Mars Surveyor Operations Project

ENGINEERING ARCHIVE DATA RECORD

SOFTWARE INTERFACE SPECIFICATION

December 11, 1998

JPL
Jet Propulsion Laboratory
California Institute of Technology

MARS SURVEYOR OPERATIONS PROJECT

SOFTWARE INTERFACE SPECIFICATION

COVER SHEET

DATE: 11 December 1998

SIS NAME:

Mars Surveyor Project '98 Climate Orbiter Mission
Engineering Archive Data Record (EADR)

DOMAIN:

System	Element	Program	Make/Use
GDS	DRS	move_offline	Make

PURPOSE OF INTERFACE (SUMMARY):

This interface describes the EADR format and content.

INTERFACE MEDIUM:

Reordable Compact Disc

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Document Change Log

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Acronyms & Abbreviations

AMMOS	Advanced Multi-Mission Operations System
ASCII	American Standard Code for Information Interchange
CCL	Channel Conversion Language
CD	Compact Disc
CD-R	Recordable Compact Disc
CHDO	Compressed Header Data Object
CODMAC	Committee on Data Management and Computation
CPT	Channel Parameter Table
DAA	Data Archive Analyst
DOY	Day-of-Year
DSN	Deep Space Network
EADR	Engineering Archive Data Record
EOM	End-of-Mission
GDS	Ground Data System
HTML	Hypertext Markup Language
ISO	International Standards Organization
IT	Instrument Team
JPL	Jet Propulsion Laboratory
MARCI	Mars Color Imager
MBytes	Megabytes
MCO	Mars Climate Orbiter
MGDS	Multimission Ground Data System
MSOP	Mars Surveyor Operations Project
MSP98	Mars Surveyor Project ‘98
NASA	National Aeronautics and Space Administration
NAIF	Navigation and Ancillary Information Facility
NSSDC	National Space Science Data Center
ODL	Object Description Language
PC	Personal Computer
PDB	Project Database
PDF	Portable Document Format
PDS	Planetary Data System
PFR	Project File Repository
PKT	Packet
PMIRR	Pressure Modulator Infrared Radiometer
ROM	Read Only Memory
S/C	Spacecraft
SCET	Spacecraft Event Time
SCLK	Spacecraft Clock
SCT	Spacecraft Team
SDV	Static Documentation Volume
SFDU	Standard Formatted Data Unit
SFOC	Space Flight Operations Center
SIS	Software Interface Specification
TDL	Template Definition Language
UTC	Coordinated Universal Time
WWW	World Wide Web

Table of Contents

1. GENERAL OVERVIEW

1.1 Content Overview

This Software Interface Specification (SIS) describes the form and content of the Mars Surveyor Project '98 (MSP98), Mars Climate Orbiter (MCO) Mission, Engineering Archive Data Record (EADR).

The EADR is comprised of a set of files containing the unprocessed (NASA level-0, or CODMAC level-2) spacecraft engineering telemetry data, Deep Space Network (DSN) monitor data, and several other types of files that are required to describe, process and aid in analyzing this data. The EADR also contains unprocessed telemetry data from the two on-board science instruments. The EADR is a deliverable product to the National Aeronautics and Space Administration (NASA) Planetary Data System (PDS).

This document describes the contents and structure of the EADR. Section 1 contains general information. Section 2 describes characteristics of the physical media used to transmit the data, and Section 3 specifies their logical (media-independent) contents.

1.2 Scope

This document provides a detailed description of the EADR interface including data flow information and a definition of all data objects that are applicable to the interface.

This document does not describe the formats of each of the individual data products that comprise the EADR, only the overall structure and content. Paragraph 1.3 "Applicable Documents" lists the SIS modules that describe the individual data products.

1.3 Applicable Documents

The following documents are applicable to this interface:

1. Mars Surveyor Project '98 Orbiter Telemetry Dictionary, JPL D15610, M98-5-4007-O, January 30, 1998

2. Space Flight Operations Center Software Interface Specification, JPL D-4675
   - SFOC0038-XX-XX
     a) SFOC-2-Any-Catalog2, Rev 4, Nov 20, 1992
     b) SFOC-5-SYS-*DU-NJPL, Rev, Sept 11, 1996
     c) SFOC-5-TIS-*DU-SFDU, Rev, July 9, 1991
     d) SFOC-5-TIS-*DU-MGSSFDU, Rev, Sep 23, 1992
     e) SFOC-1-DPS-ANY-SCLKvSCET, Rev, June 4, 1993
     f) SFOC-1-MCA-DMD-CPTSpec, Rev, June 23, 1993

3. Mars Surveyor Project '98 Archive Generation, Validation, and Transfer Plan, TBD
4. Planetary Science Data Dictionary, MOSO0099-04-00, JPL D-7116, Rev. D, July 15, 1996
5. PDS Standards Reference , D-7669 part 2, V. 3.2 July 24, 1995
6. Volume and File Structure of CD-ROM for Information Interchange, ISO 9660-1988, April 1988

1.4 Target Audience

This specification is useful to those who wish to understand the format and content of the EADR as a collection of component files. Typically these individuals would be spacecraft engineers and science data users.

2. INTERFACE CHARACTERISTICS

2.1 Operations Perspective

2.1.1 Product Source, Transfer Method and Destination

The EADR shall be produced by the Data Archive Analyst (DAA) on Recordable Compact Disc (CD-R) media and delivered to the PDS.

It should be noted that although the engineering and science data included in the EADR Volume Set are described as "raw data" they have undergone at least a first-order analysis in the MSP98 Ground Data System (GDS) to assess data quantity and continuity. Results of this analysis are included in the DAA Data Accountability Summary Report, in the CALIB directory. Also, the process of extracting data from the Project Database (PDB) will only be done once the DAA has determined that the data are complete.

2.2 Generation Method and Frequency

The DAA shall retrieve all required data objects from the PDB. When a sufficient amount of data have accumulated (see paragraph 2.4, Volume and Size), to fill a new EADR Volume, the collection of telemetry stream data and ancillary files shall be staged to an archive directory on the DAA workstation. All data files are indexed and pointed to by a corresponding detached PDS catalog label file. Additional descriptive information is necessary and placed in appropriate locations throughout the staging area. Final processing involves premastering[1] the CD image and transferring it to CD-R media.

