NASA Planetary Data System
Microwave Subnode of the Geosciences Node

Software Interface Specification

MIT-MGN-CBIDRCD

Magellan Compressed Basic Image Data Record on Compact Disk Read-Only Memory

prepared by

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DOCUMENT CHANGE LOG			
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0.6	03/28/94	All	Numerous changes
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ACRONYMS AND ABBREVIATIONS

ANSI	American National Standards Institute
ASCII	American Standard Code for Information Interchange
BAQ	Block-Adaptive Quantizer
BIDR	Basic Image Data Record
BIP	Boresight Intercept Point
BPI	Bits Per Inch
CBIDR	Compressed-Resolution BIDR
CBIDRCD	C-BIDR on Compact Disk
CCSDS	Consultative Committee for Space Data Systems
CD	Compact Disk
CD-WO	Compact Disk - Write Once
DOS	Disk Operating System
DSN	Deep Space Network
EDR	Experiment Data Record
EOF	End of File
GDS	Ground Data System
GIPS	General Image Processing System
IDPS	Image Data Processing Subsystem (of MIPL)
ISO	International Standards Organization
JPL	Jet Propulsion Laboratory
J2000	Celestial Coordinate System
LSB	Least Significant Byte
MB	Megabytes
MGN	Magellan (formerly Venus Radar Mapper)
MIPL	JPL Multi-Mission Image Processing Laboratory
MIT	Massachusetts Institute of Technology
MMC	Martin Marietta Corporation
MQPC	Mapping Quaternion Polynomial Coefficients
MRP	Mid-Range Point
MSB	Most Significant Byte
NAIF	Navigation and Ancillary Information Facility
NASA	National Aeronautics and Space Administration
NAV	Navigation Subsystem/Team
NSI	NASA Science Internet
NSSDC	National Space Science Data Center
PDS	Planetary Data System
PRF	(Radar) Pulse Repetition Frequency
PSG	Project Science Group
ROM	Read-Only Memory
SAB	SAR and Altimeter Burst
SAR	Synthetic Aperture Radar
SCET	Spacecraft Event Time (TDB or UTC)
SCLK	Spacecraft Clock
SDPS	SAR Data Processing Subsystem (JPL)
SFDU	Standard Formatted Data Unit
SFOC	Spaceflight Operations Center (JPL)
SIS	Software Interface Specification

TBD	To Be Determined
TDB	Baricentric Dynamical (Ephemeris) Time
TEDR	Temporary Experiment Data Record
UTC	Coordinated Universal Time
VBF	Venus Body-Fixed coordinate system
VME	Venus Mean Equator coordinate system
VRM	Venus Radar Mapper (now Magellan)

CHAPTER 1

OVERVIEW

This Software Interface Specification (SIS) describes the format and content of the Magellan Compressed Basic Image Data Record on Compact-Disk Read-Only Memory Product (CBIDRCD). This product is the permanent archive version of the Compressed Basic Image Data Record (C-BIDR) product that was written on 1/2" computer tape during the radar mapping phase of the Magellan mission. The CBIDRCD combines the data files from the C-BIDR tapes with image index files, PDS labels and tables.

The CBIDRCD is a deliverable product to the Planetary Data System (PDS) and to the National Space Science Data Center (NSSDC). The formats of all files in the CBIDRCD are based on PDS standards (Versions 2 and 3).

1.1. Scope

The specifications in this document apply to all volumes containing CBIDRCD data produced at MIT. This document provides a detailed description of the CBIDRCD interface.

1.2. Applicable Documents

(1) ISO 9660-1988. Information Processing - Volume and File Structure on CD-ROM for Information Exchange, April 15, 1988.

(2) Planetary Data System Standards Reference, JPL D-7669, part 2, November 20, 1992

(3) Planetary Science Data Dictionary, JPL D-7116, Rev. C, November 20, 1992

(4) Planetary Data System, Data Preparation Workbook, JPL Publication D-7669, Part 1, Version 3.0, April 21, 1993.

(5) Magellan Software Interface Specification document TPS-101, SAR and Altimeter EDR/TEDR Tapes, Betsy Wilson, JPL, Rev, D, March 15, 1989.

(6) Magellan Software Interface Specification documents SDPS-101, Full-resolution Basic Image Data Record, Rev. E, JPL, August 31, 1992, and IDPS-101, Compressed-resolution Basic Image Data Record, Rev. C, Scott Lewicki, JPL, May 31, 1991.

(7) Magellan SCLK/SCET Coefficients File, MGN SIS SES-112, SFOC-1-DCB-MGN-SCLKvSCET, January 1988.

(8) Mapping Quaternions Polynomial Coefficients File, MGN SIS RES-104, SFOC-1-CDB-MGN-Quaterni, January 1988.

(9) Decommutation Report Form, SFOC SIS SFOC0038-00-12-00, SFOC-1-TIS-Any-DecomRpt, August 1, 1988.

(10) MGN Decalibration File to DMD, MGN SIS SES-115, SFOC-1-DMD-Mgn-DECAL, December 1987. Note that this document also describes decommutation data, but this is NOT the decommutation report data that is archived in the CBIDRCD, which is described by [9], above.

(11) Spacecraft and Planet Ephemerides, NAIF S and P Kernels, SFOC-2-DPS-CDB-Ephemeris, January 8, 1988.

(12) Magellan Telemetry Formats Generated by Telemetry Input Subsystem, SFOC-2-TIS-Any-MgnTelem, November 5, 1987.

(13) Telemetry Minor Frame Formats from Telemetry Input Subsystem, SFOC-2-TIS-Any-Telem, October, 1987.

(14) NJPL SFDU Global Definitions, SFOC SIS SFOC0038-01-04-01, SFOC-5-SYS-*DU-NJPL, July 20, 1988.

(15) SFDUs Generated from TIS for Magellan, SFOC SIS SFOC0038-01-03-01, SFOC-5-TIS-*DU-MgnSFDU, May 16, 1988.

(16) Standard Formatted Data Units Generated from Telemetry Input Subsystem, SFOC SIS SFOC0038-01-04-01, SFOC-5-TIS-*DU-SFDU, August 31, 1988.

(17) VRM Spacecraft System and Subsystem Design Book, Telemetry Measurements and Data Formats, MMC VRM-2-280, June 1987.

(18) Magellan DSN Monitor Data (Mon-5-12), SFOC SIS SFOC0038-01-02-01, SFOC-1-GIF-DSN-MgnGCFMon, February 17, 1988.

(19) MGN Mission Operations System, Radar System Interface Requirements Document, 630-204.

(20) DSN Telemetry Interface with SFOC - Magellan, DSN Detailed Interface Design, 820-13, Module TLM 3-17, February 1988.

(21) DSN System Requirements, Detailed Interface Design. DSN Monitor and Control System Interface with Magellan Project, MON-5-12, 820-13, September 1, 1987.

(22) Radar Processing Bandwidths File Format and Content, MGN SIS RES-101, SFOC-1-CDB-Mgn-Bandwidth, September 15, 1989.

(23) VICAR Run-Time Reference Manual, Rev. 1, D. Stanfill, JPL MIPL, November 24, 1986.

(24) Guide to GIPS, P. Ford, MIT Center for Space Research, 1985.

1.3. System Siting

1.3.1. Interface Location and Medium

CBIDRCD volumes are created at MIT using hardware belonging to the Microwave Subnode of the PDS Geosciences Node, with a Young Minds CD-Studio compact disk authoring subsystem. All volumes intended for delivery to PDS shall be on CD-WO media.

1.3.2. Data Sources and Destinations

Each CBIDRCD volume is a collection of products representing, derived from, or needed to analyze a range of orbits of Magellan compressed-resolution radar imaging data. One copy of each CD-WO is delivered using the most appropriate means to the National Space Science Data Center (NSSDC), while a second copy is retained at the MIT Microwave Subnode of the Planetary Data System (PDS).

1.3.3. Generation Method and Frequency

Each CBIDRCD volume is produced in several stages. First, the C-BIDR data files are copied from 8mm archive tape into magnetic disk using the UNIX "tar" program. Then the "bidrindx" program is used to create index files that describe each image swath file, and a PDS detached label is created for each data and index file using the UNIX awk script "write_cbidr_cd". Next, the CD-WO is pre-mastered using the Young Minds "makedisc" command. Finally, the CD-Studio hardware is commanded to write one or more CD-WO disks.

1.4. Assumptions and Constraints

1.4.1. Usage Constraints

Access to the CBIDRCD volumes will be determined by the Planetary Data System (PDS) and by the National Space Science Data Center (NSSDC).

1.4.2. Documentation Conventions

1.4.2.1. Data Format Descriptions

Data are stored in fields of 8-, 16-. and 32-bit unsigned integers and as character strings. Most integers are stored in VAX least-significant-byte (LSB) format [2]; the first byte contains the least significant bits, while the last contains the most significant bits. Refer to the applicable documents for details.

If a field is described as containing "n" bytes of ASCII character string data, this implies that the leftmost (lowest numbered) byte contains the first character, the next lowest byte contains the next character, and so forth. Character strings are written to CD-WO with lower numbered bytes preceding higher numbered bytes.

1.4.2.2. Limits of This Document

This document applies only to CBIDRCD volumes.

1.4.2.3. Typographic Conventions

This document has been formatted for simple electronic file transfer and display. Line lengths are limited to 80 ASCII characters, including line delimiters. The last two characters on each line are the carriage-return (ASCII 13) and the line-feed (ASCII 10). No special fonts or structures are included within the file. Constant width characters are assumed for display. Hard copy pagination at the rate of 66 lines per page is assumed. For page numbers consistent with those shown in the Table of Contents, a break in page numbering immediately before "Chapter 1. OVERVIEW" will be required.

1.4.3. Time Standards

Within CBIDRCD label files, times are expressed as a string of 19 or 23 ASCII characters

YYYY-MM-DDThh:mm:ss[.fff]

where "-", "T", ":", and "." are fixed delimiters; "YYYY" is the year "19nn" or "20nn"; "MM" is a two-digit month of year; "DD" is a two-digit day of month; "T" separates the date and time segments of the string; "hh" is hour of day; "mm" is the minutes of hour (00-59); "ss" is the seconds of minute (00-59); and ".fff" gives the fractional seconds. The data type "TIME" is assigned to this format.

When only the date is required the 10-character string

YYYY-MM-DD

may be substituted. The data type "DATE" is assigned to this format.

CHAPTER 2

INTERFACE CHARACTERISTICS

2.1. Hardware Characteristics and Limitations

2.1.1. Special Equipment and Device Interfaces

CBIDRCD volumes conform to ISO 9660 standards for CD-ROM [1]. Users of the volumes must have access to systems which can read these media.

2.1.2. Special Set-Up Requirements

None.

2.2. Volume and Size

Each CBIDRCD volume contains a set of data and ancillary files representing one or more Magellan orbits. The maximum size of CBIDRCD data files will be 600 Mbytes. CBIDRCD disks may be slightly larger than this due to the additional PDS index table and label files.

2.3. Labeling and Identification

2.3.1. External Labels

Each CBIDRCD volume bears a label using the following format:

ACRONYM.SEQUENCE;VERSION

where

ACRONYM	=	CBIDRCD
SEQUENCE	=	a three digit number indicating the order in which the CD-WO volumes were produced.
VERSION	=	A single digit determining version number of the CD-WO volume. "1" is the original version.

For example, CBIDRCD.004;2 is the second version of the fourth CBIDRCD volume.

2.3.2. Internal Labels

The contents of each CBIDRCD volume will be labeled in accordance with PDS standards. Labeling is described further in subsequent sections.

2.3.3. Interface Medium Characteristics

Each CBIDRCD volume conforms to ISO 9660 standards [1]. The quantity of data stored is no more than 650 MB per disk.

2.4. Backup and Duplicates

Pairs of CD-WO disks will be written. One copy will be retained at the PDS Microwave Subnode at MIT; the other will be sent to NSSDC for archival.

CHAPTER 3

STRUCTURE AND ORGANIZATION OVERVIEW

3.1. Disk Organization

Each CBIDRCD volume contains a CATALOG directory, a DOCUMENT directory, an INDEX directory, a LABEL directory, and one or more data directories (Figure 3-1).

```
                                   ROOT
                                    |
+----+---------------+--------------+---------------+---------------+
|    |               |              |               |               |
|   [CATALOG]       [DOCUMENT]     [INDEX]         [LABEL]          |
|    |               |              |               |               |
|    |- CATINFO.TXT  |- DOCINFO.TXT |- CUMINDEX.LBL |- CBIDRIM.FMT   |
|    |- CBIDRDS.CAT  |- CBIDRCD.TXT |- CUMINDEX.TAB |- CBIDRPR.FMT   |
|    |- INSTHOST.CAT +- CBIDRCD.PS  |- INDEX.LBL    |- CBIDROPF.FMT  |
|    |- MISSION.CAT                 |- INDEX.TAB    |- DSMAPCB.LBL   |
|    |- PERSONEL.CAT                +- INDXINFO.TXT |- LABLINFO.TXT  |
|    |- REFS.CAT                                                     |
|    +- RDRSINST.CAT                                                 |
|                           +-------------+-------------+-----------+
|- AAREADME.TXT             |             |             |
|- ERRATA.TXT              [Cnnnn_vv]    [Cnnnn_vv]    [Cnnnn_vv] ...
+- VOLDESC.CAT
```

Figure 3-1. Example CBIDRCD Directory Structure

3.1.1. Root Directory

The root directory contains the following files:

AAREADME.TXT	terse description of volume contents [2].
ERRATA.TXT	cumulative list of errors on this and on previous CBIDRCD volumes.
VOLDESC.CAT	volume object definition [2].

3.1.2. CATALOG Directory

The CATALOG directory contains the following files:

CATINFO.TXT	text description of the directory contents [2].
CBIDRDS.CAT	PDS data set template.
INSTHOST.CAT	PDS instrument host template.
MISSION.CAT	PDS mission template.
PERSONEL.CAT	PDS personnel template.
REFS.CAT	PDS reference template.
RDRSINST.CAT	PDS instrument template.

3.1.3. DOCUMENT Directory

The DOCUMENT directory contains the following files:

CBIDRCD.LBL	PDS label for the PostScript SIS document (CBIDRCD.PS).
CBIDRCD.PS	a copy of this SIS document in PostScript format, suitable for previewing on a high-resolution graphics terminal or direct printing on a laser printer or photo-typesetter.
CBIDRCD.TXT	a copy of this SIS document in ASCII characters, suitable for display or printing at 66 lines per page with up to 78 constant-width characters per line.
DOCINFO.TXT	text description of the directory contents [2].

3.1.4. INDEX Directory

The INDEX directory contains the following files:

CUMINDEX.LBL	PDS label for the cumulative volume index (CUMINDEX.TAB) [2].
CUMINDEX.TAB	index in tabular form for all volumes in the CBIDRCD [2].
INDEX.LBL	PDS label for the volume index (INDEX.TAB). Identifies the volume index and describes structure of the index table [2].
INDEX.TAB	volume index in tabular form [2].
INDXINFO.TXT	text description of the directory contents [2].

3.1.5. LABEL Directory

The LABEL directory contains the following files:

CBIDRIM.FMT	Description of the binary annotation headers of IM1.DAT and IM2.DAT files.
CBIDROPF.FMT	Description of the binary data records in the OPF.DAT files.
CBIDRPR.FMT	Description of the binary data records in the PR1.DAT and PR2.DAT files.
DSMAPCB.LBL	Description of the map projections used in the IM1.DAT and IM2.DAT files.
LABLINFO.TXT	text description of the directory contents [2].

3.1.6. Data Directories

Each CBIDRCD volume contains directories for one or more orbits of image and ancillary data from C-BIDR tapes. Data directories are named

Cnnnn_vv

where "nnnn" is the orbit number, and "vv" is the version number inherited from the original F-BIDR product from which the C-BIDR was made. The version number of the C-BIDR itself can be recovered from the INDEX.TAB file in the INDEX directory.

3.2. Formats

CBIDRCD volumes conform to the ISO 9660 level 1 Interchange Standard CD-WO format [1], which is compatible with common computer systems including MS-DOS, Macintosh, SunOS, and VMS.

Data that comprise the CBIDRCD volumes are formatted in accordance with Planetary Data System specifications [2-4].

3.3. File Naming Conventions

In this document and on the disks themselves, file and directory names are in upper case characters. This ensures compatibility with operating systems in which these names are case insensitive (e.g., VMS and DOS) and operating systems in which names are automatically translated into one case or the other (e.g., Unix and MacOS). Within disk directories the characters ";1" are appended to all file names. VMS excepted, most operating systems will hide these suffixes from users.

3.3.1. PDS Labels

All files contained on CBIDRCD volumes are accompanied by PDS labels [2-4]. The label can either be prefixed to the associated primary file, or "detached", in which case the label becomes a file in its own right with the same name as the primary file except for the suffix ".LBL". Detached label files will be located in the same directory as the primary file.

PDS labels, whether prefixed to or detached from their primary file, provide descriptive information about the associated file. The PDS label is an object-oriented structure consisting of sets of "keyword=value" declarations. The object to which the label refers (e.g. IMAGE, TABLE, etc.) is denoted by a statement of the form:

ˆobject = location

in which the carat character (ˆ, also called a pointer in this context) indicates where to find the object. In a prefixed label, the location is an integer representing the starting record or byte number of the object, where the counting starts from record or byte number 1. In a detached label, the location denotes the name of the file containing the object, along with the starting record or byte number if there is more than one object. For example:

ˆTABLE_HEADER = ("SAB.DAT",1)
ˆTABLE = ("SAB.DAT",1025 <BYTES>)

indicates that the TABLE_TABLE object begins at byte 1025 of the file SAB.DAT, in the same directory as the detached label file. Below is a list of the possible formats for the ˆobject definition.

ˆobject = n
ˆobject = n<BYTES>
ˆobject = "filename.ext"
ˆobject = ("filename.ext",n)
ˆobject = ("filename.ext",n<BYTES>)

where

n — is the starting record or byte number of the object, counting from the beginning of the file (record 1 or byte 1),

<BYTES> — indicates that the number given is in units of bytes; default is RECORDS,

filename — is the (up to) 8 character, alphanumeric upper-case file name,

ext — is the 3 character upper-case file extension.

All lines in detached label files are 80 bytes long, padded on the right with blanks to a length of 78 bytes, and ending with a carriage return character (ASCII 13) followed by a line feed character (ASCII 10) in the last byte. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the label by a multiple of 80 bytes.

3.3.2. Document files

Document files (.TXT suffix) may exist in the root, CATALOG, DOCUMENT, INDEX, and LABEL directories. These are ASCII files with embedded PDS labels which employ the TEXT object. All records in document files are 80-bytes in length, with a carriage return character (ASCII 13) in the next-to-last byte and a line feed character (ASCII 10) in the last byte. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

3.3.3. Tabular Files

Tabular files (.TAB suffix) exist in the INDEX directory (where they are ASCII files formatted for direct reading into many database management systems).

ASCII tabular files consist of data "fields" separated by commas. Character fields are also enclosed in double quotation marks (") and are padded with spaces to keep quotation marks in the same columns of successive records. Character fields are left justified, and numeric fields are right justified. The "start byte" and "bytes" values listed in the labels do not include the commas between fields or the quotation marks surrounding character fields. The records in tabular files have fixed length. Where necessary, a space character (ASCII 32) is appended to the record to make it of even length, and the last two bytes of each record contain the ASCII carriage return and line feed characters. This allows a table to be treated as a fixed length record file on computers that support this file type and as a text file with embedded line delimiters on those that do not.

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

3.3.4. Catalog files

Catalog files (suffix .CAT) exist in the root and in the CATALOG directory. They are formatted in an object-oriented structure consisting of sets of "keyword=value" declarations.

VOLDESC.CAT in the root provides an overview of the contents of the volume in the form of a completed PDS template.

The files in the CATALOG directory provides a top-level understanding of the mission, instrument and data set. They are presented in the form of completed PDS templates [4]. See section 4.2 for further details.

3.3.5. Data files

Data files (.DAT suffix) exist in the per-orbit data directories. They are described in detail in section 4.3, below, and in the series of applicable documents listed in section 1.2, above. They have been copied directly from C-BIDR product tapes without reformatting. Although many contain newline-delimited ASCII records, they are written in multiples of a basic 32,500 byte logical record block, with any unused space in the last block padded with ASCII carat characters (ASCII 94).

Within the files, the data fields are written without regard for the 32,500-byte record boundaries, i.e. they are written as a data stream. All ancillary files copied from the SAR Experiment Data Record begin with SFDU labels, and the data record aggregates are themselves delimited by R-type SFDU marker labels [5,14]. These files are as follows:

CLK.DAT	SCLK/SCET conversion coefficients
DCM.DAT	Decommutation and decalibration data
DQS.DAT	EDR Data Quality Summary
ENG.DAT	Engineering data
EPH.DAT	S/C ephemeris file
HDR.DAT	Orbit Header
MON.DAT	DSN monitor records
PBW.DAT	Processing bandwidths
QTN.DAT	Quaternion pointing coefficients
SAB.DAT	Radar header records

The remaining data files consist of an aggregate of I-type binary SFDU records, without any other labeling. They are

IM1.DAT	Image data in oblique sinusoidal projection
IM2.DAT	Image data in sinusoidal projection
OPF.DAT	Per-Orbit Parameters
PR1.DAT	Processing parameters for oblique sinusoidal projection
PR2.DAT	Processing parameters for sinusoidal projection

Image data files, IM1.DAT and IM2.DAT, are also accompanied by index files, named IM1.AUX and IM2.AUX, in the so-called BIDRINDX format (see section 4.3.15, below), that describe the data structure of the image files to various software packages, e.g. VICAR [23] and GIPS [24].

The files that describe the polar portion of the image swath, IM1.DAT and PR1.DAT, will only be present if such data exist for that particular orbit. Otherwise, these files and their accompanying *.AUX index files will be omitted, along with their label files.

All data files are accompanied by detached PDS label files. The label generating process is capable of detecting certain formatting errors within the SFDU structure of the data files. When this occurs, an error message is written to the NOTE section of the new label file, and a copy is written to the ERR.TXT file in the same data directory. In general, therefore, the label files are a better guide to the location of objects within the data files than the SFDU structures themselves.

CHAPTER 4

DETAILED INTERFACE SPECIFICATIONS

4.1. Root Files

4.1.1. AAREADME.TXT File

The AAREADME.TXT file contains terse volume content and format information. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
RECORD_TYPE                     = STREAM
SPACECRAFT_NAME                 = MAGELLAN
TARGET_NAME                     = VENUS
OBJECT                          = TEXT
  PUBLICATION_DATE              = 1994-07-01
  NOTE                          = "MAGELLAN C-BIDR ARCHIVE CD-WO"
END_OBJECT                      = TEXT
```

Figure 4-1. Example Label for *.TXT Files

Labeling requirements applicable to Figure 4-1 are described in [2]; keywords are defined in [3]. For this application, the only keywords that change are

PUBLICATION_DATE — the date in YYYY-MM-DD format on which the file was created or last modified (see Section 1.5.3).

NOTE — a brief description of the file, including a title if available.

4.1.2. ERRATA.TXT File

The ERRATA.TXT file contains general information about errors on this, and previous, volumes of the CBIDRCD product. This is an ASCII file with 80 byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.1.3. VOLDESC.CAT File

VOLDESC.CAT contains a description of the contents of this volume in a PDS format readable by both humans and computers. This is an ASCII file with 80 byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. Figure 4-2 shows a sample

VOLDESC.CAT file for the first CBIDRCD volume.

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID              = PDS3
OBJECT                      = VOLUME
 VOLUME_SERIES_NAME         = "MISSION TO VENUS"
 VOLUME_SET_NAME            = "MAGELLAN RADAR DATA PRODUCT"
 VOLUME_SET_ID              = "USA_NASA_PDS_MG_3101"
 VOLUMES                    = UNK
 VOLUME_NAME                = "MAGELLAN COMPRESSED-RESOLUTION BASIC
                               IMAGE DATA RECORD ON COMPACT DISK"
 VOLUME_ID                  = "MG_3101"
 VOLUME_VERSION_ID          = "VERSION 1"
 PUBLICATION_DATE           = 1994-7-01
 DATA_SET_ID                = "MGN-V-RDRS-5-C-BIDR-V1.0"
 VOLUME_FORMAT              = "ISO-9660"
 MEDIUM_TYPE                = "CD-WO"
 DESCRIPTION                = "This volume contains Magellan C-BIDR
   (Compressed-Resolution Basic Image Data Record) products, including
   both image data files, ancillary files, and documentation."
 MISSION_NAME               = "MAGELLAN"
 SPACECRAFT_NAME            = "MAGELLAN"
 SPACECRAFT_ID              = MGN
 OBJECT                     = DATA_PRODUCER
  INSTITUTION_NAME          = "MASSACHUSETTS INSTITUTE OF TECHNOLOGY"
  FACILITY_NAME             = "CENTER FOR SPACE RESEARCH"
  FULL_NAME                 = "DR. PETER G. FORD"
  ADDRESS_TEXT              = "CENTER FOR SPACE RESEARCH
                               M.I.T. BUILDING 37
                               70 VASSAR STREET
                               CAMBRIDGE, MASSACHUSETTS 02139 USA"
 END_OBJECT                 = DATA_PRODUCER
 OBJECT                     = CATALOG
  ^MISSION_CATALOG          = "MISSION.CAT"
  ^INSTRUMENT_HOST_CATALOG  = "INSTHOST.CAT"
  ^INSTRUMENT_CATALOG       = "RDRSINST.CAT"
  ^PERSONNEL_CATALOG        = "PERSONEL.CAT"
  ^REFERENCE_CATALOG        = "REFS.CAT"
  ^DATA_SET_CATALOG         = "CBIDRDS.CAT"
 END_OBJECT                 = CATALOG
END_OBJECT                  = VOLUME
END
```

Figure 4-2. Example VOLDESC.CAT File

4.1.3.1. Keywords and Values

Keywords in Figure 4-2 are defined in [3]. They are used in this application as follows:

PDS_VERSION_ID	The version of PDS standards to which this volume adheres; set to "PDS3".
VOLUME_SERIES_NAME	The formal name that describes a broad categorization of data products. For the CBIDRCD, set to "MISSION TO VENUS"
VOLUME_SET_NAME	The formal name describing one or more volumes containing a single data set or a collection of related data sets. For the CBIDRCD, set to

	"MAGELLAN RADAR DATA PRODUCT"
VOLUME_SET_ID	Identification of a data volume or a set of archive data volumes. For the CBIDRCD, set to "USA_NASA_JPL_ACRONYM_SEQUENCE" where ACRONYM and SEQUENCE are defined in Section 2.3.1. See also VOLUME_ID, below.
VOLUMES	The number of physical volumes in a volume set. Volume sets of CBIDRCD data will generally be single volumes, so this value will be set to "1".
VOLUME_NAME	The formal name of the individual CBIDRCD volume; a more specific identification than VOLUME_SET_NAME. For the CBIDRCD, set to "MAGELLAN COMPRESSED-RESOLUTION BASIC IMAGE DATA RECORD".
VOLUME_ID	A unique identifier for the volume. Usually the last two components of the VOLUME_SET_ID (see also Section 2.3.1). For the CBIDRCD, set to "MG_31nn" or "MG_32nn".
VOLUME_VERSION_ID	The version of the data volume, starting with "1" for original versions and incrementing by 1 for each subsequent version.
PUBLICATION_DATE	The date in YYYY-MM-DD format on which the volume was published or released (see Section 1.4.3).
DATA_SET_ID	A unique alphanumeric identifier for the data set. For the CBIDRCD, set to "MGN-V-RDRS-5-C-BIDR-V1.0"
VOLUME_FORMAT	The logical format used in writing the CBIDRCD volume. Set to "ISO-9660".
MEDIUM_TYPE	The physical storage medium for the CBIDRCD volume. Set to "CD-WO".
DESCRIPTION	A brief text description of the contents of the CBIDRCD volume.
MISSION_NAME	The planetary mission or project under which the data were acquired. A single mission may be associated with one or more spacecraft. For the CBIDRCD, set to "MAGELLAN"
SPACECRAFT_NAME	The full name of the spacecraft with which these data are associated. For the CBIDRCD, set to "MAGELLAN"
SPACECRAFT_ID	A mnemonic uniquely associated with SPACECRAFT_NAME. For the CBIDRCD, set to "MGN"
INSTITUTION_NAME	The name of the institution under which this CBIDRCD volume was produced. Set to "MASSACHUSETTS INSTITUTE OF TECHNOLOGY".
FACILITY_NAME	The name of the department, laboratory, or subsystem under which this CBIDRCD volume was produced. Set to "CENTER FOR SPACE RESEARCH".
FULL_NAME	The name of the individual or organization responsible for producing this CBIDRCD volume. For the CBIDRCD, set to "DR. PETER G. FORD".
ADDRESS_TEXT	Mailing address for the individual or organization responsible for producing this CBIDRCD volume. For the CBIDRCD, set to "CENTER FOR SPACE RESEARCH, M.I.T. BUILDING 37, 70 VASSAR STREET, CAMBRIDGE, MASSACHUSETTS 02139 USA"
^MISSION_CATALOG	File name in the CATALOG directory under which the PDS mission template is stored. Set to "MISSION.CAT".

