FUNCTIONAL DESIGN SPECIFICATIONS
FOR
EXEC 8 GENERAL PLOT PROGRAM
(X8PLOT)

Job Order 83-157

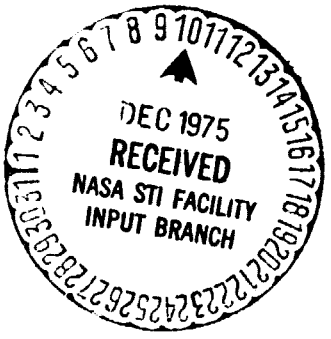
Prepared By

Lockheed Electronics Company, Inc.
Aerospace Systems Division
Houston, Texas

Contract NAS 9-12200

For

INSTITUTIONAL DATA SYSTEMS DIVISION



National Aeronautics and Space Administration

LYNDON B. JOHNSON SPACE CENTER

Houston, Texas

October 1975

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JSC-09812

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TECHNICAL REPORT INDEX/ABSTRACT

(See instructions on reverse side.)

1. TITLE AND SUBTITLE OF DOCUMENT

FUNCTIONAL DESIGN SPECIFICATIONS FOR EXEC 8 GENERAL PLOT PROGRAM (X8PLOT)

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SYSTEM

Not applicable

SUBSYSTEM

Not applicable

MAJOR EQUIPMENT GROUP

Not applicable

13. ABSTRACT

This document contains a technical description of the characteristics desired in the EXEC 8 General Plot Program.

14. SUBJECT TERMS

Plot

Plotting

CONTENTS

1. PROGRAM IDENTIFICATION

Title:	EXEC 8 General Plot Program
Symbolic name:	X8PLOT
Program type:	Stand alone
Source language:	FORTRAN V
Operating system:	EXEC 8
Computer type:	UNIVAC 1108/1110

2. BACKGROUND

As more and more posttest data reduction programs are written to execute under the EXEC 8 operating system on the UNIVAC 1108/1110 computers, the need for a general purpose plot program capable of executing under this system has become evident. This capability would improve turnaround time by enabling the plot run to execute immediately after the data reduction program.

The new general purpose plot program (X8PLOT) will be executable under EXEC 8 on the UNIVAC 1108/1110 computers. It will encompass the most frequently used options of the presently used GEPLOT and SORTPL plot programs, which execute only under the EXEC II operating system. Only standard versions of system routines will be used; there will be no special versions.

3. PROGRAM INPUT

Input data for this program will be obtained from lead cards and from time history data input from digital tape or mass storage files.

3.1 LEAD CARD INFORMATION

3.1.1 CONTROL INFORMATION

Control information will be input to the program by lead card and will consist of, but will not be limited to, the following:

- Input type specification (binary or FORTRAN formatted and unformatted).
- Multiple file input (tape or mass storage) specification.
- Input device type (magnetic tape, card reader, or mass storage).
- Track size (7 or 9), density, and parity of input tape.
- Input record size (maximum 2,000 36-bit words).
- Number of scans per input record.
- Location of time within scan.
- Type of time input (floating point seconds or integer milliseconds).
- Format of data record, if FORTRAN formatted.

3.1.2 PARAMETER INFORMATION

Parameters to be plotted will be specified by lead card. A maximum of 1,000 unique parameters may be specified, but a parameter may be plotted more than once if it is specified more than once. The parameters will be plotted in the sequence in which they are specified.

Each parameter to be plotted will be optionally identified as listed below:

- Location within scan.
- Minimum and maximum plot scale values.
- Vector or stair-step connect, or dot plot, with or without symbol.
- Automatic plot scale computation indicator (ignoring out-of-range data).
- Plot type (linear, semilog, log, or cross).
- Parameter description with engineering units.

  Note: Engineering units will be used to label the ordinate scale. If more than one parameter is to be plotted per grid, each must have the same engineering units.

- New grid indicator. All parameters will be plotted on the last grid which has been generated, unless a new grid is indicated (maximum of six parameters per grid). See section 4.3 for further explanation.
- Data thinning indicator (see section 4.5).

