



NASA CR 165,831

# NASA Contractor Report 165831

NASA-CR-165831  
19840020447

NEMAR PLOTTING COMPUTER PROGRAM

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NASA Contract NAS1-15000  
December 1981

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Review for general release December 31, 1983



National Aeronautics and  
Space Administration

Langley Research Center  
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## TABLE OF CONTENTS

	PAGE
SUMMARY . . . . .	1
1.0 INTRODUCTION . . . . .	2
2.0 DEFINITIONS . . . . .	3
3.0 PROGRAM DESCRIPTION . . . . .	4
3.1 Program Theory . . . . .	4
3.2 User Instructions . . . . .	5
3.3 Output Description . . . . .	9
4.0 SUBROUTINE DESCRIPTIONS . . . . .	16
4.1 NEMAP (Main Program) . . . . .	16
4.2 ALPHA . . . . .	16
4.3 AXIS . . . . .	16
4.4 COUNT . . . . .	16
4.5 EXPN . . . . .	17
4.6 INPUT . . . . .	17
4.7 PLACE . . . . .	17
4.8 ROUND . . . . .	17
4.9 SCALE . . . . .	17
5.0 PROGRAM CODING . . . . .	18
5.1 Subroutine Flowcharts . . . . .	18
5.2 FORTRAN Listings . . . . .	18
5.3 FORTRAN Variable Definition . . . . .	18
REFERENCES . . . . .	31
APPENDIX A Sample Data Cases . . . . .	A1
APPENDIX B FORTRAN Code Listings . . . . .	B1
APPENDIX C Scientific Data Processing Routine Summary Documentation.	C1

# NEMAR PLOTTING COMPUTER PROGRAM

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## SUMMARY

This report describes a FORTRAN coded computer program which generates CalComp plots of trajectory parameters. The trajectory parameters are calculated and placed on a data file by the Near Earth Mission Analysis Routine computer program. The plot program accesses the data file and generates the plots as defined by inputs to the plot program. Included in this report are program theory, user instructions, output definitions, subroutine descriptions and detailed FORTRAN coding information.

Although this plot program utilizes a data file created by the above mentioned trajectory program, a data file of the same type and format could be generated by any computer program and used by this plot program.

## 1.0 INTRODUCTION

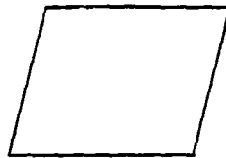
The Near Earth Mission Analysis Routine, acronym NEMAR, Reference (1), is a highly flexible and comprehensive trajectory computer program. It simulates either powered or unpowered vehicles in atmospheric or exoatmospheric flight. The equations of motion of a body in either three or six degrees-of-freedom are numerically integrated to determine the trajectory time histories. Printed output is available at any desired time interval and includes up to 83 trajectory parameters. These same 83 parameters are written on disk to be available for subsequent plotting by a plot program. The computer program written for this purpose is the NEMAR Plotting Program (acronym NEMAP) and is described herein.

## 2.0 DEFINITIONS

Flowchart conventions used in this report are as follows:



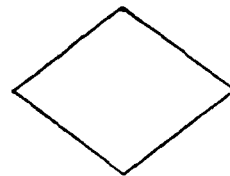
Process



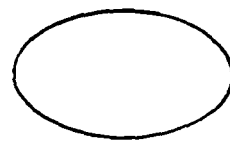
Input/Output



Subroutine



Decision



Subroutine Call

### 3.0 PROGRAM DESCRIPTION

This section describes program theory, user instructions and output definitions.

#### 3.1 Program Theory

The NEMAR Plotting Program utilizes the CalComp pen plotting facility. This facility consists of the CalComp 763 pen plotter hardware and the CalComp Basic Software Package, Reference (2). The subroutines available with this software package are used to create a plot file.

NEMAP consists of a main program, which extracts the data to be plotted from the data file and generates the plot file, and several subroutines which assist in generating the plot file. The data file resides as a random access file which is generated by NEMAR. A random access file has records that may be read at random, as opposed to a standard file which has records that may only be read in succession.

The random access data file format is as follows:

Record 1 - 102 integer numbers

Word 1 - record number (n) of first record of Case 1 data

Word 2 - record number (m) of first record of Case 2 data

.

.

Word i - record number of first record of Case i data

Record n (first record of Case 1 data) - 2 integer numbers; 100 floating point numbers

Word 1 - not used

Word 2 - not used

Word 3 - first trajectory parameter

Word 4 - second trajectory parameter

.

.

Word i - i th trajectory parameter

} all trajectory  
parameters at first  
time point of  
Case 1

Record n + 1 (second record of Case 1 data) - 2 integer numbers; 100  
floating point numbers

Word 1 - not used	}	all trajectory parameters at second time point of Case 1
Word 2 - not used		
Word 3 - first trajectory parameter		
Word 4 - second trajectory parameter		
.		
.		
Word i - i th trajectory parameter		

Record m - 2 (last record of Case 1 data) - 2 integer numbers; 100  
floating point numbers

Word 1 - not used	}	all trajectory parameters at last time point of Case 1
Word 2 - not used		
Word 3 - first trajectory parameter		
Word 4 - second trajectory parameter		
.		
.		
Word i - i th trajectory parameter		

Records containing the trajectory parameters (n through m - 2 above) are repeated for each case, each case being a single trajectory.

If any computer program creates a random access file in the above described format, the NEMAP program can be used to plot the data.

### 3.2 User Instructions

NEMAP uses a modified FORTRAN NAMELIST for inputting data which provides the user with readability and simplicity of use.

The following rules apply to NAMELIST used by NEMAP:

1. First card of a data group or case is \$INPUTD beginning in column 2.  
Blanks are not allowed.
2. Last card of a data group or case is \$END beginning in column 2.  
Blanks are not allowed.
3. Blanks may not be used within names but may be used elsewhere.
4. Variable names are followed by an equal sign which is followed by a value which is followed by a comma , e.g., FACTX = 1.852,
5. Only columns 2-72, inclusive, are used.

6. Titling information may be input by the appropriate title names,  
e.g., TITLE1= ALTITUDE - RANGE PROFILE  
TITLE1 must begin in column 2.
7. Any number of names and values may be on a single card or line.
8. Complete data arrays are input in the following form:  
name = value, value, value, ...,  
Data values may be continued on the next line, but the last character  
on every line must be a comma, excluding title cards.
9. Repeated data values may be input by using a repetition factor and an  
asterisk, e.g., FACTY = 1.852, 2\*.00016458, 2\*1.852,
10. One or more specific elements of an array may be input, e.g.,  
FACTY (5) = 1,

Subsequent data cases are allowed by providing additional sets of NAMELIST data. All input data is retained for subsequent cases but can be changed by inputting new values.

Sample data cases are included in Appendix A to exemplify data case setup.

Execution of NEMAP requires that the CalComp Basic Software Package for plotting be available to the computer job at the time of program load.

Definitions of specific NAMELIST inputs to NEMAP are shown below. Default values are shown when they are set by the program prior to reading input data.

#### NAMELIST Input Definitions

CALCODE	Two digit integer specifying the graph paper for plotting. Installation dependent. (31 built-in)
DBA	Distance between annotation in units of graph paper. (2. built-in)
FACTX	Multiplier applied to X-axis parameter before plotting. (1. built-in)
FACTY	Multiplier applied to Y-axis parameter before plotting. Array of 8 values. Input a value for each frame. (1. built-in)



NAMELIST Input Definitions (Continued)

H	Height of X- and Y-axis annotation, inches. (0.1 built-in)
HLABEL	Height of PLABEL characters, inches. Array of 9 values and same order as PLABEL. (0.1 built-in)
HTITLE	Height of PTITLE characters, inches. Array of 4 values and same order as PTITLE. (0.14 built-in)
ICASE	Trajectory numbers from which to plot data. The first trajectory on the random access file is always number 1. Input if NCURVE is greater than one. Array of 10. (1-10 built-in)
IDIV	Number of minor divisions per unit of graph paper. (10 built-in)
IFREQ	Frequency of extracting data for plotting. For example IFREQ = 4 specifies that every fourth point is plotted. (1 built-in)
IPAPER	Paper selector = 1 if inch paper = 2 if centimeter paper (2 built-in)
ISYM	Integer representing symbol to be used in plotting data. See Table 3.1. Array of 10 values. Input a value for each curve in a frame. (0 to 9 built-in)
IX	Code number of parameter plotted on X-axis. See Table 3.2.
IY	Code number of parameter plotted on Y-axis. Array of 8 values. Input a value for each frame. See Table 3.2.
LINTYP	Parameter specifying plot line type. Zero produces a line, a positive value produces a line with symbols, a negative value produces symbols without a line. Magnitude determines frequency of plotted symbol. Array of 10 values. Input a value for each curve in the frame. (0 built-in)
NCURVE	Number of curves per frame. Maximum of 10. (1 built-in)
NFRAME	Numbers of frames. Maximum of 8. (1 built-in)
PLABEL1 - PLABEL9	Labels written on plot according to XLAB and YLAB. Maximum of 30 characters.

NAMELIST Input Definitions (Continued)

PLENGTH                    Paper length in inches from one frame origin to the next. (17. built-in)

PTITLE1 -  
PTITLE4                    Titles written above plot. Maximum of 30 characters.

TITLE1  
TITLE2                    Titles to identify data case. Maximum of 72 characters.

XAXIS1                    X-axis annotation. Maximum of 30 characters.

XLNGTH                    X-axis length in units of graph paper. (16. built-in)

XLAB                      X distance from origin for PLABEL labels in units of graph paper. (18. built-in)

XMAX                      Maximum value plotted on X-axis, units as plotted. (1.E10 built-in)

XMIN                      Minimum value plotted on X-axis, units as plotted. (0. built-in)

XSINC                    X-axis annotation increment, data units per major division. Automatically scaled if zero. (0. built-in)

XSMIN                    Leftmost annotation of X-axis. Automatically scaled if XSINC is zero. (0. built-in)

YAXIS1 -  
YAXIS8                    Y-axis annotation for frames 1 to 8. Maximum of 30 characters.

YLAB                      Y distance from origin for PLABEL labels in units of graph paper. (10. built-in)

YNLNGTH                   Y-axis length in units of graph paper. (20. built -in)

YMAX                      Maximum value plotted on Y-axis, units as plotted. (1.E10 built-in)

YMIN                      Minimum value plotted on Y-axis, units as plotted. (-1.E10 built-in)

YSINC                    Y-axis annotation increment, data units per major division. Automatically scaled if zero. (0. built-in)

## NAMELIST Input Definitions (Continued)

YSMIN                      Leftmost annotation of Y-axis. Automatically scaled if YSINC is zero. (0. built-in)

### 3.3 Output Description

The NAMELIST input data card images are listed as read. This list provides a quick check of the input data for format correctness and validity.

For inspection purposes, the data plotted is listed with scaling information. Sample output is shown in Appendix A and includes plots produced by each data case.

TABLE 3.1  
PLOT SYMBOLS

<u>Integer</u> <u>(Input as ISYM)</u>	<u>Symbol</u>
0	□
1	○
2	△
3	+
4	×
5	◇
6	⋈
7	⊗
10	⊗
11	✱
14	☆
28	A
29	B
30	C
31	D
32	E
33	F

TABLE 3.2

## PLOT PARAMETER CODE NUMBERS

<u>Code Number</u>	<u>Parameter Symbol</u>	<u>Parameter Definition</u>
2	$\alpha$	Angle of attack, deg
3	$q\alpha$	Product of dynamic pressure and angle of attack, deg-lb/ft <sup>2</sup>
4	$\beta$	Angle of sideslip, deg
5	$\gamma_I$	Inertial flight path angle, deg
6	$\gamma_R$	Relative flight path angle, deg
7	$\zeta_I$	Inertial velocity heading, deg
8	$\zeta_R$	Relative velocity heading, deg
9	$\phi$	Body roll angle, deg
10	$\psi$	Body heading angle, deg
11	$\theta$	Body elevation angle, deg
12	$\int Q dt$	Integral of inertial pitch rate, deg
13	$Q_c$	Commanded pitch rate, deg/sec
14	$\epsilon_a$	Pitch attitude error or
	$\eta$	Total aerodynamic angle of attack, deg
15	$t$	Flight time, sec
16	$P$	Body roll rate, deg/sec
17	$Q$	Body pitch rate, deg/sec
18	$R$	Body yaw rate, deg/sec
19	$A$	Axial aerodynamic force, lb
20	$Y$	Side aerodynamic force, lb
21	$N$	Normal aerodynamic force, lb
22	$N_x$	Axial acceleration, g's
23	$N_y$	Side acceleration, g's

TABLE 3.2 (Continued)

## PLOT PARAMETER CODE NUMBERS

<u>Code Number</u>	<u>Parameter Symbol</u>	<u>Parameter Definition</u>
24	$N_z$	Normal acceleration, g's
25	$V_{RA}$	Air relative velocity, ft/sec
26	$V_R$	Relative velocity, ft/sec
27	$W_H$	Horizontal wind speed, ft/sec
28	$\zeta_w$	Wind direction, deg
29	$U_{Meas}$	Integral of axial acceleration, ft/sec or
	$Q_{Heat}$	Heating integral, or
	$\theta_{RS}$	Total angle change of relative velocity vector, deg
30	$\dot{H}_x$	Axial component of angular momentum derivative, ft/lbs
31	$\dot{H}_y$	Side component of angular momentum derivative, ft/lbs
32	$\dot{H}_z$	Normal component of angular momentum derivative, ft/lbs
33	$\delta_p$	Roll control surface deflection, deg or
	$F_P$	Roll reaction control motor thrust, lb
34	$\delta_o$	Pitch control surface deflection, deg or
	$F_Q$	Pitch reaction control motor thrust, lb
35	$\delta_r$	Yaw control surface deflection, deg or
	$F_R$	Yaw reaction control motor thrust, lb
39	$V_{LA}$	Velocity loss due to aerodynamic force, ft/sec
40	$V_{LG}$	Velocity loss due to gravity, ft/sec
41	$V_{LP}$	Velocity loss due to atmospheric pressure on rocket nozzle exit, ft/sec

TABLE 3.2 (Continued)

## PLOT PARAMETER CODE NUMBERS

<u>Code Number</u>	<u>Parameter Symbol</u>	<u>Parameter Definition</u>
42	$V_{La}$	Velocity loss due to thrusting at an angle of attack, ft/sec
43	$V_{ID}$	Ideal velocity, ft/sec
44	$x_L$	x component in range coordinate system, ft
45	$y_L$	y component in range coordinate system, ft
46	$z_L$	z component in range coordinate system, ft
47	$\dot{x}_L$	x component of velocity in range coordinate system, ft/sec
48	$\dot{y}_L$	y component of velocity in range coordinate system, ft/sec
49	$\dot{z}_L$	z component of velocity in range coordinate system, ft/sec
50	$R_{xy}$	Tangent plane range in range coordinate system, ft
51	$\gamma_L$	Earth relative flight path angle with respect to launch site tangent plane, deg
52	$V_L$	Velocity with respect to the launch site, ft/sec
53	$\dot{r}_{LS}$	Slant range derivative with respect to launch site, ft/sec
54	$t_{IIP}$	Time of the Instantaneous Impact Point (IIP), sec
55	$\lambda'_{IIP}$	Geodetic latitude of IIP, deg
56	$\mu_{IIP}$	Greenwich longitude of IIP, deg
57	$R_{IIP}$	Great circle range to the IIP, n.mi.
58	$x_{LIIP}$	X-component of the IIP in the range coordinate system, ft
59	$y_{LIIP}$	Y-component of the IIP in the range coordinate system, ft

TABLE 3.2 (Continued)  
PLOT PARAMETER CODE NUMBERS

<u>Code Number</u>	<u>Parameter Symbol</u>	<u>Parameter Definition</u>
60	Z <sub>LIIP</sub>	Z-component of the IIP in the range coordinate system, ft
61	W	Vehicle weight, lbs
62	T	Vehicle thrust, lbs
63	h	Altitude above spheroid, ft
64	M	Mach number
65	$\epsilon_p$	Roll displacement error, deg or
	X	X-component in an inertial cartesian coordinate system, ft
66	$\epsilon_r$	Yaw displacement error, deg or
	Y	Y-component in an inertial cartesian coordinate system, ft
67	N <sub>RE</sub>	Reynolds number, deg or
	Z	Z-component in an inertial cartesian coordinate system, ft
68	$\dot{X}$	X-component of velocity in an inertial cartesian coordinate system, ft/sec
69	$\dot{Y}$	Y-component of velocity in an inertial cartesian coordinate system, ft/sec
70	M <sub>FLEX</sub>	Pitch moment due to thrust misalignment, ft/lbs, or
	$\dot{Z}$	Z-component of velocity in an inertial cartesian coordinate system, ft/sec
71	N <sub>FLEX</sub>	Yaw moment due to thrust misalignment, ft/lbs
72	U <sub>Rel</sub>	Body x-axis component of earth relative velocity, ft/sec
73	V <sub>Rel</sub>	Body y-axis component of earth relative velocity, ft/sec



TABLE 3.2 (Continued)  
PLOT PARAMETER CODE NUMBERS

<u>Code Number</u>	<u>Parameter Symbol</u>	<u>Parameter Definition</u>
74	$W_{Rel}$	Body z-axis component of earth relative velocity, ft/sec
75	$R_S$	Earth surface range, n.mi.
77	$V_I$	Inertial velocity, ft/sec
78	$r$	Geocentric radius, ft
79	$\lambda'$	Geodetic latitude, deg
80	$\lambda$	Geocentric latitude, deg
81	$\mu$	Longitude referenced to Greenwich meridian
82	$\theta - \sigma$	Geocentric pitch attitude minus the inertial range angle, deg
83	$q$	Dynamic pressure, lb/ft <sup>2</sup>

## 4.0 SUBROUTINE DESCRIPTIONS

This section provides a brief explanation of each subroutine of NEMAP.

### 4.1 NEMAP (Main Program)

The main program initializes the input data defaults; calls the input subroutine; reads the random access plot data file; writes the output; and creates the plot file.

### 4.2 ALPHA

Subroutine ALPHA converts a floating point number to alphanumeric for annotating axes. The number is left justified in the field of 10 characters. The number of characters is also determined.

### 4.3 AXIS

Subroutine AXIS draws, annotates and labels an axis. The axis is annotated according to the scaling parameters from subroutine SCALE. The scaling exponent is chosen such that it is a multiple of three. This subroutine replaces subroutine AXIS of the CalComp Software Package.

### 4.4 COUNT

Subroutine COUNT determines the number of characters in a title. Reading the title field from right to left, the first non-blank is assumed to be the last character in the title.

#### 4.5 EXPN

Subroutine EXPN converts a floating point number to a base number and an exponent such that the base number is less than 5000 and the exponent is a multiple of three.

#### 4.6 INPUT

Subroutine INPUT reads input data in a modified NAMELIST format. Titling information on title cards are placed in appropriate arrays for use by the main program. Non-title cards are written on disk unit 8 for a FORTRAN NAMELIST read from the main program.

#### 4.7 PLACE

Subroutine PLACE determines CalComp X and Y coordinates of a point at X' and Y' coordinates relative to an axis at a specified angle to the CalComp X axis.

#### 4.8 ROUND

Subroutine ROUND numerically rounds a floating point number to a specified number of non-zero digits. The alphanumeric field is limited to 20 characters.

#### 4.9 SCALE

Subroutine SCALE scales data prior to plotting. It divides a set of data values into a given number of equal intervals such that the interval is a multiple of 2, 5 or 10 and such that the range of intervals include the range of data values scaled. This subroutine returns to the calling program the leftmost value of the axis and the scaling interval. This subroutine replaces subroutine SCALE of the CalComp Software Package.

## 5.0 PROGRAM CODING

This section presents details about the program coding. Included are flowcharts of each subroutine, FORTRAN listings of each subroutine and definitions of the FORTRAN variables. The information presented in this section is intended to be helpful in developing a thorough understanding of NEMAP and in making modifications to the program.

