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SIS

5/16/89

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PROJECT MAGELLAN  
SOFTWARE INTERFACE SPECIFICATION  
Cover Sheet

NUMBER: TPS-101  
REVISION: D  
DATE: 15 March 1989

SIS NAME: Magellan Science EDR

DOMAIN:

<u>System</u>	<u>Subsystem</u>	<u>Program</u>	<u>Make/Use</u>
MOS	TPS	WRITE EDR	MAKE
	IDPS		USE
	SDPS		USE
	RCS		USE
	SCI		USE
<u>Computer System:</u>	Magellan High Rate Processor		USE

PURPOSE OF INTERFACE (SUMMARY):

This SIS describes the format and content of each temporary or final Science Experiment Data Record product tape. The EDR is the interface between the TPS and systems used to do further processing and analysis of Science and Engineering data from the Magellan Spacecraft.

INTERFACE MEDIUM

Disk File:   
Magnetic Tape:  Tracks: 9 Density: 6250bpi Data Code:  
Other:

SIS COORDINATOR: B. Wilson, TPS SE

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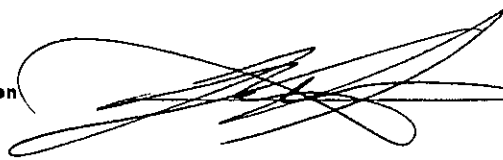
Subsystem/

Program      Position      Name      Date

IDPS

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Cog E  
Cog P

Kurt Andersen

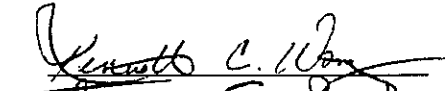


17/11/89

RES

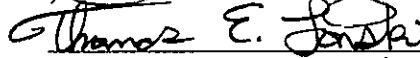
Sys E  
Cog E  
Cog P

Ken Wong



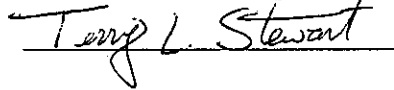
4/6/89

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4/6/89

T. Stewart

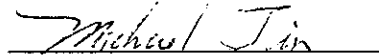


4/6/89

SDPS

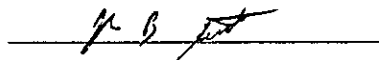
Sys E  
Cog E /  
Cog P

Michael Jin



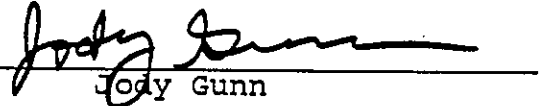
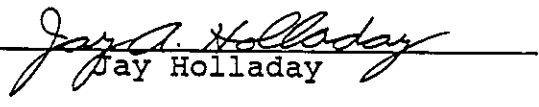
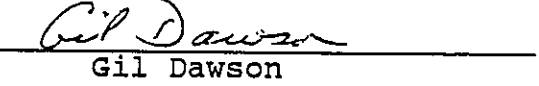


4/11/89

John Gilbert



4/11/89

SFOC Software Interface Specification (SIS) Module		Name: <u>SFOC-1-MHR-Mgn-SCIEDR</u> Revision Date: <u>11/28/88</u>	
MODULE TITLE: SAR and Altimeter EDR/TEDR Tapes			
PURPOSE: Module describes the SAR and Altimeter EDR/TEDR product tapes for the Magellan Project. Also detailed are the interfaces with the SFOC and with other Magellan teams and subsystems.			
DATA FLOW:		<u>Physical</u>	
<u>From</u>	<u>To</u>	<u>Data Object</u>	<u>Medium</u>
OPCT	RDPS	Science EDR Formats	CCT
OPCT	RES	Science EDR Formats	CCT
PREPARER(S): <del>XXXXXXXXXX</del> Betsy Wilson <i>Betsy Wil</i>			
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## ACRONYMS AND ABBREVIATIONS

ALT	Altimeter
ANSI	American National Standards Institute
AOE	Average Orbital Elements
BER	Bit Error Rate
CCT	Computer Compatible Tape
CDB	Central Data Base
CHDO	Compressed Header Data Object (SFDU structure)
DMAT	Data Management and Archive Team
DMD	Data Monitor and Display (Subsystem)
DPS	Data Products Subsystem
DQS	Data Quality Summary File
DSN	Deep Space Network
DSOT	Data Systems Operating Team of the SFOC
DSS	Deep Space Station
EDR	Experiment Data Record
EME	Earth Mean Ecliptic
ENG	Engineering Data
ERT	Earth Received Time
FID	Format I.D.
GIF	GCF Interface of the SFOC
IDPS	Image Data Processing Subsystem
IDPT	Image Data Processing Team
IOC	In Orbit Checkout phase of the MGN mission
IRD	Interface Requirements Document
LAN	Local Area Network
MGN	Magellan

MHR Magellan High Rate Processor

MMC Martin Marietta Corporation

MODmn Modulo value where mn is an integer divisor

MON Ground Monitor Data

MQPC Mapping Quaternion Polynomial Coefficients

MRO Memory Read Out portion of the telemetry stream

MSDS Mission Sequence Design Subsystem

MSN Mission (i.e. Magellan)

MSPL Multi-mission SAR Processing Laboratory

NAV Navigation Subsystem/Team

ODR Original Data Record

OHR Orbit Header Record

QQC Quality, Quantity, Continuity

RA Restricted ASCII; Character set restricted to upper case alpha characters, A-Z and numeric characters, 0-9

RCD Radar Composite Data; telemetry frames containing asynchronous portions of radar, altimeter, engineering and SAB header data

RES Radar Engineering Subsystem

RIM Real-Time Imaging count of the GDS clock

RSET Radar System Engineering Team

SAB SAR/Altimeter Burst

SAR Synthetic Aperture Radar

SCET Space Craft Event Time

SCLK Space Craft Clock

SCT Space Craft Team

SDPS Science Data Processing Subsystem

SDPT Science Data Processing Team

SES Spacecraft Engineering Subsystem

SFDU	Standard Formatted Data Unit
SFOC	Space Flight Operations Center
SGS	Sequence Generation Subsystem
SIS	Software Interface Specification
SPAT	Science Planning and Analysis Team
TBD	To Be Determined
TEDR	Temporary Experiment Data Record
TIS	Telemetry Input Subsystem of the SFOC
TLM	Telemetry
TPS	Telemetry Processing Subsystem of MGN
VOI	Venus Orbit Insertion
VRM	Venus Radar Mapper



## SECTION 1

### GENERAL DESCRIPTION

#### 1.1 OVERVIEW

This Software Interface Specification (SIS) contains the description of the SAR and Altimeter EDR/TEDR product tapes for the Magellan Project. Also detailed are the interfaces with the Space Flight Operations Center (SFOC) and with other MGN teams and subsystems.

#### 1.2 SCOPE

The format and content specifications in this SIS apply to all phases of the project for which the product is required.

#### 1.3 APPLICABLE DOCUMENTS

1. 630-300, Venus Radar Mapper, Mission Design Functional Requirements, JPL D-2769, September, 1985.
2. 820-13, Rev. A, DSN System Requirements, Detailed Interface Design, DSN Monitor and Control System Interface with Magellan Project, MON-5-12, Preliminary, September 1, 1987.
3. ANSI X3.27-1978, American National Standards Institute, Magnetic Tape Label for Information Exchange, Appendix X, Label and Volume Organization, April 18, 1977.
4. MGN SIS MSDS-104, Average Orbital Elements, Final, October 13, 1986.
5. MGN SIS SGS-108: Phase 1, Key Spacecraft Events Times File, Final, March 1988.
6. MGN SIS RES-101, SFOC-1-CDB-Mgn-Bandwidth, Radar Processing Bandwidths File Format and Content, Draft, March, 1988.
7. MGN SIS SES-112, SFOC-1-CDB-MGN-SCLKvSCET, Magellan SCLK/SCET Coefficients File, Preliminary, January, 1988.
8. MGN SIS RES-104, SFOC-1-CDB-MGN-Quaterni, Mapping Quaternions Polynomial Coefficients File, Preliminary, January, 1988.
9. SFOC SIS SFOC0038-00-12-00, SFOC-1-TIS-Any-DecomRpt, Decommutation Report Form, Draft, August 1, 1988.
10. MGN SIS SES-115, SFOC-1-DMD-Mgn-DECAL, MGN Decalibration File to DMD, Preliminary, December, 1987. NOTE: Applicable Document #10 also describes decommutation data. This data is not being used for EDR; the decommutation data used is as in Applicable Document #9.

11. SFOG-2-DPS-CDB-Ephemeris, Spacecraft and Planet Ephemerides, NAIF S and P Kernels, Preliminary, January 8, 1988.
12. SFOG-2-TIS-Any-MgnTelem, Magellan Telemetry Formats Generated by Telemetry Input Subsystem, Final, November 5, 1987.
13. SFOG-2-TIS-Any-Telem, Telemetry Minor Frame Formats from Telemetry Input Subsystem, Final, October, 1987.
14. SFOC SIS SFOC0038-01-04-01, SFOC-5-SYS-\*DU-NJPL, NJPL SFDU Global Definitions, Final, July 20, 1988.
15. SFOC SIS SFOC0038-01-03-01, SFOC-5-TIS-\*DU-MgnSFDU, SFDUs Generated from TIS for Magellan, Final, May 16, 1988.
16. SFOC SIS SFOC0038-01-04-01, SFOC-5-TIS-\*DU-SFDU, Standard Formatted Data Units Generated from Telemetry Input Subsystem, Final, August 31, 1988.
17. VRM-2-280, VRM Spacecraft System and Subsystem Design Book, Telemetry Measurements and Data Formats, Draft, June, 1987, MMC.
18. SFOC SIS SFOC0038-01-02-01, SFOC-1-GIF-DSN-MgnGCFMon, Magellan DSN Monitor Data (Mon 5-12), Final, February 17, 1988.
19. 630-204, MGN Mission Operations System, Radar System Interface Requirements Document.
20. DSN Detailed Interface Design 820-13, Module TLM 3-17, DSN Telemetry Interface with SFOG - Magellan, Final, February 1988.

#### 1.4 SUBSYSTEM SITING

##### 1.4.1 Interface Location and Medium

Experiment Data Record (EDR) tapes are created on the Magellan High Rate processor, a computing system composed of Pyramid hardware.

Temporary EDR tapes are the same format as final EDR tapes, except that they contain a predicted, not an actual, ephemeris file.

