Mars Pathfinder Project

Mars Pathfinder
Imager for Mars Pathfinder
Experiment Data Record
Compact Disc - Read Only Memory
Software Interface Specification

D-14590
PF-400-8.02
July, 1998
Version 1.8

Elizabeth Duxbury

JPL
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, California 91109-8099

Printed July 15, 1998

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ACRONYMS AND ABBREVIATIONS

ADC	Analog to Digital Converter
AIM	Attitude Information Management
APXS	Alpha Proton X-Ray Spectrometer
ASCII	American Standard Code for Information Interchange
ASI/MET	Atmospheric Structure Instrument/Meteorology Package
BTC	Block Truncation Coding
CAHV	Camera model described by four vectors C, A, H and V
CAHVOR	Camera model CAHV which accounts for CCD and non-linear distortions
CBE	Current Best Estimate
CCD	Charge-Coupled Device
CD-ROM	Compact Disc - Read Only Memory
CD-WO	Compact Disc - Write Once
c.g.	center of gravity
CODMAC	Committee On Data Management And Computation
COSPAR	Committee On Space Research
dB	Decibel
DCT	Discrete Cosine Transform
DN	Data Number or Digital Number
DOS	Disc Operating System
DPW	Data Preparation Workbook
DSN	Deep Space Network
E&H	Engineering and Health
EDL	Entry, Descent, and Landing
EDR	Experiment Data Record
EEPROM	Electronically Eraseable Programmable Read Only Memory
EH&A	Engineering, Housekeeping, and Accountability
EOF	End of File
EST	Eastern Standard Time
ETR	Eastern Test Range
FOV	Field of View
GEM	Graphite Epoxy Motor
GMT	Greenwich Mean Time
HFS	Hierarchical File System
HGA	High Gain Antenna
HTML	HyperText Markup Language
IAG	International Association of Geodesy
IAU	International Astronomical Union
IBM	International Business Machines®
ICT	Integer Cosine Transform
IDL	Interactive Data Language
IMP	Imager for Mars Pathfinder
ISA	Integrated Support Assembly
ISO	International Standards Organization
IVP	Image Vector Pointing
JPEG	Joint Photographic Experts Group
JPL	Jet Propulsion Laboratory
LCT	Linear Cosine Transform
LGA	Low Gain Antenna
LPL	Lunar and Planetary Laboratory

LREU	Lander Remote Engineering Unit
LST	Local Solar Time
Mbytes	Megabytes
MESUR	Mars Environmental Survey
MFEX	Microrover Flight Experiment
MFX	Martian Surface Fixed coordinate frame (check)
MGA	Medium Gain Antenna
MIPL	Multimission Image Processing Laboratory
MIPS	Multimission Image Processing Subsystem
MIPS	Millions of Instructions Per Second
MLL	Mars Local Level coordinate frame (check)
MPF	Mars Pathfinder
MPFL	Mars Pathfinder Lander
MPFR	Mars Pathfinder Rover
MSB	Most Significant Bit (or Byte)
MSW	Microsoft® Word
NAIF	Navigation and Ancillary Information Facility
NASA	National Aeronautics and Space Administration
NCS	Nutation Control System
NIST	National Institute of Standards and Technology
NSSDC	National Space Science Data Center
PAM-D	Payload Assist Module-D
PC	Personal Computer
PDF	Adobe® Portable Document Format
PDS	Planetary Data System
PDT	Pacific Daylight Time
PF	Pathfinder
PIO	Public Information Office
PROM	Programmable Read Only Memory
PRT	Platinum Resistance Thermometer
PSDD	Planetary Science Data Dictionary
PST	Pacific Standard Time
RAD	Rocket Assisted Descent
RAM	Random Access Memory
RF	Radio Frequency
RFS	Radio Frequency Subsystem
RICE	A lossless compression algorithm developed by Bob Rice of JPL
RPM	Revolutions Per Minute
RSI	Research Systems Incorporated®
RVR	Rover
SAT	Science Advisory Team
SFDU	Standard Formatted Data Unit
SIS	Software Interface Specification
SOG	Science Operations Group
SPICE	Spacecraft Planet Instrument C-matrix Events
sps	samples per second
TBD	To Be Determined
TC	thermocouple
TCM	Trajectory Correction Maneuver
TDS	Telemetry Delivery Subsystem
TMU	Telemetry Modulation Unit
UAMS	Upper Atmosphere Mass Spectrometer
UHF	Ultra High Frequency

UOFA	University of Arizona
USGS	United States Geological Survey
UTC	Universal Time Coordinated
VICAR	Video Image Communication and Retrieval system
VL	Viking Lander
VME	VersaModule European, a reliable, multiple-processor, bus architecture
VMS	Virtual Memory System
XAR	Extended Attribute Record

ACTION ITEMS FOR CLOSURE

Item	Assignee	Closure Date

1.0 INTRODUCTION

1.1 Content Overview

This Software Interface Specification (SIS) describes the form and content of the Imager for Mars Pathfinder (IMP) Experiment Data Record (EDR) Compact Disc - Read Only Memory (CD-ROM).

The IMP EDR CD-ROMs shall be generated by the Multi-mission Image Processing Subsystem (MIPS) at the Jet Propulsion Laboratory in order to distribute the data acquired by the IMP to the project scientists and later to the Planetary Data System (PDS).

An attached PDS label shall be included with each data file. Documentation files shall be provided which inform the user about the organization and content of each disc, the definition of the labels, and the index files containing information about all the data files stored in the data set.

All PDS label formats and documentation are based on the Planetary Data System Data Preparation Workbook (reference 1).

All data formats are based on the Planetary Science Data Dictionary Document (PSDD) (reference 3).

1.2 Scope

The specifications in this document apply to all IMP EDR CD-ROMs that are produced during the Mars Pathfinder mission.

1.3 Applicable Documents

Applicable documents used in producing this specification include:

1) Planetary Data System Data Preparation Workbook, JPL D-7669, Part 1.
2) Planetary Data System Standards Reference, JPL D-7669, Part 2.
3) Planetary Science Data Dictionary Document, JPL D-7116.
4) Information Processing - Volume and File Structure of CD-ROM for Information Interchange, ISO 9660-1988.
5) Imager for Mars Pathfinder Experiment Data Record, JPL D-12003.
6) Archive Generation, Validation, and Transfer Plan, JPL D-14432, PF-400-8.0.
7) Mars Pathfinder AIM Phasing and Coordinate Frame Document, JPL D-12103, PF-300-4.0-04

2.0 INTERFACE CHARACTERISTICS

2.1 Operations Perspective

2.1.1 Data Source, Destinations, and Transfer Method

IMP EDR CD-ROMs shall be produced by MIPS for distribution to the Mars Pathfinder Project. MIPS shall use freely available CD-ROM publishing software, which shall reside at MIPS, to produce premastered CD-WOs for delivery and release to the mastering vendor for production of CD-ROMs. The mastering vendor will ship the discs to MIPS for distribution and archiving. Copies of the CDs will be archived with the Imaging Node of the PDS and with the National Space Science Data Center.

2.1.2 Generation Method and Frequency

The IMP EDR CD-ROM data shall be generated using MIPS software. The EDR data processing includes decoding and decompressing the IMP image data in single frame form. These data products conform to NASA level 0 or CODMAC level 2 data products. (A more complete description of the EDRs is available in the IMP EDR SIS, reference 5, a copy of which will be included on the CDs.) MIPS will then pre-master the data to CD-WO.

The CD-ROMs shall be produced as rapidly as possible on a best efforts basis. It is intended that the first CD volume should be published within six months of receipt of the data.

2.2 Volume and Size

Each CD-ROM shall contain at most 650 Mbytes of data. Within this limitation, as many data files as can fit on a CD-ROM will be included. This is expected to result in the publication of a three volume set.

2.3 Interface Medium Characteristics

IMP EDR CD-ROM physical characteristics shall conform to ISO-9660 level 1 industry standards (reference 4).

2.4 Backup and Duplicate Copies

The CD-ROM contents shall be stored on magnetic disc until a validated master has been produced. CD-WO copies of the disc shall be retained at MIPS.

3.0 CD-ROM CONTENT AND FORMAT

This section describes in detail the format and content of the IMP EDR CD-ROM.

3.1 Format

IMP EDR CD-ROM data shall be formatted in accordance with Planetary Data System specifications (references 1-3). The format is described below.

3.1.1 Disc Format

The IMP EDR CD-ROM format shall be compatible with various computer systems including IBM PC, Apple Macintosh, Sun, and Digital VAX. However, the data files will not contain extended attribute records, so users of older VMS systems may have dificulty reading them. The EDR CD-ROM format shall be in accordance with the ISO-9660 level 1 Interchange Standard (reference 4).

3.1.2 File Formats

The following paragraphs describe file formats for the various kinds of files contained on the CD-ROMs.

3.1.2.1 Text Files

Text files (.TXT suffix) may exist in any directory, including the root directory. They are ASCII files with attached PDS labels, and provide information about the data on the CD (as in the AAREADME.TXT file) or about data in a specific directory. All text files are streams of bytes with both a carriage return character (ASCII 13) and a line feed character (ASCII 10) as the line terminator. This allows the files to be read by the HFS, DOS, UNIX, and VMS operating systems.

The following is a sample PDS label for an AAREADME.TXT file.

```
PDS_VERSION_ID          = PDS3
RECORD_TYPE             = STREAM

OBJECT                  = TEXT
  PUBLICATION_DATE      = 1997-07-04
  INTERCHANGE_FORMAT    = ASCII
  NOTE                  = "This file describes the format and content of
                           this CD-ROM."
END_OBJECT              = TEXT
END
```

3.1.2.2 Document Files

Document files exist in the document directory, and include textual material describing the mission, spacecraft, instruments, data sets, and calibration. The MPF Image Browser also consists of HTML formatted document files, located in the browse directory. Possible formats for these documents include Adobe Portable Document Format (".PDF"), HyperText Markup Language (".HTM"), and plain ASCII (".ASC"). At least one copy of each document file must be in either plain ASCII or HTML. Illustrations and images for these documents are stored in separate GIF or JPEG formatted files, which are also considered to be document files.

All ASCII and HTML files are streams of bytes with both a carriage return character (ASCII 13) and a line feed character (ASCII 10) as the line terminator. The ASCII files can be read on any operating system. The HTML files can be read with most World Wide Web browsers that are capable of displaying tables. The PDF documents are a binary format that can be read with the Adobe Acrobat Reader, available from "http://www.adobe.com". GIF and JPEG images can be displayed using many commonly available image display programs.

All document files are described by detached PDS labels. The PDS label file has the same name as the document file(s) it describes, with the extension ".LBL", unless the single label describes multiple files that make up the same document, (ex., "CALIB001.GIF", "CALIB002.GIF", "CALIB003.GIF"). In this case, the label file has a similar name to the document, ex. "CALIB.LBL". The following is a sample detached PDS label file, entitled "VOLSIS.LBL", describing this document, found in the "VOLSIS.HTM" and "VOLSIS.PDF" files.

```
PDS_VERSION_ID          = PDS3
RECORD_TYPE             = STREAM
^HTML_DOCUMENT          = "VOLSIS.HTM"
^PDF_DOCUMENT           = "VOLSIS.PDF"

OBJECT                  = HTML_DOCUMENT
  DOCUMENT_NAME         = "Mars Pathfinder IMP EDR CD-ROM SIS"
  DOCUMENT_TOPIC_TYPE   = VOLUME_SIS
  INTERCHANGE_FORMAT    = ASCII
  DOCUMENT_FORMAT       = HTML
  PUBLICATION_DATE      = 1998-07-01
END_OBJECT              = HTML_DOCUMENT

OBJECT                  = PDF_DOCUMENT
  DOCUMENT_NAME         = "Mars Pathfinder IMP EDR CD-ROM SIS"
  DOCUMENT_TOPIC_TYPE   = VOLUME_SIS
  INTERCHANGE_FORMAT    = BINARY
  DOCUMENT_FORMAT       = PDF
  PUBLICATION_DATE      = 1998-07-01
END_OBJECT              = PDF_DOCUMENT
END
```

3.1.2.3 Catalog Files

Catalog files (".CAT" suffix) exist in the catalog directory, with the exception of the VOLDESC.CAT file which is located in the root directory. These are ASCII files formatted as PDS catalog objects (see reference 2). All catalog files are streams of bytes with both a carriage return character and a line feed character as the line terminator. This allows the files to be read by the HFS, DOS, UNIX, and VMS operating systems.

Copies of some catalog files are also included in HTML format. These files are indicated with the suffix ".HTM" and are kept in the document, rather than the catalog, directory.

3.1.2.4 Tabular Files

Tabular files (.TAB suffix) are ASCII files formatted for direct reading into many database management systems on various computers. All fields are separated by commas, and character fields are enclosed in double quotation marks ("). (Character fields are padded with spaces to keep quotation marks in the same columns.) Character fields are left justified, and numeric fields are right justified. The "START_BYTE" and "BYTES" values listed in the 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 normal text file on other computers.

All tabular files are described by detached PDS labels. The PDS label file has the same name as the data file it describes, with the extension .LBL; for example, the file INDEX.TAB is accompanied by the detached label file INDEX.LBL in the same directory.

3.1.2.5 PDS Label Files

PDS label files (.LBL suffix) are located in many directories. They are descriptive labels (see reference 4) and may be either attached to or detached from their associated files.

The PDS label file is an object-oriented file; the object to which the label refers (e.g. IMAGE, TABLE, etc.) is denoted by a statement of the form:

```
^object = location
```

in which the carat character (^, also called a pointer in this context) indicates that the object starts at the given location. The location denotes the name of the file containing the object, if the label is detached, or the starting record or byte number, if the label is attached. For example:

```
^INDEX_TABLE = "INDEX.TAB"
```

indicates that the INDEX_TABLE object described by the INDEX.LBL file is in the file named "INDEX.TAB".

```
^IMAGE = 3
```

indicates that the IMAGE object begins at record 3 of the same file that the label is attached to. Below is a list of the possible formats for the ^object definition.

```
^object     = n
^object     = n <BYTES>
^object     = ("filename.ext")
^object     = ("filename.ext",n)
^object     = ("filename.ext",n <BYTES>)
```

where

n	is the starting record or byte number of the object, counting from the beginning of the file (unless specified as bytes, this is assumed to be records),
<BYTES>	indicates that the number given is in units of bytes,
filename	is the upper-case file name,
ext	is the upper-case file extension,
dirlist	is a UNIX style, forward slash-delimited path-list of parent directories, in upper case, that specifies the object file directory (used only when the object is not in the same directory as the label file). The list begins at directory level below the root directory of the CD-ROM. 'dirlist/' may be omitted when the object being described is located either in the same directory as the detached label, or in a subdirectory named 'label' that is located in a higher level of the directory tree, typically the CD-ROM root itself.

All labels contain 80-byte fixed-length records, with a carriage return character (ASCII 13) in the 79th byte and a line feed character (ASCII 10) in the 80th byte. This allows the files to be read by the HFS, DOS, Unix, and VMS operating systems.

3.1.2.6 Data Files

The detailed specifications for the formats of the image files are described in a Software Interface Specification published by MIPS (reference 5) and in the DATASET.CAT file, both of which are included on the CDs. The image files are all uncompressed 16-bit PDS formatted files with attached PDS labels.

3.2 Content

The following paragraphs describe the content of the CD-ROMs.

3.2.1 Volume Set

The IMP EDR CD-ROM volume set is numbered MPIM_0001 through MPIM_0003. Each CD in the set will contain the same directory structure, with the exception of the data subdirectories, which will vary from one CD to another, as they are named on the basis of time.

3.2.2 Directories

The IMP EDR CD-ROM directory structure consists of one ROOT directory, a BROWSE subdirectory, a CATALOG subdirectory, a DOCUMENT subdirectory, a GAZETTER subdirectory, an INDEX subdirectory, and multiple data subdirectories. The data subdirectories are divided first on the basis of target, then on the basis of command sequence number, and finally on the basis of planet day number or "sol".

The root directory contains files describing the content and format of the CD-ROMs. The catalog subdirectory contains the completed catalog templates for the instrument and data set included on the volume. Any other templates (mission, instrument host, reference, and personnel) that are available at the time the CDs are created will also be included. The gazetteer directory includes a gazetteer of the informal names of the rocks and other features at the MPF landing site, in tabular format. Files in the index directory include tables of label items describing the observation of each EDR frame, and PDS labels which in turn describe the index tables. Each index table entry is generated after the corresponding EDR file is processed in the CD generation procedure. The INDEX tables on each CD-ROM shall only reflect those files contained on that CD-ROM. Separate, cumulative index files which contain a complete listing of all EDRs on the set, will also be included on the volumes.

Files in each of the data subdirectories consist of an EDR data file with an associated attached PDS label, organized in sub-directories first by target, sequence number, and sol. The following tables describe the content and source of files in the CD-ROM directories. (Source indicates the group providing the current version of a file.)

3.2.2.1 Root Directory

The following table lists the files in the root directory. The ERRATA.TXT file may not be present on all CDs, as it will document errors discovered on previous CDs in the set.

Table 3.2.2.1 Root Directory Contents

File	Contents	Source
AAREADME.HTM, LBL, TXT	Textual information describing CD-ROM content and format.	MIPS
ERRATA.HTM, LBL, TXT	Textual information describing errors and/or anomalies found on the current or previous CDs.	MIPS
VOLDESC.CAT	A description of the contents of this CD-ROM volume in a human and machine readable format.	MIPS

3.2.2.2 Catalog Subdirectory

The files in this directory contain textual information about many aspects of the mission and data, and are written in a format that may be loaded into the PDS Central Node's Data Set Catalog. The following table lists the files in the catalog subdirectory.

Table 3.2.2.2 Catalog Directory Contents

File	Contents	Source
CATINFO.TXT	A textual description of the contents of the CATALOG subdirectory.	MIPS
DATASET.CAT	A description of the IMP EDR data set, including such things as processing history, data format, and ancillary data necessary to use the data.	MIPS
INST.CAT	A detailed textual description of the Imager for Mars Pathfinder.	IMP team
INSTHOST.CAT	A textual description providing an overview of the Mars Pathfinder Lander.	IMP team
MISSION.CAT	A detailed description of the Mars Pathfinder mission.	IMP team
PERSON.CAT	Contact information for people responsible for producing the Mars Pathfinder data sets.	IMP team
REF.CAT	A list of references of papers providing further information about the data set.	IMP team

3.2.2.3 Document Subdirectory

This directory contains textual files describing the data sets and instruments, plus any other supplementary information available at the time the CDs are ready to be published.

Table 3.2.2.3 Document Directory Contents

File	Contents	Source
DOCINFO.TXT	Textual description of the files included in the document directory.	MIPS
CONTACTS.ASC, LBL	Contact information for Mars Pathfinder personnel.	Project

DATASET.HTM, LBL	A description of the IMP data set, including such things as processing history, data format, and ancillary data necessary to use the data.	IMP team
EDRSIS.HTM, LBL, PDF	Imager for Mars Pathfinder Experiment Data Record	MIPS
IMPUG.HTM, PDF, LBL	Imager for Mars Pathfinder User's Guide	IMP team
INST.HTM, LBL	A detailed textual description of the Imager for Mars Pathfinder.	IMP team
INSTHOST.HTM, LBL	A textual description providing an overview of the Mars Pathfinder Lander	IMP team
MISSION.HTM, LBL	A detailed description of the Mars Pathfinder mission.	Project
REF.HTM, LBL	A list of references of papers providing further information about the data set.	IMP team
VOLSIS.HTM, LBL, PDF	MPF Imager for Mars Pathfinder Experiment Data Record CD-ROM SIS	MIPS

3.2.2.4 Gazetteer Subdirectory

The files in this directory contain textual and tabular information about the named features at the Mars Pathfinder landing site. Please note that this information is provided as a convenience to researchers, and that the names assigned to features here have not been approved by the International Astronomical Union. Also note, that only those files which are available at the time the data is ready for CD mastering will be included. Thus, no guarantee is made that all the described files will be included.

Table 3.2.2.4 Gazetteer Directory Contents

File	Contents	Source
GAZINFO.TXT	A textual description of the contents of the GAZETTER subdirectory.	MIPS
GAZETTER.TXT	A textual description of the structure and contents of the gazetteer table.	Bob Kanefsky
GAZETTER.LBL	The PDS label describing the structure of the gazetteer table.	Bob Kanefsky
GAZETTER.TAB	A table of the MPF landing site named features, along with some descriptive information.	Bob Kanefsky

3.2.2.5 Index Subdirectory

The following table lists the files in the index subdirectory.

