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SATURN 5 RESPONSE TO PRE-LAUNCH WIND LOADS
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COMPUTER SIMULATION OF SATURN V RESPONSE
TO
PRE-LAUNCH WIND LOADS

by
T. Coffin
UNIDEV, INC.
Huntsville, Alabama

November 1970

Contract No. NAS8-21418

UNIDEV Report UR-00012

Prepared for

National Aeronautics and Space Administration
George C. Marshall Space Flight Center
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FOREWORD

This report was prepared by UNIDEV, INC. for the George C. Marshall Space Flight Center, National Aeronautics and Space Administration, under Contract NAS8-21418 entitled "Wind Induced Oscillation of the Saturn V Vehicle Caused by Realistic Ground Winds." The work was conducted under the technical direction of the Aero-Astrodynamic Laboratory, with Mr. G. A. Wilhold acting as technical monitor.

The study was executed by the Solid and Fluid Mechanics Department, directed by Dr. L. L. Fontenot. Mr. T. Coffin served as Principal Investigator. Computer Program development was performed by Mr. T. S. Chandler.

This document deals with the computational aspects of the "Ground Winds" problem. Theoretical considerations are presented in reference /1/.

ABSTRACT

This document describes a Digital Computer Program developed to estimate Saturn V response to pre-launch wind conditions at Cape Kennedy. The program computes displacement and bending moment statistics as a function of parameters defining the atmospheric environment. A sample problem is provided to illustrate utilization of the program.

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INTRODUCTION

An analysis of space vehicle response to pre-launch winds at Cape Kennedy is presented in /1/. The vehicle is assumed to be axisymmetric and supported symmetrically. The equations of motion are derived based on simple "strip theory." The aerodynamic forcing function is assumed representative of a non-homogeneous, stationary normal process. Generalized harmonic analysis is applied to obtain response statistics. Lift and drag response are computed separately. Joint statistics are then computed to obtain an estimate of the probability density and cumulative distribution of resultant (i.e., vector sum) displacement and bending moment.

This document describes utilization of the computer program resulting from the analysis. A sample problem is included to illustrate application of the program.

SECTION 1

SUMMARY OF SIMULATED EQUATIONS

An analysis of Saturn V response to pre-launch wind conditions is documented in reference /1/. The equations programmed for computer simulation are summarized in this section.

1.1 NOTATION

x	Coordinate indicating position along vehicle length (identical with station no.).
y	Displacement coordinate in the drag direction (parallel to mean wind vector).
g	Displacement coordinate in the lift direction.
ψ_n	Displacement mode vector.
μ_n	Bending moment mode vector.
M_n	Generalized mass.
β_n	Generalized structural damping ratio, assuming viscous modal damping.
ν_n	Undamped natural frequency.
D	Mean diameter of discretized vehicle model.
ρ	Density of atmosphere.
C_d	Drag coefficient.
R	Reynolds no., based on local mean wind speed and vehicle diameter.
\bar{V}	Mean wind speed.
Λ^*	Peak reference wind speed at the 18.3 meter level from grade.
k	Empirical statistic defining the wind speed profile at Cape Kennedy.

ν	Frequency.
ϕ_{yy}, ϕ_{zz}	Cross spectral density of wind turbulence in drag and lift directions, respectively.
\bar{D}_y, \bar{M}_y	Mean drag displacement and bending moment, respectively.
ϕ_{yy}, ϕ_{ym}	Mean-square density spectrum of drag displacement and bending moment, respectively.
$\sigma_y^2, \sigma_{ym}^2$	Variance of drag displacement and bending moment, respectively.
$\sigma_z^2, \sigma_{zm}^2$	Variance of lift displacement and bending moment, respectively.
$ D , M $	Maximum absolute displacement and bending moment, respectively, associated with joint occurrence of 3σ response.
r	Absolute (resultant) displacement or bending moment, as indicated.
$f(r)$	Probability density of absolute displacement or bending moment, as indicated.
$F(r)$	Cumulative distribution of absolute displacement or bending moment, as indicated.

A number of the above quantities are not specified, but implied, since highly redundant equations for displacement and bending moment statistics are not repeated. Coding terminology for required input is defined in the section on computer program utilization.

1.2 DRAG RESPONSE

Mean drag displacement is computed by

$$\bar{D}_y(x) = \sum_n \frac{\rho \psi_n(x)}{8\pi^2 v_n^2 M_n} \int_l C_d(x) D(x) \bar{V}^2(x) \psi_n(x) dx \quad (1)$$

where

$$\bar{V}(x) = 39.37\Lambda_* \left(\frac{0.025x + 28.96}{18.3} \right)^k \left\{ 1 + \frac{\left(\frac{18.3}{0.025x + 28.96} \right) (0.283 - 0.435 e^{-0.2\Lambda_*})}{1.98 - 1.887 e^{-0.2\Lambda_*}} \right\}^{-1} \quad (1-A)$$

and

$$C_d(x) = \begin{cases} 1.0 & , R(x) < 2.8 \times 10^5 \\ 3.155(5.7624 - \log_{10} R(x)), & 2.8 \times 10^5 < R(x) < 5 \times 10^5 \\ 0.514(\log_{10} R(x) - 5.3099), & 5 \times 10^5 < R(x) < 3 \times 10^6 \\ 0.6 & , R(x) > 3 \times 10^6 \end{cases} \quad (1-B)$$

Mean drag bending moment is defined by a similar expression:

$$\bar{M}_y(x) = \sum_n \frac{\rho u_n(x)}{8\pi^2 v_n^2 M_n} \int_{\ell} C_d(x) D(x) \bar{V}^2(x) \psi_n(x) dx \quad (2)$$

The variance of drag displacement is estimated by

$$\sigma_y^2(x) = \int_0^{\infty} \phi_{yy}(x; v) dv \quad (3)$$

where

$$\phi_{yy}(x_i; v) = \sum_n \rho^2 \psi_n^2(x_i) \left\{ \left[4\pi^2 v_n^2 \left(M_n + \frac{\pi\rho}{4} \int_{\ell} D^2(x) \psi_n^2(x) dx \right) \right]^2 \right. \\ \left. \left[\left(1 - \left(\frac{v}{v_n} \right)^2 \right)^2 + \left(\frac{M_n}{M_n + \frac{\pi\rho}{4} \int_{\ell} D^2(x) \psi_n^2(x) dx} \right) \left(\beta_n + \right. \right. \right.$$

$$\begin{aligned}
& + \frac{\rho}{\pi v_n M_n} \int_{\ell} C_d(x) D(x) \bar{V}(x) \psi_n^2(x) dx \left. \right\}^{-1} \\
& \times \iint_L \left\{ C_d(x_1) C_d(x_2) D(x_1) D(x_2) \bar{V}(x_1) \bar{V}(x_2) \right. \\
& \left. + \left(\frac{v\pi}{4} D(x_1) D(x_2) \right)^2 \right\} \\
& \left. \phi_{yy}(x_1, x_2; v) \psi_n(x_1) \psi_n(x_2) dx_1 dx_2 \right\} \quad (3-A)
\end{aligned}$$

The cross spectral density of wind turbulence is defined in references /2,3/. In the notation of these references:

$$\phi_{yy}(x_1, x_2; v) = 1.55 \times 10^3 S(h_1, h_2; v)$$

with

$$h_i = 0.025x_i + 28.96 \quad (3-B)$$

Now the (real part of) cross spectral density is:

$$\begin{aligned}
S(h_1, h_2; v) = \sqrt{S(h_1; v) S(h_2; v)} e^{-0.3465 \frac{\Delta f}{\Delta f_{0.5}}} \cos(2\pi \gamma \Delta f) \quad (3-C)
\end{aligned}$$

with

$$\Delta f = \left| \frac{vh_2}{\bar{W}(h_2)} - \frac{vh_1}{\bar{W}(h_1)} \right|$$

$$\Delta f_{0.5} = 0.036$$

$$\gamma = \begin{cases} 0.7, & \frac{h_1+h_2}{2} \leq 100 \\ 0.3, & \frac{h_1+h_2}{2} > 100 \end{cases}$$

and

$$\bar{W}(h) = \Lambda_* \left(\frac{h}{18.3}\right)^k \left\{ 1 + \frac{\left(\frac{18.3}{h}\right)^{(0.283 - 0.435 e^{-0.2\Lambda_*})}}{1.98 - 1.887 e^{-0.2\Lambda_*}} \right\}^{-1} \quad (3-D)$$

The local spectral density function required is represented by

$$S(h;v) = \frac{\beta_* u_*^2 C_1 f/f_m}{v(1 + 1.5C_2 (f/f_m)^{C_2})^{5/3} C_2} \quad (3-E)$$

where

$$f = \frac{vh}{\bar{W}(h)}$$

$$f_m = C_3 \left(\frac{h}{18.3}\right)^{C_4}$$

$$\beta_* = \left(\frac{h}{18.3}\right)^{C_5}$$

$$u_* = C_6 \bar{W}(18.3)$$

$$C_1 = 6.198$$

$$C_2 = 0.845$$

$$C_3 = 0.03$$

$$C_4 = 1.00$$

$$C_5 = -0.63$$

$$C_6 = .0886$$

The variance of drag bending moment is similarly computed:

$$\sigma_{ym}^2 = \int_0^{\infty} \phi_{ym}(v) dv \quad (4)$$

Computation of ϕ_{ym} is identified to that for ϕ_y , with $\psi_n^2(x_i)$ outside the brackets in (3-A) replaced by $\mu_n^2(x_i)$.

1.3 LIFT RESPONSE

The variance of lift displacement is calculated in the same manner as (3) with

$$\begin{aligned} \phi_{zz}(x_i; v) = \sum_n \rho^2 \psi_n^2(x_i) & \left\{ \left[4\pi^2 v_n^2 (M_n + \frac{\pi\rho}{4} \int_{\ell} D^2(x) \psi_n^2(x) dx) \right]^2 \right. \\ & \left[(1 - (\frac{v}{v_n})^2)^2 + \left(\frac{M_n}{M_n + \frac{\pi\rho}{4} \int_{\ell} D^2(x) \psi_n^2(x) dx} \right) (\beta_n + \right. \\ & \left. \left. + \frac{\rho}{4\pi v_n M_n} \int_{\ell} C_d(x) D(x) \bar{V}(x) \psi_n^2(x) dx)^2 \left(\frac{v}{v_n} \right)^2 \right] \right\}^{-1} \\ & \times \frac{1}{4} \iint_L \left\{ C_d(x_1) C_d(x_2) D(x_1) D(x_2) \bar{V}(x_1) \bar{V}(x_2) + \frac{1}{4} (v \pi D(x_1) D(x_2))^2 \right\} \\ & \left. \phi_{zz}(x_1, x_2; v) \psi_n(x_1) \psi_n(x_2) dx_1 dx_2 \right\} , \quad (5) \end{aligned}$$

and the following constants defining the cross spectral density of turbulence in the lift direction:

$$\Delta f_{0.5} = 0.045$$

$$\gamma = \begin{cases} 1.4, & \frac{h_1+h_2}{2} \leq 100 \\ 0.5, & \frac{h_1+h_2}{2} > 100 \end{cases}$$

$$C_1 = 3.954$$

$$C_2 = 0.512$$

$$C_3 = 0.1$$

$$C_4 = 0.58$$

$$C_5 = 0.35$$

$$C_6 = 0.0886$$

The variance of lift bending moment is computed similar to displacement, with $\mu_n^2(x_i)$ inserted in (5) in place of $\psi_n^2(x_i)$, outside the brackets only.

1.4 RESULTANT RESPONSE

Maximum absolute displacement associated with concurrent 3σ lift and drag response at a given location is computed by

$$||D|| = \begin{cases} \sigma_z \left[9 + \frac{\bar{D}_y^2}{\sigma_z^2 - \sigma_y^2} \right]^{1/2}, & \frac{|\bar{D}_y| \sigma_y}{3(\sigma_z^2 - \sigma_y^2)} < 1, \text{ and } \sigma_z > \sigma_y \\ (|\bar{D}_y| + 3\sigma_y), & \text{otherwise} \end{cases} \quad (6)$$

Maximum absolute bending moment associated with concurrent 3σ lift and drag response at a given location is obtained by (6) with the substitution

$$\begin{aligned} \bar{D}_y &\rightarrow \bar{M}_y \\ \sigma_y &\rightarrow \sigma_{ym} \\ \sigma_z &\rightarrow \sigma_{zm} \end{aligned}$$

The probability density of absolute (resultant) displacement at a given vehicle location is defined by

$$f(r) = \frac{r}{2\pi\sigma_y\sigma_z} \int_0^{2\pi} e^{-Q} d\theta \quad , \quad r > 0$$

$$= 0 \quad , \quad r \leq 0$$
(7)

where

$$Q = \frac{1}{2} \left[\left(\frac{r \cos \theta - \bar{D}}{\sigma_y} \right)^2 + \left(\frac{r \sin \theta}{\sigma_z} \right)^2 \right]$$

Integration of (7) yields the cumulative distribution of absolute displacement:

$$F(r) = \int_0^r f(r') dr' \quad (8)$$

Equations (7) and (8) are used to define the same statistics associated with absolute bending moment with the substitution

$$\bar{D}_y \rightarrow \bar{M}_y$$

$$\sigma_y \rightarrow \sigma_{ym}$$

$$\sigma_z \rightarrow \sigma_{zm}$$

It should be noted that (7) and (8) represent conditional density and distribution functions, respectively, based on the assumed values taken on by meteorological constants.

In the following sections, organization and implementation of the computer program developed to solve the above equations are described.

SECTION 2

PROGRAM DESCRIPTION

Derivation of the equations leading to the computer program described herein is documented in reference /1/. The wind turbulence experienced by the vehicle is assumed representative of an inhomogeneous, stationary normal process. In the computation of joint response statistics, lift and drag components are assumed independent.

The numerical integrations are carried out by application of Simpson's method and in some cases by the trapezoidal rule. The program offers the user several options. By setting a flag card, analysis of drag response, lift response, or both, including combined response, may be obtained. Stacking of runs is provided for, permitting a series of analyses to be performed with variation of any combination of input parameters.

Printout includes a definition and listing of input terms and computed results. Results are also written on tape and processed by the SC-4020 plotter. The program was written and checked out on the UNIVAC 1108, Exec. 8 system.

SECTION 3

PROGRAM UTILIZATION

3.1 GENERAL PROGRAM ORGANIZATION

Organization of the computer program, input data and case stacking scheme is illustrated schematically as follows:

```
{ Control Cards  
  
{ Input characters to be used as an identifying  
  title (use columns 7-72)  
  
{ Main Program and Subroutine
```

CASE DATA

Second
Column

```
$NAM1  
IFLAG=3  
(Complete set of input data - first case)  
$  
$NAM1  
(Load only parameters to be changed for second case)  
$  
.  
.  
.  
$NAM1 } Stops Program  
IFLAG=0 }  
$
```

```
{ Control Cards
```

In the above iterative scheme any number of parameters may be varied for each case. As explained in Section 3.2.1 "IFLAG=3" requests an analysis in lift and drag directions

and the computation of resultant (joint) response statistics. A description of the coding format for a sample problem is provided in Section 3.2.4.

3.2 DESCRIPTION OF INPUT

Three sets of input data are required which define general program instructions, meteorological parameters and structural dynamic characteristics. The program is designed to read input in Namelist format. Therefore, the exact allocation of all spaces on a coding form is not required. Definition of constants must be separated by a comma and the elements of arrays must be separated by commas. Data should be entered beginning with column two of each line on the coding form, i.e., column one must be left blank.

3.2.1 General Instructions

The instructions define general requirements of the problem to be solved. All units are in the pound-inch-second system.

IFLAG	}	= 0	Stops program after last case
		= 1	Compute only drag response
		= 2	Compute only lift response
		= 3	Compute drag, lift and resultant response
NIPD		Number of vehicle locations for which resultant displacement statistics are to be computed (zero unless IFLAG=3).	
IPTD		Station number (in hundreds) of locations at which resultant displacement statistics are to be computed (zero unless IFLAG=3).	

NIPM Number of vehicle locations for which resultant moment statistics are to be computed (zero unless IFLAG=3).

IPTM Station number (in hundreds) of locations at which resultant moment statistics are to be computed (zero unless IFLAG=3).

SBARD Mean lift displacement due to vortex shedding from scaled wind tunnel data at points IPTD (zero unless IFLAG=3).

SIGDS Standard deviation of lift displacement due to vortex shedding from scaled wind tunnel data at points IPTD (zero unless IFLAG=3).

SBARM Mean lift moment (lb.in.X10⁻⁶) due to vortex shedding from scaled wind tunnel data at points IPTM (zero unless IFLAG=3).

SIGMS Standard deviation of lift bending moment (lb.in.X10⁻⁶) due to vortex shedding from scaled wind tunnel data at points IPTM (zero unless IFLAG=3).

3.2.2 Definition of Meteorological Conditions

The quasi-static and turbulent wind distribution at Cape Kennedy is characterized by two input constants.

XLAM Peak wind speed at the 18.3 meter level (meters/second).

XK A constant defining the wind speed gradient.

Values of the above statistics for varying levels of risk and exposure time are available from the M.S.F.C. Aerospace Environment Division. See reference /4/.

3.2.3 Structural Dynamic Characteristics

The launch vehicle to be analyzed in a given propellant loading condition is synthesized by the following parameters. All units are in the pound-inch-second system.

N Number of structural modes to be considered.

D Mean diameter of discretized vehicle segments. This array must be entered in the order of increasing vehicle station number.

XNUN Undamped natural frequencies (Hz). These must be entered in the order of increasing mode number.

XMN Generalized masses (lb.sec.²/in.). These must be entered in the order of increasing mode number.

BETAN Generalized structural damping ratios. These must be entered in the order of increasing mode number.

PSI Displacement mode vectors (in./in.), normalized to tip displacement.

XM Bending moment mode vectors ($\frac{\text{lb.in.}}{\text{in.}} \times 10^{-6}$), normalized to tip displacement.

The constants PSI and XM obviously constitute two dimensional arrays. PSI(i,j) represents the displacement of element i in mode j. The same convention applies to XM. For a given mode number the modal values must be entered in the order of increasing segment number (station number).

3.2.4 Input Format

The coding format for a sample problem is illustrated by the following printout. The input represents a series of four analyses with a fixed reference wind speed but varying wind speed gradient. Note that no information is entered in column 1. In repetition, the input data is in Namelist format so the exact allocation of fields for the entry of constants is not necessary. For example, consider the fourth row of input. These four constants may be

entered in any order and in any column other than the first. These same four constants may also be entered in four separate rows (instead of one), yielding a separate data card for each constant. The Namelist data format was selected to provide flexibility to the program user.

```

$NAM1
IFLAG=3
N=3
IPTM=1,IPTD=42,NIPM=1,NIFD=1
XK=.278,XLAM=10.3
XNLN=0.273,0.782,1.392
XMA=780.4,127.52,37.41
BETAN=3*0.01
D=713.,594.,436.,13*428.,396.,8*396.,347.8,286.8,297.,297.,259.8,259.8,
259.8,247.5,217.8,182.2,154.,154.,128.7,3*26.,5.
PSI(1,1)=0.0,0.01,0.02,0.03,0.05,0.05,0.06,0.08,0.1,0.12,0.14,0.15,
0.17,0.2,0.21,0.24,0.25,0.27,0.30,0.33,0.35,0.37,0.40,0.42,0.45,0.47,
0.50,0.53,0.55,0.58,0.60,0.64,0.66,0.7,0.73,0.75,
0.80,0.84,0.86,0.90,0.95,0.99
PSI(1,2)=-0.01,-0.02,-0.03,-0.045,-0.05,-0.055,-0.06,-0.07,6*-0.08,-0.075,
-0.07,-0.065,-0.06,-0.05,-0.04,-0.03,-0.015,-0.005,0.01,0.025,0.05,
0.07,0.09,0.12,0.15,0.155,0.2,0.25,0.259,0.349,0.4,0.475,0.55,0.65,
0.748,0.85,0.96
PSI(1,3)=0.01,0.02,0.025,0.03,0.04,0.045,3*0.048,0.04,0.03,0.025,0.02,
0.01,0.0,-0.015,-0.02,-0.03,-0.04,-0.05,-0.055,-0.06,-0.075,-0.09,
-0.095,5*-0.1,-0.08,-0.07,-0.05,-0.02,0.02,0.09,0.15,0.25,0.38,0.55,
0.75,0.95
XM(1,1)=-13.4,-12.5,-11.7,-11.0,-10.1,-9.4,-8.7,-8.0,-7.2,-6.5,-5.8,-5.3,
-4.7,-4.2,-3.75,-3.4,-3.0,-2.6,-2.25,-2.05,-1.8,-1.65,-1.45,-1.25,
-1.10,-0.85,-0.70,-0.60,-0.50,-0.35,-0.27,-0.24,-0.2,-0.15,-0.1,
-0.07,6*0.0
XM(1,2)=7.84,6.0,4.45,2.60,1.0,-0.05,-1.9,-3.20,-4.55,-5.7,-6.4,-7.0,
-7.5,-7.65,-7.5,-7.35,-7.24,-7.1,-6.75,-6.3,-5.9,-5.4,-5.0,-4.5,-4.06,
-3.7,-3.2,-2.75,-2.4,-2.05,-1.75,-1.45,-1.18,-0.90,-0.7,-0.45,-0.23,
-0.14,-0.10,-0.02,2*0.00
XM(1,3)=-3.65,-2.0,-0.24,1.20,2.63,3.80,4.59,5.40,6.20,6.42,6.20,5.77,
5.22,4.39,3.40,2.45,1.45,0.60,-.18,-0.6,-1.06,-1.40,-1.80,-2.10,
-2.39,-2.60,-2.80,-2.95,-2.80,-2.60,-2.35,-2.08,-1.80,-1.45,-1.20,
-0.82,-0.50,-0.30,-0.20,-0.15,0.04,0.00
SIGMS(1)=0.0,SBARM(1)=0.0,SIGCS(1)=0.0,SEARC(1)=0.0
$
$NAM1
XK=.216
$
$NAM1
XK=.153
$
$NAM1
XK=.090
$
$NAM1
IFLAG=0
$

```

3.2.5 Additional Constants

A number of constants are utilized which generally remain fixed for a parameter study concerning, say, various wind speeds or propellant loadings. In order to minimize required input, these constants are included in the main program.

