

# **MARS GLOBAL SURVEYOR**



## **Mars Orbiter Laser Altimeter**

**MOLA EXPERIMENT GRIDDED DATA RECORD  
SOFTWARE INTERFACE SPECIFICATION  
(MOLA EGDR SIS)**

**MGS-M-MOLA-5-IEGDR-L3-V1.0**

**MGS-M-MOLA-5-IEGDR-L3-V2.0**

**MGS-M-MOLA-5-MEGDR-L3-V1.0**

**Version 3.0**

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**NASA  
Goddard Space Flight Center  
Wallops Flight Facility  
Wallops Island, VA 23337**

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#### **(MOLA EGDR SIS)**

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# MARS ORBITER LASER ALTIMETER EXPERIMENT GRIDDED DATA RECORD SOFTWARE INTERFACE SPECIFICATION (MOLA EGDR SIS)

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## 1.0 Introduction

The MOLA Science Team is required to create, validate, and archive the MOLA standard data products. To define each standard data product, the MOLA Science Team is required to provide a Software Interface Specification (SIS). The SIS shall describe the data product contents and define the record and data format. The Planetary Data System's (PDS) Geosciences Node has agreed to archive the MOLA standard data products. The MOLA archive volume shall be described in a separate SIS. The MOLA standard science data products are the Aggregated Experiment Data Record – all MOLA raw data aggregated by orbit; Precision Experiment Data Record – MOLA science data processed into profiles with precision orbit locations added; and the Experiment Gridded Data Record – MOLA gridded data in various densities. This SIS shall define the Experiment Gridded Data Record Data Product. The term EGDR Data Product refers to the generic data product as all densities have the same format.

### 1.1 Purpose

This document generically describes the format and contents of the EGDR Data Product.

### 1.2 Scope

The description in this SIS can be applied to all densities of the EGDR Data Product. Where necessary, comments appropriate to the specific densities of EGDR Data Products are included. Also, the EGDR Data Product software, hardware, and human interfaces shall be mentioned in order to describe the interface; the actual software, hardware, or human node on the other side of the interface shall be described in detail in its own interface or other reference document.

### 1.3 Applicable Documents

1. MOLA-672-PL-89.354 *Operations Facility Configuration and Control Plan*, Version 1.0, NASA Goddard Space Flight Center Wallops Flight Facility, January 5, 1990
2. SFOC-0088-00-06-02 *Space Flight Operations Center User's Guide for Work Station End Users*, Volume 2: Working with File Data, Version 17.0, Draft, Jet Propulsion Laboratory, January 1992
3. MO-642-3-PDB-UG-01 *Mars Observer Project Database (MO PDB) User Overview*, Strawman, Jet Propulsion Laboratory, February 7, 1990
4. MOSO0099-04-00 *Planetary Science Data Dictionary Document*, PDS Version 3.0, Jet Propulsion Laboratory, August 28, 2002, JPL D-7116, Rev E

5. MOLA-9w72-SP-92.230 *Mars Orbiter Laser Altimeter Precision Experiment Data Record Product Software Interface Specification Document*, Version 2.718, NASA Goddard Space Flight Center Wallops Flight Facility, October 14, 1999
6. *Mars Observer Cartography White Paper*, Draft, Version 1.0, R. E. Arvidson, E. A. Guinness, T. A. Duxbury, December 15, 1992
7. MOLA-972-SP-92.213 *MOLA Standard Product Archive Volume Software Interface Specification*, Version 4.3, S. Slavney, R. E. Arvidson, Washington University, November 18, 1999

## **1.4 Functional Description**

### **1.4.1 Data Content Summary**

The EGDR data product contains the mapped collection of MOLA science data. The gridded products are created by binning data from the PEDR Data Products into maps covering the entire planet. A gridded product is stored either as a set of images or as an ASCII table with one row per data bin. The product includes values for mean observed planetary radius, areoid radius, median observed topography, and number of observations in the bin. Multiple revisions to the EGDR product may be released in increasingly higher resolutions. The EGDR Data Product is described further in section 4.0.

### **1.4.2 Source and Transfer Method**

The EGDR Data Product is created from the PEDR Data Products. The data are binned into cells using a series of active image grid map files. After creation, the EGDR Data Product shall be transferred to the MOLA Science Operations Planning Computer (SOPC) for transfer to the PDS Geosciences Node. The EGDR Data Product shall remain available to the MOLA Science Team on the MOLA operations file system.