2.3 Volume Release Frequency

Completed EADR volumes are released immediately after generation. See paragraph 2.7, “Backup and Duplicates” below for a list of distribution nodes.

2.4 Volume and Size

The size of an EADR Volume shall correspond to the capacity of a single CD-R disc, approximately 650 Mbytes. The time range of telemetry stream data on each volume is directly affected by spacecraft telemetry downlink data rates, telemetry formats, and DSN Deep Space Station coverage. Ancillary information (calibration data, report data, etc.) are not, however, time-dependent but are periodically updated. Updated files will be placed on the current and successive volumes as they are received.

The size of the entire volume set is dependent on the duration of the MCO Mission and cannot be determined until its completion.

2.5 Interface Medium Characteristics

CD-R discs shall be used since the low volume distribution of the EADR product precludes the expense involved in mastering CD-ROMs. Physical characteristics of CD-R discs shall conform to industry standards (see Applicable Document #6).

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[1] Premastering CD images is necessary to ensure that all files and sub-directories contained within the archive directory are compliant with the ISO-9660 standard. The multi-step process checks for directory depth violations, searches for and tracks file characteristics, generates the ISO 9660 specific information needed to create the complete CD image, and transfers the dataset to an output device in ISO 9660 compliant blocks.

2.6 Validation

The EADR is a container for spacecraft and ground system data products produced by many organizations affiliated with the MSP98 Project. It is assumed that product producers will have sufficiently validated their data products prior to making them available for general use. The DAA is therefore not responsible for individual data file content but will validate the EADR volumes prior to CD mastering using the following guidelines:

- All available spacecraft engineering and science telemetry, and DSN Monitor data will be archived.
- All ancillary data retrieved from the Project File Repository (PFR) are placed on the appropriate EADR Volume.
- Detached label additions will be verified against the PDS Standard.

2.7 Backup and Duplicates

Each EADR Volume shall be duplicated[2] to CD-R media and distributed as indicated in Table 2.7-1 "EADR Media Distribution".

Copy	Destination	Frequency
1	MSOP Data Administration (to NSSDC at EOM)	Every Volume
2	MSOP Spacecraft Team	Every Volume
3	MARCI Instrument Team	Every Volume
4	PMIRR Instrument Team	Every Volume
5	PDS NAIF Node (at MCO EOM)	Every Volume

Table 2.7-1 EADR Media Distribution

2.8 Volume Labeling

Each EADR Volume shall bear an internal media label that contains the PDS Volume Identifier using the format:

M98O_nnnn

where M98O indicates MSP98 MCO Engineering and Science data products, and "nnnn" is a four-digit volume serial number, starting with "0001". The characters USA_NASA_JPL_ will be added as a prefix, e.g., USA_NASA_JPL_M98O_0001 to form the internal VOLUME_SET_ID.

[2] Duplication and distribution is specified to accommodate the minimum number of copies that satisfies currently known requirements for data delivery and backups. Additional copies may be made upon request, or on a standing basis. All such additional distribution shall be negotiated and documented in team interface agreements with the DAA. If a sufficient number of copies are planned for any given volume, the DAA may opt to have the volume mastered, duplicated, and distributed by an outside compact disk vendor.

3. MEDIA FORMAT AND CONTENT

This section describes in detail the format and content of the EADR.

3.1 Format

The EADR shall be formatted in accordance with the ISO 9660 Level-1 Interchange Standard, (see Applicable Document #6) and the PDS Standard, (see Applicable Document #5). Compliance with these standards is accomplished by following these regulations:

ISO 9660 Level-1 Standard

1. File names are established (or altered) using an eight character name followed by a period and three character extension. A predetermined convention is used and presented in paragraph 3.2.1.8.1, "File Naming".

PDS Standard

2. PDS detached labels are generated and point to each EADR data product file. The labels are written in the Object Description Language (ODL) and are required for describing the contents and format of each individual data product within the EADR data set (see paragraphs 3.2.1.5.1 "Detached Label Files" and 3.2.1.8.2 "File Labeling" for details).

3.1.1 Volume Set

The EADR Volume Set consists of data volumes and a single Static Documentation Volume (SDV). Data volumes will be published continuously as data are received in the Multi-Mission Ground Data System (MGDS) during the MCO Mission (including the primary and any possible extension periods). The SDV (see paragraph 3.3, "EADR Static Documentation Volume") will be produced and issued just prior to the MCO Mission mapping phase.

3.1.2 File Formats

The following paragraphs describe file formats for the various kinds of files contained on the EADR.

3.1.2.1 Document and Descriptive Text Files

Document files (.ASC suffix) and descriptive text files (.TXT suffix) are ASCII text files. ASCII text files contain lines no more than 78 characters followed by a carriage return (ASCII 13) and a line feed character (ASCII 10).

3.1.2.2 Portable Document Format Files

The volume set will contain documentation using the Portable Document Format (PDF). The PDF is a cross-platform file format generated from a Postscript input. A PDF file can describe documents containing any combination of text, graphics, and images in a device and resolution independent format. These files have the suffix ".PDF".

3.1.2.3 Hypertext Markup Language Files

HTML files (.HTM suffix) contain plain-text (ASCII) data that is a collection of platform-independent styles (indicated by markup tags) that define the various components of a World Wide Web (WWW) document. The HTML format is conveniently displayed by a WWW browser application resident on most computers.

3.1.2.4 Tabular Files

Tabular files (.TAB suffix) are used for the volume index files required by PDS. They are ASCII text files containing delimited fixed-length records. This format allows the information in the file to be read directly into most database systems. All fields are separated by commas, character fields are enclosed in double quotation marks ("). (Character fields are padded with spaces to keep quotation marks in the same columns of successive records.) Character fields are left justified, and numeric fields are right justified. The "start byte" and "byte" values listed in the common catalog labels do not include the commas between fields or the quotation marks surrounding character fields. The records are of fixed length, and the last two bytes of each record contain the ASCII carriage return and line feed characters. This allows a table to be treated as a fixed length record file on computers that support this file type and as a text file with embedded line delimiters on those that don't.