NODE Number of elements in discretized vehicle model.
X1 Station number of first element from fixed end of vehicle (in.).
DX Distance (fixed) between elements (in.).
RHO Mass density of atmosphere ($\text{lb. sec.}^2 \text{in.}^{-4}$).

The presently programmed constants represent a 42 element vehicle model with elements centered at stations 100,200,...,4200. This model may be altered by modifying the above constants in the main program. Consistency with input data and program dimensions must, of course, be maintained.

3.2.6 Program Restrictions

The program is dimensioned for a maximum of:

4 bending modes,
42 vehicle elements,
10 vehicle stations at which resultant probability density and cumulative distribution functions are to be computed (for displacement and bending moment, separately).

The lift and drag spectra of turbulence are computed based on /2,3/, with constants appropriate to neutral wind conditions.

3.3 DESCRIPTION OF OUTPUT

The program output consists of the following printed information:

A. Case Information

1. Program title.
2. Definition of input terms and appropriate units.
3. Listing of input values.

B. Results

1. Definition of output terms and units.
2. Output in drag direction:
 - a) Mean displacement.
 - b) Mean bending moment.
 - c) Displacement standard deviation and variance.
 - d) Bending moment standard deviation and variance.
 - e) Mean wind speed distribution.
3. Output in lift direction:
 - a) Displacement standard deviation and variance.
 - b) Bending moment standard deviation and variance.
4. Resultant response
 - a) Maximum absolute displacement associated with 3 sigma lift and drag response.
 - b) Maximum absolute bending moment associated with 3 sigma lift and drag response.
 - c) Probability density and cumulative distribution of displacement at vehicle locations specified.
 - d) Probability density and cumulative distribution of absolute bending moment at vehicle locations specified.

The functions (c) and (d) above will generally be computed for differing vehicle locations. When joint statistics are requested at a number of points, all displacement statistics are printed out in the order of displacement locations specified, followed by bending moment statistics in the order specified.

Computed results are also written on tape and processed by the SC-4020 plotter. The order of data presentation is the same as described above.

SECTION 4

SAMPLE PROBLEM DESCRIPTION

A sample problem is presented to illustrate computer program operation. Consider the format defined in Section 3.2.4. This format indicates:

1. Structural dynamic characteristics representing the Saturn V (SA-503) vehicle in the fully fueled condition, including three bending modes.
2. A reference peak wind speed of 10.3 m/sec. (at the 18.3 m. level), which is equivalent to a mean wind speed of 20 knots.
3. Lift, drag and resultant response are to be computed.
4. Resultant displacement statistics are to be computed at station 4200.
5. Resultant bending moment statistics are to be computed at station 100.
6. Four cases are called for, with the value of XK being varied and all other parameters held fixed.

As stated previously, the quantity XK is an empirically determined statistic which defines the wind speed profile shape at Cape Kennedy, see reference /4/. The values selected for this example represent vehicle response to the 3σ , 2σ , 1σ and mean wind profile envelope, respectively, for a fixed reference wind speed.

SECTION 5

SAMPLE INPUT

The printout of input data is entirely redundant for all cases, with the exception of XK, which is specified in Section 3.2.4. Therefore, only the first case is presented.

SATURN 5 RESPONSE TO PRE-LAUNCH WIND LOADS

DEFINITION OF INPUT

N = NUMBER OF MODES
 NIPM = NUMBER OF POINTS AT WHICH JOINT PROBABILITY IS DESIRED (MOMENT)
 NIPD = NUMBER OF POINTS AT WHICH JOINT PROBABILITY IS DESIRED (DISPLACEMENT)
 IPTM = POINTS AT WHICH JOINT PROBABILITY IS DESIRED (MOMENT)
 IPTD = POINTS AT WHICH JOINT PROBABILITY IS DESIRED (DISPLACEMENT)
 D = AVERAGE DIAMETER OF VEHICLE SEGMENTS--IN.
 XK = CONSTANT DEFINING WIND SPEED GRADIENT
 XLAM = PEAK WIND SPEED AT 18.3 METER LEVEL--M/SEC
 XNUN = UNDAMPED NATURAL FREQUENCIES--HZ
 XMN = GENERALIZED MASSES--LB*SEC**2/IN.
 RETAN = STRUCTURAL DAMPING RATIOS
 PSI = DISPLACEMENT MODE VECTOR--IN./IN.
 XM = BENDING MOMENT MODE VECTOR--(LB*IN./IN.)*E-6
 SIGMS = STANDARD DEVIATION OF LIFT MOMENT DUE TO VORTEX SHEDDING--LB*IN.*E-6
 SBARM = MEAN LIFT MOMENT DUE TO VORTEX SHEDDING --LB*IN.*E-6
 SIGDS = STANDARD DEVIATION OF LIFT DISPLACEMENT DUE TO VORTEX SHEDDING--IN.
 SBARD = MEAN LIFT DISPLACEMENT DUE TO VORTEX SHEDDING--IN.

N NIPM NIPD

3 1 1

IPM = 1
SIGMS = .0000000
SBARM = .0000000

IPD = 42
SIGS = .0000000
SBARD = .0000000

XK XLAM
.27800000+00 .10300000+02

XNUN
.27300000+00 .78200000+00 .13920000+01

XMN
.78040000+03 .12752000+03 .37410000+02

BETAN
.10000000-01 .10000000-01 .10000000-01

22

.71300000+03	.59400000+03	.43600000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03
.42800000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03
.42800000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03	.42800000+03
.39600000+03	.39600000+03	.39600000+03	.39600000+03	.39600000+03	.39600000+03	.39600000+03
.37600000+03	.34780000+03	.20800000+03	.29700000+03	.29700000+03	.29700000+03	.25980000+03
.25980000+03	.25980000+03	.24750000+03	.21780000+03	.18220000+03	.15400000+03	.15400000+03
.15400000+03	.12870000+03	.26000000+02	.26000000+02	.26000000+02	.50000000+01	.50000000+01

PSI

.00000000	.10000000-01	.20000000-01	.30000000-01	.50000000-01	.50000000-01	.50000000-01
.60000000-01	.80000000-01	.10000000+00	.12000000+00	.14000000+00	.15000000+00	.15000000+00
.17000000+00	.20000000+00	.21000000+00	.24000000+00	.25000000+00	.27000000+00	.27000000+00
.30000000+00	.33000000+00	.35000000+00	.37000000+00	.40000000+00	.42000000+00	.42000000+00
.45000000+00	.47000000+00	.50000000+00	.53000000+00	.55000000+00	.58000000+00	.58000000+00
.60000000+00	.64000000+00	.66000000+00	.70000000+00	.73000000+00	.75000000+00	.75000000+00
.80000000+00	.84000000+00	.86000000+00	.90000000+00	.95000000+00	.99000000+00	.99000000+00

XM

-.13400000+02	-.12500000+02	-.11700000+02	-.11000000+02	-.10100000+02	-.09400000+01	-.09400000+01
.08700000+01	.08200000+01	.07200000+01	.06500000+01	.05900000+01	.05300000+01	.05300000+01
.47000000+01	.42000000+01	.37500000+01	.34000000+01	.30000000+01	.26000000+01	.26000000+01
-.22500000+01	-.20500000+01	-.18000000+01	-.16500000+01	-.14500000+01	-.12500000+01	-.12500000+01
-.11000000+01	-.08500000+00	-.70000000+00	-.60000000+00	-.50000000+00	-.35000000+00	-.35000000+00
-.27000000+00	-.24000000+00	-.20000000+00	-.15000000+00	-.10000000+00	-.70000000-01	-.70000000-01
.00000000	.00000000	.00000000	.00000000	.00000000	.00000000	.00000000

PSI

-.10000000-01	-.20000000-01	-.36000000-01	-.45000000-01	-.50000000-01	-.55000000-01	-.55000000-01
-.60000000-01	-.70000000-01	-.80000000-01	-.80000000-01	-.80000000-01	-.80000000-01	-.80000000-01
-.80000000-01	-.80000000-01	-.75000000-01	-.70000000-01	-.65000000-01	-.60000000-01	-.60000000-01
-.50000000-01	-.40000000-01	-.36000000-01	-.35000000-01	-.35000000-01	-.30000000-01	-.30000000-01
-.25000000-01	-.50000000-01	.70000000-01	.90000000-01	.90000000-01	.90000000-01	.90000000-01

.15500000+00 .20000000+00 .25000000+00 .25900000+00 .34900000+00 .40000000+00
.47500000+00 .55000000+00 .65000000+00 .74800000+00 .85000000+00 .96000000+00

XM

.78400000+01 .60000000+01 .44500000+01 .26000000+01 .10000000+01 -.50000000-01
-.19000000+01 -.32000000+01 -.45500000+01 -.57000000+01 -.64000000+01 -.70000000+01
-.75000000+01 -.76500000+01 -.75000000+01 -.73500000+01 -.72400000+01 -.71000000+01
-.67500000+01 -.63000000+01 -.59000000+01 -.54000000+01 -.50000000+01 -.45000000+01
-.40600000+01 -.37000000+01 -.32000000+01 -.27500000+01 -.24000000+01 -.20500000+01
-.17500000+01 -.14500000+01 -.11800000+01 -.90000000+00 -.70000000+00 -.45000000+00
-.23000000+00 -.14000000+00 -.10000000+00 -.20000000-01 .00000000 .00000000

PSI

.10000000-01 .20000000-01 .25000000-01 .30000000-01 .30000000-01 .45000000-01
.48000000-01 .48000000-01 .48000000-01 .40000000-01 .30000000-01 .25000000-01
.20000000-01 .10000000-01 .00000000 -.15000000-01 -.20000000-01 -.30000000-01
-.40000000-01 -.50000000-01 -.55000000-01 -.60000000-01 -.75000000-01 -.90000000-01
-.95000000-01 -.10000000+00 -.10000000+00 -.10000000+00 -.10000000+00 -.10000000+00
-.80000000-01 -.70000000-01 -.50000000-01 -.20000000-01 .20000000-01 .90000000-01
.15000000+00 .25000000+00 .38000000+00 .55000000+00 .75000000+00 .95000000+00

XM

-.36500000+01 -.20000000+01 -.24000000+00 -.12000000+01 .26300000+01 .38000000+01
.45900000+01 .54000000+01 .62000000+01 .64200000+01 .62000000+01 .57700000+01
.52200000+01 .43900000+01 .34000000+01 .24500000+01 .14500000+01 .60000000+00
-.18000000+00 -.60000000+00 -.10600000+01 -.14000000+01 -.18000000+01 -.21000000+01
-.23900000+01 -.26000000+01 -.28000000+01 -.29500000+01 -.28000000+01 -.26000000+01
-.23500000+01 -.20800000+01 -.18000000+01 -.14500000+01 -.12000000+01 -.62000000+00
-.50000000+00 -.30000000+00 -.20000000+00 -.15000000+00 .40000000-01 .00000000

SECTION 6
PRINTOUT OF RESULTS

DEFINITION OF OUTPUT

D BAR = MEAN DRAG DISPLACEMENT--IN.
M BAR = MEAN DRAG BENDING MOMENT--LB*IN*E-6
SIGMA(D) = STANDARD DEVIATION OF DISPLACEMENT--IN.
SIGMA(M) = STANDARD DEVIATION OF BENDING MOMENT --LB*IN*E-6
VARIANCE(D) = VARIANCE OF DISPLACEMENT--IN**2
VARIANCE(M) = VARIANCE OF BENDING MOMENT --(LB*IN)**2*E-12
V = WIND SPEED--IN./SEC
ABSD = MAX. ABSOLUTE DISPLACEMENT ASSOCIATED WITH 3 SIGMA LIFT AND DRAG RESPONSE--IN.
ABSM = MAX. ABSOLUTE BENDING MOMENT ASSOCIATED WITH 3 SIGMA LIFT AND DRAG RESPONSE--LB*IN*E-6
DINT = ABSOLUTE DISPLACEMENT (BENDING MOMENT) --IN*(LB*IN*E-6)
SFANS = PROBABILITY DENSITY OF ABSOLUTE DISPLACEMENT(BENDING MOMENT)
FANS = CUMULATIVE DISTRIBUTION OF ABSOLUTE DISPLACEMENT(BENDING MOMENT)

OUTPUT IN DRAG DIRECTION

			D BAR			
- .13114-02	.92039-02	.19936-01	.30228-01	.53009-01	.52354-01	
.63611-01	.86386-01	.10916+00	.13316+00	.15725+00	.16929+00	
.19316+00	.22907+00	.24177+00	.27834+00	.29082+00	.31535+00	
.35214+00	.30893+00	.41368+00	.43887+00	.47588+00	.50150+00	
.53851+00	.56453+00	.60182+00	.63905+00	.66534+00	.70346+00	
.72669+00	.77752+00	.80470+00	.85150+00	.89315+00	.91826+00	
.98138+00	.10310+01	.10578+01	.11063+01	.11658+01	.12141+01	
			M BAR			
- .15001046+02	- .14169717+02	- .13435936+02	- .12832933+02	- .11970995+02	- .11286016+02	
- .10654880+02	- .99762851+01	- .91833830+01	- .84660735+01	- .76901826+01	- .71329517+01	
- .6434732+01	- .56293920+01	- .52411609+01	- .47729285+01	- .42469130+01	- .37247535+01	
- .32463062+01	- .29520549+01	- .26013319+01	- .23652837+01	- .20762912+01	- .17828404+01	
- .15542260+01	- .12178394+01	- .98785049+00	- .82355249+00	- .68102486+00	- .48152740+00	
- .37137443+00	- .32122090+00	- .26230929+00	- .19372190+00	- .12783553+00	- .86835955+01	
.14315934-02	.68323023-03	- .13026607-03	.47347617-02	- .17312054-02	.00000000	
			SIGMA(D)			
.31241296-03	.25444375-02	.50145028-02	.75135581-02	.12422036-01	.12441665-01	
.14906444-01	.19836602-01	.24770820-01	.29683221-01	.34601473-01	.37062311-01	
.41986908-01	.49377009-01	.51835493-01	.59225895-01	.61687465-01	.66615945-01	
.74008903-01	.81404227-01	.86334300-01	.91264850-01	.98665557-01	.10360132+00	
.11100281+00	.11594217+00	.12334759+00	.13075455+00	.13570332+00	.14312097+00	
.14805250+00	.15795022+00	.16229022+00	.17279498+00	.18029972+00	.18530660+00	
.19774931+00	.20775366+00	.21292674+00	.22306814+00	.23573138+00	.24600540+00	
			SIGMA(M)			
.33123555+01	.30875108+01	.28682770+01	.27140867+01	.24916128+01	.23192337+01	
.21476333+01	.19768695+01	.17627450+01	.16137169+01	.14442417+01	.13239487+01	
.11796920+01	.10586234+01	.94842304+01	.86271860+01	.76578203+01	.66952089+01	
.58426099+00	.53368606+00	.47210014+00	.43296786+00	.36341601+00	.33310999+00	
.29508619+00	.23585506+00	.19803804+00	.17192741+00	.14607120+00	.11034717+00	
.89569611-01	.78086476-01	.65131711-01	.49739103-01	.36302184-01	.24700578-01	
.99805198-02	.60222254-02	.41307366-02	.24021108-02	.62408543-03	.00000000	
			VARIANCE(D)			
.97601858-07	.64738485-05	.25145239-04	.56453555-04	.15430687-03	.15479504-03	
.22220208-03	.39349078-03	.61359350-03	.88109362-03	.11972620-02	.13736149-02	
.17629005-02	.24380891-02	.26869183-02	.35077067-02	.38053439-02	.44376841-02	
.54773178-02	.66266482-02	.74536115-02	.83292729-02	.97348922-02	.107333234-01	
.12321623-01	.13442587-01	.15214627-01	.17096752-01	.18415391-01	.20483612-01	
.21919545-01	.24948271-01	.26545866-01	.29858103-01	.32507990-01	.34338537-01	
.39104788-01	.43161582-01	.45337799-01	.49759396-01	.55569283-01	.60518658-01	
			VARIANCE(M)			
.10971699+02	.95327228+01	.83421443+01	.73662670+01	.62081345+01	.53788449+01	
.46123289+01	.39080026+01	.31781796+01	.26040887+01	.20858340+01	.17528401+01	
.13916733+01	.11206834+01	.89950528+00	.74428339+00	.58642212+00	.44825823+00	
.84736079+00	.28482082+00	.22287855+00	.18746117+00	.14700784+00	.11092227+00	
.37075859-01	.55627609-01	.39219065-01	.29559035-01	.21336797-01	.12176497-01	
.80227151-02	.60974977-02	.42421399-02	.24739784-02	.13178486-02	.61011857-03	
.99610776-04	.36267199-04	.170622995-04	.57701362-05	.38948263-06	.00000000	
			V			
.31256538+03	.32114868+03	.32931314+03	.33710554+03	.34456487+03	.35172396+03	
.35861077+03	.36524934+03	.37166044+03	.37786226+03	.38387073+03	.38969997+03	
.39536248+03	.40086945+03	.40623092+03	.41145593+03	.41655266+03	.42152852+03	
.42639029+03	.43114412+03	.43579570+03	.44035022+03	.444981246+03	.44918686+03	
.45347751+03	.45768823+03	.46192254+03	.466586372+03	.46987487+03	.47379882+03	
.47765899+03	.48145580+03	.48627338+03	.49127300+03	.49612777+03	.50104777+03	

.49959189+03 .50306272+03 .50648556+03 .50986197+03 .51319346+03 .51648147+03

OUTPUT IN LIFT DIRECTION

.42858318-03	.24978039-02	.48495712-02	.72551014-02	.11903864-01	.11941987-01
.14284637-01	.18969461-01	.23662653-01	.28314678-01	.32978129-01	.35313306-01
.39989749-01	.47010531-01	.49341824-01	.56363893-01	.58701179-01	.63385714-01
.70412754-01	.77444230-01	.82131503-01	.86819657-01	.93861625-01	.98560502-01
.10560293+00	.11030736+00	.11735649+00	.12440853+00	.12912978+00	.13620151+00
.14088944+00	.15033190+00	.15510749+00	.16449131+00	.17172363+00	.17655477+00
.16849307+00	.19814460+00	.20330299+00	.21323799+00	.22564333+00	.23585976+00
			SIGMA (M)		
.31574990+01	.29409007+01	.27495974+01	.25825701+01	.23706609+01	.22071642+01
.20451105+01	.18846780+01	.17033067+01	.15459031+01	.13876194+01	.12757272+01
.11415745+01	.10279894+01	.92339904+00	.84201485+00	.75090805+00	.66107920+00
.58067557+00	.53149485+00	.47293032+00	.43403323+00	.38681174+00	.33829983+00
.30154087+00	.24715388+00	.21084094+00	.18530115+00	.15965704+00	.12599767+00
.10486854+00	.90892329-01	.76028733-01	.58656444-01	.44446355-01	.30022508-01
.14355915-01	.86548972-02	.59116246-02	.35983183-02	.94032478-03	.00000000
			VARIANCE (D)		
.18368354-06	.62390246-05	.23518341-04	.52636497-04	.14170197-03	.14261105-03
.20405086-03	.35984045-03	.55972115-03	.80172098-03	.10875570-02	.12470296-02
.15991800-02	.22099900-02	.24346156-02	.31768885-02	.34458284-02	.40177488-02
.49579560-02	.59976088-02	.67458840-02	.75376530-02	.88100047-02	.97141726-02
.11151979-01	.12167715-01	.13772546-01	.15477482-01	.16674499-01	.18550852-01
.19849834-01	.22599650-01	.24038335-01	.27057392-01	.29489005-01	.31171586-01
.35529637-01	.39261283-01	.41332104-01	.45470439-01	.50914913-01	.55629826-01
			VARIANCE (M)		
.92698000+01	.86488972+01	.75602859+01	.66696686+01	.56200334+01	.48715738+01
.41824769+01	.35520113+01	.29012536+01	.23900637+01	.19254876+01	.16274800+01
.13031924+01	.10567622+01	.85266580+00	.70898901+00	.56386291+00	.43702571+00
.33718412+00	.28248678+00	.22366308+00	.18838485+00	.14962332+00	.11444677+00
.20926895-01	.61085041-01	.44453902-01	.34336515-01	.25490372-01	.15875412-01
.10597410-01	.82614155-02	.57803682-02	.34405785-02	.19754785-02	.90135103-03
.20609230-03	.74907247-04	.34947306-04	.12947894-04	.88421071-06	.00000000
			V		
.31256538+03	.32114688+03	.32931314+03	.33710554+03	.34456487+03	.35172396+03
.35861077+03	.36524934+03	.37166044+03	.37862226+03	.38387073+03	.38969997+03
.39536248+03	.40086945+03	.40623092+03	.41145593+03	.41655266+03	.42152852+03
.42639029+03	.43114412+03	.43579570+03	.44035022+03	.44481246+03	.44918686+03
.45347751+03	.45768823+03	.46182254+03	.46588372+03	.46987487+03	.47379882+03
.47765829+03	.48145580+03	.48519368+03	.48887421+03	.49249994+03	.49607139+03
.49959169+03	.50306277+03	.50648556+03	.50986197+03	.51319346+03	.51648147+03

.99752+01	.10225+02	.10474+02	.10723+02	.10973+02	.11222+02	.11472+02	.11721+02	.11970+02	.12220+02
.12469+02	.12718+02	.12968+02	.13217+02	.13467+02	.13716+02	.13965+02	.14215+02	.14464+02	.14713+02
.14963+02	.15212+02	.15462+02	.15711+02	.15960+02	.16210+02	.16459+02	.16709+02	.16958+02	.17207+02
.17457+02	.17706+02	.17955+02	.18205+02	.18454+02	.18704+02	.18953+02	.19202+02	.19452+02	.19701+02
.19950+02	.20200+02	.20449+02	.20699+02	.20948+02	.21197+02	.21447+02	.21696+02	.21946+02	.22195+02
.22444+02	.22694+02	.22943+02	.23192+02	.23442+02	.23691+02	.23941+02	.24190+02	.24439+02	.24689+02
SFANS									
.00000	.84079-06	.18562-05	.31343-05	.48710-05	.72858-05	.10660-04	.15360-04	.21862-04	.30781-04
.42914-04	.59280-04	.81173-04	.11023-03	.14848-03	.19845-03	.26326-03	.34666-03	.45323-03	.58839-03
.75862-03	.97146-03	.12357-02	.15615-02	.19603-02	.24451-02	.30304-02	.37319-02	.45669-02	.55538-02
.67121-02	.80619-02	.96237-02	.11418-01	.13464-01	.15781-01	.18385-01	.21289-01	.24504-01	.28037-01
.31887-01	.36051-01	.40516-01	.45264-01	.50270-01	.55500-01	.60914-01	.66463-01	.72092-01	.77740-01
.83339-01	.88819-01	.94108-01	.99130-01	.10381+00	.10808+00	.11188+00	.11513+00	.11779+00	.11982+00
.12117+00	.12183+00	.12178+00	.12104+00	.11960+00	.11749+00	.11476+00	.11145+00	.10761+00	.10330+00
.98596-01	.93564-01	.88278-01	.82813-01	.77240-01	.71628-01	.66043-01	.60544-01	.55185-01	.50012-01
.45064-01	.40373-01	.35963-01	.31652-01	.28049-01	.24559-01	.21380-01	.18507-01	.15928-01	.13630-01
.11596-01	.98103-02	.82519-02	.69014-02	.57390-02	.47451-02	.39010-02	.31887-02	.25917-02	.20944-02