##### 1.4.2 Data Sources, Destinations, and Transfer Methods

EDR tapes are a compilation of files created within the MHR, plus ancillary data from the RES, SES, PPS, SGS, and MSDS. EDRs are written in ANSI standard format on computer compatible tape (CCT). Product tapes are provided to the MGN Data Management and Archive Team (DMAT), which forwards the tapes to users.

There are two categories of EDR tapes, temporary and final. Temporary EDRs differ from final EDRs only in that the ephemeris file contains predicted, rather than actual, data. See Section 3.2.2 of this module. Figure 1-1 illustrates the production of the different telemetry data types from the single received Radar Composite Data (RCD) minor frame.



### 1.4.3 Generation Method and Frequency

The Data Systems Operations Team (DSOT) will operate the MHR and will create EDR tapes on a daily basis. Two copies of each product tape will be written simultaneously. EDR product tapes contain orbit-specific sets of telemetry and ancillary data for a maximum of eight orbits on Altimeter EDR tapes and for a single orbit on SAR tapes. ALT-TEDR tapes contain data from a maximum of two consecutive orbits.

Figure 1-1 illustrates the breakdown of data into the various EDR components as further explained below.

- 1 - RCD frames are produced from ODR tapes;
- 2 - engineering minor frames are extracted from the RCDs;
- 3 - SAB frames are extracted from the RCDs;
- 4 - SAB headers, SAR data, and ALT data are extracted from the SAB frames.
- 5 - the four data types--engineering, SAB headers, SAR data (SAR EDR only), and ALT data (ALT EDR only)--end up on the EDR tapes.

### 1.4.4 Pertinent Relationships with Other Interfaces

Production of EDR products is heavily reliant on the timely production and transfer of ancillary files from DPS (see Applicable Document #11), RES (see Applicable Documents #6 and #8), MSDS (see Applicable Document #4), SES (see Applicable Documents #7 & #10), and SGS (see Applicable Document #5) to the Project Central Data Base (CDB).

EDR production requires an interface with the CDB for the acquisition of all non-telemetry inputs to the process. All MGN ancillary files are copied to CDB for storage.

## 1.5 ASSUMPTIONS AND CONSTRAINTS

### 1.5.1 Usage Constraints

EDR product tapes shall be provided, through the DMAT, only to project-designated teams (IDPT, SDPT, and RSET) and investigators.

### 1.5.2 Priority Phasing Constraints

EDR generation functions are required from November 1988 through the end of the mission.

### 1.5.3 Explicit and Derived Constraints

The production of TEDR tapes shall be expedited and given the highest job priority. The time-line for this task is driven by the availability of data from Goldstone passes and of the predict Spacecraft Ephemeris File. See Applicable Document #11 (spacecraft ephemerides).

#### 1.5.4 Documentation Conventions

##### 1.5.4.1 Data Format Descriptions

The reference data unit is the byte. The high (more significant) byte of a pair shall be numbered zero (0) and the low (less significant) byte shall be numbered one (1). The high byte shall be illustrated as the left-most byte of a pair. However, when data are written to tape, the more significant byte of a pair shall always precede the less significant byte on the tape. Please note that this is not VAX structure, but is IBM and SUN, but not PC, structure. Within a multi-byte structure, the lower addressed bytes will contain the numerically most-significant bytes and shall be written to tape first.

Within a byte, the least-significant bit shall be numbered zero (0).

Data structures internal to Monitor, ENG, SAR, and ALT data remain unchanged by the creation of an EDR product.

All numbers are decimal unless stated otherwise.

##### 1.5.4.2 Time Standards

Per the SFOC Standard, the EDR shall adopt the 0000, January 1, 1958 epoch as the time standard for ERT and SCET. As illustrated in Appendix A, when stored in binary, SCET/ERT shall be stored as unsigned integers, a sixteen-bit unsigned days since beginning of epoch, and a 32-bit unsigned milliseconds of day. Because these times are measured in elapsed days, January 1, 1958 shall be numbered as day zero (0) of the epoch.

The SCLK format is defined in Appendix A. A six-byte value, the SCLK defines its own epoch as it is initialized at the start of the Mission.

See Section 1.5.4.1 for information on formats of multi-byte structures. ASCII representatives of times are as presented in the including structure or SIS, or as defined in a footnote.

##### 1.5.4.3 Limits of This Document

This document shall define the format for SAR-EDR, SAR-TEDR, ALT-EDR, and ALT-TEDR product tapes. It shall specify ANSI and SFDU labeling at the volume and file levels, and shall extend to the logical record level for telemetry files and the Data Quality Summary and Orbit Header Record, which are created within the MHR.

The logical record content and format of all other files are defined by



## 2.3 LABELING AND IDENTIFICATION (INTERNAL/EXTERNAL)

### 2.3.1 Magnetic Label

EDR tapes delivered to DMAT shall have level 2 ANSI standard magnetic labels and file structures as described in Section 5 of this module. In addition, each file shall be identified by a set of Standard Formatted Data Unit (SFDU) labels.

### 2.3.2 External Tape Label

Each volume shall have an external label defining its contents. In addition to creation time, the label shall include the following structure designed by DMAT as the generic external product label, as the unique product identifier:

X.Y;Z

where: X = the product-specific acronym per Section 2.3.2.1,

Y = yyyyy-M/N where "y" is a five-character orbit number (for ALT (T)EDRs, this shall be the first orbit number); this number is the same as the number on the ANSI volume ID, except the ANSI number is in hexadecimal. This number is also the same as the first orbit number in the SFDU volume header file. "M" is the total number of reels for this volume, and "N" is the number of this reel (nine characters total), and

Z = a version identifier expressed as a numeric value that shall be initialized at '1' for each product and incremented by 1 for each subsequent iteration of that product.

#### 2.3.2.1 Product Acronyms

The 'X' field in the generic External Tape Label structure shall be represented by one of the following acronyms, as appropriate:

Acronym	Data Product
SAR-TEDR	SAR Experiment Data Record, Temporary
SAR-EDR	SAR Experiment Data Record, Final
ALT-TEDR	Altimeter Experiment Data Record, Temporary
ALT-EDR	Altimeter Experiment Data Record, Final

## 2.4 INTERFACE MEDIUM CHARACTERISTICS

Magellan EDR products shall be contained on one or more 1/2 inch by 3600 foot computer-compatible magnetic tapes written at 9-tracks, 6250 bytes per inch.

## 2.5 **FAILURE PROTECTION, DETECTION, AND RECOVERY PROCEDURES**

### 2.5.1 File Backup Requirements

The EDR shall have as backup the archival Original Data Record (ODR) tapes from which the SAR, ALT, ENG, and SAB header data were extracted. One of the copies of final EDR tapes--produced by the MHR--shall be maintained as a long-term archival product and shall serve as the sole archival repository for ancillary files.

## 2.6 **END-OF-FILE CONVENTIONS**

End of file labeling shall comply with ANSI standards for multi-file magnetic tapes.

## 2.7 **END-OF-VOLUME CONVENTIONS**

End of volume labeling shall comply with ANSI standards for multi-file and multi-volume tapes.



### SECTION 3

#### ACCESS

#### 3.1 PROGRAMS USING THE INTERFACE

SDPS, IDPS, and RES are expected to use the EDRs described by this SIS module. Investigators' programs that do so cannot be identified here.

#### 3.2 SYNCHRONIZATION CONSIDERATIONS

##### 3.2.1 Timing and Sequencing Considerations

Data in the telemetry records (ENG, SAR, ALT, SAB headers) are placed in Spacecraft Event Time (SCET) order, using the SCLK time field in the telemetry secondary header.

##### 3.2.2 Effective Duration (Temporary vs. Final)

EDR tapes containing final ephemeris files are considered the final data record. An ephemeris file is declared "final" by the Navigation team when the file has been made after the actual Doppler tracking data has been processed by the navigation team. Predicted data is based on: current spacecraft position & trajectory; known celestial motions & mechanics; and planned spacecraft maneuvers. In the event (which will probably never happen) that a final ephemeris is not available for an orbit or orbits, a TEDR will be made into an EDR anyway. This means only that the various ASCII strings on the tape/label will read "EDR", not "TEDR"; no data file will have changed.

##### 3.2.3 Priority Interrupts

None identified.

#### 3.3 INPUT/OUTPUT PROTOCOLS, CALLING SEQUENCES

None identified.



## SECTION 4

### DETAILED INTERFACE SPECIFICATIONS

#### 4.1 STRUCTURE AND ORGANIZATION OVERVIEW

##### 4.1.1 Altimeter EDR

The ALT-EDR/TEDR shall consist of a single Volume Header File and a single Volume Trailer File that brackets from one to eight sets of ten files (See subsection 4.1.1.1). The tape structure and organization are consistent with ANSI and SFDU standards.

If no telemetry data have been acquired for an orbit or an ODR tape is unreadable, the entire set of orbit files shall be omitted from the ALT-EDR tape. The sequence of orbits on the tape is defined in the Catalog/Keyword Label of the Volume Header File (Figure 5-4).

##### 4.1.1.1 Altimeter EDR Component Files

- |  |                              |
|--|------------------------------|
| 1. Volume Header File                  | 6. Monitor data file         |
| *** Start repeated set                 | 7. Mapping Quaternion        |
| 2. Orbit Header Record File            | Polynomial Coefficients File |
|  | 8. Decom/Decal File          |
| 3. Data Quality Summary File           | 9. Engineering Data File     |
| 4. Spacecraft Ephemeris File           | 10. SAB Header Records File  |
|  | 11. Altimeter Data File      |
| 5. S C L K / S C E T Coefficients File | *** End repeated set         |
|  | 12. Volume Trailer File      |

##### 4.1.1.2 ALT-EDR Tape Structure

The structure of the ALT-EDR/TEDR tape is straightforward; the Volume Header and Trailer Files are used only once, to bracket the remaining files on the tape. The repeated file set, those files numbered two through eleven as shown in Section 4.1.1.1, is repeated for each orbit.

The Volume Header File identifies the number and sequence of single orbit sets to be found on the tape. Each set is further identified by its Orbit Header Record, the first file in each repeated set. Although the orbital sets are written to the tape sequentially by orbit number, it cannot be assumed that orbits are consecutive. There will always be the possibility that one or more orbits of telemetry may be lost as a result of operational problems, station scheduling conflicts, or spacecraft problems.

