

SPECIFICATION NUMBER: MRF-4011
CAGE Code 12934

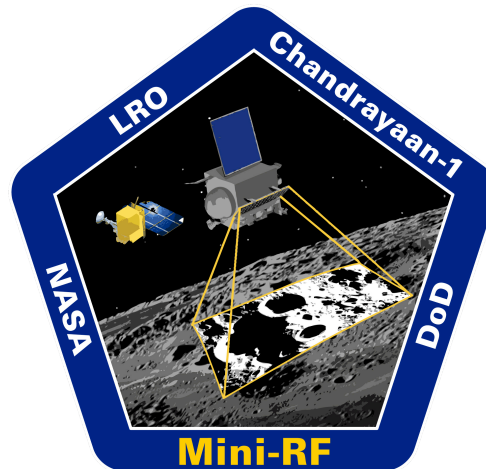
Created on 2/23/2010

PDS Archive Volume Software Interface Specification (SIS)

For

Mini-RF Advanced Technologies – Lunar Reconnaissance Orbiter (LRO)

Payload Operations Center



January 28, 2010

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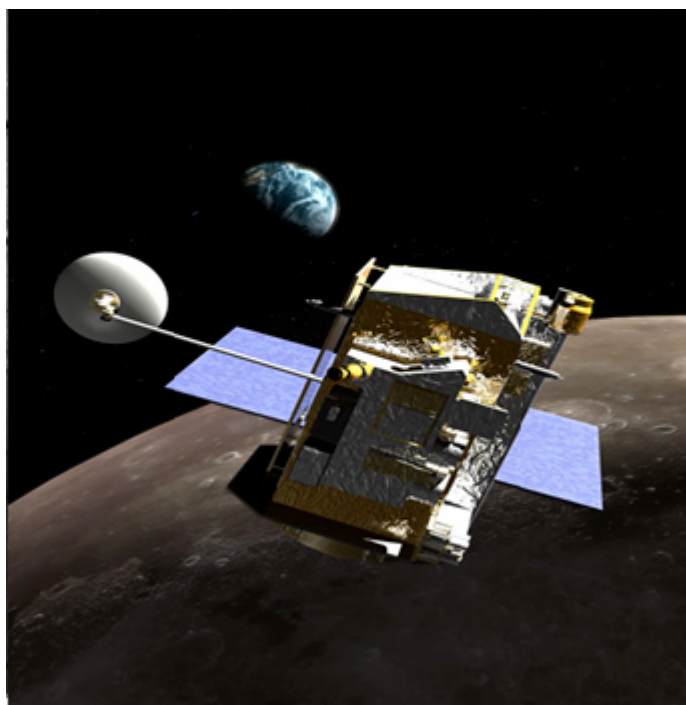
Date

RECORD OF CHANGES

CHANGE NO.	DATE	TITLE OR BRIEF DESCRIPTION	ENTERED BY
0	31 May 2007	Initial Release	Mike Reid
1	18 Oct 2007	Renamed the INTERFEROMETRY archive directory to "CONTINUOUS".	Mike Reid
2	11 April 2008	Major changes from peer review	Mike Reid
3	8 April 2009	Modified section 2.2.2 to mention the Sandia SAR Stereo Level 3 data product. Changed the front cover logo from NAWK to Mini-RF.	Mike Reid
4	30 Nov 2009	Updated reviewers and approval page; added ORBNUM/ directory in EXTRAS/; added Arecibo calibration data CALIB/ARECIBO.	Mike Reid
5	27 Jan 2010	Changed contents of CALIB directory; changed contents of DOCUMENT directory; removed BROWSE directory and replaced with QUIKVIEW directory under EXTRAS; changed TIFF images to JPEGs; updated diagrams accordingly; updated data volume sizes in sec. 4.2 to reflect greatly increased data rate.	Mike Reid

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1. Introduction

1.1. Purpose and Scope

This Software Interface Specification (SIS) is intended to be used by those who wish to understand the format and content of the Lunar Reconnaissance Orbiter (LRO) Mini-RF instrument (here referred to as “MRFLRO”) data Archive. Typically, these individuals would be software engineers, data analysts, or planetary scientists.