FANS

.00000	.10733-06	.44612-06	.10684-05	.20666-05	.35824-05	.58201-05	.90647-05	.13706-04	.20270-04
.29459-04	.42201-04	.59715-04	.83580-04	.11584-03	.15910-03	.21667-03	.29272-03	.39246-03	.52234-03
.69030-03	.90602-03	.11812-02	.15300-02	.19692-02	.25185-02	.32012-02	.40444-02	.50792-02	.63412-02
.78706-02	.97128-02	.11918-01	.14542-01	.17644-01	.21291-01	.25551-01	.30498-01	.36208-01	.42759-01
.50231-01	.58702-01	.68250-01	.78945-01	.90858-01	.10405+00	.11856+00	.13444+00	.15172+00	.17040+00
.19049+00	.21196+00	.23476+00	.25886+00	.28416+00	.31059+00	.33801+00	.36632+00	.39536+00	.42499+00
.45504+00	.48534+00	.51571+00	.54599+00	.57599+00	.60556+00	.63452+00	.66272+00	.69004+00	.71634+00
.74151+00	.76547+00	.78815+00	.80948+00	.82944+00	.84800+00	.86517+00	.88095+00	.89538+00	.90850+00
.92035+00	.93101+00	.94052+00	.94898+00	.95645+00	.96301+00	.96874+00	.97371+00	.97800+00	.98169+00
.98484+00	.98750+00	.98776+00	.99165+00	.99322+00	.99453+00	.99561+00	.99649+00	.99721+00	.99780+00

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OUTPUT IN DRAG DIRECTION

D BAR									
-.97830-03	.77021-02	.16557-01	.25098-01	.43751-01	.43262-01				
.52502-01	.71190-01	.89878-01	.10948+00	.12914+00	.13898+00				
.15847+00	.18779+00	.19812+00	.22793+00	.23808+00	.25806+00				
.28801+00	.31797+00	.33809+00	.35852+00	.38865+00	.40944+00				
.43953+00	.46060+00	.49083+00	.52106+00	.54227+00	.57313+00				
.59206+00	.63318+00	.65494+00	.69309+00	.72633+00	.74641+00				
.79732+00	.83718+00	.85824+00	.89710+00	.94481+00	.98338+00				
M BAR									
-.12322041+02	-.11626129+02	-.11012411+02	-.10502762+02	-.97842702+01	-.92150787+01				
-.86829156+01	-.81168650+01	-.74570225+01	-.68609211+01	-.62211458+01	-.57609167+01				
-.51936189+01	-.46911135+01	-.42124448+01	-.38317606+01	-.34035512+01	-.29786970+01				
-.25913767+01	-.23552284+01	-.20725331+01	-.18843296+01	-.16520244+01	-.14169253+01				
-.12342421+01	-.96279864+00	-.77949747+00	-.64936110+00	-.53600690+00	-.37610668+00				
-.28870858+00	-.25030270+00	-.20447414+00	-.15080429+00	-.98670596-01	-.67252965-01				
.30025291-02	.16799491-02	.70073799-03	.39841849-02	-.13978317-02	.00000000				
SIGMA (D)									
.26959455-03	.21039098-02	.41402673-02	.62022199-02	.10248381-01	.10266003-01				
.12298056-01	.16362341-01	.20430399-01	.24479200-01	.28533278-01	.30561879-01				
.34621794-01	.40714528-01	.42741189-01	.48834348-01	.50863773-01	.54927307-01				
.61022764-01	.67120290-01	.71185164-01	.75250450-01	.81352821-01	.85422914-01				
.91525720-01	.95598685-01	.10170479+00	.10781226+00	.11189331+00	.11801009+00				
.12207576+00	.13023790+00	.13434490+00	.14247936+00	.14867207+00	.15280445+00				
.16306992+00	.17132806+00	.17561043+00	.18399558+00	.19446806+00	.20297811+00				
SIGMA (M)									
.27315018+01	.25459373+01	.23815559+01	.22378689+01	.20544474+01	.19123843+01				
.17710015+01	.16303661+01	.14705640+01	.13314290+01	.11918550+01	.10927875+01				
.97398383+00	.87418593+00	.78326436+00	.71254473+00	.63262855+00	.55332895+00				
.48306594+00	.44131743+00	.39056379+00	.35823517+00	.31742512+00	.27597287+00				
.24466690+00	.19606237+00	.16500339+00	.14357493+00	.12224139+00	.92917693-01				
.75724901-01	.66003002-01	.55108236-01	.42172529-01	.30988297-01	.21073420-01				
.88309487-02	.53261068-02	.36449932-02	.21734480-02	.56652637-03	.00000000				
VARIANCE (D)									
.72691225-07	.44264365-05	.17141813-04	.38467532-04	.10502931-03	.10539082-03				
.15124217-03	.26772620-03	.41740121-03	.59923123-03	.81414797-03	.93402845-03				
.11986686-02	.16576728-02	.18268093-02	.23847936-02	.25871235-02	.30170091-02				
.37297778-02	.45051335-02	.50673276-02	.56626303-02	.66182815-02	.72970742-02				
.83269574-02	.91391086-02	.10343864-01	.11623484-01	.12520113-01	.13926382-01				
.14902491-01	.16961911-01	.18048551-01	.20300368-01	.22103383-01	.23349200-01				
.26591800-01	.29353305-01	.30839022-01	.33854373-01	.37817826-01	.41200112-01				
VARIANCE (M)									
.74611023+01	.64817969+01	.56718084+01	.50080575+01	.42207541+01	.36572136+01				
.31364464+01	.26580435+01	.21625584+01	.17270320+01	.14205183+01	.11941845+01				
.94864451+00	.76420105+00	.61350306+00	.50771999+00	.40021888+00	.30617294+00				
.23335271+00	.19476108+00	.15254007+00	.12833243+00	.10075871+00	.76161025-01				
.59861891-01	.38440455-01	.27226120-01	.20613760-01	.14942957-01	.86336978-02				
.57342606-02	.43563964-02	.30369177-02	.17785223-02	.96027455-03	.44408902-03				
.77959555-04	.28367414-04	.13285975-04	.47238761-05	.32095213-06	.00000000				
V									
.30224228+03	.30907316+03	.31553777+03	.32167866+03	.32753110+03	.33312467+03				
.33849444+03	.34363186+03	.34858546+03	.35336132+03	.35797355+03	.36243455+03				
.36675533+03	.37094566+03	.37501430+03	.37896913+03	.38281724+03	.38656505+03				
.39021941+03	.39378263+03	.39726260+03	.40066276+03	.40398720+03	.40723974+03				
.41042384+03	.41354273+03	.41659944+03	.41959672+03	.42253720+03	.42542329+03				

•44427653+03 •44679831+03 •44928176+03 •45172820+03 •45413890+03 •45651501+03

OUTPUT IN LEFT DIRECTION

	SIGMA (D)			SIGMA (M)			VARIANCE (D)			VARIANCE (M)		
	.38559097-03	.21702631-02	.42030322-02	.62849711-02	.10303466-01	.10338923-01						
	.12364158-01	.16413431-01	.20470746-01	.24490440-01	.28520806-01	.30539255-01						
	.34592008-01	.406651781-01	.42666275-01	.48738281-01	.50759037-01	.54809571-01						
	.60885513-01	.66965468-01	.71018377-01	.75072085-01	.81161798-01	.85225735-01						
	.91315357-01	.95383733-01	.10147910+00	.10757711+00	.11166037+00	.1177617+00						
	.12182860+00	.12999477+00	.13412660+00	.14224003+00	.14850054+00	.15268427+00						
	.16301681+00	.17137813+00	.17586796+00	.18450118+00	.19528673+00	.20419356+00						
	.27308202+01	.25432456+01	.23776584+01	.22331522+01	.2099711+01	.19087452+01						
	.17688230+01	.16304067+01	.14740377+01	.13383831+01	.12016908+01	.11050774+01						
	.98923498+00	.89097948+00	.80037022+00	.72984529+00	.65101372+00	.57339362+00						
	.50390083+00	.46131482+00	.41072289+00	.37703278+00	.33630636+00	.29444675+00						
	.26279254+00	.21613505+00	.18499196+00	.16313949+00	.14094405+00	.11959336+00						
	.93547947-01	.81112529-01	.67940616-01	.52531434-01	.40032458-01	.27046420-01						
	.13214105-01	.79634500-02	.54290001-02	.33695766-02	.88258363-03	.00000000						
	.14868657-06	.47100420-05	.17665980-04	.39500863-04	.10616141-03	.10689333-03						
	.15287240-03	.26940072-03	.41905145-03	.59978166-03	.81343637-03	.93264609-03						
	.11959153-02	.16525673-02	.18204709-02	.23754201-02	.25764799-02	.30040891-02						
	.37070457-02	.44843740-02	.50436059-02	.56358181-02	.65872375-02	.72634259-02						
	.83384245-02	.90980565-02	.10292008-01	.11572835-01	.12468039-01	.13871225-01						
	.14842208-01	.16898641-01	.17989945-01	.20232226-01	.22052411-01	.23312487-01						
	.26574480-01	.29370465-01	.30929541-01	.34040687-01	.38136908-01	.41695011-01						
	.74573792+01	.64680984+01	.56532597+01	.49869688+01	.42023816+01	.36433083+01						
	.31287347+01	.26582260+01	.2172871+01	.17912694+01	.14440608+01	.12211960+01						
	.97655885+00	.79384445+00	.64059250+00	.53267414+00	.42381886+00	.32878025+00						
	.25391604+00	.21281136+00	.16869329+00	.14215372+00	.11310197+00	.86698891-01						
	.69059920-01	.46714360-01	.34222026-01	.26614493-01	.19865227-01	.12534899-01						
	.87512184-02	.65792424-02	.46159273-02	.27595516-02	.16025977-02	.73150883-03						
	.17461257-03	.63416537-04	.29474042-04	.11354047-04	.77895388-06	.00000000						
	.30224228+03	.30907316+03	.31553777+03	.32167866+03	.32793110+03	.33312467+03						
	.33848444+03	.34363186+03	.34858546+03	.35336132+03	.35797355+03	.36243455+03						
	.36675533+03	.37094566+03	.37501430+03	.37896913+03	.38281724+03	.38656505+03						
	.39021841+03	.39378263+03	.39726260+03	.40066276+03	.40398720+03	.40729774+03						
	.41042384+03	.41354273+03	.41659944+03	.41959672+03	.42253720+03	.42542329+03						
	.42825726+03	.43104123+03	.43377718+03	.43646697+03	.43911238+03	.44171505+03						
	.44427653+03	.44679831+03	.44928176+03	.45172820+03	.45413890+03	.45651501+03						

RESULTANT RESPONSE

ABS0

.17870836-02	.14013790-01	.28977952-01	.43704478-01	.74496402-01	.74060120-01
.89395679-01	.12027701+00	.15116967+00	.18291296+00	.21474197+00	.23066116+00
.26233296+00	.30993660+00	.32633912+00	.37433318+00	.39066927+00	.42284107+00
.47108172+00	.51932858+00	.55164409+00	.58427526+00	.63271139+00	.66570643+00
.71140882+00	.74739187+00	.79594386+00	.84449992+00	.87794692+00	.92715979+00
.95828961+00	.10238910+01	.10597446+01	.11205302+01	.11723461+01	.12048214+01
.12855307+01	.13511615+01	.13850714+01	.14490834+01	.15282191+01	.15923120+01

ABSM

.20516546+02	.19263941+02	.18157079+02	.17216569+02	.15947612+02	.14952231+02
.13995920+02	.13007963+02	.11868714+02	.10855206+02	.97967107+01	.90392790+01
.81155703+01	.73136712+01	.65622379+01	.59693948+01	.53014368+01	.46386839+01
.40405745+01	.36791807+01	.32442245+01	.29590351+01	.26042997+01	.22448439+01
.19482427+01	.1550985A+01	.12744976+01	.10800859+01	.90273106+00	.65485975+00
.51598327+00	.44831171+00	.36979985+00	.27732188+00	.19163549+00	.13047322+00
.39848215-01	.23996984-01	.16314423-01	.11374088-01	.32146179-02	.00000000

DINT

.00000	.15923-01	.31846-01	.47769-01	.63692-01	.79616-01	.95539-01	.11146+00	.12738+00	.14331+00
.15923+00	.17515+00	.19108+00	.20700+00	.22292+00	.23885+00	.25477+00	.27069+00	.28662+00	.30254+00
.31846+00	.33439+00	.35031+00	.36623+00	.38215+00	.39808+00	.41400+00	.42992+00	.44585+00	.46177+00
.47769+00	.49362+00	.50954+00	.52546+00	.54139+00	.55731+00	.57323+00	.58916+00	.60508+00	.62100+00
.63692+00	.65285+00	.66877+00	.68469+00	.70062+00	.71654+00	.73246+00	.74839+00	.76431+00	.78023+00
.79616+00	.81208+00	.82800+00	.84393+00	.85985+00	.87577+00	.89169+00	.90762+00	.92354+00	.93946+00
.95539+00	.97131+00	.98723+00	.10032+01	.10191+01	.10350+01	.10509+01	.10668+01	.10828+01	.10987+01
.11146+01	.11305+01	.11465+01	.11624+01	.11783+01	.11942+01	.12102+01	.12261+01	.12420+01	.12579+01
.12738+01	.12898+01	.13057+01	.13216+01	.13375+01	.13534+01	.13693+01	.13853+01	.14012+01	.14172+01
.14331+01	.14490+01	.14649+01	.14809+01	.14968+01	.15127+01	.15286+01	.15445+01	.15605+01	.15764+01

SFANS

.00000	.31766-05	.69833-05	.12134-04	.19517-04	.30301-04	.46067-04	.68967-04	.10194-03	.14895-03
.21537-03	.30832-03	.43726-03	.61457-03	.85636-03	.11834-02	.16220-02	.22059-02	.29769-02	.39871-02
.53007-02	.69959-02	.91670-02	.11927-01	.15408-01	.19768-01	.25188-01	.31873-01	.40061-01	.50012-01
.62017-01	.76391-01	.93474-01	.11362+00	.13721+00	.16460+00	.19617+00	.23229+00	.27326+00	.31939+00
.37039+00	.42793+00	.49057+00	.55677+00	.63239+00	.71144+00	.79460+00	.88221+00	.97325+00	.10669+01
.11621+01	.12578+01	.13528+01	.14458+01	.15354+01	.16203+01	.16991+01	.17706+01	.18334+01	.18866+01
.19291+01	.19803+01	.19794+01	.19863+01	.19806+01	.19627+01	.19327+01	.18913+01	.18393+01	.17775+01
.17071+01	.16292+01	.15452+01	.14564+01	.13642+01	.12699+01	.11747+01	.10799+01	.98656+00	.89570+00
.80815+00	.72463+00	.64571+00	.57182+00	.50323+00	.44013+00	.38255+00	.33044+00	.28366+00	.24199+00
.20517+00	.17287+00	.14475+00	.12046+00	.99619-01	.81876-01	.66877-01	.54288-01	.43795-01	.35113-01

FANS

.00000	.25291-07	.10618-06	.25838-06	.51037-06	.90700-06	.15150-05	.24309-05	.37915-05	.57890-05
.86896-05	.12859-04	.18795-04	.27169-04	.38880-04	.55120-04	.77455-04	.10793-03	.14919-03	.20464-03
.27658-03	.37648-03	.50517-03	.67310-03	.89073-03	.11708-02	.15287-02	.19830-02	.25557-02	.32728-02
.41648-02	.52667-02	.66191-02	.82679-02	.10265-01	.12668-01	.15540-01	.18951-01	.22976-01	.27695-01
.33190-01	.39550-01	.46863-01	.55217-01	.64701-01	.75397-01	.87385-01	.10074+00	.11551+00	.13175+00
.14950+00	.16876+00	.18955+00	.21183+00	.23556+00	.26069+00	.28711+00	.31474+00	.34343+00	.37305+00
.40343+00	.43439+00	.46576+00	.49733+00	.52891+00	.56031+00	.59132+00	.62177+00	.65147+00	.68027+00
.70801+00	.73457+00	.75984+00	.78374+00	.80620+00	.82717+00	.84663+00	.86458+00	.88103+00	.89602+00
.90959+00	.92179+00	.93270+00	.94239+00	.95095+00	.95846+00	.96501+00	.97069+00	.97558+00	.97976+00
.98332+00	.98866+00	.99097+00	.99273+00	.99417+00	.99535+00	.99632+00	.99710+00	.99773+00	.99825+00

DINT

.00000	.20517+00	.41033+00	.61550+00	.82066+00	.10258+01	.12310+01	.14362+01	.16413+01	.18465+01
.20517+01	.22568+01	.24620+01	.26672+01	.28723+01	.30775+01	.32826+01	.34878+01	.36930+01	.38981+01
.41033+01	.43085+01	.45136+01	.47188+01	.49240+01	.51291+01	.53343+01	.55395+01	.57446+01	.59498+01
.61550+01	.63602+01	.65654+01	.67706+01	.69758+01	.71810+01	.73862+01	.75914+01	.77966+01	.80018+01

.82066+01	.84118+01	.86169+01	.88221+01	.90273+01	.92324+01	.94376+01	.96428+01	.98479+01	.10053+02
.10258+02	.10463+02	.10669+02	.10874+02	.11079+02	.11284+02	.11489+02	.11694+02	.11900+02	.12105+02
.12310+02	.12515+02	.12720+02	.12925+02	.13131+02	.13336+02	.13541+02	.13746+02	.13951+02	.14156+02
.14362+02	.14567+02	.14772+02	.14977+02	.15182+02	.15387+02	.15593+02	.15798+02	.16003+02	.16208+02
.16413+02	.16618+02	.16824+02	.17029+02	.17234+02	.17439+02	.17644+02	.17849+02	.18055+02	.18260+02
.18465+02	.18670+02	.18875+02	.19080+02	.19286+02	.19491+02	.19696+02	.19901+02	.20106+02	.20311+02

SFANS

.00000	.10756-05	.23180-05	.39107-05	.60712-05	.90705-05	.13256-04	.19078-04	.27121-04	.38143-04
.53120-04	.73301-04	.10027-03	.13602-03	.18305-03	.24443-03	.32394-03	.42620-03	.55673-03	.72216-03
.93033-03	.11904-02	.15131-02	.19106-02	.23969-02	.29876-02	.37003-02	.45540-02	.55696-02	.67693-02
.81765-02	.98156-02	.11711-01	.13888-01	.16370-01	.19178-01	.22333-01	.25852-01	.29746-01	.34023-01
.38684-01	.43723-01	.49126-01	.54871-01	.60928-01	.67255-01	.73805-01	.80519-01	.87330-01	.94164-01
.10094+00	.10758+00	.11398+00	.12007+00	.12575+00	.13093+00	.13554+00	.13950+00	.14275+00	.14523+00
.14690+00	.14774+00	.14772+00	.14686+00	.14516+00	.14265+00	.13939+00	.13542+00	.13080+00	.12562+00
.11996+00	.11389+00	.10751+00	.10091+00	.94174-01	.87384-01	.80620-01	.73955-01	.67454-01	.61174-01
.55161-01	.49456-01	.44089-01	.39079-01	.34442-01	.30182-01	.26299-01	.22784-01	.19627-01	.16811-01
.14318-01	.12125-01	.10209-01	.85473-02	.71153-02	.58896-02	.46474-02	.39669-02	.32279-02	.26117-02

FANS

.00000	.11033-06	.45845-06	.10974-05	.21214-05	.36747-05	.59650-05	.92819-05	.14021-04	.20716-04
.30078-04	.43047-04	.60852-04	.85092-04	.11782-03	.16167-03	.21998-03	.29693-03	.39776-03	.52895-03
.69847-03	.91602-03	.11934-02	.15446-02	.19864-02	.25388-02	.32249-02	.40716-02	.51101-02	.63759-02
.79090-02	.97547-02	.11963-01	.14589-01	.17693-01	.21340-01	.25598-01	.30541-01	.36244-01	.42786-01
.50244-01	.58628-01	.68222-01	.78891-01	.90770-01	.10392+00	.11839+00	.13422+00	.15144+00	.17006+00
.19007+00	.21146+00	.23419+00	.25820+00	.28342+00	.30975+00	.33709+00	.36530+00	.39426+00	.42380+00
.45377+00	.48399+00	.51430+00	.54452+00	.57447+00	.60400+00	.63293+00	.66112+00	.68843+00	.71474+00
.73993+00	.76392+00	.78663+00	.80801+00	.82802+00	.84665+00	.86388+00	.87974+00	.89425+00	.90744+00
.91938+00	.93011+00	.93970+00	.94823+00	.95578+00	.96241+00	.96820+00	.97324+00	.97759+00	.98132+00
.98452+00	.98723+00	.98952+00	.99144+00	.99305+00	.99439+00	.99549+00	.99639+00	.99713+00	.99773+00

