000
0.266	0.930	0.019	1.194	0.191	0.130	0.073	0.999	0.066
0.399	0.830	0.029	2.046	0.194	0.130	0.097	0.999	0.266
0.533	0.718	0.033	2.676	0.194	0.126	0.110	0.998	1.400
0.666	0.620	0.034	3.149	0.184	0.119	0.108	0.990	5.333
0.800	0.545	0.039	4.097	0.183	0.097	0.110	0.969	13.733
0.933	0.485	0.040	4.783	0.163	0.093	0.086	0.944	23.266
1.066	0.420	0.048	6.553	0.165	0.033	0.091	0.837	47.733
1.200	0.361	0.055	8.745	0.147	0.044	0.079	0.660	71.066
1.333	0.298	0.068	12.999	0.139	0.108	0.108	0.421	62.266
1.466	0.264	0.094	19.692	0.134	0.130	0.178	0.213	49.733
1.600	0.160	0.150	43.055	0.055	0.026	0.186	0.075	25.066
1.733	0.174	0.103	30.670	0.096	0.103	0.134	0.036	14.666
1.866	0.122	0.079	33.138	0.077	0.075	0.087	0.018	8.733
2.000	0.052	0.039	37.205	0.034	0.021	0.018	0.003	4.400

TABLE D-1 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.130	0.052	0.058	0.058

U_c(fps) = 52.270 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.043	0.027	31.996	0.021	0.017	0.009	0.001	3.333
2.333	0.050	0.032	32.502	0.029	0.013	0.017	0.002	3.933
2.166	0.085	0.073	40.877	0.057	0.021	0.093	0.005	5.866
2.000	0.173	0.125	35.821	0.068	0.079	0.186	0.278	10.333
1.833	0.236	0.142	31.170	0.117	0.136	0.329	0.048	18.600
1.666	0.262	0.127	25.864	0.129	0.131	0.248	0.178	31.066
1.500	0.361	0.092	14.392	0.141	0.070	0.117	0.359	57.733
1.333	0.407	0.071	9.919	0.155	0.054	0.096	0.517	75.400
1.166	0.452	0.057	7.285	0.172	0.031	0.104	0.685	67.600
1.000	0.536	0.054	5.822	0.176	0.108	0.106	0.886	39.733
0.833	0.636	0.048	4.390	0.187	0.127	0.116	0.975	12.400
0.666	0.746	0.048	3.744	0.196	0.134	0.118	0.995	2.466
0.500	0.839	0.043	2.993	0.200	0.136	0.105	0.999	0.600
0.333	0.929	0.037	2.329	0.197	0.140	0.070	0.999	0.200
0.166	0.978	0.021	1.282	0.194	0.142	0.033	0.999	0.200
0.000	0.995	0.008	0.483	0.191	0.143	-0.007	0.999	0.133
-0.166	0.947	-0.002	-0.143	0.193	0.144	-0.058	0.999	0.066
-0.333	0.870	-0.003	-0.251	0.204	0.134	-0.087	0.999	0.266
-0.499	0.788	-0.006	-0.446	0.202	0.128	-0.094	0.997	1.600
-0.666	0.689	-0.006	-0.551	0.209	0.076	-0.074	0.982	8.400
-0.833	0.599	-0.011	-1.144	0.209	0.024	-0.062	0.949	21.666
-0.999	0.524	-0.017	-1.940	0.184	0.077	-0.058	0.895	33.266
-1.166	0.456	-0.044	-5.518	0.193	0.101	-0.057	0.741	65.933
-1.333	0.401	-0.050	-7.173	0.186	0.125	-0.060	0.514	72.000
-1.500	0.364	-0.078	-12.156	0.192	0.184	-0.113	0.334	67.733
-1.666	0.311	-0.076	-13.747	0.161	0.167	-0.132	0.169	45.733
-1.833	0.258	-0.077	-16.623	0.136	0.145	-0.118	0.061	22.533
-1.999	0.210	-0.025	-6.977	0.159	0.161	-0.009	0.021	11.333
-2.166	0.111	-0.010	-5.394	0.129	0.118	-0.019	0.006	5.800
-2.333	0.061	-0.018	-17.026	0.053	0.034	-0.008	0.001	3.600
-2.500	0.043	-0.017	-22.462	0.019	0.010	-0.002	0.000	3.133

TABLE D-2 DATA LISTING

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
0.500	0.140	0.093	0.085	0.065

U_c(fps) = 86.983   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.021	-0.012	-0.718	0.032	0.029	-0.001	0.999	0.000
0.050	1.030	0.013	0.755	0.031	0.027	-0.000	1.000	0.000
0.100	1.026	-0.002	-0.114	0.032	0.028	-0.000	1.000	0.000
0.150	1.023	0.001	0.061	0.035	0.028	0.000	1.000	0.000
0.200	1.013	-0.001	-0.064	0.036	0.029	0.001	1.000	0.000
0.250	1.001	0.002	0.139	0.040	0.031	0.001	0.999	0.066
0.300	0.992	0.003	0.208	0.043	0.032	0.000	1.000	0.000
0.350	0.981	0.004	0.264	0.044	0.034	0.000	1.000	0.000
0.400	0.986	0.007	0.442	0.045	0.042	0.001	1.000	0.000
0.450	0.939	0.014	0.894	0.078	0.074	0.019	1.000	0.000
0.500	0.637	0.041	3.707	0.126	0.119	0.078	1.000	0.000
0.550	0.282	0.019	3.942	0.108	0.094	0.050	0.999	0.000
0.600	0.088	-0.054	-31.442	0.048	0.022	-0.010	0.914	41.266
0.650	0.033	0.052	57.321	0.012	0.026	0.006	0.072	93.666
0.700	0.024	0.036	56.015	0.013	0.022	0.004	-0.000	6.666
0.750	0.012	0.020	57.579	0.002	0.003	0.000	0.029	3.800
0.000	1.026	0.004	0.256	0.031	0.028	-0.001	1.000	0.000
-0.050	1.016	0.005	0.337	0.031	0.027	-0.001	0.999	0.066
-0.100	1.010	0.004	0.250	0.031	0.026	-0.001	1.000	0.000
-0.150	1.002	0.006	0.379	0.033	0.027	-0.002	1.000	0.000
-0.200	0.989	0.009	0.538	0.030	0.025	-0.001	1.000	0.000
-0.250	0.975	0.011	0.647	0.030	0.025	-0.001	1.000	0.000
-0.300	0.979	0.009	0.527	0.031	0.025	-0.001	1.000	0.000
-0.350	0.970	0.008	0.504	0.036	0.026	-0.000	1.000	0.000
-0.400	0.963	0.009	0.591	0.052	0.030	0.000	0.999	0.000
-0.450	0.904	-0.008	-0.517	0.096	0.075	-0.036	1.000	0.000
-0.500	0.567	-0.032	-3.295	0.129	0.116	-0.072	1.000	0.000
-0.550	0.238	-0.021	-5.226	0.102	0.075	-0.026	0.999	0.133
-0.600	0.102	-0.004	-2.702	0.050	0.020	-0.002	0.857	92.933
-0.650	0.064	-0.035	-28.575	0.028	0.018	-0.004	0.159	106.800
-0.700	0.032	-0.016	-26.815	0.020	0.013	-0.003	-0.002	4.400
-0.750	0.021	-0.008	-22.460	0.000	0.000	0.000	-0.002	3.000

TABLE D-2 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.140	0.093	0.085	0.065

U_c(fps) = 86.983 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.023	-0.009	-22.368	0.011	0.006	-0.001	-0.001	3.133
-0.933	0.031	-0.014	-24.227	0.024	0.008	-0.004	0.050	4.600
-0.866	0.049	-0.065	-53.242	0.015	0.041	-0.051	0.007	9.600
-0.800	0.069	-0.084	-50.489	0.024	0.043	-0.052	0.078	45.000
-0.733	0.117	-0.094	-39.043	0.069	0.042	-0.056	0.478	117.400
-0.666	0.227	-0.043	-10.900	0.119	0.034	-0.037	0.920	42.666
-0.600	0.357	-0.034	-5.483	0.142	0.083	-0.050	0.998	1.533
-0.533	0.518	-0.027	-3.059	0.144	0.115	-0.064	1.000	0.000
-0.466	0.683	-0.017	-1.464	0.139	0.119	-0.068	1.000	0.000
-0.400	0.834	-0.003	-0.224	0.120	0.104	-0.057	1.000	0.000
-0.333	0.936	0.003	0.217	0.084	0.071	-0.025	0.999	0.000
-0.266	0.967	0.013	0.776	0.058	0.042	-0.004	1.000	0.000
-0.200	0.995	0.009	0.536	0.044	0.032	-0.002	0.999	0.066
-0.133	1.002	0.011	0.666	0.037	0.028	-0.001	1.000	0.000
-0.066	1.016	0.010	0.578	0.035	0.027	-0.001	0.999	0.066
-0.000	1.029	0.008	0.472	0.032	0.028	-0.000	0.999	0.000
0.066	1.023	0.005	0.305	0.035	0.030	0.000	0.999	0.066
0.133	1.022	0.007	0.416	0.037	0.033	0.000	0.999	0.066
0.199	1.015	0.009	0.549	0.044	0.038	0.001	1.000	0.000
0.266	0.998	0.009	0.540	0.051	0.049	0.002	0.999	0.066
0.333	0.968	0.013	0.772	0.068	0.067	0.010	0.999	0.000
0.400	0.910	0.019	1.237	0.101	0.090	0.039	1.000	0.000
0.466	0.761	0.032	2.429	0.135	0.109	0.070	1.000	0.000
0.533	0.584	0.043	4.250	0.144	0.117	0.084	1.000	0.000
0.600	0.421	0.044	5.999	0.138	0.111	0.078	0.999	0.066
0.666	0.267	0.027	5.911	0.126	0.071	0.051	0.969	22.000
0.733	0.182	0.017	5.486	0.108	0.036	0.026	0.718	99.066
0.800	0.124	0.014	6.796	0.093	0.066	0.018	0.228	77.066
0.866	0.091	0.006	4.097	0.073	0.062	0.005	0.034	15.000
0.933	0.041	0.003	4.696	0.040	0.025	0.000	0.070	3.933
1.000	0.023	0.002	6.916	0.004	0.000	-0.000	0.006	4.533

TABLE D-2 Continued

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
3.000	0.140	0.093	0.085	0.065

U_c(fps) =86.400 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.022	0.028	52.095	0.007	0.011	0.006	-0.000	4.200
1.166	0.031	0.043	54.312	0.010	0.022	0.014	0.002	5.733
1.083	0.061	0.085	54.254	0.045	0.036	0.049	0.052	21.733
1.000	0.123	0.060	25.958	0.071	0.063	0.070	0.211	57.400
0.916	0.178	0.035	11.333	0.109	0.075	0.046	0.504	82.866
0.833	0.252	0.029	6.680	0.126	0.038	0.048	0.881	44.866
0.750	0.334	0.036	6.230	0.135	0.076	0.065	0.982	9.266
0.666	0.432	0.046	6.154	0.147	0.094	0.081	0.998	0.733
0.583	0.539	0.050	5.399	0.147	0.110	0.080	1.000	0.000
0.500	0.653	0.044	3.925	0.151	0.110	0.078	1.000	0.000
0.416	0.777	0.037	2.792	0.142	0.104	0.064	1.000	0.000
0.333	0.891	0.027	1.736	0.120	0.090	0.047	1.000	0.000
0.250	0.967	0.017	1.063	0.088	0.074	0.028	1.000	0.000
0.166	1.006	0.015	0.854	0.059	0.057	0.010	1.000	0.000
0.083	1.022	0.014	0.799	0.048	0.046	0.003	0.999	0.133
0.000	1.022	0.008	0.495	0.045	0.041	-0.000	0.999	0.066
-0.083	1.011	0.008	0.493	0.052	0.043	-0.004	0.999	0.133
-0.166	0.977	0.008	0.474	0.071	0.057	-0.013	0.999	0.000
-0.249	0.913	0.005	0.331	0.101	0.079	-0.031	0.999	0.066
-0.333	0.824	-0.002	-0.153	0.128	0.099	-0.051	1.000	0.000
-0.416	0.707	-0.008	-0.684	0.141	0.107	-0.057	1.000	0.000
-0.499	0.591	-0.011	-1.141	0.145	0.107	-0.059	1.000	0.000
-0.583	0.479	-0.012	-1.470	0.144	0.099	-0.054	0.999	0.066
-0.666	0.381	-0.014	-2.165	0.149	0.044	-0.042	0.996	2.533
-0.750	0.296	-0.017	-3.443	0.131	0.030	-0.031	0.958	18.400
-0.833	0.213	-0.026	-7.167	0.111	0.052	-0.026	0.763	70.800
-0.916	0.174	-0.021	-6.947	0.102	0.073	-0.023	0.492	81.066
-0.999	0.113	-0.027	-13.598	0.073	0.061	-0.025	0.513	31.533
-1.083	0.092	-0.042	-24.762	0.057	0.054	-0.035	0.067	24.333
-1.166	0.071	-0.031	-23.467	0.054	0.052	-0.027	0.022	10.933
-1.250	0.034	-0.011	-18.049	0.030	0.026	-0.006	0.000	4.000

TABLE D-2 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.140	0.093	0.085	0.065

U_c(fps) = 86.014 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.046	-0.006	-8.483	0.044	0.032	-0.004	0.002	4.800
-1.400	0.086	-0.009	-6.035	0.069	0.068	-0.009	0.012	8.000
-1.300	0.101	-0.004	-2.583	0.074	0.076	-0.000	0.030	14.333
-1.200	0.133	-0.029	-12.565	0.082	0.084	-0.029	0.147	38.266
-1.100	0.161	-0.026	-9.254	0.089	0.080	-0.025	0.435	67.200
-1.000	0.209	-0.026	-7.262	0.104	0.035	-0.022	0.652	73.666
-0.900	0.251	-0.021	-4.921	0.125	0.066	-0.028	0.865	40.466
-0.800	0.322	-0.013	-2.307	0.131	0.037	-0.031	0.973	11.600
-0.700	0.391	-0.009	-1.440	0.141	0.063	-0.040	0.996	2.266
-0.600	0.490	-0.012	-1.486	0.147	0.092	-0.055	0.999	0.266
-0.500	0.582	-0.007	-0.700	0.148	0.104	-0.061	1.000	0.000
-0.400	0.689	-0.007	-0.604	0.150	0.107	-0.065	1.000	0.000
-0.300	0.800	-0.006	-0.482	0.142	0.104	-0.058	1.000	0.000
-0.200	0.901	-0.003	-0.216	0.127	0.095	-0.044	1.000	0.000
-0.100	0.974	-0.001	-0.066	0.104	0.083	-0.024	0.999	0.066
-0.000	1.009	0.001	0.106	0.086	0.076	0.000	0.999	0.000
0.099	1.001	0.009	0.555	0.094	0.077	0.019	0.999	0.000
0.199	0.948	0.011	0.710	0.121	0.087	0.041	1.000	0.000
0.299	0.868	0.024	1.611	0.140	0.098	0.054	1.000	0.000
0.399	0.768	0.029	2.221	0.155	0.105	0.070	1.000	0.000
0.499	0.664	0.043	3.736	0.157	0.109	0.078	1.000	0.000
0.599	0.558	0.043	4.489	0.155	0.108	0.083	0.999	0.266
0.699	0.458	0.039	4.976	0.158	0.083	0.082	0.997	1.400
0.800	0.365	0.030	4.711	0.144	0.080	0.067	0.980	10.466
0.900	0.298	0.021	4.020	0.133	0.032	0.050	0.938	22.866
0.999	0.242	0.020	4.877	0.121	0.050	0.035	0.797	53.800
1.100	0.191	0.022	6.567	0.105	0.059	0.026	0.529	70.533
1.200	0.154	0.032	11.740	0.093	0.079	0.033	0.273	57.266
1.300	0.118	0.052	23.773	0.072	0.073	0.058	0.095	28.333
1.399	0.063	0.047	36.938	0.043	0.044	0.044	0.011	8.133
1.500	0.036	0.037	46.071	0.020	0.008	0.019	0.002	5.200

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.140	0.093	0.085	0.065

U_c(fps) = 83.088 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.875	0.023	0.025	46.735	0.007	0.004	0.002	0.000	3.600
1.750	0.037	0.036	44.846	0.021	0.013	0.017	0.004	5.600
1.625	0.054	0.058	47.157	0.016	0.011	0.036	0.014	8.400
1.500	0.096	0.073	37.255	0.038	0.050	0.065	0.077	22.000
1.375	0.174	0.055	17.779	0.098	0.083	0.072	0.244	50.466
1.250	0.218	0.033	8.718	0.113	0.076	0.040	0.502	65.733
1.125	0.260	0.024	5.326	0.129	0.057	0.038	0.701	63.800
1.000	0.320	0.026	4.788	0.129	0.073	0.054	0.915	29.333
0.875	0.409	0.033	4.656	0.147	0.088	0.076	0.988	6.200
0.750	0.497	0.041	4.725	0.161	0.099	0.090	0.998	0.800
0.625	0.595	0.042	4.110	0.163	0.114	0.093	0.999	0.000
0.500	0.698	0.043	3.597	0.171	0.117	0.093	0.999	0.066
0.375	0.812	0.036	2.589	0.169	0.114	0.080	1.000	0.000
0.250	0.918	0.028	1.760	0.164	0.111	0.061	1.000	0.000
0.125	0.988	0.016	0.931	0.152	0.110	0.035	1.000	0.000
0.000	1.009	0.008	0.506	0.143	0.109	-0.002	0.999	0.000
-0.125	0.956	0.007	0.425	0.153	0.116	-0.044	1.000	0.000
-0.250	0.862	-0.000	-0.019	0.162	0.119	-0.067	1.000	0.000
-0.375	0.740	-0.001	-0.123	0.168	0.117	-0.075	1.000	0.000
-0.500	0.632	-0.003	-0.292	0.169	0.112	-0.074	1.000	0.000
-0.625	0.521	-0.002	-0.226	0.168	0.079	-0.059	0.999	0.733
-0.750	0.428	-0.006	-0.805	0.156	0.067	-0.046	0.992	4.066
-0.875	0.349	-0.008	-1.365	0.150	0.045	-0.029	0.958	17.066
-1.000	0.285	-0.020	-4.077	0.128	0.046	-0.029	0.842	43.666
-1.125	0.233	-0.028	-6.959	0.112	0.056	-0.024	0.633	63.400
-1.250	0.200	-0.043	-12.291	0.106	0.079	-0.040	0.421	63.933
-1.375	0.131	-0.038	-16.118	0.079	0.065	-0.039	0.443	25.466
-1.500	0.121	-0.046	-20.849	0.059	0.060	-0.038	0.073	21.666
-1.625	0.074	-0.047	-32.525	0.038	0.042	-0.041	0.017	8.733
-1.750	0.035	-0.021	-31.219	0.027	0.011	-0.010	0.002	4.066
-1.875	0.026	-0.011	-23.973	0.008	0.006	-0.000	-0.001	3.133

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.140	0.093	0.085	0.065

U_c(fps) = 74.334 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.200	0.031	-0.014	-24.012	0.010	0.006	-0.000	-0.001	3.000
-2.053	0.056	-0.028	-26.564	0.052	0.038	-0.028	0.005	5.466
-1.906	0.092	-0.031	-18.603	0.083	0.075	-0.043	0.021	10.133
-1.760	0.138	-0.057	-22.726	0.083	0.075	-0.068	0.097	16.933
-1.613	0.186	-0.072	-21.284	0.104	0.088	-0.091	0.161	35.266
-1.466	0.212	-0.073	-18.987	0.103	0.081	-0.087	0.302	52.466
-1.320	0.270	-0.048	-10.217	0.131	0.077	-0.051	0.565	59.666
-1.173	0.322	-0.030	-5.351	0.142	0.054	-0.037	0.767	49.600
-1.026	0.379	-0.019	-2.950	0.162	0.044	-0.039	0.897	31.933
-0.880	0.460	-0.011	-1.382	0.176	0.029	-0.049	0.975	10.666
-0.733	0.539	-0.008	-0.894	0.180	0.092	-0.068	0.995	2.266
-0.586	0.660	-0.007	-0.636	0.192	0.102	-0.083	0.999	0.200
-0.440	0.765	-0.003	-0.294	0.190	0.130	-0.090	1.000	0.000
-0.293	0.873	-0.000	-0.045	0.191	0.136	-0.078	1.000	0.000
-0.146	0.957	0.002	0.177	0.185	0.137	-0.043	1.000	0.000
-0.000	1.004	0.010	0.579	0.183	0.137	0.002	1.000	0.000
0.146	0.985	0.021	1.248	0.188	0.134	0.044	1.000	0.000
0.293	0.912	0.027	1.719	0.194	0.134	0.082	1.000	0.000
0.439	0.812	0.036	2.604	0.198	0.132	0.108	1.000	0.000
0.586	0.706	0.044	3.634	0.188	0.130	0.116	0.999	0.000
0.733	0.591	0.041	3.986	0.196	0.108	0.124	0.997	1.866
0.879	0.521	0.037	4.167	0.176	0.108	0.109	0.991	5.133
1.026	0.427	0.033	4.507	0.163	0.076	0.089	0.956	16.000
1.173	0.358	0.031	5.009	0.155	0.039	0.065	0.847	41.066
1.320	0.305	0.031	5.841	0.140	0.061	0.049	0.696	59.733
1.466	0.264	0.033	7.255	0.122	0.042	0.037	0.521	62.666
1.613	0.204	0.061	16.660	0.115	0.087	0.080	0.257	40.600
1.759	0.162	0.070	23.333	0.089	0.090	0.080	0.106	28.466
1.906	0.128	0.064	26.878	0.070	0.066	0.058	0.084	15.000
2.053	0.040	0.055	54.119	0.004	0.036	0.030	0.002	5.466
2.200	0.027	0.042	57.600	0.014	0.017	0.011	0.000	4.333

TABLE D-2 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.140	0.093	0.085	0.065

U_c(fps) = 61.577 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.029	0.046	57.374	0.007	0.027	0.010	0.003	4.333
2.333	0.044	0.064	55.452	0.008	0.045	0.042	0.006	5.866
2.166	0.100	0.111	48.043	0.054	0.059	0.152	0.023	11.133
2.000	0.124	0.136	47.766	0.057	0.047	0.141	0.079	23.200
1.833	0.218	0.072	18.481	0.122	0.104	0.088	0.115	27.933
1.666	0.301	0.061	11.550	0.150	0.087	0.087	0.421	61.866
1.500	0.354	0.049	7.887	0.163	0.076	0.073	0.611	63.200
1.333	0.399	0.043	6.178	0.167	0.016	0.082	0.775	50.533
1.166	0.474	0.037	4.470	0.179	0.068	0.101	0.936	18.866
1.000	0.564	0.047	4.795	0.189	0.107	0.125	0.982	8.600
0.833	0.653	0.046	4.101	0.195	0.130	0.134	0.996	2.066
0.666	0.753	0.048	3.687	0.199	0.131	0.126	0.999	0.333
0.500	0.853	0.049	3.326	0.204	0.143	0.116	0.999	0.000
0.333	0.940	0.046	2.841	0.212	0.134	0.093	1.000	0.000
0.166	0.973	0.029	1.710	0.200	0.145	0.055	1.000	0.000
0.000	1.005	0.019	1.123	0.196	0.146	0.001	1.000	0.000
-0.166	0.973	0.008	0.487	0.196	0.147	-0.039	1.000	0.000
-0.333	0.893	0.001	0.121	0.203	0.145	-0.077	0.999	0.000
-0.499	0.797	-0.005	-0.429	0.207	0.125	-0.089	0.999	0.333
-0.666	0.683	-0.002	-0.231	0.205	0.106	-0.087	0.997	1.333
-0.833	0.596	-0.008	-0.825	0.198	0.069	-0.068	0.990	4.333
-0.999	0.513	-0.013	-1.490	0.188	0.036	-0.052	0.957	15.400
-1.166	0.424	-0.020	-2.735	0.184	0.077	-0.043	0.860	38.000
-1.333	0.366	-0.039	-6.089	0.171	0.098	-0.055	0.689	57.666
-1.500	0.315	-0.045	-8.269	0.145	0.063	-0.043	0.493	64.600
-1.666	0.276	-0.065	-13.281	0.135	0.090	-0.073	0.316	54.000
-1.833	0.227	-0.066	-16.323	0.106	0.117	-0.096	0.161	36.000
-1.999	0.186	-0.030	-9.206	0.135	0.132	-0.044	0.051	17.533
-2.166	0.133	-0.018	-7.863	0.112	0.104	-0.028	0.028	11.333
-2.333	0.076	-0.026	-19.207	0.063	0.048	-0.029	0.004	5.333
-2.500	0.055	-0.018	-18.755	0.047	0.036	-0.012	-0.000	3.733

TABLE D-3 DATA LISTING

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
0.500	0.110	0.046	0.086	0.071

U_c(fps) = 79.485   T = 30.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.019	-0.004	-0.279	0.032	0.027	-0.003	0.999	0.433
0.050	1.033	-0.004	-0.254	0.030	0.026	-0.002	0.999	0.433
0.100	1.045	-0.006	-0.353	0.030	0.027	-0.001	0.999	0.566
0.150	1.053	-0.010	-0.591	0.028	0.026	0.000	0.999	0.533
0.200	1.053	-0.010	-0.564	0.029	0.026	0.000	0.998	0.866
0.250	1.053	-0.009	-0.513	0.030	0.026	0.000	0.999	0.733
0.300	1.051	-0.010	-0.594	0.030	0.027	0.001	0.999	0.700
0.350	1.043	-0.012	-0.677	0.030	0.030	0.001	0.999	0.833
0.400	1.042	-0.010	-0.590	0.032	0.040	0.001	0.999	0.800
0.450	1.040	-0.007	-0.438	0.048	0.073	0.009	0.999	0.033
0.500	0.800	0.018	1.341	0.129	0.119	0.086	1.000	0.000
0.550	0.385	0.037	5.622	0.127	0.123	0.070	1.000	0.000
0.600	0.127	-0.001	-0.821	0.068	0.024	0.007	0.925	50.733
0.650	0.078	-0.001	-0.948	0.023	0.015	0.000	0.270	161.400
0.700	0.047	0.001	2.094	0.025	0.011	0.001	0.002	5.133
0.750	0.023	-0.002	-6.231	0.000	0.000	0.000	0.000	3.000
0.000	1.034	-0.001	-0.103	0.029	0.026	-0.001	0.999	0.200
-0.050	1.017	-0.000	-0.041	0.030	0.027	-0.002	0.999	0.800
-0.100	1.012	-0.001	-0.056	0.031	0.026	-0.002	0.999	0.466
-0.150	0.995	-0.000	-0.050	0.031	0.026	-0.002	0.999	0.333
-0.200	0.986	-0.000	-0.033	0.030	0.025	-0.001	0.999	0.733
-0.250	0.985	-0.001	-0.078	0.030	0.025	-0.001	0.998	1.066
-0.300	0.986	-0.000	-0.038	0.032	0.025	-0.000	0.999	0.666
-0.350	0.973	-0.000	-0.057	0.037	0.026	-0.000	0.999	0.600
-0.400	0.976	-0.004	-0.238	0.062	0.032	-0.001	0.999	0.466
-0.450	0.846	-0.028	-1.930	0.109	0.094	-0.054	1.000	0.000
-0.500	0.463	-0.037	-4.591	0.130	0.115	-0.072	1.000	0.000
-0.550	0.160	-0.019	-7.018	0.082	0.035	-0.013	0.975	19.866
-0.600	0.088	-0.017	-11.277	0.035	0.014	-0.002	0.391	188.466
-0.650	0.069	-0.030	-23.879	0.022	0.014	-0.002	0.041	13.066
-0.700	0.021	-0.010	-26.335	0.000	0.000	0.000	0.000	3.000
-0.750	0.021	-0.010	-26.335	0.000	0.000	0.000	0.000	3.000

TABLE D-3 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.110	0.046	0.086	0.071

U_c(fps) = 79.485 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.200	0.021	-0.010	-26.335	0.000	0.000	0.000	0.000	3.000
-1.149	0.022	-0.010	-25.629	0.006	0.001	-0.000	0.058	2.866
-1.100	0.024	-0.011	-25.201	0.007	0.002	-0.000	0.105	3.200
-1.050	0.026	-0.011	-24.149	0.011	0.003	-0.000	0.104	3.333
-0.999	0.021	-0.010	-26.335	0.000	0.000	0.000	0.000	3.000
-0.949	0.021	-0.010	-26.335	0.000	0.000	0.000	0.000	3.000
-0.900	0.034	-0.015	-24.161	0.045	0.032	-0.012	0.000	3.666
-0.849	0.082	-0.038	-25.090	0.070	0.052	-0.035	0.006	6.600
-0.800	0.129	-0.021	-9.545	0.093	0.091	-0.020	0.031	19.666
-0.750	0.151	-0.047	-17.500	0.093	0.076	-0.047	0.181	73.933
-0.699	0.174	-0.043	-13.854	0.105	0.071	-0.045	0.478	122.533
-0.650	0.231	-0.023	-5.710	0.124	0.034	-0.032	0.827	80.400
-0.600	0.316	-0.023	-4.257	0.142	0.071	-0.051	0.982	11.666
-0.550	0.432	-0.031	-4.137	0.145	0.112	-0.071	0.999	0.533
-0.500	0.551	-0.034	-3.628	0.147	0.124	-0.082	1.000	0.000
-0.450	0.687	-0.031	-2.623	0.143	0.123	-0.080	1.000	0.000
-0.400	0.814	-0.022	-1.600	0.127	0.114	-0.064	0.999	0.066
-0.350	0.904	-0.011	-0.716	0.102	0.090	-0.041	0.999	0.200
-0.300	0.947	-0.002	-0.132	0.079	0.064	-0.018	0.998	1.200
-0.250	0.967	0.001	0.098	0.062	0.044	-0.005	0.999	0.666
-0.200	0.985	-0.000	-0.005	0.048	0.033	-0.001	0.998	1.000
-0.150	0.989	-0.002	-0.167	0.041	0.029	-0.002	0.998	1.066
-0.100	1.002	-0.005	-0.323	0.037	0.028	-0.003	0.999	0.800
-0.050	1.004	-0.003	-0.187	0.034	0.026	-0.002	0.999	0.800
-0.000	1.014	-0.004	-0.281	0.032	0.026	-0.002	0.998	1.266
0.049	1.023	-0.003	-0.202	0.031	0.027	-0.001	0.998	1.000
0.099	1.032	-0.006	-0.361	0.031	0.028	-0.001	0.998	1.133
0.149	1.035	-0.005	-0.310	0.030	0.030	-0.000	0.998	1.200
0.199	1.039	-0.004	-0.225	0.032	0.033	0.000	0.998	1.133
0.249	1.036	-0.007	-0.416	0.035	0.040	0.000	0.999	0.666
0.299	1.028	-0.009	-0.543	0.040	0.052	0.003	0.998	1.133
0.349	1.012	-0.011	-0.638	0.059	0.072	0.015	0.999	0.400
0.399	0.974	-0.008	-0.502	0.095	0.092	0.043	0.999	0.066
0.449	0.877	0.000	0.055	0.130	0.110	0.068	0.999	0.066
0.499	0.748	0.011	0.853	0.151	0.121	0.080	1.000	0.000
0.549	0.602	0.023	2.229	0.157	0.121	0.080	1.000	0.000
0.599	0.459	0.026	3.326	0.154	0.116	0.077	0.999	0.266
0.649	0.328	0.023	4.055	0.142	0.093	0.061	0.987	9.000
0.699	0.229	0.014	3.642	0.135	0.047	0.037	0.829	81.466
0.749	0.176	0.010	3.537	0.106	0.055	0.021	0.480	128.000
0.799	0.140	0.001	0.646	0.099	0.086	0.001	0.214	63.200
0.849	0.124	-0.000	-0.075	0.080	0.078	-0.001	0.030	19.733
0.899	0.071	-0.002	-2.034	0.061	0.054	-0.001	0.005	6.266
0.949	0.030	-0.003	-7.234	0.023	0.019	-0.000	0.145	2.866
0.999	0.024	-0.002	-6.843	0.009	0.004	0.000	0.000	3.066
1.050	0.023	-0.003	-7.599	0.000	0.000	0.000	0.000	3.000
1.100	0.025	-0.003	-7.283	0.005	0.000	-0.000	0.063	4.400
1.149	0.023	-0.003	-7.599	0.000	0.000	0.000	0.000	3.000
1.199	0.024	-0.003	-7.727	0.003	0.000	-0.000	0.028	3.400

TABLE D-3 Continued

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
3.000	0.110	0.046	0.086	0.071

U_c(fps) =79.948 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.275	0.030	0.007	14.020	0.026	0.002	0.001	0.000	3.133
1.200	0.073	0.021	15.900	0.060	0.055	0.019	0.006	6.200
1.125	0.101	0.048	25.512	0.059	0.064	0.036	0.029	14.066
1.050	0.108	0.071	33.350	0.051	0.067	0.062	0.074	29.200
0.975	0.169	0.047	15.584	0.092	0.074	0.052	0.256	68.400
0.900	0.186	0.025	7.675	0.106	0.037	0.035	0.757	50.066
0.825	0.257	0.025	5.687	0.117	0.059	0.041	0.866	49.200
0.750	0.334	0.025	4.437	0.139	0.068	0.056	0.972	13.933
0.675	0.427	0.022	3.050	0.147	0.093	0.065	0.997	1.600
0.600	0.534	0.024	2.642	0.156	0.109	0.075	1.000	0.000
0.525	0.644	0.020	1.790	0.155	0.109	0.070	1.000	0.000
0.450	0.771	0.013	0.980	0.148	0.108	0.068	1.000	0.000
0.375	0.878	0.006	0.433	0.131	0.098	0.057	1.000	0.000
0.300	0.970	0.006	0.401	0.098	0.084	0.035	0.999	0.066
0.225	1.001	-0.000	-0.016	0.067	0.066	0.015	0.999	0.600
0.150	1.023	0.002	0.117	0.047	0.051	0.003	0.998	1.200
0.075	1.020	0.001	0.087	0.042	0.043	-0.001	0.998	1.400
0.000	1.011	0.001	0.110	0.044	0.040	-0.002	0.997	2.066
-0.074	0.997	0.001	0.112	0.051	0.044	-0.005	0.998	1.600
-0.149	0.967	0.006	0.359	0.070	0.057	-0.014	0.998	1.000
-0.224	0.921	0.000	0.004	0.094	0.076	-0.028	0.999	0.333
-0.299	0.843	-0.005	-0.407	0.123	0.096	-0.048	1.000	0.000
-0.374	0.741	-0.013	-1.057	0.141	0.108	-0.063	1.000	0.000
-0.449	0.643	-0.019	-1.717	0.147	0.112	-0.073	1.000	0.000
-0.525	0.539	-0.019	-2.104	0.156	0.096	-0.077	1.000	0.000
-0.599	0.440	-0.015	-2.051	0.144	0.100	-0.065	0.998	1.266
-0.675	0.343	-0.016	-2.765	0.142	0.057	-0.050	0.973	14.533
-0.749	0.267	-0.016	-3.421	0.132	0.037	-0.032	0.860	51.666
-0.824	0.216	-0.023	-6.114	0.119	0.075	-0.032	0.694	76.800
-0.899	0.173	-0.035	-11.680	0.104	0.087	-0.048	0.489	68.000
-0.974	0.160	-0.027	-9.883	0.098	0.097	-0.031	0.165	50.800
-1.050	0.145	-0.034	-13.429	0.087	0.098	-0.041	0.059	24.200
-1.125	0.080	-0.018	-13.005	0.067	0.069	-0.021	0.007	6.400
-1.199	0.049	-0.011	-12.550	0.046	0.036	-0.008	0.071	4.000
-1.274	0.027	-0.009	-18.847	0.029	0.022	-0.003	0.000	3.200

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
4.500	0.110	0.046	0.086	0.071

U_c(fps) =79.716 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.041	-0.011	-15.483	0.044	0.035	-0.006	0.033	4.400
-1.400	0.071	-0.014	-11.657	0.069	0.058	-0.018	0.007	5.333
-1.300	0.087	-0.077	-41.598	0.037	0.005	-0.035	0.021	10.333
-1.200	0.137	-0.080	-30.292	0.050	0.056	-0.072	0.124	29.400
-1.100	0.171	-0.056	-18.338	0.088	0.072	-0.058	0.211	51.666
-1.000	0.217	-0.039	-10.386	0.113	0.088	-0.043	0.492	81.000
-0.900	0.258	-0.036	-8.044	0.135	0.081	-0.052	0.742	67.200
-0.800	0.302	-0.015	-2.997	0.139	0.043	-0.036	0.897	39.600
-0.700	0.354	-0.047	-7.625	0.142	0.055	-0.062	0.979	10.866
-0.600	0.442	-0.044	-5.790	0.141	0.098	-0.067	0.997	1.866
-0.500	0.548	-0.049	-5.162	0.151	0.095	-0.081	0.999	0.200
-0.400	0.647	-0.053	-4.718	0.147	0.109	-0.080	1.000	0.000
-0.300	0.759	-0.052	-3.955	0.138	0.104	-0.065	1.000	0.000
-0.200	0.851	-0.048	-3.245	0.125	0.095	-0.050	0.999	0.066
-0.100	0.932	-0.047	-2.940	0.093	0.079	-0.025	0.999	0.733
-0.000	0.973	-0.044	-2.638	0.074	0.070	-0.008	0.998	1.600
0.099	0.980	-0.040	-2.368	0.075	0.071	0.006	0.998	1.000
0.199	0.945	-0.037	-2.298	0.101	0.082	0.026	0.999	0.400
0.299	0.873	-0.030	-1.992	0.129	0.093	0.044	1.000	0.000
0.399	0.760	-0.021	-1.634	0.147	0.101	0.053	1.000	0.000
0.499	0.660	-0.009	-0.866	0.154	0.105	0.060	0.999	0.066
0.599	0.549	-0.005	-0.578	0.151	0.102	0.062	0.999	0.133
0.699	0.445	-0.004	-0.636	0.148	0.092	0.058	0.998	1.000
0.800	0.354	-0.004	-0.755	0.139	0.079	0.049	0.977	12.333
0.900	0.286	-0.006	-1.258	0.124	0.051	0.033	0.911	33.933
0.999	0.234	-0.000	-0.020	0.116	0.050	0.022	0.749	68.866
1.100	0.179	-0.004	-1.592	0.101	0.053	0.010	0.636	54.333
1.200	0.172	0.005	1.674	0.093	0.068	0.011	0.232	60.400
1.300	0.148	0.002	1.050	0.094	0.096	0.002	0.074	26.200
1.399	0.108	0.026	13.824	0.072	0.079	0.025	0.020	10.533
1.500	0.062	0.012	11.039	0.070	0.060	0.018	0.005	5.333

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.110	0.046	0.086	0.071

U_c(fps) = 77.235   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.700	0.063	0.031	26.120	0.050	0.040	0.022	0.007	5.733
1.600	0.102	0.054	28.095	0.064	0.068	0.055	0.014	8.000
1.500	0.121	0.072	31.047	0.049	0.059	0.073	0.038	16.400
1.400	0.169	0.041	13.879	0.106	0.100	0.084	0.133	37.600
1.300	0.200	0.020	5.785	0.099	0.077	0.025	0.245	54.200
1.200	0.238	0.009	2.236	0.111	0.031	0.025	0.535	76.466
1.100	0.259	-0.001	-0.350	0.120	0.031	0.025	0.744	60.733
1.000	0.305	0.006	1.170	0.129	0.060	0.044	0.874	42.000
0.900	0.367	0.004	0.635	0.149	0.051	0.051	0.966	15.266
0.800	0.429	-0.001	-0.183	0.152	0.075	0.056	0.992	4.600
0.700	0.508	0.004	0.454	0.152	0.102	0.067	0.998	1.266
0.600	0.596	0.003	0.337	0.159	0.107	0.069	0.999	0.266
0.500	0.681	-0.001	-0.165	0.160	0.109	0.068	0.999	0.066
0.400	0.771	-0.007	-0.589	0.160	0.109	0.062	1.000	0.000
0.300	0.850	-0.017	-1.191	0.153	0.106	0.054	1.000	0.000
0.200	0.924	-0.023	-1.468	0.141	0.105	0.037	1.000	0.000
0.100	0.955	-0.030	-1.843	0.128	0.102	0.013	1.000	0.000
0.000	0.952	-0.034	-2.066	0.130	0.105	-0.017	0.999	0.066
-0.099	0.913	-0.041	-2.571	0.137	0.107	-0.042	0.999	0.066
-0.199	0.838	-0.040	-2.790	0.152	0.113	-0.069	1.000	0.000
-0.299	0.757	-0.044	-3.382	0.159	0.116	-0.085	1.000	0.000
-0.399	0.676	-0.045	-3.808	0.157	0.115	-0.089	1.000	0.000
-0.499	0.566	-0.038	-3.925	0.164	0.098	-0.091	0.999	0.266
-0.599	0.499	-0.040	-4.633	0.152	0.105	-0.078	0.997	2.000
-0.699	0.427	-0.042	-5.622	0.171	0.046	-0.081	0.989	6.000
-0.799	0.366	-0.045	-7.003	0.151	0.021	-0.070	0.967	14.400
-0.899	0.306	-0.044	-8.203	0.147	0.082	-0.060	0.888	40.133
-0.999	0.256	-0.051	-11.369	0.131	0.079	-0.058	0.762	61.133
-1.099	0.227	-0.065	-15.966	0.124	0.084	-0.068	0.541	73.533
-1.199	0.202	-0.078	-21.267	0.110	0.086	-0.092	0.362	68.200
-1.299	0.168	-0.070	-22.554	0.109	0.109	-0.097	0.167	44.133
-1.399	0.141	-0.082	-30.221	0.087	0.090	-0.105	0.073	23.800
-1.499	0.090	-0.062	-34.739	0.048	0.031	-0.059	0.024	11.066
-1.599	0.074	-0.069	-43.032	0.048	0.055	-0.094	0.048	7.200
-1.699	0.050	-0.038	-36.897	0.035	0.021	-0.034	0.003	4.866

TABLE D-3 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.110	0.046	0.086	0.071

U_c(fps) = 70.520   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.100	0.038	-0.031	-39.530	0.020	0.011	-0.012	0.003	4.600
-1.950	0.089	-0.062	-34.831	0.040	0.036	-0.065	0.010	6.733
-1.800	0.109	-0.079	-36.020	0.049	0.050	-0.095	0.022	11.333
-1.650	0.197	-0.040	-11.632	0.106	0.125	-0.071	0.074	24.333
-1.500	0.239	-0.058	-13.733	0.131	0.122	-0.100	0.230	41.466
-1.350	0.282	-0.019	-3.948	0.154	0.137	-0.032	0.414	63.600
-1.200	0.332	-0.024	-4.141	0.171	0.115	-0.052	0.612	69.533
-1.050	0.389	-0.009	-1.406	0.161	0.016	-0.042	0.814	54.133
-0.900	0.460	0.013	1.679	0.185	0.012	-0.049	0.955	17.733
-0.750	0.553	0.015	1.564	0.202	0.025	-0.067	0.987	6.666
-0.600	0.669	0.018	1.559	0.202	0.088	-0.085	0.998	1.000
-0.450	0.774	0.021	1.575	0.187	0.131	-0.092	0.999	0.333
-0.300	0.893	0.022	1.433	0.190	0.137	-0.076	1.000	0.000
-0.150	0.988	0.033	1.946	0.182	0.138	-0.040	1.000	0.000
-0.000	1.026	0.045	2.552	0.180	0.139	0.009	1.000	0.000
0.149	1.014	0.057	3.270	0.184	0.138	0.055	1.000	0.000
0.299	0.937	0.066	4.038	0.194	0.136	0.092	1.000	0.000
0.449	0.837	0.074	5.077	0.196	0.135	0.115	0.999	0.066
0.599	0.709	0.079	6.352	0.195	0.123	0.125	0.999	0.533
0.749	0.592	0.072	6.985	0.189	0.124	0.127	0.992	4.466
0.899	0.526	0.072	7.823	0.179	0.105	0.116	0.982	9.800
1.049	0.425	0.068	9.155	0.158	0.107	0.097	0.964	14.266
1.199	0.358	0.067	10.673	0.143	0.049	0.080	0.792	55.000
1.349	0.297	0.076	14.486	0.136	0.084	0.094	0.503	72.066
1.499	0.255	0.097	20.855	0.121	0.094	0.129	0.266	56.533
1.649	0.158	0.121	37.631	0.066	0.085	0.165	0.083	25.600
1.799	0.094	0.132	54.394	0.051	0.054	0.096	0.029	11.666
1.949	0.058	0.091	57.519	0.052	0.065	0.065	0.037	8.333
2.100	0.022	0.035	57.843	0.013	0.019	0.004	0.001	3.600

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.110	0.046	0.086	0.071

U_c(fps) =59.158 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.024	0.035	55.118	0.019	0.027	0.008	0.000	3.266
2.333	0.025	0.041	58.983	0.019	0.023	0.007	0.001	3.666
2.166	0.033	0.071	64.717	0.057	0.066	0.039	0.007	5.933
2.000	0.077	0.168	65.222	0.128	0.126	0.127	0.028	12.533
1.833	0.218	0.126	30.176	0.097	0.099	0.198	0.080	25.533
1.666	0.304	0.054	10.188	0.145	0.113	0.074	0.239	53.533
1.500	0.346	0.041	6.782	0.155	0.089	0.075	0.515	71.800
1.333	0.389	0.025	3.786	0.157	0.060	0.067	0.699	66.133
1.166	0.458	0.019	2.492	0.171	0.093	0.084	0.868	42.200
1.000	0.539	0.022	2.369	0.181	0.120	0.106	0.954	18.466
0.833	0.607	0.017	1.658	0.189	0.123	0.111	0.986	7.733
0.666	0.718	0.020	1.604	0.201	0.129	0.114	0.996	2.066
0.500	0.827	0.017	1.232	0.197	0.138	0.091	0.999	0.400
0.333	0.913	0.009	0.572	0.195	0.140	0.061	0.999	0.066
0.166	0.962	-0.004	-0.254	0.193	0.141	0.026	0.999	0.066
0.000	0.967	-0.013	-0.782	0.188	0.146	-0.033	0.999	0.133
-0.166	0.911	-0.018	-1.172	0.192	0.146	-0.078	0.999	0.200
-0.333	0.861	-0.032	-2.162	0.200	0.145	-0.100	0.999	0.200
-0.499	0.757	-0.029	-2.193	0.204	0.128	-0.116	0.998	0.733
-0.666	0.654	-0.032	-2.885	0.218	0.005	-0.098	0.993	3.800
-0.833	0.568	-0.039	-4.003	0.198	0.084	-0.094	0.968	13.933
-0.999	0.489	-0.049	-5.767	0.203	0.081	-0.096	0.910	31.000
-1.166	0.411	-0.059	-8.203	0.168	0.008	-0.073	0.773	59.333
-1.333	0.363	-0.070	-10.980	0.175	0.118	-0.099	0.585	69.933
-1.500	0.310	-0.090	-16.327	0.143	0.117	-0.117	0.385	70.200
-1.666	0.264	-0.115	-23.523	0.133	0.125	-0.195	0.207	49.066
-1.833	0.221	-0.112	-26.895	0.089	0.099	-0.145	0.096	31.333
-1.999	0.166	-0.088	-28.033	0.078	0.078	-0.101	0.038	15.800
-2.166	0.113	-0.086	-37.509	0.016	0.024	-0.144	0.018	9.133
-2.333	0.060	-0.026	-23.539	0.058	0.048	-0.025	0.003	4.666
-2.500	0.053	-0.025	-25.574	0.061	0.038	-0.025	0.001	3.800

TABLE D-4 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.100	0.052	0.058	0.050

U_c(fps) = 97.206 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.077	0.007	0.401	0.023	0.022	-0.000	0.997	2.133
0.050	1.089	0.003	0.203	0.022	0.021	-0.000	0.997	2.333
0.100	1.087	0.011	0.619	0.021	0.021	-0.000	0.997	2.133
0.150	1.089	0.015	0.820	0.021	0.021	0.000	0.996	3.133
0.200	1.083	0.013	0.720	0.021	0.021	0.000	0.995	3.400
0.250	1.072	0.014	0.758	0.021	0.021	0.000	0.995	3.533
0.300	1.074	0.022	1.221	0.021	0.022	0.001	0.996	2.600
0.350	1.067	0.017	0.930	0.022	0.025	0.001	0.998	1.733
0.400	1.075	0.023	1.233	0.022	0.036	0.000	0.999	0.266
0.450	1.034	0.023	1.326	0.058	0.067	0.019	1.000	0.000
0.500	0.538	0.044	4.770	0.104	0.110	0.053	1.000	0.000
0.550	0.129	0.030	13.353	0.051	0.050	0.009	0.997	1.866
0.600	0.068	0.021	17.346	0.014	0.011	0.000	0.249	122.666
0.650	0.032	0.008	15.285	0.016	0.008	0.001	0.003	5.733
0.700	0.019	0.003	10.984	0.000	0.000	0.000	0.000	3.000
0.750	0.019	0.003	10.984	0.000	0.000	0.000	0.000	3.000