Table 3.2.2.5 Index Directory Contents

File	Contents	Source
INDXINFO.TXT	Textual description of the contents of the INDEX directory.	MIPS
INDEX.LBL	A PDS formatted label describing the format of the INDEX.TAB file.	MIPS

INDEX.TAB	A tabular index of selected label items describing the IMP image files on the CD. This table alone is sufficient for doing simple searches for data on the CDs.	MIPS
CUMINDEX.LBL	A PDS formatted label describing the format of the CUMINDEX.TAB file.	MIPS
CUMINDEX.TAB	A cumulative tabular index containing the contents of the INDEX.TAB files from all of the IMP EDR CD-ROMs.	MIPS
COMMAND.LBL	A PDS formatted label describing the format of the COMMAND.TAB file.	MIPS
COMMAND.TAB	A table containing information about the commands sent to the IMP camera. Along with the EDRINDEX table, forms a relational database describing most of the available parameters for the images on the CDs.	MIPS
EDRINDEX.LBL	A PDS formatted label describing the format of the EDRINDEX.TAB file.	MIPS
EDRINDEX.TAB	A detailed tabular index of parameters describing the IMP image files. Along with the COMMAND table, forms a relational database describing most of the available parameters for the images on the CDs.	MIPS

3.2.2.6 Data Subdirectories

The data directories that contain the image EDRs are first subdivided on the basis of target, then on the basis of command sequence number, and finally by spacecraft clock start count. Thus the pathname for any image will be constructed as follows:

```
target/sequence/sclk/filename
```

The division of images by target is done primarily on the basis of the observational intent of an image, as indicated by the OBSERVATION_NAME and IMAGE_OBSERVATION_TYPE. The targets include both planetary bodies such as Mars, Phobos, the Sun, and generic "Star", as well as specific objects like calibration targets, and the Rover and Lander. One of the reasons this was done is so that IMP images that were taken primarily for the support of other instrument experiments will all be collected in a single location. However, users of the data should be aware that useful "Mars" images will be scattered throughout the directory heirarchy. For example, an image taken specifically to study the windsocks, and therefore included in the WINDSOCK directory, may also be useful for studying the geological features visible in the background. The targets do not include specific features on Mars like "Barnacle Bill" or "Yogi". Most of the images containing these features will be classified under the general target "MARS". To find images containing specific features, please consult the gazetteer. (See section 3.2.2.4.)

The list of the target directory names and their meanings is shown in the table below. Also included is a list of the command sequences that will be included in each target directory.

Table 3.2.2.6.A Data Target Directories and Their Contents

Directory Name	Description	Command Sequences

APXSSITE	This directory contains images taken of sites where the APXS instrument was deployed. Their purpose is to support that instrument.	71, 72
CALIMG	The images in this directory were taken for calibration purposes. This includes images of the radiometric and fiducial targets on the lander, flat field and dark current images, and readouts of the dark strip and null strip on the CCD.	0 - 2, 7, 8, 15, 17, 25, 30 - 33, 46, 49, 51, 52, 54, 55, 62, 64 - 67, 69, 70, 72 - 74, 161, 164, 171, 172, 190, 191, 194 - 196, 250, 267, 283, 466
DEIMOS	These images were targeted at Deimos.	154
LANDER	These are images targeted at parts of the lander to assess its status. This includes things like the airbag assessment pan and ramp deployment images.	9, 10, 22, 23, 53, 180
MAG	These images were aimed at the various magnetic targets on the lander to study the magnetic properties of airborne particles.	7, 62, 64, 65, 252, 257, 266, 267
MARS	This category consists of the vast majority of the images, those which were taken primarily to view the Martian landscape. It includes most of the major panoramas, the super resolution images, and the change monitoring images.	1, 2, 8, 24, 30 - 33, 44, 69, 70, 73, 74, 161, 162, 164 - 167, 171, 172, 178, 179, 181 - 188, 190, 194, 195, 199, 265, 275 - 277, 279, 288, 290, 294 - 298
PHOBOS	These images were targeted at Phobos.	155, 158, 258, 259
ROVER	These sequences of images were taken to support Rover operations and investigations. This includes things like end of day sequences, movie sequences, navigation images, and soil experiment images.	13, 50, 53 - 56, 350, 353, 354
SKY	This directory includes a variety of images including those taken looking at both high elevations and at the horizon, and at a variety of times of day. (Some images may include the Sun.) Many were taken for the purpose of studying the atmosphere and the particles suspended in it.	35, 36, 39, 46, 151, 152, 156, 280, 283, (1520)
STAR (ARCTURUS, ALTAIR, VEGA)	These images were targeted at the stars Altair, Arcturus, and Vega. These are the one exception to the rule that target = directory name, since they are all grouped together in the “STAR” directory.	154, 158, 258
SUN	These images were targeted at the Sun, usually for the purpose of studying the atmosphere. In cases where a sequence of images, usually around sunset or sunrise, included some images with the sun and some without, the sequence has been included in the SKY directory.	59, 60, 260 - 263
WINDSOCK	The images in this directory were targeted at the windsocks on the ASI/MET mast.	68, 173 - 175

The next level of subdirectories are divided by command sequence number. The command sequence number usually represents a set of commands designed to carry out a particular task. These command sequences were often repeated regularly, and resulted in the production of varying numbers of images. A list of the command sequence numbers and their corresponding observation names is provided in the following table. The "Target" column shows which top-level directory each sequence is stored in on the CDs.

In cases where two targets are listed, the images have been placed in a target directory based on the IMAGE_OBSERVATION_TYPE, pointing angle, or visual inspection. (The target for observations which include either Phobos or Deimos and a star were determined by Nicolas Thomas of the Max Planck Institut fur Aeronomie in Germany.)

Table 3.2.2.6.B IMP Command Sequences

Seq Num	Observation Name	Target
0	IMP_HEALTH_CHECK_#1_(CRUISE)	CALIMG
1	PRE_DEPLOY_RED_PANORAMA	MARS or CALIMG
2	MISSION_SUCCESS_FIRST_LOOK_PART_ONE	MARS or CALIMG
7	MAG_TARGETS_IMP_DEPLOYED_12_FILTERS	MAG
7	MAG_TARGETS_IMP_DEPLOYED_12_FILTERS+RAD_CAL	MAG or CALIMG
7	MAG_TARG_DEPLOYED_15_FILTERS+RAD_CAL_15_FILTERS	MAG or CALIMG
8	IMP_HEALTH_CHECK_#2_(CRUISE)	CALIMG
8	MISSION_SUCCESS_FIRST_LOOK_PART_TWO	MARS
9	FORWARD_RAMP_DEPLOYMENT_IMAGES	LANDER
10	REAR_RAMP_DEPLOYMENT_IMAGES	LANDER
13	ROVER_MOVIE_REAR_RAMP	ROVER
15	UPPER_RAD_CAL_DEPLOYED_15_COLOR	CALIMG
15	UPPER_RAD_CAL_IMAGES_DEPLOYED_12_COLOR	CALIMG
17	COMPRESSED_RAD_CAL2_STOWED_1_COLOR	CALIMG
22	PREDEPLOY_AIRBAG_ASSESS_PAN	LANDER
23	DEPLOYED_AIRBAG_ASSESS_PAN	LANDER
24	SUN_EARTH_HORIZON_PANORAMA[1]	MARS
25	RAD_CAL2_IMP_STOWED_7_COLOR	CALIMG
30	INSURANCE_PAN_FILTER_0_QUADRANT_1	MARS or CALIMG
30	INSURANCE_PAN_FILTER_6_QUADRANT_1	MARS
30	INSURANCE_PAN_FILTER_8_QUADRANT_1	MARS
30	INSURANCE_PAN_FILTER_9_QUADRANT_1	MARS
31	INSURANCE_PAN_FILTER_0_QUADRANT_2	MARS or CALIMG
31	INSURANCE_PAN_FILTER_6_QUADRANT_2	MARS
31	INSURANCE_PAN_FILTER_8_QUADRANT_2	MARS
31	INSURANCE_PAN_FILTER_9_QUADRANT_2	MARS or CALIMG
32	INSURANCE_PAN_FILTER_0_QUADRANT_3	MARS or CALIMG
32	INSURANCE_PAN_FILTER_6_QUADRANT_3	MARS
32	INSURANCE_PAN_FILTER_8_QUADRANT_3	MARS
32	INSURANCE_PAN_FILTER_9_QUADRANT_3	MARS or CALIMG
33	INSURANCE_PAN_FILTER_0_QUADRANT_4	MARS or CALIMG
33	INSURANCE_PAN_FILTER_6_QUADRANT_4	MARS

[1]Sequence 24 actually only included images of the Martian horizon, not the Sun and Earth.

33	INSURANCE_PAN_FILTER_8_QUADRANT_4	MARS
33	INSURANCE_PAN_FILTER_9_QUADRANT_4	MARS
35	NIGHTTIME_OPACITY	SKY
36	EVENING_AUREOLE_AEROSOL_MEASUREMENTS	SKY
39	MORNING_AUREOLE_AEROSOL_MEASUREMENTS	SKY
44	PREDEPLOY_13_COLOR_NEAR_FIELD_LOSSLESS_IMAGE	MARS
46	CLOUD_DETECTION	SKY or CALIMG
49	UPPER_RAD_CAL_IMAGES_DEPLOYED_12_COLOR	CALIMG
50	ROVER_MOVIE	ROVER
51	DARK_CURRENT_CALIBRATION	CALIMG
52	DARK_CURRENT_SUBFRAMES	CALIMG
53	ROVER_MOVIE	ROVER
53	ROVER_NAVIGATION_IMAGES	ROVER
53	LANDER_SOLAR_ARRAY_IMAGES	LANDER
54	ROVER_NAVIGATION_IMAGES	ROVER or CALIMG
54	CONCURRENT_REAR_WHEEL_DIG_IMG	ROVER
55	ROVER_NAVIGATION/ROVER_END_OF_DAY_IMAGES	ROVER or CALIMG
56	ROVER_TRACK_IMAGES	ROVER
56	ROVER_NAVIGATION_IMAGES	ROVER
59	COMPRESSED_AEROSOL_OPACITY_SUN	SUN
60	AEROSOL_OPACITY_SUN	SUN
62	MAG_UPPER_LOWER_STOWED_1	MAG or CALIMG
64	MAG_UPPER_LOWER_STOWED_2	MAG or CALIMG
65	LOWER_MAG_STOWED_2	MAG or CALIMG
66	RAD_CAL2_IMP_STOWED_12_COLOR	CALIMG
67	RAD_CAL2_IMP_STOWED_5_COLOR	CALIMG
68	WINDSOCK_IMAGES	WINDSOCK
69	FILTER_0_IN_2_TIERS_FIRST_QUAD_MONSTER_PAN	MARS or CALIMG
69	FILTER_5_IN_4_TIERS_FIRST_QUAD_MONSTER_PAN	MARS
69	FILTER_6_IN_2_TIERS_FIRST_QUAD_MONSTER_PAN	MARS
69	FILTER_9_IN_2_TIERS_FIRST_QUAD_MONSTER_PAN	MARS
69	FILTER_11_IN_2_TIERS_FIRST_QUAD_MONSTER_PAN	MARS
70	FILTER_0_IN_2_TIERS_SECOND_QUAD_MONSTER_PAN	MARS or CALIMG
70	FILTER_5_IN_4_TIERS_SECOND_QUAD_MONSTER_PAN	MARS
70	FILTER_6_IN_2_TIERS_SECOND_QUAD_MONSTER_PAN	MARS
70	FILTER_9_IN_2_TIERS_SECOND_QUAD_MONSTER_PAN	MARS
70	FILTER_11_IN_2_TIERS_SECOND_QUAD_MONSTER_PAN	MARS
71	APXS_SITE_IMG	APXSSITE
72	APXS_SITE_IMG	APXSSITE or CALIMG
73	FILTER_0_IN_2_TIERS_THIRD_QUAD_MONSTER_PAN	MARS or CALIMG
73	FILTER_5_IN_4_TIERS_THIRD_QUAD_MONSTER_PAN	MARS
73	FILTER_6_IN_2_TIERS_THIRD_QUAD_MONSTER_PAN	MARS
73	FILTER_9_IN_2_TIERS_THIRD_QUAD_MONSTER_PAN	MARS
73	FILTER_11_IN_2_TIERS_THIRD_QUAD_MONSTER_PAN	MARS
74	FILTER_0_IN_2_TIERS_FOURTH_QUAD_MONSTER_PAN	MARS or CALIMG
74	FILTER_5_IN_4_TIERS_FOURTH_QUAD_MONSTER_PAN	MARS
74	FILTER_6_IN_2_TIERS_FOURTH_QUAD_MONSTER_PAN	MARS
74	FILTER_9_IN_2_TIERS_FOURTH_QUAD_MONSTER_PAN	MARS

74	FILTER_11_IN_2_TIERS_FOURTH_QUAD_MONSTER_PAN	MARS
151	SUNSET_EVENING_AEROSOL_MEASUREMENTS	SKY
151	MORNING_TWILIGHT_AEROSOL_MEASUREMENTS	SKY
152	SUNSET_EVENING_AEROSOL_MEASUREMENTS	SKY
154	DEIMOS_13_FILTERS+2_STARS	DEIMOS or STAR
154	STARS_2_+_DEIMOS_13_FILTERS	DEIMOS or STAR
154	ALTAIR_VEGA_+_DEIMOS_13_FILTERS	DEIMOS or STAR
155	FAST_PHOBOS_IMAGING	PHOBOS
156	NIGHTTIME_OPACITY_2	SKY
158	STARS_2_+_PHOBOS_13_FILTERS	PHOBOS or STAR
158	ALTAIR_VEGA_+_PHOBOS_13_FILTERS	PHOBOS or STAR
158	ARCTURUS_VEGA_+_PHOBOS_13_FILTERS	PHOBOS or STAR
161	MULTISPECTRAL_SLICE	MARS or CALIMG
162	MISTY_MOUNTAIN	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN_TIER_1_RED	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_RED	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_RED	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_RED	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_RED	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_BLUE	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_BLUE	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_BLUE	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_BLUE	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_BLUE	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_GREEN	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_GREEN	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_GREEN	MARS
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_GREEN	MARS or CALIMG
164	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_GREEN	MARS or CALIMG
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_RED	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_RED	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_RED	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_RED	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_RED	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_BLUE	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_BLUE	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_BLUE	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_BLUE	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_BLUE	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_GREEN	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_GREEN	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_GREEN	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_GREEN	MARS
165	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_GREEN	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_RED	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_RED	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_RED	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_RED	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_RED	MARS

166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_BLUE	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_BLUE	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_BLUE	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_BLUE	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_BLUE	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_1_GREEN	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_2_GREEN	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_3_GREEN	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_4_GREEN	MARS
166	GALLERY_PAN/PRESIDENTIAL_PAN _TIER_5_GREEN	MARS
167	GALLERY_PAN/PRESIDENTIAL_PAN _MISSING_IMAGES	MARS
171	MULTISPECTRAL_SPOTS_13_COLOR+LOWER_RAD_CAL	MARS or CALIMG
172	MULTISPECTRAL_SPOTS_13_COLOR+RAD_CAL	MARS or CALIMG
173	WINDSOCK_IMAGES	WINDSOCK
174	NO_PROFILE_WINDSOCK_IMAGES	WINDSOCK
175	WINDSOCK_IMAGES	WINDSOCK
178	DUST_DEVIL_SEARCH	MARS
179	CHANGE_MONITORING	MARS
179	CHANGE_MONITORING_I	MARS
180	AIRBAG_RECHECK/ROVER_PETAL_PANORAMA	LANDER
181	SUPERPAN_OCTANT_1_TIER_A	MARS
182	SUPERPAN_OCTANT_1_TIER_C	MARS
182	SUPERPAN_OCTANT_2_TIER_A	MARS
182	SUPERPAN_OCTANT_2_TIER_B	MARS
182	SUPERPAN_OCTANT_2_TIER_C	MARS
182	SUPERPAN_OCTANT_2_TIER_D	MARS
182	SUPERPAN_OCTANT_2_TIER_E	MARS
183	SUPERPAN_OCTANT_3	MARS
183	SUPERPAN_OCTANT_3_TIER_A	MARS
184	SUPERPAN_OCTANT_4_TIER_A	MARS
184	SUPERPAN_OCTANT_4_TIER_B	MARS
184	SUPERPAN_OCTANT_4_TIER_C	MARS
184	SUPERPAN_OCTANT_4_TIER_D	MARS
184	SUPERPAN_OCTANT_4_TIER_E	MARS
185	SUPERPAN_OCTANT_5_TIER_A	MARS
185	SUPERPAN_OCTANT_5_TIER_B	MARS
185	SUPERPAN_OCTANT_5_TIER_C	MARS
185	SUPERPAN_OCTANT_5_TIER_D	MARS
185	SUPERPAN_OCTANT_5_TIER_E	MARS
186	SUPERPAN_OCTANT_6	MARS
187	SUPERPAN_OCTANT_7_TIER_A	MARS
188	SUPERPAN_OCTANT_8_TIER_A	MARS
188	SUPERPAN_OCTANT_8_TIER_B	MARS
188	SUPERPAN_OCTANT_8_TIER_C	MARS
188	SUPERPAN_OCTANT_8_TIER_D	MARS
188	SUPERPAN_OCTANT_8_TIER_E	MARS
188	SUPERPAN_OCTANT_8_TIER_F	MARS
190	UPPER_RAD_CAL_6_COLORS_AND_PHOTOMETRIC_SPOTS	CALIMG or MARS
191	UPPER_RAD_CAL_4_COLOR	CALIMG

194	BOTH_RAD_CAL_6_COLORS_AND_PHOTOMETRIC_SPOTS	CALIMG or MARS
195	LOWER_RAD_CAL_5+1_AND_PHOTOMETRIC_SPOT	CALIMG or MARS
195	LOWER_RAD_CAL_6_COLORS_AND_PHOTOMETRIC_SPOTS	CALIMG or MARS
196	BOTH_RAD_CAL_1+1_POINTING_SUBFRAME_SCATTERED_LIGHT	CALIMG
196	UPPER_RAD_CAL_1+1_POINTING_SUBFRAME_SCATTERED_LIGHT	CALIMG
199	SUPER_RESOLUTION_0	MARS
199	SUPER_RESOLUTION_1	MARS
199	SUPER_RESOLUTION_2	MARS
199	SUPER_RESOLUTION_3	MARS
199	SUPER_RESOLUTION_4	MARS
250	IMP_FIDUCIAL_CHECK	CALIMG
252	REAR_RAMP_MAGNET	MAG
257	TIP_PLATE_MAGNET_DIOPTER_LENS	MAG
258	ALTAIR_VEGA_+_PHOBOS_13_FILTERS	STAR or PHOBOS
259	PHOBOS_FOG	PHOBOS
260	AEROSOL_OPACITY_SUN	SUN
260	AEROSOL_OPACITY_SUN_LOW	SUN
261	AEROSOL_OPACITY_SUN	SUN
261	WATER_OPACITY_SUN_CAL	SUN
262	WATER_OPACITY_SUN_EVENING	SUN
263	WATER_OPACITY_SUN_EVENING	SUN
265	YOGI_PHOTOMETRY	MARS
266	MAG_TARG_DEPLOYED_ILLUM_HGA_CN_250_CLK_90	MAG
267	MAG_TARGET_MONITORING_IMP_DEPLOYED_3_FILTERS	MAG or CALIMG
267	MAG_TARGET_DAILY_MONITORING_IMP_DEPLOYED_3_FILTERS	MAG or CALIMG
275	VERTICAL_STEREO_1	MARS
276	VERTICAL_STEREO_2	MARS
277	VERTICAL_STEREO_3	MARS
279	CHANGE_MONITORING_II	MARS
280	HALF_SKY_SURVEY-NORTH_2_COLOR	SKY
283	CLOUD_DETECTION	SKY or CALIMG
288	DEEP_FIELD_TEST	MARS
290	PHOTOMETRIC-STRIP-PM	MARS
290	PHOTOMETRIC-STRIP-MORNING	CALIMG
294	SUPER_RESOLUTION	MARS
295	PHOTOMETRIC-STRIP-PM	MARS
296	SUPER_RESOLUTION	MARS
297	SUPER_RESOLUTION	MARS
298	SUPER_RESOLUTION	MARS
350	ROVER_MOVIE	ROVER
353	ROVER_CONCURRENT_WAE_IMG	ROVER
354	CONCURRENT_FRONT_WHEEL_PUSH_IMG	ROVER
466	LOWER_RAD_CAL_DEPLOYED_15_COLOR	CALIMG
1520[2]	SUNSET_EVENING_AEROSOL_MEASUREMENTS	SKY

[2]Sequence 1520 exists due to a typographical error; it is identical with sequence 152.

The final level of directory subdivision is by spacecraft clock start count or “sclk”. The first four digits of the ten-digit sclk are used in the directory name; the remaining six digits are used in the file names. The directory name begins with a “c”, indicating that the number that follows is a clock count, and ends with “xxx”, indicating a range of numbers in the directory. The following table shows the spacecraft clock count range and the command sequences of the images that were acquired each “sol” or planet day number. The planet day number is the Martian day since surface operations began, with the day of the Mars Pathfinder landing being "1" (July 4, 1997). Negative sols refer to data acquired before the spacecraft landed. The last day when science data was returned from the surface was sol 83 (September 27, 1997).