3.1.2.5 Data Files

There are two types of data files on the EADR Volume; 1) telemetry "stream" type data files, hereafter referred to as stream data, (i.e., engineering and science telemetry, DSN Monitor blocks), and 2) "ancillary file" type data files, hereafter referred to as file data (i.e., status reports, decom maps, channel parameter table). The two types are described below.

3.1.2.5.1 Stream Data

Telemetry stream data files are composed of time-ordered sets of variable-size, unique telemetry data records. These records are formatted according to the Advanced Multi-Mission Operations System (AMMOS) Compressed Header Data Object (CHDO) standard described in SFOC-5-SYS-*DU-NJPL (see Applicable Document #2), and may include spacecraft telemetry packets, DSN Monitor blocks, or channelized versions of these two stream data types. Channelized stream data records are essentially telemetry data packets or blocks in which the contents are decommutated and organized in a tabular format. All unique channelized engineering and DSN Monitor data records available in the PDB at the time of the archive process are included.

Stream data are stored on the EADR Volume as binary, time-ordered, byte stream files described by detached PDS (ASCII formatted) labels (see paragraph 3.2.1.8.2, “File Labeling”). Unless otherwise noted, each file is sized to hold the amount of data processed by the MSP98 Ground Data System (GDS) during 6 or 24 hours[3] depending on the data type (see Table 3.2-5 “EADR Product Types”).

3.1.2.5.2 Ancillary Data Files

The ancillary data files associated with this volume set contain information necessary to calibrate, interpret, or support analysis of the stream data (see paragraph 3.2.1.5, CALIB Directory

[3] Each MCO data type is designated to transport specific spacecraft information in the telemetry stream. Some types carry specialized data that is gathered when the spacecraft is configured accordingly. These files will be sized to hold 24 hours since their volume will typically be low.

Contents). This ancillary information should not be confused with a more comprehensive set, commonly referred to as SPICE, that will be provided in a separate volume collection for the MSP98 Project.

The file data objects include:

Channel Parameter Table
Channel Conversion Language File
Template Definition Language File
Data Accountability Report File
SCLK/SCET File

They are placed on the EADR in the same format as retrieved from the PFR. This format may include SFDU label structures that are not fully compliant with PDS standards. They are, however, in accordance with specification SFOC-2-Any-Catalog2. Minor changes may have been made to make the files compatible with the Level-1 standard, such as filename simplification, but changing the catalog header would risk making these files incompatible with the MGDS subsystems that use them. These files will be described using PDS compliant detached labels (see paragraph 3.2.1.5.1 "Detached Label Files").

3.1.2.5.2.1 EADR Data Object SIS

Those EADR data objects that are described by an AMMOS SIS document are listed in Table 3.1-1 "EADR Data Object SIS Identification". Each SIS module identified is provided in at least ASCII text form on the SDV. Wherever possible PDF and HTML files will be provided as well.

Data Object	**AMMOS SIS Module #**
Raw DSN Monitor Blocks	SFOC-1-GIF-DSN-MOGCFMON
S/C Channelized Eng Data	SFOC-5-TIS-*DU-MGSFDU SFOC-5-SYS-*DU-NJPL SFOC-5-TIS-*DU-SFDU
Channelized Monitor Data	SFOC-5-TIS-*DU-SFDU SFOC-1-9-00-03
S/C ENG Packet Telemetry	SFOC-5-TIS-*DU-MGSFDU SFOC-5-SYS-*DU-NJPL SFOC-5-TIS-*DU-SFDU
MARCI Packet Data Record	SFOC-5-TIS-*DU-MGSFDU SFOC-5-SYS-*DU-NJPL SFOC-5-TIS-*DU-SFDU
PMIRR Packet Data Record	SFOC-5-TIS-*DU-MGSFDU SFOC-5-SYS-*DU-NJPL SFOC-5-TIS-*DU-SFDU
SCLK/SCET Coefficients File	SFOC-1-DPS-ANY-SCLKvSCET
Channel Parameter Table (CPT) File	SFOC-2-DMD-ANY-CPTSPEC

Table 3.1-1 EADR Data Object SIS Identification

3.2 Content

The following paragraphs describe the content of the EADR Volume Set.

3.2.1 Directory Structure

The EADR is constructed using the standard PDS archive set directory structure (see Applicable Document #4). This standard provides for a top-level root directory containing a volume description, and subdirectories for each of the primary types of data provided on the archive volume. The EADR Volume Directory Tree follows in Figure 3.2-1.

```
ROOT-
      |
      |-AAREADME.TXT (Information describing this volume set)
      |-ERRATA.TXT   (Error data for this and all volumes in the set)
      |-VOLDESC.CAT  (PDS language description of this volume set)
      |
      |- CATALOG-
      |          |
      |          |- CATINFO.TXT (Information about the files in this directory)
      |          |- DATASET.CAT (PDS catalog template for this data set)
      |
      |-INDEX-
      |       |
      |       |-INDXINFO.TXT (Information about the files in this directory)
      |       |-INDEX.LBL    (PDS compliant detached label)
      |       |-INDEX.TAB    (Tabular list of stream data files on this volume)
      |       |-CUMINDEX.LBL (PDS compliant detached label)
      |       |-CUMINDEX.TAB (Tabular list of stream data files on all volumes)
      |
      |-CALIB-
      |       |
      |       |-CALINFO.TXT  (Information about the files in this directory)
      |       |-(Ancillary files, see paragraph 3.1.2.5.2, Ancillary Data Files)
      |
      |-DOCUMENT-
      |          |
      |          |-DOCINFO.TXT  (Information about the files in this directory)
      |          |-VOLINFO.TXT  (This document in ASCII text)
      |          |-EADRSIS.HTM  (This document in Hypertext Markup format)
      |          |-EADRSIS.PDF  (This document in Portable Document Format)
      |
      |-SOFTWARE-
      |          |
      |          |-SOFTINFO.TXT (Information about the files in this directory)
      |          |-SRCHVOL.PL (Perl Script to extract data from this archive)
      |          |-SRCHVOL.TXT (Usage instructions for SRCHVOL.PL)
      |
      |-BUS-
      |     |- (Directory containing spacecraft bus (engineering health and status)
      |     |   data in packet format; one sub-directory for each packet type. Each
      |     |   subdirectory contains raw data packet files, and channelized
      |     |   data files identified by filename. Note that not all of these
      |     |   directories will appear on every volume.)
      |     |
      |     |-DATASET.TXT (A file containing a description of the binary stream
      |     |              data. A copy of DATASET.TXT will be placed in each
      |     |              sub-directory where stream data is present.)
      |     |
      |     |-AACS----
      |     |         | Packets containing AACS memory readout values.
      |     |
      |     |
      |     |
```