0.000	1.050	0.017	0.935	0.022	0.021	-0.001	0.998	1.666
-0.050	1.048	0.015	0.835	0.022	0.021	-0.000	0.998	0.933
-0.100	1.044	0.014	0.796	0.022	0.021	-0.000	0.998	1.400
-0.150	1.042	0.019	1.073	0.021	0.021	-0.000	0.997	1.733
-0.200	1.040	0.016	0.925	0.021	0.021	-0.000	0.997	2.133
-0.250	1.039	0.022	1.222	0.019	0.020	0.000	0.996	2.666
-0.300	1.042	0.021	1.170	0.019	0.020	0.000	0.997	2.533
-0.350	1.047	0.021	1.159	0.020	0.020	0.000	0.996	2.800
-0.400	1.054	0.018	0.998	0.023	0.020	0.000	0.997	2.533
-0.450	1.042	0.007	0.405	0.040	0.030	-0.001	0.999	0.266
-0.500	0.642	-0.034	-3.096	0.096	0.098	-0.043	1.000	0.000
-0.550	0.192	-0.021	-6.371	0.066	0.061	-0.013	0.999	0.066
-0.600	0.078	-0.008	-6.494	0.018	0.005	-0.000	0.176	116.866
-0.650	0.019	-0.003	-10.744	0.000	0.000	0.000	0.000	3.000
-0.700	0.019	-0.003	-10.744	0.000	0.000	0.000	0.000	3.000
-0.750	0.019	-0.003	-10.744	0.000	0.000	0.000	0.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.100	0.052	0.058	0.050

U_c(fps) = 97.206 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.020	-0.003	-10.197	0.006	0.000	0.000	0.002	3.733
-0.933	0.019	-0.003	-10.744	0.000	0.000	0.000	0.000	3.000
-0.866	0.019	-0.003	-10.744	0.000	0.000	0.000	0.000	3.000
-0.800	0.024	-0.004	-10.357	0.027	0.019	-0.000	0.000	3.200
-0.733	0.094	-0.028	-16.660	0.051	0.040	-0.009	0.035	28.333
-0.666	0.125	-0.031	-14.296	0.062	0.016	-0.010	0.603	148.000
-0.600	0.250	-0.014	-3.348	0.104	0.069	-0.026	0.997	1.733
-0.533	0.493	-0.021	-2.511	0.125	0.102	-0.056	1.000	0.000
-0.466	0.786	-0.008	-0.645	0.119	0.103	-0.057	1.000	0.000
-0.400	1.014	0.011	0.646	0.076	0.063	-0.019	0.999	0.133
-0.333	1.044	0.019	1.046	0.047	0.027	0.001	0.995	2.533
-0.266	1.032	0.021	1.184	0.031	0.021	0.000	0.994	4.466
-0.200	1.030	0.022	1.253	0.023	0.019	0.000	0.994	4.733
-0.133	1.026	0.019	1.102	0.021	0.019	0.000	0.995	3.466
-0.066	1.028	0.021	1.188	0.020	0.019	0.000	0.996	2.600
-0.000	1.034	0.017	0.983	0.021	0.020	-0.000	0.996	2.600
0.066	1.051	0.016	0.922	0.021	0.021	0.000	0.994	4.666
0.133	1.053	0.018	1.025	0.022	0.024	-0.000	0.995	3.733
0.199	1.068	0.021	1.171	0.024	0.031	0.000	0.994	4.466
0.266	1.060	0.022	1.227	0.029	0.043	0.001	0.995	3.133
0.333	1.057	0.022	1.198	0.042	0.066	0.006	0.998	1.000
0.400	0.994	0.024	1.404	0.101	0.105	0.054	1.000	0.000
0.466	0.799	0.032	2.336	0.140	0.123	0.087	1.000	0.000
0.533	0.570	0.049	4.984	0.149	0.124	0.080	1.000	0.000
0.600	0.343	0.051	8.460	0.135	0.106	0.059	0.999	0.533
0.666	0.180	0.048	15.063	0.107	0.039	0.047	0.901	57.733
0.733	0.111	0.070	32.399	0.062	0.023	0.046	0.214	103.533
0.800	0.063	0.070	48.031	0.018	0.002	0.046	0.018	14.200
0.866	0.019	0.018	43.949	0.010	0.016	0.006	0.000	3.266
0.933	0.015	0.012	38.860	0.000	0.000	0.000	0.000	3.000
1.000	0.015	0.012	38.860	0.000	0.000	0.000	0.000	3.000

TABLE D-4 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.100	0.052	0.058	0.050

U_c(fps) = 97.086 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.016	0.012	37.889	0.008	0.004	0.000	0.000	3.066
1.166	0.032	0.024	36.879	0.026	0.016	0.011	0.002	3.733
1.083	0.075	0.075	44.812	0.007	0.024	0.050	0.013	9.200
1.000	0.085	0.095	48.447	0.024	0.037	0.065	0.074	31.133
0.916	0.123	0.093	36.944	0.054	0.013	0.082	0.317	87.266
0.833	0.187	0.064	18.984	0.104	0.025	0.069	0.707	89.400
0.750	0.270	0.046	9.785	0.129	0.063	0.055	0.950	26.666
0.666	0.380	0.040	6.124	0.140	0.097	0.062	0.997	1.666
0.583	0.510	0.036	4.138	0.151	0.108	0.072	1.000	0.000
0.500	0.657	0.036	3.211	0.152	0.110	0.078	1.000	0.000
0.416	0.796	0.032	2.322	0.145	0.110	0.075	1.000	0.000
0.333	0.936	0.029	1.824	0.117	0.097	0.055	1.000	0.000
0.250	1.008	0.025	1.444	0.076	0.077	0.024	0.999	0.600
0.166	1.035	0.024	1.362	0.047	0.055	0.007	0.997	1.533
0.083	1.034	0.023	1.300	0.038	0.038	0.000	0.994	3.933
0.000	1.027	0.022	1.274	0.037	0.031	0.001	0.993	5.600
-0.083	1.027	0.019	1.112	0.041	0.030	0.001	0.992	6.133
-0.166	1.029	0.020	1.129	0.050	0.032	0.002	0.988	8.266
-0.249	1.026	0.021	1.180	0.070	0.050	-0.004	0.994	4.533
-0.333	0.977	0.013	0.809	0.103	0.084	-0.037	0.999	0.733
-0.416	0.850	0.004	0.286	0.133	0.108	-0.065	1.000	0.000
-0.499	0.659	-0.002	-0.259	0.146	0.112	-0.067	1.000	0.000
-0.583	0.502	-0.015	-1.742	0.145	0.107	-0.064	1.000	0.000
-0.666	0.344	-0.008	-1.468	0.137	0.077	-0.046	0.996	2.600
-0.750	0.233	-0.009	-2.361	0.126	0.028	-0.023	0.923	28.466
-0.833	0.174	-0.013	-4.356	0.109	0.074	-0.009	0.598	105.600
-0.916	0.140	-0.010	-4.421	0.088	0.071	-0.004	0.179	65.933
-0.999	0.115	-0.002	-1.360	0.070	0.063	0.002	0.036	17.800
-1.083	0.044	-0.002	-2.785	0.052	0.033	0.000	0.002	4.266
-1.166	0.019	-0.002	-6.200	0.000	0.000	0.000	0.000	3.000
-1.250	0.019	-0.002	-6.200	0.000	0.000	0.000	0.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.100	0.052	0.058	0.050

U_c(fps) = 97.680   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.027	-0.001	-3.178	0.036	0.026	0.001	0.000	3.333
-1.400	0.036	-0.004	-7.368	0.047	0.036	-0.000	0.001	3.600
-1.300	0.103	-0.001	-1.095	0.082	0.078	0.003	0.087	10.466
-1.200	0.117	0.002	1.429	0.085	0.083	0.009	0.260	29.133
-1.100	0.153	-0.002	-0.994	0.101	0.095	0.007	0.253	63.400
-1.000	0.186	-0.015	-4.686	0.113	0.076	-0.012	0.513	86.333
-0.900	0.232	-0.014	-3.480	0.126	0.064	-0.021	0.843	54.933
-0.800	0.291	-0.014	-2.821	0.157	0.075	-0.041	0.959	20.000
-0.700	0.405	-0.017	-2.406	0.153	0.055	-0.054	0.998	1.000
-0.600	0.512	-0.013	-1.472	0.147	0.103	-0.065	0.999	0.066
-0.500	0.630	-0.006	-0.596	0.148	0.108	-0.064	1.000	0.000
-0.400	0.753	0.002	0.219	0.147	0.109	-0.064	1.000	0.000
-0.300	0.888	0.010	0.700	0.130	0.103	-0.057	0.999	0.066
-0.200	0.976	0.017	1.055	0.100	0.082	-0.030	0.998	1.400
-0.100	1.008	0.020	1.159	0.073	0.062	-0.007	0.994	3.866
-0.000	1.020	0.018	1.065	0.060	0.055	0.004	0.994	4.533
0.099	1.013	0.020	1.159	0.072	0.068	0.016	0.998	1.733
0.199	0.974	0.021	1.259	0.105	0.085	0.038	0.999	0.533
0.299	0.880	0.021	1.423	0.137	0.099	0.065	1.000	0.000
0.399	0.771	0.026	1.935	0.149	0.104	0.075	1.000	0.000
0.499	0.646	0.026	2.330	0.154	0.106	0.076	1.000	0.000
0.599	0.526	0.028	3.045	0.152	0.104	0.073	1.000	0.000
0.699	0.407	0.027	3.901	0.148	0.089	0.065	0.997	1.733
0.800	0.324	0.038	6.691	0.142	0.058	0.060	0.977	11.933
0.900	0.254	0.032	7.305	0.117	0.052	0.043	0.901	41.866
0.999	0.200	0.035	10.063	0.101	0.026	0.039	0.680	79.133
1.100	0.159	0.044	15.558	0.084	0.041	0.037	0.379	79.266
1.200	0.136	0.045	18.442	0.076	0.072	0.042	0.143	42.333
1.300	0.091	0.068	36.709	0.033	0.047	0.046	0.032	13.466
1.399	0.040	0.047	49.568	0.013	0.034	0.030	0.005	5.133
1.500	0.022	0.023	45.921	0.012	0.024	0.009	0.001	3.666

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.100	0.052	0.058	0.050

U_c(fps) =96.899 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.021	0.025	49.498	0.006	0.016	0.007	0.002	3.666
1.633	0.041	0.058	54.506	0.025	0.030	0.032	0.010	6.533
1.516	0.023	0.094	76.235	0.072	0.064	0.029	0.027	11.866
1.400	0.050	0.130	68.829	0.091	0.086	0.057	0.111	32.800
1.283	0.064	0.146	66.381	0.083	0.096	0.060	0.271	59.000
1.166	0.148	0.119	38.931	0.028	0.059	0.147	0.484	75.733
1.050	0.243	0.060	13.909	0.117	0.020	0.066	0.790	60.266
0.933	0.300	0.042	8.042	0.132	0.058	0.059	0.937	27.600
0.816	0.383	0.033	4.967	0.143	0.080	0.062	0.993	3.866
0.700	0.491	0.038	4.475	0.153	0.103	0.074	0.999	0.600
0.583	0.594	0.036	3.504	0.160	0.107	0.081	1.000	0.000
0.466	0.701	0.033	2.705	0.158	0.108	0.082	1.000	0.000
0.350	0.818	0.033	2.341	0.156	0.107	0.079	1.000	0.000
0.233	0.918	0.032	2.050	0.143	0.102	0.063	0.999	0.066
0.116	0.986	0.029	1.727	0.124	0.096	0.038	0.999	0.333
0.000	1.010	0.026	1.483	0.113	0.094	0.005	0.999	0.533
-0.116	0.989	0.018	1.045	0.120	0.099	-0.023	0.999	0.666
-0.233	0.914	0.014	0.919	0.139	0.108	-0.050	0.999	0.066
-0.349	0.824	0.004	0.340	0.148	0.111	-0.061	0.999	0.066
-0.466	0.699	-0.001	-0.141	0.156	0.111	-0.068	1.000	0.000
-0.583	0.577	-0.010	-1.070	0.155	0.107	-0.069	0.999	0.066
-0.699	0.471	-0.010	-1.229	0.149	0.099	-0.064	0.998	1.066
-0.816	0.394	-0.017	-2.522	0.163	0.022	-0.055	0.993	4.533
-0.933	0.298	-0.015	-3.021	0.149	0.061	-0.036	0.934	29.533
-1.050	0.242	-0.021	-5.105	0.128	0.066	-0.026	0.798	59.800
-1.166	0.198	-0.023	-6.796	0.114	0.086	-0.022	0.530	77.133
-1.283	0.161	-0.024	-8.497	0.093	0.087	-0.025	0.286	63.466
-1.399	0.155	-0.027	-10.086	0.098	0.093	-0.024	0.120	35.400
-1.516	0.113	0.001	0.539	0.078	0.079	0.000	0.047	15.866
-1.633	0.065	0.015	13.181	0.057	0.051	0.016	0.009	6.000
-1.750	0.046	0.008	10.432	0.052	0.034	0.010	0.150	3.000

TABLE D-4 Continued

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
8.000	0.100	0.052	0.058	0.050

U_c(fps) = 91.700 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.000	0.062	0.011	10.745	0.066	0.040	0.015	0.005	4.600
-1.866	0.090	-0.008	-5.085	0.072	0.075	-0.015	0.029	8.733
-1.733	0.151	-0.008	-3.295	0.112	0.116	-0.003	0.102	14.066
-1.600	0.189	-0.014	-4.340	0.128	0.127	-0.003	0.174	42.066
-1.466	0.201	-0.026	-7.422	0.125	0.119	-0.028	0.275	59.533
-1.333	0.244	-0.029	-6.997	0.140	0.106	-0.033	0.576	77.266
-1.200	0.283	-0.029	-6.001	0.150	0.095	-0.044	0.740	61.400
-1.066	0.335	-0.019	-3.401	0.153	0.023	-0.042	0.914	26.466
-0.933	0.413	-0.015	-2.099	0.170	0.047	-0.060	0.977	11.733
-0.800	0.499	-0.016	-1.913	0.185	0.054	-0.074	0.996	2.200
-0.666	0.604	-0.018	-1.713	0.170	0.118	-0.084	0.999	0.466
-0.533	0.701	-0.016	-1.329	0.177	0.123	-0.084	1.000	0.000
-0.400	0.810	-0.008	-0.602	0.174	0.125	-0.072	1.000	0.000
-0.266	0.897	0.000	0.019	0.171	0.126	-0.058	1.000	0.000
-0.133	0.978	0.006	0.360	0.166	0.127	-0.032	1.000	0.000
-0.000	1.014	0.016	0.950	0.163	0.126	0.012	1.000	0.000
0.133	0.971	0.017	1.022	0.172	0.124	0.061	0.999	0.066
0.266	0.911	0.024	1.537	0.177	0.122	0.081	1.000	0.000
0.399	0.824	0.029	2.030	0.184	0.122	0.096	1.000	0.000
0.533	0.713	0.035	2.850	0.182	0.121	0.101	1.000	0.000
0.666	0.621	0.039	3.593	0.176	0.118	0.094	0.999	0.200
0.800	0.496	0.036	4.230	0.178	0.089	0.092	0.994	3.466
0.933	0.427	0.042	5.612	0.166	0.086	0.085	0.983	9.266
1.066	0.356	0.037	6.040	0.148	0.079	0.071	0.950	21.066
1.200	0.294	0.046	9.074	0.137	0.012	0.065	0.795	54.933
1.333	0.244	0.054	12.538	0.120	0.049	0.065	0.551	70.000
1.466	0.209	0.063	16.833	0.101	0.069	0.067	0.373	67.000
1.600	0.179	0.063	19.570	0.096	0.094	0.079	0.158	38.266
1.733	0.119	0.100	40.229	0.038	0.043	0.099	0.077	22.000
1.866	0.068	0.062	42.487	0.030	0.027	0.052	0.457	4.133
2.000	0.055	0.052	43.635	0.017	0.021	0.035	0.008	5.800

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.100	0.052	0.058	0.050

U_c(fps) =78.272 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.031	0.025	38.740	0.019	0.013	0.013	0.001	3.533
2.333	0.027	0.039	55.349	0.016	0.036	0.019	0.003	4.533
2.166	-0.004	0.110	92.491	0.095	0.092	-0.013	0.017	8.800
2.000	-0.021	0.142	98.585	0.102	0.099	-0.035	0.039	15.133
1.833	0.149	0.138	42.725	0.021	0.035	0.182	0.118	30.533
1.666	0.223	0.102	24.696	0.110	0.087	0.157	0.279	55.466
1.500	0.270	0.078	16.137	0.135	0.084	0.121	0.454	66.600
1.333	0.334	0.057	9.697	0.141	0.023	0.077	0.746	57.533
1.166	0.395	0.049	7.104	0.159	0.086	0.082	0.893	31.933
1.000	0.484	0.050	5.915	0.185	0.095	0.108	0.975	12.066
0.833	0.587	0.045	4.450	0.201	0.100	0.120	0.992	4.200
0.666	0.722	0.047	3.732	0.198	0.132	0.117	0.999	0.133
0.500	0.826	0.042	2.942	0.200	0.136	0.108	1.000	0.000
0.333	0.923	0.037	2.347	0.193	0.137	0.086	1.000	0.000
0.166	0.984	0.028	1.643	0.188	0.138	0.055	1.000	0.000
0.000	0.999	0.013	0.791	0.182	0.140	0.013	1.000	0.000
-0.166	0.966	0.006	0.366	0.185	0.140	-0.038	1.000	0.000
-0.333	0.878	-0.001	-0.128	0.191	0.140	-0.070	0.999	0.066
-0.499	0.783	-0.008	-0.614	0.193	0.135	-0.091	1.000	0.000
-0.666	0.688	-0.010	-0.892	0.203	0.106	-0.092	0.999	0.533
-0.833	0.582	-0.014	-1.447	0.204	0.076	-0.091	0.995	2.666
-0.999	0.481	-0.012	-1.478	0.206	0.091	-0.059	0.980	8.666
-1.166	0.401	-0.014	-2.009	0.179	0.058	-0.047	0.923	26.733
-1.333	0.331	-0.029	-5.159	0.169	0.103	-0.045	0.736	59.000
-1.500	0.269	-0.025	-5.463	0.145	0.122	-0.036	0.524	65.733
-1.666	0.249	-0.040	-9.153	0.152	0.141	-0.062	0.337	59.600
-1.833	0.223	-0.040	-10.176	0.144	0.156	-0.052	0.178	43.466
-1.999	0.191	0.011	3.464	0.136	0.136	0.055	0.074	22.466
-2.166	0.102	0.076	36.816	0.048	0.058	0.064	0.024	10.066
-2.333	0.052	-0.042	-38.801	0.043	0.024	-0.039	0.005	5.000
-2.500	0.033	-0.026	-37.620	0.023	0.013	-0.013	0.003	4.066

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.097	0.052	0.083	0.070

U_c(fps) = 107.895 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.131	-0.002	-0.135	0.022	0.018	0.001	0.999	0.400
0.050	1.131	-0.000	-0.016	0.005	0.018	0.001	0.999	0.200
0.100	1.128	0.003	0.188	0.008	0.019	0.001	0.999	0.133
0.150	1.116	0.004	0.213	0.011	0.020	0.002	0.999	0.133
0.200	1.097	0.004	0.253	0.011	0.019	0.002	0.999	0.266
0.250	1.085	0.002	0.134	0.018	0.019	0.002	0.999	0.066
0.300	1.091	0.002	0.136	0.013	0.020	0.001	0.999	0.066
0.350	1.079	0.003	0.174	0.018	0.027	0.001	0.999	0.066
0.400	1.077	0.000	0.027	0.022	0.044	0.003	0.999	0.066
0.450	1.050	0.003	0.164	0.073	0.100	0.043	1.000	0.000
0.500	0.712	0.035	2.885	0.127	0.125	0.090	1.000	0.000
0.550	0.305	0.051	9.620	0.110	0.113	0.053	1.000	0.000
0.600	0.111	0.015	7.920	0.046	0.022	0.004	0.995	3.600
0.650	0.068	-0.015	-12.811	0.011	0.014	-0.000	0.814	80.600
0.700	0.044	0.003	4.924	0.019	0.008	0.000	0.075	75.133
0.750	0.020	0.003	10.651	0.010	0.003	0.000	-0.003	3.666
0.000	1.091	-0.000	-0.046	0.021	0.019	0.001	0.999	0.200
-0.050	1.096	0.001	0.057	0.017	0.018	0.001	0.999	0.400
-0.100	1.096	-0.001	-0.052	0.005	0.019	0.000	0.999	0.133
-0.150	1.095	-0.003	-0.189	0.010	0.019	0.000	0.999	0.066
-0.200	1.082	-0.001	-0.102	0.017	0.019	-0.000	0.999	0.066
-0.250	1.064	0.000	0.011	0.017	0.019	-0.000	0.999	0.066
-0.300	1.056	-0.000	-0.019	0.012	0.020	-0.000	0.999	0.066
-0.350	1.050	-0.001	-0.066	0.013	0.019	0.000	0.999	0.000
-0.400	1.051	-0.002	-0.131	0.020	0.019	0.001	0.999	0.000
-0.450	1.024	-0.019	-1.073	0.050	0.043	-0.007	1.000	0.000
-0.500	0.531	-0.041	-4.426	0.093	0.097	-0.039	1.000	0.000
-0.550	0.110	-0.045	-22.546	0.048	0.032	-0.007	0.999	0.133
-0.600	0.045	-0.047	-45.886	0.018	0.020	-0.003	0.191	120.533
-0.650	0.014	-0.013	-41.790	0.006	0.008	-0.000	-0.004	3.333
-0.700	0.012	-0.010	-39.473	0.000	0.000	0.000	-0.002	3.000
-0.750	0.012	-0.010	-39.473	0.000	0.000	0.000	-0.002	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.097	0.052	0.083	0.070

U_c(fps) = 107.895 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.012	-0.010	-39.473	0.000	0.000	0.000	-0.002	3.000
-0.933	0.019	-0.017	-40.738	0.012	0.011	-0.001	0.201	2.666
-0.866	0.013	-0.011	-39.450	0.004	0.003	-0.000	-0.001	3.133
-0.800	0.015	-0.012	-39.130	0.009	0.009	-0.000	-0.003	3.333
-0.733	0.047	-0.044	-43.128	0.024	0.023	-0.005	0.188	44.533
-0.666	0.089	-0.053	-30.836	0.049	0.023	-0.014	0.734	141.066
-0.600	0.224	-0.007	-1.885	0.104	0.046	-0.017	0.999	0.400
-0.533	0.445	-0.003	-0.401	0.122	0.096	-0.041	1.000	0.000
-0.466	0.721	0.008	0.682	0.124	0.103	-0.059	1.000	0.000
-0.400	0.948	0.020	1.243	0.089	0.072	-0.028	1.000	0.000
-0.333	1.009	0.031	1.804	0.054	0.029	0.002	0.999	0.066
-0.266	1.018	0.037	2.122	0.032	0.022	0.001	0.999	0.133
-0.200	1.017	0.030	1.737	0.023	0.020	-0.000	0.999	0.066
-0.133	1.034	0.028	1.568	0.018	0.020	-0.000	0.999	0.000
-0.066	1.035	0.032	1.801	0.019	0.020	0.000	0.999	0.000
-0.000	1.040	0.028	1.585	0.014	0.020	0.000	0.999	0.400
0.066	1.039	0.029	1.618	0.018	0.022	0.000	0.999	0.333
0.133	1.040	0.034	1.898	0.019	0.025	0.001	0.999	0.200
0.199	1.041	0.035	1.975	0.019	0.033	0.001	0.999	0.466
0.266	1.037	0.041	2.281	0.031	0.049	0.004	0.999	0.133
0.333	1.013	0.039	2.214	0.055	0.079	0.021	0.999	0.000
0.400	0.949	0.039	2.358	0.114	0.111	0.073	1.000	0.000
0.466	0.790	0.047	3.449	0.143	0.120	0.086	1.000	0.000
0.533	0.617	0.065	6.025	0.148	0.123	0.083	1.000	0.000
0.600	0.439	0.066	8.640	0.143	0.117	0.081	1.000	0.000
0.666	0.276	0.058	11.858	0.128	0.083	0.063	0.998	1.733
0.733	0.159	0.037	13.094	0.101	0.020	0.039	0.856	80.133
0.800	0.080	0.049	31.649	0.058	0.027	0.040	0.282	118.466
0.866	0.025	0.071	70.370	0.032	0.052	0.016	0.014	19.866
0.933	0.008	0.027	72.042	0.020	0.033	0.006	-0.000	4.066
1.000	-0.002	0.018	97.451	0.003	0.011	-0.000	-0.001	3.066

TABLE D-5 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.097	0.052	0.083	0.070

U_c(fps) = 107.659 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.042	0.003	5.419	0.050	0.041	0.001	0.001	4.800
1.166	0.072	0.045	31.951	0.052	0.039	0.029	0.016	11.066
1.083	0.057	0.081	54.554	0.029	0.048	0.045	0.075	31.400
1.000	0.072	0.098	53.575	0.019	0.061	0.055	0.275	72.133
0.916	0.145	0.077	27.924	0.084	0.032	0.083	0.640	90.866
0.833	0.225	0.049	12.449	0.114	0.055	0.048	0.918	39.733
0.750	0.324	0.050	8.911	0.131	0.081	0.064	0.996	2.600
0.666	0.422	0.053	7.280	0.142	0.101	0.075	0.999	0.000
0.583	0.537	0.055	5.889	0.146	0.107	0.077	1.000	0.000
0.500	0.666	0.056	4.811	0.148	0.108	0.075	1.000	0.000
0.416	0.791	0.047	3.471	0.141	0.104	0.067	1.000	0.000
0.333	0.915	0.041	2.566	0.122	0.097	0.059	1.000	0.000
0.250	0.991	0.034	1.992	0.087	0.080	0.034	0.999	0.066
0.166	1.028	0.029	1.628	0.057	0.059	0.013	0.999	0.400
0.083	1.034	0.030	1.686	0.033	0.039	0.004	0.999	0.400
0.000	1.032	0.027	1.509	0.041	0.033	0.003	0.999	0.533
−0.083	1.028	0.029	1.621	0.043	0.033	0.002	0.999	0.266
−0.166	1.021	0.035	1.983	0.052	0.039	0.002	0.999	0.066
−0.249	0.998	0.032	1.856	0.079	0.060	−0.011	0.999	0.066
−0.333	0.925	0.025	1.564	0.115	0.092	−0.046	1.000	0.000
−0.416	0.791	0.020	1.497	0.139	0.111	−0.070	1.000	0.000
−0.499	0.620	0.015	1.453	0.146	0.110	−0.061	1.000	0.000
−0.583	0.469	0.005	0.717	0.141	0.100	−0.047	1.000	0.000
−0.666	0.333	0.003	0.566	0.144	0.032	−0.025	0.998	1.066
−0.750	0.213	0.002	0.664	0.127	0.056	−0.009	0.929	40.933
−0.833	0.152	0.010	3.808	0.099	0.057	0.006	0.631	101.733
−0.916	0.109	0.008	4.444	0.080	0.062	0.008	0.208	69.733
−0.999	0.092	0.018	11.375	0.068	0.051	0.016	0.057	28.466
−1.083	0.065	0.029	24.048	0.057	0.032	0.020	0.007	7.733
−1.166	0.044	0.011	14.727	0.052	0.026	0.008	0.002	4.666
−1.250	0.024	0.005	12.259	0.014	0.002	0.000	0.198	2.466

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.097	0.052	0.083	0.070

U_c(fps) =107.653   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.020	-0.011	-29.808	0.019	0.007	-0.002	-0.001	3.400
-1.400	0.063	-0.018	-16.312	0.064	0.042	-0.020	0.008	6.866
-1.300	0.098	-0.007	-4.495	0.073	0.063	-0.005	0.039	16.400
-1.200	0.119	-0.012	-6.041	0.083	0.074	-0.012	0.177	45.533
-1.100	0.144	-0.012	-5.088	0.096	0.078	-0.009	0.348	72.800
-1.000	0.182	-0.010	-3.384	0.114	0.079	-0.010	0.664	76.600
-0.900	0.229	-0.008	-2.027	0.128	0.061	-0.015	0.896	43.066
-0.800	0.301	-0.006	-1.255	0.135	0.014	-0.026	0.983	7.733
-0.700	0.389	-0.000	-0.127	0.147	0.046	-0.035	0.999	0.266
-0.600	0.491	0.005	0.633	0.142	0.096	-0.046	0.999	0.000
-0.500	0.605	0.014	1.385	0.146	0.106	-0.058	1.000	0.000
-0.400	0.735	0.019	1.549	0.145	0.109	-0.066	1.000	0.000
-0.300	0.846	0.026	1.806	0.134	0.105	-0.062	1.000	0.000
-0.200	0.945	0.029	1.807	0.112	0.091	-0.040	1.000	0.000
-0.100	1.004	0.027	1.594	0.080	0.071	-0.010	0.999	0.133
-0.000	1.020	0.032	1.832	0.067	0.064	0.004	0.999	0.200
0.099	1.012	0.031	1.753	0.079	0.070	0.020	0.999	0.133
0.199	0.972	0.033	1.999	0.107	0.084	0.041	1.000	0.000
0.299	0.875	0.037	2.446	0.138	0.097	0.062	1.000	0.000
0.399	0.771	0.044	3.326	0.147	0.100	0.068	1.000	0.000
0.499	0.654	0.048	4.213	0.151	0.103	0.075	1.000	0.000
0.599	0.541	0.049	5.271	0.149	0.102	0.077	1.000	0.000
0.699	0.440	0.048	6.335	0.146	0.089	0.074	0.999	0.266
0.800	0.335	0.046	7.885	0.137	0.070	0.067	0.994	4.533
0.900	0.284	0.037	7.543	0.125	0.042	0.055	0.974	9.866
0.999	0.207	0.035	9.831	0.109	0.028	0.043	0.853	50.333
1.100	0.162	0.047	16.205	0.087	0.029	0.037	0.628	75.133
1.200	0.126	0.041	18.304	0.076	0.052	0.036	0.315	65.200
1.300	0.086	0.059	34.616	0.050	0.038	0.042	0.082	28.466
1.399	0.056	0.050	41.781	0.023	0.020	0.027	0.019	12.000
1.500	0.017	0.037	65.335	0.028	0.038	0.014	0.004	5.400

TABLE D-5 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.097	0.052	0.083	0.070

U_c(fps) = 106.213 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.875	0.019	-0.014	-37.179	0.016	0.002	-0.006	-0.001	3.400
-1.750	0.029	-0.011	-21.218	0.028	0.015	-0.005	0.000	3.733
-1.625	0.046	-0.036	-38.517	0.032	0.019	-0.029	0.004	6.400
-1.500	0.105	-0.027	-14.464	0.075	0.068	-0.025	0.070	24.266
-1.375	0.122	-0.004	-2.117	0.081	0.075	-0.002	0.141	35.666
-1.250	0.152	-0.007	-2.916	0.096	0.077	-0.006	0.370	63.066
-1.125	0.205	-0.013	-3.799	0.118	0.076	-0.016	0.734	64.266
-1.000	0.253	-0.015	-3.483	0.137	0.070	-0.026	0.903	35.066
-0.875	0.328	-0.011	-2.091	0.148	0.028	-0.034	0.980	9.466
-0.750	0.420	-0.006	-0.877	0.155	0.052	-0.042	0.998	1.000
-0.625	0.514	-0.000	-0.042	0.148	0.099	-0.053	0.999	0.133
-0.500	0.647	-0.000	-0.001	0.153	0.108	-0.060	1.000	0.000
-0.375	0.746	0.010	0.829	0.154	0.112	-0.065	1.000	0.000
-0.250	0.852	0.015	1.013	0.148	0.112	-0.061	1.000	0.000
-0.125	0.954	0.016	0.998	0.135	0.107	-0.040	1.000	0.000
0.000	1.001	0.018	1.064	0.122	0.101	-0.001	1.000	0.000
0.125	0.989	0.023	1.339	0.128	0.099	0.038	1.000	0.000
0.250	0.903	0.026	1.691	0.148	0.102	0.063	1.000	0.000
0.375	0.798	0.033	2.432	0.155	0.103	0.072	1.000	0.000
0.500	0.684	0.039	3.272	0.157	0.105	0.078	1.000	0.000
0.625	0.560	0.042	4.322	0.155	0.104	0.080	1.000	0.000
0.750	0.449	0.041	5.215	0.148	0.099	0.076	0.999	0.400
0.875	0.365	0.037	5.778	0.143	0.061	0.068	0.995	2.733
1.000	0.294	0.035	6.854	0.120	0.070	0.051	0.965	13.466
1.125	0.219	0.034	8.839	0.112	0.028	0.040	0.808	53.666
1.250	0.180	0.029	9.415	0.097	0.056	0.033	0.621	68.733
1.375	0.116	0.065	29.392	0.065	0.042	0.060	0.330	43.666
1.500	0.090	0.058	32.990	0.046	0.047	0.045	0.077	24.933
1.625	0.024	0.071	71.107	0.048	0.053	0.022	0.022	10.266
1.750	0.005	0.044	82.418	0.034	0.044	0.005	0.005	4.866
1.875	0.002	0.022	82.718	0.015	0.021	0.001	-0.001	3.400

TABLE D-5 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.097	0.052	0.083	0.070

U_c(fps) = 98.190 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.250	0.003	0.028	83.172	0.023	0.029	0.002	-0.001	3.466
2.100	0.010	0.034	73.663	0.029	0.037	0.008	-0.001	4.066
1.950	0.014	0.081	79.556	0.072	0.075	0.019	0.012	7.266
1.800	0.004	0.112	87.655	0.091	0.081	0.006	0.057	18.133
1.650	0.132	0.089	34.191	0.063	0.040	0.102	0.173	37.600
1.500	0.183	0.057	17.479	0.103	0.079	0.077	0.402	58.466
1.350	0.230	0.067	16.437	0.117	0.044	0.081	0.678	59.333
1.200	0.294	0.042	8.269	0.139	0.044	0.066	0.904	33.000
1.050	0.367	0.042	6.565	0.148	0.078	0.075	0.973	10.933
0.900	0.466	0.042	5.251	0.172	0.076	0.098	0.998	0.733
0.750	0.554	0.046	4.761	0.171	0.115	0.102	0.999	0.333
0.600	0.672	0.046	3.951	0.179	0.119	0.103	1.000	0.000
0.450	0.802	0.044	3.205	0.179	0.119	0.097	1.000	0.000
0.300	0.907	0.040	2.553	0.172	0.120	0.075	1.000	0.000
0.150	0.985	0.035	2.037	0.165	0.122	0.038	1.000	0.000
0.000	0.990	0.027	1.561	0.162	0.127	-0.008	1.000	0.000
-0.149	0.929	0.022	1.402	0.167	0.126	-0.049	1.000	0.000
-0.299	0.842	0.017	1.203	0.171	0.124	-0.065	1.000	0.000
-0.449	0.731	0.011	0.925	0.170	0.120	-0.065	1.000	0.000
-0.599	0.624	0.005	0.474	0.181	0.084	-0.059	1.000	0.000
-0.749	0.505	0.002	0.288	0.173	0.070	-0.051	0.998	0.666
-0.899	0.409	-0.002	-0.364	0.172	0.039	-0.037	0.993	4.400
-1.049	0.336	-0.007	-1.225	0.155	0.054	-0.030	0.958	17.000
-1.199	0.281	-0.013	-2.659	0.150	0.092	-0.015	0.847	39.600
-1.349	0.224	-0.012	-3.140	0.125	0.078	-0.010	0.631	60.666
-1.499	0.174	-0.016	-5.419	0.115	0.101	-0.016	0.310	54.200
-1.649	0.147	0.002	0.779	0.108	0.106	0.013	0.139	32.933
-1.799	0.124	0.009	4.415	0.075	0.078	0.011	0.071	20.333
-1.949	0.077	0.023	17.163	0.061	0.053	0.020	0.022	9.133
-2.099	0.069	0.022	17.993	0.059	0.045	0.016	0.007	6.133
-2.249	0.025	0.009	21.468	0.020	0.014	0.001	-0.000	3.400

TABLE D-5 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.097	0.052	0.083	0.070

U_c(fps) = 84.300   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.500	0.034	0.010	17.436	0.034	0.029	0.006	-0.001	3.600
-2.333	0.055	-0.040	-36.404	0.030	0.013	-0.022	0.413	4.066
-2.166	0.079	-0.026	-18.168	0.075	0.063	-0.039	0.018	9.333
-2.000	0.148	-0.057	-21.012	0.089	0.079	-0.069	0.076	22.466
-1.833	0.176	-0.040	-12.989	0.109	0.106	-0.052	0.183	38.066
-1.666	0.227	-0.025	-6.354	0.130	0.105	-0.026	0.409	59.400
-1.500	0.264	-0.026	-5.755	0.144	0.093	-0.034	0.627	61.866
-1.333	0.315	-0.016	-2.913	0.166	0.096	-0.023	0.803	47.733
-1.166	0.393	-0.015	-2.298	0.174	0.009	-0.051	0.950	17.066
-1.000	0.466	-0.004	-0.545	0.193	0.063	-0.046	0.986	5.066
-0.833	0.561	-0.004	-0.508	0.205	0.014	-0.060	0.996	1.466
-0.666	0.670	-0.002	-0.235	0.183	0.125	-0.077	0.999	0.200
-0.500	0.765	0.008	0.605	0.187	0.130	-0.071	1.000	0.000
-0.333	0.887	0.010	0.706	0.186	0.137	-0.063	1.000	0.000
-0.166	0.964	0.014	0.844	0.180	0.139	-0.035	1.000	0.000
-0.000	0.998	0.023	1.354	0.179	0.140	0.007	1.000	0.000
0.166	0.983	0.031	1.825	0.185	0.137	0.054	1.000	0.000
0.333	0.922	0.039	2.447	0.195	0.135	0.091	1.000	0.000
0.499	0.820	0.045	3.181	0.201	0.135	0.119	1.000	0.000
0.666	0.706	0.047	3.835	0.198	0.131	0.129	0.999	0.200
0.833	0.604	0.054	5.109	0.197	0.111	0.131	0.998	0.666
0.999	0.512	0.050	5.642	0.193	0.086	0.126	0.994	3.866
1.166	0.434	0.047	6.253	0.169	0.081	0.104	0.974	10.866
1.333	0.348	0.052	8.512	0.164	0.031	0.098	0.878	34.933
1.500	0.292	0.049	9.692	0.141	0.064	0.072	0.709	53.666
1.666	0.244	0.043	9.999	0.128	0.075	0.058	0.519	63.200
1.833	0.173	0.057	18.313	0.105	0.076	0.065	0.437	33.600
1.999	0.132	0.083	32.155	0.072	0.061	0.088	0.077	20.800
2.166	0.037	0.099	69.450	0.071	0.066	0.043	0.017	9.066
2.333	0.004	0.040	83.107	0.029	0.039	0.004	0.001	4.600
2.500	0.006	0.039	80.702	0.032	0.042	0.005	0.000	3.733

TABLE D-6 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.089	0.053	0.075	0.071

U_c(fps) = 104.022 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.944	0.009	0.597	0.014	0.015	-0.000	0.994	4.400
0.050	0.947	0.008	0.490	0.013	0.015	-0.000	0.991	5.666
0.100	0.945	0.008	0.517	0.013	0.015	0.000	0.991	5.600
0.150	0.939	0.005	0.309	0.015	0.015	0.000	0.993	5.333
0.200	0.940	0.006	0.412	0.014	0.015	0.000	0.992	6.000
0.250	0.944	0.009	0.580	0.015	0.015	0.000	0.993	5.600
0.300	0.945	0.011	0.699	0.015	0.016	0.000	0.992	6.533
0.350	0.943	0.013	0.792	0.015	0.017	0.000	0.993	5.266
0.400	0.938	0.013	0.822	0.015	0.019	0.000	0.996	3.066
0.450	0.933	0.015	0.922	0.020	0.034	0.000	1.000	0.000
0.500	0.687	0.023	1.933	0.088	0.087	0.045	1.000	0.000
0.550	0.229	0.009	2.318	0.073	0.070	0.027	1.000	0.000
0.600	0.048	-0.019	-21.958	0.014	0.008	-0.000	0.704	133.333
0.650	0.036	-0.017	-25.998	0.007	0.006	-0.000	0.009	10.733
0.700	0.016	-0.006	-20.864	0.000	0.000	0.000	0.000	3.000
0.750	0.016	-0.006	-20.864	0.000	0.000	0.000	0.000	3.000
0.000	0.929	0.023	1.433	0.013	0.014	-0.000	0.992	5.866
-0.050	0.921	0.027	1.717	0.014	0.015	-0.000	0.995	4.000
-0.100	0.912	0.027	1.751	0.016	0.015	-0.001	0.997	2.266
-0.150	0.908	0.027	1.744	0.014	0.014	-0.000	0.996	2.800
-0.200	0.897	0.026	1.674	0.013	0.014	-0.000	0.994	4.800
-0.250	0.898	0.025	1.651	0.012	0.014	0.000	0.989	7.933
-0.300	0.903	0.026	1.672	0.013	0.014	0.000	0.993	4.533
-0.350	0.905	0.025	1.619	0.014	0.014	0.000	0.986	10.533
-0.400	0.909	0.023	1.454	0.020	0.015	0.000	0.993	5.066
-0.450	0.784	-0.006	-0.452	0.061	0.057	-0.013	1.000	0.000
-0.500	0.348	-0.031	-5.199	0.074	0.082	-0.021	1.000	0.000
-0.550	0.071	-0.037	-27.911	0.025	0.018	-0.001	0.928	47.933
-0.600	0.035	-0.021	-30.538	0.015	0.009	-0.001	0.004	7.533
-0.650	0.016	-0.009	-29.722	0.005	0.002	-0.000	0.027	3.333
-0.700	0.015	-0.009	-29.977	0.000	0.000	0.000	0.000	3.000
-0.750	0.015	-0.009	-29.977	0.000	0.000	0.000	0.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.089	0.053	0.075	0.071

U_c(fps) = 104.022 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.015	-0.009	-29.977	0.000	0.000	0.000	0.000	3.000
-0.933	0.015	-0.009	-29.977	0.000	0.000	0.000	0.000	3.000
-0.866	0.015	-0.009	-29.977	0.000	0.000	0.000	0.000	3.000
-0.800	0.021	-0.011	-28.196	0.013	0.005	-0.000	0.130	2.400
-0.733	0.044	-0.025	-29.408	0.036	0.006	-0.008	0.002	5.333
-0.666	0.067	-0.046	-34.737	0.036	0.016	-0.013	0.186	107.666
-0.600	0.140	-0.024	-10.020	0.067	0.032	-0.006	0.957	30.200
-0.533	0.314	0.000	0.163	0.098	0.075	-0.023	0.999	0.066
-0.466	0.570	0.010	1.053	0.106	0.089	-0.036	1.000	0.000
-0.400	0.797	0.040	2.918	0.076	0.064	-0.019	1.000	0.000
-0.333	0.871	0.056	3.685	0.042	0.025	0.001	0.995	4.066
-0.266	0.871	0.057	3.758	0.026	0.016	0.001	0.987	9.666
-0.200	0.871	0.055	3.632	0.018	0.014	0.000	0.994	4.133
-0.133	0.879	0.056	3.668	0.015	0.013	-0.000	0.993	5.066
-0.066	0.884	0.058	3.793	0.015	0.013	-0.000	0.990	6.733
-0.000	0.960	-0.001	-0.089	0.014	0.016	-0.000	0.991	6.666
0.066	0.962	-0.001	-0.114	0.016	0.017	0.000	0.992	6.000
0.133	0.958	-0.005	-0.307	0.017	0.018	0.000	0.990	7.466
0.199	0.950	-0.003	-0.202	0.019	0.021	0.000	0.993	4.666
0.266	0.958	0.001	0.065	0.021	0.028	0.000	0.994	4.466
0.333	0.959	0.003	0.179	0.026	0.042	0.000	0.997	2.000
0.400	0.942	0.007	0.428	0.050	0.069	0.012	1.000	0.000
0.466	0.812	0.014	0.989	0.109	0.100	0.059	1.000	0.000
0.533	0.569	0.018	1.908	0.128	0.109	0.064	1.000	0.000
0.600	0.331	0.017	3.060	0.118	0.094	0.050	1.000	0.000
0.666	0.160	0.004	1.712	0.090	0.025	0.017	0.945	36.133
0.733	0.102	-0.008	-4.860	0.056	0.021	0.001	0.277	126.800
0.800	0.067	-0.039	-30.220	0.038	0.017	-0.010	0.010	10.466
0.866	0.015	-0.009	-32.827	0.000	0.000	0.000	0.000	3.000
0.933	0.015	-0.009	-32.827	0.000	0.000	0.000	0.000	3.000
1.000	0.015	-0.009	-32.827	0.000	0.000	0.000	0.000	3.000

TABLE D-6 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.089	0.053	0.075	0.071

U_c(fps) = 103.844 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.017	-0.010	-30.788	0.012	0.001	-0.000	0.000	3.133
1.166	0.025	-0.030	-50.390	0.018	0.019	-0.013	0.069	4.733
1.083	0.020	-0.084	-76.555	0.058	0.055	-0.013	0.085	10.866
1.000	0.120	0.024	11.678	0.080	0.081	0.017	0.094	38.533
0.916	0.139	0.044	17.676	0.081	0.055	0.037	0.350	95.466
0.833	0.189	0.044	13.278	0.105	0.036	0.042	0.758	86.400
0.750	0.270	0.049	10.385	0.127	0.064	0.055	0.975	12.600
0.666	0.392	0.050	7.269	0.136	0.098	0.066	0.999	0.400
0.583	0.533	0.057	6.129	0.143	0.108	0.076	0.999	0.066
0.500	0.677	0.054	4.575	0.143	0.110	0.083	1.000	0.000
0.416	0.827	0.059	4.088	0.128	0.105	0.071	0.999	0.066
0.333	0.934	0.056	3.468	0.091	0.086	0.039	0.999	0.333
0.250	0.970	0.050	2.987	0.057	0.064	0.013	0.998	1.600
0.166	0.986	0.048	2.800	0.037	0.043	0.003	0.990	7.333
0.083	0.993	0.048	2.784	0.032	0.031	0.002	0.981	13.533
0.000	0.997	0.044	2.577	0.032	0.028	0.001	0.978	15.466
-0.083	0.986	0.048	2.824	0.038	0.028	0.000	0.990	7.200
-0.166	0.981	0.047	2.791	0.047	0.032	0.001	0.989	8.400
-0.249	0.958	0.049	2.946	0.070	0.051	-0.006	0.995	3.866
-0.333	0.889	0.042	2.727	0.107	0.085	-0.037	1.000	0.000
-0.416	0.740	0.031	2.415	0.133	0.103	-0.052	1.000	0.000
-0.499	0.569	0.014	1.485	0.138	0.104	-0.051	1.000	0.000
-0.583	0.407	0.005	0.842	0.132	0.091	-0.044	0.999	0.066
-0.666	0.277	0.007	1.504	0.132	0.024	-0.023	0.988	8.133
-0.750	0.180	0.003	1.099	0.109	0.062	-0.004	0.782	82.400
-0.833	0.140	-0.003	-1.435	0.086	0.066	-0.004	0.377	92.066
-0.916	0.115	-0.011	-5.483	0.072	0.072	-0.011	0.062	30.400
-0.999	0.092	-0.007	-4.898	0.064	0.052	-0.006	0.011	8.466
-1.083	0.021	-0.004	-12.744	0.015	0.007	-0.000	0.000	3.266
-1.166	0.019	-0.004	-12.058	0.014	0.008	0.000	0.000	3.066
-1.250	0.017	-0.004	-13.567	0.000	0.000	0.000	0.000	3.000

TABLE D-6 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.089	0.053	0.075	0.071

U_c(fps) = 104.115 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.017	-0.004	-13.567	0.000	0.000	0.000	0.000	3.000
-1.400	0.028	-0.005	-10.411	0.033	0.016	-0.001	0.001	3.400
-1.300	0.051	-0.015	-17.061	0.039	0.032	-0.007	0.401	4.133
-1.200	0.103	-0.033	-18.019	0.054	0.061	-0.027	0.039	17.000
-1.100	0.128	-0.026	-11.670	0.071	0.079	-0.031	0.134	42.533
-1.000	0.153	-0.012	-4.702	0.088	0.066	-0.015	0.402	76.866
-0.900	0.196	-0.004	-1.291	0.110	0.064	-0.012	0.696	82.133
-0.800	0.249	0.006	1.569	0.137	0.076	-0.014	0.916	35.466
-0.700	0.338	0.001	0.338	0.133	0.068	-0.038	0.992	5.000
-0.600	0.453	0.007	0.945	0.141	0.095	-0.051	0.999	0.066
-0.500	0.572	0.011	1.161	0.143	0.102	-0.053	1.000	0.000
-0.400	0.698	0.024	2.008	0.141	0.104	-0.053	1.000	0.000
-0.300	0.830	0.036	2.516	0.129	0.100	-0.053	0.999	0.133
-0.200	0.930	0.040	2.511	0.101	0.082	-0.031	0.998	1.266
-0.100	0.977	0.045	2.657	0.072	0.062	-0.009	0.993	5.266
-0.000	1.000	0.041	2.391	0.055	0.051	0.004	0.990	7.666
0.099	0.990	0.043	2.500	0.061	0.060	0.013	0.992	5.800
0.199	0.954	0.044	2.666	0.091	0.078	0.031	0.998	1.266
0.299	0.881	0.047	3.106	0.124	0.095	0.058	0.999	0.066
0.399	0.789	0.051	3.766	0.142	0.104	0.076	1.000	0.000
0.499	0.673	0.054	4.634	0.149	0.107	0.081	1.000	0.000
0.599	0.552	0.052	5.386	0.150	0.105	0.079	1.000	0.000
0.699	0.434	0.049	6.509	0.148	0.089	0.072	0.999	0.666
0.800	0.333	0.045	7.825	0.137	0.068	0.063	0.986	7.666
0.900	0.260	0.048	10.658	0.127	0.015	0.054	0.931	30.000
0.999	0.191	0.048	14.095	0.100	0.044	0.043	0.676	82.733
1.100	0.152	0.060	21.670	0.081	0.071	0.051	0.369	79.133
1.200	0.116	0.075	32.937	0.057	0.060	0.063	0.134	42.266
1.300	0.088	0.071	39.056	0.030	0.055	0.040	0.033	14.866
1.399	0.059	0.042	35.660	0.043	0.033	0.029	0.009	7.200
1.500	0.023	0.013	29.542	0.016	0.003	0.003	0.101	2.533