3.1.3 PLOT INFORMATION

The following information will be provided for any one program execution:

- Title to be printed at the top of each microfilm frame.
- Grid start-stop times.
- Additive and multiplicative time bias.
- Time interval per grid.
- Start-stop times associated with data to be plotted.
- Abscissa time (scale) specification.
- Number of grids per microfilm frame (six maximum). See section 4.3.

- Scan increment (i.e., which scans to process). Every *Nth* scan may be specified for processing.

3.1.4 DEFAULT VALUES

The program will generate appropriate default values for each lead card field which does not contain a value.

Default values associated with control information (section 3.1.1) will include, but will not be limited to, one 7-track binary, 800 bpi, odd parity tape, with 1,000 words per record, 1 scan per record, and time in integer milliseconds in word 1 of each record. Note that, with the use of system routine DYNCOR (*CAD Procedures Manual – JSC, EXEC 8 System,* Part 20, Revision 1, August 1975, page 20.50.230), the size of the input record will be used to specify the size of an array to buffer that input data.

Parameter information (section 3.1.2) default values will include, but will not be limited to, the following. The scan location of parameters will be determined by the sequence in which parameters are specified for plotting; that is, the first parameter specified without a scan location given will be in scan word 2, the second in scan word 3, the third in scan word 4, etc. If a parameter is specified more than once, the first specification will determine the scan location. Parameter descriptions will be similarly determined by parameter sequence. Engineering units will be defaulted to "ENGR UNITS". Other default values will specify vector connecting every scan, computing plot scales automatically, linear plotting, and one parameter per grid without data thinning.

Default values for plot information (section 3.1.3) will include, but will not be limited to, a blank-filled title, a 0 additive and 1 multiplicative time bias, an abscissa scale specified in days-hours-minutes, and one grid per microfilm frame. When

grid start-stop times, time interval per grid, and data start-stop times are defaulted, all data records input will be plotted one parameter per grid, and abscissa scale values will be appropriately computed to avoid any "odd ball" scales.

3.2 TIME HISTORY DATA

Data input for processing will be limited to computer cards, binary tapes, FORTRAN written tapes, and a mass storage device. The capability to process other input types will be provided as required.

3.2.1 BINARY DATA TAPES

Binary data tapes will consist of scans of data, where each scan consists of time in floating point seconds or integer milliseconds and data words which must be in floating point. Each scan must be identical in format. A maximum of 2,000 36-bit words may occur per record, of which a maximum of 1,000 may be processed in any one execution.

Scan 1	Time	Data 1	Data 2		Data N
Scan 2	Time	Data 1	Data 2		Data N
⋮	⋮	⋮	⋮		⋮
Scan N	Time	Data 1	Data 2		Data N

Each binary tape may be 7- or 9-track; 200, 556, or 800 bpi; odd or even parity.

3.2.2 FORTRAN DATA TAPES

FORTRAN written (binary or formatted) tapes will be subject to the same limitations as the binary data tapes except that each record will contain header and trailer words and must be read with a FORTRAN read.

3.2.3 MASS STORAGE FILES

When X8PLOT is used as a postprocessor for another program, it will be capable of reading time history input from a mass storage file. Such a mass storage file will be subject to the same limitations as the binary data tapes and FORTRAN data tapes.

3.2.4 COMPUTER CARDS

Computer card input will consist of scans of data as described in section 3.2.1. One logical record may consist of several computer cards. All records must be read with a FORTRAN formatted read.

4. PROCESSING

Processing performed by this program will be limited to grouping data in such a manner that the data can be efficiently plotted. No computations on the data will be performed by this program (see fig. 4-1).

4.1 LEAD CARD PROCESSING

All lead cards read will be output to the line printer. The control information contained on them will be edited for appropriate content, with default values being set before any data processing begins. If lead card discrepancies exist, appropriate diagnostic information will be output to the line printer.