^INSTRUMENT_HOST_CATALOG	File name in the CATALOG directory under which the PDS instrument host template is stored. Set to "INSTHOST.CAT".
^INSTRUMENT_CATALOG	File name in the CATALOG directory under which the PDS instrument template is stored. Set to "RDRSINST.CAT".
^PERSONNEL_CATALOG	File name in the CATALOG directory under which the PDS personnel template is stored. Set to "PERSONEL.CAT".
^REFERENCE_CATALOG	File name in the CATALOG directory under which the PDS reference template is stored. Set to "REFS.CAT".
^DATA_SET_CATALOG	File name in the CATALOG directory under which the PDS data set template is stored. Set to "CBIDRDS.CAT".

4.2. Static Directories

Static directories are those which do not change (or change very little) from one volume to another. They appear on all volumes.

4.2.1. CATALOG Directory

The CATALOG directory contains files used in cataloging the data, including files which provide a detailed description of this volume.

4.2.1.1. CATINFO.TXT File

The CATINFO.TXT file contains a description of the contents of the CATALOG directory. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.1.2. CBIDRDS.CAT File

The CBIDRDS.CAT file contains PDS catalog information about the data set on this archive volume. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.1.3. INSTHOST.CAT File

The INSTHOST.CAT file contains PDS catalog information about the Magellan spacecraft. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.1.4. MISSION.CAT File

The MISSION.CAT file contains PDS catalog information about the Magellan mission. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.1.5. PERSONEL.CAT File

The PERSONEL.CAT file contains PDS catalog information about personnel who contributed to this data set. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset

4.2.1.6. RDRSINST.CAT File

The RDRSINST.CAT file contains PDS catalog information about the Magellan radar sensor. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.1.7. REFS.CAT File

The REFS.CAT file contains PDS catalog information of references to published papers that describe this data set. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.2. DOCUMENT Directory

The DOCUMENT directory contains files which describe the data included in the CBIDRCD volume.

4.2.2.1. CBIDRDS.LBL File

CBIDRDS.LBL is a detached label that completely describes CBIDRDS.PS. The length of the CBIDRDS.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks. Each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.2.2. CBIDRCD.PS File

The CBIDRCD.PS file is the Software Interface Specification for the CBIDRCD (this document). This is a PostScript file with varying length records, suitable for previewing with a Display PostScript application on a high-resolution graphics terminal or direct printing on a laser printer or photo-typesetter. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair.

4.2.2.3. CBIDRCD.TXT File

The CBIDRCD.TXT file is the Software Interface Specification for the CBIDRCD (this document). The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records, suitable for display or printing at 66 lines per page with up to 78 constant-width characters per line. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.2.4. DOCINFO.TXT File

The DOCINFO.TXT file contains a description of the contents of the DOCUMENT directory. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.3. INDEX Directory

4.2.3.1. CUMINDEX.LBL File

CUMINDEX.LBL is a detached label that completely describes CUMINDEX.TAB. The length of the CUMINDEX.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks. Each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

CUMINDEX.LBL differs from INDEX.LBL (see Appendix A) in only three ways:

* DESCRIPTION refers to CUMINDEX.TAB rather than to INDEX.TAB
* ^TABLE points to CUMINDEX.TAB rather than to INDEX.TAB
* INDEX_TYPE = CUMULATIVE rather than SINGLE

4.2.3.2. CUMINDEX.TAB File

CUMINDEX.TAB is a table listing all CBIDRCD data files published in all volumes of the volume set to date. It is an ASCII file with fixed-length 80-byte records. Each record contains 78 data bytes followed by a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The detailed format and content are described by CUMINDEX.LBL.

4.2.3.3. INDEX.LBL File

INDEX.LBL is a detached label that completely describes INDEX.TAB. The length of the INDEX.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks. Each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example label for a CBIDRCD index is shown in Appendix A. Keywords are defined in [3].

4.2.3.4. INDEX.TAB File

INDEX.TAB is a table listing all CBIDRCD data files published in this volume. It is an ASCII file with fixed-length 80-byte records. Each record contains 78 data bytes followed by a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The detailed format and content are described by INDEX.LBL.

4.2.3.5. INDXINFO.TXT File

The INDXINFO.TXT file contains a description of the contents of the INDEX directory. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.2.4. LABEL Directory

4.2.4.1. CBIDRIM.FMT File

This file describes the contents of the first 92 bytes of each binary data record in the IM1.DAT and IM2.DAT files in the data directories. The remainder of each record consists of varying-length binary data described in [6]. CBIDRIM.FMT has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. records. Each record is delimited by a carriage-return (ASCII 13) line-feed (ASCII 10) pair.

4.2.4.2. CBIDROPF.FMT File

This file describes the binary contents of the OPF.DAT file in the data directories. The information is derived from [6]. CBIDROPF.FMT has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. records. Each record is delimited by a carriage-return (ASCII 13) line-feed (ASCII 10) pair.

4.2.4.3. CBIDRPR.FMT File

This file describes the contents of the binary data records in the PR1.DAT and PR2.DAT files in the data directories. The information is derived from [6]. CBIDRPR.FMT has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. records. Each record is delimited by a carriage-return (ASCII 13) line-feed (ASCII 10) pair.

4.2.4.4. DSMAPCB.LBL File

This file describes the map projections used in the IM1.DAT and IM2.DAT files. The information is DSMAPCB.LBL has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. records. Each record is delimited by a carriage-return (ASCII 13) line-feed (ASCII 10) pair.

4.2.4.5. LABLINFO.TXT File

The LABLINFO.TXT file contains a description of the contents of the LABEL directory. The file has an attached PDS label of the form shown in Figure 4-1. This is an ASCII file with 80-byte records. Each line is terminated with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes.

4.3. Data Directories

CBIDRCD volumes include directories for each orbit during which useful imaging data were taken. The data inherited from the C-BIDR products are recorded in 15 separate files, some purely ASCII, the others containing a mixture of ASCII and binary fields.

CLK.DAT	Sclk/scet conversion coefficients	ASCII
DCM.DAT	Decommutation and decalibration data	ASCII
DQS.DAT	EDR Data Quality Summary	ASCII
ENG.DAT	Engineering data	Binary
EPH.DAT	S/C ephemeris file	ASCII
HDR.DAT	Orbit Header	ASCII
IM1.DAT	Polar image data	Binary
IM2.DAT	Image data	Binary
MON.DAT	DSN monitor records	Binary
OPF.DAT	Orbit parameters	Binary
PBW.DAT	Processing bandwidths	ASCII
PR1.DAT	Polar processing parameters	Binary
PR2.DAT	Processing parameters	Binary
QTN.DAT	Quaternion pointing coefficients	ASCII
SAB.DAT	Radar header records	Binary

The bulk of the image data, from 89 degrees north to 89 degrees south latitude, are to be found in the IM2.DAT file in a sinusoidal equal-area projection. If either the north or south pole was imaged, data north of 80 degrees north latitude, or south of 80 degrees south latitude, are also written to the IM1.DAT file in an oblique sinusoidal projection. At no time could both poles be imaged in the same mapping orbit. If no polar data were taken, the IM1.DAT file, and its associated PR1.DAT file, will NOT be present in that particular CBIDRCD data directory.

The image files IM1.DAT and IM2.DAT, which represent long thin image strips, are not recorded as simple numeric arrays since few elements would contain valid data. Instead, they use varying-length data blocks, each with a header as described in [6] and in CBIDRIM.FMT in the LABEL directory. This format reduces the size of the files, but makes it impossible for the user to calculate the location of any desired image pixel without reading the file sequentially until that pixel is reached. For this reason, auxiliary information about the length of each data block is written into the files

IM1.AUX	Polar image index file	Binary
IM2.AUX	Image index file	Binary

while the CBIDRCD is created. These are called BIDRINDX files after the VICAR utility of the same name [23]. Used in conjunction with the corresponding IM*.DAT files, VICAR and GIPS [24] utilities can directly access any pixel in the image and greatly speed up many computations.

Each DAT and AUX file is paired with a PDS detached label file with the same name, e.g. SAB.DAT is paired with SAB.LBL, except that the label for IM1.AUX is named IX1.LBL and for IM2.AUX is IX2.LBL. The label files describe the data files.

Finally, each data directory also contains a ERR.TXT file that holds any error messages generated by the software that created the label files. Examples of label files and of ERR.TXT are included in Appendices A and B, respectively.

4.3.1. CLK.DAT

The SCLK/SCET Coefficients File is created by the Spacecraft Team. It contains the necessary parameters to translate from Magellan on-board clock time (SCLK) to on-board event time in UTC or TDB. By design and function, this is a dynamic file, slowly growing in size as time passes. This file contains only printable ASCII characters. Its format is defined in [7].

4.3.2. CLK.LBL

CLK.LBL is a detached label that describes the CLK.DAT file. The length of the CLK.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a

```
                         Cnnnn_vv
                            |
+------------+------------+------------+------------+
|            |            |            |            |
|- CLK.DAT   |- CLK.LBL   |- MON.DAT   |- MON.LBL   |- IM1.AUX
|- DCM.DAT   |- DCM.LBL   |- OPF.DAT   |- OPF.LBL   |- IM2.AUX
|- DQS.DAT   |- DQS.LBL   |- PBW.DAT   |- PBW.LBL   |- IX1.LBL
|- ENG.DAT   |- ENG.LBL   |- PR1.DAT   |- PR1.LBL   |- IX2.LBL
|- EPH.DAT   |- EPH.LBL   |- PR2.DAT   |- PR2.LBL   |- ERR.TXT
|- HDR.DAT   |- HDR.LBL   |- QTN.DAT   |- QTN.LBL
|- IM1.DAT   |- IM1.LBL   |- SAB.DAT   |- SAB.LBL
|- IM2.DAT   |- IM2.LBL
```

Figure 4-3. Example CBIDRCD Data Directory Structure

40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example CLK.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.3. DCM.DAT

The Decommutation/Decalibration File contains all necessary information to interpret the ENG.DAT downlink engineering data file. It is divided into 5 segments by SFDU labels: a decommutation segment, described in [9], that defines the location of each data channel, and 4 decalibration segments which assist in the conversion of channel values into engineering units, described in [10]. This file contains only printable ASCII characters.

4.3.4. DCM.LBL

DCM.LBL is a detached label that describes the DCM.DAT file. The length of the DCM.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example DCM.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.5. DQS.DAT

The Data Quality Summary File provides a measure of the continuity of ENG.DAT, and SAB.DAT data in the current orbit. Each gap of one or more successive whole SAB frames causes a logical record to be added to DQS.DAT. This file contains only printable ASCII characters. Its format is defined in [5].

4.3.6. DQS.LBL

DQS.LBL is a detached label that describes the DQS.DAT file. The length of the DQS.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example DQS.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.7. ENG.DAT

The Engineering File contains 100-byte binary data blocks, generated by the spacecraft every 2/3 second. The format is described in [5]. During ground data system processing, header labels are added to the blocks. Their formats are described in [12-16]. The location of particular data channels within the engineering records is defined in the accompanying DCM.DAT file.

4.3.8. ENG.LBL

ENG.LBL is a detached label that describes the ENG.DAT file. The length of the ENG.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example ENG.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.9. EPH.DAT

The Spacecraft Ephemeris File contains data for the mapping portion of a single orbit. The entire ephemeris file for each orbit plus 10% overlap on each end of the orbit will be included in EPH.DAT even if data gaps occurred during mapping, downlink, or data processing. This file contains only printable ASCII characters. Its format is defined in [11]. It is intended to be interpreted by SPICELIB software distributed by NAIF.

4.3.10. EPH.LBL

EPH.LBL is a detached label that describes the EPH.DAT file. The length of the EPH.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example EPH.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.11. HDR.DAT

The Orbit Header Record File identifies the orbit number, time frame, and characteristics of orbital geometry for one orbit. This file contains only printable ASCII characters. Its format is defined in [5].

4.3.12. HDR.LBL

HDR.LBL is a detached label that describes the HDR.DAT file. The length of the HDR.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example HDR.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.13. IM1.DAT

IM1.DAT contains compressed-resolution image data in an oblique sinusoidal equal-area projection. The file includes all available image data north of 80 N latitude for left-looking orbits, or south of 80 S latitude for right-looking orbits. Its format is defined in [6] and in the CBIDRIM.FMT file in the LABEL directory of each CBIDRCD disk. If no polar observations were made during a particular orbit, the corresponding IM1.DAT and PR1.DAT files will be omitted, along with their IM1.AUX, IM1.LBL, IX1.LBL, and PR1.LBL files.

4.3.14. IM1.LBL

IM1.LBL is a detached label that describes the IM1.DAT file. The length of the IM1.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example IM1.LBL file is shown in Appendix A. Keywords are defined in [3]. If no polar observations were made during a particular orbit, the corresponding IM1.LBL file will be omitted.

4.3.15. IM1.AUX

IM1.AUX describes the layout of the accompanying IM1.DAT file in VICAR IBIS format [23]. It consists of an ASCII header, followed by data blocks. The header consists of a series of blank-delimited ASCII strings, each in the format 'keyword=value'. If the value contains blanks, it is enclosed in single quotes. If no polar observations were made during a particular orbit, the corresponding IM1.AUX file will be omitted.

The first keyword is LBLSIZE, whose value (usually 512) is the length of the header, in bytes. Other important header keywords are NS, the length of each data block (also usually 512 bytes); NL, the number of data blocks; ORBIT, the BIDR orbit number; and REF_MERIDIAN, the reference meridian of the BIDR's sinusoidal projection. The remainder of the header block is filled with ASCII NULs.

The header is followed by a single data block which starts with a 4-byte integer field whose value is the number of logical data blocks, NBLK, in the IM1.DAT file. The integer is written in VAX binary format.

The remainder of the index file consists of 10 groups of data blocks. Each group consists of NBLK 4-byte fields, and the last block of each group is padded with NUL bytes to a multiple of the block length, NS. The total number of data blocks is therefore 10*CEIL(4*NBLK/NS)+1, where the CEIL function returns the smallest integer that is not less than its argument.

The ten sets of data blocks contain information about the NBLK BIDR image data blocks:

(1) Running sum of the number of pixel lines of data preceding the start of the image data block (4-byte VAX integer)

(2) Physical BIDR record number containing start of image data block header. Record numbering starts at 1. (4-byte VAX integer)

(3) Byte number of start of BIDR image data block header in the physical record. Byte numbering starts at 1. (4-byte VAX integer)

(4) Physical BIDR record number containing start of image data block. Record numbering starts at 1. (4-byte VAX integer)

(5) Byte number of start of BIDR image data block in the physical record. Byte numbering starts at 1. (4-byte VAX integer)

(6) Number of image lines in the BIDR image data block. (4-byte VAX integer)

(7) Number of image samples (+ 4-byte header) in the BIDR image data block. (4-byte VAX integer)

(8) Latitude of first pixel in the BIDR image data block. (4-byte VAX float)

(9) Longitude of first pixel in the BIDR image data block. (4-byte VAX float)

(10) Offset of first pixel the BIDR image data block from the reference meridian, in pixels. (4-byte VAX integer)

4.3.16. IX1.LBL

IX1.LBL is a detached label that describes the IX1.AUX file. The length of the IX1.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example IX1.LBL file is shown in Appendix A. Keywords are defined in [3]. If no polar observations are made during a particular orbit, the corresponding IX1.LBL file will be omitted.

4.3.17. IM2.DAT

IM2.DAT contains compressed-resolution image data in a sinusoidal equal-area projection. The file includes all available image data between 89 N latitude and 89 S latitude. Its format is defined in [6] and in the CBIDRIM.FMT file in the LABEL directory of each CBIDRCD disk.

4.3.18. IM2.LBL

IM2.LBL is a detached label that describes the IM2.DAT file. The length of the IM2.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example IM2.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.19. IM2.AUX

IM2.AUX describes the layout of the accompanying IM2.AUX file in VICAR IBIS format [23]. It consists of an ASCII header, followed by data blocks. The header consists of a series of blank-delimited ASCII strings, each in the format 'keyword=value'. If contains blanks, it is enclosed in single quotes. The format is identical to that of the IM1.AUX file, described above.

4.3.20. IX2.LBL

IX2.LBL is a detached label that describes the IX2.AUX file. The length of the IX2.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example IX2.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.21. MON.DAT

The Monitor 5-12 File contains 600-byte binary monitor blocks from the DSN stations that received the downlink data for this orbit. Its format is defined in [18,20,21].

4.3.22. MON.LBL

MON.LBL is a detached label that describes the MON.DAT file. The length of the MON.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example MON.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.23. OPF.DAT

The Per-Orbit Processing Constants File contains the values of all adjustable parameters used by the SAR data processing system when generating the full-resolution swath (F-BIDR product) from which this C-BIDR was made. The file consists of a single binary data record and is described in [6] and in file CBIDROPF.FMT in the LABEL directory.

4.3.24. OPF.LBL

OPF.LBL is a detached label that describes the OPF.DAT file. The length of the OPF.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a

40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example OPF.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.25. PBW.DAT

The Processing Bandwidths File is created by the Radar Engineering Team and lists the pulse repetition frequencies (PRFs) at which the radar operated during the mapping orbit. This file contains only printable ASCII characters. Its format is defined in [22].

4.3.26. PBW.LBL

PBW.LBL is a detached label that describes the PBW.DAT file. The length of the PBW.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example PBW.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.27. PR1.DAT

The Processing Parameters for Oblique Sinusoidal Data File contains the values of all parameters used by the SAR data processing system when generating the full-resolution swath (F-BIDR product) from which this IM1.DAT image was made. The file comprises one binary data record per radar burst and is described in [6] and in file CBIDROPF.FMT in the LABEL directory. If no polar observations were made during a particular orbit, the corresponding PR1.DAT file will be omitted.

4.3.28. PR1.LBL

PR1.LBL is a detached label that describes the PR1.DAT file. The length of the PR1.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example PR1.LBL file is shown in Appendix A. Keywords are defined in [3]. If no polar observations were made during a particular orbit, the corresponding PR1.LBL file will be omitted.

4.3.29. PR2.DAT

The Processing Parameters for Sinusoidal Data File contains the values of all parameters used by the SAR data processing system when generating the full-resolution swath (F-BIDR product) from which this IM2.DAT image was made. The file comprises one binary data record per radar burst and is described in [6] and in file CBIDROPF.FMT in the LABEL directory.

4.3.30. PR2.LBL

PR2.LBL is a detached label that describes the PR2.DAT file. The length of the PR2.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example PR2.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.31. QTN.DAT

The Mapping Quaternion Polynomial Coefficients File is created by the Radar Engineering Team and describes the commanded orientation of the spacecraft in the J2000 coordinate system. This file contains only printable ASCII characters. Its format is defined in [8].

4.3.32. QTN.LBL

QTN.LBL is a detached label that describes the QTN.DAT file. The length of the QTN.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example QTN.LBL file is shown in Appendix A. Keywords are defined in [3].

4.3.33. SAB.DAT

The SAR/Altimeter Burst File contains all 54-byte binary burst header records that were downlinked during this orbit. The format is described in [17,19]. During ground data system processing, header labels are added to the blocks. Their formats are described in [12-16].

4.3.34. SAB.LBL

SAB.LBL is a detached label that describes the SAB.DAT file. The length of the SAB.LBL file is an integral multiple of 80 bytes. All records are padded to 80 bytes with ASCII blanks, and each record ends with a carriage-return (ASCII 13) line-feed (ASCII 10) pair. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. An example SAB.LBL file is shown in Appendix A. Keywords are defined in [3].

CHAPTER 5

SUPPORT STAFF AND COGNIZANT PERSONNEL

For questions concerning this volume set:

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Telephone:	617-253-6485
Datafax:	617-253-0861
Internet:	pds-requests@space.mit.edu
URL:	http://delcano.mit.edu/

Planetary Data System:

PDS Operator
MS 525/3610
Jet Propulsion Laboratory
4800 Oak Grove Drive
Pasadena, CA 91109

Phone:	818-306-6130
NSI/Decnet:	JPLPDS::PDS_OPERATOR
Internet:	pds_operator@jplpds.jpl.nasa.gov
URL:	http://stardust.jpl.nasa.gov/pds_home.html

APPENDIX A

EXAMPLE PDS LABELS

A.1. CLK.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'CLK00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 1

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                  = 'CLK.DAT'
^TABLE                         = ('CLK.DAT',414<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'SCLK/SCET_COEFFICIENT_FILE'
DESCRIPTION                    = "This is the SCLK/SCET Coefficients File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE_HEADER
 HEADER_TYPE                   = 'N/A'
 SFDU_FORMAT_ID                = 'CCSD1Z000001'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
 BYTES                         = 413
 RECORDS                       = 14
 DESCRIPTION                   = "Combined SFDU keyword label (K-type) and
                                 data aggregate start label (R-type)."
END_OBJECT                     = TABLE_HEADER

OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I000128'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
```

```
 ROW_BYTES                    = 82
 ROWS                         = 40
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This table is the SCLK/SCET Coefficients
    File created by the Spacecraft Team. By design and function, it is a
    dynamic file, slowly growing in size as mission time passes. For more
    information, refer to SES-112, Magellan SCLK/SCET Coefficients File,
    Preliminary, January 1988."
END_OBJECT                    = TABLE

END
```

A.2. CUMINDEX.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID           = PDS3
RECORD_TYPE              = FIXED_LENGTH
RECORD_BYTES             = 80
FILE_RECORDS             = 351
DATA_SET_ID              = 'MGN-V-RDRS-5-C-BIDR-V1.0'
^TABLE                   = "CUMINDEX.TAB"
SPACECRAFT_NAME          = MAGELLAN
INSTRUMENT_NAME          = 'RADAR SYSTEM'
TARGET_NAME              = VENUS
DESCRIPTION              = "This table locates all C-BIDR products
                            on all archive volumes"

/* DESCRIPTION OF THE COLUMNS CONTAINED IN THE TABLE */

OBJECT                   = TABLE
  INTERCHANGE_FORMAT     = ASCII
  ROW_BYTES              = 78
  ROWS                   = 351
  COLUMNS                = 7

  OBJECT                 = COLUMN
    NAME                 = ORBIT_NUMBER
    DESCRIPTION          = "Orbit number of the data file"
    DATA_TYPE            = 'ASCII INTEGER'
    START_BYTE           = 1
    BYTES                = 4
  END_OBJECT

  OBJECT                 = COLUMN
    NAME                 = VERSION_NUMBER
    DESCRIPTION          = "Version number of the data file"
    DATA_TYPE            = 'ASCII INTEGER'
    START_BYTE           = 6
    BYTES                = 2
  END_OBJECT

  OBJECT                 = COLUMN
    NAME                 = FILE_NAME
    DESCRIPTION          = "File name of the data file on its CD-ROM"
    DATA_TYPE            = CHARACTER
```

```
     START_BYTE              = 10
     BYTES                   = 7
   END_OBJECT

   OBJECT                    = COLUMN
     NAME                    = DIRECTORY_NAME
     DESCRIPTION             = "Directory in which the data file resides
                                on its CD-ROM"
     DATA_TYPE               = CHARACTER
     START_BYTE              = 20
     BYTES                   = 8
   END_OBJECT

   OBJECT                    = COLUMN
     NAME                    = DERIVED_PRODUCT
     DESCRIPTION             = "Unique Product ID of the C-BIDR data tape
                                assigned by the Magellan Project. This
                                product was made by compressing several
                                F-BIDR image products, as listed in the
                                original_product column."
     DATA_TYPE               = CHARACTER
     START_BYTE              = 31
     BYTES                   = 18
   END_OBJECT

   OBJECT                    = COLUMN
     NAME                    = ORIGINAL_PRODUCT
     DESCRIPTION             = "Unique Product ID of the original F-BIDR data
                                tape assigned by the Magellan Project from
                                which this C-BIDR was generated."
     DATA_TYPE               = CHARACTER
     START_BYTE              = 52
     BYTES                   = 15
   END_OBJECT

   OBJECT                    = COLUMN
     NAME                    = VOLUME_ID
     DESCRIPTION             = "CD-ROM volume in which the data file resides"
     DATA_TYPE               = CHARACTER
     START_BYTE              = 70
     BYTES                   = 7
   END_OBJECT

END_OBJECT
END
```

A.3. DCM.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'DCM00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
```

```
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 17

/* LOCATION OF OBJECTS WITHIN THE FILE
^AGGREGATE_HEADER              = 'DCM.DAT'
^DECOM_TABLE_HEADER            = ('DCM.DAT',289<BYTES>)
^DECOM_TABLE                   = ('DCM.DAT',719<BYTES>)
^CHANNEL_TABLE_HEADER          = ('DCM.DAT',247578<BYTES>)
^CHANNEL_TABLE                 = ('DCM.DAT',248008<BYTES>)
^STATUS_TABLE_HEADER           = ('DCM.DAT',450492<BYTES>)
^STATUS_TABLE                  = ('DCM.DAT',450929<BYTES>)
^POLYNOMIAL_TABLE_HEADER       = ('DCM.DAT',480980<BYTES>)
^POLYNOMIAL_TABLE              = ('DCM.DAT',481418<BYTES>)
^LOOKUP_TABLE_HEADER           = ('DCM.DAT',482297<BYTES>)
^LOOKUP_TABLE                  = ('DCM.DAT',482728<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'DECOM_DECAL_FILE'
DESCRIPTION                    = "This is the Decom/Decal File and is
    necessary to locate and interpret channelized data in the
    accompanying ENG.DAT file. It consists of 5 separate ANSI-formatted
    SFDUs concatenated together: the Telemetry Decommutation Map, the
    Channel Description, Channel Status, DN-EU Conversion Polynomial
    Coefficients, and DN-EU Conversion Tables."
CONFIDENCE_LEVEL_NOTE          = "The following errors were noted by the
  software that generated this PDS label:
     bad DECAL2 SMARKER label length: 85"

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = AGGREGATE_HEADER
 HEADER_TYPE                   = 'N/A'
 SFDU_FORMAT_ID                = 'CCSD1Z000001'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
 BYTES                         = 288
 RECORDS                       = 9
 DESCRIPTION                   = "Combined SFDU keyword label (K-type) and
                                 data aggregate start label (R-type)."
END_OBJECT                     = AGGREGATE_HEADER

 OBJECT                        = DECOM_TABLE_HEADER
  HEADER_TYPE                  = 'N/A'
  SFDU_FORMAT_ID               = 'CCSD1Z000001'
  INTERCHANGE_FORMAT           = ASCII
  RECORD_TYPE                  = STREAM
```