### **1.4.3 Recipients and Utilization**

The PDS Geosciences Node will receive the EGDR data product and make it available to the science community.

The EGDR data product shall remain on the MOLA operations file system and be available to the MOLA science team for further analysis.

### **1.4.4 Pertinent Relationships with Other Interfaces**

The EGDR data product is created from the Precision Experiment Data Record (PEDR) data product. Any changes to the PEDR data product can affect the EGDR data product format or content. Changes in the PEDR aggregation frequency or scheduled availability can cause changes to the EGDR Data Product's availability or density. See applicable document #5 for a detailed description of the PEDR Data Product.

Any changes to the EGDR data product, either format or content, shall also affect the software that creates the data product.

### **1.5 Assumptions and Constraints**

The EGDR data product contains only data elements collected from MOLA science mode data.

## **2.0 Environment**

### **2.1 Hardware Characteristics and Limitations**

Not applicable.

### **2.2 Interface Medium and Characteristics**

The EGDR data product shall be produced on computer(s) within the MOLA operating environment. The EGDR data product shall be transferred to the MOLA SOPC via FTP in preparation for distribution to the PDS Geosciences Node for archival. The SOPC architecture is described in applicable document #1.

### **2.3 Failure Protection, Detection, and Recovery Features**

#### **2.3.1 Backup Requirements**

The EGDR data product will be backed up on magnetic media on the MOLA operations file system via the MOLA operations' back-up plan. The PDS Geosciences Node will archive the EGDR Data Product on physical media and will send copies to the National Space Science Data Center for permanent storage. The MGS Project Data Base will be available as an additional backup location.

#### **2.3.2 Security / Integrity Measures**

Refer to applicable document #1 for a description of the MOLA operations system security and integrity plan.

### **2.4 End-Of-File (or Medium) Convention**

When stored in table format, the EGDR Data Product is an ASCII file with fixed-length records. Each record ends with a carriage return followed by a line feed. When stored as an image, the EGDR Data Product is a set of 8-bit or 16-bit binary files with fixed-length records in most-significant-byte-first storage order.

## **3.0 Access**

### **3.1 Access Tools**

The MOLA Science Team shall have access to the EGDR data product on the MOLA operations file system via FTP. The science community will have access to the EGDR Data Product through the Archive Volume produced by the PDS Geosciences Node and should obtain the MOLA Archive Volume SIS for information on data access. The MOLA Science Team will not provide the PDS any special tools to access the EGDR Data Product.

### **3.2 Input / Output Protocol**

N/A

### **3.3 Timing and Sequencing Characteristics**

There will be at least two deliveries of MOLA Experiment Gridded Data Products – the Initial Experiment Gridded Data Record (IEGDR) released during the course of the mission, and the Mission Experiment Gridded Data Record (MEGDR) released at the end of the mission. The EGDR product is delivered either as a table or as a set of images.

The IEGDR data product requires a period of nominally 70 days to generate and covers the first 90 mapping days (all data acquired through May 31, 1999). Revisions to the IEGDR product may be released throughout the mission, with increasingly higher densities as more complete coverage of the planet is obtained. The MEGDR data product requires a period of nominally 761 days to generate and covers the entire mapping mission which shall be approximately 687 days. Each completed EGDR data product will be examined by the MOLA Science Team for product quality control and validation. Upon team approval, the EGDR data product is delivered to the PDS Geosciences Node for archive.

### **3.4 PDB Information**

The EGDR Data Product will be stored in the Science category as a science data product in the Mars Global Surveyor PDB. See applicable document #3 for an end user overview of the PDB. The PDB catalog attributes (as part of the K-header) are listed and described below in section 4.3.1.2.

The data set IDs for the MOLA EGDR Data Products are:

MGS-M-MOLA-5-IEGDR-L3-V1.0 – Initial Experiment Gridded Data Record, table format

MGS-M-MOLA-5-IEGDR-L3-V2.0 – Initial Experiment Gridded Data Record, image format

MGS-M-MOLA-5-MEGDR-L3-V1.0 – Mission Experiment Gridded Data Record.

These are the data set IDs that were provided to the PDB and the Planetary Data System. These IDs describe the EGDR data product level and version number. The version number is incremented should the EGDR Data Product format change.