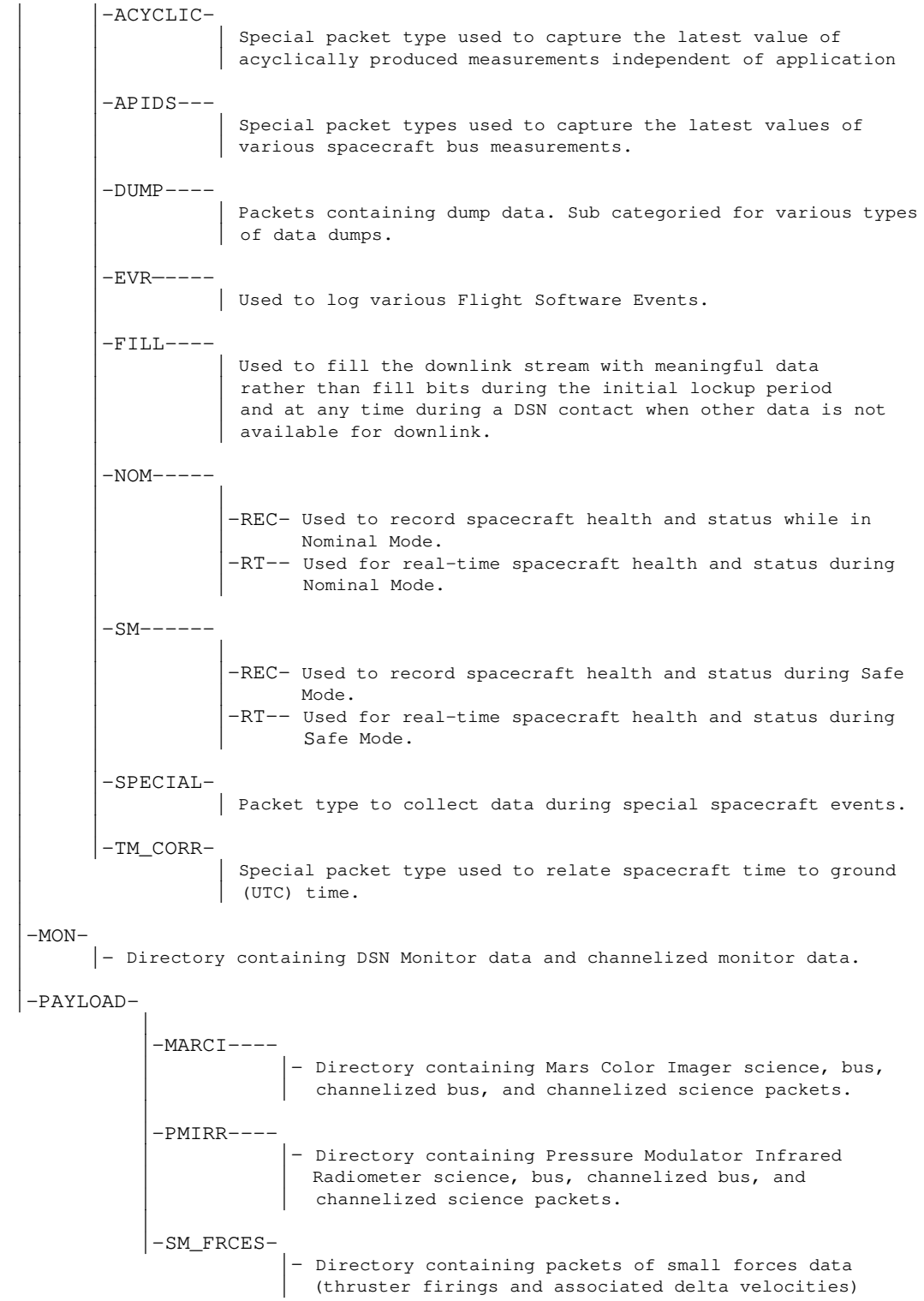

Figure 3.2-1 EADR Volume Directory Tree

3.2.1.1 Root Directory Files

The files included in the root directory provide information to human and machine users of this data set. The following table defines these files.

File	Contents	Source
AAREADME.TXT	High-level description of the volume structure and content in human-readable format	DAA
ERRATA.TXT	A description of known errors and anomalies in this and all previous EADR volumes in human-readable format.	DAA
VOLDESC.CAT	A description of the specific contents of this volume in a format readable by both humans and computers.	DAA