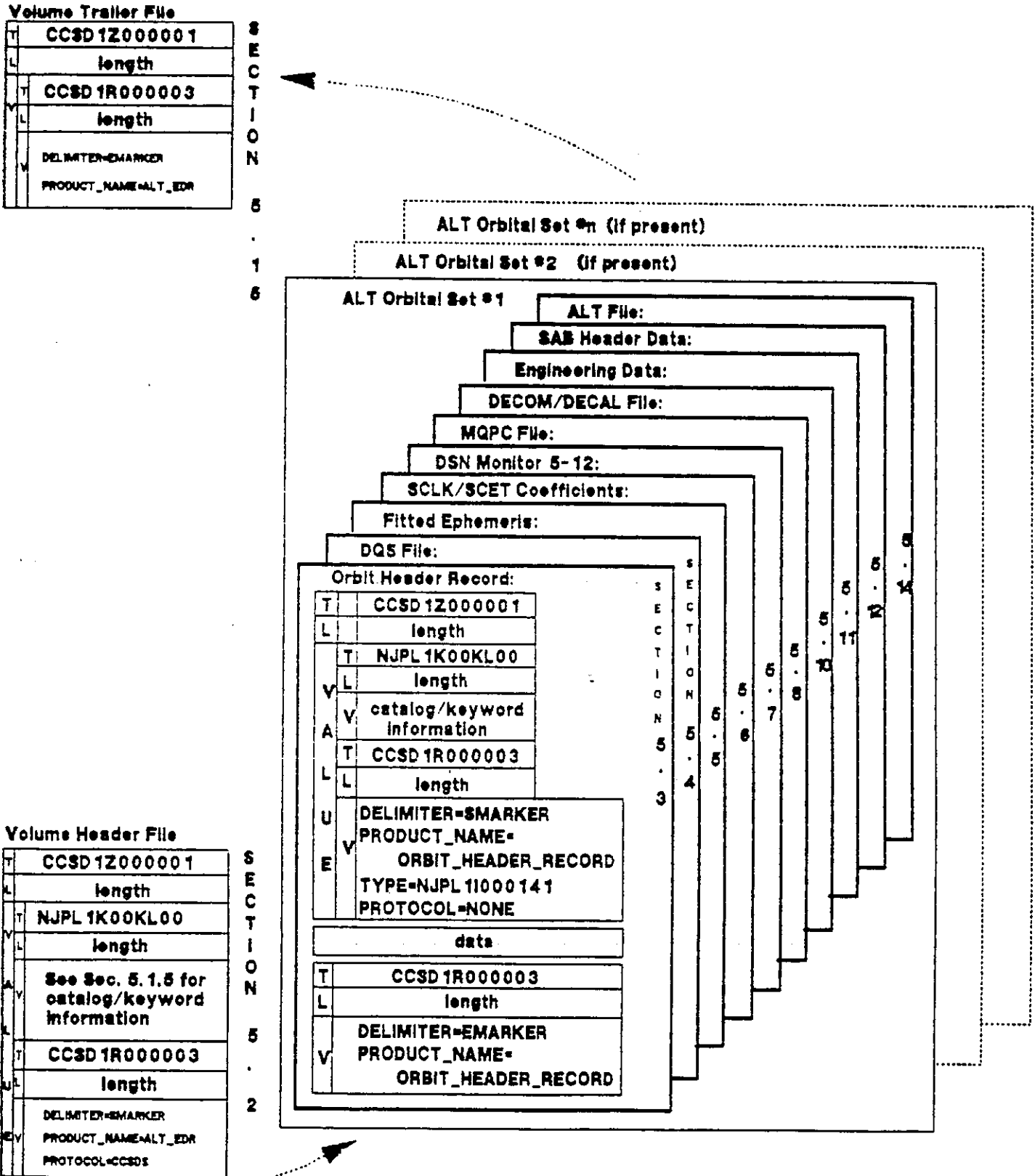


Figure 4-1 ALT EDR Tape Structure

Using the file numbers defined in Section 4.1.1.1, the file sequence on any ALT tape would be:

1, Set 1(2 - 11), Set 2(2 - 11) . . . Set n(2 - 11), 12  
 where n = the total number of orbits included on the tape, a number in the range [1,8]

#### 4.1.2 SAR-EDR

The SAR-EDR/TEDR written to magnetic tape shall consist of a single set of thirteen files (See 4.1.2.1). The tape structure and organization are consistent with ANSI and SFDU standards.

##### 4.1.2.1 SAR-EDR Component Files

- |  |  |
|--|--|
| 1. Volume Header File                  | 7. Mapping Quaternion Polynomial Coefficients File |
| 2. Orbit Header Record File            | 8. Processing Bandwidths File                      |
| 3. Data Quality Summary File           | 9. Decom/Decal File                                |
| 4. Spacecraft Ephemeris File           | 10. Engineering Data File                          |
| 5. S C L K / S C E T Coefficients File | 11. SAB Header Records File                        |
| 6. Monitor 5-12 File                   | 12. SAR Data File                                  |
|  | 13. Volume Trailer File                            |

#### 4.2 SUBSTRUCTURE DEFINITION AND FORMAT

Section 5 of this module details the use of Standard Formatted Data Unit (SFDU) labels and headers and provides a description of the format and content of each of the data files on the tape. The Volume Header and Trailer Files are detailed in Sections 5.2 and 5.15, respectively.

##### 4.2.1 SFDU Labels and Headers

SFDU labels are used to identify and characterize each file on the product tapes. Guidelines for the use of SFDU headers are found in Applicable Document #14.

To conform with the convention adopted for other Magellan data products, the length field in all SFDU labels defined in this document shall be an 8-byte ASCII value. Note that the length field of SFDU labels on Monitor, Engineering, SAB header and ALT data are not in ASCII but SAB/SAR records are. That is, each individual SFDU label is binary in these records, but the SFDU labels around the files containing these records are ASCII.

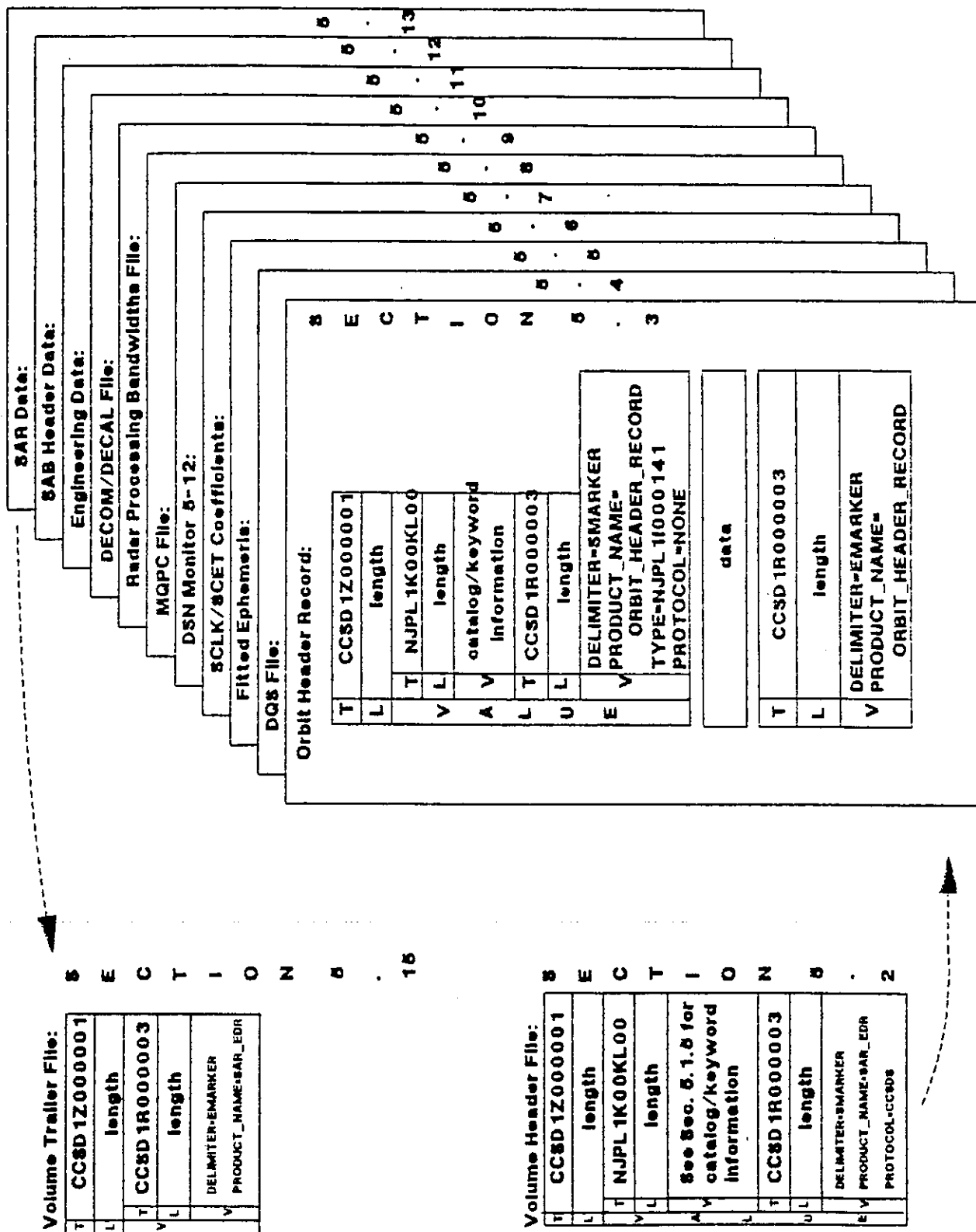


Figure 4-2 SAR EDR Tape Structure

Put another way:

<u>File name</u>	<u>Logical record length</u>	<u>File headers</u>
Volume header	ASCII	ASCII
OHR	ASCII	ASCII
DQS	ASCII	ASCII
Ephemeris	ASCII	ASCII
SCLK/SCET	ASCII	ASCII
Monitor	Binary	ASCII
Quaternions	ASCII	ASCII
Proc. BW	ASCII	ASCII
Decom/Decal	ASCII	ASCII
Engineering	Binary	ASCII
SAB header	Binary	ASCII
SAR	ASCII	ASCII
ALT	Binary	ASCII

#### 4.2.2 Data Blocking

If the data of any entire file can be contained in less than one physical record, it shall be written to tape as a single block of 32500 bytes.