The required catalog keywords for the EGDR Data Products are:

|                       |                              |
|-----------------------|------------------------------|
| PDS_VERSION_ID        | START_ORBIT_NUMBER           |
| RECORD_TYPE           | STOP_ORBIT_NUMBER            |
| FILE_RECORDS          | MISSION_PHASE_NAME           |
| LABEL_RECORDS         | MINIMUM_LATITUDE             |
| RECORD_BYTES          | MAXIMUM_LATITUDE             |
| DATA_SET_ID           | MINIMUM_LONGITUDE            |
| FILE_NAME             | MAXIMUM_LONGITUDE            |
| PRODUCT_ID            | POSITIVE_LONGITUDE_DIRECTION |
| SOFTWARE_NAME         | SPACECRAFT_NAME              |
| UPLOAD_ID             | INSTRUMENT_ID                |
| SOURCE_PRODUCT_ID     | INSTRUMENT_NAME              |
| PRODUCT_RELEASE_DATE  | TARGET_NAME                  |
| START_TIME            | PRODUCER_ID                  |
| STOP_TIME             | PRODUCER_FULL_NAME           |
| NATIVE_START_TIME     | PRODUCER_INSTITUTION_NAME    |
| NATIVE_STOP_TIME      | DESCRIPTION                  |
| PRODUCT_CREATION_TIME |                              |

## 4.0 Detailed Interface Specifications

### 4.1 Labeling and Identification

The data set IDs for the EGDR Data Products and required catalog keywords are listed in Section 3.4.

The file naming convention for IEGDR tabular files is IEGnnn[n][v].TAB, where nnn or nnnn is the bin resolution, e.g. 100 for 1.0 degree bins or 025 for 0.25 degree bins, and v is an optional letter representing the product version, the first version being A.

The file naming convention for IEGDR image files is IEGnnn[n]z.IMG, where nnn or nnnn is the bin resolution, and z is a letter indicating the type of data: a for areoid, c for counts, r for radius, and t for topography.

The file naming convention for MEGDR image files is MEGkxxdyyyrv.IMG, where:

- k = A for areoid, C for counts, R for radius, T for topography
- xx = latitude of pixel in upper left corner of the image
- d = N for north latitude, S for south
- yyy = longitude of the pixel in the upper left corner of the image (0-360 east)
- r = map resolution in pixels per degree, e.g.

- C = 4 pix/deg
- E = 16 pix/deg
- F = 32 pix/deg
- G = 64 pix/deg
- H = 128 pix/deg

- v = version letter.

## 4.2 Structure and Organization Overview

When stored in table format, the IEGDR Data Product is written as an ASCII file with one row per latitude-longitude bin. The table has columns for center latitude, center longitude, mean observed planetary radius, areoid radius, median observed topography, and number of observations in the bin. The file has fixed-length records terminated by carriage return and line feed characters. The IEGDR has a detached PDS label in a separate file of the same name, extension .LBL. Only the early, low-resolution IEGDR products are stored as ASCII tables.

At higher resolutions the size of the IEGDR product makes storage as an ASCII file impractical; therefore the IEGDR is stored as a set of image files (planetary radius, areoid, topography, and counts). The images are written as binary arrays of 16-bit integers, with one image line per file record. Each file is described by a detached PDS label in a separate file of the same name, extension .LBL.

See Appendix B for examples of PDS labels for IEGDR products.

The MEGDR product is generated at various resolutions and stored as a set of images (planetary radius, topography, areoid, and counts). Since the higher resolution MEGDRs are very large, the images are tiled for easier access and file transfer. See Appendix C for a detailed description of the storage format for MEGDR products.

## 4.3 Volume, Size, and Frequency Estimates

There shall be one IEGDR Data Product produced from data collected up through the first 90 days of the MGS mapping mission. The first IEGDR Data Product will have a bin size of one degree, thus containing  $360 \times 180 = 64800$  bins of data. One line in the table represents one bin. With about 60 characters (bytes) per line, the approximate size of the IEGDR Data Product is therefore  $64800 \times 60 / 1024000 = 3.8$  megabytes. It is expected that this data product will be reprocessed up to 3 times for a total of about 11.4 megabytes over the life of the mission, or more if higher resolutions are used.

The MEGDR Data Product shall be produced from data collected during the entire Mars Global Surveyor mapping mission for a total of one data product. The MEGDR Data Product shall cover a period of at least 687 days. It shall have a bin size of at least one-quarter degree, thus containing  $360 \times 4 \times 180 \times 4 = 1036800$  bins of data, making a product size of approximately 60.8 megabytes, or more if a higher resolution is used.

