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SYSTEM DESIGN DOCUMENT

WIDEBAND ANALOG DATA SYSTEM
(WADS)

CPD 905

Job Order 52-319

Prepared by

Lockheed Electronics Company, Inc.
Systems and Services Division
Houston, Texas

Contract NAS 9-15200
for
STRUCTURES AND MECHANICS DIVISION

February 1979

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16. Abstract

This document defines a system which will enable the Structures and Mechanics Division to perform post-flight structural dynamic analysis of wideband FM data recorded during orbital flight tests. The Wideband Analog Data System is part of a semi-automated processing capability jointly being developed with the Institutional Data Systems Division entitled "OFT Wideband Structural Dynamics Anomaly System".

The WADS provides for screening, reporting and plotting steady state and transient wave analysis data.

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ABBREVIATIONS AND ACRONYMS

ABS	Absolute Value
ASCII	American Standard Code for Information Interchange
A/D	Analog-to-Digital
bpi	Bytes-per-inch
dB	Decibels
DIST	Distribution
EOF	End-of-File
ES2	Structures Branch
EU	Engineering Units
EXEC 8	UNIVAC Executive Monitoring System 8
FDL	Flight Data Library
FPF	Flight Parameters File
FTR	Flight Test Requirements
GET	Ground Elapsed Time
GMT	Greenwich Mean Time
h	Altitude
Hz	Hertz
ID	Identification
IDSD	Institutional Data Systems Division
LIB	Library
M	Mach Number
MAX	Maximum
ME	Mission Event
MMDBCT	Master Measurement Data Base Calibration Tape

MODCOMP	Modular Computer Products (minicomputer)
MPAD	Mission Planning and Analysis Division
MSD	Mean-squared Spectral Distribution
MSID	Measurement Identification
NTRAN	UNIVAC Buffer Input/Output Routine
OFT	Orbital Flight Test
OGRAMS	Oscillograms
OWSDAS	OFT Wideband Structural Dynamics Anomaly System
PFL	Preflight Data Library
PSD	Power Spectral Density
Q	Dynamic Pressure
RMS	Root-mean-square
SEC	Second
SMD	Structures and Mechanics Division
SPL	Sound Pressure Level
SRF	Screen Report File
STCS	Special Telemetry Conversion System
WADS	Wideband Analog Data System
α	Angle of Attack
β	Slide Slip Angle
Δ	Increment between values; off scale plotting symbol

1. INTRODUCTION

1.1 BACKGROUND

Requirements placed upon the Structures and Mechanics Division to provide post-flight structural dynamics analyses of the Orbiter Flight Test missions of the Space Shuttle in a timely and efficient manner, prompted the concept of developing a semi-automated data processing system to handle structural dynamics wideband data.

The functional concepts for such a system were presented in a Requirements Document for the OFT Wideband Structural Dynamics Anomaly System (reference 1). IDSD, which is jointly involved in the development, prepared a Preproject Implementation Plan which provided estimates of resources and schedules for implementation of their functions (reference 2).

That portion of the system to be developed by the Structures Branch (ES2) within SMD was presented in a Technical Report Project Plan, reference 3. This document outlined the Wideband Analog Data System (WADS) which provides for a semi-automated analyses processing capability.

1.2 PURPOSE AND SCOPE

The purpose of this document is to define the system in sufficient detail to enable the development work to be accomplished. Detailed requirements obtained during the course of preparing this document are reflected in the capabilities provided. Certain concessions were made in order to provide a capability that can reasonably be attained in the allotted time frame for development.

2. SYSTEM OVERVIEW

The overall OWSDAS data flow is presented in figure 2-1. The WADS data flow is presented in figure 2-2.

Within the WADS five basic functions are identified. These are:

1. Preflight Data Library Generation
2. Flight Data Library Generation
3. Data Screen and Processing
4. Output Plot
5. Screen Report Processing

The main features of the system are to provide: (1) a catalog and status summary of processed data generated by IDSD during the course of the post-flight data processing, (2) data screening and analysis, (3) selected storage of wave analysis data, and (4) generation of tabular and graphical display of the data and contents of associated data files.

Specific capabilities of the system include:

- Operation in demand mode
- Starting of remote batch runs for the majority of data processing needs
- Enter program control information via remote terminal to supplement or override existing information
- Optionally display data (tabular and graphical) to the remote terminal for manual verification
- Minimal manual inputs - control information defaulted
- Display and edit of data base information

The system is designed with the main function being that of performing screening and analysis of the processed data. In order to accomplish this, certain functions are required to be performed prior to the processing of data. It is therefore expected that a logical sequence of operations will be followed.

The entire processing scheme is based on first establishing the "Preflight Library". From this library file the Flight Data Library is created. Next the flight parameters library must be created prior to any analysis screening for it contains MPAD flight parameters used in tabulations and plots of the data. Once these files have been established analysis screening can be performed. The sequence of processing is then controlled by user inputs.

The processing flow within the system is illustrated in flow charts in Appendix B.

A significant factor in the design of the system is that of providing for expansion to include new requirements.

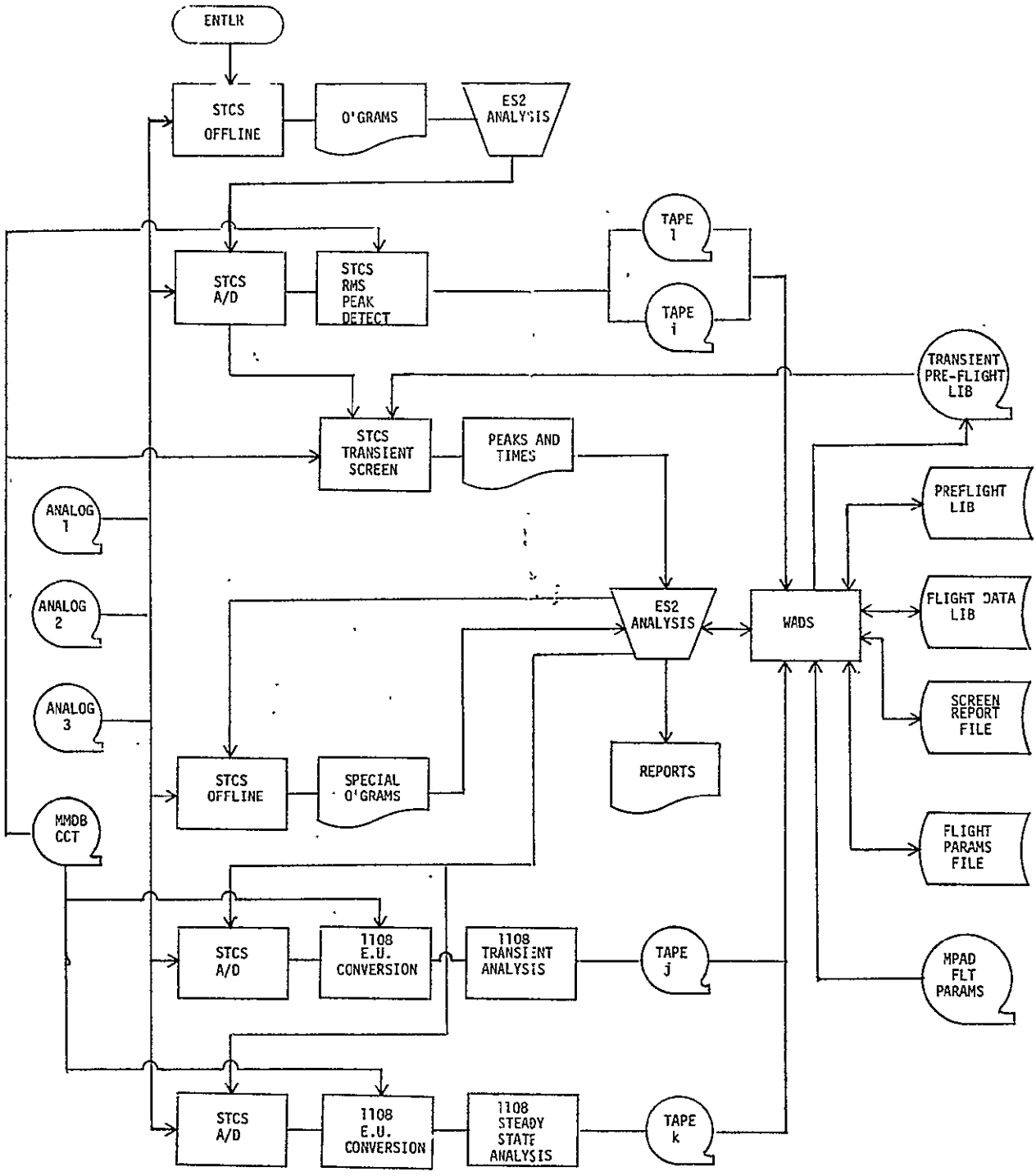


Figure 2-1. - OFT Wideband Structural Dynamics Anomaly System

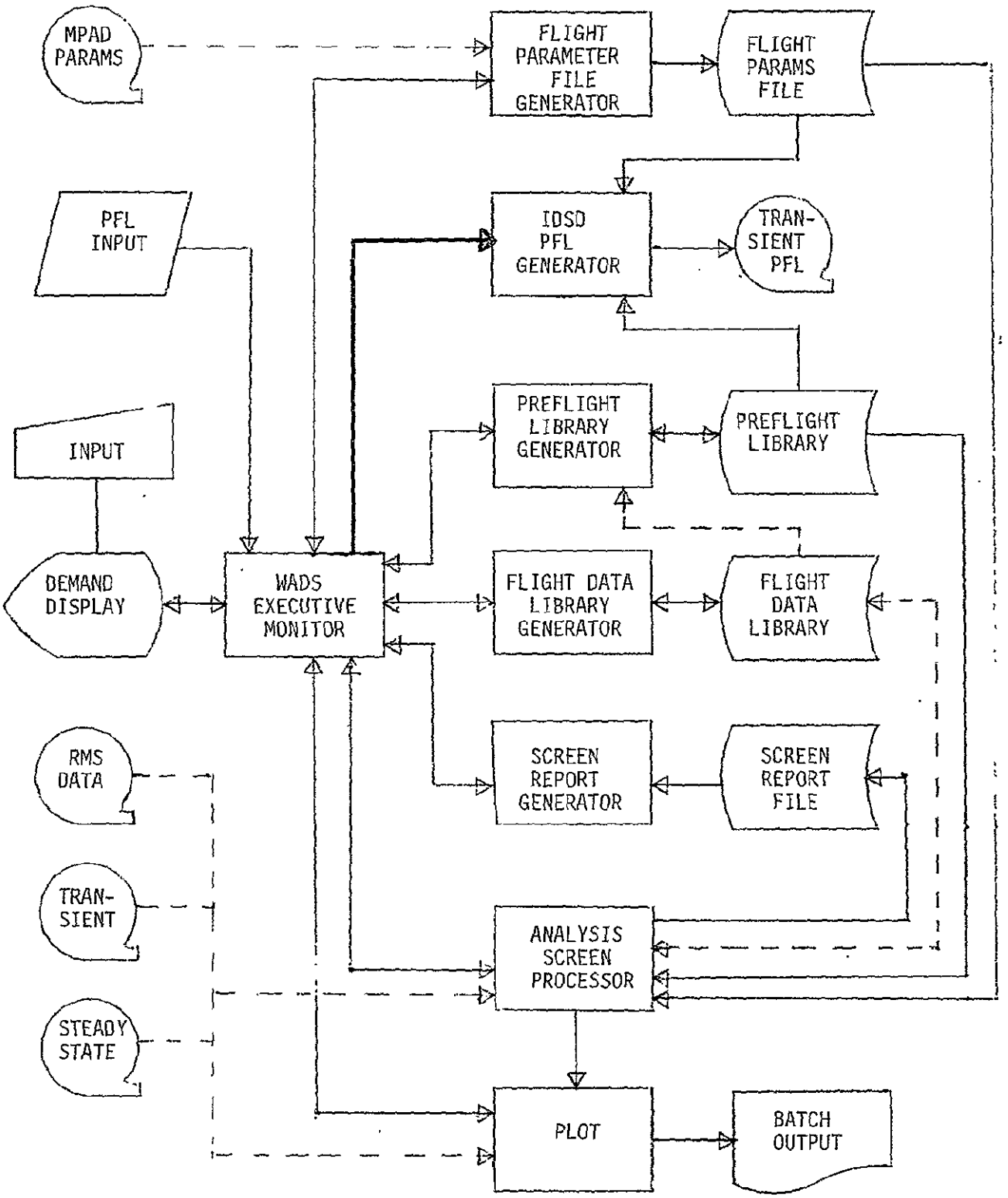


Figure 2-2. - Wideband Analog Data System

3. SYSTEM DESIGN

All of the system except that which is dependent upon graphics display will be operated via teletype compatible remote terminal. The demand graphics capability requires the use of the Tektronics 4014-1 terminal with hard copy unit.

When employing the Wideband Analog Data System the user will activate the "WADS Executive" and will be presented a display of available functions. The user may elect to establish the Pre-flight Library, Flight Data Library or Flight Parameter file; view data from any existing file, perform screening analysis, or plot parameters from the Flight Parameter File or data from tape or mass storage.

After the data manipulation functions have been performed the user may wish to start the processing program which will run in either a demand or batch mode. In order to start batch jobs, the user will exercise the Remote Job Entry capability of EXEC 8.

The programs to be developed will be written in FORTRAN V on the UNIVAC 1110. Graphical presentations will employ the Display Integrated Software Systems and Plotting Language (DISSPLA).

3.1 WADS DATA FILES

A summary of the inputs to the system is contained in this section. The content of each file is identified. The detailed formats of tapes to be exchanged between ES2 and IDSD are contained in the Interface Control Document, reference 6.

3.1.1 RMS TIME HISTORY TAPE(S)

Tapes containing RMS time histories are created by IDSD on a MODCOMP IV over time intervals requested by the user. These tapes will be used as inputs to the RMS screening and analysis function to be performed by WADS. Identification information contained on the tape will be used to provide a catalog of available data and update the processing summary file.

Each tape contains a header record with the following information:

- o Flight number
- o Tape number
- o Date tape was created
- o Time tape was created
- o Measurement ID's
- o Time intervals on tape

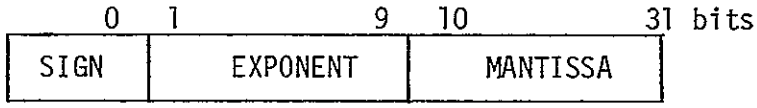
Data for each measurement will be contained in a separate file.

The data records for each measurement consist of:

- o Measurement ID
- o Time slice number
- o Time
- o RMS value
- o Peak/RMS ratio

Time will be integer milli-seconds with the Julian date as an integer value.

Data values will be in floating-point engineering units contained in 32-bits. The format of the floating point notation is as follows:



The exponent or characteristic is biased by 400_8. Negative numbers are in two's complement notation. The range of data values allowable are $10^{\pm 75}$.

The tape and file (measurement) header records will be ASCII characters.

The tape characteristics are as follows:

- o 9 track
- o 800 bpi
- o Buffered records (non-FORTRAN)
- o Odd parity (binary)
- o Record length compatible with UNIVAC 1100 systems
- o Double EOF following last measurements data

The exact format and content are contained in the ICD reference 6.

3.1.2 STEADY STATE WAVE ANALYSIS TAPE(S)

Tapes containing steady state wave analysis data are produced by IDSD from inputs provided by ES2.

These tapes will be used as input to the Wave Analysis screening and analysis function. Identification information contained on the tape will be used to provide a catalog of available data and update a processing status file.

Each tape contains a header record with the following information:

- Flight number
- Tape number
- Date and time tape created
- Data type (acoustic or vibration, i.e., SPL or PSD)
- Analysis bandwidth
- Measurement ID(s)
- Time interval(s)

Data for each measurement will be output in a separate file with the measurement ID in the first word(s) in each record. The delta frequency, number of data values, and cut frequency are also contained in the record.

Contents of the data records for each measurement will vary according to data type.

(1) Acoustic measurements (microphones)

- Sound Pressure Level values (dB) at 1/3 octave frequencies
- Overall Sound Pressure Level (dB)

(2) Vibration measurements (accelerometer, strain gage, pressures)

- PSD
- MSD
- Δ Frequency
- Number of frequency increments
- Cut off frequency

Tape characteristics:

- 7 track

- 800 bpi
- UNIVAC compatible
- Double EOF following last measurements data

The exact format and content is contained in Reference 6.

3.1.3 TRANSIENT SHOCK SPECTRUM ANALYSIS TAPE(S)

Tapes containing transient shock spectrum analysis data are produced by IDSD from inputs provided by ES2.

These tapes will be used as input to the wave analysis screening and analysis function in the WADS. Identification information contained on tape will be used to provide a catalog of available data and to update the processing summary file.

Each tape contains a header record with the following information:

- Flight number
- Tape number
- Date and time tape created
- Data Type (shock)
- Analysis bandwidth
- Measurement ID(s)
- Time interval(s)

Data for each measurement will be output in a separate file with the measurement ID as the first word in each record. Input data will be also contained on the tape.

Contents of the data record are as follows:

- Input data
- Shock response amplitude

Tape characteristics:

- 7-track
- 800 bpi
- UNIVAC compatible
- Double EOF following last measurements data

The exact format and content is contained in reference 6.

3.1.4 PRE-FLIGHT DATA LIBRARY (PFL)

The pre-flight data library contains structural dynamic threshold criteria for use in automated screening of the RMS and Wave Analysis data for each measurement. The screening criteria are accessible by:

- Measurement ID
- FTR number
- Sub-structure
- Zone number
- Mission Event
- Data type

Screening criteria contained for each measurement vary according to data type. All measurements have an RMS threshold. Steady state acoustic measurements will also have a 1/3 octave sound pressure level threshold. Steady state vibration measurements have a PSD power spectrum threshold. Transient data measurements will have a PSD power spectrum and peak shock spectrum threshold.

Threshold criteria for acoustic SPL screening will be stored for each 1/3 octave point from 1.25 Hz to 8000 Hz, plus the overall value (40 entries). A table of 1/3 octave points and frequency ranges is shown in figure 3-4.1.

Steady state and transient wave analysis threshold spectrum criteria are stored in frequency segments as a positive or negative slope in dB/octave, or a constant value.

