Mars Global Surveyor

Mars Orbiter Laser Altimeter

MOLA STANDARD PRODUCT
ARCHIVE VOLUME
SOFTWARE INTERFACE SPECIFICATION

(MOLA Archive Volume SIS)

Version 4.2

rev. February 23, 1999

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1. Preface

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1.1. Distribution List

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1.2. Document Change Log

Change	Date	Affected Portions
Original outline	7/31/92	All
Updates to reflect PDS Standards	12/1/92	File names: CUMINDEX.*, *.ASC for SISs, Vol.Set ID
Updates to include Washington U. generation of write-once CDs (CD-WOs)	12/7/92	TBD item list, Scope, Interface, Media format and contents, Appendix A, Figure 1.
Updates to include reviewers' comments, new values for data volumes, W.U. separation of gridded products	2/1/93	All
Updates to reflect production of two volume sets, one for raw data and one for derived data	8/9/93	All
Revised for Mars Global Surveyor in place of Mars Observer	8/24/94	All
Revised to reflect new MGS MOLA products	10/24/97	All
Revised with minor corrections	8/6/98	All
Revised sections 4.7 and 5.2.4 regarding software on archive volumes; removed discussion of calibration directory; removed appendices showing directory structure (redundant with section 4); other minor corrections	10/29/98	4.4, 4.7, 5.2.4; appendices A.1 and A.2
Added description of BROWSE directory; changed description of SOFTWARE directory to replace PDCODE with PEDR2TAB; added a few missing files to directory contents listings	2/23/99	2.1, 4.8, 5.2.4, 4.8, 5.2.6.4

1.3. TBD Items

None.

1.4. Acronyms and Abbreviations

AEDR	Aggregated Experiment Data Record
ASCII	American Standard Code for Information Interchange
CD-ROM	Compact Disk - Read-Only Memory
CD-WO	Write-Once Compact Disk
ISO	International Standards Organization
JPL	Jet Propulsion Laboratory
Mb	Megabytes
MGS	Mars Global Surveyor
MOLA	Mars Orbiter Laser Altimeter
NSSDC	National Space Science Data Center
PDB	Project Database
PDS	Planetary Data System
PEDR	Precision Experiment Data Record
PSG	Project Science Group
SDVT	Science Data Validation Team
SFDU	Standard Formatted Data Unit
SIS	Software Interface Specification
TBD	To Be Determined

1.5. Glossary

Archive – An archive consists of one or more data sets along with all the documentation and ancillary information needed to understand and use the data. An archive is a logical construct independent of the medium on which it is stored.

Archive Volume, Archive Volume Set – A volume is a unit of media on which data products are stored; for example, one CD-ROM. An *archive volume* is a volume containing all or part of an archive; that is, data products plus documentation and ancillary files. When an archive spans multiple volumes, they are called an *archive volume set*. Usually the documentation and some ancillary files are repeated on each volume of the set, so that a single volume can be used alone.

Catalog Information – High-level descriptive information about a data set (e.g. mission description, spacecraft description, instrument description), expressed in Object Description Language (ODL) which is suitable for loading into a PDS catalog.

Data Product – A labeled grouping of data resulting from a scientific observation, usually stored in one file. A product label identifies, describes, and defines the structure of the data. An example of a data product is a planetary image, a spectrum table, or a time series table.

Data Set – An accumulation of data products. A data set together with supporting documentation and ancillary files is an archive.

Standard Data Product – A data product generated in a predefined way using well-understood procedures, processed in "pipeline" fashion. Data products that are generated in a nonstandard way are sometimes called *special data products*.

2. Introduction

2.1. Content Overview

The Mars Orbiter Laser Altimeter, MOLA, is an instrument on the Mars Global Surveyor (MGS) orbiter. Standard data products generated by the MOLA instrument are listed in Table 1.

Table 1 – Standard Data Products in MOLA Archive Collection

Acronym	Standard Data Product
MOLA-AEDR	Aggregate Experiment Data Record
MOLA-PEDR	Precision Experiment Data Record
MOLA-IEGDR	Initial Experiment Gridded Data Record
MOLA-MEGDR	Mission Experiment Gridded Data Record

Each MOLA-AEDR product is an aggregation of MOLA telemetry packets for a single orbit (i.e., the raw data). Each MOLA-PEDR product contains one orbit's worth of telemetry data that has been converted to engineering and physical units using precision orbit data. The MOLA-IEGDR and MOLA-MEGDR products, together known as the gridded products, are sets of global images at two different resolutions created by binning the MOLA-PEDR products. The MOLA standard data products are generated by the MOLA Instrument Team and archived by the Planetary Data System (PDS). The PDS Geosciences Node is responsible for compiling the MOLA archive volumes on CD-ROM media.

This Software Interface Specification (SIS) describes the format, content, and generation of the MOLA Standard Product Archive Volumes. Section 3, Archive Volume Generation, describes the procedure for transferring data products to archive media. Section 4, Archive Volume Contents, describes the structure of the archive volumes and the contents of each file. Section 5, Archive Volume Format, describes the file formats used on the archive volumes. Finally, Section 6, Support Staff and Cognizant Persons, lists the individuals responsible for generating the archive volumes.