```
 BYTES                        = 430
 RECORDS                      = 16
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = DECOM_TABLE_HEADER

OBJECT                        = DECOM_TABLE
 SFDU_FORMAT_ID               = 'NJPL1I000170'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 ROW_BYTES                    = 80
 ROWS                         = 3085
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This is the Decommutation Map. It
   consists of a listing of all channels in the Engineering frame, the
   length of each in bits, the offset of each into the data, and the
   value of any parameter that must be specified to ascertain its
   existence. Also included is the name for the location of the channel,
   information not required for machine interpretation. For more
   information, refer to SES-115, Decommutation Report Form, JPL, August
   1, 1988."
END_OBJECT                    = DECOM_TABLE

OBJECT                        = CHANNEL_TABLE_HEADER
 HEADER_TYPE                  = 'N/A'
 SFDU_FORMAT_ID               = 'CCSD1Z000001'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 430
 RECORDS                      = 16
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = CHANNEL_TABLE_HEADER

OBJECT                        = CHANNEL_TABLE
 SFDU_FORMAT_ID               = 'NJPL1I000171'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 ROW_BYTES                    = 'UNK'
 BYTES                        = 202425
 ROWS                         = 2600
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This is the first decalibration data
   file. It contains references to all channels specifying in each case
   the name, type, the unit of measure, alarm limits, and pointers to
   following SFDUs containing additional information. For more
   information, refer to TPS-129, MGN Decalibration File to DMD,
   December, 1987."
END_OBJECT                    = CHANNEL_TABLE

OBJECT                        = STATUS_TABLE_HEADER
 HEADER_TYPE                  = 'N/A'
 SFDU_FORMAT_ID               = 'CCSD1Z000001'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
```

```
 BYTES                        = 437
 RECORDS                      = 16
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = STATUS_TABLE_HEADER

OBJECT                        = STATUS_TABLE
 SFDU_FORMAT_ID               = 'NJPL1I000172'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 ROW_BYTES                    = 'UNK'
 BYTES                        = 29988
 ROWS                         = 356
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This is the second decalibration data
   file. It provides titles for the different states of each status-type
   channel. For more information, refer to TPS-129, MGN Decalibration
   File to DMD, December, 1987."
END_OBJECT                    = STATUS_TABLE

OBJECT                        = POLYNOMIAL_TABLE_HEADER
 HEADER_TYPE                  = 'N/A'
 SFDU_FORMAT_ID               = 'CCSD1Z000001'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 438
 RECORDS                      = 17
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = POLYNOMIAL_TABLE_HEADER

OBJECT                        = POLYNOMIAL_TABLE
 SFDU_FORMAT_ID               = 'NJPL1I000173'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 ROW_BYTES                    = 204
 ROWS                         = 4
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This is the third decalibration data
   file. It provides DN-EU correlation parameters for the polynomial
   (calibration-curve) type of conversion. For more information, refer
   to TPS-129, MGN Decalibration File to DMD, December, 1987."
END_OBJECT                    = POLYNOMIAL_TABLE

OBJECT                        = LOOKUP_TABLE_HEADER
 HEADER_TYPE                  = 'N/A'
 SFDU_FORMAT_ID               = 'CCSD1Z000001'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 431
 RECORDS                      = 16
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = LOOKUP_TABLE_HEADER
```

```
 OBJECT                        = LOOKUP_TABLE
  SFDU_FORMAT_ID               = 'NJPL1I000174'
  INTERCHANGE_FORMAT           = ASCII
  RECORD_TYPE                  = STREAM
  ROW_BYTES                    = 60
  ROWS                         = 788
  COLUMNS                      = 'UNK'
  DESCRIPTION                  = "This is the the fourth decalibration
    data file. It provides DN-EU correlation parameters for the table
    look-up (interpolation) type of conversion. For more information,
    refer to TPS-129, MGN Decalibration File to DMD, December, 1987."
 END_OBJECT                    = LOOKUP_TABLE

END
```

A.4. DQS.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'DQS00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 1

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                  = 'DQS.DAT'
^TABLE                         = ('DQS.DAT',403<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'DATA_QUALITY_SUMMARY_FILE'
DESCRIPTION                    = "This is the Data Quality Summary File."
CONFIDENCE_LEVEL_NOTE          = "The following errors were noted by the
  software that generated this PDS label:
     bad DATA_QUALITY_SUMMARY logical record length: 85"

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE_HEADER
 HEADER_TYPE                   = 'N/A'
 SFDU_FORMAT_ID                = 'CCSD1Z000001'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
 BYTES                         = 402
```

```
 RECORDS                       = 14
 DESCRIPTION                   = "Combined SFDU keyword label (K-type) and
                                 data aggregate start label (R-type)."
END_OBJECT                     = TABLE_HEADER

OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I000142'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = FIXED_LENGTH
 ROW_BYTES                     = 85
 ROWS                          = 1
 COLUMNS                       = 'UNK'
 DESCRIPTION                   = "This is a set of Data Quality Summary
    Records which provide a measure of the continuity of SAR, ALT, ENG,
    and SAB Header data in the current file set. Each gap of one or more
    successive whole SAB frames causes a DQS logical record to be
    generated. This file does not report gaps of finer granularity such
    as missing RCD frames. For more information, refer to TPS-101, SAR
    and Altimeter EDR/TEDR Tapes, Betsy Wilson, JPL, Rev, D, March 15,
    1989."
END_OBJECT                     = TABLE

END
```

A.5. DSMAPCB.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                     = PDS3

OBJECT                             = DATA_SET_MAP_PROJECTION
 DATA_SET_ID                       = 'MGN-V-RDRS-5-C-BIDR-V1.0'
 OBJECT                            = DATA_SET_MAP_PROJECTION_INFO
  MAP_PROJECTION_TYPE              = SINUSOIDAL
  MAP_PROJECTION_DESC              = "

    C-BIDR MAP PROJECTIONS
    ======================
      C-BIDR data are present in sinusoidal map projections, using the
      Venus body-fixed coordinate system approved by the IAU in 1985
      [DAVIESETAL1989].  Although the C-BIDR data files are formatted
      as a series of rectangular arrays of varying size, following the
      long, narrow image swath, the underlying organization is that of
      a single rectangular array of pixels, centered on the integral
      values of a two-dimensional Cartesian coordinate system.  The
      relationship between Cartesian coordinates (x,y) and geographic
      coordinates (latitude,longitude) is mathematically defined by the
      particular map projection.  In all C-BIDR images, the x-coordinate
      increases from left to right and the y-coordinate increases from
      bottom to top.  Longitude on Venus conventionally increases
      toward the east [LYONS1988].

    SINUSOIDAL MAP PROJECTION
    =========================
      In the sinusoidal projection, parallels of latitude are straight
      lines, with constant distances between equal latitude intervals.
```

Lines of constant longitude on either side of the projection meridian are curved since longitude intervals decrease with the cosine of latitude to account for their convergence toward the poles. Areas on the map are proportional to the same areas on the planet. Distances are correct along all parallels and the central meridian, but shapes are increasingly distorted away from the central meridian and near the poles [ALPHA&SNYDER1982; SNYDER1987].

The sinusoidal equal-area projection is characterized by a projection longitude and a scale. The projection longitude defines the center meridian (X=0) of the projection; the planet's equator is coincident with the line Y=0. The scale is given in units of pixels/degree along the projection equator, which can be converted to km/pixel using the planetary radius. The object IMAGE_MAP_PROJECTION in the IM2.LBL file provides the specific projection parameters for the Sinusoidal projection used with this data set. The most important parameters are:

```
A_AXIS_RADIUS                Planetary radius
CENTER_LATITUDE              Center latitude
CENTER_LONGITUDE             Center longitude
MAP_SCALE                    Pixel scale (225 meters/pixel)
LINE_PROJECTION_OFFSET       Image pixel offset of Y=0
SAMPLE_PROJECTION_OFFSET     Image pixel offset of X=0
```

(See the PDS Data Dictionary [PDSDD1992] for a more detailed description of these and other parameters.)

The transformation from latitude and longitude (LAT,LON) in radians to Sinusoidal Cartesian coordinates (X,Y) is given by the following equations.

```
  SCALE = A_AXIS_RADIUS / MAP_SCALE

      X = SCALE * (LON - CENTER_LONGITUDE) * COS(LAT)

      Y = SCALE * LAT;
```

The transformation between Cartesian coordinates (X,Y) and image pixel coordinates (SAMPLE,LINE) is

```
   LINE = 1 + LINE_PROJECTION_OFFSET - Y

 SAMPLE = 1 + SAMPLE_PROJECTION_OFFSET + X
```

In the above definitions, integral values of LINE and SAMPLE correspond to the center of a C-BIDR pixel, and the top left image pixel has LINE=1 and SAMPLE=1. Note that while SAMPLE increases from left to right (the same as X), LINE increases from top to bottom (the reverse of Y).

OBLIQUE SINUSOIDAL MAP PROJECTION

In the oblique sinusoidal projection, parallels of latitude and meridians of longitude are, in general, curved lines. Areas on the map are proportional to the same areas on the planet. Distances are correct along the central meridian (which maps to a straight line), but shapes are increasingly distorted away from the central meridian [ALPHA&SNYDER1982; SNYDER1987].

The sinusoidal equal-area projection employed for Magellan polar image data is characterized by a projection longitude, a projection latitude, and a scale. The projection longitude defines the center meridian of the projection (X=0), i.e. the coordinate system has been rotated by this angle about the planet's rotation axis; the projection latitude defines a second rotation that has been made to the coordinate system about an axis perpendicular to the central meridian. The effect of these two rotations is to bring to the center of the projection (X=0,Y=0) that point on the planet whose coordinates are equal to the projection latitude and longitude. A general oblique sinusoidal projection is characterized by a third parameter, a further rotation about the radius vector to the projection center. However, for Magellan images, this angle is always zero.

The mapping scale is given in units of pixels/degree at the projection origin, which can be converted to km/pixel using the planetary radius. The object IMAGE_MAP_PROJECTION in the IM1.LBL file provides the specific projection parameters for the oblique sinusoidal projection used with this data set. The most important parameters are:

A_AXIS_RADIUS	Planetary radius
CENTER_LATITUDE	Projection latitude
CENTER_LONGITUDE	Projection longitude
MAP_SCALE	Pixel scale (225 meters/pixel)
LINE_PROJECTION_OFFSET	Line index of map origin
SAMPLE_PROJECTION_OFFSET	Sample index of map origin

(See the PDS Data Dictionary [PDSDD1992] for a more detailed description of these and other parameters.)

The transformation from latitude and longitude (LAT,LON) in radians to Oblique Sinusoidal Cartesian coordinates (X,Y) is given by the following equations.

```
  SCALE = A_AXIS_RADIUS / MAP_SCALE

   PLAT = ASIN(SIN(LAT) * COS(CENTER_LATITUDE) - COS(LAT) *
          SIN(CENTER_LATITUDE) * COS(LON - CENTER_LONGITUDE))

   PLON = ATAN2(COS(LAT) * SIN(LON - CENTER_LONGITUDE),
          SIN(LAT) * SIN(CENTER_LATITUDE) + COS(LAT) *
          COS(CENTER_LATITUDE) * COS(LON - CENTER_LONGITUDE))

      Y = SCALE * PLON * COS(PLAT)

      X = SCALE * PLAT;
```

```
      The transformation between Cartesian coordinates (X,Y) and image
      pixel coordinates (SAMPLE,LINE) is

         LINE = 1 + LINE_PROJECTION_OFFSET + Y

       SAMPLE = 1 + SAMPLE_PROJECTION_OFFSET + X

      In the above definitions, integral values of LINE and SAMPLE
      correspond to the center of a C-BIDR pixel, and the top left image
      pixel has LINE=1 and SAMPLE=1."

  ROTATIONAL_ELEMENT_DESC         = "See [DAVIESETAL1989]."

  OBJECT                          = DS_MAP_PROJECTION_REF_INFO
   REFERENCE_KEY_ID               = "DAVIESETAL1989"
  END_OBJECT                      = DS_MAP_PROJECTION_REF_INFO

  OBJECT                          = DS_MAP_PROJECTION_REF_INFO
   REFERENCE_KEY_ID               = "SNYDER1987"
  END_OBJECT                      = DS_MAP_PROJECTION_REF_INFO

  OBJECT                          = DS_MAP_PROJECTION_REF_INFO
   REFERENCE_KEY_ID               = "LYONS1988"
  END_OBJECT                      = DS_MAP_PROJECTION_REF_INFO

  OBJECT                          = DS_MAP_PROJECTION_REF_INFO
   REFERENCE_KEY_ID               = "PDSDD1992"
  END_OBJECT                      = DS_MAP_PROJECTION_REF_INFO

  OBJECT                          = DS_MAP_PROJECTION_REF_INFO
   REFERENCE_KEY_ID               = "ALPHA&SNYDER1982"
  END_OBJECT                      = DS_MAP_PROJECTION_REF_INFO
 END_OBJECT                       = DATA_SET_MAP_PROJECTION_INFO

END_OBJECT                        = DATA_SET_MAP_PROJECTION
END
```

A.6. ENG.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'ENG00376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 32500
FILE_RECORDS                  = 29

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                 = 'ENG.DAT'
^TABLE                        = ('ENG.DAT',309<BYTES>)
```

```
/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'ENGINEERING_DATA_FILE'
DESCRIPTION                    = "This is the Engineering Data File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE_HEADER
 HEADER_TYPE                   = 'N/A'
 SFDU_FORMAT_ID                = 'CCSD1Z000001'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
 BYTES                         = 308
 RECORDS                       = 10
 DESCRIPTION                   = "Combined SFDU keyword label (K-type) and
                                 data aggregate start label (R-type)."
END_OBJECT                     = TABLE_HEADER

OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I00C108'
 INTERCHANGE_FORMAT            = BINARY
 RECORD_TYPE                   = FIXED_LENGTH
 ROW_BYTES                     = 274
 ROWS                          = 3341
 COLUMNS                       = 'UNK'
 DESCRIPTION                   = "This is a collection of Engineering Data
    records containing data for the mapping portion of the orbit as well
    as all data recorded for the period of up to 20 minutes immediately
    preceding and immediately following mapping. This 20 minutes
    (maximum) includes the spacecraft-turning maneuvers. For more
    information, refer to TPS-101, SAR and Altimeter EDR/TEDR Tapes Betsy
    Wilson, JPL, Revision D, March 15, 1989, and SFOC-5-TIS-*DU-MgnSFDU,
    Standard Formatted Data Units Generated from Telemetry Input
    Subsystem, JPL, August 31, 1988."
END_OBJECT                     = TABLE

END
```

A.7. EPH.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'EPH00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
```

```
RECORD_BYTES                  = 32500
FILE_RECORDS                  = 4

/* LOCATION OF OBJECTS WITHIN THE FILE
^SPICE_KERNEL_HEADER          = 'EPH.DAT'
^SPICE_KERNEL                 = ('EPH.DAT',906<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME               = 'MAGELLAN'
MISSION_PHASE_NAME            = 'PRIMARY MISSION'
INSTRUMENT_NAME               = 'RADAR SYSTEM'
TARGET_NAME                   = 'VENUS'
ORBIT_NUMBER                  = 376
START_TIME                    = 1990-09-15T16:22:15.592
STOP_TIME                     = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT  = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT   = '00723813.48.8.0'
NOTE                          = 'SPACECRAFT_EPHEMERIS_FILE'
DESCRIPTION                   = "This is the Spacecraft Ephemeris File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                        = SPICE_KERNEL_HEADER
 HEADER_TYPE                  = 'N/A'
 SFDU_FORMAT_ID               = 'CCSD1Z000001'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 905
 RECORDS                      = 56
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = SPICE_KERNEL_HEADER

OBJECT                        = SPICE_KERNEL
 KERNEL_TYPE                  = EPHEMERIS
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 99949
 ROWS                         = 1445
 DESCRIPTION                  = "This is the Spacecraft and Planetary
    Ephemeris. It contains data for the mapping portion of a single
    orbit. The entire ephemeris for each orbit plus 10% overlap on each
    end of the orbit is included, even if data gaps occurred during
    mapping, downlink, or ground processing. For more information, refer
    to SFOC-2-DPS-CDB-Ephemeris, Spacecraft and Planet Ephemerides, NAIF
    S and P Kernels, Preliminary, January 8, 1988."
END_OBJECT                    = SPICE_KERNEL

END
```

A.8. HDR.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'HDR00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 1

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                  = 'HDR.DAT'
^TABLE                         = ('HDR.DAT',413<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'ORBIT_HEADER_FILE'
DESCRIPTION                    = "This is the Orbit Header File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE_HEADER
 HEADER_TYPE                   = 'N/A'
 SFDU_FORMAT_ID                = 'CCSD1Z000001'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
 BYTES                         = 412
 RECORDS                       = 15
 DESCRIPTION                   = "Combined SFDU keyword label (K-type) and
                                 data aggregate start label (R-type)."
END_OBJECT                     = TABLE_HEADER

OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I000141'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = FIXED_LENGTH
 ROW_BYTES                     = 306
 ROWS                          = 1
 COLUMNS                       = 'UNK'
 DESCRIPTION                   = "This is the Orbit Header Record. It
    identifies the orbit number, time frame, and characteristics of
    orbital geometry for one orbit. For more information, refer to
    TPS-101, SAR and Altimeter EDR/TEDR Tapes, Betsy Wilson, JPL, Rev, D,
    March 15, 1989."
END_OBJECT                     = TABLE
```

```
END
```

A.9. IM1.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'IM100376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 32500
FILE_RECORDS                  = 31

/* LOCATION OF OBJECTS WITHIN THE FILE
^IMAGE                        = 'IM1.DAT'

/* GENERAL PARAMETERS
SPACECRAFT_NAME               = 'MAGELLAN'
MISSION_PHASE_NAME            = 'PRIMARY MISSION'
INSTRUMENT_NAME               = 'RADAR SYSTEM'
TARGET_NAME                   = 'VENUS'
ORBIT_NUMBER                  = 376
START_TIME                    = 1990-09-15T16:22:15.592
STOP_TIME                     = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT  = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT   = '00723813.48.8.0'
NOTE                          = 'OBLIQUE_SINUSOIDAL_IMAGE_FILE'
DESCRIPTION                   = "This is the Oblique Sinusoidal Image
    File consisting of a set of logical image data records, each
    containing multi-look image data in the oblique sinusoidal
    projection. The image data will correspond to the mapped area north
    of 80 deg N latitude or south of 80 deg S latitude on the Venusian
    surface. For more information, refer to IDPS-101, Compressed
    Resolution Basic Image Data Record, JPL, MIPL, February 14, 1990, and
    to SDPS-101, Full Resolution Basic Image Data Record, J. Gilbert,
    JPL, 1990."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                        = IMAGE
 SFDU_FORMAT_ID               = 'NJPL1I000111'
 INTERCHANGE_FORMAT           = BINARY
 BYTES                        = 1007500
 FILE_RECORDS                 = 272
 ^STRUCTURE                   = 'CBIDRIM.FMT'
 COLUMNS                      = 16
 LINE_SAMPLES                 = 171
 LINES                        = 5537
 LINE_PREFIX_BYTES            = 4
 SAMPLE_TYPE                  = MSB_UNSIGNED_INTEGER
 SAMPLE_BITS                  = 8
 SCALING_FACTOR               = 0.2 <DECIBELS>
 OFFSET                       = -20.2 <DECIBELS>
 MISSING                      = 0
```

```
 DESCRIPTION                  = "This file consists of varying-length
    logical data records. Each record contains a 92-byte header, followed
    by a rectangular pixel array. Each line of the pixel array begins
    with a pair of 2-byte integers defining the start and end of valid
    pixels in that line. The 8-bit integer pixel values (DN) are related
    to the normalized radar cross-section (SIGMA-N) by DN =
    1+INT((MIN(MAX(RV,-20),30)+20)*5)."
END_OBJECT                    = IMAGE

OBJECT                        = IMAGE_MAP_PROJECTION
 OBJECT                       = DATA_SET_MAP_PROJECTION
  DATA_SET_ID                 = 'MGN-V-RDRS-5-C-BIDR-V1.0'
  ^STRUCTURE                  = 'DSMAPCB.LBL'
 END_OBJECT                   = DATA_SET_MAP_PROJECTION
 IMAGE_ID                     = 'IM100376;03'
 MAP_PROJECTION_TYPE          = SINUSOIDAL
 MAP_RESOLUTION               = 469.1 <PIXEL/DEG>
 MAP_SCALE                    = 225 <M/PIXEL>
 LINE_PROJECTION_OFFSET       = 953
 SAMPLE_PROJECTION_OFFSET     = -1859
 A_AXIS_RADIUS                = 6051.92 <KM>
 B_AXIS_RADIUS                = 6051.92 <KM>
 C_AXIS_RADIUS                = 6051.92 <KM>
 FIRST_STANDARD_PARALLEL      = 0.0 <DEG>
 SECOND_STANDARD_PARALLEL     = 'N/A'
 POSITIVE_LONGITUDE_DIRECTION = EAST
 CENTER_LATITUDE              = 85.494 <DEG>
 CENTER_LONGITUDE             = 239.351 <DEG>
 MAP_PROJECTION_ROTATION      = -90.0 <DEG>
 LINE_FIRST_PIXEL             = 'N/A'
 LINE_LAST_PIXEL              = 'N/A'
 MAXIMUM_LATITUDE             = 'N/A'
 MAXIMUM_LONGITUDE            = 'N/A'
 MINIMUM_LATITUDE             = 'N/A'
 MINIMUM_LONGITUDE            = 'N/A'
 REFERENCE_LATITUDE           = 'N/A'
 REFERENCE_LONGITUDE          = 'N/A'
 SAMPLE_FIRST_PIXEL           = 'N/A'
 SAMPLE_LAST_PIXEL            = 'N/A'
END_OBJECT                    = IMAGE_MAP_PROJECTION

END
```

A.10. IM2.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'IM200376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 32500
FILE_RECORDS                  = 371
```

```
/* LOCATION OF OBJECTS WITHIN THE FILE
^IMAGE                         = 'IM2.DAT'

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'SINUSOIDAL_IMAGE_FILE'
DESCRIPTION                    = "This is the Sinusoidal Image File
    consisting of a set of logical image data records, each containing
    multi-look image data in the sinusoidal projection. The image data
    will include all available data between 89 degrees N and 89 degrees S
    latitude. For more information, refer to IDPS-101, Compressed
    Resolution Basic Image Data Record, JPL, MIPL, February 14, 1990, and
    to SDPS-101, Full Resolution Basic Image Data Record, J. Gilbert,
    JPL, 1990."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = IMAGE
 SFDU_FORMAT_ID                = 'NJPL1I000111'
 INTERCHANGE_FORMAT            = BINARY
 BYTES                         = 12057500
 FILE_RECORDS                  = 5187
 ^STRUCTURE                    = 'CBIDRIM.FMT'
 COLUMNS                       = 16
 LINE_SAMPLES                  = 171
 LINES                         = 66170
 LINE_PREFIX_BYTES             = 4
 SAMPLE_TYPE                   = MSB_UNSIGNED_INTEGER
 SAMPLE_BITS                   = 8
 SCALING_FACTOR                = 0.2 <DECIBELS>
 OFFSET                        = -20.2 <DECIBELS>
 MISSING                       = 0
 DESCRIPTION                   = "This file consists of varying-length
    logical data records. Each record contains a 92-byte header, followed
    by a rectangular pixel array. Each line of the pixel array begins
    with a pair of 2-byte integers defining the start and end of valid
    pixels in that line. The 8-bit integer pixel values (DN) are related
    to the normalized radar cross-section (SIGMA-N) by DN =
    1+INT((MIN(MAX(RV,-20),30)+20)*5)."
END_OBJECT                     = IMAGE

OBJECT                         = IMAGE_MAP_PROJECTION
 OBJECT                        = DATA_SET_MAP_PROJECTION
  DATA_SET_ID                  = 'MGN-V-RDRS-5-C-BIDR-V1.0'
  ^STRUCTURE                   = 'DSMAPCB.LBL'
 END_OBJECT                    = DATA_SET_MAP_PROJECTION
 IMAGE_ID                      = 'IM200376;03'
 MAP_PROJECTION_TYPE           = SINUSOIDAL
```

```
 MAP_RESOLUTION               = 469.1 <PIXEL/DEG>
 MAP_SCALE                    = 225 <M/PIXEL>
 LINE_PROJECTION_OFFSET       = 41957
 SAMPLE_PROJECTION_OFFSET     = 58
 A_AXIS_RADIUS                = 6051.92 <KM>
 B_AXIS_RADIUS                = 6051.92 <KM>
 C_AXIS_RADIUS                = 6051.92 <KM>
 FIRST_STANDARD_PARALLEL      = 0.0 <DEG>
 SECOND_STANDARD_PARALLEL     = 'N/A'
 POSITIVE_LONGITUDE_DIRECTION = EAST
 CENTER_LATITUDE              = 0.0 <DEG>
 CENTER_LONGITUDE             = 329.371 <DEG>
 MAP_PROJECTION_ROTATION      = 0.0 <DEG>
 LINE_FIRST_PIXEL             = 'N/A'
 LINE_LAST_PIXEL              = 'N/A'
 MAXIMUM_LATITUDE             = 'N/A'
 MAXIMUM_LONGITUDE            = 'N/A'
 MINIMUM_LATITUDE             = 'N/A'
 MINIMUM_LONGITUDE            = 'N/A'
 REFERENCE_LATITUDE           = 'N/A'
 REFERENCE_LONGITUDE          = 'N/A'
 SAMPLE_FIRST_PIXEL           = 'N/A'
 SAMPLE_LAST_PIXEL            = 'N/A'
END_OBJECT                    = IMAGE_MAP_PROJECTION

END
```

A.11. INDEX.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID           = PDS3
RECORD_TYPE              = FIXED_LENGTH
RECORD_BYTES             = 80
FILE_RECORDS             = 351
DATA_SET_ID              = 'MGN-V-RDRS-5-C-BIDR-V1.0'
^TABLE                   = "INDEX.TAB"
SPACECRAFT_NAME          = MAGELLAN
INSTRUMENT_NAME          = 'RADAR SYSTEM'
TARGET_NAME              = VENUS
DESCRIPTION              = "This table locates all C-BIDR products
                            on the current volume"

/* DESCRIPTION OF THE COLUMNS CONTAINED IN THE TABLE */

OBJECT                   = TABLE
  INTERCHANGE_FORMAT     = ASCII
  ROW_BYTES              = 78
  ROWS                   = 351
  COLUMNS                = 7

  OBJECT                 = COLUMN
    NAME                 = ORBIT_NUMBER
    DESCRIPTION          = "Orbit number of the data file"
    DATA_TYPE            = 'ASCII INTEGER'
    START_BYTE           = 1
```

```
  BYTES                = 4
END_OBJECT

OBJECT                 = COLUMN
  NAME                 = VERSION_NUMBER
  DESCRIPTION          = "Version number of the data file"
  DATA_TYPE            = 'ASCII INTEGER'
  START_BYTE           = 6
  BYTES                = 2
END_OBJECT

OBJECT                 = COLUMN
  NAME                 = FILE_NAME
  DESCRIPTION          = "File name of the data file on this CD-ROM"
  DATA_TYPE            = CHARACTER
 START_BYTE            = 10
 BYTES                 = 7
END_OBJECT

OBJECT                 = COLUMN
  NAME                 = DIRECTORY_NAME
  DESCRIPTION          = "Directory in which the data file resides
                          on this CD-ROM"
  DATA_TYPE            = CHARACTER
  START_BYTE           = 20
  BYTES                = 8
END_OBJECT

OBJECT                 = COLUMN
  NAME                 = DERIVED_PRODUCT
  DESCRIPTION          = "Unique Product ID of the C-BIDR data tape
                          assigned by the Magellan Project. This
                          product was made by compressing several
                          F-BIDR image products, as listed in the
                          original_product column."
  DATA_TYPE            = CHARACTER
  START_BYTE           = 31
  BYTES                = 18
END_OBJECT

OBJECT                 = COLUMN
  NAME                 = ORIGINAL_PRODUCT
  DESCRIPTION          = "Unique Product ID of the original F-BIDR data
                          tape assigned by the Magellan Project from
                          which this C-BIDR was generated."
  DATA_TYPE            = CHARACTER
  START_BYTE           = 52
  BYTES                = 15
END_OBJECT

OBJECT                 = COLUMN
  NAME                 = VOLUME_ID
  DESCRIPTION          = "CD-ROM volume in which the data file resides"
  DATA_TYPE            = CHARACTER
  START_BYTE           = 70
```

```
    BYTES                 = 7
  END_OBJECT

END_OBJECT
END
```

A.12. IX1.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'IM100376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 512
FILE_RECORDS                  = 32

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                 = 'IM1.AUX'
^TABLE                        = ('IM1.AUX',2)

/* GENERAL PARAMETERS
SPACECRAFT_NAME               = 'MAGELLAN'
MISSION_PHASE_NAME            = 'PRIMARY MISSION'
INSTRUMENT_NAME               = 'RADAR SYSTEM'
TARGET_NAME                   = 'VENUS'
ORBIT_NUMBER                  = 376
START_TIME                    = 1990-09-15T16:22:15.592
STOP_TIME                     = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT  = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT   = '00723813.48.8.0'
NOTE                          = 'OBLIQUE_SINUSOIDAL_IMAGE_INDEX_FILE'
DESCRIPTION                   = "This is the Oblique Sinusoidal Image
    Index File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                        = TABLE_HEADER
 HEADER_TYPE                  = 'VICAR2'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 512
 RECORDS                      = 1
 DESCRIPTION                  = "Header of VICAR/IBIS file."
END_OBJECT                    = TABLE_HEADER

OBJECT                        = TABLE
 SFDU_FORMAT_ID               = 'VICAR/IBIS'
 INTERCHANGE_FORMAT           = BINARY
 RECORD_TYPE                  = FIXED_LENGTH
 ROW_BYTES                    = 512
 ROWS                         = 31
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This file serves as an index to the
```

image data in the accompanying .DAT file. The index is used by several VICAR and GIPS programs to directly access portions of the BIDR swath without having to read the entire image.