OUTPUT IN DRAG DIRECTION

		D BAR				
-71399-03	.64575-02	.13761-01	.20838-01	.36121-01	.35764-01	
.43345-01	.58665-01	.73985-01	.89966-01	.10600+00	.11402+00	
.12992+00	.15364+00	.16221+00	.18649+00	.19473+00	.21099+00	
.23536+00	.25973+00	.27609+00	.29266+00	.31717+00	.33401+00	
.35847+00	.37550+00	.40006+00	.42462+00	.44174+00	.46675+00	
.48222+00	.51553+00	.53303+00	.56419+00	.59085+00	.60708+00	
.64832+00	.68061+00	.69747+00	.72896+00	.76773+00	.79997+00	
		M BAR				
-10117000+02	-95336819+01	-90190331+01	-85883528+01	-79884248+01	-75145645+01	
-70667892+01	-65947356+01	-60458189+01	-55514833+01	-50252813+01	-46467566+01	
-41817108+01	-37723716+01	-33847222+01	-30769798+01	-27302988+01	-23862099+01	
-20739188+01	-13848884+01	-16575934+01	-15078195+01	-13215501+01	-11334008+01	
-98764786+00	-76875185+00	-62266003+00	-51956565+00	-42887117+00	-30006420+00	
-23002567+00	-19994063+00	-16358606+00	-12073600+00	-78863828-01	-53926739-01	
-27773982-02	-15762418-02	-75017038-03	-30430511-02	-10520061-02	-00000000	
		SIGMA (D)				
.23537384-03	.17391121-02	.34151993-02	.51144101-02	.8442302-02	.84404323-02	
.10133077-01	.13478143-01	.16926910-01	.20158127-01	.23494307-01	.25163865-01	
.28505580-01	.33520736-01	.35188694-01	.40204433-01	.41874923-01	.45220086-01	
.50237925-01	.55257628-01	.58603934-01	.61950609-01	.66974738-01	.70325962-01	
.75350240-01	.78703751-01	.83730813-01	.88759101-01	.92119638-01	.97156187-01	
.10050267+00	.10722367+00	.11160702+00	.11730345+00	.12240744+00	.12581426+00	
.13427266+00	.14108220+00	.14462778+00	.15155832+00	.16021663+00	.16726814+00	
		SIGMA (M)				
.22491745+01	.20962009+01	.19607452+01	.18423792+01	.16913910+01	.15745156+01	
.14582464+01	.13426629+01	.12114065+01	.10971364+01	.98242702+00	.90100978+00	
.80337125+00	.72124644+00	.64632858+00	.58804666+00	.5227003+00	.45707066+00	
.39926862+00	.36484082+00	.32308614+00	.29639468+00	.26284969+00	.22875094+00	
.20302696+00	.16327821+00	.13784105+00	.12030606+00	.10271908+00	.78712378-01	
.64477026-01	.56183108-01	.46967996-01	.36036950-01	.26700443-01	.18145065-01	
.79210635-02	.47750682-02	.32602619-02	.19926527-02	.52098489-03	.00000000	
		VARIANCE (D)				
.95490845+07	.30245109+05	.11663587+04	.26157191+04	.71305024+04	.71578916+04	
.10267925-03	.18166034-03	.28314152-03	.40635007-03	.55198246-03	.63222013-03	
.81256811-03	.11236398-02	.12382442-02	.16163964-02	.17535092-02	.20448562-02	
.25238491-02	.30534054-02	.34344211-02	.38378780-02	.44856155-02	.49457410-02	
.56776587-02	.61942804-02	.70108492-02	.78781779-02	.84860278-02	.94393247-02	
.10100786-01	.11496915-01	.12239913-01	.13760100-01	.14983580-01	.15829229-01	
.18029146-01	.19904188-01	.20917194-01	.22969923-01	.25669369-01	.27978633-01	
		VARIANCE (M)				
.50587859+01	.43940585+01	.38446217+01	.33943610+01	.28608036+01	.24790995+01	
.21264826+01	.18027436+01	.14675057+01	.12037083+01	.96516284+00	.81181862+00	
.64540537+00	.52019644+00	.41774064+00	.34579888+00	.27276599+00	.20891359+00	
.15941543+00	.13310882+00	.10438465+00	.87849810-01	.69089959-01	.52326991-01	
.41219945-01	.26659773-01	.19000156-01	.14473547-01	.10551210-01	.61956385-02	
.41572870-02	.31565547-02	.22059927-02	.12986618-02	.71291367-03	.32924339-03	
.62743247-04	.22801277-04	.10623308-04	.39706648-05	.27142526-06	.00000000	
		V				
.29210186+03	.29726787+03	.30213033+03	.30672592+03	.31108492+03	.31523256+03	
.31919016+03	.32297587+03	.32660529+03	.33009194+03	.33344762+03	.33682666+03	
.33980620+03	.34282634+03	.34575032+03	.34858461+03	.35133503+03	.35400686+03	
.35660484+03	.35913334+03	.36159627+03	.36399727+03	.36633966+03	.36862648+03	
.37086053+03	.37304443+03	.37518058+03	.37727120+03	.37931838+03	.38132403+03	
.3832899+03	.38521727+03	.38719999+03	.38915740+03	.39109014+03	.39299810+03	

.39433870+03 .39606830+03 .39776908+03 .39944207+03 .40108826+03 .40270856+03

OUTPUT IN LIFT DIRECTION

	SIGMA(D)			
.35069173-03	.18907602-02	.36492663-02	.54533699-02	.89303798-02
.10716457-01	.14219359-01	.17730185-01	.21206158-01	.26438512-01
.29936759-01	.35189393-01	.36932965-01	.42187477-01	.43936300-01
.52701115-01	.57963716-01	.61471678-01	.64980367-01	.70252181-01
.79042000-01	.82564058-01	.87840056-01	.93118468-01	.96653717-01
.10545456+00	.11252446+00	.11610332+00	.12312524+00	.12855154+00
.14113433+00	.14838995+00	.15231056+00	.15983368+00	.16923265+00
	SIGMA(M)			
.23643515+01	.22016668+01	.20581478+01	.19329846+01	.17745017+01
.15315760+01	.14121333+01	.12732279+01	.11603478+01	.10423008+01
.85870253+00	.77358142+00	.69472981+00	.63368711+00	.56536762+00
.43810725+00	.40118451+00	.35745487+00	.32824523+00	.29312892+00
.22979098+00	.18984380+00	.16320847+00	.14458495+00	.12535234+00
.84285408-01	.73123531-01	.61354490-01	.47566794-01	.36495188-01
.12345005-01	.74364714-02	.50588798-02	.32070290-02	.84202285-03

VARIANCE(D)

.12298469-06	.35749743-05	.13317145-04	.29739243-04	.79751683-04	.80353037-04
.11484245-03	.20219017-03	.31435948-03	.44970115-03	.60970871-03	.69899493-03
.89420958-03	.12382934-02	.13640439-02	.17797832-02	.19303985-02	.22507635-02
.27774075-02	.33597924-02	.37787673-02	.42224482-02	.49353690-02	.54421423-02
.62476378-02	.68168237-02	.77158754-02	.86710491-02	.93419411-02	.10393463-01
.11120664-01	.12661753-01	.13479982-01	.15159826-01	.165225498-01	.17471536-01
.19918900-01	.22019576-01	.23128507-01	.25546807-01	.28642060-01	.31341796-01

VARIANCE(M)

.55901579+01	.48473368+01	.42359723+01	.37364294+01	.31488563+01	.27305706+01
.23457252+01	.19941205+01	.16315665+01	.13464070+01	.10863911+01	.91932703+00
.73737003+00	.59842823+00	.48292744+00	.40155936+00	.31964282+00	.24823131+00
.19193796+00	.16094902+00	.12777399+00	.10774444+00	.85924562+01	.66057709-01
.52803894-01	.36040669-01	.26637004-01	.20904808-01	.15713210-01	.10078447-01
.71040302-02	.53470508-02	.37643735-02	.22625999-02	.13318988-02	.60833788-03
.15239914-03	.55301107-04	.25592265-04	.10285035-04	.70900248-06	.00000000

V

.29210186+03	.29726787+03	.30213033+03	.30672592+03	.31108492+03	.31523256+03
.31919016+03	.32297587+03	.32669529+03	.33009194+03	.33344762+03	.33668266+03
.33980620+03	.34282634+03	.34575032+03	.34958461+03	.35133503+03	.35400686+03
.35660484+03	.35913334+03	.36158227+03	.36399727+03	.36633966+03	.36862648+03
.37086053+03	.37304443+03	.37518058+03	.37727120+03	.37931838+03	.38132403+03
.38328996+03	.38521786+03	.38710229+03	.38896576+03	.39078861+03	.39257919+03
.39433870+03	.39606830+03	.39776908+03	.39944207+03	.40108826+03	.40270856+03

RESULTANT RESPONSE

•14263672-02	•11674860-01	•24006134-01	•36181286-01	•61453249-01	•61144862-01	•10406+00	•11707+00
•73743901-01	•99099111-01	•1246512+00	•15044047+00	•17648301+00	•18950869+00	•23414+00	•24715+00
•21543633+00	•25440139+00	•2677917+00	•30710287+00	•32035684+00	•34665182+00	•36422+00	•37723+00
•38607582+00	•42550541+00	•45189782+00	•47851682+00	•51809119+00	•54498684+00	•49430+00	•50736+00
•58452415+00	•61161464+00	•65125430+00	•69089764+00	•71810320+00	•75822230+00	•62437+00	•63738+00
•78373223+00	•83720366+00	•86485365+00	•91610181+00	•95807715+00	•98452764+00	•74144+00	•75445+00
•10511347+01	•11038577+01	•11313563+01	•11836385+01	•12483810+01	•13007783+01	•85851+00	•87152+00
•16864524+02	•15822285+02	•14901268+02	•14115490+02	•13062598+02	•12238111+02	•10016+01	•10276+01
•11441528+02	•10622724+02	•96800382+01	•88428925+01	•79725623+01	•73497859+01	•10146+01	•11447+01
•65918246+01	•59361107+01	•53237079+01	•40411197+01	•42971088+01	•37574219+01	•11187+01	•11317+01
•32717247+01	•29793908+01	•26268518+01	•23970036+01	•21100991+01	•18196536+01	•12618+01	•12748+01
•15967287+01	•12585865+01	•10351932+01	•88048381+00	•73702842+00	•53620134+00	•10515-03	•15429-03
•42345675+00	•36848995+00	•30449004+00	•22884685+00	•15896516+00	•10836193+00	•43046-01	•53840-01
•37211618-01	•22403964-01	•15288317-01	•10375381-01	•28590602-02	•00000000	•30026+00	•35190+00
•00000	•13008-01	•26016-01	•39023-01	•52031-01	•65039-01	•48129+00	•61137+00
•13008+00	•14309+00	•15609+00	•16910+00	•18211+00	•19512+00	•59836+00	•62437+00
•26016+00	•27316+00	•28617+00	•29918+00	•31219+00	•32519+00	•74144+00	•75445+00
•39023+00	•40324+00	•41625+00	•42926+00	•44226+00	•45527+00	•85851+00	•87152+00
•52031+00	•53332+00	•54633+00	•55933+00	•57234+00	•58535+00	•98859+00	•10016+01
•65039+00	•66340+00	•67640+00	•68941+00	•70242+00	•71543+00	•11187+01	•11317+01
•78047+00	•79347+00	•80648+00	•81947+00	•83250+00	•84551+00	•12487+01	•12618+01
•91054+00	•92355+00	•93656+00	•94957+00	•96258+00	•97558+00	•10515-03	•15429-03
•10406+01	•10536+01	•10666+01	•10796+01	•10927+01	•11057+01	•43046-01	•53840-01
•11707+01	•11837+01	•11967+01	•12097+01	•12227+01	•12357+01	•30026+00	•35190+00
•00000	•50340-05	•11024-04	•19045-04	•30424-04	•46891-04	•11034+01	•12140+01
•32141-03	•45700-03	•64379-03	•89893-03	•12445-02	•17089-02	•20823+01	•22394+01
•74297-02	•97506-02	•12706-01	•16442-01	•21129-01	•26968-01	•22879+01	•22238+01
•82567-01	•10124+00	•12334+00	•14927+00	•17950+00	•21445+00	•14197+01	•11936+01
•47417+00	•54521+00	•62292+00	•70724+00	•79791+00	•89456+00	•46668+00	•40373+00
•14222+01	•15573+01	•16711+01	•17821+01	•16887+01	•19893+01	•83249+01	•67754+01
•23495+01	•23843+01	•24048+01	•24105+01	•24013+01	•23775+01	•19225+05	•30666+05
•20624+01	•19679+01	•18663+01	•17591+01	•16479+01	•15343+01	•12803-03	•17595-03
•97912+00	•87870+00	•78378+00	•69484+00	•61224+00	•53617+00	•22294-02	•28596-02
•25199+00	•21274+00	•17850+00	•14887+00	•12340+00	•10166+00	•20406+01	•24647+01
•00000	•32741-07	•13718-06	•33274-06	•65448-06	•11573-05	•10498+00	•12006+00
•10760-04	•15822-04	•22982-04	•33015-04	•46956-04	•66165-04	•32077+00	•34943+00
•32484-03	•43657-03	•58263-03	•77221-03	•10166-02	•13294-02	•62560+00	•65495+00
•46169-02	•58124-02	•72730-02	•90460-02	•11184-01	•13747-01	•86529+00	•88155+00
•35350-01	•41980-01	•49578-01	•58229-01	•68018-01	•79026-01	•97079+00	•97479+00
•15460+00	•17411+00	•19510+00	•21756+00	•24144+00	•26666+00	•99620+00	•99700+00
•40920+00	•43999+00	•47114+00	•50245+00	•53375+00	•59551+00	•99522+00	•99700+00
•91077+00	•73698+00	•76192+00	•78550+00	•80766+00	•82835+00	•10119+01	•11305+01
•90778+00	•92186+00	•93268+00	•94229+00	•95079+00	•95826+00	•26983+01	•28670+01
•98309+00	•98611+00	•98865+00	•99078+00	•99255+00	•99402+00	•43848+01	•47221+01
•00000	•16865+00	•33729+00	•50594+00	•67458+00	•84323+00	•60712+01	•62399+01
•16865+01	•18551+01	•20237+01	•21924+01	•23610+01	•25297+01	•59026+01	•59534+01
•33729+01	•35415+01	•37102+01	•38786+01	•40475+01	•42161+01	•67178+01	•72043+01
•50594+01	•52280+01	•53966+01	•55653+01	•57339+01	•59026+01	•67178+01	•72043+01
						•60712+01	•62399+01
						•13492+01	•15178+01
						•28670+01	•30356+01
						•47221+01	•48907+01
						•64095+01	•65772+01

.67458+01	.69145+01	.70831+01	.72517+01	.74204+01	.75890+01	.77577+01	.79263+01	.80950+01	.82636+01
.84323+01	.86009+01	.87696+01	.89382+01	.91068+01	.92755+01	.94441+01	.96128+01	.97814+01	.99501+01
.10119+02	.10287+02	.10456+02	.10625+02	.10793+02	.10962+02	.11131+02	.11299+02	.11468+02	.11637+02
.11805+02	.11974+02	.12142+02	.12311+02	.12480+02	.12649+02	.12817+02	.12986+02	.13154+02	.13323+02
.13492+02	.13660+02	.13829+02	.13998+02	.14166+02	.14335+02	.14503+02	.14672+02	.14841+02	.15009+02
.15178+02	.15347+02	.15515+02	.15684+02	.15853+02	.16021+02	.16190+02	.16359+02	.16527+02	.16696+02
SFANS									
.00000	.13147-05	.28324-05	.47762-05	.74104-05	.11064-04	.16159-04	.23241-04	.33018-04	.46407-04
.64591-04	.89078-04	.12179-03	.16512-03	.22210-03	.29643-03	.39269-03	.51642-03	.67431-03	.87435-03
.11260-02	.14403-02	.18300-02	.23101-02	.28973-02	.36104-02	.44705-02	.55008-02	.67261-02	.81735-02
.98712-02	.11848-01	.14135-01	.16761-01	.19754-01	.23142-01	.26949-01	.31194-01	.35893-01	.41056-01
.46682-01	.52767-01	.59293-01	.66235-01	.73556-01	.81208-01	.89133-01	.97260-01	.10551+00	.11380+00
.12202+00	.13008+00	.13787+00	.14527+00	.15220+00	.15853+00	.16418+00	.16904+00	.17305+00	.17614+00
.17825+00	.17935+00	.17942+00	.17847+00	.17650+00	.17356+00	.16969+00	.16495+00	.15944+00	.15322+00
.14641+00	.13911+00	.13141+00	.12343+00	.11528+00	.10705+00	.98847-01	.90750-01	.82843-01	.75195-01
.67866-01	.60902-01	.54343-01	.48215-01	.42535-01	.37312-01	.32544-01	.28224-01	.24339-01	.20870-01
.17794-01	.15085-01	.12717-01	.10659-01	.88839-02	.73625-02	.60671-02	.49713-02	.40504-02	.32814-02
FANS									
.00000	.11086-06	.46056-06	.11021-05	.21298-05	.36876-05	.59831-05	.93054-05	.14049-04	.20747-04
.30106-04	.43064-04	.60845-04	.85038-04	.11769-03	.16141-03	.21952-03	.29618-03	.39659-03	.52717-03
.69585-03	.91224-03	.11880-02	.15371-02	.19762-02	.25250-02	.32064-02	.40472-02	.50782-02	.63345-02
.78561-02	.96076-02	.11879-01	.14484-01	.17563-01	.21180-01	.25404-01	.30308-01	.35963-01	.42452-01
.49850-01	.58236-01	.67685-01	.78270-01	.90058-01	.10311+00	.11747+00	.13319+00	.15029+00	.16878+00
.18846+00	.20922+00	.23251+00	.25639+00	.28147+00	.30767+00	.33489+00	.36298+00	.39183+00	.42127+00
.45116+00	.48131+00	.51156+00	.54174+00	.57167+00	.60119+00	.63014+00	.65835+00	.68571+00	.71207+00
.73734+00	.76141+00	.78422+00	.80571+00	.82584+00	.84459+00	.86195+00	.87794+00	.89258+00	.90590+00
.91796+00	.92882+00	.93854+00	.94719+00	.95484+00	.96157+00	.96746+00	.97259+00	.97702+00	.98083+00
.98409+00	.98687+00	.98921+00	.99118+00	.99283+00	.99420+00	.99533+00	.99626+00	.99702+00	.99764+00

OUTPUT IN DRAG DIRECTION

		D BAR		
51020-03	54297-02	11464-01	17338-01	29889-01
35866-01	48445-01	61024-01	74076-01	87165-01
10670-00	12624+00	13304+00	15284+00	15954+00
19265+00	21251+00	22583+00	23931+00	25926+00
29285+00	30665+00	32664+00	34664+00	36050+00
39350+00	42055+00	43468+00	46020+00	48169+00
52843+00	55474+00	56840+00	59413+00	62587+00
		M BAR		
83223636+01	78321390+01	73991826+01	70343105+01	65322191+01
57593901+01	53649443+01	49074141+01	44969960+01	40638079+01
33710908+01	30377091+01	27239190+01	24753862+01	21949421+01
16646297+01	15132357+01	13304406+01	12112042+01	10617940+01
79469907+00	66179135+00	50132600+00	41953816+00	34693388+00
18591678+00	16203777+00	13286111+00	98236755+01	64290638+01
20679403-02	11765391-02	57027562-03	21938974-02	75630627-03
		SIGMA(D)		
20899299-03	1445960-02	28286267-02	42341328-02	69830407-02
83796481-02	11141575-01	13907043-01	16656422-01	19410429-01
23548258-01	27689788-01	20666877-01	33209128-01	34588610-01
41495660-01	45641623-01	48405413-01	51169545-01	55319696-01
62238299-01	65008667-01	69161075-01	73314619-01	76091257-01
83015764-01	88568655-01	91366054-01	96896727-01	10111932+00
11093386+00	11657113+00	11952303+00	12527911+00	13247296+00
		SIGMA(M)		
18582775+01	17316846+01	16126520+01	15217962+01	13971001+01
12047630+01	11095204+01	10014561+01	90739144+00	81287419+00
66534569+00	59755802+00	53560606+00	48739968+00	43309129+00
33164564+00	30313976+00	26868213+00	24654307+00	21889133+00
16955294+00	13701389+00	11613878+00	10175948+00	87194941-01
55627074-01	48452924-01	40564731-01	31219069-01	23352383-01
72230246-02	43523335-02	29451163-02	18530528-02	48574931-03
		VARIANCE(D)		
43678071-07	20868575-05	80011292-05	17927881-04	48762857-04
70218503-04	12413469-03	19340586-03	27743639-03	37676474-03
55452046-03	76672438-03	84488335-03	11028462-02	11963719-02
17218899-02	20831578-02	23430840-02	26183224-02	30402688-02
38736059-02	42261269-02	47825443-02	53750334-02	57898794-02
68916171-02	78444420-02	83477558-02	93889758-02	10225118-01
12306322-01	13588829-01	14285754-01	15694856-01	17549086-01
		VARIANCE(M)		
34531951+01	29987317+01	26232727+01	23158635+01	19518886+01
14514539+01	12310355+01	10029143+01	82335923+00	66076446+00
44268489+00	35707559+00	28687385+00	23755845+00	18756806+00
10995883+00	91893714+01	72190089-01	60783487-01	47913414-01
28748198-01	18772807-01	13488216-01	10354992-01	76029578-02
30943714-02	23476859-02	16454975-02	97463030-03	54533378-03
52172085-04	18942807-04	87919145-05	34338046-05	23595240-06
		V		
28230165+03	28591349+03	28929258+03	29246824+03	29546454+03
3009569+03	30356152+03	30601108+03	30835489+03	31060204+03
31483729+03	31683859+03	31874993+03	32063622+03	32244186+03
32586677+03	32753286+03	32913207+03	33068713+03	33220049+03
33511099+03	33651214+03	33787965+03	33921513+03	34052013+03
34304425+03	34426590+03	34546217+03	34663414+03	34770281+03
				34890915+03
				29830144+03
				31276050+03
				32419086+03
				33367440+03
				34179607+03
				34890915+03
				29830144+03
				31276050+03
				32419086+03
				33367440+03
				34179607+03
				34890915+03