## **APPENDICES**

### **APPENDIX A Acronyms**

|       |                                        |
|-------|----------------------------------------|
| EGDR  | Experiment Gridded Data Record         |
| FTP   | File Transfer Protocol                 |
| IEGDR | Initial Experiment Gridded Data Record |
| MEGDR | Mission Experiment Gridded Data Record |
| MOLA  | Mars Orbiter Laser Altimeter           |
| PEDR  | Precision Experiment Data Record       |
| PDB   | Project Data Base                      |
| PDS   | Planetary Data System                  |
| SIS   | Software Interface Specification       |
| SOPC  | Science Operations Planning Computer   |

**APPENDIX B.1 Example Tabular EGDR Label**

```

PDS_VERSION_ID      = PDS3
RECORD_TYPE         = FIXED_LENGTH
FILE_RECORDS        = 64800
RECORD_BYTES        = 58
^TABLE              = "IEG100_A.TAB"

DATA_SET_ID         = "MGS-M-MOLA-5-IEGDR-L3-V1.0"
PRODUCT_ID          = "MOLA-IEG100_A.TAB"
SPACECRAFT_NAME     = MARS_GLOBAL_SURVEYOR
INSTRUMENT_ID       = MOLA
INSTRUMENT_NAME     = MARS_ORBITER_LASER_ALTIMETER
TARGET_NAME         = MARS
START_TIME          = 1997-09-15T19:10:00.000
STOP_TIME           = 1999-05-31T23:59:59.999
START_ORBIT_NUMBER  = 3
STOP_ORBIT_NUMBER   = 11027
PRODUCT_CREATION_TIME = 1999-10-18T20:05:00.000
PRODUCER_ID         = MGS_MOLA_TEAM
PRODUCER_FULL_NAME  = "DAVID E. SMITH"
PRODUCER_INSTITUTION_NAME = "GODDARD SPACE FLIGHT CENTER"
DESCRIPTION          = "This data set is a topographic
    map of Mars at a resolution of 1 by 1 degree, based on
    altimetry data acquired by the Mars Global Surveyor MOLA
    instrument and accumulated over the course of the mission so far.
    The MOLA Precision Experiment Data Records (PEDRs) are the source
    for this data set. The map is in the form of an ASCII table with
    one row for each 1 by 1 degree latitude-longitude bin, from 90 to
    -90 degrees latitude and from 0 to 360 degrees longitude. The binned
    data include all MOLA nadir observations from the Orbit Insertion
    phase, plus Mapping Phase nadir observations from the beginning of
    mapping through the end of May 1999, plus off-nadir observations
    of the north pole above 86 degrees latitude acquired during
    spring 1998. Orbits 355 and 358 of the Orbit Insertion Phase
    and orbits 10709 through 10716, inclusive, of the Mapping Phase are
    excluded because solutions for these orbits are deemed to be
    poor. (Note: subtract 10000 from MOLA mapping phase orbit number
    to determine the equivalent MGS Project orbit number.) Also excluded
    are shots more than 1 degree off-nadir (except as noted above),
    channel 4 returns, and any returns not classified as ground returns,
    e.g. clouds or noise, according to the SHOT_CLASSIFICATION_CODE.
    A total of 52,495,550 observations are represented."

OBJECT              = TABLE
INTERCHANGE_FORMAT  = ASCII
ROWS                = 64800
ROW_BYTES           = 58
COLUMNS            = 6

OBJECT              = COLUMN
NAME                = AREOCENTRIC_LONGITUDE
DATA_TYPE           = REAL
START_BYTE          = 1
BYTES               = 8
FORMAT              = "F8.1"
UNIT                = DEGREE