Table 3.2-1 Root Directory Files

3.2.1.1.1 VOLDESC.CAT

The VOLDESC.CAT file is the EADR Volume label. It is an ASCII formatted text file in the form of a PDS catalog object that describes the contents of the EADR Volume. It is structured as described in Figure 3.2-2 below.

```
PDS_VERSION_ID     = PDS3
OBJECT             = VOLUME
VOLUME_SERIES_NAME = "MISSION TO MARS"
VOLUME_SET_NAME    = "MARS SURVEYOR 98 CLIMATE ORBITER SPACECRAFT
LEVEL ZERO DATA"
VOLUME_SET_ID      = USA_NASA_JPL_M98O_nnnn
VOLUMES            = UNK
VOLUME_NAME        = "MARS CLIMATE ORBITER ENGINEERING ARCHIVE
DATA RECORD"
VOLUME_ID          = M98O_nnnn
VOLUME_VERSION_ID  = "VERSION n.n"
MEDIUM_TYPE        = "CD-R"
VOLUME_FORMAT      = "ISO-9660"
PUBLICATION_DATE   = yyyy-mm-dd
DATA_SET_ID        = "M98O-M-ENGINEERING-2-EADR-V1.0"
DESCRIPTION        = "
     This volume contains Mars Surveyor 98 Climate Orbiter
     unprocessed engineering and science telemetry data, Deep
     Space Network monitor data, as well as channelized
     engineering science and monitor data."
OBJECT             = DATA_PRODUCER
FULL_NAME          = "Mars Surveyor Operations Project Data
Archive"
FACILITY_NAME      = "Mars Surveyor Operations Project Mission
Operations System"
INSTITUTION_NAME  = "Jet Propulsion Laboratory"
ADDRESS_TEXT      = "4800 Oak Grove Drive
                     Pasadena, CA 91109
                     Mail Stop 230-109"
END_OBJECT         = DATA_PRODUCER
OBJECT             = CATALOG
 ^DESCRIPTION      = "DATASET.CAT"
END_OBJECT         = CATALOG
END_OBJECT         = VOLUME
END
```

Figure 3.2-2 VOLDESC.CAT File Description

3.2.1.2 Descriptive Files

Many of the directories on the EADR will contain an INFO.TXT or DATASET.TXT file These files will provide relevant information about how to interpret or use the files they describe.

3.2.1.3 CATALOG Directory

The CATALOG directory contains the template file that PDS uses to load its Data Set Catalog. DATASET.CAT includes a free-form textual description of the EADR data set.

3.2.1.4 INDEX Directory

The following table lists the files in the INDEX directory.

Filename	Contents	Format
INDXINFO.TXT	A text description of the files in this directory.	Text

INDEX.TAB	A tabular index of the contents of this Volume.	Table
CUMINDEX.TAB	A tabular index of contents of all volumes published so far.	Table
INDEX.LBL	Label file describing INDEX.TAB	Label
CUMINDEX.LBL	Label file describing CUMINDEX.TAB.	Label

Table 3.2-2 INDEX Directory File

3.2.1.4.1 INDEX.TAB, INDEX.LBL

INDEX.TAB is a table file constructed according to PDS standards (character column values are quoted and right-padded with spaces to the defined lengths; all columns are separated by commas) that lists in time-order all of the telemetry and monitor data files on a given volume. The columns objects are described in Table 3.2-3 "INDEX.TAB Column Objects". The INDEX.LBL file describes the format of the INDEX.TAB file in PDS table object format.

Column	Description
VOLUME_ID	Identifies the volume containing the named file
PRODUCT_ID	Unique identifier for each data file
FILE_SPEC	Path and physical file name
PRODUCT_CREATION_TIME	UTC time reference when data file was generated
START_TIME	UTC Start time of period containing data
STOP_TIME	UTC Stop time of period containing data
START_SCLK	Spacecraft clock count at start time
STOP_SCLK	Spacecraft clock count at stop time
DATA_RECORDS	Number of CHDO records in this file
FILE_SIZE	Absolute file size in bytes

Table 3.2-3 INDEX.TAB Column Objects

3.2.1.4.2 CUMINDEX.TAB, CUMINDEX.LBL

CUMINDEX.TAB is a tabular index of all EADR volumes published to date, including the volume on which it is included. This file is formatted using the same structure as INDEX.TAB. CUMINDEX.LBL is a catalog object describing the format of the index file. It is structured identically to INDEX.LBL with the exception that the TABLE pointer points to CUMINDEX.TAB instead of INDEX.TAB and the INDEX_TYPE keyword value indicates "CUMULATIVE" rather than "SINGLE".

3.2.1.5 CALIB Directory Contents

The files contained in the CALIB directory aid users to interpret and analyze EADR data objects. The following table describes these files providing their contributing source and PDS label requirements.

Filename	Contents	Source	PDS Label
<filename>.CPT	Channel Parameter Table (CPT) file. The CPT are the spacecraft engineering channel calibrations that allow conversion of binary channel values into engineering units. All available files will be	SCT	Detached

	archived. Names of these files are defined by the SCT and may be shortened from the original PFR name to conform with the ISO-9660 naming constraints.		
<filename>.CCL	Channel Conversion Language (CCL) file. The channel conversion tables define derived channels as a function of one or more base telemetry channels. This specification is intended for use with MGDS tools for processing and displaying engineering data. Names of these files are defined by the SCT and may be shortened from the original PFR name to conform with the ISO-9660 naming constraints .	SCT	Detached
<filename>.TDL	Template Definition Language (TDL). TDL is the programming language used to lay out, character by character, the format of the human-readable output from the Data Monitor and Display subsystem. This output includes both display output and file or hard copy output. The TDL specification of this output is called a display template. This specification is intended for use with MGDS tools for processing and displaying engineering data. Names of these files are defined by the SCT and may be shortened from the original PFR name to conform with the ISO-9660 naming constraints .	SCT	Detached
SCLKSCET.DAT	The file SCLKSCET.DAT contains the calibration table for the spacecraft clock. This calibration is given as a list of linear coefficients to a piecewise linear model of the behavior of the spacecraft clock with respect to UTC. The telemetry data records include internal labels for spacecraft clock, spacecraft event time, and earth-received time, but the spacecraft event time values are not guaranteed to be accurate because they are generated using the predicted calibration. The predicted calibration is derived from the telemetry data, and so the final calibration for a given time period cannot be available at the moment that the telemetry data for that time period is being received into the MGDS.	SCT	Detached
<filename>.DAR	DAA Data Accountability Report File (DAR). This report, a.k.a. Packet Telemetry Stream Summary, is generated to summarize a specific range (typically a spacecraft day) of the telemetry data received and processed in terms of quantity and continuity. They are produced for each science instrument.	DAA	Detached

Table 3.2-4 CALIB Directory Files

3.2.1.5.1 Detached Label Files

The PDS data product label for the CCL, CPT, TDL, DECOM Map Source, and SCLKSCET file types is detached from the data and resides in a separate file that points to the product file. There is one detached label file for every product file. The label file should have the same base name as its associated data file, but the extension is .LBL

The contents of the detached label are:

PDS_VERSION_ID
RECORD_TYPE
^FILE_NAME
PRODUCT_ID
PRODUCT_CREATION_TIME
DESCRIPTION
SPACECRAFT_NAME
START_TIME
STOP_TIME
END

3.2.1.6 DOCUMENT Directory Contents

The DOCUMENT directory contains this SIS document in three distinct formats, ASCII text, Hypertext Markup Language, and Portable Document Format.