### 5.1 Subroutine Flowcharts

Flowcharts are presented in Figures 5.1 through 5.9. Flowchart conventions used in these figures are defined in Section 2.0 of this report.

### 5.2 FORTRAN Listings

NEMAP is coded in FORTRAN IV, Reference (3), on the CDC CYBER 175 computer with the NOS/BE 1.4 operating system. Listings of the FORTRAN coding are presented in Appendix B.

### 5.3 FORTRAN Variable Definition

Definitions of the FORTRAN variables in the main program are shown below. This information is normally used only when making modifications to the program.

<u>Variable</u>	<u>Definition</u>
CALCODE	Input data.
DATA	Array of floating point data read from one record on TAPE14.
DBA	Input data.
FACTX	Input data.
FACTY	Input data.

<u>Variable</u>	<u>Definition</u>
H	Input data.
HLABEL	Input data.
HTITLE	Input data.
IA	Array containing master index of the random access file TAPE14.
IC	Current value of ICASE.
ICAL	Two digit alphanumeric word representing the CALCODE.
ICASE	Input data.
ICX	X-axis plot parameter code plus 2.
ICY	Y-axis plot parameter code plus 2.
IDATA	Array of integer data read from one record on TAPE14.
IDIV	Input data.
IFREQ	Input data.
IPAPER	Input data.
IREC	Current TAPE14 record number.
IRECF	First record number of TAPE14.
IRECL	Last record number of TAPE14.
ISYM	Input data.
IX	Input data.
IY	Input data.
L	Index for plot annotation.
LABEL	Alphanumeric data of PLABEL1-PLABEL9.
LINTYP	Input data.
NCRVE	Current curve number being plotted.
NCURVE	Input data.

<u>Variable</u>	<u>Definition</u>
NFRAME	Input data.
NFRME	Current frame number.
NPT	Number of data points in current curve being plotted.
PLENGTH	Input data.
SFACT	Conversion factor to inches.
TITLE	Alphanumeric data of PTITLE1-PTITLE4.
TITLE1	Input data.
TITLE2	Input data.
X	Array of data to be plotted on X-axis.
XAXIS	Input data.
XLAB	Input data.
XLABEL	Alphanumeric data of XAXIS.
XLNGTH	Input data.
XMAX	Input data.
XMIN	Input data.
XO	X distance of origin
XSINC	Input data.
XSMIN	Input data.
XT	X distance of plot title.
XVALUE	Value of X parameter in units to be plotted.
Y	Array of data to be plotted on Y-axis.
YAXIS	Input data.
YLAB	Input data.
YLABEL	Alphanumeric data of YAXIS
YLNTH	Input data.

<u>Variable</u>	<u>Definition</u>
YMAX	Input data.
YMIN	Input data.
YO	Y distance of origin.
YSAVE	Saved value of YSINC from previous case.
YSINC	Input data.
YSMIN	Input data.
YVALUE	Value of Y parameter in units to be plotted.