```

# Mars Global Surveyor MOLA EGDR SIS

```

MINIMUM                = 0.5
MAXIMUM                = 359.5
DESCRIPTION            = "Areocentric east longitude of the center
of the 1 by 1 degree area of observation. The rows in the table
are in order by increasing longitude (0.5 to 359.5) and
decreasing latitude (89.5 to -89.5), with longitude varying
first."
END_OBJECT             = COLUMN

OBJECT                = COLUMN
NAME                  = AREOCENTRIC_LATITUDE
DATA_TYPE             = REAL
START_BYTE            = 9
BYTES                 = 8
FORMAT                = "F8.1"
UNIT                  = DEGREE
MINIMUM               = -89.5
MAXIMUM               = 89.5
DESCRIPTION            = "Areocentric latitude of the center of
the 1 by 1 degree area of observation. The rows in the table
are in order by increasing longitude (0.5 to 359.5) and
decreasing latitude (89.5 to -89.5), with longitude varying
first."
END_OBJECT             = COLUMN

OBJECT                = COLUMN
NAME                  = MEAN_PLANETARY_RADIUS
DATA_TYPE             = REAL
START_BYTE            = 17
BYTES                 = 12
FORMAT                = "F12.2"
UNIT                  = METER
MINIMUM               = 3373396.58
MAXIMUM               = 3416455.71
DESCRIPTION            = "Mean observed planetary radius within
the 1 by 1 degree area. Where no observations lie within the area,
an interpolated value is supplied. The mean of the observations
is provided as an areodetically useful average, while the median is
used for topography."
END_OBJECT             = COLUMN

OBJECT                = COLUMN
NAME                  = AREOID_RADIUS
DATA_TYPE             = REAL
START_BYTE            = 29
BYTES                 = 12
FORMAT                = "F12.2"
UNIT                  = METER
MINIMUM               = 3378182.02
MAXIMUM               = 3397474.00
DESCRIPTION            = "Areoid radius at the center of the 1 by 1
degree area of observation. The areoid radius lies on an
equipotential surface whose mean radius at the equator is 3396000
meters. The surface is defined by the Goddard Mars Potential
Model MGM0964C20, evaluated to degree and order 50."
END_OBJECT             = COLUMN

OBJECT                = COLUMN
NAME                  = MEDIAN_TOPOGRAPHY
DATA_TYPE             = REAL

```

# Mars Global Surveyor MOLA EGDR SIS

```

START_BYTE      = 41
BYTES           = 10
FORMAT          = "F10.2"
UNIT            = METER
MINIMUM         = -7501.22
MAXIMUM         = 20882.70
DESCRIPTION     = "Median observed topography within the 1
                  by 1 degree area.  Where no observations lie within the area, an
                  interpolated value is supplied. The minimum and maximum topography
                  observations within the current data set are -8162.04 and 21223.5.
                  Topography is the planetary radius minus the areoid radius at a
                  longitude and latitude. The areoid radius at the center of the area
                  is not, in general, the same as the mean of the areoid radii at the
                  individual observations. Moreover, the median observed topography
                  follows sharp transitions in height more rapidly than the mean.
                  Thus, the median topography added to the areoid radius is not
                  exactly equal to the mean planetary radius."
END_OBJECT      = COLUMN

OBJECT          = COLUMN
NAME            = OBSERVATIONS
DATA_TYPE       = INTEGER
START_BYTE     = 51
BYTES          = 6
FORMAT         = "I6"
MINIMUM        = 0
MAXIMUM        = 2152
DESCRIPTION    = "Number of observations in the 1 by 1 degree
                  area."
END_OBJECT     = COLUMN

END_OBJECT     = TABLE

END