3.2.1.7 SOFTWARE Directory Contents

The SOFTWARE directory contains a program, SRCHVOL.PL written in the PERL language, that is useful for searching and retrieving data from EADR volumes. It is specifically intended for use by MSP98 mission data users and other users of this data who have access to a PERL interpreter.

PERL is a public-domain text and file manipulation program that is used extensively in the MGDS. The INFO.TXT file in this directory will provide information about how to get a copy of PERL for most UNIX and PC environments.

3.2.1.8 BUS, PAYLOAD and MON Data Directory Contents

A file shall be generated for each of the stream data types where at least one data record is available. These files will be identified with a .PKT extension for spacecraft telemetry types and .RAW for DSN Monitor blocks. Whenever channelized versions of data are produced they will also be provided and identified with the .CHN extension. Although this format can be derived from the provided packets or monitor records using one of the decommutation maps in the CALIB directory, this is a tedious process, and the channelized data are readily available in the MGDS for archiving.

Note that the primary time key used to query spacecraft telemetry data from the PDB is Spacecraft Event Time (SCET), and the primary time key for querying DSN Monitor data is Monitor Sample Time (MST). Both time keys are given in UTC, although they represent different, asynchronous events. SCET is the time at which an event was measured on board the spacecraft, whereas MST is the time at which the monitor data sample was taken in the DSN.

Note: due to the way the PDB query mechanism works, there will likely be a small record overlap between the end of one file and the start of the next sequentially ordered file.

3.2.1.8.1 File Naming

The EADR Volume Set is a deliverable product to the PDS and therefore must follow the ISO 9660 Level-1 Standard in all areas, most notably file naming. The Standard requires files names to be no more than 8 characters long followed by a period and a 3 character extension (see Applicable Document #6).

Stream data files shall be named using the following convention:

<YEAR><UTC_START_DOY><UTC_START_HOUR>.TYPE

YEAR:	A number two digits in length indicating the year in which the data was acquired.
UTC_START_DOY:	A three digit number indicating the day-of-year of the data START_TIME.
UTC_START_HOUR:	A two-digit number indicating the hour of the data START_TIME.
TYPE:	"PKT" for packet/frame data "CHN" for channelized packet data “RAW” for DSN Monitor data

Table 3.2-5 EADR Data File Naming Template

An example file name would be 9903500.PKT for a file containing packet data starting at the beginning of day 35 of year 1999.

3.2.1.8.2 File Labeling

PDS requires a distinct data product label for each individual data file. The label identifies and describes the organization, content, and format of each EADR data product. The PDS data product label is detached, in its own file, in the same directory as the file it describes.

The label consists of four parts:

- Label standards identifier
- File characteristic data element
- Identification data element
- Descriptive data element
- End statement

3.2.1.8.2.1 Label Standard Identifiers

EADR labels adhere to the standards described in PDS Standards Reference, Version 3.2 and its associated Planetary Science Data Dictionary, Version 3.0. The identifiers are as follows:

- PDS Data Element

PDS_VERSION_ID = PDS3

3.2.1.8.2.2 File Characteristic Data Element

PDS data product labels contain data element information that describe important attributes of the physical structure of a data product file. PDS file characteristic data elements are:

RECORD_TYPE
RECORD_BYTES
FILE_RECORDS

The RECORD_TYPE data element identifies the record characteristics of the data product file. The RECORD_BYTES data element identifies the number of bytes in each physical record in the data product file. The FILE_RECORDS data element identifies the number of physical records in the file.

3.2.1.8.2.3 Identification Data Element

The identification data element provides important information about the data to uniquely identify the data product and to associate it with other data products that may be related. This information is often used to populate PDS product level catalogs or inventories.

The following identification data elements are included in the EADR labels:

DATA_SET_ID
PRODUCT_ID
PRODUCT_VERSION_ID
PRODUCT_CREATION_TIME
^FILE_NAME
SPACECRAFT_NAME
START_TIME
STOP_TIME
SPACECRAFT_CLOCK_START_COUNT (omitted for monitor data)
SPACECRAFT_CLOCK_STOP_COUNT (omitted for monitor data)
MISSION_PHASE_NAME
SOFTWARE_NAME
DATA_RECORDS
PRODUCER_ID
INTERCHANGE_FORMAT

- RECORD_TYPE, FILE_RECORD, and RECORD_BYTES

  Because the data files are a stream of binary data the RECORD_TYPE is FIXED_LENGTH. The FILE_RECORD value is set at one and the total number of data bytes is assigned to the RECORD_BYTES value.

- DATA_SET_ID

  M98O-M-ENGINEERING-2-EADR-V1.0

- PRODUCT_ID

Each file shall have a unique PRODUCT_ID which identifies the type and format of the data in the file. PRODUCT_ID values shall be constructed according to the following convention:

<PRODUCT_TYPE>_<yyyy>_<ddd>_<hh>

Where the value <yyyy> is the UTC year of the first data in the file, and <ddd> is the UTC day of year of the first data and <hh> is the UTC hour of the first data. The PRODUCT_TYPEs are defined in the following table.