	FREQ (Hz)	RANGE (Hz)		SPL AMPLITUDE (dB)
(1)	1.25	1.125	1.125	T
(2)	1.6	1.425	1.8	H
(3)	2.0	1.8	2.25	R
(4)	2.5	2.25	2.825	E
(5)	3.15	2.825	3.575	S
(6)	4.0	3.575	4.5	H
(7)	5.0	4.5	5.65	O
(8)	6.3	5.65	7.15	L
(9)	8.0	7.15	9.0	D
(10)	10.0	9.0	11.25	
(11)	12.5	11.25	14.25	
(12)	16.0	14.25	18.0	
(13)	20.0	18.0	22.5	
(14)	25.0	22.5	28.25	
(15)	31.5	28.25	35.75	
(16)	40.0	35.75	45.0	
(17)	50.0	45.0	56.5	
(18)	63.0	56.5	71.5	V
(19)	80.0	71.5	90.0	A
(20)	100.0	90.0	112.5	L
(21)	125.0	112.5	142.5	U
(22)	160.0	142.5	180.0	E
(23)	200.0	180.0	225.0	S
(24)	250.0	225.0	282.5	
(25)	320.0	282.5	357.5	
(26)	400.0	357.5	450.0	
(27)	500.0	450.0	565.0	
(28)	630.0	565.0	715.0	
(29)	800.0	715.0	900.0	
(30)	1000.0	900.0	1125.0	
(31)	1250.0	1125.0	1425.0	
(32)	1600.0	1425.0	1800.0	
(33)	2000.0	1800.0	2250.0	
(34)	2500.0	2250.0	2825.0	
(35)	3200.0	2825.0	3575.0	
(36)	4000.0	3575.0	4500.0	
(37)	5000.0	4500.0	5650.0	
(38)	6300.0	5650.0	7150.0	
(39)	8000.0	7150.0	9000.0	

OA (Overall Average)

Figure 3-4.1 - 1/3 Octave Table

The table in figure 3-4.2 illustrates the steady state and transient threshold criteria. The file format is shown in figure 3-4.3.

3.1.5 FLIGHT DATA LIBRARY (FDL)

The Flight Data Library serves as a repository for wave analysis data to be available for subsequent screening and plotting. It also contains information for producing a catalog of available RMS and wave analysis data. The file format is shown in figure 3-5.1.

Contents of the file include:

- o Flight number
- o Measurement ID
- o Data type
- o Time interval encompassed by the data
- o Tape and file number for RMS data
- o Tape and file number for wave analysis data
- o Date and time generated
- o Band width of wave analysis data
- o Wave analysis data in EU's
- o Shock spectrum input data in EU's

The RMS Screen flag is utilized to indicate processing status, data anomaly, and some indication of data quality. The values and the relationships are as follows:

0 = Data not received from IDSD

1 = Data anomaly - not screened

2 = Data acceptable

3 = Data intermittent

4 = Data quality unknown

5 = Data unusable

Wave Analysis Screen Flag values are as follows:

0 = Unknown

1 = Good

2 = Unusable

PSD OR PEAK VS FREQUENCY TABLE

ZONE NO._____

RMS _____

SEG NO.	START FREQUENCY	STOP FREQUENCY	DB/OCTAVE SLOPE	E.U.'S
1	FREQ (1)	FREQ (2)		
2	FREQ (2)	FREQ (3)		
3	FREQ (3)	FREQ (4)		
.				
.				
.				
n	FREQ (n)	FREQ (n+1)		

Figure 3-4.2. - Steady State and Transient Threshold Spectrum

PREFLIGHT LIBRARY

Header Block (2 sectors)

24 words	A	File header information
1 word	I	Next available sector address
1 word	I	Number of substructures
1 word	I	Substructure Index sector address
1 word	I	Number of zones
1 word	I	Zone Index sector address
1 word	I	Number of FTRs
1 word	I	FTR Index sector address
1 word	I	Number of data tables (NTABLE)
1 word	I	Data Table Index sector address
1 word		Spare
1 word	A	Flight number
1 word	I	Flight Data Block sector address
20 words		space for additional flights

Flight Data Block (2 sectors)

1 word	I	Number of measurements
1 word		Spare
2 words	A	1st measurement ID for 1st Measurement ID Block
1 word	I	Sector address of 1st Measurement ID Block
⋮	⋮	⋮
2 words	A	1st measurement ID of 18th Measurement ID Block
1 word	I	Sector address of 18th Measurement ID Block

Figure 3-4.3 - Preflight Library Format

Measurement ID Block (9 sectors)

2 words	A	1st measurement ID
1 word	I	1st Measurement Data Block sector address
⋮	⋮	⋮
2 words	A	84th measurement ID
1 word	I	84th Measurement Data Block sector address

Measurement Data Block (1 sector)

	2 words	A	Substructure ID
	1 word	A	Zone ID
	1 word	A	Engineering units
	1 word	O	Flight indicator. A "1" in bit n designates the presence of this measurement in flight n.
	1 word	R	RMS value
	1 word	R	Peak value
	1 word		Spare
	1 word	I	Number of flight test requirements
Repeat for Multiple FTR's	2 words	A	1st Flight test requirement
	1 word	I	FTR Data Block sector address
	⋮	⋮	(Repeat for 5 more FTR's)
	1 word	I	Sector address FTR overflow area

Figure 3-4.3 - Continued

FTR Data Block (14 words)

1 word	I	Number of RMS mission events (NRMS)
1 word	I	RMS Block sector address
1 word	I	Number of Peak mission events (NPEAK)
1 word	I	Peak Block sector address
1 word	I	Number of 3rd Octave mission events
1 word	I	3rd Octave Block sector address
1 word	I	Number of PSD mission events (NPSD)
1 word	I	PSD Block sector address
1 word	I	Number of shock spectra mission events
1 word	I	Shock Spectra Block sector address
4 words		Spare

Substructure Index (2 sectors)

2 words	A	1st substructure ID
1 word	I	Measurement List sector address
⋮	⋮	⋮
2 words	A	18th substructure ID
1 word	I	Measurement List sector address
1 word		Spare
1 word	I	Sector address of next Substructure Index

Figure 3-4.3 - Continued

Zone Index (2 sectors)

1 word	A	1st Zone ID
1 word	I	Measurement List sector address
⋮	⋮	⋮
1 word	A	27th Zone ID
1 word	I	Measurement List sector address
1 word		Spare
1 word	I	Sector address of next Zone Index

Measurement List (1 sector)

2 words	A	Measurement ID
⋮	⋮	⋮
2 words	A	Measurement ID
1 word		not used
1 word	I	Sector address of next Measurement List

Figure 3-4.3 - Continued

RMS Table (3 sectors)

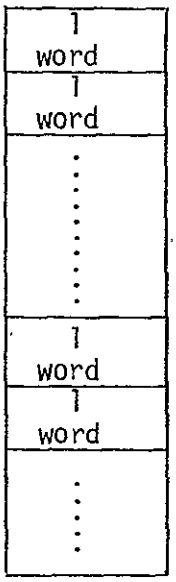
1 word	A	Mission event (1st)
1 word	R	Screening percentage
1 word	A	Source
⋮	⋮	⋮
1 word	A	Mission event (27th)
1 word	R	Screening percentage
1 word	A	Source
2 words		Spare
1 word	I	Sector address of next RMS Table

PSD Table (3 sectors)

1 word	A	Mission event (1st)
1 word	R	Screening percentage
1 word	A	Source
1 word	A	Data table ID
⋮		
1 word	A	Mission event (20th)
1 word	R	Screening percentage
1 word	A	Source
1 word	A	Data table ID
3 words		Spare
1 word	I	Sector address of next PSD Table

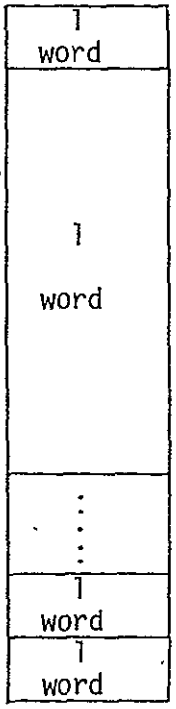
Figure 3-4.3 - Continued

Data Table Index (4 sectors)



A	1st entry of 1st Data Table ID Block
I	Sector address of 1st Data Table ID Block
A	1st entry of 14th Data Table ID Block
I	Sector address of 14th Data Table ID Block

Data Table ID Block (4 sectors)



A	1st Data Table ID
Ø	Data table description

Bits 0-3 Table type. = 1 3rd Octave format
= 2 Slope and line format
= 3 Curve format (uneven frequency increments)
= 4 Curve format (even frequency increments)

Bits 4-12 Number of entries in table (NVAL)

Bits 13-35 Data Table sector address

A	56th Data Table ID
Ø	Data table description

Figure 3-4.3 - Continued

Data Tables

Type 1 (2*NVAL+1 words)

1 word	R	RMS of data
NVAL words	R	Frequency
NVAL words	R	Sound pressure level (dB)

Type 2 (3*NVAL+2 words)

1 word	R	RMS of data
NVAL words	R	Frequency
NVAL words	R	Slope (dB/octave)
NVAL words	R	Constant line value (E.U.)
1 word	R	Max. frequency

Type 3 (2*NVAL+1 words)

1 word	R	RMS of data
NVAL words	R	Frequency
NVAL words	R	Spectral value

Type 4 (NVAL+3 words)

1 word	R	RMS of data
1 word	R	Starting frequency
1 word	R	Delta frequency
NVAL words	R	Spectral values

Figure 3-4.3 - Concluded

NOTES:

1. File is NTRAN random access type.
2. All data blocks begin at first word of a sector unless otherwise stated.
3. Sectors 0 and 1 always contain Header Block.
4. Blocks are zero-filled upon initialization. Sector address of 0 indicates data not available. Negative sector address signifies Block begins at word 15 of sector.
5. PSD Table, 3rd Octave Table and Shock Spectra Table have identical formats.
6. Peak Table and RMS Table have identical formats.
7. Entries in Measurement ID Block and Data Table ID Block must be inserted in numeric order.
8. Substructure Index and FTR Index have identical formats.
9. Maximum of 1512 measurements allowed on file.
10. Maximum of 3136 data tables allowed on file.

FLIGHT DATA LIBRARY

Header Block (2 sectors)

24 words	A	File header information
1 word	I	Next available sector address
1 word	I	Number of substructures
1 word	I	Substructure Index sector address
1 word	I	Number of zones
1 word	I	Zone Index sector address
5 words		Spare
1 word	A	Flight number
1 word	I	Flight Data Block sector address
20 words		space for additional flights

Flight Data Block (2 sectors)

1 word	I	Number of measurements
1 word		Spare
2 words	A	1st measurement ID for 1st Measurement ID Block
1 word	I	Sector address of 1st Measurement ID Block
⋮	⋮	⋮
2 words	A	1st measurement ID of 18th Measurement ID Block
1 word	I	Sector address of 18th Measurement ID Block

Figure 3-5.1 - Flight Data Library Format

Measurement ID Block (9 sectors)

2 words	A	1st measurement ID
1 word	I	1st Measurement Data Block sector address
⋮	⋮	⋮
2 words	A	84th measurement ID
1 word	I	84th Measurement Data Block sector address

Measurement Data Block (14 words)

2 words	A	Substructure ID
1 word	A	Zone ID
1 word	I	Number of RMS data sets (NRMS)
1 word	I	Sector address of RMS Data Index
1 word	I	Number of 3rd Octave data sets (NØCT)
1 word	I	Sector address of 3rd Octave Data Index
1 word	I	Number of PSD data sets
1 word	I	Sector address of PSD Data Index
1 word	I	Number of Shock data sets
1 word	I	Sector address of Shock Data Index
3 words		Spare

Figure 3-5.1 - Continued

RMS Data Index (1 sector)

1 word	I	GMT start time
1 word	I	GMT stop time
1 word	A	Tape number
1 word	I	File number
1 word	I	Date generated
1 word	I	Time generated
1 word	I	Screen flag
⋮	⋮	(Repeat for each data set)
1 word	I	Sector address of RMS overflow area

3rd Octave Data Index (1 sector)

1 word	I	GMT start time
1 word	I	GMT stop time
1 word	A	Tape number
1 word	I	Sector address of 3rd Octave Data Block
1 word	I	Number of data points (NDATA)
⋮	⋮	(Repeat for each data set)
1 word	I	Sector address of 3rd octave overflow area

Figure 3-5.1 - Continued

Shock Data Index (1 sector)

1 word	I	GMT start time
1 word	I	GMT stop time
1 word	A	Tape number
1 word	I	Sector address of Shock Data Block
1 word	Ø	Bits 0-17 Number of Shock data frequency points (NF) Bits 18-39 Number of Shock data time points (NDATA)
⋮	⋮	(Repeat for each data set)
1 word	I	Shock overflow area

Zone Index (2 sectors)

1 word	A	1st Zone ID
1 word	I	Measurement List sector address
⋮	⋮	⋮
1 word	A	27th Zone ID
1 word	I	Measurement List sector address
1 word		Spare
1 word	I	Sector address of next Zone Index

Measurement List (1 sector)

2 words	A	Measurement ID
⋮	⋮	⋮
2 words	A	Measurement ID
1 word		not used
1 word	I	Sector address of Measurement List

Figure 3-5.1 - Continued

Substructure Index (2 sectors)

2 words	A	1st substructure ID
1 word	I	Measurement List sector address
⋮	⋮	⋮ ⋮
2 words	A	18th substructure ID
1 word	I	Measurement List sector address
1 word		Spare
1 word	I	Sector address of next Substructure Index

3rd Octave Data Block (2*NDATA+14 words)

1 word	I	File number
1 word	I	Date generated
1 word	I	Time generated
1 word	I	Screen flag
1 word	A	Mission event
1 word	R	Bandwidth
1 word	R	Cut-off frequency
1 word	R	Lowpass filter setting
1 word	R	Time increment
1 word	R	Overall sound pressure level
1 word	R	Min SPL
1 word	R	Max SPL
2 words		Spare
NDATA words	R	Frequency array
NDATA words	R	Sound pressure level array

Figure 3-5.1 - Continued

PSD Data Block (2*NDATA+14 words)

1 word	I	File number
1 word	I	Date generated
1 word	I	Time generated
1 word	I	Screen flag
1 word	A	Mission event
1 word	R	Bandwidth
1 word	R	Cut-off frequency
1 word	R	Low-pass filter setting
1 word	R	Time increment
1 word	R	Standard deviation
1 word	R	Min PSD
1 word	R	Max PSD
1 word	R	Min MSD
1 word	R	Max MSD
NDATA words	R	PSD values
NDATA words	R	MSD values

Figure 3-5.1 - Continued

Shock Data Block (2*NF+NDATA+14 words)

1 word	I	File number
1 word	I	Date generated
1 word	I	Time generated
1 word	I	Screen flag
1 word	A	Mission event
1 word	R	Bandwidth
1 word	R	Cut-off frequency
1 word	R	Low-pass filter setting
1 word	R	Time increment
1 word	R	Damping constant
1 word	R	Min amplitude
1 word	R	Max amplitude
1 word	R	Min input
1 word	R	Max input
NF words	R	Frequency
NF words	R	Amplitude
NDATA words	R	Shock input data

Figure 3-5.1 - Continued

NOTES:

1. File is NTRAN random access type.

2. All data blocks begin at first word of a sector unless otherwise stated.

3. Sectors 0 and 1 always contain Header Block.

4. Blocks are zero-filled upon initialization. Sector address of 0 indicates data not available. Negative sector address signifies Block begins at word 15 of sector.

5. 3rd Octave Data Index and PSD Data Index have identical formats.

6. Entries in Measurement ID Block must be inserted in numerical order.

7. Overflow areas are 1 sector long with word 28 pointing to next overflow area.

8. Maximum of 1512 measurements allowed on file.

Figure 3-5.1 - Concluded

3.1.6 MPAD FLIGHT PARAMETERS TAPE

Estimated or actual flight parameters versus time are contained on this tape. The five (5) parameters to be utilized from the tape in addition to time are:

1. Dynamic pressure - Q
2. Altitude - h
3. Mach number - M
4. Angle of attack - α
5. Side slip angle - β

The exact format is TBD.

3.1.7. FLIGHT PARAMETERS FILE (PFP)

The Flight Parameters File will be constructed from the parameters identified in 3.1.6. In addition, values occurring at Max Q for Ascent and Descent will be stored. A table correlating mission events with GET and/or GMT will also be contained in the file. The format is shown in figure 3-7.1.

3.1.8 PREFLIGHT DATA LIBRARY TRANSIENT SCREEN TAPE

The purpose of this tape is to provide IDSD with the transient screening criteria in a format suitable to their use. The format and content are contained in reference 6.

3.1.9 SCREEN REPORT FILE (SRF)

The Screen Report Log file contains the results of the RMS and Wave Analysis Screening process. The purpose is to enable the generation of a summary of processing for each measurement. The format is shown in figure 3-9.1.