4.2 PARAMETER PROCESSING

All parameters to be plotted will be grouped and buffered to mass storage such that all values for each parameter to be plotted will be located in two or more contiguous "positions" of mass storage.

A large area of core (size AVCORE) will be allocated for buffering data to mass storage. Time and unique parameters specified to be plotted will be buffered through this area of core to mass storage. Time plus the number of unique parameters specified (NUP) will determine the number of scans (NSCANS) of data which will be blocked to mass storage at one time; i.e.,

$$NSCANS = \left\{[AVCORE/(NUP + 1)]/28\right\} * 28$$

NSCANS will be 0 module 28, so that each parameter grouped in this area of core will be buffered to mass storage in some integral multiple of 28 scans. (Twenty-eight words comprise one mass storage sector.)

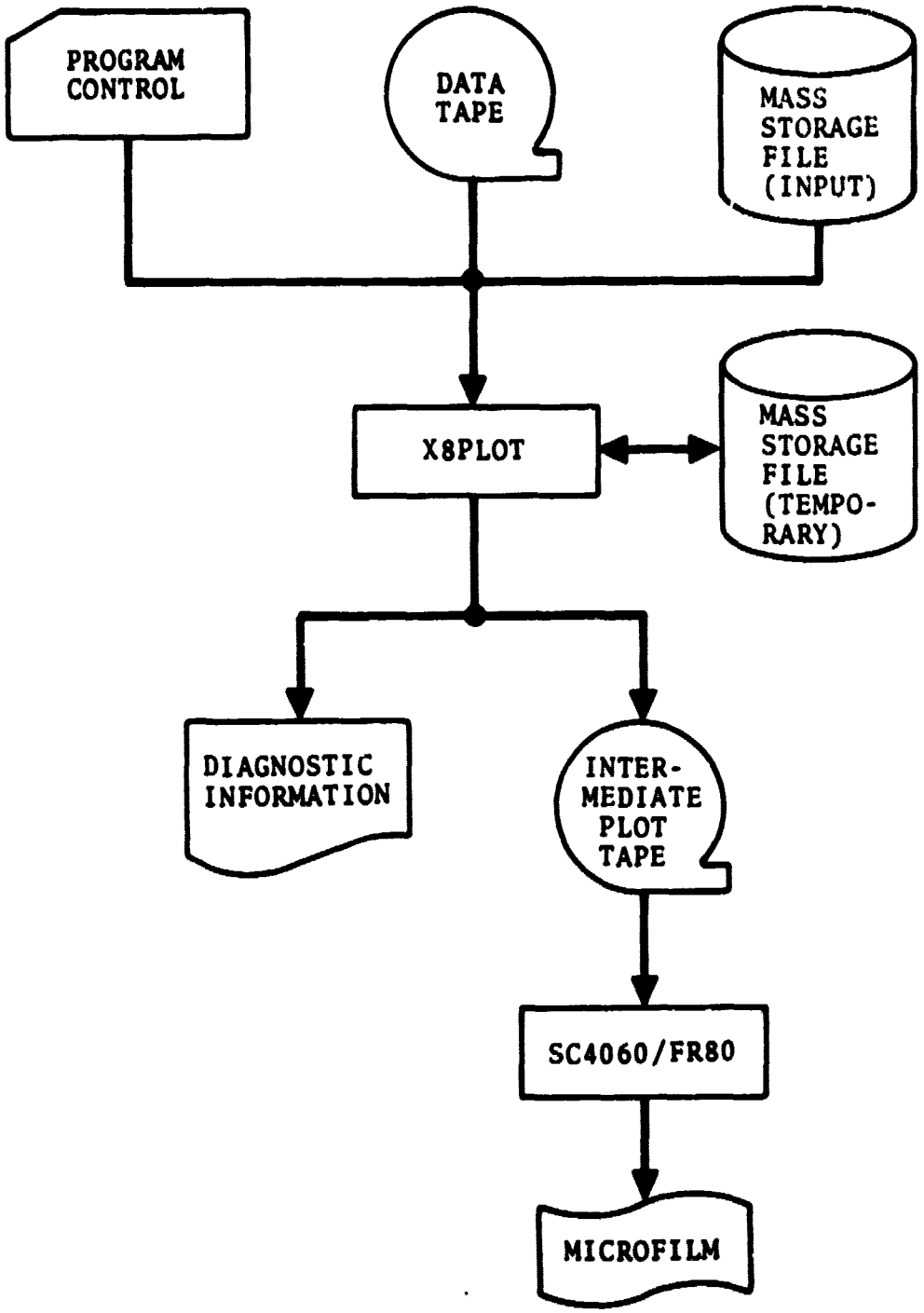

Figure 4-1. – Diagram of X8PLOT data processing flow.

Mass storage will be blocked in segments of two positions each (8,192 sectors). Each segment will consist of NUP+1 blocks. A block will contain data associated with time or one parameter. Each segment block size (SEGBLK) will consist of up to an integral multiple of NSCANS scans; i.e.,

$$SEGBLK = \left\{[8192/(NUP + 1)]/NSCANS\right\} * NSCANS$$

If more than one mass storage (two-position) segment is necessary to group time and those parameters specified to be plotted, each succeeding (two-position) segment will be blocked the same as the first. This technique facilitates sector addressing of mass storage and provides the capability of plotting a very large number of points.

4.3 MICROFILM FRAMES AND GRIDS

A microfilm frame may contain one or more grids of plotted data. Microfilm frames and grids will be sequential, 1 to N. The microfilm frames and grids on which parameters are to be plotted will be specified indirectly.

The number of grids to be generated on a microfilm frame will be specified in the plot information lead cards (see section 3.1.3). This number will remain constant in a given X8PLOT run.

Each parameter information lead card (see section 3.1.2) will determine if the parameter being described is to be plotted on a new grid or on the last grid generated. An appropriate error message will be output to the line printer if more than six parameters have been specified for the same grid.

4.4 EXECUTION MODE

This program will be executable in the demand and batch modes under the EXEC 8 operating system.