Product Type	Description	Size (hours)
MON	DSN Monitor frames	6
CH_MON	Channelized DSN Monitor data	6
ORB_AACS_DUMP	AACS Dump, S/C Bus Packets (SBP)	24
CH_ORB_AACS_DUMP	AACS Dump, SBP channelized	24
ORB_ACYCLIC	Acyclic Measurements, SBP	24
CH_ORB_ACYCLIC	Acyclic Measurements, channelized	24
ORB_APID_18	APID-18, SBP	24
CH_ORB_APID_18	APID-18, SBP channelized	24
ORB_APID_19	APID-19, SBP	24
CH_ORB_APID_19	APID-19, SBP channelized	24
ORB_APID_23	APID-23, SBP	24
CH_ORB_APID_23	APID-23, SBP channelized	24
ORB_APID_24	APID-24, SBP	24
CH_ORB_APID_24	APID-24, SBP channelized	24
ORB_APID_25	APID-25, SBP	24
CH_ORB_APID_25	APID-25, SBP channelized	24
ORB_APID_26	APID-26, SBP	24
CH_ORB_APID_26	APID-26, SBP channelized	24
ORB_APID_27	APID-27, SBP	24
CH_ORB_APID_27	APID-27, SBP channelized	24
ORB_APID_28	APID-28, SBP	24
CH_ORB_APID_28	APID-28, SBP channelized	24
ORB_APID_29	APID-29, SBP	24
CH_ORB_APID_29	APID-29, SBP channelized	24
ORB_DATA_DUMP	Data Dump, SBP	24
CH_ORB_DATA_DUMP	Data Dump, SBP channelized	24
ORB_EVR_INFO	EVR Information, SBP	24
CH_ORB_EVR_INFO	EVR Information, SBP channelized	24
ORB_EVR_WARNING	EVR Warning, SBP	24
CH_ORB_EVR_WARNING	EVR Warning, SBP channelized	24
ORB_EVR_FAULT	EVR Fault, SBP	24
CH_ORB_EVR_FAULT	EVR Fault, SBP channelized	24
ORB_EVR_FATAL	EVR Fatal, SBP	24
CH_ORB_EVR_FATAL	EVR Fatal, SBP channelized	24
ORB_FILL_RT	Fill Realtime, SBP	24
CH_ORB_FILL_RT	Fill Realtime, SBP channelized	24
ORB_NOM_REC_LOW	Nominal Recorded Low Rate, SBP	6
CH_ORB_NOM_REC_LOW	Nominal Recorded Low Rate, SBP channelized	6
ORB_NOM_REC_MED	Nominal Recorded Med Rate, SBP	6
CH_ORB_NOM_REC_MED	Nominal Recorded Med Rate, SBP channelized	6
ORB_NOM_REC_HIGH	Nominal Recorded High Rate, SBP	6
CH_ORB_NOM_REC_HIGH	Nominal Recorded High Rate, SBP channelized	6

ORB_NOM_REC_MAP	Nominal Recorded Mapping, SBP	6
CH_ORB_NOM_REC_MAP	Nominal Recorded Mapping, SBP channelized	6
ORB_NOM_RT	Nominal Realtime, SBP	6
CH_ORB_NOM_RT	Nominal Realtime, SBP channelized	6
ORB_SM_REC_LOW	Safe Mode Recorded Low Rate, SBP	24
CH_ORB_SM_REC_LOW	Safe Mode Recorded Low Rate, SBP channelized	24
ORB_SM_REC_MED	Safe Mode Recorded Med Rate, SBP	24
CH_ORB_SM_REC_MED	Safe Mode Recorded Med Rate, SBP channelized	24
ORB_SM_REC_HIGH	Safe Mode Recorded High Rate, SBP	24
CH_ORB_SM_REC_HIGH	Safe Mode Recorded High Rate, SBP channelized	24
ORB_SM_RT	Safe Mode Realtime Data, SBP	24
CH_ORB_SM_RT	Safe Mode Realtime Data, SBP channelized	24
ORB_SPEC_ABDP	Special Aerobraking, SBP	24
CH_ORB_SPEC_ABDP	Special Aerobraking, SBP channelized	24
ORB_SPEC_ACAL	Special Accelerometer, SBP	24
CH_ORB_SPEC_ACAL	Special Accelerometer, SBP channelized	24
ORB_SPEC_BURN	Special Burns, SBP	24
CH_ORB_SPEC_BURN	Special Burns, SBP channelized	24
ORB_SPEC_DUAL	Special Dual AD, SBP	24
CH_ORB_SPEC_DUAL	Special Dual AD, SBP channelized	24
ORB_SPEC_SLEW	Special Slews, SBP	24
CH_ORB_SPEC_SLEW	Special Slews, SBP channelized	24
ORB_SPEC_STOW	Special Stows, SBP	24
CH_ORB_SPEC_STOW	Special Stows, SBP channelized	24
ORB_SPEC_UPLV	Special Uplink verification, SBP	24
ORB_CH_SPEC_UPLV	Special Uplink verification, SBP channelized	24
ORB_TIME_CORR	Time Correlation, SBP	24
CH_ORB_TIME_CORR	Time Correlation, SBP channelized	24
ORB_MARCI_ENG	MARCI Engineering, SBP	6
CH_ORB_MARCI_ENG	MARCI Engineering, SBP channelized	6
ORB_MARCI_SCI	MARCI Science Instrument Packets	6
CH_ORB_MARCI_SCI	MARCI Science Instrument Packets, channelized	6
ORB_SMALL_FORCES	Small Forces Packets	24
CH_ORB_SMALL_FORCES	Small Forces Packets, channelized	24
ORB_PMIRR_HIGH	PMIRR Eng High Rate, SBP	6
CH_ORB_PMIRR_HIGH	PMIRR Eng High Rate, SBP channelized	6
ORB_PMIRR_LOW	PMIRR Eng Low Rate, SBP	6
CH_ORB_PMIRR_LOW	PMIRR Eng Low Rate, SBP channelized	6
ORB_PMIRR_SCI_1	PMIRR Science Instrument Packets	6
CH_ORB_PMIRR_SCI_1	PMIRR Science Instrument Packets, channelized	6
ORB_PMIRR_SCI_ANOM	PMIRR Instrument Anomaly Packets	6
CH_ORB_PMIRR_SCI_ANOM	PMIRR Instrument Anomaly Packets, channelized	6

Table 3.2-5 EADR Product Types

For example, the PRODUCT_ID for nominal real-time bus data for the first six hours of day 035 of year 1999 will be:

ORB_NOM_RT_1999_035_00

- START_TIME & STOP_TIME

The START_TIME and STOP_TIME attributes shall be SCET for spacecraft telemetry data, and MST for DSN Monitor data.