FLIGHT PARAMETERS FILE FORMAT

Header Block (11 sectors)

1 word	A	Flight number	
1 word	A	Tape number (MPAD)	
1 word	I	Julian date of MPAD tape, DDDY	
1 word	I	Julian year	YY
1 word	I	Julian day	DDD
1 word	I	Hour (GMT)	of
1 word	I	Minutes (GMT)	launch
1 word	I	Seconds (GMT)	(GET)
1 word	I	Milliseconds (GMT)	T-0
1 word	I	Time in Milliseconds (GMT) of T-0	
1 word	I	(GMT OF MAX Q - Ascent (Integer Milliseconds)	
1 word	R	h	
1 word	R	α	
1 word	R	β	
1 word	R	Q	
1 word	R	M	
1 word	I	(GMT) OF MAX Q - Descent (integer milliseconds)	
1 word	R	h	
1 word	R	α	
1 word	R	β	
1 word	R	Q	
1 word	R	M	
6 words		Spare	
1 word	I	No Mission Events in Table	
1 word	A	Mission event (1)	

Figure 3-7.1. - Flight Parameters File Format

FLIGHT PARAMETERS FILE FORMAT (continued)

Header Block (11 sectors) (concluded)

1 word	I	(GMT) START in milliseconds
1 word	I	(GMT) STOP in milliseconds
297 words		(Repeat above for ME(2) - ME(100)
7 words		Spare

Data Index Block (4 sectors)

1 word	I	Number of time values (n), $n \leq 9324$
1 word	I	84th GMT of Data Block
1 word	I	168th GMT of Data Block
1 word	I	252nd GMT of Data Block
⋮		⋮ ⋮
j^{th} word	I	j^{th} GMT of Data Block $j = (((n-1)/84)+1)*84$
⋮		⋮ ⋮
1 word	I	9324th GMT of Data Block

Figure 3-7.1 - Flight Parameters File Format (continued)

FLIGHT PARAMETERS FILE FORMAT (concluded)

Data Block (6*n words)

1 word	I	GMT (1)
1 word	R	h
1 word	R	α
1 word	R	β
1 word	R	Q
1 word	R	M
6 words		GMT (2)
⋮		⋮
6 words		GMT (n)
		⋮

Note:

1. File is NTRAN TYPE
2. Sectors 0 thru 10 contain the Header Block.
3. Sectors 11 thru 14 contain the Data Index Block.
4. The Data Block begins at the first word of sector 15.
5. The starting sector address for an 18 sector block (504 words) which contains the time reflected in the i^{th} word of the Data Index Block is (18*i)-21

Figure 3-7.1. - Flight Parameters File Format (concluded)

SCREEN REPORT LOG

Header Block (2 sectors)

24 words	A	File header information
1 word	I	Next available sector address
1 word	I	Number of substructures
1 word	I	Substructure Index sector address
1 word	I	Number of zones
1 word	I	Zone Index sector address
1 word	I	Number of FTRs
1 word	I	FTR Index sector address
3 words		Spare
1 word	A	Flight number
1 word	I	Flight Data Block sector address
20 words		space for additional flights

Flight Data Block (2 sectors)

1 word	I	Number of measurements
1 word		Spare
2 words	A	1st measurement ID for 1st Measurement ID Block
1 word	I	Sector address of 1st Measurement ID Block
⋮	⋮	⋮
2 words	A	1st measurement ID of 18th Measurement ID Block
1 word	I	Sector address of 18th Measurement ID Block

Figure 3-9.1 - Screen Report Log File Format

Measurement ID Block (9 sectors)

2 words	A	1st measurement ID
1 word	I	1st Measurement Data Block sector address
⋮	⋮	⋮
2 words	A	84th measurement ID
1 word	I	84th Measurement Data Block sector address

Measurement Data Block (2 sectors)

2 words	A	Substructure ID
1 word	A	Zone ID
2 words	A	1st Flight Test Requirement
1 word	I	Number of RMS data sets (NRMS)
1 word	I	Sector address of RMS Data Index
1 word	I	Number of 3rd Octave data sets (NØCT)
1 word	I	Sector address of 3rd Octave Data Index
1 word	I	Number of PSD data sets
1 word	I	Sector address of PSD Data Index
1 word	I	Number of Shock data sets
1 word	I	Sector address of Shock Data Index
⋮	⋮	⋮ (Additional FTRs)
1 word	I	Sector address of FTR overflow area

Figure 3-9.1 - Continued

Zone Index (2 sectors)

1 word	A	1st Zone ID
1 word	I	Measurement List sector address
⋮	⋮	⋮
1 word	A	27th Zone ID
1 word	I	Measurement List sector address
1 word		Spare
1 word	I	Sector address of next Zone Index

Measurement List (1 sector)

2 words	A	Measurement ID
⋮	⋮	⋮
2 words	A	Measurement ID
1 word		not used
1 word	I	Sector address of next Measurement List

Substructure Index (2 sectors)

2 words	A	1st substructure ID
1 word	I	Measurement List sector address
⋮	⋮	⋮
2 words	A	18th substructure ID
1 word	I	Measurement List sector address
1 word		Spare
1 word	I	Sector address of next Substructure Index

Figure 3-9.1 - Continued

RMS Data Index (1 sector)

1 word	I	GMT start time
1 word	I	GMT stop time
1 word	A	Tape number
1 word	I	Sector address of RMS Data Block
⋮	⋮	⋮ (Repeat for additional data sets)
1 word	I	Sector address of RMS overflow area

RMS Data Block (1 sector)

1 word	A	Mission event
1 word	R	PFL RMS value
1 word	R	Screen RMS value
1 word	A	Source
1 word	R	Screen Dist. 0-25%
1 word	R	25-50
1 word	R	50-75
1 word	R	75-100
1 word	R	100+
1 word	R	Maximum RMS
1 word	I	Time of max. RMS
1 word	R	Maximum peak value
1 word	I	Time of max. peak
1 word	R	Ratio screen 0-1.4
1 word	R	1.4-3.2
1 word	R	3.2+
12 words		Spare

Figure 3-9.1 - Continued

3rd Octave Data Block (14 words)

1 word	A	Mission event
1 word	R	PFL RMS value
1 word	R	Screening percentage
1 word	A	Source
1 word	R	Screen Dist. 0-25%
1 word	R	25-50
1 word	R	50-75
1 word	R	75-100
1 word	R	100+
1 word	R	Maximum value
1 word	R	Frequency of maximum value
1 word	R	Standard deviation of input data
2 words		Spare

Figure 3-9.1 - Continued

NOTES:

1. File is NTRAN random access type.
2. All data blocks begin at first word of a sector unless otherwise stated.
3. Sectors 0 and 1 always contain Header Block.
4. Blocks are zero-filled upon initialization. Sector address of 0 indicates data not available. Negative sector address signifies Block begins at word 15 of sector.
5. RMS Data Index, 3rd Octave Data Index, PSD Data Index, and Shock Data Index have identical formats.
6. Entries in Measurement ID Block must be inserted in numerical order.
7. Overflow areas are 1 sector long with word 28 pointing to next overflow area.
8. Substructure Index and FTR Index have identical formats.
9. Maximum of 1512 measurements allowed on file.

Figure 3-9.1 - Concluded

3.2 WADS EXECUTIVE

The Executive program provides the control for execution of the basic functions provided in the WADS. When utilizing the system, execution of the Executive from the terminal will cause the available options to be displayed.

The functions performed in the WADS are:

- Analysis and Screen Processing
- Preflight Library Update/Display/Create
- Flight Data Library Create/Update
- Catalog and Processing Summary Display
- Plot MPAD Parameters or Other Time or Frequency Series

Initially the program will display selection criteria and an indication if a batch run is to be started. If so the executive will create the run stream from the interactive dialog.

Processing options are selected and control is passed to the individual function. Upon completion control is returned to the executive to determine if processing is complete.

The flow charts in Appendix B illustrate processing performed.

3.3 PREFLIGHT DATA LIBRARY GENERATOR

This function will generate and maintain a data file containing threshold or design values to be used for comparisons with actual flight data.

3.3.1 INPUT

- Card images of threshold values, design values, etc. necessary to create and/or update the Preflight Data Library File.
- Preflight Data Library File.
- Flight Data Library.

3.3.2 PROCESSING

Three processing functions are performed by the Preflight Library generator.

The first is to create the file from lead cards for each measurement. It is anticipated that a batch run will be submitted due to the volume of input.

The second function is the demand display and update feature. If this option is selected, measurement ID's entered by the user will cause information contained in the file to be displayed. Changes may be entered to correct erroneous data.

The third function is to update the RMS values, screen profile, and screen percentages for each mission event, from output generated by the Analysis Screen function.

3.3.3 OUTPUT

The output is the Preflight Data Library File or updated file and a tape to be used by IDSD for transient screening.

3.4 FLIGHT DATA LIBRARY GENERATOR

The Flight Data Library Generation routine performs the following functions:

- Creates the Flight Data Library
- Displays Data Catalog Reports
- Updates information in the FDL
- Compresses the FDL

3.4.1 FLIGHT DATA LIBRARY CREATE

Input to the FDL "create" function is the Preflight Library. The processing performed consists of creating an entry in the FDL for each measurement ID in the Preflight Library.

The output produced is the FDL. The format and content are defined in section 3.1.5.

3.4.2 CATALOG AND PROCESSING STATUS UPDATE/DISPLAY

In order to manage the processing of data through the WADS a method of keeping track of data available for processing and processing performed is required. Two types of reports are generated by the system in which this information is contained.

The first is the Data Category of either RMS or Wave Analysis data. The second is a Summary of the RMS and Wave Analysis Screen Reports which are covered in Section 3.7.

3.4.2.1 RMS Data Catalog

The input is the FDL. Processing requires the retrieval and display of information from the FDL based upon criteria selected by the user. RMS options are:

- Data availability by MSID
- Data availability by Substructure
- Data availability by Zone

Format and content of the report is shown in figure 3.4-1.

3.4.2.2 Wave Analysis Data Catalog

The FDL is the input source. Processing requires retrieval and display of information from the FDL based on criteria selected by the user.

Wave analysis options are:

- Data availability by MSID
- Data availability by Data Type
- Data availability by FTR
- Data availability by Substructure
- Data availability by Zone

Format and content of the output report is shown in figure 3.4-2.

RMS DATA CATALOG

FLT # _____ Date _____

FTR _____

MSID	GMT TIME INTERVAL	TAPE NO.	FILE	DATE	TIME	DATA QUAL SCREEN FLAG

Figure 3.4-1. - RMS Data Catalog Report

WAVE ANALYSIS DATA CATALOG

FLT#_____ DATE_____

FTR_____ SUBSTRUCTURE_____ ZONE_____

MSID	TYPE	TIME INTERVAL	MISSION EVENT	BW	TAPE NO.	DATE	TIME	DATA QUAL SCREEN FLAG

Figure 3.4-2. - Wave Analysis Data Catalog Report

3.4.3 FDL COMPRESS

Input to this function is the FDL. Processing consists of deleting wave analysis data or measurement information determined to be erroneous or invalid.

Output is a file with the bad entries removed.

3.5 ANALYSIS AND SCREEN PROCESSING

The Analysis and Screen processing Subroutine performs two basic functions. These are, 1) screen rms and peak/rms ratios for the purpose of reducing further processing through the IDSD Wave Analysis Programs, and 2) screen wave analysis output on those measurements that required wave analysis processing for the purpose of reducing graphical output.

3.5.1 RMS AND PEAK/RMS

3.5.1.1 Input

- Rms and peak/rms time history tape
- Screen Summary file
- Preflight data library
- Flight data library

3.5.1.2 Processing

3.5.1.2.1 RMS

Processing of the rms time history file consists of comparing the rms data with threshold values obtained from the preflight data library, and comparing peak/rms ratios to predetermined levels.

Rms screening criteria are selected from the preflight library in one of the following ways.

1. In a default mode each measurement ID is used to retrieve a Specified Threshold rms value and percentage level for Ascent and Descent mission event for each FTR in sequence.

2. Each measurement to be screened may be input with Threshold Type Selection, FTR and mission event.

The program calculates four screening levels for each mission event as a percentage of the rms value. These levels are 25 percent, 50 percent, 75 percent, and 100 percent. Therefore, if the rms screen level for a specific mission event is 80 percent of the 50 g's contained in the preflight library, the four values would be 10, 20, 30, and 40 g's respectively. (Percentages exceeding 100 are possible.)

From the start time of the specific mission event until the next defined time the percentage values are used to screen the data.

If 0.0 < rms (i) $\leq$ .25(*screen value)	add 1 to count 1
If .25 *screen value < rms (i) $\leq$ .50 *screen value	add 1 to count 2
If .50 *screen value < rms (i) $\leq$ .75 *screen value	add 1 to count 3
If .75 *screen value < rms (i) $\leq$ 1.00 *screen value	add 1 to count 4
If 1.00 *screen value < rms (i)	add 1 to count 5

Determine maximum value and the time of occurrence.

If rms (i) < rms (i+1)

$rms_{(max)} = rms\ (i+1)$

$time_{(max)} = time_{(i+1)}$

Calculate percentage of values in each level

$$\text{RMS Level}_{(k)} = \frac{\text{Count}_{(k)}}{\sum_{k=1}^{n} \text{Count}_{(k)}}$$

Tabular output is generated from the screen results.

Screen results are stored then tested to determine if plots are necessary.

If the number of values in rms counter 5 is greater than zero, generate a plot and flag with special annotation on the tabular and graphical output.

3.5.1.2.2 Peak/rms Ratios

Test the ratio as follows:

If $0 < R_{(j)} \leq 1.4$ add 1 to count 1

If $1.4 < R_{(j)} \leq 3.2$ add 1 to count 2

If $3.2 < R_{(j)}$ add 1 to count 3

Calculate percentage of data in each level

$$\text{Ratio Level}_{(i)} = \frac{\text{Count}_{(i)}}{\sum_{i=1}^{n} \text{Count}_{(i)}}$$

Calculate the peak value for each time and determine the maximum and time of occurrence.

$\text{peak}_{(j)} = R_{(j)} \times \text{rms}_{(j)}$

If $\text{peak}_{(j)} < \text{peak}(j+1)$

$\text{peak}_{(max)} = \text{peak}\ (j+1)$

3.5.1.3 Output

The output consists of a tabulation by measurement of the percentage of data in each screen level, the max peak value, maximum rms value, and time each occurred for each mission event. The graphical representation consists of the rms and threshold profile vs time, and headings which contain the following:

- Flight number
- Measurement ID

- FTR
- Ascent max Q and GMT
- Descent max Q and GMT

Examples of tabular and graphical formats are shown in figures 3.5-1 and 3.5-2, 3 respectively.

The system also generates an output, which will serve as part of a processing request form for IDSD wave analysis processing, when any value exceeds 100 percent of the threshold.

The form contains a list of the measurement ID's and provides space for entry of the type of processing required digitizing rates, filtering bandwidth, frequency band of analysis, time intervals, tape number, track, and channel.

A value to be set in the RMS, PEAK/RMS screen flag is determined by the following:

Screen flag	Criteria
4	Ratio Level (2) $\leq$ 50
3	Ratio Level (2) = 50 to 95
2	Ratio Level (2) > 95

All other values are manually set in the FDL during Catalog Update and Display processing.

3.5.2 WAVE ANALYSIS

The wave analysis data encompasses several criteria. Processing is performed on three types of spectral analyses.

- o 1/3 Octave Spectrum of Sound Pressure Level
- o Power Spectral Density
- o Shock Spectrum (maximum absolute displacement)

RMS SCREEN REPORT

FLT NO. XXX-X FTR XXXXXXXXX DATE DD/MM/YY - HH:MM

MSID	TAPE NO.	MISSN EVENT	TIME START/ STOP	RMS PFL/ SCREEN	SOURCE	DISTRIBUTION OF RMS AS A PERCENT OF SCREEN VALUE 0 25	25 50	50 75	75 100	100 +	MAX PEAK RMS	TIME OF MAX	DISTRIBUTION OF PEAK/RMS RATIO IN PERCENT 0 1.4	1.4 3.2	3.2 +
XXXXXXXXX	XXXXX	XXXXXX	DD:HH:MM:SS	XXXX.	X	XXX.X	XXX.X	XXX.X	XXX.X	XXX.X	XXXX.	HH:MM:SS	XXX.X	XXX.X	XXX.X