•35001400+03 •35109823+03 •35216262+03 •35320790+03 •35423478+03 •35524393+03

OUTPUT IN LIFT DIRECTION

	SIGMA (D)				
.32413243-03	.16587008-02	.31867240-02	.47579852-02	.77796266-02	.78126661-02
.93359547-02	.12379567-01	.15431219-01	.18449801-01	.21478311-01	.22995729-01
.26036443-01	.30602568-01	.32117656-01	.36686251-01	.38206633-01	.41255145-01
.45827819-01	.50403961-01	.53454239-01	.56505193-01	.61090294-01	.64151328-01
.68735083-01	.71798459-01	.76386349-01	.80976513-01	.84051746-01	.88656962-01
.91704148-01	.97853730-01	.10096878+00	.10707386+00	.11180131+00	.11496501+00
.12276452+00	.12909572+00	.13254608+00	.13914826+00	.14741130+00	.15429462+00
			SIGMA (M)		
.20567374+01	.19148758+01	.17898450+01	.16809065+01	.15431815+01	.14372621+01
.13324516+01	.12290252+01	.11124513+01	.10112533+01	.90892588+00	.83649825+00
.74963190+00	.67552697+00	.60686991+00	.55338046+00	.49387600+00	.43554486+00
.38330028+00	.35111839+00	.31316258+00	.28770228+00	.25732233+00	.22605706+00
.20257922+00	.16834221+00	.14553720+00	.12966010+00	.11289496+00	.91299980+01
.77079092-01	.66915109-01	.56295082-01	.43745621-01	.33815455-01	.22861247-01
.11732422-01	.70644554-02	.47956355-02	.31020380-02	.81623317-03	.00000000

VARIANCE (D)

.10506184-04	.27512883-05	.10155210-04	.22638424-04	.60527819-04	.61037754-04
.87160050-04	.15325368-03	.23812252-03	.34039514-03	.46131784-03	.52880355-03
.67289639-03	.93651717-03	.10315967-02	.13458810-02	.14597468-02	.17019870-02
.21001890-02	.25405592-02	.28573557-02	.31928369-02	.37320241-02	.41153930-02
.47245117-02	.51550187-02	.58348744-02	.65571957-02	.70646961-02	.78600568-02
.84096509-02	.95753527-02	.10194694-01	.11464812-01	.12499534-01	.13216954-01
.15071128-01	.16665704-01	.17568464-01	.19362239-01	.21730092-01	.23806830-01

VARIANCE (M)

.42301481+01	.36667494+01	.32035453+01	.28254465+01	.23814092+01	.20457224+01
.17754273+01	.15105029+01	.12375478+01	.10226332+01	.82614626+00	.69972933+00
.56194799+00	.45633669+00	.36829110+00	.30622993+00	.24391350+00	.18969932+00
.14691911+00	.12328412+00	.98070805-01	.82772604-01	.66214785-01	.51101795-01
.41038339-01	.28339099-01	.21181078-01	.16811742-01	.12745272-01	.83356864-02
.59411866-02	.44776318-02	.31676342-02	.19136793-02	.11434850-02	.52263660-03
.13764973-03	.49906531-04	.22928120-04	.96226401-05	.66623658-06	.00000000

V

.28230165+03	.28591349+03	.28929258+03	.29246824+03	.29546454+03	.29630144+03
.30099569+03	.30356152+03	.30601109+03	.30835489+03	.31060207+03	.31276050+03
.31463729+03	.31683859+03	.31876993+03	.32063622+03	.32244188+03	.32419086+03
.32588677+03	.32753285+03	.32913207+03	.33068713+03	.33220049+03	.33367440+03
.33511099+03	.33651214+03	.33787965+03	.33921513+03	.34052013+03	.34179607+03
.34304425+03	.34426590+03	.34546217+03	.34663414+03	.34778281+03	.34890915+03
.35001400+03	.35109823+03	.35216262+03	.35320790+03	.35423347+03	.35524393+03

RESULTANT RESPONSE

ABSD

.11774429-02	.97634871-02	.19950019-01	.30040415-01	.50837706-01	.50628643-01
.61005245-01	.81870105-01	.10274559+00	.14539650+00	.15607642+00	
.17734938+00	.20931336+00	.22024436+00	.25246561+00	.28484751+00	
.31714077+00	.34943917+00	.37104641+00	.39281524+00	.44719198+00	
.47956859+00	.50167725+00	.53412704+00	.56458024+00	.62157071+00	
.64254356+00	.68625923+00	.70877852+00	.75089273+00	.80671787+00	
.86122719+00	.90445708+00	.92696423+00	.96996764+00	.10664753+01	
ABSSH					
.13897196+02	.13027193+02	.12258139+02	.11599699+02	.10723519+02	.10038515+02
.93736790+01	.86935054+01	.79117824+01	.72191703+01	.65024304+01	.59898194+01
.53671278+01	.48303832+01	.43307372+01	.39375853+01	.34942159+01	.30543883+01
.26595666+01	.24226550+01	.21364870+01	.19508334+01	.17184680+01	.14833179+01
.13033579+01	.10289570+01	.84974234+00	.72481659+00	.60821870+00	.44489898+00
.35279800+00	.30739654+00	.25455530+00	.19189396+00	.13488129+00	.91930243-01
.35294957-01	.21245937-01	.14405192-01	.96998703-02	.26233170-02	.00000000

DINT

.00000	.10665-01	.21330-01	.31994-01	.42659-01	.53324-01	.63989-01	.74653-01	.85318-01	.95983-01
.10665+00	.11731+00	.12798+00	.13864+00	.14931+00	.15997+00	.17064+00	.18130+00	.19197+00	.20263+00
.21330+00	.22396+00	.23462+00	.24529+00	.25595+00	.26662+00	.27728+00	.28795+00	.29861+00	.30928+00
.31994+00	.33061+00	.34127+00	.35194+00	.36260+00	.37327+00	.38393+00	.39460+00	.40526+00	.41593+00
.42659+00	.43725+00	.44792+00	.45858+00	.46925+00	.47991+00	.49058+00	.50124+00	.51191+00	.52257+00
.53324+00	.54390+00	.55457+00	.56523+00	.57590+00	.58656+00	.59723+00	.60789+00	.61856+00	.62922+00
.63989+00	.65055+00	.66121+00	.67188+00	.68254+00	.69321+00	.70387+00	.71454+00	.72520+00	.73587+00
.74653+00	.75720+00	.76786+00	.77853+00	.78919+00	.79986+00	.81052+00	.82119+00	.83185+00	.84252+00
.85318+00	.86384+00	.87451+00	.88517+00	.89584+00	.90650+00	.91717+00	.92783+00	.93850+00	.94916+00
.95983+00	.97049+00	.98116+00	.99182+00	.10025+01	.10132+01	.10238+01	.10345+01	.10451+01	.10558+01

F

SFANS

.00000	.78959-05	.17225-04	.29592-04	.46957-04	.71852-04	.10763-03	.15877-03	.23129-03	.33319-03
.47510-03	.67095-03	.93893-03	.13025-02	.17919-02	.24451-02	.33104-02	.44478-02	.59315-02	.78525-02
.10321-01	.13470-01	.17457-01	.22470-01	.28725-01	.36475-01	.46007-01	.57648-01	.71759-01	.88742-01
.10903+00	.13310+00	.16145+00	.19457+00	.23301+00	.27727+00	.32785+00	.38523+00	.44922+00	.52195+00
.60188+00	.68973+00	.78550+00	.88903+00	.99999+00	.11179+01	.12419+01	.13713+01	.15049+01	.16413+01
.17792+01	.19168+01	.20525+01	.21844+01	.23107+01	.24293+01	.25366+01	.26366+01	.27218+01	.27928+01
.28492+01	.28871+01	.29089+01	.29132+01	.28998+01	.28690+01	.28215+01	.27580+01	.26798+01	.25880+01
.24844+01	.23705+01	.22483+01	.21196+01	.19862+01	.18500+01	.17129+01	.15763+01	.14420+01	.13112+01
.11851+01	.10548+01	.95088+00	.84409+00	.74482+00	.65328+00	.56957+00	.49361+00	.42523+00	.36412+00
.30994+00	.26224+00	.22056+00	.18439+00	.15324+00	.12658+00	.10394+00	.84843-01	.68839-01	.55521-01

FANS

.00000	.42104-07	.17606-06	.42570-06	.83389-06	.14674-05	.24245-05	.38450-05	.59249-05	.89349-05
.13245-04	.19356-04	.27941-04	.39893-04	.56393-04	.78987-04	.10968-03	.15105-03	.20639-03	.27990-03
.37680-03	.50367-03	.66858-03	.88149-03	.11545-02	.15022-02	.19420-02	.24947-02	.31847-02	.40406-02
.50952-02	.63864-02	.79570-02	.98555-02	.12135-01	.14856-01	.18083-01	.226338-01	.26338-01	.31520-01
.37513-01	.44400-01	.52267-01	.61196-01	.71269-01	.82562-01	.95145-01	.10908+00	.12442+00	.14119+00
.15943+00	.17914+00	.20031+00	.22290+00	.24687+00	.27215+00	.29864+00	.32623+00	.35481+00	.38421+00
.41429+00	.44487+00	.47578+00	.50683+00	.53782+00	.56858+00	.59899+00	.62868+00	.65768+00	.68577+00
.71241+00	.73870+00	.76333+00	.78662+00	.80852+00	.82897+00	.84797+00	.86551+00	.88161+00	.89629+00
.90960+00	.92159+00	.93234+00	.94191+00	.95039+00	.95784+00	.96436+00	.97003+00	.97493+00	.97914+00
.98274+00	.98579+00	.98836+00	.99052+00	.99232+00	.99381+00	.99504+00	.99605+00	.99687+00	.99753+00

DINT

.00000	.13897+00	.27794+00	.41692+00	.55589+00	.69486+00	.83383+00	.97280+00	.11118+01	.12507+01
.13897+01	.15287+01	.16677+01	.18066+01	.19456+01	.20846+01	.22236+01	.23625+01	.25015+01	.26405+01
.27794+01	.29184+01	.30574+01	.31964+01	.33353+01	.34743+01	.36133+01	.37522+01	.38912+01	.40302+01
.41692+01	.43081+01	.44471+01	.45861+01	.47250+01	.48640+01	.50030+01	.51420+01	.52809+01	.54199+01

.55589+01	.56979+01	.58368+01	.59758+01	.61148+01	.62537+01	.63927+01	.65317+01	.66707+01	.68096+01
.69406+01	.70876+01	.72265+01	.73655+01	.75045+01	.76435+01	.77824+01	.79214+01	.80604+01	.81993+01
.83383+01	.84773+01	.86163+01	.87552+01	.88942+01	.90332+01	.91721+01	.93111+01	.94501+01	.95891+01
.97280+01	.98670+01	.10006+02	.10145+02	.10284+02	.10423+02	.10562+02	.10701+02	.10840+02	.10979+02
.11118+02	.11257+02	.11396+02	.11535+02	.11674+02	.11813+02	.11952+02	.12091+02	.12230+02	.12369+02
.12507+02	.12646+02	.12785+02	.12924+02	.13063+02	.13202+02	.13341+02	.13480+02	.13619+02	.13758+02
SFANS									
.0000	.16453-05	.35421-05	.59666-05	.92453-05	.13784-04	.20102-04	.28870-04	.40957-04	.57486-04
.79902-04	.11005-03	.15027-03	.20349-03	.27338-03	.36446-03	.48226-03	.63353-03	.82636-03	.10704-02
.13771-02	.17598-02	.22341-02	.28176-02	.35308-02	.43963-02	.54394-02	.66879-02	.81720-02	.99237-02
.11977-01	.14368-01	.17130-01	.20301-01	.23915-01	.28003-01	.32595-01	.37715-01	.43380-01	.49602-01
.56383-01	.63715-01	.71578-01	.79942-01	.88762-01	.97983-01	.10753+00	.11733+00	.12728+00	.13727+00
.14720+00	.15693+00	.16634+00	.17530+00	.18369+00	.19137+00	.19823+00	.20417+00	.20907+00	.21287+00
.21551+00	.21693+00	.21711+00	.21606+00	.21379+00	.21034+00	.20577+00	.20015+00	.19358+00	.18617+00
.17802+00	.16926+00	.16003+00	.15044+00	.14062+00	.13070+00	.12050+00	.11101+00	.10144+00	.92170-01
.83275-01	.74814-01	.66833-01	.59367-01	.52437-01	.46055-01	.40222-01	.34929-01	.30162-01	.25899-01
.22114-01	.18775-01	.15851-01	.13306-01	.11108-01	.92204-02	.76106-02	.62466-02	.50982-02	.41375-02
FANS									
.0000	.11433-06	.47478-06	.11355-05	.21925-05	.37926-05	.61474-05	.95503-05	.14402-04	.21243-04
.30789-04	.43988-04	.62077-04	.86658-04	.11979-03	.16411-03	.22295-03	.30048-03	.40192-03	.53372-03
.70379-03	.92176-03	.11993-02	.15503-02	.19914-02	.25422-02	.32257-02	.40684-02	.51009-02	.63583-02
.78601-02	.97107-02	.11899-01	.14500-01	.17573-01	.21180-01	.25391-01	.30277-01	.35912-01	.42373-01
.49237-01	.58082-01	.67483-01	.78012-01	.89734-01	.10271+00	.11699+00	.13262+00	.14961+00	.16800+00
.18776+00	.20889+00	.23136+00	.25510+00	.28004+00	.30610+00	.33318+00	.36114+00	.38985+00	.41917+00
.44894+00	.47898+00	.50914+00	.53924+00	.56911+00	.59858+00	.62750+00	.65570+00	.68306+00	.70945+00
.73475+00	.75888+00	.78177+00	.80334+00	.82356+00	.84242+00	.85989+00	.87600+00	.89076+00	.90421+00
.91641+00	.92739+00	.93723+00	.94600+00	.95377+00	.96061+00	.96661+00	.97183+00	.97635+00	.98025+00
.98359+00	.98643+00	.98883+00	.99086+00	.99256+00	.99397+00	.99514+00	.99610+00	.99689+00	.99753+00