2.2. Scope

The specifications in this document apply to all MOLA standard product archive volumes that are produced on compact disk media during the Mapping Phase of the Mars Global Surveyor mission. Most of the specifications in this document also apply to MOLA archive volumes containing data acquired during the Orbit Insertion Phase of the mission, prior to the Mapping Phase. The chief difference between the Orbit Insertion Phase and Mapping Phase volumes is that AEDRs and PEDRs are archived together on Orbit Insertion Phase volumes, while during the Mapping Phase they are archived on separate volumes.

2.3. Applicable Documents

ISO 9660-1988, Information Processing - Volume and File Structure of CD-ROM for Information Exchange, April 15, 1988.

Arvidson, R., E. Guinness, and S. Slavney, Mars Global Surveyor Project Archive Generation, Validation, and Transfer Plan, MGS Document #542-312, 1998.

Mars Global Surveyor MOLA (Mars Orbiter Laser Altimeter) Aggregated Experiment Data Record Software Interface Specification (MOLA AEDR SIS), September 24, 1998, Version 2.1, NASA Goddard Space Flight Center.

Mars Global Surveyor MOLA (Mars Orbiter Laser Altimeter) Any-Experiment Gridded Data Record Software Interface Specification (MOLA ?EGDR SIS), March 31, 1997, Version 1.0, NASA Goddard Space Flight Center.

Mars Global Surveyor MOLA (Mars Orbiter Laser Altimeter) Precision Experiment Data Record Software Interface Specification (MOLA PEDR SIS), December 12, 1998, Version 2.7, NASA Goddard Space Flight Center.

Planetary Science Data Dictionary Document, July 15, 1996, Planetary Data System, JPL D-7116, Rev. D.

Planetary Data System Data Preparation Workbook, February 1995, Version 3.1, JPL D-7669, Part 1.

Planetary Data System Standards Reference, July, 1995, Version 3.2. JPL D-7669, Part 2.

2.4. Audience

This specification is useful to those who wish to understand the format and content of the MOLA Standard Product Archive Collection. Typically, these individuals would be software engineers, data analysts, or planetary scientists.

3. Archive Volume Generation

3.1. Data Transfer and Validation Methods

The MOLA Standard Product Archive Collection is produced by the PDS Geosciences Node at Washington University, in conjunction with the MOLA Instrument Team. The Washington University activities is funded by the Mars Global Surveyor Project.

The Archive Collection includes data acquired during the Orbit Insertion and Mapping Phases of the MGS mission. The archive validation procedure described in this section applies to volumes generated during the Mapping Phase of the mission. The few volumes produced with Orbit Insertion data, before mapping begins, are validated using PDS peer review procedures.

During the Mapping Phase of the MGS mission, two archive volume sets of MOLA data are produced: one contains the MOLA-AEDR products, and the other contains the MOLA-PEDR and gridded products. (see Figure 1, Generation of MOLA Standard Product Archive Volumes). Upon notification by the MOLA Team, the Geosciences Node extracts standard products by electronic file transfer from the MOLA Team's processing facility and generates associated

documentation and ancillary products (e.g. index tables). Each volume of standard products, documentation and ancillary products is stored on a write-once CD-ROM (CD-WO) generated at Washington University. All data formats are based on the Planetary Data System standards as documented in the PDS Standards Reference [section 2.3, Applicable Documents].

Four copies of each volume are produced. Two are sent to the MOLA Team and the SDVT for review, along with a Manifest that lists the contents of the volume in detail, and an Error Report Log that describes any known deviations from the Manifest or other anomalies. A third copy remains at Washington University for backup. Upon approval of a volume from the MOLA Team and the SDVT, the volume is considered officially released to the PDS as defined by the Mars Global Surveyor data release policy [Arvidson et al., 1998]. The Geosciences Node then sends the fourth copy of the volume to a CD-ROM vendor for replication.

The Geosciences Node provides the vendor with a mailing list for distribution of copies. The list includes MGS personnel who have expressed interest in receiving the data, the Planetary Data System, and the National Space Science Data Center (NSSDC). The PDS requests enough copies to serve its anticipated user needs, and funds those copies. The PDS is responsible for making additional future copies as needed.

In the event that a volume is found to contain errors, the reviewers can recommend one of two courses of action: (1) if the errors are minor, the volume may be published anyway, with an explanatory note added to the volume's errata file and the errors corrected on subsequent volumes; (2) if the errors are major, the volume must be re-generated to correct them.

3.2. Data Product Sizes and Delivery Rates

Table 2 summarizes sizes and delivery rates for the MOLA Standard Products.