TABLE D-6 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.089	0.053	0.075	0.071

U_c(fps) = 102.301 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.022	0.012	29.276	0.015	0.004	0.003	0.001	3.600
1.633	0.039	0.046	49.363	0.008	0.012	0.020	0.008	5.933
1.516	0.047	0.103	65.391	0.053	0.012	0.030	0.039	14.266
1.400	0.030	0.123	76.297	0.073	0.073	0.025	0.102	31.000
1.283	0.075	0.138	61.403	0.077	0.085	0.075	0.255	58.200
1.166	0.164	0.099	31.151	0.078	0.024	0.106	0.587	78.400
1.050	0.234	0.053	12.931	0.111	0.026	0.052	0.813	55.266
0.933	0.307	0.050	9.414	0.129	0.057	0.059	0.966	16.600
0.816	0.399	0.052	7.451	0.148	0.079	0.070	0.994	3.000
0.700	0.487	0.057	6.741	0.157	0.090	0.081	0.999	0.133
0.583	0.584	0.054	5.337	0.154	0.106	0.080	1.000	0.000
0.466	0.701	0.054	4.419	0.154	0.107	0.083	1.000	0.000
0.350	0.804	0.053	3.809	0.150	0.106	0.079	1.000	0.000
0.233	0.904	0.052	3.339	0.139	0.102	0.067	0.999	0.200
0.116	0.971	0.049	2.931	0.117	0.092	0.039	0.999	0.333
0.000	0.994	0.047	2.760	0.107	0.091	0.005	0.999	0.866
-0.116	0.959	0.044	2.629	0.120	0.099	-0.027	0.999	0.600
-0.233	0.876	0.035	2.300	0.140	0.107	-0.047	0.999	0.200
-0.349	0.755	0.029	2.215	0.146	0.107	-0.053	0.999	0.066
-0.466	0.646	0.019	1.701	0.149	0.106	-0.057	1.000	0.000
-0.583	0.525	0.011	1.231	0.148	0.099	-0.056	0.999	0.066
-0.699	0.432	0.006	0.831	0.140	0.092	-0.049	0.999	0.533
-0.816	0.328	0.006	1.134	0.134	0.050	-0.033	0.981	9.600
-0.933	0.266	-0.000	-0.163	0.121	0.032	-0.024	0.912	35.066
-1.050	0.216	-0.006	-1.819	0.120	0.073	-0.014	0.687	73.200
-1.166	0.171	-0.014	-4.853	0.090	0.078	-0.019	0.432	75.133
-1.283	0.152	0.007	2.875	0.095	0.093	0.013	0.189	50.666
-1.399	0.136	-0.007	-3.304	0.082	0.089	-0.009	0.091	28.533
-1.516	0.088	0.017	10.872	0.069	0.067	0.022	0.016	8.333
-1.633	0.066	0.016	13.937	0.061	0.051	0.021	0.006	5.733
-1.750	0.033	0.009	15.565	0.033	0.024	0.005	0.001	3.666

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
8.000	0.089	0.053	0.075	0.071

U_c(fps) = 96.571 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.100	0.031	0.008	14.178	0.028	0.023	0.003	0.001	3.466
-1.950	0.051	0.015	16.343	0.042	0.031	0.009	0.005	5.000
-1.800	0.107	0.044	22.595	0.052	0.065	0.031	0.027	10.666
-1.650	0.152	-0.025	-9.523	0.089	0.097	-0.037	0.100	28.066
-1.500	0.179	-0.020	-6.574	0.095	0.097	-0.028	0.216	48.666
-1.350	0.213	-0.010	-2.828	0.121	0.110	-0.014	0.454	73.000
-1.200	0.259	-0.021	-4.711	0.130	0.068	-0.027	0.715	61.933
-1.050	0.321	-0.018	-3.210	0.154	0.064	-0.045	0.903	33.466
-0.900	0.405	-0.009	-1.272	0.174	0.036	-0.056	0.980	9.200
-0.750	0.494	-0.009	-1.074	0.175	0.071	-0.070	0.997	1.733
-0.600	0.622	-0.006	-0.570	0.172	0.117	-0.079	0.999	0.066
-0.450	0.734	0.002	0.207	0.174	0.121	-0.073	1.000	0.000
-0.300	0.849	0.013	0.936	0.172	0.125	-0.062	1.000	0.000
-0.150	0.953	0.024	1.480	0.169	0.129	-0.040	1.000	0.000
-0.000	1.007	0.033	1.927	0.166	0.128	0.005	1.000	0.000
0.149	0.985	0.039	2.280	0.170	0.125	0.062	1.000	0.000
0.299	0.893	0.038	2.490	0.178	0.123	0.091	1.000	0.000
0.449	0.800	0.046	3.314	0.179	0.122	0.098	1.000	0.000
0.599	0.677	0.043	3.682	0.176	0.119	0.097	0.999	0.133
0.749	0.548	0.043	4.516	0.169	0.113	0.091	0.999	0.600
0.899	0.447	0.042	5.373	0.169	0.085	0.086	0.989	5.333
1.049	0.370	0.041	6.331	0.156	0.066	0.073	0.959	19.400
1.199	0.300	0.036	6.846	0.134	0.043	0.053	0.852	46.133
1.349	0.236	0.038	9.312	0.119	0.062	0.045	0.654	62.466
1.499	0.204	0.059	16.166	0.097	0.070	0.055	0.355	62.866
1.649	0.144	0.088	31.401	0.065	0.080	0.106	0.137	35.400
1.799	0.083	0.093	48.286	0.031	0.028	0.067	0.039	15.333
1.949	0.050	0.077	56.780	0.043	0.043	0.046	0.010	6.200
2.100	0.018	0.023	52.297	0.002	0.015	0.003	0.001	3.400

TABLE D-6 Continued

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
10.000	0.089	0.053	0.075	0.071

U_c(fps) = 82.444 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.009	0.026	71.135	0.008	0.009	0.000	0.000	3.133
2.333	0.008	0.055	80.865	0.054	0.075	0.013	0.004	4.533
2.166	-0.026	0.118	102.806	0.098	0.090	-0.031	0.023	9.266
2.000	0.092	0.131	54.739	0.052	0.036	0.075	0.061	19.066
1.833	0.162	0.111	34.555	0.058	0.075	0.160	0.173	34.466
1.666	0.235	0.060	14.507	0.120	0.090	0.075	0.435	50.466
1.500	0.283	0.042	8.437	0.135	0.075	0.054	0.559	65.933
1.333	0.338	0.034	5.872	0.140	0.063	0.061	0.798	51.533
1.166	0.414	0.027	3.853	0.169	0.061	0.075	0.931	26.000
1.000	0.493	0.032	3.720	0.188	0.083	0.099	0.989	5.200
0.833	0.609	0.040	3.780	0.184	0.124	0.106	0.998	0.733
0.666	0.717	0.033	2.707	0.197	0.130	0.111	0.999	0.333
0.500	0.826	0.032	2.277	0.195	0.134	0.100	1.000	0.000
0.333	0.930	0.027	1.676	0.191	0.136	0.080	1.000	0.000
0.166	0.987	0.023	1.358	0.184	0.141	0.042	1.000	0.000
0.000	1.002	0.014	0.831	0.182	0.141	-0.000	1.000	0.000
-0.166	0.940	0.006	0.400	0.189	0.141	-0.048	1.000	0.000
-0.333	0.862	-0.007	-0.485	0.191	0.137	-0.073	1.000	0.000
-0.499	0.739	-0.011	-0.927	0.190	0.132	-0.092	0.999	0.066
-0.666	0.644	-0.016	-1.484	0.188	0.126	-0.095	0.999	0.466
-0.833	0.537	-0.018	-1.925	0.189	0.087	-0.086	0.993	3.266
-0.999	0.441	-0.020	-2.646	0.189	0.039	-0.077	0.962	16.733
-1.166	0.368	-0.020	-3.185	0.175	0.086	-0.054	0.882	37.533
-1.333	0.310	-0.039	-7.237	0.161	0.114	-0.065	0.713	60.333
-1.500	0.272	-0.056	-11.777	0.141	0.112	-0.077	0.530	73.000
-1.666	0.225	-0.079	-19.416	0.107	0.084	-0.087	0.276	56.133
-1.833	0.191	-0.062	-18.162	0.098	0.098	-0.081	0.138	35.533
-1.999	0.151	-0.050	-18.635	0.080	0.081	-0.054	0.051	18.066
-2.166	0.120	-0.040	-18.458	0.077	0.082	-0.050	0.022	10.066
-2.333	0.044	-0.010	-12.843	0.042	0.037	-0.007	0.003	4.200
-2.500	0.029	-0.010	-18.941	0.016	0.012	-0.000	0.000	3.266

TABLE D-7 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.074	0.050	0.051	0.046

U_c(fps) = 89.626 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.028	-0.014	-0.788	0.015	0.014	0.000	1.000	0.000
0.050	1.029	0.005	0.280	0.014	0.015	0.000	0.980	12.666
0.100	1.032	0.003	0.187	0.014	0.015	0.000	0.976	17.133
0.150	1.041	0.002	0.133	0.013	0.016	-0.000	0.970	19.200
0.200	1.040	0.000	0.015	0.013	0.015	-0.000	0.964	23.400
0.250	1.039	0.005	0.303	0.011	0.015	-0.000	0.962	24.400
0.300	1.035	0.021	1.207	0.014	0.017	-0.000	0.959	25.600
0.350	1.028	0.022	1.263	0.014	0.023	-0.000	0.974	17.133
0.400	1.027	0.027	1.536	0.019	0.042	-0.001	0.997	2.066
0.450	0.975	0.021	1.237	0.085	0.089	-0.044	1.000	0.000
0.500	0.555	0.053	5.458	0.130	0.112	-0.067	1.000	0.000
0.550	0.163	0.039	13.681	0.086	0.057	-0.006	0.996	3.400
0.600	0.080	0.029	20.200	0.029	0.008	0.001	0.467	167.800
0.650	0.039	0.052	53.289	0.018	0.016	0.002	0.009	11.933
0.700	0.010	0.018	60.694	0.000	0.000	0.000	0.000	3.000
0.750	0.010	0.018	60.251	0.002	0.002	0.000	0.007	4.866
0.000	1.018	0.019	1.070	0.010	0.013	0.000	0.948	33.200
-0.050	1.018	0.018	1.068	0.010	0.013	0.000	0.951	30.933
-0.100	1.023	0.022	1.256	0.010	0.013	0.000	0.952	29.866
-0.150	1.024	0.020	1.122	0.010	0.013	0.000	0.954	29.466
-0.200	1.026	0.018	1.050	0.010	0.013	0.000	0.954	29.200
-0.250	1.029	0.017	0.949	0.011	0.013	0.000	0.956	27.733
-0.300	1.033	0.019	1.105	0.012	0.015	0.000	0.966	22.733
-0.350	1.032	0.017	0.972	0.013	0.015	0.000	0.972	19.400
-0.400	1.034	0.013	0.733	0.015	0.014	0.000	0.971	19.866
-0.450	1.026	0.007	0.404	0.034	0.023	-0.000	0.998	1.800
-0.500	0.648	-0.033	-2.996	0.095	0.098	-0.043	1.000	0.000
-0.550	0.194	-0.019	-5.710	0.066	0.062	-0.014	0.999	0.333
-0.600	0.083	-0.017	-11.911	0.029	0.017	-0.001	0.092	30.600
-0.650	0.020	-0.005	-15.399	0.000	0.000	0.000	0.000	3.000
-0.700	0.020	-0.005	-15.399	0.000	0.000	0.000	0.000	3.000
-0.750	0.020	-0.005	-15.399	0.000	0.000	0.000	0.000	3.000

TABLE D-7 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.074	0.050	0.051	0.046

U_c(fps) = 89.626 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.023	-0.005	-14.123	0.011	0.001	-0.000	0.049	3.066
-0.933	0.019	-0.005	-15.399	0.000	0.000	0.000	0.000	3.000
-0.866	0.019	-0.005	-15.399	0.000	0.000	0.000	0.000	3.000
-0.800	0.021	-0.005	-15.553	0.010	0.003	-0.000	0.000	3.066
-0.733	0.074	-0.066	-42.025	0.038	0.008	-0.025	0.040	9.400
-0.666	0.110	-0.062	-29.532	0.055	0.015	-0.016	0.314	133.400
-0.600	0.240	-0.015	-3.801	0.097	0.057	-0.021	0.993	5.733
-0.533	0.468	-0.019	-2.361	0.119	0.097	-0.053	1.000	0.000
-0.466	0.764	-0.013	-1.019	0.113	0.097	-0.049	1.000	0.000
-0.400	0.974	0.002	0.146	0.065	0.054	-0.014	0.999	0.466
-0.333	1.013	0.013	0.738	0.037	0.022	0.000	0.969	20.066
-0.266	1.013	0.014	0.815	0.024	0.017	0.000	0.948	32.533
-0.200	1.009	0.012	0.713	0.016	0.014	0.000	0.943	35.933
-0.133	1.006	0.008	0.474	0.014	0.014	0.000	0.952	30.533
-0.066	1.002	0.009	0.534	0.013	0.014	0.000	0.941	35.066
-0.000	0.996	0.006	0.375	0.012	0.015	0.000	0.920	46.800
0.066	1.004	0.001	0.107	0.014	0.017	-0.000	0.953	30.800
0.133	1.005	0.008	0.466	0.016	0.020	-0.000	0.960	26.466
0.199	1.009	0.004	0.260	0.019	0.026	0.000	0.959	25.933
0.266	1.007	0.004	0.269	0.024	0.038	0.001	0.964	23.533
0.333	0.997	0.004	0.256	0.043	0.064	0.009	0.993	5.466
0.400	0.938	0.009	0.594	0.097	0.091	0.046	0.999	0.133
0.466	0.762	0.025	1.902	0.134	0.113	0.076	1.000	0.000
0.533	0.530	0.044	4.740	0.142	0.117	0.072	1.000	0.000
0.600	0.327	0.039	6.915	0.129	0.092	0.056	0.997	2.000
0.666	0.176	0.038	12.375	0.091	0.055	0.029	0.732	115.133
0.733	0.114	0.070	31.618	0.060	0.030	0.044	0.122	67.800
0.800	0.019	0.077	75.581	0.046	0.061	0.019	0.048	7.000
0.866	0.008	0.018	66.432	0.000	0.000	0.000	0.000	3.000
0.933	0.008	0.018	66.432	0.000	0.000	0.000	0.000	3.000
1.000	0.008	0.018	66.432	0.000	0.000	0.000	0.000	3.000

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
3.000	0.074	0.050	0.051	0.046

U_c(fps) = 90.915 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.008	0.021	68.976	0.008	0.013	0.000	0.000	3.066
1.166	0.005	0.027	79.369	0.021	0.026	0.001	0.001	3.400
1.083	0.000	0.086	89.890	0.072	0.075	-0.012	0.006	6.466
1.000	0.006	0.135	87.287	0.103	0.101	-0.001	0.036	19.666
0.916	0.012	0.153	85.521	0.101	0.109	0.001	0.201	67.666
0.833	0.081	0.166	63.880	0.061	0.105	0.066	0.525	103.466
0.750	0.247	0.083	18.725	0.116	0.057	0.067	0.893	48.400
0.666	0.368	0.034	5.323	0.138	0.090	0.060	0.993	4.266
0.583	0.508	0.034	3.849	0.149	0.106	0.071	0.999	0.066
0.500	0.654	0.029	2.620	0.149	0.109	0.074	1.000	0.000
0.416	0.794	0.021	1.553	0.137	0.101	0.065	1.000	0.000
0.333	0.907	0.011	0.739	0.112	0.088	0.047	0.999	0.066
0.250	0.979	0.005	0.337	0.072	0.068	0.021	0.994	4.266
0.166	1.005	0.003	0.201	0.042	0.048	0.006	0.979	15.400
0.083	1.009	-0.000	-0.052	0.033	0.034	0.002	0.957	29.000
0.000	1.005	0.005	0.337	0.031	0.028	0.001	0.946	34.400
-0.083	1.007	0.008	0.477	0.036	0.026	0.002	0.941	35.866
-0.166	1.009	0.009	0.551	0.043	0.030	0.002	0.939	36.200
-0.249	1.004	0.010	0.590	0.061	0.043	-0.003	0.966	22.666
-0.333	0.946	0.007	0.426	0.096	0.077	-0.030	0.998	1.600
-0.416	0.814	-0.004	-0.292	0.127	0.102	-0.055	0.999	0.066
-0.499	0.637	-0.008	-0.784	0.142	0.109	-0.066	1.000	0.000
-0.583	0.460	-0.009	-1.145	0.140	0.100	-0.062	0.999	0.066
-0.666	0.311	-0.004	-0.812	0.144	0.014	-0.035	0.986	9.266
-0.750	0.213	-0.013	-3.667	0.113	0.048	-0.017	0.792	76.333
-0.833	0.174	-0.015	-5.182	0.105	0.080	-0.009	0.448	96.533
-0.916	0.140	-0.026	-10.813	0.094	0.096	-0.026	0.083	37.400
-0.999	0.089	-0.014	-9.494	0.074	0.066	-0.013	0.008	7.666
-1.083	0.038	-0.004	-7.196	0.042	0.026	-0.001	0.001	3.466
-1.166	0.020	-0.005	-14.880	0.000	0.000	0.000	0.000	3.000
-1.250	0.020	-0.005	-14.880	0.000	0.000	0.000	0.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.074	0.050	0.051	0.046

U_c(fps) = 90.430 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.020	-0.005	-14.880	0.000	0.000	0.000	0.000	3.000
-1.400	0.037	-0.004	-7.236	0.043	0.029	-0.002	0.001	3.600
-1.300	0.082	0.014	9.802	0.070	0.065	0.019	0.007	6.400
-1.200	0.121	-0.047	-21.304	0.074	0.084	-0.052	0.032	15.000
-1.100	0.153	-0.052	-18.823	0.095	0.094	-0.068	0.147	47.066
-1.000	0.187	-0.047	-14.046	0.106	0.088	-0.051	0.372	82.133
-0.900	0.216	-0.017	-4.491	0.125	0.083	-0.019	0.704	76.666
-0.800	0.297	-0.016	-3.178	0.134	0.029	-0.035	0.943	21.066
-0.700	0.374	-0.014	-2.243	0.145	0.067	-0.053	0.993	3.600
-0.600	0.492	-0.015	-1.850	0.144	0.102	-0.066	0.999	0.200
-0.500	0.614	-0.012	-1.164	0.148	0.109	-0.070	1.000	0.000
-0.400	0.757	-0.008	-0.658	0.141	0.108	-0.063	1.000	0.000
-0.300	0.874	0.000	0.043	0.124	0.098	-0.050	0.999	0.066
-0.200	0.963	0.004	0.273	0.092	0.077	-0.024	0.998	1.666
-0.100	1.001	0.005	0.287	0.064	0.055	-0.002	0.987	9.600
-0.000	1.005	0.003	0.214	0.056	0.052	0.005	0.991	7.266
0.099	0.992	0.004	0.242	0.068	0.062	0.014	0.995	4.066
0.199	0.954	0.005	0.350	0.095	0.075	0.031	0.998	1.333
0.299	0.872	0.009	0.593	0.128	0.090	0.054	0.999	0.133
0.399	0.758	0.016	1.218	0.144	0.099	0.066	1.000	0.000
0.499	0.644	0.023	2.106	0.152	0.103	0.071	1.000	0.000
0.599	0.535	0.030	3.216	0.150	0.102	0.069	0.999	0.066
0.699	0.410	0.031	4.400	0.146	0.084	0.063	0.996	2.266
0.800	0.328	0.032	5.581	0.130	0.080	0.053	0.977	12.600
0.900	0.250	0.033	7.618	0.115	0.049	0.043	0.869	46.400
0.999	0.201	0.033	9.575	0.103	0.044	0.038	0.663	75.200
1.100	0.162	0.045	15.659	0.082	0.044	0.037	0.359	76.133
1.200	0.120	0.068	29.796	0.056	0.058	0.060	0.112	34.866
1.300	0.073	0.074	45.272	0.005	0.030	0.041	0.024	11.200
1.399	0.043	0.047	47.387	0.021	0.011	0.023	0.004	5.000
1.500	0.019	0.015	37.942	0.005	0.005	0.002	0.000	3.200

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.074	0.050	0.051	0.046

U_c(fps) = 89.931 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.023	0.022	44.404	0.009	0.013	0.004	0.001	3.733
1.633	0.029	0.047	57.935	0.027	0.039	0.026	0.005	4.666
1.516	0.044	0.090	63.757	0.059	0.049	0.046	0.036	11.933
1.400	0.058	0.120	64.280	0.072	0.070	0.050	0.068	23.666
1.283	0.104	0.123	49.783	0.062	0.065	0.106	0.193	46.733
1.166	0.174	0.097	29.285	0.078	0.005	0.107	0.471	70.800
1.050	0.238	0.051	12.208	0.117	0.043	0.062	0.749	58.200
0.933	0.294	0.032	6.204	0.126	0.054	0.051	0.919	30.066
0.816	0.384	0.036	5.425	0.148	0.068	0.066	0.989	5.266
0.700	0.480	0.035	4.222	0.147	0.099	0.068	0.999	0.533
0.583	0.582	0.032	3.204	0.154	0.104	0.071	1.000	0.000
0.466	0.692	0.029	2.439	0.157	0.105	0.074	1.000	0.000
0.350	0.796	0.022	1.627	0.150	0.102	0.068	0.999	0.066
0.233	0.895	0.018	1.158	0.137	0.097	0.055	0.999	0.400
0.116	0.969	0.013	0.769	0.120	0.090	0.038	0.999	0.800
0.000	1.000	0.011	0.650	0.104	0.087	0.007	0.998	1.533
-0.116	0.976	0.004	0.269	0.116	0.095	-0.019	0.999	0.733
-0.233	0.900	0.002	0.178	0.137	0.106	-0.050	0.999	0.266
-0.349	0.801	-0.004	-0.345	0.149	0.110	-0.062	1.000	0.000
-0.466	0.669	-0.007	-0.659	0.157	0.111	-0.073	1.000	0.000
-0.583	0.564	-0.013	-1.374	0.155	0.107	-0.074	0.999	0.333
-0.699	0.451	-0.013	-1.669	0.159	0.075	-0.062	0.998	1.466
-0.816	0.364	-0.012	-1.958	0.159	0.023	-0.048	0.984	8.600
-0.933	0.282	-0.008	-1.663	0.139	0.043	-0.026	0.904	34.266
-1.050	0.231	-0.010	-2.684	0.123	0.066	-0.011	0.700	69.400
-1.166	0.196	-0.026	-7.596	0.121	0.109	-0.029	0.424	71.066
-1.283	0.160	-0.008	-2.945	0.108	0.109	-0.000	0.177	42.666
-1.399	0.122	-0.023	-10.786	0.084	0.087	-0.030	0.132	19.533
-1.516	0.099	-0.030	-17.076	0.076	0.070	-0.035	0.020	9.333
-1.633	0.050	-0.019	-21.377	0.051	0.044	-0.015	0.004	4.466
-1.750	0.032	-0.013	-22.279	0.042	0.030	-0.010	0.002	3.533

$_c$(fps)
y/
-2.0
-1.8
-1.7
-1.6
-1.4
-1.3
-1.2
-1.06
-0.93
-0.80
-0.66
-0.53
-0.40
-0.26
-0.13
-0.00
0.13
0.26
0.39
0.53
0.66
0.80
0.93
1.06
1.20
1.33
1.46
1.60
1.73
1.86
2.00

TABLE D-7 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.074	0.050	0.051	0.046

U_c(fps) = 85.439 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{2}$	γ	C/T
-2.000	0.048	-0.015	-17.521	0.051	0.039	-0.014	0.003	4.333
-1.866	0.085	-0.028	-18.254	0.068	0.068	-0.038	0.014	8.333
-1.733	0.132	-0.018	-7.838	0.104	0.104	-0.022	0.033	13.466
-1.600	0.167	0.010	3.668	0.117	0.122	0.037	0.090	25.133
-1.466	0.197	-0.002	-0.849	0.137	0.140	0.027	0.220	46.066
-1.333	0.229	-0.022	-5.631	0.138	0.122	-0.020	0.433	62.400
-1.200	0.273	-0.025	-5.366	0.145	0.094	-0.033	0.742	58.133
-1.066	0.319	-0.024	-4.434	0.153	0.056	-0.043	0.877	40.200
-0.933	0.388	-0.015	-2.245	0.170	0.032	-0.055	0.971	13.466
-0.800	0.485	-0.014	-1.767	0.198	0.079	-0.070	0.993	3.733
-0.666	0.577	-0.016	-1.615	0.185	0.083	-0.087	0.999	0.600
-0.533	0.680	-0.013	-1.156	0.177	0.122	-0.091	1.000	0.000
-0.400	0.780	-0.012	-0.883	0.175	0.124	-0.083	1.000	0.000
-0.266	0.879	-0.008	-0.549	0.170	0.127	-0.063	1.000	0.000
-0.133	0.963	-0.001	-0.106	0.163	0.125	-0.034	1.000	0.000
-0.000	1.000	0.006	0.383	0.158	0.122	0.002	1.000	0.000
0.133	0.977	0.012	0.759	0.164	0.119	0.046	1.000	0.000
0.266	0.912	0.019	1.246	0.172	0.119	0.071	1.000	0.000
0.399	0.798	0.021	1.554	0.177	0.118	0.085	1.000	0.000
0.533	0.704	0.029	2.434	0.185	0.102	0.094	0.999	0.133
0.666	0.596	0.034	3.265	0.177	0.106	0.092	0.999	0.200
0.800	0.488	0.030	3.627	0.169	0.097	0.083	0.995	3.066
0.933	0.422	0.030	4.171	0.155	0.089	0.073	0.982	9.000
1.066	0.337	0.042	7.225	0.144	0.052	0.069	0.901	33.200
1.200	0.287	0.044	8.830	0.136	0.053	0.069	0.766	53.200
1.333	0.242	0.048	11.272	0.106	0.040	0.046	0.535	69.333
1.466	0.196	0.072	20.272	0.108	0.098	0.116	0.244	49.600
1.600	0.159	0.087	28.758	0.080	0.087	0.136	0.137	37.200
1.733	0.086	0.116	53.372	0.057	0.045	0.074	0.045	16.666
1.866	0.014	0.089	81.145	0.061	0.071	0.017	0.012	6.800
2.000	-0.003	0.049	93.721	0.044	0.054	-0.006	0.003	4.533

TABLE D-8 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.083	0.057	0.060	0.050

U_c(fps) = 91.798 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	1.103	-0.034	-1.791	0.030	0.014	-0.000	0.999	1.133
0.050	1.099	-0.029	-1.547	0.019	0.015	0.000	0.999	0.866
0.100	1.097	-0.024	-1.278	0.006	0.014	0.000	0.999	0.666
0.150	1.093	-0.022	-1.167	0.014	0.015	0.000	0.999	0.533
0.200	1.091	-0.022	-1.205	0.019	0.017	-0.000	0.999	0.533
0.250	1.087	-0.024	-1.280	0.016	0.016	0.000	0.999	0.466
0.300	1.095	-0.034	-1.790	0.015	0.016	-0.000	0.999	0.600
0.350	1.088	-0.022	-1.203	0.026	0.021	-0.000	0.999	0.600
0.400	1.081	-0.017	-0.913	0.016	0.035	0.000	0.999	0.066
0.450	1.064	-0.016	-0.908	0.055	0.078	0.017	1.000	0.000
0.500	0.698	0.024	1.991	0.125	0.121	0.080	1.000	0.000
0.550	0.226	0.013	3.307	0.088	0.080	0.032	1.000	0.000
0.600	0.058	-0.060	-45.916	0.028	0.026	-0.006	0.940	32.733
0.650	0.035	0.030	41.277	0.013	0.013	0.001	0.164	110.000
0.700	0.017	0.017	45.035	0.009	0.009	0.000	-0.008	4.200
0.750	0.013	0.013	45.341	0.000	0.000	0.000	-0.002	3.000
0.000	1.087	-0.016	-0.876	0.014	0.014	0.000	0.998	0.666
-0.050	1.086	-0.019	-1.029	0.018	0.014	-0.000	0.998	1.000
-0.100	1.084	-0.016	-0.867	0.022	0.013	0.000	0.998	0.666
-0.150	1.082	-0.016	-0.855	0.010	0.013	0.000	0.999	0.466
-0.200	1.081	-0.014	-0.749	0.003	0.014	-0.000	0.999	0.466
-0.250	1.078	-0.014	-0.788	0.018	0.013	-0.000	0.999	0.666
-0.300	1.076	-0.016	-0.855	0.010	0.013	-0.000	0.999	0.800
-0.350	1.070	-0.017	-0.955	0.014	0.013	0.000	0.998	1.133
-0.400	1.072	-0.019	-1.016	0.020	0.014	0.000	0.999	0.466
-0.450	1.051	-0.030	-1.670	0.048	0.041	-0.008	1.000	0.000
-0.500	0.549	-0.048	-5.076	0.096	0.103	-0.044	1.000	0.000
-0.550	0.102	-0.058	-29.699	0.046	0.038	-0.003	0.999	1.066
-0.600	0.022	-0.045	-64.004	0.010	0.022	-0.001	0.072	56.133
-0.650	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000
-0.700	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000
-0.750	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000

TABLE D-8 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.083	0.057	0.060	0.050

U_c(fps) = 91.798 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000
-0.933	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000
-0.866	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000
-0.800	0.010	-0.016	-58.775	0.000	0.000	0.000	-0.002	3.000
-0.733	0.026	-0.051	-62.705	0.022	0.043	-0.014	-0.009	9.266
-0.666	0.045	-0.083	-61.580	0.013	0.046	-0.016	0.386	143.600
-0.600	0.204	-0.023	-6.527	0.087	0.053	-0.014	0.998	2.866
-0.533	0.430	-0.006	-0.902	0.122	0.087	-0.041	1.000	0.000
-0.466	0.716	0.011	0.893	0.121	0.102	-0.053	1.000	0.000
-0.400	0.972	0.031	1.833	0.078	0.066	-0.023	1.000	0.000
-0.333	1.022	0.042	2.405	0.044	0.023	0.000	0.999	0.533
-0.266	1.018	0.044	2.505	0.027	0.017	0.000	0.998	1.000
-0.200	1.015	0.042	2.399	0.032	0.014	-0.000	0.998	1.400
-0.133	1.019	0.049	2.754	0.021	0.014	0.000	0.999	0.333
-0.066	1.021	0.039	2.232	0.014	0.013	0.000	0.998	0.933
-0.000	1.022	0.037	2.075	0.022	0.014	0.000	0.999	1.133
0.066	1.022	0.037	2.091	0.009	0.015	0.000	0.998	0.933
0.133	1.026	0.037	2.079	0.022	0.017	0.000	0.998	1.066
0.199	1.030	0.037	2.106	0.006	0.021	0.000	0.999	0.666
0.266	1.027	0.038	2.126	0.022	0.032	0.000	0.999	0.666
0.333	1.020	0.041	2.336	0.030	0.054	0.004	0.999	0.333
0.400	0.981	0.042	2.489	0.076	0.085	0.033	1.000	0.000
0.466	0.814	0.053	3.728	0.127	0.114	0.075	1.000	0.000
0.533	0.567	0.064	6.494	0.142	0.125	0.086	1.000	0.000
0.600	0.350	0.049	7.992	0.135	0.102	0.072	1.000	0.000
0.666	0.166	0.026	9.178	0.098	0.042	0.030	0.945	41.666
0.733	0.100	0.029	16.501	0.072	0.040	0.021	0.371	133.800
0.800	0.054	0.040	36.838	0.040	0.005	0.020	0.005	14.000
0.866	0.019	0.014	36.391	0.016	0.005	0.002	-0.001	3.333
0.933	0.015	0.012	37.886	0.000	0.000	0.000	-0.002	3.000
1.000	0.015	0.012	37.886	0.000	0.000	0.000	-0.002	3.000

TABLE D-8 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.083	0.057	0.060	0.050

U_c(fps) = 92.018 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.015	0.012	37.886	0.000	0.000	0.000	-0.002	3.000
1.166	0.030	0.023	37.731	0.029	0.008	0.012	0.000	4.266
1.083	0.046	0.064	54.486	0.027	0.032	0.037	0.013	9.533
1.000	0.056	0.078	54.377	0.035	0.043	0.048	0.071	33.733
0.916	0.111	0.073	33.455	0.060	0.018	0.070	0.357	85.866
0.833	0.184	0.035	10.895	0.106	0.008	0.039	0.809	74.466
0.750	0.277	0.039	8.156	0.127	0.062	0.058	0.983	10.600
0.666	0.388	0.056	8.262	0.137	0.102	0.075	0.999	0.466
0.583	0.524	0.063	6.921	0.148	0.111	0.084	1.000	0.000
0.500	0.666	0.062	5.358	0.146	0.111	0.079	1.000	0.000
0.416	0.819	0.060	4.192	0.131	0.102	0.065	1.000	0.000
0.333	0.936	0.053	3.243	0.100	0.085	0.040	0.999	0.066
0.250	1.001	0.049	2.837	0.057	0.061	0.013	0.999	0.333
0.166	1.015	0.047	2.651	0.038	0.041	0.002	0.999	0.933
0.083	1.010	0.042	2.416	0.043	0.030	0.000	0.997	2.466
0.000	1.007	0.042	2.389	0.029	0.025	0.001	0.998	1.733
-0.083	1.011	0.048	2.739	0.042	0.026	0.001	0.998	1.333
-0.166	1.010	0.048	2.725	0.033	0.029	0.002	0.998	1.066
-0.249	0.998	0.045	2.633	0.066	0.046	-0.005	0.999	0.666
-0.333	0.938	0.036	2.244	0.099	0.079	-0.034	0.999	0.000
-0.416	0.796	0.028	2.062	0.132	0.103	-0.057	1.000	0.000
-0.499	0.607	0.017	1.628	0.145	0.107	-0.057	1.000	0.000
-0.583	0.449	0.004	0.580	0.140	0.096	-0.047	1.000	0.000
-0.666	0.297	-0.005	-1.065	0.139	0.021	-0.027	0.994	4.466
-0.750	0.197	-0.009	-2.617	0.110	0.051	-0.011	0.867	59.000
-0.833	0.133	-0.018	-8.006	0.085	0.056	-0.014	0.418	101.600
-0.916	0.102	-0.018	-10.245	0.075	0.054	-0.013	0.087	38.800
-0.999	0.071	-0.025	-19.388	0.057	0.038	-0.018	0.015	10.133
-1.083	0.028	-0.009	-18.818	0.028	0.005	-0.003	-0.000	3.533
-1.166	0.018	-0.005	-15.016	0.000	0.000	0.000	-0.002	3.000
-1.250	0.018	-0.005	-15.016	0.000	0.000	0.000	-0.002	3.000

TABLE D-8 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.083	0.057	0.060	0.050

U_c(fps) = 92.255 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.025	-0.007	-15.985	0.022	0.008	-0.002	-0.001	3.400
-1.400	0.032	-0.009	-15.701	0.038	0.029	-0.007	0.000	3.800
-1.300	0.072	-0.021	-16.951	0.062	0.045	-0.019	0.018	8.200
-1.200	0.097	-0.030	-17.538	0.071	0.058	-0.028	0.058	22.000
-1.100	0.119	-0.036	-16.879	0.079	0.063	-0.033	0.155	43.733
-1.000	0.145	-0.020	-8.046	0.090	0.073	-0.019	0.399	80.400
-0.900	0.192	-0.012	-3.609	0.115	0.080	-0.016	0.745	71.866
-0.800	0.260	-0.003	-0.855	0.130	0.051	-0.017	0.951	22.400
-0.700	0.361	-0.001	-0.187	0.149	0.041	-0.034	0.997	2.266
-0.600	0.474	0.006	0.803	0.143	0.097	-0.049	0.999	0.066
-0.500	0.599	0.017	1.659	0.148	0.105	-0.057	1.000	0.000
-0.400	0.740	0.028	2.224	0.144	0.107	-0.061	1.000	0.000
-0.300	0.867	0.037	2.476	0.125	0.097	-0.049	0.999	0.000
-0.200	0.963	0.039	2.318	0.094	0.076	-0.026	0.999	0.266
-0.100	1.000	0.043	2.507	0.065	0.055	-0.004	0.999	0.733
-0.000	1.009	0.047	2.687	0.049	0.049	0.003	0.998	0.733
0.099	1.000	0.042	2.428	0.063	0.059	0.011	0.998	0.933
0.199	0.969	0.045	2.663	0.093	0.075	0.029	0.999	0.200
0.299	0.890	0.049	3.185	0.123	0.091	0.051	1.000	0.000
0.399	0.790	0.058	4.236	0.140	0.100	0.065	1.000	0.000
0.499	0.655	0.057	4.982	0.151	0.108	0.081	1.000	0.000
0.599	0.538	0.060	6.373	0.152	0.108	0.086	1.000	0.000
0.699	0.422	0.050	6.828	0.143	0.101	0.079	0.999	0.533
0.800	0.321	0.042	7.494	0.135	0.075	0.066	0.990	6.200
0.900	0.249	0.038	8.758	0.115	0.061	0.047	0.934	29.733
0.999	0.176	0.042	13.683	0.097	0.023	0.040	0.687	74.933
1.100	0.143	0.043	17.036	0.081	0.047	0.035	0.406	76.600
1.200	0.100	0.049	26.285	0.064	0.052	0.043	0.166	47.400
1.300	0.062	0.060	44.332	0.016	0.024	0.034	0.032	14.066
1.399	0.025	0.031	50.919	0.008	0.015	0.009	0.075	5.266
1.500	0.013	0.020	55.709	0.005	0.012	0.003	-0.001	3.333

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.083	0.057	0.060	0.050

U_c(fps) = 91.554 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.012	0.023	62.069	0.006	0.013	0.003	-0.001	3.400
1.633	0.012	0.052	77.008	0.038	0.051	0.012	0.003	5.333
1.516	0.007	0.078	84.864	0.057	0.059	0.009	0.027	12.200
1.400	0.012	0.109	83.529	0.075	0.078	0.010	0.091	24.800
1.283	0.077	0.118	56.933	0.066	0.082	0.084	0.288	58.333
1.166	0.170	0.052	17.167	0.092	0.054	0.051	0.524	72.933
1.050	0.232	0.043	10.630	0.119	0.016	0.053	0.827	49.800
0.933	0.291	0.044	8.581	0.130	0.062	0.062	0.956	20.933
0.816	0.384	0.052	7.697	0.143	0.084	0.077	0.995	2.533
0.700	0.482	0.059	7.014	0.147	0.105	0.084	0.999	0.266
0.583	0.589	0.063	6.157	0.155	0.110	0.089	1.000	0.000
0.466	0.703	0.064	5.273	0.154	0.108	0.083	1.000	0.000
0.350	0.814	0.062	4.359	0.146	0.103	0.071	1.000	0.000
0.233	0.917	0.060	3.800	0.129	0.094	0.050	0.999	0.000
0.116	0.983	0.058	3.378	0.106	0.086	0.024	0.999	0.200
0.000	0.999	0.058	3.342	0.100	0.086	0.000	0.999	0.133
-0.116	0.958	0.052	3.111	0.118	0.094	-0.029	0.999	0.133
-0.233	0.875	0.046	3.009	0.141	0.103	-0.050	1.000	0.000
-0.349	0.769	0.035	2.665	0.153	0.109	-0.061	1.000	0.000
-0.466	0.631	0.031	2.884	0.158	0.106	-0.060	1.000	0.000
-0.583	0.529	0.018	2.016	0.152	0.100	-0.053	0.999	0.066
-0.699	0.415	0.011	1.654	0.164	0.029	-0.035	0.997	1.933
-0.816	0.330	-0.001	-0.207	0.145	0.015	-0.027	0.983	8.533
-0.933	0.275	-0.004	-1.021	0.132	0.041	-0.018	0.927	26.666
-1.050	0.206	-0.011	-3.294	0.118	0.086	-0.016	0.729	64.800
-1.166	0.158	-0.018	-6.616	0.103	0.074	-0.020	0.402	71.066
-1.283	0.133	-0.033	-14.288	0.080	0.070	-0.033	0.207	44.666
-1.399	0.098	-0.038	-21.619	0.060	0.048	-0.030	0.073	23.266
-1.516	0.077	-0.039	-26.934	0.052	0.044	-0.033	0.019	10.000
-1.633	0.042	-0.020	-26.209	0.038	0.027	-0.014	0.003	5.066
-1.750	0.023	-0.010	-24.855	0.013	0.007	-0.002	-0.000	3.533

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.083	0.057	0.060	0.050

U_c(fps) = 75.526   T = 15.000 (averaging time)   Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.018	0.031	59.060	0.009	0.016	0.004	0.000	3.666
2.333	0.026	0.041	57.498	0.010	0.035	0.022	0.004	4.933
2.166	0.007	0.077	84.261	0.068	0.076	0.008	0.009	6.133
2.000	-0.007	0.111	93.820	0.079	0.088	-0.007	0.022	11.466
1.833	-0.007	0.160	92.553	0.098	0.107	-0.021	0.132	32.666
1.666	0.074	0.182	67.812	0.084	0.123	0.078	0.286	53.200
1.500	0.244	0.066	15.251	0.128	0.079	0.095	0.508	64.066
1.333	0.319	0.053	9.513	0.148	0.018	0.084	0.810	47.533
1.166	0.393	0.047	6.843	0.159	0.077	0.090	0.943	20.533
1.000	0.489	0.057	6.713	0.180	0.085	0.120	0.986	5.866
0.833	0.587	0.061	6.023	0.194	0.115	0.139	0.998	1.133
0.666	0.693	0.067	5.569	0.190	0.136	0.132	0.999	0.133
0.500	0.820	0.072	5.071	0.192	0.137	0.118	0.999	0.000
0.333	0.924	0.072	4.458	0.192	0.138	0.091	1.000	0.000
0.166	0.981	0.061	3.588	0.186	0.140	0.053	1.000	0.000
0.000	0.998	0.052	2.997	0.181	0.140	0.007	1.000	0.000
-0.166	0.944	0.044	2.674	0.189	0.140	-0.043	1.000	0.000
-0.333	0.861	0.032	2.173	0.191	0.137	-0.068	0.999	0.066
-0.499	0.738	0.021	1.689	0.206	0.106	-0.074	0.999	0.133
-0.666	0.623	0.017	1.597	0.189	0.107	-0.070	0.999	0.400
-0.833	0.525	0.007	0.834	0.208	0.064	-0.050	0.995	2.533
-0.999	0.438	-0.001	-0.207	0.194	0.069	-0.043	0.975	11.400
-1.166	0.364	-0.008	-1.413	0.162	0.048	-0.031	0.913	28.333
-1.333	0.286	-0.020	-4.099	0.154	0.078	-0.028	0.687	61.733
-1.500	0.251	-0.042	-9.659	0.135	0.103	-0.049	0.497	64.000
-1.666	0.205	-0.055	-15.143	0.120	0.096	-0.069	0.305	54.666
-1.833	0.172	-0.047	-15.279	0.108	0.090	-0.057	0.138	34.333
-1.999	0.118	-0.040	-18.661	0.072	0.072	-0.044	0.045	15.866
-2.166	0.060	-0.010	-10.230	0.051	0.045	-0.012	0.009	7.133
-2.333	0.050	-0.008	-9.402	0.047	0.030	-0.007	0.005	4.933
-2.500	0.043	-0.009	-12.007	0.050	0.040	-0.008	0.002	3.733

TABLE D-8 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.083	0.057	0.060	0.050

U_c(fps) = 87.644 T = 15.000 (averaging time) Condition: Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.100	0.026	-0.011	-23.506	0.019	0.008	-0.002	-0.001	3.333
-1.960	0.047	-0.023	-26.415	0.050	0.035	-0.026	0.005	5.133
-1.820	0.063	-0.030	-26.105	0.048	0.042	-0.027	0.009	6.733
-1.680	0.122	-0.052	-23.172	0.074	0.061	-0.049	0.054	18.333
-1.540	0.158	-0.034	-12.467	0.102	0.090	-0.039	0.177	42.466
-1.400	0.186	-0.036	-10.967	0.113	0.081	-0.039	0.374	62.733
-1.260	0.228	-0.023	-5.777	0.128	0.079	-0.027	0.728	47.133
-1.120	0.276	-0.012	-2.639	0.136	0.063	-0.023	0.842	44.866
-0.980	0.347	-0.002	-0.360	0.162	0.072	-0.021	0.961	16.533
-0.840	0.434	0.003	0.424	0.177	0.015	-0.044	0.992	4.400
-0.700	0.531	0.009	1.041	0.181	0.068	-0.057	0.999	0.333
-0.560	0.635	0.017	1.602	0.173	0.116	-0.072	0.999	0.066
-0.420	0.750	0.025	1.969	0.173	0.120	-0.066	1.000	0.000
-0.280	0.879	0.031	2.065	0.171	0.123	-0.058	1.000	0.000
-0.140	0.960	0.041	2.456	0.162	0.123	-0.033	1.000	0.000
-0.000	0.991	0.048	2.776	0.158	0.122	0.006	1.000	0.000
0.139	0.979	0.058	3.402	0.160	0.119	0.043	1.000	0.000
0.279	0.900	0.060	3.847	0.174	0.120	0.083	1.000	0.000
0.419	0.807	0.066	4.737	0.178	0.122	0.101	1.000	0.000
0.559	0.679	0.063	5.331	0.178	0.123	0.112	0.999	0.000
0.699	0.573	0.061	6.097	0.170	0.120	0.111	0.999	0.333
0.839	0.467	0.054	6.682	0.168	0.097	0.104	0.995	2.400
0.979	0.379	0.045	6.792	0.155	0.083	0.087	0.981	9.266
1.119	0.315	0.038	6.938	0.132	0.054	0.061	0.943	19.400
1.260	0.247	0.037	8.491	0.120	0.053	0.048	0.761	54.933
1.399	0.204	0.044	12.194	0.108	0.057	0.047	0.525	67.200
1.540	0.169	0.046	15.450	0.100	0.081	0.053	0.295	55.533
1.679	0.113	0.070	31.635	0.062	0.057	0.068	0.090	24.800
1.820	0.078	0.065	39.937	0.034	0.040	0.044	0.029	12.133
1.959	0.030	0.035	49.646	0.012	0.009	0.014	0.006	5.333
2.100	0.016	0.027	59.071	0.008	0.020	0.006	0.000	3.666

TABLE D-9 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.130	0.052	0.058	0.058

U_c(fps) = 70.190 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.207	0.018	5.094	0.389	0.030	0.107	0.000	0.533
0.050	0.119	0.009	4.741	0.299	0.032	0.094	0.000	0.266
0.100	0.170	0.012	4.327	0.366	0.027	0.092	0.000	0.400
0.150	0.173	0.015	5.256	0.373	0.034	0.121	0.000	0.400
0.200	0.218	0.016	4.416	0.411	0.025	0.092	0.000	0.533
0.250	0.196	0.017	5.173	0.395	0.033	0.120	0.000	0.600
0.300	0.190	0.014	4.252	0.382	0.025	0.088	0.000	0.600
0.350	0.218	0.018	4.731	0.412	0.028	0.104	0.000	0.600
0.400	0.191	0.018	5.378	0.385	0.034	0.123	0.000	0.466
0.450	0.026	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.500	0.026	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.550	0.084	-0.024	-16.062	0.057	0.027	-0.003	0.003	3.200
0.600	0.059	-0.043	-36.158	0.016	0.016	-0.000	0.738	141.466
0.650	0.035	-0.046	-53.020	0.006	0.010	-0.000	0.996	5.733
0.700	0.019	-0.048	-68.065	0.002	0.006	-0.000	0.999	3.066
0.750	0.010	-0.046	-77.626	0.001	0.004	-0.000	1.000	3.000
0.000	0.146	0.011	4.463	0.339	0.028	0.094	0.000	0.400
-0.050	0.164	0.012	4.364	0.352	0.028	0.089	0.000	0.400
-0.100	0.164	0.011	4.162	0.352	0.025	0.083	0.000	0.400
-0.150	0.191	0.017	5.106	0.383	0.033	0.113	0.000	0.533
-0.200	0.257	0.022	4.931	0.429	0.027	0.100	0.000	0.733
-0.250	0.162	0.014	5.047	0.346	0.031	0.104	0.000	0.600
-0.300	0.250	0.018	4.297	0.417	0.022	0.077	0.000	0.733
-0.350	0.187	0.017	5.345	0.374	0.033	0.116	0.000	0.533
-0.400	0.182	0.015	4.816	0.364	0.029	0.099	0.000	0.466
-0.450	0.026	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.500	0.026	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.550	0.048	0.005	6.853	0.047	0.022	0.009	0.000	0.533
-0.600	0.082	0.029	19.749	0.020	0.019	0.001	0.425	190.533
-0.650	0.065	0.040	31.891	0.010	0.012	0.000	0.969	29.066
-0.700	0.040	0.046	48.609	0.005	0.009	0.000	1.000	3.000
-0.750	0.044	0.057	52.660	0.004	0.005	0.000	1.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.130	0.052	0.058	0.058