- SPACECRAFT_CLOCK_START_COUNT & SPACECRAFT_CLOCK_STOP_COUNT

  The SPACECRAFT_CLOCK_... fields are not applicable to DSN Monitor data, and will not be included in labels of this type.

- DATA_RECORDS

  The DATA_RECORDS attribute specifies the total number of telemetry data records (CHDOs) contained in the file.

3.2.1.8.2.4 Descriptive Data Element

The descriptive data element provides information that is needed to interpret or process the data objects and to catalog them to support product level search criteria.

The following descriptive data element is included in the EADR detached labels:

^DESCRIPTION
NOTE

3.2.1.8.2.5 End Statement

The end of the PDS label is identified by the END statement.

```
PDS_VERSION_ID          = PDS3
RECORD_TYPE             = FIXED_LENGTH
FILE_RECORDS            = 1
RECORD_BYTES            = 2341655
SPACECRAFT_NAME         = MARS_CLIMATE_ORBITER
DATA_SET_ID             = "M98O-M-ENGINEERING-2-EADR-V1.0"
PRODUCT_ID              = ORB_NOM_RT_1999_035_00
PRODUCT_VERSION_ID      = "1.0"
PRODUCT_CREATION_TIME   = 1999-039T21:36:59.000
^FILE_NAME              = "9903500.PKT"
MISSION_PHASE_NAME      = CRUISE
SOFTWARE_NAME           = "Multimission Ground Data System V23.2"
START_TIME              = 1999-035T00:00:00.000
STOP_TIME               = 1999-035T06:00:00.000
SPACECRAFT_CLOCK_START_COUNT = "543045615.071"
SPACECRAFT_CLOCK_STOP_COUNT  = "543067215.072"
DATA_RECORDS            = 1000
PRODUCER_ID             = MSOP_DATA_ADMINISTRATION
INTERCHANGE_FORMAT      = BINARY
^DESCRIPTION            = "DATASET.TXT"
END
```

Figure 3.2-3 EADR Detached Data Product Label Structure

3.3 EADR Static Documentation Volume

The Static Documentation Volume (SDV) is intended to supplement the EADR Volume Set by providing MSP98 mission documentation and other associated documentation.

3.3.1.1 Directory Structure

The SDV is constructed using the standard PDS archive set directory structure (see Applicable Document #5). The SDV Directory Tree follows in Figure 3.3-1.

```
ROOT-
      |
      |-AAREADME.TXT (Information describing this volume)
      |-ERRATA.TXT   (Error data for this volumes in the set)
      |-VOLDESC.CAT  (PDS language description of this volume)
      |
      |-INDEX-
      |        |
      |        |-INDXINFO.TXT (Information about the files in this directory)
      |        |-INDEX.LBL    (PDS compliant detached label)
      |        |-INDEX.TAB    (Tabular list of document and software files on this
      |                        volume)
      |
      |-DOCUMENT-
                 |
                 |-DOCINFO.TXT  (Information about the files in this directory)
                 |-(Many documents in ASCII text, and Portable Document Format.
                 |-(See paragraph 3.3.1.3 below)
```

Figure 3.3-1 SDV Directory Tree

3.3.1.2 INDEX Directory Contents

This volume will include the same INDEX type directory files as are included on the data volumes (see paragraph 3.2.1.3.1, “INDEX.TAB, INDEX.LBL”).

3.3.1.3 DOCUMENT Directory Contents

The DOCUMENT directory contains relevant project and AMMOS documents in ASCII text format. Postscript image and Portable Document Format will be provided wherever possible. Each file contains a single document.

The following table lists the files in the DOCUMENT directory:

File	Contents	AMMOS SIS
DUNJPL.TXT	Compressed Header Data Object (CHDO) Description	SFOC-5-SYS-*DU-NJPL
DUSFDU.TXT	CHDO Secondary Header Description	SFOC-5-TIS-*DU-SFDU

MCOSFDU.TXT	Description of Tertiary and Quaternary Headers for M98 Stream Data	SFOC-5-TIS-*DU-M98SFDU
MCORAWMN.TXT	Description of Standard Formatted Unit (SFDU) for M98 Raw GCF Monitor Blocks	SFOC-1-GIF-DSN-M98GCFMON
MCOCHMON.TXT	Description of SFDU for MSP98 Channelized Monitor	SFOC-5-TIS-*DU-SFDU SFOC-1-9-00-03
MCOCHENG.TXT	Description of SFDU for MSP98 Channelized ENG	SFOC-5-TIS-*DU-MGSFDU SFOC-5-SYS-*DU-NJPL SFOC-5-TIS-*DU-SFDU
MCOTLMDI.TXT	MSP98 MCO Telemetry Dictionary	N/A
SFDUCAT2.TXT	SFDU K-Header Description, File Data	SFOC-2-Any-Catalog2
CRTSPEC.TXT	Channel Parameter Table SIS	SFOC-1-MCA-DMD-CPTSpec
SCLKSCET.TXT	SCLK/SCET Coefficients	SFOC-1-DPS-ANY-SCLKvSCET

Table 3.3-1 SDV DOCUMENT Directory Files

Appendix A

4. Appendix A

4.1 Support Staff

The following table lists the support staff and facilities.

Information Required	**Contact Address**
How to read the EADR Volume:	Gary L. Smith, DAA Cog. Engineer MS 230-109 Jet Propulsion Laboratory 4800 Oak Grove Drive Pasadena, CA 91109 818-393-5973 Electronic mail address: Gary.L.Smith@jpl.nasa.gov