GFIN

RUNID: GRWWD ACCOUNT: 401240 PROJECT: COFFINBIN223

I-TAPE NEEDED FOR SC4020. TYPE GO WHEN DRIVE AVAILAB

I GO

LOAD SC4020 18/10 112470176160-1 2260

I-REMOVE TAPE SC4020 AND SAVE. TYPE GO WHEN FINISHED

I GO

TIME: 00:03:48.157 IN: 617 OUT: 0 PAGES: 35

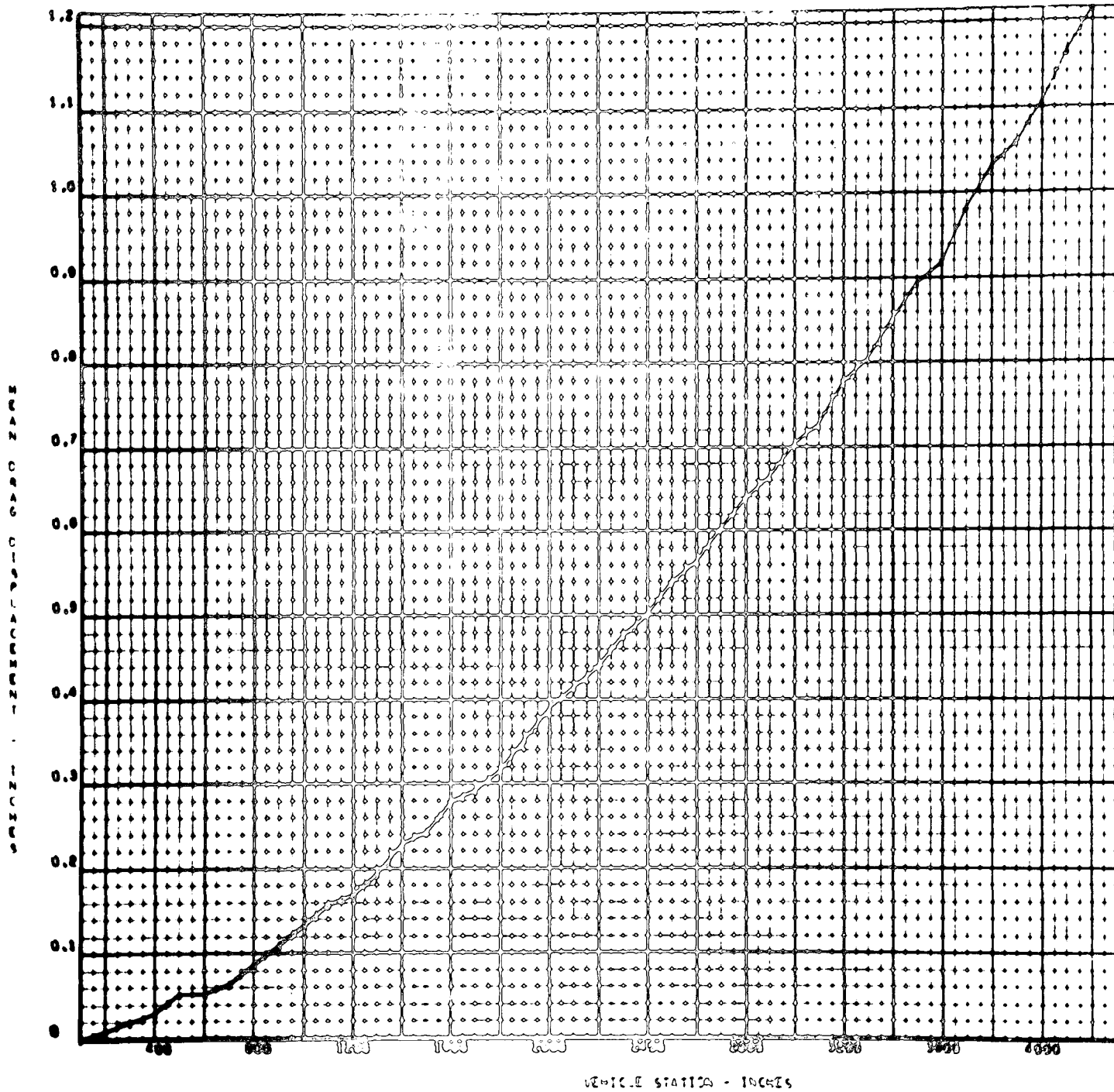
INITIATION TIME: 10:34:37-NOV 24,1970

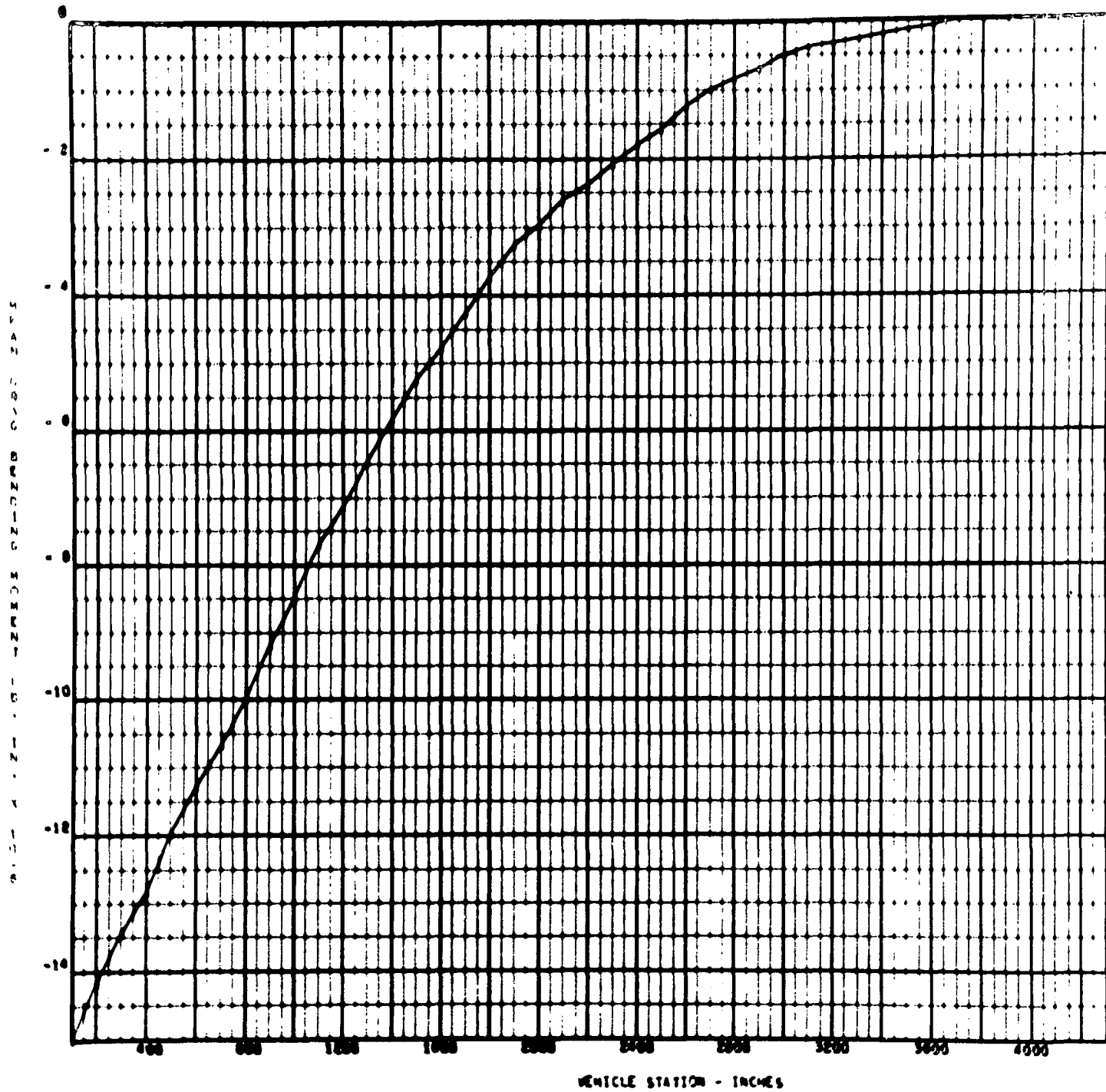
TERMINATION TIME: 10:43:22-NOV 24,1970

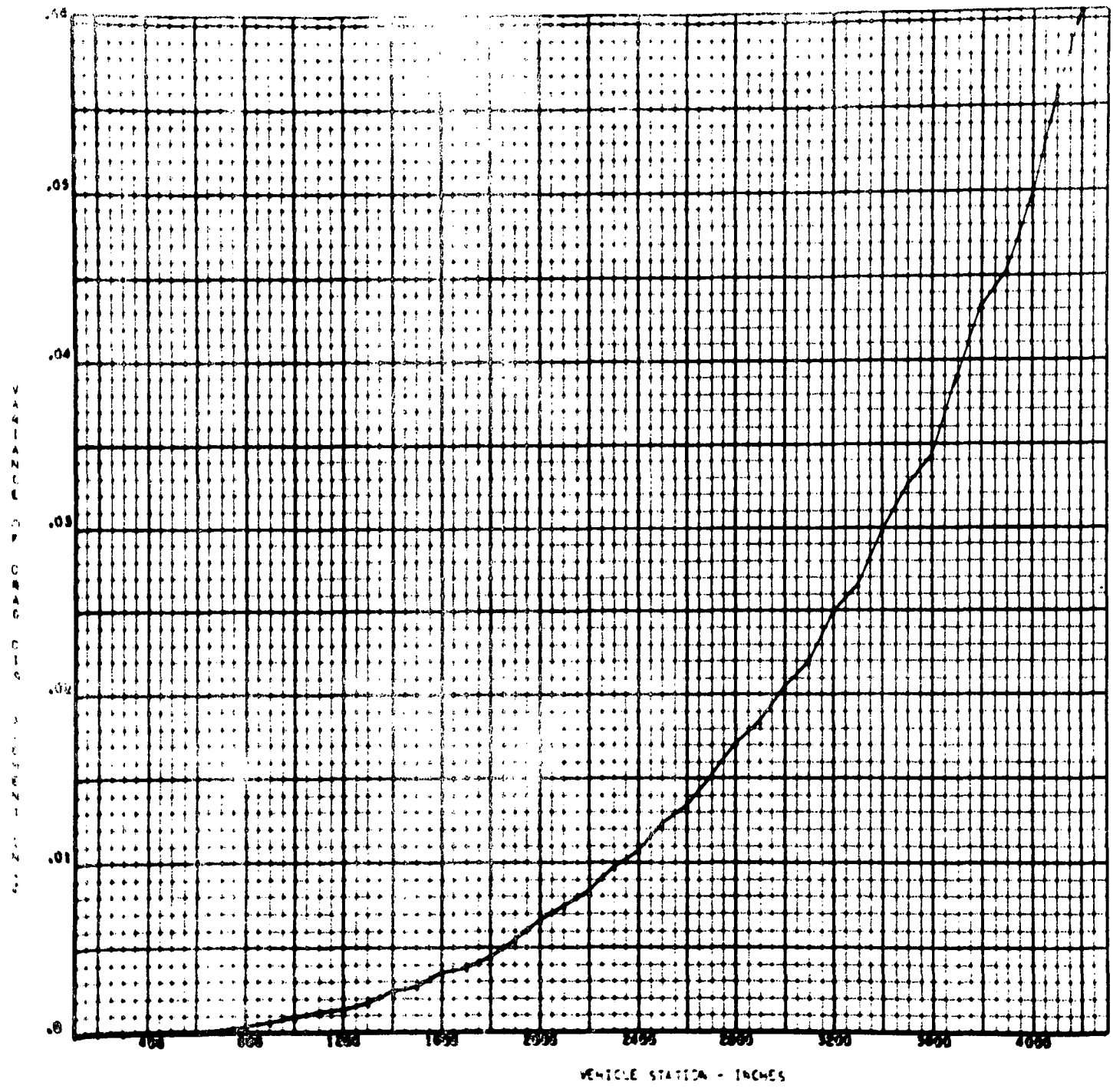
SECTION 7

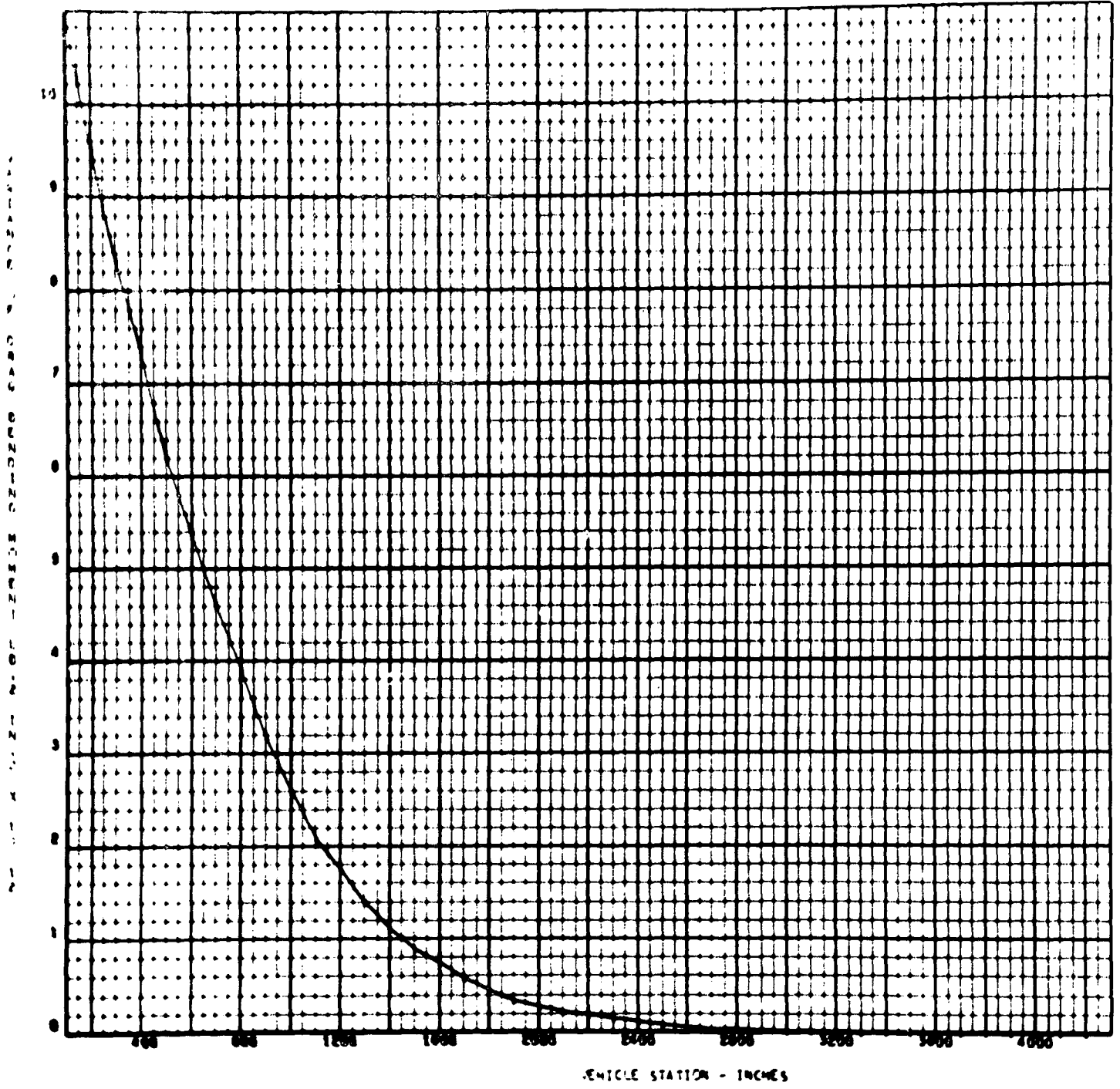
PLOTTED RESULTS

A series of 12 response quantities are plotted for each case, yielding 48 figures. Since results for the four cases are printed in Section 6, only the first case is illustrated.