Figure 5.1

FLOWCHART OF MAIN PROGRAM NEMAP

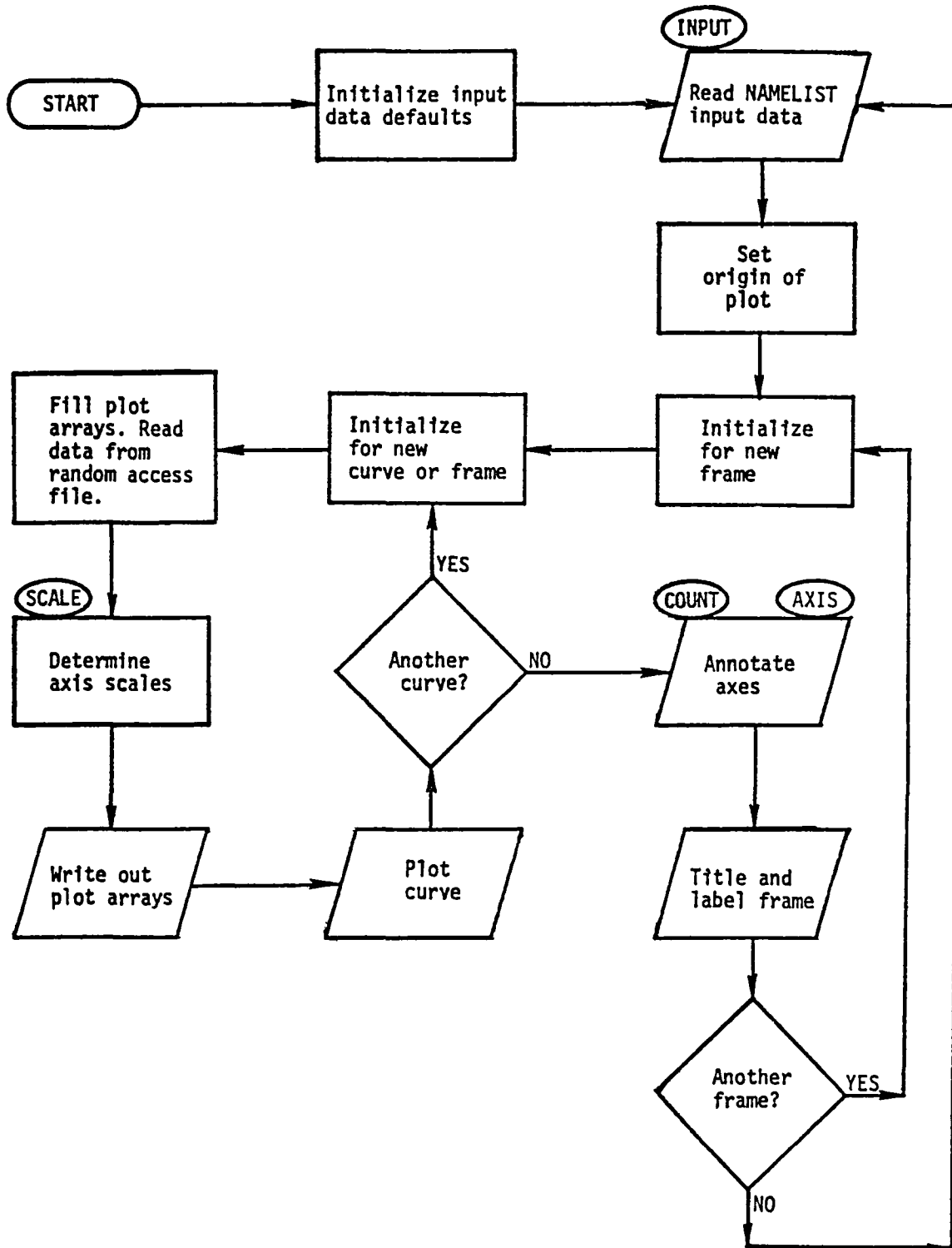




Figure 5.2

FLOWCHART OF SUBROUTINE ALPHA

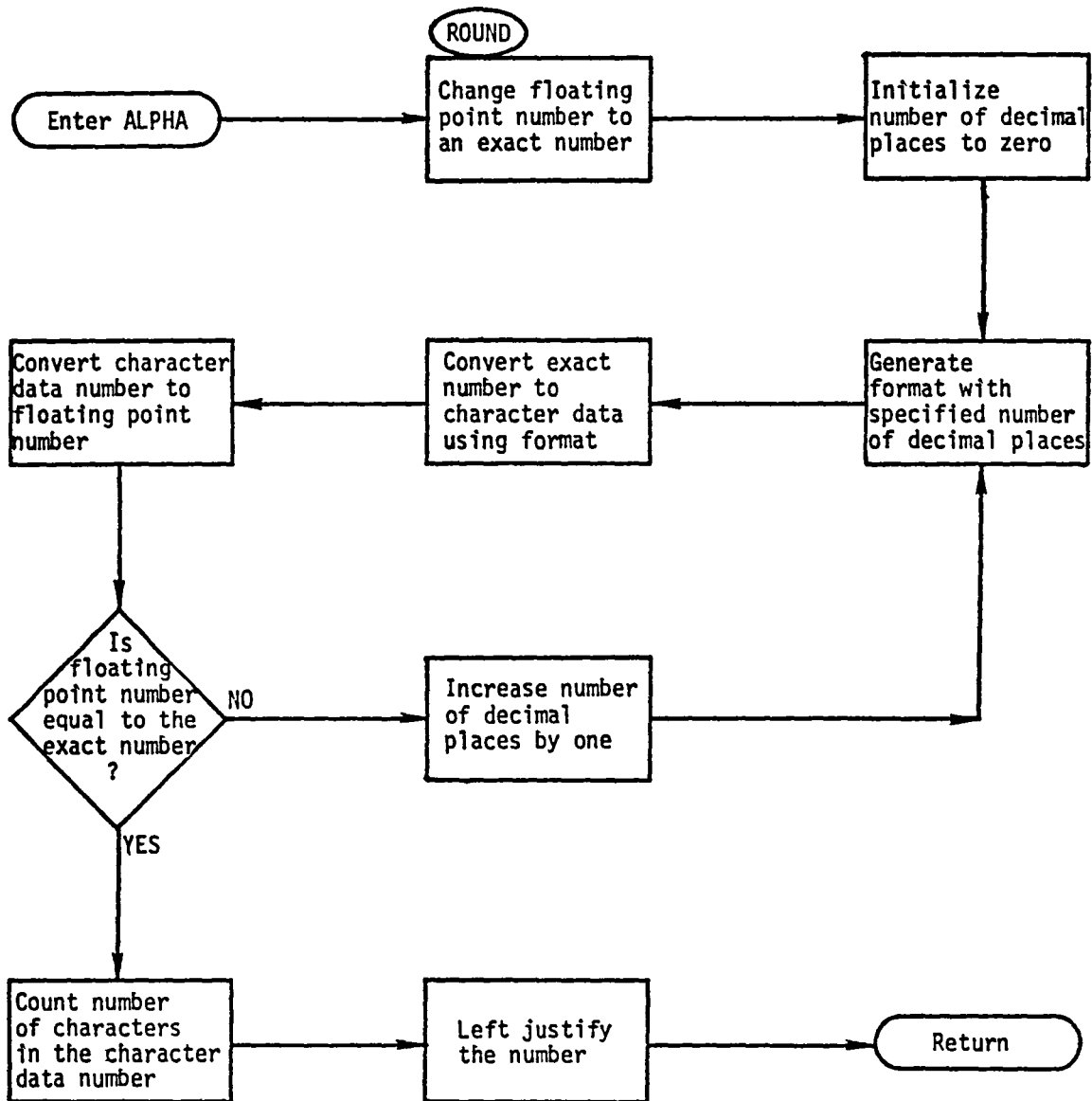


Figure 5.3  
 FLOWCHART OF SUBROUTINE AXIS

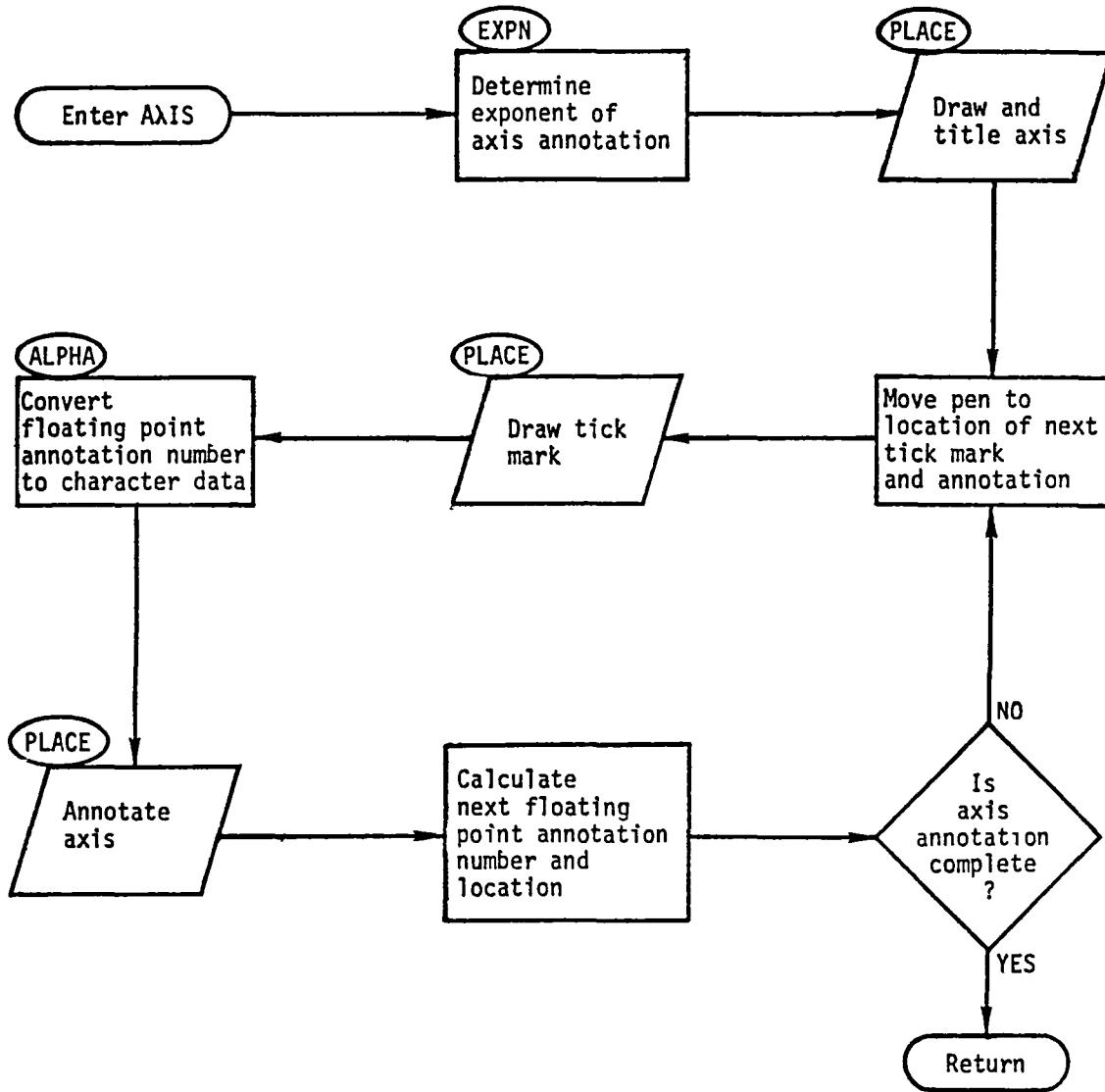


Figure 5.4

FLOWCHART OF SUBROUTINE COUNT

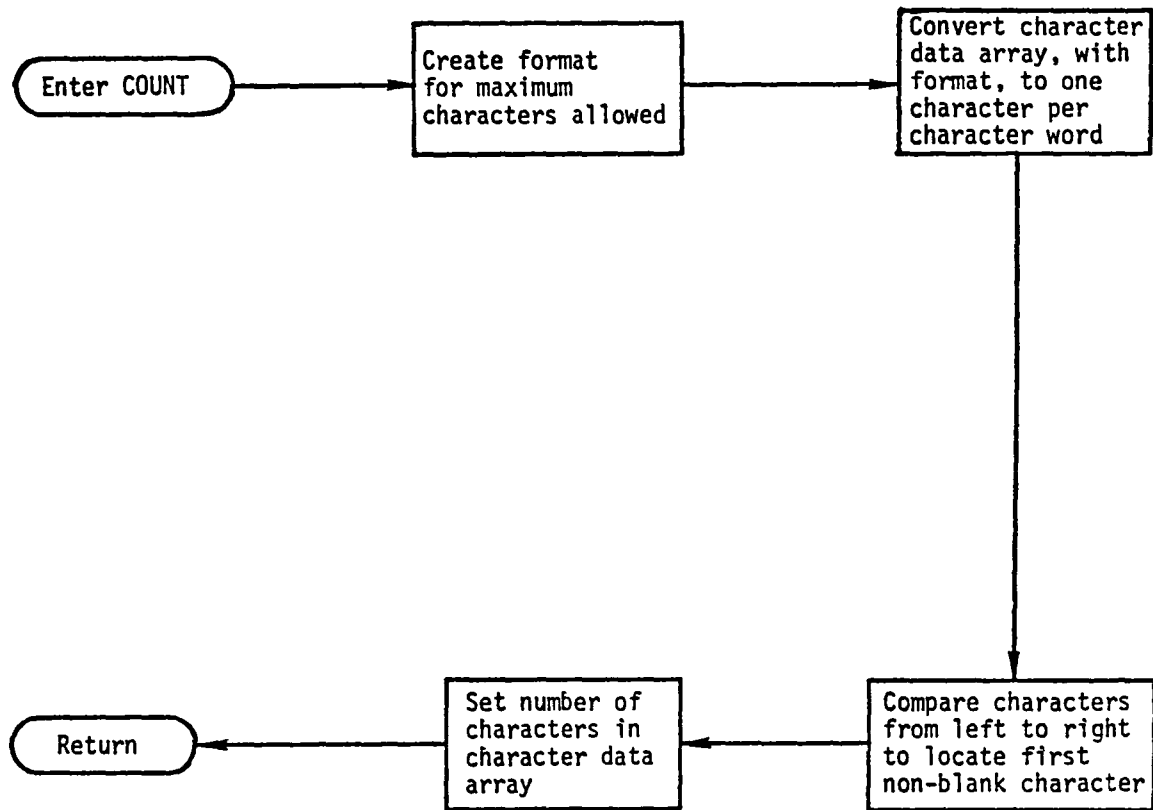


Figure 5.5  
FLOWCHART OF SUBROUTINE EXPN

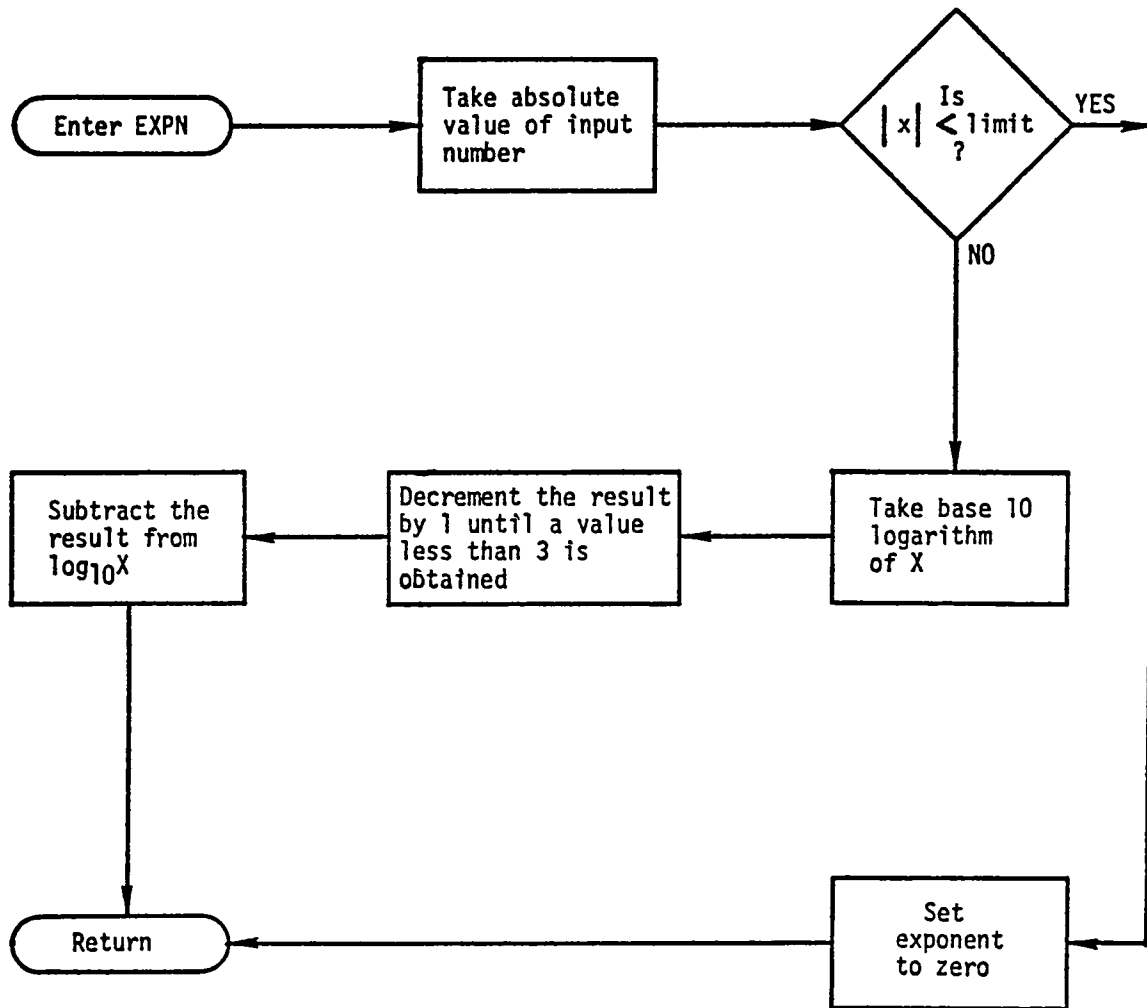


Figure 5.6  
FLOWCHART OF SUBROUTINE INPUT

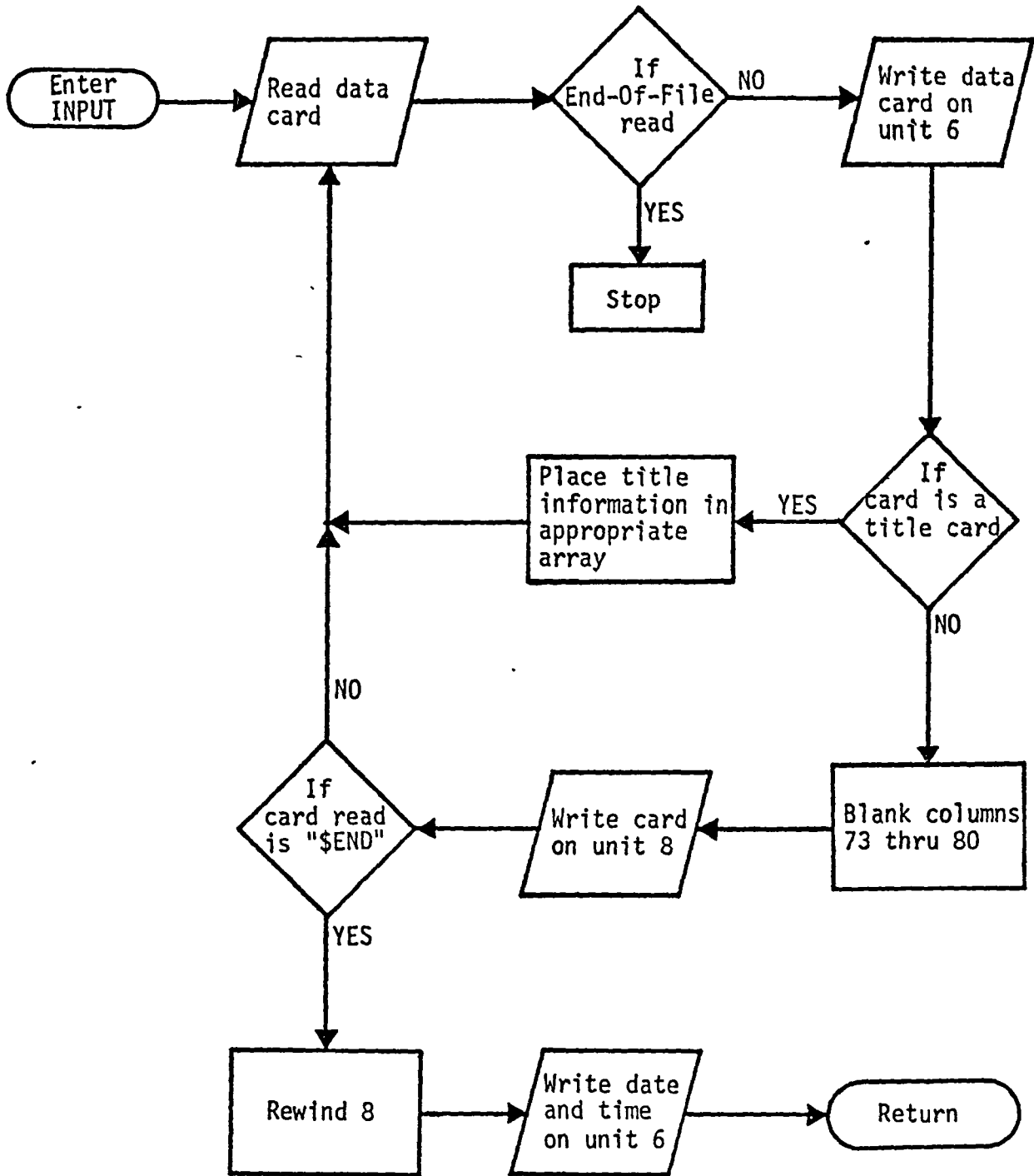


Figure 5.7

FLOWCHART OF SUBROUTINE PLACE

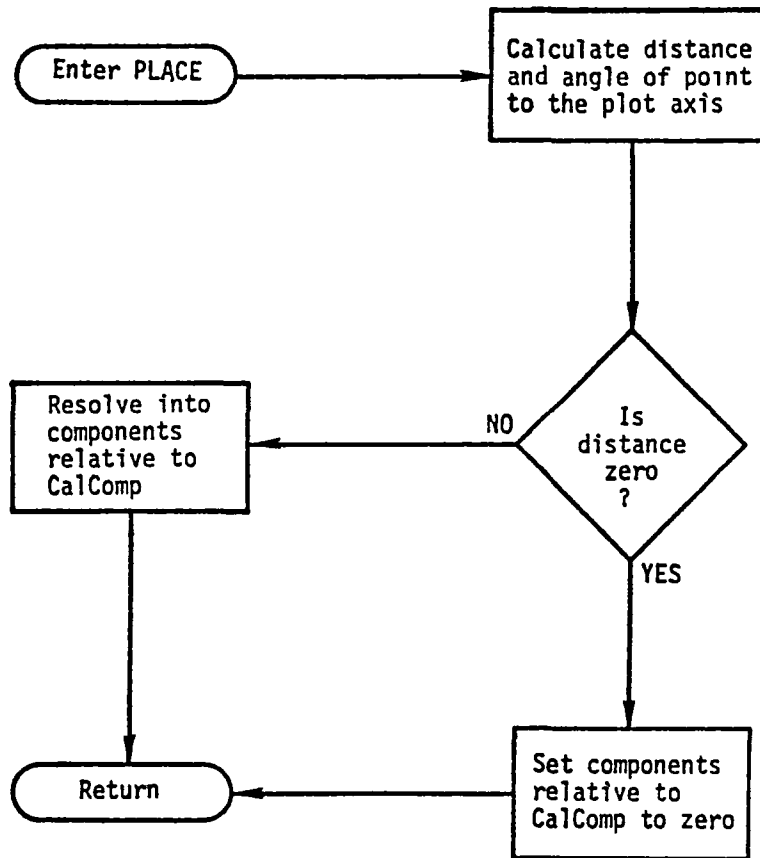


Figure 5.8

FLOWCHART OF SUBROUTINE ROUND

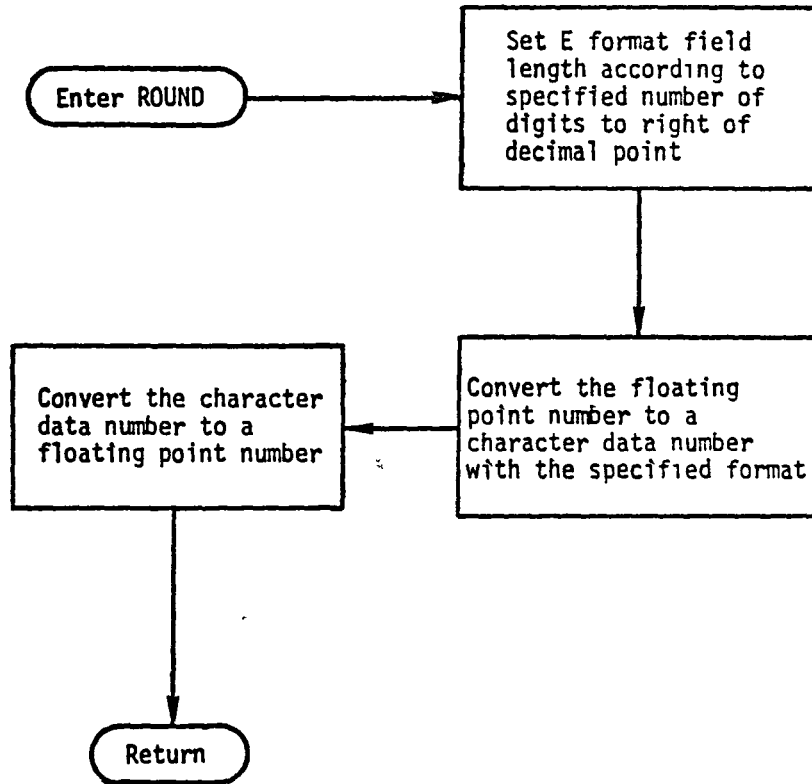
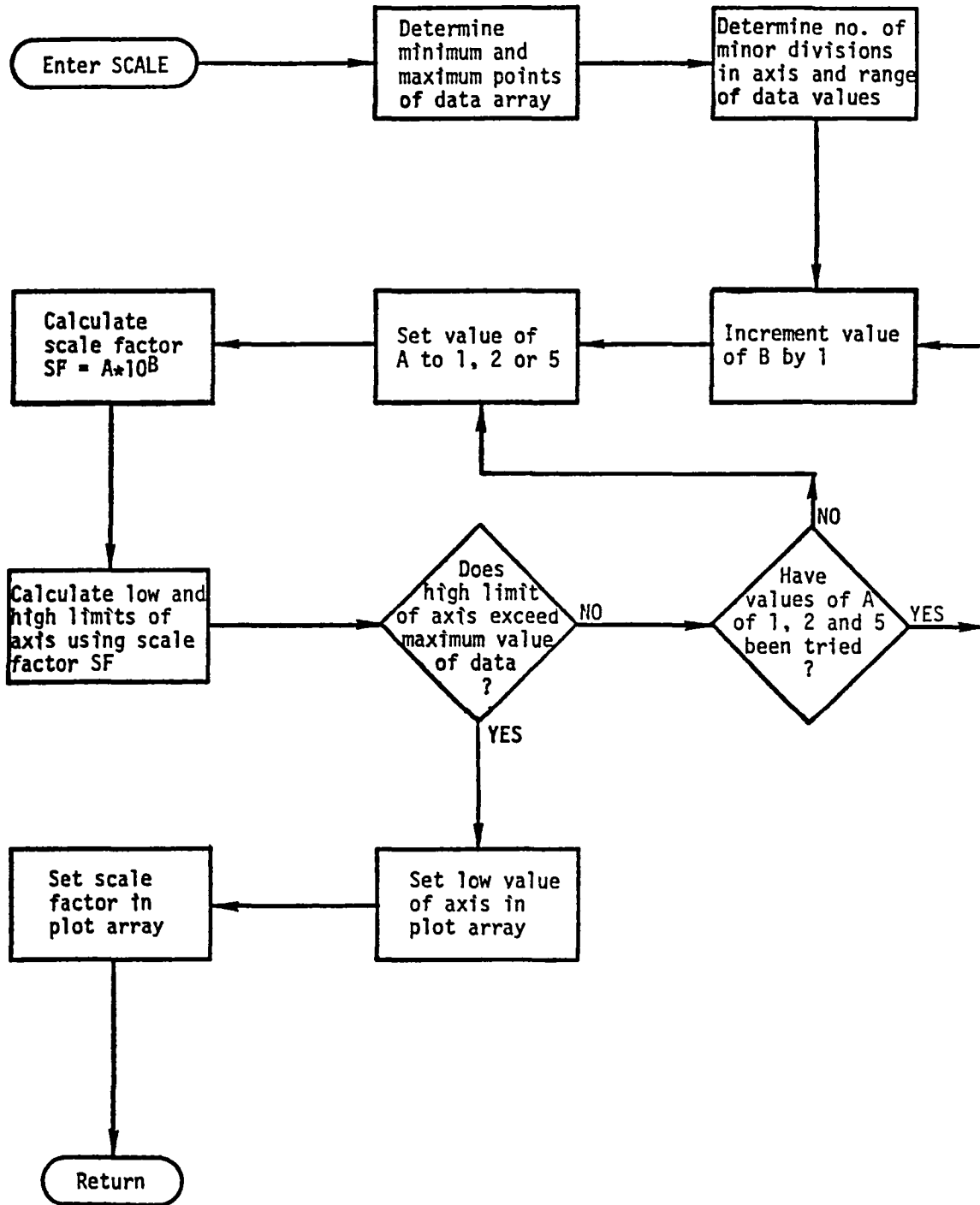


Figure 5.9

FLOWCHART OF SUBROUTINE SCALE





## REFERENCES

1. Vought Corporation Report No. 00.1371, Revision C, "The Near-Earth Mission Analysis Routine" dated 15 September 1978.
2. CalComp Software Reference Manual, No. 1005, dated 1 June 1968.
3. Control Data Corporation, "FORTRAN Extended Version 4 Reference Manual", Revision C, dated 15 April 1977.

```

$INPUTD
CALCODE=27,PLENGTH=12.,
TITLE1=VELOCITY PROFILE
PTITLE1=TRAJECTORY DATA
PTITLE2=VELOCITY PROFILE
PLABEL1=NOMINAL TRAJECTORY
IX=15,IY=77,
XLAB=10,YLAB=16,
XSMIN=0,YSMIN=0,XSINC=0,YSINC=0,
XAXIS1=TIME, SECONDS
YAXIS1=INERTIAL VELOCITY, FPS
$END

```

```

DATE IS 05/06/81
TIME IS 08.51.07

```

CALCODE= CAL27

FRAME= 1 CURVE= 1

ABCISSA VALUES

0.	0.	.100000E+01	.200000E+01	.300000E+01	.400000E+01	.500000E+01	.600000E+01	.700000E+01
.800000E+01	.900000E+01	.100000E+02	.110000E+02	.120000E+02	.130000E+02	.140000E+02	.150000E+02	.160000E+02
.170000E+02	.180000E+02	.190000E+02	.200000E+02	.210000E+02	.220000E+02	.230000E+02	.240000E+02	.250000E+02
.260000E+02	.270000E+02	.280000E+02	.290000E+02	.300000E+02	.310000E+02	.320000E+02	.330000E+02	.340000E+02
.350000E+02	.360000E+02	.370000E+02	.380000E+02	.390000E+02	.400000E+02	.410000E+02	.420000E+02	.430000E+02
.440000E+02	.450000E+02	.460000E+02	.470000E+02	.480000E+02	.490000E+02	.500000E+02	.510000E+02	.520000E+02
.530000E+02	.540000E+02	.550000E+02	.560000E+02	.570000E+02	.580000E+02	.590000E+02	.600000E+02	.610000E+02
.620000E+02	.630000E+02	.640000E+02	.650000E+02	.660000E+02	.670000E+02	.680000E+02	.690000E+02	.700000E+02
.710000E+02	.720000E+02	.730000E+02	.740000E+02	.750000E+02	.760000E+02	.770000E+02	.780000E+02	.790000E+02
.800000E+02	.810000E+02	.820000E+02	.830000E+02	.840000E+02	.844000E+02	.844000E+02	.844000E+02	.850000E+02
.852500E+02	.852500E+02	.852500E+02	.860000E+02	.870000E+02	.880000E+02	.890000E+02	.900000E+02	.910000E+02
.920000E+02	.930000E+02	.940000E+02	.950000E+02	.960000E+02	.970000E+02	.980000E+02	.990000E+02	1.000000E+03
1.010000E+03	1.020000E+03	1.030000E+03	1.040000E+03	1.050000E+03	1.060000E+03	1.070000E+03	1.080000E+03	1.090000E+03
1.100000E+03	1.110000E+03	1.120000E+03	1.130000E+03	1.140000E+03	1.150000E+03	1.160000E+03	1.170000E+03	1.180000E+03
1.190000E+03	1.200000E+03	1.210000E+03	1.220000E+03	1.230000E+03	1.240000E+03	1.24150E+03	1.24150E+03	1.24150E+03
1.300000E+03	1.400000E+03	1.500000E+03	1.56460E+03	1.56460E+03	1.56460E+03	1.58160E+03	1.58160E+03	1.58160E+03
1.590000E+03	1.600000E+03	1.610000E+03	1.620000E+03	1.630000E+03	1.640000E+03	1.650000E+03	1.660000E+03	1.670000E+03
1.680000E+03	1.690000E+03	1.700000E+03	1.710000E+03	1.720000E+03	1.730000E+03	1.740000E+03	1.750000E+03	1.760000E+03
1.770000E+03	1.780000E+03	1.790000E+03	1.800000E+03	1.810000E+03	1.820000E+03	1.830000E+03	1.840000E+03	1.850000E+03
1.860000E+03	1.870000E+03	1.880000E+03	1.890000E+03	1.900000E+03	1.910000E+03	1.920000E+03	1.930000E+03	1.940000E+03
1.950000E+03	1.960000E+03	1.970000E+03	1.980000E+03	1.990000E+03	2.000000E+03	2.010000E+03	2.020000E+03	2.030000E+03
2.040000E+03	2.050000E+03	2.060000E+03	2.06370E+03	2.06370E+03	2.06370E+03	2.100000E+03	2.200000E+03	2.300000E+03
2.400000E+03	2.500000E+03	2.600000E+03	2.700000E+03	2.800000E+03	2.900000E+03	3.000000E+03	3.100000E+03	3.200000E+03
3.300000E+03	3.400000E+03	3.500000E+03	3.600000E+03	3.700000E+03	3.800000E+03	3.900000E+03	4.000000E+03	4.100000E+03
4.200000E+03	4.300000E+03	4.400000E+03	4.500000E+03	4.600000E+03	4.700000E+03	4.800000E+03	4.900000E+03	5.000000E+03
5.100000E+03	5.18320E+03	5.18320E+03	5.18320E+03	5.190000E+03	5.200000E+03	5.210000E+03	5.220000E+03	5.230000E+03
5.240000E+03	5.250000E+03	5.260000E+03	5.270000E+03	5.280000E+03	5.290000E+03	5.300000E+03	5.310000E+03	5.320000E+03
5.330000E+03	5.340000E+03	5.350000E+03	5.360000E+03	5.370000E+03	5.380000E+03	5.390000E+03	5.400000E+03	5.410000E+03
5.420000E+03	5.430000E+03	5.440000E+03	5.450000E+03	5.460000E+03	5.470000E+03	5.480000E+03	5.490000E+03	5.500000E+03
5.510000E+03	5.520000E+03	5.52760E+03	5.52760E+03					

```

AXIS MINIMUM= 0. DATA UNITS
AXIS INCREMENT= .12700E+03 DATA UNITS PER INCH