Figure 3.5-1. - RMS Screen Report

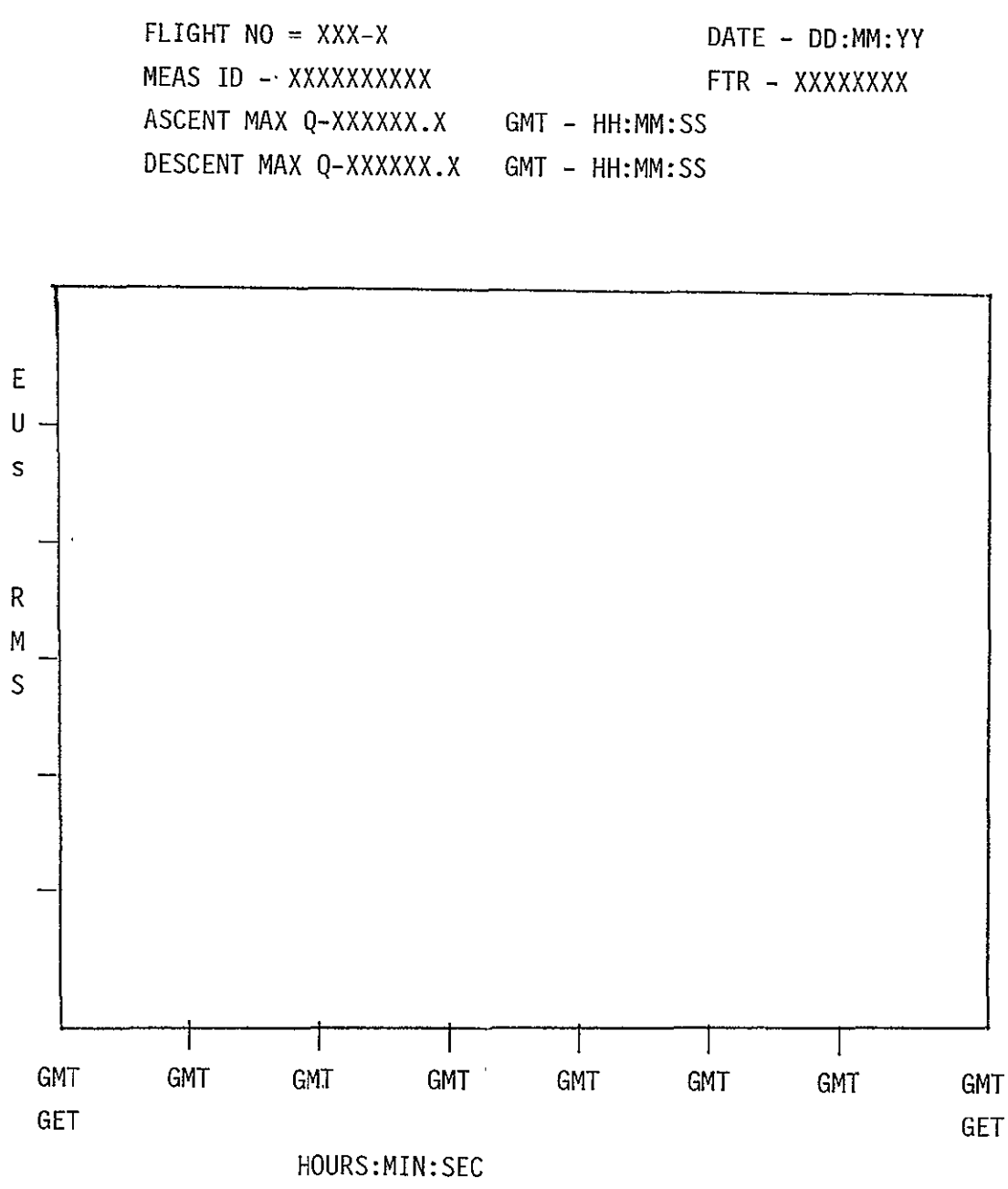


Figure 3.5-2. - RMS Plot Output

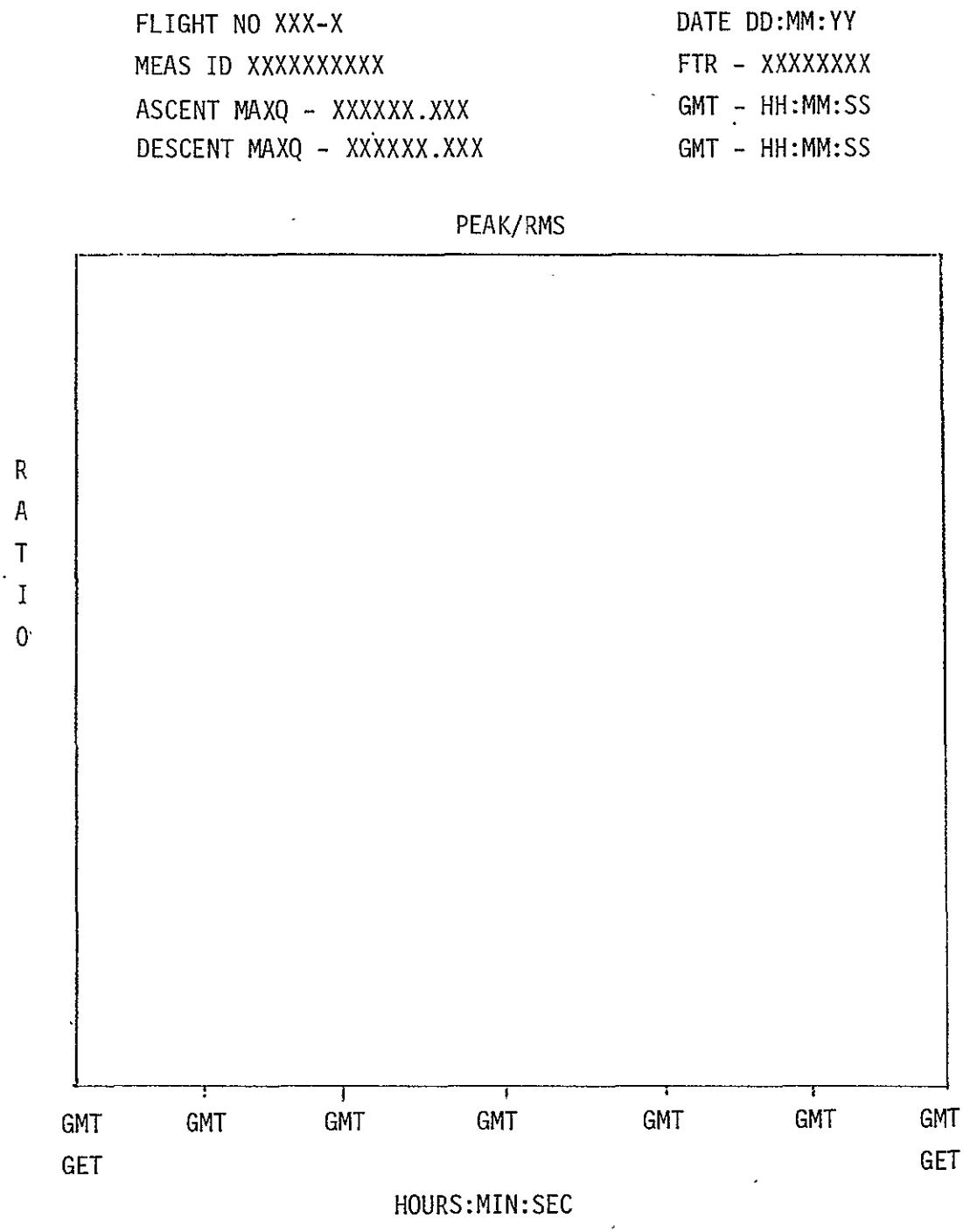


Figure 3.5-3. - Peak/RMS Ratio Plot

3.5.2.1 Input

- Steady state power spectrum
- Transient shock spectrum
- Pre-flight library
- Flight data library
- Screen Summary file

The wave analysis data is initially obtained from tape generated by IDSD.

3.5.2.2 Processing

Screening of wave analysis measurements involves comparing each spectral value with threshold values obtained from the Pre-flight Library.

Screening criteria are selected from the Pre-flight Data Library in one of the following ways:

Tape Input:

1. In the default mode each measurement ID is used to retrieve threshold values for the data type determined from the tape. The screen percentage for the mission event is also retrieved based on the time interval obtained from the tape.

FDL Input:

1. In the default mode measurements to be screened are selected from the PFL by:
   - FTR number
   - Substructure
   - Zone
   - Mission event

Associated threshold values and percentage levels are also obtained based on the data type determined from the PFL.

2. Each measurement to be screened may be input with FTR, data type, mission event and screen percentage. The screen percentage will default to that on the PFL if not supplied.

The program calculates from screening levels for the mission event as percentages of the threshold values. These are 25 percent, 50 percent, 75 percent, and 100 percent. Threshold spectra are contained in the PFL in two separate formats; tables for 1/3 octave spectra, and, slopes and constants for power spectra and shock spectra. The procedure for comparison is basically the same as that for the rms screening. Each spectral value is compared to the threshold profile. Tabs of the results are produced. Plots are produced if screen criteria are exceeded.

3.5.2.2.1 1/3 Octave SPL

Each 1/3 octave value is tested as follows:

$$\text{If} \quad 0 < SPL_{(i)} \leq .25 * TABLE_{(i)}; \quad CT1 = CT1+1$$

$$.25 * TABLE_{(i)} < SPL_{(i)} \leq .50 * TABLE_{(i)}; \quad CT2 = CT2+1$$

$$.50 * TABLE_{(i)} < SPL_{(i)} \leq .75 * TABLE_{(i)}; \quad CT3 = CT3+1$$

$$.75 * TABLE_{(i)} < SPL_{(i)} \leq 1.0 * TABLE_{(i)}; \quad CT4 = CT4+1$$

$$1.0 * TABLE_{(i)} < SPL_{(i)} \qquad CT5 = CT5+1$$

Determine maximum value and frequency at which it occurred.

$$\text{If} \quad SPL_{(i)} < SPL_{(i+1)}$$

$$SPL_{(max)} = SPL\ (i+1)$$

$$Freq_{(max)} = Freq_{(i+1)}$$

Calculate the percentage of values in each screen level

$$Level_{(k)} = \frac{CT(k)}{\sum_{k=1}^{4} CT(k)}$$

The results of the screening performed are tested to determine if graphical output is necessary. If the number of values in the 100+% range exceeds zero the program produces graphical output of the data. If the data exceeds 100 percent a special annotation will be employed for both tabular and graphical output.

3.5.2.2.2 Power and Shock Spectra

Power and shock threshold spectra are contained in the PFL in segments for specified frequency intervals as a constant E.U. or a slope in dB/octave.

In order to screen the data the threshold value must be determined on that portion of the spectrum defined by the slope.

The threshold spectrum value at any frequency (f) for segment (i), with $slope_{(i)}$ (dB/octave) is

$$Th_{(f)} = \frac{f}{f_{(i)}} ** \frac{slope_{(i)}/R}{\log 2} * C_{(i)}$$

where,

i = number of spectrum segment

$f_{(i)}$ = A frequency value in the range for segment (i)

$C_{(i)}$ = The value at f(i)

R_p = Factor for power ratio (=10)

R_a = Factor for Amplitude ratio (=20)

Where contiguous slopes are defined in the table, the value $C_{(i)}$, for the end frequency (i) in the frequency range, must be determined from the next segment with a constant value.

Each spectral value is then compared to the threshold values in the maximum as the 1/3 octave procedure.

Output is also determined using the same technique.

3.5.2.3 Output

Output consists of tabulations, by measurement and mission event, of the percentage of data in each screen level and plots of the data that exceed the threshold. Headings for the graphical data contain:

- Flight number
- FTR
- Date
- Measurement ID
- Standard Devation
- Mission Event
- Time Interval
- Bandwidth
- α, β, Q, h and M at interval start time.

Examples of tabulations and graphical representations are shown in figures 3.5-4 to 3.5-9.

Settings for the Wave Analysis Screen flag are manually set.

3.6 PLOT

The function performed by this subroutine is to produce the graphical representation of the data processed by the system.

3.6.1 INPUT

- Flight data library
- RMS time history tape
- MPAD tape
- Wave analysis tapes

WAVE ANALYSIS SCREEN REPORT

FLT NO. XXX-X FTR XXXXXXXX DATE DD/MM/YY-HH:MM

MSID XXXXXXXXX SUBSTRUCTURE XXXXXX ZONE XXXX

MISSN EVENT	DATA TYPE	TAPE NO.	DATA START	INTERVAL STOP	PFL DB RMS PEAK	DATA DB SIGMA PEAK	PROFL SCRN PRCNT	SOURCE	DISTRIBUTION OF DATA AS A PERCENT OF SCREEN PROFILE 0 25	25 50	50 75	75 100	100 +	MAX VALUE	FREQ
XXXXXX	XXX	XXXXX	HH:MM:SS	HH:MM:SS	XXXX..	XXXXX.X	XXX.X	X	XXX.X	XXX.X	XXX.X	XXX.X	XXX.X	XXXXX.X	XXXX.X

Figure 3.5-4. - Wave Analysis Screen Report

FLT NO. - XXX.X FTR XXXXXXXX DATE - DDMMYY

MEAS ID- XXXXXXXXXX OVERALL DB - XXX.X

MISSION EV. - XXXXXX GMT START - HH:MM:SS

BANDWIDTH - XX.XXX GMT STOP - HH:MM:SS

ALPHA - XXX.X BETA - XXX.X Q - XXXXXX.X

H - XXXXXX. M - XX.XXX

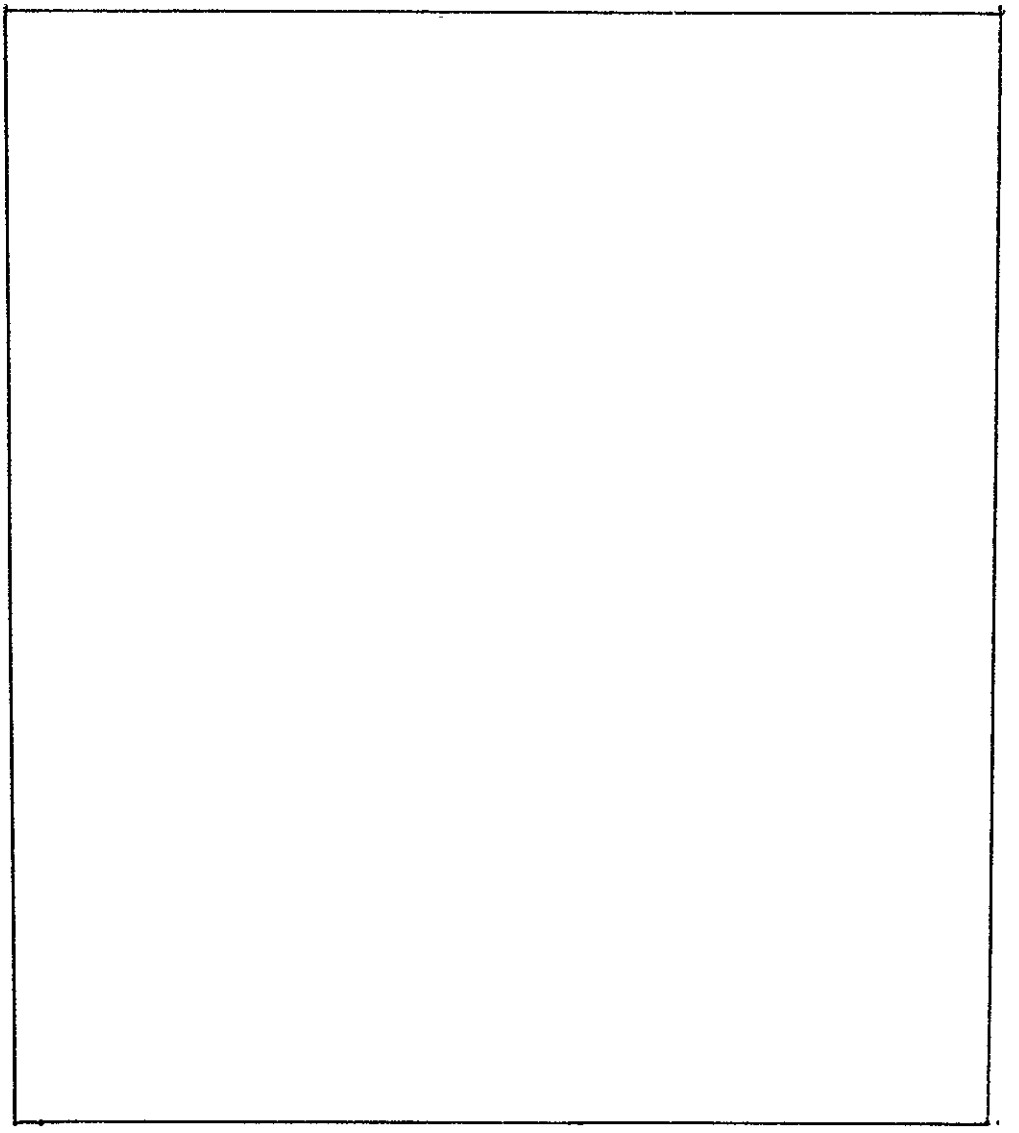
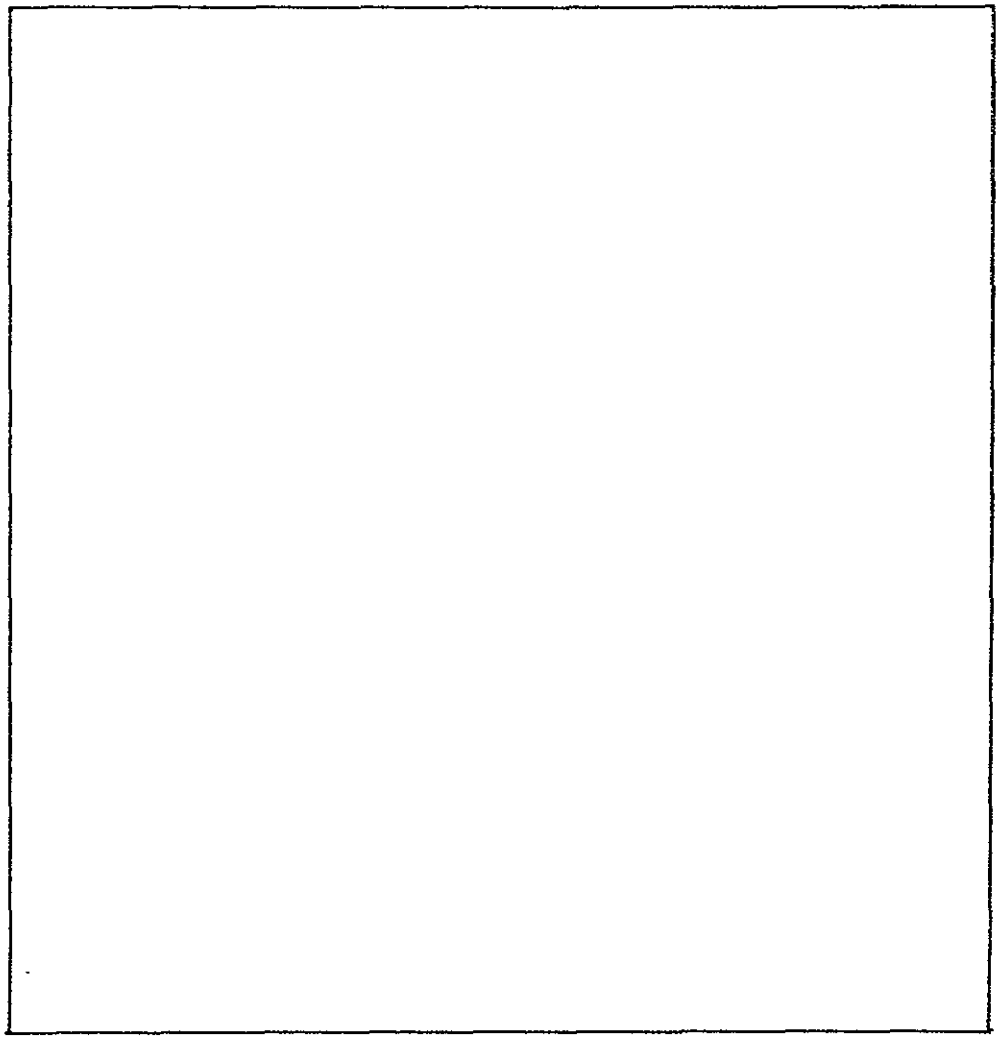


Figure 3.5-5. - 1/3 Octave Plot

FLT NO. - XXX-X FTR - XXXXXXXX DATE - DDMMYY
MEAS ID. - XXXXXXXXXX STD. DEV. - XXXXXX.X
MISSION EV. - XXXXXX GMT START - HH:MM:SS
BANDWIDTH - XX.XXX GMT STOP - HH:MM:SS
ALPHA - XXX.X BETA - XXX.X Q - XXXXXX.X
H - XXXXXX M - XX.XXX



PSD $\frac{U^2}{Hz}$

Frequency - (Hz)

Figure 3.5-6. - PSD Plot

FLT NO. - XXX-X FTR - XXXXXXXX DATE - DDMMYY
MEID - XXXXXXXXXX STD DEV. - XXXXXX.X
MISSION EV. - XXXXXX GMT START - HH:MM:SS
BANDWIDTH - XX.XXX GMT STOP - HH:MM:SS
ALPHA - XXX.X BETA - XXX.X Q - XXXXXX.X
H - XXXXXX M - XX.XXX

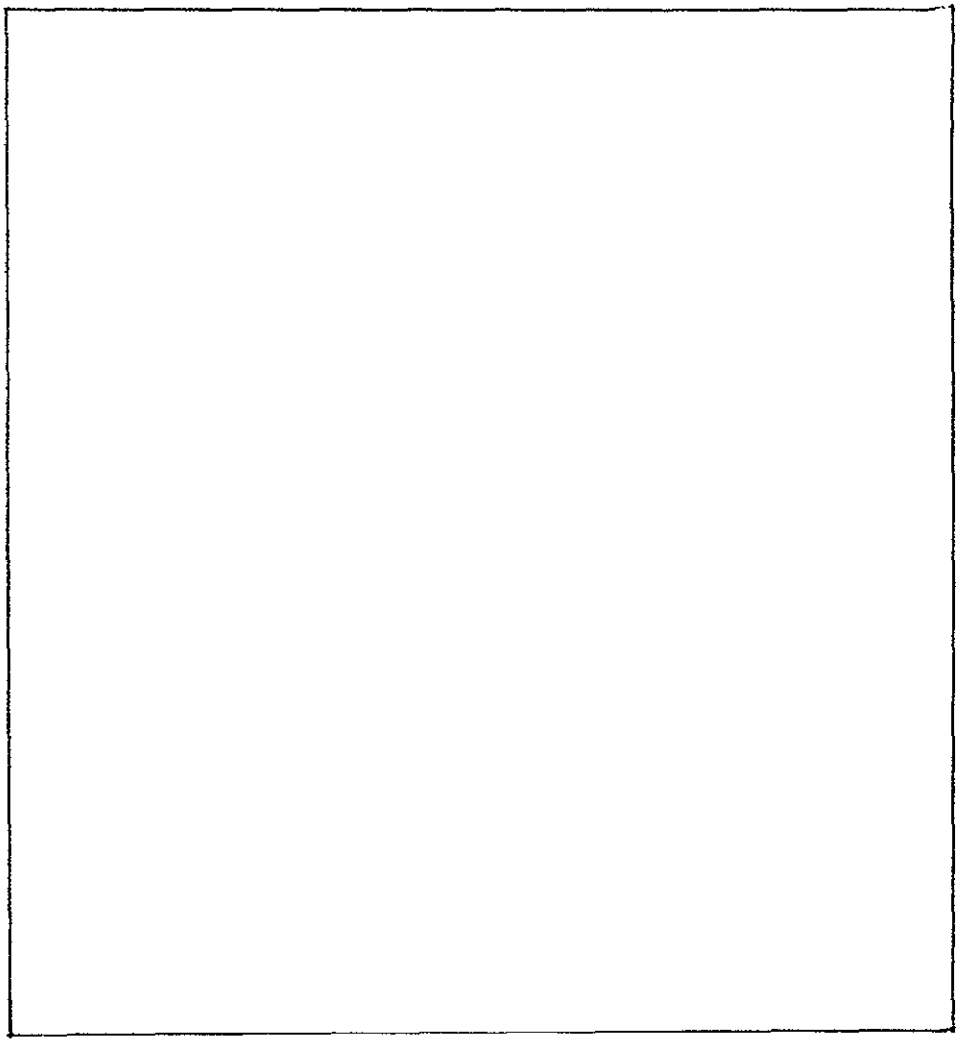


Figure 3.5-7. - MSD Pilot

FLT NO. - XXX-X FTR - XXXXXXXX DATE - DDMMYY
MEAS. ID. - XXXXXXXXXX DAMPING CONST. - XXX.X
MISSION EV. - XXXXXX GMT START - HH:MM:SS
BANDWIDTH - XX.XXX GMT STOP - HH:MM:SS