Index files are in VICAR/IBIS format. They consist of an ASCII header, followed by data blocks. The header consists of a series of blank-delimited ASCII strings, each in the format ’keyword=value’. If ’value’ contains blanks, it is enclosed in single quotes.

The first keyword is LBLSIZE, whose value (usually 512) is the length of the header, in bytes. Other important header keywords are NS, the length of each data block (also usually 512 bytes), NL, the number of data blocks, ORBIT, the BIDR orbit number, and REF_MERIDIAN , the reference meridian of the BIDR’s sinusoidal projection. The remainder of the header block is filled with ASCII NULs.

The header is followed by a single data block which starts with a 4-byte integer field whose value is the number of data blocks, nblk, in the original BIDR. The integer is written in VAX binary format.

The remainder of the index file consists of 10 groups of data blocks. Each group consists of nblk 4-byte fields, and the last block of each group is padded with NUL bytes to a multiple of the block length, NS. The total number of data blocks is therefore 10*ceil(4*nblk/NS)+1, where the ceil function returns the smallest integer that is not less than its argument.

The ten sets of data blocks contain information about the nblk BIDR image data blocks. Fields marked (I) contain 4-byte VAX signed integers, while those marked (F) contain 4-byte single-precision VAX floats.

1. Running sum of the number of pixel lines of data preceding the start of the image data block (I)

2. Physical BIDR record number containing start of image data block header. Record numbering starts at 1. (I)

3. Byte number of start of BIDR image data block header in the physical record. Byte numbering starts at 1. (I)

4. Physical BIDR record number containing start of image data block. Record numbering starts at 1. (I)

5. Byte number of start of BIDR image data block in the physical record. Byte numbering starts at 1. (I)

6. Number of image lines in the BIDR image data block. (I)

7. Number of image samples (+ 4-byte header) in the BIDR image data block. (I)

8. Latitude of first pixel in the BIDR image data block. (F)

9. Longitude of first pixel in the BIDR image data block. (F)

```
    10. Offset of first pixel the BIDR image data block from the
    reference meridian, in pixels. (I)"
END_OBJECT                    = TABLE

END
```

A.13. IX2.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'IM200376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 512
FILE_RECORDS                  = 412

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                 = 'IM2.AUX'
^TABLE                        = ('IM2.AUX',2)

/* GENERAL PARAMETERS
SPACECRAFT_NAME               = 'MAGELLAN'
MISSION_PHASE_NAME            = 'PRIMARY MISSION'
INSTRUMENT_NAME               = 'RADAR SYSTEM'
TARGET_NAME                   = 'VENUS'
ORBIT_NUMBER                  = 376
START_TIME                    = 1990-09-15T16:22:15.592
STOP_TIME                     = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT  = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT   = '00723813.48.8.0'
NOTE                          = 'SINUSOIDAL_IMAGE_INDEX_FILE'
DESCRIPTION                   = "This is the Sinusoidal Image Index File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                        = TABLE_HEADER
 HEADER_TYPE                  = 'VICAR2'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 512
 RECORDS                      = 1
 DESCRIPTION                  = "Header of VICAR/IBIS file."
END_OBJECT                    = TABLE_HEADER

OBJECT                        = TABLE
 SFDU_FORMAT_ID               = 'VICAR/IBIS'
 INTERCHANGE_FORMAT           = BINARY
 RECORD_TYPE                  = FIXED_LENGTH
 ROW_BYTES                    = 512
 ROWS                         = 411
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This file serves as an index to the
    image data in the accompanying .DAT file. The index is used by
```

several VICAR and GIPS programs to directly access portions of the BIDR swath without having to read the entire image.

Index files are in VICAR/IBIS format. They consist of an ASCII header, followed by data blocks. The header consists of a series of blank-delimited ASCII strings, each in the format 'keyword=value'. If 'value' contains blanks, it is enclosed in single quotes.

The first keyword is LBLSIZE, whose value (usually 512) is the length of the header, in bytes. Other important header keywords are NS, the length of each data block (also usually 512 bytes), NL, the number of data blocks, ORBIT, the BIDR orbit number, and REF_MERIDIAN , the reference meridian of the BIDR's sinusoidal projection. The remainder of the header block is filled with ASCII NULs.

The header is followed by a single data block which starts with a 4-byte integer field whose value is the number of data blocks, nblk, in the original BIDR. The integer is written in VAX binary format.

The remainder of the index file consists of 10 groups of data blocks. Each group consists of nblk 4-byte fields, and the last block of each group is padded with NUL bytes to a multiple of the block length, NS. The total number of data blocks is therefore 10*ceil(4*nblk/NS)+1, where the ceil function returns the smallest integer that is not less than its argument.

The ten sets of data blocks contain information about the nblk BIDR image data blocks. Fields marked (I) contain 4-byte VAX signed integers, while those marked (F) contain 4-byte single-precision VAX floats.

1. Running sum of the number of pixel lines of data preceding the start of the image data block (I)

2. Physical BIDR record number containing start of image data block header. Record numbering starts at 1. (I)

3. Byte number of start of BIDR image data block header in the physical record. Byte numbering starts at 1. (I)

4. Physical BIDR record number containing start of image data block. Record numbering starts at 1. (I)

5. Byte number of start of BIDR image data block in the physical record. Byte numbering starts at 1. (I)

6. Number of image lines in the BIDR image data block. (I)

7. Number of image samples (+ 4-byte header) in the BIDR image data block. (I)

8. Latitude of first pixel in the BIDR image data block. (F)

9. Longitude of first pixel in the BIDR image data block. (F)

```
    10. Offset of first pixel the BIDR image data block from the
    reference meridian, in pixels. (I)"
END_OBJECT                    = TABLE

END
```

A.14. MON.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'MON00376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 32500
FILE_RECORDS                  = 51

/* LOCATION OF OBJECTS WITHIN THE FILE
^AGGREGATE_HEADER             = 'MON.DAT'
^STATION_1_TABLE_HEADER       = ('MON.DAT',281<BYTES>)
^STATION_1_TABLE              = ('MON.DAT',357<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME               = 'MAGELLAN'
MISSION_PHASE_NAME            = 'PRIMARY MISSION'
INSTRUMENT_NAME               = 'RADAR SYSTEM'
TARGET_NAME                   = 'VENUS'
ORBIT_NUMBER                  = 376
START_TIME                    = 1990-09-15T16:22:15.592
STOP_TIME                     = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT  = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT   = '00723813.48.8.0'
NOTE                          = 'DSN_MONITOR_RECORDS_FILE'
DESCRIPTION                   = "This is the DSN Monitor Records File."
CONFIDENCE_LEVEL_NOTE         = "The following errors were noted by the
  software that generated this PDS label:
     bad MONITOR aggregate length: 356"

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                        = AGGREGATE_HEADER
 HEADER_TYPE                  = 'N/A'
 SFDU_FORMAT_ID               = 'CCSD1Z000001'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 280
 RECORDS                      = 9
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = AGGREGATE_HEADER

 OBJECT                       = STATION_1_TABLE_HEADER
  HEADER_TYPE                 = 'N/A'
  SFDU_FORMAT_ID              = 'CCSD1R000003'
```

```
  INTERCHANGE_FORMAT           = ASCII
  RECORD_TYPE                  = STREAM
  BYTES                        = 76
  RECORDS                      = 3
  DESCRIPTION                  = "SFDU data aggregate start label (R-type)."
 END_OBJECT                    = STATION_1_TABLE_HEADER

 OBJECT                        = STATION_1_TABLE
  SFDU_FORMAT_ID               = 'NJPL2I00C115'
  INTERCHANGE_FORMAT           = BINARY
  RECORD_TYPE                  = FIXED_LENGTH
  ROW_BYTES                    = 586
  ROWS                         = 2820
  COLUMNS                      = 'UNK'
  DESCRIPTION                  = "This is a collection of DSN Monitor
    Records generated at five-second intervals by each DSN station
    tracking the spacecraft. For more information, refer to MON-105,
    Magellan DSN Monitor Data, February 17, 1988."
 END_OBJECT                    = STATION_1_TABLE

END
```

A.15. OPF.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'OPF00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 1

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE                         = 'OPF.DAT'

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'ORBIT_PARAMETER_FILE'
DESCRIPTION                    = "This is the Orbit Parameter File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I000104'
 INTERCHANGE_FORMAT            = BINARY
```

```
 RECORD_TYPE                 = FIXED_LENGTH
 ROW_BYTES                   = 540
 ROWS                        = 1
 ^STRUCTURE                  = 'CBIDROPF.FMT'
 COLUMNS                     = 40
 DESCRIPTION                 = "This is the Orbit Parameter record,
    consisting of 40 parameters, plus spares. Parameter sizes vary from
    four to 32 bytes. They are used for processing, and are constant for
    the orbit corresponding to the BIDR. For more information, refer to
    IDPS-101, Compressed Resolution Basic Image Data Record, JPL, MIPL,
    February 14, 1990, and to SDPS-101, Full Resolution Basic Image Data
    Record, J. Gilbert, JPL, 1990."
END_OBJECT                   = TABLE

END
```

A.16. PBW.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID               = PDS3
DATA_SET_ID                  = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                   = 'PBW00376;03'
SOURCE_PRODUCT_ID            = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                  = FIXED_LENGTH
RECORD_BYTES                 = 32500
FILE_RECORDS                 = 1

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                = 'PBW.DAT'
^TABLE                       = ('PBW.DAT',344<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME              = 'MAGELLAN'
MISSION_PHASE_NAME           = 'PRIMARY MISSION'
INSTRUMENT_NAME              = 'RADAR SYSTEM'
TARGET_NAME                  = 'VENUS'
ORBIT_NUMBER                 = 376
START_TIME                   = 1990-09-15T16:22:15.592
STOP_TIME                    = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT  = '00723813.48.8.0'
NOTE                         = 'PROCESSING_BANDWIDTHS_FILE'
DESCRIPTION                  = "This is the Processing Bandwidths File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                       = TABLE_HEADER
 HEADER_TYPE                 = 'N/A'
 SFDU_FORMAT_ID              = 'CCSD1Z000001'
 INTERCHANGE_FORMAT          = ASCII
 RECORD_TYPE                 = STREAM
 BYTES                       = 343
 RECORDS                     = 12
 DESCRIPTION                 = "Combined SFDU keyword label (K-type) and
```

```
                                data aggregate start label (R-type)."
END_OBJECT                    = TABLE_HEADER

OBJECT                        = TABLE
 SFDU_FORMAT_ID               = 'NJPL1I000124'
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 ROW_BYTES                    = 29
 ROWS                         = 645
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This is the Processing Bandwidths File
    created by the Radar System Engineering Team. For more information,
    refer to RES-101, Radar Processing Bandwidths File Format and
    Content, Draft, March, 1988."
END_OBJECT                    = TABLE

END
```

A.17. PR1.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
DATA_SET_ID                   = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                    = 'PR100376;03'
SOURCE_PRODUCT_ID             = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 32500
FILE_RECORDS                  = 12

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE                        = 'PR1.DAT'

/* GENERAL PARAMETERS
SPACECRAFT_NAME               = 'MAGELLAN'
MISSION_PHASE_NAME            = 'PRIMARY MISSION'
INSTRUMENT_NAME               = 'RADAR SYSTEM'
TARGET_NAME                   = 'VENUS'
ORBIT_NUMBER                  = 376
START_TIME                    = 1990-09-15T16:22:15.592
STOP_TIME                     = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT  = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT   = '00723813.48.8.0'
NOTE                          = 'OBLIQUE_SINUSOIDAL_PROCESSING_PARAMETER_FILE'
DESCRIPTION                   = "This is the Oblique Sinusoidal
    Processing Parameter File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                        = TABLE
 SFDU_FORMAT_ID               = 'NJPL1I000104'
 INTERCHANGE_FORMAT           = BINARY
 RECORD_TYPE                  = FIXED_LENGTH
 ROW_BYTES                    = 1315
 ROWS                         = 277
```

```
 ^STRUCTURE                    = 'CBIDRPR.FMT'
 COLUMNS                       = 108
 DESCRIPTION                   = "This is a collection of Oblique
    Sinusoidal Processing Parameter records, each containing the
    parameters used to control the SAR processing that produced the image
    data in the Image Data in Oblique Sinusoidal Projection file. This
    file is provided for diagnostic use, and to facilitate sophisticated
    interpretation of image data. One processing parameter record will be
    recorded in this file for each burst of SAR data for which processing
    into oblique sinusoidal imagery is attempted. For more information,
    refer to IDPS-101, Compressed Resolution Basic Image Data Record,
    JPL, MIPL, February 14, 1990, and to SDPS-101, Full Resolution Basic
    Image Data Record, J. Gilbert, JPL, 1990."
END_OBJECT                     = TABLE

END
```

A.18. PR2.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'PR200376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 210

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE                         = 'PR2.DAT'

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'SINUSOIDAL_PROCESSING_PARAMETER_FILE'
DESCRIPTION                    = "This is the Sinusoidal Processing
    Parameter File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I000104'
 INTERCHANGE_FORMAT            = BINARY
 RECORD_TYPE                   = FIXED_LENGTH
 ROW_BYTES                     = 1315
 ROWS                          = 5190
 ^STRUCTURE                    = 'CBIDRPR.FMT'
```

```
 COLUMNS                        = 108
 DESCRIPTION                    = "This is a collection of Sinusoidal
    Processing Parameter records, each containing the parameters used to
    control the SAR processing that produced the image data in the Image
    Data in Sinusoidal Projection file. This file is provided for
    diagnostic use, and to facilitate sophisticated interpretation of
    image data. One processing parameter record will be recorded in this
    file for each burst of SAR data for which processing into sinusoidal
    imagery is attempted. For more information, refer to IDPS-101,
    Compressed Resolution Basic Image Data Record, JPL, MIPL, February
    14, 1990, and to SDPS-101, Full Resolution Basic Image Data Record,
    J. Gilbert, JPL, 1990."
END_OBJECT                      = TABLE

END
```

A.19. QTN.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
DATA_SET_ID                     = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                      = 'QTN00376;03'
SOURCE_PRODUCT_ID               = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 32500
FILE_RECORDS                    = 1

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                   = 'QTN.DAT'
^TABLE                          = ('QTN.DAT',336<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME                 = 'MAGELLAN'
MISSION_PHASE_NAME              = 'PRIMARY MISSION'
INSTRUMENT_NAME                 = 'RADAR SYSTEM'
TARGET_NAME                     = 'VENUS'
ORBIT_NUMBER                    = 376
START_TIME                      = 1990-09-15T16:22:15.592
STOP_TIME                       = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT    = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT     = '00723813.48.8.0'
NOTE                            = 'MAPPING_QUATERNION_POLYNOMIAL_COEFF_FILE'
DESCRIPTION                     = "This is the Mapping Quaternion
    Polynomial Coefficients File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                          = TABLE_HEADER
 HEADER_TYPE                    = 'N/A'
 SFDU_FORMAT_ID                 = 'CCSD1Z000001'
 INTERCHANGE_FORMAT             = ASCII
 RECORD_TYPE                    = STREAM
 BYTES                          = 335
 RECORDS                        = 12
```

```
 DESCRIPTION                   = "Combined SFDU keyword label (K-type) and
                                 data aggregate start label (R-type)."
END_OBJECT                     = TABLE_HEADER

OBJECT                         = TABLE
 SFDU_FORMAT_ID                = 'NJPL1I000127'
 INTERCHANGE_FORMAT            = ASCII
 RECORD_TYPE                   = STREAM
 ROW_BYTES                     = 'UNK'
 BYTES                         = 1964
 ROWS                          = 51
 COLUMNS                       = 'UNK'
 DESCRIPTION                   = "This is the Mapping Quaternion
    Polynomial Coefficients File created by the Radar System Engineering
    Team. For more information, refer to RES-104, Mapping Quaternion
    Polynomial Coefficients File, Preliminary, January, 1988."
END_OBJECT                     = TABLE

END
```

A.20. SAB.LBL Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'
PRODUCT_ID                     = 'SAB00376;03'
SOURCE_PRODUCT_ID              = 'C-BIDR.0376-0380;1'

/* PHYSICAL DESCRIPTION OF THE FILE
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 32500
FILE_RECORDS                   = 55

/* LOCATION OF OBJECTS WITHIN THE FILE
^TABLE_HEADER                  = 'SAB.DAT'
^TABLE                         = ('SAB.DAT',301<BYTES>)

/* GENERAL PARAMETERS
SPACECRAFT_NAME                = 'MAGELLAN'
MISSION_PHASE_NAME             = 'PRIMARY MISSION'
INSTRUMENT_NAME                = 'RADAR SYSTEM'
TARGET_NAME                    = 'VENUS'
ORBIT_NUMBER                   = 376
START_TIME                     = 1990-09-15T16:22:15.592
STOP_TIME                      = 1990-09-15T16:59:27.259
SPACECRAFT_CLOCK_START_COUNT   = '00723776.72.2.0'
SPACECRAFT_CLOCK_STOP_COUNT    = '00723813.48.8.0'
NOTE                           = 'SAR_ALTIMETER_BURST_HEADER_FILE'
DESCRIPTION                    = "This is the SAR and Altimeter Burst
    Header File."

/* DESCRIPTION OF OBJECTS WITHIN THE FILE
OBJECT                         = TABLE_HEADER
 HEADER_TYPE                   = 'N/A'
 SFDU_FORMAT_ID                = 'CCSD1Z000001'
```

```
 INTERCHANGE_FORMAT           = ASCII
 RECORD_TYPE                  = STREAM
 BYTES                        = 300
 RECORDS                      = 10
 DESCRIPTION                  = "Combined SFDU keyword label (K-type) and
                                data aggregate start label (R-type)."
END_OBJECT                    = TABLE_HEADER

OBJECT                        = TABLE
 SFDU_FORMAT_ID               = 'NJPL1I00C111'
 INTERCHANGE_FORMAT           = BINARY
 RECORD_TYPE                  = FIXED_LENGTH
 ROW_BYTES                    = 338
 ROWS                         = 5258
 COLUMNS                      = 'UNK'
 DESCRIPTION                  = "This is the full set of SAR and
    Altimeter Burst (SAB) Headers available from the telemetry for that
    orbit. A maximum of ~6000 SAB Headers is anticipated from the mapping
    portion of each orbit creating a total file length of more than two
    megabytes. For more information, refer to TPS-101, SAR and Altimeter
    EDR/TEDR Tapes, Betsy Wilson, JPL, Revision D, March 15, 1989."
END_OBJECT                    = TABLE

END
```

APPENDIX B

EXAMPLES OF OTHER FILES

B.1. AAREADME.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
RECORD_TYPE                     = FIXED_LENGTH
RECORD_BYTES                    = 80
SPACECRAFT_NAME                 = MAGELLAN
TARGET_NAME                     = VENUS
OBJECT                          = TEXT
  PUBLICATION_DATE              = 1994-07-01
  NOTE                          = "MAGELLAN C-BIDR ARCHIVE CD-WO"
END_OBJECT                      = TEXT
END

                       MAGELLAN C-BIDR ARCHIVE CD-WO


1.  Introduction

  This CD-WO contains Magellan C-BIDR (Compressed-Resolution Basic Image
  Data Record) products, including image and data files. It also contains
  documentation files which describe the C-BIDRs. Each C-BIDR data
  directory contains the compressed-resolution radar return for one orbit
  and the ancillary files necessary to understand the data.

  The C-BIDR products archived on this volume are the exact products
  released by the Magellan Project.  Errors and anomalies are noted where
  detected.  Supporting documentation and label files conform to the
  Planetary Data System (PDS) Standards, Version 3.0, Jet Propulsion
  Laboratory (JPL) document JPL D-7669.

2.  Disk Format

  The disk has been formatted so that a variety of computer systems
  (e.g.  IBM PC, Macintosh, 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, 15 April 1988.

3.  File Formats

  Each orbit for which C-BIDR data exist is represented by a set of
  either 13 or 15 files (the latter when polar imaging was available),
  copied from the C-BIDR tape product. The files marked with an asterisk
  (*) are only present when the orbit imaged either the north or the
  south pole.
```

```
    CLK.DAT   - SCLK/SCET conversion coefficients
    DCM.DAT   - Decommutation and decalibration data
    DQS.DAT   - EDR Data Quality Summary
    ENG.DAT   - Engineering data
    EPH.DAT   - S/C ephemeris file
    HDR.DAT   - Orbit Header
  * IM1.DAT   - Image data in oblique sinusoidal projection
    IM2.DAT   - Image data in sinusoidal projection
    MON.DAT   - DSN monitor records
    OPF.DAT   - Per-Orbit Parameters
    PBW.DAT   - Processing bandwidth
  * PR1.DAT   - Processing parameters for oblique sinusoidal projection
    PR2.DAT   - Processing parameters for sinusoidal projection
    QTN.DAT   - Quaternion pointing coefficients
    SAB.DAT   - Radar header records
```

Since the image files IM1.DAT and IM2.DAT are written with varying-length data blocks, index files in VICAR-IBIS format named IM1.AUX and IM2.AUX have been created to assist certain software packages, e.g. VICAR and GIPS, to navigate efficiently through the image files.

The content of each file is described in a detached PDS label, a file with the same 3-letter name and an extension of "LBL". This file may also contain a "CONFIDENCE_NOTE" that describes potential problems with the data file. Further information on C-BIDR file formats and their contents can be obtained from the Magellan Software Interface Specification documents IDPS-102, January 14, 1990, and SDPS-101, Revision E, August 31, 1991. Note: the label files for IM1.AUX and IM2.AUX are named IX1.LBL and IX2.LBL, respectively.

Finally, each data directory contains a file ERR.TXT which lists all error messages from the program that created the *.AUX and *.LBL files.

All document files (*.TXT) and detached label files (*.LBL) 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. The first two lines are an exception: the first contains a 40-byte SFDU aggregate label, followed by a carriage return and a line feed. The second contains 36 space characters (ASCII 32) followed by a carriage return and a line feed. The first PAIR of lines is therefore 80 bytes long, and all remaining lines are offset from the start of the file by a multiple of 80 bytes. This allows the files to be read by the MacOS, DOS, Unix, and VMS operating systems. The PDS label file has the same name as the data file it describes, with the extension .LBL.

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. In an embedded label, the location is an integer representing the starting record number of the object (the first record in the file is record 1). In a detached label, the location denotes the name of the file containing the object, along with the starting record or byte number. For example:

```
^TABLE = ("SAB.DAT",312<BYTES>)
```

indicates that the TABLE object begins at byte 312 of the file SAB.DAT, 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",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 (record 1,
          byte 1).
<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.
```

4. CD-ROM Contents

The files on this CD-ROM are organized in one top-level directory with several subdirectories. The following table shows the structure and content of these directories. In the table, directory names are enclosed in square brackets ([]), upper-case letters indicate an actual directory or file name, and lower-case letters indicate the general form of a set of directory or file names.

```
FILE                   CONTENTS

Top-level directory
  |
  |- AAREADME.TXT      The file you are reading.
  |
  |- ERRATA.TXT        Overview of errors on this, and previous,
  |                    volumes of CBIDRCD products.
  |
  |- VOLDESC.CAT       A description of the contents of this CD-ROM
  |                    volume in a format readable by both human and
  |                    computers.
  |
  |- [CATALOG]         A directory containing information about the
  |    |               Magellan C-BIDR dataset.
  |    |
  |    |- CATINFO.TXT  Description of contents of the CATALOG directory.
  |    |
  |    |- CBIDRDS.CAT  PDS dataset catalog object
  |    |
  |    |- INSTHOST.CAT PDS spacecraft catalog object
  |    |
  |    |- MISSION.CAT  PDS mission catalog object
  |    |
```

```
|    |- PERSONEL.CAT  PDS personnel catalog object
|    |
|    |- RDRSINST.CAT  PDS instrument catalog object
|    |
|    '- REFS.CAT      PDS reference catalog object
|
|- [DOCUMENT]         A directory containing document files relating
|    |                to this disk.
|    |
|    |- CBIDRCD.LBL   A detached PDS label file describing CBIDRCD.PS
|    |
|    |- CBIDRCD.PS    A copy of CBIDRCD.TXT in PostScript format,
|    |                suitable for previewing on a high-resolution
|    |                graphics terminal or direct printing on a
|    |                laser printer or photo-typesetter.
|    |
|    |- CBIDRCD.TXT   A machine readable version of the MIT-MGN-CBIDRCD
|    |                SIS document describing the format and content of
|    |                the Magellan C-BIDR Archive CD-WO data files.
|    |
|    '- DOCINFO.TXT   Description of contents of the DOCUMENT directory.
|
|- [INDEX]            A directory containing information about the
|    |                contents of this CD-WO volume.
|    |
|    |- CUMINDEX.LBL  Description of CUMINDEX.TAB.
|    |
|    |- CUMINDEX.TAB  Cumulative index of all C-BIDR archive data files.
|    |
|    |- INDEX.LBL     Description of INDEX.TAB.
|    |
|    |- INDEX.TAB     Index of C-BIDR archive data files on this volume.
|    |
|    '- INDXINFO.TXT  Description of the contents of the INDEX directory.
|
|- [LABEL]            A directory containing information on PDS formats
|    |                beyond what is in individual detached LBL files.
|    |
|    |- CBIDRIM.FMT   Format of BIDR image file blocks headers
|    |
|    |- CBIDRPR.FMT   Format of BIDR processing parameter file records
|    |
|    |- CBIDROPF.FMT  Format of BIDR orbit parameter file records.
|    |
|    |- DSMAPCB.LBL   Description of the Sinusoidal and Oblique
|    |                Sinusoidal map projections used in this data set.
|    |
|    '- LABLINFO.TXT  Description of contents of the LABEL directory.
|
'- [Cnnnn_vv]         Directories containing C-BIDR data files for
     |                orbit 'nnnn', version 'vv'.
     |
     |- CLK.DAT       SCLK/SCET conversion coefficients
     |- DCM.DAT       Documentation and decalibration data
     |- DQS.DAT       EDR Data Quality Summary
```

```
|- ENG.DAT       Engineering data
|- EPH.DAT       S/C ephemeris file
|- ERR.TXT       Error messages from PDS label generator
|- HDR.DAT       Orbit Header
|- IM1.AUX *+    Index file for IM1.DAT
|- IM1.DAT +     Polar image data in oblique sinusoidal projection
|- IM2.AUX *     Index file for IM2.DAT
|- IM2.DAT       Non-polar image data in sinusoidal projection
|- MON.DAT       DSN monitor records
|- OPF.DAT       Per-Orbit Parameters
|- PBW.DAT       Processing bandwidth
|- PR1.DAT +     Processing parameters for IM1.DAT
|- PR2.DAT       Processing parameters for IM2.DAT
|- QTN.DAT       Quaternion pointing coefficients
|- SAB.DAT       Radar header records
'- nnn.LBL       PDS labels for the DAT and AUX files
```

* If no polar measurements were made during a given orbit, the IM1.AUX, IM1.DAT, and PR1.DAT files will be omitted, along with their PDS label files, IM1.LBL, IX1.LBL, and PR1.LBL, respectively.