4.5 OPTIONAL DATA THINNING

Data for a parameter which has been specified to be plotted on one grid is often too dense (i.e., has a large number of points), resulting in the plotted data obliterating the entire grid. To resolve this problem if it occurs, the capability to optionally plot every N*th* scan and to optionally thin the data will be provided (see section 3.1.3). The thinning indicator, if specified on a lead card, will be the minimum radius allowed in rasters between the last point plotted and the next point plotted. If the next point is within the radius of the previous point, it will not be plotted.

5. PROGRAM OUTPUT

5.1 QUALITY CONTROL OUTPUT

The following information should be output to the line printer:

- All lead card images.
- All lead card parameter values actually used by the program.
- Appropriate error messages.
- Appropriate messages to indicate the various stages of program execution completed.
- Messages to indicate that parameters have been plotted, immediately after they are plotted.
- Print the first N scans of data in the time slice, where N is a lead card value ($0 \leq N \leq 10$).

5.2 PLOTS

Each microfilm frame will be identified by a title, page number, and processing date.

Each parameter plotted will be designated above the grid on which it appears. If more than one parameter is plotted per grid, an alphabetic symbol will be used to identify that plotted parameter above the grid and on the plot.

Ordinate scales will be identified with appropriate engineering units and will consist of an appropriate number of major divisions (depending on the number of grids per microfilm frame). Five to 20 major divisions will be used. The scale value and label associated with any ordinate major division will be an integral multiple of some power of 10 multiplied by 1, 2, or 5. This will also apply to the abscissa scales for major divisions on cross plots.

The abscissa scale (time history only) will be the time optionally labeled in days, hours, minutes, and seconds, or some subset of these, as appropriate. When more than one grid is plotted per microfilm frame, only the abscissa of the grid at the bottom of the microfilm frame will be labeled.

The grid start-stop times and the grid intervals may be such that more than one microfilm frame and grid will be required to plot each parameter or group of parameters.

Figure 5-1 is a sample plot similar to the product to be generated by this program.