Table 2 – MOLA Standard Product Sizes and Delivery Rates

Product	Product Size	Production Rate (approximate)	Days to Fill One 650-Mbyte Volume	Volumes for 687-Day Primary Mission
AEDR	1.50 Mb	12 products per day 8 Mb per day	81.25	9
PEDR	0.38 Mb	13 products per day 34 Mb per day	19.12	36
IEGDR	0.50 Mb	1 product after the first 30 days of mapping	N/A	<1*
MEGDR	12.00 Mb	1 product after completion of the Primary Mission	N/A	<1*
*Since the gridded products are relatively small, they are not placed on separate volumes, but instead are included on the PEDR archive volumes.				

Each MOLA Standard Product Archive Volume contains at most 650 Mbytes of data, including documentation and ancillary files, based on the storage capacity of CD-ROMs readable by most CD-ROM drives.

The Archive Volumes are produced as enough data are accumulated to fill each disk. The MOLA-AEDRs are accumulated at the rate of about 56 Mb per week, so CD-WO volumes containing these data are produced about every 11 weeks. The MOLA-PEDRs are accumulated at the rate of about 238 Mb per week, resulting in a new volume every 2 to 3 weeks. The MOLA IEGDR consists of a single product generated after the first 30 days of mapping, and the MOLA MEGDR is a single product generated after the primary mission is completed. As they become available, these products are included on PEDR volumes, as their small size does not justify placing them on separate volumes.

The MOLA Team expects to issue revised versions of PEDR products as more precise orbit information is obtained in the course of the mission. The plan is for three revisions of the orbit information, although the number of versions of an individual PEDR product may vary.

3.3. Interface Media Characteristics

All volumes in the MOLA Standard Product Archive Collection conform to ISO 9660 standards [ISO 9660, 1988].

3.4. Backup and Duplicates

Washington University keeps a backup copy of each CD-WO volume. The backup copy can be used if the CD-WO sent to the vendor becomes lost or damaged. The two CD-WO volumes sent to the MOLA Team and the SDVT for review do not need to be returned to Washington University.

3.5. Labeling and Identification

Each MOLA CD-WO bears a volume ID using the last two components of the volume set ID [PDS Standards Reference, 1995]. For archive volumes containing data acquired during the Mapping Phase, the AEDR volume set ID is **USA_NASA_JPL_MGSL_1nnn**, and the PEDR/gridded product volume set ID is **USA_NASA_JPL_MGSL_2nnn**, where nnn is the sequence number of the individual volume. Hence the first AEDR volume has the volume ID **MGSL_1001**, and the first PEDR and gridded products volume has the volume ID **MGSL_2001**. For archive volumes containing pre-Mapping Phase data, AEDR and PEDR products will be combined on the same volume. The volume set ID is **USA_NASA_JPL_MGSL_0nnn**.

4. Archive Volume Contents

This section describes the contents of the MOLA Standard Product Archive Collection volumes, including the file names, file contents, file types, and organization responsible for providing the files. The complete directory structure is shown in Appendix A. All the ancillary files described herein appear on both the AEDR volumes and the PEDR / gridded products volumes, except where noted. See the MOLA Data Product SIS documents [MOLA AEDR SIS, 1998; MOLA Any-EGDR SIS, 1997; MOLA PEDR SIS, 1998] for examples of PDS labels for each type of product.

4.1. Root Directory Contents

The following files are contained in the Root Directory, and are produced by the Geosciences Node at Washington University:

File Name	File Contents	File Provided By
AAREADME.TXT	Volume content and format information	Geosciences Node
AAREADME.HTM	Hypertext version of AAREADME.TXT	Geosciences Node
AAREADME.LBL	A PDS detached label that describes both AAREADME.TXT and AAREADME.HTM.	Geosciences Node
ERRATA.TXT	A cumulative listing of comments and updates concerning all MOLA Standard Products Data Products on all MOLA compact disk volumes published so far	Geosciences Node
VOLDESC.CAT	A description of the contents of this volume in a PDS format readable by both humans and computers	Geosciences Node

4.2. Index Directory Contents

The following files are contained in the Index Directory and are produced by the Geosciences Node.

File Name	File Contents	File Provided By
INDXINFO.TXT	A description of the contents of this directory	Geosciences Node
AEDCMIDX.TAB	A table listing all MOLA-AEDR products published so far in this volume set, including the data on this volume (AEDR volumes only)	Geosciences Node
AEDCMIDX.LBL	A PDS detached label that describes AEDCMIDX.TAB (AEDR volumes only)	Geosciences Node
AEDINDEX.TAB	A table listing all MOLA-AEDR products on this volume (AEDR volumes only)	Geosciences Node
AEDINDEX.LBL	A PDS detached label that describes AEDINDEX.TAB (AEDR volumes only)	Geosciences Node
EGDCMIDX.TAB	A table listing all MOLA EGDR products published so far in this volume set, including the data on this volume (PEDR/EGDR volumes only)	Geosciences Node
EGDCMIDX.LBL	A PDS detached label that describes EGDCMIDX.TAB (PEDR/EGDR volumes only)	Geosciences Node
EGDINDEX.TAB	A table listing all MOLA EGDR products on this volume (PEDR/EGDR volumes only)	Geosciences Node
EGDINDEX.LBL	A PDS detached label that describes EGDINDEX.TAB (PEDR/EGDR volumes only)	Geosciences Node
PEDCMIDX.TAB	A table listing all MOLA-PEDR products published so far in this volume set, including the data on this volume (PEDR/EGDR volumes only)	Geosciences Node