U_c(fps) = 70.190 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.026	0.050	62.815	0.003	0.006	0.000	1.000	3.000
-0.933	0.020	0.058	70.786	0.003	0.008	0.000	0.999	3.133
-0.866	0.023	0.067	70.683	0.004	0.017	0.000	0.941	8.066
-0.800	0.028	0.073	69.043	0.004	0.026	0.002	0.852	44.333
-0.733	0.054	0.093	59.784	0.021	0.030	0.002	0.568	113.533
-0.666	0.103	0.076	36.486	0.034	0.033	0.002	0.134	65.333
-0.600	0.130	0.090	34.630	0.070	0.053	0.022	0.007	6.000
-0.533	0.030	-0.000	-1.839	0.023	0.011	0.002	0.000	0.066
-0.466	0.026	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.400	0.045	-0.000	-0.924	0.127	0.013	0.013	0.000	0.066
-0.333	0.276	0.011	2.343	0.437	0.025	0.009	0.000	0.800
-0.266	0.366	0.021	3.408	0.472	0.020	0.020	0.001	1.200
-0.200	0.393	0.022	3.301	0.482	0.017	0.010	0.001	1.400
-0.133	0.256	0.017	3.989	0.428	0.023	0.064	0.000	0.733
-0.066	0.278	0.016	3.332	0.440	0.021	0.040	0.000	0.733
-0.000	0.215	0.018	4.793	0.404	0.028	0.103	0.000	0.666
0.066	0.431	0.018	2.499	0.495	0.021	-0.030	0.001	1.266
0.133	0.165	0.012	4.209	0.354	0.028	0.087	0.000	0.400
0.199	0.265	0.019	4.143	0.445	0.022	0.076	0.000	0.733
0.266	0.139	0.007	3.235	0.321	0.023	0.062	0.000	0.400
0.333	0.140	0.010	4.248	0.326	0.034	0.074	0.000	0.400
0.400	0.050	0.004	4.791	0.158	0.031	0.050	0.000	0.066
0.466	0.026	-0.000	-1.568	0.000	0.000	0.000	0.000	0.000
0.533	0.031	-0.002	-4.157	0.029	0.011	-0.003	0.000	0.066
0.600	0.070	-0.027	-21.461	0.069	0.030	-0.014	0.003	2.733
0.666	0.121	-0.033	-15.359	0.043	0.027	0.002	0.198	88.600
0.733	0.067	-0.021	-17.423	0.035	0.015	-0.001	0.495	65.533
0.800	0.052	-0.033	-32.662	0.018	0.002	-0.002	0.962	19.933
0.866	0.036	-0.032	-41.840	0.009	0.009	-0.001	0.850	3.733
0.933	0.030	-0.036	-50.254	0.003	0.006	-0.000	0.999	3.133
1.000	0.025	-0.038	-56.776	0.003	0.005	-0.000	1.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.130	0.052	0.058	0.058

U_c(fps) = 70.310   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.022	-0.038	-59.818	0.002	0.006	-0.000	0.999	3.400
1.166	0.017	-0.041	-67.537	0.006	0.012	-0.001	0.908	4.133
1.083	0.030	-0.052	-60.105	0.001	0.016	-0.003	0.969	14.066
1.000	0.040	-0.055	-53.717	0.017	0.019	-0.004	0.907	33.000
0.916	0.083	-0.053	-32.467	0.037	0.017	-0.004	0.673	81.933
0.833	0.119	-0.043	-19.992	0.047	0.021	-0.000	0.338	87.066
0.750	0.145	-0.045	-17.564	0.052	0.032	0.002	0.097	41.933
0.666	0.168	-0.048	-16.122	0.072	0.040	-0.007	0.010	6.800
0.583	0.045	-0.010	-12.823	0.068	0.017	-0.005	0.000	0.266
0.500	0.025	-0.007	-16.264	0.000	0.000	0.000	0.000	0.000
0.416	0.049	-0.001	-1.614	0.159	0.039	0.062	0.000	0.066
0.333	0.049	-0.001	-1.935	0.157	0.037	0.059	0.000	0.066
0.250	0.146	0.010	4.069	0.337	0.044	0.138	0.000	0.400
0.166	0.124	0.006	3.140	0.311	0.040	0.120	0.000	0.333
0.083	0.074	0.000	0.017	0.227	0.033	0.072	0.000	0.200
0.000	0.317	0.018	3.407	0.463	0.022	0.070	0.000	0.866
-0.083	0.172	0.006	2.106	0.367	0.025	0.082	0.000	0.466
-0.166	0.310	0.010	1.963	0.455	0.025	0.009	0.000	0.866
-0.249	0.113	0.000	0.334	0.281	0.020	0.055	0.000	0.266
-0.333	0.025	-0.007	-16.264	0.000	0.000	0.000	0.000	0.000
-0.416	0.025	-0.007	-16.264	0.000	0.000	0.000	0.000	0.000
-0.499	0.037	-0.004	-6.524	0.055	0.017	0.008	0.000	0.133
-0.583	0.088	0.003	1.970	0.100	0.028	0.014	0.001	1.200
-0.666	0.150	0.065	23.592	0.079	0.042	0.015	0.012	8.066
-0.750	0.128	0.067	27.610	0.043	0.031	0.004	0.117	48.133
-0.833	0.096	0.053	29.151	0.041	0.028	0.006	0.348	76.333
-0.916	0.083	0.050	31.152	0.033	0.018	0.007	0.674	73.000
-0.999	0.063	0.040	32.606	0.025	0.008	0.007	0.877	37.866
-1.083	0.045	0.043	43.621	0.010	0.011	0.003	0.978	11.066
-1.166	0.032	0.050	57.223	0.001	0.012	0.001	0.996	5.000
-1.250	0.015	0.045	70.707	0.003	0.008	0.000	0.999	3.333

TABLE D-9 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.130	0.052	0.058	0.058

U_c(fps) =70.574 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.009	0.049	79.435	0.008	0.012	0.000	0.997	3.733
-1.400	0.004	0.057	85.320	0.014	0.020	0.000	0.990	6.133
-1.300	0.011	0.066	80.070	0.023	0.032	0.001	0.955	17.000
-1.200	0.018	0.077	76.434	0.020	0.037	0.002	0.880	36.266
-1.100	0.041	0.090	65.503	0.023	0.043	0.009	0.747	58.200
-1.000	0.096	0.075	38.163	0.037	0.029	0.009	0.505	76.933
-0.900	0.114	0.050	23.639	0.056	0.028	0.011	0.255	63.066
-0.800	0.149	0.068	24.463	0.047	0.035	0.002	0.098	38.733
-0.700	0.177	0.080	24.518	0.059	0.043	0.003	0.020	11.600
-0.600	0.078	0.042	28.151	0.089	0.056	0.043	0.001	1.400
-0.500	0.035	0.015	23.260	0.042	0.027	0.010	0.000	0.133
-0.400	0.060	0.007	7.127	0.165	0.010	-0.016	0.000	0.133
-0.300	0.025	0.009	19.971	0.000	0.000	0.000	0.000	0.000
-0.200	0.227	0.020	5.105	0.393	0.024	0.045	0.000	0.733
-0.100	0.642	0.032	2.902	0.446	0.038	0.046	0.003	2.933
-0.000	0.384	0.020	2.994	0.499	0.032	0.006	0.001	1.000
0.099	0.240	0.022	5.337	0.427	0.036	0.111	0.000	0.666
0.199	0.101	0.015	8.694	0.277	0.055	0.152	0.000	0.200
0.299	0.027	-0.000	-1.548	0.000	0.000	0.000	0.000	0.000
0.399	0.035	-0.000	-0.961	0.054	0.002	0.000	0.000	0.066
0.499	0.036	-0.000	-0.141	0.062	0.005	0.002	0.000	0.066
0.599	0.098	-0.013	-7.771	0.111	0.035	-0.016	0.001	1.400
0.699	0.183	-0.022	-7.091	0.096	0.044	-0.002	0.012	7.333
0.800	0.164	-0.064	-21.259	0.061	0.036	0.001	0.078	32.866
0.900	0.145	-0.048	-18.477	0.052	0.031	0.002	0.211	64.133
0.999	0.114	-0.033	-16.453	0.053	0.024	-0.001	0.427	75.466
1.100	0.101	-0.019	-10.656	0.044	0.013	0.000	0.750	60.533
1.200	0.075	-0.048	-32.795	0.035	0.006	-0.009	0.851	43.866
1.300	0.042	-0.045	-46.909	0.016	0.012	-0.005	0.969	14.400
1.399	0.031	-0.039	-51.363	0.009	0.011	-0.003	0.891	7.000
1.500	0.023	-0.043	-61.567	0.002	0.011	-0.001	0.996	4.400

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.130	0.052	0.058	0.058

U_c(fps) = 68.407   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.023	-0.046	-63.583	0.008	0.015	-0.002	0.899	4.733
1.633	0.026	-0.052	-63.831	0.007	0.019	-0.004	0.922	5.666
1.516	0.042	-0.054	-52.539	0.014	0.018	-0.006	0.970	12.533
1.400	0.075	-0.059	-38.313	0.035	0.016	-0.012	0.882	36.266
1.283	0.108	-0.042	-21.377	0.049	0.002	-0.004	0.778	55.533
1.166	0.138	-0.027	-11.045	0.057	0.012	-0.000	0.586	73.800
1.050	0.154	-0.033	-12.188	0.057	0.030	0.002	0.366	72.133
0.933	0.168	-0.049	-16.402	0.076	0.038	-0.002	0.135	42.533
0.816	0.207	-0.059	-15.877	0.074	0.044	0.002	0.052	24.000
0.700	0.207	-0.071	-19.081	0.102	0.054	-0.026	0.012	7.333
0.583	0.127	-0.030	-13.516	0.150	0.051	-0.030	0.001	1.200
0.466	0.066	-0.007	-6.863	0.143	0.026	0.020	0.000	0.200
0.350	0.061	-0.008	-8.233	0.162	0.023	0.022	0.000	0.133
0.233	0.085	-0.002	-1.364	0.264	0.041	0.104	0.000	0.133
0.116	0.136	0.005	2.272	0.341	0.047	0.157	0.000	0.266
0.000	0.056	-0.005	-5.084	0.189	0.039	0.073	0.000	0.066
-0.116	0.057	-0.008	-8.786	0.191	0.014	0.025	0.000	0.066
-0.233	0.028	-0.011	-21.363	0.000	0.000	0.000	0.000	0.000
-0.349	0.028	-0.011	-21.363	0.000	0.000	0.000	0.000	0.000
-0.466	0.043	-0.007	-10.100	0.070	0.016	0.011	0.000	0.200
-0.583	0.170	0.010	3.546	0.167	0.038	0.027	0.002	1.666
-0.699	0.079	0.036	24.554	0.104	0.047	0.038	0.001	0.866
-0.816	0.197	0.072	20.042	0.072	0.037	0.005	0.062	27.800
-0.933	0.166	0.060	19.806	0.055	0.032	0.004	0.174	49.533
-1.050	0.145	0.053	20.068	0.055	0.025	0.007	0.375	72.200
-1.166	0.117	0.033	16.149	0.056	0.009	0.009	0.594	62.000
-1.283	0.111	0.026	13.402	0.051	0.026	0.009	0.789	53.066
-1.399	0.076	0.031	22.291	0.036	0.022	0.009	0.949	17.866
-1.516	0.049	0.042	40.533	0.016	0.010	0.005	0.981	9.000
-1.633	0.036	0.043	50.045	0.002	0.013	0.003	0.996	4.400
-1.750	0.034	0.041	49.759	0.007	0.012	0.001	0.742	3.000

TABLE D-9 Continued

x/d	Λ_u/d =	Λ_v/d =	λ_x/d =	λ_y/d =
8.000	0.130	0.052	0.058	0.058

U_c(fps) = 62.270 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.000	0.032	0.059	61.648	0.011	0.020	0.003	0.995	5.333
-1.866	0.026	0.070	69.502	0.020	0.028	0.004	0.991	5.866
-1.733	0.016	0.093	80.049	0.032	0.045	0.002	0.962	14.066
-1.600	0.042	0.108	68.647	0.031	0.056	0.012	0.878	33.400
-1.466	0.091	0.105	49.103	0.031	0.048	0.024	0.778	50.400
-1.333	0.138	0.063	24.625	0.071	0.023	0.039	0.612	58.466
-1.200	0.167	0.047	15.956	0.075	0.002	0.015	0.460	63.133
-1.066	0.209	0.051	13.884	0.071	0.036	0.002	0.281	67.800
-0.933	0.232	0.076	18.177	0.072	0.047	0.002	0.121	42.333
-0.800	0.249	0.106	23.075	0.080	0.052	0.005	0.051	21.533
-0.666	0.245	0.083	18.908	0.157	0.064	0.052	0.009	5.400
-0.533	0.116	0.042	19.888	0.168	0.072	0.091	0.000	0.733
-0.400	0.101	0.011	6.738	0.212	0.051	-0.011	0.000	0.333
-0.266	0.060	0.007	7.178	0.165	0.010	0.010	0.000	0.066
-0.133	0.051	0.009	10.684	0.106	0.021	0.022	0.000	0.066
-0.000	0.035	0.006	10.280	0.000	0.000	0.000	0.000	0.000
0.133	0.035	0.006	10.280	0.000	0.000	0.000	0.000	0.000
0.266	0.053	0.004	4.545	0.083	0.011	-0.008	0.000	0.133
0.399	0.075	0.005	3.952	0.118	0.016	-0.006	0.000	0.333
0.533	0.089	0.002	1.795	0.130	0.028	-0.014	0.000	0.466
0.666	0.222	-0.040	-10.253	0.159	0.056	-0.053	0.005	3.533
0.800	0.285	-0.096	-18.625	0.107	0.054	0.000	0.022	11.266
0.933	0.236	-0.070	-16.610	0.091	0.047	-0.003	0.083	32.600
1.066	0.145	-0.037	-14.428	0.104	0.042	-0.016	0.123	34.400
1.200	0.191	-0.037	-11.099	0.072	0.023	0.002	0.387	68.666
1.333	0.160	-0.023	-8.257	0.064	0.027	0.003	0.670	65.933
1.466	0.132	-0.019	-8.413	0.063	0.023	0.000	0.834	43.933
1.600	0.099	-0.087	-41.461	0.047	0.033	-0.019	0.783	42.133
1.733	0.060	-0.066	-47.749	0.024	0.022	-0.013	0.959	15.400
1.866	0.049	-0.057	-48.894	0.017	0.015	-0.008	0.980	9.133
2.000	0.039	-0.049	-51.032	0.009	0.010	-0.004	0.996	4.600

TABLE D-9 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.130	0.052	0.058	0.058

U_c(fps) = 52.270   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.047	-0.050	-47.087	0.007	0.007	-0.002	0.999	3.066
2.333	0.054	-0.048	-41.437	0.012	0.005	-0.003	0.999	3.400
2.166	0.069	-0.049	-35.411	0.029	0.015	-0.009	0.915	5.400
2.000	0.097	-0.052	-28.212	0.049	0.026	-0.017	0.967	14.200
1.833	0.137	-0.032	-13.381	0.067	0.036	-0.007	0.924	26.333
1.666	0.163	-0.028	-9.866	0.078	0.031	-0.001	0.847	40.666
1.500	0.182	-0.026	-8.218	0.081	0.025	0.003	0.723	55.666
1.333	0.231	-0.041	-10.175	0.082	0.042	0.008	0.498	76.000
1.166	0.255	-0.053	-11.731	0.090	0.044	0.005	0.287	65.800
1.000	0.300	-0.074	-13.865	0.099	0.061	0.011	0.130	45.666
0.833	0.336	-0.094	-15.770	0.129	0.063	0.003	0.029	14.933
0.666	0.306	-0.081	-14.818	0.195	0.088	-0.048	0.007	4.666
0.500	0.219	-0.042	-11.024	0.221	0.070	-0.078	0.002	1.600
0.333	0.126	-0.018	-8.371	0.212	0.045	-0.016	0.000	0.533
0.166	0.076	-0.013	-9.782	0.134	0.029	-0.013	0.000	0.200
0.000	0.092	-0.011	-7.307	0.217	0.031	0.020	0.000	0.200
-0.166	0.074	-0.002	-1.929	0.155	0.044	0.064	0.000	0.200
-0.333	0.213	0.028	7.650	0.243	0.069	0.106	0.001	1.200
-0.499	0.221	0.030	7.942	0.231	0.066	0.103	0.002	1.666
-0.666	0.302	0.083	15.396	0.195	0.035	0.077	0.011	6.533
-0.833	0.322	0.101	17.547	0.107	0.066	-0.004	0.038	17.133
-0.999	0.284	0.072	14.292	0.087	0.053	0.000	0.158	47.333
-1.166	0.247	0.064	14.635	0.082	0.049	0.002	0.325	68.666
-1.333	0.224	0.046	11.750	0.083	0.028	0.007	0.500	76.066
-1.500	0.183	0.035	10.924	0.089	0.059	0.023	0.699	58.866
-1.666	0.163	0.028	10.002	0.083	0.055	0.021	0.829	40.266
-1.833	0.124	0.031	14.148	0.068	0.055	0.022	0.943	20.733
-1.999	0.105	0.026	13.976	0.052	0.035	0.011	0.980	9.933
-2.166	0.084	0.032	21.034	0.036	0.029	0.010	0.990	7.133
-2.333	0.069	0.042	31.419	0.020	0.011	0.006	0.996	4.333
-2.500	0.050	0.048	43.920	0.005	0.006	0.002	0.999	3.133

TABLE D-10 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.140	0.093	0.085	0.065

U_c(fps) = 86.983 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.037	0.003	5.032	0.124	0.012	0.015	0.000	0.066
0.050	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.100	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.150	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.200	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.250	0.036	0.003	4.755	0.117	0.010	0.012	0.000	0.066
0.300	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.350	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.400	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.450	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.500	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.550	0.023	0.001	3.911	0.006	0.002	-0.000	0.000	0.066
0.600	0.045	-0.033	-35.920	0.021	0.020	-0.003	0.123	70.733
0.650	0.016	-0.056	-73.777	0.006	0.018	-0.000	0.736	167.933
0.700	0.001	-0.042	-87.431	0.003	0.017	-0.000	0.590	10.466
0.750	-0.002	-0.052	-92.198	0.003	0.008	0.000	0.999	3.533
0.000	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.050	0.036	0.002	4.449	0.115	0.008	0.009	0.000	0.066
-0.100	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.150	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.200	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.250	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.300	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.350	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.400	0.036	0.003	5.343	0.116	0.013	0.015	0.000	0.066
-0.450	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.500	0.022	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.550	0.025	0.002	5.396	0.014	0.004	0.000	0.000	0.133
-0.600	0.050	0.027	28.458	0.021	0.016	0.002	0.118	83.800
-0.650	0.046	0.043	43.622	0.015	0.015	0.001	0.677	154.400
-0.700	0.048	0.047	44.089	0.007	0.008	0.000	0.997	7.400
-0.750	0.028	0.049	59.766	0.005	0.006	0.000	0.999	3.000

TABLE D-10 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.140	0.093	0.085	0.065

U_c(fps) = 86.983   T = 15.000   (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.025	0.044	60.096	0.005	0.007	0.000	0.999	3.000
-0.933	0.015	0.054	73.671	0.004	0.009	0.000	0.998	3.800
-0.866	0.018	0.059	72.861	0.006	0.014	0.000	0.982	13.266
-0.800	0.034	0.063	61.579	0.013	0.019	0.001	0.846	67.133
-0.733	0.060	0.055	42.237	0.024	0.024	0.003	0.372	110.266
-0.666	0.079	0.038	25.803	0.042	0.028	0.007	0.064	39.533
-0.600	0.039	0.019	26.390	0.041	0.024	0.007	0.000	1.000
-0.533	0.020	0.010	27.634	0.000	0.000	0.000	0.000	0.000
-0.466	0.020	0.010	27.634	0.000	0.000	0.000	0.000	0.000
-0.400	0.020	0.010	27.634	0.000	0.000	0.000	0.000	0.000
-0.333	0.032	0.011	19.900	0.104	0.010	0.009	0.000	0.066
-0.266	0.020	0.010	27.634	0.000	0.000	0.000	0.000	0.000
-0.200	0.037	0.003	4.790	0.120	0.011	0.013	0.000	0.066
-0.133	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.066	0.023	0.001	4.534	0.000	0.000	0.000	-0.000	0.000
-0.000	0.037	0.003	4.790	0.122	0.011	0.013	0.000	0.066
0.066	0.023	0.001	4.534	0.000	0.000	0.000	-0.000	0.000
0.133	0.037	0.003	5.516	0.125	0.010	0.013	0.000	0.066
0.199	0.023	0.002	5.952	0.000	0.000	0.000	0.000	0.000
0.266	0.023	0.002	5.952	0.000	0.000	0.000	-0.000	0.000
0.333	0.036	0.003	5.833	0.119	0.011	0.013	0.000	0.066
0.400	0.023	0.002	5.952	0.000	0.000	0.000	0.000	0.000
0.466	0.023	0.002	5.952	0.000	0.000	0.000	0.000	0.000
0.533	0.023	0.002	5.952	0.000	0.000	0.000	0.000	0.000
0.600	0.032	0.000	1.220	0.043	0.011	-0.002	0.000	0.266
0.666	0.080	-0.046	-30.229	0.049	0.035	-0.012	0.020	17.400
0.733	0.060	-0.058	-44.153	0.028	0.028	-0.005	0.255	96.733
0.800	0.019	-0.049	-68.373	0.011	0.028	-0.002	0.398	51.400
0.866	0.008	-0.059	-82.275	0.005	0.018	-0.000	0.956	24.666
0.933	0.007	-0.050	-81.580	0.001	0.011	-0.000	0.995	5.733
1.000	0.000	-0.038	-89.738	0.001	0.013	0.000	0.585	2.000

TABLE D-10 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.140	0.093	0.085	0.065

U_c(fps) = 86.400 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.001	-0.045	-87.913	0.007	0.012	0.000	0.993	6.133
1.166	0.002	-0.050	-86.613	0.008	0.016	-0.000	0.888	10.000
1.083	0.006	-0.060	-83.363	0.008	0.020	-0.000	0.886	30.466
1.000	0.017	-0.069	-75.781	0.009	0.023	-0.001	0.723	61.733
0.916	0.049	-0.075	-56.655	0.024	0.030	-0.004	0.378	83.666
0.833	0.072	-0.063	-41.393	0.039	0.033	-0.009	0.121	46.666
0.750	0.080	-0.059	-36.322	0.058	0.044	-0.019	0.014	9.466
0.666	0.032	-0.027	-40.344	0.042	0.032	-0.013	0.000	0.666
0.583	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.500	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.416	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.333	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.250	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.166	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
0.083	0.038	0.003	4.672	0.130	0.011	0.014	0.000	0.066
0.000	0.037	0.003	5.188	0.119	0.013	0.015	0.000	0.066
-0.083	0.023	0.001	4.534	0.000	0.000	0.000	-0.000	0.000
-0.166	0.036	0.002	4.003	0.116	0.007	0.007	0.000	0.066
-0.249	0.023	0.001	4.534	0.000	0.000	0.000	-0.000	0.000
-0.333	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.416	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.499	0.023	0.001	4.534	0.000	0.000	0.000	0.000	0.000
-0.583	0.023	0.001	4.534	0.000	0.000	0.000	-0.000	0.000
-0.666	0.048	0.023	25.590	0.055	0.027	0.012	0.000	1.400
-0.750	0.089	0.049	28.994	0.050	0.033	0.010	0.052	24.266
-0.833	0.082	0.039	25.721	0.040	0.025	0.005	0.189	61.000
-0.916	0.069	0.045	32.884	0.027	0.019	0.003	0.522	82.466
-0.999	0.056	0.038	34.100	0.021	0.012	0.003	0.807	51.800
-1.083	0.047	0.034	35.875	0.015	0.008	0.002	0.924	24.600
-1.166	0.043	0.031	35.448	0.010	0.004	0.001	0.984	7.800
-1.250	0.015	0.036	66.828	0.003	0.011	0.000	0.659	3.866

TABLE D-10 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.140	0.093	0.085	0.065

U_c(fps) = 86.014   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.019	0.045	66.751	0.000	0.010	0.000	0.994	4.600
-1.400	0.018	0.048	69.419	0.007	0.014	0.001	0.973	10.133
-1.300	0.032	0.050	57.492	0.006	0.018	0.004	0.933	21.733
-1.200	0.045	0.053	49.671	0.017	0.019	0.004	0.835	40.266
-1.100	0.056	0.044	38.337	0.033	0.023	0.010	0.377	50.800
-1.000	0.091	0.041	24.462	0.038	0.018	0.005	0.344	67.000
-0.900	0.095	0.045	25.499	0.048	0.028	0.007	0.147	45.600
-0.800	0.102	0.056	28.850	0.059	0.034	0.014	0.035	15.466
-0.700	0.051	0.027	28.385	0.063	0.032	0.016	0.001	1.333
-0.600	0.028	0.020	36.356	0.037	0.024	0.008	0.000	0.333
-0.500	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
-0.400	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
-0.300	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
-0.200	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
-0.100	0.030	0.015	27.043	0.101	0.010	0.009	0.000	0.066
-0.000	0.044	0.016	20.879	0.152	0.014	0.020	0.000	0.133
0.099	0.032	0.016	27.082	0.113	0.016	0.018	0.000	0.066
0.199	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
0.299	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
0.399	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
0.499	0.019	0.014	37.392	0.000	0.000	0.000	0.000	0.000
0.599	0.019	0.014	37.392	0.000	0.000	0.000	-0.000	0.000
0.699	0.062	0.023	20.678	0.078	0.022	0.011	0.001	1.200
0.800	0.097	-0.054	-29.470	0.066	0.042	-0.019	0.015	8.733
0.900	0.099	-0.055	-29.274	0.056	0.036	-0.012	0.070	27.266
0.999	0.093	-0.048	-27.394	0.047	0.029	-0.007	0.183	52.933
1.100	0.076	-0.054	-35.860	0.032	0.021	-0.004	0.467	66.400
1.200	0.056	-0.059	-46.093	0.023	0.021	-0.004	0.700	56.400
1.300	0.038	-0.056	-55.830	0.012	0.020	-0.003	0.866	35.266
1.399	0.011	-0.052	-77.180	0.011	0.019	-0.001	0.939	12.666
1.500	0.012	-0.046	-75.235	0.008	0.014	-0.000	0.990	6.333

TABLE D-10 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.140	0.093	0.085	0.065

U_c(fps) = 83.088   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.875	0.012	-0.047	-75.256	0.007	0.011	-0.000	0.998	3.533
1.750	0.014	-0.055	-75.349	0.008	0.016	-0.000	0.986	7.266
1.625	0.013	-0.058	-77.387	0.010	0.022	-0.001	0.912	11.866
1.500	0.020	-0.069	-73.371	0.014	0.027	-0.002	0.890	28.800
1.375	0.055	-0.074	-53.467	0.016	0.027	-0.007	0.746	52.466
1.250	0.089	-0.061	-34.472	0.041	0.027	-0.007	0.446	62.000
1.125	0.097	-0.070	-35.963	0.045	0.031	-0.008	0.325	62.866
1.000	0.124	-0.065	-27.543	0.068	0.040	-0.015	0.065	27.133
0.875	0.092	-0.048	-27.625	0.082	0.046	-0.031	0.006	4.666
0.750	0.063	-0.032	-27.362	0.078	0.042	-0.030	0.002	1.266
0.625	0.027	-0.013	-26.022	0.028	0.012	-0.003	0.000	0.066
0.500	0.024	-0.011	-26.326	0.000	0.000	0.000	-0.000	0.000
0.375	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
0.250	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
0.125	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
0.000	0.039	-0.013	-18.257	0.136	0.010	-0.014	0.000	0.066
-0.125	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
-0.250	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
-0.375	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
-0.500	0.024	-0.011	-26.326	0.000	0.000	0.000	0.000	0.000
-0.625	0.044	0.006	7.963	0.053	0.016	0.006	0.000	0.533
-0.750	0.115	0.052	24.239	0.091	0.048	0.030	0.010	5.066
-0.875	0.121	0.058	25.633	0.068	0.039	0.014	0.038	16.466
-1.000	0.117	0.051	23.418	0.053	0.031	0.007	0.179	48.466
-1.125	0.096	0.042	23.798	0.043	0.023	0.005	0.429	60.600
-1.250	0.091	0.037	22.097	0.037	0.004	0.005	0.643	58.333
-1.375	0.077	0.032	22.560	0.031	0.001	0.004	0.835	37.533
-1.500	0.060	0.027	24.592	0.024	0.011	0.003	0.936	17.000
-1.625	0.040	0.038	43.730	0.010	0.003	0.002	0.986	6.933
-1.750	0.024	0.033	54.072	0.007	0.010	0.001	0.610	3.000
-1.875	0.020	0.040	62.949	0.001	0.005	0.000	0.999	3.133

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.140	0.093	0.085	0.065

U_c(fps) = 74.334   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.200	0.020	0.050	67.360	0.000	0.007	0.000	0.999	3.000
-2.053	0.022	0.052	66.708	0.008	0.017	0.002	0.827	4.466
-1.906	0.033	0.066	63.489	0.014	0.025	0.005	0.973	10.400
-1.760	0.053	0.063	49.736	0.017	0.023	0.010	0.882	17.933
-1.613	0.074	0.038	27.405	0.045	0.001	0.011	0.577	24.333
-1.466	0.112	0.037	18.685	0.047	0.012	0.005	0.664	47.666
-1.320	0.138	0.040	16.255	0.055	0.023	0.005	0.440	62.600
-1.173	0.149	0.045	16.895	0.065	0.029	0.007	0.252	53.600
-1.026	0.147	0.055	20.827	0.079	0.041	0.016	0.087	28.200
-0.880	0.159	0.078	26.350	0.094	0.051	0.028	0.031	13.266
-0.733	0.081	0.036	24.311	0.102	0.052	0.045	0.001	1.466
-0.586	0.039	0.016	23.232	0.050	0.025	0.012	0.000	0.133
-0.440	0.030	0.012	21.988	0.000	0.000	0.000	0.000	0.000
-0.293	0.032	0.002	4.534	0.000	0.000	0.000	0.000	0.000
-0.146	0.032	0.002	4.534	0.000	0.000	0.000	0.000	0.000
-0.000	0.032	0.002	4.534	0.000	0.000	0.000	0.000	0.000
0.146	0.032	0.002	4.534	0.000	0.000	0.000	0.000	0.000
0.293	0.032	0.002	4.534	0.000	0.000	0.000	0.000	0.000
0.439	0.032	0.002	4.534	0.000	0.000	0.000	0.000	0.000
0.586	0.055	-0.003	-4.036	0.089	0.029	-0.018	0.000	0.466
0.733	0.069	-0.024	-19.053	0.097	0.051	-0.037	0.000	0.866
0.879	0.104	-0.045	-23.479	0.098	0.055	-0.044	0.005	3.533
1.026	0.149	-0.066	-23.886	0.099	0.051	-0.034	0.033	14.466
1.173	0.148	-0.060	-22.236	0.079	0.037	-0.017	0.132	39.533
1.320	0.140	-0.064	-24.599	0.059	0.033	-0.008	0.309	59.400
1.466	0.125	-0.064	-27.394	0.052	0.027	-0.007	0.494	61.733
1.613	0.098	-0.057	-30.244	0.041	0.017	-0.008	0.777	41.666
1.759	0.078	-0.051	-33.213	0.032	0.009	-0.009	0.890	24.466
1.906	0.047	-0.061	-52.428	0.005	0.019	-0.006	0.957	13.466
2.053	0.032	-0.060	-61.957	0.004	0.021	-0.003	0.981	8.866
2.200	0.031	-0.052	-59.222	0.008	0.014	-0.002	0.993	5.066

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.140	0.093	0.085	0.065

U_c(fps) = 61.577 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.035	-0.060	-59.521	0.010	0.016	-0.003	0.994	4.600
2.333	0.043	-0.069	-57.966	0.010	0.024	-0.006	0.987	8.400
2.166	0.044	-0.078	-60.718	0.015	0.036	-0.012	0.792	13.933
2.000	0.053	-0.094	-60.358	0.010	0.038	-0.011	0.909	22.533
1.833	0.119	-0.076	-32.685	0.052	0.020	-0.018	0.756	45.266
1.666	0.128	-0.069	-28.205	0.068	0.032	-0.019	0.486	49.800
1.500	0.170	-0.074	-23.576	0.068	0.031	-0.011	0.416	60.266
1.333	0.172	-0.079	-24.783	0.083	0.043	-0.020	0.222	47.600
1.166	0.194	-0.088	-24.601	0.103	0.055	-0.030	0.076	25.266
1.000	0.176	-0.079	-24.278	0.137	0.066	-0.059	0.014	7.200
0.833	0.118	-0.058	-26.246	0.140	0.074	-0.092	0.002	1.466
0.666	0.062	-0.032	-27.324	0.096	0.055	-0.049	0.000	0.400
0.500	0.051	-0.023	-24.563	0.080	0.038	-0.029	0.000	0.200
0.333	0.038	0.003	4.534	0.000	0.000	0.000	0.000	0.000
0.166	0.038	0.003	4.534	0.000	0.000	0.000	0.000	0.000
0.000	0.038	0.003	4.534	0.000	0.000	0.000	0.000	0.000
-0.166	0.038	0.003	4.534	0.000	0.000	0.000	0.000	0.000
-0.333	0.055	0.010	10.972	0.084	0.042	0.034	0.000	0.200
-0.499	0.046	0.007	8.799	0.048	0.025	0.012	0.000	0.133
-0.666	0.107	0.026	14.042	0.146	0.057	0.061	0.001	1.066
-0.833	0.191	0.044	13.221	0.144	0.055	0.048	0.013	6.266
-0.999	0.182	0.072	21.555	0.112	0.055	0.038	0.039	15.800
-1.166	0.187	0.072	21.233	0.086	0.045	0.016	0.117	33.466
-1.333	0.178	0.051	15.950	0.085	0.035	0.012	0.247	53.066
-1.500	0.164	0.049	16.782	0.064	0.020	0.009	0.509	61.000
-1.666	0.143	0.040	15.946	0.062	0.021	0.009	0.734	45.866
-1.833	0.122	0.031	14.535	0.057	0.034	0.010	0.849	31.600
-1.999	0.093	0.055	30.702	0.043	0.015	0.016	0.935	20.466
-2.166	0.065	0.054	39.893	0.024	0.007	0.010	0.977	9.133
-2.333	0.053	0.059	48.128	0.011	0.012	0.007	0.991	5.600
-2.500	0.035	0.054	57.267	0.004	0.013	0.002	0.898	4.000

TABLE D-11 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.110	0.046	0.086	0.071

U_c(fps) = 79.485 T = 30.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.227	0.017	4.412	0.420	0.020	0.079	0.000	0.600
0.050	0.230	0.017	4.315	0.424	0.020	0.078	0.000	0.633
0.100	0.171	0.013	4.485	0.376	0.026	0.092	0.000	0.400
0.150	0.232	0.018	4.516	0.429	0.021	0.086	0.000	0.600
0.200	0.339	0.020	3.462	0.482	0.013	0.020	0.001	0.933
0.250	0.292	0.017	3.474	0.464	0.013	0.033	0.000	0.766
0.300	0.242	0.016	3.921	0.434	0.017	0.062	0.000	0.700
0.350	0.253	0.018	4.242	0.440	0.020	0.071	0.000	0.800
0.400	0.192	0.014	4.316	0.392	0.024	0.083	0.000	0.466
0.450	0.023	-0.002	-5.705	0.000	0.000	0.000	0.000	0.000
0.500	0.023	-0.002	-5.705	0.000	0.000	0.000	0.000	0.000
0.550	0.023	-0.002	-5.705	0.000	0.000	0.000	0.000	0.000
0.600	0.078	-0.022	-16.360	0.026	0.017	-0.000	0.065	48.533
0.650	0.044	-0.044	-45.330	0.010	0.013	-0.000	0.709	166.233
0.700	0.021	-0.047	-65.579	0.004	0.009	-0.000	0.995	7.266
0.750	0.012	-0.043	-73.339	0.003	0.007	-0.000	0.895	2.766
0.000	0.215	0.018	4.895	0.410	0.024	0.096	0.000	0.666
-0.050	0.119	0.010	5.055	0.307	0.031	0.096	0.000	0.333
-0.100	0.280	0.021	4.454	0.444	0.019	0.068	0.000	0.733
-0.150	0.186	0.017	5.327	0.378	0.029	0.107	0.000	0.466
-0.200	0.252	0.019	4.404	0.424	0.020	0.070	0.000	0.733
-0.250	0.207	0.017	4.841	0.393	0.024	0.090	0.000	0.666
-0.300	0.344	0.023	3.911	0.464	0.014	0.034	0.001	1.266
-0.350	0.361	0.019	3.087	0.464	0.012	-0.001	0.001	1.200
-0.400	0.142	0.013	5.569	0.336	0.034	0.111	0.000	0.333
-0.450	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.500	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.550	0.091	0.025	15.588	0.036	0.026	0.005	0.012	10.200
-0.600	0.071	0.037	27.777	0.015	0.016	0.001	0.594	193.200
-0.650	0.033	0.036	47.620	0.011	0.017	0.001	0.648	30.600
-0.700	0.026	0.061	66.269	0.005	0.010	0.000	1.000	3.000
-0.750	0.014	0.052	74.912	0.005	0.008	0.000	1.000	3.000

TABLE D-11 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.110	0.046	0.086	0.071

U_c(fps) = 79.485 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.200	0.006	0.050	82.145	0.001	0.005	-0.000	1.000	3.000
-1.149	0.006	0.049	82.792	0.002	0.004	-0.000	1.000	3.000
-1.100	0.005	0.045	83.065	0.002	0.004	0.000	1.000	3.000
-1.050	0.005	0.046	83.698	0.002	0.007	-0.000	1.000	3.000
-0.999	0.007	0.046	81.345	0.002	0.005	0.000	1.000	3.000
-0.949	0.006	0.054	82.987	0.003	0.007	-0.000	0.999	3.066
-0.900	0.008	0.058	81.814	0.003	0.010	0.000	0.998	4.200
-0.849	0.013	0.069	79.419	0.004	0.016	0.000	0.982	12.200
-0.800	0.018	0.073	75.667	0.007	0.022	0.000	0.914	39.333
-0.750	0.031	0.087	70.317	0.014	0.028	0.001	0.712	95.933
-0.699	0.065	0.086	52.908	0.022	0.031	0.003	0.399	117.066
-0.650	0.061	0.046	36.908	0.047	0.039	0.014	0.063	32.466
-0.600	0.113	0.082	36.039	0.045	0.038	0.003	0.014	11.000
-0.550	0.028	0.017	32.204	0.032	0.021	0.006	0.000	0.200
-0.500	0.029	0.000	1.216	0.039	0.018	0.007	0.000	0.066
-0.450	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.400	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.350	0.044	0.000	0.685	0.140	0.016	0.023	0.000	0.066
-0.300	0.159	0.007	2.730	0.345	0.021	0.051	0.000	0.400
-0.250	0.342	0.018	3.015	0.463	0.022	0.001	0.001	1.133
-0.200	0.321	0.018	3.275	0.459	0.018	0.017	0.001	1.133
-0.150	0.210	0.018	5.120	0.401	0.030	0.099	0.000	0.600
-0.100	0.389	0.019	2.926	0.476	0.014	-0.013	0.001	1.266
-0.050	0.186	0.016	5.142	0.380	0.027	0.099	0.000	0.533
-0.000	0.350	0.022	3.616	0.474	0.012	0.020	0.001	1.133
0.049	0.213	0.017	4.570	0.407	0.022	0.082	0.000	0.600
0.099	0.426	0.021	2.858	0.495	0.016	-0.023	0.001	1.333
0.149	0.383	0.023	3.466	0.491	0.014	0.009	0.001	1.200
0.199	0.405	0.019	2.752	0.494	0.019	-0.024	0.001	1.066
0.249	0.449	0.017	2.273	0.497	0.024	-0.049	0.001	1.333
0.299	0.286	0.020	4.091	0.455	0.026	0.056	0.000	0.933
0.349	0.214	0.019	5.169	0.407	0.033	0.104	0.000	0.533
0.399	0.047	0.002	2.996	0.161	0.029	0.048	0.000	0.066
0.449	0.023	-0.002	-5.275	0.000	0.000	0.000	0.000	0.000
0.499	0.023	-0.002	-5.275	0.000	0.000	0.000	0.000	0.000
0.549	0.023	-0.002	-5.275	0.000	0.000	0.000	0.000	0.000
0.599	0.026	-0.003	-8.241	0.021	0.011	-0.002	0.000	0.066
0.649	0.108	-0.081	-37.042	0.064	0.040	-0.014	0.007	6.133
0.699	0.087	-0.065	-37.050	0.042	0.028	-0.005	0.084	48.400
0.749	0.060	-0.066	-47.806	0.026	0.022	-0.002	0.425	124.066
0.799	0.036	-0.059	-58.240	0.014	0.019	-0.002	0.810	76.333
0.849	0.021	-0.053	-67.779	0.007	0.016	-0.001	0.947	26.933
0.899	0.014	-0.049	-73.363	0.003	0.013	-0.000	0.955	10.066
0.949	0.010	-0.044	-76.671	0.001	0.008	-0.000	0.998	3.466
0.999	0.008	-0.043	-78.227	0.002	0.005	-0.000	0.999	3.066
1.050	0.007	-0.040	-79.773	0.002	0.004	-0.000	1.000	3.000
1.100	0.004	-0.041	-83.582	0.001	0.004	-0.000	1.000	3.000
1.149	0.005	-0.040	-81.811	0.001	0.003	0.000	1.000	3.000
1.199	0.007	-0.038	-79.362	0.001	0.003	-0.000	1.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.110	0.046	0.086	0.071

U_c(fps) = 79.948   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.275	0.010	-0.040	-75.673	0.002	0.007	-0.000	0.998	3.466
1.200	0.016	-0.045	-70.641	0.006	0.014	-0.001	0.985	9.000
1.125	0.018	-0.043	-67.268	0.006	0.018	-0.002	0.773	13.666
1.050	0.035	-0.055	-57.781	0.014	0.021	-0.004	0.860	44.800
0.975	0.058	-0.061	-46.363	0.028	0.021	-0.004	0.639	78.800
0.900	0.079	-0.065	-39.497	0.036	0.023	-0.004	0.405	90.666
0.825	0.109	-0.056	-27.222	0.043	0.027	-0.000	0.159	59.200
0.750	0.143	-0.063	-23.790	0.053	0.034	-0.002	0.022	14.200
0.675	0.072	-0.035	-25.987	0.074	0.039	-0.021	0.002	1.733
0.600	0.028	-0.015	-29.085	0.036	0.021	-0.007	0.000	0.133
0.525	0.034	-0.016	-25.272	0.063	0.023	-0.014	0.000	0.133
0.450	0.020	-0.011	-28.487	0.000	0.000	0.000	0.000	0.000
0.375	0.045	-0.007	-9.012	0.164	0.026	0.043	0.000	0.066
0.300	0.278	0.012	2.540	0.420	0.028	0.094	0.000	0.733
0.225	0.329	0.025	4.445	0.467	0.023	0.060	0.001	1.200
0.150	0.489	0.024	2.918	0.493	0.028	-0.020	0.001	1.666
0.075	0.576	0.018	1.817	0.480	0.025	-0.070	0.002	1.933
0.000	0.420	0.020	2.779	0.487	0.018	-0.026	0.001	1.400
-0.074	0.433	0.023	3.156	0.478	0.020	-0.012	0.001	1.666
-0.149	0.258	0.011	2.568	0.436	0.015	0.007	0.000	0.866
-0.224	0.160	0.010	3.590	0.349	0.023	0.065	0.000	0.400
-0.299	0.044	-0.000	-0.708	0.140	0.011	0.015	0.000	0.066
-0.374	0.036	-0.001	-2.893	0.085	0.011	0.002	0.000	0.066
-0.449	0.023	-0.002	-5.825	0.000	0.000	0.000	0.000	0.000
-0.525	0.031	-0.000	-0.905	0.037	0.009	0.002	0.000	0.133
-0.599	0.082	0.020	13.588	0.080	0.035	0.022	0.001	1.466
-0.675	0.132	0.071	28.563	0.053	0.039	0.005	0.022	13.000
-0.749	0.111	0.064	30.189	0.037	0.029	0.004	0.152	57.200
-0.824	0.092	0.058	32.330	0.032	0.026	0.003	0.374	90.866
-0.899	0.054	0.039	35.693	0.030	0.023	0.007	0.446	47.400
-0.974	0.055	0.048	40.963	0.019	0.018	0.004	0.866	41.133
-1.050	0.038	0.049	52.255	0.008	0.017	0.003	0.943	20.666
-1.125	0.024	0.046	62.623	0.002	0.013	0.000	0.988	6.800
-1.199	0.018	0.051	70.224	0.005	0.012	0.000	0.997	4.200
-1.274	0.007	0.057	82.146	0.002	0.009	0.000	0.999	3.400

TABLE D-11 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.110	0.046	0.086	0.071

U_c(fps) =79.716 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.006	0.041	80.900	0.005	0.009	0.000	0.999	3.400
-1.400	0.010	0.050	78.786	0.012	0.016	0.000	0.990	6.200
-1.300	0.009	0.049	79.137	0.011	0.026	0.001	0.620	12.933
-1.200	0.020	0.068	72.893	0.017	0.031	0.003	0.875	34.200
-1.100	0.055	0.077	54.316	0.012	0.033	0.010	0.712	62.933
-1.000	0.095	0.056	30.682	0.036	0.022	0.006	0.464	78.866
-0.900	0.123	0.031	14.264	0.039	0.027	0.002	0.253	67.533
-0.800	0.087	0.120	54.239	0.035	0.045	0.006	0.061	27.666
-0.700	0.110	0.040	20.091	0.076	0.038	0.016	0.010	6.533
-0.600	0.075	0.030	22.296	0.076	0.038	0.020	0.002	1.666
-0.500	0.026	-0.002	-4.527	0.011	0.001	0.000	0.000	0.066
-0.400	0.024	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.300	0.024	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.200	0.107	-0.003	-1.948	0.270	0.017	-0.032	0.000	0.266
-0.100	0.086	0.001	0.889	0.233	0.011	0.020	0.000	0.200
-0.000	0.394	0.005	0.809	0.483	0.033	-0.094	0.001	1.333
0.099	0.165	0.011	3.978	0.361	0.028	0.074	0.000	0.466
0.199	0.137	0.014	6.146	0.319	0.039	0.119	0.000	0.333
0.299	0.135	0.015	6.389	0.314	0.043	0.123	0.000	0.333
0.399	0.045	0.002	3.135	0.138	0.030	0.042	0.000	0.066
0.499	0.024	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.599	0.042	-0.008	-11.402	0.066	0.022	-0.012	0.000	0.266
0.699	0.091	-0.020	-12.817	0.090	0.035	-0.018	0.002	1.933
0.800	0.149	-0.100	-34.118	0.065	0.037	-0.008	0.014	9.000
0.900	0.118	-0.071	-30.993	0.049	0.029	-0.002	0.072	31.133
0.999	0.092	-0.066	-35.535	0.042	0.026	-0.002	0.299	73.866
1.100	0.073	-0.056	-37.855	0.036	0.022	-0.004	0.538	77.666
1.200	0.045	-0.059	-52.664	0.022	0.021	-0.006	0.753	59.133
1.300	0.019	-0.053	-70.176	0.010	0.022	-0.004	0.900	30.933
1.399	0.005	-0.037	-81.840	0.011	0.017	-0.001	0.639	7.000
1.500	-0.007	-0.038	-100.718	0.009	0.011	0.000	0.995	4.800

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.110	0.046	0.086	0.071

U_c(fps) = 77.235 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.700	-0.017	-0.043	-111.964	0.012	0.015	0.001	0.988	6.600
1.600	-0.018	-0.044	-113.241	0.014	0.018	0.002	0.883	9.133
1.500	-0.032	-0.046	-125.123	0.006	0.019	0.004	0.929	21.333
1.400	-0.064	-0.044	-145.479	0.027	0.018	0.008	0.709	60.333
1.300	0.075	-0.068	-42.067	0.037	0.021	-0.011	0.652	70.800
1.200	0.086	-0.063	-36.375	0.045	0.027	-0.007	0.408	67.533
1.100	0.092	-0.052	-29.607	0.062	0.033	-0.012	0.171	45.133
1.000	0.138	-0.065	-25.261	0.055	0.033	0.001	0.111	41.400
0.900	0.163	-0.082	-26.734	0.067	0.035	-0.001	0.033	16.533
0.800	0.158	-0.075	-25.365	0.093	0.049	-0.012	0.010	5.933
0.700	0.054	-0.018	-18.692	0.070	0.033	-0.017	0.000	0.733
0.600	0.037	-0.011	-16.686	0.054	0.018	-0.008	0.000	0.133
0.500	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
0.400	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
0.300	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
0.200	0.048	-0.003	-4.540	0.154	0.023	0.034	0.000	0.066
0.100	0.081	0.001	0.996	0.259	0.038	0.097	0.000	0.133
0.000	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
-0.099	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
-0.199	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
-0.299	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
-0.399	0.025	-0.007	-16.116	0.000	0.000	0.000	0.000	0.000
-0.499	0.056	-0.003	-3.953	0.082	0.016	0.007	0.000	0.466
-0.599	0.091	0.023	14.300	0.106	0.039	0.032	0.001	1.000
-0.699	0.161	0.049	17.067	0.080	0.042	0.010	0.011	6.733
-0.799	0.168	0.035	11.909	0.054	0.034	0.001	0.037	18.133
-0.899	0.139	0.030	12.315	0.057	0.031	0.004	0.109	42.266
-0.999	0.132	0.009	4.101	0.049	0.026	0.001	0.220	59.466
-1.099	0.108	-0.005	-2.770	0.046	0.010	-0.000	0.472	71.200
-1.199	0.096	-0.019	-11.389	0.043	0.012	-0.002	0.576	61.333
-1.299	0.076	-0.033	-23.585	0.039	0.022	-0.007	0.821	42.400
-1.399	0.049	-0.048	-43.914	0.024	0.003	-0.009	0.916	26.800
-1.499	0.031	-0.054	-59.819	0.005	0.020	-0.007	0.958	15.533
-1.599	0.007	0.062	82.989	0.017	0.026	0.000	0.976	10.466
-1.699	0.006	0.055	83.327	0.011	0.017	0.000	0.950	5.200