Table 3.2.2.6.C Command Sequences Listed By Sol and SCLK Range

Sol	Spacecraft Clock Count	Command Sequences
-194	1229455934 - 1229455947	0
-13	1245530232 - 1245531137	8
1	1246747799 - 1246767518	1, 2, 8 - 10, 17, 22, 25, 59, 62, 180
2	1246830148 - 1246879404	9, 10, 13, 22, 24, 30 - 33, 35, 44, 51, 52, 55, 59, 60, 64 - 68, 161, 174, 180
3	1246922727 - 1246979484	7, 15, 23, 35, 49, 51, 53 - 55, 60, 69 - 74, 152, 173, 175, 250
4	1246984293 - 1247042575	36, 39, 50, 53 - 56, 59, 60, 151, 154, 156, 172, 261, 353, 354
5	1247103484 - 1247134363	7, 46, 50, 55, 59, 60, 172
6	1247166077 - 1247245173	35, 50, 55, 59, 60, 158, 172, 250, 261, 262, 267
7	1247249105 - 1247281767	59, 60, 155, 156
8	1247362822 - 1247381899	55, 164, 191
9	1247461885 - 1247465543	59, 166, 191
10	1247540474 - 1247558766	50, 55, 60, 164, 172, 175, 267
11	1247644526 - 1247667452	36, 55, 60, 165, 167, 175, 191
12	1247718030 - 1247777747	35, 36, 39, 46, 50, 55, 60, 158, 172, 175, 260, 267
13	1247780956 - 1247866489	35, 36, 39, 46, 50, 53 - 55, 60, 151, 156, 172, 173, 175, 185, 260, 267, 353
14	1247869697 - 1247955762	35, 39, 46, 50, 51, 55, 60, 151, 154, 156, 172, 173, 175, 196, 199, 260 - 262, 267
15	1247958470 - 1248043453	7, 35, 36, 39, 46, 50, 54, 55, 60, 151, 156, 158, 172, 173, 175, 260, 263
16	1248059512 - 1248070341	151, 162
18	1248261679 - 1248288282	50, 51, 53 - 55, 60, 172, 173, 175, 182, 261, 263, 267, 466
19	1248339450 - 1248377542	36, 39, 46, 55, 60, 173, 175, 179, 252, 260, 267
20	1248407687 - 1248488477	35, 46, 50, 54, 55, 60, 154, 156, 172, 173, 175, 188, 199, 258, 260, 261, 267, 466

21	1248491877 - 1248577248	35, 39, 46, 50, 55, 56, 60, 156, 158, 172, 173, 175, 190, 195, 260, 263, 266, 267, 280
22	1248580652 - 1248666028	15, 35, 36, 50, 55, 60, 152, 156, 172, 173, 175, 260, 267, 1520
23	1248669426 - 1248754802	7, 35, 36, 39, 46, 54, 55, 60, 156, 158, 162, 172, 173, 175, 199, 252, 257, 260, 350
24	1248758201 - 1248843578	35, 36, 39, 46, 50, 55, 60, 152, 162, 173, 175, 179, 259, 260, 1520
25	1248846980 - 1248932352	35, 36, 51, 55, 60, 151, 154 - 156, 158, 175, 191, 199, 260 - 262
26	1248935755 - 1248999060	35, 36, 39, 50, 55, 60, 156, 173, 175, 260, 267
27	1249053327 - 1249086979	50, 53 - 55, 60, 173, 175, 260, 267, 283, 290, 295
28	1249141978 - 1249176630	36, 53, 55, 60, 173, 175, 179, 260, 267
29	1249230714 - 1249234574	60, 175, 290
30	1249327087 - 1249339269	50, 54, 55, 60, 173, 175, 267
32	1249501633 - 1249553780	35, 36, 50, 55, 60, 173, 175, 184, 257, 260 - 262
33	1249557179 - 1249610784	7, 35, 39, 50, 53, 55, 60, 156, 162, 173, 175, 260
34	1249678267 - 1249700185	55, 60, 171, 173, 175, 186, 267
35	1249766743 - 1249788649	55, 60, 172, 173, 175, 179, 267, 294, 297
36	1249855505 - 1249877079	15, 55, 60, 173, 175, 186, 196, 267, 275
37	1249944280 - 1249965854	15, 53, 55, 60, 173, 175, 185, 186
38	1250033055 - 1250086206	15, 35, 36, 51, 60, 173, 175, 183, 188, 194, 195, 260, 261, 267, 276, 277, 466
39	1250089605 - 1250143589	35, 39, 53, 55, 60, 151, 156, 162, 173, 175, 190, 194, 260, 267
40	1250210604 - 1250227270	7, 60, 173, 175, 283, 297
41	1250304397 - 1250310442	15, 55, 60, 173, 186
42	1250388155 - 1250403239	15, 50, 55, 60, 173, 175, 187, 267
44	1250565703 - 1250574341	15, 50, 56, 60, 173, 175, 181, 267
47	1250839150 - 1250839174	56
49	1251009882 - 1251024647	50, 54, 60, 173, 175
50	1251098642 - 1251118168	54, 55, 60, 173, 175, 267
52	1251276247 - 1251295182	7, 15, 50, 54, 55, 60, 173, 175, 288
53	1251365020 - 1251372802	50, 54, 55, 60, 173, 175, 267
54	1251453602 - 1251470240	15, 54, 55, 60, 173, 175, 183, 267
55	1251542386 - 1251574951	7, 15, 36, 55, 60, 173, 175, 182, 187, 195, 260, 265, 466
56	1251604264 - 1251649732	15, 39, 55, 60, 155, 158, 162, 173, 175, 190, 260, 265, 267, 283
57	1251719965 - 1251721489	15, 60, 175, 183
58	1251808714 - 1251817460	60, 173, 175, 267, 298
59	1251897621 - 1251912101	50, 55, 60, 175
60	1251986403 - 1252001360	55, 60, 173, 175, 267
61	1252075187 - 1252090991	60, 173, 175, 267

62	1252163969 - 1252182364	7, 60, 173, 175
63	1252252751 - 1252262891	60, 173, 175, 267
64	1252341337 - 1252359834	50, 54, 60, 175, 179, 267
65	1252430692 - 1252448618	53, 60, 173, 175, 267, 279, 283, 296
66	1252518903 - 1252537564	15, 50, 55, 60, 173, 175, 178, 181, 184, 185, 199, 257, 267
67	1252607685 - 1252626161	50, 55, 60, 173, 175, 267, 298
68	1252696473 - 1252722326	15, 53, 55, 60, 173, 175, 181, 267, 283
69	1252757190 - 1252803749	15, 60, 154, 155, 158, 173, 175, 187, 267, 297
70	1252874105 - 1252892509	7, 15, 50, 55, 60, 173, 175, 183
71	1252971823 - 1252978716	55, 60, 175, 199, 267
72	1253051760 - 1253070156	50, 51, 55, 60, 173, 175, 267, 297, 298
73	1253140544 - 1253145585	60, 175
74	1253229326 - 1253245120	50, 55, 60, 175, 199, 267, 283, 296
75	1253318109 - 1253328272	15, 55, 60, 173, 183, 265
76	1253406891 - 1253417652	15, 56, 60, 175, 181, 267, 298
77	1253495656 - 1253502191	15, 56, 60, 173, 183, 186
78	1253584457 - 1253595729	50, 56, 60, 175, 179, 257
79	1253673212 - 1253678269	60, 175, 196
80	1253761994 - 1253769706	55, 60, 175, 267, 296
81	1253850777 - 1253855828	60, 175
82	1253939542 - 1253958186	51, 60, 173, 175, 199, 283
83	1254028324 - 1254046834	15, 60, 175, 183, 298

A sample data directory structure might look like this:

```
APXSSITE----SEQ0071-----C1246XXX
            SEQ0072-----C1246XXX
CALIMG------SEQ0007-----C1246XXX
               |--------C1247XXX
               :
               :
            SEQ0015-----C1246XXX
               |--------C1248XXX
               :
               :
PHOBOS------SEQ0155-----C1247XXX
               :
               :
```

The contents of the data subdirectories are image files with attached PDS labels, as shown in the following table.

Table 3.2.2.6.D Data Directory Contents

File	Contents	Source

WXXXXXXY.ZZZ (e.g. I392384R.IMG)	Experiment Data Record with attached PDS label. (Complete format descriptions provided in reference 5 and DATASET.CAT.)	MIPS / IMP team

According to PDS and ISO-9660 level 1 standards, filenames on the CDs are limited to the "8.3" format, ie., eight characters, followed by a period ".", followed by a three character extension. Therefore, the names for the individual images will consist of an instrument identifier, followed by the six least significant digits of the spacecraft clock count, followed by a single character frame identifier, followed by a three character representation of the image observation type. The filenames will be of the form WXXXXXXY.ZZZ, where:

Table 3.2.2.6.E IMP EDR PDS Filename Components

		Possible Values	Meaning
W	instrument identifier	I	Imager for Mars Pathfinder
XXXXXX	clock count	(any six digit integer)	six least significant digits of Spacecraft Clock Start count
Y	frame identifier	L	left image
		R	right image
		S	dark strip
		N	null strip
ZZZ	file extension	IMG	regular image
		STR	dark strip
		NUL	null strip
		FLT	flat field
		DRK	dark field
		HST	histogram
		SUM	summed

Given the combination of directory name and filename, the complete spacecraft clock count can be determined for any image from the table above. The image filenames may not be unique; it is always best to use the product id when looking for a unique image identifier.

3.2.2.7 Browse Subdirectory

The browse directory contains HTML, GIF, and JPEG files designed to allow for the easy perusal of the data on the CD. This HTML “browser” begins at the top level with the INDEX.HTM file in the BROWSE directory. Beneath this, the browse directory contains a directory structure identical to that of the data subdirectories. Each of these browse subdirectories contains JPEG-formatted thumbnail-sized and GIF-formatted full-sized versions of the images in the equivalent data directory. They also contain HTML files describing both the individual images, and whole directories.

The GIF and JPEG files, and the HTML files describing individual images, all have identical names to the images they describe, except that the file extensions have been changed to “.GIF”, “.JPG”, and “.HTM” respectively. PDS labels with “.LBL” extensions are also present, describing the other files in each directory.

A PDS KEYWORDS AND THEIR DEFINITIONS

A.1 IMAGE AND TABLE LABEL KEYWORDS

The following table lists, in alphabetical order, the PDS keywords that are used in the IMP EDR image labels and the INDEX, COMMAND, and EDRINDEX tables that describe them. Any keywords that are shown in lower case characters are used solely as column names in the tables, and are therefore not necessarily formal PDS keywords. Please note that the definitions provided are often specific to the Mars Pathfinder mission. Formal PDS definitions are available in the Planetary Science Data Dictionary (reference 3).

Many of these definitions make reference to various MPF-specific coordinate systems. For details, please see the Mars Pathfinder AIM Phasing and Coordinate Frame Document (reference 7) or the DATASET.CAT file, which is included on the IMP EDR CDs.

There are also a variety of keywords and terms used below which are related to the various data compression methods used on-board the spacecraft. For details on these, please see the DATASET.CAT file.

PDS Keyword	Mars Pathfinder Definition
APPLICATION_PACKET_ID	The id of the telemetry packet queue to which the image data was directed. For details see application_packet_name.
APPLICATION_PACKET_ NAME	The name associated with the telemetry packet queue to which the image data was directed. The queues are distinguished on the basis of type and priority of data. The ids and names that were used during the mission are shown below: APPLICATION PACKET ID / APPLICATION PACKET NAME 3 TECH_IMG 15 SCI_IMG_1 19 SCI_IMG_2 20 OPS_IMG_1 21 OPS_IMG_2[3] 22 ENG_IMG 26 RVR_IMG 32 IMG_ASI 34 SCI_IMG_3 40 SCI_IMG_4
atmos_flag	A flag that indicates that the given observation was directed at the sun.
AUTO_EXPOSURE_DATA_ CUT	The DN value which a specified fraction of pixels is permitted to exceed. The fraction is specified using the auto exposure pixel fraction keyword. Valid range: 0 to 4095
AUTO_EXPOSURE_PIXEL_ FRACTION	The percentage of pixels whose value is higher than the number specified by the auto exposure data cut keyword. This field is only applicable if the exposure type is set to AUTO or INCREMENTAL. Valid range: 0 to 100

[3]The actual application packet name is "OPS_IMP_2"; however IMP is a typographical error and should be IMG.

AZIMUTH_FOV	The angular measure of the horizontal field of view of an imaged scene. For MPF, "horizontal" is measured in the x-y plane of the IMP coordinate system.
AZIMUTH_MOTOR_CLICKS	The number of motor step counts the camera rotated in the horizontal direction from the low hard stop. Since each step count is 0.553 degrees, the approximate azimuthal position of the camera can be derived from this value. Valid range is 0 to 1023.
BAD_PIXEL_ REPLACEMENT_FLAG	Indicates whether or not bad pixel replacement processing was completed. If set to TRUE, certain pixels in the image were replaced based on a bad pixel table. Valid values: TRUE, FALSE.
BANDS	The number of spectral bands in the image. Value: 1
CHECKSUM	An unsigned 32-bit sum of every byte of data in the image data object.
COMMAND_DESC command_description	The textual description associated with a COMMAND_NAME. The valid values for the IMP EDRs are shown below. Command Name — Command Description IMP_IMAGE_AZ_EL — This is the image taken by the IMP using absolute azimuth & elevation as the coordinate system IMP_IMAGE_LCLGRD — This is the image taken by the IMP using a grid location in the local level coordinate system IMP_IMAGE_LCLVEC — This is the image taken by the IMP using a unit vector in the local level coordinate system IMP_IMAGE_OBJECT — This is the image taken by the IMP using an IVP object to identify where to point IMP_IMAGE_VECTOR — This is the image taken by the IMP using a unit vector in the IMP camera coordinate system???
COMMAND_NAME	The name of an uplinked command sent to a spacecraft or instrument. For the IMP EDRs, this indicates the method the IMP camera was instructed to use to determine its pointing direction. For details, see command_desc.
COMMAND_SEQUENCE_ NUMBER	A numeric identifier for a sequence of commands sent to a spacecraft or instrument. For the IMP EDRs, these are specifically the commands sent to the IMP camera, ordering it to perform a particular task. Valid range is 1 to 9999. For a complete list of the command sequence numbers used during the mission and their descriptions, see table 3.2.2.6.B of this document.
command_version_number	The version number of the command. The commands (ie., IMAGE_IDs) were intended to be unique, but in a few cases they were re-used with different command parameters. This keyword was added to distinguish between differing versions of the commands. Valid range is 1 to 9, where the lowest version number reflects the oldest version of a command.

DARK_CURRENT_ CORRECTION_FLAG	A flag indicating whether or not a dark current correction was applied to the image. For MPF, this correction was applied to the image on board the spacecraft, before the image was transmitted to Earth. Valid values: TRUE, FALSE
DARK_CURRENT_ DOWNLOAD_FLAG	A flag indicating whether or not an image of the dark strip area of the CCD was downlinked along with the image data. Valid values: TRUE, FALSE
DATA_SET_ID	A unique alphanumeric identifier for a data set. Value: MPFL-M-IMP-2-EDR-V1.0
DATA_SET_NAME	The full name given to a data set. Typically identifies the instrument that acquired the data, the target of that instrument, and the processing level of the data. Value: MPF LANDER MARS IMAGER FOR MARS PATHFINDER 2 EDR V1.0
DETECTOR_PIXEL_HEIGHT	The height of a pixel in the CCD sensor measured in microns. Value: 23.0
DETECTOR_PIXEL_WIDTH	The width of a pixel in the CCD sensor measured in microns. Value: 23.0
DOWNLOAD_TYPE	Specifies which image data to download, any or all of: image data (IM), dark current strip (DS), and null pixel data (NS). Valid values: NONE, DS, IM, DSIM, NS, DSNS, IMNS, DSIMNS
EARTH_RECEIVED_START_ TIME	Identifies the earliest time that a telemetry packet containing data for the image was received. Has the form "YYYY-MM-DDThh:mm:ss.fffZ".
EARTH_RECEIVED_STOP_ TIME	Identifies the latest time that a telemetry packet containing data for the image was received. Has the form "YYYY-MM-DDThh:mm:ss.fffZ".
ELEVATION_FOV	The angular measure of the vertical field of view of an imaged scene. For MPF, "vertical" is measured along the Z_{IMP} axis of the IMP coordinate system.
ELEVATION_MOTOR_ CLICKS	The number of motor step counts the camera rotated in the vertical direction from the low hard stop. Since each step count is 0.553 degrees, the approximate elevational position of the camera can be derived from this value. Valid range is 0 to 1023.
ERROR_PIXELS	After all decompression and post decompression processing has been completed, this is the number of pixels that are outside the valid DN range of 0 to 4095.
EXPECTED_PACKETS	The total number of telemetry packets which constitute a complete image, ie., an image without missing data.
EXPOSURE_COUNT	Maximum number of exposures taken. Value is dependant on exposure type. Valid range: 0 - 16
EXPOSURE_DURATION	Provides the value of the time interval between the opening and closing of an instrument aperture. The IMP camera does not have a shutter in the traditional sense, so for MPF this value is the integration time for manual and auto exposure, measured in milliseconds.

<table>
<tr><td>EXPOSURE_TYPE</td><td>Exposure type for the image. Valid values: AUTO, INCREMENTAL, MANUAL, PRETIMED, NONE. The auto and incremental exposures iterate off a starting value to determine the exposure time. For auto exposures, the value is preset. Incremental exposures start with the exposure time of the previous exposure. Manual exposure is a single exposure with a set exposure time. Pre-timed exposure uses the very last exposure time used, regardless of the type of exposure that it was. No exposure indicates that the command moves only the camera and doesn't take an exposure.</td></tr>
<tr><td>file_name</td><td>This is the name of the PDS formatted file as it is stored on the CD-ROM archive media. For the IMP EDRs, it consists of the instrument identifier “I”, followed by the six least significant digits of the spacecraft clock start count, followed by a frame identifier (L=left, R=right, S=dark strip, N=null strip), followed by a 3 character extension. The extension indicates the image observation type as follows: IMG=regular, STR=dark strip, NUL=null strip, FLT=flat field, DRK=dark current, HST=histogram, and SUM=summation. (Note that the latter two values were never used.)</td></tr>
<tr><td>FILE_RECORDS</td><td>The number of physical file records, including both label records and data records, in a file.</td></tr>
<tr><td>FILTER_NAME</td><td>The name of the instrument filter through which the image was acquired. The numbers refer to the effective wavelength in nm of the filter for the left (L) or right (R) eye.

<table>
<tr><th>FILTER NUMBER</th><th>FILTER NAME</th><th>APPLICATION</th></tr>
<tr><td>0</td><td>L440_R440</td><td>Stereo, Geology</td></tr>
<tr><td>1</td><td>L450_R670</td><td>Solar</td></tr>
<tr><td>2</td><td>L885_R947</td><td>Solar</td></tr>
<tr><td>3</td><td>L925_R935</td><td>Solar</td></tr>
<tr><td>4</td><td>L935_R990</td><td>Solar</td></tr>
<tr><td>5</td><td>L670_R670</td><td>Stereo, Geology</td></tr>
<tr><td>6</td><td>L800_R750</td><td>Geology</td></tr>
<tr><td>7</td><td>L860_R-DIOPTER</td><td>Geology</td></tr>
<tr><td>8</td><td>L900_R600</td><td>Geology</td></tr>
<tr><td>9</td><td>L930_R530</td><td>Stereo, Ranging, Geology</td></tr>
<tr><td>10</td><td>L1000_R480</td><td>Geology</td></tr>
<tr><td>11</td><td>L965_R965</td><td>Stereo, Ranging, Geology</td></tr>
</table>
</td></tr>
<tr><td>FILTER_NUMBER</td><td>The number of the instrument filter through which the image was acquired. (See filter_name for details.)</td></tr>
<tr><td>FIRST_LINE</td><td>The line within a source image that corresponds to the first line in the sub-image. For the IMP EDRs, the source image is the complete 256x256 image area within the CCD.</td></tr>
<tr><td>FIRST_LINE_SAMPLE</td><td>The sample within a source image that corresponds to the first sample in the sub-image. For the IMP EDRs, the source image is the complete 256x256 image area within the CCD.</td></tr>
<tr><td>FLAT_FIELD_CORRECTION_FLAG</td><td>Indicates whether or not a flat field correction was applied to the image. For MPF, this correction was applied to the image on board the spacecraft, before the image was transmitted to Earth. Valid values: TRUE, FALSE</td></tr>
</table>

FRAME_ID	Provides an identification for a particular instrument frame. Valid values are LEFT, RIGHT, BOTH, and HALFL. The IMP camera nominally operates in a mode where both the left and right images are exposed and transferred into the frame buffer simultaneously. Then either the RIGHT, LEFT, or BOTH frames are transmitted. For even shorter shutter times, the left image only may be transferred into the frame buffer (HALFL). The presence of BOTH in this field indicates that the image should be part of a stereo pair.
grid_position_x, grid_position_y, grid_position_z	The x (north / south), y (east / west), and z (vertical) components of a position defining the IMP pointing, measured with respect to the Martian Local Level Coordinate Frame (M Frame). Positive x is north, positive y is east, and positive z is down. Units are measured in meters. For details, see [MELLSTROM&LAU1996].
histogram_flag	A flag to indicate that the product returned was a histogram.
^IMAGE	A pointer to the first record of the image data within a PDS image file.
IMAGE_ID	Uniquely identifies the observation parameters of an image. The most significant four digits identify the command sequence that contains the imaging command. The middle two digits indicate the version of the command sequence, and the right four digits identify the image within a single imaging sequence. If the image id is even and non-zero, it is a left frame image. If the image id is one greater than the left frame image id (and therefore odd), it is the right frame of a stereo image. NOTE: During operations, a small number of image ids were re-used with different command parameters. This eliminates the uniqueness of the image id for those images. The TLM_CMD_DISCREPANCY_FLAG may be useful in identifying images that have this problem.