PEDCMIDX.LBL	A PDS detached label that describes PEDCMIDX.TAB (PEDR/EGDR volumes only)	Geosciences Node
PEDINDEX.TAB	A table listing all MOLA-PEDR products on this volume (PEDR/EGDR volumes only)	Geosciences Node
PEDINDEX.LBL	A PDS detached label that describes PEDINDEX.TAB (PEDR/EGDR volumes only)	Geosciences Node

4.3. Document Directory Contents

The following files are contained in the Document Directory and are produced or collected by the MOLA team.

File Name	File Contents	File Provided By
DOCINFO.TXT	A description of the contents of this directory	Geosciences Node
AEDRSIS.CSS	HTML style sheet used in AEDRSIS.HTM	MOLA Team
AEDRSIS.HTM	The AEDR SIS as hypertext (on AEDR volumes only)	MOLA Team
AEDRSIS.PDF	The AEDR SIS as a PDF file readable with Adobe Acrobat Reader software	MOLA Team
AEDRSIS.LBL	A PDS detached label that describes both AEDRSIS.HTM and AEDRSIS.PDF.	Geosciences Node
ARCHSIS.HTM	The Archive Volume SIS (this document) as hypertext	Geosciences Node
ARCHSIS.PDF	The Archive Volume SIS (this document) as a PDF file readable with Adobe Acrobat Reader software	Geosciences Node
ARCHSIS.LBL	A PDS detached label that describes both ARCHSIS.HTM and ARCHSIS.PDF.	Geosciences Node
MOLALOGO.GIF	MOLA logo image used in AEDRSIS.HTM and PEDRSIS.HTM	MOLA Team
PEDRSIS.CSS	HTML style sheet used in PEDRSIS.HTM	MOLA Team
PEDRSIS.HTM	The PEDR SIS as hypertext (on PEDR/EGDR volumes only)	MOLA Team
PEDRSIS.PDF	The PEDR SIS as a PDF file readable with Adobe Acrobat Reader software	MOLA Team
PEDRSIS.LBL	A PDS detached label that describes both PEDRSIS.HTM and PEDRSIS.PDF.	Geosciences Node
EGDRSIS.CSS	HTML style sheet used in EGDRSIS.HTM	MOLA Team
EGDRSIS.HTM	The EGDR SIS as hypertext (on PEDR/EGDR volumes only)	MOLA Team
EGDRSIS.PDF	The EGDR SIS as a PDF file readable with Adobe Acrobat Reader software	MOLA Team
EGDRSIS.LBL	A PDS detached label that describes both EGDRSIS.HTM and EGDRSIS.PDF.	Geosciences Node

4.4. Label Directory Contents

The following files are contained in the Label Directory and are produced by the MOLA team.

File Name	File Contents	File Provided By
LABINFO.TXT	A description of the contents of this directory	MOLA Team
MOLASCI.FMT	The format file that describes the science-mode record format of the AEDR product (AEDR volumes only)	MOLA Team
MOLASCFR.FMT, MOLASCCT.FMT	Additional format files referenced by MOLASCI.FMT (AEDR volumes only)	MOLA Team
MOLAMNT.FMT	The format file that describes the maintenance-mode record format of the AEDR product (AEDR volumes only)	MOLA Team
PEDRSEC1.FMT	The format file that describes the first 500 bytes of a PEDR record (PEDR/EGDR volumes only)	MOLA Team
PEDRENG1.FMT, PEDRENG2.FMT, PEDRENG3.FMT, PEDRENG4.FMT, PEDRENG5.FMT, PEDRENG6.FMT, PEDRENG7.FMT	The format files that describe the 28 bytes of engineering information in a PEDR (bytes 501-528). There are seven different types of record structures, one for each frame. (PEDR/EGDR volumes only)	MOLA Team
PEDRSEC3.FMT	The format file that describes bytes 529 through the end of a PEDR record (PEDR/EGDR volumes only)	MOLA Team

4.5. Catalog Directory Contents

The files in the Catalog directory provide a top-level understanding of the Mars Global Surveyor Mission, spacecraft, instruments, and data sets in the form of completed PDS templates. The files are produced or collected by the MOLA team. The files in this directory are coordinated with the PDS data engineer.