```

**APPENDIX B.2 Example Image EGDR Label**

```

PDS_VERSION_ID      = PDS3
RECORD_TYPE         = FIXED_LENGTH
FILE_RECORDS        = 720
RECORD_BYTES        = 2880
^IMAGE              = "IEG025R.IMG"

DATA_SET_ID         = "MGS-M-MOLA-5-IEGDR-L3-V2.0"
PRODUCT_ID          = "MOLA-IEG025_RADIUS.IMG"
SPACECRAFT_NAME     = "MARS GLOBAL SURVEYOR"
INSTRUMENT_ID       = MOLA
INSTRUMENT_NAME     = MARS_ORBITER_LASER_ALTIMETER
TARGET_NAME         = MARS
START_TIME          = 1997-09-15T19:10:00.000
STOP_TIME           = 2000-06-01T16:51:07.180
START_ORBIT_NUMBER  = 3
STOP_ORBIT_NUMBER   = 15516
PRODUCT_CREATION_TIME = 2000-07-14T12:00:00
PRODUCER_ID         = MGS_MOLA_TEAM
PRODUCER_FULL_NAME  = "DAVID E. SMITH"
PRODUCER_INSTITUTION_NAME = "GODDARD SPACE FLIGHT CENTER"
DESCRIPTION          = "This data product is a shape
    map of Mars at a resolution of 0.25 by 0.25 degrees, based on
    altimetry data acquired by the Mars Global Surveyor MOLA
    instrument and accumulated over the course of the mission so far.
    The MOLA Precision Experiment Data Records (PEDRs) are the source
    for this data set. The map is in the form of a binary table with
    one row for each 0.25-degree latitude, from 0 to 360 degrees East
    longitude and 90 to -90 degrees latitude. The binned
    data include all MOLA nadir observations from the Mapping Phase,
    from the end of aerobraking through June 2000. Additionally, off-nadir
    observations of the north pole are included from 87 N latitude and
    northward, taken during the spring of 1998, and of both poles taken
    during Mapping from 87 N and S to the poles. Parts of orbits
    are excluded where solutions for
    these orbits are deemed to be poor. (Note: subtract 10000 from a MOLA
    mapping phase orbit number to determine the equivalent MGS Project
    orbit number.) Also excluded are shots more than 1 degree off-nadir
    (except as noted above), channel 4 returns, and any returns not
    classified as ground returns, e.g. clouds or noise, according to the
    SHOT_CLASSIFICATION_CODE. A total of approximately 333 million
    observations are represented."

OBJECT              = IMAGE
NAME                = MEAN_RADIUS
DESCRIPTION         = "Mean observed planetary radius within the
    0.25 by 0.25 degree area, after subtracting 3,396,000 meters (the mean
    radius at the equator). Where no observations lie within the area,
    an interpolated value is supplied."
LINES               = 720
LINE_SAMPLES        = 1440
SAMPLE_TYPE         = MSB_INTEGER
SAMPLE_BITS         = 16
UNIT                = METER
SCALING_FACTOR      = 1
OFFSET              = 3396000
MINIMUM             = -22957
MAXIMUM             = 21245

```

# Mars Global Surveyor MOLA EGDR SIS

```

END_OBJECT                = IMAGE

OBJECT                    = IMAGE_MAP_PROJECTION
^DATA_SET_MAP_PROJECTION = "DSMAP.CAT"
MAP_PROJECTION_TYPE      = "SIMPLE CYLINDRICAL"
A_AXIS_RADIUS            = 3396.0 <KM>
B_AXIS_RADIUS            = 3396.0 <KM>
C_AXIS_RADIUS            = 3396.0 <KM>
FIRST_STANDARD_PARALLEL  = "N/A"
SECOND_STANDARD_PARALLEL = "N/A"
POSITIVE_LONGITUDE_DIRECTION = "EAST"
CENTER_LATITUDE          = 0.0 <DEGREE>
CENTER_LONGITUDE         = 180.0 <DEGREE>
REFERENCE_LATITUDE       = "N/A"
REFERENCE_LONGITUDE      = "N/A"
LINE_FIRST_PIXEL         = 1
LINE_LAST_PIXEL          = 720
SAMPLE_FIRST_PIXEL       = 1
SAMPLE_LAST_PIXEL        = 1440
MAP_PROJECTION_ROTATION  = 0.0
MAP_RESOLUTION           = 4.0 <PIXEL/DEGREE>
MAP_SCALE                = 14.818 <KM/PIXEL>
MAXIMUM_LATITUDE         = 90.0 <DEGREE>
MINIMUM_LATITUDE         = -90.0 <DEGREE>
WESTERNMOST_LONGITUDE    = 0.0 <DEGREE>
EASTERNMOST_LONGITUDE    = 360.0 <DEGREE>
LINE_PROJECTION_OFFSET   = 360.5
SAMPLE_PROJECTION_OFFSET = 720.5
COORDINATE_SYSTEM_TYPE   = "BODY-FIXED ROTATING"
COORDINATE_SYSTEM_NAME   = "PLANETOCENTRIC"
END_OBJECT                = IMAGE_MAP_PROJECTION

END

```



## APPENDIX C MEGDR Products

The MEGDR products consist of a set of global maps of the observed planetary radius, the areoid, the computed topography, and the counts (number of observations in each cell of the map). The MEGDR products are generated from the PEDR altimetry data at resolutions of 4, 16, 32, 64, and 128 pixels per degree. The 4, 16, and 32 pixels per degree maps are stored as images with one image per file. Higher resolution maps are stored as tiled images; each map is subdivided into smaller files for easier handling.

The file naming convention for MEGDR image files is MEGkxxdyyyrv.IMG, where:

k = A for areoid, C for counts, R for radius, T for topography  
 xx = latitude of pixel in upper left corner of the image  
 d = N for north latitude, S for south  
 yyy = longitude of the pixel in the upper left corner of the image (0-360 east)  
 r = map resolution in pixels per degree, e.g.