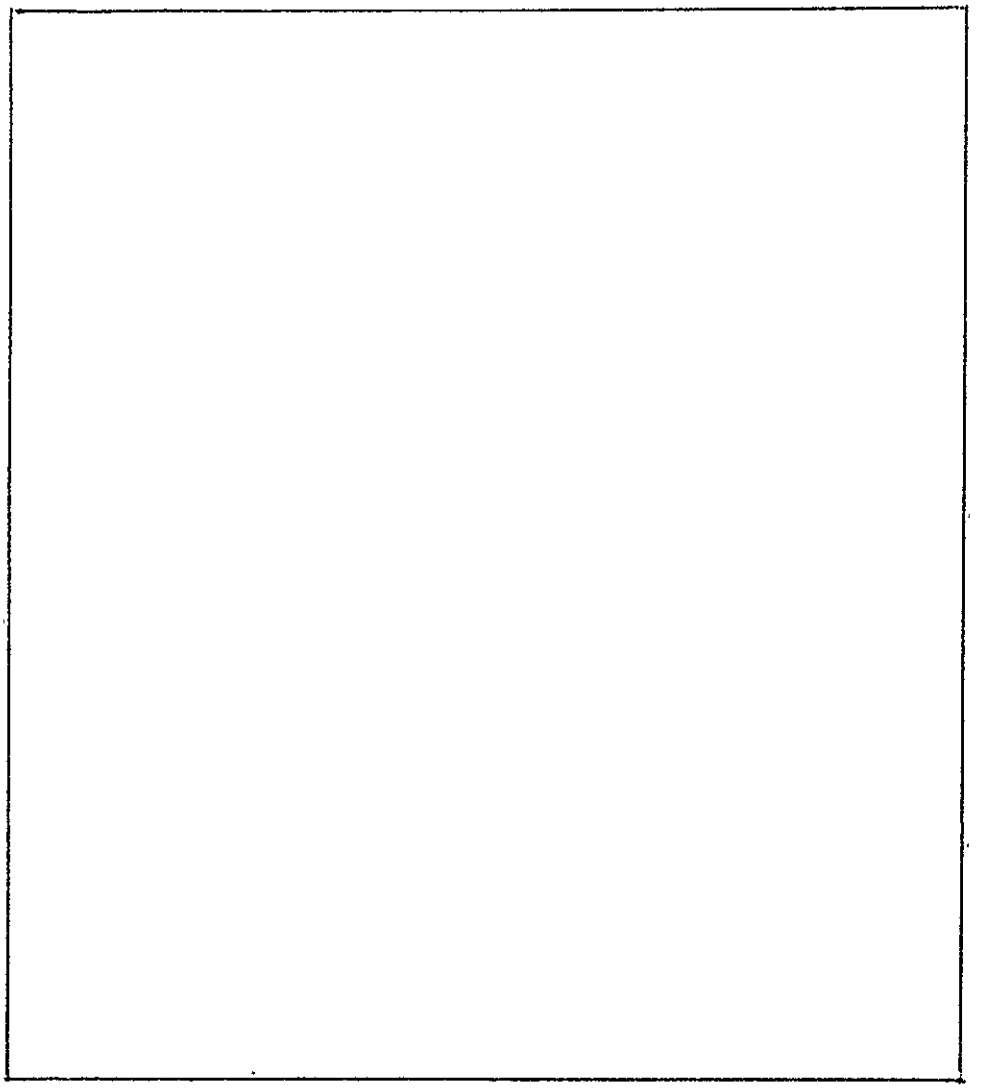


Figure 3.5-8. - Shock Spectrum Plot

FLT NO. XXX-X DATE - DDMMYY

MEAS ID. - XXXXXXXXXX GMT START - HH:MM:SS

MISSION EV. - XXXXXX GMT STOP - HH:MM:SS

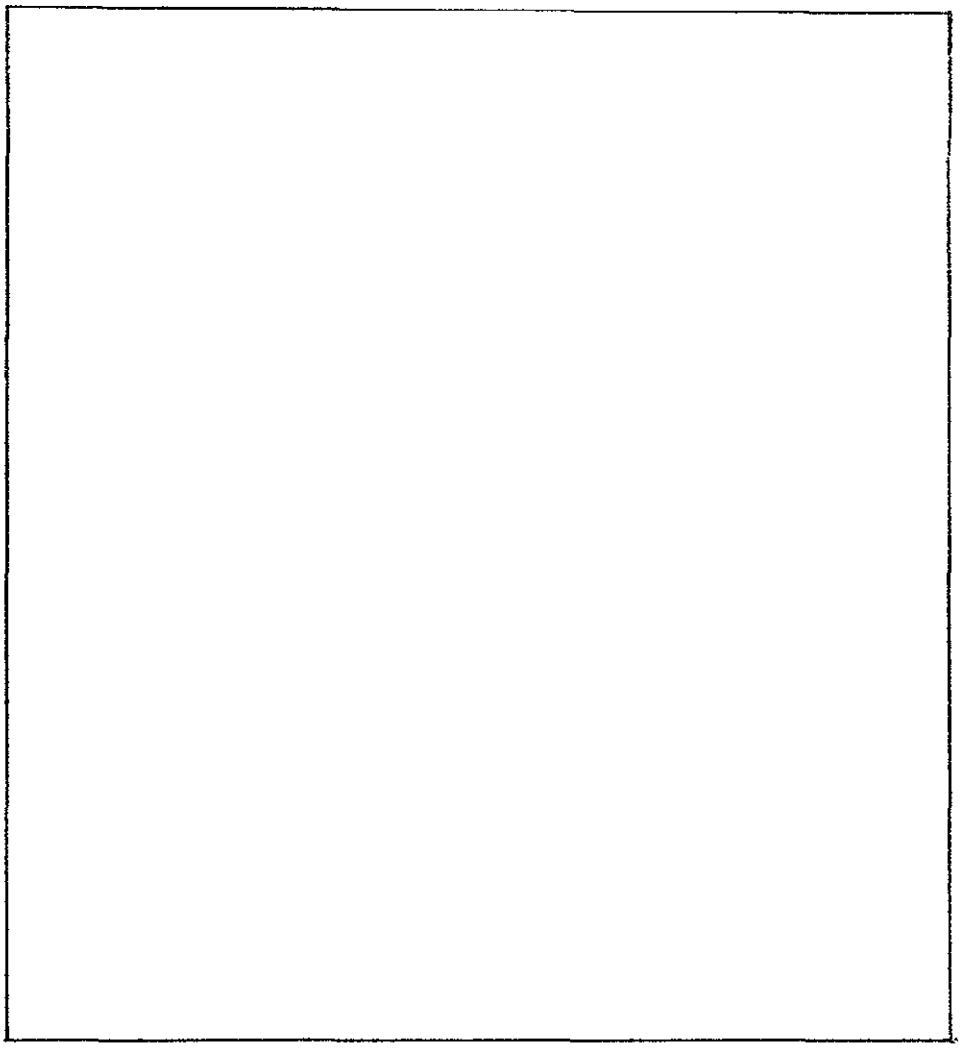


Figure 3.5-9. - Shock Spectrum Input Data Plot

3.6.2 PROCESSING

Plots are produced for screened data upon being flagged to the analysis screen program. The threshold screening spectrum will be coplotted with the measurements data.

In order to coplot the threshold screening spectrum or specification limit the following procedures are followed:

RMS Plot screening limits are plotted as a constant value band on each mission event's percentage of the RMS screen value as calculated by the Analysis Screen Program.

1/3 octave SPL screen spectrum is plotted as contained in the PFL. Frequency vs. SPL (dB).

PSD and Shock Amplitude screening spectrum are plotted as either a frequency series as contained in the PFL or calculated from the constant values and slopes of the spectrum as calculated by the analysis screening program.

Scales will not be altered on either axis to accept the threshold coplot. The symbol Δ will be used to indicate where the threshold exceeds the data scale and a dashed line will be employed to vector connect the points.

Plots of data from tape or mass storage not processed by the Analysis Screen routine will not have the threshold profile coplotted.

Data points plotted will be vector connected. No off scale symbol is utilized when the data exceeds the limits of the vertical axis. Points greater than one Δt in time apart will not be vector connected.

3.6.2.1 RMS Data Plot Options

- Linear axes
- Length of time interval per frame (default = one mission event)

- Abscissa scale (default - automatic scaling)
- Ordinate scale upper limit - optional (default = automatic scaling)
- Ordinate axis lower limit - optional (default = automatic scaling)
- Ordinate label (default to units in PFL)
- Abscissa label - GET vs. GMT

3.6.2.2 PEAK/RMS Ratio Plot Options

- Linear axes
- Length of time interval per frame (default = one mission event)
- Abscissa scale (default = automatic scaling)
- Ordinate scale upper limit - optional (default = automatic scaling)
- Ordinate scale lower limit - optional (default = 1)
- Ordinate label - Ratio
- Abscissa label - GET vs. GMT

3.6.2.3 1/3 Octave SPL Plot Options

- Logrithmic axes
- Ordinate scale upper limit - optional (default - 7 cycle automatic scaling)
- Ordinate label - dB
- Abscissa scale - fixed
  1. 1.25 Hz to 500 Hz - 9 octaves
  2. 20 Hz to 8000 Hz - 9 octaves (default) see figure 3.6-1.

3.6.2.4 PSD Plot Options

- Logrithmic and/or linear axes
- Ordinate scale no. cycles - optional (default 3 cycle - automatic scaling)
- Ordinate label - EU^2/Hz

1.25	20.
1.6	25.
2.0	31.5
2.5	40.0
3.15	50.0
4.0	63.0
5.0	80.0
6.0	100.0
8.0	125.0
10.0	160.0
12.5	200.0
16.0	250.0
20.0	320.0
25.0	400.0
31.5	500.0
40.0	630.0
50.0	800.0
63.0	1000.0
80.0	1250.0
100.0	1600.0
125.0	2000.0
160.0	2500.0
200.0	3200.0
250.0	4000.0
320.0	5000.0
400.0	6300.0
500.0	8000.0

Figure 3.6-1. - 1/3 Octave Plot Scales

- Abscissa scale no. cycles - optional (default 3 cycle - automatic scaling)
- Abscissa label - frequency (Hz)
- Plot grid size consistant with the North American (Rockwell) grid option in the MSC Statistical and Wave Analysis Program VIBAN 3 (see reference 4).
- Ordinate and abscissa scale upper and lower limits

3.6.2.5 MSD Plot Options

- Automatically produced with PSD
- Linear ordinate/log abscissa
- Ordinate scale (automatic scaling)
- Abscissa scale no. cycles - same as PSD (default 3 cycle automatic scaling)
- Ordinate label - EU^2
- Abscissa label - frequency (Hz)

3.6.2.6 Shock Spectra Input Data Plot Options

- Linear axes
- Length of time interval per frame (default = .1 sec)
- Abscissa scale (automatic scaling)
- Ordinate scale upper limit - optional (default = automatic scaling)
- Ordinate scale lower limit - optional (default = automatic scaling)
- Ordinate label - EU
- Abscissa label - GET vs. GMT

3.6.2.7 Shock Absolute Response Amplitude Plot Options

- Logrithmic axes
- Ordinate scale no. cycles - optional (default 3 cycle - automatic scaling)
- Abscissa scale no. cycles - optional (default 3 cycle - automatic scaling)

- o Abscissa scale upper limit - linear option
- o Abscissa scale lower limit - linear option
- o Ordinate label - Max ABS EU
- o Abscissa label - frequency (Hz)

3.7 SCREEN REPORT SUMMARY PROCESSING

Summaries of the individual screen processing reports are generated by the System.

3.7.1 RMS SCREEN REPORT SUMMARY

Input is the Processing Summary File. Processing involves the retrieval and display of RMS screen information selected by the user. Options are:

- o FTR
- o MSID
- o Mission Event

The format and content are the same as shown in figure 3.5-1.

3.7.2 WAVE ANALYSIS SCREEN REPORT SUMMARY

Processing requires the retrieval and display of screen report information selected by the user. Options are:

- o FTR
- o MSID
- o Substructure
- o Zone

The format and content are the same as shown in figure 3.5-4.

3.8 FLIGHT PARAMETER FILE CREATE

The input required is:

- o MPAD tape
- o Table of Mission Events vs. GET

Processing required in creating the FPF consists of storing the Table of Mission Events vs. time and determining the time of maximum Q during the Ascent and Descent Mission Event and the values of Q, α, β, M, and h for the time that max Q was attained. The output FPF format and content are shown in Section 3.1.7.

4. IMPLEMENTATION

A detailed implementation and training plan will be developed during the period of system development.

APPENDIX A

LIST OF REFERENCES

LIST OF REFERENCES

1. Requirements Document OFT Widebound Structural Dynamics Anomaly System, LEC-12681, TR 8024, August 1978

2. Preproject Implementation Plan for the OWSDAPS. IDSD, August 1978, JSC 14418

3. Technical Report Project Plan (OWSDAS), LEC, TR 8026, October 1978

4. Program Documentation, MSC Statistical and Wave Analysis Program, VIBAN 3, Revised February 1972

5. Program Documentation, Shock Spectrum Analysis Program, SHOCK 3, November 1970

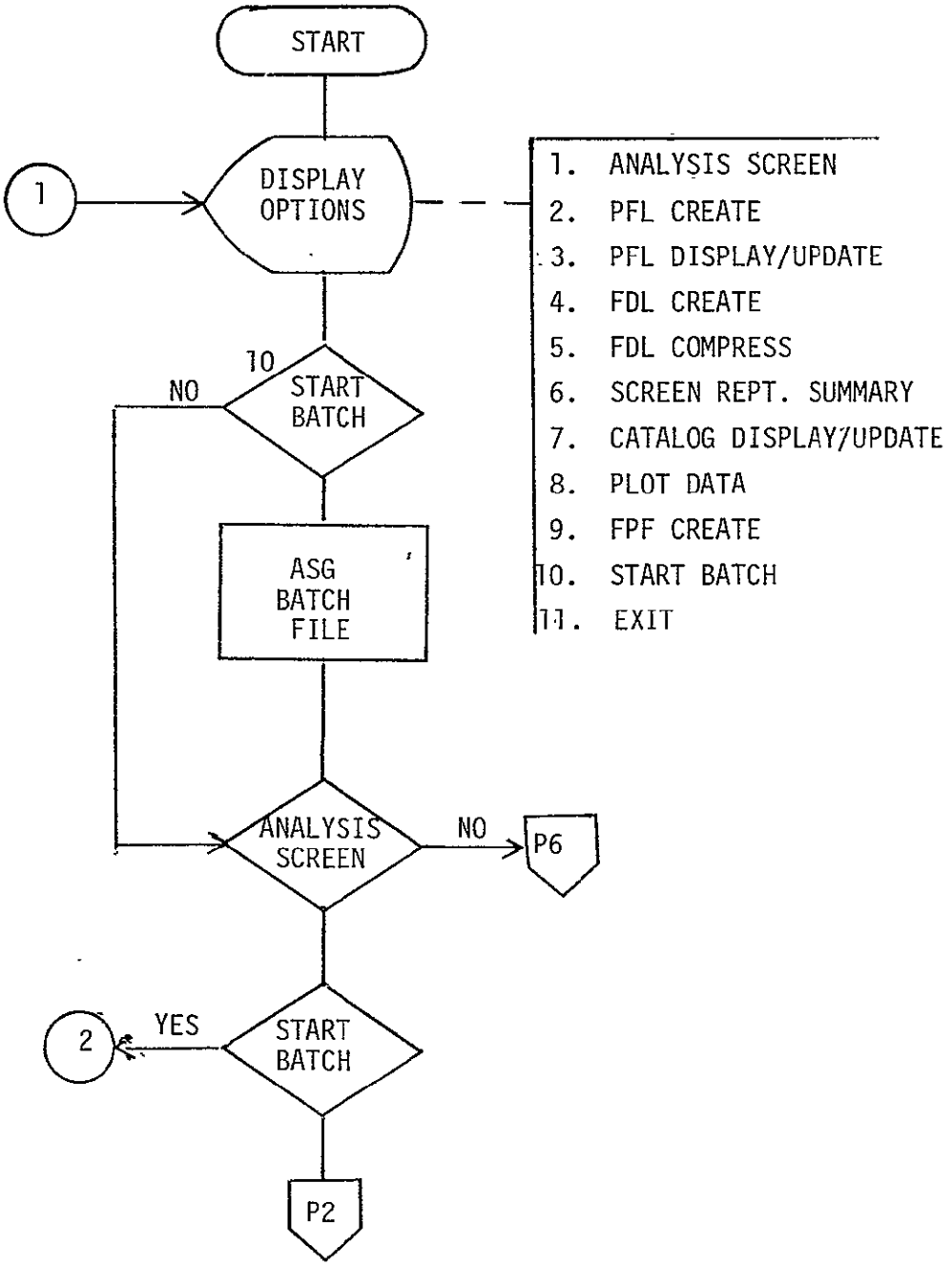
6. Interface Control Document (Not Available at time of Publication)

7. Detailed Requirements Document for the Master Measurement Data Base System, Vol. 1, JSC-11731, LEC-9608, December 1976