File Name	File Contents	File Provided By
CATINFO.TXT	A description of the contents of this directory	Geosciences Node
AEDRDS.CAT	PDS data set catalog information about MOLA AEDRs	MOLA Team
PEDRDS.CAT	PDS data set catalog information about MOLA PEDRs	MOLA Team
EGDRDS.CAT	PDS data set catalog information about MOLA EGDRs	MOLA Team
INSTHOST.CAT	PDS instrument host catalog information about the MGS spacecraft	Geosciences Node
INST.CAT	PDS instrument catalog information about the MOLA instrument	MOLA Team
MISSION.CAT	PDS mission catalog information about the MGS mission	Geosciences Node
PERSON.CAT	PDS personnel catalog information about MOLA Team members responsible for generating data products	Geosciences Node
REF.CAT	References mentioned in other *.CAT files	Geosciences Node

4.6. Software Directory Contents

Two programs are provided on the PEDR/EGDR volumes for accessing PEDR data. They are:

MPROF	Script for use with the commercial image processing software IDL to plot elevation profiles from PEDR data. For Sun/UNIX and PC computers that have IDL installed. Written by C. David Brown, Washington University.
PEDR2TAB	Fortran program that generates ASCII tables from PEDR files. For Sun/UNIX and PC computers. Written by Gregory Neumann, NASA/Goddard Space Flight Center.

These programs are also available from the PDS Geosciences Node web site, *http://wwwpds.wustl.edu*, and from the MOLA Team web site, *http://ltpwww.gsfc.nasa.gov /tharsis/mola.html*. They are subject to change during the course of the mission. The MOLA site may include variants of the software for computer platforms other than those listed here. Updates to the software, as well as additional programs, are posted on the web sites as they become available. The archive volumes contain the latest version of programs available at the time the volume is generated.

The Software Directory is divided into subdirectories for each program, and then further divided by computer platform. The Software Directory appears only on PEDR/EGDR volumes, not on AEDR volumes.

File Name	File Contents	File Provided By
SOFTINFO.TXT	A description of the contents of this directory	MOLA Team / Geosciences Node
MPROF	Subdirectory containing IDL scripts	
PC	Subdirectory containing files for PC platforms	
MPRFINFO.TXT	Instructions for using MPROF	Geosciences Node
MPROF.PRO	PC version of IDL script to plot elevation profiles	Geosciences Node
SUN	Subdirectory containing files for Sun/UNIX platforms	
MPRFINFO.TXT	Instructions for using MPROF	Geosciences Node
MPROF.PRO	Sun/UNIX version of IDL script to plot elevation profiles	Geosciences Node
PEDR2TAB	Subdirectory containing PEDR2TAB program files	
P2TINFO.TXT	A description of the contents of the PEDR2TAB directory	MOLA Team / Geosciences Node
PC	Subdirectory containing files for PC platforms	
MOLA.LBL	Example of PDS label for PEDR2TAB output file	MOLA Team
P2TINFO.TXT	Instructions for using PEDR2TAB	MOLA Team / Geosciences Node
PEDR2TAB.EXE	Executable file compiled for Solaris 2.4	MOLA Team / Geosciences Node
PEDR2TAB.F	Fortran 77 source code for Sun/UNIX platforms	MOLA Team
PEDR2TAB.PRM	Preferences file to be edited by user	MOLA Team

SUN	Subdirectory containing files for Sun/UNIX platforms	
MOLA.LBL	Example of PDS label for PEDR2TAB output file	MOLA Team
P2TINFO.TXT	Instructions for using PEDR2TAB	MOLA Team / Geosciences Node
PEDR2TAB.EXE	Executable file compiled for MS-DOS/Windows	MOLA Team / Geosciences Node
PEDR2TAB.F	Fortran 77 source code for PC platforms	MOLA Team
PEDR2TAB.PRM	Preferences file to be edited by user	MOLA Team

4.7. Standard Products Data Directory Contents

The Standard Products data directories contain the actual data products produced by the MOLA team.

Two volume sets are produced during the Mapping Phase of the mission, one containing raw data (AEDRs) and one containing derived data (PEDRs and the gridded products, IEGDRs and MEGDRs). The contents of data directories on these two volume sets are described below. Volumes containing Orbit Insertion Phase data will have the same contents as Mapping Phase volumes, the only difference being that AEDR and PEDR products are combined on the same volume.

4.7.1. AEDR Data Directory Contents and Naming

The AEDR Data Products are aggregations of MOLA telemetry packets. Each file contains one orbit's worth of data, with one telemetry packet per record. The maximum number of packets in one orbit is approximately 486 [MOLA PEDR SIS, 1998]. Files are named according to the form **AAnnnnnv.B**, where the first A stands for Altimeter, the second A stands for the product type, AEDR, nnnnn is the orbit number, and v indicates the version. For example, the file AA00219F.B contains AEDR data from orbit 219, version F.

The AEDR Data Products are contained in the AEDR directory, organized into subdirectories by groups of orbits. These subdirectory names are of the form **AAnnnXX** where nnnXX is the number of the first orbit in the directory. For example, the subdirectory AA001XX is the subdirectory of AEDR products covering orbits 100 through 199.