All physical records shall have a fixed length of 32,500 bytes. Circumflex characters (^)<sup>1</sup> shall fill only the remainder of the last physical record of each file. These characters are henceforth in this document referred to as "fill characters". Logical records are packed into physical records, thus spanning physical records where necessary. No null characters shall be required if the last logical record in a physical record ends on byte 32500. Section 5 of this module provides the file-specific structures and formats.

Logical records fill physical records entirely. A logical record may span a physical record boundary, and a physical record may contain more than one logical record. This is known now as the "sausage" explanation, where physical records are created every 32,500 bytes regardless of logical record size and boundaries. Figure 5-17 illustrates this condition for large physical records, and may be logically extrapolated for small logical records. Note that each logical record has a SFDU structure, where each physical record does not.

In summary, all physical records on the tape are 32,500 bytes except ANSI components. These consist of the volume header and volume trailer files, and the ANSI file header & trailer records. These will be less than 32,500 bytes in length.

#### 4.2.3 Block Length

The physical record length shall be 32,500 bytes.

---

<sup>1</sup> Note: the " ^ " is hexadecimal 94.



## SECTION 5

## EDR DATA BLOCK FORMAT DESCRIPTIONS

## 5.1 ANSI and SFDU Label Structures

The volume shall be bracketed by VOL/EOV labels. All files shall be bracketed by HDR1/HDR2 and EOF1/EOF2 labels. ANSI labels at the volume and file levels include fields reserved for user-specific information. The contents of the fields to be used on Magellan science EDR tapes are defined here. The remainder of the label is defined in Applicable Document #3, the ANSI Tape Standards. All reels prior to the last reel of a multi-reel volume end with an EOV label.

## 5.1.1 Volume Header and Trailer (VOL1/EOV1)

Table 5-1 MGN-Specific Volume Header/Trailer Label Content

Byte(s)	Field Name	Contents
5 - 10	Volume Identifier	Six-character tape volume serial number
	Byte 5 - product type identifier	U - SAR-TEST EDR T - SAR-TEDR S - SAR-EDR B - ALT-TEDR A - ALT-EDR C - ALT TEST EDR
	Bytes 6-10: product number	The most-significant (left-most) four characters will be the hexadecimal orbit number. In the case of ALT-(T)EDRs, it will be the first orbit number of the set. The least-significant (right-most) character will be a version number starting at 1 (one).
38-51	Owner-identifier	Set permanently to 'SFOC_MGN_MHR ' (two trailing blanks)

## 5.1.2 ANSI File Header/Trailer Label (HDR1/EOF1)

Table 5-2 MGN-Specific File Header/Trailer 1 Label Content

Byte(s)	Field Name	Contents
5 - 21	File Identifier	See 5.1.3, Table 5-3, Field Identifier Codes

## 5.1.3 ANSI File Header/Trailer 1 (HDR1/EOF1) Field Identifier Codes

**Table 5-3 ANSI File Header/Trailer (HDR1/EOF1) Field Identifier Values**

EDR File	File ID Values	Trailing Blanks
Volume Header File	n-VOLUME_HEADER	2
Orbit Header Record	n-ORB_HEAD_RECORD	0
Data Quality Summary	n-DATA_QUAL_SMRY	1
S/C Ephemeris	n-EPHEMERIS_DATA	1
SCLK/SCET Coefficients	n-SCLK_SCET_COEF	1
Monitor 5-12	n-MONITOR_5_12	3
Mapping Quaternion Polynomial Coefficients	n-MAP_QUAT_COEF	2
Processing Bandwidths	n-PROC_BANDWIDTHS	0
Decom/Decal	n-ENG_DECOM_DECAL	0
Engineering Minor Frames	n-ENG_DATA	7
SAB Header	n-SAB_HEADER	5
SAR data	n-SAR_DATA	7
Altimeter Frames	n-ALT_DATA	7
Volume Trailer File	n-VOLUME_TRAILER	1
n = 1 for all SAR-(T)EDRs, 1-2 for all ALT-TEDRs, and 1-8 for all ALT-EDRs.		

## 5.1.4 ANSI Header/Trailer 2 Labels (HDR2/EOF2)

**Table 5-4 MGN-specific ANSI Header/Trailer 2 (HDR2/EOF2) Fields**

Byte(s)	Field Name	Contents
5	Record Format	'F' (fixed length)

5.1.5 Catalog Keyword Labels

The SFDU catalog keyword label is made up of a set of fields that completely identify each file according to its type, content, origin, and version. In addition, the label contains time tags identifying the time and date on which the data were created.

The value field of the catalog keyword label is an ASCII string comprising several keyword/value pairs. Alpha characters must be upper case. Underline characters are used between words. No 'white spaces' such as space or null characters are permitted. All numeric fields are of fixed lengths. Leading zeroes must fill unused digits. Unless otherwise specified in Table 5-5, field lengths are not limited.

The end of each keyword/value pair shall be indicated by a single carriage return followed by a single line feed. These two bytes per string are accounted for in length fields, but are not shown in figures.

Catalog keyword headers must be an even number of bytes. To accomplish this, an ASCII blank (hex 20) may be added before the last carriage return and line feed. This will cause succeeding data to line up on even byte boundaries.

There is no convention for keyword ordering.

The following table identifies parameters used for the creation of each field. Not all fields are used in each file. However, the format of a field will not vary from file to file.

Figure 5-1 Sample Catalog/Keyword Label

T	NJPL1K00KLO0
L	00000xxx
V	DATA_SET_NAME=SAR_EDR.YYYYY
A	DATA_OBJECT_TYPE=SAR_EDR
L	MISSION_ID=4
L	SPACECRAFT_NAME=MAGELLAN
U	SPACECRAFT_ID=18
E	MISSION_NAME=MAGELLAN
	PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff
	VERSION_ID=01
	UPLOAD_ID=NNNNNN
	ORBIT_NUMBER=NNNNN

Table 5-5 Sample Catalog/Key Word Label Field Formats

Field Name	Format/Rules
Type Label	NJPL1K00KL00, restricted ASCII Catalog/Keyword Label; "1" indicates an ASCII length field.
Length Field	Eight bytes, ASCII, with lead-zeroes mandatory; length of the value field <b>including two bytes per keyword/value pair for the unillustrated line feed and carriage return characters.</b>
DATA_SET_NAME DATA_OBJECT_TYPE	Field is used for both volume and file-level labels. Length is specific to each product.  Both keywords must be present. The "name" must be unique for each instance of the "type"; that is, all tapes are the same type--like SAR_EDR--but each tape represents a different orbit. Therefore, the name will be of the form 'SAR_EDR.yyyyy', where 'yyyyy' is the orbit number. Throughout this document, unless stated otherwise, 'yyyyy' is the orbit number.
MISSION_ID	Set to "4"
SPACECRAFT_NAME	Set to "MAGELLAN"
SPACECRAFT_ID	Set to "18" for spacecraft data or "28" for simulated spacecraft data.
MISSION_NAME	Set to "MAGELLAN"
NOTE:	These keywords are the current standard for the Planetary Data System and have the concurrence of the JPL SFDU Control Authority.

Table 5-5 (continued) Catalog Keyword Label Field Formats

Field Name	Format/Rules
PROCESS_TIME	YYYY-MM-DDThh:mm:ss.fff is an ASCII string where: "-", "T", ":" and "." are fixed delimiters; YYYY is 19__ or 20__ year; MM is two-digit month of year; DD is two-digit day of month; T separate the date and time segments of the string; hh is hour of day; 00-59 mm is minutes of hour; 00-59 ss is seconds of hr; fff is milliseconds of a second.
UPLOAD_ID	Six or fewer characters ABBBBC, where "A" is mission phase <sup>1</sup> "BBBB." starts at one for each phase and increments by one for each upload (this need not include leading zeros), and "C" is a revision indicator which has values from A to Z.
ORBIT_NUMBER(S) (not shown in sample figure).	Five-digit decimal integer in ASCII with leading zeros when necessary. Identifies the orbit during which this telemetry set was generated. Multiple orbit numbers are valid for ALT-EDR and ALT-TEDR tapes and are separated by commas. Each number in addition to the first adds six bytes to the lengths of SFDU structures. In the volume header, the order of the orbit numbers in the header is the same as the order of the orbit file sets on the tape. If multiple orbit numbers are used, the optional 'S' is added to the keyword.
VERSION_ID	Two-digit ASCII number. Starts at 01 and increments by 1 every time a product is updated, not including TEDR to EDR update.

---

1 L-Launch, C-Cruise, V-VOI, I-IOC, M-Mapping, T-Test, N-Non-standard

5.1.6 Aggregation Start/End Marker Labels

Each collection of logical SFDUs within a file, or collection of files within a volume, is bounded by a pair of SFDU "R" labels identifying positionally the start and end of that collection. The value field of the label contains an appropriate set of restricted ASCII strings, selected from those depicted in Table 5-6, which characterize the label and the structures being collected.

Collected data structures begin immediately after the last byte of the start label and continue to the last byte preceding the "R" label marking the end of the aggregation.

Aggregations of structures can be nested to any level. Each level of nesting must use a start and end label pair that clearly identifies by PRODUCT\_NAME the title/type of the collection being bounded. Alpha characters must be upper case. Words are separated by underline characters. Each string in the value label must be uninterrupted by 'white spaces' such as null or space characters.

NOTE: The end of each keyword/value pair shall be marked by a single carriage return and a single line feed. These two bytes per string are accounted for in length fields, but are not shown in figures.

Figure 5-2 Sample Aggregation Marker Label

T	CCSD1R000003	
L	00000xxx	<----- (varies by product)
V	DELIMITER=SMARKER PRODUCT_NAME=ORBIT_HEADER_RECORD TYPE=NJPL1I000141 PROTOCOL=NONE	

Table 5-6 Start/End Aggregation Marker Label Field Formats/Rules

Field Name	Format/Rules
Type Label	CCSD1R000003, restricted ASCII Aggregation Start/End
Length Field	Eight bytes, ASCII, with lead-zeroes mandatory; length of the value field including two bytes per keyword/value pair for the unillustrated line feed and carriage return characters.