\+ IM1.AUX and IM2.AUX contain information describing the location of data blocks in IM1.DAT and IM2.DAT respectively, in a format that is known as 'BIDRINDX' within the VICAR system. Consult IM1.LBL and IM2.LBL for further details.

5. Whom to Contact for Information

For questions concerning this volume set:

Peter G. Ford
Center for Space Research
Building 37 Room 601
Massachusetts Institute of Technology
70 Vassar Street
Cambridge, MA 02139

Telephone: 617-253-6485
Datafax: 617-253-0861
Internet: pds-requests@space.mit.edu
URL: http://delcano.mit.edu/

6. Cognizant Persons

Magellan Archive Project Coordinator	Dr. Raymond Arvidson Washington University St. Louis, MO
C-BIDR Data	Dr. Peter Ford MIT 37-601
Volume generation, validation, labels, catalog templates, documentation	Peter Ford and Joan Quigley MIT Cambridge, MA

```
    This disk was produced at MIT by Peter Ford and Joan Quigley.
```

B.2. CATINFO.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = STREAM
SPACECRAFT_NAME               = MAGELLAN
TARGET_NAME                   = VENUS
OBJECT                        = TEXT
  PUBLICATION_DATE            = 1994-07-01
  NOTE                        = "MAGELLAN C-BIDR ARCHIVE CD-WO"
END_OBJECT                    = TEXT
END

                 DESCRIPTION OF CATALOG FILES ON THIS VOLUME

  This file describes the files present in the [CATALOG] directory on this
volume.  The files are:

      CBIDRDS.CAT   - PDS dataset catalog object
      INSTHOST.CAT  - PDS spacecraft catalog object
      MISSION.CAT   - PDS mission catalog object
      PERSONEL.CAT  - PDS personnel catalog object
      RDRSINST.CAT  - PDS instrument catalog object
```

B.3. CBIDRDS.CAT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3

OBJECT                          = DATA_SET
 DATA_SET_ID                    = 'MGN-V-RDRS-5-C-BIDR-V1.0'

 OBJECT                         = DATA_SET_INFORMATION
  DATA_SET_NAME                 = "MGN V RDRS COMPRESSED BASIC IMAGE
                                     DATA RECORD CD ARCHIVE"
  DATA_SET_COLLECTION_MEMBER_FLG  = "N"
  START_TIME                    = 1990-09-15T16:23:12
  STOP_TIME                     = 1992-09-14T02:28:37
  DATA_SET_RELEASE_DATE         = 1994-07-01
  PRODUCER_FULL_NAME            = 'DR. PETER G FORD'
  DETAILED_CATALOG_FLAG         = "N"

  DATA_SET_DESC                 = "This volume contains Magellan
    C-BIDR (Compressed Resolution Basic Image Data Record) archive
    products.  It also contains documentation files which describe the
    C-BIDRs.  Each C-BIDR data directory contains the compressed image
    swaths obtained from one orbit and the ancillary files necessary to
    understand the data.  The C-BIDR products archived on this volume
    are the exact products released by the Magellan Project, with
    additional PDS labels, swath index files, and documentation added
    for the convenience of the user.  Supporting documentation and
```

label files conform to the Planetary Data System (PDS) Standards, Version 3.0, Jet Propulsion Laboratory (JPL) document JPL D-7669.

Compressed resolution basic image data files consist of SAR image data acquired along one orbit. Pixel widths are 225m. Data are presented as 8 bit pixel brightness values where the brightness is in proportion to the radar scaled backscatter cross section. Scaling is accomplished by dividing the radar cross section value for each pixel by the value estimated from the Muhleman Law for the relevant incidence angle, converting the ratio to decibels, and scaling to a 1 to 251 output range. The 1 value corresponds to -20 dB and 251 to +30 dB, with a linear quantization of 0.2 dB in between. Data have at least 4 looks. Specifically, the scaled radar backscatter cross section is generated by:

1. Dividing the radar cross section by the value obtained from the Muhleman Law,

```
                     alpha * cos(i)
  sigma[0] = --------------------------
             (sin(i) + beta * cos(i))**3
```

   where i = incidence angle, and alpha and beta are 0.0118 and 0.111, respectively [PETTENGILLETAL1988].

   (Note: A value of 0.0188 was intended for the multiplicative alpha, but 0.0118 was used by mistake. Also, the incidence angles used to compute the Muhleman Law are systematically low by 0.5 degrees.)

2. Converting to dB by taking 10 times log base 10 of the ratio generated in the first step.

3. Scaling output to a byte DN value using the expression:

```
  DN = 1 + ROUND({MIN [MAX(RV,-20), 30] + 20} * 5)
```

   where RV = value produced in step 2, and
   ROUND = round to nearest integer.

C-BIDRs are presented as image files containing two integers at the beginning of each line. The first integer specifies the pixel offset to the first valid pixel; the second specifies the pixel offset to the last valid pixel. The remainder of the line consists of scaled backscatter cross section values.

Regions within 89 degrees of the equator have C-BIDRs in sinusoidal equal area projection; C-BIDR data located more than 80 degrees from the equator are also in oblique sinusoidal equal area projections. For the sinusoidal equal area projection, the origin is at 0 degrees latitude and the central meridian is the sub-spacecraft longitude at the equator, adjusted to the nearest multiple of 225m, relative to a pixel centered at 0 degrees longitude. For details of use of the oblique sinusoidal equal area projection see Magellan Software Interface Specification (SIS) Document, Full Resolution Basic Image Data Record, SDPS-101 [LEUNG1993].

```
   The first mapping cycle C-BIDRs extend from the north pole to
   approximately 60 degrees south latitude for northern strips and from
   just below the north pole to about 70 degrees south latitude for
   intervening F-BIDR strips. Images sizes are approximately 120 samples by
   70,000 lines.

   Each C-BIDR orbit is located in a separate subdirectory on this CD-WO.
   Each product consists of 1 or 2 image files and 12 or 13 ancillary files
   for a total of 13 or 15 files. The higher numbers refer to orbits that
   include either north or south polar mapping. In addition, 1 or 2 index
   files have been added to assist in the use of the product.

   Originally, up to 5 orbits of C-BIDR products were located, together
   with a number of other, ancillary files, on one 6250 BPI 2400 foot 9
   track tape.

   Each C-BIDR orbit consists of approximately 12 million bytes of image data
   and 13 million bytes of ancillary data.  Included in the ancillary files
   are processing parameters, orbital information, and radar operational
   information."

 CONFIDENCE_LEVEL_NOTE           = "Consult the ERRATA.TXT file in the root
   directory and ERR.TXT files in the data directories for information
   about errors that were detected during PDS label generation."

END_OBJECT                       = DATA_SET_INFORMATION

OBJECT                           = DATA_SET_TARGET
 TARGET_NAME                     = VENUS
END_OBJECT                       = DATA_SET_TARGET

OBJECT                           = DATA_SET_HOST
 INSTRUMENT_HOST_ID              = MGN
 INSTRUMENT_ID                   = RDRS
END_OBJECT                       = DATA_SET_HOST

OBJECT                           = DATA_SET_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                = "BARRY1987"
END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

OBJECT                           = DATA_SET_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                = "BRILL&MEISL1990"
END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

OBJECT                           = DATA_SET_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                = "CUEVAS1989"
END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

OBJECT                           = DATA_SET_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                = "DAVIESETAL1989"
END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

OBJECT                           = DATA_SET_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                = "FORD1992"
END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION
```

```
  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "FORD1993"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "FORD&PETTENGILL1992"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "HAGFORS1964"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "HAGFORS&EVANS1968"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "LYONS1988"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "PDSSR1992"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "PETTENGILLETAL1992"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "SCIEDR"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "SDPS101"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "SE011"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "SNYDER1987"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

  OBJECT                           = DATA_SET_REFERENCE_INFORMATION
   REFERENCE_KEY_ID                = "TYLER1992"
  END_OBJECT                       = DATA_SET_REFERENCE_INFORMATION

 END_OBJECT                        = DATA_SET

 END
```

B.4. CBIDRIM.FMT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                       = PDS3

OBJECT                               = COLUMN
 NAME                                = NJPL_LABEL
 START_BYTE                          = 1
 DATA_TYPE                           = CHARACTER
 BYTES                               = 20
 UNIT                                = 'N/A'
 DESCRIPTION                         = "An NJPL logical record label.
  The first 12 bytes contain the registered SFDU identifier
  'NJPL1I000111', indicating that this is a Magellan C-BIDR imaging
  record. Bytes 13-20 contain the number of bytes in the remainder of
  this logical record, starting with the 21st byte, coded as an ASCII
  integer with leading zeroes, e.g. '00001234'. The value varies from
  record to record."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = SECONDARY_LABEL_TYPE
 START_BYTE                          = 21
 DATA_TYPE                           = LSB_INTEGER
 BYTES                               = 2
 UNIT                                = 'N/A'
 DESCRIPTION                         = "Indicates the type of
  record. Its value is always '2' for image data records."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = SECONDARY_LABEL_LENGTH
 START_BYTE                          = 23
 DATA_TYPE                           = LSB_INTEGER
 BYTES                               = 2
 UNIT                                = 'N/A'
 DESCRIPTION                         = "Number of bytes in the
  secondary header of this record. Its value is always '68' for image
  data records."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = ORBIT_NUMBER
 START_BYTE                          = 25
 DATA_TYPE                           = LSB_INTEGER
 BYTES                               = 2
 UNIT                                = 'N/A'
 DESCRIPTION                         = "The orbit during which the
  data used to create this record was collected. For test C-BIDRs, this
  field will contain the test number 999."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = DATA_CLASS
 START_BYTE                          = 27
```

```
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 1
 UNIT                             = 'N/A'
 DESCRIPTION                      = "An indication of the type of
  data in this logical record. The value is '2' for image data,
  sinusoidal projection, multi-look, and '66' for image data, oblique
  sinusoidal projection, multi-look."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = ANNOTATION_LABEL_LENGTH
 START_BYTE                       = 28
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 1
 UNIT                             = 'N/A'
 DESCRIPTION                      = "The number of bytes in the
  data annotation label of this record, starting with the third byte.
  The value is always '64' for image data records."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = NUMBER_OF_IMAGE_LINES
 START_BYTE                       = 29
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 2
 UNIT                             = 'N/A'
 DESCRIPTION                      = "The number of image lines in
  the record."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = NUMBER_OF_BYTES_PER_LINE
 START_BYTE                       = 31
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 2
 UNIT                             = 'N/A'
 DESCRIPTION                      = "The number of bytes in each
  image line in data portion of record, including the offset to the
  first valid pixel, the pointer to the last valid pixel, and all of the
  data pixels, in bytes."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = REFERENCE_ORIGIN_LATITUDE
 START_BYTE                       = 33
 DATA_TYPE                        = VAX_REAL
 BYTES                            = 4
 UNIT                             = DEGREES
 DESCRIPTION                      = "The latitude (in degrees N) of
  the origin of the projection system used. For sinusoidal data, this is
  always 0 degrees. For oblique sinusoidal data, this is the latitude of
  the origin of the oblique sinusoidal system, and will vary with each
  orbit."
END_OBJECT                        = COLUMN
```

```
OBJECT                                = COLUMN
 NAME                                 = REFERENCE_ORIGIN_LONGITUDE
 START_BYTE                           = 37
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = DEGREES
 DESCRIPTION                          = "The longitude (in degrees E
  from 0 to 360) of the origin of the projection system used. For
  sinusoidal data, this is the longitude at which the sub-satellite
  point intersects the planet equator, adjusted to the nearest multiple
  of 225 meters with respect to a pixel centered at 0 degrees longitude.
  For oblique sinusoidal data, this is the longitude of the origin of
  the oblique sinusoidal system, and will vary with each orbit."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = REFERENCE_LATITUDE
 START_BYTE                           = 41
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = DEGREES
 DESCRIPTION                          = "The latitude (in degrees N)
  corresponding to the center of the first pixel in the first image line
  of the record."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = REFERENCE_LONGITUDE
 START_BYTE                           = 45
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = DEGREES
 DESCRIPTION                          = "The longitude (in degrees E
  from 0 to 360) corresponding to the center of the first pixel in the
  first image line of the record."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = REFERENCE_OFFSET_LINES
 START_BYTE                           = 49
 DATA_TYPE                            = LSB_INTEGER
 BYTES                                = 4
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "The Coordinate-1 value of the
  reference point. For the sinusoidal projection, this is the number of
  225-meter lines from the projection origin latitude to the first image
  line in this record; for oblique sinusoidal projection, the number of
  225-meter lines from the great circle passing through the oblique
  sinusoidal origin and the pole to the first image line. See [LEUNG1993]
  for a definition of the coordinate system."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = REFERENCE_OFFSET_SAMPLES
 START_BYTE                           = 53
```

```
 DATA_TYPE                       = LSB_INTEGER
 BYTES                           = 4
 UNIT                            = 'N/A'
 DESCRIPTION                     = "The Coordinate-2 value of the
  reference point. For the sinusoidal projection, this is the number of
  225-meter pixels from the projection origin longitude to the first
  pixel of the first image line in this record; for oblique sinusoidal
  projection, the number of 225-meter pixels from the nadir track to the
  first pixel of the first image line. See [LEUNG1993] for a definition
  of the coordinate system."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
 NAME                            = BURST_COUNTER
 START_BYTE                      = 57
 DATA_TYPE                       = LSB_UNSIGNED_INTEGER
 BYTES                           = 4
 UNIT                            = 'N/A'
 DESCRIPTION                     = "The burst count of the burst
  associated with this image record. Note that the burst count depends
  on the number of bursts on the EDR, and is not absolute. If an EDR is
  regenerated, its BIDR burst numbering may differ from that used in the
  original BIDR."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
 NAME                            = NAV_UNIQUE_ID
 START_BYTE                      = 61
 DATA_TYPE                       = CHARACTER
 BYTES                           = 32
 UNIT                            = 'N/A'
 DESCRIPTION                     = "A string copied from the
  Catalog and History Data portion of the Spacecraft Ephemeris file
  SFDU. A 32-byte ASCII character string used to identify the NAV
  solution used to produce the Ephemeris file on the EDR."
END_OBJECT                       = COLUMN

END
```

B.5. CBIDROPF.FMT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                   = PDS3

OBJECT                           = COLUMN
 NAME                            = NJPL_LABEL
 START_BYTE                      = 1
 DATA_TYPE                       = CHARACTER
 BYTES                           = 20
 UNIT                            = 'N/A'
 DESCRIPTION                     = "An NJPL logical record label.
  The first 12 bytes contain the registered SFDU identifier 'NJPL1I000104'
  indicating that this is a Magellan BIDR parameter record. Bytes 13-20
  contain the number of bytes in the remainder of this logical record,
  starting with the 21st byte, coded as an ASCII integer with leading zeroes.
```

```
  For an orbit parameter record, its value is always ’00000520’."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = SECONDARY_LABEL_TYPE
 START_BYTE                       = 21
 DATA_TYPE                        = LSB_INTEGER
 BYTES                            = 2
 UNIT                             = ’N/A’
 DESCRIPTION                      = "Indicates the type of
  annotation label to follow. Its value is always ’1’ for orbit
  parameter records."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = SECONDARY_LABEL_LENGTH
 START_BYTE                       = 23
 DATA_TYPE                        = LSB_INTEGER
 BYTES                            = 2
 UNIT                             = ’N/A’
 DESCRIPTION                      = "Number of bytes in the
  secondary header of this record. Its value is always ’4’ for orbit
  parameter records."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = ORBIT_NUMBER
 START_BYTE                       = 25
 DATA_TYPE                        = LSB_INTEGER
 BYTES                            = 2
 UNIT                             = ’N/A’
 DESCRIPTION                      = "The orbit during which the
  data used to create this record was collected. For test C-BIDRs, this
  field will contain the test orbit number 999."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = DATA_CLASS
 START_BYTE                       = 27
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 1
 UNIT                             = ’N/A’
 DESCRIPTION                      = "An indication of the type of
  data in this logical record. The value is ’1’ for orbit parameter data."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = ANNOTATION_LABEL_LENGTH
 START_BYTE                       = 28
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 1
 UNIT                             = ’N/A’
 DESCRIPTION                      = "The number of bytes in the
  data annotation label of this record. The value is always ’0’ for orbit
  parameter records."
```

```
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = ORBIT_NUMBER
 START_BYTE                         = 29
 DATA_TYPE                          = LSB_UNSIGNED_INTEGER
 BYTES                              = 4
 UNIT                               = 'N/A'
 DESCRIPTION                        = "The orbit during which the
  data used to create this record was collected. For test C-BIDRs, this
  field will contain the test orbit number 999."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = START_SCET
 START_BYTE                         = 33
 DATA_TYPE                          = VAX_REAL
 BYTES                              = 8
 UNIT                               = SECONDS
 DESCRIPTION                        = "Mapping start time (SCET) in
  TDB from epoch J2000."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = STOP_SCET
 START_BYTE                         = 41
 DATA_TYPE                          = VAX_REAL
 BYTES                              = 8
 UNIT                               = SECONDS
 DESCRIPTION                        = "Mapping stop time (SCET) in
  TDB from epoch J2000."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = NUMBER_OF_BURSTS
 START_BYTE                         = 49
 DATA_TYPE                          = LSB_UNSIGNED_INTEGER
 BYTES                              = 4
 UNIT                               = 'N/A'
 DESCRIPTION                        = "Total number of bursts on the
  EDR this orbit."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = PRODUCT_ID
 START_BYTE                         = 53
 DATA_TYPE                          = CHARACTER
 BYTES                              = 9
 UNIT                               = 'N/A'
 DESCRIPTION                        = "Same as the value of the
  MINOR_DATA_CODE keyword in the BIDR Header Record."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = TAPE_VOLUME_ID
```

```
  START_BYTE                      = 62
  DATA_TYPE                       = CHARACTER
  BYTES                           = 6
  UNIT                            = 'N/A'
  DESCRIPTION                     = "The ANSI Volume Label of
   the F-BIDR tape."
 END_OBJECT                       = COLUMN

 OBJECT                           = COLUMN
  NAME                            = TAPE_WRITE_TIME
  START_BYTE                      = 68
  DATA_TYPE                       = CHARACTER
  BYTES                           = 19
  UNIT                            = 'N/A'
  DESCRIPTION                     = "Wall-clock time of start of
   processing (same as the value of the TAPE_WRITE_DOY keyword in the
   BIDR Header Record)."
 END_OBJECT                       = COLUMN

 OBJECT                           = COLUMN
  NAME                            = NUMBER_OF_LOOKS_TO_PROCESS
  START_BYTE                      = 87
  DATA_TYPE                       = LSB_UNSIGNED_INTEGER
  BYTES                           = 4
  UNIT                            = 'N/A'
  DESCRIPTION                     = "Number of looks to process
   this orbit (0 to 16; 0 means use all available looks)."
 END_OBJECT                       = COLUMN

 OBJECT                           = COLUMN
  NAME                            = LEFT_OR_RIGHT_LOOKING
  START_BYTE                      = 91
  DATA_TYPE                       = LSB_UNSIGNED_INTEGER
  BYTES                           = 4
  UNIT                            = 'N/A'
  DESCRIPTION                     = "Left-looking ( 0 ) or
   right-looking ( 1 ) orbit."
 END_OBJECT                       = COLUMN

 OBJECT                           = COLUMN
  NAME                            = ID_FROM_EPHEMERIS
  START_BYTE                      = 95
  DATA_TYPE                       = CHARACTER
  BYTES                           = 32
  UNIT                            = 'N/A'
  DESCRIPTION                     = "NAV_Unique_ID of the
   Spacecraft Ephemeris File. Will be blank if ephemeris file wasn't used."
 END_OBJECT                       = COLUMN

 OBJECT                           = COLUMN
  NAME                            = PREDICTED_PERIAPSIS_SCLK
  START_BYTE                      = 127
  DATA_TYPE                       = CHARACTER
  BYTES                           = 15
  UNIT                            = SECONDS
```

```
 DESCRIPTION                       = "Predicted time of periapsis in
  SCLK."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = PREDICTED_PERIAPSIS_SCET
 START_BYTE                        = 142
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = SECONDS
 DESCRIPTION                       = "Predicted time of periapsis in
  TDB from epoch J2000."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = PREDICTED_PERIAPSIS_SMA
 START_BYTE                        = 150
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = METERS
 DESCRIPTION                       = "Orbit semi-major axis from the
  EDR Orbit Header File."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = PREDICTED_PERIAPSIS_ECC
 START_BYTE                        = 158
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = 'N/A'
 DESCRIPTION                       = "Orbit eccentricity from the
  EDR Orbit Header File."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = PREDICTED_PERIAPSIS_INCL
 START_BYTE                        = 166
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = DEGREES
 DESCRIPTION                       = "Orbit inclination angle from
  the EDR Orbit Header File, J2000 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = PREDICTED_PERIAPSIS_LAN
 START_BYTE                        = 174
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = DEGREES
 DESCRIPTION                       = "Longitude of the ascending
  node from the EDR Orbit Header File, J2000 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
```

```
 NAME                                 = PREDICTED_PERIAPSIS_ARG
 START_BYTE                           = 182
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 8
 UNIT                                 = DEGREES
 DESCRIPTION                          = "Argument of periapsis from the
  EDR Orbit Header File, J2000 coordinates."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = PREDICTED_PERIAPSIS_PER
 START_BYTE                           = 190
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = SECONDS
 DESCRIPTION                          = "Orbit period."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = REFERENCE_SCLK
 START_BYTE                           = 194
 DATA_TYPE                            = CHARACTER
 BYTES                                = 13
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "Reference SCLK factor."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = SCLK_CONVERSION_SLOPE
 START_BYTE                           = 207
 DATA_TYPE                            = CHARACTER
 BYTES                                = 12
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "Slope coefficient of the
  SCLK/SCET conversion (A1)."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = INTERCEPT_COEFFICIENT
 START_BYTE                           = 219
 DATA_TYPE                            = CHARACTER
 BYTES                                = 19
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "Intercept coefficient of the
  SCLK/SCET conversion (A0)."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = UTC_ET_DIFFERENCE
 START_BYTE                           = 238
 DATA_TYPE                            = CHARACTER
 BYTES                                = 6
 UNIT                                 = SECONDS
 DESCRIPTION                          = "UTC-to-epoch J2000 correction
  factor (DUT)."
```

```
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = COUNTER_OF_FIRST_AT_CT_BURST
 START_BYTE                            = 244
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Burst counter of the first
  oblique sinusoidal burst processed."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = COUNTER_OF_LAST_AT_CT_BURST
 START_BYTE                            = 248
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Burst counter of the last
  oblique sinusoidal burst processed."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = COUNTER_OF_FIRST_SINUSOIDAL_BURST
 START_BYTE                            = 252
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Burst counter of the first
  sinusoidal burst processed."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = COUNTER_OF_LAST_SINUSOIDAL_BURST
 START_BYTE                            = 256
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Burst counter of the last
  sinusoidal burst processed."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = SINUSOIDAL_REFERENCE_LONGITUDE
 START_BYTE                            = 260
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 UNIT                                  = DEGREES
 DESCRIPTION                           = "Sinusoidal projection
  reference longitude."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = COUNTER_OF_BURST_AT_85_LAT
 START_BYTE                            = 264
```

```
 DATA_TYPE                          = LSB_UNSIGNED_INTEGER
 BYTES                              = 4
 UNIT                               = 'N/A'
 DESCRIPTION                        = "Burst count of the burst with
  boresight intercept point closest to 85 degrees latitude. (This burst
  is used to produce an estimate of the instantaneous body-fixed orbit
  plane, which is then used to determine the oblique sinusoidal origin)."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = SCET_OF_BURST_AT_85_LAT
 START_BYTE                         = 268
 DATA_TYPE                          = VAX_REAL
 BYTES                              = 8
 UNIT                               = SECONDS
 DESCRIPTION                        = "Time from J2000 epoch at which
  the spacecraft crosses 85 deg latitude."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = OBLIQUE_SINUSOIDAL_ROTATION
 START_BYTE                         = 276
 DATA_TYPE                          = VAX_REAL
 BYTES                              = 4
 ITEMS                              = 9
 UNIT                               = 'N/A'
 DESCRIPTION                        = "Cartesian rotation matrix to
  transform VBF85 coordinates to the oblique sinusoidal projection."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = OBLIQUE_LONGITUDE_ORIGIN
 START_BYTE                         = 312
 DATA_TYPE                          = VAX_REAL
 BYTES                              = 4
 UNIT                               = DEGREES
 DESCRIPTION                        = "Longitude of the oblique
  sinusoidal origin, which lies along the line formed by the oblique
  sinusoidal x'-axis. This is the angle of the first of two rotations
  which together translate points given in VBF85 coordinates to the
  oblique rectangular coordinate system."
END_OBJECT                          = COLUMN

OBJECT                              = COLUMN
 NAME                               = OBLIQUE_LATITUDE_ORIGIN
 START_BYTE                         = 316
 DATA_TYPE                          = VAX_REAL
 BYTES                              = 4
 UNIT                               = DEGREES
 DESCRIPTION                        = "Additive inverse of the
  latitude of the oblique sinusoidal origin, which lies along the line
  formed by the oblique sinusoidal x'-axis. This is the angle of the
  second of two rotations which together translate points given in VBF85
  coordinates to the oblique rectangular coordinate system."
END_OBJECT                          = COLUMN
```

```
OBJECT                                = COLUMN
 NAME                                 = OBLIQUE_SINUSOIDAL_START_TIME
 START_BYTE                           = 320
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 8
 UNIT                                 = SECONDS
 DESCRIPTION                          = "Oblique sinusoidal start time
  (SCET) in TDB from epoch J2000."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = OBLIQUE_SINUSOIDAL_STOP_TIME
 START_BYTE                           = 328
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 8
 UNIT                                 = SECONDS
 DESCRIPTION                          = "Oblique sinusoidal stop time
  (SCET) in TDB from epoch J2000."
END_OBJECT                            = COLUMN

END
```

B.6. CBIDRPR.FMT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                        = PDS3