TABLE D-11 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.110	0.046	0.086	0.071

U_c(fps) = 70.520 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.100	0.004	0.056	85.224	0.013	0.016	0.000	0.996	4.600
-1.950	0.005	0.069	85.372	0.020	0.030	-0.000	0.986	7.800
-1.800	0.013	0.073	79.622	0.027	0.035	0.001	0.968	13.333
-1.650	0.040	0.088	65.257	0.029	0.045	0.012	0.897	27.666
-1.500	0.090	0.081	41.944	0.036	0.037	0.022	0.778	48.666
-1.350	0.123	0.076	31.612	0.051	0.022	0.031	0.606	65.400
-1.200	0.149	0.067	24.319	0.058	0.033	0.011	0.423	70.200
-1.050	0.176	0.078	23.848	0.065	0.043	0.011	0.188	51.000
-0.900	0.217	0.105	26.003	0.077	0.054	0.012	0.052	20.800
-0.750	0.140	0.075	28.189	0.118	0.068	0.060	0.006	3.266
-0.600	0.123	0.067	28.589	0.143	0.086	0.104	0.001	1.066
-0.450	0.041	0.016	21.493	0.079	0.035	0.026	0.000	0.133
-0.300	0.041	0.004	5.511	0.064	0.045	0.029	0.000	0.066
-0.150	0.031	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.000	0.088	0.006	4.503	0.266	0.043	0.107	0.000	0.133
0.149	0.031	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.299	0.031	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.449	0.057	0.001	1.875	0.125	0.025	0.029	0.000	0.133
0.599	0.078	-0.004	-3.223	0.118	0.027	-0.019	0.000	0.533
0.749	0.172	-0.055	-17.746	0.143	0.054	-0.044	0.004	2.600
0.899	0.240	-0.067	-15.765	0.119	0.049	-0.011	0.018	9.533
1.049	0.227	-0.061	-15.082	0.081	0.045	0.009	0.090	32.000
1.199	0.188	-0.045	-13.578	0.074	0.034	0.005	0.250	63.133
1.349	0.168	-0.035	-11.955	0.068	0.029	0.003	0.476	76.066
1.499	0.119	-0.021	-10.237	0.060	0.008	0.000	0.701	51.066
1.649	0.093	-0.017	-10.623	0.051	0.033	-0.003	0.923	23.733
1.799	0.025	-0.056	-65.363	0.002	0.032	-0.008	0.604	16.333
1.949	0.010	-0.060	-80.635	0.017	0.027	-0.002	0.937	12.133
2.100	0.006	-0.049	-82.760	0.011	0.015	-0.000	0.997	4.133

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.110	0.046	0.086	0.071

U_c(fps) = 59.158   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.001	-0.061	-88.927	0.016	0.019	-0.000	0.996	4.200
2.333	-0.002	-0.067	-92.038	0.023	0.029	-0.000	0.989	6.333
2.166	0.002	-0.082	-88.440	0.034	0.042	-0.002	0.969	14.133
2.000	0.001	-0.087	-89.059	0.031	0.044	-0.001	0.858	20.533
1.833	0.030	-0.112	-75.004	0.027	0.054	-0.012	0.844	39.400
1.666	0.099	-0.115	-49.495	0.040	0.044	-0.025	0.713	58.133
1.500	0.169	-0.085	-26.668	0.075	0.035	-0.005	0.491	72.933
1.333	0.205	-0.081	-21.546	0.078	0.038	-0.003	0.312	70.666
1.166	0.199	-0.083	-22.666	0.103	0.053	-0.014	0.140	41.933
1.000	0.277	-0.075	-15.257	0.089	0.060	0.007	0.028	13.200
0.833	0.296	-0.118	-21.765	0.121	0.069	-0.006	0.016	9.600
0.666	0.252	-0.084	-18.518	0.202	0.075	-0.091	0.004	3.066
0.500	0.077	-0.024	-17.640	0.163	0.035	-0.013	0.000	0.333
0.333	0.054	-0.018	-19.020	0.108	0.028	0.008	0.000	0.133
0.166	0.072	-0.020	-16.166	0.156	0.030	-0.007	0.000	0.200
0.000	0.062	-0.018	-16.388	0.134	0.012	-0.000	0.000	0.133
-0.166	0.067	-0.012	-10.562	0.130	0.022	0.028	0.000	0.200
-0.333	0.067	0.014	12.131	0.110	0.067	0.074	0.000	0.200
-0.499	0.144	0.033	13.034	0.181	0.066	0.095	0.001	0.933
-0.666	0.233	0.082	19.418	0.164	0.073	0.078	0.006	3.800
-0.833	0.297	0.083	15.757	0.111	0.066	0.006	0.026	11.733
-0.999	0.208	0.056	15.135	0.097	0.052	0.012	0.090	30.066
-1.166	0.214	0.031	8.353	0.080	0.037	0.003	0.205	52.733
-1.333	0.195	-0.003	-0.986	0.069	0.040	-0.000	0.387	71.866
-1.500	0.153	-0.022	-8.415	0.068	0.004	-0.006	0.645	62.266
-1.666	0.102	-0.026	-14.684	0.068	0.028	-0.012	0.555	29.133
-1.833	0.100	-0.045	-24.337	0.051	0.027	-0.015	0.908	26.000
-1.999	0.051	0.084	58.740	0.029	0.047	0.017	0.947	19.066
-2.166	0.041	0.070	59.744	0.013	0.032	0.009	0.971	11.533
-2.333	0.048	0.060	51.384	0.011	0.021	0.008	0.992	5.200
-2.500	0.038	0.055	55.099	0.008	0.013	0.002	0.999	3.400

TABLE D-12 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.100	0.052	0.058	0.050

U_c(fps) =97.206 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.511	0.029	3.272	0.484	0.009	-0.012	0.002	1.866
0.050	0.532	0.035	3.830	0.483	0.009	0.014	0.002	2.333
0.100	0.841	0.031	2.159	0.433	0.023	-0.085	0.004	4.133
0.150	0.791	0.035	2.565	0.442	0.017	-0.055	0.004	3.400
0.200	0.767	0.039	2.909	0.445	0.013	-0.033	0.004	3.600
0.250	0.655	0.037	3.286	0.462	0.009	-0.007	0.003	2.800
0.300	0.589	0.039	3.816	0.469	0.010	0.014	0.003	2.600
0.350	0.591	0.038	3.723	0.471	0.010	0.011	0.002	2.266
0.400	0.212	0.026	7.089	0.412	0.035	0.142	0.000	0.533
0.450	0.019	-0.000	-2.443	0.000	0.000	0.000	0.000	0.000
0.500	0.019	-0.000	-2.443	0.000	0.000	0.000	0.000	0.000
0.550	0.048	0.004	4.922	0.042	0.016	0.002	0.001	1.600
0.600	0.050	0.000	0.595	0.011	0.007	0.000	0.522	155.066
0.650	0.055	0.005	5.889	0.012	0.005	0.000	0.988	12.000
0.700	0.045	0.016	19.752	0.007	0.004	0.000	1.000	3.000
0.750	0.024	-0.035	-54.600	0.004	0.004	-0.000	1.000	3.000
0.000	0.391	0.034	5.013	0.475	0.014	0.058	0.001	1.066
-0.050	0.559	0.035	3.658	0.464	0.010	0.007	0.002	2.066
-0.100	0.538	0.034	3.697	0.467	0.009	0.008	0.002	1.933
-0.150	0.578	0.037	3.691	0.459	0.009	0.009	0.002	2.400
-0.200	0.514	0.035	3.924	0.467	0.008	0.015	0.002	1.866
-0.250	0.598	0.037	3.549	0.455	0.009	0.004	0.002	2.466
-0.300	0.557	0.037	3.865	0.462	0.010	0.015	0.003	2.466
-0.350	0.725	0.035	2.822	0.432	0.011	-0.025	0.003	2.866
-0.400	0.733	0.035	2.778	0.438	0.011	-0.028	0.003	3.133
-0.450	0.043	0.003	4.453	0.158	0.027	0.043	0.000	0.066
-0.500	0.019	-0.000	-2.879	0.000	0.000	0.000	0.000	0.000
-0.550	0.019	-0.000	-2.879	0.000	0.000	0.000	0.000	0.000
-0.600	0.071	0.004	3.868	0.013	0.005	0.000	0.776	128.333
-0.650	0.063	0.004	3.740	0.011	0.002	0.000	0.974	2.933
-0.700	-0.009	0.070	97.664	0.004	0.008	-0.000	0.999	3.466
-0.750	0.009	0.056	80.483	0.002	0.007	-0.000	1.000	3.000

TABLE D-12 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.100	0.052	0.058	0.050

U_c(fps) = 97.206 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.004	0.054	85.178	0.002	0.005	-0.000	1.000	3.000
-0.933	-0.006	0.059	96.565	0.003	0.006	-0.000	1.000	3.000
-0.866	-0.012	0.062	101.326	0.003	0.008	-0.000	1.000	3.000
-0.800	-0.003	0.068	92.759	0.005	0.009	-0.000	0.997	5.266
-0.733	0.001	0.063	89.000	0.009	0.016	-0.000	0.839	86.533
-0.666	0.030	0.076	68.407	0.017	0.023	0.000	0.136	78.266
-0.600	0.011	0.026	67.213	0.017	0.033	0.005	0.000	0.200
-0.533	0.019	0.001	4.118	0.000	0.000	0.000	0.000	0.000
-0.466	0.019	0.001	4.118	0.000	0.000	0.000	0.000	0.000
-0.400	0.066	0.005	4.545	0.217	0.028	0.061	0.000	0.133
-0.333	0.780	0.035	2.601	0.421	0.020	-0.039	0.005	3.533
-0.266	0.829	0.034	2.396	0.391	0.018	-0.048	0.007	5.266
-0.200	0.805	0.034	2.478	0.399	0.018	-0.044	0.005	4.333
-0.133	0.802	0.032	2.309	0.396	0.018	-0.051	0.004	4.066
-0.066	0.555	0.035	3.628	0.460	0.008	0.006	0.003	2.533
-0.000	0.700	0.037	3.078	0.434	0.012	-0.020	0.004	3.466
0.066	0.665	0.036	3.136	0.447	0.011	-0.011	0.003	3.066
0.133	0.626	0.039	3.581	0.459	0.010	0.003	0.003	3.000
0.199	0.757	0.039	3.003	0.436	0.018	-0.033	0.004	3.866
0.266	0.567	0.036	3.721	0.471	0.018	0.011	0.002	2.333
0.333	0.232	0.030	7.549	0.422	0.041	0.156	0.000	0.733
0.400	0.043	0.003	4.750	0.163	0.032	0.052	0.000	0.066
0.466	0.019	-0.001	-4.370	0.000	0.000	0.000	0.000	0.000
0.533	0.019	-0.001	-4.370	0.000	0.000	0.000	0.000	0.000
0.600	0.027	-0.002	-4.624	0.032	0.011	-0.000	0.000	0.200
0.666	0.092	-0.032	-19.484	0.030	0.022	-0.000	0.081	54.266
0.733	0.068	-0.036	-28.487	0.021	0.014	-0.001	0.636	133.600
0.800	0.051	-0.037	-36.201	0.013	0.011	-0.001	0.967	22.666
0.866	0.031	-0.044	-54.675	0.007	0.009	-0.000	0.998	4.000
0.933	0.030	-0.049	-58.484	0.004	0.006	-0.000	1.000	3.000
1.000	0.032	-0.045	-54.821	0.004	0.004	-0.000	1.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.100	0.052	0.058	0.050

U_c(fps) = 97.086 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.020	-0.038	-61.753	0.003	0.006	-0.000	0.999	3.333
1.166	0.024	-0.043	-60.543	0.004	0.008	-0.000	0.997	4.200
1.083	0.023	-0.042	-60.683	0.004	0.012	-0.001	0.971	14.266
1.000	0.033	-0.055	-58.914	0.011	0.017	-0.001	0.870	44.466
0.916	0.049	-0.054	-47.396	0.022	0.018	-0.002	0.610	93.466
0.833	0.072	-0.048	-33.523	0.036	0.023	-0.005	0.244	81.733
0.750	0.104	-0.058	-29.167	0.039	0.027	-0.002	0.031	19.933
0.666	0.038	-0.029	-37.254	0.047	0.031	-0.013	0.001	0.866
0.583	0.013	-0.013	-45.755	0.000	0.000	0.000	0.000	0.000
0.500	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.416	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.333	0.040	0.001	2.326	0.141	0.025	0.032	0.000	0.066
0.250	0.187	0.025	7.750	0.387	0.043	0.163	0.000	0.533
0.166	0.565	0.031	3.174	0.465	0.019	-0.008	0.002	2.133
0.083	0.830	0.037	2.556	0.395	0.029	-0.055	0.004	3.933
0.000	0.848	0.035	2.368	0.380	0.027	-0.064	0.008	6.400
-0.083	0.925	0.024	1.528	0.330	0.036	-0.085	0.010	8.333
-0.166	0.893	0.027	1.742	0.349	0.034	-0.081	0.009	7.333
-0.249	0.699	0.022	1.826	0.433	0.023	-0.050	0.004	3.600
-0.333	0.182	0.010	3.363	0.377	0.016	0.040	0.000	0.466
-0.416	0.019	-0.002	-6.650	0.000	0.000	0.000	0.000	0.000
-0.499	0.019	-0.002	-6.650	0.000	0.000	0.000	0.000	0.000
-0.583	0.023	-0.000	-0.922	0.026	0.012	0.003	0.000	0.066
-0.666	0.074	0.016	12.184	0.064	0.029	0.013	0.002	2.133
-0.750	0.092	0.051	29.334	0.030	0.027	0.002	0.083	33.600
-0.833	0.066	0.054	39.704	0.022	0.022	0.003	0.427	105.800
-0.916	0.051	0.059	48.909	0.015	0.021	0.003	0.729	73.066
-0.999	0.034	0.054	57.337	0.008	0.015	0.000	0.955	21.200
-1.083	0.027	0.044	58.864	0.004	0.009	0.000	0.995	5.000
-1.166	0.025	0.053	64.947	0.004	0.009	0.000	0.999	3.466
-1.250	0.021	0.047	65.760	0.002	0.005	0.000	1.000	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.100	0.052	0.058	0.050

U_c(fps) = 97.680 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.014	0.044	71.557	0.002	0.009	0.000	0.998	3.600
-1.400	0.015	0.055	74.261	0.002	0.010	0.000	0.994	5.200
-1.300	0.011	0.056	78.397	0.007	0.016	0.000	0.973	12.600
-1.200	0.011	0.066	79.824	0.002	0.023	0.000	0.865	39.200
-1.100	0.025	0.075	71.108	0.007	0.029	0.001	0.668	72.533
-1.000	0.058	0.077	52.809	0.020	0.030	0.004	0.393	86.466
-0.900	0.094	0.064	34.066	0.034	0.027	0.004	0.176	61.400
-0.800	0.120	0.067	29.042	0.041	0.031	0.003	0.026	15.600
-0.700	0.070	0.032	24.437	0.076	0.034	0.022	0.001	1.066
-0.600	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.500	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.400	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.300	0.041	0.000	1.238	0.148	0.017	0.024	0.000	0.066
-0.200	0.433	0.016	2.192	0.474	0.021	-0.055	0.001	1.400
-0.100	0.832	0.023	1.596	0.393	0.031	-0.057	0.005	4.400
-0.000	0.763	0.033	2.511	0.416	0.025	-0.034	0.005	4.600
0.099	0.521	0.042	4.608	0.473	0.023	0.043	0.002	2.133
0.199	0.177	0.028	9.215	0.370	0.050	0.178	0.000	0.466
0.299	0.019	0.000	1.716	0.000	0.000	0.000	0.000	0.000
0.399	0.019	0.000	1.716	0.000	0.000	0.000	0.000	0.000
0.499	0.019	0.000	1.716	0.000	0.000	0.000	0.000	0.000
0.599	0.023	-0.000	-1.920	0.027	0.009	-0.002	0.000	0.066
0.699	0.044	-0.023	-27.335	0.056	0.035	-0.018	0.001	0.666
0.800	0.136	-0.053	-21.386	0.050	0.034	-0.000	0.018	11.933
0.900	0.107	-0.048	-24.328	0.041	0.026	-0.000	0.113	46.533
0.999	0.084	-0.038	-24.452	0.033	0.020	-0.000	0.388	83.666
1.100	0.065	-0.030	-24.605	0.031	0.014	-0.002	0.575	67.800
1.200	0.057	-0.028	-25.964	0.024	0.005	-0.002	0.848	43.066
1.300	0.045	-0.026	-30.192	0.017	0.002	-0.001	0.958	16.666
1.399	0.024	-0.037	-56.588	0.005	0.010	-0.001	0.987	7.533
1.500	0.024	-0.037	-56.162	0.004	0.007	-0.000	0.998	3.666

TABLE D-12 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.100	0.052	0.058	0.050

U_c(fps) = 96.899 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.016	-0.038	-66.575	0.005	0.010	-0.000	0.996	4.000
1.633	0.013	-0.042	-72.186	0.010	0.014	-0.001	0.987	7.133
1.516	0.023	-0.048	-63.719	0.004	0.016	-0.002	0.950	16.333
1.400	0.033	-0.051	-56.837	0.011	0.019	-0.005	0.864	37.066
1.283	0.064	-0.051	-38.692	0.030	0.018	-0.004	0.657	65.333
1.166	0.095	-0.045	-25.608	0.038	0.021	-0.001	0.390	78.600
1.050	0.112	-0.044	-21.775	0.042	0.026	-0.000	0.179	56.333
0.933	0.129	-0.052	-22.009	0.056	0.030	-0.002	0.039	18.600
0.816	0.122	-0.065	-28.137	0.076	0.045	-0.017	0.006	4.533
0.700	0.053	-0.026	-25.949	0.102	0.041	-0.011	0.000	0.600
0.583	0.022	-0.013	-30.328	0.039	0.013	-0.005	0.000	0.066
0.466	0.020	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.350	0.020	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.233	0.045	0.005	6.339	0.166	0.044	0.073	0.000	0.066
0.116	0.069	0.008	6.688	0.230	0.043	0.098	0.000	0.133
0.000	0.141	0.019	7.646	0.343	0.044	0.145	0.000	0.333
-0.116	0.143	0.015	6.288	0.348	0.034	0.115	0.000	0.333
-0.233	0.042	0.001	2.218	0.149	0.015	0.023	0.000	0.066
-0.349	0.020	-0.000	-2.529	0.000	0.000	0.000	0.000	0.000
-0.466	0.020	-0.000	-2.529	0.000	0.000	0.000	0.000	0.000
-0.583	0.020	-0.000	-2.529	0.000	0.000	0.000	0.000	0.000
-0.699	0.054	0.034	32.748	0.075	0.058	0.039	0.001	0.800
-0.816	0.128	0.071	29.149	0.077	0.043	0.022	0.007	4.666
-0.933	0.115	0.073	32.268	0.041	0.031	0.004	0.065	27.666
-1.050	0.090	0.053	30.735	0.042	0.029	0.008	0.191	55.533
-1.166	0.080	0.050	31.916	0.031	0.021	0.006	0.518	78.466
-1.283	0.069	0.048	35.144	0.025	0.015	0.008	0.747	56.333
-1.399	0.043	0.048	48.092	0.012	0.017	0.003	0.919	25.333
-1.516	0.030	0.050	58.573	0.007	0.018	0.003	0.948	17.800
-1.633	0.023	0.050	65.181	0.006	0.014	0.001	0.984	7.866
-1.750	0.014	0.049	73.111	0.002	0.011	0.000	0.995	4.400

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.100	0.052	0.058	0.050

U_c(fps) = 91.700 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.000	0.016	0.057	73.612	0.009	0.017	0.000	0.990	5.800
-1.866	0.013	0.065	78.367	0.018	0.027	0.001	0.959	13.466
-1.733	0.023	0.075	72.622	0.003	0.030	0.002	0.901	19.266
-1.600	0.031	0.082	68.919	0.017	0.036	0.005	0.814	41.333
-1.466	0.071	0.075	46.914	0.024	0.032	0.013	0.673	61.933
-1.333	0.105	0.065	31.883	0.043	0.026	0.012	0.461	72.400
-1.200	0.133	0.061	24.641	0.048	0.031	0.005	0.233	55.333
-1.066	0.149	0.069	24.852	0.050	0.034	0.004	0.109	35.333
-0.933	0.175	0.085	25.800	0.061	0.042	0.005	0.026	13.000
-0.800	0.131	0.071	28.499	0.108	0.059	0.052	0.004	2.733
-0.666	0.043	0.028	33.050	0.063	0.055	0.031	0.000	0.333
-0.533	0.021	0.009	24.089	0.000	0.000	0.000	0.000	0.000
-0.400	0.042	0.010	14.388	0.139	0.009	0.009	0.000	0.066
-0.266	0.021	0.009	24.089	0.000	0.000	0.000	0.000	0.000
-0.133	0.021	0.009	24.089	0.000	0.000	0.000	0.000	0.000
-0.000	0.021	0.009	24.089	0.000	0.000	0.000	0.000	0.000
0.133	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.266	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.399	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.533	0.023	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.666	0.060	-0.007	-6.847	0.100	0.020	-0.012	0.000	0.400
0.800	0.154	-0.052	-18.895	0.129	0.057	-0.047	0.003	2.733
0.933	0.191	-0.077	-22.016	0.095	0.051	-0.004	0.016	8.733
1.066	0.163	-0.061	-20.574	0.060	0.035	-0.000	0.068	27.800
1.200	0.135	-0.052	-21.180	0.054	0.025	-0.003	0.232	61.266
1.333	0.115	-0.045	-21.568	0.050	0.013	-0.005	0.416	72.333
1.466	0.095	-0.040	-22.833	0.042	0.014	-0.003	0.637	63.000
1.600	0.075	-0.034	-24.427	0.036	0.013	-0.005	0.841	40.333
1.733	0.053	-0.045	-40.499	0.026	0.011	-0.006	0.904	27.800
1.866	0.038	-0.041	-47.462	0.013	0.008	-0.005	0.968	8.533
2.000	0.029	-0.039	-52.939	0.006	0.010	-0.002	0.991	5.933

TABLE D-12 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.100	0.052	0.058	0.050

U_c(fps) = 78.272 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.028	-0.045	-58.100	0.004	0.009	-0.001	0.999	3.400
2.333	0.031	-0.049	-57.261	0.002	0.015	-0.003	0.989	6.533
2.166	0.036	-0.056	-57.012	0.009	0.020	-0.007	0.967	12.600
2.000	0.058	-0.053	-42.178	0.026	0.010	-0.011	0.931	20.200
1.833	0.091	-0.041	-24.538	0.045	0.006	-0.006	0.809	40.866
1.666	0.119	-0.032	-15.037	0.055	0.014	-0.003	0.691	55.933
1.500	0.138	-0.038	-15.343	0.057	0.025	-0.000	0.485	68.200
1.333	0.161	-0.048	-16.881	0.066	0.034	-0.000	0.252	58.733
1.166	0.192	-0.075	-21.307	0.070	0.042	0.001	0.081	30.266
1.000	0.227	-0.085	-20.673	0.090	0.049	-0.007	0.023	11.866
0.833	0.128	-0.042	-18.255	0.140	0.051	-0.045	0.003	1.733
0.666	0.072	-0.021	-16.845	0.128	0.032	-0.028	0.000	0.400
0.500	0.025	-0.011	-23.346	0.000	0.000	0.000	0.000	0.000
0.333	0.028	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.166	0.028	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.000	0.028	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.166	0.028	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.333	0.028	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.499	0.027	0.004	8.381	0.000	0.000	0.000	0.000	0.000
-0.666	0.057	0.015	15.054	0.099	0.039	0.036	0.000	0.266
-0.833	0.154	0.077	26.681	0.142	0.076	0.090	0.005	3.066
-0.999	0.200	0.086	23.321	0.103	0.047	0.026	0.018	9.333
-1.166	0.177	0.089	26.715	0.065	0.041	0.006	0.079	26.600
-1.333	0.163	0.070	23.274	0.058	0.040	0.004	0.210	56.133
-1.500	0.140	0.062	23.893	0.057	0.016	0.017	0.401	68.133
-1.666	0.119	0.056	25.216	0.053	0.006	0.017	0.639	59.000
-1.833	0.098	0.053	28.377	0.044	0.013	0.019	0.782	43.733
-1.999	0.068	0.050	36.520	0.027	0.010	0.013	0.936	18.733
-2.166	0.048	0.051	47.065	0.012	0.017	0.006	0.976	9.666
-2.333	0.035	0.057	57.989	0.004	0.017	0.002	0.957	4.933
-2.500	0.026	0.062	66.678	0.005	0.016	0.001	0.996	4.533

TABLE D-13 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.097	0.052	0.083	0.070

U_c(fps) = 107.895 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.083	0.007	4.931	0.265	0.021	0.055	0.000	0.266
0.050	0.075	0.006	5.084	0.250	0.020	0.051	0.000	0.333
0.100	0.095	0.008	5.068	0.285	0.023	0.066	0.000	0.333
0.150	0.075	0.006	5.117	0.249	0.020	0.051	0.000	0.266
0.200	0.089	0.007	4.981	0.273	0.021	0.059	0.000	0.400
0.250	0.119	0.012	5.836	0.316	0.028	0.088	0.000	0.466
0.300	0.045	0.004	6.204	0.173	0.015	0.027	0.000	0.133
0.350	0.030	0.003	6.912	0.123	0.012	0.015	0.000	0.066
0.400	0.030	0.003	6.799	0.123	0.012	0.014	0.000	0.066
0.450	0.016	0.002	7.722	0.000	0.000	0.000	0.000	0.000
0.500	0.016	0.002	7.722	0.000	0.000	0.000	0.000	0.000
0.550	0.016	0.002	7.722	0.000	0.000	0.000	0.000	0.000
0.600	0.039	-0.000	-0.654	0.034	0.006	-0.000	0.005	4.266
0.650	0.043	-0.053	-50.933	0.020	0.025	-0.005	0.405	145.133
0.700	0.012	-0.065	-78.844	0.004	0.015	-0.000	0.845	121.800
0.750	0.000	-0.051	-89.330	0.003	0.009	-0.000	0.997	7.333
0.000	0.045	0.004	5.412	0.177	0.016	0.029	0.000	0.133
-0.050	0.104	0.009	5.015	0.297	0.023	0.070	0.000	0.400
-0.100	0.088	0.009	6.040	0.270	0.024	0.066	0.000	0.333
-0.150	0.059	0.006	6.343	0.211	0.020	0.042	0.000	0.200
-0.200	0.045	0.005	6.829	0.173	0.018	0.031	0.000	0.133
-0.250	0.044	0.005	6.733	0.171	0.017	0.029	0.000	0.133
-0.300	0.058	0.006	6.467	0.206	0.020	0.042	0.000	0.266
-0.350	0.044	0.005	6.720	0.171	0.017	0.029	0.000	0.133
-0.400	0.044	0.005	6.584	0.168	0.016	0.027	0.000	0.133
-0.450	0.016	0.002	8.069	0.000	0.000	0.000	0.000	0.000
-0.500	0.016	0.002	8.069	0.000	0.000	0.000	0.000	0.000
-0.550	0.016	0.003	11.340	0.000	0.000	0.000	-0.000	0.000
-0.600	0.071	0.008	6.651	0.016	0.004	0.000	0.715	141.866
-0.650	0.039	0.058	56.056	0.005	0.007	0.000	0.997	7.133
-0.700	0.036	0.051	54.489	0.006	0.009	0.000	0.999	3.000
-0.750	0.003	0.064	86.725	0.002	0.005	-0.000	0.999	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.097	0.052	0.083	0.070

U_c(fps) = 107.895 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.006	0.052	82.438	0.002	0.006	0.000	0.999	3.000
-0.933	0.005	0.047	82.854	0.002	0.005	0.000	1.000	3.066
-0.866	0.016	0.059	74.314	0.004	0.011	0.000	0.999	3.000
-0.800	0.018	0.063	74.141	0.006	0.011	0.000	0.997	5.800
-0.733	0.018	0.069	74.851	0.009	0.020	0.000	0.824	112.666
-0.666	0.041	0.055	52.909	0.023	0.028	0.005	0.048	64.733
-0.600	0.008	0.014	59.779	0.000	0.000	0.000	-0.000	0.000
-0.533	0.008	0.014	59.779	0.000	0.000	0.000	0.000	0.000
-0.466	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.400	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.333	0.016	0.001	5.341	0.000	0.000	0.000	-0.000	0.000
-0.266	0.075	0.007	5.540	0.240	0.022	0.053	0.000	0.266
-0.200	0.059	0.006	5.798	0.208	0.021	0.043	0.000	0.200
-0.133	0.045	0.004	5.634	0.171	0.017	0.029	0.000	0.133
-0.066	0.030	0.002	5.342	0.119	0.011	0.013	0.000	0.066
-0.000	0.113	0.013	6.958	0.302	0.033	0.099	0.000	0.533
0.066	0.099	0.013	7.647	0.280	0.033	0.092	0.000	0.400
0.133	0.044	0.006	8.984	0.167	0.023	0.039	0.000	0.200
0.199	0.126	0.018	8.101	0.318	0.041	0.128	0.000	0.600
0.266	0.032	0.005	9.191	0.127	0.017	0.022	0.000	0.066
0.333	0.029	0.004	9.111	0.115	0.015	0.017	0.000	0.066
0.400	0.016	0.003	10.459	0.000	0.000	0.000	0.000	0.000
0.466	0.016	0.003	10.459	0.000	0.000	0.000	0.000	0.000
0.533	0.016	0.003	10.459	0.000	0.000	0.000	0.000	0.000
0.600	0.016	0.003	10.459	0.000	0.000	0.000	0.000	0.000
0.666	0.035	0.002	3.252	0.038	0.008	-0.000	0.001	1.466
0.733	0.067	-0.021	-17.631	0.036	0.019	-0.004	0.098	64.666
0.800	0.045	-0.045	-45.017	0.016	0.018	-0.001	0.630	128.466
0.866	0.034	-0.045	-52.787	0.010	0.014	-0.001	0.941	39.133
0.933	0.026	-0.055	-64.391	0.005	0.010	-0.000	0.996	5.133
1.000	0.021	-0.045	-64.111	0.005	0.009	-0.000	0.999	3.066

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.097	0.052	0.083	0.070

U_c(fps) =107.659 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.023	-0.043	-61.433	0.004	0.009	-0.000	0.992	5.400
1.166	0.021	-0.044	-64.037	0.003	0.013	-0.000	0.964	15.800
1.083	0.027	-0.055	-63.301	0.007	0.018	-0.001	0.866	42.933
1.000	0.041	-0.058	-54.893	0.016	0.021	-0.002	0.641	83.266
0.916	0.057	-0.048	-39.887	0.027	0.023	-0.003	0.292	86.466
0.833	0.073	-0.042	-30.314	0.041	0.028	-0.007	0.051	29.933
0.750	0.042	-0.025	-31.557	0.047	0.032	-0.013	0.002	1.866
0.666	0.020	-0.011	-28.250	0.029	0.018	-0.005	0.000	0.200
0.583	0.014	-0.007	-27.617	0.000	0.000	0.000	0.000	0.000
0.500	0.014	-0.007	-27.617	0.000	0.000	0.000	0.000	0.000
0.416	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.333	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.250	0.016	0.001	5.341	0.000	0.000	0.000	-0.000	0.000
0.166	0.045	0.004	5.992	0.172	0.019	0.032	-0.000	0.133
0.083	0.116	0.010	5.236	0.309	0.026	0.079	0.000	0.533
0.000	0.073	0.007	5.920	0.241	0.024	0.059	0.000	0.266
-0.083	0.045	0.004	5.797	0.174	0.018	0.031	0.000	0.133
-0.166	0.101	0.010	6.019	0.289	0.029	0.083	0.000	0.400
-0.249	0.045	0.004	5.395	0.171	0.016	0.027	0.000	0.133
-0.333	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.416	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.499	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.583	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.666	0.039	0.008	11.942	0.051	0.018	0.007	0.000	0.866
-0.750	0.075	0.040	28.359	0.044	0.028	0.008	0.043	29.600
-0.833	0.065	0.037	29.930	0.031	0.022	0.004	0.311	88.666
-0.916	0.044	0.056	51.708	0.014	0.019	0.001	0.729	78.133
-0.999	0.027	0.066	67.197	0.009	0.018	0.001	0.898	37.866
-1.083	0.022	0.064	70.869	0.006	0.012	0.000	0.983	9.733
-1.166	0.017	0.056	72.604	0.004	0.012	0.000	0.995	4.466
-1.250	0.019	0.057	71.634	0.003	0.006	0.000	0.999	3.333

TABLE D-13 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.097	0.052	0.083	0.070

U_c(fps) =107.653   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.014	0.046	72.463	0.002	0.007	0.000	0.998	4.000
-1.400	0.014	0.058	76.272	0.004	0.011	0.000	0.981	8.933
-1.300	0.018	0.058	72.682	0.003	0.015	0.000	0.951	17.200
-1.200	0.022	0.061	70.222	0.004	0.021	0.001	0.811	46.066
-1.100	0.049	0.061	51.204	0.017	0.022	0.003	0.625	71.333
-1.000	0.054	0.057	46.856	0.024	0.025	0.004	0.347	76.933
-0.900	0.052	0.036	34.817	0.042	0.029	0.009	0.060	26.533
-0.800	0.081	0.052	32.415	0.052	0.036	0.013	0.022	11.466
-0.700	0.025	0.018	36.248	0.039	0.029	0.010	0.000	0.533
-0.600	0.018	0.002	7.083	0.017	0.007	0.001	0.000	0.066
-0.500	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.400	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.300	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.200	0.016	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.100	0.030	0.003	6.316	0.117	0.007	0.008	0.000	0.066
-0.000	0.059	0.008	7.893	0.207	0.028	0.056	0.000	0.200
0.099	0.016	0.002	8.329	0.000	0.000	0.000	-0.000	0.000
0.199	0.016	0.002	8.329	0.000	0.000	0.000	0.000	0.000
0.299	0.016	0.002	8.329	0.000	0.000	0.000	0.000	0.000
0.399	0.016	0.002	8.329	0.000	0.000	0.000	0.000	0.000
0.499	0.016	0.002	8.329	0.000	0.000	0.000	0.000	0.000
0.599	0.016	0.002	8.329	0.000	0.000	0.000	0.000	0.000
0.699	0.021	0.001	3.669	0.025	0.006	-0.001	0.000	0.133
0.800	0.043	-0.019	-24.266	0.052	0.028	-0.012	-0.000	1.400
0.900	0.083	-0.042	-26.715	0.051	0.031	-0.010	0.038	17.000
0.999	0.079	-0.036	-24.259	0.041	0.024	-0.005	0.124	46.400
1.100	0.067	-0.036	-28.593	0.029	0.018	-0.003	0.357	75.333
1.200	0.060	-0.035	-30.282	0.023	0.013	-0.002	0.659	64.800
1.300	0.038	-0.038	-44.506	0.015	0.013	-0.002	0.839	40.066
1.399	0.021	-0.040	-61.822	0.003	0.013	-0.001	0.950	17.800
1.500	0.014	-0.037	-68.077	0.006	0.011	-0.000	0.993	5.666

TABLE D-13 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.097	0.052	0.083	0.070

U_c(fps) = 106.213 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.875	0.012	0.047	75.066	0.002	0.007	0.000	0.998	3.466
-1.750	0.009	0.042	77.180	0.000	0.009	0.000	0.996	4.133
-1.625	0.013	0.055	75.882	0.005	0.016	0.000	0.971	12.400
-1.500	0.018	0.064	73.857	0.007	0.021	0.001	0.906	24.933
-1.375	0.037	0.069	61.852	0.013	0.025	0.003	0.767	49.800
-1.250	0.049	0.069	54.360	0.020	0.027	0.004	0.526	67.000
-1.125	0.049	0.049	45.550	0.037	0.034	0.010	0.148	37.933
-1.000	0.087	0.054	32.208	0.047	0.031	0.010	0.083	32.266
-0.875	0.092	0.052	29.446	0.067	0.039	0.020	0.016	8.666
-0.750	0.033	0.022	33.693	0.054	0.036	0.017	0.000	0.666
-0.625	0.022	0.013	31.801	0.042	0.021	0.008	0.000	0.133
-0.500	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.375	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.250	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.125	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.000	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.125	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.250	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.375	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.500	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.625	0.018	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.750	0.026	-0.000	-1.489	0.034	0.012	-0.003	0.000	0.266
0.875	0.069	-0.031	-24.608	0.070	0.039	-0.021	0.004	2.800
1.000	0.092	-0.048	-27.832	0.056	0.033	-0.012	0.050	20.333
1.125	0.086	-0.042	-26.335	0.043	0.025	-0.005	0.154	47.066
1.250	0.080	-0.035	-23.484	0.034	0.018	-0.003	0.389	71.466
1.375	0.063	-0.033	-27.656	0.026	0.015	-0.002	0.664	60.800
1.500	0.046	-0.039	-40.112	0.019	0.012	-0.003	0.846	37.400
1.625	0.032	-0.038	-49.921	0.009	0.012	-0.002	0.960	13.000
1.750	0.016	-0.030	-61.349	0.003	0.014	-0.001	0.629	4.400
1.875	0.012	-0.038	-72.269	0.004	0.008	-0.000	0.998	3.466

TABLE D-13 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.097	0.052	0.083	0.070

U_c(fps) = 98.190 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.250	0.015	-0.038	-68.109	0.008	0.010	-0.000	0.998	3.666
2.100	0.017	-0.044	-68.631	0.008	0.014	-0.001	0.989	6.800
1.950	0.024	-0.050	-64.066	0.009	0.019	-0.002	0.961	12.400
1.800	0.029	-0.043	-55.459	0.009	0.025	-0.006	0.590	18.400
1.650	0.055	-0.058	-46.370	0.023	0.022	-0.006	0.752	49.066
1.500	0.085	-0.042	-26.606	0.038	0.022	-0.004	0.469	60.333
1.350	0.097	-0.048	-26.175	0.045	0.024	-0.006	0.322	60.933
1.200	0.076	-0.033	-23.460	0.067	0.034	-0.016	0.031	14.600
1.050	0.123	-0.060	-26.124	0.083	0.044	-0.025	0.019	9.733
0.900	0.074	-0.029	-21.572	0.092	0.043	-0.031	0.004	2.200
0.750	0.041	-0.013	-18.291	0.078	0.034	-0.016	0.000	0.400
0.600	0.020	-0.004	-13.015	0.000	0.000	0.000	0.000	0.000
0.450	0.020	-0.004	-13.015	0.000	0.000	0.000	0.000	0.000
0.300	0.020	-0.004	-13.015	0.000	0.000	0.000	0.000	0.000
0.150	0.020	-0.004	-13.015	0.000	0.000	0.000	0.000	0.000
0.000	0.020	-0.004	-13.015	0.000	0.000	0.000	0.000	0.000
-0.149	0.020	-0.004	-13.015	0.000	0.000	0.000	0.000	0.000
-0.299	0.021	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.449	0.021	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.599	0.021	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.749	0.049	0.010	11.956	0.080	0.026	0.017	0.000	0.533
-0.899	0.070	0.039	29.298	0.088	0.048	0.036	0.001	2.066
-1.049	0.115	0.071	31.782	0.070	0.046	0.022	0.033	15.400
-1.199	0.110	0.057	27.401	0.056	0.033	0.012	0.139	42.933
-1.349	0.101	0.050	26.598	0.045	0.021	0.010	0.342	64.000
-1.499	0.090	0.048	28.332	0.035	0.018	0.006	0.598	57.133
-1.649	0.062	0.052	40.324	0.023	0.016	0.008	0.830	37.733
-1.799	0.040	0.051	52.023	0.011	0.018	0.004	0.922	19.800
-1.949	0.020	0.064	72.816	0.003	0.017	0.001	0.977	8.666
-2.099	0.014	0.057	76.021	0.007	0.016	0.000	0.987	6.266
-2.249	0.001	0.045	87.526	0.005	0.020	0.000	0.590	2.800

TABLE D-13 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.097	0.052	0.083	0.070

U_c(fps) = 84.300 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.500	0.002	0.066	88.238	0.012	0.020	0.000	0.991	5.800
-2.333	0.005	0.067	85.144	0.013	0.022	0.000	0.986	8.333
-2.166	0.011	0.084	82.069	0.011	0.031	0.001	0.937	16.800
-2.000	0.019	0.088	77.401	0.019	0.038	0.003	0.858	30.666
-1.833	0.041	0.091	65.353	0.001	0.044	0.010	0.658	39.333
-1.666	0.104	0.071	34.467	0.042	0.028	0.013	0.558	59.000
-1.500	0.116	0.067	30.079	0.051	0.029	0.013	0.382	61.666
-1.333	0.129	0.061	25.513	0.058	0.032	0.012	0.229	50.200
-1.166	0.106	0.053	26.655	0.087	0.046	0.030	0.047	17.600
-1.000	0.148	0.070	25.342	0.110	0.057	0.044	0.016	7.933
-0.833	0.072	0.043	31.368	0.095	0.054	0.043	0.003	1.933
-0.666	0.024	0.019	39.142	0.033	0.020	0.005	0.000	0.133
-0.500	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
-0.333	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
-0.166	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
-0.000	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
0.166	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
0.333	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
0.499	0.019	0.016	40.714	0.000	0.000	0.000	0.000	0.000
0.666	0.022	0.019	41.285	0.029	0.028	0.008	-0.000	0.066
0.833	0.047	-0.010	-12.379	0.070	0.031	-0.020	0.000	0.466
0.999	0.100	-0.042	-22.924	0.111	0.054	-0.051	0.003	2.666
1.166	0.149	-0.068	-24.748	0.097	0.051	-0.033	0.028	12.333
1.333	0.140	-0.061	-23.677	0.074	0.041	-0.014	0.093	28.600
1.500	0.124	-0.050	-21.917	0.055	0.030	-0.006	0.295	56.666
1.666	0.113	-0.045	-22.009	0.049	0.018	-0.006	0.492	62.800
1.833	0.095	-0.042	-23.870	0.041	0.003	-0.006	0.743	46.866
1.999	0.075	-0.041	-28.553	0.033	0.004	-0.006	0.874	27.866
2.166	0.051	-0.048	-43.272	0.017	0.011	-0.007	0.948	16.800
2.333	0.043	-0.041	-43.455	0.011	0.010	-0.003	0.988	7.000
2.500	0.041	-0.039	-43.806	0.008	0.008	-0.001	0.995	4.066

TABLE D-14 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.089	0.053	0.075	0.071

U_c(fps) =104.022 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.644	0.023	2.104	0.395	0.011	-0.032	0.004	3.466
0.050	0.804	0.018	1.344	0.330	0.020	-0.060	0.008	6.666
0.100	0.707	0.021	1.716	0.375	0.015	-0.048	0.006	4.333
0.150	0.798	0.016	1.174	0.326	0.023	-0.070	0.007	6.000
0.200	0.802	0.021	1.548	0.328	0.020	-0.058	0.008	6.600
0.250	0.605	0.027	2.574	0.405	0.010	-0.025	0.006	5.266
0.300	0.802	0.021	1.520	0.328	0.021	-0.059	0.007	6.133
0.350	0.779	0.022	1.685	0.340	0.018	-0.049	0.006	5.600
0.400	0.510	0.028	3.159	0.423	0.008	-0.009	0.002	2.400
0.450	0.018	-0.001	-3.680	0.000	0.000	0.000	0.000	0.000
0.500	0.018	-0.001	-3.680	0.000	0.000	0.000	0.000	0.000
0.550	0.018	-0.001	-3.680	0.000	0.000	0.000	0.000	0.000
0.600	0.031	-0.019	-32.248	0.010	0.008	-0.000	0.215	98.933
0.650	0.016	-0.033	-63.872	0.003	0.005	-0.000	0.982	17.333
0.700	0.005	-0.040	-82.262	0.002	0.007	-0.000	1.000	3.000
0.750	-0.003	-0.037	-94.683	0.001	0.004	0.000	0.999	3.066
0.000	0.751	0.030	2.321	0.345	0.013	-0.032	0.006	5.466
-0.050	0.539	0.034	3.691	0.409	0.007	0.007	0.003	3.333
-0.100	0.574	0.034	3.432	0.400	0.008	-0.000	0.003	2.800
-0.150	0.547	0.035	3.705	0.397	0.007	0.007	0.003	2.933
-0.200	0.749	0.035	2.732	0.319	0.013	-0.029	0.006	5.066
-0.250	0.853	0.029	1.989	0.203	0.015	-0.019	0.010	8.066
-0.300	0.881	0.031	2.041	0.152	0.014	-0.012	0.011	8.466
-0.350	0.680	0.033	2.825	0.362	0.009	-0.016	0.007	6.000
-0.400	0.570	0.032	3.210	0.396	0.008	-0.003	0.003	3.066
-0.450	0.018	-0.001	-3.798	0.000	0.000	0.000	0.000	0.000
-0.500	0.018	-0.001	-3.798	0.000	0.000	0.000	0.000	0.000
-0.550	0.066	-0.008	-7.362	0.016	0.010	0.000	0.045	33.800
-0.600	0.050	-0.028	-29.391	0.012	0.007	-0.000	0.901	4.066
-0.650	0.047	0.007	9.103	0.006	0.001	0.000	1.000	3.000
-0.700	0.039	0.035	42.083	0.004	0.005	0.000	1.000	3.000
-0.750	0.028	0.037	52.220	0.007	0.009	0.000	0.894	2.933

TABLE D-14 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.089	0.053	0.075	0.071

U_c(fps) = 104.022 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.016	0.042	68.993	0.001	0.004	0.000	1.000	3.000
-0.933	0.019	0.035	60.839	0.001	0.003	0.000	1.000	3.000
-0.866	0.025	0.044	59.560	0.004	0.007	0.000	0.968	3.266
-0.800	0.026	0.042	58.079	0.003	0.006	0.000	1.000	2.600
-0.733	0.031	0.052	59.064	0.005	0.008	0.000	0.990	9.600
-0.666	0.045	0.054	49.939	0.011	0.015	0.000	0.638	136.066
-0.600	0.073	0.038	27.626	0.021	0.020	0.000	0.022	16.866
-0.533	0.016	0.006	22.462	0.000	0.000	0.000	0.000	0.000
-0.466	0.018	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.400	0.018	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.333	0.572	0.048	4.835	0.380	0.017	0.039	0.004	3.066
-0.266	0.829	0.057	3.997	0.193	0.016	0.003	0.014	11.000
-0.200	0.827	0.055	3.847	0.192	0.011	-0.002	0.009	7.533
-0.133	0.607	0.053	5.025	0.368	0.013	0.040	0.004	3.666
-0.066	0.721	0.059	4.705	0.325	0.010	0.012	0.006	5.333
-0.000	0.936	-0.002	-0.124	0.172	0.023	-0.033	0.011	9.066
0.066	0.774	0.012	0.939	0.363	0.022	-0.074	0.008	6.666
0.133	0.575	0.014	1.493	0.417	0.016	-0.054	0.005	4.066
0.199	0.727	0.018	1.468	0.378	0.023	-0.070	0.005	4.400
0.266	0.709	0.018	1.496	0.384	0.021	-0.055	0.005	4.466
0.333	0.479	0.028	3.362	0.434	0.021	-0.005	0.002	1.866
0.400	0.018	-0.001	-4.243	0.000	0.000	0.000	0.000	0.000
0.466	0.038	0.003	4.528	0.138	0.028	0.038	0.000	0.066
0.533	0.018	-0.001	-4.243	0.000	0.000	0.000	0.000	0.000
0.600	0.018	-0.001	-4.243	0.000	0.000	0.000	0.000	0.000
0.666	0.072	-0.040	-29.441	0.031	0.020	-0.000	0.034	25.866
0.733	0.042	-0.043	-45.792	0.015	0.014	-0.001	0.601	144.133
0.800	0.024	-0.044	-61.129	0.006	0.010	-0.000	0.981	15.200
0.866	0.010	-0.032	-72.158	0.003	0.009	-0.000	0.805	2.533
0.933	0.009	-0.039	-75.905	0.002	0.005	-0.000	1.000	3.000
1.000	0.004	-0.049	-84.693	0.002	0.010	-0.000	0.965	3.333