**Table 5-6 (continued) Start/End Aggregation Marker Label Field Formats/Rules**

Field Name	Format/Rules
DELIMITER=SMARKER	Start marker; indicates that a collection of data structures follow the value field of this label.
DELIMITER=EMARKER	End Marker; indicates that a collection of data structures ended with the byte immediately preceding the type field of this label.
PRODUCT_NAME	ASCII string of any length which identifies this collection by a unique name. Each structure within this module or each referenced module identifies the valid product name for that structure.
TYPE	Identifies the 12 byte type field assigned to data structures in this collection. <sup>2</sup> This string has the generic format: <div style="margin-left: 40px;">                     NJPLlI00nnnn where                      NJPL identifies the Control Authority, "l" indicates an ASCII length field, "I" indicates that a data object follows, nnnn is a four-digit integer DDR ID, a unique data structure identifier assigned by the JPL Control Authority for each data type. See Applicable Document #14.                 </div>
PROTOCOL	TYPE and PROTOCOL are required only if the aggregated data does <u>not</u> contain its own SFDU labels. In this case, 'PROTOCOL' is always set to NONE'.

<sup>2</sup> This is used only if the aggregated data inside does not contain its own SFDU labels and a unique ID.

5.1.7 Generic File Structure

All EDR tape files share a common file structure that is illustrated in Figure 5-3. The internal structure of each individual file is detailed either in this document or in a referenced SIS module.

The data area of a file may be a set of SFDUs, another SFDU, or a set of logical non-SFDU structured records. This module states what the data area of each file actually is.

Figure 5-3 Sample File Structure

T	CCSD1Z000001		
L	00000nnn		<----- length varies
V	T	NJPL1K00KL00	
	L	00000nnn	
A V A L U E	<catalog/keyword information>		
U	T	CCSD1R000003	
	L	00000nnn	
E V	DELIMITER=SMARKER PRODUCT_NAME=ORBIT_HEADER_RECORD		(typical)
	<internal file data>		
T	CCSD1R000003		
L	00000nnn		
V	DELIMITER=EMARKER PRODUCT_NAME=ORBIT_HEADER_RECORD		(typical)

**Table 5-7 Sample File Content**

Field	Size (bytes)	Description
CCSD Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the byte offset to the data portion of this file, beginning at byte 20.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	ASCII value for the length in bytes of the value portion of the keyword label.
Value Field	varies	ASCII text per Table 5-5
Start of Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	ASCII value for the length in bytes of the value field of this Marker Label.
Value Field	varies	ASCII text per Table 5-6
Data	varies	
End of Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	ASCII value for the length in bytes of the value field of this Marker Label.
Value Field	varies	ASCII text per Table 5-6

## 5.2 Volume Header File

The Volume Header File, a set of SFDU volume descriptors and catalog keywords, constitutes the first file on each data product volume. It appears only at the beginning of the first reel, whether it is a single or multiple reel product. It identifies the number and sequence of orbits on multi-orbit products and a single orbit number on single-orbit products.

Figure 5-4 Volume Header File Format

T	CCSD1Z000001	
L	00000xxx	
V	T	NJPL1K00KL00
	L	00000xxx
A	DATA_SET_NAME=SAR_EDR.YYYYYY DATA_OBJECT_TYPE=SAR_EDR <sup>3</sup>	
	V	MISSION_ID=4
	A	SPACECRAFT_NAME=MAGELLAN
	L	SPACECRAFT_ID=18
	L	MISSION_NAME=MAGELLAN
	U	PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff VERSION_ID=01 ORBIT_NUMBER(S)=nnnnn[,nnnnn . . .]
E	T	CCSD1R000003
	L	000000xx
	V	DELIMITER=SMARKER PRODUCT_NAME=SAR_EDR <sup>3</sup> PROTOCOL=CCSDS

<sup>3</sup> May also be ALT\_EDR, ALT\_TEDR, or SAR\_TEDR as appropriate.

**Table 5-8 Volume Header File Content**

Field	Size (bytes)	Description
CCSD Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the value field of this label in bytes.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII.
Length Field	8	ASCII value for the length in bytes of the value portion of the keyword label; increased by six bytes for each orbit in addition to the first, and by an additional three bytes total if more than one orbit.
Value Field		ASCII text per Table 5-5 and Figure 5-4.
Start of Aggregation Marker Label	12	CCSD1R000003, restricted ASCII.
Length Field	8	ASCII value for the length in bytes of the value field of this Marker Label.
Value Field		ASCII text per Table 5-6 and Figure 5-4.

### 5.3 Orbit Header Record File

The Orbit Header Record File (OHR) identifies the orbit number, time frame, and characteristics of orbital geometry for one orbit. The OHR data block, depicted in Figure 5-6, occurs once for each single-orbit file set. The file format is illustrated in Figure 5-5.

The data area of this file is a set of non-SFDU ASCII records, conforming to Figure 5-6.

Figure 5-5 Orbit Header Record File - Block Format

T	CCSD1Z000001
L	00000xxx
V	T NJPL1K00KL00
	L 00000xxx
A L U E	V DATA_SET_NAME=ORBIT_HEADER_RECORD.YYYYY DATA_OBJECT_TYPE=ORBIT_HEADER_RECORD
	A MISSION_ID=4
	L SPACECRAFT_NAME=MAGELLAN
	L SPACECRAFT_ID=18
	L MISSION_NAME=MAGELLAN
	E PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff VERSION_ID=01 UPLOAD_ID=NNNNNN ORBIT_NUMBER=NNNNN
U E	T CCSD1R000003
	L 000000xx
	V DELIMITER=SMARKER PRODUCT_NAME=ORBIT_HEADER_RECORD TYPE=NJPL1I000141 PROTOCOL=NONE
OHR DATA BLOCK	
T	CCSD1R000003
L	000000xx
V	DELIMITER=EMARKER PRODUCT_NAME=ORBIT_HEADER_RECORD

Table 5-9 Orbit Header Record File Contents

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	Byte offset to the data portion of this file, ASCII.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	ASCII value for the length in bytes of the value field of this label.
Value Field		ASCII text per Table 5-5
Start of Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	ASCII value for the length in bytes of the value field of this Marker. Leading zeros to fill the 8-byte field are mandatory.
Value Field		ASCII text per Table 5-6
OHR Data Block	306	See Figure 5-6
End of Aggregation Marker Label	12	CCSD1R000003, restricted ASCII.
Length Field	8	ASCII value for the length in bytes of the value field of this label.
Value Field		ASCII text per Table 5-6

**Figure 5-6 Orbit Header Record Data Diagram**

Orbit Number
Commanded Mapping Start Time - SCLK
Commanded Mapping Stop Time - SCLK
First SAB Data Time - SCLK
Last SAB Data Time - SCLK
First SAB Data Time - SCET
Last SAB Data Time - SCET
First RCD Received by DSS - ERT
Last RCD Received by DSS - ERT
Number of SAR or ALT records
Number of SAB header records
Total Data Present - This Orbit
Total Gap Time - This Orbit
Predicted Time of Periapsis - SCLK
AOE - Semi-major Axis
AOE - Eccentricity
AOE - Inclination
AOE - Longitude of Ascending Node
AOE - Argument of Periapsis

Table 5-10 MGN EDR Orbit Header Record Data Contents

Bytes	Description
0 - 4	Orbit number counting sequentially from VOI; expressed as a five-character leading-zeros ASCII string
5 -19	Commanded start of mapping, SCLK <sup>4</sup>
20-34	Commanded end of mapping, SCLK <sup>4</sup>
35-49	Time of first SAB frame of this orbit, on this (T)EDR, SCLK <sup>4</sup>
50-64	Time of last SAB frame of this orbit, on this (T)EDR, SCLK <sup>4</sup>
65-87	Time of first SAB frame of this orbit, on this (T)EDR, SCET <sup>5</sup>
88-110	Time of last SAB frame of this orbit, on this (T)EDR, SCET
111-133	ERT First RCD received, this mapping pass
134-156	ERT Last RCD received, this mapping pass
157-160	number of logical SAR or ALT records (SFDUs) in this one orbit set; expressed as a 4-byte ASCII positive integer with leading zero(s) if needed (one record (SFDU) = one burst or one 2266 byte (+ headers) ALT data area.
161-164	Number of SAB header records in SAB header file of this orbit; expressed as a four-byte ASCII positive integer with leading zero(s) if needed.
165-169	Total data present for this mapping pass; expressed in ASCII as the sum of all RCD times in the format: mm:ss (i.e., total amount of time data captured & present for this pass).
170-174	Total gap time for this mapping pass; expressed in ASCII as the sum of all gaps in the format: mm:ss (i.e., total amount of time data should have been, but was not, present for this pass).

(Continued on next page)

4 SCLK represented as XXXXXXXX.YY.Z.A (15 characters).

5 SCET/ERT represented as YYYY-MM-DDThh:mm:ss.fff.

Table 5-10 MGN EDR Orbit Header Record Data Contents (Continued)

Bytes	Description
175-189	Predicted time of periapsis - SCLK <sup>4</sup>
190-212	AOE - Semi-major axis (23-character floating point <sup>6</sup> decimal number in ASCII, plus trailing blank). Units = Kilometers.
213-235	AOE - Eccentricity (23-character floating point decimal number in ASCII, plus trailing blank). No units.
236-258	AOE - Inclination - EME of J2000 (23-character floating point decimal number in ASCII, plus trailing blank). Units = Degrees, with respect to Earth Mean Equator of J2000 coordinate system.
259-281	AOE - Longitude of ascending node - EME of J2000 (23-character floating-point decimal number in ASCII, plus trailing blank). Units = Degrees, with respect to Earth Mean Equator of J2000 coordinate system.
282-304	AOE - Argument of periapsis - EME of J2000 (23 character floating-point decimal number in ASCII, plus trailing blank). Units = Degrees, with respect to Earth Mean Equator of J2000 coordinate system.
305	Blank - to get an even number of bytes.

#### 5.4 Data Quality Summary File

The Data Quality Summary (DQS) File provides a measure of the continuity of SAR, ALT, ENG, and SAB Header data in the current file set. Each gap of one or more successive whole SAB frames shall cause a DQS logical record to be generated. This file shall not report gaps of finer granularity such as missing RCD frames.

The time assigned to the first missing SAB burst of a gap shall be the SCLK time of the first RCD frame following the RCD containing the last bit of the last SAB frame before a gap, whether or not the RCD is present. The time resolution for RCDs is one MOD8 count, or 8 1/3 milliseconds.

<sup>6</sup> All AOE numbers are represented as .12345678901234567D+01, where numbers to the right of the "D" (standing for "double precision") are an exponent.

DQS logical records shall be written to the appropriate area of the data block, in packed format. That is, the records shall follow one another with neither a header nor an inter-record gap separating them. The entire file is all ASCII. The data area is a set of non-SFDU records conforming to Figure 5-12. The file format is depicted in Figure 5-7. The content of the DQS logical record is depicted in Figure 5-8.