The specifications in this document apply to all LRO standard product archive volumes that are generated by the Mini-RF Project. Identifying keywords are given below in Table 1. The data sets included on these archive volumes have the following Planetary Data System data set IDs for the Raw data, Level 1 SAR, Level 1 interferometry, Level 2 SAR, Level 3 SAR mosaics, and Level 3 Sandia SAR Stereo products respectively:

- LRO-L-MRFLRO-1-PDR-V1.0
- LRO-L-MRFLRO-4-CDR-V1.0
- LRO-L-MRFLRO-4-CDR-INSAR-V1.0
- LRO-L-MRFLRO-5-CDR-MAP-V1.0
- LRO-L-MRFLRO-5-CDR-MOSAIC-V1.0
- LRO-L-MRFLRO-5-CDR-STEREO-V1.0
- LRO-L-SPICE-6-V1.0

Keyword	Value
MISSION_NAME	"LUNAR RECONNAISSANCE ORBITER"
MISSION_ID	LRO
INSTRUMENT_HOST_NAME	" LUNAR RECONNAISSANCE ORBITER "
INSTRUMENT_HOST_ID	LRO
INSTRUMENT_NAME	"MINI-RF LRO"
INSTRUMENT_ID	MRFLRO

Table 1 Values of mission and instrument identifying key words.

1.2. Content Overview

This SIS describes the format, content, and generation of the MRFLRO Archive. Section 2, *Archive Volume Contents*, describes the structure of the archive volumes and the contents of each file. Section 3, *Archive Volume Format*, describes the file formats used on the archive volumes. Section 4, *Archive Volume Generation*, describes the procedure for transferring data products to the archive and data volumes. Finally, Section 5, *Support Staff and Cognizant Persons*, lists the individuals responsible for generating the archive volumes. All data products are produced and assembled by the Mini-RF Payload Operations Center (POC) located at the Johns Hopkins University Applied Physics Laboratory (JHU/APL) located in Laurel, Maryland.

1.3. Applicable Documents and Constraints

This Archive Volume SIS is intended to be consistent with the following documents:

1. *PDS Data Product Software Interface Specification (SIS) For Mini-RF Advanced Technologies – Lunar Reconnaissance Orbiter (LRO) Payload Operations Center*, Mini-RF Program. MRF-4009.
2. *Planetary Data System Archive Preparation Guide*, August 29, 2006, Version 1.1, JPL D-31224.
3. *Planetary Data System Standards Reference*, NASA/JPL, February 27, 2009, Version 3.8. JPL D-7669, Part-2. Available from <http://pds.jpl.nasa.gov/documents/sr/index.html>. [Accessed: January 26, 2010].
4. *LRO Mini-RF Science Team and PDS Geosciences Node Interface Control Document (ICD)*.
5. *Lunar Reconnaissance Orbiter Data Management and Archive Plan*, 431-PLAN-000182, NASA/GSFC LRO Project.

1.4. Relationships with Other Interfaces

This Archive Volume SIS could be affected by changes to the design of the LRO standard data products. See the data product SIS (MRF-4009) [section 1.3]. LRO project SPICE kernels and any generated at the POC will be archived separately at the NAIF PDS node.

2. Archive Volume Contents

This section describes the contents of the MRFLRO Archive volumes, including the file names, file contents, file types, and organization responsible for providing the files. All products are included in a single archive volume (Volume ID: **LROMRF_0XXX**).

The data products consist of binary images, non-image binary data, supporting data in free-formatted text files, spreadsheet (comma separated values) text files, and “CONI” text. CONI is a human and machine-readable structured text format developed by Vexcel[®] corporation and is the standard parameter file format for their SAR processors. We include these parameter files with the products as metadata.