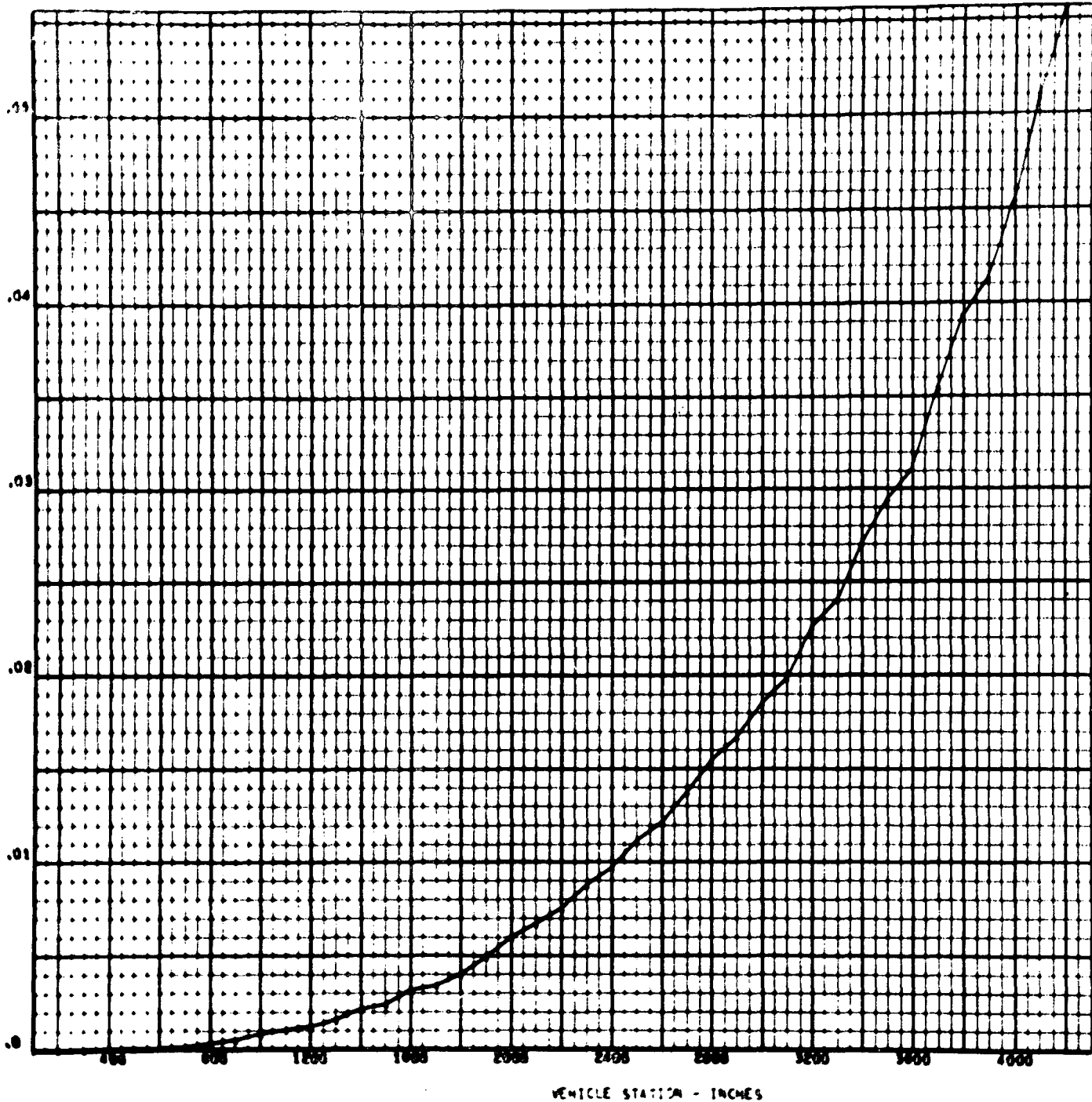


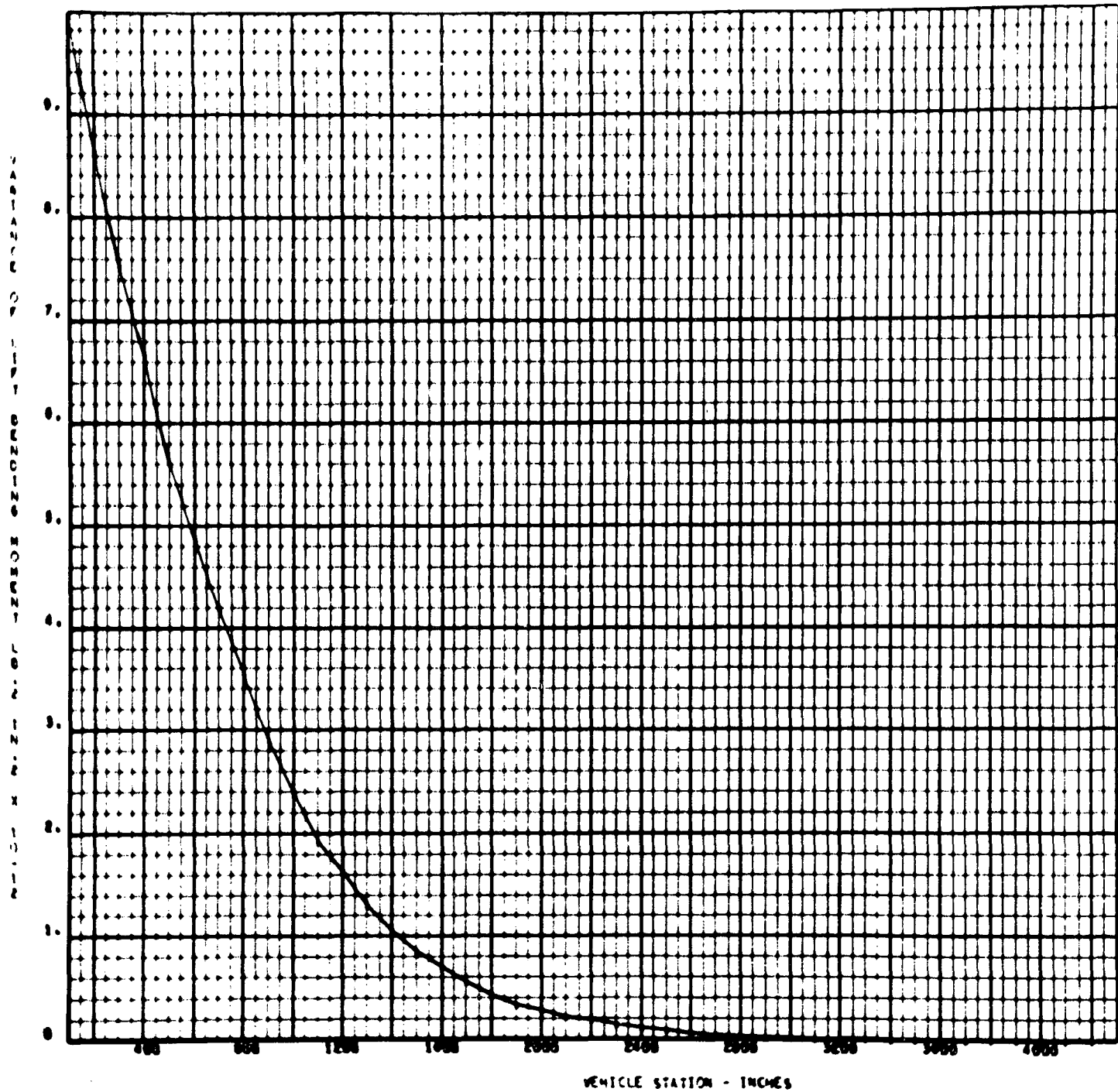


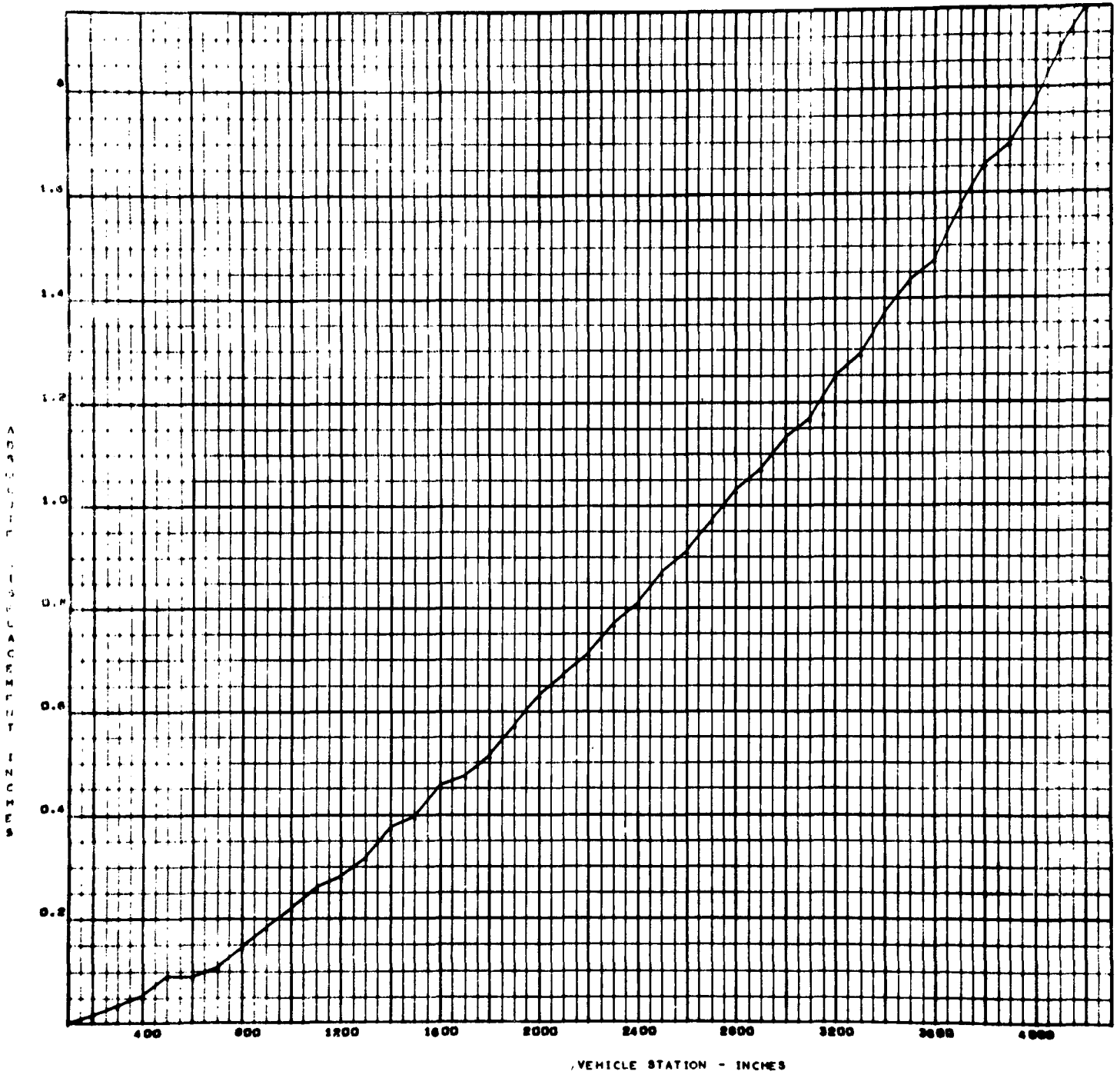


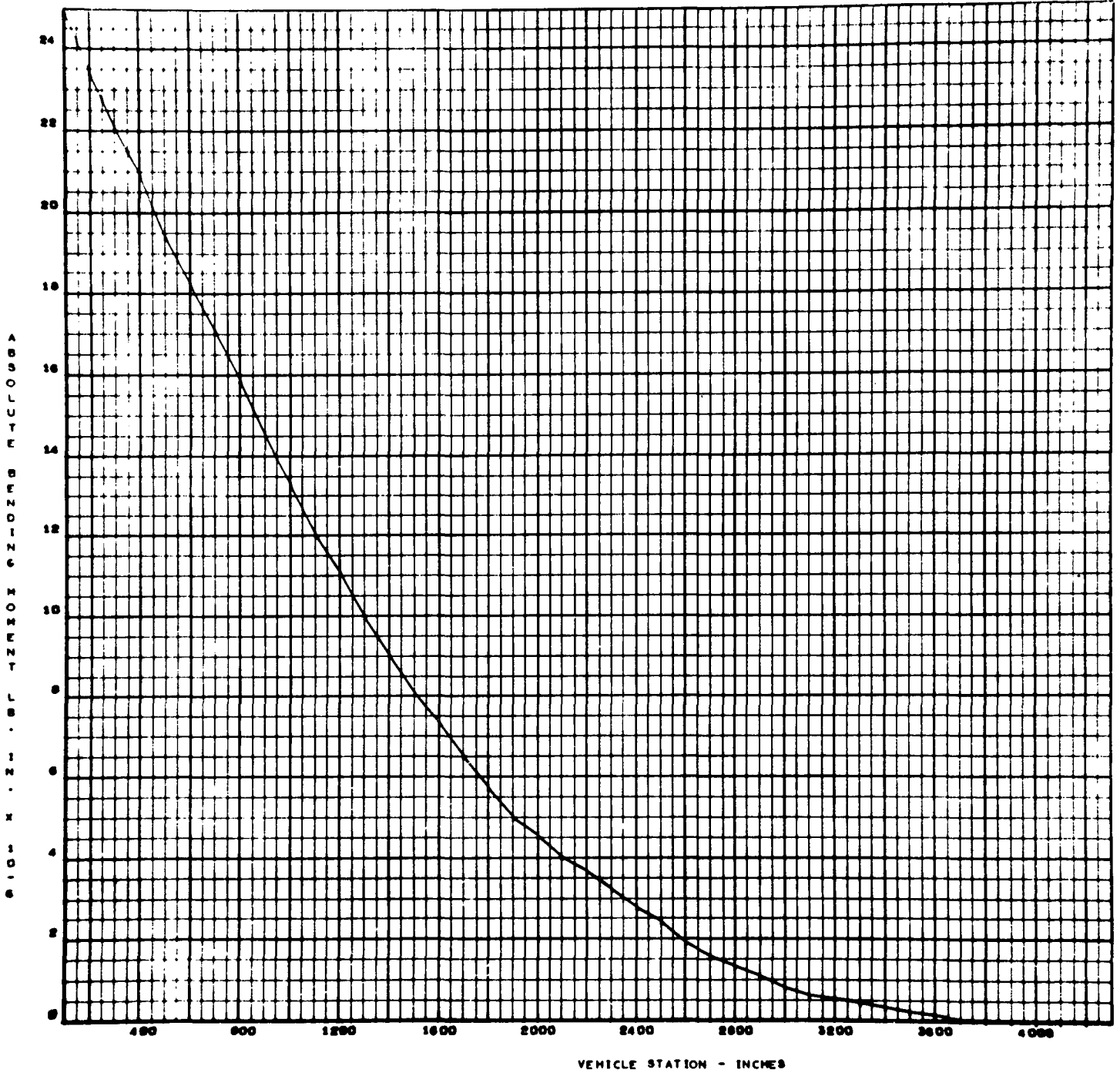


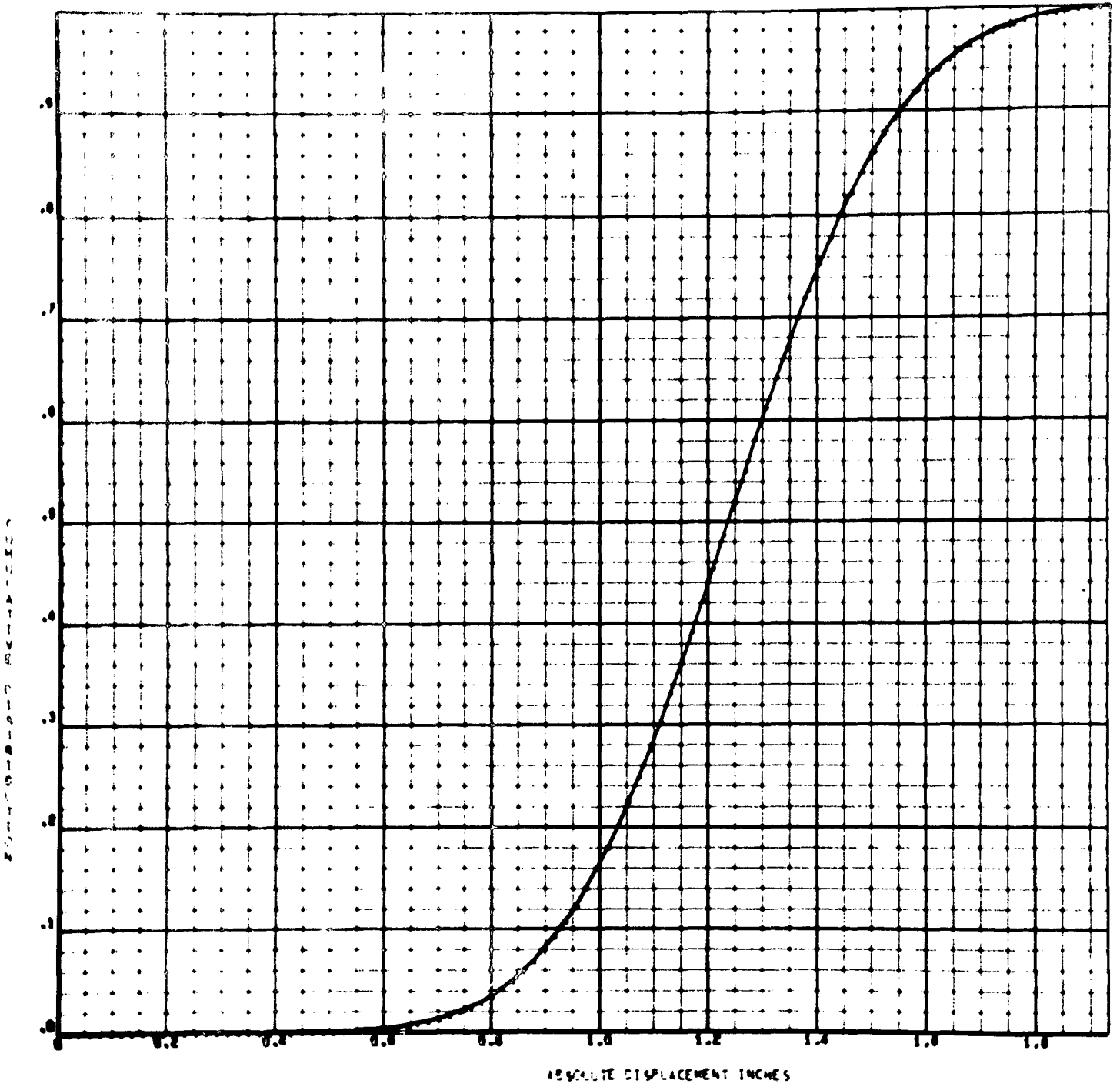
VEHICLE STATION - INCHES

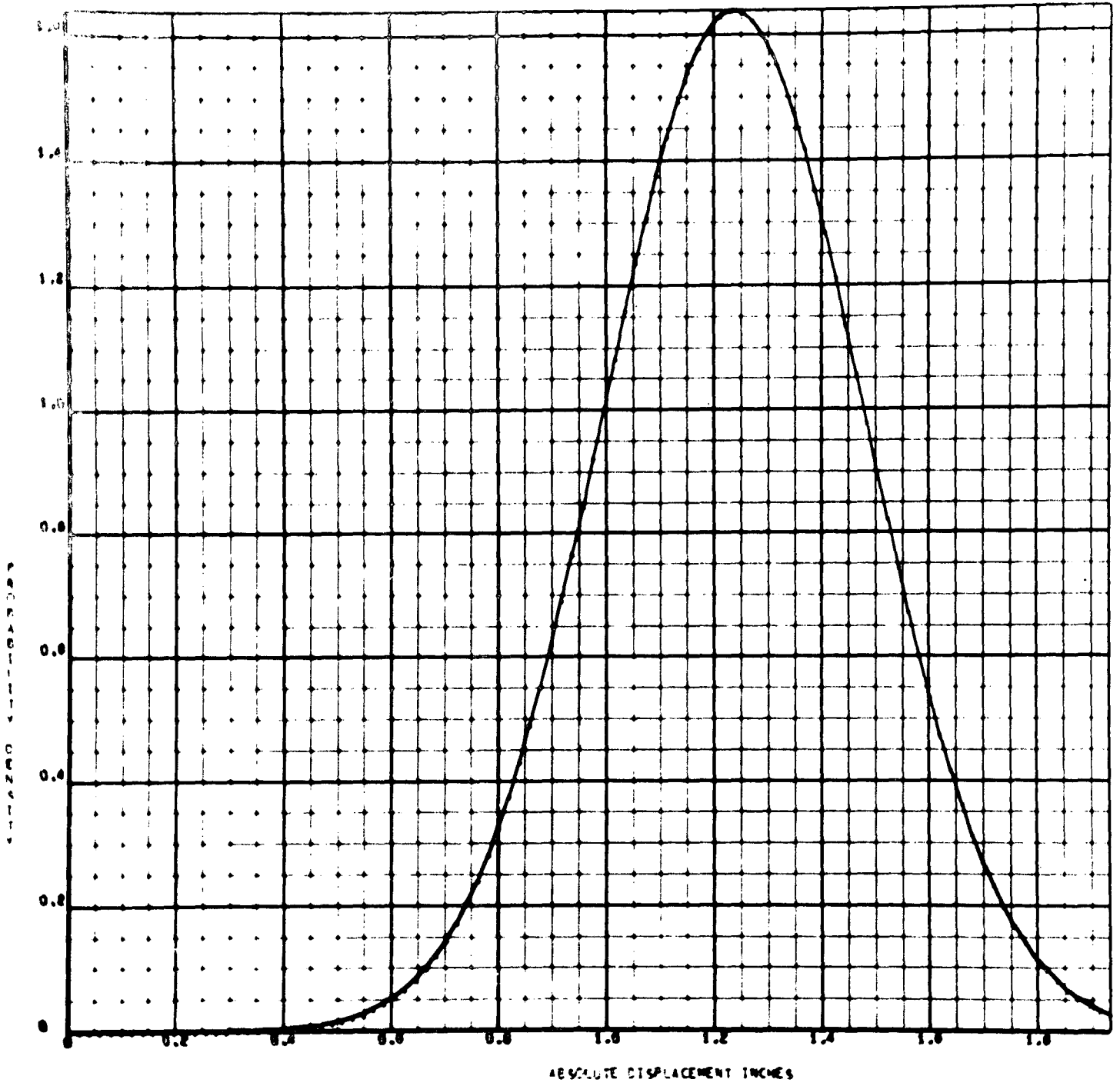


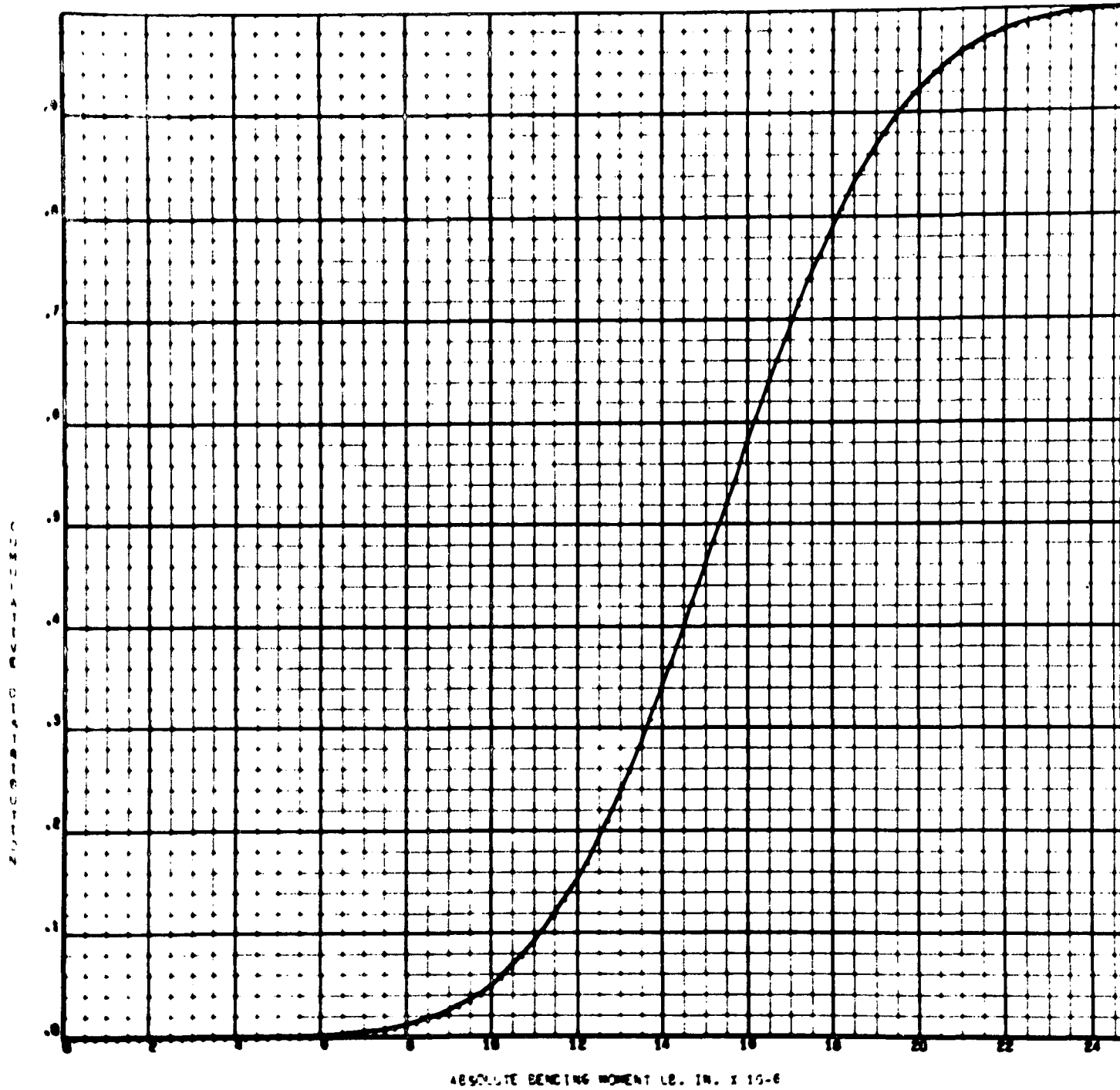


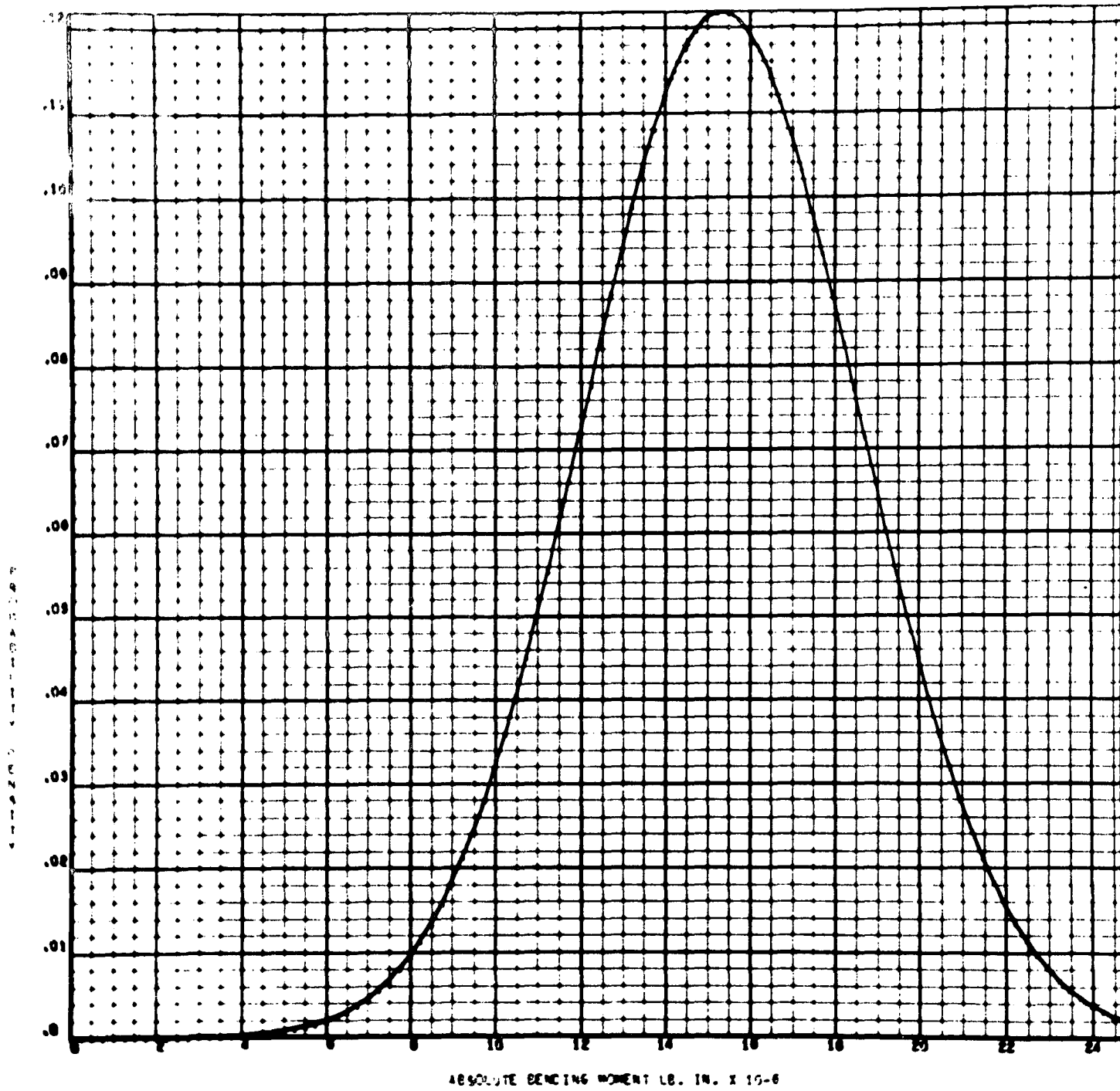












SECTION 8
COMPUTER LISTING

C
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SATURN 5 RESPONSE TO PRE-LAUNCH WIND LOADS
VEHICLE SA-503
FULLY FUELED CONDITION

DIMENSION ABSD(42),ABSM(42)
DIMENSION H(42),W(42),V(42),V2(42),FM(42),BETA(42),D(42),
\$X(42),CD(42),C2(42),CDV(42),CEV2(42),XNUN(4),XMN(4),
\$BETAN(4),PSI(42,4),PSI2(4,42),C0N5(4,42),C0N6(4,42),
\$TAB1(42),TAB2(42),SUM1(4),SUM2(4),C0N1(4),
\$C0N3(4),XNU(100),S(42),PHI(42,42),PHIY(100),
\$ARRAY(42),DB(42),SIGCZ(42),SIGDY(42),SIGMZ(42),SIGMY(42),
\$XNU2(100),SUM3(100,4),FF(42),CDINT(2),DINT(150)
DIMENSION CDVS(42),C4(42),SUM4(100,4),F103(42)
DIMENSION C0N7(4,42),XM(42,4),XMB(42),
\$C0N8(4,42),PHIM(100),XM2(4,42),SFANS(150),FANS(150),
\$SIDE9(12),B0TTP(12,2),IPTM(10),IPTD(10)
DIMENSION SIDE10(12)
DIMENSION ACARY(6),VARC(42),VARM(42),B0TT(12),SIDE1(12),SIDE2(12),
\$SIDE3(12),SIDE4(12),SIDE5(12),SIDE6(12),SIDE7(12),SIDE8(12)
DIMENSION B0TF(12),B0TFP(12)
DIMENSION SIGMS(42),SBARM(42),SIGCS(42),SBARD(42)
EQUIVALENCE (B0TTP(1,2),B0TFP)
EQUIVALENCE (B0TTP(1,1),B0TF)
DATA ACARY/36H 401240 BIN 223 T CHANDLER APR 70/
DATA SIDE1/3*6H ,36+MEAN DRAG DISPLACEMENT - INCHES ,
\$3*6H /
DATA SIDE2/2*6H ,42+MEAN DRAG BENDING M0MENT LB. IN. X 10-6
\$,3*6H /
DATA SIDE3/3*6H ,36+VARIANCE 0F DRAG DISPLACEMENT IN.2 ,
\$3*6H /
DATA SIDE4/3*6H ,36+VARIANCE 0F LIFT DISPLACEMENT IN.2 ,
\$3*6H /
DATA SIDE5/6H ,54+VARIANCE 0F DRAG BENDING M0MENT LB.2 IN.2 X
\$ 10-12 ,2*6H /
DATA SIDE6/6H ,54+VARIANCE 0F LIFT BENDING M0MENT LB.2 IN.2 X
\$ 10-12 ,2*6H /
DATA SIDE7/3*6H ,30+ABS0LUTE DISPLACEMENT INCHES ,4*6H
\$/
DATA SIDE8/3*6H ,42+ABS0LUTE BENDING M0MENT LB. IN. X 10-6
\$,2*6H /
DATA SIDE9/4*6H ,30+ CUMULATIVE DISTRIBUTION ,3*6H
\$/
DATA SIDE10/5*6H ,24+PR0BABILITY DENSITY ,3*6H /
DATA B0TT/4*6H ,24+VEHICLE STATION - INCHES ,4*6H /
DATA B0TF/4*6H ,30+ABS0LUTE DISPLACEMENT INCHES ,3*6H /
DATA B0TFP/2*6H ,42+ABS0LUTE BENDING M0MENT LB. IN. X 10-6
\$,3*6H /

STANT=1.

WRITE(6,6051)

6051 F0RMPAT(1H1,4X42HSATURN 5 RESPONSE TO PRE-LAUNCH WIND LOADS//)

WRITE(6,6061)

6061 F0RMPAT(4X19+DEFINITION 0F INPUT//)

WRITE(6,6001)

6001 F0RMPAT(4X25HN = NUMBER 0F M0DES)

WRITE(6,6006)

6006 F0RMPAT(4X53HNIPM = NUMBER 0F P0INTS AT WHICH JOINT PR0BABILITY,
11 X19HIS DESIRED (M0MENT))

WRITE(6,6025)

6025 F0RMPAT(4X53HNIPC = NUMBER 0F P0INTS AT WHICH JOINT PR0BABILITY,
11X25HIS DESIRED (DISPLACEMENT))

```

WRITE(6,6008)
6008 FORMAT(4X46HIPTM = POINTS AT WHICH JOINT PROBABILITY IS,
11 X16HDESIREC (MOMENT))
WRITE(6,6009)
6009 FORMAT(4X46HIPTC = POINTS AT WHICH JOINT PROBABILITY IS,
11 X22HDESIREC (DISPLACEMENT))
WRITE(6,6010)
6010 FORMAT(4X37HC = AVERAGE DIAMETER OF VEHICLE,
11X13HSEGMENTS--IN.)
WRITE(6,6033)
6033 FORMAT(4X47HXK = CONSTANT DEFINING WIND SPEED GRADIENT)
WRITE(6,6020)
6020 FORMAT(4X52HXLAM = PEAK WIND SPEED AT 18.3 METER LEVEL--M/SEC)
WRITE(6,6021)
6021 FORMAT(4X42HXNUN = UNDAMPED NATURAL FREQUENCIES--HZ)
WRITE(6,6022)
6022 FORMAT(4X43HXMN = GENERALIZED MASSES--LB*SEC**2/IN.)
WRITE(6,6023)
6023 FORMAT(4X35HBETAN = STRUCTURAL DAMPING RATIOS)
WRITE(6,6024)
6024 FORMAT(4X43HPSI = DISPLACEMENT MODE VECTOR--IN./IN.)
WRITE(6,6030)
6030 FORMAT(4X50HXM = BENDING MOMENT MODE VECTOR--(LB*IN./IN.),
14H*E-6)
WRITE(6,6026)
6026 FORMAT(4X43HSIGMS = STANDARD DEVIATION OF LIFT MOMENT,
11X34HDUE TO VORTEX SHECCING--LB*IN.*E-6)
WRITE(6,6027)
6027 FORMAT(4X49HSBARM = MEAN LIFT MOMENT DUE TO VORTEX SHECCING,
11X12H--LB*IN.*E-6)
WRITE(6,6028)
6028 FORMAT(4X49HSIGDS = STANDARD DEVIATION OF LIFT DISPLACEMENT,
11X27HDUE TO VORTEX SHECCING--IN.)
WRITE(6,6029)
6029 FORMAT(4X39HSBARC = MEAN LIFT DISPLACEMENT DUE TO,
11X20HVORTEX SHECCING--IN.)
N0CE = 42
NFREQ = 85
XR = 3.
NPD = 100
DTHETA= .62831853E-1
RH0 = .11470000E-6
X1 = 100.
DX = 100.
FREQ1 = .052
DFREQ = .017
3000 FORMAT(1H1,17H N NIPM NIPD/315,
1//4X,6HIPTM =,(8I15))
3001 FORMAT(/8X2HXK,14X,4HXLAM/2E16.8)
3002 FORMAT(/23X,4HXNUN/5E16.8)
3003 FORMAT(/23X,3HXMN/5E16.8)
3004 FORMAT(/23X,5HBETAN/5E16.8)
3005 FORMAT(/50X,1HD/(6E16.8))
3006 FORMAT(/50X,3HPSI/(6E16.8))
3007 FORMAT(/50X,2HXM/(6E16.8))
3008 FORMAT(/4X,6HIPTC =,(8I15))
3009 FORMAT(3X,7HSIGMS =,(8E15.7))
3010 FORMAT(3X,7HSBARM =,(8E15.7))
3011 FORMAT(3X,7HSIGDS =,(8E15.7))
3012 FORMAT(3X,7HSBARC =,(8E15.7))
CALL IDENT(ACARY,9)