C = 4 pix/deg  
 E = 16 pix/deg  
 F = 32 pix/deg  
 G = 64 pix/deg  
 H = 128 pix/deg

v = version letter.

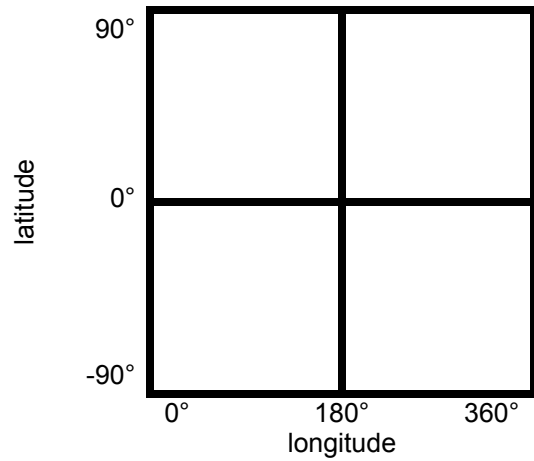
Each image file is accompanied by a PDS label file with the same name, extension ".LBL". A PDS label is a text file that describes the content and structure of the image file.

Table C-1 summarizes files that make up the MEGDR 4, 16, and 32 pixel/degree products.

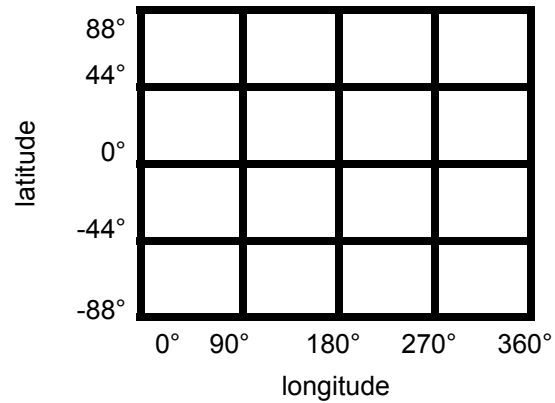
**Table C-1: MEGDR Image Files at 4, 16, and 32 Pixels Per Degree Resolution**

| Directory | File Name        | Map Type   | Area Covered                                    | Resolution (pixels/degree) |
|-----------|------------------|------------|-------------------------------------------------|----------------------------|
| meg004    | mega90n000cb.img | areoid     | 90°N to 90°S latitude<br>0°E to 360°E longitude | 4                          |
|           | megc90n000cb.img | counts     |                                                 |                            |
|           | megr90n000cb.img | radius     |                                                 |                            |
|           | megt90n000cb.img | topography |                                                 |                            |
| meg016    | mega90n000eb.img | areoid     | 90°N to 90°S latitude<br>0°E to 360°E longitude | 16                         |
|           | megc90n000eb.img | counts     |                                                 |                            |
|           | megr90n000eb.img | radius     |                                                 |                            |
|           | megt90n000eb.img | topography |                                                 |                            |
| meg032    | megc90n000fb.img | counts     | 90°N to 90°S latitude<br>0°E to 360°E longitude | 32                         |
|           | megr90n000fb.img | radius     |                                                 |                            |
|           | megt90n000fb.img | topography |                                                 |                            |

MEGDR maps at 64 pixels per degree are tiled into four images of equal size. MEGDR maps at 128 pixels per degree are tiled into sixteen images of equal size. Note that the 128 pixel/degree MEGDR extends only to 88 degrees north and south latitude. Tiling schemes are shown in Figures C-1 and C-2.



**Figure C-1. Tiling scheme for MEGDR at 64 pixels per degree resolution.**



**Figure C-2. Tiling scheme for MEGDR at 128 pixels per degree resolution.**

Tables C-2 and C-3 summarize the files that make up the MEGDR 64 and 128 pixel/degree products. These files are found in the MEG064 and MEG128 directories.