```

- 11 -

APPENDIX A  
SAMPLE DATA CASES

ORDINATE VALUES

.125730E+04	.125730E+04	.125810E+04	.126008E+04	.126311E+04	.126707E+04	.127176E+04	.127708E+04	.128303E+04
.128970E+04	.129720E+04	.130554E+04	.131479E+04	.132504E+04	.133636E+04	.134885E+04	.136259E+04	.137755E+04
.139343E+04	.141019E+04	.142781E+04	.144623E+04	.146544E+04	.148537E+04	.150602E+04	.152764E+04	.155024E+04
.157381E+04	.159849E+04	.162432E+04	.165134E+04	.167966E+04	.170942E+04	.174079E+04	.177393E+04	.180909E+04
.184636E+04	.188585E+04	.192764E+04	.197182E+04	.201850E+04	.206776E+04	.211971E+04	.217452E+04	.223230E+04
.229318E+04	.235724E+04	.242458E+04	.249536E+04	.256973E+04	.264778E+04	.272964E+04	.281542E+04	.290522E+04
.299914E+04	.309733E+04	.319991E+04	.330700E+04	.341875E+04	.353533E+04	.365361E+04	.378886E+04	.387866E+04
.398257E+04	.407875E+04	.416623E+04	.424481E+04	.431462E+04	.437540E+04	.442820E+04	.447363E+04	.451176E+04
.454377E+04	.456971E+04	.459015E+04	.460580E+04	.461664E+04	.462318E+04	.462552E+04	.462420E+04	.462031E+04
.461389E+04	.460561E+04	.459574E+04	.458428E+04	.457070E+04	.456416E+04	.456416E+04	.456416E+04	.455389E+04
.454964E+04	.454964E+04	.454964E+04	.454964E+04	.466393E+04	.474006E+04	.482140E+04	.490811E+04	.500039E+04
.509839E+04	.520234E+04	.531248E+04	.542900E+04	.555190E+04	.568133E+04	.581748E+04	.596038E+04	.611022E+04
.626722E+04	.643141E+04	.660305E+04	.678231E+04	.696902E+04	.716325E+04	.736484E+04	.757385E+04	.779013E+04
.801375E+04	.824455E+04	.848194E+04	.872514E+04	.897367E+04	.922740E+04	.948629E+04	.974979E+04	.100220E+05
.103044E+05	.105962E+05	.108731E+05	.109612E+05	.109616E+05	.109520E+05	.109503E+05	.109503E+05	.109503E+05
.108813E+05	.107693E+05	.106644E+05	.106004E+05	.106004E+05	.106004E+05	.105840E+05	.105840E+05	.105840E+05
.106323E+05	.107139E+05	.108059E+05	.109076E+05	.110127E+05	.111231E+05	.112390E+05	.113607E+05	.114883E+05
.116218E+05	.117611E+05	.119056E+05	.120553E+05	.122107E+05	.123715E+05	.125374E+05	.127082E+05	.128836E+05
.130638E+05	.132486E+05	.134377E+05	.136298E+05	.138248E+05	.140219E+05	.142208E+05	.144213E+05	.146229E+05
.148251E+05	.150277E+05	.152300E+05	.154318E+05	.156345E+05	.158408E+05	.160524E+05	.162700E+05	.164932E+05
.167224E+05	.169579E+05	.171999E+05	.174484E+05	.177031E+05	.179629E+05	.182282E+05	.184996E+05	.187775E+05
.190427E+05	.191319E+05	.191334E+05	.191311E+05	.191311E+05	.191311E+05	.191048E+05	.190337E+05	.189650E+05
.188986E+05	.188346E+05	.187728E+05	.187134E+05	.186562E+05	.186014E+05	.185488E+05	.184985E+05	.184505E+05
.184047E+05	.183612E+05	.183200E+05	.182811E+05	.182444E+05	.182099E+05	.181777E+05	.181478E+05	.181201E+05
.180946E+05	.180714E+05	.180504E+05	.180317E+05	.180152E+05	.180010E+05	.179889E+05	.179792E+05	.179716E+05
.179663E+05	.179636E+05	.179636E+05	.179636E+05	.180262E+05	.181618E+05	.183234E+05	.185071E+05	.187099E+05
.189163E+05	.191287E+05	.193496E+05	.195797E+05	.198188E+05	.200671E+05	.203250E+05	.205920E+05	.208667E+05
.211489E+05	.214377E+05	.217321E+05	.220304E+05	.223320E+05	.226335E+05	.229341E+05	.232327E+05	.235249E+05
.238100E+05	.240900E+05	.243716E+05	.246553E+05	.249395E+05	.252209E+05	.254906E+05	.257055E+05	.257807E+05
.258056E+05	.258127E+05	.258139E+05	.258139E+05					

AXIS MINIMUM= .72760E-11 DATA UNITS  
 AXIS INCREMENT= .50800E+04 DATA UNITS PER INCH

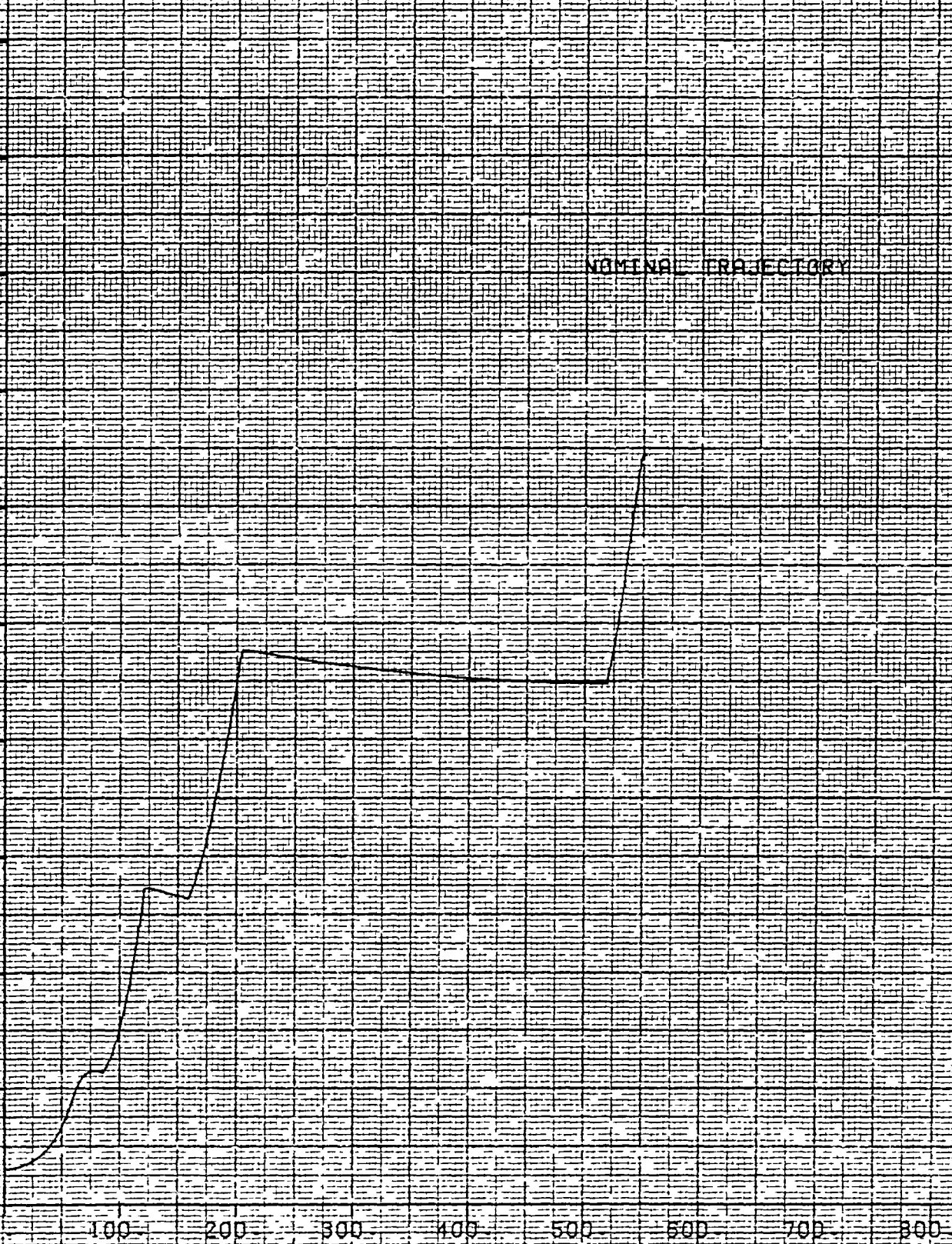
CURVE COMPLETED

FRAME COMPLETED

# TRAJECTORY DATA VELOCITY PROFILE

VERTICAL VELOCITY, FPS  
0  
4000  
8000  
12000  
16000  
20000  
24000  
28000  
32000  
36000  
40000

NOMINAL TRAJECTORY



TIME, SECONDS

```

$INPUTD
TITLE1=TRAJECTORY DATA
PTITLE2=
NFRAME=2,IFREQ=10,
YLNPTH=10,XLAB=8,
XLNPTH=12,XMAX=200,XSINC=0,
IY=5,83,YSINC=0,ISYM=11,LINTYP=1,
YAXIS1=FLIGHT PATH ANGLE, DEG
YAXIS2=DYNAMIC PRESSURE, PSF
$END

```

```

DATE IS 05/06/81
TIME IS 08.52.53

```

```

CALCODE= CAL27

```

```

FRAME= 1 CURVE= 1

```

ABCISSA VALUES

0.	0.	.100000E+01	.200000E+01	.300000E+01	.400000E+01	.500000E+01	.600000E+01	.700000E+01
.800000E+01	.900000E+01	.100000E+02	.110000E+02	.120000E+02	.130000E+02	.140000E+02	.150000E+02	.160000E+02
.170000E+02	.180000E+02	.190000E+02	.200000E+02	.210000E+02	.220000E+02	.230000E+02	.240000E+02	.250000E+02
.260000E+02	.270000E+02	.280000E+02	.290000E+02	.300000E+02	.310000E+02	.320000E+02	.330000E+02	.340000E+02
.350000E+02	.360000E+02	.370000E+02	.380000E+02	.390000E+02	.400000E+02	.410000E+02	.420000E+02	.430000E+02
.440000E+02	.450000E+02	.460000E+02	.470000E+02	.480000E+02	.490000E+02	.500000E+02	.510000E+02	.520000E+02
.530000E+02	.540000E+02	.550000E+02	.560000E+02	.570000E+02	.580000E+02	.590000E+02	.600000E+02	.610000E+02
.620000E+02	.630000E+02	.640000E+02	.650000E+02	.660000E+02	.670000E+02	.680000E+02	.690000E+02	.700000E+02
.710000E+02	.720000E+02	.730000E+02	.740000E+02	.750000E+02	.760000E+02	.770000E+02	.780000E+02	.790000E+02
.800000E+02	.810000E+02	.820000E+02	.830000E+02	.840000E+02	.844000E+02	.844000E+02	.844000E+02	.850000E+02
.852500E+02	.852500E+02	.852500E+02	.860000E+02	.870000E+02	.880000E+02	.890000E+02	.900000E+02	.910000E+02
.920000E+02	.930000E+02	.940000E+02	.950000E+02	.960000E+02	.970000E+02	.980000E+02	.990000E+02	.100000E+03
.101000E+03	.102000E+03	.103000E+03	.104000E+03	.105000E+03	.106000E+03	.107000E+03	.108000E+03	.109000E+03
.110000E+03	.111000E+03	.112000E+03	.113000E+03	.114000E+03	.115000E+03	.116000E+03	.117000E+03	.118000E+03
.119000E+03	.120000E+03	.121000E+03	.122000E+03	.123000E+03	.124000E+03	.124150E+03	.124150E+03	.124150E+03
.130000E+03	.140000E+03	.150000E+03	.156460E+03	.156460E+03	.156460E+03	.158160E+03	.158160E+03	.158160E+03
.159000E+03	.160000E+03	.161000E+03	.162000E+03	.163000E+03	.164000E+03	.165000E+03	.166000E+03	.167000E+03
.168000E+03	.169000E+03	.170000E+03	.171000E+03	.172000E+03	.173000E+03	.174000E+03	.175000E+03	.176000E+03
.177000E+03	.178000E+03	.179000E+03	.180000E+03	.181000E+03	.182000E+03	.183000E+03	.184000E+03	.185000E+03
.186000E+03	.187000E+03	.188000E+03	.189000E+03	.190000E+03	.191000E+03	.192000E+03	.193000E+03	.194000E+03
.195000E+03	.196000E+03	.197000E+03	.198000E+03	.199000E+03	.200000E+03			

```

AXIS MINIMUM= 0. DATA UNITS
AXIS INCREMENT= .50800E+02 DATA UNITS PER INCH

```

- A5 -

ORDINATE VALUES

0.	0.	.207787E+01	.394602E+01	.572203E+01	.740682E+01	.899364E+01	.104897E+02	.119144E+02
.132908E+02	.146460E+02	.159811E+02	.172972E+02	.186049E+02	.199026E+02	.211933E+02	.224756E+02	.237374E+02
.249491E+02	.261073E+02	.272098E+02	.282548E+02	.292411E+02	.301655E+02	.310286E+02	.318443E+02	.326116E+02
.333289E+02	.340012E+02	.346285E+02	.352116E+02	.357533E+02	.362558E+02	.367223E+02	.371539E+02	.375533E+02
.379193E+02	.382506E+02	.385455E+02	.388033E+02	.390229E+02	.392038E+02	.393465E+02	.394626E+02	.395523E+02
.396157E+02	.396534E+02	.396650E+02	.396511E+02	.396127E+02	.395499E+02	.394689E+02	.393709E+02	.392553E+02
.391227E+02	.389736E+02	.388089E+02	.386293E+02	.384374E+02	.382436E+02	.380442E+02	.378335E+02	.376107E+02
.373777E+02	.371344E+02	.368816E+02	.366204E+02	.363521E+02	.360771E+02	.357968E+02	.355118E+02	.35223E+02
.349292E+02	.346326E+02	.343326E+02	.340297E+02	.337237E+02	.334148E+02	.331028E+02	.327880E+02	.324706E+02
.321505E+02	.318279E+02	.315028E+02	.311750E+02	.308443E+02	.307108E+02	.307108E+02	.307108E+02	.305096E+02
.304256E+02	.304256E+02	.304256E+02	.301963E+02	.299029E+02	.296137E+02	.293283E+02	.290467E+02	.287688E+02
.284946E+02	.282244E+02	.279599E+02	.277014E+02	.274489E+02	.272022E+02	.269612E+02	.267258E+02	.264960E+02
.262716E+02	.260524E+02	.258383E+02	.256291E+02	.254247E+02	.252248E+02	.250293E+02	.248380E+02	.246507E+02
.244673E+02	.242874E+02	.241109E+02	.239401E+02	.237752E+02	.236158E+02	.234617E+02	.233126E+02	.231685E+02
.230290E+02	.228941E+02	.227636E+02	.226374E+02	.225125E+02	.223876E+02	.223688E+02	.223688E+02	.223688E+02
.216334E+02	.203568E+02	.190560E+02	.182033E+02	.182033E+02	.182033E+02	.179773E+02	.179773E+02	.179773E+02
.178637E+02	.177287E+02	.175949E+02	.174624E+02	.173315E+02	.172022E+02	.170747E+02	.169494E+02	.168265E+02
.167062E+02	.165885E+02	.164734E+02	.163609E+02	.162512E+02	.161442E+02	.160400E+02	.159385E+02	.158398E+02
.157438E+02	.156506E+02	.155600E+02	.154721E+02	.153869E+02	.153041E+02	.152239E+02	.151461E+02	.150706E+02
.149974E+02	.149265E+02	.148576E+02	.147909E+02	.147261E+02	.146635E+02	.146029E+02	.145444E+02	.144880E+02
.144337E+02	.143814E+02	.143312E+02	.142831E+02	.142370E+02	.141929E+02			

AXIS MINIMUM= 0. DATA UNITS  
 AXIS INCREMENT= .12700E+01 DATA UNITS PER INCH

CURVE COMPLETED

FRAME COMPLETED

FRAME= 2 CURVE= 1

ABCISSA VALUES

0.	0.	.100000E+01	.200000E+01	.300000E+01	.400000E+01	.500000E+01	.600000E+01	.700000E+01
.800000E+01	.900000E+01	.100000E+02	.110000E+02	.120000E+02	.130000E+02	.140000E+02	.150000E+02	.160000E+02
.170000E+02	.180000E+02	.190000E+02	.200000E+02	.210000E+02	.220000E+02	.230000E+02	.240000E+02	.250000E+02
.260000E+02	.270000E+02	.280000E+02	.290000E+02	.300000E+02	.310000E+02	.320000E+02	.330000E+02	.340000E+02
.350000E+02	.360000E+02	.370000E+02	.380000E+02	.390000E+02	.400000E+02	.410000E+02	.420000E+02	.430000E+02
.440000E+02	.450000E+02	.460000E+02	.470000E+02	.480000E+02	.490000E+02	.500000E+02	.510000E+02	.520000E+02
.530000E+02	.540000E+02	.550000E+02	.560000E+02	.570000E+02	.580000E+02	.590000E+02	.600000E+02	.610000E+02
.620000E+02	.630000E+02	.640000E+02	.650000E+02	.660000E+02	.670000E+02	.680000E+02	.690000E+02	.700000E+02
.710000E+02	.720000E+02	.730000E+02	.740000E+02	.750000E+02	.760000E+02	.770000E+02	.780000E+02	.790000E+02
.800000E+02	.810000E+02	.820000E+02	.830000E+02	.840000E+02	.844000E+02	.844000E+02	.844000E+02	.850000E+02
.852500E+02	.852500E+02	.852500E+02	.860000E+02	.870000E+02	.880000E+02	.890000E+02	.900000E+02	.910000E+02
.920000E+02	.930000E+02	.940000E+02	.950000E+02	.960000E+02	.970000E+02	.980000E+02	.990000E+02	.100000E+03
.101000E+03	.102000E+03	.103000E+03	.104000E+03	.105000E+03	.106000E+03	.107000E+03	.108000E+03	.109000E+03
.110000E+03	.111000E+03	.112000E+03	.113000E+03	.114000E+03	.115000E+03	.116000E+03	.117000E+03	.118000E+03
.119000E+03	.120000E+03	.121000E+03	.122000E+03	.123000E+03	.124000E+03	.124150E+03	.124150E+03	.124150E+03
.130000E+03	.140000E+03	.150000E+03	.156460E+03	.156460E+03	.156460E+03	.158160E+03	.158160E+03	.158160E+03
.159000E+03	.160000E+03	.161000E+03	.162000E+03	.163000E+03	.164000E+03	.165000E+03	.166000E+03	.167000E+03
.168000E+03	.169000E+03	.170000E+03	.171000E+03	.172000E+03	.173000E+03	.174000E+03	.175000E+03	.176000E+03
.177000E+03	.178000E+03	.179000E+03	.180000E+03	.181000E+03	.182000E+03	.183000E+03	.184000E+03	.185000E+03
.186000E+03	.187000E+03	.188000E+03	.189000E+03	.190000E+03	.191000E+03	.192000E+03	.193000E+03	.194000E+03
.195000E+03	.196000E+03	.197000E+03	.198000E+03	.199000E+03	.200000E+03			