IMAGE_OBSERVATION_ TYPE	Identifies the type or purpose of an observation. Valid values are shown in the table below. Observation Type — Description REGULAR — A normal image file. DARK_CURRENT — A calibration image acquired by using the shortest exposure time possible and pointing the camera downwards to exclude external light. FLAT_FIELD — A calibration image acquired by looking at a uniformly illuminated target (in this case, the sky). HISTOGRAM — A single record file containing 4096 values, each of which is a count of the number of correspond-ing DN-valued pixels in the image. SUMMATION — A two record file containg first the sums of the image columns, and then the sums of the image rows. DARK_STRIP — A calibration image collected from a covered area of the CCD. NULL_STRIP — A calibration image collected from the readout register of the CCD.
IMAGE_TIME	Date and time at which the image was acquired, recorded in UTC system format. Shown as: "YYYY-MM-DDThh:mm:ss.fffZ".
INST_CMPRS_BLK_SIZE	The dimensions of a block for on-board compression. In the PDS labels, the value is a two dimensional array, where the first value is the line dimension of the block, and the second value is the sample dimension of the block. In the EDRINDEX.TAB file, it is a single value, the product of the line dimension and the sample direction.
INST_CMPRS_BLOCKS	The number of blocks used to spatially segment the image file prior to compression.
INST_CMPRS_MODE	The targetted image quality or compression factor for on-board compression. Compression is obtained with Huffman or arithmetic entropy encoding, with or without LCT. Odd modes specify a targetted image quality, whereas even modes specify a targetted compression factor. Modes 1,2,5,6 utilize Huffman encoding; modes 3,4,7,8 use arithmetic encoding. Modes 5,6,7,8 use LCT. Mode 9 specifies RICE compression. Valid values: 1 to 9. (See inst_cmprs_name.)

INST_CMPRS_NAME	The type of on-board compression used for data storage and transmission. Valid values are shown below: INST_CMPRS_MODE INST_CMPRS_NAME --- N/A NULL 1 JPEG DISCRETE COSINE TRANSFORM (DCT); HUFFMAN/QUALITY 2 JPEG DISCRETE COSINE TRANSFORM (DCT); HUFFMAN/RATIO 3 JPEG DISCRETE COSINE TRANSFORM (DCT); ARITHMETIC/QUALITY 4 JPEG DISCRETE COSINE TRANSFORM (DCT); ARITHMETIC/RATIO 5 JPEG DISCRETE COSINE TRANSFORM (DCT); HUFFMAN/QUALITY/LCT 6 JPEG DISCRETE COSINE TRANSFORM (DCT); HUFFMAN/RATIO/LCT 7 JPEG DISCRETE COSINE TRANSFORM (DCT); ARITHMETIC/QUALITY/LCT 8 JPEG DISCRETE COSINE TRANSFORM (DCT); ARITHMETIC/RATIO/LCT 9 RICE ADAPTIVE VARIABLE-LENGTH CODING (RICE)
INST_CMPRS_PARAM	This is a JPEG specific variable. It selects the on-board compression rate by image quality or by compression factor, based on selected on-board compression mode.
INST_CMPRS_QUALITY	A JPEG specific variable. If an odd IMP compression mode is used for on-board compression, this is the desired image quality index. If an even IMP compression mode is used, this is the resultant image quality used to reach a desired on-board compression factor.
INST_CMPRS_QUANTZ_ TBL_ID	The identifier for the reference table used for quantization in the frequency domain for on-board transform compression. This name or code should be specific enough to allow the user of the data to have sufficient information to reference the quantization table used to compress the data.
INST_CMPRS_QUANTZ_ TYPE	The method of quantization used for the output of transform coders. Valid value: TABULAR
INST_CMPRS_RATE	The average number of bits needed to represent a pixel for an on-board compressed image.
INST_CMPRS_RATIO	The ratio of the size, in bytes, of the original uncompressed data file to its compressed form.
INST_CMPRS_SYNC_BLKS	RICE specific variable. Number of compressed blocks between sync markers.
INSTRUMENT_AZIMUTH	One of two angular measurements of the pointing direction of the instrument. The azimuth is measured positively in the clockwise direction (as viewed from above) from a fixed reference direction. The angle is measured in the x-y plane of the instrument's coordinate system, which is not necessarily co-linear with the surface fixed coordinate system. Note that for the MPF IMP, the reference direction is the Y_{IMP} axis of the IMP coordinate frame, and is co-linear with the Y_L axis of the lander coordinate frame. Valid values: 0 to 360 degrees

INSTRUMENT_AZIMUTH_ METHOD	Identifies the method used to calculate the instrument azimuth from the azimuth motor clicks. Valid values: TELEMETRY, MPFNAV-MIPS, BACKLASH-UOFA
INSTRUMENT_ DEPLOYMENT_STATE	Indicates whether or not the IMP camera had been deployed to the end of its 62 cm mast at the time the image was acquired. Valid values are STOWED and DEPLOYED.
INSTRUMENT_ELEVATION	One of two angular measurements of the pointing direction of the instrument. The positive direction of the elevation is set by the positive_elevation_direction data element, which for MPF is UP. The elevation is measured with respect to the plane which is co-planar with the x-y plane of the instrument's coordinate system and which intersects the elevation axis around which the camera rotates. This is not necessarily co-linear with the surface fixed coordinate system. Valid values: -90 degrees (nadir) to +90 degrees (zenith)
INSTRUMENT_ ELEVATION_METHOD	Identifies the method used to calculate the instrument elevation from the elevation motor clicks. Valid values: TELEMETRY, MPFNAV-MIPS, BACKLASH-UOFA
INSTRUMENT_HOST_ NAME	The full name of the host on which an instrument is based. Value: MARS PATHFINDER LANDER
INSTRUMENT_ID	An abbreviated name or acronym which identifies an instrument. Value: IMP
INSTRUMENT_NAME	The full name of an instrument. Value: IMAGER FOR MARS PATHFINDER
INSTRUMENT_ TEMPERATURE instrument_ccd_temperature, instrument_head_temperature	The temperature, in degrees Celcius, of the CCD sensor array and the camera head when the image was acquired. This is an array of two elements. (The values in the index tables are stored in two separate columns named instrument ccd temperature and instrument head temperature, respectively.)
INSTRUMENT_ TEMPERATURE_COUNT	The raw temperature counts of the CCD and camera head when the image was acquired. This is an array of two elements.
INTERCHANGE_FORMAT	The manner in which the data elements are stored. Value: BINARY
ivp_target_name	Identifies the image vector pointing object at which the IMP camera was aimed. Valid values include SUN, EARTH, and PHOBOS. Note that the camera was "tricked" into pointing at other objects (like Deimos or stars) by directing it to point at Phobos, but re-defining the position of Phobos in the sky.
LABEL_RECORDS	The number of physical file records that contain only label information. The number of data records in a file is determined by subtracting the number of label records from the number of file records.
LANDER_SURFACE_ QUATERNION lander_surface_quaternion_x, lander_surface_quaternion_y, lander_surface_quaternion_z, lander_surface_quaternion_a	An array of four values that define the relationship between the lander coordinate frame and the local level coordinate frame. These values are listed in the NAIF defined order of "cosine, x, y, z". (In the index tables, these values are split out into four separate columns.)
LINE_SAMPLES	The total number of pixels along the horizontal axis of an image.
LINES	The total number of pixels along the vertical axis of an image.

MAXIMUM	The maximum DN value in the image file. For the IMP, this range is 0 - 4095.
MEAN	The average of the DN values in the image array. For MPF, this is the average of only those pixels within the valid DN range of 0 to 4095.
MEDIAN	The median of the DN values in the image array. For MPF, this is the median value of only those pixels within the valid DN range of 0 to 4095. This value will be at most 8 DN greater than or equal to the true median value.
MINIMUM	The minimum DN value in the image file. For the IMP, this range is 0 - 4095.
MISSION_NAME	A major planetary mission or project. Value: MARS PATHFINDER.
MPF_LOCAL_TIME	Local time at the lander site on the surface of Mars, measured in local hours, minutes, and seconds, from midnight. Local hours are defined as one twenty-fourth of a local solar day. Local minutes are one sixtieth of a local hour, and local seconds are one sixtieth of a local minute. Format is hh:mm:ss. Based on the IAU standard for the Martian prime meridian. See [DAVIESETAL1994] for more details.
OBSERVATION_NAME	The purpose of an observation or sequence of commands. See table 3.2.2.6.B in this document for a complete listing of the values.
packet_map_mask	A series of binary digits identifying which of the expected packets were actually received. The bits are to be read left to right. Ie., the first packet is represented by the leftmost bit.
path_name	Path to directory containing file. This path is shown in UNIX format. It begins at the root level of the CD. It has a trailing slash, but no leading slash.
PDS_VERSION_ID	The version number of the PDS standards documents that is valid when a data product label is created. For the Mars Pathfinder IMP EDRs, the version is 'PDS3'.
PIXEL_AVERAGING_ HEIGHT	The vertical dimension, in pixels, of the area over which pixels were averaged prior to image compression.
PIXEL_AVERAGING_ WIDTH	The horizontal dimension, in pixels, of the area over which pixels were averaged prior to image compression.
PLANET_DAY_NUMBER	The Martian day (ie., sidereal day, equal to a rotation of 360 degrees) on which the image was taken. Starts with 1 as the first day of surface operations, the day the spacecraft landed. Negative values refer to pre-surface images.
POSITIVE_ELEVATION_ DIRECTION	The direction in which elevation is measured in positive degrees for an observer on the surface of a body. The elevation is measured with respect to the azimuthal reference plane. A value of UP indicates that elevation is measured positively upwards, ie., the zenith point would be at +90 degrees and the nadir point at -90 degrees. DOWN indicates that the elevation is measured positively downwards; the zenith point would be at -90 degrees and the nadir point at +90 degrees.
PROCESSING_HISTORY_ TEXT	A textual summary of the processing used to produce the image file.
PRODUCER_FULL_NAME	The full name of the individual mainly responsible for the production of a data set. Value: ALLAN J. RUNKLE

PRODUCER_ID	A short name or acronym for the producer or producing team / group of a dataset. Value: MIPL OF JPL
PRODUCER_INSTITUTION_ NAME	A university, research center, NASA center, or other institution associated with the production of a data set. This would generally be an institution associated with the producer full name. Value: MULTIMISSION IMAGE PROCESSING LABORATORY, JET PROPULSION LAB
PRODUCT_CREATION_ TIME	Defines the UTC time when a product was created or last modified. Has the form "YYYY-MM-DDThh:mm:ss.fffZ".
PRODUCT_ID	A permanent, unique identifier assigned to each data product. For the IMP EDRs, this is constructed from the words "IMP_EDR" followed by the spacecraft clock start count, followed by the image observation type, followed by the image id.
RECEIVED_PACKETS	The total number of telemetry packets which constitute a reconstructed image.
RECORD_BYTES	The number of bytes in a physical file record, including record terminators and separators.
RECORD_TYPE	The record format of a file. Value: FIXED_LENGTH
RICE_OPTION_VALUE	RICE compressor specific variable.
RICE_START_OPTION	RICE compressor specific variable.
SAMPLE_BIT_MASK	A mask identifying the active bits in a sample.
SAMPLE_BITS	The number of bits, or units of binary information contained in a line_sample value.
SAMPLE_TYPE	The data storage representation of a sample value. Value: MSB_UNSIGNED_INTEGER
SHUTTER_EFFECT_ CORRECTION_FLAG	Indicates whether or not a shutter effect correction was applied to the image. The shutter effect correction involves the removal from the image of the shutter, or fixed-pattern. For MPF, this correction was applied to the image on board the spacecraft, before the image was transmitted to Earth. Valid values: TRUE, FALSE
SOFTWARE_NAME	The name of the telemetry processing software used to generate the image data.
SOFTWARE_VERSION_ID	Indicates the version or development level of a program or a program library used to generate the data.
SOLAR_AZIMUTH	One of two angular measurements indicating the position of the Sun as measured from a specific point on the surface of a planet (ex., from a lander or rover). The azimuth is measured positively in the clockwise direction (as viewed from above) with the meridian passing through the positive spin axis of the planet (ie., the north pole) defining the zero reference.
SOLAR_ELEVATION	One of two angular measurements indicating the position of the Sun as measured from a specific point on the surface of a planet (ex., from a lander or rover). The positive direction of the elevation is set by the positive_elevation_direction data element. It is measured from the plane which is perpendicular to the line passing between the observer and the planet's center and which intersects the observer.
SOURCE_PRODUCT_ID	Identifies a product used as input to create a new product. For MPF, this refers to the filenames of the SPICE kernels used to produce the image and its ancillary data.

SPACECRAFT_CLOCK_ START_COUNT	The value of the lander clock (in seconds) at which the image was acquired.
SQRT_COMPRESSION_ FLAG	Indicates whether or not square root compression was applied to the image. For MPF, this compression was performed onboard the lander, prior to transmission of the data to Earth. It involved the compression of the pixels from 12 bits down to 8 bits.
SQRT_MAXIMUM_PIXEL	The maximum pixel value in a 12-bit image prior to square root compression.
SQRT_MINIMUM_PIXEL	The minimum pixel value in a 12-bit image prior to square root compression.
STANDARD_DEVIATION	The standard deviation of the DN values in the image array. For MPF, this is calculated on only those pixels within the valid DN range of 0 to 4095.
subframe_flag	A flag to indicate that the image is not full size. Valid values: TRUE, FALSE
sum_flag	A flag to indicate that the product returned is a "summation" file. For the IMP EDRs, this means that it contains two records, the first a list of the sums of the image columns, and the second a list of the sums of the image rows. Valid values: TRUE, FALSE
SURFACE_BASED_INST_ AZIMUTH	One of two angular measurements of the pointing direction of the instrument. The azimuth is measured positively in the clockwise direction (as viewed from above) with the meridian passing through the positive spin axis (“north pole”) defining the zero reference. The surface_based_inst_azimuth is derived from the instrument pointing and spacecraft orientation. It is co-linear with the surface fixed coordinate system, but the origin of the observation may not be co-incident with the origin of the surface fixed frame. Note that the surface_based_inst_azimuth describes the pointing direction of the instrument rather than the angular coordinates of the target of the observation. If there has been any significant change over time in the position of the observing instrument, this data element cannot be used to uniquely describe the vector to a viewed object. See surface_based_inst_elevation.

SURFACE_BASED_INST_ ELEVATION	One of two angular measurements of the pointing direction of the instrument. The positive direction of the elevation is set by the positive_elevation_direction data element. It is measured from the plane which is perpendicular to the local gravity vector and which intersects the elevation axis around which the instrument rotates. The surface_based_inst_elevation is derived from the instrument pointing and spacecraft orientation. It is co-linear with the surface fixed coordinate system, but the origin of the observation may not be co-incident with the origin of the surface fixed frame. Note that the surface_based_inst_elevation describes the pointing direction of the instrument rather than the angular coordinates of the target of the observation. If there has been any change over time in the position of the observing instrument, this data element can not be used to uniquely describe the vector to a viewed object. Assuming a flat surface, and combined with the height of the instrument above the surface, it can be used to determine the position of an object; however, given realistic non-flat surfaces, observations from another point of origin are required to determine an object's distance.
SURFACE_BASED_INST_ METHOD	Identifies the method used to calculate the surface based instrument pointing. Valid values: NULL, L_FRAME-QUATERNION
TARGET_NAME	Identifies the intended target of an observation. Can be either a planetary body or a physical object. For the IMP, this is the intended target of the observation, and may not accurately represent what is actually in an image frame. Valid values: ALTAIR, APXS SITE, ARCTURUS, CALIMG, DEIMOS, LANDER, MAG(NETIC TARGET), MARS, PHOBOS, ROVER, SKY, SUN, VEGA, and WINDSOCK. Note that this list does not include specific feature names like "Barnacle Bill" and "Yogi". For details on feature names, please consult the gazetteer on the IMP CDs.

TLM_CMD_DISCREPANCY_ FLAG	Indicates whether or not discrepancies were found between the IMP uplinked commands and the downlinked telemetry. The fields checked when determining this flag are:
	
	`APPLICATION_PACKET_ID`
	`EXPOSURE_TYPE`
	`FILTER_NUMBER`
	`FRAME_ID`
	`INST_CMPRS_MODE`
	`LINES`
	`LINE_SAMPLES`
	`PIXEL_AVERAGING_HEIGHT`
	`PIXEL_AVERAGING_WIDTH`
	`SQRT_COMPRESSION_FLAG`
	
	Valid values: TRUE, FALSE

vector_component_x, vector_component_y, vector_component_z	The x, y, and z components of a unit vector which defines the commanded IMP pointing. The vector is defined with respect to one of two possible coordinate frames, indicated by the command_name. If the command name is IMP_IMAGE_VECTOR, the coordinate system is the IMP camera frame (IMP Frame); if the command name is IMP_IMAGE_LCLVEC, the coordinate system is the Martian Local Level Frame (M Frame). Valid range: -1.0 to 1.0
volume_id	Identifies the CD volume containing the named file. For the IMP EDRs, this consists of the identifier "MPIM_" followed by the four digit volume number.

B AAREADME FILE

The AAREADME.TXT file contains general information about the contents and format of the CD-ROM.

B.1 AAREADME.TXT

```
PDS_VERSION_ID          = PDS3
RECORD_TYPE             = STREAM
OBJECT                  = TEXT
  PUBLICATION_DATE      = 1998-07-01
  INTERCHANGE_FORMAT    = ASCII
  NOTE                  = "AAREADME.TXT for Mars Pathfinder IMP EDR
                           Archive CD-ROMs."
END_OBJECT              = TEXT
END


                MARS PATHFINDER IMP EDR ARCHIVE CD-ROM

1.  Introduction

This CD-ROM is one of three CD-ROMs that contain Mars Pathfinder IMP
(Imager for Mars Pathfinder) EDR (Experiment Data Record) images and
ancillary files.  The spacecraft clock start count ranges of the
images contained on the three volumes are shown below.  Each volume
also contains a complete set of documentation files that describe the
archive EDR images.  Each EDR image has an attached PDS label that
describes the file structure and instrument parameters used for that
image.

          Volume ID            SCLK Range
          ---------      ----------------------
          MPIM_0001      1229455934 - 1247913223
          MPIM_0002      1247913268 - 1249772261
          MPIM_0003      1249772268 - 1254046834

The MPF IMP EDR products archived on this volume are the original
products released by the Mars Pathfinder project.  They have been
converted from the VICAR format used during mission operations to a
PDS format. Supporting documentation and label files conform to the
Planetary Data System (PDS) Standards, Version 3.2, Jet Propulsion
Laboratory (JPL) document number D-7669.


2.  CD-ROM Format

This CD-ROM has been formatted so that a variety of computer systems
(e.g., PC, Macintosh, and Sun) may access the data.  Specifically, it
is formatted according to the ISO-9660 level 1 Interchange Standard.
For further information, refer to the ISO-9660 Standard Document: RF#
ISO 9660-1988, April 15, 1988.

This CD-ROM does not contain any Extended Attribute Records (XARs).
Thus, VAX/VMS users on older platforms may have some problems
accessing files on this volume.


3.  File Formats

The Mars Pathfinder IMP EDR images on this set of CD-ROMs are
uncompressed, 16-bit files, labelled in conformance with PDS
```

standards. Each image file is stored with a fixed length record format. There is an attached PDS label at the beginning of each image file that describes the content and format of the image. If the PDS label size is not an exact multiple of the file record length, padding is added after the end of the PDS label. Thus, the image object always starts on a record boundary. A more detailed specification of the image file format is given in the EDRSIS and VOLSIS files in the DOCUMENT directory.

All detached label and document files (with the exception of PDF formatted files) are stream format files, with a carriage return (ASCII 13) and a line feed character (ASCII 10) at the end of each record. This allows the files to be read by the MacOS, DOS, Unix, and VMS operating systems. The PDF documentation files are in the binary Adobe Portable Document Format. These files can be read with the Adobe Acrobat Reader, available from "http://www.adobe.com/". (If this URL has expired, contact the PDS Operator for more information. Contact information for the PDS is shown in section 8.)

All tabular files are described by detached PDS labels, which are label files having the same name as the data files they describe, with the extension .LBL. For example, the file INDEX.TAB is accompanied by the detached label file INDEX.LBL in the same directory. Tabular files are formatted so that they may be read directly into many database management systems (DBMS) or spreadsheet programs on various computers. All fields are separated by commas, and character fields are enclosed in double quotation marks ("). Character fields are left justified, and numeric fields are right justified. The "start byte" and "bytes" values listed in a PDS label 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 normal text file on other computers.

PDS labels are object-oriented. The object to which the label refers (e.g., IMAGE, TABLE, etc.) is denoted by a statement of the form:

```
^object = location
```

in which the carat character ('^', also called a pointer in this context) indicates that the object starts at the given location. For an object in the same file as the label, the location is an integer representing the starting record number of the object (the first record in the file is record 1). For an object located outside the label file, the location denotes the name of the file containing the object, along with the starting record or byte number. For example:

```
^IMAGE = ("C102.IMG",3)
```

indicates that the IMAGE object begins at record 3 of the file C102.IMG, in the same directory as the detached label file. Below is a list of the possible formats that use the ^object keyword.

```
^object = n
^object = n <BYTES>
^object = "filename.ext"
^object = ("filename.ext",n)
^object = ("filename.ext",n <BYTES>)
```

where:

```
n         starting record or byte number of the object,
```

```
            counting from beginning of the file (record 1,
            byte 1); default is record number.
    <BYTES> indicates that number given is in units of bytes.
    filename upper-case file name.
    ext     upper-case file extension.
```

4. Data Calibration

Formal calibration files and software could not be prepared in time to be included on this set of CD volumes. These files will be made available on the CD archive of the IMP derived products. However, some information has already been written about the calibration of the IMP camera, the magnets mounted on the lander, and the windsocks mounted on the ASI/MET mast. This documentation is referenced in the REF.CAT file in the CATALOG directory. See in particular [CROWEETAL1997], [SMITHETAL1997A], and [REIDETAL1998].