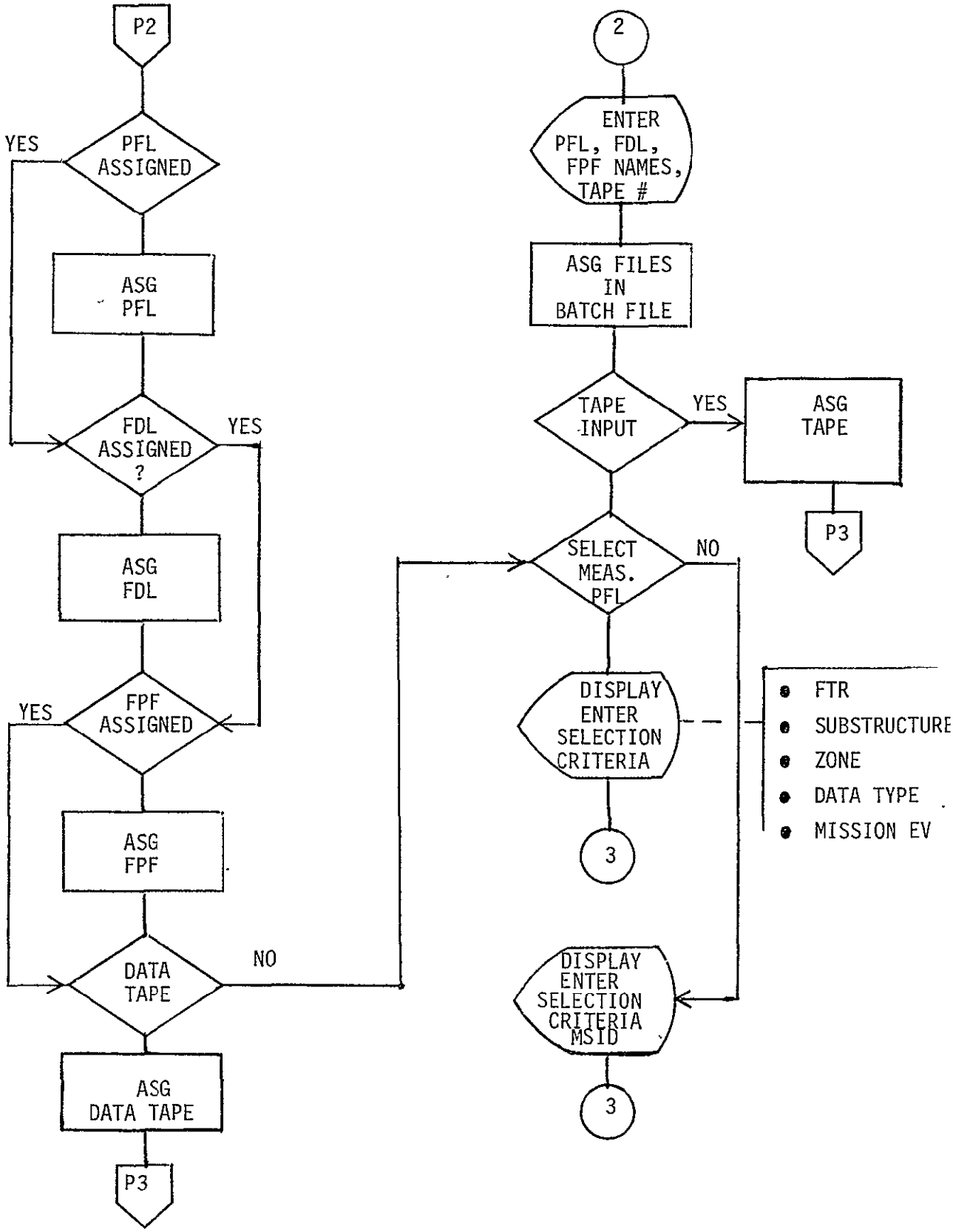
APPENDIX B

FLOW CHARTS

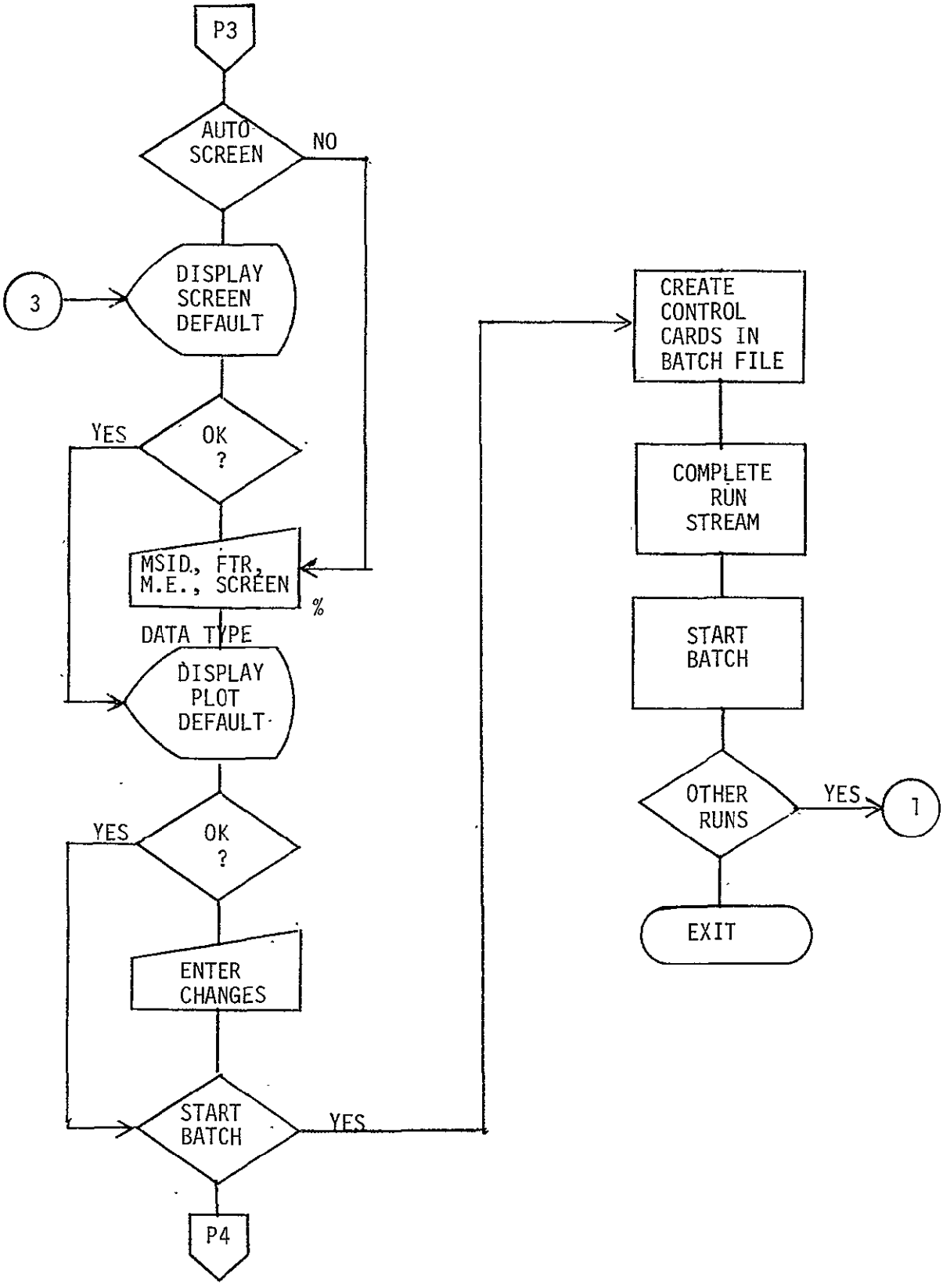
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE



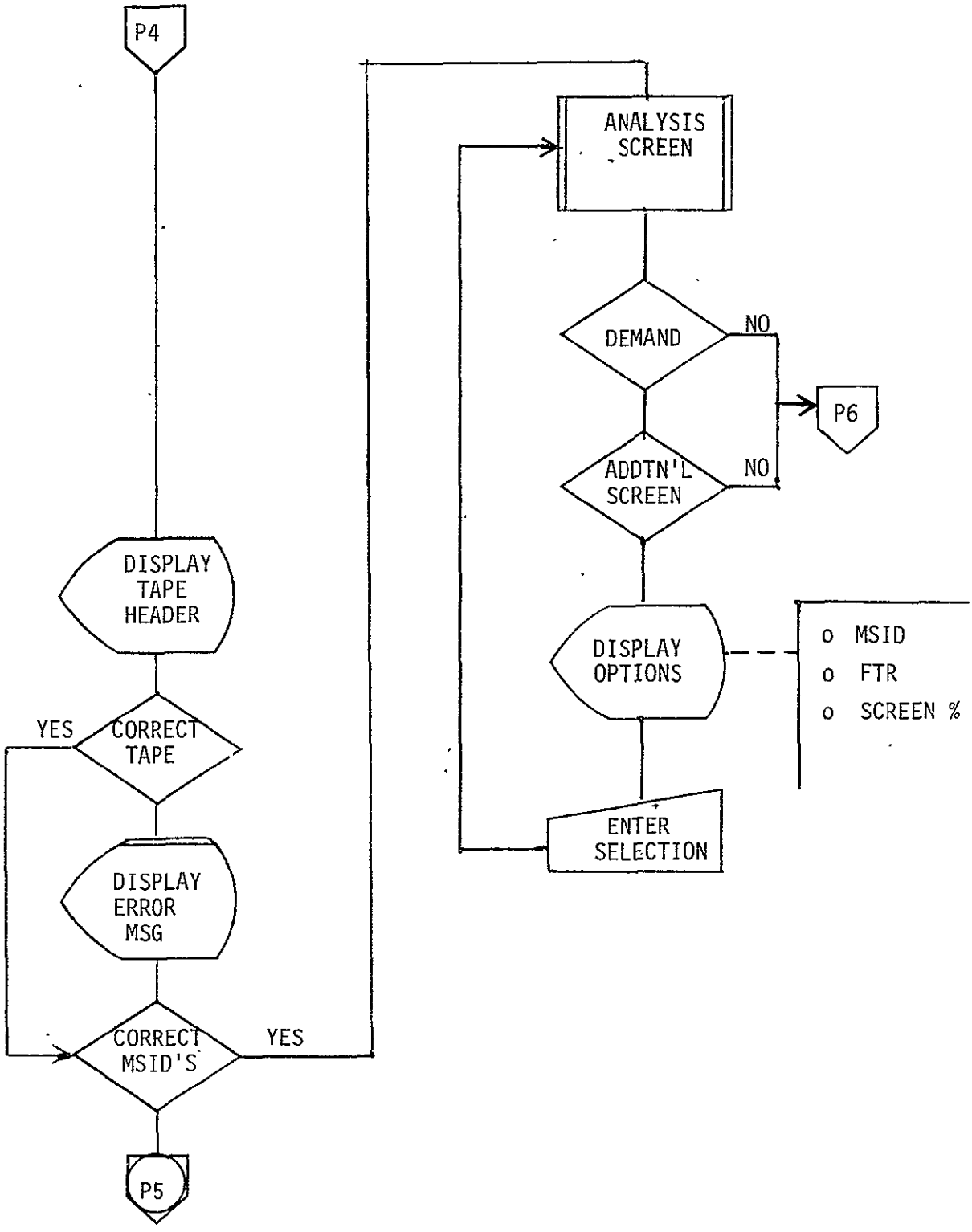
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



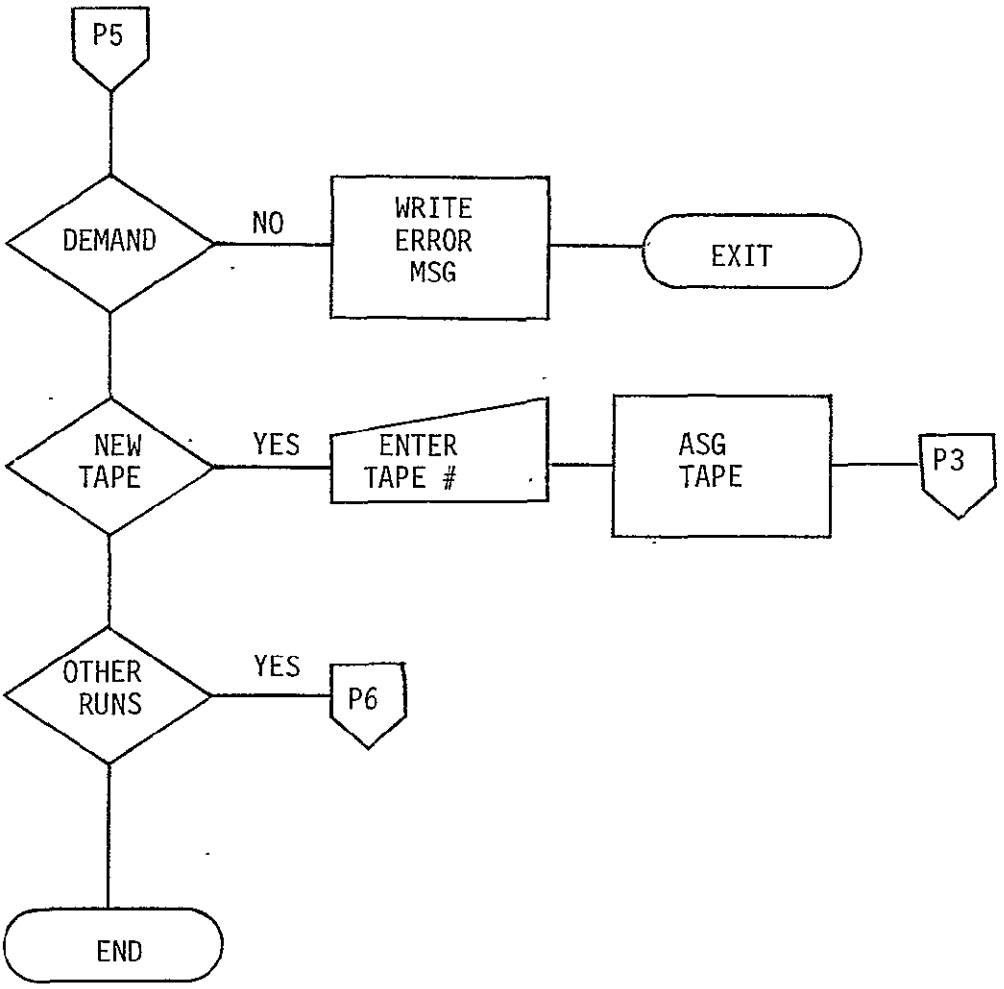
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



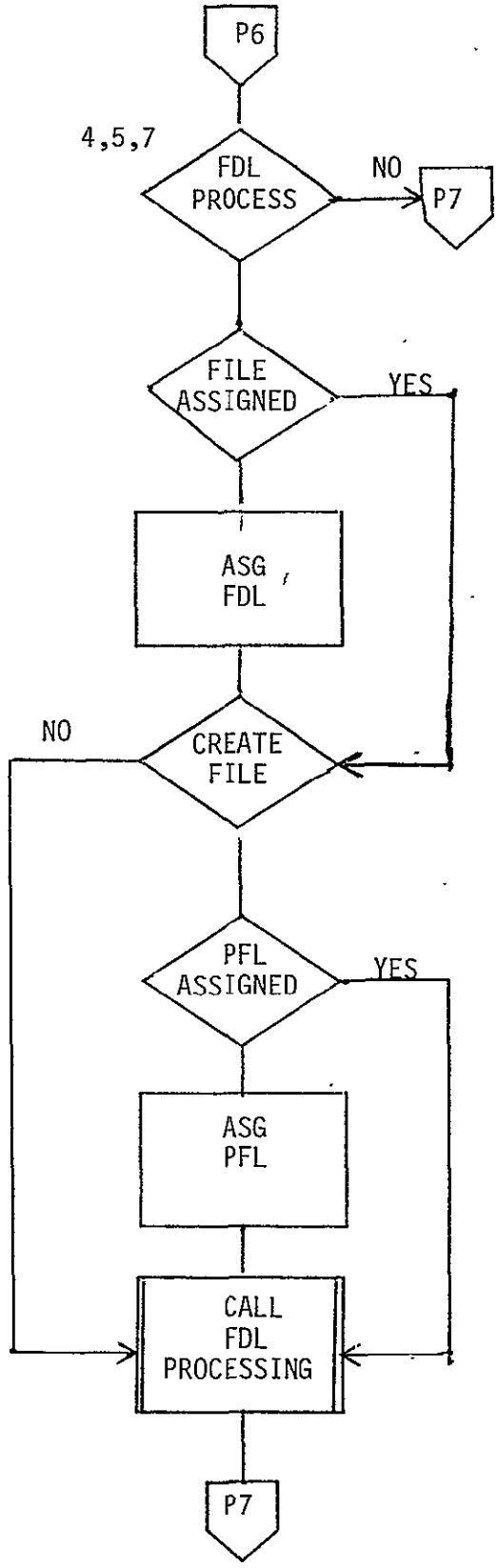
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