AXIS MINIMUM= 0. DATA UNITS  
AXIS INCREMENT= .50800E+02 DATA UNITS PER INCH

ORDINATE VALUES

0.	0.	.244808E+01	.882938E+01	.185668E+02	.311472E+02	.460543E+02	.629173E+02	.816512E+02
.102311E+03	.125111E+03	.150050E+03	.177188E+03	.206758E+03	.238769E+03	.273391E+03	.310707E+03	.350415E+03
.391517E+03	.433709E+03	.476725E+03	.520296E+03	.564158E+03	.607971E+03	.651567E+03	.695496E+03	.739559E+03
.783531E+03	.827571E+03	.871538E+03	.915335E+03	.958995E+03	.100255E+04	.104617E+04	.108988E+04	.113395E+04
.117822E+04	.122247E+04	.126650E+04	.131007E+04	.135292E+04	.139476E+04	.143528E+04	.147425E+04	.151136E+04
.154622E+04	.157838E+04	.160739E+04	.161730E+04	.161660E+04	.161237E+04	.160451E+04	.159292E+04	.157750E+04
.155822E+04	.153510E+04	.150819E+04	.147756E+04	.144332E+04	.140565E+04	.136200E+04	.130963E+04	.124874E+04
.117947E+04	.110336E+04	.102437E+04	.944474E+03	.865437E+03	.788493E+03	.715040E+03	.645877E+03	.581340E+03
.521860E+03	.467352E+03	.417755E+03	.372913E+03	.332483E+03	.296193E+03	.263690E+03	.233545E+03	.206895E+03
.183486E+03	.152955E+03	.144943E+03	.129118E+03	.115165E+03	.110029E+03	.110029E+03	.110029E+03	.102798E+03
.999529E+02	.999529E+02	.999529E+02	.943631E+02	.879180E+02	.820637E+02	.767292E+02	.718549E+02	.673891E+02
.632853E+02	.595047E+02	.560129E+02	.527776E+02	.497682E+02	.469598E+02	.444176E+02	.422636E+02	.401909E+02
.381924E+02	.362603E+02	.343901E+02	.326154E+02	.310390E+02	.294737E+02	.279178E+02	.263731E+02	.248405E+02
.233237E+02	.218253E+02	.203470E+02	.188913E+02	.175751E+02	.162895E+02	.150114E+02	.137483E+02	.125201E+02
.113348E+02	.101942E+02	.906325E+01	.772761E+01	.645937E+01	.537213E+01	.522387E+01	.522387E+01	.522387E+01
.159057E+01	.173011E+00	.247309E-01	.872504E-02	.872504E-02	.872504E-02	.672092E-02	.672092E-02	.672092E-02
.601055E-02	.530897E-02	.471827E-02	.421683E-02	.378420E-02	.341021E-02	.308544E-02	.275082E-02	.245089E-02
.219927E-02	.198621E-02	.180413E-02	.164741E-02	.151165E-02	.139330E-02	.128940E-02	.119769E-02	.111630E-02
.104373E-02	.978737E-03	.920249E-03	.867268E-03	.819081E-03	.775041E-03	.734658E-03	.697487E-03	.663170E-03
.631368E-03	.601816E-03	.574252E-03	.548501E-03	.524477E-03	.502218E-03	.481644E-03	.463496E-03	.448416E-03
.434224E-03	.420859E-03	.408260E-03	.396360E-03	.385089E-03	.374350E-03			

AXIS MINIMUM= 0. DATA UNITS  
AXIS INCREMENT= .25400E+03 DATA UNITS PER INCH

CURVE COMPLETED

FRAME COMPLETED

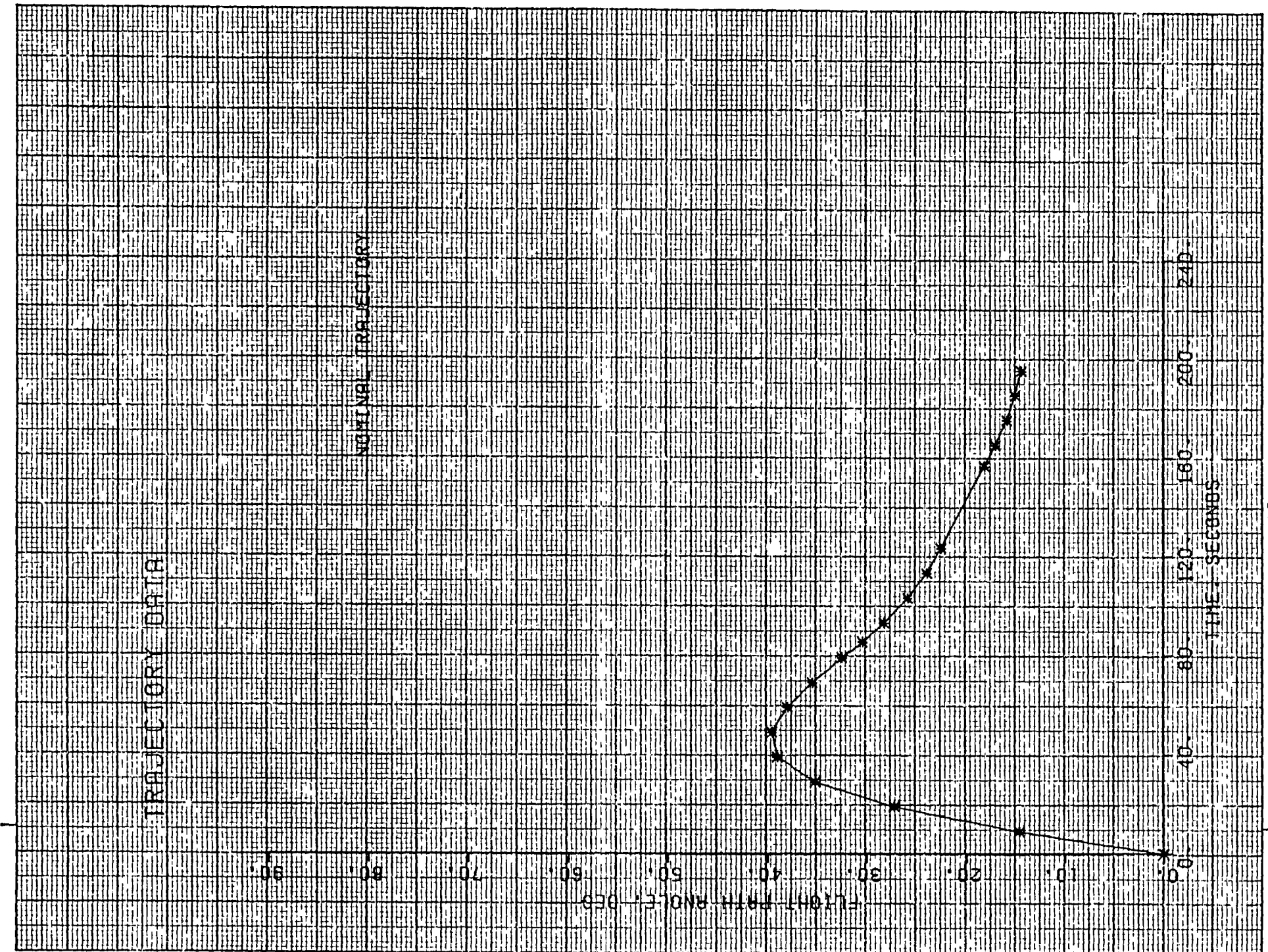
TRAJECTORY DATA

LIGHT PATH ANGLE DEG

NOMINAL TRAJECTORY

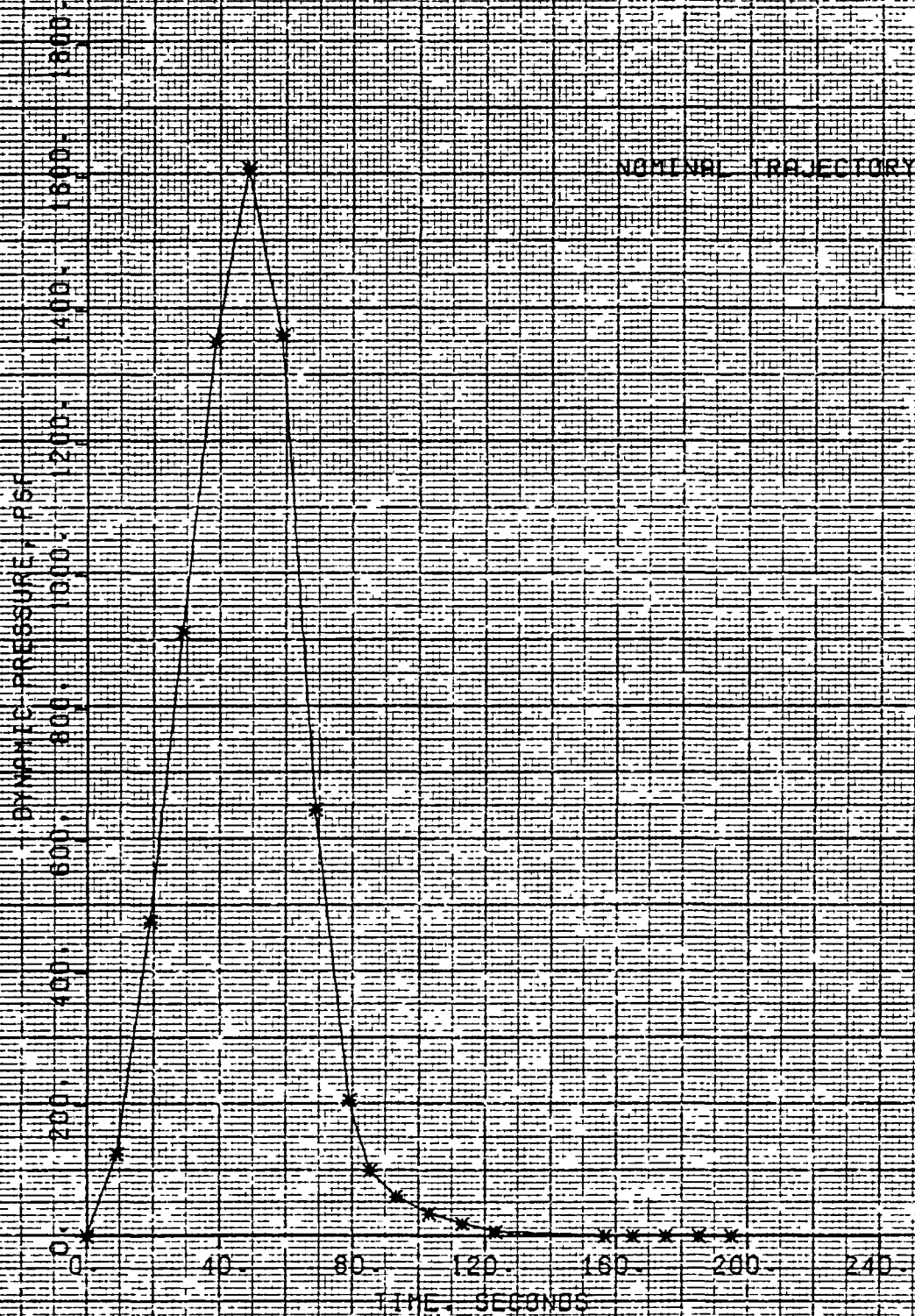
TIME - SECONDS

40 80 120 160 200 240





# TRAJECTORY DATA



```

$INPUTO
TITLE1=ALTITUDE RANGE PROFILE
PTITLE2=ALTITUDE RANGE PROFILE
IX=75,IY=63,FACTY=.0001645788,
XLAB=10,YLAB=18,
NFRAME=1,NCURVE=3,ICASE=1,2,3,
XLNGTH=16,YLNGTH=20,
XSINC=0,YSINC=0,XMAX=1E6,ISYM=29,28,30,
IFREQ=1,LINTYP=250,250,250,
XAXIS1=RANGE, N MI
YAXIS1=ALTITUDE, N MI
PLABEL1=A= +3 SIGMA TRAJECTORY
PLABEL2=B= NOMINAL TRAJECTORY
PLABEL3=C= -3 SIGMA TRAJECTORY
$END

```

```

DATE IS 05/06/81
TIME IS 08.54.53

```

```

CALCODE= CAL27

```

```

FRAME= 1 CURVE= 1

```

ABCISSA VALUES

.352111E-04	.352111E-04	.465656E-04	.946612E-04	.943330E-04	.574159E-03	.223409E-02	.531229E-02	.101217E-01
.169594E-01	.259508E-01	.372008E-01	.508864E-01	.672074E-01	.863474E-01	.108496E+00	.133860E+00	.162649E+00
.195043E+00	.231202E+00	.271286E+00	.315454E+00	.363862E+00	.416669E+00	.474035E+00	.536140E+00	.603179E+00
.675341E+00	.752823E+00	.835829E+00	.924562E+00	1.01923E+01	.112005E+01	.122726E+01	.134111E+01	.146186E+01
.158987E+01	.172540E+01	.186880E+01	.202042E+01	.218061E+01	.234977E+01	.252827E+01	.271649E+01	.291480E+01
.312359E+01	.334326E+01	.357422E+01	.381693E+01	.407186E+01	.433951E+01	.462038E+01	.491497E+01	.522362E+01
.554747E+01	.588652E+01	.624155E+01	.661321E+01	.700215E+01	.740899E+01	.783423E+01	.827772E+01	.873884E+01
.921685E+01	.971085E+01	1.02197E+02	1.07423E+02	1.12774E+02	1.18239E+02	1.23805E+02	1.29462E+02	1.35202E+02
1.41013E+02	1.46889E+02	1.52821E+02	1.58801E+02	1.64824E+02	1.70883E+02	1.76971E+02	1.83084E+02	1.89215E+02
1.95363E+02	2.01523E+02	2.07693E+02	2.13870E+02	2.20052E+02	2.22525E+02	2.22525E+02	2.22525E+02	2.26234E+02
2.27779E+02	2.27779E+02	2.27779E+02	2.32441E+02	2.38764E+02	2.45216E+02	2.51806E+02	2.58540E+02	2.65428E+02
2.72478E+02	2.79698E+02	2.87097E+02	2.94685E+02	3.02470E+02	3.10463E+02	3.18674E+02	3.27111E+02	3.35786E+02
3.44708E+02	3.53889E+02	3.63340E+02	3.73070E+02	3.83093E+02	3.93419E+02	4.04059E+02	4.15025E+02	4.26327E+02
4.37976E+02	4.49984E+02	4.62361E+02	4.75116E+02	4.88257E+02	5.01793E+02	5.15730E+02	5.30077E+02	5.44841E+02
5.60039E+02	5.75684E+02	5.91782E+02	6.08187E+02	6.24647E+02	6.41109E+02	6.43579E+02	6.43579E+02	6.43579E+02
7.39761E+02	9.03700E+02	1.06708E+03	1.17235E+03	1.17235E+03	1.17235E+03	1.20001E+03	1.20001E+03	1.20001E+03
1.21371E+03	1.23013E+03	1.24670E+03	1.26342E+03	1.28032E+03	1.29740E+03	1.31466E+03	1.33211E+03	1.34977E+03
1.36764E+03	1.38573E+03	1.40405E+03	1.42261E+03	1.44141E+03	1.46047E+03	1.47979E+03	1.49938E+03	1.51924E+03
1.53939E+03	1.55983E+03	1.58057E+03	1.60162E+03	1.62297E+03	1.64463E+03	1.66660E+03	1.68890E+03	1.71151E+03
1.73444E+03	1.75769E+03	1.78126E+03	1.80515E+03	1.82936E+03	1.85389E+03	1.87874E+03	1.90394E+03	1.92948E+03
1.95538E+03	1.98164E+03	2.00828E+03	2.03530E+03	2.06271E+03	2.09052E+03	2.11875E+03	2.14739E+03	2.17646E+03
2.20597E+03	2.23577E+03	2.26562E+03	2.27666E+03	2.27666E+03	2.27666E+03	2.27666E+03	2.27666E+03	2.27666E+03
3.27341E+03	3.56731E+03	3.86015E+03	4.15199E+03	4.44285E+03	4.73278E+03	5.02183E+03	5.31004E+03	5.59744E+03
5.88409E+03	6.17001E+03	6.45524E+03	6.73984E+03	7.02383E+03	7.30725E+03	7.59014E+03	7.87254E+03	8.15449E+03
8.43601E+03	8.71716E+03	8.99796E+03	9.27845E+03	9.55867E+03	9.83865E+03	1.01184E+04	1.03980E+04	1.06775E+04
1.09569E+04	1.11893E+04	1.11893E+04	1.11893E+04	1.12083E+04	1.12364E+04	1.12648E+04	1.12934E+04	1.13224E+04
1.13516E+04	1.13812E+04	1.14111E+04	1.14414E+04	1.14720E+04	1.15030E+04	1.15344E+04	1.15662E+04	1.15984E+04
1.16311E+04	1.16642E+04	1.16977E+04	1.17318E+04	1.17662E+04	1.18012E+04	1.18366E+04	1.18725E+04	1.19088E+04
1.19456E+04	1.19829E+04	1.20205E+04	1.20586E+04	1.20972E+04	1.21362E+04	1.21756E+04	1.22154E+04	1.22554E+04
1.22955E+04	1.23356E+04	1.23661E+04	1.23661E+04	1.23661E+04	1.23661E+04	1.23661E+04	1.23661E+04	1.23661E+04

- 6A -

AXIS MINIMUM= 0. DATA UNITS  
 AXIS INCREMENT= .25400E+03 DATA UNITS PER INCH

ORDINATE VALUES

.534884E-01	.534884E-01	.571648E-01	.680325E-01	.855541E-01	.1C9383E+00	.139206E+00	.174710E+00	.215637E+00
.261817E+00	.313177E+00	.369712E+00	.431413E+00	.498313E+00	.570471E+00	.647956E+00	.730861E+00	.819270E+00
.913173E+00	.101250E+01	.111717E+01	.122710E+01	.134220E+01	.146237E+01	.158750E+01	.171752E+01	.185239E+01
.199208E+01	.213655E+01	.228580E+01	.243983E+01	.259865E+01	.276228E+01	.293078E+01	.310423E+01	.328274E+01
.346644E+01	.365545E+01	.384991E+01	.404995E+01	.425570E+01	.446729E+01	.468486E+01	.490857E+01	.513864E+01
.537527E+01	.561867E+01	.586907E+01	.612667E+01	.639171E+01	.666442E+01	.694504E+01	.723384E+01	.753110E+01
.783706E+01	.815201E+01	.847622E+01	.880995E+01	.915348E+01	.950715E+01	.987122E+01	.102454E+02	.106290E+02
.110214E+02	.114215E+02	.118284E+02	.122409E+02	.126582E+02	.130790E+02	.135025E+02	.139278E+02	.143540E+02
.147805E+02	.152065E+02	.156314E+02	.160548E+02	.164759E+02	.168945E+02	.173100E+02	.177221E+02	.181304E+02
.185346E+02	.189347E+02	.193302E+02	.197212E+02	.201074E+02	.202605E+02	.202605E+02	.202605E+02	.204886E+02
.205831E+02	.205831E+02	.205831E+02	.208662E+02	.212456E+02	.216277E+02	.220127E+02	.224010E+02	.227929E+02
.231889E+02	.235892E+02	.239943E+02	.244046E+02	.248204E+02	.252422E+02	.256704E+02	.261053E+02	.265475E+02
.269973E+02	.274551E+02	.279214E+02	.283966E+02	.288810E+02	.293752E+02	.298795E+02	.303943E+02	.309199E+02
.314568E+02	.320052E+02	.325655E+02	.331380E+02	.337230E+02	.343207E+02	.349313E+02	.355551E+02	.361925E+02
.368439E+02	.375100E+02	.381908E+02	.388802E+02	.395679E+02	.402514E+02	.403536E+02	.403536E+02	.403536E+02
.442612E+02	.505947E+02	.564926E+02	.600718E+02	.600718E+02	.600718E+02	.609836E+02	.609836E+02	.609836E+02
.614304E+02	.619623E+02	.624944E+02	.630275E+02	.635617E+02	.640971E+02	.646341E+02	.651729E+02	.657138E+02
.662569E+02	.668026E+02	.673512E+02	.679028E+02	.684578E+02	.690163E+02	.695786E+02	.701449E+02	.707154E+02
.712904E+02	.718701E+02	.724545E+02	.730440E+02	.736387E+02	.742386E+02	.748438E+02	.754545E+02	.760706E+02
.766923E+02	.773196E+02	.779525E+02	.785909E+02	.792349E+02	.798845E+02	.805401E+02	.812019E+02	.818700E+02
.825448E+02	.832266E+02	.839156E+02	.846121E+02	.853165E+02	.860289E+02	.867497E+02	.874789E+02	.882165E+02
.889623E+02	.897129E+02	.904624E+02	.907392E+02	.907392E+02	.907392E+02	.934372E+02	.100708E+03	.107742E+03
.114540E+03	.121101E+03	.127426E+03	.133517E+03	.139372E+03	.144993E+03	.150379E+03	.155531E+03	.160450E+03
.165136E+03	.169588E+03	.173808E+03	.177795E+03	.181550E+03	.185073E+03	.188365E+03	.191424E+03	.194252E+03
.196849E+03	.199215E+03	.201350E+03	.203255E+03	.204928E+03	.206372E+03	.207584E+03	.208566E+03	.209318E+03
.209840E+03	.210099E+03	.210099E+03	.210099E+03	.210113E+03	.210132E+03	.210148E+03	.210162E+03	.210173E+03
.210182E+03	.210189E+03	.210194E+03	.210197E+03	.210198E+03	.210197E+03	.210195E+03	.210191E+03	.210185E+03
.210179E+03	.210171E+03	.210162E+03	.210152E+03	.210141E+03	.210130E+03	.210118E+03	.210106E+03	.210094E+03
.210082E+03	.210070E+03	.210058E+03	.210047E+03	.210036E+03	.210026E+03	.210017E+03	.210009E+03	.210001E+03
.209994E+03	.209988E+03	.209983E+03	.209983E+03					