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.089	0.053	0.075	0.071

U_c(fps) =103.844 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.001	-0.040	-87.690	0.001	0.006	-0.000	0.999	3.133
1.166	0.001	-0.046	-87.821	0.000	0.009	-0.000	0.998	4.000
1.083	0.018	-0.049	-69.604	0.003	0.013	-0.000	0.980	11.066
1.000	0.030	-0.049	-58.178	0.010	0.016	-0.002	0.861	49.400
0.916	0.045	-0.048	-46.688	0.019	0.016	-0.002	0.618	95.933
0.833	0.079	-0.043	-28.821	0.032	0.019	-0.000	0.181	71.733
0.750	0.108	-0.040	-20.458	0.046	0.026	-0.001	0.019	10.533
0.666	0.028	-0.012	-23.725	0.043	0.017	-0.006	0.000	0.266
0.583	0.016	-0.007	-25.302	0.000	0.000	0.000	0.000	0.000
0.500	0.016	-0.007	-25.302	0.000	0.000	0.000	0.000	0.000
0.416	0.016	-0.007	-25.302	0.000	0.000	0.000	0.000	0.000
0.333	0.041	0.004	6.607	0.154	0.041	0.063	0.000	0.066
0.250	0.402	0.057	8.110	0.443	0.040	0.156	0.001	1.666
0.166	0.911	0.054	3.411	0.290	0.029	-0.020	0.009	7.466
0.083	0.949	0.053	3.245	0.255	0.028	-0.017	0.016	11.800
0.000	0.941	0.049	3.029	0.254	0.029	-0.040	0.017	12.333
-0.083	0.911	0.050	3.170	0.291	0.027	-0.031	0.012	9.733
-0.166	0.785	0.055	4.010	0.381	0.022	-0.036	0.009	7.866
-0.249	0.725	0.042	3.340	0.400	0.022	0.004	0.004	3.600
-0.333	0.037	0.000	1.511	0.132	0.013	0.016	0.000	0.066
-0.416	0.018	-0.000	-3.114	0.000	0.000	0.000	0.000	0.000
-0.499	0.018	-0.000	-3.114	0.000	0.000	0.000	0.000	0.000
-0.583	0.027	0.003	7.897	0.038	0.022	0.007	0.000	0.200
-0.666	0.072	0.061	40.293	0.041	0.037	0.009	0.006	5.000
-0.750	0.074	0.060	38.969	0.024	0.025	0.002	0.178	73.533
-0.833	0.047	0.059	51.093	0.016	0.022	0.001	0.616	101.466
-0.916	0.026	0.059	66.224	0.007	0.018	0.000	0.893	42.800
-0.999	0.016	0.059	74.606	0.005	0.011	0.000	0.982	10.533
-1.083	0.007	0.047	80.676	0.002	0.008	0.000	0.998	3.800
-1.166	0.001	0.050	88.785	0.002	0.007	-0.000	0.999	3.066
-1.250	0.002	0.043	86.213	0.002	0.006	-0.000	1.000	3.000

TABLE D-14 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.089	0.053	0.075	0.071

U_c(fps) = 104.115 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	-0.003	0.046	94.184	0.002	0.005	-0.000	0.999	3.200
-1.400	-0.002	0.043	93.586	0.002	0.010	-0.000	0.949	4.400
-1.300	-0.002	0.049	92.675	0.008	0.014	-0.000	0.981	9.400
-1.200	-0.003	0.059	93.180	0.009	0.021	-0.000	0.926	24.466
-1.100	0.002	0.071	88.144	0.008	0.027	-0.000	0.776	60.066
-1.000	0.029	0.074	68.827	0.008	0.029	0.002	0.580	83.400
-0.900	0.062	0.074	50.222	0.025	0.028	0.002	0.240	74.733
-0.800	0.100	0.067	33.880	0.032	0.030	0.002	0.053	27.133
-0.700	0.101	0.055	28.676	0.057	0.038	0.014	0.007	4.533
-0.600	0.026	0.001	3.091	0.037	0.017	0.005	0.000	0.133
-0.500	0.018	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.400	0.018	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.300	0.038	0.000	1.117	0.134	0.016	0.020	0.000	0.066
-0.200	0.309	0.026	4.912	0.438	0.018	0.054	0.001	1.000
-0.100	0.740	0.029	2.257	0.407	0.026	-0.009	0.005	5.066
-0.000	1.019	0.041	2.319	0.048	0.036	0.001	0.014	11.666
0.099	0.779	0.067	4.925	0.397	0.025	0.005	0.007	5.666
0.199	0.412	0.059	8.172	0.454	0.041	0.167	0.001	1.466
0.299	0.107	0.024	12.948	0.286	0.069	0.196	0.000	0.266
0.399	0.018	0.000	0.480	0.000	0.000	0.000	0.000	0.000
0.499	0.018	0.000	0.480	0.000	0.000	0.000	0.000	0.000
0.599	0.018	0.000	0.480	0.000	0.000	0.000	0.000	0.000
0.699	0.051	-0.005	-5.640	0.077	0.016	-0.008	0.000	0.600
0.800	0.117	-0.052	-24.223	0.059	0.034	-0.008	0.009	6.200
0.900	0.110	-0.043	-21.226	0.042	0.025	-0.000	0.070	32.600
0.999	0.089	-0.039	-23.757	0.036	0.018	-0.001	0.239	72.466
1.100	0.068	-0.030	-24.224	0.031	0.013	-0.002	0.545	78.400
1.200	0.051	-0.031	-31.222	0.022	0.007	-0.002	0.822	50.733
1.300	0.040	-0.032	-38.738	0.015	0.009	-0.001	0.880	17.333
1.399	0.030	-0.032	-46.554	0.007	0.007	-0.001	0.988	7.333
1.500	0.027	-0.030	-48.255	0.005	0.005	-0.000	0.996	3.400

TABLE D-14 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.089	0.053	0.075	0.071

U_c(fps) = 102.301 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.024	-0.031	-51.267	0.004	0.006	-0.001	0.992	5.533
1.633	0.028	-0.034	-50.446	0.006	0.008	-0.001	0.988	6.133
1.516	0.031	-0.040	-52.490	0.007	0.014	-0.003	0.940	20.800
1.400	0.041	-0.046	-48.302	0.017	0.016	-0.004	0.826	41.933
1.283	0.063	-0.050	-38.727	0.028	0.017	-0.005	0.605	72.533
1.166	0.092	-0.036	-21.602	0.038	0.020	-0.000	0.371	74.266
1.050	0.109	-0.032	-16.283	0.041	0.024	0.000	0.168	52.866
0.933	0.137	-0.049	-19.804	0.052	0.031	0.001	0.029	14.800
0.816	0.102	-0.037	-20.038	0.088	0.038	-0.019	0.005	3.266
0.700	0.043	-0.007	-10.210	0.069	0.020	-0.008	0.000	0.400
0.583	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.466	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.350	0.019	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
0.233	0.042	0.003	5.019	0.153	0.035	0.053	0.000	0.066
0.116	0.115	0.015	7.850	0.308	0.046	0.141	0.000	0.266
0.000	0.240	0.030	7.169	0.432	0.041	0.155	0.000	0.600
-0.116	0.111	0.014	7.537	0.296	0.039	0.114	0.000	0.266
-0.233	0.087	0.008	5.839	0.255	0.030	0.073	0.000	0.200
-0.349	0.019	-0.000	-1.432	0.000	0.000	0.000	0.000	0.000
-0.466	0.019	-0.000	-1.432	0.000	0.000	0.000	0.000	0.000
-0.583	0.023	0.002	5.036	0.026	0.017	0.004	0.000	0.066
-0.699	0.086	0.033	20.936	0.087	0.047	0.035	0.002	1.533
-0.816	0.119	0.076	32.670	0.047	0.038	0.007	0.019	11.200
-0.933	0.109	0.062	29.677	0.039	0.027	0.006	0.097	40.800
-1.050	0.090	0.049	28.852	0.032	0.024	0.003	0.313	72.666
-1.166	0.066	0.050	37.229	0.025	0.020	0.005	0.606	72.400
-1.283	0.051	0.047	42.653	0.018	0.017	0.004	0.829	44.400
-1.399	0.033	0.052	57.617	0.012	0.023	0.003	0.782	25.533
-1.516	0.016	0.051	71.858	0.011	0.018	0.001	0.963	13.800
-1.633	0.010	0.051	78.746	0.004	0.012	0.000	0.992	5.666
-1.750	0.002	0.047	87.374	0.001	0.009	-0.000	0.997	3.733

TABLE D-14 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.089	0.053	0.075	0.071

U_c(fps) = 96.571 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.100	-0.007	0.052	97.999	0.004	0.010	-0.000	0.997	3.800
-1.950	-0.012	0.059	101.741	0.009	0.017	-0.001	0.987	7.133
-1.800	-0.010	0.058	100.034	0.016	0.023	-0.001	0.962	14.800
-1.650	-0.008	0.066	97.064	0.014	0.030	-0.002	0.854	23.666
-1.500	-0.008	0.076	96.040	0.010	0.033	-0.003	0.788	44.600
-1.350	0.020	0.095	77.981	0.010	0.045	0.001	0.492	61.866
-1.200	0.097	0.092	43.517	0.036	0.036	0.008	0.252	61.000
-1.050	0.135	0.083	31.433	0.046	0.038	0.005	0.095	34.200
-0.900	0.199	0.070	19.364	0.070	0.041	0.005	0.016	9.266
-0.750	0.097	0.035	20.113	0.114	0.051	0.045	0.003	1.933
-0.600	0.030	0.006	12.623	0.052	0.030	0.015	0.000	0.066
-0.450	0.022	0.002	5.881	0.000	0.000	0.000	0.000	0.000
-0.300	0.022	0.002	5.881	0.000	0.000	0.000	0.000	0.000
-0.150	0.022	0.002	5.881	0.000	0.000	0.000	0.000	0.000
-0.000	0.022	0.002	5.881	0.000	0.000	0.000	0.000	0.000
0.149	0.022	0.002	5.881	0.000	0.000	0.000	0.000	0.000
0.299	0.049	0.010	11.960	0.176	0.051	0.091	0.000	0.066
0.449	0.022	0.002	5.881	0.000	0.000	0.000	0.000	0.000
0.599	0.032	0.003	5.644	0.063	0.007	0.003	0.000	0.066
0.749	0.083	-0.012	-8.163	0.115	0.028	-0.016	0.001	1.066
0.899	0.173	-0.081	-25.131	0.096	0.046	-0.012	0.008	4.733
1.049	0.157	-0.075	-25.502	0.061	0.037	-0.005	0.050	21.400
1.199	0.138	-0.054	-21.268	0.052	0.030	-0.001	0.146	45.466
1.349	0.110	-0.040	-20.064	0.051	0.021	-0.003	0.327	62.133
1.499	0.090	-0.040	-23.983	0.041	0.003	-0.005	0.644	62.866
1.649	0.064	-0.048	-37.085	0.030	0.009	-0.009	0.811	43.666
1.799	0.042	-0.044	-46.086	0.018	0.013	-0.005	0.936	20.600
1.949	0.029	-0.041	-54.346	0.007	0.013	-0.003	0.981	8.666
2.100	0.024	-0.038	-56.897	0.003	0.009	-0.001	0.993	4.666

TABLE D-14 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.089	0.053	0.075	0.071

U_c(fps) = 82.444 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.016	-0.043	-68.810	0.008	0.012	-0.001	0.957	4.200
2.333	0.015	-0.051	-73.599	0.014	0.018	-0.002	0.989	6.133
2.166	0.019	-0.058	-71.183	0.016	0.025	-0.003	0.908	12.066
2.000	0.040	-0.070	-60.244	0.012	0.029	-0.007	0.893	27.400
1.833	0.077	-0.066	-40.808	0.039	0.025	-0.007	0.766	44.866
1.666	0.111	-0.068	-31.579	0.049	0.025	-0.005	0.548	66.066
1.500	0.130	-0.067	-27.370	0.055	0.027	-0.006	0.409	68.800
1.333	0.163	-0.077	-25.426	0.064	0.035	-0.003	0.171	50.933
1.166	0.187	-0.082	-23.781	0.070	0.041	0.001	0.051	20.133
1.000	0.198	-0.065	-18.364	0.112	0.051	-0.026	0.013	7.600
0.833	0.093	-0.028	-16.678	0.127	0.047	-0.037	0.001	1.000
0.666	0.046	-0.016	-19.475	0.079	0.031	-0.020	0.000	0.200
0.500	0.025	-0.009	-20.556	0.000	0.000	0.000	0.000	0.000
0.333	0.025	-0.009	-20.556	0.000	0.000	0.000	0.000	0.000
0.166	0.025	-0.009	-20.556	0.000	0.000	0.000	0.000	0.000
0.000	0.025	-0.009	-20.556	0.000	0.000	0.000	0.000	0.000
-0.166	0.025	-0.009	-20.556	0.000	0.000	0.000	0.000	0.000
-0.333	0.044	-0.003	-4.224	0.090	0.029	0.026	0.000	0.133
-0.499	0.035	0.000	1.479	0.058	0.023	0.013	0.000	0.066
-0.666	0.059	0.007	7.551	0.092	0.033	0.027	0.000	0.333
-0.833	0.107	0.022	12.074	0.125	0.043	0.041	0.002	1.666
-0.999	0.183	0.099	28.535	0.083	0.051	0.016	0.023	11.933
-1.166	0.176	0.069	21.426	0.063	0.040	0.005	0.106	36.200
-1.333	0.157	0.063	21.999	0.058	0.024	0.009	0.243	59.133
-1.500	0.142	0.035	14.085	0.055	0.016	0.006	0.461	67.533
-1.666	0.108	0.065	31.234	0.045	0.022	0.016	0.661	59.333
-1.833	0.094	0.040	23.431	0.042	0.019	0.012	0.826	37.733
-1.999	0.067	0.030	24.313	0.032	0.022	0.009	0.944	18.200
-2.166	0.066	0.025	20.645	0.030	0.016	0.006	0.865	9.066
-2.333	0.046	0.024	27.833	0.012	0.001	0.001	0.941	4.266
-2.500	0.038	0.027	35.567	0.006	0.004	0.000	0.999	3.133

TABLE D-15 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.074	0.050	0.051	0.046

U_c(fps) = 89.626 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.045	-0.002	-2.735	0.158	0.025	-0.039	0.000	0.066
0.050	1.001	0.016	0.935	0.176	0.021	0.030	0.025	17.200
0.100	1.027	0.013	0.741	0.012	0.014	0.000	0.036	24.466
0.150	1.038	0.017	0.942	0.010	0.014	-0.000	0.031	22.200
0.200	1.037	0.018	0.997	0.011	0.015	-0.000	0.026	17.600
0.250	1.038	0.013	0.732	0.011	0.014	-0.000	0.037	25.466
0.300	1.028	0.016	0.930	0.012	0.015	-0.000	0.042	28.266
0.350	1.033	0.015	0.872	0.016	0.021	-0.000	0.020	14.733
0.400	0.651	-0.006	-0.587	0.450	0.028	0.098	0.002	2.200
0.450	0.020	0.002	6.365	0.000	0.000	0.000	0.000	0.000
0.500	0.020	0.002	6.365	0.000	0.000	0.000	0.000	0.000
0.550	0.062	-0.011	-10.751	0.044	0.024	-0.005	0.002	2.533
0.600	0.062	-0.019	-17.638	0.014	0.010	-0.000	0.516	176.333
0.650	0.048	-0.031	-32.788	0.010	0.007	-0.000	0.974	25.066
0.700	0.029	-0.044	-55.817	0.005	0.009	-0.000	0.999	3.000
0.750	0.022	-0.037	-58.998	0.002	0.004	-0.000	1.000	3.000
0.000	1.011	0.018	1.023	0.008	0.012	0.000	0.054	34.533
-0.050	1.019	0.020	1.128	0.009	0.012	0.000	0.057	35.533
-0.100	1.022	0.022	1.237	0.009	0.012	0.000	0.037	25.533
-0.150	1.025	0.019	1.106	0.008	0.011	0.000	0.044	29.866
-0.200	1.021	0.018	1.021	0.008	0.012	0.000	0.053	36.533
-0.250	1.027	0.020	1.147	0.010	0.012	0.000	0.037	24.600
-0.300	1.031	0.016	0.904	0.010	0.012	0.000	0.040	26.800
-0.350	0.975	0.021	1.265	0.228	0.019	-0.029	0.019	14.400
-0.400	1.007	0.017	1.014	0.170	0.017	-0.019	0.022	16.133
-0.450	0.418	0.028	3.956	0.483	0.011	0.017	0.001	1.466
-0.500	0.020	-0.001	-4.101	0.000	0.000	0.000	0.000	0.000
-0.550	0.022	-0.001	-3.658	0.013	0.001	0.000	0.000	0.066
-0.600	0.066	0.008	7.705	0.015	0.006	0.000	0.914	49.933
-0.650	0.054	0.014	15.120	0.008	0.003	0.000	1.000	3.000
-0.700	0.051	0.018	19.297	0.010	0.003	0.000	1.000	3.000
-0.750	0.038	0.017	24.914	0.007	0.003	0.000	0.941	2.933

TABLE D-15 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.074	0.050	0.051	0.046

U_c(fps) = 89.626 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.000	0.054	89.039	0.003	0.008	-0.000	1.000	3.000
-0.933	0.000	0.041	88.884	0.002	0.011	-0.000	0.785	2.400
-0.866	-0.001	0.050	91.687	0.003	0.007	-0.000	1.000	3.000
-0.800	-0.004	0.061	94.459	0.005	0.011	-0.000	0.998	3.866
-0.733	-0.015	0.074	101.480	0.011	0.018	-0.000	0.880	69.266
-0.666	0.008	0.090	84.747	0.019	0.026	-0.000	0.210	103.933
-0.600	0.084	0.042	26.703	0.059	0.035	0.012	0.004	3.533
-0.533	0.019	0.007	22.196	0.000	0.000	0.000	0.000	0.000
-0.466	0.019	0.007	22.196	0.000	0.000	0.000	0.000	0.000
-0.400	0.292	0.014	2.910	0.440	0.015	-0.001	0.000	0.800
-0.333	1.009	0.007	0.408	0.035	0.022	0.000	0.024	17.466
-0.266	1.010	0.010	0.579	0.022	0.016	0.000	0.047	31.466
-0.200	1.008	0.007	0.446	0.016	0.013	0.000	0.055	34.333
-0.133	1.004	0.008	0.503	0.013	0.013	0.000	0.061	38.666
-0.066	1.002	0.009	0.558	0.012	0.013	0.000	0.053	34.400
-0.000	0.997	0.009	0.542	0.012	0.014	0.000	0.066	39.800
0.066	1.000	0.006	0.363	0.013	0.015	-0.000	0.053	33.533
0.133	1.007	0.002	0.122	0.015	0.019	0.000	0.042	27.000
0.199	1.009	0.006	0.358	0.019	0.023	0.000	0.044	29.333
0.266	1.000	0.006	0.372	0.023	0.032	0.001	0.037	24.733
0.333	0.835	0.029	2.020	0.348	0.035	-0.038	0.005	4.866
0.400	0.042	0.003	5.002	0.147	0.032	0.047	0.000	0.066
0.466	0.020	-0.001	-3.549	0.000	0.000	0.000	0.000	0.000
0.533	0.020	-0.001	-3.549	0.000	0.000	0.000	0.000	0.000
0.600	0.081	-0.010	-6.990	0.072	0.025	-0.008	0.002	1.866
0.666	0.101	-0.015	-8.564	0.034	0.023	0.001	0.228	108.933
0.733	0.071	-0.022	-17.907	0.022	0.013	-0.000	0.817	85.066
0.800	0.050	-0.026	-27.665	0.013	0.008	-0.000	0.987	10.666
0.866	0.039	-0.033	-40.105	0.008	0.006	-0.000	0.999	3.333
0.933	0.023	-0.044	-61.670	0.004	0.006	-0.000	1.000	3.000
1.000	0.018	-0.035	-63.213	0.003	0.004	-0.000	1.000	3.000

TABLE D-15 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.074	0.050	0.051	0.046

U_c(fps) = 90.915 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.017	-0.040	-66.230	0.003	0.006	-0.000	0.999	3.066
1.166	0.021	-0.050	-66.684	0.004	0.010	-0.000	0.998	3.933
1.083	0.017	-0.053	-71.481	0.003	0.014	-0.001	0.984	10.066
1.000	0.020	-0.049	-67.314	0.012	0.024	-0.002	0.645	22.400
0.916	0.052	-0.065	-51.295	0.022	0.023	-0.004	0.688	85.000
0.833	0.083	-0.058	-34.863	0.037	0.021	-0.003	0.345	96.800
0.750	0.122	-0.051	-22.887	0.046	0.028	0.000	0.055	29.533
0.666	0.108	-0.031	-16.102	0.091	0.037	-0.015	0.003	2.666
0.583	0.022	-0.012	-29.201	0.032	0.015	-0.004	0.000	0.066
0.500	0.018	-0.010	-30.103	0.000	0.000	0.000	0.000	0.000
0.416	0.018	-0.010	-30.103	0.000	0.000	0.000	0.000	0.000
0.333	0.274	0.008	1.739	0.412	0.020	0.054	0.000	0.800
0.250	0.756	0.035	2.660	0.395	0.032	-0.000	0.005	4.533
0.166	0.984	0.014	0.821	0.168	0.037	-0.018	0.021	16.933
0.083	1.010	0.005	0.298	0.032	0.029	0.001	0.036	24.666
0.000	1.007	0.003	0.182	0.032	0.026	0.001	0.046	30.600
-0.083	1.007	0.008	0.461	0.035	0.027	0.002	0.055	34.666
-0.166	1.016	0.012	0.730	0.041	0.028	0.002	0.059	37.600
-0.249	1.005	-0.005	-0.303	0.047	0.029	0.001	0.036	25.333
-0.333	0.459	0.004	0.572	0.458	0.032	-0.111	0.002	2.133
-0.416	0.063	-0.000	-0.167	0.201	0.013	0.016	0.000	0.133
-0.499	0.020	-0.002	-7.490	0.000	0.000	0.000	0.000	0.000
-0.583	0.033	0.002	3.791	0.042	0.019	0.007	0.000	0.266
-0.666	0.126	0.065	27.390	0.052	0.035	0.007	0.009	7.666
-0.750	0.092	0.050	28.623	0.040	0.029	0.005	0.172	70.733
-0.833	0.070	0.051	36.222	0.023	0.022	0.003	0.616	97.333
-0.916	0.050	0.055	47.725	0.013	0.018	0.002	0.909	39.266
-0.999	0.034	0.050	55.746	0.006	0.016	0.001	0.979	12.266
-1.083	0.027	0.058	64.419	0.005	0.010	0.000	0.997	4.400
-1.166	0.019	0.049	68.585	0.003	0.008	0.000	0.999	3.066
-1.250	0.017	0.055	72.736	0.003	0.007	0.000	0.996	4.000

TABLE D-15 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.074	0.050	0.051	0.046

U_c(fps) = 90.430 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.009	0.050	78.702	0.002	0.007	0.000	0.999	3.066
-1.400	0.013	0.053	75.816	0.001	0.012	0.000	0.998	4.066
-1.300	0.016	0.054	73.563	0.004	0.015	0.000	0.990	6.866
-1.200	0.022	0.068	72.058	0.009	0.024	0.001	0.939	23.600
-1.100	0.033	0.068	63.879	0.005	0.030	0.004	0.793	48.400
-1.000	0.060	0.070	49.341	0.016	0.030	0.010	0.602	82.266
-0.900	0.102	0.059	30.108	0.037	0.023	0.008	0.230	64.066
-0.800	0.115	0.063	28.959	0.042	0.032	0.003	0.075	28.000
-0.700	0.110	0.050	24.305	0.069	0.043	0.018	0.005	4.066
-0.600	0.034	0.016	25.016	0.046	0.037	0.016	0.000	0.266
-0.500	0.020	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.400	0.020	-0.001	-5.220	0.000	0.000	0.000	0.000	0.000
-0.300	0.113	0.004	2.448	0.297	0.018	0.047	0.000	0.266
-0.200	0.671	0.002	0.174	0.426	0.037	-0.106	0.003	2.800
-0.100	0.875	0.003	0.217	0.344	0.042	-0.089	0.007	6.400
-0.000	0.893	0.014	0.953	0.323	0.041	-0.070	0.012	9.800
0.099	0.413	0.035	4.847	0.479	0.022	0.054	0.002	2.266
0.199	0.314	0.041	7.438	0.450	0.040	0.153	0.001	1.200
0.299	0.065	0.009	8.582	0.208	0.045	0.093	0.000	0.133
0.399	0.020	-0.000	-1.356	0.000	0.000	0.000	0.000	0.000
0.499	0.031	-0.002	-4.267	0.051	0.011	-0.004	0.000	0.133
0.599	0.020	-0.000	-1.356	0.000	0.000	0.000	0.000	0.000
0.699	0.077	-0.008	-6.282	0.086	0.025	-0.010	0.001	1.200
0.800	0.143	-0.060	-22.755	0.068	0.033	-0.001	0.020	11.466
0.900	0.113	-0.045	-21.793	0.042	0.026	0.000	0.103	40.133
0.999	0.095	-0.039	-22.418	0.039	0.018	-0.001	0.342	81.066
1.100	0.071	-0.032	-24.114	0.031	0.014	-0.001	0.643	65.066
1.200	0.062	-0.031	-26.569	0.025	0.002	-0.002	0.855	42.133
1.300	0.041	-0.032	-37.903	0.016	0.003	-0.003	0.961	15.533
1.399	0.029	-0.029	-45.896	0.008	0.004	-0.001	0.990	6.666
1.500	0.027	-0.033	-50.577	0.005	0.006	-0.000	0.998	3.466

TABLE D-15 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.074	0.050	0.051	0.046

U_c(fps) = 89.931 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.020	-0.033	-58.393	0.002	0.007	-0.000	0.999	3.266
1.633	0.020	-0.039	-62.971	0.006	0.012	-0.002	0.984	7.666
1.516	0.024	-0.043	-60.711	0.004	0.018	-0.003	0.837	14.066
1.400	0.036	-0.054	-56.297	0.013	0.020	-0.005	0.858	34.866
1.283	0.064	-0.050	-38.117	0.030	0.014	-0.007	0.694	60.066
1.166	0.096	-0.041	-23.431	0.039	0.016	-0.002	0.412	72.800
1.050	0.114	-0.039	-18.889	0.044	0.024	-0.000	0.244	62.200
0.933	0.133	-0.061	-24.792	0.046	0.030	-0.000	0.053	23.600
0.816	0.134	-0.053	-21.671	0.086	0.044	-0.023	0.005	3.533
0.700	0.069	-0.029	-22.972	0.090	0.042	-0.027	0.001	1.133
0.583	0.020	-0.008	-23.985	0.000	0.000	0.000	0.000	0.000
0.466	0.034	-0.000	-1.637	0.083	0.008	0.004	0.000	0.066
0.350	0.046	0.004	5.108	0.164	0.039	0.065	0.000	0.066
0.233	0.046	0.003	4.273	0.161	0.034	0.056	0.000	0.066
0.116	0.218	0.028	7.553	0.420	0.044	0.174	0.000	0.600
0.000	0.232	0.024	5.985	0.421	0.033	0.111	0.000	0.600
-0.116	0.139	0.015	6.336	0.335	0.034	0.104	0.000	0.333
-0.233	0.022	0.000	0.445	0.000	0.000	0.000	0.000	0.000
-0.349	0.022	0.000	0.445	0.000	0.000	0.000	0.000	0.000
-0.466	0.022	0.000	0.445	0.000	0.000	0.000	0.000	0.000
-0.583	0.030	0.004	8.338	0.037	0.022	0.007	0.000	0.133
-0.699	0.072	0.024	18.916	0.086	0.037	0.028	0.001	1.333
-0.816	0.137	0.064	25.096	0.057	0.040	0.009	0.022	11.933
-0.933	0.117	0.056	25.743	0.041	0.029	0.003	0.130	43.266
-1.050	0.073	0.032	24.094	0.049	0.025	0.009	0.165	33.200
-1.166	0.089	0.045	26.803	0.034	0.013	0.007	0.585	70.466
-1.283	0.064	0.038	30.571	0.027	0.005	0.007	0.768	41.800
-1.399	0.048	0.041	40.515	0.015	0.012	0.004	0.940	18.666
-1.516	0.030	0.046	56.977	0.002	0.016	0.002	0.928	11.400
-1.633	0.022	0.048	65.070	0.007	0.013	0.001	0.993	5.333
-1.750	0.012	0.050	75.978	0.002	0.008	0.000	0.990	5.066

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.074	0.050	0.051	0.046

U_c(fps) = 85.439 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.000	0.007	0.061	82.769	0.012	0.018	0.000	0.995	4.866
-1.866	0.009	0.068	82.531	0.016	0.023	0.000	0.984	7.466
-1.733	0.011	0.069	80.929	0.019	0.030	0.001	0.904	15.066
-1.600	0.026	0.082	72.234	0.016	0.039	0.004	0.777	33.666
-1.466	0.044	0.090	63.885	0.014	0.039	0.006	0.721	52.800
-1.333	0.090	0.081	41.956	0.032	0.034	0.013	0.469	64.200
-1.200	0.125	0.066	27.935	0.045	0.030	0.008	0.339	68.200
-1.066	0.141	0.065	24.981	0.049	0.034	0.003	0.187	52.533
-0.933	0.143	0.072	26.880	0.073	0.045	0.017	0.036	15.066
-0.800	0.145	0.091	32.222	0.091	0.057	0.036	0.006	3.933
-0.666	0.088	0.041	25.038	0.112	0.054	0.049	0.001	1.133
-0.533	0.028	0.014	26.791	0.035	0.024	0.008	0.000	0.066
-0.400	0.023	0.010	24.668	0.000	0.000	0.000	0.000	0.000
-0.266	0.025	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.133	0.025	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
-0.000	0.025	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.133	0.025	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.266	0.025	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.399	0.025	-0.002	-5.220	0.000	0.000	0.000	0.000	0.000
0.533	0.029	-0.004	-8.631	0.025	0.014	-0.003	0.000	0.066
0.666	0.101	-0.016	-9.039	0.126	0.037	-0.025	0.001	1.133
0.800	0.134	-0.063	-25.299	0.116	0.056	-0.050	0.004	2.600
0.933	0.186	-0.083	-24.195	0.065	0.041	-0.004	0.019	9.400
1.066	0.160	-0.066	-22.430	0.057	0.034	0.000	0.082	29.666
1.200	0.129	-0.056	-23.480	0.050	0.029	-0.001	0.222	49.200
1.333	0.119	-0.041	-19.035	0.047	0.025	-0.000	0.476	68.000
1.466	0.091	-0.031	-19.179	0.045	0.021	-0.007	0.672	45.466
1.600	0.076	-0.032	-23.324	0.038	0.019	-0.006	0.869	31.133
1.733	0.044	-0.048	-47.747	0.019	0.014	-0.006	0.933	18.333
1.866	0.035	-0.045	-52.366	0.008	0.012	-0.005	0.979	8.933
2.000	0.032	-0.038	-50.200	0.007	0.007	-0.002	0.990	5.466

TABLE D-16 DATA LISTING

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
0.500	0.083	0.057	0.060	0.050

U_c(fps) = 91.798 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
0.000	0.130	0.007	3.296	0.337	0.014	0.049	0.000	0.466
0.050	0.169	0.009	3.212	0.380	0.015	0.056	0.000	0.666
0.100	0.175	0.011	3.698	0.387	0.019	0.072	0.000	0.733
0.150	0.124	0.008	3.758	0.327	0.016	0.052	0.000	0.466
0.200	0.094	0.006	4.105	0.279	0.015	0.042	0.000	0.333
0.250	0.190	0.012	3.879	0.400	0.021	0.082	0.001	0.866
0.300	0.231	0.012	3.081	0.433	0.016	0.066	0.001	0.933
0.350	0.049	0.004	5.001	0.182	0.012	0.022	-0.000	0.133
0.400	0.034	0.003	5.242	0.128	0.007	0.009	0.000	0.066
0.450	0.019	0.002	6.590	0.000	0.000	0.000	0.000	0.000
0.500	0.019	0.002	6.590	0.000	0.000	0.000	0.000	0.000
0.550	0.019	0.002	6.590	0.000	0.000	0.000	0.000	0.000
0.600	0.028	-0.031	-48.113	0.011	0.016	-0.001	0.093	53.800
0.650	0.006	-0.057	-83.388	0.004	0.017	-0.000	0.712	152.533
0.700	-0.002	-0.051	-92.554	0.003	0.008	0.000	0.992	15.600
0.750	-0.001	-0.047	-91.546	0.002	0.007	0.000	0.999	3.600

0.000	0.228	0.012	3.244	0.431	0.017	0.073	0.001	0.933
-0.050	0.191	0.011	3.454	0.402	0.018	0.072	0.000	0.800
-0.100	0.273	0.015	3.147	0.457	0.016	0.074	0.001	1.200
-0.150	0.179	0.011	3.668	0.390	0.019	0.075	0.000	0.666
-0.200	0.139	0.009	3.851	0.346	0.019	0.065	0.000	0.533
-0.250	0.131	0.009	3.984	0.335	0.019	0.064	0.000	0.466
-0.300	0.202	0.012	3.529	0.409	0.019	0.077	0.000	0.800
-0.350	0.257	0.013	2.925	0.445	0.015	0.064	0.001	1.466
-0.400	0.108	0.006	3.669	0.302	0.015	0.046	0.000	0.400
-0.450	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.500	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.550	0.020	0.001	4.942	0.010	0.001	-0.000	-0.000	0.066
-0.600	0.047	-0.048	-45.399	0.009	0.010	-0.000	0.930	51.266
-0.650	0.032	0.052	57.998	0.004	0.006	0.000	0.999	3.333
-0.700	0.006	0.066	84.363	0.002	0.005	-0.000	0.999	3.000
-0.750	0.026	0.059	66.174	0.002	0.004	0.000	0.999	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
1.500	0.083	0.057	0.060	0.050

U_c(fps) = 91.798 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.000	0.012	0.048	75.172	0.001	0.005	0.000	0.999	3.000
-0.933	0.002	0.039	86.337	0.002	0.005	0.000	0.999	3.000
-0.866	0.006	0.054	82.854	0.003	0.006	0.000	0.999	3.000
-0.800	0.004	0.051	85.403	0.003	0.010	0.000	0.999	3.466
-0.733	0.016	0.057	73.418	0.007	0.012	0.000	0.965	33.533
-0.666	0.051	0.049	43.867	0.021	0.020	0.003	0.361	139.200
-0.600	0.018	0.019	45.591	0.020	0.015	0.002	-0.001	0.466
-0.533	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.466	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.400	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
-0.333	0.061	0.005	5.509	0.207	0.019	0.040	-0.000	0.200
-0.266	0.185	0.018	5.647	0.384	0.034	0.129	0.000	0.866
-0.200	0.138	0.013	5.673	0.336	0.031	0.103	0.000	0.533
-0.133	0.219	0.020	5.353	0.411	0.032	0.134	0.001	1.066
-0.066	0.269	0.027	5.897	0.440	0.037	0.162	0.001	1.333
-0.000	0.178	0.021	6.851	0.376	0.038	0.145	0.000	0.733
0.066	0.175	0.020	6.722	0.372	0.037	0.139	0.001	1.000
0.133	0.306	0.033	6.193	0.455	0.040	0.181	0.002	1.800
0.199	0.192	0.022	6.667	0.388	0.039	0.149	0.001	0.866
0.266	0.123	0.015	7.229	0.315	0.035	0.109	0.000	0.533
0.333	0.104	0.014	8.009	0.288	0.037	0.104	0.000	0.400
0.400	0.019	0.003	10.217	0.000	0.000	0.000	0.000	0.000
0.466	0.019	0.003	10.217	0.000	0.000	0.000	0.000	0.000
0.533	0.019	0.003	10.217	0.000	0.000	0.000	0.000	0.000
0.600	0.019	0.003	10.217	0.000	0.000	0.000	0.000	0.000
0.666	0.058	-0.038	-33.359	0.035	0.026	-0.007	0.018	22.933
0.733	0.048	-0.044	-42.419	0.017	0.017	-0.002	0.564	133.600
0.800	0.029	-0.041	-54.800	0.007	0.013	-0.000	0.963	28.266
0.866	0.024	-0.041	-58.810	0.006	0.010	-0.000	0.999	3.866
0.933	0.019	-0.037	-62.390	0.003	0.006	-0.000	0.999	3.000
1.000	0.018	-0.044	-67.762	0.003	0.006	-0.000	0.999	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
3.000	0.083	0.057	0.060	0.050

U_c(fps) = 92.018 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.250	0.015	-0.041	-69.492	0.003	0.006	-0.000	0.999	3.333
1.166	0.017	-0.046	-69.538	0.002	0.008	-0.000	0.997	4.200
1.083	0.018	-0.049	-69.549	0.002	0.013	-0.000	0.975	12.533
1.000	0.022	-0.051	-65.958	0.005	0.018	-0.001	0.845	53.533
0.916	0.040	-0.060	-56.278	0.017	0.023	-0.002	0.546	92.933
0.833	0.043	-0.034	-38.210	0.032	0.027	-0.007	0.076	35.666
0.750	0.065	-0.047	-36.070	0.046	0.035	-0.012	0.014	10.400
0.666	0.024	-0.017	-34.299	0.033	0.021	-0.006	0.000	0.333
0.583	0.015	-0.011	-35.495	0.000	0.000	0.000	0.000	0.000
0.500	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.416	0.019	0.001	5.341	0.000	0.000	0.000	0.000	0.000
0.333	0.034	0.003	6.544	0.126	0.017	0.022	0.000	0.066
0.250	0.047	0.005	6.373	0.172	0.021	0.036	-0.000	0.133
0.166	0.159	0.022	8.165	0.356	0.044	0.157	0.000	0.666
0.083	0.220	0.028	7.278	0.407	0.045	0.181	0.000	1.400
0.000	0.312	0.036	6.731	0.454	0.045	0.199	0.002	1.800
-0.083	0.141	0.018	7.627	0.338	0.041	0.137	0.000	0.666
-0.166	0.350	0.038	6.277	0.467	0.043	0.189	0.002	1.933
-0.249	0.103	0.011	6.184	0.283	0.025	0.070	0.000	0.400
-0.333	0.032	0.003	6.119	0.115	0.002	0.002	0.000	0.066
-0.416	0.019	0.003	9.653	0.000	0.000	0.000	0.000	0.000
-0.499	0.019	0.003	9.653	0.000	0.000	0.000	0.000	0.000
-0.583	0.019	0.003	9.653	0.000	0.000	0.000	0.000	0.000
-0.666	0.044	0.033	36.937	0.048	0.033	0.013	0.001	2.266
-0.750	0.070	0.040	29.582	0.035	0.024	0.005	0.121	56.066
-0.833	0.068	0.040	30.522	0.024	0.017	0.003	0.564	100.733
-0.916	0.048	0.046	43.741	0.013	0.013	0.001	0.899	41.466
-0.999	0.034	0.050	55.819	0.006	0.009	0.000	0.985	8.600
-1.083	0.029	0.044	56.473	0.005	0.007	0.000	0.973	3.666
-1.166	0.019	0.037	62.252	0.004	0.006	0.000	0.999	3.066
-1.250	0.021	0.039	61.658	0.003	0.005	0.000	0.999	3.000

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
4.500	0.083	0.057	0.060	0.050

U_c(fps) = 92.255 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-1.500	0.017	0.039	65.892	0.002	0.005	0.000	0.999	3.000
-1.400	0.017	0.040	66.906	0.004	0.008	0.000	0.998	3.333
-1.300	0.018	0.042	66.425	0.001	0.010	0.000	0.990	6.266
-1.200	0.022	0.055	67.418	0.006	0.017	0.001	0.937	22.133
-1.100	0.035	0.056	57.683	0.008	0.021	0.003	0.816	48.533
-1.000	0.064	0.050	38.140	0.024	0.020	0.003	0.553	80.133
-0.900	0.075	0.042	29.595	0.033	0.024	0.004	0.260	73.533
-0.800	0.078	0.047	31.070	0.044	0.030	0.008	0.057	26.266
-0.700	0.037	0.030	38.608	0.043	0.036	0.014	0.001	1.200
-0.600	0.018	0.014	37.587	0.023	0.021	0.004	0.000	0.066
-0.500	0.015	0.011	37.128	0.000	0.000	0.000	0.000	0.000
-0.400	0.015	0.011	37.128	0.000	0.000	0.000	0.000	0.000
-0.300	0.027	0.012	24.044	0.098	0.002	0.001	0.000	0.066
-0.200	0.099	0.019	10.893	0.261	0.024	0.057	0.000	0.466
-0.100	0.133	0.015	6.545	0.328	0.033	0.102	0.000	0.666
-0.000	0.233	0.027	6.715	0.417	0.042	0.172	0.001	1.200
0.099	0.177	0.025	8.197	0.375	0.048	0.178	0.000	0.933
0.199	0.032	0.007	12.952	0.118	0.020	0.023	-0.000	0.066
0.299	0.019	0.005	15.269	0.000	0.000	0.000	0.000	0.000
0.399	0.019	0.005	15.269	0.000	0.000	0.000	0.000	0.000
0.499	0.019	0.005	15.269	0.000	0.000	0.000	0.000	0.000
0.599	0.019	0.005	15.269	0.000	0.000	0.000	0.000	0.000
0.699	0.032	0.002	4.091	0.044	0.010	-0.003	0.000	0.466
0.800	0.071	-0.035	-26.464	0.064	0.034	-0.017	0.003	3.733
0.900	0.081	-0.045	-29.141	0.046	0.030	-0.008	0.044	22.800
0.999	0.052	-0.029	-28.992	0.038	0.023	-0.007	0.135	43.733
1.100	0.061	-0.041	-34.016	0.025	0.017	-0.003	0.556	75.000
1.200	0.038	-0.045	-49.190	0.014	0.016	-0.002	0.825	45.266
1.300	0.031	-0.040	-52.559	0.007	0.012	-0.001	0.951	18.200
1.399	0.021	-0.036	-59.052	0.003	0.010	-0.001	0.986	8.133
1.500	0.015	-0.035	-65.607	0.004	0.008	-0.000	0.997	4.066

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
6.000	0.083	0.057	0.060	0.050

U_c(fps) = 91.554 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
1.750	0.016	-0.034	-64.487	0.004	0.009	-0.000	0.995	4.333
1.633	0.014	-0.038	-70.032	0.009	0.012	-0.000	0.987	7.733
1.516	0.015	-0.047	-71.366	0.009	0.018	-0.001	0.951	16.133
1.400	0.019	-0.042	-65.080	0.008	0.024	-0.002	0.552	18.066
1.283	0.040	-0.060	-56.279	0.017	0.023	-0.003	0.667	62.600
1.166	0.072	-0.049	-34.411	0.034	0.023	-0.004	0.362	68.333
1.050	0.087	-0.048	-28.987	0.047	0.028	-0.007	0.124	44.400
0.933	0.088	-0.049	-29.016	0.057	0.036	-0.013	0.020	12.666
0.816	0.059	-0.035	-30.451	0.066	0.041	-0.021	0.003	2.133
0.700	0.022	-0.012	-28.395	0.023	0.014	-0.003	0.000	0.133
0.583	0.018	-0.009	-28.507	0.000	0.000	0.000	0.000	0.000
0.466	0.018	-0.009	-28.507	0.000	0.000	0.000	0.000	0.000
0.350	0.018	-0.009	-28.507	0.000	0.000	0.000	0.000	0.000
0.233	0.047	-0.009	-11.004	0.177	0.006	0.006	0.000	0.133
0.116	0.124	-0.007	-3.545	0.325	0.015	0.018	0.000	0.466
0.000	0.110	-0.011	-5.972	0.308	0.011	-0.021	0.000	0.400
-0.116	0.035	0.002	4.591	0.132	0.017	0.023	0.000	0.066
-0.233	0.020	0.000	2.261	0.000	0.000	0.000	0.000	0.000
-0.349	0.020	0.000	2.261	0.000	0.000	0.000	0.000	0.000
-0.466	0.020	0.000	2.261	0.000	0.000	0.000	0.000	0.000
-0.583	0.025	0.003	7.515	0.031	0.016	0.005	0.000	0.133
-0.699	0.049	0.008	9.484	0.066	0.020	0.010	0.000	0.933
-0.816	0.090	0.041	24.650	0.064	0.036	0.016	0.014	8.333
-0.933	0.089	0.042	25.532	0.046	0.028	0.007	0.095	34.600
-1.050	0.078	0.043	28.826	0.034	0.020	0.004	0.341	70.466
-1.166	0.075	0.034	24.629	0.030	0.016	0.002	0.548	70.466
-1.283	0.069	0.036	27.470	0.026	0.007	0.004	0.789	47.866
-1.399	0.048	0.033	34.723	0.018	0.005	0.003	0.881	21.533
-1.516	0.028	0.035	51.399	0.006	0.008	0.001	0.977	9.066
-1.633	0.023	0.040	60.186	0.003	0.008	0.000	0.993	5.066
-1.750	0.019	0.036	61.821	0.002	0.006	0.000	0.998	3.600

TABLE D-16 Continued

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
8.000	0.083	0.057	0.060	0.050

U_c(fps) = 87.644   T = 15.000 (averaging time)   Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
-2.100	0.023	0.039	59.476	0.008	0.013	0.001	0.700	3.333
-1.960	0.019	0.051	69.320	0.006	0.013	0.001	0.990	5.266
-1.820	0.023	0.054	66.821	0.007	0.017	0.001	0.973	9.933
-1.680	0.027	0.061	66.280	0.015	0.025	0.004	0.918	20.533
-1.540	0.070	0.063	42.297	0.027	0.023	0.008	0.772	44.733
-1.400	0.076	0.052	34.838	0.032	0.018	0.008	0.638	55.400
-1.260	0.102	0.046	24.471	0.044	0.024	0.006	0.368	65.933
-1.120	0.109	0.050	24.634	0.052	0.028	0.009	0.174	46.533
-0.980	0.118	0.056	25.519	0.068	0.038	0.016	0.048	19.066
-0.840	0.100	0.057	30.003	0.089	0.056	0.040	0.005	3.466
-0.700	0.047	0.031	33.146	0.066	0.043	0.027	0.001	0.866
-0.560	0.019	0.013	33.929	0.000	0.000	0.000	-0.000	0.000
-0.420	0.019	0.013	33.929	0.000	0.000	0.000	0.000	0.000
-0.280	0.023	0.002	5.341	0.000	0.000	0.000	0.000	0.000
-0.140	0.023	0.002	5.341	0.000	0.000	0.000	0.000	0.000
-0.000	0.023	0.002	5.341	0.000	0.000	0.000	0.000	0.000
0.139	0.023	0.002	5.341	0.000	0.000	0.000	0.000	0.000
0.279	0.023	0.002	5.341	0.000	0.000	0.000	0.000	0.000
0.419	0.023	0.002	5.341	0.000	0.000	0.000	0.000	0.000
0.559	0.028	-0.000	-1.093	0.037	0.022	-0.008	0.000	0.066
0.699	0.027	0.000	1.747	0.031	0.012	-0.003	-0.000	0.133
0.839	0.072	-0.036	-26.627	0.077	0.049	-0.027	0.004	2.466
0.979	0.114	-0.054	-25.240	0.081	0.042	-0.022	0.012	7.266
1.119	0.110	-0.054	-26.185	0.061	0.036	-0.012	0.069	25.466
1.260	0.104	-0.053	-26.962	0.050	0.029	-0.007	0.197	50.066
1.399	0.092	-0.040	-23.846	0.039	0.021	-0.003	0.465	65.200
1.540	0.074	-0.040	-28.755	0.030	0.015	-0.003	0.730	50.400
1.679	0.057	-0.043	-37.258	0.025	0.011	-0.007	0.829	38.733
1.820	0.036	-0.044	-51.113	0.009	0.017	-0.004	0.942	18.200
1.959	0.030	-0.040	-52.562	0.003	0.011	-0.002	0.990	5.666
2.100	0.027	-0.036	-53.383	0.002	0.008	-0.000	0.998	3.800

x/d	Λ_u/d =	Λ_y/d =	λ_x/d =	λ_y/d =
10.000	0.083	0.057	0.060	0.050

U_c(fps) = 75.526 T = 15.000 (averaging time) Condition: Non-Vortical

y/d	U/U_c	V/U_c	Θ	u'/U_c	v'/U_c	$\overline{uv}/U_c^{-2}$	γ	C/T
2.500	0.027	-0.038	-54.038	0.004	0.009	-0.001	0.920	3.266
2.333	0.023	-0.047	-63.533	0.012	0.015	-0.002	0.987	6.400
2.166	0.030	-0.053	-60.603	0.005	0.020	-0.002	0.977	10.133
2.000	0.057	-0.051	-42.049	0.023	0.018	-0.008	0.913	24.200
1.833	0.085	-0.045	-28.186	0.039	0.011	-0.008	0.800	42.733
1.666	0.099	-0.047	-25.820	0.044	0.008	-0.009	0.653	55.733
1.500	0.119	-0.054	-24.416	0.052	0.024	-0.008	0.403	60.866
1.333	0.130	-0.059	-24.594	0.064	0.036	-0.009	0.203	48.466
1.166	0.151	-0.062	-22.608	0.084	0.044	-0.017	0.059	21.600
1.000	0.134	-0.075	-29.478	0.099	0.059	-0.040	0.016	7.266
0.833	0.078	-0.026	-18.814	0.104	0.047	-0.042	0.001	1.200
0.666	0.033	-0.007	-12.475	0.048	0.011	-0.005	0.000	0.066
0.500	0.033	-0.008	-14.054	0.044	0.018	-0.007	0.000	0.066
0.333	0.028	0.002	5.341	0.000	0.000	0.000	0.000	0.000
0.166	0.028	0.002	5.341	0.000	0.000	0.000	0.000	0.000
0.000	0.028	0.002	5.341	0.000	0.000	0.000	0.000	0.000
-0.166	0.028	0.002	5.341	0.000	0.000	0.000	0.000	0.000
-0.333	0.028	0.002	5.341	0.000	0.000	0.000	-0.000	0.000
-0.499	0.028	0.002	5.341	0.000	0.000	0.000	-0.000	0.000
-0.666	0.046	0.008	10.406	0.073	0.026	0.017	0.000	0.333
-0.833	0.100	0.052	27.722	0.104	0.059	0.045	0.004	2.800
-0.999	0.148	0.066	24.156	0.105	0.055	0.036	0.016	8.666
-1.166	0.138	0.062	24.200	0.071	0.035	0.016	0.130	35.400
-1.333	0.127	0.055	23.596	0.056	0.032	0.007	0.253	54.733
-1.500	0.123	0.043	19.309	0.052	0.020	0.007	0.465	65.733
-1.666	0.100	0.037	20.403	0.043	0.019	0.008	0.742	46.600
-1.833	0.092	0.033	20.125	0.040	0.021	0.008	0.866	30.266
-1.999	0.070	0.047	33.780	0.027	0.010	0.008	0.936	17.333
-2.166	0.061	0.043	34.972	0.018	0.009	0.004	0.977	8.866
-2.333	0.048	0.035	36.174	0.012	0.003	0.001	0.994	4.733
-2.500	0.037	0.041	48.224	0.010	0.011	0.001	0.864	3.066

LIST OF REFERENCES

7. REFERENCES

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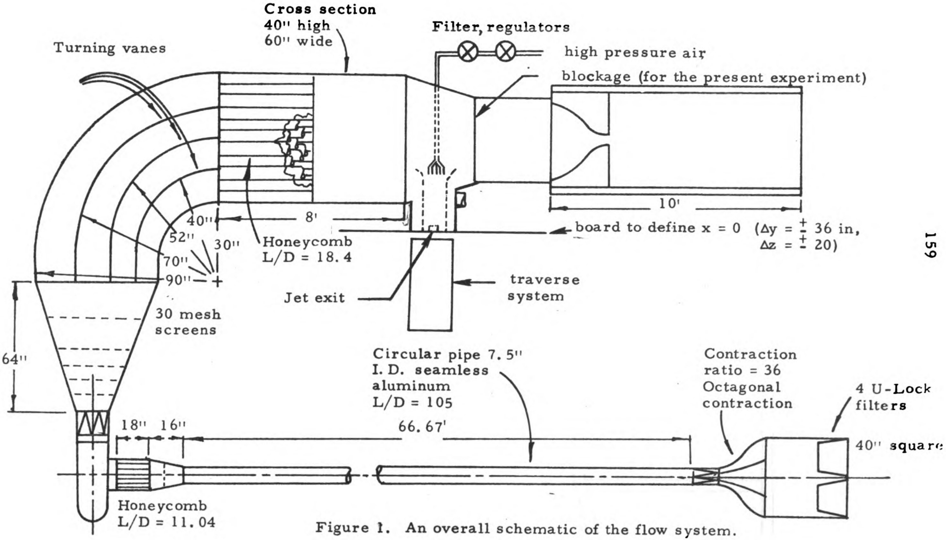


Figure 1. An overall schematic of the flow system.