OBJECT                                = COLUMN
 NAME                                 = NJPL_LABEL
 START_BYTE                           = 1
 DATA_TYPE                            = CHARACTER
 BYTES                                = 20
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "An NJPL logical record label.
  The first 12 bytes contain the registered SFDU identifier
  'NJPL1I000104', indicating that this is a Magellan BIDR parameter
  record. Bytes 13-20 contain the number of bytes in the remainder of
  this logical record, starting with the 21st byte, coded as an ASCII
  integer with leading zeroes. For processing parameter records, its
  value is always '00001295'."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = SECONDARY_LABEL_TYPE
 START_BYTE                           = 21
 DATA_TYPE                            = LSB_INTEGER
 BYTES                                = 2
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "Indicates the type of
  annotation label to follow. Its value is always '4' for processing
  parameter records."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = SECONDARY_LABEL_LENGTH
```

```
 START_BYTE                      = 23
 DATA_TYPE                       = LSB_INTEGER
 BYTES                           = 2
 UNIT                            = 'N/A'
 DESCRIPTION                     = "Number of bytes in the
  secondary header of this record. Its value is always '11' for processing
  parameter records."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
 NAME                            = ORBIT_NUMBER
 START_BYTE                      = 25
 DATA_TYPE                       = LSB_INTEGER
 BYTES                           = 2
 UNIT                            = 'N/A'
 DESCRIPTION                     = "The orbit during which the
  data used to create this record were collected. For test C-BIDRs, this
  field will contain the test number."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
 NAME                            = DATA_CLASS
 START_BYTE                      = 27
 DATA_TYPE                       = LSB_UNSIGNED_INTEGER
 BYTES                           = 1
 UNIT                            = 'N/A'
 DESCRIPTION                     = "An indication of the type of
  data in this logical record. The value is '4' for processing
  parameters, sinusoidal projection, and '68' for processing parameters,
  oblique sinusoidal projection."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
 NAME                            = ANNOTATION_LABEL_LENGTH
 START_BYTE                      = 28
 DATA_TYPE                       = LSB_UNSIGNED_INTEGER
 BYTES                           = 1
 UNIT                            = 'N/A'
 DESCRIPTION                     = "The number of bytes in the
  data annotation label of this record. The value is always '7' for
  processing parameter records."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
 NAME                            = BURST_RADAR_CLOCK_TIME
 START_BYTE                      = 29
 DATA_TYPE                       = LSB_UNSIGNED_INTEGER
 BYTES                           = 1
 ITEMS                           = 7
 UNIT                            = 'N/A'
 DESCRIPTION                     = "56-bit radar clock time (RCLK)
  at start of transmission of this burst."
END_OBJECT                       = COLUMN

OBJECT                           = COLUMN
```

```
 NAME                              = BURST_COUNTER
 START_BYTE                        = 36
 DATA_TYPE                         = LSB_UNSIGNED_INTEGER
 BYTES                             = 4
 UNIT                              = 'N/A'
 DESCRIPTION                       = "EDR burst counter (increments
  from 1 beginning with the first burst on the EDR)."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = BURST_START_SCET
 START_BYTE                        = 40
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = SECONDS
 DESCRIPTION                       = "Burst start time in TDB since
  epoch J2000."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = BURST_REFERENCE_SCET
 START_BYTE                        = 48
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = SECONDS
 DESCRIPTION                       = "Burst reference time in TDB
  since epoch J2000."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = BURST_CENTER_SCET
 START_BYTE                        = 56
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 8
 UNIT                              = SECONDS
 DESCRIPTION                       = "Burst center time in TDB since
  epoch J2000."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = ECHO_DELAY_TIME
 START_BYTE                        = 64
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 UNIT                              = SECONDS
 DESCRIPTION                       = "Echo delay time."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = BURST_DATA_FLAG
 START_BYTE                        = 68
 DATA_TYPE                         = LSB_UNSIGNED_INTEGER
 BYTES                             = 4
 UNIT                              = 'N/A'
 DESCRIPTION                       = "'Test' flag (1 = burst
```

```
  consists of test data, 0 = otherwise)."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = BAD_BURST_DATA_FLAG
 START_BYTE                       = 72
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 4
 UNIT                             = 'N/A'
 DESCRIPTION                      = "'Anomaly' flag (1 = burst is
  below data quality threshold and so was not processed, 0 = otherwise)."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = PROCESSING_ERROR_FLAG
 START_BYTE                       = 76
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 4
 UNIT                             = 'N/A'
 DESCRIPTION                      = "'Error' flag (1 = an error
  occurred during processing which prevented this burst from being
  processed, 0 = otherwise)."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = PROJECTION_TYPE
 START_BYTE                       = 80
 DATA_TYPE                        = LSB_UNSIGNED_INTEGER
 BYTES                            = 4
 UNIT                             = 'N/A'
 DESCRIPTION                      = "Projection used for this
  processing parameter record (1=sinusoidal; 2=oblique sinusoidal;
  3=record is sinusoidal, burst is processed into both; 4=record is
  oblique sinusoidal, burst is processed into both)."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = SC_POSITION_J2000
 START_BYTE                       = 84
 DATA_TYPE                        = VAX_REAL
 BYTES                            = 4
 ITEMS                            = 3
 UNIT                             = METERS
 DESCRIPTION                      = "Spacecraft position vector in
  Venus-centered J2000 coordinates."
END_OBJECT                        = COLUMN

OBJECT                            = COLUMN
 NAME                             = SC_POSITION_VBF85
 START_BYTE                       = 96
 DATA_TYPE                        = VAX_REAL
 BYTES                            = 4
 ITEMS                            = 3
 UNIT                             = METERS
 DESCRIPTION                      = "Spacecraft position vector in
```

```
  Venus-centered VBF85 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = SC_VELOCITY_J2000
 START_BYTE                        = 108
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 3
 UNIT                              = "METERS/SECOND"
 DESCRIPTION                       = "Spacecraft velocity vector in
  J2000 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = SC_VELOCITY_VBF85
 START_BYTE                        = 120
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 3
 UNIT                              = "METERS/SECOND"
 DESCRIPTION                       = "Spacecraft velocity vector in
  VBF85 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = SC_ACCELERATION_J2000
 START_BYTE                        = 132
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 3
 UNIT                              = "METERS/SECOND/SECOND"
 DESCRIPTION                       = "Spacecraft acceleration vector
  in J2000 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = SC_ACCELERATION_VBF85
 START_BYTE                        = 144
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 3
 UNIT                              = "METERS/SECOND/SECOND"
 DESCRIPTION                       = "Spacecraft acceleration vector
  in VBF85 coordinates."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = BORESIGHT_QUATERNIONS
 START_BYTE                        = 156
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 4
 UNIT                              = 'N/A'
 DESCRIPTION                       = "Boresight pointing quaternions
```

```
  (q1,q2,q3,q4) derived from the MQPC file."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BORESIGHT_QUATERNION_RATES
 START_BYTE                     = 172
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 ITEMS                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Differences between the
  uplinked and measured values of the boresight pointing quaternion
  elements (uplinked - measured), as reported in telemetry. Will be zero
  if not used."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BORESIGHT_VECTOR_J2000
 START_BYTE                     = 188
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 ITEMS                          = 3
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Boresight unit pointing vector
  in VME85 spacecraft-centered coordinates."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BORESIGHT_VECTOR_VBF85
 START_BYTE                     = 200
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 ITEMS                          = 3
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Boresight unit pointing vector
  in VBF85 spacecraft-centered coordinates."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = LOOK_ANGLE
 START_BYTE                     = 212
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = DEGREES
 DESCRIPTION                    = "High-gain antenna look angle."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BORESIGHT_INTERCEPT_POINT
 START_BYTE                     = 216
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 ITEMS                          = 3
 UNIT                           = METERS
 DESCRIPTION                    = "Boresight Intercept Point
```

```
  (BIP) vector in VBF85 coordinates."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = BIP_LONGITUDE
 START_BYTE                           = 228
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = DEGREES
 DESCRIPTION                          = "East longitude of Boresight
  Intercept Point."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = BIP_LATITUDE
 START_BYTE                           = 232
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = DEGREES
 DESCRIPTION                          = "Boresight Intercept Point
  latitude."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = BIP_ELEVATION
 START_BYTE                           = 236
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = METERS
 DESCRIPTION                          = "Terrain elevation at Boresight
  Intercept Point above a sphere of radius 6051 km."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = BIP_INCIDENCE_ANGLE
 START_BYTE                           = 240
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = DEGREES
 DESCRIPTION                          = "Boresight Intercept Point
  incidence angle."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = RANGE_TO_BIP
 START_BYTE                           = 244
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = METERS
 DESCRIPTION                          = "Boresight Intercept Point
  apparent range."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = BIP_DOPPLER_FREQUENCY
```

```
 START_BYTE                     = 248
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = HZ
 DESCRIPTION                    = "Boresight Intercept Point
  instantaneous Doppler frequency."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BIP_DOPPLER_RATE
 START_BYTE                     = 252
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = "HZ/METER"
 DESCRIPTION                    = "Doppler drift rate along range."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = MID_RANGE_POINT_INCIDENCE
 START_BYTE                     = 256
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = DEGREES
 DESCRIPTION                    = "Mid_Range Point Incidence
  angle."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BIP_SIGMA_ZERO
 START_BYTE                     = 260
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Boresight Intercept Point
  backscattering coefficient expressed as a function of
  'bip_incidence_angle - 0.5'."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = MRP_LATITUDE
 START_BYTE                     = 264
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = DEGREES
 DESCRIPTION                    = "Mid_Range Point latitude."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = MRP_LONGITUDE
 START_BYTE                     = 268
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = DEGREES
 DESCRIPTION                    = "Mid_Range Point east longitude."
END_OBJECT                      = COLUMN
```

```
OBJECT                               = COLUMN
 NAME                                = MRP_ELEVATION
 START_BYTE                          = 272
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 UNIT                                = METERS
 DESCRIPTION                         = "Mid_Range Point elevation
  above a sphere of radius 6051 km."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = MRP_TRUNCATED_RANGE
 START_BYTE                          = 276
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 UNIT                                = METERS
 DESCRIPTION                         = "Apparent range to the first
  range sample in the truncated framelet."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = MRP_RANGE
 START_BYTE                          = 280
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 UNIT                                = METERS
 DESCRIPTION                         = "Mid_Range Point apparent range."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = MRP_DOPPLER_FREQUENCY
 START_BYTE                          = 284
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 UNIT                                = HZ
 DESCRIPTION                         = "Mid_Range Point instantaneous
  Doppler frequency."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = MRP_DOPPLER_RATE
 START_BYTE                          = 288
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 UNIT                                = "HZ/SECOND"
 DESCRIPTION                         = "Mid_Range Point instantaneous
  Doppler frequency rate."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = MRP_LOCATION_VBF85
 START_BYTE                          = 292
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 ITEMS                               = 3
```

```
 UNIT                                  = METERS
 DESCRIPTION                           = "Mid_Range Point position
  vector in VME85 coordinates."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = RECEIVER_GAIN
 START_BYTE                            = 304
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Sensor-processor gain from
  calibration."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = RANGE_FFT_LENGTH
 START_BYTE                            = 308
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Range FFT length in bins."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = DOPPLER_FFT_LENGTH
 START_BYTE                            = 312
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Azimuth FFT length in bins."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = NUMBER_PULSES_IN_BURST
 START_BYTE                            = 316
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Number of pulses in the burst."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = TIME_TO_GROUND_RANGE_FACTOR
 START_BYTE                            = 320
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 UNIT                                  = "METERS/SECOND"
 DESCRIPTION                           = "Time to ground range
  conversion factor."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = DOPPLER_TO_DISTANCE_FACTOR
 START_BYTE                            = 324
```

```
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = "METERS/HZ"
 DESCRIPTION                    = "Doppler to Along-Track
  distance conversion factor."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = BAQ_RECONSTRUCTION_FACTOR
 START_BYTE                     = 328
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "BAQ reconstruction scaling
  factor."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = TRANSMITTER_POWER_COMPENSATION
 START_BYTE                     = 332
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Transmitter power correction
  factor."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = RECEIVER_GAIN_COMPENSATION
 START_BYTE                     = 336
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Receiver gain correction
  factor."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = REDUNDANCY_GAIN_COMPENSATION
 START_BYTE                     = 340
 DATA_TYPE                      = VAX_REAL
 BYTES                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Gain correction factor for
  non-standard redundancy configuration."
END_OBJECT                      = COLUMN

OBJECT                          = COLUMN
 NAME                           = RANGE_REFERENCE_INDEX
 START_BYTE                     = 344
 DATA_TYPE                      = LSB_UNSIGNED_INTEGER
 BYTES                          = 4
 UNIT                           = 'N/A'
 DESCRIPTION                    = "Range reference group index."
END_OBJECT                      = COLUMN
```

```
OBJECT                                      = COLUMN
 NAME                                       = RANGE_WALK_INDEX
 START_BYTE                                 = 348
 DATA_TYPE                                  = VAX_REAL
 BYTES                                      = 4
 UNIT                                       = 'N/A'
 DESCRIPTION                                = "Absolute range walk across all
  pulses this burst (number of slant range samples)."
END_OBJECT                                  = COLUMN

OBJECT                                      = COLUMN
 NAME                                       = RANGE_WALK_COEFF_1
 START_BYTE                                 = 352
 DATA_TYPE                                  = VAX_REAL
 BYTES                                      = 4
 UNIT                                       = 'N/A'
 DESCRIPTION                                = "Range walk correction
  coefficient (order 0) in range bins."
END_OBJECT                                  = COLUMN

OBJECT                                      = COLUMN
 NAME                                       = RANGE_WALK_COEFF_2
 START_BYTE                                 = 356
 DATA_TYPE                                  = VAX_REAL
 BYTES                                      = 4
 UNIT                                       = 'N/A'
 DESCRIPTION                                = "Range walk correction
  coefficient (order 1) in range bins per inter-pulse period."
END_OBJECT                                  = COLUMN

OBJECT                                      = COLUMN
 NAME                                       = TRANSMITTER_STATE
 START_BYTE                                 = 360
 DATA_TYPE                                  = LSB_UNSIGNED_INTEGER
 BYTES                                      = 4
 UNIT                                       = 'N/A'
 DESCRIPTION                                = "Transmitter A state (0 =
  transmitter B on, 1 = transmitter A on)."
END_OBJECT                                  = COLUMN

OBJECT                                      = COLUMN
 NAME                                       = RECEIVER_STATE
 START_BYTE                                 = 364
 DATA_TYPE                                  = LSB_UNSIGNED_INTEGER
 BYTES                                      = 4
 UNIT                                       = 'N/A'
 DESCRIPTION                                = "Receiver A state (0 = receiver
  B on, 1 = receiver A on)."
END_OBJECT                                  = COLUMN

OBJECT                                      = COLUMN
 NAME                                       = OUTPUT_NETWORK_STATE
 START_BYTE                                 = 368
 DATA_TYPE                                  = LSB_UNSIGNED_INTEGER
 BYTES                                      = 4
```

```
 UNIT                                   = 'N/A'
 DESCRIPTION                            = "ONU A state (0 = ONU B on, 1 =
  ONU A on)."
END_OBJECT                              = COLUMN

OBJECT                                  = COLUMN
 NAME                                   = TRANSMITTER_A_TEMPERATURE
 START_BYTE                             = 372
 DATA_TYPE                              = VAX_REAL
 BYTES                                  = 4
 UNIT                                   = DEGREES_C
 DESCRIPTION                            = "Transmitter A Temperature."
END_OBJECT                              = COLUMN

OBJECT                                  = COLUMN
 NAME                                   = RECEIVER_A_TEMPERATURE
 START_BYTE                             = 376
 DATA_TYPE                              = VAX_REAL
 BYTES                                  = 4
 UNIT                                   = DEGREES_C
 DESCRIPTION                            = "Receiver A Temperature."
END_OBJECT                              = COLUMN

OBJECT                                  = COLUMN
 NAME                                   = OUTPUT_NETWORK_A_TEMP
 START_BYTE                             = 380
 DATA_TYPE                              = VAX_REAL
 BYTES                                  = 4
 UNIT                                   = DEGREES_C
 DESCRIPTION                            = "ONU A temperature."
END_OBJECT                              = COLUMN

OBJECT                                  = COLUMN
 NAME                                   = TRANSMITTER_B_TEMPERATURE
 START_BYTE                             = 384
 DATA_TYPE                              = VAX_REAL
 BYTES                                  = 4
 UNIT                                   = DEGREES_C
 DESCRIPTION                            = "Transmitter B stage 1
  temperature."
END_OBJECT                              = COLUMN

OBJECT                                  = COLUMN
 NAME                                   = RECEIVER_B_TEMPERATURE
 START_BYTE                             = 388
 DATA_TYPE                              = VAX_REAL
 BYTES                                  = 4
 UNIT                                   = DEGREES_C
 DESCRIPTION                            = "Receiver B Temperature."
END_OBJECT                              = COLUMN

OBJECT                                  = COLUMN
 NAME                                   = OUTPUT_NETWORK_B_TEMP
 START_BYTE                             = 392
 DATA_TYPE                              = VAX_REAL
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```
 BYTES                             = 4
 UNIT                              = DEGREES_C
 DESCRIPTION                       = "ONU B temperature."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = SAR_CABLE_TEMPERATURES
 START_BYTE                        = 396
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 5
 UNIT                              = DEGREES_C
 DESCRIPTION                       = "Sensor-antenna Cable
  temperatures at 5 points."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = APPARENT_RANGE_TO_REFERENCE_PTS
 START_BYTE                        = 416
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 9
 UNIT                              = METERS
 DESCRIPTION                       = "A 3x3 array containing the
  apparent ranges of the 9 radiometric reference points, relative to
  that of the central reference point. The central element contains the
  apparent range to the central radiometric reference point."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = DOPPLER_SHIFTS_TO_REF_POINTS
 START_BYTE                        = 452
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 9
 UNIT                              = HZ
 DESCRIPTION                       = "A 3x3 array containing the
  Doppler shifts of the 9 radiometric reference points, relative to that
  of the central reference point. The central element contains the
  Doppler shift of the central radiometric reference point."
END_OBJECT                         = COLUMN

OBJECT                             = COLUMN
 NAME                              = COORDINATES_OF_REF_POINT_1
 START_BYTE                        = 488
 DATA_TYPE                         = VAX_REAL
 BYTES                             = 4
 ITEMS                             = 9
 UNIT                              = 'N/A'
 DESCRIPTION                       = "A 3x3 array containing the
  coordinate-1 values (in 75-meter pixel counts) of the 9 radiometric
  reference points. See [LEUNG1993] for a definition of the
  coordinate system."
END_OBJECT                         = COLUMN
```

```
OBJECT                                = COLUMN
 NAME                                 = COORDINATES_OF_REF_POINT_2
 START_BYTE                           = 524
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "A 3x3 array containing the
  coordinate-2 values (in 75-meter pixel counts) of the 9 radiometric
  reference points. See [LEUNG1993] for a definition of the
  coordinate system."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = RANGE_TO_REF_POINTS
 START_BYTE                           = 560
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = METERS
 DESCRIPTION                          = "A 3x3 array containing the
  distance from the sensor to the 9 radiometric reference points."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = OFF_BORE_ELEV_ANGLE_OF_REF_POINT
 START_BYTE                           = 596
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = DEGREES
 DESCRIPTION                          = "A 3x3 array containing the
  off-boresight elevation angles of the 9 radiometric reference points."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = OFF_BORE_HORIZ_ANGLE_OF_REF_POINT
 START_BYTE                           = 632
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = DEGREES
 DESCRIPTION                          = "A 3x3 array containing the
  off-boresight horizontal angles of the 9 radiometric reference points."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = ANTENNA_GAIN_TO_REF_POINTS
 START_BYTE                           = 668
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "A 3x3 array containing the
  antenna gain to the 9 radiometric reference points."
```

```
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = MRP_BACKSCATTER_COEFF_AT_REF_POINT
 START_BYTE                           = 704
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "Mid_Range Point Backscatter
  coefficient at the central radiometric reference point expressed as a
  function of 'mrp_incidence_angle - 0.5 degree'."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = RADIOMETRIC_COMPENSATION_AT_REF_POINT
 START_BYTE                           = 708
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "A 3x3 array containing the
  radiometric compensation factors of the 9 radiometric reference points."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = DOPPLER_WALK_AT_REF_POINTS
 START_BYTE                           = 744
 DATA_TYPE                            = VAX_REAL
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "Constant, linear, and
  quadratic compensation coefficients for generating Doppler walk for a
  given apparent range."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = C1_AT_GEOMETRIC_REFERENCE_POINTS
 START_BYTE                           = 780
 DATA_TYPE                            = LSB_INTEGER
 BYTES                                = 4
 ITEMS                                = 9
 UNIT                                 = 'N/A'
 DESCRIPTION                          = "A 3x3 array containing the
  Coordinate-1 values (in 75-meter pixel counts) of the 9 geometric
  reference points. See [LEUNG1993] for a definition of the
  coordinate system."
END_OBJECT                            = COLUMN

OBJECT                                = COLUMN
 NAME                                 = C2_AT_GEOMETRIC_REFERENCE_POINTS
 START_BYTE                           = 816
 DATA_TYPE                            = LSB_INTEGER
 BYTES                                = 4
 ITEMS                                = 9
```

```
 UNIT                                = 'N/A'
 DESCRIPTION                         = "A 3x3 array containing the
  Coordinate-2 values (in 75-meter pixel counts) of the 9 geometric
  reference points. See [LEUNG1993] for a definition of the
  coordinate system."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = ELEVATION_OF_REFERENCE_POINTS
 START_BYTE                          = 852
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 ITEMS                               = 9
 UNIT                                = METERS
 DESCRIPTION                         = "A 3x3 array containing the
  terrain elevations of the 9 geometric reference points above a sphere
  of radius 6051 km."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = RANGE_TO_REFERENCE_POINTS
 START_BYTE                          = 888
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 ITEMS                               = 9
 UNIT                                = METERS
 DESCRIPTION                         = "A 3x3 array containing the
  apparent ranges of the 9 geometric reference points, relative to that
  of the central reference point. The central element contains the
  apparent range to the central geometric reference point."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = DOPPLER_TO_REFERENCE_POINTS
 START_BYTE                          = 924
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 ITEMS                               = 9
 UNIT                                = HZ
 DESCRIPTION                         = "A 3x3 array containing the
  apparent Doppler shifts of the 9 geometric reference points, relative
  to that of the central reference point. The central element contains
  the apparent Doppler shift of the central geometric reference point."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = C2_TO_DOPPLER_COEFFICIENTS
 START_BYTE                          = 960
 DATA_TYPE                           = VAX_REAL
 BYTES                               = 4
 ITEMS                               = 9
 UNIT                                = 'N/A'
 DESCRIPTION                         = "Constant, linear, and
  quadratic compensation coefficients for generating range walk for a
  given Coordinate-2 value."
```

```
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C1_TO_C2_COEFFICIENTS
 START_BYTE                            = 996
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 ITEMS                                 = 9
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Constant, linear, and
  quadratic compensation coefficients for generating Coordinate-2
  correction for a given Coordinate-1 value. See [LEUNG1993] for a
  definition of the coordinate system."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = RANGE_TO_FRAMELET_CORNERS
 START_BYTE                            = 1032
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 ITEMS                                 = 4
 UNIT                                  = METERS
 DESCRIPTION                           = "A 2x2 array containing the
  apparent ranges to the framelet corners. In terms of Doppler (f) and
  range (r) coordinates, framelet corner (1,1) corresponds to
  (rsmallest, fsmallest); framelet corner (1,2) corresponds to
  (rsmallest, fgreatest); framelet corner (2,1) corresponds to
  (rgreatest, fsmallest); framelet corner (2,2) corresponds to
  (rgreatest, fgreatest)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = DOPPLER_TO_FRAMELET_CORNERS
 START_BYTE                            = 1048
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 ITEMS                                 = 4
 UNIT                                  = HZ
 DESCRIPTION                           = "A 2x2 array containing the
  Doppler shifts of the framelet corners. In terms of Doppler (f) and
  range (r) coordinates, framelet corner (1,1) corresponds to
  (rsmallest, fsmallest); framelet corner (1,2) corresponds to
  (rsmallest, fgreatest); framelet corner (2,1) corresponds to
  (rgreatest, fsmallest); framelet corner (2,2) corresponds to
  (rgreatest, fgreatest)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C1_OF_FRAMELET_CORNERS
 START_BYTE                            = 1064
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 ITEMS                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "A 2x2 array containing the
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  Coordinate-1 values (in 75-meter pixel counts) of the framelet corners.
  See [LEUNG1993] for a definition of the coordinate system."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C2_OF_FRAMELET_CORNERS
 START_BYTE                            = 1080
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 ITEMS                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "A 2x2 array containing the
  Coordinate-2 values (in 75-meter pixel counts) of the framelet corners.
  See [LEUNG1993] for a definition of the coordinate system."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = PULSE_REPETITION_FREQUENCY
 START_BYTE                            = 1096
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Pulse Repetition Frequency."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = PULSES_PER_BURST
 START_BYTE                            = 1100
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Number of pulses in burst."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = SAMPLES_PER_BURST
 START_BYTE                            = 1104
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Number of samples per pulse."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = PROCESSING_BANDWIDTH
 START_BYTE                            = 1108
 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 UNIT                                  = HZ
 DESCRIPTION                           = "Processing Bandwith."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = PROCESSING_RANGE_SWATH
 START_BYTE                            = 1112
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 DATA_TYPE                             = VAX_REAL
 BYTES                                 = 4
 UNIT                                  = METERS
 DESCRIPTION                           = "Processing range swath width."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = MIN_LOOKS_TO_FLAG_IN_OUTPUT
 START_BYTE                            = 1116
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Minimum number of looks to
  flag in output."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = BAQ_THRESHOLDS
 START_BYTE                            = 1120
 DATA_TYPE                             = LSB_UNSIGNED_INTEGER
 BYTES                                 = 1
 ITEMS                                 = 24
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "An array of 24 Block Adaptive
  Quantization thresholds."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C1_OF_FRAME_EDGE_WITH_MAX_DOPPLER
 START_BYTE                            = 1144
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "The C1 address of the frame
  edge associated with the greatest Doppler coordinate. (This is the
  smallest C1 coordinate for sinusoidal bursts, the greatest C1
  coordinate for oblique sinusoidal bursts)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C2_OF_FRAME_EDGE_WITH_MIN_RANGE
 START_BYTE                            = 1148
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "For left-looking bursts, the
  C2 address of the frame edge associated with the smallest range
  coordinate. For right-looking bursts, the C2 address of the frame edge
  associated with the greatest range coordinate. (This is the smallest
  C2 coordinate of the frame)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C2_OF_AZ_FRAME_EDGE_WITH_MIN_RANGE
 START_BYTE                            = 1152
```

```
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "The C2 address of the
  azimuth-processed frame edge associated with the smallest range
  coordinate. (This is the smallest C2 coordinate of the
  azimuth-processed frame)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C1_OF_FRAME_EDGE_WITH_MIN_DOPPLER
 START_BYTE                            = 1156
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "The C1 address of the frame
  edge associated with the smallest Doppler coordinate. (This is the
  greatest C1 coordinate for sinusoidal bursts, the smallest C1
  coordinate for oblique sinusoidal bursts)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C2_OF_FRAME_EDGE_WITH_MAX_RANGE
 START_BYTE                            = 1160
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "For left-looking bursts, the
  C2 address of the frame edge associated with the greatest range
  coordinate. For right-looking bursts, the C2 address of the frame edge
  associated with the smallest range coordinate. (This is the greatest
  C2 coordinate of the frame)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = C2_OF_AZ_FRAME_EDGE_WITH_MAX_RANGE
 START_BYTE                            = 1164
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "The C2 address of the
  azimuth-processed frame edge associated with the greatest range
  coordinate. (This is the greatest C2 coordinate of the
  azimuth-processed frame)."
END_OBJECT                             = COLUMN

OBJECT                                 = COLUMN
 NAME                                  = ALONG_TRACK_FRAME_TO_FRAME_OFFSET
 START_BYTE                            = 1168
 DATA_TYPE                             = LSB_INTEGER
 BYTES                                 = 4
 UNIT                                  = 'N/A'
 DESCRIPTION                           = "Along-track offset between the
  current and previous frame."
END_OBJECT                             = COLUMN
```

```
OBJECT                               = COLUMN
 NAME                                = CROSS_TRACK_FRAME_TO_FRAME_OFFSET
 START_BYTE                          = 1172
 DATA_TYPE                           = LSB_INTEGER
 BYTES                               = 4
 UNIT                                = 'N/A'
 DESCRIPTION                         = "Cross-track offset between the
  current and previous frame."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = CROSS_TRACK_WEIGHTING_INDEX
 START_BYTE                          = 1176
 DATA_TYPE                           = LSB_UNSIGNED_INTEGER
 BYTES                               = 4
 UNIT                                = 'N/A'
 DESCRIPTION                         = "Set number of cross-track
  (projection domain) weights. There are a total of 128 sets available."
END_OBJECT                           = COLUMN

OBJECT                               = COLUMN
 NAME                                = OFFSET_WITHIN_CROSS_TRACK_WEIGHT
 START_BYTE                          = 1180
 DATA_TYPE                           = LSB_INTEGER
 BYTES                               = 4
 UNIT                                = 'N/A'
 DESCRIPTION                         = "Offset within one set of
  cross-track weights."
END_OBJECT                           = COLUMN

END
```

B.7. DOCINFO.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = STREAM
SPACECRAFT_NAME               = MAGELLAN
TARGET_NAME                   = VENUS
OBJECT                        = TEXT
  PUBLICATION_DATE            = 1994-07-01
  NOTE                        = "MAGELLAN C-BIDR ARCHIVE CD-WO"
END_OBJECT                    = TEXT
END

              DESCRIPTION OF DOCUMENTATION FILES ON THIS VOLUME

  This file describes the files present in the [DOCUMENT] directory on
this volume.  The files are:

      CBIDRCD.TXT   - Software Interface Specification for the Magellan
                      Compressed-Resolution Basic Image Data Record on
                      Compact Disk Read-Only Memory (CBIDRCD) Product.
                      Formatted for display or printing at 66 lines per
                      page with up to 78 constant-width characters per line.
```

```
                  This file begins with a 12-line PDS label, which
                  should be stripped off before printing.

CBIDRCD.LBL    - PDS detached label file describing CBIDRCD.PS.

CBIDRCD.PS     - Software Interface Specification for the Magellan
                  Compressed-Resolution Basic Image Data Record on
                  Compact Disk Read-Only Memory (CBIDRCD) Product.
                  Formatted in Adobe PostScript.
```

B.8. ERR.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
RECORD_TYPE                     = STREAM
SPACECRAFT_NAME                 = MAGELLAN
TARGET_NAME                     = VENUS
OBJECT                          = TEXT
  PUBLICATION_DATE              = 1994-07-01
  NOTE                          = "MAGELLAN C-BIDR ARCHIVE ERROR REPORT"
END_OBJECT                      = TEXT
END

The following errors were noted by the label generator when creating
detached PDS label files for directory C0376_03 of product MG_3101
on Wed Jul 20 14:45:57 EDT 1994.