AXIS MINIMUM= 0. DATA UNITS  
 AXIS INCREMENT= .50800E+02 DATA UNITS PER INCH

CURVE COMPLETED

FRAME= 1 CURVE= 2

ABCISSA VALUES

.352111E-04	.352111E-04	.421623E-04	.187509E-03	.429093E-03	.269460E-03	.106378E-02	.362510E-02	.789194E-02
.141746E-01	.225972E-01	.332738E-01	.464100E-01	.622222E-01	.809098E-01	.102688E+00	.127783E+00	.156399E+00
.188717E+00	.224915E+00	.265166E+00	.309656E+00	.358536E+00	.411975E+00	.470138E+00	.533192E+00	.601305E+00
.674672E+00	.753506E+00	.837992E+00	.928333E+00	.102486E+01	.112798E+01	.123812E+01	.135568E+01	.148109E+01
.161484E+01	.175736E+01	.190913E+01	.207065E+01	.224243E+01	.242501E+01	.261897E+01	.282482E+01	.304308E+01
.327425E+01	.351885E+01	.377740E+01	.405039E+01	.433839E+01	.464195E+01	.496162E+01	.529798E+01	.565160E+01
.602312E+01	.641318E+01	.682250E+01	.725155E+01	.770609E+01	.816740E+01	.865255E+01	.915443E+01	.967172E+01
.102031E+02	.107472E+02	.113028E+02	.118685E+02	.124433E+02	.130260E+02	.136159E+02	.142118E+02	.148130E+02
.154188E+02	.160284E+02	.166411E+02	.172564E+02	.178737E+02	.184926E+02	.191127E+02	.197339E+02	.203557E+02
.208659E+02	.208659E+02	.208659E+02	.209779E+02	.215999E+02	.222216E+02	.228432E+02	.234646E+02	.240857E+02
.242410E+02	.242410E+02	.242410E+02	.247095E+02	.253454E+02	.259948E+02	.266584E+02	.273370E+02	.280316E+02
.287430E+02	.294722E+02	.302201E+02	.309877E+02	.317760E+02	.325860E+02	.334187E+02	.342753E+02	.351568E+02
.360644E+02	.369991E+02	.379622E+02	.389549E+02	.399783E+02	.410338E+02	.421224E+02	.432453E+02	.444038E+02
.455990E+02	.468321E+02	.481042E+02	.494161E+02	.507687E+02	.521628E+02	.535992E+02	.550790E+02	.566035E+02
.581746E+02	.597927E+02	.614427E+02	.630982E+02	.647539E+02	.664860E+02	.682608E+02	.700808E+02	.719325E+02
.927997E+02	.109212E+03	.119783E+03	.119783E+03	.119783E+03	.122561E+03	.122561E+03	.122561E+03	.123937E+03
.125586E+03	.127252E+03	.128934E+03	.130635E+03	.132355E+03	.134095E+03	.135856E+03	.137638E+03	.139444E+03
.141274E+03	.143128E+03	.145009E+03	.146916E+03	.148850E+03	.150813E+03	.152806E+03	.154828E+03	.156882E+03
.158967E+03	.161085E+03	.163235E+03	.165418E+03	.167635E+03	.169885E+03	.172170E+03	.174488E+03	.176841E+03
.179227E+03	.181647E+03	.184102E+03	.186591E+03	.189116E+03	.191678E+03	.194277E+03	.196915E+03	.199594E+03
.202313E+03	.205075E+03	.207879E+03	.210728E+03	.213621E+03	.216561E+03	.219543E+03	.222539E+03	.224644E+03
.224644E+03	.224644E+03	.243482E+03	.273280E+03	.302941E+03	.332469E+03	.361869E+03	.391146E+03	.420304E+03
.449347E+03	.478281E+03	.507108E+03	.535834E+03	.564463E+03	.592998E+03	.621443E+03	.649803E+03	.678082E+03
.706282E+03	.734409E+03	.762465E+03	.790455E+03	.818382E+03	.846250E+03	.874062E+03	.901822E+03	.929533E+03
.957199E+03	.984823E+03	.101241E+04	.103996E+04	.106748E+04	.109497E+04	.111782E+04	.111782E+04	.111782E+04
.111969E+04	.112246E+04	.112525E+04	.112807E+04	.113092E+04	.113381E+04	.113673E+04	.113968E+04	.114267E+04
.114570E+04	.114877E+04	.115188E+04	.115504E+04	.115824E+04	.116148E+04	.116478E+04	.116812E+04	.117151E+04
.117494E+04	.117843E+04	.118196E+04	.118555E+04	.118918E+04	.119285E+04	.119657E+04	.120033E+04	.120415E+04
.120800E+04	.121190E+04	.121584E+04	.121978E+04	.122373E+04	.122768E+04	.122787E+04	.122787E+04	.122787E+04

AXIS MINIMUM= 0. DATA UNITS  
AXIS INCREMENT= .25400E+03 DATA UNITS PER INCH

ORDINATE VALUES

.534884E-01	.534884E-01	.576574E-01	.700318E-01	.898666E-01	.116860E+00	.150668E+00	.190956E+00	.237471E+00
.290063E+00	.348684E+00	.413333E+00	.484032E+00	.560849E+00	.643859E+00	.733169E+00	.828889E+00	.931034E+00
.103953E+01	.115429E+01	.127522E+01	.140224E+01	.153520E+01	.167401E+01	.181860E+01	.196898E+01	.212509E+01
.228695E+01	.245460E+01	.262812E+01	.280764E+01	.299321E+01	.318490E+01	.338283E+01	.358715E+01	.379799E+01
.401551E+01	.423984E+01	.447112E+01	.470952E+01	.495517E+01	.520821E+01	.546879E+01	.573711E+01	.601338E+01
.629787E+01	.659084E+01	.689259E+01	.720344E+01	.752369E+01	.785369E+01	.819378E+01	.854437E+01	.890583E+01
.927859E+01	.966304E+01	.100596E+02	.104684E+02	.108891E+02	.113208E+02	.117625E+02	.122133E+02	.126718E+02
.131369E+02	.136072E+02	.140817E+02	.145593E+02	.150389E+02	.155196E+02	.160007E+02	.164814E+02	.169611E+02
.174391E+02	.179148E+02	.183878E+02	.188575E+02	.193236E+02	.197858E+02	.202439E+02	.206975E+02	.211466E+02
.215112E+02	.215112E+02	.215112E+02	.215908E+02	.220299E+02	.224638E+02	.228924E+02	.233160E+02	.237343E+02
.238381E+02	.238381E+02	.238381E+02	.241492E+02	.245663E+02	.249866E+02	.254105E+02	.258383E+02	.262704E+02
.267073E+02	.271493E+02	.275970E+02	.280506E+02	.285107E+02	.289778E+02	.294523E+02	.299346E+02	.304252E+02
.309247E+02	.314335E+02	.319520E+02	.324807E+02	.330202E+02	.335708E+02	.341330E+02	.347074E+02	.352941E+02
.358938E+02	.365068E+02	.371334E+02	.377739E+02	.384286E+02	.390979E+02	.397819E+02	.404811E+02	.411961E+02
.419275E+02	.426754E+02	.434332E+02	.441894E+02	.449417E+02	.449901E+02	.449901E+02	.449901E+02	.500856E+02
.570651E+02	.636119E+02	.676118E+02	.676118E+02	.676118E+02	.686345E+02	.686345E+02	.686345E+02	.691363E+02
.697342E+02	.703331E+02	.709336E+02	.715366E+02	.721406E+02	.727476E+02	.733574E+02	.739703E+02	.745866E+02
.752067E+02	.758307E+02	.764591E+02	.770921E+02	.777299E+02	.783730E+02	.790215E+02	.796748E+02	.803359E+02
.810023E+02	.816751E+02	.823545E+02	.830405E+02	.837334E+02	.844331E+02	.851398E+02	.858536E+02	.865744E+02
.873022E+02	.880371E+02	.887791E+02	.895286E+02	.902857E+02	.910508E+02	.918243E+02	.926064E+02	.933976E+02
.941982E+02	.950086E+02	.958290E+02	.966599E+02	.975015E+02	.983542E+02	.992168E+02	.100081E+03	.100677E+03
.100687E+03	.100687E+03	.106071E+03	.114431E+03	.122560E+03	.130458E+03	.138127E+03	.145565E+03	.152774E+03
.159754E+03	.166506E+03	.173029E+03	.179325E+03	.185393E+03	.191234E+03	.196849E+03	.202237E+03	.207399E+03
.212335E+03	.217046E+03	.221532E+03	.225792E+03	.229828E+03	.233639E+03	.237226E+03	.240589E+03	.243728E+03
.246644E+03	.249336E+03	.251804E+03	.254056E+03	.256072E+03	.257871E+03	.259199E+03	.259199E+03	.259199E+03
.259300E+03	.259449E+03	.259598E+03	.259746E+03	.259895E+03	.260044E+03	.260193E+03	.260344E+03	.260495E+03
.260647E+03	.260801E+03	.260956E+03	.261113E+03	.261273E+03	.261435E+03	.261599E+03	.261766E+03	.261936E+03
.262109E+03	.262286E+03	.262466E+03	.262650E+03	.262838E+03	.263029E+03	.263224E+03	.263423E+03	.263626E+03
.263834E+03	.264046E+03	.264261E+03	.264478E+03	.264696E+03	.264914E+03	.264924E+03	.264924E+03	.264924E+03

AXIS MINIMUM= 0. DATA UNITS  
 AXIS INCREMENT= .50800E+02 DATA UNITS PER INCH

CURVE COMPLETED

FRAME= 1 CURVE= 3

ABCISSA VALUES

.352111E-04	.352111E-04	.521847E-04	.302797E-04	.253795E-03	.118114E-02	.321949E-02	.670648E-02	.119457E-01
.192130E-01	.286256E-01	.402806E-01	.543429E-01	.709916E-01	.903945E-01	.112719E+00	.138148E+00	.166871E+00
.199077E+00	.234921E+00	.274539E+00	.318067E+00	.365639E+00	.417387E+00	.473440E+00	.533930E+00	.599017E+00
.668884E+00	.743712E+00	.823702E+00	.909123E+00	.100023E+01	.109720E+01	.120025E+01	.130963E+01	.142548E+01
.154792E+01	.167712E+01	.181322E+01	.195635E+01	.210673E+01	.226459E+01	.243022E+01	.260384E+01	.278569E+01
.297600E+01	.317503E+01	.338306E+01	.360038E+01	.382729E+01	.406413E+01	.431122E+01	.456891E+01	.483759E+01
.511771E+01	.540980E+01	.571441E+01	.603213E+01	.636361E+01	.670947E+01	.707029E+01	.744668E+01	.783926E+01
.824857E+01	.867465E+01	.911705E+01	.957515E+01	.100483E+02	.105354E+02	.110357E+02	.115480E+02	.120713E+02
.126045E+02	.131467E+02	.136970E+02	.142545E+02	.148184E+02	.153881E+02	.159628E+02	.165416E+02	.171247E+02
.177109E+02	.182997E+02	.188907E+02	.194835E+02	.200778E+02	.206732E+02	.208222E+02	.208222E+02	.208222E+02
.212718E+02	.218814E+02	.225035E+02	.231387E+02	.237877E+02	.244515E+02	.251307E+02	.258262E+02	.265388E+02
.272694E+02	.280189E+02	.287882E+02	.295782E+02	.303899E+02	.312241E+02	.320819E+02	.329643E+02	.338723E+02
.348069E+02	.357693E+02	.367604E+02	.377813E+02	.388331E+02	.399169E+02	.410335E+02	.421842E+02	.433698E+02
.445914E+02	.458498E+02	.471457E+02	.484799E+02	.498529E+02	.512656E+02	.527188E+02	.542139E+02	.557523E+02
.573343E+02	.589460E+02	.605632E+02	.621808E+02	.625615E+02	.625615E+02	.625615E+02	.702605E+02	.863793E+02
.102449E+03	.112806E+03	.112806E+03	.112806E+03	.115528E+03	.115528E+03	.115528E+03	.116875E+03	.118491E+03
.120120E+03	.121763E+03	.123423E+03	.125100E+03	.126794E+03	.128506E+03	.130237E+03	.131987E+03	.133758E+03
.135551E+03	.137365E+03	.139202E+03	.141063E+03	.142948E+03	.144858E+03	.146793E+03	.148755E+03	.150744E+03
.152760E+03	.154804E+03	.156877E+03	.156979E+03	.161110E+03	.163271E+03	.165462E+03	.167683E+03	.169934E+03
.172216E+03	.174528E+03	.176869E+03	.179241E+03	.181644E+03	.184076E+03	.186540E+03	.189036E+03	.191565E+03
.194127E+03	.196724E+03	.199356E+03	.202024E+03	.204728E+03	.207471E+03	.210252E+03	.213073E+03	.215933E+03
.218835E+03	.221775E+03	.224731E+03	.227687E+03	.227798E+03	.227798E+03	.227798E+03	.230643E+03	.260144E+03
.289544E+03	.318850E+03	.348065E+03	.377193E+03	.406240E+03	.435209E+03	.464105E+03	.492932E+03	.521694E+03
.550394E+03	.579039E+03	.607630E+03	.636173E+03	.664671E+03	.693128E+03	.721548E+03	.749935E+03	.778293E+03
.806626E+03	.834936E+03	.863230E+03	.891509E+03	.919778E+03	.948040E+03	.976300E+03	.100456E+04	.103283E+04
.106110E+04	.108939E+04	.111293E+04	.111293E+04	.111293E+04	.111486E+04	.111771E+04	.112058E+04	.112348E+04
.112641E+04	.112936E+04	.113235E+04	.113537E+04	.113842E+04	.114151E+04	.114463E+04	.114779E+04	.115099E+04
.115423E+04	.115751E+04	.116083E+04	.116419E+04	.116760E+04	.117105E+04	.117455E+04	.117809E+04	.118168E+04
.118531E+04	.118899E+04	.119271E+04	.119647E+04	.120027E+04	.120412E+04	.120801E+04	.121194E+04	.121591E+04
.121993E+04	.122397E+04	.122803E+04	.123209E+04	.123616E+04	.123808E+04	.123808E+04		

AXIS MINIMUM= 0. DATA UNITS  
AXIS INCREMENT= .25400E+03 DATA UNITS PER INCH

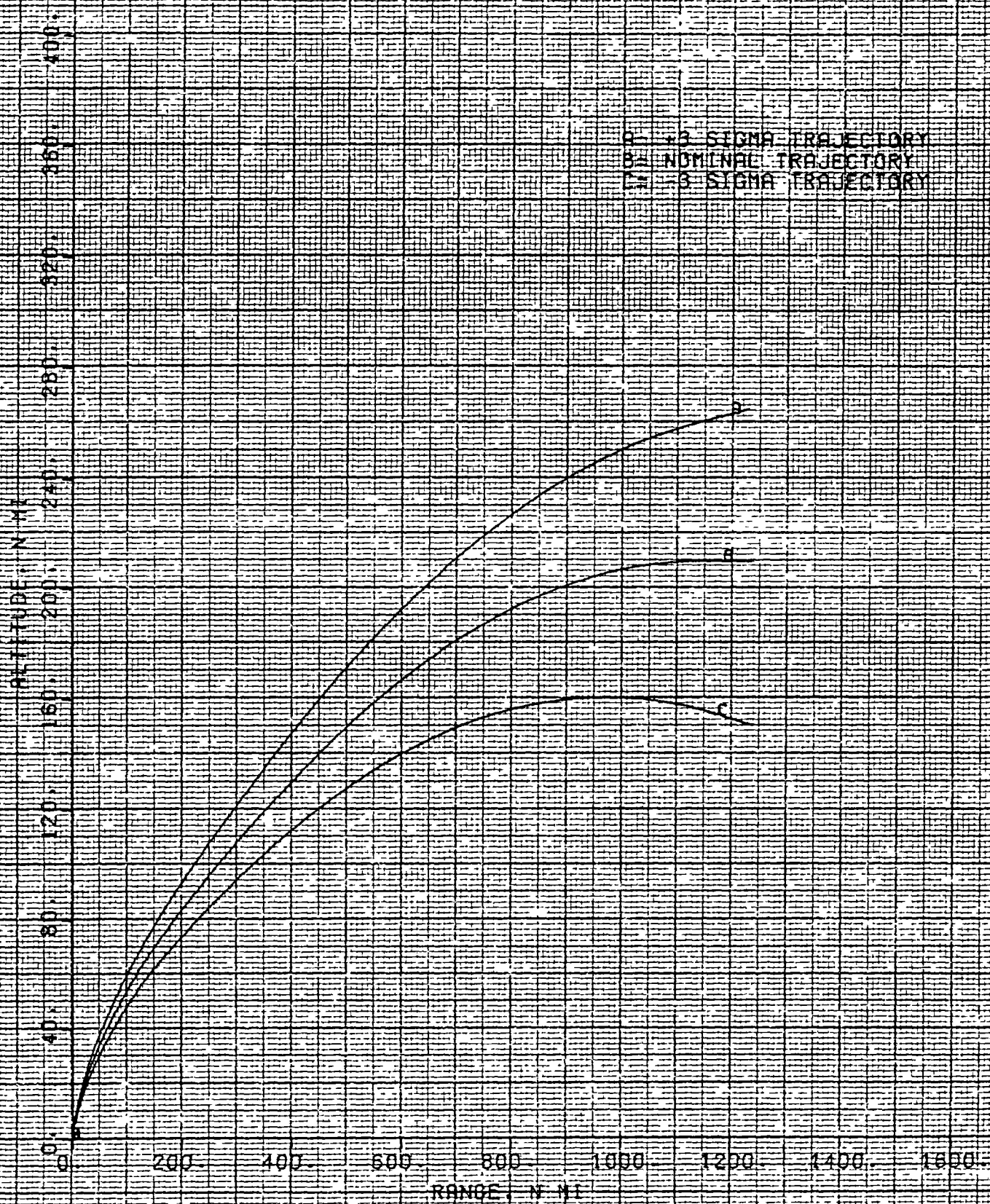
ORDINATE VALUES									
.534884E-01	.534884E-01	.566084E-01	.662307E-01	.816543E-01	.102608E+00	.128802E+00	.159944E+00	.195774E+00	
.236099E+00	.280824E+00	.329926E+00	.383381E+00	.441179E+00	.503360E+00	.569967E+00	.641055E+00	.716694E+00	
.796938E+00	.881749E+00	.971049E+00	.106476E+01	.116278E+01	.126504E+01	.137142E+01	.148181E+01	.159611E+01	
.171428E+01	.183624E+01	.196191E+01	.209124E+01	.222412E+01	.236050E+01	.250030E+01	.264346E+01	.279002E+01	
.294007E+01	.309371E+01	.325112E+01	.341252E+01	.357609E+01	.374798E+01	.392237E+01	.410143E+01	.428540E+01	
.447450E+01	.466894E+01	.486900E+01	.507489E+01	.528688E+01	.550520E+01	.573008E+01	.596180E+01	.620060E+01	
.644668E+01	.670022E+01	.696137E+01	.723030E+01	.750710E+01	.779192E+01	.808499E+01	.838654E+01	.869679E+01	
.901594E+01	.934375E+01	.967965E+01	.100229E+02	.103728E+02	.107285E+02	.110891E+02	.114535E+02	.118211E+02	
.121908E+02	.125619E+02	.129336E+02	.133054E+02	.136766E+02	.140466E+02	.144149E+02	.147811E+02	.151447E+02	
.155054E+02	.158627E+02	.162164E+02	.165662E+02	.169118E+02	.172530E+02	.173376E+02	.173376E+02	.173376E+02	
.175911E+02	.179306E+02	.182722E+02	.186161E+02	.189627E+02	.193123E+02	.196652E+02	.200217E+02	.203822E+02	
.207470E+02	.211165E+02	.214911E+02	.218711E+02	.222569E+02	.226489E+02	.230473E+02	.234526E+02	.238652E+02	
.242854E+02	.247137E+02	.251503E+02	.255956E+02	.260500E+02	.265137E+02	.269872E+02	.274707E+02	.279644E+02	
.284687E+02	.289839E+02	.295102E+02	.300477E+02	.305968E+02	.311576E+02	.317303E+02	.323156E+02	.329138E+02	
.335251E+02	.341438E+02	.347605E+02	.353731E+02	.359167E+02	.355167E+02	.355167E+02	.383699E+02	.440321E+02	
.492540E+02	.523938E+02	.523938E+02	.523938E+02	.531897E+02	.531897E+02	.531897E+02	.535790E+02	.540419E+02	
.545046E+02	.549673E+02	.554305E+02	.558942E+02	.563586E+02	.568239E+02	.572903E+02	.577581E+02	.582274E+02	
.586985E+02	.591715E+02	.596467E+02	.601243E+02	.606045E+02	.610874E+02	.615732E+02	.620621E+02	.625543E+02	
.630499E+02	.635492E+02	.640522E+02	.645590E+02	.650698E+02	.655845E+02	.661034E+02	.666264E+02	.671536E+02	
.676850E+02	.682206E+02	.687604E+02	.693044E+02	.698527E+02	.704053E+02	.709625E+02	.715243E+02	.720911E+02	
.726631E+02	.732404E+02	.738233E+02	.744120E+02	.750068E+02	.756077E+02	.762147E+02	.768276E+02	.774464E+02	
.780710E+02	.787004E+02	.793306E+02	.799586E+02	.799822E+02	.799822E+02	.799822E+02	.805842E+02	.867049E+02	
.925796E+02	.982087E+02	.103593E+03	.108732E+03	.113626E+03	.118277E+03	.122684E+03	.126847E+03	.130767E+03	
.134444E+03	.137878E+03	.141070E+03	.144019E+03	.146727E+03	.149192E+03	.151416E+03	.153398E+03	.155139E+03	
.156639E+03	.157897E+03	.158915E+03	.159691E+03	.160227E+03	.160521E+03	.160575E+03	.160388E+03	.159960E+03	
.159291E+03	.158381E+03	.157440E+03	.157440E+03	.157440E+03	.157356E+03	.157228E+03	.157097E+03	.156961E+03	
.156820E+03	.156675E+03	.156524E+03	.156370E+03	.156210E+03	.156046E+03	.155878E+03	.155704E+03	.155526E+03	
.155343E+03	.155156E+03	.154964E+03	.154768E+03	.154567E+03	.154362E+03	.154153E+03	.153939E+03	.153722E+03	
.153501E+03	.153276E+03	.153048E+03	.152816E+03	.152582E+03	.152345E+03	.152105E+03	.151862E+03	.151617E+03	
.151369E+03	.151121E+03	.150871E+03	.150622E+03	.150372E+03	.150255E+03	.150255E+03			