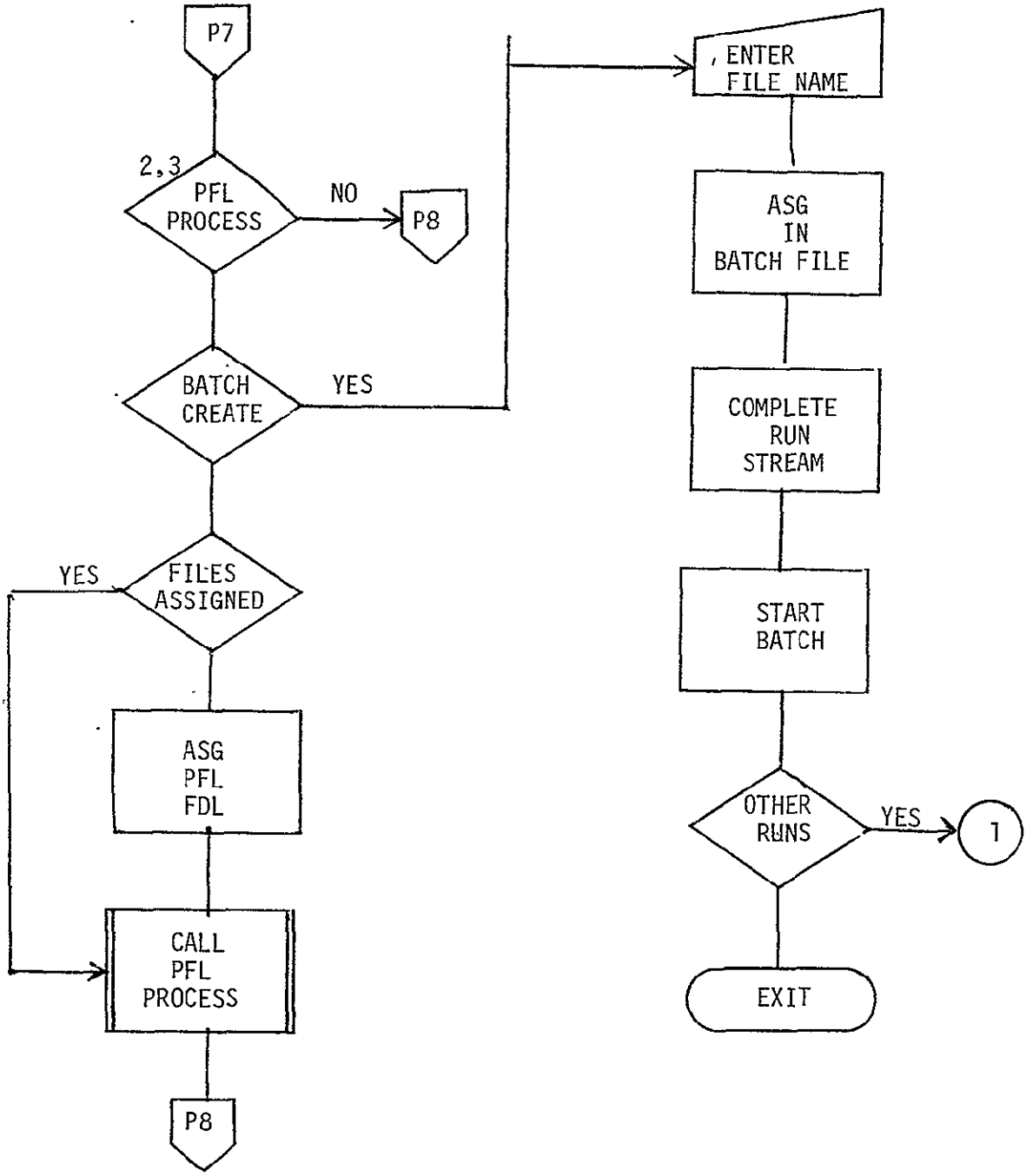
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



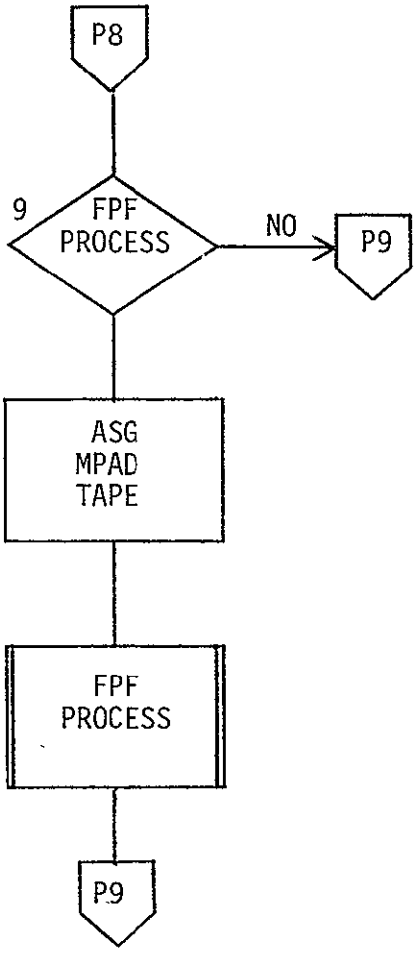
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



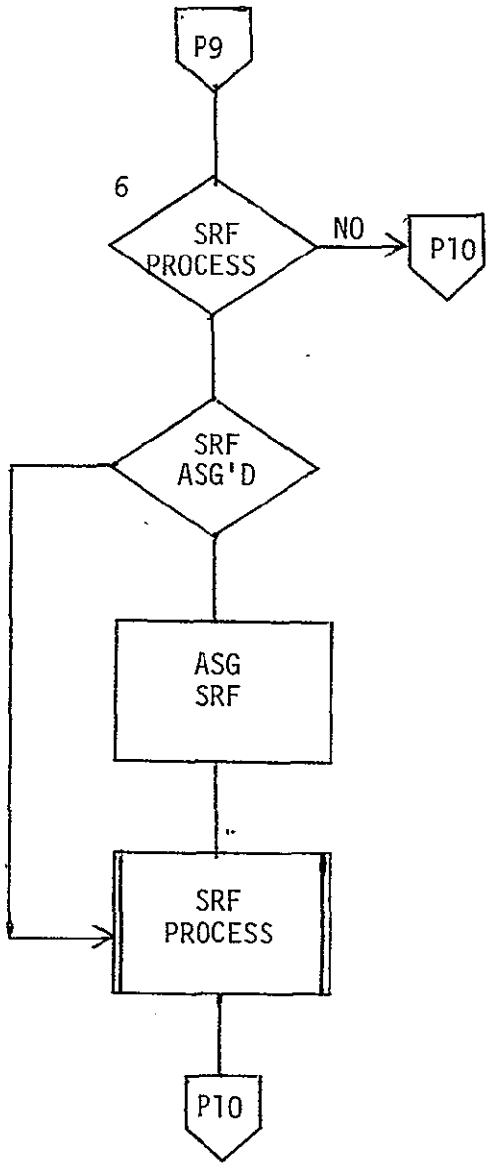
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



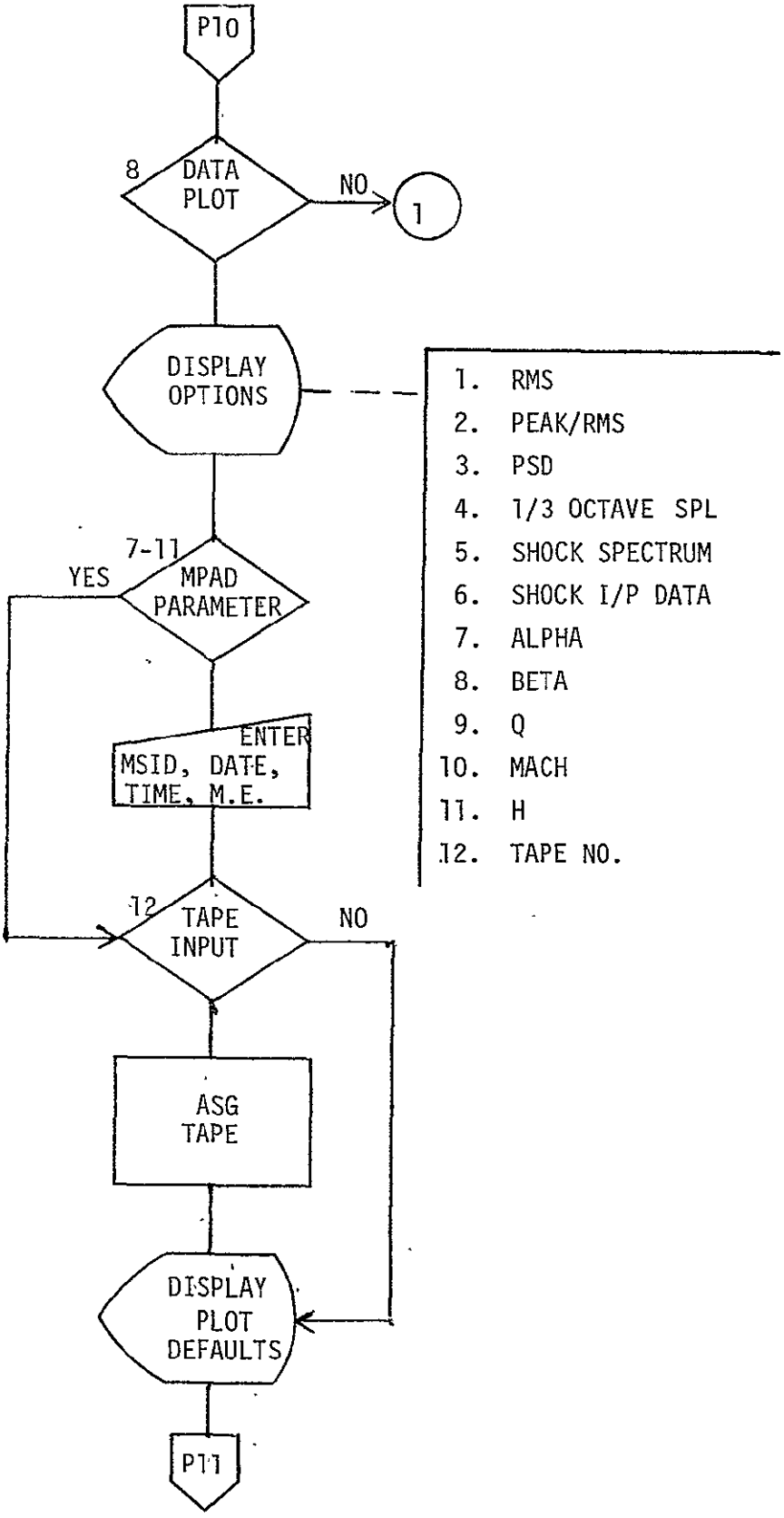
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



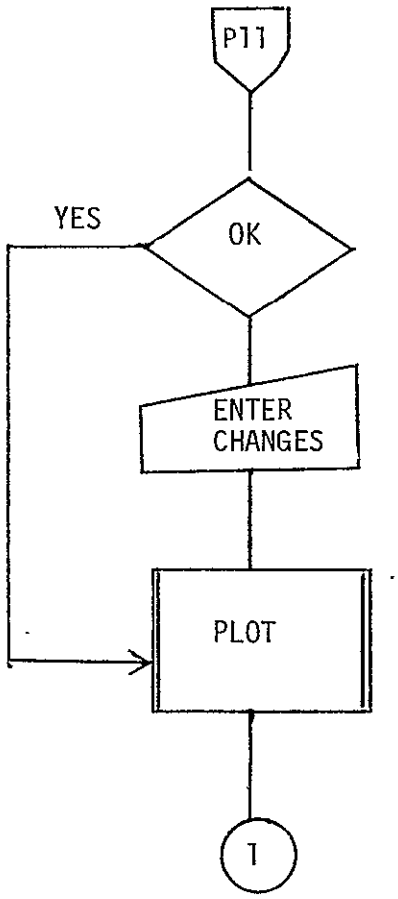
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



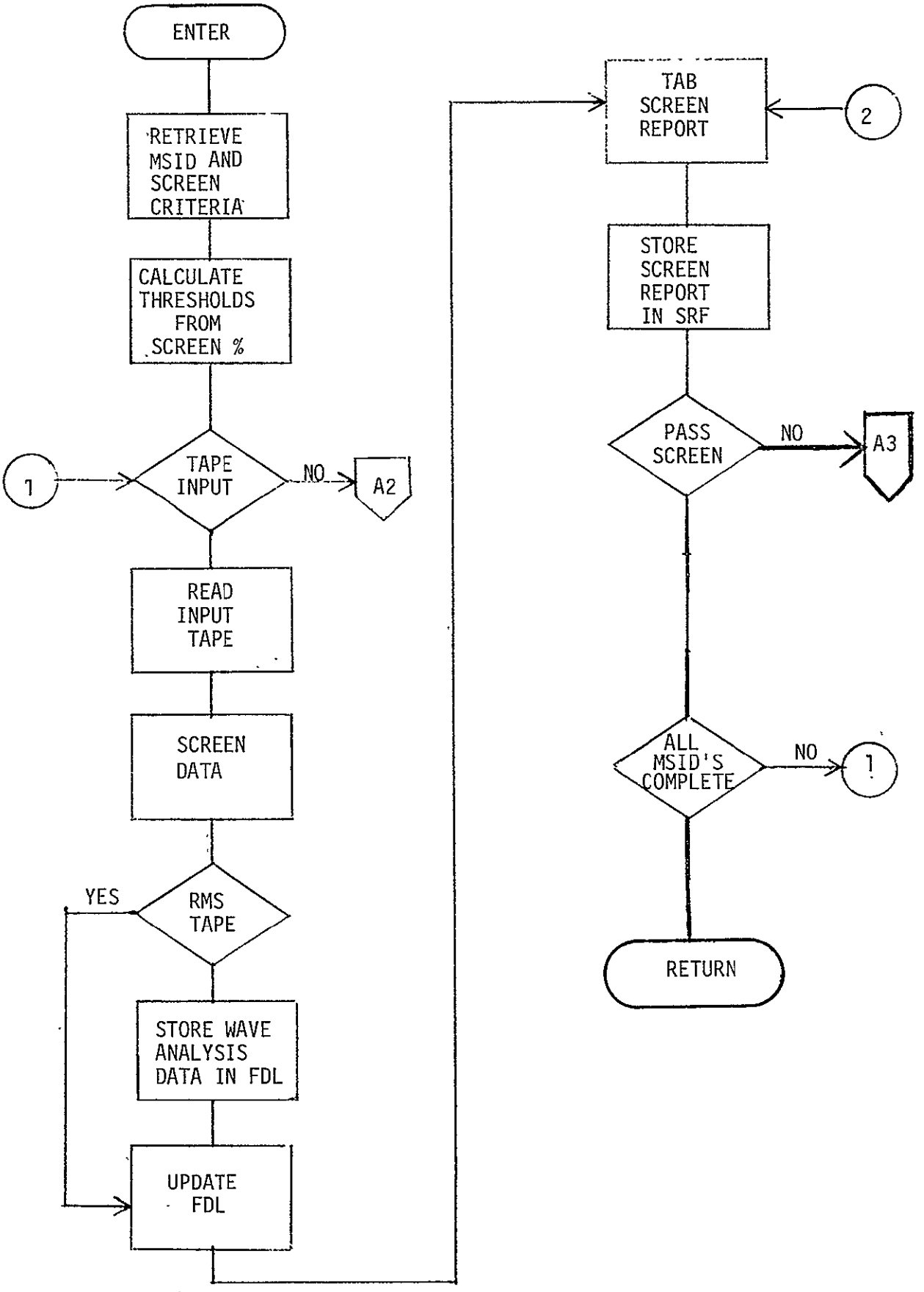
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (continued)



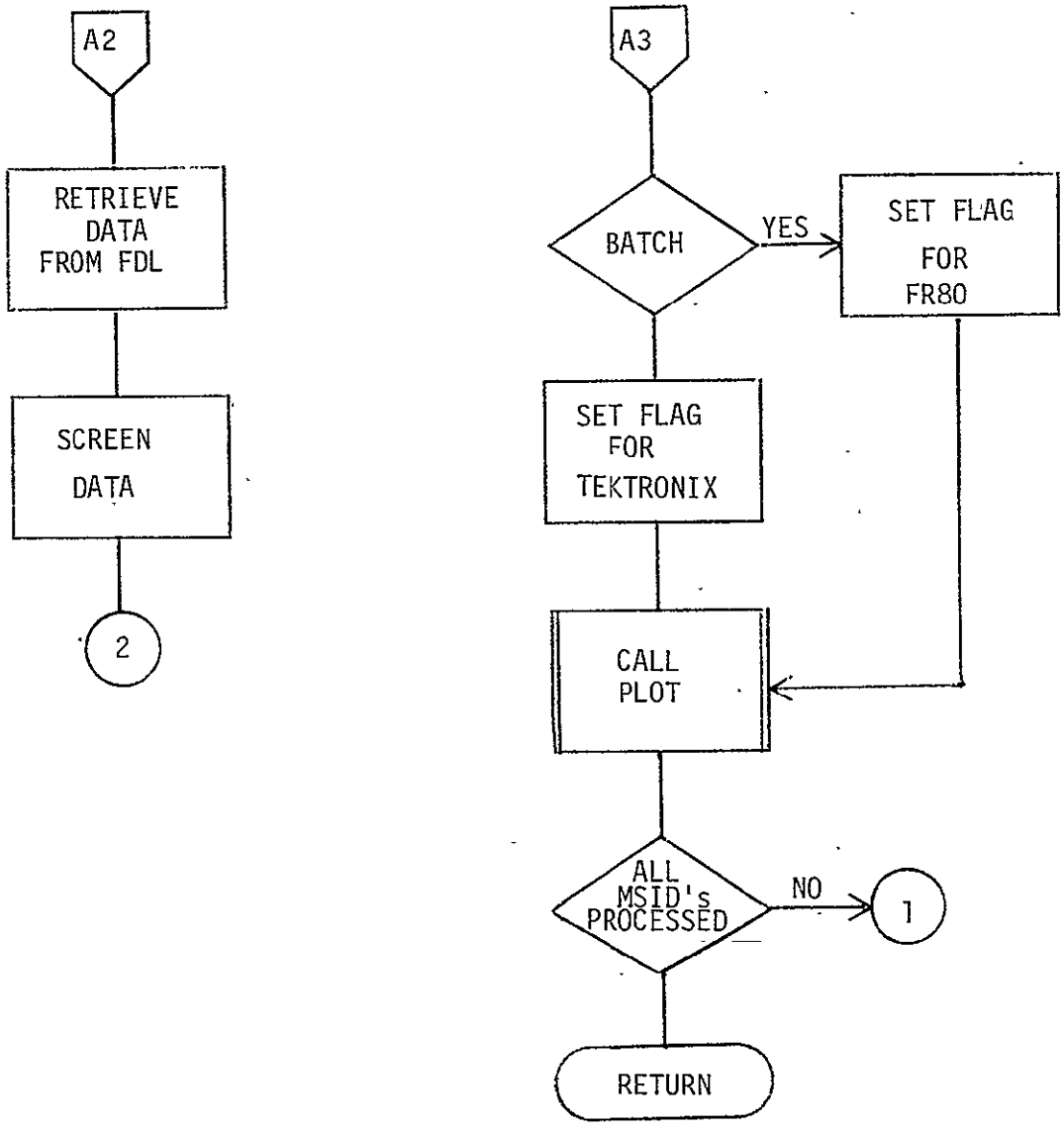
WIDEBAND ANALOG DATA SYSTEM EXECUTIVE (concluded)