DC1.DAT: bad DECAL2 SMARKER label length: 85
DQS.DAT: bad DATA_QUALITY_SUMMARY logical record length: 85
MON.DAT: bad MONITOR aggregate length: 356
```

B.9. ERRATA.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3
RECORD_TYPE                     = STREAM
SPACECRAFT_NAME                 = MAGELLAN
TARGET_NAME                     = VENUS
OBJECT                          = TEXT
  PUBLICATION_DATE              = 1994-07-01
  NOTE                          = "MAGELLAN C-BIDR ARCHIVE ERROR REPORT"
END_OBJECT                      = TEXT
END

The PDS labels on this volume conform to the Data Dictionary distributed
with Release 4.1 of the PDS Toolkit. All IMAGE, TEXT, HEADER, SPICE KERNEL
and TABLE objects obey GENERIC PDS standards, except that some TABLE objects
are not accompanied by sets of COLUMN sub-objects, in which case format
information is included in an accompanying DESCRIPTION element.

The PDS Catalog files, *.CAT, conform to the PDS "streamlined" standards
introduced in April 1994.
```

With exceptions noted below, all *.DAT files in the data directories were copied directly from C-BIDR product tapes without change. Error messages from the PDS label generation routines have been copied to the ERR.TXT files within the data directories. Most errors are concerned with incorrect SFDU lengths, and the object pointers in the label files, e.g. ^TABLE = ('SAB.DAT',566<BYTES>), should be used in preference to the object lengths recorded in the *.DAT files themselves.

Volume	Dir	File	Description of Anomaly
MG_3101	C0381_03	DCM.DAT	Missing file replaced from ALTEDRCD.001.
	C0385_04	MON.DAT	Corrupted file replaced from ALTEDRCD.001.
	C0386_03	IM2.DAT	Removed truncated block at end of file.

B.10. INDEX.TAB Example

```
0376,03,"CLK.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"DCM.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"DQS.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"ENG.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"EPH.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"HDR.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"IM1.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"IM2.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"MON.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"OPF.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"PBW.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"PR1.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"PR2.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"QTN.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
0376,03,"SAB.DAT","C0376_03","C-BIDR.0376-0380;1","F-BIDR.00376;03","MG_3101"
```

B.11. INDXINFO.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                = PDS3
RECORD_TYPE                   = FIXED_LENGTH
RECORD_BYTES                  = 80
SPACECRAFT_NAME               = MAGELLAN
TARGET_NAME                   = VENUS
OBJECT                        = TEXT
 PUBLICATION_DATE             = 1994-07-01
 NOTE                         = "MAGELLAN C-BIDR ARCHIVE CD-WO"
END_OBJECT                    = TEXT
END

                  DESCRIPTION OF INDEX FILES ON THIS VOLUME

  This file describes the files present in the [INDEX] directory on this
volume.  The files are:

      INDEX.LBL     - PDS label for the volume index (INDEX.TAB).  It
```

```
                    identifies the volume index and describes the
                    structure (columns) of the index table.

      INDEX.TAB     - Volume index in tabular format.

      CUMINDEX.LBL  - PDS label for the cumulative volume index
                      (CUMINDEX.TAB).

      CUMINDEX.TAB  - Cumulative volume index in tabular format.
```

B.12. INSTHOST.CAT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3

OBJECT                          = INSTRUMENT_HOST
INSTRUMENT_HOST_ID              = "MGN"

 OBJECT                         = INSTRUMENT_HOST_INFORMATION
  INSTRUMENT_HOST_NAME          = "MAGELLAN"
  INSTRUMENT_HOST_TYPE          = "SPACECRAFT"
  INSTRUMENT_HOST_DESC          = "

    Spacecraft Overview
    ===================
      The Magellan spacecraft was built by the Martin Marietta
      Corporation.  The spacecraft structure included four major
      sections: High-Gain Antenna (HGA), Forward Equipment Module
      (FEM), Spacecraft Bus (including the solar array), and the Orbit
      Insertion Stage.  Spacecraft subsystems included those for
      thermal control, power, attitude control, propulsion, command
      data and data storage, and telecommunications.

      Design of the Magellan spacecraft was driven by the need for a
      low-cost, high-performance vehicle.  Protoflight units that had
      been built for preflight tests or were spares from the Voyager
      spacecraft were available from storage at no cost.  These
      included the 3.7 meter diameter high-gain antenna (HGA), the
      spacecraft bus, propulsion system components, thermal control
      louvers, and much of the radio subsystem.  The stockpile of
      flight spares for the Galileo spacecraft provided Magellan's
      command and data system, tape recorders, attitude control
      processor, power subsystem and propulsion components.  Further
      elements were drawn from other projects and from NASA standard
      designs.  Only about 30% (by mass) of the Magellan spacecraft --
      primarily the radar electronics and the solar panels -- was
      especially designed for the mission.

      The high-gain antenna (HGA) was used as the antenna for the
      synthetic aperture radar (SAR) and as the primary antenna for
      the telecommunications system.  The HGA boresight was defined to
      be the +Z axis for the spacecraft-fixed coordinate system.

      The spacecraft bus was a ten sided structure containing the star
      scanner, medium-gain antenna (MGA), rocket engine modules
```

(REMs), command data and data storage (CDDS) subsystem, attitude control monopropellant tank, and a nitrogen tank for providing propellant pressurization. The solar panel array was attached to the bus; its rotation axis defined the +X axis for the spacecraft-fixed coordinate system. The +Y axis of the coordinate system was in the nominal direction of the star scanner boresight, forming a right-hand coordinate system.

The radar electronics, the reaction wheels, and various other spacecraft subsystem components were contained within the Forward Equipment Module, located between the bus and HGA.

The orbit insertion stage contained a STAR-48 solid rocket motor (SRM) that was used to provide the impulse required to perform the Venus Orbit Insertion (VOI) maneuver.

Thermal control of the spacecraft was accomplished by a combination of louvers, thermal blankets, passive coatings, and heat dissipating elements. The nominal operating temperature for the spacecraft components was between -5 and +40 degrees Celsius. The thermal control subsystem maintained these components at the appropriate temperatures for all orientations of the spacecraft orbit and sun-line and for all spacecraft operating modes. Electrical power was supplied by two large solar panels with a total area of 12.6 square meters. This array was capable of producing a minimum power of 1029 W at the end of the nominal mission; it could rotate about its axis to allow tracking of the Sun despite the changing Earth-Sun-spacecraft geometry during the mission. A dedicated sun sensor optimized power production. Bus voltage regulation was controlled by the power control unit (PCU) with a shunt regulator for diverting excess power from the solar arrays to maintain power as raw power (28-35 v), regulated power at 28 vDC +/-0.56 vDC, and as AC at 2.4 kHz through an inverter. Two 30 amp-hour, 26-cell nickel cadmium batteries provided power during times of solar occultation and allowed normal spacecraft operations independent of real-time solar illumination. These batteries were sized to allow a degraded mission in the event that one of them failed.

The attitude of the Magellan spacecraft was controlled through the use of reaction wheels, with monopropellant rocket motors being used to desaturate the reaction wheels periodically. During both the interplanetary cruise and the orbital portions of the mission, attitude reference was provided by an inertial reference unit (IRU), updated each orbit using celestial references. During the mapping part of each orbit, the spacecraft was initially oriented with the HGA pointing down toward Venus, with the exact attitude being a function of the spacecraft altitude and the SAR mapping objectives. During the downlink transmission part of the orbit, the spacecraft was oriented with the HGA slightly off the Earth-line. The low gain antenna (LGA) was mounted coaxially with the HGA and did not require pointing since it had an omnidirectional beam pattern. The altimeter horn (ALTA) was mounted so that a portion of the fan-shaped beam nominally pointed in the nadir direction during the mapping part of an orbit.

The Magellan propulsion subsystem consisted of two parts. The first, a Star 48 SRM, provided the impulse for VOI. Following that maneuver, the empty casing and parts of its support structure were ejected from the spacecraft. The second part consisted of monopropellant hydrazine thrusters that were used for trajectory correction maneuvers (TCMs) during inter-planetary cruise, thrust vector control (TVC) during VOI, orbit trim maneuvers during the mapping mission, and attitude control when the reaction wheels were being desaturated. The rocket motors were clustered in modules located on the end of outrigger booms in order to increase their moment arms and thus decrease attitude control propellant requirements.

Twelve 0.9-N (Newton) and four 22-N rocket motors were used for attitude control, with thrust being provided by eight 445-N rocket motors or by the 0.9-N motors for small TCMs. All engines pointed in the -Z direction, with the exception of the roll motors.

The 0.9-N motors were used for tip-off control following separation of the inertial upper stage (IUS), reaction wheel desaturation, roll control for all times other than VOI, to back up any failed reaction wheels, and for small TCMs or orbit trim maneuvers (OTMs). The 22-N motors were used for roll control during VOI. The 445-N motors were used for controlling the spacecraft rotational axis during VOI, and to provide impulses during all propulsive maneuvers. The monopropellant motors also provided the impulses needed to trim the VOI maneuver.

The command, data and data storage (CDDS) system received uplink commands via the radio frequency subsystem (RFS) and controlled the spacecraft in response to those commands. It also controlled the acquisition and storage of scientific data and sending that data, along with supplemental engineering data, to the RFS for downlink transmission to Earth. The commands were sent to the spacecraft as time-event pairs for storage and later execution, and also in the form of blocks which the CDDS later expanded into spacecraft executable commands. In the Venus orbit phase, commands for up to three days of radar operation were stored. There was also a provision for receiving and executing discrete commands sent from the ground. SAR data were stored on two multi-track digital tape records (DTRs) for later playback over the high-rate X-band link; there was no provision for real-time transmission of the SAR data. Data storage capacity of the two DTRs was approximately 1.8 billion bits. Engineering data were normally transmitted to Earth over a real-time S-band link. During those times when a real-time link was not possible, the engineering data were recorded on a DTR and played back via the X-band high-rate link with the SAR data. The recorded data stream was alternately switched between the two DTRs so that the data would not be lost during the DTR track change.

```
     The Magellan telecommunications subsystem contained all the
     hardware necessary to maintain communications between Earth and
     the spacecraft.  The subsystem contained the radio frequency
     subsystem, the LGA, MGA, and HGA.  The RFS performed the
     functions of carrier transponding, command detection and
     decoding, and telemetry modulation.  The spacecraft was capable
     of simultaneous X-band and S-band uplink and downlink
     operations.  The S-band operated at a transmitter power of 5 W,
     while the X-band operated at a power of 22 W.  Uplink data rates
     were 31.25 and 62.5 bps (bits per second) with downlink data
     rates of 40 bps (emergency only), 1200 bps (real-time
     engineering rate), 115.2 kbps (kilobits per second) (radar
     downlink backup), and 268.8 kbps (nominal).

     For more information on the Magellan spacecraft see the papers
     by [SAUNDERSETAL1990] and [SAUNDERSETAL1992].  "

 END_OBJECT                      = INSTRUMENT_HOST_INFORMATION

 OBJECT                          = INSTRUMENT_HOST_REFERENCE_INFO
  REFERENCE_KEY_ID               = "SAUNDERSETAL1990"
 END_OBJECT                      = INSTRUMENT_HOST_REFERENCE_INFO

 OBJECT                          = INSTRUMENT_HOST_REFERENCE_INFO
  REFERENCE_KEY_ID               = "SAUNDERSETAL1992"
 END_OBJECT                      = INSTRUMENT_HOST_REFERENCE_INFO

END_OBJECT                       = INSTRUMENT_HOST

END
```

B.13. LABLINFO.TXT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                 = PDS3
RECORD_TYPE                    = FIXED_LENGTH
RECORD_BYTES                   = 80
SPACECRAFT_NAME                = MAGELLAN
TARGET_NAME                    = VENUS
OBJECT                         = TEXT
 PUBLICATION_DATE              = 1994-07-01
 NOTE                          = "MAGELLAN C-BIDR ARCHIVE CD-WO"
END_OBJECT                     = TEXT
END

                   DESCRIPTION OF LABEL FILES ON THIS VOLUME

  This file describes the files present in the [LABEL] directory on this
volume.  The files are:

      CBIDRIM.FMT   - PDS detached object format file describing the
                      structure of the binary annotation header records
                      contained in the IM1.DAT and IM2.DAT image swath
                      files in the data directories of this volume.
```

```
CBIDROPF.FMT  - PDS detached object format file describing the
                structure of the single binary data record that
                comprises the OPF.DAT orbit parameter file in each
                data directory of this volume.

CBIDRPR.FMT   - PDS detached object format file describing the
                structure of the binary data records that comprise
                the PR1.DAT and PR2.DAT processing parameter files
                in each data directory of this volume.

DSMAPCB.LBL   - Description of the Sinusoidal and Oblique
                Sinusoidal projections used in this data set.
```

The remaining PDS label files on this volume are located in the several data directories. They are named *.LBL and describe the corresponding *.DAT data files. In addition, the image index files IM1.AUX and IM2.AUX that describe the IM1.DAT and IM2.DAT image swath files are accompanied by PDS label files IX1.LBL and IX2.LBL, respectively.

The keywords in all PDS label files are described in "Planetary Science Data Dictionary", JPL D-7116, Rev. C, 20 November 1992.

B.14. MISSION.CAT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                   = PDS3

OBJECT                           = MISSION
 MISSION_NAME                    = "MAGELLAN"

 OBJECT                          = MISSION_INFORMATION
  MISSION_START_DATE             = 1989-05-04
  MISSION_STOP_DATE              = UNK
  MISSION_ALIAS_NAME             = "VENUS RADAR MAPPER (VRM)"
  MISSION_DESC                   = "

    Mission Overview
    ================
      The Magellan spacecraft was launched from the Kennedy Space
      Center on 4 May 1989.  The spacecraft was deployed from the
      Shuttle cargo bay after the Shuttle achieved parking orbit.
      Magellan, using an inertial upper stage rocket, was then placed
      into a Type IV transfer orbit to Venus where it carried out
      radar mapping and gravity studies starting in August 1990.  The
      Mission has been described in many papers including two special
      issues of the Journal of Geophysical Research [VRMPP1983;
      SAUNDERSETAL1990; JGRMGN1992].  The radar system is also
      described in [JOHNSON1990].

      Magellan was powered by single degree of freedom, sun-tracking,
      solar panels.  The spacecraft was 3-axis stabilized by reaction
      wheels using gyros and a star sensor for attitude reference.
      The spacecraft carried a solid rocket motor for Venus orbit
      insertion.  A small hydrazine system was used for trajectory
```

corrections and certain attitude control functions. Earth communication with the Deep Space Network (DSN) was by means of S- and X-band channels. The high-gain antenna also functioned as the SAR mapping antenna during orbital operations.

The interplanetary cruise phase lasted until 10 August 1990. During the cruise phase there were small trajectory correction maneuvers to ensure proper approach geometry. Using the solid rocket motor, the spacecraft was placed into an elliptical orbit around the planet, with a periapsis latitude of approximately 10 degrees north, a periapsis altitude of 295 km, a period of 3.263 hours, and an apoapsis altitude of approximately 7762 km.

After orbit insertion, the radar system acquired test data. Then, unexpectedly, the signal from the spacecraft was lost twice. Placed in a 'Safe Mode', the spacecraft resumed mapping operations on 15 September 1990, after commands were relayed to avoid further communication interruptions.

Each mapping cycle lasted 243 days, which was the time required for Venus to make one rotation under the spacecraft orbit. The first mapping cycle ended on 15 May 1991. Typical activities during a single mapping pass on Cycle 1 were as follows. As the spacecraft neared periapsis, it was oriented so the high-gain antenna pointed slightly to the side of the ground track. At a true anomaly of -59 degrees, the radar was commanded on. The radar continued to take data to a true anomaly of 80 degrees and then the radar was commanded off. On the next pass the swath started at -80 degrees and went to 59 degrees. Alternating north and south swaths were repeated throughout Cycle 1.

The range of latitudes covered by the synthetic aperture radar (SAR) during Cycle 1 was 67 degrees S to 90 degrees N. The range of SAR incidence angles was from just under 20 to just over 40 degrees. The SAR data were taken at a data rate of 750 kilobits/second and were stored in the spacecraft tape recorder. Altimeter and radiometer data were also taken when SAR data were acquired. The altimeter data were taken using a small fan beam antenna at a data rate of 30 kb/s. As the spacecraft moved away from the planet toward apoapsis, the spacecraft reoriented the high-gain antenna towards Earth and the stored radar data were transmitted to DSN stations. This data taking- and transmitting-cycle was repeated for every orbit. By 15 May 1991, the planet had been completely mapped except for the area near the South Pole and a few regions which had been missed because of temporary equipment failures.

Cycle 2 observations focused on filling the gaps in Cycle 1 coverage (including the south pole area), acquiring SAR data at a constant incidence angle (25 degrees), and conducting a suite of ad hoc experiments, including high resolution imaging and radar stereo. To observe the south pole the spacecraft was rotated 180 degrees about its nadir-pointing axis so as to conduct right-looking SAR observations. Gaps in the Cycle 1 coverage were filled by rotating the spacecraft back to its initial left-looking direction. The orbit plane was adjusted slightly at the beginning of Cycle 2 so that altimetry tracks would be offset by about 10 km at the equator, bisecting the orbit-to-orbit offset of altimetry tracks in Cycle 1. The spacecraft was rotated 90 deg about the HGA boresight on orbits 3716-3719 to obtain SAR and radiometry data with VV polarization. Radio occultation measurements were made on orbits 3212-3214.

The principal objective of Cycle 3 was to perform radar stereo mapping of the Venusian surface. About 30 percent of the Cycle 1 coverage was remapped in this cycle with a different, left-looking incidence angle on the surface. Gravity data were collected over Artemis Chasma. In addition, high resolution altimetry data were collected by pointing the high gain antenna straight down during orbits 4919 to 4921. Transmission of acquired radar data to Earth became nearly impossible after spacecraft equipment failures late in Cycle 3, and the radar was not used for science purposes after that.

Cycle 4 was used for full (360 degree) longitudinal collection of gravity data because of favorable planetary and spacecraft geometry. The cycle was extended by about ten days to compensate for passage of the radio ray through the Venus atmosphere during the first ten days. To improve sensitivity to gravity features, orbit periapsis was lowered on orbit 5752. Radio occultation measurements were made on orbits 6369, 6370, 6471, and 6472.

The aerobraking phase of the mission was designed to change the Magellan orbit from eccentric to nearly circular. This was accomplished by dropping periapsis to less than 150 km above the surface and using atmospheric drag to reduce the energy in the orbit. Aerobraking ended on 3 August 1993, and periapsis was boosted above the atmosphere leaving the spacecraft in an orbit that was 540 km above the surface at apoapsis and 197 km above the surface at periapsis. The orbit period was 94 minutes. The spacecraft remained on its medium-gain antenna in this orbit until Cycle 5 began officially on 16 August 1993.

During Cycles 5 and 6 the orbit was low and approximately circular. The emphasis was on collecting high-resolution gravity data. Two bistatic surface scattering experiments were conducted, one on 6 October (orbits 9331, 9335, and 9336) and the second on 9 November (orbits 9846-9848).

Mission Phases

Mission phases were defined for significant spacecraft activity periods. During orbital operations a ’cycle’ was approximately the time required for Venus to rotate once under the spacecraft (about 243 days). But there were orbit adjustments and other activities that made some mapping cycles not strictly contiguous and slightly longer or shorter than the rotation period.

```
PRELAUNCH
---------
  The prelaunch phase extended from delivery of the spacecraft
  to Kennedy Space Center until the start of the launch
  countdown.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1988-09-01
  Mission Phase Stop Time        : 1989-05-04
  Spacecraft Operations Type     : ORBITER


LAUNCH
------
  The launch phase extended from the start of launch countdown
  until completion of the injection into the Earth-Venus
  trajectory.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1989-05-04
  Mission Phase Stop Time        : 1989-05-04
  Spacecraft Operations Type     : ORBITER


CRUISE
------
  The cruise phase extended from injection into the Earth-Venus
  trajectory until 10 days before Venus orbit insertion.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1989-05-04
  Mission Phase Stop Time        : 1990-08-01
  Spacecraft Operations Type     : ORBITER


ORBIT INSERTION
---------------
  The Venus orbit insertion phase extended from 10 days before
  Venus orbit insertion until burnout of the solid rocket
  injection motor.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1990-08-01
  Mission Phase Stop Time        : 1990-08-10
  Spacecraft Operations Type     : ORBITER


ORBIT CHECKOUT
--------------
  The orbit trim and checkout phase extended from burnout of the
  solid rocket injection motor until the beginning of radar
```

```
  mapping.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1990-08-10
  Mission Phase Stop Time        : 1990-09-15
  Spacecraft Operations Type     : ORBITER


MAPPING CYCLE 1
---------------
  The first mapping cycle extended from completion of the orbit
  trim and checkout phase until completion of one cycle of radar
  mapping (approximately 243 days).

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1990-09-15
  Mission Phase Stop Time        : 1991-05-15
  Spacecraft Operations Type     : ORBITER


MAPPING CYCLE 2
---------------
  The second mapping cycle extended from completion of the first
  mapping cycle through an additional cycle of mapping.
  Acquisition of 'right-looking' SAR data was emphasized.  Radio
  occultation measurements were carried out on orbits 3212-3214.
  A period of battery reconditioning followed completion of
  Cycle 2.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1991-05-16
  Mission Phase Stop Time        : 1992-01-17
  Spacecraft Operations Type     : ORBITER


MAPPING CYCLE 3
---------------
  The third mapping cycle extended from completion of battery
  reconditioning through an additional cycle of mapping
  (approximately 243 days).  Acquisition of 'stereo' SAR data
  was emphasized.  The last orbit in the third cycle was orbit
  5747.

  Spacecraft Id                  : MGN
  Target Name                    : VENUS
  Mission Phase Start Time       : 1992-01-24
  Mission Phase Stop Time        : 1992-09-14
  Spacecraft Operations Type     : ORBITER


MAPPING CYCLE 4
---------------
```

The fourth mapping cycle extended from completion of the third mapping cycle through an additional cycle of mapping. Acquisition of radio tracking data for gravity studies was emphasized. Radio occultation measurements were carried out on orbits 6369, 6370, 6471, and 6472. Because of poor observing geometry for gravity data collection at the beginning of the cycle, this cycle was extended 10 days beyond the nominal 243 days. Orbits included within the fourth cycle were 5748 through 7626. Periapsis was lowered on orbit 5752 to improve sensitivity to gravity features in Cycle 4.

```
Spacecraft Id                  : MGN
Target Name                    : VENUS
Mission Phase Start Time       : 1992-09-14
Mission Phase Stop Time        : 1993-05-25
Spacecraft Operations Type     : ORBITER
```

AEROBRAKING

The aerobraking phase extended from completion of the fourth mapping cycle through achievement of a near-circular orbit. Circularization was achieved more quickly than expected; the first gravity data collection in the circular orbit was not scheduled until 11 days later. Orbits included within the aerobraking phase were 7627 through 8392.

```
Spacecraft Id                  : MGN
Target Name                    : VENUS
Mission Phase Start Time       : 1993-05-26
Mission Phase Stop Time        : 1993-08-05
Spacecraft Operations Type     : ORBITER
```

MAPPING CYCLE 5

The fifth mapping cycle extended from completion of the aerobraking phase through an additional cycle of mapping (approximately 243 days). Acquisition of radio tracking data for gravity studies was emphasized. The first orbit in the fifth cycle was orbit 8393.

```
Spacecraft Id                  : MGN
Target Name                    : VENUS
Mission Phase Start Time       : 1993-08-16
Mission Phase Stop Time        : 1994-04-15
Spacecraft Operations Type     : ORBITER
```

MAPPING CYCLE 6

The sixth mapping cycle extended from completion of the fifth mapping cycle through an additional cycle of mapping (approximately 243 days). Acquisition of radio tracking data for gravity studies was emphasized. The first orbit in the

```
    sixth cycle was orbit 12249.

    Spacecraft Id                   : MGN
    Target Name                     : VENUS
    Mission Phase Start Time        : 1994-04-16
    Mission Phase Stop Time         : TBD
    Spacecraft Operations Type      : ORBITER "


MISSION_OBJECTIVES_SUMMARY      = "

  Volcanic and Tectonic Processes
  ===============================
    Magellan images of the Venus surface show widespread evidence
    for volcanic activity.  A major goal of the Magellan mission was
    to provide a detailed global characterization of volcanic
    landforms on Venus and an understanding of the mechanics of
    volcanism in the Venus context.  Of particular interest was the
    role of volcanism in transporting heat through the lithosphere.
    While this goal will largely be accomplished by a careful
    analysis of images of volcanic features and of the geological
    relationships of these features to tectonic and impact
    structures, an essential aspect of characterization will be an
    integration of image data with altimetry and other measurements
    of surface properties.

    Explosive pyroclastic volcanism should not occur in the present
    Venus environment, unless the magma contains amounts of
    volatiles that are large by terrestrial experience.  Thus,
    evidence for extensive pyroclastic deposits would imply the
    presence of large amounts of volatiles or, if the deposits are
    old, may suggest historic changes in atmospheric density.  Such
    ideas can be tested using SAR and altimetry data, combined with
    knowledge of the local geopotential field and may shed light on
    magma dynamics.  Measurements of longitudinal and transverse
    slope, flow margin relief, and flow surface relief also provide
    powerful constraints on flow models, as well as on the
    rheological properties and physical state of the lava.

    A parallel goal was the global characterization of tectonic
    features on Venus and an appreciation of the tectonic evolution
    of the planet.  This goal addressed issues on several scales.
    On the scale of individual tectonic features is the mechanical
    nature of the faulting process, the documentation of geometry
    and sense of fault slip, and the relationship between mechanical
    and thermal properties of the lithosphere.  On a somewhat
    broader scale is linking groups of features to specific
    processes (e.g., uplift, orogeny, gravity sliding, flexure,
    compression or extension of the lithosphere) and testing
    quantitative models for these processes with SAR images and
    supporting topographic, gravitational, and surface compositional
    data.  On a global scale is the question of whether spatially
    coherent, large-scale patterns in tectonic behavior are
    discernible, patterns that might be related to an organized
    system of plates or to mantle convective flow
```

For more information on volcanic and tectonic investigations see papers by [HEADETAL1992] and [SOLOMONETAL1992], respectively.