Figure 5-7 Data Quality Summary File Format

T	CCSD1Z000001	
L	00000nnn	
V	T NJPL1K00KL00	
	L 00000nnn	
A V A L U L E	DATA_SET_NAME=DATA_QUALITY_SUMMARY.YYYYYY DATA_OBJECT_TYPE=DATA_QUALITY_SUMMARY MISSION_ID=4 SPACECRAFT_NAME=MAGELLAN SPACECRAFT_ID=18 MISSION_NAME=MAGELLAN PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff VERSION_ID=01 UPLOAD_ID=NNNNNN ORBIT_NUMBER=nnnnn	
	U T CCSD1R000003	
	L 000000nn	
	E V DELIMITER=SMARKER PRODUCT_NAME=DATA_QUALITY_SUMMARY TYPE=NJPL1I000142 PROTOCOL=NONE	
	Data Quality Summary Logical Records	
	T CCSD1R000003	
L 000000nn		
V DELIMITER=EMARKER PRODUCT_NAME=DATA_QUALITY_SUMMARY		

Table 5-11 Data Quality Summary File Contents

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	Byte offset to the data portion of this file, ASCII. Leading zeros to fill the 8-byte field are mandatory.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	ASCII value for the length in bytes of the remaining offset to beginning of data beginning at byte offset 40. Leading zeros to fill the 8-byte field are mandatory.
Value Field		ASCII text per Table 5-5
Start of Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	ASCII value for the length of the value field in bytes of this label. Leading zeros to fill the 8-byte field are mandatory.
Value Field		ASCII text per Table 5-6
DQS data logical records	n @ 80 bytes each	See Figure 5-8 and Table 5-12.
End of Aggregation Marker Label	12	NJPL1R00KL00, restricted ASCII.
Length Field	8	ASCII value for the length of the value field of this Marker label beginning at byte offset 20 following the end of the data block
Value Field		ASCII text per Table 5-6

**Figure 5-8 Data Quality Summary Logical Record Structure**

Valid SABs Since Last Gap
Approx. time of first missing SAB-SCET
Approx. time of first missing SAB-SCLK
Time of first SAB Frame after gap-SCET
Time of first SAB Frame after gap-SCLK

**Table 5-12 Data Quality Summary Logical Record Content**

Bytes	Description
0 - 3	Valid SAB Frames since last gap-decimal ASCII, right-justified, four characters leading zeros
4 - 26	Calculated approximate time of the first SAB frame of this gap - SCET <sup>7</sup>
27 - 41	Calculated approximate time of the first SAB frame of this gap - SCLK <sup>8</sup>
42 - 64	Time of first SAB Frame after this gap - SCET <sup>7</sup>
65 - 79	Time of first SAB Frame after this gap - SCLK <sup>8</sup>

**5.5 Ephemeris File**

Each 'fitted' or final Spacecraft Ephemeris File contains data for the mapping portion of a single orbit. The entire ephemeris file for each orbit plus 10% overlap on each end of the orbit will be included on the EDR even if data gaps occurred during mapping, downlink, or ground processing.

The predict file used on temporary product tapes covers a period greater than the commanded mapping portion of an orbit. The file is copied in its entirety as it is shown in the referenced SIS without being changed by the EDR generation process. The format of the file is defined by Applicable Document #11. The data area of this file is ASCII text, non-SFDU structured.

<sup>7</sup> SCET/ERT represented as YYYY-MM-DDThh:mm:ss.fff.

<sup>8</sup> SCLK represented as XXXXXXXX.YY.Z.A (15 characters).

## 5.6 SCLK/SCET Coefficients File

The SCLK/SCET Coefficients File is created by the Spacecraft Team. The file is uploaded to a CDB file from which it is read by an MHR process during EDR production.

By design and function, SCLK/SCET is a dynamic file, slowly growing in size as time passes. The data portion of the file is bounded by Start and End 'R' (aggregation by marker) labels. This file and others not detailed in this SIS share the generic SFDU structure depicted in Figure 5-3, Section 5.1.7 (see Applicable Document #14). In other words, the file is copied in its entirety as it is shown in the referenced SIS without being changed by the EDR generation process. The exact form of the file is described in Applicable Document #7. The data area of this file is non-SFDU structured ASCII.

## 5.7 DSN Monitor 5-12 File

A 600-byte GCF block--with a 566-byte Monitor record embedded in it--is created every five seconds by each DSN station tracking the spacecraft. These GCF blocks are transmitted to the Laboratory in real time. The incoming stream of GCF blocks is processed through the SFOC GIF. This processing results in the 24-byte transport header and 10-byte transport trailer being stripped away. The GIF then creates the 586-byte Monitor SFDU; these are stored on the SFOC Central Data Base and retrieved to produce an EDR.

The Monitor 5-12 File on EDR tapes, packaged as depicted in Figure 5-10, is a collection of these SFDUs. When two or more stations acquire data for an orbit, all of the Monitor data for each of the stations shall be assembled into station-specific, time-ordered collections. The collection from the 'setting' station shall be written to the EDR tape first. The collection from the 'rising' station follows.

The Monitor 5-12 block format is defined in Applicable Document #18. Details of the primary and secondary headers are found in SFOC-5-TIS-\*DU-SFDU, Applicable Document #16.

The data area(s) of this file is (are) a set of SFDU structured records as defined in Applicable Document #18.

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as a tombstone for Figure 5-9 which has been deleted.

Figure 5-10 Monitor 5-12 File Format



\* PROCESS\_TIME=YYYY-MM-DDThh:mm:ss.fff

NOTE: Brackets [ indicate portions of this file that occur only when station overlap has occurred during an orbit. See Table 5-12 for further details.

Table 5-13 DSN Monitor 5-12 File Content

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the byte offset to the beginning of the first data block in this file beginning at byte 20.
Catalog/Keyword Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of Catalog/Keyword value field.
Catalog Keywords		ASCII text per Table 5-5;
***** START SECONDARY NESTING FIELDS DEPENDENT ON THE PRESENCE OF MONITOR DATA FROM A SECOND ('RISING') STATION *****		
Aggregation Start Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the Start Marker.
Data Start Keys		ASCII text per Table 5-6;
***** END SECONDARY NESTING FIELDS DEPENDENT ON THE PRESENCE OF MONITOR DATA FROM A SECOND ('RISING') STATION *****		
Aggregation Start Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the Start Marker.

(continued on next page)

Table 5-13 (continued) DSN Monitor 5-12 File Content

Field	Size (bytes)	Description
Data Start Keys		ASCII text per Table 5-6;
Monitor 5-12 Data from Station 1	n @ 586 bytes each	Reference document 18
Aggregation End Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the value field of this end marker. ASCII.
Data End Keys		ASCII text per Table 5-6;
***** START FIELDS DEPENDENT ON THE PRESENCE OF MONITOR DATA FROM A SECOND ('RISING') STATION *****		
Aggregation Start Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the start marker.
Data Start Keys		ASCII text per Table 5-6;
Monitor 5-12 Data	n @ 586 bytes each	See Applicable Document #18, Figure 5-10.
Aggregation End Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the value field of this end marker.

(continued on next page)

**Table 5-13 (continued) DSN Monitor 5-12 File Content**

Field	Size (bytes)	Description
Data End Keys		ASCII text per Table 5-6;
Aggregation End Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the value field of this end marker. ASCII.
Data End Keys		ASCII text per Table 5-6;
***** END FIELDS DEPENDENT ON THE PRESENCE OF MONITOR DATA FROM A SECOND ('RISING') STATION *****		

**Figure 5-11 Monitor 5-12 SFDU Format**

T	NJPL1I00C115
L	00000566
V A L U E	Subheader Aggregation CHDO
	TLM Primary Header
	GIF Mon 5-12 Secondary Header
	Monitor 5-12 Data Area

**Table 5-14 Monitor 5-12 SFDU Content**

Field	Size (bytes)	Description
Primary Label	12	SFOC-5-TIS-*DU-SFDU
Length Field	8	Length of the remainder of this data object beginning at byte offset 20; set to 00000566.
Subheader Aggregation CHDO Type	2	Value = 1, binary
Subheader Aggregation CHDO Length	2	Byte offset to beginning of data; set to 30, binary
TLM Primary Header	8	SFOC-5-TIS-*DU-SFDU
GIF Monitor 5-12 Secondary Header	32	SFOC-5-TIS-*DU-SFDU
Monitor 5-12 Data Area (including data CHDO)	522	SFOC-1-GIF-DSN-MgnGCFMon

### 5.8 Mapping Quaternion Polynomial Coefficients (MQPC) File

The MQPC File is created by the Radar System Engineering Team (RSET). The file is uploaded to a CDB file from which it is read by MHR during EDR production. This file and others not detailed in this SIS module share the generic SFDU structure depicted in Figure 5-3, Section 5.1.7 (see Applicable Document #14). In other words, the file is copied in its entirety as it is shown in the SIS module without being changed by the process. The exact file format and content is described in Applicable Document #8. The data area of this file is non-SFDU structured ASCII.

### 5.9 Radar Processing Bandwidths File

The Processing Bandwidths File (PBW) is a product of the RSET. The PBW is included only on the SAR-EDR and TEDR product tapes. This file and others not detailed in this SIS share the generic SFDU structure depicted in Figure 5-3, Section 5.1.7 (see Applicable Document #14). In other words, the file is copied in its entirety as it is shown in the SIS without being changed by the process. The exact file format and content is included in Applicable Document #6. The data area of this file is non-SFDU structured ASCII.

## 5.10 Decom/Decal File

The Decom/Decal File consists of a set of ASCII-formatted SFDUs necessary to locate and interpret channelized data. The Decommutation Map consists of a listing of all channels in the Engineering frame, the length of each in bits, the offset of each into the data area (also in bits), and the value of any parameter (i.e., MOD91 count, etc.) that must be specified to ascertain its existence. Also included is the name for the location of the channel, information not required for machine interpretation. Decom data is defined in Applicable Document #9.

The decalibration data consists of four ASCII SFDUs; see Applicable Document #10.<sup>9</sup> The first contains references to all channels specifying in each case the name (title), type (such as ASCII, unsigned integer, floating point), the unit of measure, alarm limits (if applicable), and pointers to following SFDUs containing additional information. The second of these provides titles for the different states of each status-type channel. The third provides DN-EU correlation parameters for the polynomial (cal-curve) type of conversion. The fourth provides DN-EU correlation parameters for the table look-up (interpolation) type of conversion.