5. Image Display

The PDS provides software for displaying PDS formatted images on a variety of computer platforms. The application program for image display is called NASAView, which has versions for SUN, Macintosh, and PC platforms. For some computer platforms, there is a NASAView version that will work as a Web Browser helper application.

Since the IMP data is 16-bit, some earlier versions of NASAView may not be able to display it. Versions 1.1.2 and later have been tested and are able to display this data.

It is the intention of PDS to distribute NASAView through its World Wide Web and FTP sites. Consult the PDS WWW site for the status of NASAView in terms of its capabilities and availability. The address for the PDS NASAView web site is:

    http://pds.jpl.nasa.gov/license.html

(Complete contact information for the PDS is available below in section 8.)

6. CD-ROM Contents

Files on this CD-ROM are organized into a series of subdirectories below the top-level directory. The following table shows the structure and content of these directories. In the table, directory names are enclosed in square brackets ([]). (More details on the contents and structure of the CDs can be found in section 3.2 of the VOLSIS located in the DOCUMENT directory.)

```
  FILE                  CONTENTS

  Top-level directory
   |
   |- AAREADME.TXT             The file you are now reading.
   |- AAREADME.HTM             Hypertext version of the AAREADME.TXT file.
   |- AAREADME.LBL             PDS label describing the AAREADME.HTM file.
   |- ERRATA.TXT               List of comments and errors for this
   |                           volume set.
   |- ERRATA.HTM               Hypertext version of the ERRATA.TXT file.
   |- ERRATA.LBL               PDS label describing the ERRATA.HTM file.
   |- VOLDESC.CAT              Description of the contents of this CD-ROM
   |                           volume in PDS label format.
```

```
|
|- [CATALOG]                Directory containing PDS catalog information
|   |                       about the Mars Pathfinder IMP EDR data set.
|   |- CATINFO.TXT          Description of files in the CATALOG directory.
|   |- DATASET.CAT          IMP EDR dataset descripton catalog object.
|   |- INST.CAT             IMP instrument description catalog object.
|   |- INSTHOST.CAT         MPF Lander description catalog object.
|   |- MISSION.CAT          MPF mission description catalog object.
|   |- PERSON.CAT           MPF personnel  objects.
|   |- REF.CAT              MPF reference objects.
|
|- [DOCUMENT]               Directory containing document files.
|   |- DOCINFO.TXT          Description of files in DOCUMENT directory.
|   |- CONTACTS.*           Contact information for MPF project personnel.
|   |- DATASET.*            MPF IMP EDR dataset description.
|   |- EDRSIS.*             IMP Experiment Data Record SIS.
|   |- IMPUG.*              IMP User's Guide.
|   |- INST.*               Instrument description.
|   |- INSTHOST.*           MPF Lander description.
|   |- MISSION.*            Mars Pathfinder mission description.
|   |- REF.*                References related to MPF.
|   |- VOLSIS.*             MPF IMP EDR CD-ROM specification.
|
|- [GAZETTER]               Directory containing a gazetteer of informal
|   |                       feature names at the MPF landing site.
|   |- GAZINFO.TXT          Description of files in the GAZETTER directory.
|   |- GAZETTER.LBL         PDS label for GAZETTER.TAB.
|   |- GAZETTER.TAB         Gazetteer in tabular format.
|   |- GAZETTER.TXT         Description of the gazetteer.
|
|- [INDEX]                  Directory containing index files.
|   |- INDXINFO.TXT         Description of files in the INDEX directory.
|   |- INDEX.TAB            Abbreviated volume index in tabular format.
|   |- INDEX.LBL            PDS label for INDEX.TAB.
|   |- CUMINDEX.TAB         Cumulative version of INDEX.TAB.
|   |- CUMINDEX.LBL         PDS label for CUMINDEX.TAB.
|   |- EDRINDEX.TAB         Detailed volume index in tabular format.
|   |- EDRINDEX.LBL         PDS label for EDRINDEX.TAB.
|   |- COMMAND.TAB          List of command parameters in tabular format.
|   |- COMMAND.LBL          PDS label for COMMAND.TAB.
|
|- [BROWSE]                 Directory containing the image browser.
|   |- BROWSER.LBL          PDS label for HTML files at top level of
|   |                       browser.
|   |- BRWSINFO.TXT         Description of files in the BROWSE directory.
|   |- DD.HTM               Definitions of PDS keywords used in browser.
|   |- HELP.HTM             Help file for browser.
|   |- INDEX.HTM            Top page of the browser.  (Start here
|   |                       to use the browser.)
|   |- [ICONS]              Directory containing icons used in HTML pages.
|   |- [UUUUUUUU]           Target directories containing HTML pages, GIF
|   |   |- [SEQVVVV]        browse images and JPEG thumbnails.  Directories
|   |   |   |- [CWWWWXXX]   beneath this have an identical structure to the
|   |   |   |   |           data directories.
|
|- [UUUUUUUU]               Data directories containing PDS formatted
|   |- [SEQVVVV]            image files.  These directories are subdivided
|   |   |- [CWWWWXXX]       first by target (UUUUUUUU), then by command
|   |   |   |- IYYYYYYZ.IMG sequence number (where VVVV is the four digit
|   |   |   |               number and finally by spacecraft clock start
|   |   |   |               count (WWWW represents the four most
|   |   |   |               significant digits of the clock count).  Each
|   |   |   |               of the bottom level directories contains PDS
|   |   |   |               formatted data files where YYYYYY represents
```

```
|   |   |   |              the six least significant digits of the SCLK
|   |   |   |              and Z indicates the frame id, L=left, R=right.
|
|                          The top-level data directories are:
|
|- [APXSSITE]              Directory containing images of sites where
|                          the APXS instrument was deployed.
|
|- [CALIMG]                Directory containing images taken for
|                          calibration purposes. This includes images of
|                          the radiometric and fiducial targets on the
|                          lander, flat field and dark current images,
|                          and readouts of the dark strip and null strip
|                          on the CCD.
|
|- [DEIMOS]                Directory containing images targeted at
|                          Deimos.
|
|- [LANDER]                Directory containing images targeted at parts
|                          of the lander to assess its status. This
|                          includes things like the airbag assessment
|                          pan and ramp deployment images.
|
|- [MAG]                   Directory containing images aimed at the
|                          various magnetic targets on the lander to
|                          study the magnetic properties of airborne
|                          particles.
|
|- [MARS]                  Directory containing the vast majority of the
|                          images, those which were taken primarily to
|                          view the Martian landscape. It includes most
|                          of the major panoramas, the super resolution
|                          images, and the change monitoring images.
|
|- [PHOBOS]                Directory containing images targeted at
|                          Phobos.
|
|- [ROVER]                 Directory containing images taken to support
|                          Rover operations and investigations. This
|                          includes things like end of day sequences,
|                          movie sequences, navigation images, and soil
|                          experiment images.
|
|- [SKY]                   Directory containing a variety of images
|                          including those taken looking at both high
|                          elevations and at the horizon, and at a
|                          variety of times of day. (Some images may
|                          include the Sun.)  Many were taken for the
|                          purpose of studying the atmosphere and the
|                          particles suspended in it.
|
|- [STAR]                  Directory containing images targeted at the
|                          stars Altair, Arcturus, and Vega. These are
|                          the one exception to the rule that target =
|                          directory name, since they are all grouped
|                          together in the "STAR" directory.
|
|- [SUN]                   Directory containing images targeted at the
|                          Sun, usually for the purpose of studying the
|                          atmosphere. In cases where a sequence of
|                          images, usually around sunset or sunrise,
|                          included some images with the sun and some
|                          without, the sequence has been included in the
|                          SKY directory.
```

```
   |
   |- [WINDSOCK]              Directory containing images targeted at the
   |                          windsocks on the ASI/MET mast.
```

More specific details on the file naming conventions used for the image files are available in section 2.2.2 of the EDRSIS or Table 3.2.2.6.E of the VOLSIS, both of which are in the DOCUMENT directory.

7. Image Browser

The image browser contained on this volume is a HyperText Markup Language based system that provides a simple search and quick-look capability. The browser is organized on a different basis than the CD volume. The CD image directories are sorted by target, command sequence number, and spacecraft clock start count, while the browser pages are sorted by target and observation name. This was done because the observation name is more descriptive than the command sequence number and should help people unfamiliar with the data find an image they are interested in. However, there is some loose correspondence between observation names and command sequence numbers, so the command sequence numbers have been included alongside observation names in the browser. For details of the relationship between these two values, please see Table 3.2.2.6.B in the VOLSIS, located in the DOCUMENT directory.

The system consists of an HTML page for each image that displays a GIF version of the image and a limited portion of its respective label data. Each full resolution data file may be accessed directly from its corresponding HTML page.

To use the image browser, open up the BROWSE/INDEX.HTM file in your web browser. For a more comprehensive search engine and browser for the data, please used the Planetary Image Atlas, available from the WWW page of the PDS Imaging Node: "http://www-pdsimage.jpl.nasa.gov/PDS/".

8. Whom to Contact for Information

For questions concerning this volume set, contact:

PDS Imaging Node
Susan K. LaVoie
M/S 168-527
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-5677

WWW Site: http://www-pdsimage.jpl.nasa.gov/PDS/
E-mail: pds_imaging@www-pdsimage.jpl.nasa.gov

For general information related to the PDS, contact:

Planetary Data System, PDS Operator
M/S 202-101
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109-8099
(818) 354-4321

WWW Site: http://pds.jpl.nasa.gov/

E-mail: pds_operator@jpl.nasa.gov

9. Cognizant Persons & Acknowledgments

The IMP camera was supplied by Principal Investigator Peter Smith at the University of Arizona Lunar and Planetary Laboratory.

This volume set was designed and produced at the Jet Propulsion Laboratory, Pasadena, California by Elizabeth Duxbury. The following people provided assistance in various capacities:

PDS Standards, Keywords, etc:

Betty Sword, Steve Hughes, Karen Law, and Jean Mortellaro (PDS-CN JPL), Eric Eliason and Janet Barrett (PDS-IMG, U.S. Geological Survey, Flagstaff, Arizona), Charles Acton (PDS-NAIF, JPL), and Joe Mafi (PDS-PPI UCLA, Los Angeles, California)

Data Preparation and Documentation:

Doug Alexander, Sue LaVoie, Jean Lorre, Justin Maki, Allan Runkle, and Pamela Woncik (Multimission Image Processing Laboratory, JPL)

Geometry Information:

Boris Semenov (PDS-NAIF, JPL), Nicolas Thomas (Max Plank Institut fur Aeronomie, Katlenburg-Lindau, Germany), and John Wellman (JPL)

MPF Project Support:

Kathleen Spellman, Susan Merrill, and Susan Roberts (JPL)

Calibration Information:

Haraldur Gunnlaugsson (Niels Bohr Institute for Astronomy, Copenhagen, Denmark), Devon Crowe and Bob Reid (Lunar & Planetary Laboratory, University of Arizona, Tucson, Arizona), Robert Sullivan (Cornell Univeristy, Ithaca, New York)

MPF Landing Site Gazetteer:

Bob Kanefsky, Ted Blackmon, Carol Stoker, and Eric Zbinden (NASA Ames, Moffett Field, California) and Nathan Bridges and Albert Haldemann (JPL)

Mars Pathfinder IMP Image Browser:

The image browser used on this CD was based largely on the HTML browser developed for the Viking Lander EDR archive CD-ROMs, which were produced by Edward A. Guinness, Thomas C. Stein, and Jennifer Herron of Washington University, St. Louis, MO.

CD Reviewers:

Thanks to Ed Guinness (PDS-GEO, Washington University, St. Louis, Missouri), Bob Reid (Lunar & Planetary Laboratory, University of Arizona, Tucson, Arizona), and Betty Sword (PDS-CN, JPL) for their helpful comments on this set of CDs.

C TABLE LABELS

C.1 INDEX.LBL

The INDEX.LBL file describes the structure of the INDEX.TAB file, which contains a selected set of parameters describing each EDR image file on the CD volume. The CUMINDEX.LBL and CUMINDEX.TAB files are very similar to these, except that they contain all the IMP images from all three volumes.

```
PDS_VERSION_ID            = PDS3

RECORD_TYPE               = FIXED_LENGTH
RECORD_BYTES              = 409
FILE_RECORDS              = 4661
DESCRIPTION               = "INDEX.TAB lists all the IMP EDR image
                             files on this volume, along with a
                             selected set of parameters describing
                             them."
^INDEX_TABLE              = "INDEX.TAB"

DATA_SET_ID               = "MPFL-M-IMP-2-EDR-V1.0"
MISSION_NAME              = "MARS PATHFINDER"
INSTRUMENT_HOST_NAME      = "MARS PATHFINDER LANDER"
INSTRUMENT_NAME           = "IMAGER FOR MARS PATHFINDER"

OBJECT                    = INDEX_TABLE
  INTERCHANGE_FORMAT      = ASCII
  ROW_BYTES               = 409
  ROWS                    = 4661
  COLUMNS                 = 24
  INDEX_TYPE              = SINGLE
  INDEXED_FILE_NAME       = {"*.DRK","*.FLT","*.HST","*.IMG",
                             "*.NUL","*.STR","*.SUM"}

  OBJECT                  = COLUMN
    NAME                  = PRODUCT_ID
    DATA_TYPE             = CHARACTER
    START_BYTE            = 2
    BYTES                 = 42
    DESCRIPTION           = "A permanent, unique identifier assigned
                             to each data product.  For the IMP EDRs,
                             this is constructed from the words
                             'IMP_EDR' followed by the spacecraft
                             clock start count, followed by the image
                             observation type, followed by the image id."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = VOLUME_ID
    DATA_TYPE             = CHARACTER
    START_BYTE            = 47
    BYTES                 = 9
    DESCRIPTION           = "Identifies the CD volume containing the
                             named file.  For the IMP EDRs, this
                             consists of the identifier 'MPIM_'
                             followed by the four digit volume
                             number."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = PATH_NAME
    DATA_TYPE             = CHARACTER
```

```
    START_BYTE            = 59
    BYTES                 = 26
    DESCRIPTION           = "Path to directory containing file.  This
                             path is shown in UNIX format.  It begins
                             at the root level of the CD.  It has a
                             trailing slah, but no leading slash."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = FILE_NAME
    DATA_TYPE             = CHARACTER
    START_BYTE            = 88
    BYTES                 = 12
    DESCRIPTION           = "This is the name of the PDS formatted
                             file as it is stored on the CD-ROM
                             archive media.  For the IMP EDRs, it
                             consists of the instrument identifier
                             'I', followed by the six least
                             significant digits of the spacecraft
                             clock start count, followed by a frame
                             identifier (L=left, R=right, S=dark
                             strip, N=null strip), followed by a 3
                             character extension.  The extension
                             indicates the image observation type as
                             follows: IMG=regular, STR=dark strip,
                             NUL=null strip, FLT=flat field, DRK=dark
                             current, HST=histogram, and
                             SUM=summation.  (Note that the latter two
                             values were never used.)"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = SPACECRAFT_CLOCK_START_COUNT
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 102
    BYTES                 = 10
    DESCRIPTION           = "The value of the lander clock (in
                             seconds) at which the image was
                             acquired."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = IMAGE_OBSERVATION_TYPE
    DATA_TYPE             = CHARACTER
    START_BYTE            = 114
    BYTES                 = 12
    DESCRIPTION           = "Identifies the type or purpose of an
                             observation.  Valid values are
                             REGULAR, DARK_CURRENT, FLAT_FIELD,
                             HISTOGRAM, SUMMATION, DARK_STRIP, and
                             NULL_STRIP.  For the meanings of these
                             values, please see appendix A of the IMP
                             EDR CD-ROM SIS."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = COMMAND_SEQUENCE_NUMBER
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 128
    BYTES                 = 4
    DESCRIPTION           = "Identifies a set of commands sent to
                             the IMP camera, ordering it to perform
                             a particular task.  Valid range is 1
                             to 9999.  For a complete list of the
```

```
                           command sequence numbers used during
                           the mission and their descriptions, see
                           section 3.2.2.7 of the IMP EDR CD-ROM
                           SIS."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = IMAGE_ID
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 133
  BYTES                 = 10
  DESCRIPTION           = "Uniquely identifies the observation
                           parameters of an image.  The most
                           significant four digits identify the
                           command sequence that contains the
                           imaging command.  The middle two
                           digits indicate the version of the
                           command sequence, and the right four
                           digits identify the image within a
                           single imaging sequence."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FRAME_ID
  DATA_TYPE             = CHARACTER
  START_BYTE            = 145
  BYTES                 = 9
  DESCRIPTION           = "Provides an identification for a
                           particular instrument frame.  Valid
                           values are LEFT, RIGHT, BOTH, and
                           HALFL.  The IMP camera nominally
                           operates in a mode where both the
                           left and right images are exposed and
                           transferred into the frame buffer
                           simultaneously.  Then either the
                           RIGHT, LEFT, or BOTH frames are
                           transmitted.  For even shorter
                           shutter times, the left image only
                           may be transferred into the frame
                           buffer (HALFL).  The presence of
                           BOTH in this field indicates that
                           the image should be part of a stereo
                           pair."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = INSTRUMENT_DEPLOYMENT_STATE
  DATA_TYPE             = CHARACTER
  START_BYTE            = 157
  BYTES                 = 8
  DESCRIPTION           = "Indicates whether or not the IMP camera
                           had been deployed to the end of its mast.
                           Valid values are STOWED and DEPLOYED."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FILTER_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 168
  BYTES                 = 14
  DESCRIPTION           = "The name of the instrument filter
                           through which the image was acquired.
                           The numbers refer to the effective
                           wavelength in nm of the filter for
```

```
                        the left (L) or right (R) image.

                         FILTER   FILTER
                         NUMBER    NAME             APPLICATION
                        ------------------------------------------------
                            0    L440_R440       Stereo, Geology
                            1    L450_R670       Solar
                            2    L885_R947       Solar
                            3    L925_R935       Solar
                            4    L935_R990       Solar
                            5    L670_R670       Stereo, Geology
                            6    L800_R750       Geology
                            7    L860_R-DIOPTER  Geology
                            8    L900_R600       Geology
                            9    L930_R530       Stereo, Ranging, Geology
                           10    L1000_R480      Geology
                           11    L965_R965       Stereo, Ranging, Geology
                      "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FILTER_NUMBER
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 184
  BYTES                 = 2
  DESCRIPTION           = "The number of the instrument filter
                           through which the image was acquired.
                           (See FILTER_NAME for details.)"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = IMAGE_TIME
  DATA_TYPE             = TIME
  START_BYTE            = 187
  BYTES                 = 24
  DESCRIPTION           = "Date and time at which the image was
                           acquired, recorded in UTC system format.
                           Shown as YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = PRODUCT_CREATION_TIME
  DATA_TYPE             = TIME
  START_BYTE            = 212
  BYTES                 = 24
  DESCRIPTION           = "Defines the UTC time a product was
                           created or last modified.  Has the form
                           YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EARTH_RECEIVED_START_TIME
  DATA_TYPE             = TIME
  START_BYTE            = 237
  BYTES                 = 24
  DESCRIPTION           = "Identifies the earliest time that a
                           telemetry packet containing data for
                           the image was received.  Has the form
                           YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EARTH_RECEIVED_STOP_TIME
  DATA_TYPE             = TIME
```

```
  START_BYTE            = 262
  BYTES                 = 24
  DESCRIPTION           = "Identifies the latest time that a
                           telemetry packet containing data for
                           the image was received.  Has the form
                           YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = PLANET_DAY_NUMBER
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 287
  BYTES                 = 4
  DESCRIPTION           = "The Martian day (ie., sidereal day,
                           equal to a rotation of 360 degrees)
                           on which the image was taken.  Starts
                           with 1 as the first day of surface
                           operations, the day the spacecraft
                           landed.  Negative values refer to
                           pre-surface images."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = MPF_LOCAL_TIME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 293
  BYTES                 = 8
  DESCRIPTION           = "Local time at the lander site on the
                           surface of Mars, measured in local
                           hours, minutes, and seconds, from
                           midnight.  Local hours are defined as
                           one twenty-fourth of a local solar day.
                           Local minutes are one sixtieth of a
                           local hour, and local seconds are one
                           sixtieth of a local minute.  Format is
                           hh:mm:ss.  Based on the IAU standard
                           for the Martian prime meridian.  See
                           [DAVIESETAL1994] for more details."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = TARGET_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 304
  BYTES                 = 8
  DESCRIPTION           = "Identifies the intended target of an
                           observation.  Can be either a planetary
                           body or a physical object.  The following
                           is the list of targets imaged by the IMP:

                           APXSSITE,   ALTAIR,     ARCTURUS,
                           CALIMG,     DEIMOS,     LANDER,
                           MAG,        MARS,       PHOBOS,
                           ROVER,      SKY,        SUN,
                           VEGA,       WINDSOCKS
                          "
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = AZIMUTH_MOTOR_CLICKS
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 314
  BYTES                 = 4
  DESCRIPTION           = "The number of motor step counts the
```

```
                           camera rotated in the horizontal direction
                           from the low hard stop.  Since each step
                           count is 0.553 degrees, the azimuthal
                           position of the camera can be derived
                           from this value.  Valid range is 0 to
                           1023."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = ELEVATION_MOTOR_CLICKS
    DATA_TYPE            = ASCII_INTEGER
    START_BYTE           = 319
    BYTES                = 4
    DESCRIPTION          = "The number of motor step counts the
                           camera rotated in the vertical direction
                           from the low hard stop.  Since each step
                           count is 0.553 degrees, the elevational
                           position of the camera can be derived
                           from this value.  Valid range is 0 to
                           1023."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = SURFACE_BASED_INST_AZIMUTH
    DATA_TYPE            = ASCII_REAL
    START_BYTE           = 324
    BYTES                = 8
    DESCRIPTION          = "One of two angular measurements of the
                           pointing direction of the instrument.
                           The azimuth is measured positively in the
                           clockwise direction (as viewed from
                           above) with the meridian passing through
                           the positive spin axis ('north pole')
                           defining the zero reference.  The angle
                           is measured in the local gravity
                           horizontal plane, ie., a plane
                           perpendicular to the local gravity
                           vector."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = SURFACE_BASED_INST_ELEVATION
    DATA_TYPE            = ASCII_REAL
    START_BYTE           = 333
    BYTES                = 8
    DESCRIPTION          = "One of two angular measurements of the
                           pointing direction of the instrument.
                           For the Mars Pathfinder IMP EDRs,
                           elevation is measured positively upwards
                           from the plane which is perpendicular to
                           the local gravity vector and which
                           intersects the elevation axis around with
                           the camera rotates.  Valid values: -90
                           degrees (nadir) to +90 degrees (zenith)."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = OBSERVATION_NAME
    DATA_TYPE            = CHARACTER
    START_BYTE           = 343
    BYTES                = 64
    DESCRIPTION          = "The intended purpose of an observation or
                           sequence of commands.  See table
                           3.2.2.7.B in the IMP EDR CD-ROM SIS for a
```

```
                              complete listing of the values."
  END_OBJECT                = COLUMN

END_OBJECT                  = INDEX_TABLE
END
```