4.7.2. PEDR Data Directory Contents and Naming

The PEDR Data Products contain corrected along-track, time series range and planetary radius data in engineering and physical units, created from the raw telemetry data (AEDRs) using precision orbit information. The products also contain engineering and housekeeping data from the telemetry packets, as well as data correction values that were used to process the telemetry data into the PEDR data. Each record covers a two-second time span, called a frame, that is retrieved from the 14-second AEDR telemetry packet. Hence for every AEDR record, seven PEDR records will be generated. Since the maximum number of packets in an orbit is approximately 486, the maximum number of records in a PEDR file is approximately 3402 [MOLA PEDR SIS, 1998]. The names of PEDR files follow the format Apnnnnnv.B, where A is for Altimeter, P is for PEDR, nnnnn is the orbit number, and v is the version. For example, the file AP00125K.B contains the PEDR product from orbit 125, version K.

The PEDR Data Products are contained in the PEDR directory, organized into subdirectories by groups of orbits. These subdirectory names are of the form **APnnnXX** where nnnXX is the number of the first orbit in the directory. For example, the subdirectory AP001XX is the subdirectory of PEDRs covering orbits 100 through 199.

4.7.3. Gridded Product Data Directory Contents and Naming

The gridded products (IEGDR and MEGDR) are created by binning data from the PEDR Data Products into maps covering the entire planet. Each gridded product consists of 16 separate images representing different data parameters (e.g. mean planetary radius, planetary radius standard deviation, surface reflectance). An IEGDR image has a resolution of 5 degrees per pixel, giving an image 36 lines by 72 samples. A MEGDR image has a resolution of 0.5 degrees per pixel, giving an image 360 lines by 720 samples. [MOLA Any-EGDR SIS, 1997]. The images have detached PDS labels.

The gridded products are located in the data directory called EGDR. A product consists of 16 image files and 16 detached label files (see section 5.2.6.3, Gridded Data Product Format). The names of data files follow the format Axpyyzzv.IMG, where A is for Altimeter, x is either I for IEGDR or M for MEGDR, p is a letter between A and P to represent images 1 through 16, yy and zz are the starting and ending mapping cycle numbers represented by the product, and v is a version letter. For example, data file AIB01201.IMG contains image 2 of the IEGDR product from mapping cycles 01 through 20, version 1. Detached label files carry the same names as their corresponding data files with an extension .LBL; for example, data file AIB01201.IMG has a detached label in the file AIB01201.LBL. Finally, the common detached label file has a name following the pattern Apyyzzv.FMT; for example, AI01201.FMT.

4.8. Browse Directory Contents

A set of images of topography profiles derived from the PEDRs is provided in the BROWSE directory. These images may be viewed in a Web browser by opening the file BROWSE.HTM. The Web interface also includes links to the PEDRs from which the profiles were derived.

File Name	File Contents	File Provided By
BROWINFO.TXT	A description of the contents of this directory	Geosciences Node
BROWSE.HTM	HTML file that can be used in a Web browser as an interface to the browse images	Geosciences Node
BROWSE.LBL	PDS label describing BROWSE.HTM	Geosciences Node
APnnnXX	Subdirectories containing browse images, where nnnXX refers to a group of orbits; e.g., AP002XX contains files from orbits 200 through 299	
APnnnnnv.GIF	GIF images of topography profiles derived from PEDRs, where nnnnn = orbit number and v = version of the PEDR	MOLA Team

5. Archive Volume Format

This section describes the format of MOLA Standard Product Archive Volumes. Data that comprise the MOLA Standard Product Archives will be formatted in accordance with Planetary Data System specifications [Planetary Science Data Dictionary, 1996; PDS Data Preparation Workbook, 1995; PDS Standards Reference, 1995].

5.1. Disk Format

Archive Volumes have a compact disk format that is compatible with the computer operating systems MS-DOS, Macintosh, and SunOS. The MOLA CD-ROM format is in accordance with ISO 9660 level 1 Interchange Standard [ISO 9660, 1988].

5.2. File Formats

The following section describes file formats for the kinds of files contained on Archive Volumes. For more information, see the PDS Data Preparation Workbook [1995] and Appendix B.

5.2.1. Document File Format

Document files with the .TXT suffix exist in the Root, Index, Software, Catalog, and Label directories. They are ASCII files with embedded PDS labels. All document files contain 80-byte fixed-length records, with a carriage return character (ASCII 13) in the 79th byte and a line feed character (ASCII 10) in the 80th byte. This allows the files to be read by the MacOS, DOS, Unix, OS2, and VMS operating systems.

Documents in the Document directory contain formatting and figures that cannot be rendered as ASCII text. Therefore each document is given in two formats, hypertext and PDF. The hypertext file contains ASCII text plus hypertext markup language (HTML) commands that enable it to be viewed in a Web browser such as Netscape Navigator or Microsoft Internet Explorer. The hypertext file may be accompanied by ancillary files such as images and style sheets that are incorporated into the document by the Web browser. The second format, PDF (Portable Document Format) is a proprietary format of Adobe Systems Incorporated that is frequently used for distributing documents. Adobe offers free software, Acrobat Reader, for viewing PDF files.