Impact Processes

The final physical form of an impact crater has meaning only when the effects of the cratering event and any subsequent modification of the crater can be distinguished. To this end, a careful search of the SAR images can identify and characterize both relatively pristine and degraded impact craters, together with their ejecta deposits (in each size range) as well as distinguishing impact craters from those of volcanic origin. The topographic measures of depth-to-diameter ratio, ejecta thickness distribution as a function of distance from the crater, and the relief of central peaks contribute to this documentation.

It is expected that several time-dependent processes influence the change in appearance of craters with increasing crater age, including continued bombardment of the surface, variations in the mechanical properties of the lithosphere (as a result of cooling or loss of near-surface volatiles), horizontal deformation of the lithosphere, possible variations in the mass of the atmosphere, volcanism, and finally, surface erosion and deposition. Distinguishing and understanding these processes constitute important components of the study of crater morphology.

Beyond their intrinsic interest in providing a record of impact and deformational processes, craters provide a tool for the relative dating of surface geological units. Relative ages can be established from a comparison of the variations in the areal density of craters of a given size as well as from a comparison of the maximum extent to which different craters are degraded. Together with superpositional relationships (a lava flow that covers an older fault) and transectional relationships (a graben that cuts through an older volcano), the relative temporal evolution of large areas of the Venus surface can be reconstructed.

For more information on investigations of impact processes see [SCHABERETAL1992].

Erosional, Depositional, and Chemical Processes

The nature of erosional and depositional processes on Venus is poorly known, primarily because the diagnostic landforms typically occur at a scale too small to have been resolved in Earth-based or Venera 15/16 radar images. Magellan images show wind eroded terrains, landforms produced by deposition (dune fields), possible landslides and other down slope movements, as well as aeolian features such as radar bright or dark streaks 'downwind' from prominent topographic anomalies. One measure of weathering, erosion, and deposition is provided by the extent to which soil covers the surface (for Venus, the term soil is used for porous material, as implied by its relatively low value of bulk dielectric constant). The existence of such material, and its dependence on elevation and geologic setting, provide important insights into the interactions that have taken place between the atmosphere and the lithosphere.

Because of the inference drawn from the deuterium-to-hydrogen ratio of the present atmosphere for the past existence of substantial amounts of water on Venus, radar images continue to be searched for evidence of past episodes of fluvial activity (drainage systems) and for lake beds and coastal signatures (strandlines).

The existence of a thick and cloudy atmosphere precludes infrared, visual, ultraviolet, x-ray, or gamma-ray observation of the Venus surface from orbit. Thus it is impossible to obtain information on a global basis about the surface composition or mineralogy using remote-sensing techniques at these wavelengths. Pioneer Venus and Magellan have disclosed that very often the surfaces of elevated regions possess both anomalously high values of normal-incidence radar reflectivity, occasionally exceeding 0.43, and associated low values of radio emissivity, reaching as low as 0.50. In the absence of liquid water, which is known from a variety of evidence not to be present today on Venus, it is necessary to assume a surface composition that would be unusual in terrestrial experience to explain values of dielectric constant implied by these observations. The most acceptable of the current hypotheses requires a significant number of electrically conducting elements in surface materials. If these are iron sulfides, as some chemical evidence suggests, they may possibly be brought to the surface by volcanic activity. The good spatial resolution of the Magellan instrumentation, both in determining the surface reflectivity from the altimetric observations and in measuring the emissivity from radiometric observations, promises to outline the structure of these regions and may shed light on their origin. Results will be applied to testing hypotheses for regional and global buffering of atmospheric composition by reactions with crustal materials.

For more information on erosional, depositional, and chemical processes see papers by [ARVIDSONETAL1992], [GREELEYETAL1992], and [GREELEYETAL1994].

Isostatic and Convective Processes

Topography and gravity are intimately and inextricably related, and must be jointly examined when undertaking geophysical investigations of the interior of a planet, where isostatic and convective processes dominate. Topography provides a surface boundary condition for modeling the interior density of Venus.

```
     Modeling of the interior density using gravity data is, of
     course, nonunique.  Meaningful interpretation rests on
     integrating other data sets and/or incorporating specific
     mechanical models of the interior.  For example, a single
     density interface underlying the known topography can be found
     that exactly matches any observed gravity field.  The interface
     can be at any depth; the greater the depth, the larger the
     density contrast needed.

     The thickness of the elastic lithosphere of Venus, i.e., the
     outer region of the planet that behaves elastically over
     geologically long periods of time, is of special interest.  The
     base of this zone is likely to be defined by a specific isotherm
     whose location depends on the particular temperature-dependent
     flow or creep properties of the material underneath.  If this
     isotherm can be mapped in space and time, then models for the
     thermal evolution of the planet can be developed.

     The key to determining lithospheric thickness variations in
     space and time is through flexure studies.  If a mass load,
     e.g., a shield volcano or a mascon, is placed on the planetary
     surface, then the elastic lithosphere will flex under the load.
     The controlling parameter is the flexural rigidity, which is
     dependent on the elastic constants and lithospheric thickness.

     Crucial to applying estimates of flexural rigidity to the task
     of unraveling the thermal history is an estimate of when the
     load was emplaced.  Thus age determinations derived by various
     geologic techniques are essential to this scheme.

     For more information on topography and gravity see papers by
     [FORD&PETTENGILL1992], [KONOPLIVETAL1993], and
     [MCNAMEEETAL1993].  "

END_OBJECT                       = MISSION_INFORMATION

OBJECT                           = MISSION_HOST
 INSTRUMENT_HOST_ID              = "MGN"

 OBJECT                          = MISSION_TARGET
 TARGET_NAME                     = "VENUS"
 END_OBJECT                      = MISSION_TARGET
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OBJECT                           = MISSION_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                = "ARVIDSON1991"
END_OBJECT                       = MISSION_REFERENCE_INFORMATION

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 REFERENCE_KEY_ID                = "ARVIDSONETAL1992"
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 REFERENCE_KEY_ID                   = "KONOPLIVETAL1993"
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OBJECT                              = MISSION_REFERENCE_INFORMATION
 REFERENCE_KEY_ID                   = "MCNAMEEETAL1993"
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 REFERENCE_KEY_ID                   = "PETTENGILL1988"
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 REFERENCE_KEY_ID                   = "PETTENGILL1991"
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 OBJECT                            = MISSION_REFERENCE_INFORMATION
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  REFERENCE_KEY_ID                 = "PLAUT&ARVIDSON1992"
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  REFERENCE_KEY_ID                 = "SAUNDERSETAL1990"
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  REFERENCE_KEY_ID                 = "TYLER1991"
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  REFERENCE_KEY_ID                 = "TYLER1992"
 END_OBJECT                        = MISSION_REFERENCE_INFORMATION

 OBJECT                            = MISSION_REFERENCE_INFORMATION
  REFERENCE_KEY_ID                 = "VRMPP1983"
 END_OBJECT                        = MISSION_REFERENCE_INFORMATION

END_OBJECT                         = MISSION

END
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B.15. PERSONEL.CAT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                  = PDS3

OBJECT                          = PERSONNEL
 PDS_USER_ID                    = GPETTENGILL

 OBJECT                         = PERSONNEL_INFORMATION
  FULL_NAME                     = "GORDON H. PETTENGILL"
  LAST_NAME                     = PETTENGILL
  TELEPHONE_NUMBER              = "6172534281"
  ALTERNATE_TELEPHONE_NUMBER    = "N/A"
  FAX_NUMBER                    = "6172530861"
  INSTITUTION_NAME              = "MASSACHUSETTS INSTITUTE OF TECHNOLOGY"
  NODE_ID                       = "GEOSCIENCE"
  PDS_AFFILIATION               = "N/A"
  REGISTRATION_DATE             = 1991-02-27
  ADDRESS_TEXT                  = "Massachusetts Institute of Technology
                                   CENTER FOR SPACE RESEARCH
                                   BUILDING 37 ROOM 641
                                   CAMBRIDGE, MA  02139"
 END_OBJECT                     = PERSONNEL_INFORMATION

 OBJECT                         = PERSONNEL_ELECTRONIC_MAIL
  ELECTRONIC_MAIL_ID            = "GHP@SPACE.MIT.EDU"
  ELECTRONIC_MAIL_TYPE          = "INTERNET"
  PREFERENCE_ID                 = 1
 END_OBJECT                     = PERSONNEL_ELECTRONIC_MAIL

END_OBJECT                      = PERSONNEL

OBJECT                          = PERSONNEL
 PDS_USER_ID                    = PFORD

 OBJECT                         = PERSONNEL_INFORMATION
  FULL_NAME                     = "PETER G. FORD"
  LAST_NAME                     = FORD
  TELEPHONE_NUMBER              = "6172536485"
  ALTERNATE_TELEPHONE_NUMBER    = "6172534287"
  FAX_NUMBER                    = "6172530861"
  INSTITUTION_NAME              = "MASSACHUSETTS INSTITUTE OF TECHNOLOGY"
  NODE_ID                       = "GEOSCIENCE"
  PDS_AFFILIATION               = "NODE OPERATIONS MANAGER"
  REGISTRATION_DATE             = 1990-02-06
  ADDRESS_TEXT                  = "Massachusetts Institute of Technology
                                   Center for Space Research
                                   Building 37-601
                                   Cambridge, MA  02139"
 END_OBJECT                     = PERSONNEL_INFORMATION

 OBJECT                         = PERSONNEL_ELECTRONIC_MAIL
  ELECTRONIC_MAIL_ID            = "PGF@SPACE.MIT.EDU"
  ELECTRONIC_MAIL_TYPE          = "INTERNET"
  PREFERENCE_ID                 = 1
```

```
 END_OBJECT                       = PERSONNEL_ELECTRONIC_MAIL

 OBJECT                           = PERSONNEL_ELECTRONIC_MAIL
  ELECTRONIC_MAIL_ID              = "JPLPDS::PFORD"
  ELECTRONIC_MAIL_TYPE            = "NSI/DECNET"
  PREFERENCE_ID                   = 2
 END_OBJECT                       = PERSONNEL_ELECTRONIC_MAIL

END_OBJECT                        = PERSONNEL

END
```

B.16. RDRSINST.CAT Example

```
CCSD3ZF0000100000001NJPL3IF0PDSX00000001

PDS_VERSION_ID                    = PDS3

OBJECT                            = INSTRUMENT
 INSTRUMENT_HOST_ID               = "MGN"
 INSTRUMENT_ID                    = "RDRS"

 OBJECT                           = INSTRUMENT_INFORMATION
  INSTRUMENT_NAME                 = "RADAR SYSTEM"
  INSTRUMENT_TYPE                 = "RADAR"
  INSTRUMENT_DESC                 = "

    Instrument Specifications
    =========================
      The radar was manufactured by Hughes Aircraft Company and the
      'build date' is taken to be 1989-01-01.  The radar dimensions
      were 0.304 by 1.35 by 0.902 (height by length by width in
      meters) and the mass was 126.1 kg.

      Instrument Id                  : RDRS
      Instrument Host Id             : MGN
      Pi Pds User Id                 : GPETTENGILL
      Instrument Name                : RADAR SYSTEM
      Instrument Type                : RADAR
      Build Date                     : 1989-01-01
      Instrument Mass                : 126.100000
      Instrument Length              : 1.350000
      Instrument Width               : 0.902000
      Instrument Height              : 0.304000
      Instrument Manufacturer Name   : HUGHES AIRCRAFT

      For more information on the radar system see the papers by
      [JOHNSON1990] and [SAUNDERSETAL1990].


    Instrument Overview
    ===================
      The Magellan radar system included a 3.7 m diameter high gain
      antenna (HGA) for SAR and radiometry and a smaller fan-beam
      antenna (ALTA) for altimetry.  The system operated at 12.6 cm
      wavelength.  Common electronics were used in SAR, altimetry, and
```

radiometry modes. The SAR operated in a burst mode; altimetry and radiometry observations were interleaved with the SAR bursts.

Between SAR bursts (typically several times a second) groups of altimeter pulses were transmitted from a dedicated fan-beam altimeter antenna directed toward the spacecraft's nadir. The altimeter pulses were identical in waveform and bandwidth to the SAR pulses, resulting in a range accuracy of better than 15 m. The pulse-repetition rate and burst duration differed between the two modes.

Radiometry data were obtained by spending a portion of the time between SAR bursts and after altimeter operation in a passive (receive-only) mode, with the HGA antenna capturing the microwave thermal emission from the planet. Noise power within the 10-MHz receiver bandwidth was detected and accumulated for 50 ms. To reduce the sensitivity to receiver gain changes in this mode, the receiver was connected on alternate bursts first to a comparison dummy load at a known physical temperature and then to the HGA. The short-term temperature resolution was about 2 K; the long-term absolute accuracy after calibration was about 20 K.

Science Objectives

See MISSION_OBJECTIVES_SUMMARY under MISSION.

Operational Considerations

The Magellan radar system was used to acquire radar back-scatter (SAR) images, altimetry, and radiometry when the spacecraft was close to the planet. Nominal operation extended from about 20 minutes before periapsis until about 20 minutes after periapsis. In the SAR mode output from the radar receiver was sampled, blocks of samples were quantized using an adaptive procedure, and the results were stored on tape. In the altimetry mode samples were recorded directly, without quantization. Radiometry measurements were stored in the radar header records. During most of the remainder of each orbit, the HGA was pointed toward Earth and the contents of the tape recorder were transmitted to a station of the DSN at approximately 270 kilobits/second. SAR, altimetry, and radiometry data were then processed using ground software into images, altimetry profiles, estimates of backscatter coefficient, emissivity, and other quantities.

Calibration Description

The radar was calibrated before flight using an active electronic target simulator [CUEVAS1989].

```
Platform Mounting Descriptions
==============================
  The spacecraft +Z axis vector was in the nominal direction of
  the HGA boresight.  The +X axis vector was parallel to the
  nominal rotation axis of the solar panels.  The +Y axis vector
  formed a right-handed coordinate system and was in the nominal
  direction of the star scanner boresight.  The spacecraft
  velocity vector was in approximately the -Y direction when the
  spacecraft was oriented for left-looking SAR operation.  The
  nominal HGA polarization was linear in the y-direction.

  Cone Offset Angle              : 0.00
  Cross Cone Offset Angle        : 0.00
  Twist Offset Angle             : 0.00

  The altimetry antenna boresight was in the x-z plane 25 degrees
  from the +Z direction and 65 degrees from the +X direction.  The
  altimetry antenna was aimed approximately toward nadir during
  nominal radar operation.  The altimetry antenna polarization was
  linear in the y-direction.

  The medium gain antenna boresight was 70 degrees from the +Z
  direction and 20 degrees from the -Y direction.  The low gain
  antenna was mounted on the back of the HGA feed; it’s boresight
  was in the +Z direction and it had a hemispherical radiation
  pattern.


Principal Investigator
======================
  The Principal Investigator for the radar instrument was Gordon
  H. Pettengill.


Instrument Section / Operating Mode Descriptions
================================================
  The Magellan radar system consisted of the following sections,
  each of which operated in the following modes:

  Section      Mode
  ------------------------------------------
  SAR          Synthetic Aperture Radar (SAR)
  ALT          Altimetry
  RAD          Radiometry


  (1) SAR Characteristics
  -----------------------
    In the Synthetic Aperture Radar mode, the radar transmitted
    bursts of phase-modulated pulses through its high gain
    antenna.  Echo signals were captured by the antenna, sampled
    at the receiver output, and stored on tape after being
    quantized to reduce data volume.  Pulse repetition rate and
    incidence angle were chosen to meet a minimum signal-to-noise
    ratio requirement (8 dB) for image pixels after ground
```

```
processing.  Multiple looks were used in processing to reduce
speckle noise.  Incidence angles varied from about 13 degrees
at the pole to about 44 degrees at periapsis during normal
mapping operations (e.g., Cycle 1); but other 'look angle
profiles' were used during the mission.

Peak transmit power                : 350 watts
Transmitted pulse length           : 26.5 microsecs
Pulse repetition frequency         : 4400-5800 per sec
Time bandwidth product             : 60
Inverse baud width                 : 2.26 MHz
Data quantization (I and Q)        : 2 bits each
Recorded data rate                 : 750 kilobits/sec
Polarization (nominal)             : linear horizontal
HGA half-power full beam width     : 2.2 deg (azimuth)
                                   : 2.5 deg (elev)
    one-way gain (from SAR RF port) : 35.7 dBi
System temperature (viewing Venus)  : 1250 K
Surface resolution (range)         : 120-360 m
                   (along track)    : 120-150 m
Number of looks                    : 4 or more
Swath width                        : 25 km (approx)
Antenna look angle                 : 13-47 deg
Incidence angle on surface         : 18-50 deg

Data Path Type                     : RECORDED DATA
                                       PLAYBACK
Instrument Power Consumption       : UNK
```

```
(2) ALT Characteristics
-----------------------
  After SAR bursts (typically several times a second) groups of
  altimeter pulses were transmitted from a dedicated fan beam
  altimeter antenna (ALTA) directed toward the spacecraft's
  nadir.  Output from the radar receiver was sampled, and the
  samples were stored on tape for transmission to Earth.  During
  nominal left-looking SAR operation the ALTA pointed
  approximately 20 deg to the left of the spacecraft ground
  track at periapsis and about 10 deg to the right of the ground
  track near the north and south pole.

  Data quantization (I and Q)          : 4 bits each
  Recorded data rate                   : 35 kbs
  Polarization                         : linear
  ALTA half-power full beamwidth
                         (along track): 11 deg
                         (cross track): 31 deg
       one-way gain referenced to
                          ALT RF port : 18.9 dBi
  ALTA offset from HGA                 : 25 deg
  Burst interval                       : 0.5-1.0 sec
        duration                       : 1.0 millisec
  Dynamic range                        : 30 dB (or more)
```

```
        Data Path Type                       : RECORDED DATA
                                                PLAYBACK
        Instrument Power Consumption         : UNK


      (3) RAD Characteristics
      -----------------------
        Radiometry measurements were made by the radar receiver and
        HGA in a receive-only mode that was activated after the
        altimetry mode to record the level of microwave radiothermal
        emission from the planet.  Noise power within the 10-MHz
        receiver bandwidth was detected and accumulated for 50 ms.  To
        reduce the sensitivity to receiver gain changes in this mode,
        the receiver was connected on alternate bursts first to a
        comparison dummy load at a known physical temperature and then
        to the HGA.  The short-term temperature resolution was about 2
        K; the long-term absolute accuracy after calibration was about
        20 K.  At several times during the mission, radiometry
        measurements were carried out using known cosmic radio
        sources.

        Receiver Bandwidth                   : 10 MHz
        Integration Time                     : 50 millisecs
        Polarization (nominal)               : linear horizontal
        Data Quantization                    : 12 bits
        Data Rate                            : 10-48 bits/sec
        HGA half-power full beam width       : 2.2 deg
        System temperature (viewing Venus)   : 1250 K
        Antenna look angle                   : 13-47 deg
        Incidence angle on surface           : 18-50 deg
        Surface resolution (along track)     : 15-120 km
                           (cross track)     : 20-125 km

        Data Path Type                 : RECORDED DATA PLAYBACK
        Instrument Power Consumption   : UNK "

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B.17. REFS.CAT Example

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 REFERENCE_KEY_ID               = "ARVIDSON1991"
 REFERENCE_DESC                 = "Arvidson, R. E., V.R. Baker,
  C. Elachi, R.S. Saunders, J.A. Wood, Magellan: Initial Analysis
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END_OBJECT                      = REFERENCE

OBJECT                          = REFERENCE
 REFERENCE_KEY_ID               = "ARVIDSONETAL1992"
 REFERENCE_DESC                 = "Arvidson, R. E., R. Greeley,
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END_OBJECT                      = REFERENCE

OBJECT                          = REFERENCE
 REFERENCE_KEY_ID               = "ASMAR&HERRERA1993"
 REFERENCE_DESC                 = "Asmar, S.W., and R.G.
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OBJECT                          = REFERENCE
 REFERENCE_KEY_ID               = "ASMAR&RENZETTI"
 REFERENCE_DESC                 = "Asmar, S.W., and N.A.
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OBJECT                          = REFERENCE
 REFERENCE_KEY_ID               = "BARRY1987"
 REFERENCE_DESC                 = "Barry, S., Magellan Mission
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 REFERENCE_KEY_ID               = "BRILL&MEISL1990"
 REFERENCE_DESC                 = "Brill, R., C. and Meisl,
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OBJECT                          = REFERENCE
 REFERENCE_KEY_ID               = "CAMPBELLETAL1992"
 REFERENCE_DESC                 = "Campbell, D. B., N.J.S.
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END_OBJECT                        = REFERENCE

OBJECT                            = REFERENCE
 REFERENCE_KEY_ID                 = "CAMPBELLETAL1992B"
 REFERENCE_DESC                   = "Campbell, B. A., and D.B.
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END_OBJECT                        = REFERENCE

OBJECT                            = REFERENCE
 REFERENCE_KEY_ID                 = "CUEVAS1989"
 REFERENCE_DESC                   = "Cuevas, C., Magellan Radar
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OBJECT                            = REFERENCE
 REFERENCE_KEY_ID                 = "DAVIESETAL1989"
 REFERENCE_DESC                   = "Davies, M.E., V.K. Abalakin,
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 REFERENCE_KEY_ID                 = "DAVIESETAL1992"
 REFERENCE_DESC                   = "Davies, M.E., T.R. Colvin,
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 REFERENCE_KEY_ID                 = "FORD1992"
 REFERENCE_DESC                   = "Ford, P. G., Magellan
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 REFERENCE_KEY_ID                 = "FORD1993"
 REFERENCE_DESC                   = "Ford, P. G., Magellan Global
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 REFERENCE_KEY_ID                 = "FORD&PETTENGILL1992"
 REFERENCE_DESC                   = "Ford, P. G., and G.H.
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 REFERENCE_KEY_ID                 = "GEO-10REVD"
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 REFERENCE_DESC                   = "Greeley, R., R.E. Arvidson,
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 REFERENCE_KEY_ID                 = "GREELEYETAL1994"
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OBJECT                            = REFERENCE
 REFERENCE_KEY_ID                 = "HAGFORS1964"
 REFERENCE_DESC                   = "Hagfors, T., Backscattering
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 REFERENCE_KEY_ID                 = "HEAD1991"
 REFERENCE_DESC                   = "Head, J. W., D.B. Campbell,
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 REFERENCE_KEY_ID                 = "HEADETAL1992"
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 REFERENCE_KEY_ID                 = "JGRMGN1992"
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 REFERENCE_KEY_ID                 = "JOHNSON1990"
 REFERENCE_DESC                   = "W.T.K. Johnson, Magellan
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 REFERENCE_KEY_ID                 = "KONOPLIVETAL1993"
 REFERENCE_DESC                   = "Konopliv, A.S., N.J.
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 REFERENCE_KEY_ID                 = "LYONS1988"
 REFERENCE_DESC                   = "Lyons, D.T., Magellan
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 REFERENCE_KEY_ID                 = "MCNAMEEETAL1993"
 REFERENCE_DESC                   = "McNamee, J.B., N.J.
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 REFERENCE_KEY_ID                 = "MOYER1971"
 REFERENCE_DESC                   = "Moyer, T.D. Mathematical
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 REFERENCE_KEY_ID                 = "MOYER1987"
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 REFERENCE_KEY_ID                  = "PDSSR1992"
 REFERENCE_DESC                    = "Planetary Data System
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END_OBJECT                         = REFERENCE

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 REFERENCE_KEY_ID                  = "PETTENGILL1988"
 REFERENCE_DESC                    = "Pettengill, G. H., Magellan
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 REFERENCE_KEY_ID                  = "PETTENGILL1991"
 REFERENCE_DESC                    = "Pettengill, G. H., P.G.
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 REFERENCE_KEY_ID                  = "PETTENGILLETAL1992"
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OBJECT                             = REFERENCE
 REFERENCE_KEY_ID                  = "PHILLIPS1991"
 REFERENCE_DESC                    = "Phillips, R. J., R.E.
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OBJECT                             = REFERENCE
 REFERENCE_KEY_ID                  = "PLAUT&ARVIDSON1992"
 REFERENCE_DESC                    = "Plaut, J. J., and R.E.
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END_OBJECT                         = REFERENCE

OBJECT                             = REFERENCE
 REFERENCE_KEY_ID                  = "SAUNDERSETAL1990"
 REFERENCE_DESC                    = "Saunders, R.S., G.H.
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 REFERENCE_KEY_ID                  = "SAUNDERS1991A"
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END_OBJECT                        = REFERENCE

OBJECT                            = REFERENCE
 REFERENCE_KEY_ID                 = "SAUNDERS1991B"
 REFERENCE_DESC                   = "Saunders, R. S., G.H.
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END_OBJECT                        = REFERENCE

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 REFERENCE_KEY_ID                 = "SAUNDERSETAL1992"
 REFERENCE_DESC                   = "Saunders, R. S., A.J. Spear,
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END_OBJECT                        = REFERENCE

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 REFERENCE_KEY_ID                 = "SCHABERETAL1992"
 REFERENCE_DESC                   = "Schaber, G.G., R.G. Strom,
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END_OBJECT                        = REFERENCE

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 REFERENCE_KEY_ID                 = "SCIEDR"
 REFERENCE_DESC                   = "Project Magellan Software
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 REFERENCE_KEY_ID                 = "SDPS101"
 REFERENCE_DESC                   = "Project Magellan Software
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 REFERENCE_KEY_ID                 = "SE011"
 REFERENCE_DESC                   = "Magellan Project Radar
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 REFERENCE_KEY_ID                 = "SJOGRENETAL1983"
 REFERENCE_DESC                   = "Sjogren, W.L., B.G. Bills,
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 REFERENCE_KEY_ID                 = "SNYDER1987"
 REFERENCE_DESC                   = "Snyder, John P., Map
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 REFERENCE_KEY_ID                 = "SOLOMON1991A"
 REFERENCE_DESC                   = "Solomon, S. C., J.W. Head,
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 REFERENCE_KEY_ID                 = "TYLER1991"
 REFERENCE_DESC                   = "Tyler, G. L., P.G. Ford,
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 REFERENCE_KEY_ID               = "TYLERETAL92"
 REFERENCE_DESC                 = "Tyler, G. L., G. Balmino,
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 REFERENCE_DESC                 = "Tyler, G. L., R.A. Simpson,
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