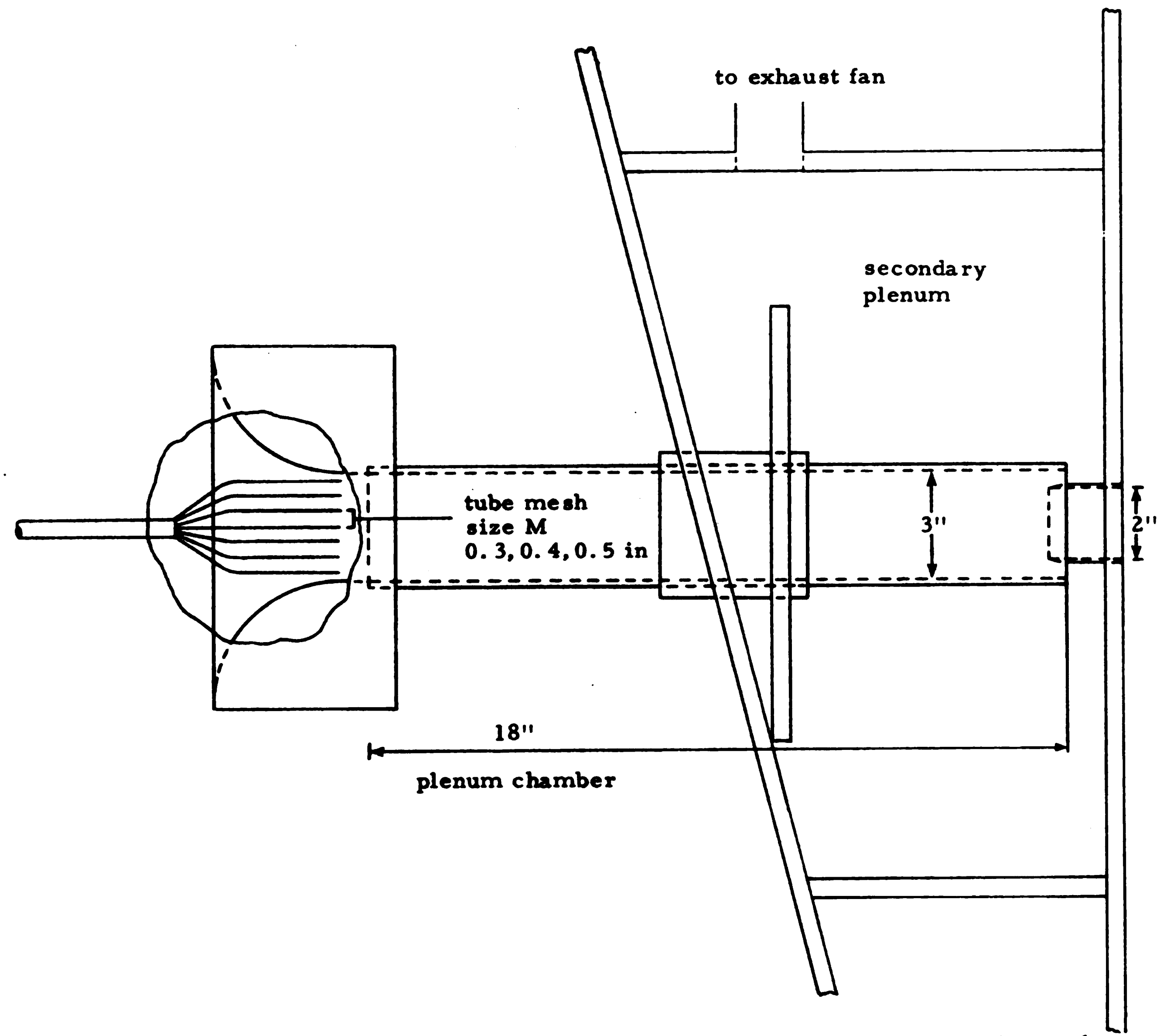


Figure 2. Configuration to achieve controlled intensity and scale at exit plane of axisymmetric jet.

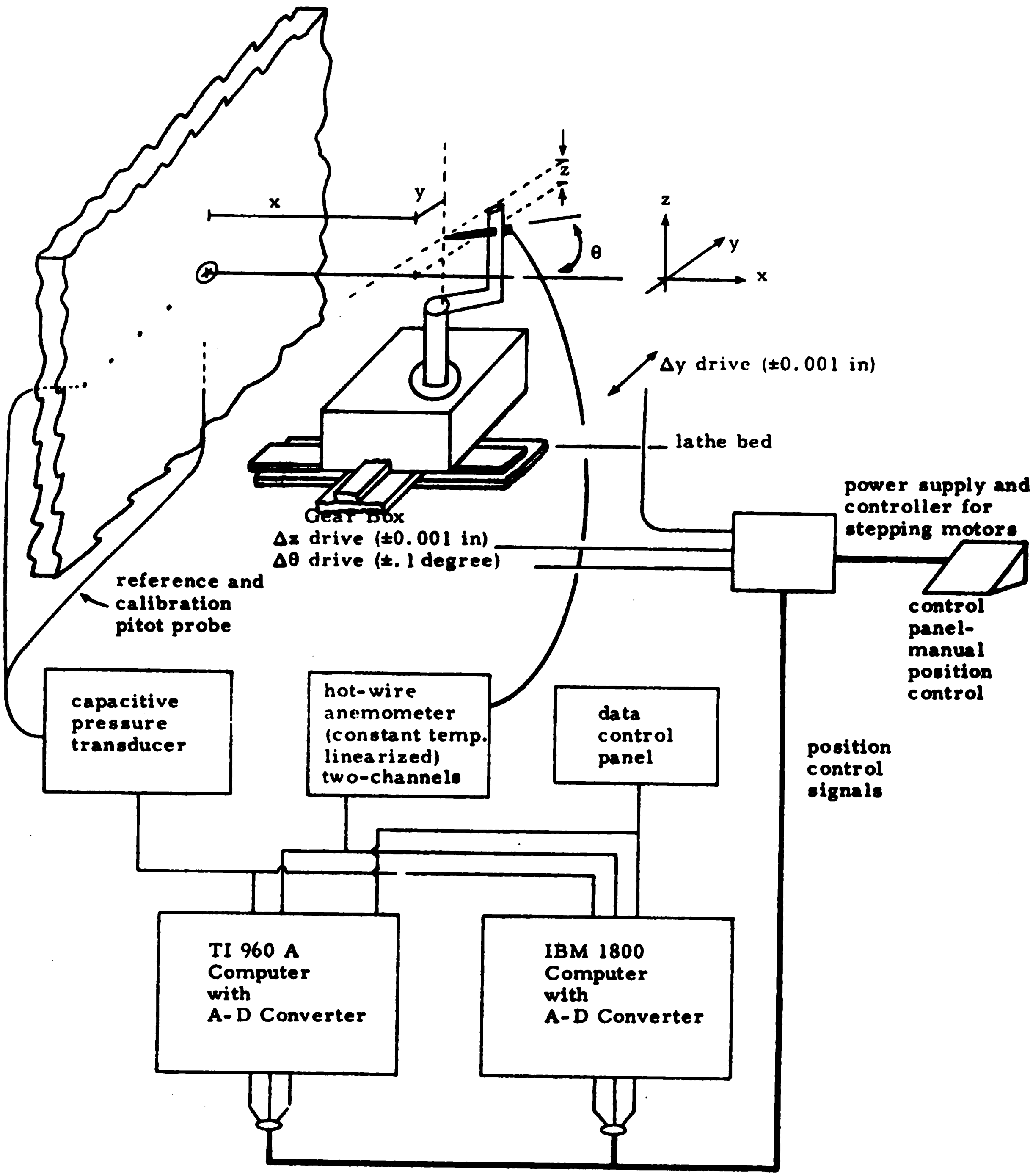
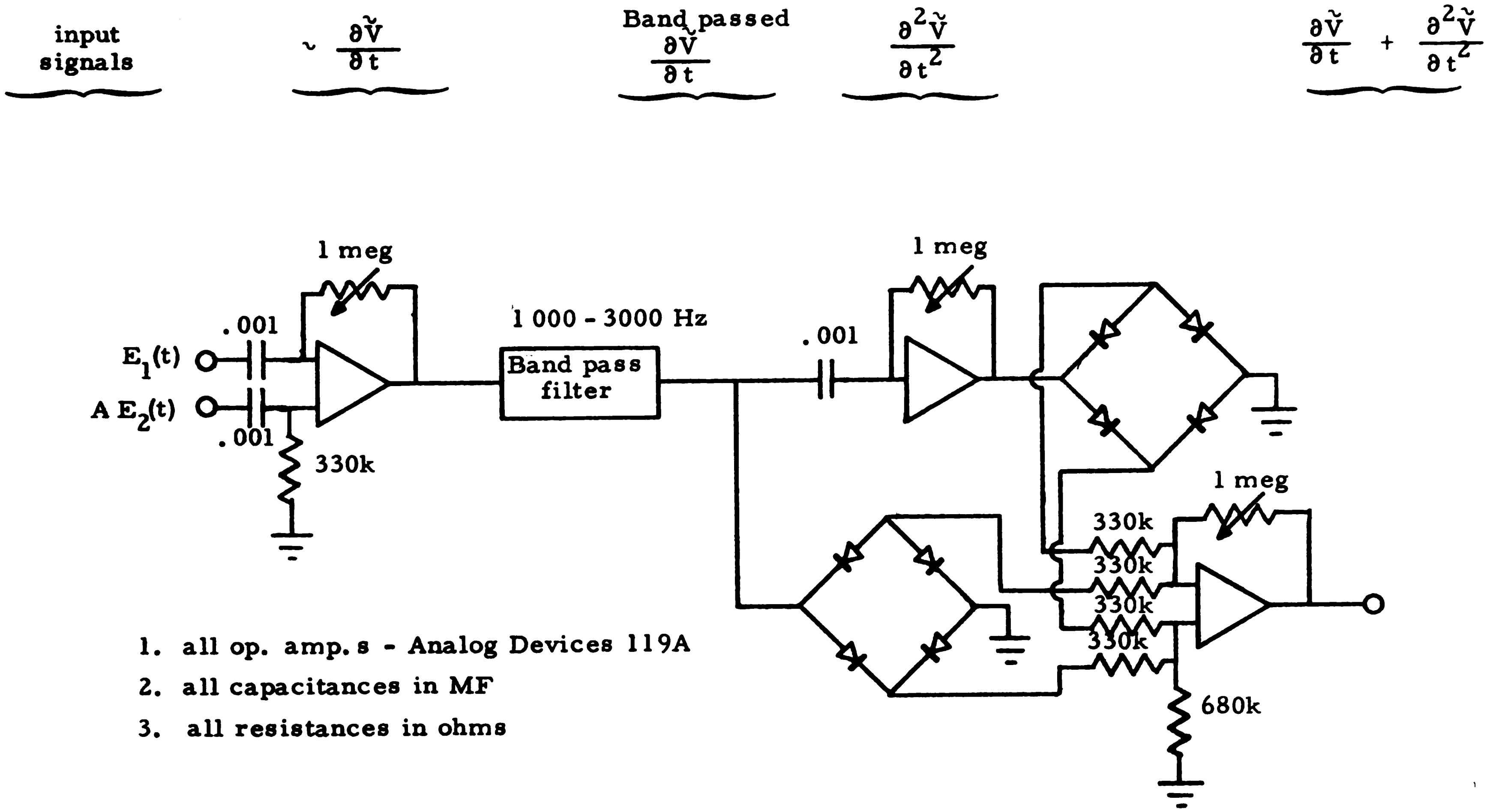


Figure 3. Schematic of data acquisition facility.



1. all op. amp.s - Analog Devices 119A
2. all capacitances in MF
3. all resistances in ohms

Figure 4. Discriminator Circuit

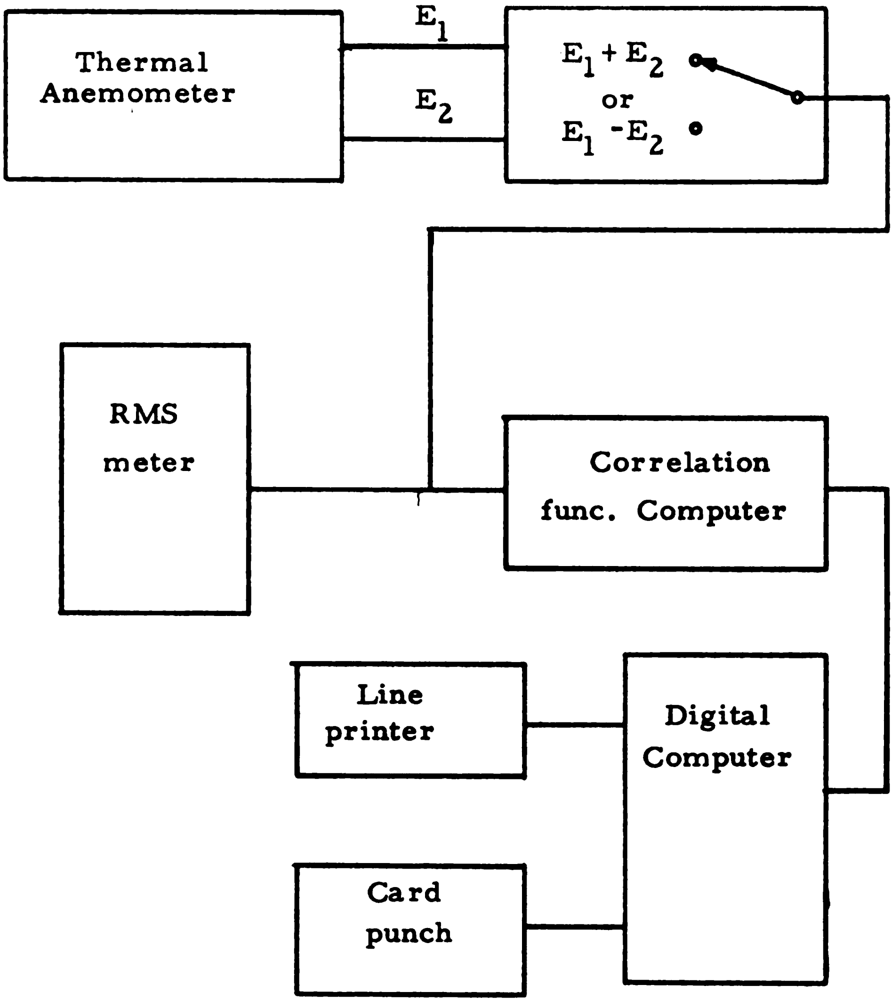


Figure 5. Sum and difference circuit processing

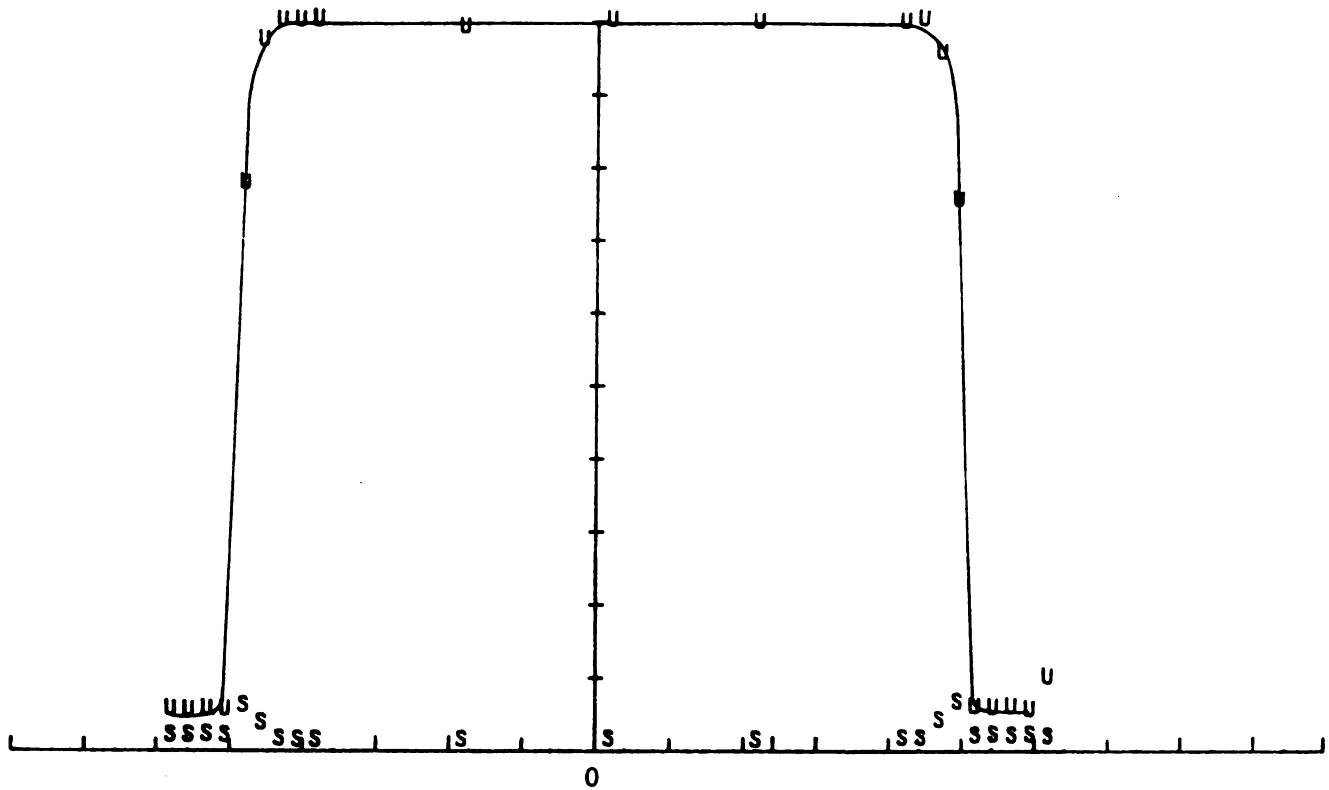


Figure 6. Mean velocity ratio, $U(0, y, 0)/U(0, 0, 0)$, and the relative intensity of the longitudinal fluctuation, $\tilde{u}(0, y, 0)$ for the conditions 0.3, 5, 980.

Note: Nominal mean velocity and r.m.s. relative intensity values are $U = 103.8 \pm 0.5$ fps and $\tilde{u} = 0.8 \pm 0.1$ percent. The tolerance values indicate the maximum deviations observed over the core region at the exit plane.

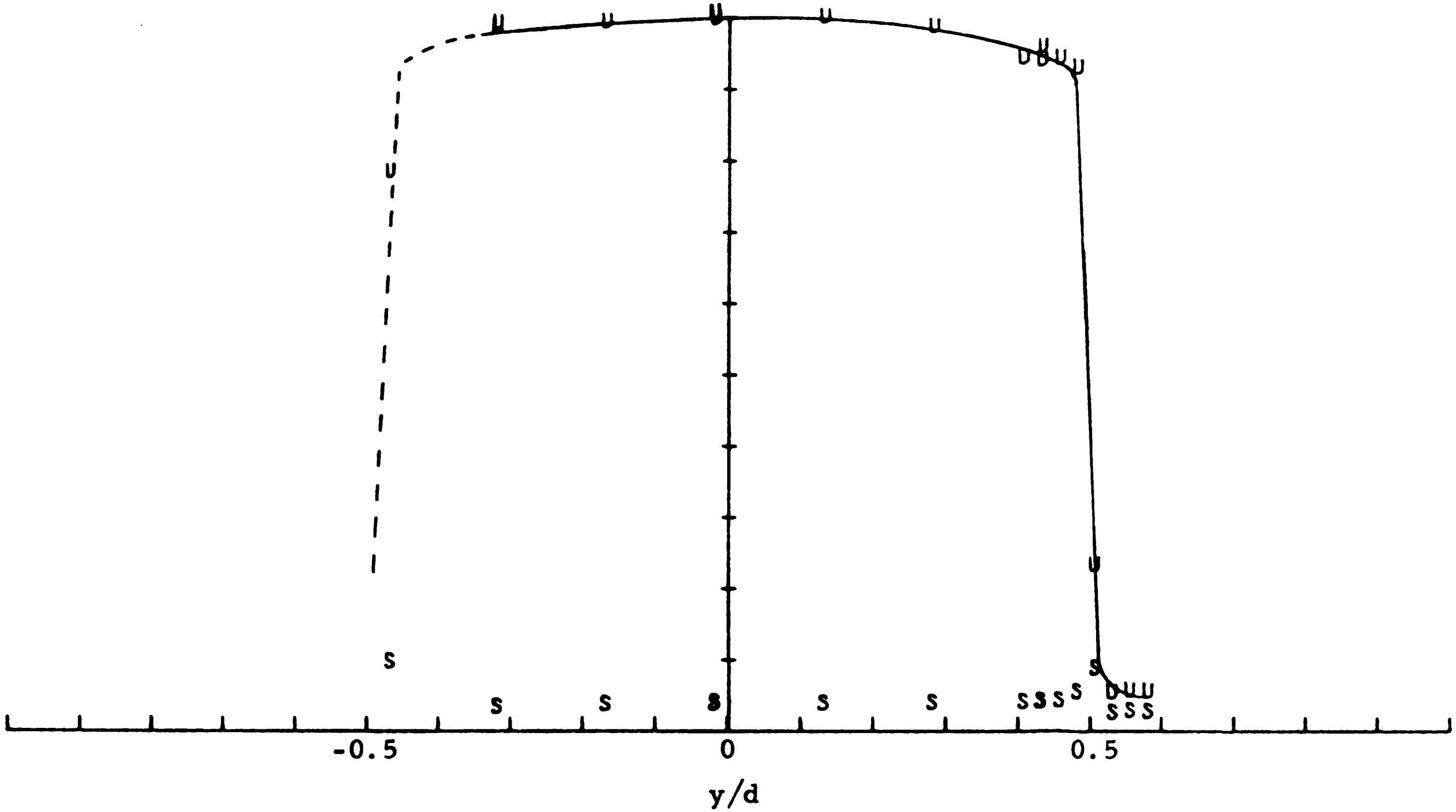


Figure 7. Mean velocity ratio, $U(0, y, 0)/U(0, 0, 0)$, and the relative intensity of the longitudinal fluctuation, $\tilde{u}(0, y, 0)$ for the conditions 0.5, 20, 0.

Note: Nominal mean velocity and r.m.s. relative intensity values are $U = 65.1 \pm 0.6$ fps and $\tilde{u} = 2.8 \pm 0.3$ percent. The tolerance values indicate the maximum deviations observed over the core region at the exit plane.

Comment: Nozzle exit flow results from jet-pump action of the tube array for the zero RPM condition. This apparently results in a minor rounding of the mean velocity profile. Note that $\tilde{u}$ distribution is not seriously effected for M = 0.5 but $\tilde{u}$ tolerance for M = 0.3 is approximately twice that of next largest.

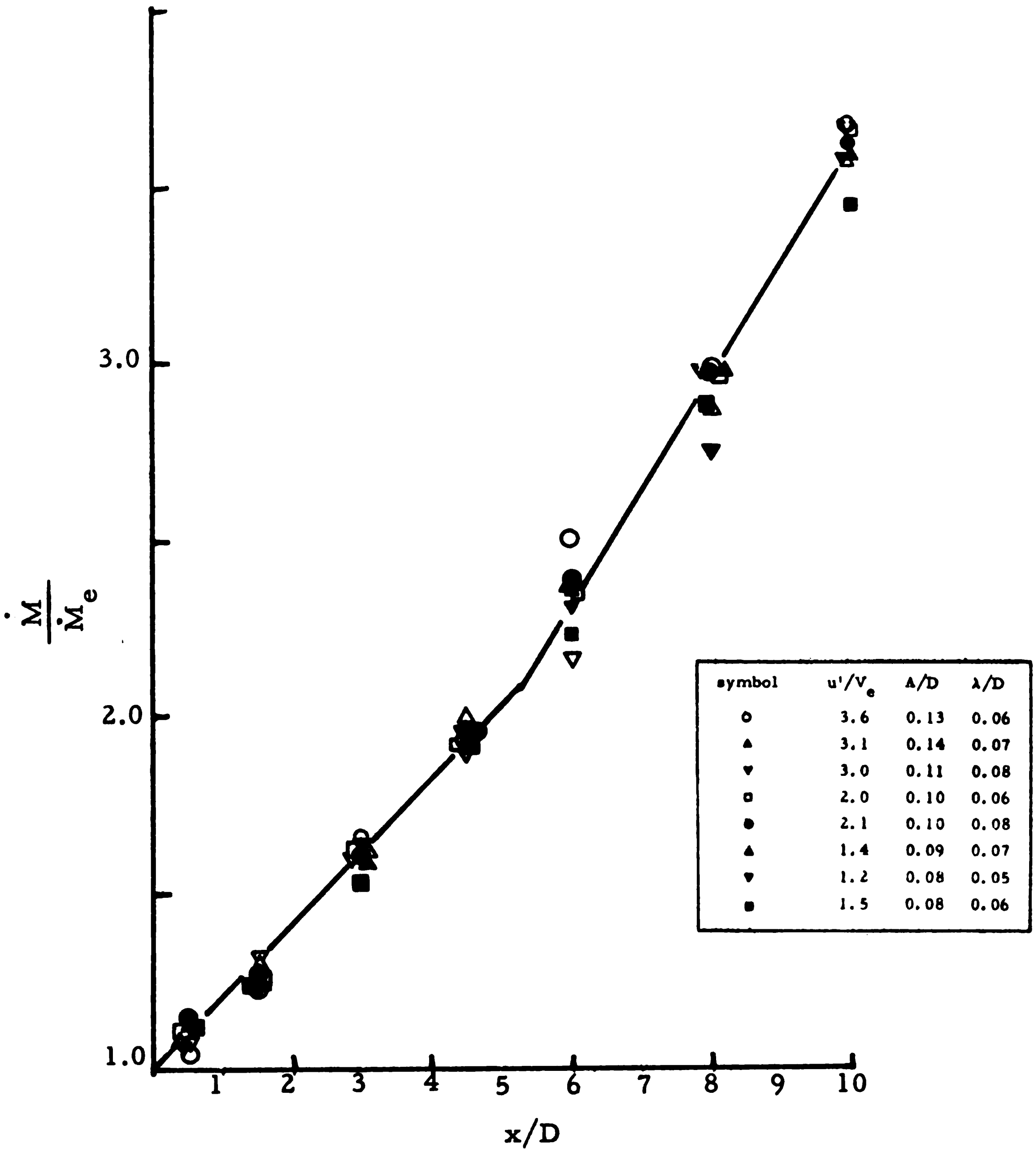


Figure 8. Normalized Mass Flux

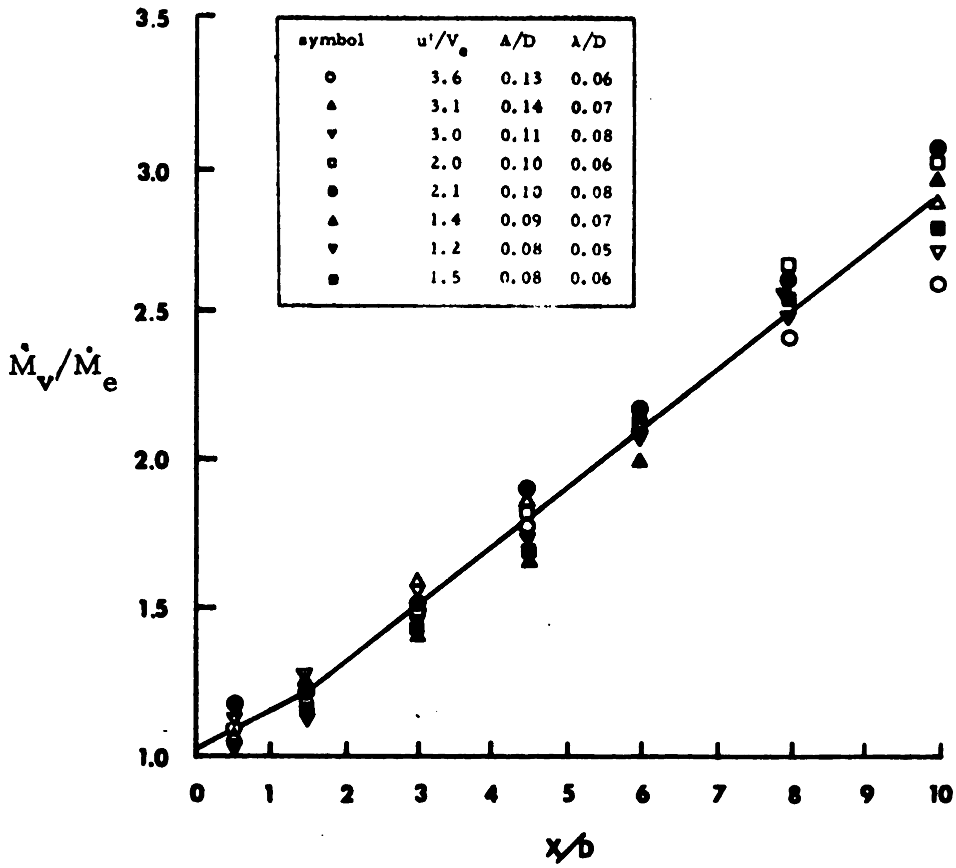


Figure 9. Normalized Mass Flux Ratio for the Vortical Fluid

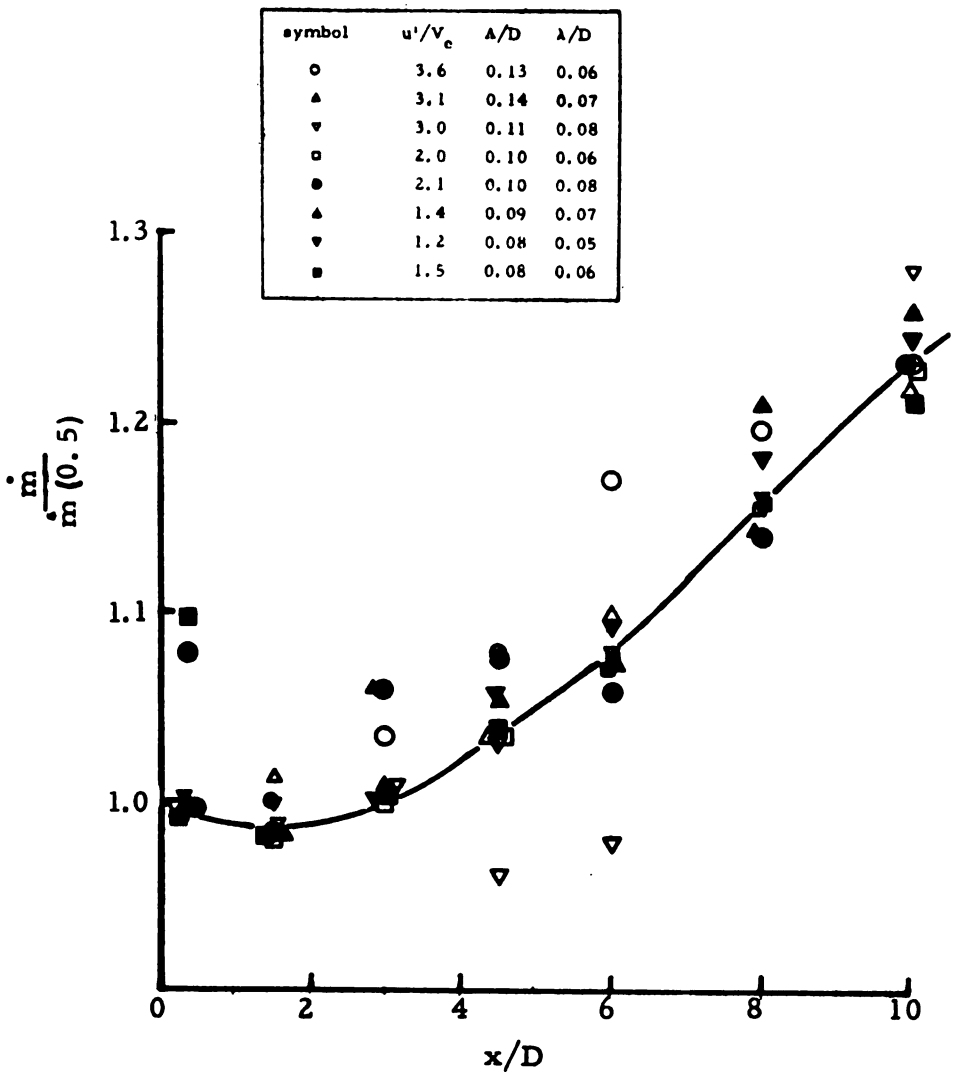


Figure 10. Normalized Momentum Flux

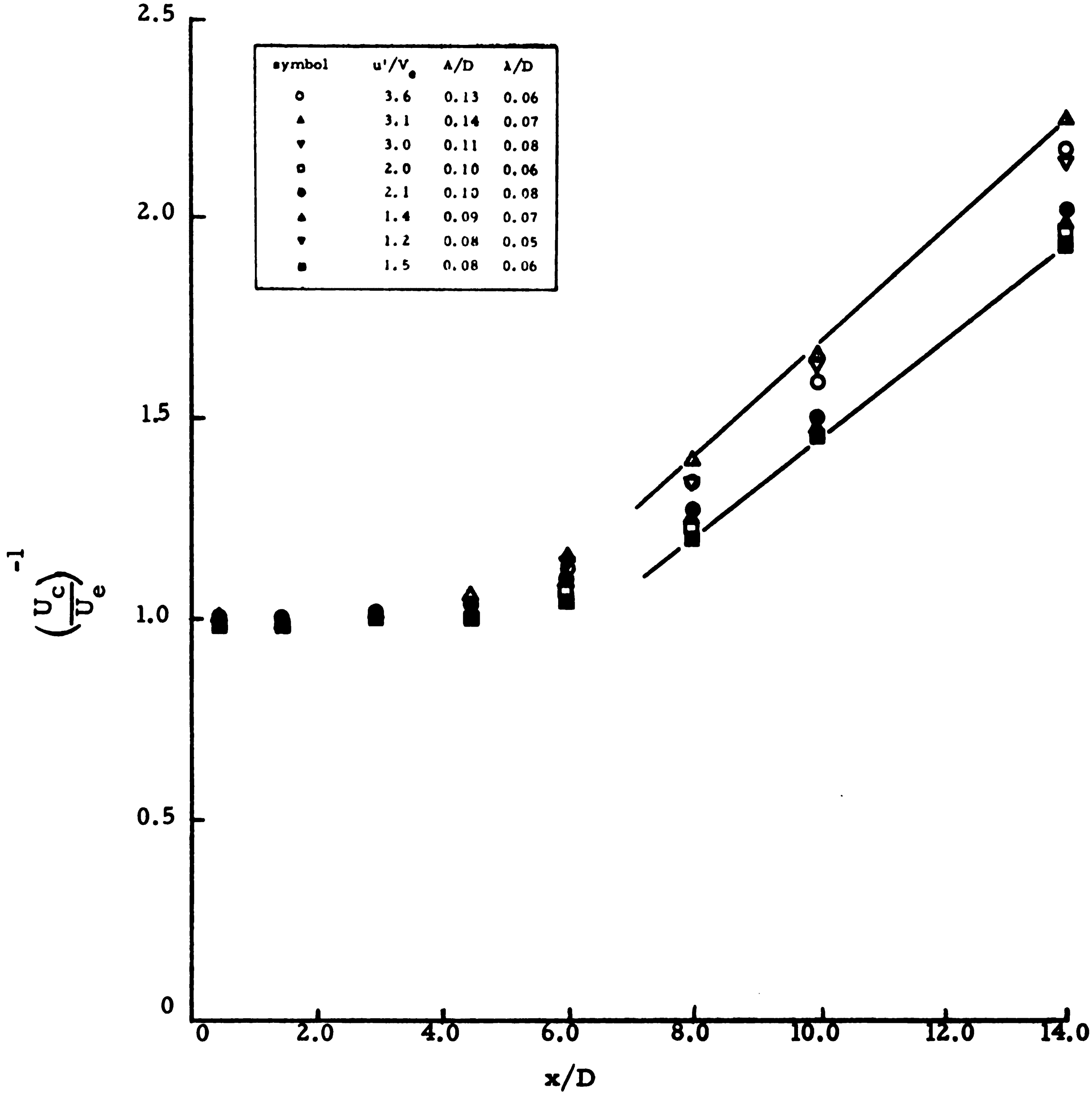


Figure 11. Centerline Mean Velocity Distribution

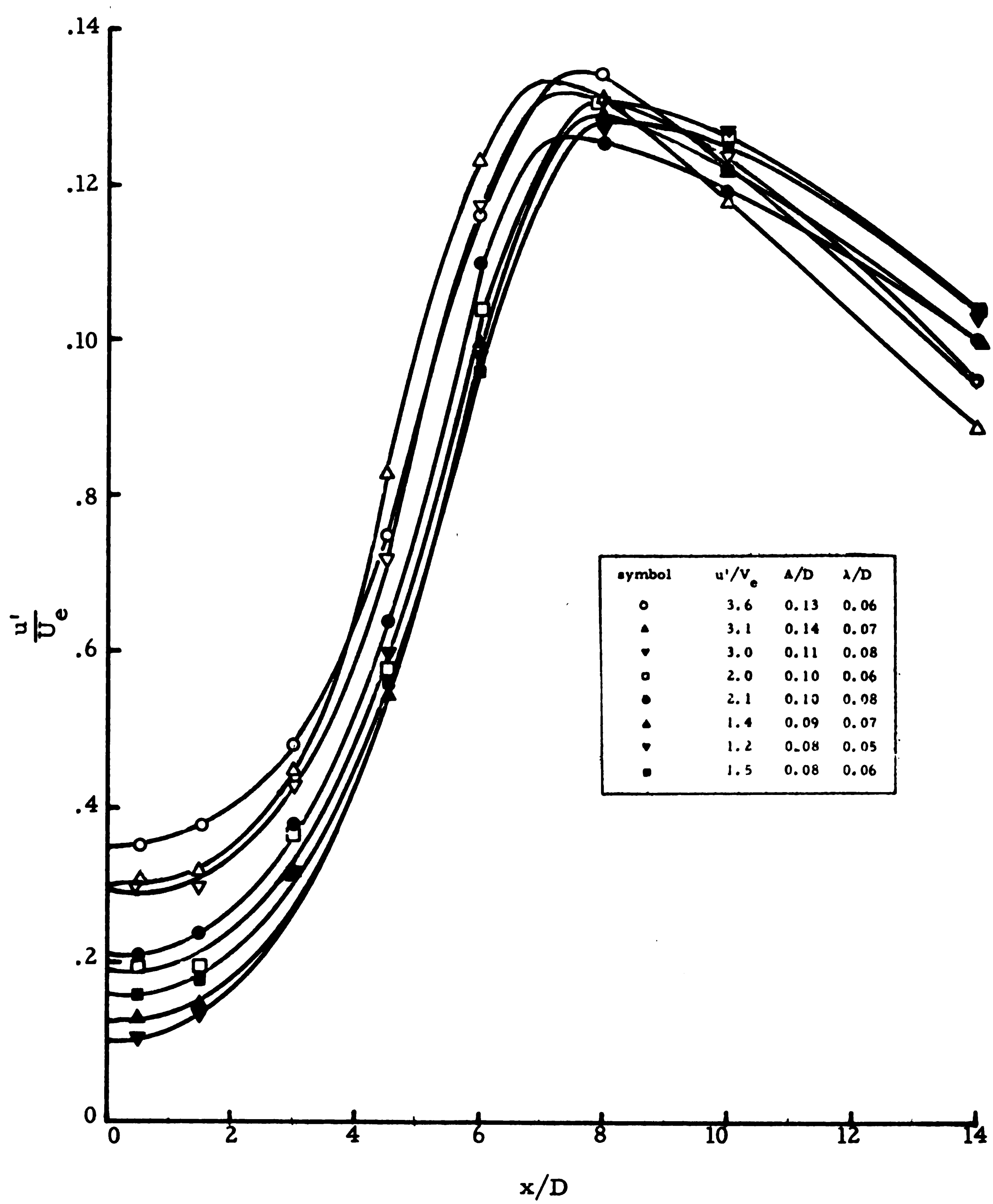


Figure 12. Centerline RMS Velocity Distribution

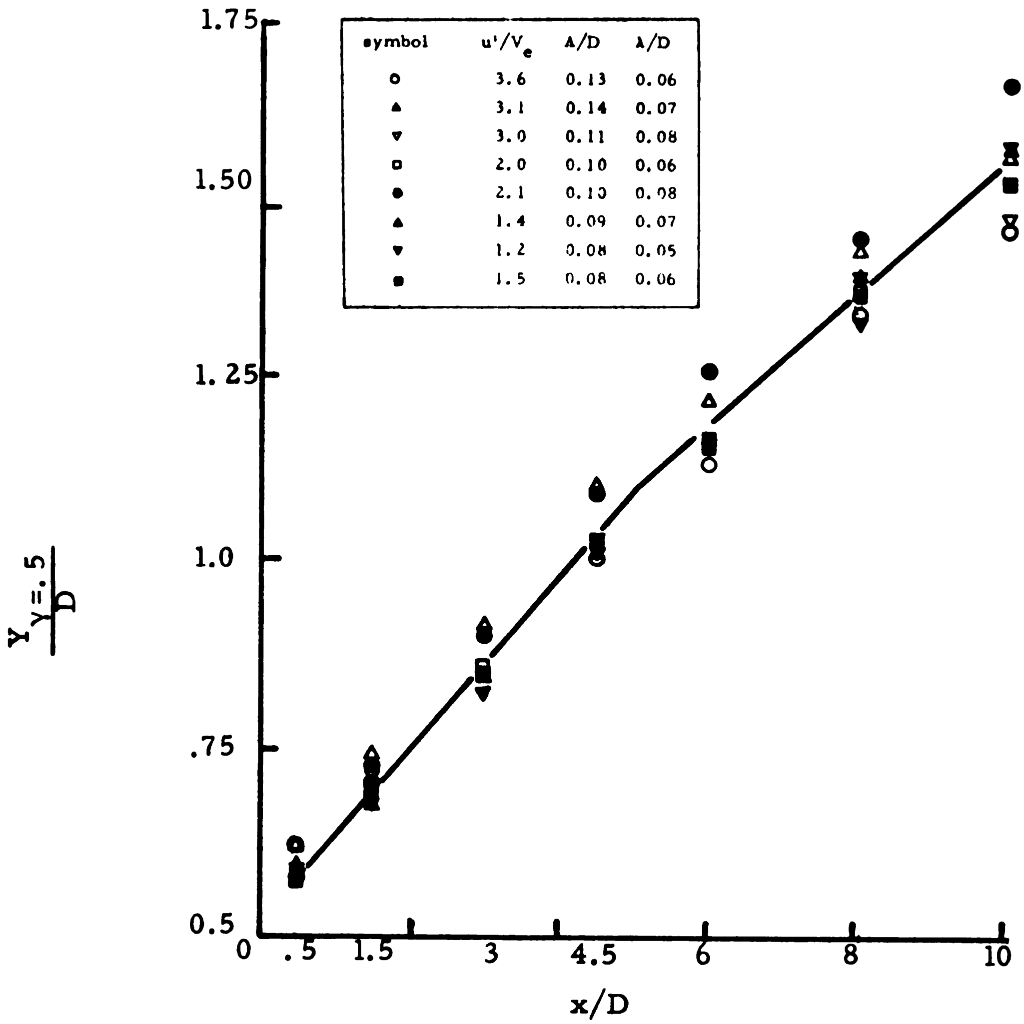


Figure 13. Mean Position of the Viscous Superlayer

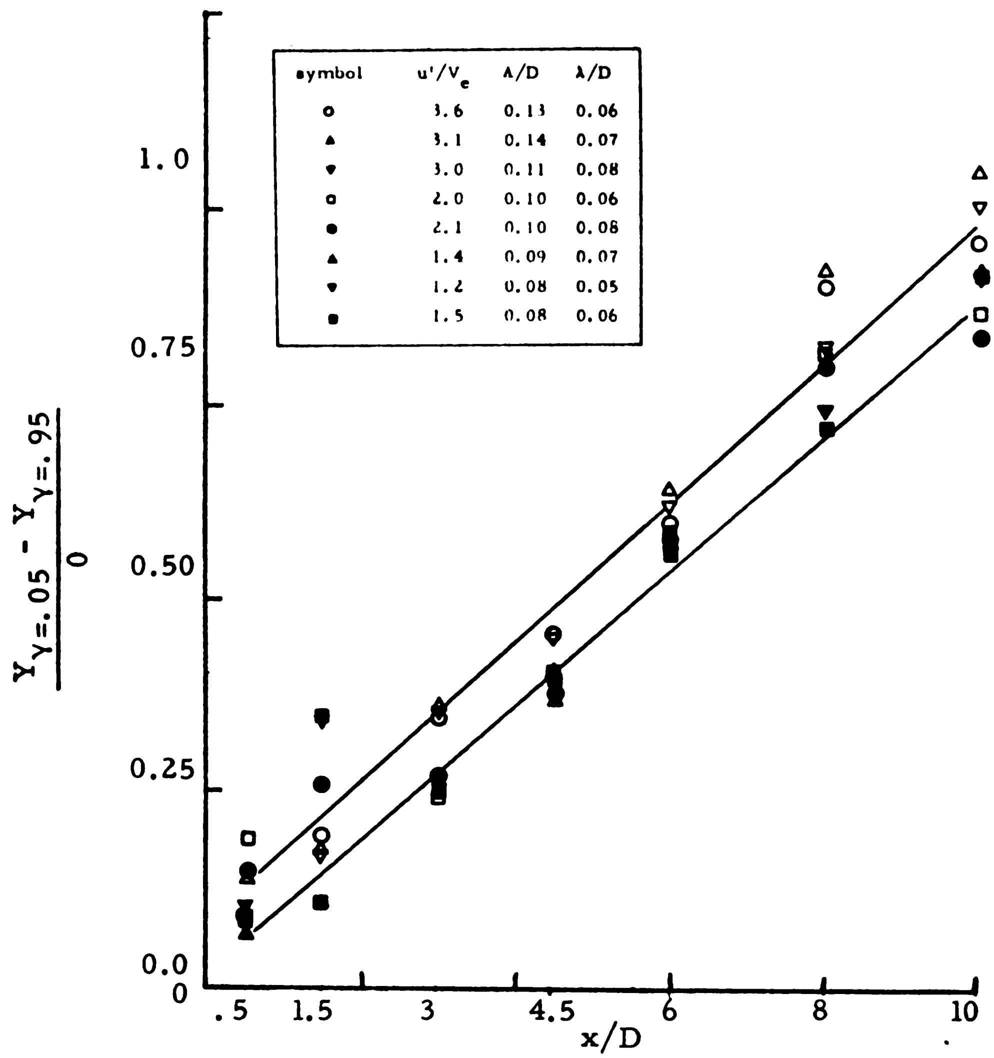


Figure 14. Excursion of the Viscous Superlayer

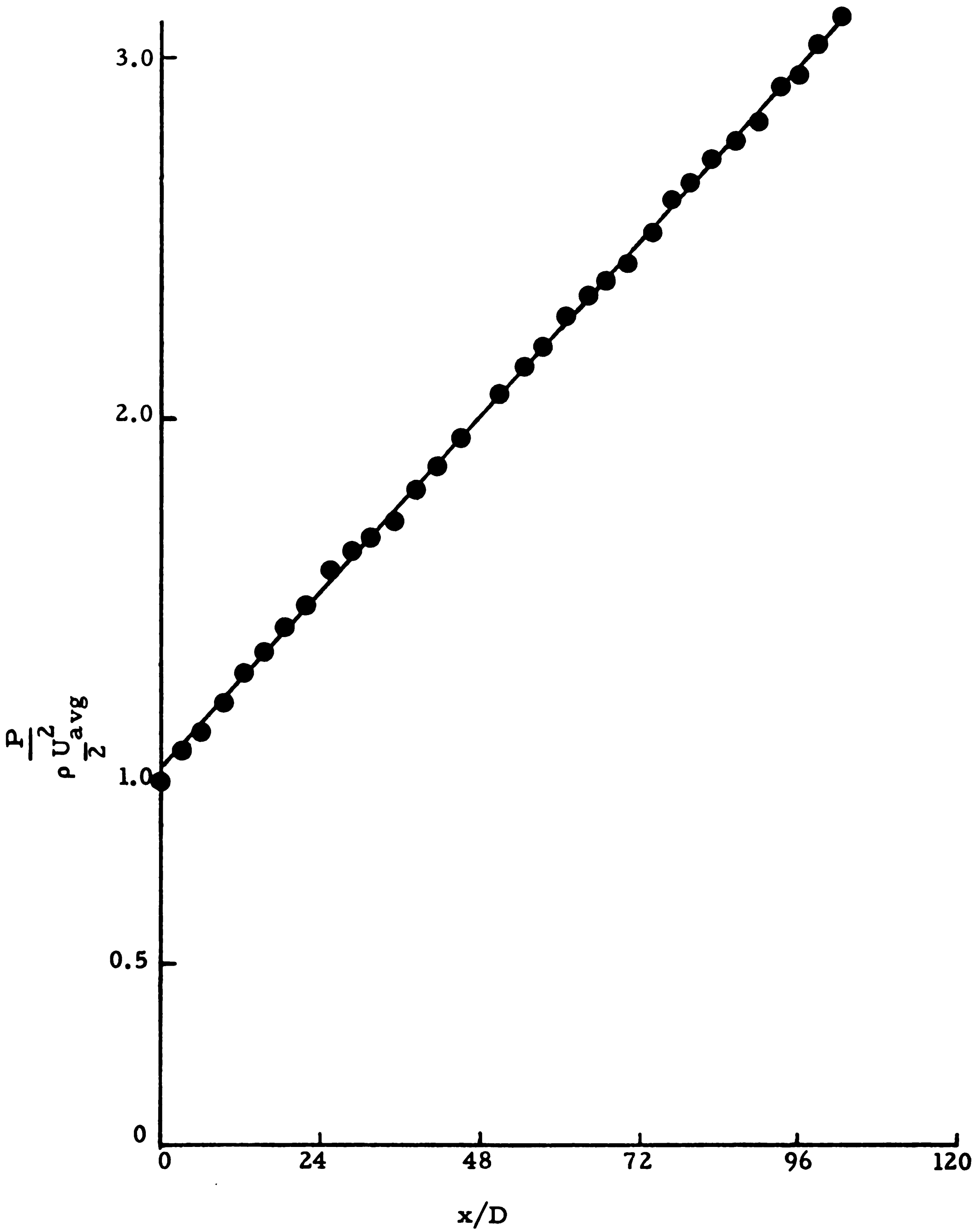


Figure 15. **Pressure distribution in the fully developed pipe flow for the thermal anemometer system evaluation**