**Table C-2: MEGDR Tiled Image Files at 64 Pixels Per Degree Resolution**

|                     |                                                |                                                  |
|---------------------|------------------------------------------------|--------------------------------------------------|
| <b>Area Covered</b> | 90°N to 0° latitude,<br>0°E to 180°E longitude | 90°N to 0° latitude,<br>180°E to 360°E longitude |
| <b>Counts</b>       | megc90n000gb.img                               | megc90n180gb.img                                 |
| <b>Radius</b>       | megr90n000gb.img                               | megr90n180gb.img                                 |
| <b>Topography</b>   | megt90n000gb.img                               | megt90n180gb.img                                 |
| <b>Area Covered</b> | 0° to 90°S latitude,<br>0°E to 180°E longitude | 0° to 90°S latitude,<br>180°E to 360°E longitude |
| <b>Counts</b>       | megc00n000gb.img                               | megc00n180gb.img                                 |
| <b>Radius</b>       | megr00n000gb.img                               | megr00n180gb.img                                 |
| <b>Topography</b>   | megt00n000gb.img                               | megt00n180gb.img                                 |

**Table C-3: MEGDR Tiled Image Files at 128 Pixels Per Degree Resolution**

|                     |                                      |                                        |                                         |                                         |
|---------------------|--------------------------------------|----------------------------------------|-----------------------------------------|-----------------------------------------|
| <b>Area Covered</b> | 88°N to 44°N lat,<br>0°E to 90°E lon | 88°N to 44°N lat,<br>90°E to 180°E lon | 88°N to 44°N lat,<br>180°E to 270°E lon | 88°N to 44°N lat,<br>270°E to 360°E lon |
| <b>Counts</b>       | megc88n000hb.img                     | megc88n090hb.img                       | megc88n180hb.img                        | megc88n270hb.img                        |
| <b>Radius</b>       | megr88n000hb.img                     | megr88n090hb.img                       | megr88n180hb.img                        | megr88n270hb.img                        |
| <b>Topography</b>   | megt88n000hb.img                     | megt88n090hb.img                       | megt88n180hb.img                        | megt88n270hb.img                        |
| <b>Area Covered</b> | 44°N to 0° lat,<br>0°E to 90°E lon   | 44°N to 0° lat,<br>90°E to 180°E lon   | 44°N to 0° lat,<br>180°E to 270°E lon   | 44°N to 0° lat,<br>270°E to 360°E lon   |
| <b>Counts</b>       | megc44n000hb.img                     | megc44n090hb.img                       | megc44n180hb.img                        | megc44n270hb.img                        |
| <b>Radius</b>       | megr44n000hb.img                     | megr44n090hb.img                       | megr44n180hb.img                        | megr44n270hb.img                        |
| <b>Topography</b>   | megt44n000hb.img                     | megt44n090hb.img                       | megt44n180hb.img                        | megt44n270hb.img                        |
| <b>Area Covered</b> | 0° to 44°S lat,<br>0°E to 90°E lon   | 0° to 44°S lat,<br>90°E to 180°E lon   | 0° to 44°S lat,<br>180°E to 270°E lon   | 0° to 44°S lat,<br>270°E to 360°E lon   |
| <b>Counts</b>       | megc00n000hb.img                     | megc00n090hb.img                       | megc00n180hb.img                        | megc00n270hb.img                        |
| <b>Radius</b>       | megr00n000hb.img                     | megr00n090hb.img                       | megr00n180hb.img                        | megr00n270hb.img                        |
| <b>Topography</b>   | megt00n000hb.img                     | megt00n090hb.img                       | megt00n180hb.img                        | megt00n270hb.img                        |
| <b>Area Covered</b> | 44°S to 88°S lat,<br>0°E to 90°E lon | 44°S to 88°S lat,<br>90°E to 180°E lon | 44°S to 88°S lat,<br>180°E to 270°E lon | 44°S to 88°S lat,<br>270°E to 360°E lon |
| <b>Counts</b>       | megc44s000hb.img                     | megc44s090hb.img                       | megc44s180hb.img                        | megc44s270hb.img                        |
| <b>Radius</b>       | megr44s000hb.img                     | megr44s090hb.img                       | megr44s180hb.img                        | megr44s270hb.img                        |
| <b>Topography</b>   | megt44s000hb.img                     | megt44s090hb.img                       | megt44s180hb.img                        | megt44s270hb.img                        |

All the maps described above are in simple cylindrical projection.

Map projection details for each image are found in the PDS label file that accompanies the image file, in the IMAGE\_MAP\_PROJECTION object. General information about the simple cylindrical projection, including equations for converting between latitude-longitude and line-sample coordinates, can be found in the file DSMAP.CAT in the CATALOG directory.

All MEGDR images are binary arrays of 16-bit most-significant-byte-first signed integers, except for the 64 and 128 pixel/degree counts images, which have 8-bit unsigned integers.