C.2 COMMAND.LBL

The COMMAND.LBL file describes the structure of the COMMAND.TAB file, which contains descriptive parameters describing each command, or IMAGE_ID, used to command the IMP camera. The IMAGE_IDs can be used as a common key with the EDRINDEX.TAB file to create a relational database.

```
PDS_VERSION_ID            = PDS3

RECORD_TYPE               = FIXED_LENGTH
RECORD_BYTES              = 469
FILE_RECORDS              = 7223
DESCRIPTION               = "COMMAND.TAB provides a detailed description
                             of the commands used on the Mars
                             Pathfinder mission.  Note that these are
                             the values that were commanded, and may
                             in some instances differ from the values
                             that were actually used, which are shown
                             in the EDRINDEX.TAB file.  The records in
                             this table are keyed on the IMAGE_ID,
                             which represents an individual command
                             with a set of unique command parameters.
                             Each command usually produced multiple
                             images."
^TABLE                    = "COMMAND.TAB"

DATA_SET_ID               = "MPFL-M-IMP-2-EDR-V1.0"
MISSION_NAME              = "MARS PATHFINDER"
INSTRUMENT_HOST_NAME      = "MARS PATHFINDER LANDER"
INSTRUMENT_NAME           = "IMAGER FOR MARS PATHFINDER"

OBJECT                    = TABLE
  INTERCHANGE_FORMAT      = ASCII
  ROW_BYTES               = 469
  ROWS                    = 7223
  COLUMNS                 = 43

  OBJECT                  = COLUMN
    NAME                  = IMAGE_ID
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 1
    BYTES                 = 10
    FORMAT                = "I10"
    DESCRIPTION           = "Uniquely identifies the observation
                             parameters of an image.  The most
                             significant four digits identify the
                             command sequence that contains the
                             imaging command.  The middle two
                             digits indicate the version of the
                             command sequence, and the right four
                             digits identify the image within a
                             single imaging sequence."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = COMMAND_VERSION_NUMBER
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 12
    BYTES                 = 1
    FORMAT                = "I1"
    DESCRIPTION           = "The version number of the command.  The
                             commands (ie., IMAGE_IDs) were intended
                             to be unique, but in a few cases they
```

```
                           were re-used with different command
                           parameters.  This keyword was added to
                           distinguish between differing versions of
                           the commands.  Valid range is 1 to 9,
                           where the lowest version number reflects
                           the oldest version of a command."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = APPLICATION_PACKET_ID
    DATA_TYPE            = ASCII_INTEGER
    START_BYTE           = 14
    BYTES                = 2
    FORMAT               = "I2"
    DESCRIPTION          = "The id of the telemetry packet queue to
                            which the image data was directed."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = AUTO_EXPOSURE_DATA_CUT
    DATA_TYPE            = ASCII_INTEGER
    START_BYTE           = 17
    BYTES                = 4
    FORMAT               = "I4"
    DESCRIPTION          = "The DN value which a specified fraction
                            of pixels is permitted to exceed.  Valid
                            range: 0 to 4095."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = AUTO_EXPOSURE_PIXEL_FRACTION
    DATA_TYPE            = ASCII_REAL
    START_BYTE           = 22
    BYTES                = 6
    FORMAT               = "F6.2"
    DESCRIPTION          = "The percentage of pixels whose value is
                            higher than the auto exposure data cut.
                            This field isonly applicable if the
                            exposure type is set to AUTO or
                            INCREMENTAL.  Valid range: 0 to 100."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = AZIMUTH_MOTOR_CLICKS
    DATA_TYPE            = ASCII_INTEGER
    START_BYTE           = 29
    BYTES                = 3
    FORMAT               = "I3"
    DESCRIPTION          = "The number of motor step counts the
                            camera rotated in the horizontal direction
                            from the low hard stop.  Since each step
                            count is 0.553 degrees, the azimuthal
                            position of the camera can be derived
                            from this value.  Valid range is 0 to
                            1023."
  END_OBJECT             = COLUMN

  OBJECT                 = COLUMN
    NAME                 = BAD_PIXEL_REPLACEMENT_FLAG
    DATA_TYPE            = CHARACTER
    START_BYTE           = 34
    BYTES                = 1
    FORMAT               = "A1"
    DESCRIPTION          = "Indicates whether or not bad pixel
```

```
                        replacement processing was completed.  If
                        set to 'T' (TRUE), certain pixels in the
                        image were replaced based on a bad pixel
                        table.  Valid values: T, F."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = COMMAND_DESCRIPTION
    DATA_TYPE           = CHARACTER
    START_BYTE          = 38
    BYTES               = 94
    FORMAT              = "A94"
    DESCRIPTION         = "The textual description associated with a
                        command name."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = COMMAND_NAME
    DATA_TYPE           = CHARACTER
    START_BYTE          = 135
    BYTES               = 16
    FORMAT              = "A16"
    DESCRIPTION         = "The name of an uplinked command sent to a
                        spacecraft or instrument.  For the IMP
                        EDRs, this indicates the method the IMP
                        camera was instructed to use to determine
                        its pointing direction.  Valid values:
                        IMP_IMAGE_AZ_EL, IMP_IMAGE_LCLGRD,
                        IMP_IMAGE_LCLVEC, IMP_IMAGE_OBJECT,
                        IMP_IMAGE_VECTOR."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = DARK_CURRENT_CORRECTION_FLAG
    DATA_TYPE           = CHARACTER
    START_BYTE          = 154
    BYTES               = 1
    FORMAT              = "A1"
    DESCRIPTION         = "A flag indicating whether or not a dark
                        current correction was applied to the
                        image.  For MPF, this correction was
                        applied to the image on board the
                        spacecraft, before the image was
                        transmitted to Earth.  Valid values: T, F."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = DOWNLOAD_TYPE
    DATA_TYPE           = CHARACTER
    START_BYTE          = 158
    BYTES               = 6
    FORMAT              = "A6"
    DESCRIPTION         = "Specifies which image data to download,
                        any or all of: image data (IM), dark
                        current strip (DS), and null pixel data
                        (NS).  Valid values: NONE, DS, IM, DSIM,
                        NS, DSNS, IMNS, DSIMNS."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = ELEVATION_MOTOR_CLICKS
    DATA_TYPE           = ASCII_INTEGER
    START_BYTE          = 166
    BYTES               = 3
```

```
  FORMAT                = "I3"
  DESCRIPTION           = "The number of motor step counts the
                           camera rotated in the vertical direction
                           from the low hard stop.  Since each step
                           count is 0.553 degrees, the elevational
                           position of the camera can be derived
                           from this value.  Valid range is 0 to
                           1023."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EXPOSURE_COUNT
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 170
  BYTES                 = 1
  FORMAT                = "I1"
  DESCRIPTION           = "Maximum number of exposures taken.  Value
                           is dependant on exposure type.  Valid
                           range: 0 - 16."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EXPOSURE_DURATION
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 172
  BYTES                 = 7
  FORMAT                = "F7.1"
  DESCRIPTION           = "The commanded integration time for MANUAL
                           and AUTO exposures, measured in
                           milliseconds."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EXPOSURE_TYPE
  DATA_TYPE             = CHARACTER
  START_BYTE            = 181
  BYTES                 = 6
  FORMAT                = "A6"
  DESCRIPTION           = "Exposure type for the image.  Valid
                           values: AUTO, INCR (incremental), MANUAL,
                           PRETMD (pretimed), and NONE.  AUTO
                           exposure automatically adjusts the
                           exposure time by iterating off of a
                           pre-set exposure time.  INCR exposure
                           also automatically adjusts the exposure
                           time, but iterates off of the exposure
                           time from the previous image.  MANUAL
                           exposure is a single exposure with a set
                           exposure time.  PRETMD exposure uses the
                           last exposure time used, regardless of
                           the type of exposure it was.  NONE
                           indicates that the command moves only the
                           camera and doesn't take an exposure."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FILTER_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 190
  BYTES                 = 14
  FORMAT                = "A14"
  DESCRIPTION           = "The name of the instrument filter
                           through which the image was acquired.
                           The numbers refer to the effective
```

```
                        wavelength in nm of the filter for
                        the left (L) or right (R) image.

                         FILTER   FILTER
                         NUMBER    NAME             APPLICATION
                        ------------------------------------------------
                            0    L440_R440       Stereo, Geology
                            1    L450_R670       Solar
                            2    L885_R947       Solar
                            3    L925_R935       Solar
                            4    L935_R990       Solar
                            5    L670_R670       Stereo, Geology
                            6    L800_R750       Geology
                            7    L860_R-DIOPTER  Geology
                            8    L900_R600       Geology
                            9    L930_R530       Stereo, Ranging, Geology
                           10    L1000_R480      Geology
                           11    L965_R965       Stereo, Ranging, Geology
                       "
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = FILTER_NUMBER
    DATA_TYPE           = ASCII_INTEGER
    START_BYTE          = 206
    BYTES               = 2
    FORMAT              = "I2"
    DESCRIPTION         = "The number of the instrument filter
                           through which the image was acquired.
                           (See FILTER_NAME for details.)"
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = FIRST_LINE
    DATA_TYPE           = ASCII_INTEGER
    START_BYTE          = 209
    BYTES               = 3
    FORMAT              = "I3"
    DESCRIPTION         = "The line within a source image that
                           corresponds to the first line in the
                           sub-image.  For the IMP EDRs, the source
                           image is the complete 256x256 image area
                           within the CCD."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = FIRST_LINE_SAMPLE
    DATA_TYPE           = ASCII_INTEGER
    START_BYTE          = 213
    BYTES               = 3
    FORMAT              = "I3"
    DESCRIPTION         = "The sample within a source image that
                           corresponds to the first sample in the
                           sub-image.  For the IMP EDRs, the source
                           image is the complete 256x256 image area
                           within the CCD."
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = FLAT_FIELD_CORRECTION_FLAG
    DATA_TYPE           = CHARACTER
    START_BYTE          = 218
    BYTES               = 1
    FORMAT              = "A1"
```

```
  DESCRIPTION           = "Indicates whether or not a flat field
                          correction was applied to the image.  For
                          MPF, this correction was applied to the
                          image on board the spacecraft, before the
                          image was transmitted to Earth.  Valid
                          values: T, F."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FRAME_ID
  DATA_TYPE             = CHARACTER
  START_BYTE            = 222
  BYTES                 = 5
  FORMAT                = "A5"
  DESCRIPTION           = "Provides an identification for a
                          particular instrument frame.  Valid
                          values are LEFT, RIGHT, BOTH, and
                          HALFL.  The IMP camera nominally
                          operates in a mode where both the
                          left and right images are exposed and
                          transferred into the frame buffer
                          simultaneously.  Then either the
                          RIGHT, LEFT, or BOTH frames are
                          transmitted.  For even shorter
                          shutter times, the left image only
                          may be transferred into the frame
                          buffer (HALFL).  The presence of
                          BOTH in this field indicates that
                          the image should be part of a stereo
                          pair."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = GRID_POSITION_X
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 229
  BYTES                 = 8
  FORMAT                = "F8.4"
  DESCRIPTION           = "The north / south component of a positon
                          defining the IMP pointing, measured with
                          respect to the Martian Local Level
                          Coordinate Frame (M Frame).  A positive
                          value indicates that the position was to
                          the north of the lander; a negative value
                          indicates it was to the south.  The
                          magnitude gives the distance, in meters,
                          between the position and an east / west
                          line drawn through the center of the
                          lander base petal."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = GRID_POSITION_Y
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 238
  BYTES                 = 8
  FORMAT                = "F8.4"
  DESCRIPTION           = "The east / west component of a positon
                          defining the IMP pointing, measured with
                          respect to the Martian Local Level
                          Coordinate Frame (M Frame).  A positive
                          value indicates that the position was to
                          the east of the lander; a negative value
                          indicates it was to the west.  The
```

```
                           magnitude gives the distance, in meters,
                           between the position and an north / south
                           line drawn through the center of the
                           lander base petal."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = GRID_POSITION_Z
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 247
    BYTES                  = 7
    FORMAT                 = "F7.4"
    DESCRIPTION            = "The vertical component of a position
                             defining the IMP pointing, measured with
                             respect to the Martian Local Level
                             Coordinate Frame (M Frame).  A positive
                             value indicates that the position was
                             below the lander base petal; a negative
                             value indicates that it was above the
                             base petal."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = HISTOGRAM_FLAG
    DATA_TYPE              = CHARACTER
    START_BYTE             = 256
    BYTES                  = 1
    FORMAT                 = "A1"
    DESCRIPTION            = "A flag to indicate that the product
                             returned was a histogram.  Valid values:
                             T, F."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = INST_CMPRS_MODE
    DATA_TYPE              = ASCII_INTEGER
    START_BYTE             = 259
    BYTES                  = 1
    FORMAT                 = "I1"
    DESCRIPTION            = "The targetted image quality or
                             compression factor for on-board
                             compression.  Compression is obtained
                             with Huffman or arithmetic entropy
                             encoding, with or without LCT.  Odd modes
                             specify a targetted image quality,
                             whereas even modes specify a targetted
                             compression factor.  Modes 1,2,5,6
                             utilize Huffman encoding; modes 3,4,7,8
                             use arithmetic encoding.  Modes 5,6,7,8
                             use LCT.  Mode 9 specifies RICE
                             compression.  Valid values: 1 to 9."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = INST_CMPRS_NAME
    DATA_TYPE              = CHARACTER
    START_BYTE             = 262
    BYTES                  = 60
    FORMAT                 = "A60"
    DESCRIPTION            = "The type of on-board compression used for
                             data storage and transmission."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
```

```
  NAME                = INST_CMPRS_PARAM
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 324
  BYTES               = 2
  FORMAT              = "I2"
  DESCRIPTION         = "This is a JPEG compression specific
                         variable.  It specifies the on-board
                         compression rate as image quality or
                         compression factor, based on the selected
                         instrument compression mode."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INST_CMPRS_QUANTZ_TBL_ID
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 327
  BYTES               = 1
  FORMAT              = "I1"
  DESCRIPTION         = "The identifier for the reference table
                         used for quantization in the frequency
                         domain for on-board transform
                         compression.  This name or code should be
                         specific enough to allow the user of the
                         data to have sufficient information to
                         reference the quantization table used to
                         compress the data."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = IVP_TARGET_NAME
  DATA_TYPE           = CHARACTER
  START_BYTE          = 330
  BYTES               = 6
  FORMAT              = "A6"
  DESCRIPTION         = "Specifies the image vector pointing
                         object at which the IMP camera was aimed.
                         Valid values include SUN, EARTH, PHOBOS,
                         and NULL.  Note that the camera was
                         'tricked' into pointing at other objects
                         (like Deimos or stars) by directing it to
                         point to Phobos, but redefining the
                         position of Phobos in the sky."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = LINES
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 338
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "The total number of pixels along the
                         vertical axis of an image."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = LINE_SAMPLES
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 342
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "The total number of pixels along the
                         horizontal axis of an image."
END_OBJECT            = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = PIXEL_AVERAGING_HEIGHT
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 346
  BYTES               = 1
  FORMAT              = "I1"
  DESCRIPTION         = "The vertical dimension, in pixels, of the
                         area over which pixels were averaged
                         prior to image compression."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = PIXEL_AVERAGING_WIDTH
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 348
  BYTES               = 1
  FORMAT              = "I1"
  DESCRIPTION         = "The horizontal dimension, in pixels, of
                         the area over which pixels were averaged
                         prior to image compression."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SHUTTER_EFFECT_CORRECTION_FLAG
  DATA_TYPE           = CHARACTER
  START_BYTE          = 351
  BYTES               = 1
  FORMAT              = "A1"
  DESCRIPTION         = "Indicates whether or not a shutter effect
                         correction was applied to the image.  The
                         shutter effect correction involves the
                         removal from the image of the shutter or
                         fixed-pattern.  For MPF, this correction
                         was applied to the image on board the
                         spacecraft, before the image was
                         transmitted to Earth.  Valid values: T, F."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SOURCE_PRODUCT_ID
  DATA_TYPE           = CHARACTER
  START_BYTE          = 355
  BYTES               = 16
  FORMAT              = "A16"
  DESCRIPTION         = "Identifies a product used as input to
                         create a new product.  For MPF, this
                         refers to the filenames of the SPICE
                         kernels used to produce the image and its
                         ancillary data."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SQRT_COMPRESSION_FLAG
  DATA_TYPE           = CHARACTER
  START_BYTE          = 374
  BYTES               = 1
  FORMAT              = "A1"
  DESCRIPTION         = "Indicates whether or not square root
                         compression was applied to the image.
                         For MPF, this compression was performed
                         on-board the lander, prior to
                         transmission of the data to Earth.  It
                         involved the compression of the pixels
                         from 12 bits down to 8 bits.  Valid
```

```
                        values: T, F."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = SUBFRAME_FLAG
  DATA_TYPE             = CHARACTER
  START_BYTE            = 378
  BYTES                 = 1
  FORMAT                = "A1"
  DESCRIPTION           = "A flag to indicate that the image is not
                           full size.  Valid values: T, F."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = SUM_FLAG
  DATA_TYPE             = CHARACTER
  START_BYTE            = 382
  BYTES                 = 1
  FORMAT                = "A1"
  DESCRIPTION           = "A flag to indicate that the product
                           returned is a 'summation' file.  For the
                           IMP EDRs, this means that it contains two
                           records, the first a list of the sums of
                           the image columns, and the second a list
                           of the sums of the image rows.  Valid
                           values: T, F."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = ATMOS_FLAG
  DATA_TYPE             = CHARACTER
  START_BYTE            = 386
  BYTES                 = 1
  FORMAT                = "A1"
  DESCRIPTION           = "A flag that indicates that the given
                           observation was directed at the sun.
                           Valid values: T, F."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = OBSERVATION_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 390
  BYTES                 = 56
  FORMAT                = "A56"
  DESCRIPTION           = "The intended purpose of an observation or
                           sequence of commands.  See table
                           3.2.2.7.B in the IMP EDR CD-ROM SIS for a
                           complete listing of the values."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = VECTOR_COMPONENT_X
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 448
  BYTES                 = 6
  FORMAT                = "F6.3"
  DESCRIPTION           = "The x component of a unit vector which
                           defines the IMP pointing.  The vector is
                           defined with respect to one of two
                           possible coordinate frames, indicated by
                           the command name.  If the command name is
                           IMP_IMAGE_VECTOR, the coordinate system
                           is the IMP camera frame (IMP Frmae); if
```

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                              the command name is IMP_IMAGE_LCLVEC, the
                              coordinate system is the Martian Local
                              Level Frame (M Frame).  Valid range: -1.0
                              to 1.0."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = VECTOR_COMPONENT_Y
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 455
    BYTES                   = 6
    FORMAT                  = "F6.3"
    DESCRIPTION             = "The y component of a unit vector which
                              defines the IMP pointing.  The vector is
                              defined with respect to one of two
                              possible coordinate frames, indicated by
                              the command name.  If the command name is
                              IMP_IMAGE_VECTOR, the coordinate system
                              is the IMP camera frame (IMP Frmae); if
                              the command name is IMP_IMAGE_LCLVEC, the
                              coordinate system is the Martian Local
                              Level Frame (M Frame).  Valid range: -1.0
                              to 1.0."
  END_OBJECT                = COLUMN

  OBJECT                    = COLUMN
    NAME                    = VECTOR_COMPONENT_Z
    DATA_TYPE               = ASCII_REAL
    START_BYTE              = 462
    BYTES                   = 6
    FORMAT                  = "F6.3"
    DESCRIPTION             = "The z component of a unit vector which
                              defines the IMP pointing.  The vector is
                              defined with respect to one of two
                              possible coordinate frames, indicated by
                              the command name.  If the command name is
                              IMP_IMAGE_VECTOR, the coordinate system
                              is the IMP camera frame (IMP Frmae); if
                              the command name is IMP_IMAGE_LCLVEC, the
                              coordinate system is the Martian Local
                              Level Frame (M Frame).  Valid range: -1.0
                              to 1.0."
  END_OBJECT                = COLUMN

END_OBJECT                  = TABLE
END
```

C.3 EDRINDEX.LBL

The EDRINDEX.LBL file describes the structure of the EDRINDEX.TAB file, which contains a detailed listing of many parameters describing each EDR image. The only parameters which were used during the mission which have not been included here are those specifically pertaining to active mission operations.