AXIS MINIMUM= 0. DATA UNITS  
AXIS INCREMENT= .50800E+02 DATA UNITS PER INCH

CURVE COMPLETED

FRAME COMPLETED

TRAJECTORY DATA  
ALTITUDE-RANGE PROFILE



A - +3 SIGMA TRAJECTORY  
B - NOMINAL TRAJECTORY  
C - -3 SIGMA TRAJECTORY



```

$INPUTD
TITLE1=SECOND STAGE THRUST PROFILE
PTITLE2=SECOND STAGE THRUST PROFILE
IX=15,IY=62,FACTY=1,NCURVE=1,ISYM=14,
LINTYP=2,XMAX=125,XMIN=85,
DBA=2,XLNGTH=12,
XSINC=10,XSMIN=85,
YSINC=10000,YSMIN=0,
XAXIS1=TIME, SECONDS
YAXIS1=THRUST, LBS
PLABEL1=
PLABEL2=NOMINAL TRAJECTORY
PLABEL3=
SEND

```

```

DATE IS 05/06/81
TIME IS 08.56.19

```

```

CALCODE= CAL27

```

```

FRAME= 1 CURVE= 1

```

ABCISSA VALUES

.852500E+02	.852500E+02	.852500E+02	.860000E+02	.870000E+02	.880000E+02	.890000E+02	.900000E+02	.910000E+02
.920000E+02	.930000E+02	.940000E+02	.950000E+02	.960000E+02	.970000E+02	.980000E+02	.990000E+02	.100000E+03
.101000E+03	.102000E+03	.103000E+03	.104000E+03	.105000E+03	.106000E+03	.107000E+03	.108000E+03	.109000E+03
.110000E+03	.111000E+03	.112000E+03	.113000E+03	.114000E+03	.115000E+03	.116000E+03	.117000E+03	.118000E+03
.119000E+03	.120000E+03	.121000E+03	.122000E+03	.123000E+03	.124000E+03	.124150E+03	.124150E+03	.124150E+03

```

AXIS MINIMUM= .85000E+02 DATA UNITS
AXIS INCREMENT= .12700E+02 DATA UNITS PER INCH

```

ORDINATE VALUES

0.	0.	-.615747E+02	.416413E+05	.435001E+05	.453221E+05	.471436E+05	.489649E+05	.507857E+05
.526063E+05	.544265E+05	.562465E+05	.580262E+05	.596639E+05	.613015E+05	.628735E+05	.643290E+05	.657844E+05
.671466E+05	.684155E+05	.696843E+05	.707576E+05	.717161E+05	.724720E+05	.731531E+05	.736110E+05	.740200E+05
.742227E+05	.742299E+05	.740179E+05	.733417E+05	.726452E+05	.718249E+05	.708789E+05	.702188E+05	.704137E+05
.706086E+05	.696366E+05	.486899E+05	.659543E+04	.963547E+03	.125306E+03	-.431885E+00	-.431885E+00	0.

```

AXIS MINIMUM= 0. DATA UNITS
AXIS INCREMENT= .12700E+05 DATA UNITS PER INCH

```

```

CURVE COMPLETED

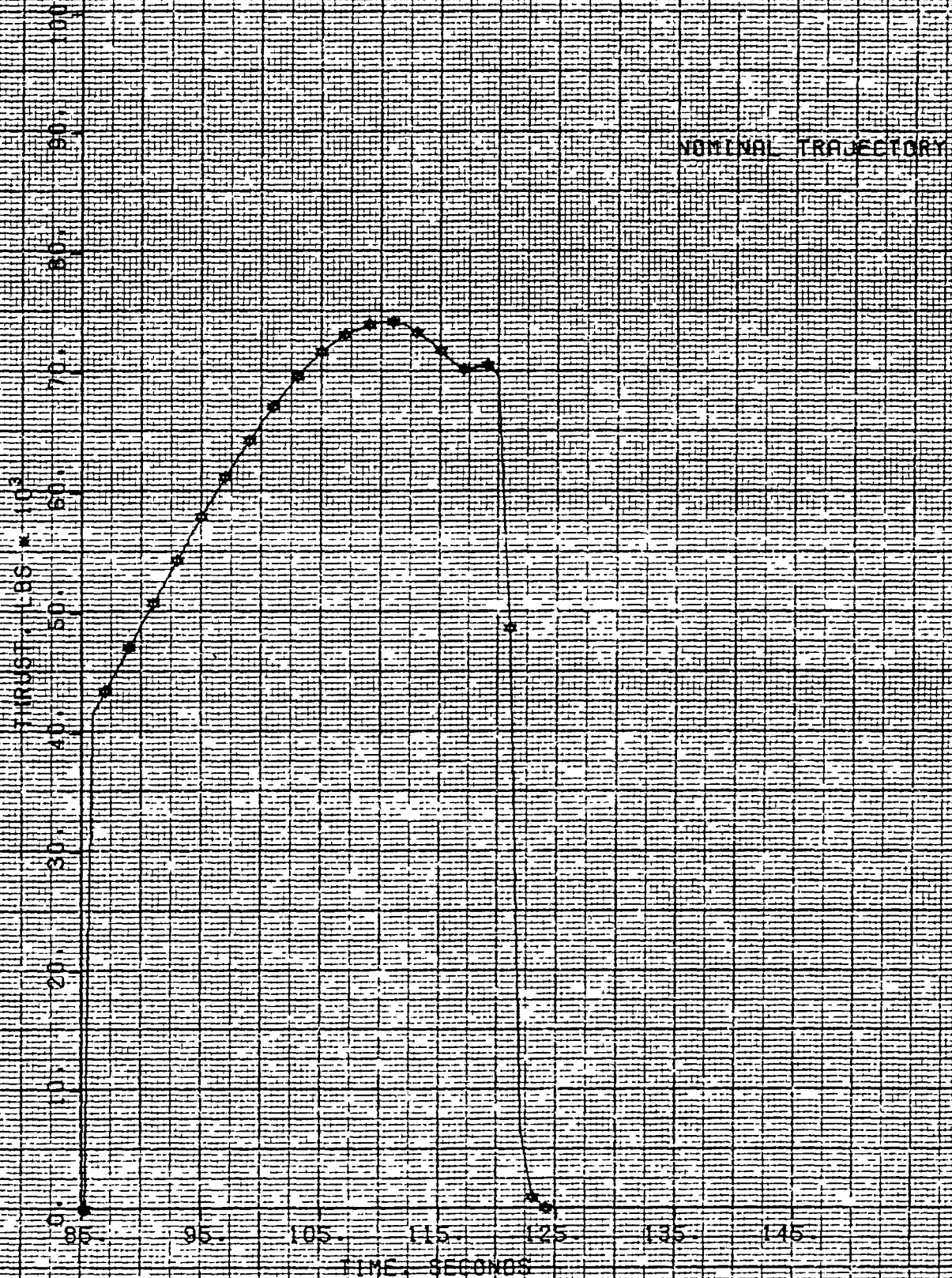
```

```

FRAME COMPLETED

```

TRAJECTORY DATA  
SECOND STAGE THRUST PROFILE



APPENDIX B  
FORTRAN CODE LISTINGS

```

PROGRAM NEMAP(INPUT,OUTPUT,TAPE14,TAPE5=INPUT,TAPE6=OUTPUT,
 ^ TAPE8,TAPE10)
C GENERAL PURPOSE PLOTTING ROUTINE. PLOT DATA FROM A RANDOM ACCESS FILE.
C ***** INPUT DATA *****
C CALCODE = TWO DIGIT INTEGER REPRESENTING PLOT CODE IN USERS MANUAL.
C ONLY ONE VALUE ALLOWED PER PLOT FILE. (CAL31 BUILT-IN)
C DBA = DISTANCE BETWEEN ANNOTATION IN UNITS OF GRAPH PAPER. (2 BUILT-IN)
C FACTX = MULTIPLIER APPLIED TO X-AXIS PARAMETER BEFORE PLOTTING. (1. BN)
C FACTY = MULTIPLIER APPLIED TO Y-AXIS PARAMETER BEFORE PLOTTING.
C ARRAY OF 8. (1. BUILT-IN)
C H = HEIGHT OF AXIS ANNOTATION, INCHES.
C (.1 BUILT-IN)
C HLABEL = HEIGHT OF PLOT LABEL LETTERS, INCHES, ARRAY OF 9. SAME
C ORDER AS PLABEL. (.1 BUILT-IN)
C HTITLE = HEIGHT OF PLOT TITLE LETTERS, INCHES, ARRAY OF 4. SAME
C ORDER AS PTITLE. (.14 BUILT-IN)
C ICASE = TRAJECTORY NUMBERS FROM WHICH TO PLOT DATA. INPUT IF
C NCURVE IS GREATER THAN ONE. ARRAY OF 10. (1-10 BUILT-IN)
C IDIV = NO. OF MINOR DIVISIONS PER UNIT LENGTH OF GRAPH PAPER. (10 BUILT-IN)
C IFREQ = FREQUENCY OF EXTRACTING DATA FOR PLOTTING. (1 BUILT-IN)
C IPAPER = 1 IF INCH PAPER
C 2 IF CENTIMETER PAPER (2 BUILT-IN)
C ISYM = INTEGER EQUIVALENT OF PLOTTED SYMBOL. SAME ORDER AS
C LINTYP, ARRAY OF 10. (VALUES 0 TO 9 BN)
C IX = CODE OF PARAMETER OF X-AXIS(REF. REPORT FOR CODES)
C IY = CODE OF PARAMETER OF Y-AXIS, ARRAY OF 8(REF. REPORT FOR CODES)
C LINTYP = PARAMETER SPECIFYING PLOT LINE TYPE. ZERO IS NO
C SYMBOL, POSITIVE IS CONNECT SYMBOLS, NEGATIVE IS NOT
C CONNECT SYMBOLS. SAME ORDER AS PLOTTED ACCORDING
C TO ICASE AND NCURVE. ARRAY OF 10. MAGNITUDE DETERMINES
C FREQUENCY OF PLOTTED SYMBOL. (0 BN)
C NCURVE = NUMBER OF CURVES PER FRAME. MAX OF 10. (1 BUILT-IN)
C NFRAME = NUMBER OF FRAMES. MAX OF 8. (1 BN)
C PLABEL1 = PLOT LABELS WRITTEN TO SIDE OF PLOT ACCORDING TO XLAB AND
C -PLABEL9 YLAB. 30 CHARACTERS MAX.
C PLENGTH = PAPER LENGTH IN INCHES. (17 BUILT-IN)
C PTITLE1 = PLOT TITLES WRITTEN ABOVE PLOT.
C -PTITLE4 30 CHARACTERS MAX.
C TITLE1 = TITLES TO IDENTIFY DATA CASE.
C TITLE2 72 CHARACTERS MAX.
C XAXIS1 = X-AXIS ANNOTATION. 30 CHARACTERS MAX.
C XLNGTH = X-AXIS LENGTH IN UNITS OF GRAPH PAPER. (16 BUILT-IN)
C XLAB = X DISTANCE OF PLABEL ANNOTATION IN UNITS OF GRAPH PAPER. (18. BN)
C XMAX = MAXIMUM VALUE PLOTTED ON X-AXIS, UNITS AS PLOTTED. (1E6 BUILT-IN)
C XMIN = MINIMUM VALUE PLOTTED ON X-AXIS, UNITS AS PLOTTED. (0 BUILT-IN)
C XSINC = ANNOTATION INCREMENT ON X-AXIS, DATA UNITS PER MAJOR DIVISION.
C AUTOMATICALLY SCALED IF ZERO. (0. BN)
C XSMIN = LEFTMOST ANNOTATION ON X-AXIS, AUTO SCALED IF XSINC ZERO. (0. BN)
C YAXIS1 = Y-AXIS ANNOTATION FOR PLOT FRAMES 1 TO 8.
C -YAXIS8 30 CHARACTERS MAX.
C YLNGTH = Y-AXIS LENGTH IN UNITS OF GRAPH PAPER. (20 BUILT-IN)
C YLAB = Y DISTANCE OF PLABEL ANNOTATION IN UNITS OF GRAPH PAPER. (10. BN)
C YMAX = MAXIMUM VALUE PLOTTED ON Y-AXIS, UNITS AS PLOTTED. (1E6 BUILT-IN)
C YMIN = MINIMUM VALUE PLOTTED ON Y-AXIS, UNITS AS PLOTTED. (-1E6 BUILT-IN)

```

```

C YSINC = ANNOTATION INCREMENT ON Y-AXIS, DATA UNITS PER MAJOR DIVISION.
C AUTOMATICALLY SCALED IF ZERO. (0. BN)
C YSMIN = LOWER ANNOTATION ON Y-AXIS, AUTO SCALED IF YSINC ZERO. (0. BN)
C

```

```

      IMPLICIT REAL(A-H,O-Z)
      INTEGER CALCODE
      COMMON /BLK1/TITLE1(8),TITLE2(8),TITLE(16),LABEL(36),
      ^ XLABEL(4),YLABEL(32)
      DIMENSION X(1000),Y(1000),FACTY(8),IY(8),IA(2001),DATA(102),
      ^ IDATA(2),LINTYP(10),ISYM(10),ICASE(10),HTITLE(4),
      ^ HLABEL(9),SFACT(2)
      EQUIVALENCE (IDATA,DATA)
      NAMELIST /INPUTD/IX,IY,DBA,NFRAME,FACTX,FACTY,H,CALCODE,
      ^ XLNGTH,YLNGTH,IFREQ,IDIV,IPAPER,PLENGTH,XMIN,XMAX,
      ^ XSMIN,XSINC,YSMIN,YSINC,ICASE,YMIN,NCURVE,
      ^ YMAX,LINTYP,ISYM,XLAB,YLAB,HTITLE,HLABEL
      DATA FACTX,FACTY/9*1./
      DATA HLABEL/9*0.07/
      DATA HTITLE/4*0.14/
      DATA ICASE/1,2,3,4,5,6,7,8,9,10/
      DATA ISYM/0,1,2,3,4,5,6,7,8,9/
      DATA LINTYP/10*0/
      DATA SFACT/1.,2.54/
      DATA TITLE1,TITLE2,TITLE,LABEL,XLABEL,YLABEL/104*10H

```

```

C
C INITIALIZE INPUT DATA

```

```

      CALCODE=31
      DBA=2.
      H=.10
      IDIV=10
      IFREQ=1
      IPAPER=2
      NCURVE=1
      NFRAME=1
      PLENGTH=17.
      XLNGTH=16.
      XLAB=18.
      XMAX=1.E10
      XMIN=0.
      XSINC=0.
      XSMIN=0.
      YLNGTH=20.
      YLAB=10.
      YMAX=1.E10
      YMIN=-1.E10
      YSINC=0.
      YSMIN=0.
      CALL OPENMS(14,IA,2001,0)

```

```

C
C ***NEW PROBLEM***

```

```

10 CONTINUE
      CALL INPUT
      READ(8,INPUTD)
      SET ORIGIN AT 1 INCH OR 2 CM
      XD=FLOAT(IPAPER)/SFACT(IPAPER)
      YO=XD

```

```

C WRITE OUT CALCODE

```

```

        ENCODE(5,80,ICAL) CALCODE
        WRITE(6,90)ICAL
C
        YSAVE=YSINC
C
C          GENERATE PLOTS
DO 70 NFRME=1,NFRAME
    YSINC=YSAVE
    CALL PLOTS(ICAL,0,4HPLOT)
    CALL PLOT(X0,Y0,-3)
    DO 40 NCRVE=1,NCURVE
        CALL READMS(14,DATA(1),102,1)
        IC=ICASE(NCRVE)
        IREFC=IDATA(IC)
        IRECL=IDATA(IC+1)-2
        NPT=0
        ICX=IX+2
        ICY=IY(NFRME)+2
C
C          EXTRACT DATA FROM RANDOM ACCESS FILE AND FILL PLOT ARRAY
DO 20 IREC=IREFC,IRECL
    CALL READMS(14,DATA(1),102,IREC)
    XVALUE=DATA(ICX)*FACTX
    YVALUE=DATA(ICY)*FACTY(NFRME)
    IF(XVALUE.GT.XMAX) GOTO 30
    IF(YVALUE.GT.YMAX) GOTO 30
    IF(XVALUE.LT.XMIN) GOTO 20
    IF(YVALUE.LT.YMIN) GOTO 20
    NPT=NPT+1
    X(NPT)=XVALUE
    Y(NPT)=YVALUE
20  CONTINUE
C
C          SET SCALES
30  CONTINUE
    NPTS=NPT/IFREQ+1
    IF(IFREQ.EQ.1)NPTS=NPT
    INDX1=NPTS*IFREQ+1
    INDX2=NPTS*IFREQ+IFREQ+1
    X(INDX1)= XSMIN
    X(INDX2)= XSINC/DBA*SFACT(IPAPER)
    IF(XSINC.EQ.0.)CALL SCALE(X,XLNGTH,NPTS,IFREQ,IDIV,IPAPER)
    XSMIN=X(INDX1)
    XSINC=X(INDX2)*DBA/SFACT(IPAPER)
    Y(INDX1)= YSMIN
    Y(INDX2)= YSINC/DBA*SFACT(IPAPER)
    IF(YSINC.EQ.0.)CALL SCALE(Y,YLNGTH,NPTS,IFREQ,IDIV,IPAPER)
    YSMIN=Y(INDX1)
    YSINC=Y(INDX2)*DBA/SFACT(IPAPER)
C
    WRITE(6,100) NFRME,NCRVE
    WRITE(6,110) (X(I),I=1,NPT)
    WRITE(6,120) X(INDX1),X(INDX2)
    WRITE(6,130) (Y(I),I=1,NPT)
    WRITE(6,120) Y(INDX1),Y(INDX2)
C
C          PLOT LINE