5.2.2. Tabular File Format

Tabular files (.TAB suffix) exist in the Index directory. Tabular files are ASCII files formatted for direct reading into many database management systems on various computers. All fields are separated by commas, and character fields are enclosed in double quotation marks ("). (Character fields are padded with spaces to keep quotation marks in the same columns 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 are of fixed length, and the last two bytes of each record contain the ASCII carriage return and line feed characters. This allows a table to be treated as a fixed length record file on computers that support this file type and as a text file with embedded line delimiters on those that don't.

All tabular files are described by PDS labels, either embedded at the beginning of the file or detached. If detached, the PDS label file has the same name as the data file it describes, with the extension .LBL; for example, the file AEDINDEX.TAB is accompanied by the detached label file AEDINDEX.LBL in the same directory.

5.2.3. PDS Label Format

All data files in the MOLA Standard Product Archive Collection have PDS labels [Planetary Science Data Dictionary, 1996; PDS Standards Reference, 1995]. For AEDR and PEDR products, these labels are embedded at the beginning of the data files. The IEGDR and MEGDR products have detached PDS labels. For examples of PDS labels for each type of data product, see the Data Product SISs [MOLA AEDR SIS, 1998; MOLA PEDR SIS, 1998; MOLA Any-EGDR SIS, 1997].

A PDS label, whether embedded or detached from its associated file, provides 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:

 ^object = location

in which the carat character (^, also called a pointer in this context) indicates where to find the object. 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, if there is more than one object in the file. For example:

 ^HEADER = ("F01.IMG",1)

 ^IMAGE = ("F01.IMG",1025 <BYTES>)

indicates that the IMAGE object begins at byte 1025 of the file F01.IMG, in the same directory as the detached label file. Below is a list of the possible formats for the ^object definition.

 ^object   = n

 ^object   = n<BYTES>

 ^object   = "filename.ext"

 ^object   = ("filename.ext",n)

 ^object   = ("[dirlist]filename.ext",n)

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

 ^object   = ("[dirlist]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 up to 8 character, alphanumeric upper-case file name,

 ext is the 3 character upper-case file extension,

> **dirlist** is a period-delimited path-list of parent directories, in upper case, that specifies the object file directory (used only when the object is not in the same directory as the label file). The list begins at the directory level below the root directory of the CD-ROM. '[dirlist]' may be omitted when the object being described is located either in the same directory as the detached label, or in a subdirectory named LABEL that is located in a higher level of the directory tree, typically the CD-ROM root itself.

All detached labels contain 80-byte fixed-length records, with a carriage return character (ASCII 13) in the 79th byte and a line feed character (ASCII 10) in the 80th byte. This allows the files to be read by the MacOS, DOS, Unix, OS2, and VMS operating systems.

5.2.4. Software File Format

Two programs are provided for accessing PEDR data products. MPROF is a script for use with the commercial software IDL. It is provided as an ASCII text file in two versions, one for use on Sun/UNIX computers and one for PC/Windows computers. PEDR2TAB is a Fortran program for use on Sun/UNIX and PC computers. Binary executable files compiled for Solaris 2.4 and MS-DOS/Windows are also provided. Documentation for both MPROF and PEDR2TAB is provided as ASCII text files.

5.2.5. Catalog File Format

Catalog files (suffix .CAT) exist in the Root and Catalog directories. They are formatted in an object-oriented structure consisting of sets of 'keyword=value' declarations.

5.2.6. Science Data File Formats

5.2.6.1. AEDR Data Product Format

An AEDR product is organized as a table of binary data for a single orbit. Each record contains one packet of telemetry data. For information about the format and contents of an AEDR product, see the MOLA AEDR SIS [1998].

5.2.6.2. PEDR Data Product Format

A PEDR product is organized as a table of binary data for a single orbit. Each record represents a 2-second time span, called a frame, that is generated from the 14-second telemetry packet (the AEDR). For information about the format and contents of a PEDR product, see the MOLA PEDR SIS [1998].

5.2.6.3. Gridded Data Product Format

Each gridded product is a set of 16 images in which each image represents a different data parameter (e.g. mean planetary radius, planetary radius standard deviation, surface reflectance). A gridded product image file contains an image with either 2-byte integer pixels or 4-byte integer pixels, depending on the observation parameter represented by the image. The image has no embedded labels; rather, each of the 16 image files has a detached PDS label containing information to identify the image, and a pointer (described above in section 5.2.3) to a common label file in same directory.

For information about the format and content of the gridded products, see the MOLA Any-EGDR SIS [1997].