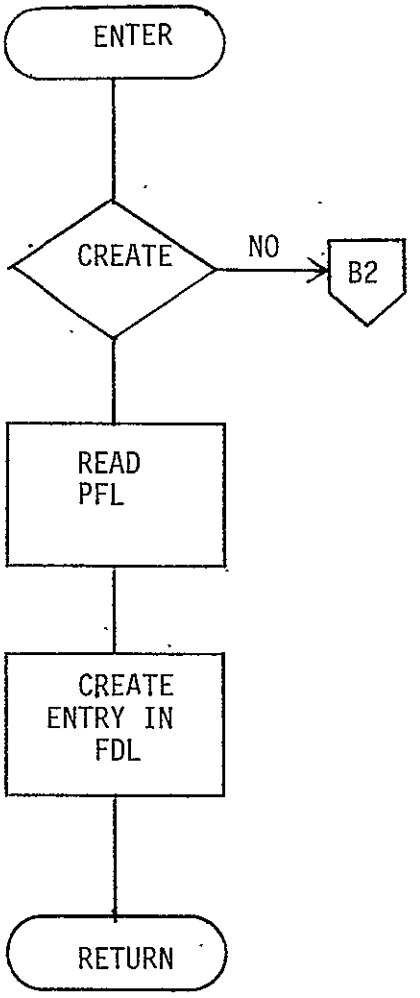
ANALYSIS SCREEN PROCESSING

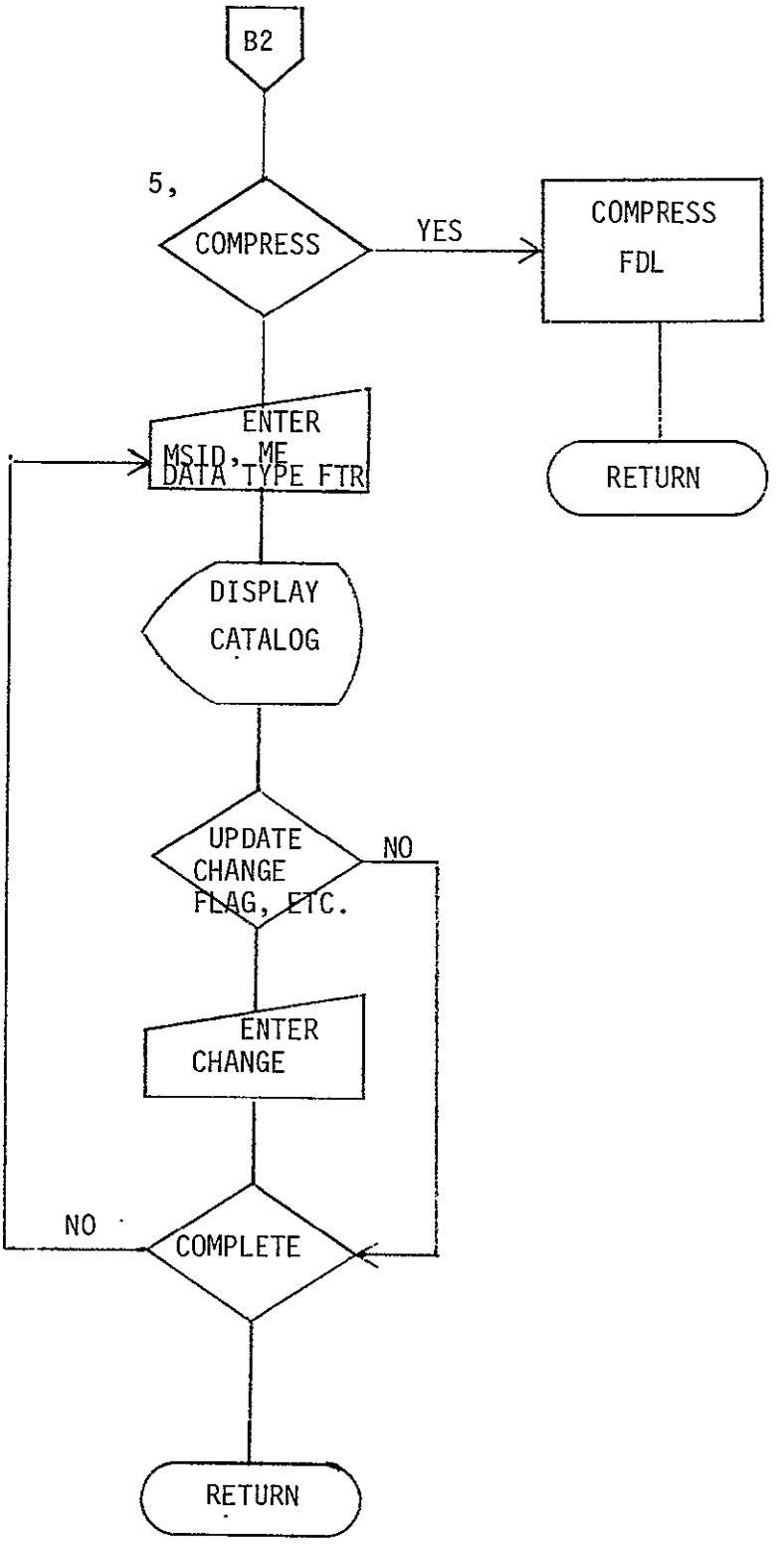


ANALYSIS SCREEN PROCESSING (Concluded)

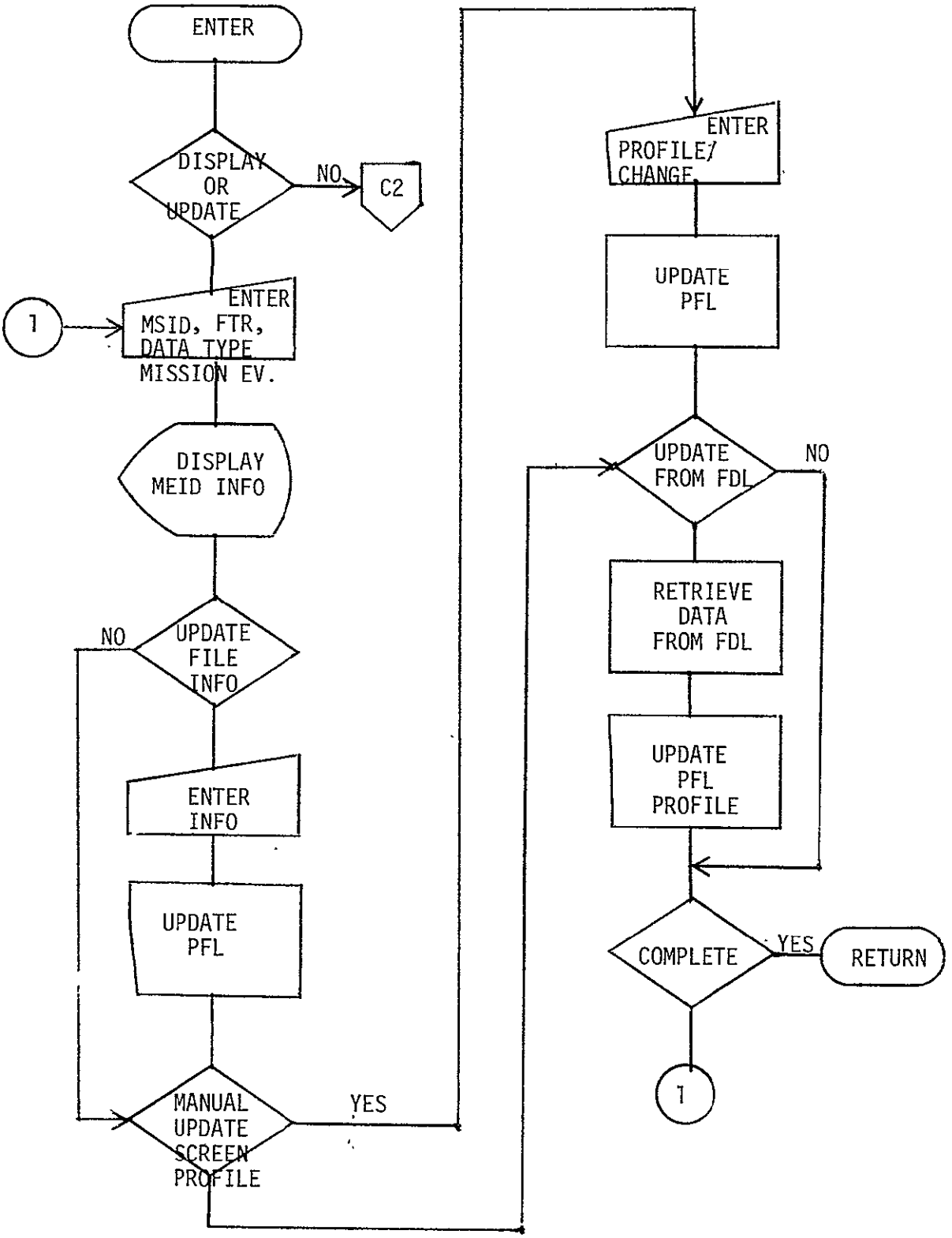


FLIGHT DATA LIBRARY PROCESS

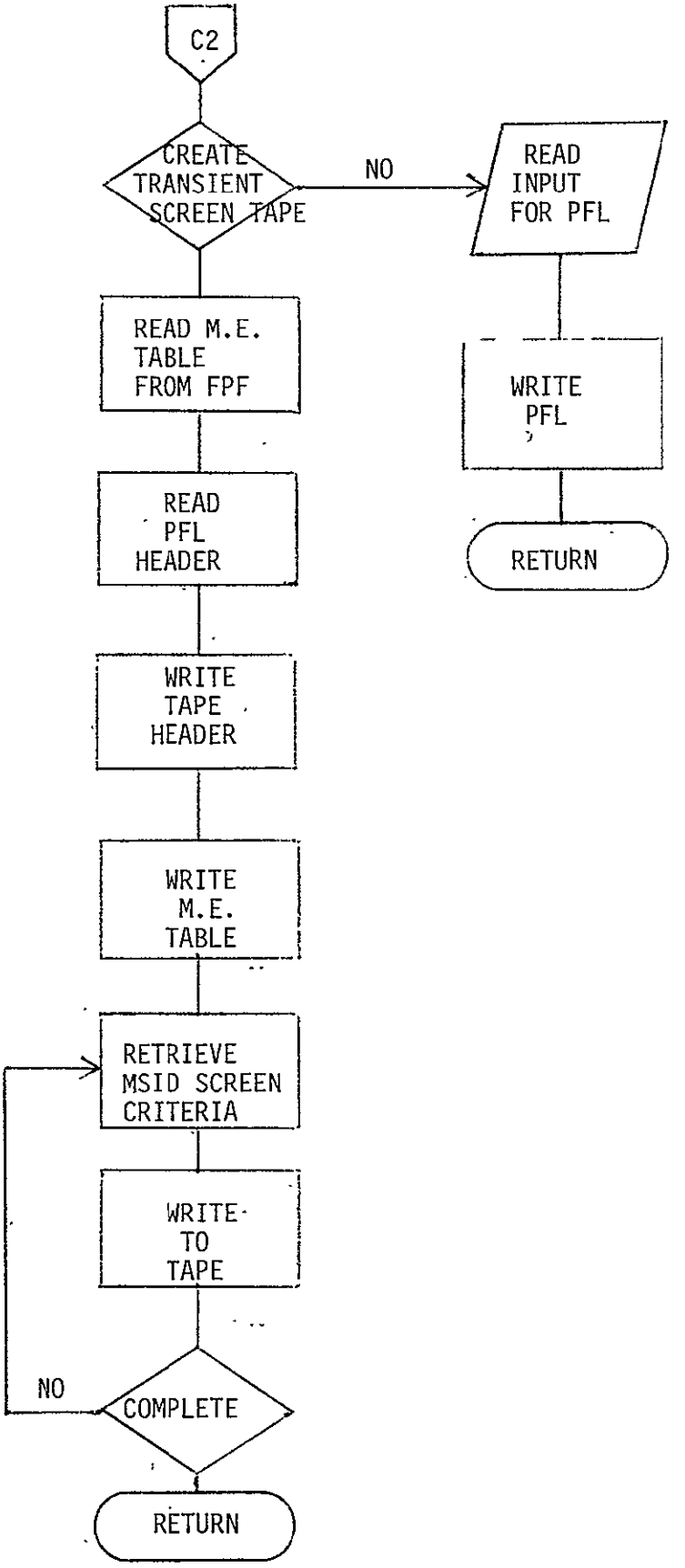



B2
5,
COMPRESS
YES
COMPRESS
FDL
RETURN
ENTER
MSID, ME
DATA TYPE FTR
DISPLAY
CATALOG
UPDATE
CHANGE
FLAG, ETC.
NO
ENTER
CHANGE
NO
COMPLETE
RETURN

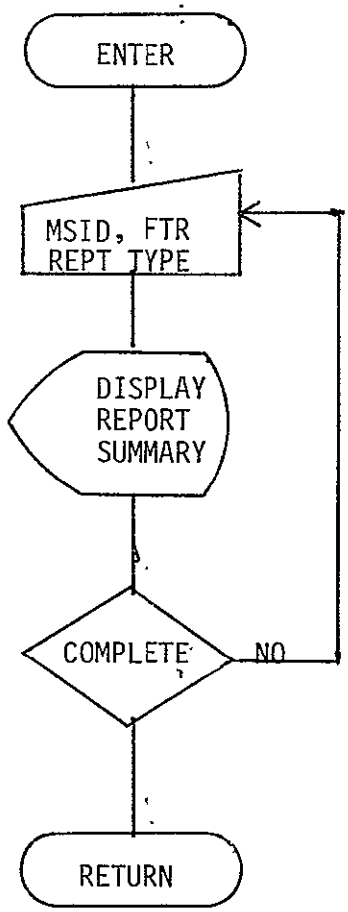
PFL PROCESSING



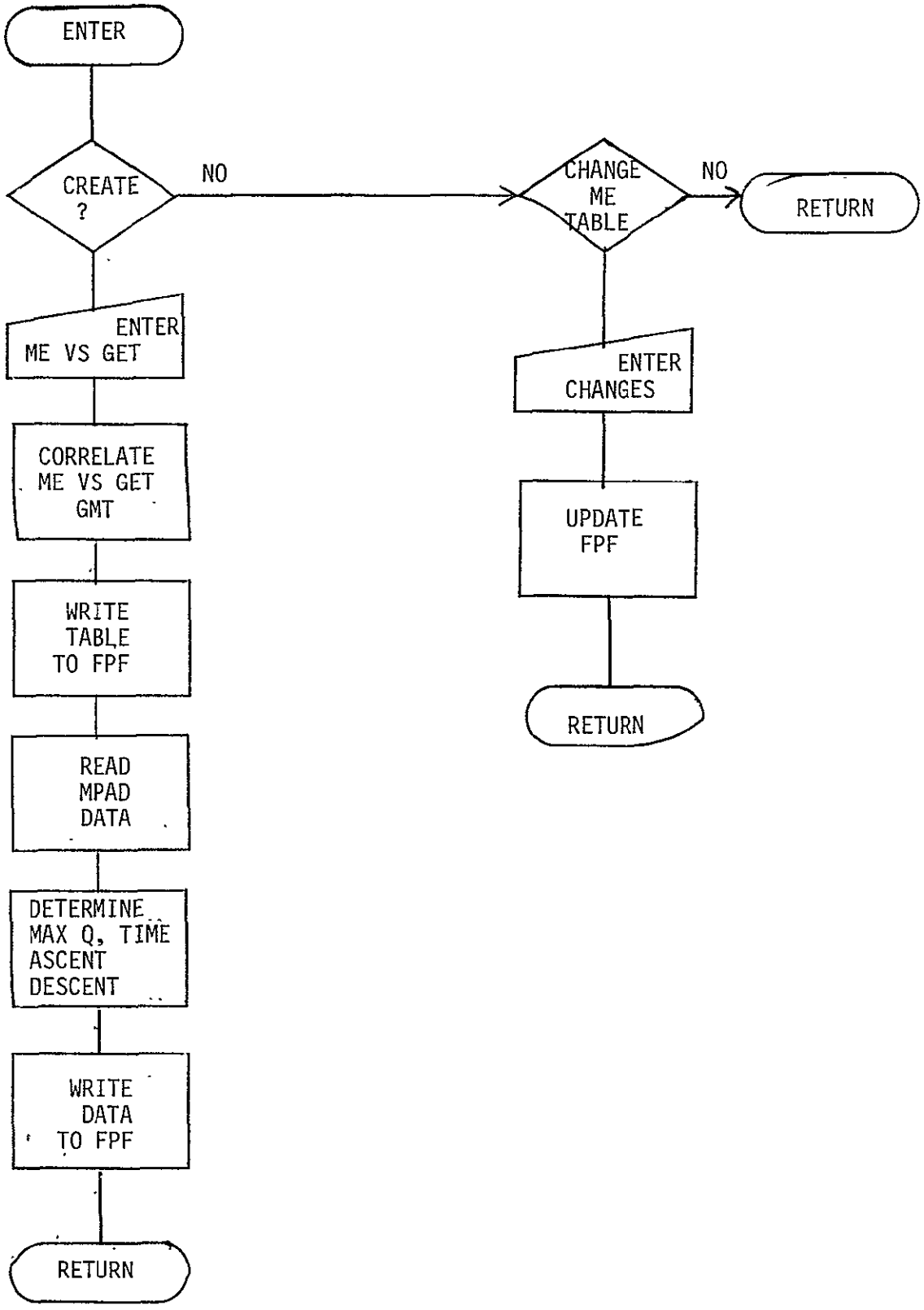
PFL PROCESSING (concluded)



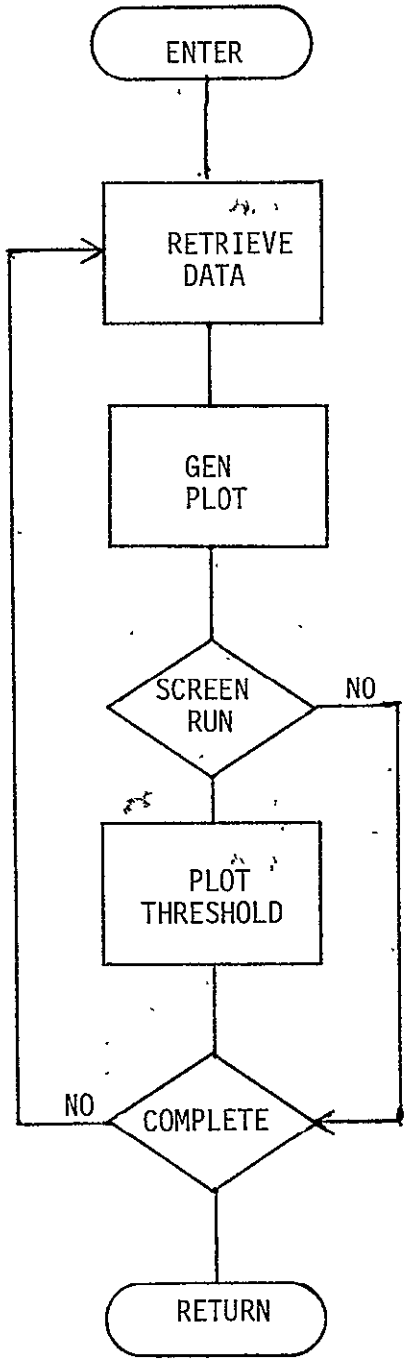
SCREEN REPORT PROCESS



FLIGHT PARAMETERS FILE PROCESS



PLOT


ENTER
RETRIEVE DATA
GEN PLOT
SCREEN RUN
NO
PLOT THRESHOLD
NO
COMPLETE
RETURN

C-2