```

```

NAMELIST/NAM1/N,
$IFLAG,XK,
$,SIGMS,SBARM,SIGCS,SBARC
4 READ(5,NAM1)
C IFLAG=1 Y DIRECTION, IFLAG=2 Z DIRECTION, IFLAG=3 BOTH DIRECTIONS
C IFLAG=0, LAST CASE
IBOTH =
1 IF (IBOTH) 3,3,500
3 IF (IFLAG) 813,813,2
2 CONTINUE
WRITE(6,3000) N, NIPM,NIPD,
$ (IPTM(I),I=1,NIPM)
WRITE(6,3009) (SIGMS(I),I=1,NIPM)
WRITE(6,3010) (SBARM(I),I=1,NIPM)
WRITE(6,3008) (IPTC(I),I=1,NIPD)
WRITE(6,3011) (SIGCS(I),I=1,NIPD)
WRITE(6,3012) (SBARC(I),I=1,NIPD)
WRITE(6,3001) XK, XLAM
WRITE(6,3002) (XNUN(I),I=1,N)
WRITE(6,3003) (XMN(I),I=1,N)
WRITE(6,3004) (BETAN(I),I=1,N)
WRITE(6,3005) (C(I),I=1,N0CE)
D0 6 I=1,N
WRITE(6,3006) (PSI(J,I),J=1,N0CE)
6 WRITE(6,3007) (XM(J,I),J=1,N0CE)
X2=X1+N0CE*CX
FREQ11=FREQ1-CFREQ
D0 10 I=1,NFREQ
XI=I
XNL(I)=FREQ11+XI*CFREQ
10 XNL2(I)=XNU(I)**2
N1=N0CE-1
DX2=DX*CX
PI=3.14159265
PI22=PI**2
P1=4.0*PI22
P2=2.0*PI
P3=PI/4.0
P4=RH0*PI/4.0
NPT=(PI/DTHETA)+1.00001
RH02=RH0*RH0
P6=RH0/(8.0*PI22)
ELAM=EXP(-0.2*XLAM)
P=0.283-0.435*ELAM
G0=1.98-1.887*ELAM
W183=XLAM/(1.0+1.0/G0)
X11=X1-DX
D0 50 I=1,N0CE
XI=I
X(I)=X11+XI*CX
H(I)=0.025*X(I)+28.956
H183(I)=H(I)/18.3
W(I)=XLAM*H183(I)**XK/(1.0+(18.2/H(I))**P/G0)
V(I)=39.27*W(I)
V2(I)=V(I)*V(I)
R=44.2321*V(I)*C(I)
IF (R-2.8E5) 20,20,25
20 CD(I)=1.0
G0 T0 46
25 IF (R-5.0E5) 30,30,35
30 CD(I)=3.155*(5.7624-AL2G10(R)) 62

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```

02 T2 46
35 IF (F-3. E6) 4.,45,45
40 CD(I)=0.514*(ALOG10(R)-5.3099)
02 T3 46
45 CD(I)=0.6
46 CONTINUE
D2(I)=C(I)*C(I)
D4(I)=D2(I)*C2(I)
CDV(I)=CD(I)*C(I)*V(I)
CDVS(I)=CDV(I)**2
CDV2(I)=CDV(I)*V(I)
50 CONTINUE
D2 70 I=1,N
C2N=P6/(XNUN(I)**2*XMN(I))
D2 60 K=1,N2CE
PSI2(I,K)=PSI(K,I)**2
XM2(I,K)=XM(K,I)**2
TAB1(K)=D2(K)*PSI2(I,K)
TAB2(K)=CDV(K)*PSI2(I,K)
C2N5(I,K)=RH22*PSI2(I,K)
C2N6(I,K)=C2N*PSI(K,I)
C2N7(I,K)=C2N*XM(K,I)
C2N8(I,K)=RH22*XM2(I,K)
60 CONTINUE
CALL INTGRA(TAB1,N2CE,DX,SUM1(I))
CALL INTGRA(TAB2,N2CE,DX,SUM2(I))
70 CONTINUE
D2 80 I=1,N
C2N1(I)=(P1*XNUN(I)**2*(XMN(I)+P4*SUM1(I)))**2
80 CONTINUE
IF(IFLAG-2) 85,90,85
85 C1=6.198
C2=1.845
C3=0.03
C4=1.1
C5=-1.63
C6=0.3886
DF5=0.036
GAM1=0.7
GAM2=0.3
P5=RH22/(4.)*PI)
IF(STANT-1.) 197,198,197
198 WRITE(6,6052)
6052 FORMAT(1H1,4X2)HDEFINITION OF OUTPUT//)
WRITE(6,6035)
6035 FORMAT(4X40H)H BAR = MEAN DRAG DISPLACEMENT--IN.)
WRITE(6,6036)
6036 FORMAT(4X49H)H BAR = MEAN DRAG BENDING MOMENT--LB*IN.*E-6)
WRITE(6,6037)
6037 FORMAT(4X52H)HSIGMA(D) = STANDARD DEVIATION OF DISPLACEMENT--IN.)
WRITE(6,6038)
6038 FORMAT(4X49H)HSIGMA(M) = STANDARD DEVIATION OF BENDING MOMENT,
11X12H--LE*IN.*E-6)
WRITE(6,6039)
6039 FORMAT(4X45H)VARIANCE(D)= VARIANCE OF DISPLACEMENT--IN.**2)
WRITE(6,6041)
6041 FORMAT(4X39H)VARIANCE(M)= VARIANCE OF BENDING MOMENT,
11X18H--(LB*IN.)**2*E-12)
WRITE(6,6043)
6043 FORMAT(4X32H)V = WIND SPEED--IN./SEC)
WRITE(6,6049)

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```

6049 F0RMA7(4X50HABSC      = MAX. ABSOLUTE DISPLACEMENT ASSOCIATED,
      11X40HWITF 3 SIGMA LIFT AND DRAG RESPONSE--IN.)
      WRITE(6,6050)
6050 F0RMA7(4X52HABSM      = MAX. ABSOLUTE BENDING M0MENT ASSOCIATED,
      11X47HWITF 3 SIGMA LIFT AND DRAG RESPONSE--LB*IN.*E-6)
      WRITE(6,6044)
6044 F0RMA7(4X53HCINT      = ABSOLUTE DISPLACEMENT( BENDING M0MENT ),
      11X17H--IN.(LB*IN.*E-6))
      WRITE(6,6046)
6046 F0RMA7(4X44HSFANS      = PR0EABILITY DENSITY 0F ABSOLUTE,
      11X28HDISPLACEMENT(BENDING M0MENT))
      WRITE(6,6047)
6047 F0RMA7(4X48HFANS      = CUMULATIVE DISTRIBUTI0N 0F ABSOLUTE,
      11X28HDISPLACEMENT(BENDING M0MENT))
197 C0NTINUE
      STANT=STANT+1.
      WRITE(6 ,2010)
2010 F0RMA7(1F1,25H 0UTPUT IN DRAG DIRECTI0N)
      02 T0 95
      90 C1=3.954
          C2=0.512
          C3=0.1
          C4=0.58
          C5=-0.35
          C6=0.0886
          DF5=0.045
          GAM1=1.4
          GAM2=0.5
          P5=RH0/(8.0*PI)
          WRITE(6 ,2011)
2011 F0RMA7(1F1,25H 0UTPUT IN LIFT DIRECTI0N)
      95 00 97 I=1,N
          C0N3(I)=(XMN(I)/(XMN(I)+P4*SUM1(I)))*
          S(BETAN(I)+(P5/(XNUN(I)*XMN(I)))*SUM2(I))*2
      97 C0NTINUE
          U=C6*W183
          U2=U*U
          C215=1.5*C2
          C253=5.0/(3.0*C2)
          UC=U2*C1
          02 96 I=1,N0DE
          FM(I)=C3*H183(I)**C4
          BETA(I)=H183(I)**C5
          FF(I)=H(I)/(W(I)*FM(I))
      96 C0NTINUE
          02 120 J=1,NFREC
          P8=XNU(J)*P3
          P9=P8*P8
          02 100 I=1,N0DE
          FFM=XNU(J)*FF(I)
          S(I)=BETA(I)*UC*FFM/(XNU(J)*(1.0+C215*FFM**C2)**C253)
100 C0NTINUE
          02 110 I1=1,N0DE
          02 110 I2=I1,N0DE
          DF=ABS(XNU(J)*H(I2)/W(I2)-XNU(J)*H(I1)/W(I1))
          EXP0=EXP(-0.3465*DF/DF5)
          IF((H(I1)+H(I2))/2.0-100) 102,102,103
102 GAM=GAM1
          02 T0 104
103 GAM=GAM2
104 PHI(I1,I2)=(SCRT(S(I1)*S(I2))*EXP0)

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SCDS(P2*GAM*CF))*1550.0
110 CONTINUE
D2 120 K=1,N
SUM3(J,K)=0.0
D2 115 I=1,N0DE
SUM3(J,K)=SUM3(J,K)+(CCVS(I)+P9*D4(I))*PHI(-I,I)*PSI2(K,I)
115 CONTINUE
SUM4(J,K)=0.0
IF(IFLAG-2) 119,116,119
116 D2 117 I=1,N1
I1=I+1
D2 117 L=I1,N0DE
SUM4(J,K)=SUM4(J,K)+(CCV(I)*CCV(L)/4.0+P9*D2(I)*D2(L))*PHI(I,L)
S*PSI(I,K)*PSI(L,K)
117 CONTINUE
G2 T2 121
119 D2 118 I=1,N1
I1=I+1
D2 118 L=I1,N0DE
SUM4(J,K)=SUM4(J,K)+(CCV(I)*CCV(L)+P9*D2(I)*D2(L))*PHI(I,L)
S*PSI(I,K)*PSI(L,K)
118 CONTINUE
121 CONTINUE
SUM3(J,K)=DX2*(SUM3(J,K)+2.0*SUM4(J,K))
120 CONTINUE
D2 250 L=1,N0DE
D2 200 J=1,NFREQ
PHIM(J)=0.0
PHIY(J)=0.0
D2 140 K=1,N
C2NST= (SUM3(J,K)/(C2N1(K))*((1.0-(XNU(J)/
SXNLN(K))*2)*2+C2N3(K)*4.0*(XNU(J)/XNUN(K))*2)))
PHIM(J)=FHIM(J)+C2N8(K,L)*C2NST
PHIY(J)=FHIY(J)+C2N5(K,L)*C2NST
140 CONTINUE
200 CONTINUE
CALL INTGRA(PHIM,NFREQ,CFREQ,VARM(L))
CALL INTGRA(PHIY,NFREQ,CFREQ,VARC(L))
250 CONTINUE
IF(IFLAG-2)360,380,360
360 D2 350 I=1,N0DE
SIGDY(I)=SCRT(VARC(I))
SIGMY(I)=SCRT(VARM(I))
DB(I)=0.0
XMB(I)=0.0
D2 350 K=1,N
D2 275 J=1,N0DE
275 ARRAY(J)=CCV2(J)*PSI(J,K)
CALL INTGRA(ARRAY,N0DE,CX,XINT)
DB(I)=DB(I)+C2N6(K,I)*XINT
XMB(I)=XMB(I)+C2N7(K,I)*XINT
350 CONTINUE
VARD1=VARD(1)
VARD2=VARD(1)
VARM1=VARM(1)
VARM2=VARM(1)
DB1=DB(1)
DB2=DB(1)
XMB1=XMB(1)
XMB2=XMB(1)
D2 351 I=2,N0DE

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IF (VARD(I).GT.VARC2) VARC2=VARD(I)
IF (VARD(I).LT.VARC1) VARC1=VARD(I)
IF (VARM(I).GT.VARM2) VARM2=VARM(I)
IF (VARM(I).LT.VARM1) VARM1=VARM(I)
IF (CB(I).GT.CB2) CB2 =CB(I)
IF (CB(I).LT.CB1) CB1 =CB(I)
IF (XMB(I).GT.XMB2) XMB2 =XMB(I)
IF (XMB(I).LT.XMB1) XMB1 =XMB(I)
351 C0NTINUE
WRITE(6 ,2001)(CB(I),I=1,N0CE)
WRITE(6 ,2004) (XMB(I),I=1,N0CE)
CALL QUIK3L(-1,X1,X2,CB1,CB2,6H.....,B0TT,SIDE1,-N0DE,X,DB)
CALL QUIK3L(-1,X1,X2,XMB1,XMB2,6H.....,B0TT,SIDE2,-N0DE,X,XMB)
CALL QUIK3L(-1,X1,X2,VARC1,VARC2,6H.....,B0TT,SIDE3,-N0DE,X,VARD)
CALL QUIK3L(-1,X1,X2,VARM1,VARM2,6H.....,B0TT,SIDE5,-N0DE,X,VARM)
WRITE(6,2000) (SIGDY(I),I=1,N0DE)
WRITE(6,2003) (SIGMY(I),I=1,N0DE)
G0 T0 390
380 C0NTINUE
D0 381 I=1,N0CE
SIGDZ(I)=SQRT(VARC(I))
SIGMZ(I)=SQRT(VARM(I))
ABSD(I)=XR*SIGDY(I)
ABSM(I)=XR*SIGMY(I)
381 C0NTINUE
VARD1=VARC(1)
VARD2=VARC(1)
VARM1=VARM(1)
VARM2=VARM(1)
D0 382 I=2,N0CE
IF (VARD(I).GT.VARC2) VARC2=VARD(I)
IF (VARD(I).LT.VARC1) VARC1=VARD(I)
IF (VARM(I).GT.VARM2) VARM2=VARM(I)
IF (VARM(I).LT.VARM1) VARM1=VARM(I)
382 C0NTINUE
WRITE(6,2000)(SIGDZ(I),I=1,N0CE)
WRITE(6,2003)(SIGMZ(I),I=1,N0CE)
CALL QUIK3L(-1,X1,X2,VARC1,VARC2,6H.....,B0TT,SIDE4,-N0DE,X,VARD)
CALL QUIK3L(-1,X1,X2,VARM1,VARM2,6H.....,B0TT,SIDE6,-N0DE,X,VARM)
390 C0NTINUE
WRITE(6,2006) (VARD(I),I=1,N0CE)
WRITE(6,2007)(VARM(I),I=1,N0CE)
2006 F0RMAT(50X,11H-VARIANCE(D)/(6E16.8))
2007 F0RMAT(50X,11H-VARIANCE(M)/(6E16.8))
2000 F0RMAT(50X,8HSIGMA(D)/(6E16.8))
2001 F0RMAT(50X,5HC EAR/(6E16.5))
2003 F0RMAT(50X,8HSIGMA(M)/(6E16.8))
2004 F0RMAT(50X,5HM EAR/(6E16.8))
WRITE(6 ,1113) (V(I),I=1,N0CE)
1113 F0RMAT(/53X,1HV/(6E16.8))
IF (IB0TH) 393,393,392
392 C0NTINUE
D0 422 I=1,N0CE
C0MPUTE **ABSM**
A=XR*SIGMZ(I)
ABSXMB=ABS(XMB(I))
IF (A.GT.ABSM(I)) G0 T0 410
ABSM(I)=ABSXMB+ABSM(I)
G0 T0 417
410 AB2=ABSXMB/(A**2-ABSM(I)**2)
IF (AB2*ABSM(I).LT.1.0) G0 T0 415

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      ABSM(I)=ABSXME+ABSM(I)
      GØ TØ 417
415 ABSM(I)=A*(1.0+ABSXME*AB2)**0.5
C
C      CØMPUTE **ABSD**
417 A=XR*SIGCZ(I)
      ABSDCB=ABS(CB(I))
      IF(A.GT.ABSC(I)) GØ TØ 419
      ABSDC(I)=ABSDCB+ABSC(I)
      GØ TØ 422
419 AB2=ABSDCB/(A**2-ABSC(I)**2)
      IF(AB2*ABSC(I).LT.1.0) GØ TØ 421
      ABSDC(I)=ABSDCB+ABSC(I)
      GØ TØ 422
421 ABSC(I)=A*(1.0+ABSCE*AB2)**0.5
422 CØNTINUE
      ABSD1=ABSC(1)
      ABSC2=ABSC(1)
      ABSM1=ABSM(1)
      ABSM2=ABSM(1)
      DØ 423 I=2,NØDE
      IF(ABSD(I).GT.ABSC2) ABSC2=ABSC(I)
      IF(ABSD(I).LT.ABSC1) ABSC1=ABSD(I)
      IF(ABSM(I).GT.ABSM2) ABSM2=ABSM(I)
      IF(ABSM(I).LT.ABSM1) ABSM1=ABSM(I)
423 CØNTINUE
      WRITE(6,6053)
6053 FØRMAT(1F1,4X18FRESULTANT RESPONSE//)
      WRITE(6,2021) (ABSC(I),I=1,NØDE)
      WRITE(6,2022) (ABSM(I),I=1,NØDE)
2021 FØRMAT(50X,4HABSC/(6E16.8))
2022 FØRMAT(50X,4HABSM/(6E16.8))
      CALL CUIK3L(-1,X1,X2,ABSC1,ABSD2,6H.....,BØTT,SIDE7,-NØDE,X,ABSD)
      CALL CUIK3L(-1,X1,X2,ABSM1,ABSM2,6H.....,BØTT,SIDE8,-NØDE,X,ABSM)
393 CØNTINUE
      IF(IFLAG-3)1,400,1
400 IFLAG=2
      IBØTH=1
      GØ TØ 90
C
C      EVALUATE F AS A FUNCTION ØF C AND M ABSØLUTE
C
500 DØ 800 L=1,2
      IF(L.EC.1) GØ TØ 722
      NIPP=NIPM
      GØ TØ 723
722 NIPP=NIPC
723 DØ 800 KS=1,NIPP
      IF(L.EC.1) GØ TØ 720
C      CØMPUTE FØR (M)
      NIP=IPTM(KS)
      SY=SIGMY(NIP)
      SZ=SIGMZ(NIP)
      SS=SIGMS(KS)
      SB=SBARM(KS)
      ABSDM=ABS(XMB(NIP))
      DDINT(2)=1.0*ABSM(NIP)/NPD
      GØ TØ 430
C      CØMPUTE FØR (C)
720 NIP=IPTC(KS)
      SY=SIGCY(NIP)

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SZ=SIGDZ(NIP)
SS=SIGDS(KS)
SB=SBARC(KS)
ABSDM=ABS(DB(NIP))
DDINT(1)=1.0*ABSC(NIP)/NFC
430 CONTINUE
NCT=0
DØ 600 I=1,NFC
NCT=NCT+1
SFANS(I)=0.0
DINT(I)=(I-1)*DCINT(L)
SSM2=0.0
SSM4=0.0
DØ 700 J=1,NFT
THETA=(J-1)*CTHETA
Y=DINT(I)*COS(THETA)
Z=DINT(I)*SIN(THETA)
Q=0.5*((Y-ABSDM)/SY)**2+(Z-SE)**2/(SZ**2+SS**2)
XINT=EXP(-C)*DINT(I)/(P2*SY*(SZ**2+SS**2)**0.5)
IF(J.EC.1.ØR.J.EC.NFT) GØ TØ 480
IF((J/2)*2.EC.J) GØ TØ 460
SSM2=SSM2+XINT
GØ TØ 700
460 SSM4=SSM4+XINT
GØ TØ 700
480 SFANS(I) = XINT+SFANS(I)
700 CONTINUE
SFANS(I)=(DTHETA/3.0)*(SFANS(I)+4.0*SSM4+2.0*SSM2)
SFANS(I)=2.0*SFANS(I)
IF(I.EC.1) GØ TØ 560
FANS(I)=0.5*(SFANS(I-1)+SFANS(I))*DCINT(L)+FANS(I-1)
GØ TØ 600
560 FANS(1)=0.0
600 CONTINUE
DINT1=DINT(1)
DINT2=DINT(1)
FANS1=FANS(1)
FANS2=FANS(1)
SFANS1=SFANS(1)
SFANS2=SFANS(1)
DØ 605 I=2,NCT
IF(DINT1.GT.DINT(I)) DINT1=DINT(I)
IF(DINT2.LT.DINT(I)) DINT2=DINT(I)
IF(FANS1.GT.FANS(I)) FANS1=FANS(I)
IF(FANS2.LT.FANS(I)) FANS2=FANS(I)
IF(SFANS1.GT.SFANS(I)) SFANS1=SFANS(I)
IF(SFANS2.LT.SFANS(I)) SFANS2=SFANS(I)
605 CONTINUE
CALL GUIK3L(-1,DINT1,DINT2,FANS1,FANS2,6H.....,BØTTP(1,L),
*SIDE9,-NCT,DINT,FANS)
CALL GUIK3L(-1,DINT1,DINT2,SFANS1,SFANS2,6H.....,BØTTP(1,L),
*SIDE10,-NCT,DINT,SFANS)
WRITE(6,2005) (DINT(I),I=1,NCT)
WRITE(6,2002) (SFANS(I),I=1,NCT)
WRITE(6,2318) (FANS(I),I=1,NCT)
2005 FØRMPAT(51X,4HDINT/(10E13.5))
2002 FØRMPAT(51X,5HSFANS/(10E13.5))
2318 FØRMPAT(51X,4HFANS/(10E13.5))
800 CONTINUE
GØ TØ 4
813 CONTINUE

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CALL ENDJOB
STOP
END
FOR, IS INTG, INTG
SUBROUTINE INTGRA(Y,N,DX,ANS)
DIMENSION Y(1)
SUM=0.0
DO 1) I=1,N
1) SUM=SUM+Y(I)
ANS=DX*SUM
RETURN
END
XCT,D
```

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