```

```

      CALL LINE(X,Y,NPTS,IFREQ,LINTYP(NCRVE),ISYM(NCRVE))
      WRITE(6,140)
40  CONTINUE
C
C      AXIS ANNOTATION
      CALL COUNT(XLABEL(1),30,NC)
      CALL AXIS(0.,0.,XLABEL(1),-NC,XLNGTH,0.,X(INDX1),X(INDX2),
      ^      H,DBA,IPAPER)
      L=1+NFRME*4-4
      CALL COUNT(YLABEL(L),30,NC)
      CALL AXIS(0.,0.,YLABEL(L),NC,YLNGTH,90.,Y(INDX1),Y(INDX2),
      ^      H,DBA,IPAPER)
C
C      TITLE ANNOTATION
      XT=XLNGTH/SFACT(IPAPER)/2.-15.*HTITLE(1)
      YT=YLNGTH/SFACT(IPAPER)+0.28*HTITLE(1)+HTITLE(2)+
      ^      HTITLE(3)+HTITLE(4)
      L=1
      DO 50 I=1,4
          CALL SYMBOL(XT,YT,HTITLE(I),TITLE(L),0.,30)
          XT=XLNGTH/SFACT(IPAPER)/2.-15.*HTITLE(I+1)
          YT=YT-1.5*HTITLE(I+1)
          L=L+4
50  CONTINUE
C
C      LABEL ANNOTATION
      XT=XLAB/SFACT(IPAPER)
      YT=YLAB/SFACT(IPAPER)
      L=1
      DO 60 I=1,9
          CALL SYMBOL(XT,YT,HLABEL(I),LABEL(L),0.,30)
          YT=YT-1.5*HLABEL(I+1)
          L=L+4
60  CONTINUE
C
C      ADVANCE TO NEXT FRAME
      CALL PLOT(PLNGTH-X0,-Y0,999)
      WRITE(6,150)
70  CONTINUE
      GO TO 10
80  FORMAT(3HCAL,I2)
90  FORMAT(/10X,9HCALCODE=,A5)
100 FORMAT(/10X,*FRAME= *I2* CURVE= *I2)
110 FORMAT(/10X,*ABCISSA VALUES*/(5X,9E13.6))
120 FORMAT(/10X,*AXIS MINIMUM= *E12.5* DATA UNITS*/
      ^      10X,*AXIS INCREMENT= *E12.5* DATA UNITS PER INCH*)
130 FORMAT(/10X,*ORDINATE VALUES*/(5X,9E13.6))
140 FORMAT(/10X,*CURVE COMPLETED*)
150 FORMAT(/10X,*FRAME COMPLETED*)
      END

```

```

SUBROUTINE INPUT
C   THIS SUBROUTINE READS MODIFIED NAMELIST FORMATTED DATA.
C   IT READS A CARD ON UNIT 5, WRITES THE CARD ON UNIT 6,
C   WRITES THE CARD ON UNIT 8 (FIRST 72 CHARACTERS ONLY).
C   THE TITLE CARDS AS DEFINED IN THE DATA STATEMENT BELOW
C   ARE NOT WRITTEN ON UNIT 8 BUT THE DATA IS PLACED IN
C   THE APPROPRIATE ARRAYS FOR TRANSFER BACK TO THE CALLING
C   PROGRAM. THE TITLE CARDS MUST BEGIN IN COLUMN 2 WITH
C   NO SPACES. THE CALLING PROGRAM MUST BLANK THE TITLE
C   ARRAYS, CALL INPUT AND READ(8, INPUTD). NAMELIST DATA
C   MUST BEGIN WITH $INPUT AND END WITH $END, BOTH
C   BEGINNING IN COLUMN 2.
  IMPLICIT INTEGER (A-Z)
  COMMON /BLK1/ TITLE(104)
  DIMENSION CARD(8), LINE(24)
  DATA LINE/10H TITLE1= ,10H TITLE2= ,10H PTITLE1 ,10H PTITLE2
  ^      ,10H PTITLE3 ,10H PTITLE4 ,10H PLABEL1 ,10H PLABEL2
  ^      ,10H PLABEL3 ,10H PLABEL4 ,10H PLABEL5 ,10H PLABEL6
  ^      ,10H PLABEL7 ,10H PLABEL8 ,10H PLABEL9 ,10H XAXIS1=
  ^      ,10H YAXIS1= ,10H YAXIS2= ,10H YAXIS3= ,10H YAXIS4=
  ^      ,10H YAXIS5= ,10H YAXIS6= ,10H YAXIS7= ,10H YAXIS9=
  DATA BLANK/10H /
C
C
  REWIND 8
  WRITE (6,70)
10 CONTINUE
  READ (5,110) CARD
  IF (EOF(5).NE.0) STOP
  WRITE (6,90) CARD
  C      BLANK COLUMNS 9 AND 10
  ENCODE (10,80,WORD) CARD(1),BLANK
  DO 30 I=1,24
  C      IF (WORD.NE.LINE(I)) GOTO 30
  C      CARD READ IS A TITLE CARD
  IF (I.EQ.1) J=1
  IF (I.EQ.2) J=9
  IF (I.GE.3) GOTO 20
  ENCODE(72,60,TITLE(J))CARD
  GOTO 10
C
C
20 CONTINUE
  J=17+4*(I-3)
  IF (I.GE.16) GOTO 25
  ENCODE(30,50,TITLE(J)) CARD(1), CARD(2), CARD(3), CARD(4)
  GOTO 10
C
C
25 CONTINUE
  ENCODE(30,55,TITLE(J)) CARD(1),CARD(2),CARD(3),CARD(4)
  GOTO 10
C
C
30 CONTINUE
  C      BLANK COLUMNS 73-80 OF DATA CARD
  ENCODE (10,100,CARD(8)) CARD(8), BLANK
  WRITE (8,110) CARD
  IF (CARD(1).NE.10H $END ) GOTO 10
C

```

```
REWIND 8
CALL DATE(DAT)
CALL TIME(TIM)
WRITE (6,40) DAT,TIM
RETURN
```

C  
C

```
40 FORMAT (//10X,*DATE IS *,A9/  
^      10X,*TIME IS *,A9)  
50 FORMAT (R1,A10,A10,A9)  
55 FORMAT (R2,A10,A10,A8)  
60 FORMAT (R2,7A10)  
70 FORMAT (1H1)  
80 FORMAT (A8,A2)  
90 FORMAT (10X,8A10)  
100 FORMAT (A2,A8)  
110 FORMAT (8A10)  
END
```



```

SUBROUTINE SCALE(X,XL,NPTS,INC,IDIV,IPAPER)
C ***** INPUT DATA *****
C X = ARRAY CONTAINING DATA TO BE SCALED
C XL = LENGTH OF AXIS IN UNITS OF GRAPH PAPER
C NPTS=NO. OF DATA POINTS IN X ARRAY TO BE SCALED, NOT NECESSARILY THE
C DIMENSION OF X.
C INC= FREQUENCY OF DATA TO BE SCALED IN X ARRAY.
C POSITIVE VALUE YIELDS FIRSTV AS MINIMUM AND POSITIVE DELTAV.
C NEGATIVE VALUE YIELDS FIRSTV AS MAXIMUM AND NEGATIVE DELTAV.
C IDIV=NO. OF MINOR DIVISIONS PER UNIT LENGTH OF GRAPH PAPER
C IPAPER=1 IF INCH PAPER
C 2 IF CENTIMETER PAPER
C ***** OUTPUT DATA *****
C X(NPTS+1) = LEFTMOST VALUE OF AXIS
C X(NPTS+2) = DATA UNITS PER INCH OF AXIS
C ***** WORKING DATA *****
C DX = GRID INTERVAL OF ONE MINOR DIVISION SUCH THAT DX=A*10**B
C XN = NO. OF MINOR DIVISIONS IN ENTIRE AXIS
C Y = DATA UNITS PER INCH
C
C
C IMPLICIT REAL(A-H,O-Z)
C DIMENSION X(1),SFACT(2)
C DATA SFACT/1.,2.54/
C
C NCR=IABS(INC)
C NARRAY=NPTS*NCR
C XMIN= 1.E10
C XMAX=-1.E10
C DO 10 I=1,NARRAY,NCR
C XMIN=AMIN1(XMIN,X(I))
C XMAX=AMAX1(XMAX,X(I))
10 CONTINUE
C XN=XL*FLOAT(IDIV)
C D=AMAX1(XMAX-XMIN,1.E-10)
C M1=ALOG10(D/XN)-2.
C DO 50 I=1,20
C B=FLOAT(M1+I)
C DO 40 J=1,3
C IF(J.EQ.1) A=1.
C IF(J.EQ.2) A=2.
C IF(J.EQ.3) A=5.
C DX=A*10.**B
C XINT1=AIN1(XMIN/DX)
C Y=DX*FLOAT(IDIV)
C IF(XMIN.GE.0.) GOTO 20
C XLO=XINT1*DX-DX
C XLO=XLO-Y+AMOD(ABS(XLO/Y),1.)*Y
C GO TO 30
20 CONTINUE
C XLO=XINT1*DX
C XLO=XLO-AMOD(ABS(XLO/Y),1.)*Y
30 CONTINUE
C XHI=XLO+XN*DX
C IF(XHI.GE.XMAX)GO TO 60
40 CONTINUE
50 CONTINUE

```

C

```
60 CONTINUE
  IF(INC.LT.0)GO TO 70
  X(NPTS+INC+1)=XLD
  X(NPTS+INC+INC+1)=Y*SFACT(IPAPER)
  RETURN
```

C

```
70 CONTINUE
  X(NPTS+NCR+1)=XHI
  X(NPTS+NCR+NCR+1)=-Y*SFACT(IPAPER)
  RETURN
  END
```

```

      SUBROUTINE AXIS(XP,YP,IBCD,NCHAR,XLNGTH,ANGLE,FIRSTX,DELTA,
      ^      H,DBA,IPAPER)
C ***** INPUT DATA *****
C XP      = X COORDINATE OF STARTING POINT OF AXIS, INCHES
C YP      = Y COORDINATE OF STARTING POINT OF AXIS, INCHES
C IBCD    = TITLE OF AXIS
C NCHAR   = NO. OF CHARACTERS IN AXIS TITLE.
C          POSITIVE VALUE PLACES TITLE ON COUNTERCLOCKWISE SIDE OF AXIS.
C          NEGATIVE VALUE PLACES TITLE ON CLOCKWISE SIDE OF AXIS.
C XLNGTH  = LENGTH OF X AXIS IN UNITS OF GRAPH PAPER
C ANGLE   = ANGLE FROM NORMAL X AXIS TO DRAW AXIS, DEG
C FIRSTX  = STARTING VALUE OF AXIS IN DATA UNITS
C DELTA   = DATA UNITS PER INCH
C H       = HEIGHT OF AXIS ANNOTATION, INCHES
C DBA     = DISTANCE BETWEEN ANOTATION IN UNITS OF GRAPH PAPER
C IPAPER  = 1 IF INCH PAPER
C          2 IF CENTIMETER PAPER
C
C          IMPLICIT REAL(A-H,O-Z)
C          DIMENSION IBCD(1),SFACT(2)
C          DATA SFACT/1.,2.54/
C
C          XL=XLNGTH/SFACT(IPAPER)
C          ADIS=DBA/SFACT(IPAPER)
C          ZNUM=DELTA/SFACT(IPAPER)*DBA
C          CALL EXPN(ZNUM,5000.,IEXP)
C
C          DRAW AXIS
C          CALL PLOT(XP,YP,-3)
C          CALL PLACE(XL,0.,ANGLE,XA,YA)
C          CALL PLOT(XA,YA,2)
C
C          LABEL AXIS
C          NCR=IABS(NCHAR)
C          IF(IEXP.EQ.0) X=XL/2.-FLOAT(NCR)/2.*H
C          IF(IEXP.NE.0) X=XL/2.-FLOAT(NCR+4)/2.*H
C          IF(NCHAR.LE.0)Y=-3.*H-.14
C          IF(NCHAR.GT.0)Y= 2.*H+.14
C          CALL PLACE(X,Y,ANGLE,XA,YA)
C          CALL SYMBOL(XA,YA,H,IBCD,ANGLE,NCR)
C          IF(IEXP.EQ.0)GO TO 10
C          X=X+FLOAT(NCR+1)*H
C          CALL PLACE(X,Y,ANGLE,XA,YA)
C          CALL SYMBOL(XA,YA,H,4H* 10,ANGLE,4)
C          X=X+4.*H
C          Y=Y+.70*H
C          CALL PLACE(X,Y,ANGLE,XA,YA)
C          CALL NUMBER(XA,YA,H*.666,FLOAT(IEXP),ANGLE,-1)
10 CONTINUE
C
C          ANNOTATE AXIS
C          XNUM=FIRSTX/10.**IEXP
C          DELX=DELTA/10.**IEXP
C          XDIS=0.
20 CONTINUE
C          CALL PLACE(XDIS,0.,ANGLE,XA,YA)

```

```
CALL PLOT(XA,YA,3)
X=XDIS
IF(NCHAR.LE.0)Y=-.07
IF(NCHAR.GT.0)Y=.07
CALL PLACE(X,Y,ANGLE,XA,YA)
CALL PLOT(XA,YA,2)
CALL ALPHA(XNUM,ANUM,NC)
X=XDIS-FLOAT(NC/2)*H
IF(NCHAR.LE.0)Y=-1.5*H-.07
IF(NCHAR.GT.0)Y= 0.5*H+.07
CALL PLACE(X,Y,ANGLE,XA,YA)
CALL SYMBOL(XA,YA,H,ANUM,ANGLE,NC)
XNUM=XNUM+DELX*ADIS
XDIS=XDIS+ADIS
IF(XDIS.LE.XL) GOTO 20
CALL PLOT(-XP,-YP,-3)
RETURN
END
```

```

      SUBROUTINE EXPN(XNUM,XLIMIT,IEXP)
C   DETERMINE EXPONENT OF NUMBER. EXPONENT IS DIVISIBLE BY 3.
C   ***** INPUT DATA *****
C   XNUM   = FLOATING POINT NUMBER. MAXIMUM OF 10 CHARACTERS.
C   XLIMIT = IF NON-ZERO, AN EXPONENT IS CALCULATED ONLY IF
C           XNUM IS GREATER THAN XLIMIT.
C   ***** OUTPUT DATA *****
C   IEXP = VALUE OF EXPONENT
C
C           X=ABS(XNUM)
C           Z=ALOG10(X)
C           IEXP=INT(Z-AMOD(Z,3.))
C           RETURN
C
10  CONTINUE
    IEXP=0
    RETURN
    END

```

```

      SUBROUTINE COUNT(TITLE,NCMAX,NC)
C   COUNTS CHARACTERS IN A TITLE
C
C   ***** INPUT DATA *****
C   TITLE = ALPHANUMERIC ARRAY TO COUNT
C   NCMAX = MAX PERMISSIBLE CHARACTERS IN TITLE
C   ***** OUTPUT DATA *****
C   NC = NO. OF CHARACTERS IN TITLE
C
      IMPLICIT REAL(A-H,O-Z)
      DIMENSION TITLE(1), Z(80)
C
      DO 10 I=1,NCMAX
         Z(I)=10H
10  CONTINUE
C
      ENCODE(10,20,FMT) NCMAX
      20  FORMAT(1H(,I2,3HA1))
C
      DECODE(NCMAX,FMT,TITLE) Z
C
      DO 30 I=1,NCMAX
         IF(Z(NCMAX+1-I).NE.1H ) GOTO 40
30  CONTINUE
         I=NCMAX
C
40  CONTINUE
      NC=NCMAX+1-I
      RETURN
      END

```

```

      SUBROUTINE ROUND(XNUM, IDIG)
C   NUMERICALLY ROUNDS A NUMBER (XNUM) TO (IDIG) NO.
C   OF DIGITS IN AN E FORMAT.
C
C   ***** INPUT DATA *****
C   XNUM = FLOATING POINT NUMBER
C   IDIG = NUMBER OF DIGITS TO RIGHT OF
C         DECIMAL POINT
C   ***** OUTPUT DATA *****
C   XNUM = ROUNDED FLOATING POINT NUMBER
C
      DIMENSION ANUM(2)

      IDIG=MIN0(IDIG,14)
      IFLD=IDIG+6
      ENCODE(8,10,FMT)IFLD,IDIG
10  FORMAT(2H(E,I2,1H.,I2,1H))
      ENCODE(IFLD,FMT,ANUM)XNUM
      DECODE(IFLD,FMT,ANUM)XNUM
      RETURN
      END

```

APPENDIX C

SCIENTIFIC DATA PROCESSING ROUTINE  
SUMMARY DOCUMENTATION

IDENTIFICATION

Title NEMAR Plotting Computer Program

Routine No. 1949 Date Filed May 1980 Security Class. U

Responsible Engineer T. R. Myler

Date Completed 1975 Source FORTRAN  
Language: IV

Key Words CalComp plot

RESOURCE REQUIREMENTS

Typical CPU 5 sec Machine(s) CDC CYBER 175 No. Source Cards 590

Core 60k (octal) Tape none Plot yes Graphics none

DESCRIPTION

Purpose: To generate CalComp plots of data residing on a random access file produced by NEMAR and containing all output parameters of NEMAR.

Input: NAMELIST format - title information, selection of plot parameters, axis lengths, paper selection, etc.

Output: List of input data, data plotted, CalComp plots

DOCUMENTATION

Vought Report 2-53030/1R-52692, "NEMAR Plotting Computer Program"  
dated 1 June 1981.



1 Report No NASA CR-165831		2 Government Accession No.		3 Recipient's Catalog No	
4 Title and Subtitle NEMAR Plotting Computer Program				5 Report Date December 1981	
				6 Performing Organization Code	
7 Author(s) T. R. Myler				8 Performing Organization Report No	
9 Performing Organization Name and Address Vought Corporation P. O. Box 225907 Dallas, TX 75265				10 Work Unit No	
				11 Contract or Grant No NAS1-15000	
12 Sponsoring Agency Name and Address National Aeronautics and Space Administration Washington, DC 20546				13 Type of Report and Period Covered Contractor Report	
				14 Sponsoring Agency Code 490-02-02-77-00	
15 Supplementary Notes  Langley Technical Monitor: R. J. Keynton					
16 Abstract  This report describes a FORTRAN coded computer program which generates CalComp plots of trajectory parameters. The trajectory parameters are calculated and placed on a data file by the Near Earth Mission Analysis Routine computer program. The plot program accesses the data file and generates the plots as defined by inputs to the plot program. Included in this report are program theory, user instructions, output definitions, subroutine descriptions and detailed FORTRAN coding information.  Although this plot program utilizes a random access data file created by the above mentioned trajectory program, a data file of the same type and formatted in 102 numbers per record could be generated by any computer program and used by this plot program.					
17 Key Words (Suggested by Author(s)) Subprogram: Plotting Trajectory Launch Vehicles			18 Distribution Statement  FEDD Distribution  Subject Category 61		
19 Security Classif (of this report) Unclassified		20 Security Classif (of this page) Unclassified		21 No of Pages 66	22 Price

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