6. Support Staff and Cognizant Persons

Table 3 – MOLA Archive Collection Support Staff

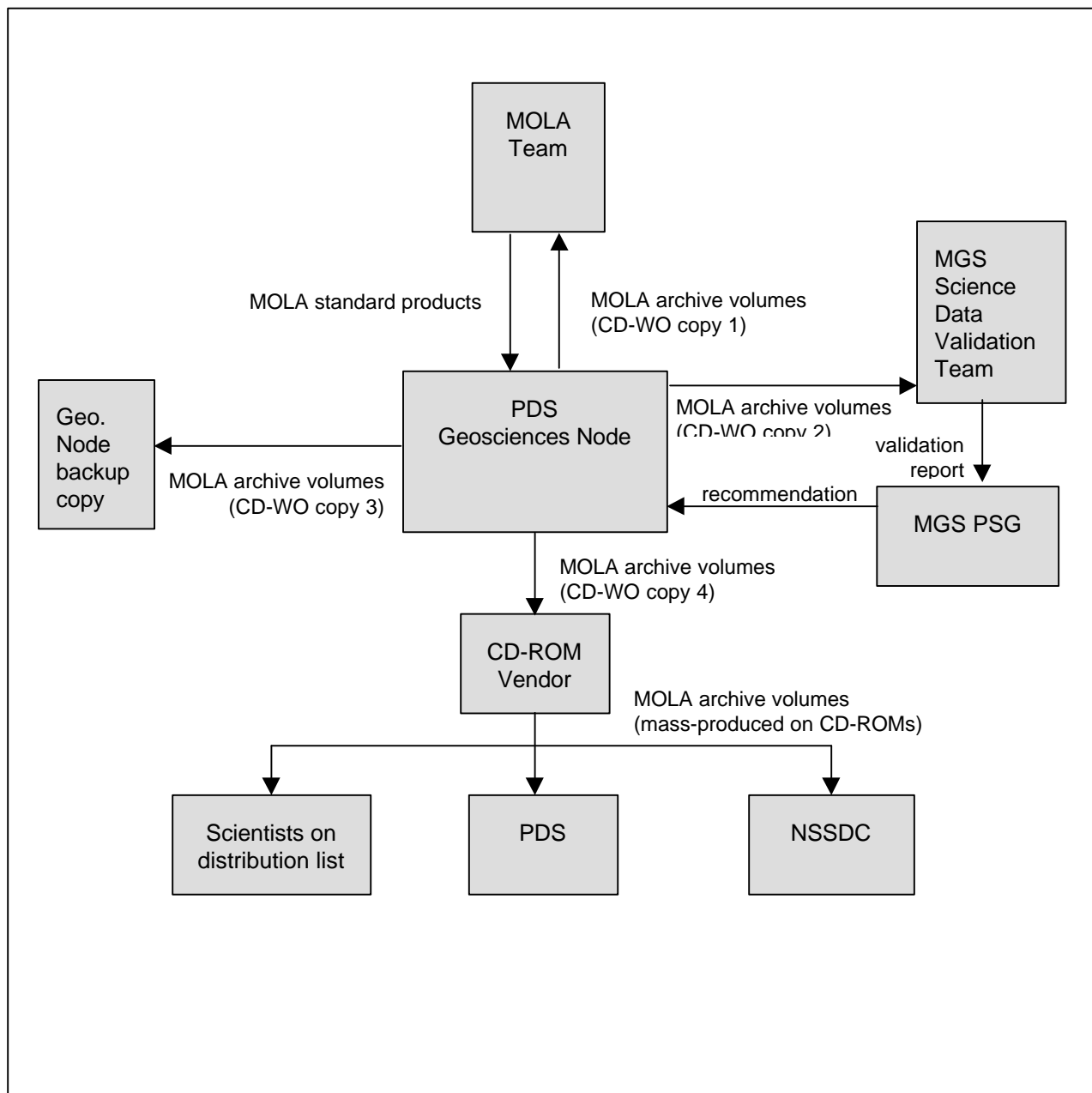| MOLA Team			
Gregory A. Neumann	NASA/Goddard Space Flight Center Code 926 Space Geodesy Greenbelt, MD 20771	301-286-9291	neumann@tharsis.gsfc.nasa.gov
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Washington University			
Raymond E. Arvidson MGS Interdisciplinary Scientist	Washington University Campus Box 1169 1 Brookings Drive St. Louis, MO 63130	314-935-5679	arvidson@wunder.wustl.edu
Susan Slavney WU MOLA Data Manager	Washington University Campus Box 1169 1 Brookings Drive St. Louis, MO 63130	314-935-5493	slavney@wunder.wustl.edu

Figure 1 – Generation of MOLA Archive Volumes During Mapping. The MOLA Team generates MOLA standard data products. The Geosciences Node extracts MOLA standard products from the MOLA Team's processing facility and generates archive volumes on write-once CD-ROM media. Four copies of each archive volume are made. One is sent back to the MOLA Team and another to the MGS Science Data Validation Team (SDVT) for validation. A third copy is kept as a backup at the Geosciences Node. The SDVT sends validation reports to the MGS Project Science Group, who recommends either that the volume be released or, in case of errors, that it be regenerated. When a volume passes validation and is approved by the MGS Project for release, the fourth CD-WO copy is delivered to a CD-ROM vendor for replication. The vendor mails the CD-ROM archive volumes to a distribution list including planetary scientists, the PDS, and the NSSDC.