In addition, each of these SFDUs will contain version and validity information, providing assurance that these files are, indeed, intended to be used with the data on this tape. SFDUs with identical version and validity information are guaranteed to be identical. The decalibration file components are defined in Applicable Document #10.

Each of the five data-containing SFDUs in this file are exactly as specified in the referenced Applicable Documents, including SFDU labels. MHR merely aggregates the five SFDUs with an additional SFDU.

Each one of the five variable-length areas conforms to the generic file structure seen in Section 5.1.7 of this module, though in this case they are part of a file and not individual files. Each SIS module contains exact descriptions of individual SFDUs and data structures.

File structure is depicted in Figure 5-12.

The data areas of this file are each an entire SFDU structure, aggregated by markers.

## 5.11 Engineering Data

The Engineering File format for EDR product tapes shall be a SCLK-ordered stream of engineering minor frames. An 800-bit Engineering minor frame is generated by the spacecraft once every 2/3 second (SCLK MOD91 count). It is anticipated that approximately 4800 minor frames will be generated in a typical 37.2 minute mapping pass.

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<sup>9</sup> The decom description in this document is not the format of decom data on the EDR, as further explained previously in this paragraph.

Figure 6-12 Decom/Decal Data File Structure

T	<b>CCSD1Z000001</b>	
L	<b>00000nnn</b>	
V A L	T	<b>NJPL1K00KL00</b>
	L	<b>00000nnn</b>
	V	DATA_SET_NAME=DECOM_DECAL.YYYYY DATA_OBJECT_TYPE=DECOM_DECAL MISSION_NAME=MAGELLAN MISSION_ID=4 SPACECRAFT_NAME=MAGELLAN SPACECRAFT_ID=18 PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff
	L	
U	T	<b>CCSD1R000003</b>
	L	<b>00000nnn</b>
E	V	DELIMITER=SMARKER PRODUCT_NAME=DECOM_DECAL
<b>DECOM DATA</b>		
<b>DECAL 1 DATA</b>		
<b>DECAL 2 DATA</b>		
<b>DECAL 3 DATA</b>		
<b>DECAL 4 DATA</b>		
T	<b>CCSD1R000003</b>	
L	<b>00000nnn</b>	
V	DELIMITER=EMARKER PRODUCT_NAME=DECOM_DECAL	

Table 5-15 Decom/Decal Data File Content

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the byte offset to the first data block of this file;
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	Length in bytes of Catalog/Keyword value field.
Catalog Keywords		ASCII text per Table 5-5
Aggregation Start Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the Start Marker.
Data Start Keys		ASCII text per Table 5-6
Decom Data	varies	SFOC-1-TIS-Any_DecomRpt
Decal 1 Data	varies	SFOC-1-DMD-Mgn-DECAL, all channel parameters (SES-115)
Decal 2 Data	varies	SFOC-1-DMD-Mgn-DECAL (SES-115), Cal-curve coefficients (polynomial expansion).
Decal 3 Data	varies	SFOC-1-DMD-Mgn-DECAL, interpolation tables
Decal 4 Data	varies	SFOC-1-DMD-Mgn-DECAL, status titles
Aggregation End Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the value field of this end marker; ASCII.
Data End Keys		ASCII text per Table 5-6

During ground data system processing that precedes EDR production, an SFDU label and a set of SFDU headers are added to identify and characterize the minor frames. The format of the processed Engineering minor frames is illustrated in Figure 5-14. See Applicable Documents #14, #15, #16, and #17.

The Engineering file shall contain data for the mapping portion of the orbit as well as all data recorded for the period of up to 20 minutes immediately preceding and immediately following mapping. (Each spacecraft turn to and from Venus takes approximately six minutes, but there is usually idle time between the turns and the mapping pass start/stop; this idle time may be as long as five minutes.) This 20 minutes (maximum) is used to accommodate the spacecraft-turning maneuvers. The structure of the file is depicted in Figure 5-13. The data area of this file consists of SFDU-structured records conforming to the format shown in Figure 5-14 of this document.

**Figure 5-13 Spacecraft Engineering File Format**

T	CCSD1Z000001	
L	00000nnn	
V	T NJPL1K00KL00	
	L 00000nnn	
A V A L U L E	DATA_SET_NAME = ENGINEERING.yyyyy DATA_OBJECT_TYPE = ENGINEERING MISSION_ID=4 SPACECRAFT_NAME=MAGELLAN SPACECRAFT_ID=18 MISSION_NAME=MAGELLAN PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff ORBIT_NUMBER=nnnnn	
	T CCSD1R000003	
	L 000000nn	
	U	DELIMITER=SMARKER PRODUCT_NAME=ENGINEERING
		Processed Engineering Minor Frames
T	CCSD1R000003	
L	000000nn	
V	DELIMITER=EMARKER PRODUCT_NAME=ENGINEERING	

**Table 5-16    Spacecraft Engineering File Content**

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	Byte offset to the data portion of this file.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	Length of Catalog/Keyword value field.
Catalog Keywords		ASCII text per Table 5-5
Aggregation Start Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the Start Marker.
Data Start Keys		ASCII text per Table 5-6
Engineering Data	n frames @ 274 bytes each	Processed Engineering minor frames. Figure 5-14
Aggregation End Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length of the value field of this end marker; ASCII
Data End Keys		ASCII text per Table 5-6

**Figure 5-14 Processed Engineering Minor Frame Format**

byte offset	
0 - 11	T NJPL1I00C108
12 - 19	L 00000254
20 - 23	V Subheader Aggregation CHDO
24 - 31	A TLM Primary Header
32 - 115	A TIS TLM Secondary Header
116 - 139	L Mgn TLM Tertiary Header
140 - 169	U Engineering Quaternary Header
170 - 173	U Data CHDO
174 - 273	E Engineering Minor Frame

**Table 5-17 Processed Engineering Minor Frame Content**

Field	Size (bytes)	Description
Data ID Label	12	NJPL1I00C108, restricted ASCII; Engineering minor frame.
Length Field	8	Length of remainder of this data structure; set to 254 bytes.
Subheader Aggregation CHDO Type	2	Value = 01, binary
Subheader Aggregation CHDO Length	2	16-bit integer, byte offset (from start of primary header) to beginning of data CHDO; set to 146 binary.
TLM Primary Header	8	SFOC-5-TIS-*DU-SFDU
TIS TLM Secondary Header	84	SFOC-5-TIS-*DU-SFDU
Mgn TLM Tertiary Header	24	SFOC-5-TIS-*DU-MgnSFDU
Engineering Quaternary Header	30	SFOC-5-TIS-*DU-MgnSFDU
Data Header (CHDO)	4	SFOC-5-TIS-*DU-SFDU
Engineering Frame	100	VRM 2-280 and SFOC-5-SYS-*DU-NJPL

5.12 SAB Header Record File

The SAR Altimeter Burst (SAB) Header, after Golay correction, is a logical record of 54 bytes. The structure of the data area of the SAB Header is defined in Applicable Document #19. During processing, an SFDU Primary label and four levels of headers are added to identify and describe each logical record. The Processed SAB Header Record structure is depicted in Figure 5-16.

The SAB Header file on both ALT and SAR EDR tapes is composed of the full set of SAB Headers available from the telemetry for that orbit. A maximum of ~6000 SAB headers is anticipated from the mapping portion of each orbit creating a total file length of more than two megabytes. The data area of this file consists of SFDU-structured logical records conforming to the format shown in Figure 5-16 of this document.

Figure 5-15 SAB Header File Format

T	CCSD1Z000001	
L	00000nnn	
V	T NJPL1K00KL00	
	L 00000nnn	
A V A L U L E	DATA_SET_NAME = SAB_HEADER.yyyyyy DATA_OBJECT_TYPE=SAB HEADER MISSION_ID=4 SPACECRAFT_NAME=MAGELLAN SPACECRAFT_ID=18 PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff ORBIT_NUMBER=nnnnn UPLOAD_ID=nnnnnn	
	T CCSD1R000003	
	L 000000nn	
	E V	DELIMITER=SMARKER PRODUCT_NAME=SAB_HEADER
		Processed SAB Header SFDUs
T	CCSD1R000003	
L	000000nn	
V	DELIMITER=EMARKER PRODUCT_NAME=SAB_HEADER	

Table 5-18 SAB Header File Content

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the byte offset to the data portion of this file beginning at byte 20.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Catalog/Keyword Values		ASCII text per Table 5-5
Start Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Value Field		ASCII text per Table 5-6
SAB Headers SFDUs	variable	References 14, 15, 16, and 17 per Figure 5-16 and Table 5-19.
End Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Value Field		ASCII text per Table 5-6

**Figure 5-16 Processed SAB Header Record Format**

byte offset		
0 - 11	T	NJPL1I00C111
12 - 19	L	00000318
20 - 23	V	Subheader Aggregation CHDO
24 - 31	A	TLM Primary Header
32 - 115		TIS TLM Secondary Header
116 - 139	L	Mgn TLM Tertiary Header
140 - 279	U	SAB Quaternary Header
280 - 283		Data CHDO
284 - 337	E	SAB Header

**Table 5-19 Processed SAB Header Record Content**

Field	Size (bytes)	Description
Primary Label	12	NJPL1I00C111, restricted ASCII
Length Field	8	Length of this structure beginning at byte offset 20; set to 314.
Subheader Aggregation CHDO Type	2	Value = 01, binary
Subheader Aggregation CHDO Length	2	Byte offset (from start of primary header) to beginning of data CHDO; set to 256, binary.
TLM Primary Header	8	SFOC-5-TIS-*DU-SFDU
TIS TLM Secondary Header	84	SFOC-5-TIS-*DU-SFDU
MGN TLM Tertiary Header	24	SFOC-5-TIS-*DU-MgnSFDU
SAB Quaternary Header	140	SFOC-5-TIS-*DU-MgnSFDU
Data Header (CHDO)	4	SFOC-5-TIS-*DU-SFDU
SAB Header Data	54	MOS-RS IRD (Appl. Doc. #19)

### 5.13 SAR File

The SAR file contains SAB headers and associated radar data portions of the telemetry from a single mapping pass of the planet.

SAR records are of a size that will span several physical tape records. The maximum length of the SAR data portion of the Processed SAR Burst Frame is approximately 90 kilobytes.

During processing and extraction from the telemetry stream, an SFDU label and a set of four headers are added to each SAB Header/SAR burst frame. The resulting structure is depicted in Figure 5-19.