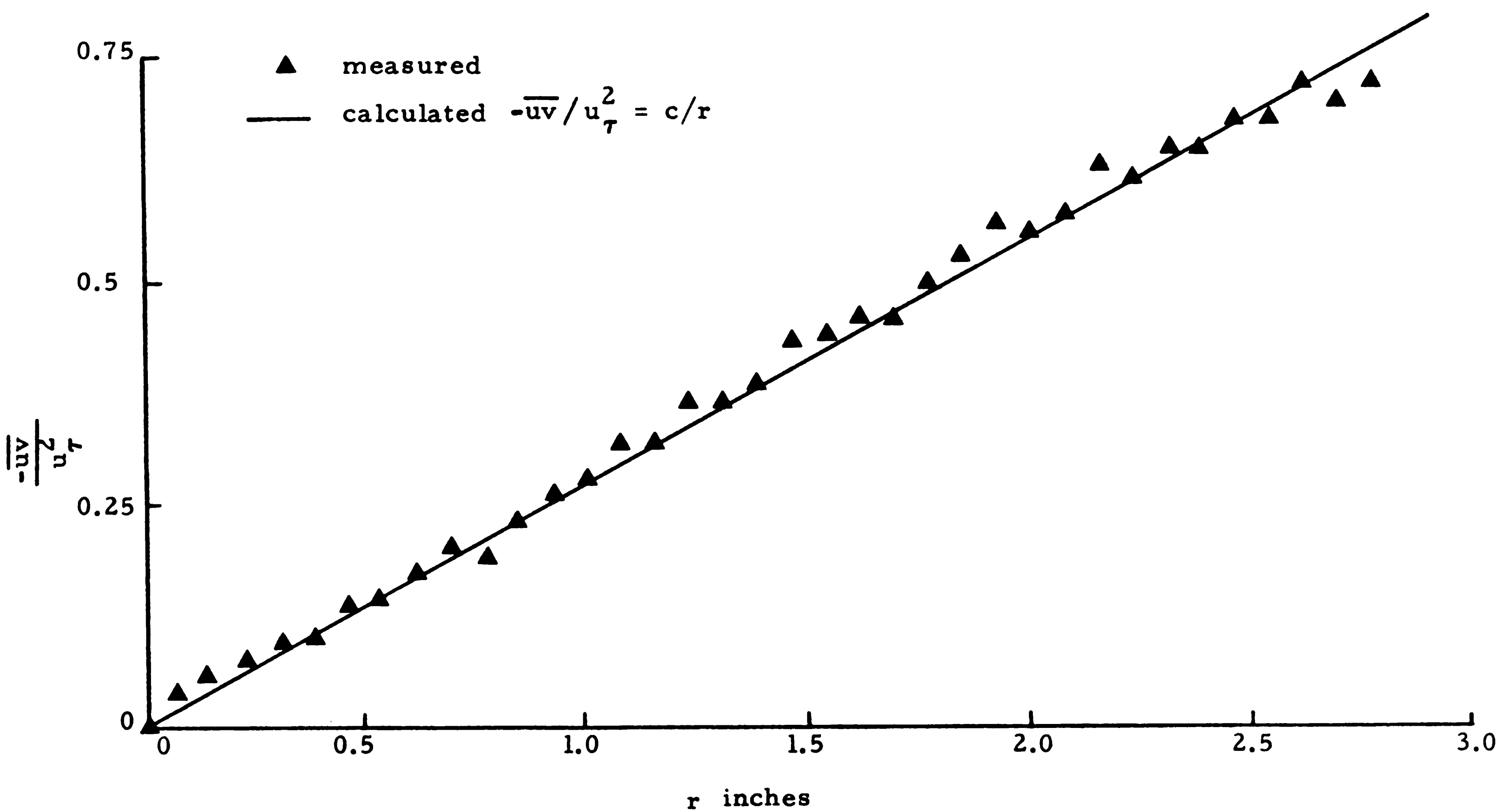


Figure 16. Reynolds stress distribution in a fully developed turbulent flow to demonstrate measuring accuracy

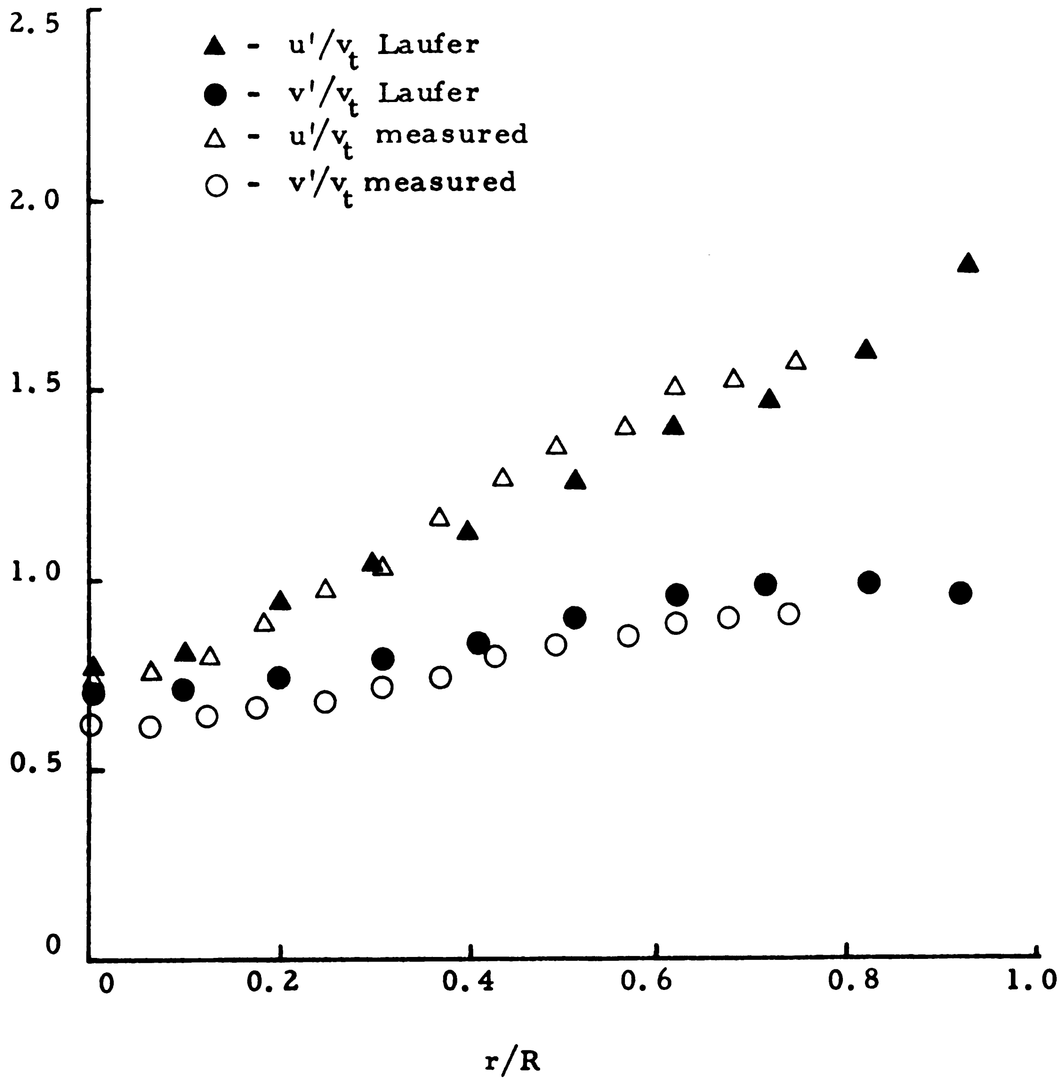


Figure 17. Comparison of u' and v' distributions with the published results of Laufer (1954)

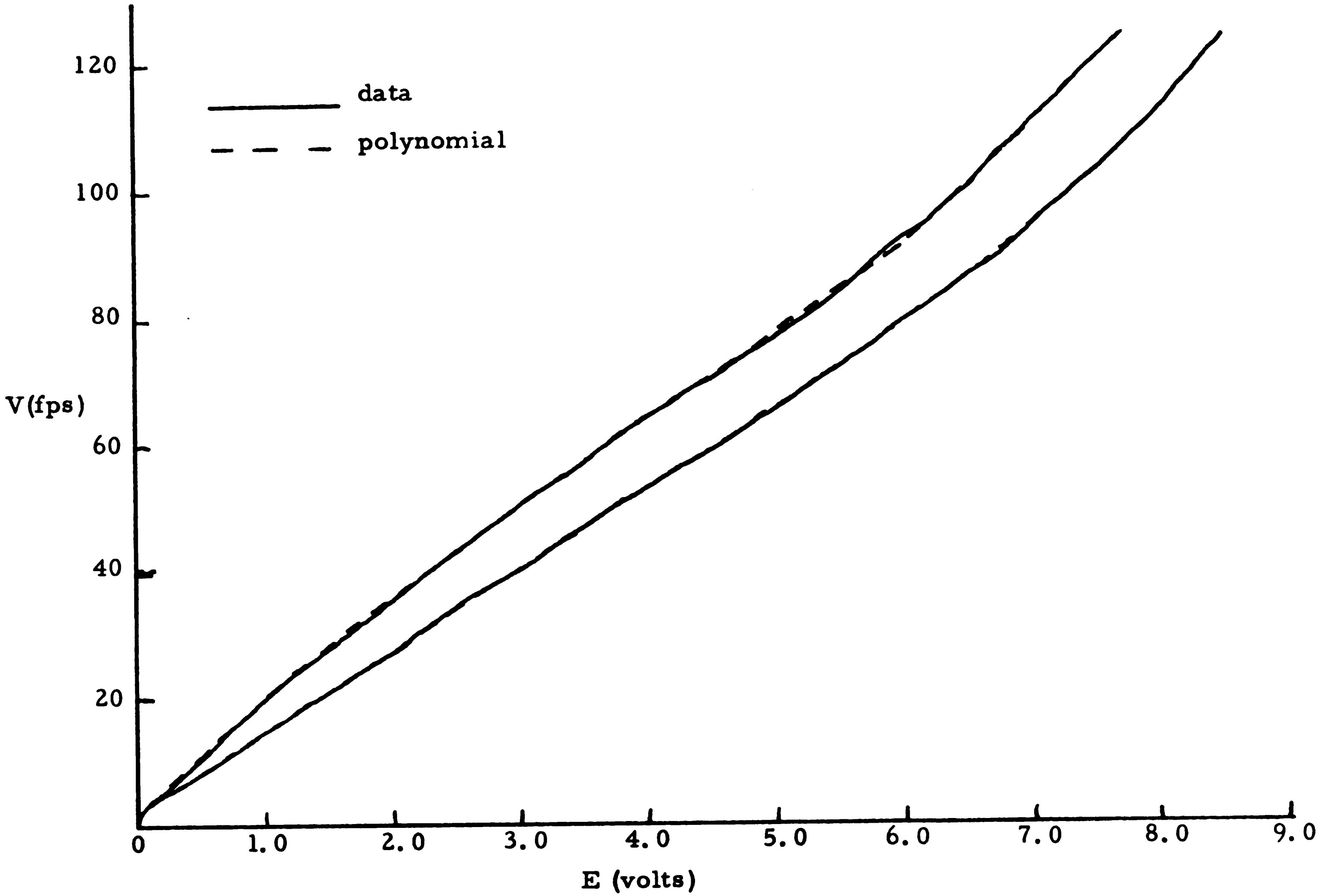
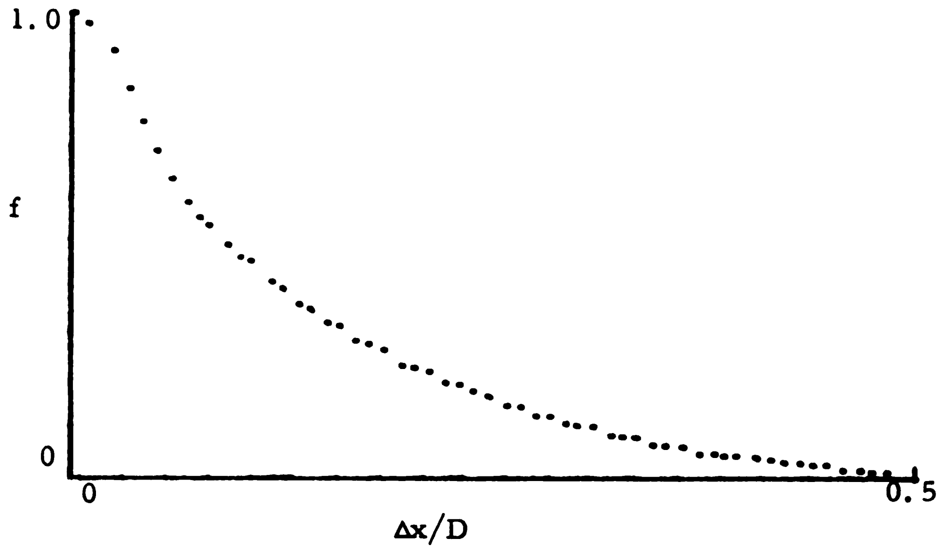


Figure 18. Thermal Anemometer Calibration



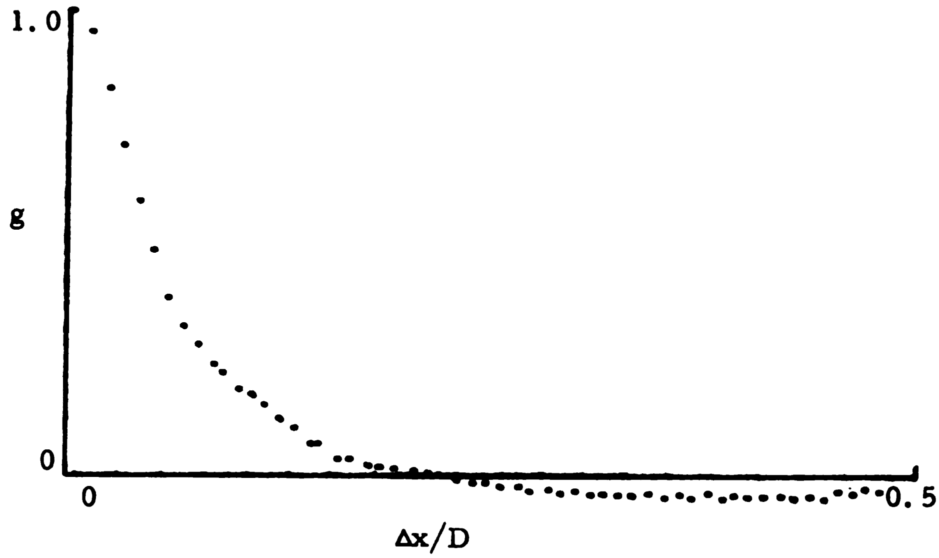


Figure 19. Exit correlations $\Lambda_x/D = .13$, $\Lambda_y/D = .052$ $\lambda_x/D = .058$, $\lambda_y/D \cong .058$

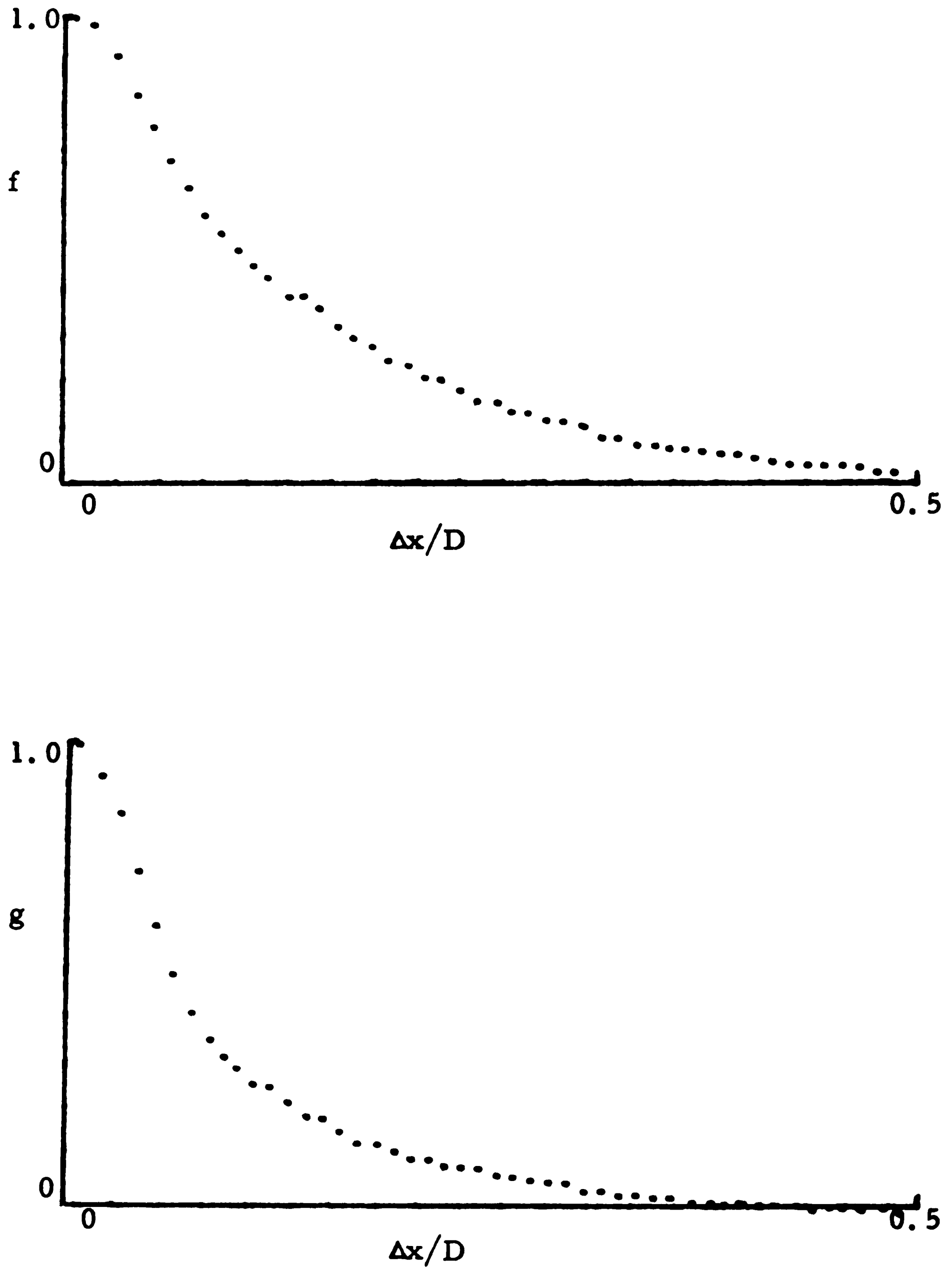


Figure 20. Exit correlations $\Lambda_x/D = .14$, $\Lambda_y/D = .093$
$\lambda_x/D = .085$, $\lambda_y/D = .065$

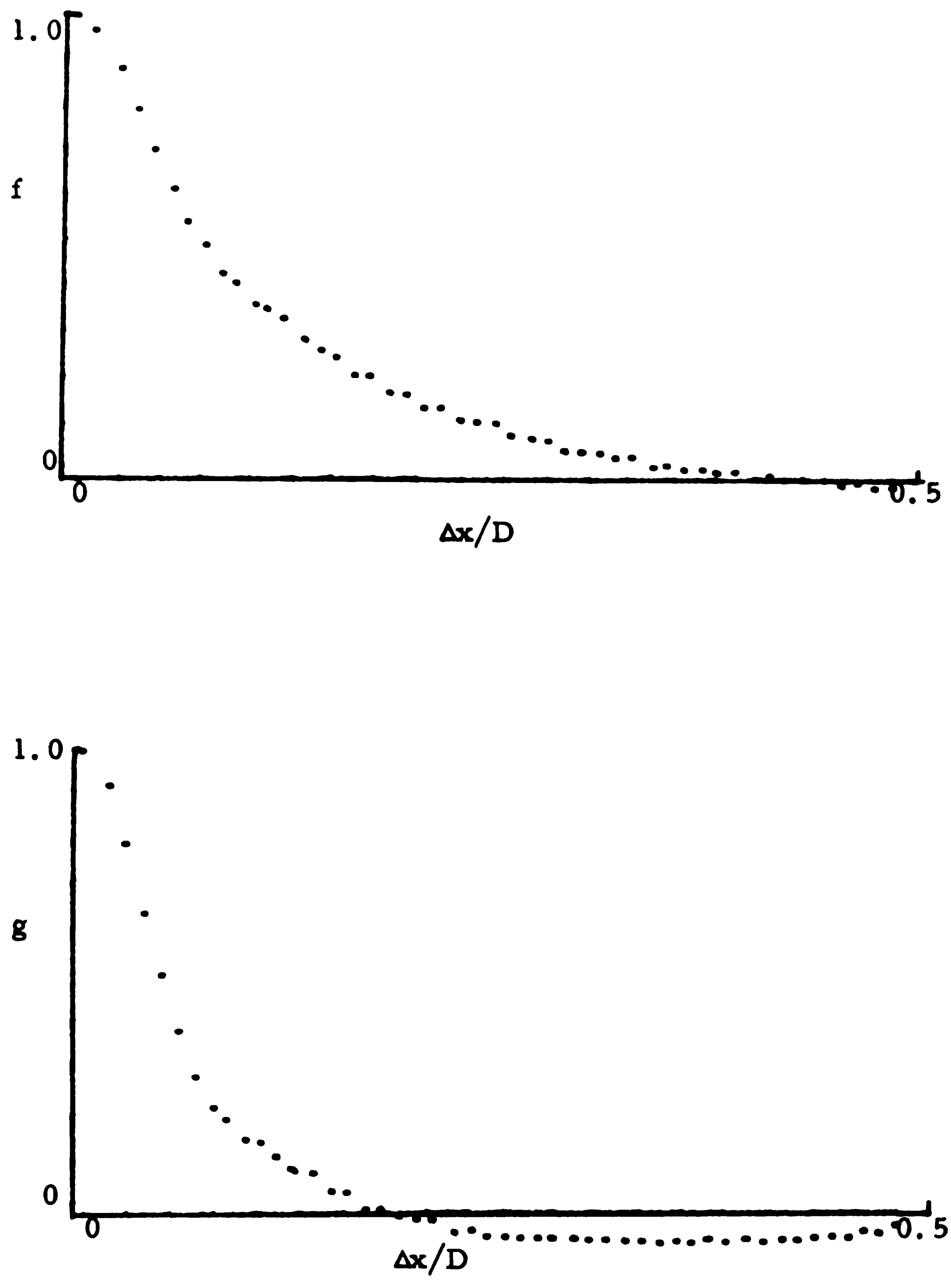


Figure 21. Exit correlations $\Lambda_x/D = .11$, $\Lambda_y/D = .046$
$\lambda_x = .086$, $\lambda_y = .071$

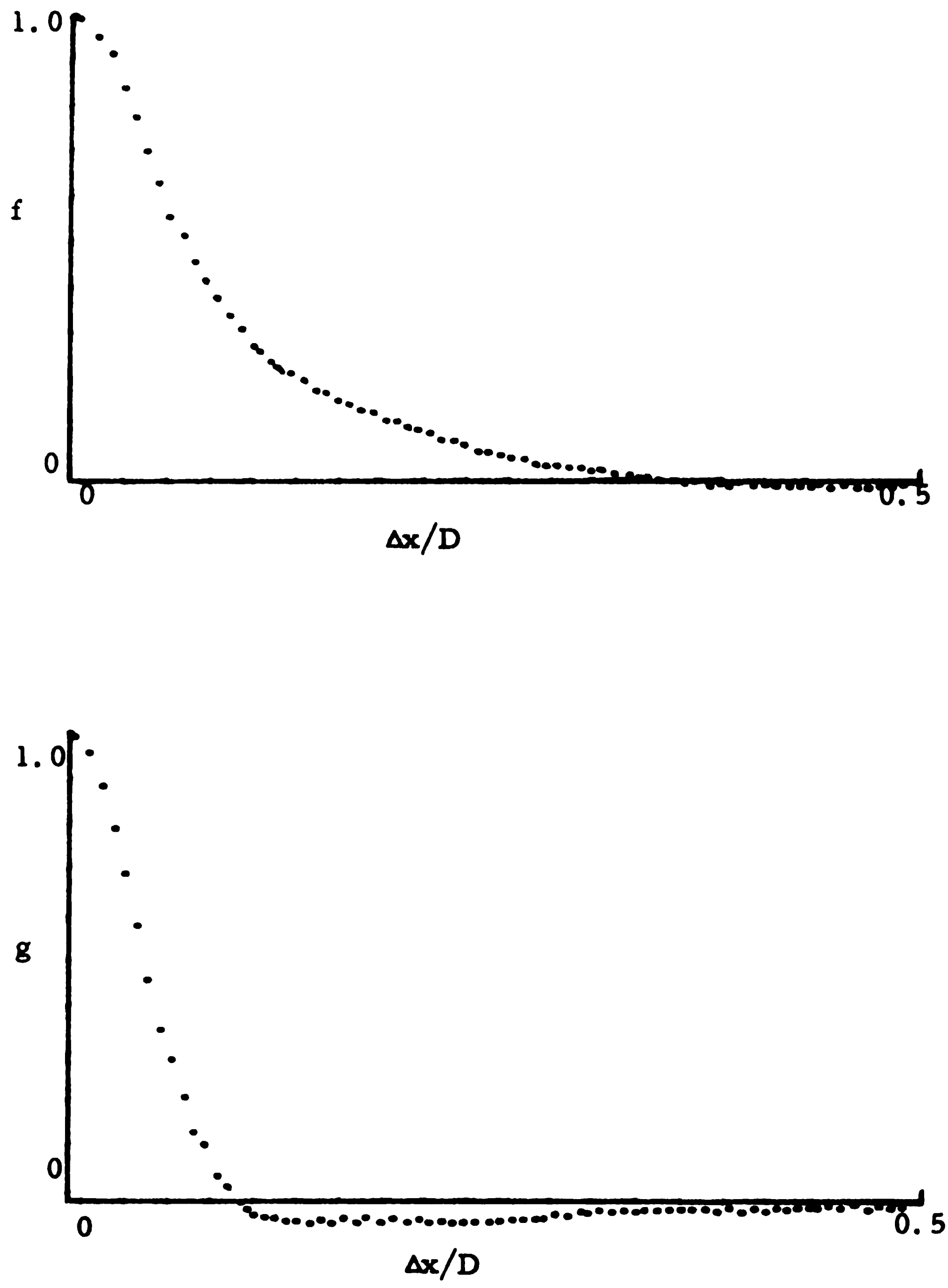
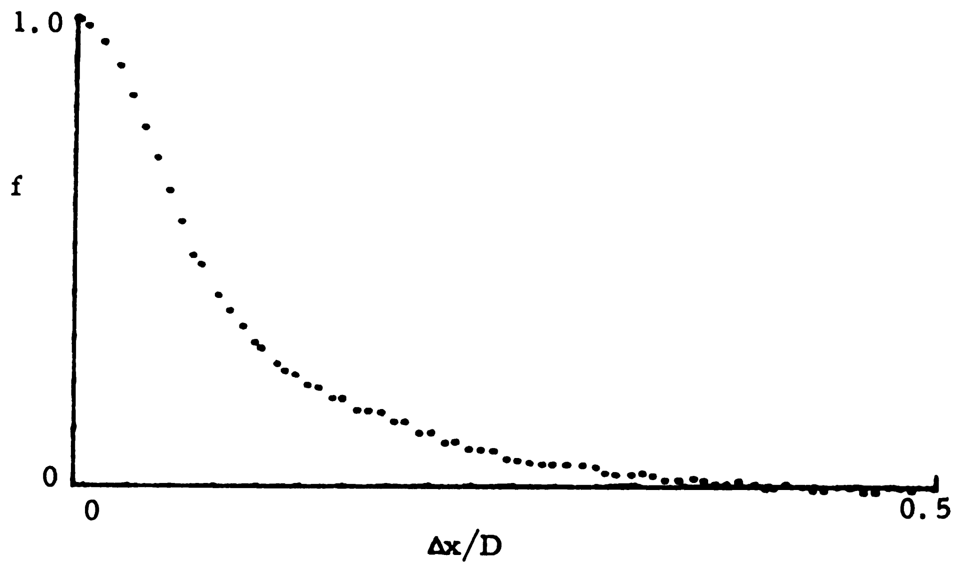


Figure 22. Exit correlations $\Lambda_x/D = .10$, $\Lambda_y/D = .052$
$\lambda_x/D = .058$, $\lambda_y/D = .05$



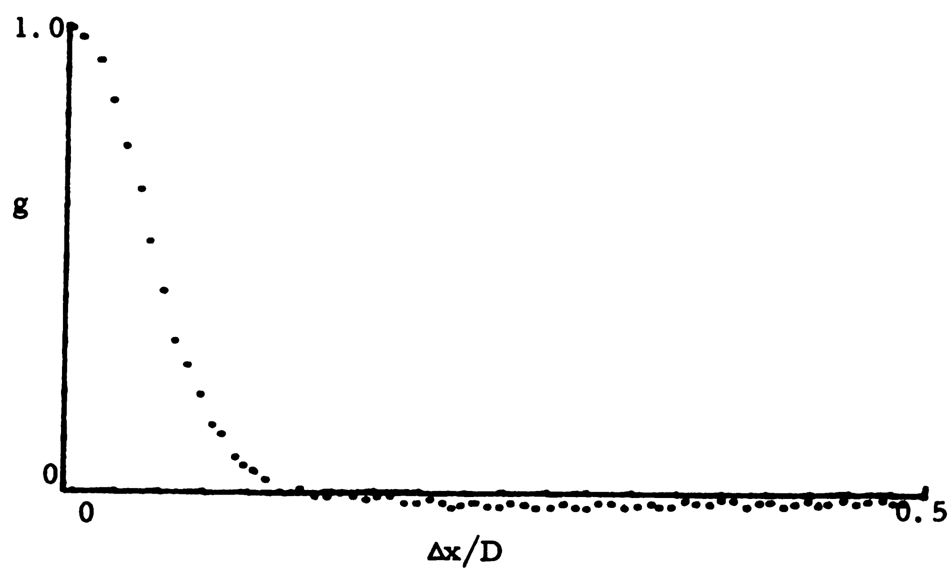
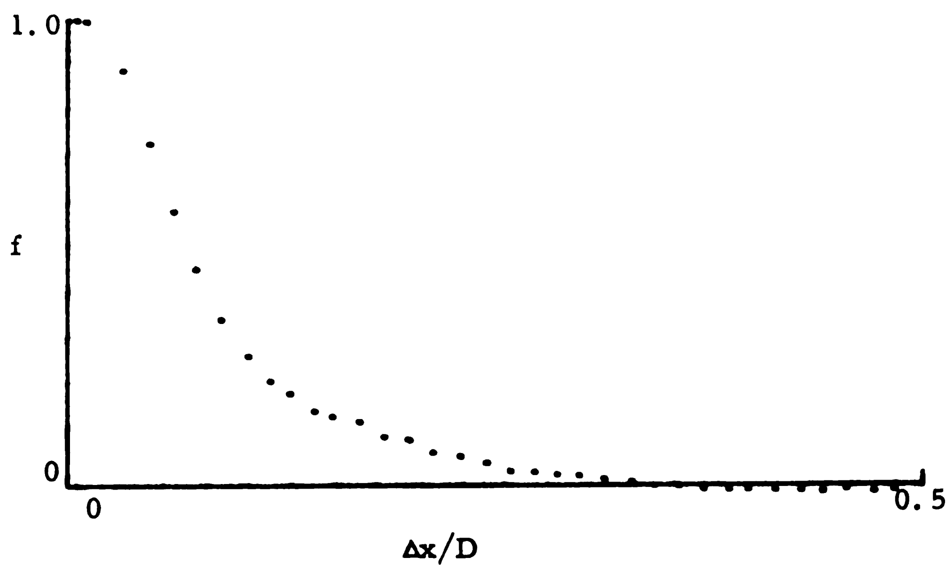


Figure 23. Exit correlations $\Lambda_x/D = .097$, $\Lambda_y/D = .052$
$\lambda_x/D = .083$, $\lambda_y/D = .07$



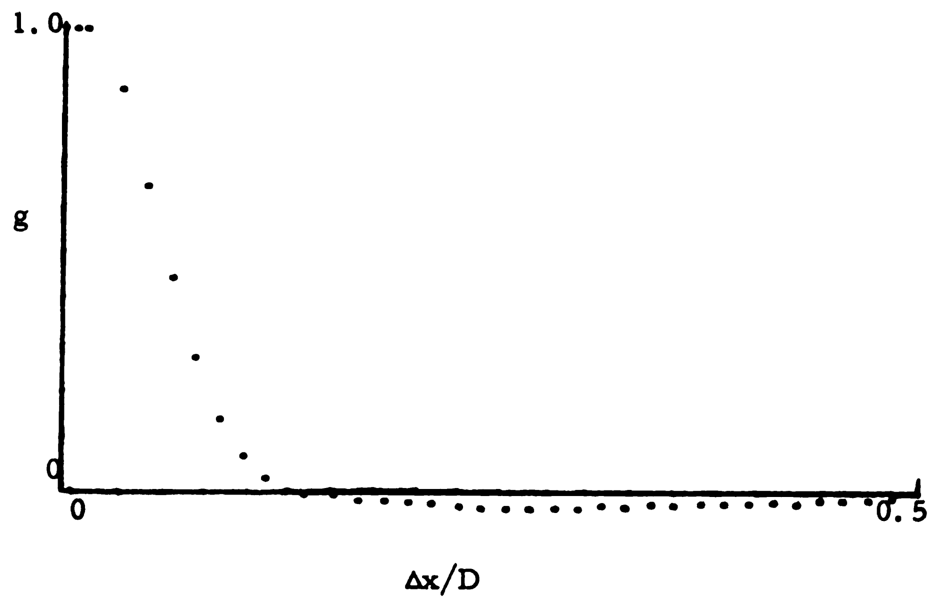


Figure 24. Exit correlations $\Lambda_x/D = .089$, $\Lambda_y/D = .053$ $\lambda_x/D = .075$, $\lambda_y/D = .071$

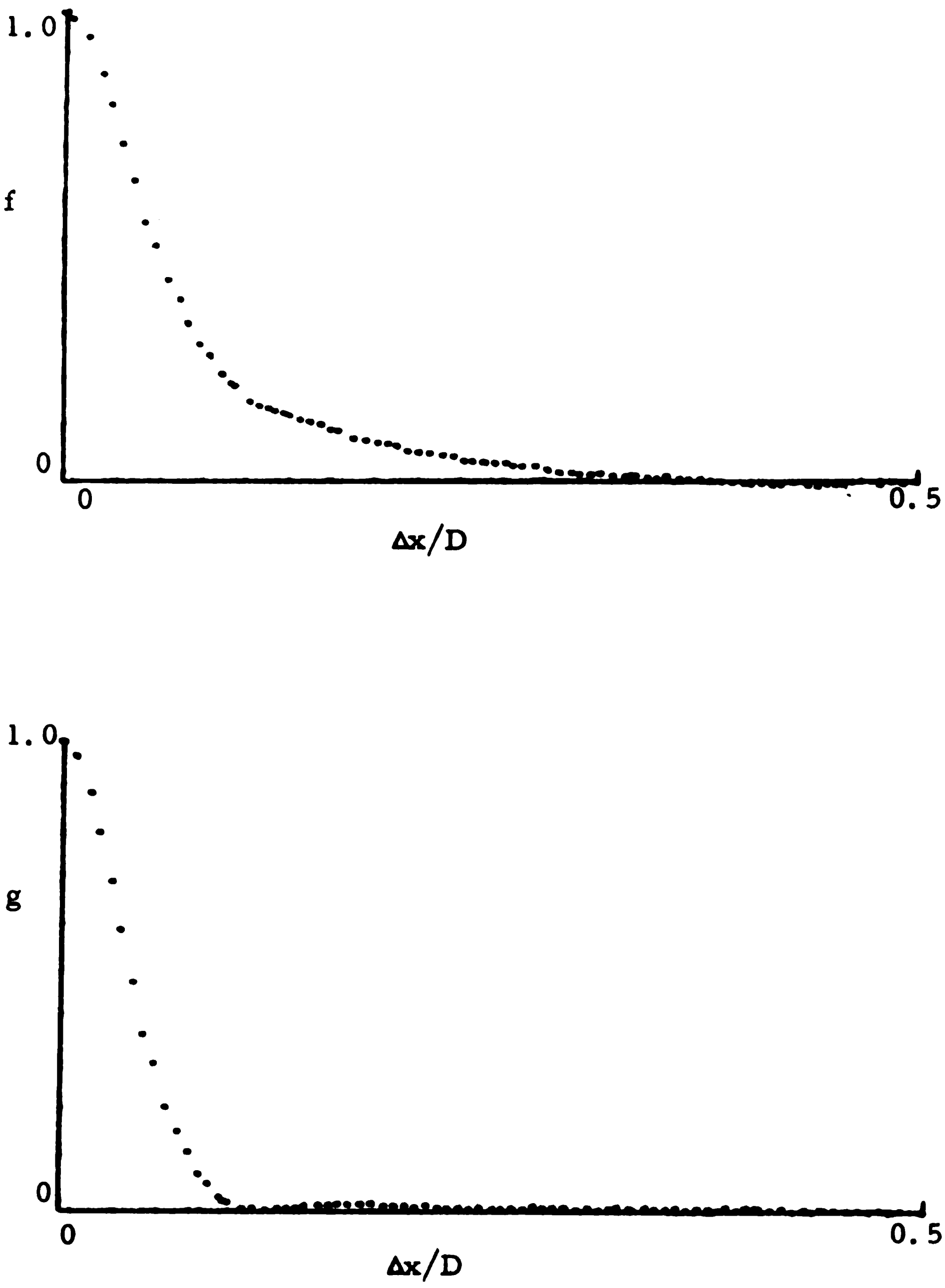


Figure 25. Exit correlations $\Lambda_x/D = .074$, $\Lambda_y/D = .049$
$\lambda_x/D = .052$, $\lambda_y/D = .046$

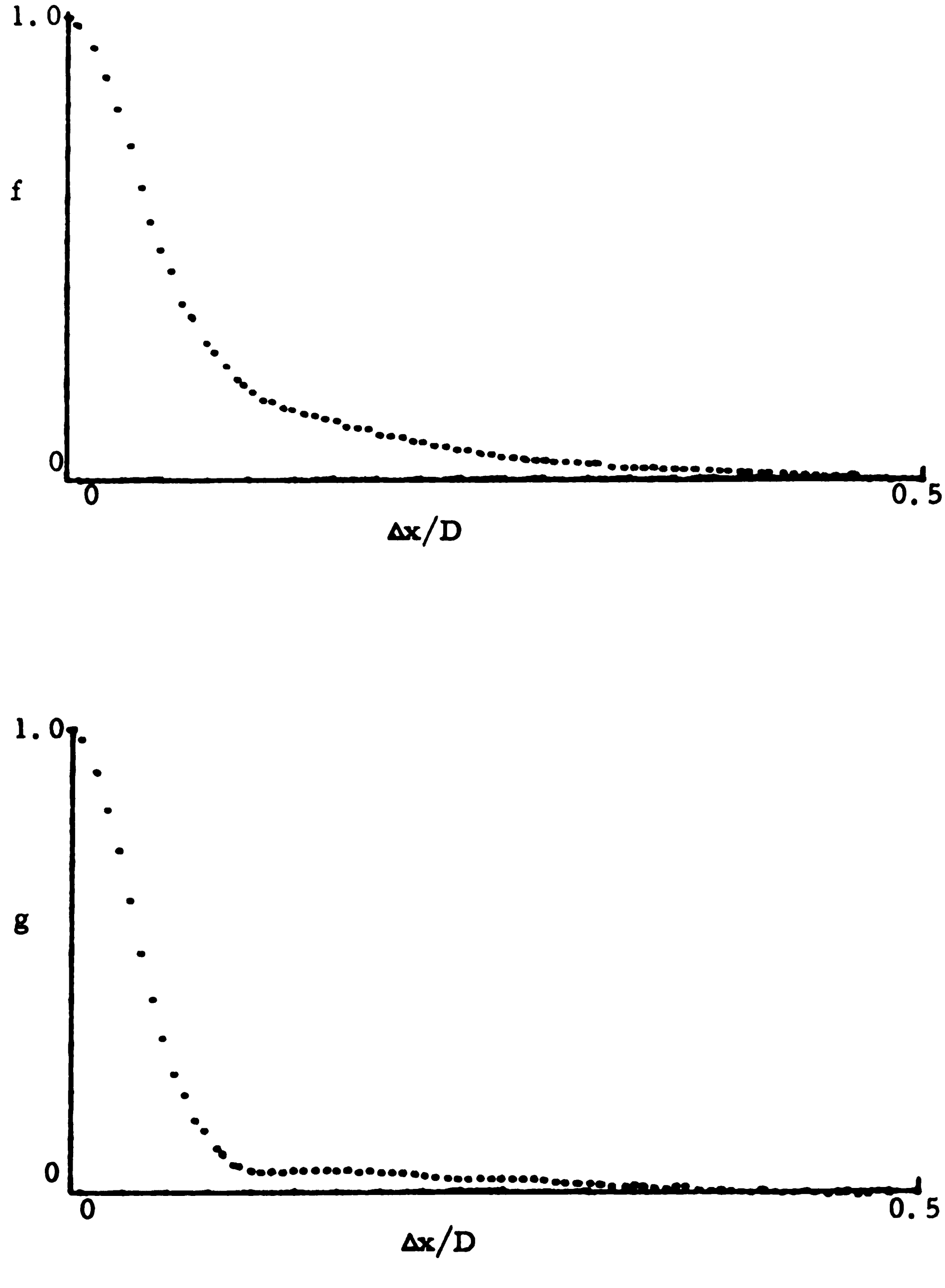


Figure 26. Exit correlations $\Lambda_x/D = .083$, $\Lambda_y/D = .057$
$\lambda_x/D = .062$, $\lambda_y/D = .056$

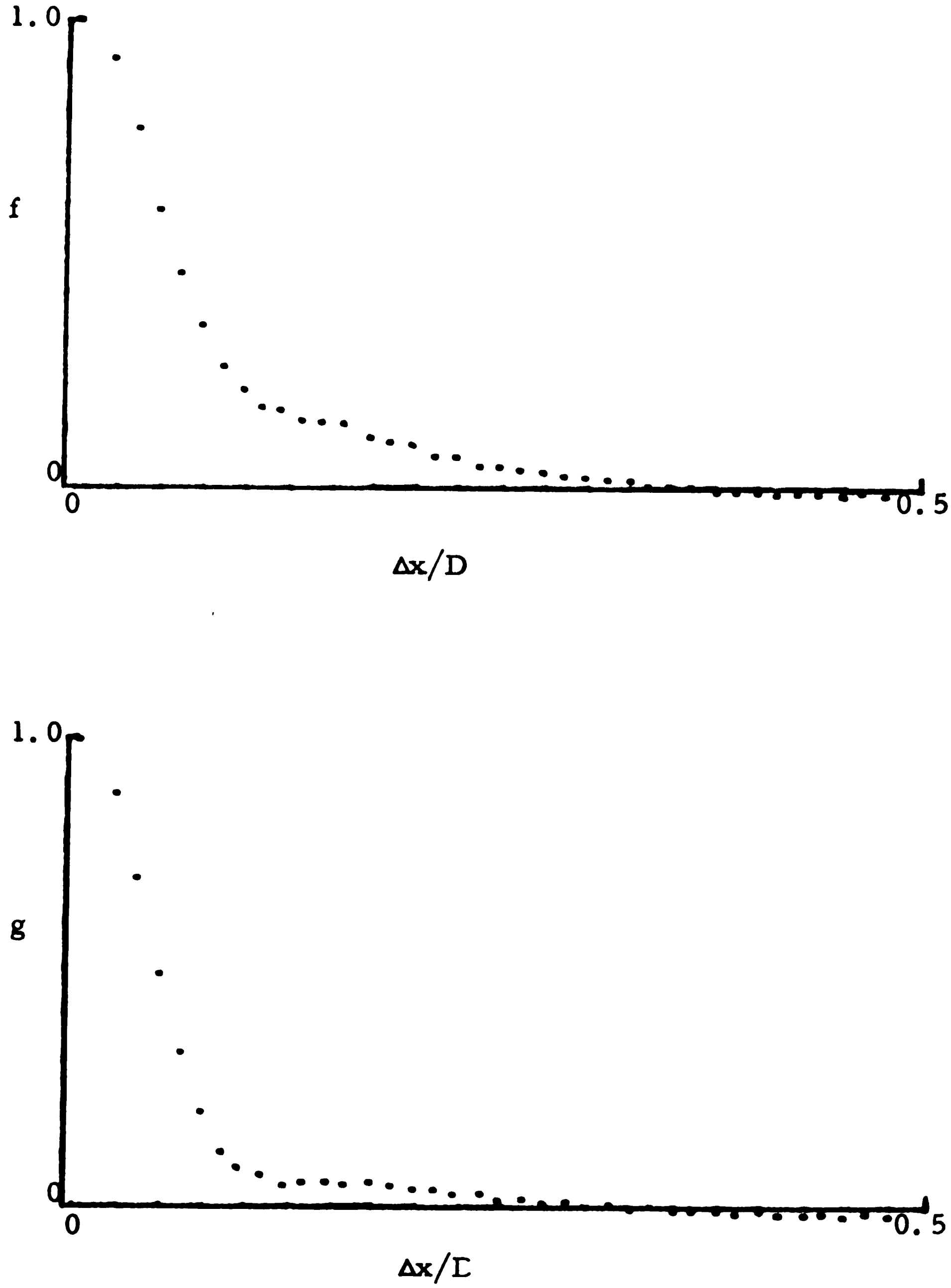


Figure 27. Exit correlations $\Lambda_x/D = .08$, $\Lambda_y/D = .059$, $\lambda_x/D = .062$, $\lambda_y/D = .056$