```
PDS_VERSION_ID            = PDS3

RECORD_TYPE               = FIXED_LENGTH
RECORD_BYTES              = 777
FILE_RECORDS              = 16661
DESCRIPTION               = "EDRINDEX.TAB lists all IMP EDR image
                             files on this set of 3 CD volumes.  It
                             includes most of the parameters from the
                             project database except those that were
                             applicable only to mission operations."
^INDEX_TABLE              = "EDRINDEX.TAB"

DATA_SET_ID               = "MPFL-M-IMP-2-EDR-V1.0"
MISSION_NAME              = "MARS PATHFINDER"
INSTRUMENT_HOST_NAME      = "MARS PATHFINDER LANDER"
INSTRUMENT_NAME           = "IMAGER FOR MARS PATHFINDER"

OBJECT                    = INDEX_TABLE
  INTERCHANGE_FORMAT      = ASCII
  ROW_BYTES               = 777
  ROWS                    = 16661
  COLUMNS                 = 63
  INDEX_TYPE              = CUMULATIVE
  INDEXED_FILE_NAME       = {"*.DRK","*.FLT","*.HST","*.IMG",
                             "*.NUL","*.STR","*.SUM"}

  OBJECT                  = COLUMN
    NAME                  = SPACECRAFT_CLOCK_START_COUNT
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 1
    BYTES                 = 10
    FORMAT                = "I10"
    DESCRIPTION           = "The value of the lander clock (in
                             seconds) at which the image was
                             acquired."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = IMAGE_ID
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 12
    BYTES                 = 10
    FORMAT                = "I10"
    DESCRIPTION           = "Uniquely identifies the observation
                             parameters of an image.  The most
                             significant four digits identify the
                             command sequence that contains the
                             imaging command.  The middle two
                             digits indicate the version of the
                             command sequence, and the right four
                             digits identify the image within a
                             single imaging sequence."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = IMAGE_OBSERVATION_TYPE
```

```
  DATA_TYPE             = CHARACTER
  START_BYTE            = 24
  BYTES                 = 12
  FORMAT                = "A12"
  DESCRIPTION           = "Identifies the type or purpose of an
                           observation.  Valid values are
                           REGULAR, DARK_CURRENT, FLAT_FIELD,
                           HISTOGRAM, SUMMATION, DARK_STRIP, and
                           NULL_STRIP.  For the meanings of these
                           values, please see appendix A of the IMP
                           EDR CD-ROM SIS."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = PRODUCT_ID
  DATA_TYPE             = CHARACTER
  START_BYTE            = 39
  BYTES                 = 42
  FORMAT                = "A42"
  DESCRIPTION           = "A permanent, unique identifier assigned
                           to each data product.  For the IMP EDRs,
                           this is constructed from the words
                           'IMP_EDR' followed by the spacecraft
                           clock start count, followed by the image
                           observation type, followed by the image id."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = VOLUME_ID
  DATA_TYPE             = CHARACTER
  START_BYTE            = 84
  BYTES                 = 9
  FORMAT                = "A9"
  DESCRIPTION           = "Identifies the CD volume containing the
                           named file.  For the IMP EDRs, this
                           consists of the identifier 'MPIM_'
                           followed by the four digit volume
                           number."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = PATH_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 96
  BYTES                 = 26
  FORMAT                = "A26"
  DESCRIPTION           = "Path to directory containing file.  This
                           path is shown in UNIX format.  It begins
                           at the root level of the CD.  It has a
                           trailing slah, but no leading slash."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FILE_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 125
  BYTES                 = 12
  FORMAT                = "A12"
  DESCRIPTION           = "This is the name of the PDS formatted
                           file as it is stored on the CD-ROM
                           archive media.  For the IMP EDRs, it
                           consists of the instrument identifier
                           'I', followed by the six least
                           significant digits of the spacecraft
```

```
                           clock start count, followed by a frame
                           identifier (L=left, R=right, S=dark
                           strip, N=null strip), followed by a 3
                           character extension.  The extension
                           indicates the image observation type as
                           follows: IMG=regular, STR=dark strip,
                           NUL=null strip, FLT=flat field, DRK=dark
                           current, HST=histogram, and
                           SUM=summation.  (Note that the latter two
                           values were never used.)"
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = APPLICATION_PACKET_ID
    DATA_TYPE              = ASCII_INTEGER
    START_BYTE             = 139
    BYTES                  = 2
    FORMAT                 = "I2"
    DESCRIPTION            = "The id of the telemetry packet queue to
                             which the image data was directed."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = INSTRUMENT_AZIMUTH
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 142
    BYTES                  = 8
    FORMAT                 = "F8.4"
    DESCRIPTION            = "One of two angular measurements of the
                             pointing direction of the instrument.
                             The azimuth is measured positively in the
                             clockwise direction (as viewed from
                             above) from a fixed reference direction.
                             The angle is measured in the x-y plane of
                             the instrument's coordinate system, which
                             is not necessarily co-linear with the
                             surface fixed coordinate system."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = INSTRUMENT_AZIMUTH_METHOD
    DATA_TYPE              = CHARACTER
    START_BYTE             = 152
    BYTES                  = 9
    FORMAT                 = "A9"
    DESCRIPTION            = "Identifies the method used to calculate
                             the instrument azimuth from the azimuth
                             motor clicks.  Valid values: TELEMETRY,
                             MPFNAV-MIPS, BACKLASH-UOFA."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = AZIMUTH_FOV
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 163
    BYTES                  = 7
    FORMAT                 = "F7.4"
    DESCRIPTION            = "The angular measure of the horizontal
                             field of view of an imaged scene.  For
                             MPF, 'horizontal' is measured in the x-y
                             plane of the IMP coordinate system."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
```

```
  NAME                = AZIMUTH_MOTOR_CLICKS
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 171
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "The number of motor step counts the
                         camera rotated in the horizontal direction
                         from the low hard stop.  Since each step
                         count is 0.553 degrees, the azimuthal
                         position of the camera can be derived
                         from this value.  Valid range is 0 to
                         1023."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INSTRUMENT_ELEVATION
  DATA_TYPE           = ASCII_REAL
  START_BYTE          = 175
  BYTES               = 8
  FORMAT              = "F8.4"
  DESCRIPTION         = "One of two angular measurements of the
                         pointing direction of the instrument.
                         The elevation is measured with respect to
                         the plane which is co-planar with the x-y
                         plane of the instrument's coordinate
                         system (in this case the IMP Frame) and
                         which intersects the elevation axis
                         around which the instrument rotates.  For
                         the Mars Pathfinder IMP EDRs, the
                         elevation is measured positive upwards.
                         Valid values: -90 degrees (nadir) to +90
                         degrees (zenith)."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INSTRUMENT_ELEVATION_METHOD
  DATA_TYPE           = CHARACTER
  START_BYTE          = 185
  BYTES               = 9
  FORMAT              = "A9"
  DESCRIPTION         = "Identifies the method used to calculate
                         the instrument elevation from the
                         elevation motor clicks.  Valid values:
                         TELEMETRY, MPFNAV-MIPS, BACKLASH-UOFA."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = ELEVATION_FOV
  DATA_TYPE           = ASCII_REAL
  START_BYTE          = 196
  BYTES               = 7
  FORMAT              = "F7.4"
  DESCRIPTION         = "The angular measure of the vertical field
                         of view of an imaged scene.  For MPF,
                         'vertical' is measured along the Z-IMP
                         axis of the IMP coordinate system."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = ELEVATION_MOTOR_CLICKS
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 204
  BYTES               = 3
  FORMAT              = "I3"
```

```
  DESCRIPTION           = "The number of motor step counts the
                           camera rotated in the vertical direction
                           from the low hard stop.  Since each step
                           count is 0.553 degrees, the elevational
                           position of the camera can be derived
                           from this value.  Valid range is 0 to
                           1023."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EXPECTED_PACKETS
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 208
  BYTES                 = 3
  FORMAT                = "I3"
  DESCRIPTION           = "The total number of telemetry packets
                           which constitute a complete image, ie.,
                           an image without missing data."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = RECEIVED_PACKETS
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 212
  BYTES                 = 3
  FORMAT                = "I3"
  DESCRIPTION           = "The total number of telemetry packets
                           which constitute a reconstructed image."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EXPOSURE_DURATION
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 216
  BYTES                 = 7
  FORMAT                = "F7.1"
  DESCRIPTION           = "The integration time for MANUAL and AUTO
                           exposures, measured in milliseconds."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = FILTER_NAME
  DATA_TYPE             = CHARACTER
  START_BYTE            = 225
  BYTES                 = 14
  FORMAT                = "A14"
  DESCRIPTION           = "The name of the instrument filter
                           through which the image was acquired.
                           The numbers refer to the effective
                           wavelength in nm of the filter for
                           the left (L) or right (R) image.

                            FILTER   FILTER
                            NUMBER    NAME             APPLICATION
                           ------------------------------------------------
                               0    L440_R440       Stereo, Geology
                               1    L450_R670       Solar
                               2    L885_R947       Solar
                               3    L925_R935       Solar
                               4    L935_R990       Solar
                               5    L670_R670       Stereo, Geology
                               6    L800_R750       Geology
                               7    L860_R-DIOPTER  Geology
                               8    L900_R600       Geology
```

```
                                9    L930_R530       Stereo, Ranging, Geology
                               10    L1000_R480      Geology
                               11    L965_R965       Stereo, Ranging, Geology
                          "
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = FILTER_NUMBER
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 241
    BYTES                 = 2
    FORMAT                = "I2"
    DESCRIPTION           = "The number of the instrument filter
                             through which the image was acquired.
                             (See FILTER_NAME for details.)"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = COMMAND_SEQUENCE_NUMBER
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 244
    BYTES                 = 4
    FORMAT                = "I4"
    DESCRIPTION           = "Identifies a set of commands sent to
                             the IMP camera, ordering it to perform
                             a particular task.  Valid range is 1
                             to 9999.  For a complete list of the
                             command sequence numbers used during
                             the mission and their descriptions, see
                             section 3.2.2.7 of the IMP EDR CD-ROM
                             SIS."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = IMAGE_TIME
    DATA_TYPE             = TIME
    START_BYTE            = 249
    BYTES                 = 24
    FORMAT                = "A24"
    DESCRIPTION           = "Date and time at which the image was
                             acquired, recorded in UTC system format.
                             Shown as YYYY-MM-DDThh:mm:ss.fffZ"
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = INST_CMPRS_BLK_SIZE
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 274
    BYTES                 = 3
    FORMAT                = "I3"
    DESCRIPTION           = "Dimension of a block for on-board
                             compression."
  END_OBJECT              = COLUMN

  OBJECT                  = COLUMN
    NAME                  = INST_CMPRS_BLOCKS
    DATA_TYPE             = ASCII_INTEGER
    START_BYTE            = 278
    BYTES                 = 4
    FORMAT                = "I4"
    DESCRIPTION           = "Number of blocks used to spatially
                             segment the image file prior to
                             compression."
  END_OBJECT              = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = INST_CMPRS_MODE
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 283
  BYTES               = 1
  FORMAT              = "I1"
  DESCRIPTION         = "The targetted image quality or
                         compression factor for on-board
                         compression.  Compression is obtained
                         with Huffman or arithmetic entropy
                         encoding, with or without LCT.  Odd modes
                         specify a targetted image quality,
                         whereas even modes specify a targetted
                         compression factor.  Modes 1,2,5,6
                         utilize Huffman encoding; modes 3,4,7,8
                         use arithmetic encoding.  Modes 5,6,7,8
                         use LCT.  Mode 9 specifies RICE
                         compression.  Valid values: 1 to 9."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INST_CMPRS_NAME
  DATA_TYPE           = CHARACTER
  START_BYTE          = 286
  BYTES               = 60
  FORMAT              = "A60"
  DESCRIPTION         = "The type of on-board compression used for
                         data storage and transmission."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INST_CMPRS_PARAM
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 348
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "This is a JPEG compression specific
                         variable.  It specifies the on-board
                        copmression rate as image quality or
                        compression factor, based on the selected
                        instrument compression mode."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INST_CMPRS_QUANTZ_TBL_ID
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 352
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "The identifier for the reference table
                         used for quantization in the frequency
                         domain for on-board transform
                         compression.  This name or code should be
                         specific enough to allow the user of the
                         data to have sufficient information to
                         reference the quantization table used to
                         compress the data."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = INST_CMPRS_QUALITY
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 356
```

```
  BYTES                = 3
  FORMAT               = "I3"
  DESCRIPTION          = "A JPEG specific variable.  If an odd IMP
                          compression mode is used for on-board
                          compression, this is the desired image
                          quality index.  If an even IMP
                          compression mode is used, this is the
                          resultant image quality used to reach a
                          desired on-board compression factor."
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                 = INST_CMPRS_RATE
  DATA_TYPE            = ASCII_REAL
  START_BYTE           = 360
  BYTES                = 6
  FORMAT               = "F6.3"
  DESCRIPTION          = "The average number of bits needed to
                          represent a pixel for an ob-board
                          compressed image."
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                 = INST_CMPRS_RATIO
  DATA_TYPE            = ASCII_REAL
  START_BYTE           = 367
  BYTES                = 8
  FORMAT               = "F8.2"
  DESCRIPTION          = "The ratio of the size, in bytes, of the
                          original uncompressed data file to its
                          compressed form."
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                 = INST_CMPRS_SYNC_BLKS
  DATA_TYPE            = ASCII_INTEGER
  START_BYTE           = 376
  BYTES                = 4
  FORMAT               = "I4"
  DESCRIPTION          = "A RICE specific variable.  The number of
                          compressed blocks between synchronization
                          counters."
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                 = INSTRUMENT_DEPLOYMENT_STATE
  DATA_TYPE            = CHARACTER
  START_BYTE           = 382
  BYTES                = 8
  FORMAT               = "A8"
  DESCRIPTION          = "Indicates whether or not the IMP camera
                          had been deployed to the end of its mast.
                          Valid values are STOWED and DEPLOYED."
END_OBJECT             = COLUMN

OBJECT                 = COLUMN
  NAME                 = INSTRUMENT_CCD_TEMPERATURE
  DATA_TYPE            = ASCII_REAL
  START_BYTE           = 392
  BYTES                = 5
  FORMAT               = "F5.1"
  DESCRIPTION          = "The temperature, in degrees Celcius, of
                          the CCD sensor array when the image was
                          acquired."
```

```
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = INSTRUMENT_HEAD_TEMPERATURE
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 398
  BYTES                 = 5
  FORMAT                = "F5.1"
  DESCRIPTION           = "The temperature, in degrees Celcius, of
                           the camera head when the image was
                           acquired."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = LINES
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 404
  BYTES                 = 3
  FORMAT                = "I3"
  DESCRIPTION           = "The total number of pixels along the
                           vertical axis of an image."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = LINE_SAMPLES
  DATA_TYPE             = ASCII_INTEGER
  START_BYTE            = 408
  BYTES                 = 3
  FORMAT                = "I3"
  DESCRIPTION           = "The total number of pixels along the
                           horizontal axis of an image."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = LANDER_SURFACE_QUATERNION_X
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 412
  BYTES                 = 7
  FORMAT                = "F7.4"
  DESCRIPTION           = "One of four values that define the
                           relationship between the lander
                           coordinate frame and the local level
                           coordinate frame."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = LANDER_SURFACE_QUATERNION_Y
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 420
  BYTES                 = 7
  FORMAT                = "F7.4"
  DESCRIPTION           = "One of four values that define the
                           relationship between the lander
                           coordinate frame and the local level
                           coordinate frame."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = LANDER_SURFACE_QUATERNION_Z
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 428
  BYTES                 = 7
  FORMAT                = "F7.4"
  DESCRIPTION           = "One of four values that define the
```

```
                           relationship between the lander
                           coordinate frame and the local level
                           coordinate frame."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = LANDER_SURFACE_QUATERNION_A
    DATA_TYPE              = ASCII_REAL
    START_BYTE             = 436
    BYTES                  = 7
    FORMAT                 = "F7.4"
    DESCRIPTION            = "One of four values that define the
                           relationship between the lander
                           coordinate frame and the local level
                           coordinate frame."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = PLANET_DAY_NUMBER
    DATA_TYPE              = ASCII_INTEGER
    START_BYTE             = 444
    BYTES                  = 4
    FORMAT                 = "I4"
    DESCRIPTION            = "The Martian day (ie., sidereal day,
                           equal to a rotation of 360 degrees)
                           on which the image was taken.  Starts
                           with 1 as the first day of surface
                           operations, the day the spacecraft
                           landed.  Negative values refer to
                           pre-surface images."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = MPF_LOCAL_TIME
    DATA_TYPE              = CHARACTER
    START_BYTE             = 450
    BYTES                  = 8
    FORMAT                 = "A8"
    DESCRIPTION            = "Local time at the lander site on the
                           surface of Mars, measured in local
                           hours, minutes, and seconds, from
                           midnight.  Local hours are defined as
                           one twenty-fourth of a local solar day.
                           Local minutes are one sixtieth of a
                           local hour, and local seconds are one
                           sixtieth of a local minute.  Format is
                           hh:mm:ss.  Based on the IAU standard
                           for the Martian prime meridian.  See
                           [DAVIES1994] for more details."
  END_OBJECT               = COLUMN

  OBJECT                   = COLUMN
    NAME                   = PACKET_MAP_MASK
    DATA_TYPE              = CHARACTER
    START_BYTE             = 461
    BYTES                  = 116
    FORMAT                 = "A116"
    DESCRIPTION            = "A series of binary digits identifying
                           which of the expected packets were
                           actually received.  The bits are to be
                           read left to right.  Ie., the first
                           packet is represented by the leftmost
                           bit."
  END_OBJECT               = COLUMN
```

```
OBJECT                = COLUMN
  NAME                = PIXEL_AVERAGING_HEIGHT
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 579
  BYTES               = 1
  FORMAT              = "I1"
  DESCRIPTION         = "The vertical dimension, in pixels, of the
                         area over which pixels were averaged
                         prior to image compression."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = PIXEL_AVERAGING_WIDTH
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 581
  BYTES               = 1
  FORMAT              = "I1"
  DESCRIPTION         = "The horizontal dimension, in pixels, of
                         the area over which pixels were averaged
                         prior to image compression."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = PRODUCT_CREATION_TIME
  DATA_TYPE           = TIME
  START_BYTE          = 583
  BYTES               = 24
  FORMAT              = "A24"
  DESCRIPTION         = "Defines the UTC time was a product was
                         created or last modified.  Has the form
                         YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = RICE_OPTION_VALUE
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 608
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "A RICE compressor specific variable."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = RICE_START_OPTION
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 612
  BYTES               = 3
  FORMAT              = "I3"
  DESCRIPTION         = "A RICE compressor specific variable."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SOFTWARE_NAME
  DATA_TYPE           = CHARACTER
  START_BYTE          = 617
  BYTES               = 16
  FORMAT              = "A16"
  DESCRIPTION         = "The name of the telemetry processing
                         software used to generate the image
                         data."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
```

```
  NAME                = SOFTWARE_VERSION_ID
  DATA_TYPE           = CHARACTER
  START_BYTE          = 636
  BYTES               = 8
  FORMAT              = "A8"
  DESCRIPTION         = "The version of the telemetry processing
                         software used to generate the image
                         data."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SOLAR_AZIMUTH
  DATA_TYPE           = ASCII_REAL
  START_BYTE          = 646
  BYTES               = 8
  FORMAT              = "F8.4"
  DESCRIPTION         = "One of two angular measurements
                         indicating the position of the Sun as
                         measured from a specific point on the
                         surface of a planet (ex., from a lander
                         or rover).  The azimuth is measured
                         positively in the clockwise direction (as
                         viewed from above) with the meridian
                         passing through the positive spin axis of
                         the planet (ie., the north pole) defining
                         the zero reference."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SOLAR_ELEVATION
  DATA_TYPE           = ASCII_REAL
  START_BYTE          = 655
  BYTES               = 8
  FORMAT              = "F8.4"
  DESCRIPTION         = "One of two angular measurements
                         indicating the position of the Sun as
                         measured from a specific point on the
                         surface of a planet (ex., from a lander
                         or rover).  The positive direction of the
                         elevation is set by the
                         positive_elevation_direction data
                         element.  It is measured from the plane
                         which is perpendicular to the line
                         passing between the observer and the
                         planet's center and which intersects the
                         observer."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SQRT_MAXIMUM_PIXEL
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 664
  BYTES               = 4
  FORMAT              = "I4"
  DESCRIPTION         = "The maximum pixel value in a 12-bit image
                         prior to square root compression."
END_OBJECT            = COLUMN