See Section 4.2.2 for a discussion of Logical/Physical Blocking.

The data area of this file consists of SFDU-structured records conforming to the format shown in Figure 5-19 of this document.

Figure 5-17 SAR Data File Format

T	CCSD1Z000001	
L	00000nnn	
V	T	NJPL1K00KL00
	L	00000nnn
A V A L U L E	DATA_SET_NAME=SAR_BURST.yyyyy DATA_OBJECT_TYPE = SAR_BURST MISSION_ID=4 SPACECRAFT_NAME=MAGELLAN SPACECRAFT_ID=18 PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff ORBIT_NUMBER=nnnnn UPLOAD_ID = nnnnnn	
	T	CCSD1R000003
	L	000000nn
	E V	DELIMITER=SMARKER PRODUCT_NAME=SAR_BURST
Processed SAR Burst Frames		
T	CCSD1R000003	
L	000000nn	
V	DELIMITER=EMARKER PRODUCT_NAME=SAR_BURST	



Table 5-20 SAR Data File Content

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the byte offset to the data portion of this file beginning at byte 20.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Catalog/Keyword Values		ASCII text per Table 5-5
Start Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Value Field		ASCII text per Table 5-6
Processed SAR Burst Frames	variable	See Figure 5-19
End Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Value Field		ASCII text per Table 5-6

**Figure 5-19 Processed SAB Header/SAR Burst Frame Configuration**

byte offset		
0 - 11	T	CCSD1I000001
12 - 19	L	variable
20 - 31	V	T NJPL1K00KL10
32 - 39		L 00000256
40 - 47	A	TLM Primary Header
48 - 131		V TIS TLM Secondary Header
132 - 155		L Mgn TLM Tertiary Header
156 - 295		U SAB Quaternary Header
296 - 307	U	T NJPL1I00C112
308 - 315		L variable
316 - 369	E	V SAB Header
370 - varies		L SAR Burst Data

**Table 5-21 Processed SAB Header/SAR Burst Frame Content**

Field	Size (bytes)	Description
Aggregate label	12	CCSD1I000001 - ASCII; this label is an aggregation of the next two objects.
Length Field	8	Length of the entire aggregation in bytes, in ASCII NOTE: This can take up to six characters since these records are large.
Label	12	NJPL1K00KL10 - ASCII; this is the label for the following CHDOs.
Length Field	8	Length of the following CHDOs in bytes, in ASCII.

(continued on next page)

**Table 5-21 Processed SAB Header/SAR  
Burst Frame Content (continued)**

Field	Size (bytes)	Description
TLM Primary Header	8	SFOC-5-TIS-*DU-SFDU
TIS TLM Secondary Header	84	SFOC-5-TIS-*DU-SFDU
Mgn TLM Tertiary Header	24	SFOC-5-*DU-MgnSFDU
SAB Quaternary	140	SFOC-5-*DU-MgnSFDU
Label	12	NJPL1I00C112 - ASCII; this is the label for the data area.
Length Field	8	Length of the following data fields in bytes, in ASCII NOTE: This can take up to six characters.
SAB Header	54	MOS-RS IRD, reference #19.
SAR Data	varies	MOS-RS IRD, reference #19.

#### 5.14 ALT File

Altimeter data will be created at one of four ratios to SAB Header data: 1:1, 1:2, 1:3, or 1:4. The ratio is commandable and will be determined by the Radar System Engineering Team. The ratio will vary during a mapping pass. The frame has a non-varying data area length of 2266 bytes.

During processing and extraction from the telemetry stream, an SFDU label and a set of four headers are added to each ALT frame. Each ALT frame is appended to the SAB Header of the SAB frame from which it was extracted. The resulting SAB Header/ALT package is depicted in Figure 5-21. Detail of the contents of the headers is found Sections 5.1.5 and 5.1.6 and in Applicable Documents #14, #15, and #16. The data area of this file consists of SFDU-structured records conforming to the format shown in Figure 5-21 of this document.

Figure 5-20 Altimeter Data File Format

T	CCSD1Z000001	
	00000nnn	
V	T NJPL1K00KL00	
	L 00000nnn	
A V A L L U E	DATA_SET_NAME = ALTIMETER.YYYYYY DATA_OBJECT_TYPE = ALTIMETER MISSION_ID=4 SPACECRAFT_NAME=MAGELLAN SPACECRAFT_ID=18 PROCESS_TIME=YYYY-MM-DDThh:mm:ss.fff ORBIT_NUMBER=nnnnn UPLOAD_ID=nnnnnn	
	U T CCDS1R000003	
	L 000000nn	
	E	DELIMITER=SMARKER PRODUCT_NAME=ALTIMETER
		Processed SAB Header and Processed Altimeter Frames
T	CCSD1R000003	
L	000000nn	
V	DELIMITER=EMARKER PRODUCT_NAME=ALTIMETER	

Table 5-22 Altimeter Data File Content

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the offset to the data portion of this file beginning at byte 20.
Catalog/Keyword Label	12	NJPL1K00KL00, restricted ASCII
Length Field	8	Length of the data portion of this label in bytes.
Catalog/Keyword Values		ASCII text per Table 5-5
Start Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length of the data portion of this label in bytes; set to 38.
Value Field		ASCII text per Table 5-6
SAB Header and ALT Data	2484(X)*	see Figure 5-21
End Aggregation Marker Label	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the data portion of this label.
Value Field		ASCII text per Table 5-6

\* - X = number of sabheader and ALT frames.

**Figure 5-21 Processed SAB Header and Altimeter  
Frame Format**

byte offset		
0 - 11	T	NJPL1I00C114
12 - 19	L	00002464
20 - 23	V	Subheader Aggregation CHDO
24 - 31		TLM Primary Header
32 - 115	A	TIS TLM Secondary Header
116 - 139	L	Mgn TLM Tertiary Header
140 - 159		ALT Quaternary Header
160 - 163	U	Data CHDO
164 - 217	E	SAB Header
218 - 2483		ALT Data

These structures are accumulated in local storage during the processing of telemetry for each orbit. When EDR tapes are written, the SAB Header/ALT structures are written to tape using the file structure depicted in Figure 5-20.

**Table 5-23 Processed SAB Header and Altimeter  
Frame Content**

Field	Size (bytes)	Description
Data Identification Label	12	NJPL1I00C114, restricted ASCII
Length Field	8	Length of the remainder of this record beginning at byte offset 20; set to 2464 bytes.
Subheader Aggregation CHDO Type	2	Value = 01, binary
Subheader Aggregation CHDO Length	2	Byte offset to beginning of data; set to 136, binary.
TLM Primary Header	8	SFOC-5-TIS-*DU-SFDU
TIS TLM Secondary Header	84	SFOC-5-TIS-*DU-SFDU
MGN TLM Tertiary Header	24	SFOC-5-TIS-*DU-MgnSFDU
Altimeter Quaternary Header	20	SFOC-5-TIS-*DU-MgnSFDU
Data Area Header (CHDO)	4	SFOC-5-TIS-*DU-SFDU
SAB Header Data	54	MOS-RS IRD, Applicable Doc. #19
ALT Data	2266	MOS-RS IRD, Applicable Doc. #19

### 5.15 Volume Trailer File Format

The Volume Trailer file, a set of SFDU labels, constitutes the last file on the volume and marks the end of the aggregation of files constituting the product collection. It appears only at the end of the last reel, whether it is a single- or multiple-reel product.

**Figure 5-22 Volume Trailer File**

T		CCSD1Z000001
L		000000nn
V A L U E	T	CCSD1R000003
	L	000000nn
	V	DELIMITER=EMARKER PRODUCT_NAME=SAR_EDR*

\* - alternatively, ALT\_EDR, SAR\_TEDR, or ALT\_TEDR.

**Table 5-24 Volume Trailer File Content**

Field	Size (bytes)	Description
CCSDS Primary Label	12	CCSD1Z000001, restricted ASCII
Length Field	8	ASCII value for the length of the remainder of the file beginning with byte offset 20.
End of Aggregation Marker	12	CCSD1R000003, restricted ASCII
Length Field	8	Length in bytes of the Value field.
Marker Values		ASCII text per Table 5-6.

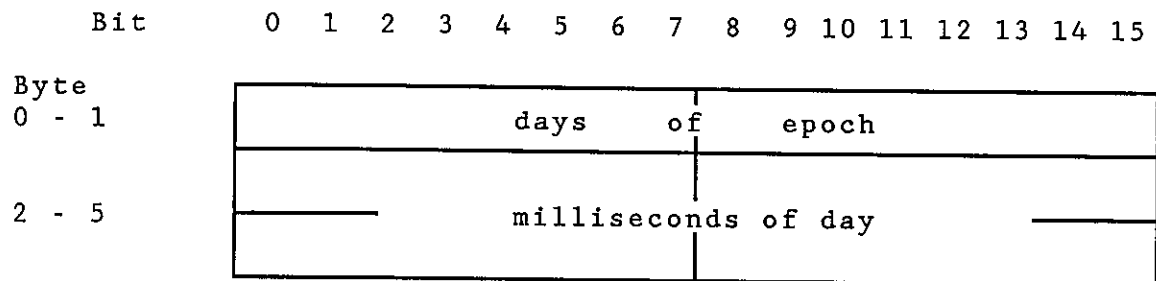


APPENDIX A

JPL STANDARD TIME FORMAT

A.1 SCET/ERT

Figure A-1 JPL Standard Time Format - SCET/ERT




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Bytes	Description
0-1	Binary unsigned 16-bit integer; days elapsed since beginning of epoch, 0000 1 January 1958, UTC.
2-5	Binary unsigned 32-bit integer; milliseconds of day

---

NOTE: Lowest-numbered bytes appear on tape first (i.e., most-significant byte is first).

## A.2 Magellan Spacecraft Clock (SCLK)

Figure A-2 JPL Standard Time Format - SCLK

BYTE	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
0 - 1	RIM															
2 - 3	RIM								MOD91							
4 - 5	MOD10								MOD8							

---

Bytes	Description
0-2	RIM Count 24-bit binary unsigned integer, one per 60 2/3 seconds or one per major frame.
3	MOD91 count 8-bit binary unsigned integer, one per 2/3 second or one per engineering minor frame.
4	MOD10 count 8-bit binary unsigned integer, one per Real Time Interrupt (RTI)
5	MOD8 count 8-bit binary unsigned integer, one per 8 1/2 msec or one per RCD minor frame.

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