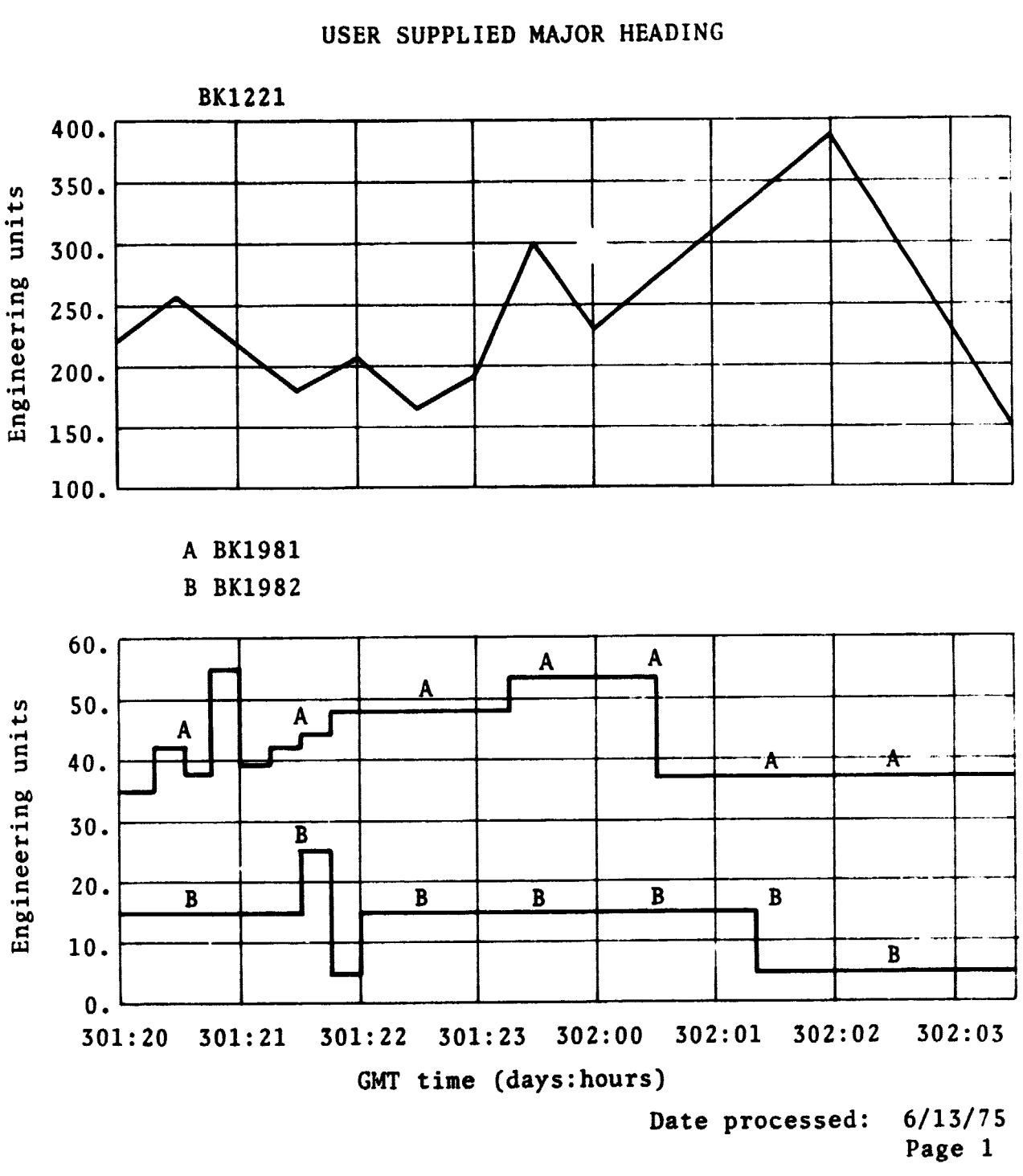

Figure 5-1. – Sample X8PLOT microfilm frame.