OBJECT                = COLUMN
  NAME                = SQRT_MINIMUM_PIXEL
  DATA_TYPE           = ASCII_INTEGER
  START_BYTE          = 669
  BYTES               = 3
  FORMAT              = "I3"
```

```
  DESCRIPTION           = "The minimum pixel value in a 12-bit image
                           prior to square root compression."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EARTH_RECEIVED_START_TIME
  DATA_TYPE             = TIME
  START_BYTE            = 673
  BYTES                 = 24
  FORMAT                = "A24"
  DESCRIPTION           = "Identifies the earliest time that a
                           telemetry packet containing data for
                           image was received.  Has the form
                           YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = EARTH_RECEIVED_STOP_TIME
  DATA_TYPE             = TIME
  START_BYTE            = 698
  BYTES                 = 24
  FORMAT                = "A24"
  DESCRIPTION           = "Identifies the latest time that a
                           telemetry packet containing data for
                           image was received.  Has the form
                           YYYY-MM-DDThh:mm:ss.fffZ"
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = SURFACE_BASED_INST_AZIMUTH
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 723
  BYTES                 = 8
  FORMAT                = "F8.4"
  DESCRIPTION           = "One of two angular measurements of the
                           pointing direction of the instrument.
                           The azimuth is measured positively in the
                           clockwise direction (as viewed from
                           above) with the meridian passing through
                           the positive spin axis ('north pole')
                           defining the zero reference.  The angle
                           is measured in the local gravity
                           horizontal place, ie., a plane
                           perpendicular to the local gravity
                           vector."
END_OBJECT              = COLUMN

OBJECT                  = COLUMN
  NAME                  = SURFACE_BASED_INST_ELEVATION
  DATA_TYPE             = ASCII_REAL
  START_BYTE            = 732
  BYTES                 = 8
  FORMAT                = "F8.4"
  DESCRIPTION           = "One of two angular measurements of the
                           pointing direction of the instrument.
                           For the Mars Pathfinder IMP EDRs,
                           elevation is measured positively upwards
                           from the plane which is perpendicular to
                           the local gravity vector and which
                           intersects the elevation axis around with
                           the camera rotates.  Valid values: -90
                           degrees (nadir) to +90 degrees (zenith)."
END_OBJECT              = COLUMN
```

```
  OBJECT                = COLUMN
    NAME                = SURFACE_BASED_INST_METHOD
    DATA_TYPE           = CHARACTER
    START_BYTE          = 742
    BYTES               = 18
    FORMAT              = "A18"
    DESCRIPTION         = "Identifies the method used to calculate
                           the surface based instrument pointing.
                           Valid values: NULL, L_FRAME-QUATERNION"
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = TARGET_NAME
    DATA_TYPE           = CHARACTER
    START_BYTE          = 763
    BYTES               = 8
    FORMAT              = "A8"
    DESCRIPTION         = "Identifies the intended target of an
                           observation.  Can be either a planetary
                           body or a physical object.  The following
                           is the list of targets imaged by the IMP:

                           APXSSITE,   ALTAIR,     ARCTURUS,
                           CALIMG,     DEIMOS,     LANDER,
                           MAG,        MARS,       PHOBOS,
                           ROVER,      SKY,        SUN,
                           VEGA,       WINDSOCKS
                          "
  END_OBJECT            = COLUMN

  OBJECT                = COLUMN
    NAME                = TLM_CMD_DISCREPANCY_FLAG
    DATA_TYPE           = CHARACTER
    START_BYTE          = 774
    BYTES               = 1
    FORMAT              = "A1"
    DESCRIPTION         = "Indicates whether or not discrepancies
                           were found between the IMP uplinked
                           commands and the downlinked telemetry.
                           Valid values: 'T' and 'F'."
  END_OBJECT            = COLUMN

END_OBJECT              = INDEX_TABLE
END
```

C.4 GAZETTER.LBL

The GAZETTER.LBL file describes the structure of the GAZETTER.TAB file, which contains a listing of some of the informal feature names at the Mars Pathfinder landing site.

```
PDS_VERSION_ID       = PDS3

RECORD_TYPE          = FIXED_LENGTH
RECORD_BYTES         = 104
FILE_RECORDS         = 91
^TABLE               = "GAZETTER.TAB"

OBJECT               = TABLE
  NAME               = "Mars Pathfinder Landing Site Gazetteer"
  INTERCHANGE_FORMAT = ASCII
  ROWS               = 91
  COLUMNS            = 9
  ROW_BYTES          = 104
  DESCRIPTION        = "This table is a gazetteer of the names
                        informally assigned to many of the rocks and
                        other local small features visible near the
                        Mars Pathfinder landing site."

  OBJECT             = COLUMN
    NAME             = TARGET_NAME
    DATA_TYPE        = CHARACTER
    START_BYTE       = 2
    BYTES            = 8
    FORMAT           = "A8"
    DESCRIPTION      = "The planet or satellite on which the feature
                        is located."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = SEARCH_FEATURE_NAME
    DATA_TYPE        = CHARACTER
    START_BYTE       = 13
    BYTES            = 20
    FORMAT           = "A20"
    DESCRIPTION      = "The geographical feature name with all
                        diacritical marks stripped off.  This name is
                        stored in upper case only so that it can be
                        used for sorting and search purposes."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = DIACRITIC_FEATURE_NAME
    DATA_TYPE        = CHARACTER
    START_BYTE       = 36
    BYTES            = 20
    FORMAT           = "A20"
    DESCRIPTION      = "The geographical feature name containing
                        standard diacritical information.  Only one
                        feature in the Pathfinder table requires a
                        diacritical mark, and that is Souffle, which
                        has an acute accent on the 'e'."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = GRID_POSITION_X
    DATA_TYPE        = ASCII_REAL
    START_BYTE       = 58
    BYTES            = 6
```

```
    FORMAT           = "F6.2"
    UNIT             = METER
    DESCRIPTION      = "The north / south component of the object's
                        position.  A positive value indicates that the
                        object was north of the lander; a negative
                        value indicates it was to the south.  The
                        magnitude gives the distance between the
                        object and an east / west line drawn through
                        the center of the lander base petal (the
                        origin of Mars Local Level coordinate frame)."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = GRID_POSITION_Y
    DATA_TYPE        = ASCII_REAL
    START_BYTE       = 65
    BYTES            = 6
    FORMAT           = "F6.2"
    UNIT             = METER
    DESCRIPTION      = "The east / west component of the object's
                        position.  A positive value indicates that the
                        object was east of the lander; a negative
                        value indicates that it was to the west.  The
                        magnitude gives the distance between the
                        object and a north / south line drawn through
                        the center of the lander base petal (the
                        origin of the Mars Local Level coordinate frame)."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = FEATURE_DISTANCE
    DATA_TYPE        = ASCII_REAL
    START_BYTE       = 72
    BYTES            = 6
    FORMAT           = "F6.2"
    UNIT             = METER
    DESCRIPTION      = "The object's distance from the origin of the
                        Mars Local Level coordinate frame."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = FEATURE_WIDTH
    DATA_TYPE        = ASCII_REAL
    START_BYTE       = 79
    BYTES            = 5
    FORMAT           = "F5.2"
    UNIT             = METER
    DESCRIPTION      = "The horizontal size of the object: the width
                        of its maximum intersection with any plane
                        perpendicular to the IMP camera's line of
                        sight.  Estimated by virtual measurement."
  END_OBJECT         = COLUMN

  OBJECT             = COLUMN
    NAME             = FEATURE_HEIGHT
    DATA_TYPE        = ASCII_REAL
    START_BYTE       = 85
    BYTES            = 5
    FORMAT           = "F5.2"
    UNIT             = METER
    DESCRIPTION      = "The vertical size of the feature.  Consider a
                        diagonal line segment drawn from the highest
                        point of a rock to a point where it touches
                        the Mars surface or extends below it.  Taking
```

```
                        that line segment as the hypoteneus of a right
                        triangle, the length of the vertical side is
                        the height of the rock.  The distance was
                        determined by virtual measurement, using the
                        following technique:

                          (i) find the lowest point (maximum Z value) of
                              the Martian surface in close proximity to
                              a rock by moving the cursor around in
                              MarsMap,
                         (ii) finding the highest point on the rock
                              (minimum Z value) by moving the cursor
                              over the rock in Marsmap, and
                        (iii) taking the difference of the Z values."
  END_OBJECT          = COLUMN

  OBJECT              = COLUMN
    NAME              = FEATURE_TYPE
    DATA_TYPE         = CHARACTER
    START_BYTE        = 92
    BYTES             = 10
    FORMAT            = "A10"
    UNIT              = "N/A"
    DESCRIPTION       = "This is used to distinguish rock-like objects
                         from a few other named surface features.  The
                         types used, which are not the usual list of
                         IAU feature types visible from orbit, are:

                         ROCK:   Any object that superficially appears
                                 to be a rock, although many of them
                                 may later be interpreted to be crust,
                                 clods, conglomerates, etc.
                         DUNE:   Used for Mermaid Dune.
                         AREA:   An extended area that bears a name for
                                 easy reference.  Used for Baker's
                                 Bench and Photometry Flats."
  END_OBJECT          = COLUMN

END_OBJECT            = TABLE
END
```

D SAMPLE PDS IMAGE LABEL

D.1 IXXXXXXR.LBL

```
PDS_VERSION_ID                = PDS3

/* FILE CHARACTERISTICS */

RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = number of bytes per record in the file
FILE_RECORDS                  = total number of records in the file
LABEL_RECORDS                 = number of records in the file containing
                                only label information

/* POINTERS TO DATA OBJECTS */

^IMAGE                        = first record in file containing image data

/* IDENTIFICATION DATA ELEMENTS */

DATA_SET_ID                   = "MPFL-M-IMP-2-EDR-V1.0"
DATA_SET_NAME                 = "MPF LANDER MARS IMAGER FOR MARS PATHFINDER 2
                                 EDR V1.0"
PRODUCER_ID                   = "MIPL OF JPL"
PRODUCER_FULL_NAME            = "ALLAN J. RUNKLE"
PRODUCER_INSTITUTION_NAME     = "MULTIMISSION IMAGE PROCESSING LABORATORY,
                                 JET PROPULSION LAB"
PRODUCT_ID                    = "IMP_EDR-<sclkstrtcnt>-<image_observation_
                                 type>-<image_id>"
IMAGE_ID                      = nnnnnnnnnn
COMMAND_SEQUENCE_NUMBER       = nnnn
IMAGE_OBSERVATION_TYPE        = <REGULAR, DARK_CURRENT, FLAT_FIELD,
                                 HISTOGRAM, SUMMATION, DARK_STRIP,
                                 NULL_STRIP>
FRAME_ID                      = <LEFT, RIGHT, BOTH, LEFT_HALF>
MISSION_NAME                  = "MARS PATHFINDER"
INSTRUMENT_HOST_NAME          = "MARS PATHFINDER LANDER"
INSTRUMENT_NAME               = "IMAGER FOR MARS PATHFINDER"
INSTRUMENT_ID                 = "IMP"
TARGET_NAME                   = planetary body, feature, or region
OBSERVATION_NAME              = purpose of observation
IMAGE_TIME                    = yyyy-mm-ddThh:mm:ss.fffZ
PLANET_DAY_NUMBER             = nn
MPF_LOCAL_TIME                = hh:mm:ss
SPACECRAFT_CLOCK_START_COUNT  = nnnnnnnnnn
EARTH_RECEIVED_START_TIME     = yyyy-mm-ddThh:mm:ss.fffZ
EARTH_RECEIVED_STOP_TIME      = yyyy-mm-ddThh:mm:ss.fffZ
PRODUCT_CREATION_TIME         = yyyy-mm-ddThh:mm:ss.fffZ

/* DESCRIPTIVE DATA ELEMENTS */

EXPECTED_PACKETS              = n
RECEIVED_PACKETS              = n
APPLICATION_PACKET_ID         = n
APPLICATION_PACKET_NAME       = group name associated with APID
EXPOSURE_DURATION             = f.ffff
EXPOSURE_TYPE                 = <AUTO, INCREMENTAL, MANUAL, PRETIMED, NONE>
EXPOSURE_COUNT                = n
AUTO_EXPOSURE_DATA_CUT        = n
AUTO_EXPOSURE_PIXEL_FRACTION  = f.ffff
ERROR_PIXELS                  = n
FILTER_NAME                   = <"L440_R440", "L450_R670", "L885_R947",
                                 "L925_R935", "L935_R990", "L670_R670",
```

```
                                   "L800_R750", "L860_R-DIOPTER", "L900_R600",
                                   "L930_R530", "L1000_R480", "L965_R965">
FILTER_NUMBER                   = n
INSTRUMENT_TEMPERATURE          = (f.ffff, f.ffff)
INSTRUMENT_TEMPERATURE_COUNT    = (n, n)
INSTRUMENT_DEPLOYMENT_STATE     = <"STOWED", "DEPLOYED", "UNKNOWN">
DETECTOR_PIXEL_HEIGHT           = f.ffff
DETECTOR_PIXEL_WIDTH            = f.ffff
SOURCE_PRODUCT_ID               = standard SPICE kernel names for PCK, SPK, etc
SOFTWARE_NAME                   = name of MPF telemetry processing software
SOFTWARE_VERSION_ID             = version of MPF telemetry processing software
PROCESSING_HISTORY_TEXT         = "CODMAC LEVEL 1 TO LEVEL 2 CONVERSION VIA
                                   JPL/MIPL MPFTELEMPROC"

/* GEOMETRY DATA ELEMENTS */

INSTRUMENT_AZIMUTH              = f.ffff
AZIMUTH_FOV                     = f.ffff
AZIMUTH_MOTOR_CLICKS            = n
INSTRUMENT_AZIMUTH_METHOD       = <"TELEMETRY", "MPFNAV-MIPS", "BACKLASH-UOFA">
INSTRUMENT_ELEVATION            = f.ffff
ELEVATION_FOV                   = f.ffff
ELEVATION_MOTOR_CLICKS          = n
INSTRUMENT_ELEVATION_METHOD     = <"TELEMETRY", "MPFNAV-MIPS", "BACKLASH-UOFA">
SURFACE_BASED_INST_AZIMUTH      = f.ffff
SURFACE_BASED_INST_ELEVATION    = f.ffff
SURFACE_BASED_INST_METHOD       = "L_FRAME-QUATERNION"
POSITIVE_ELEVATION_DIRECTION    = UP
SOLAR_AZIMUTH                   = f.ffff
SOLAR_ELEVATION                 = f.ffff
LANDER_SURFACE_QUATERNION       = (f.ffff, f.ffff, f.ffff, f.ffff)

/* IMP FLIGHT SOFTWARE COMMAND DATA ELEMENTS */

COMMAND_NAME                    = name of the uplinked command
COMMAND_DESC                    = text which describes the uplinked command
TLM_CMD_DISCREPANCY_FLAG        = <TRUE, FALSE>
DOWNLOAD_TYPE                   = <NONE, DS, IM, DSIM, NS, DSNS, IMNS, DSIMNS>
DARK_CURRENT_DOWNLOAD_FLAG      = <TRUE, FALSE>
DARK_CURRENT_CORRECTION_FLAG    = <TRUE, FALSE>
FLAT_FIELD_CORRECTION_FLAG      = <TRUE, FALSE>
BAD_PIXEL_REPLACEMENT_FLAG      = <TRUE, FALSE>
SHUTTER_EFFECT_CORRECTION_FLAG  = <TRUE, FALSE>
SQRT_COMPRESSION_FLAG           = <TRUE, FALSE>

/* COMPRESSION DATA ELEMENTS */

INST_CMPRS_BLK_SIZE             = (n, n)
INST_CMPRS_BLOCKS               = n
INST_CMPRS_MODE                 = n
INST_CMPRS_PARAM                = n
INST_CMPRS_QUALITY              = n
INST_CMPRS_QUANTZ_TBL_ID        = name or code identifying the reference table
                                  used for quantization in the frequency domain
                                  for on-board transform compression
INST_CMPRS_QUANTZ_TYPE          = TABULAR
INST_CMPRS_SYNC_BLKS            = n
INST_CMPRS_NAME                 = <"RICE ADAPTIVE VARIABLE-LENGTH CODING
                                   (RICE)", "JPEG DIRECT COSINE TRANSFORM
                                   (DCT)">
INST_CMPRS_RATE                 = f.ffff
INST_CMPRS_RATIO                = f.ffff
PIXEL_AVERAGING_HEIGHT          = n
PIXEL_AVERAGING_WIDTH           = n
```

```
RICE_START_OPTION              = n
RICE_OPTION_VALUE              = n
SQRT_MINIMUM_PIXEL             = n
SQRT_MAXIMUM_PIXEL             = n

/* IMAGE OBJECT DATA ELEMENTS */

OBJECT                         = IMAGE
  INTERCHANGE_FORMAT           = BINARY
  LINES                        = n
  LINE_SAMPLES                 = n
  BANDS                        = 1
  SAMPLE_TYPE                  = MSB_UNSIGNED_INTEGER
  SAMPLE_BITS                  = <8, 16, or 32>
  SAMPLE_BIT_MASK              = <2#11111111#, 2#0000111111111111#, or
                                  2#11111111111111111111111111111111#>
  MAXIMUM                      = n
  MEAN                         = f.ffff
  MEDIAN                       = n
  MINIMUM                      = n
  STANDARD_DEVIATION           = f.ffff
  FIRST_LINE                   = n
  FIRST_LINE_SAMPLE            = n
  CHECKSUM                     = <32 bit unsigned integer>
END_OBJECT                     = IMAGE
END
```

E VOLUME DESCRIPTION FILE

This file contains a description of the contents of the CD in a human and machine readable format.

E.1 VOLDESC.CAT

```
PDS_VERSION_ID               = PDS3

OBJECT                       = VOLUME
  VOLUME_SERIES_NAME         = "MISSION TO MARS"
  VOLUME_SET_NAME            = "MARS PATHFINDER: THE IMAGER FOR MARS
                                PATHFINDER EDR"
  VOLUME_SET_ID              = "USA_NASA_PDS_MPIM_00XX"
  VOLUMES                    = 3
  VOLUME_NAME                = "VOLUME 1: IMP EDRS 1229455934 - 1247913223"
  VOLUME_ID                  = "MPIM_0001"
  VOLUME_FORMAT              = "ISO-9660"
  VOLUME_VERSION_ID          = "VERSION 1"
  MEDIUM_TYPE                = "CD-ROM"
  DATA_SET_ID                = "MPFL-M-IMP-2-EDR-V1.0"
  PUBLICATION_DATE           = 1998-07-01
  DESCRIPTION                = "This volume contains images taken by
                                the Imager for Mars Pathfinder on July
                                4 through July 18, 1997 (plus a few
                                pre-landing calibration images).  The
                                images are Experiment Data Records, which
                                have been decoded and decompressed in
                                single frame form, but not calibrated
                                or radiometrically corrected.  The
                                volume also contains detailed
                                documentation about the mission,
                                spacecraft, instrument, and data set,
                                as well as calibration information,
                                a gazetteer, an HTML image browser,
                                and index tables."

  OBJECT                     = DATA_PRODUCER
    INSTITUTION_NAME         = "JET PROPULSION LABORATORY"
    FACILITY_NAME            = "MULTIMISSION IMAGE PROCESSING LABORATORY"
    FULL_NAME                = "ALLAN J. RUNKLE"
    ADDRESS_TEXT             = "JET PROPULSION LABORATORY\n
                                4800 OAK GROVE DRIVE\n
                                MAILSTOP 168-414\n
                                PASADENA, CA 91109\n
                                USA"
    TELEPHONE_NUMBER         = "8183546006"
    ELECTRONIC_MAIL_TYPE     = "INTERNET"
    ELECTRONIC_MAIL_ID       = "allan.j.runkle@jpl.nasa.gov"
  END_OBJECT                 = DATA_PRODUCER

  OBJECT                     = DATA_SUPPLIER
    INSTITUTION_NAME         = "JET PROPULSION LABORATORY"
    FACILITY_NAME            = "MULTIMISSION IMAGE PROCESSING LABORATORY"
    FULL_NAME                = "SUSAN K. LAVOIE"
    DISCIPLINE_NAME          = "IMAGE PROCESSING"
    NODE_NAME                = "IMAGING"
    ADDRESS_TEXT             = "JET PROPULSION LABORATORY\n
                                4800 OAK GROVE DRIVE\n
                                MAILSTOP 168-527\n
                                PASADENA, CA 91109\n
                                USA"
```

```
    TELEPHONE_NUMBER          = "8183545677"
    ELECTRONIC_MAIL_TYPE      = "INTERNET"
    ELECTRONIC_MAIL_ID        = "susan.k.lavoie@jpl.nasa.gov"
  END_OBJECT                  = DATA_SUPPLIER

  OBJECT                      = CATALOG
    ^DATA_SET_CATALOG         = "DATASET.CAT"
    ^INSTRUMENT_CATALOG       = "INST.CAT"
    ^INSTRUMENT_HOST_CATALOG  = "INSTHOST.CAT"
    ^MISSION_CATALOG          = "MISSION.CAT"
    ^PERSONNEL_CATALOG        = "PERSON.CAT"
    ^REFERENCE_CATALOG        = "REF.CAT"
  END_OBJECT                  = CATALOG

END_OBJECT                    = VOLUME
END
```