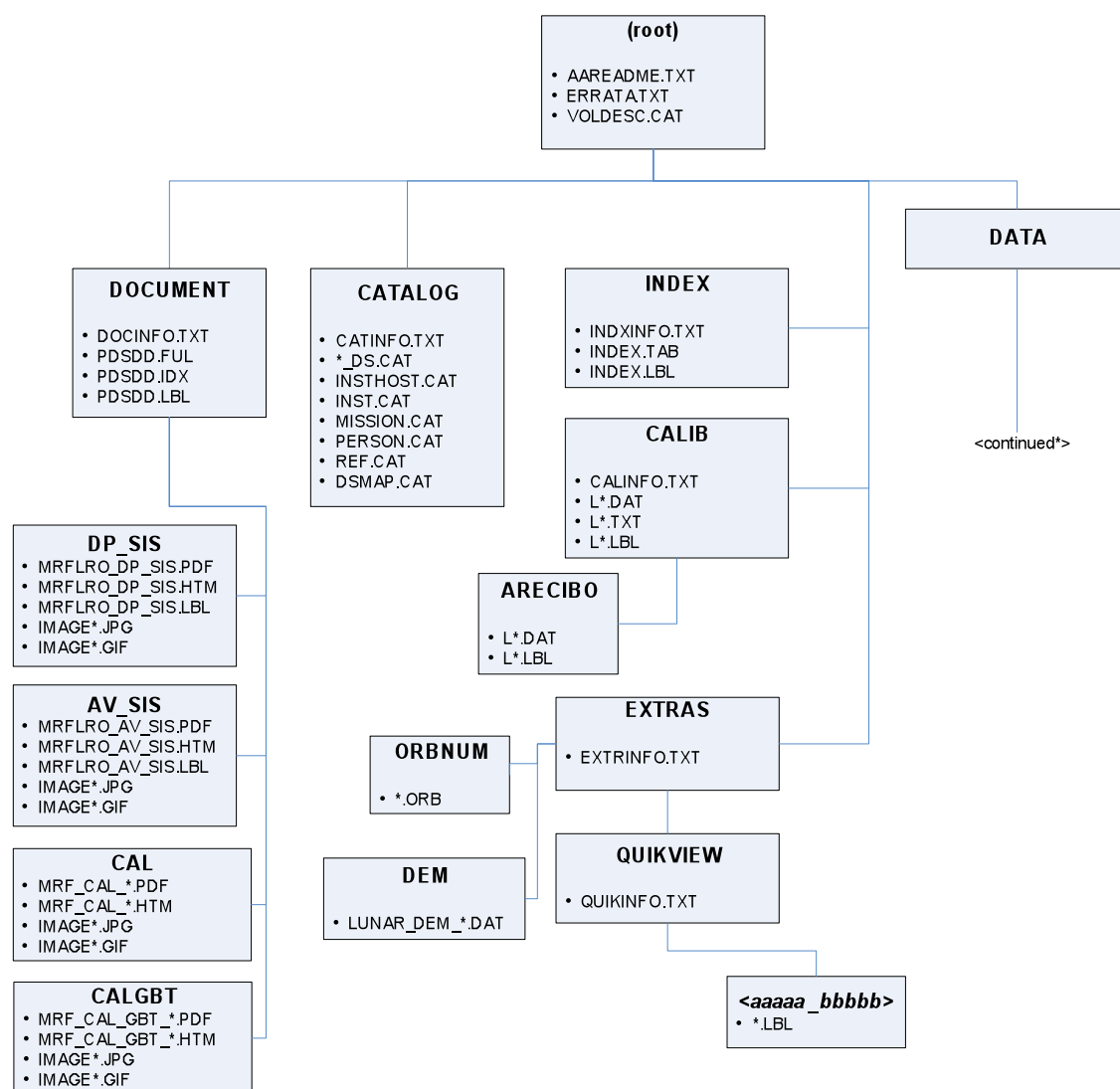


Figure 1 Root directory of the archive and its immediate subdirectories. *The DATA subdirectory is given in Figure 2.

2.1. Root Directory Contents

Files in the root directory include an overview of the archive, a description of the volume for the PDS Catalog, and a list of errata or comments about the archive. The following files are contained in the Root Directory.

File Name	File Contents	File Provided By
AAREADME.TXT	Volume content and format information with an attached PDS label. This file also contains a description of publicly available software, which was used in generating the products and which might be useful in analyzing them.	POC
ERRATA.TXT	A cumulative listing of comments and updates concerning all archive volumes published to date	POC
VOLDESC.CAT	A description of the contents of this volume in a PDS format readable by both humans and computers	POC

Table 2 Root directory contents.

2.2. DATA Directory Contents and Naming

The Data Directory contains the delivered science data products. Under the **DATA** directory there is a separate subdirectory for the two types of science products, SAR and interferometry. These directories are named **SAR** and **CONTINUOUS** respectively. The SAR and continuous mode subdirectories are further divided into a single subdirectory for the Level 3 mosaic products and multiple subdirectories for the lower-level products. There is no Level 2 continuous mode directory.

The subdirectories for the lower-level products are named based on the number of the orbit during which the original raw data were collected. The directory naming scheme contains two five-digit natural numbers separated by an underscore. The first number *aaaaa* is the number of the first orbit and the second number *bbbbb* is the number of the last orbit represented in the directory. In other words, a directory named “00402_00578” contains all data collected in orbits 402 through 578. The orbit numbers given in the directory names are padded with leading zeroes. The number of orbits represented in a given directory will be determined by the investigator who creates the product set. There will be multiple directories of this type. Additional orbit numbered directories will be added to the archive with each delivery to the PDS over the lifetime of the mission.

Within each orbit numbers directory, there is a subdirectory for the raw data and each level of science data processing up to, but not including the Level 3 mosaics. The Level 3 SAR products reside in a separate **MOSAICS** directory at the same level as the orbit number directories because the mosaic products are constructed from data acquired during multiple orbits and are therefore not associated with one particular orbit. The Level 3 continuous mode products reside in the **../CONTINUOUS/LEVEL3** directory. The data product SIS document [1.3] describes the naming convention for the files that reside within these subdirectories.

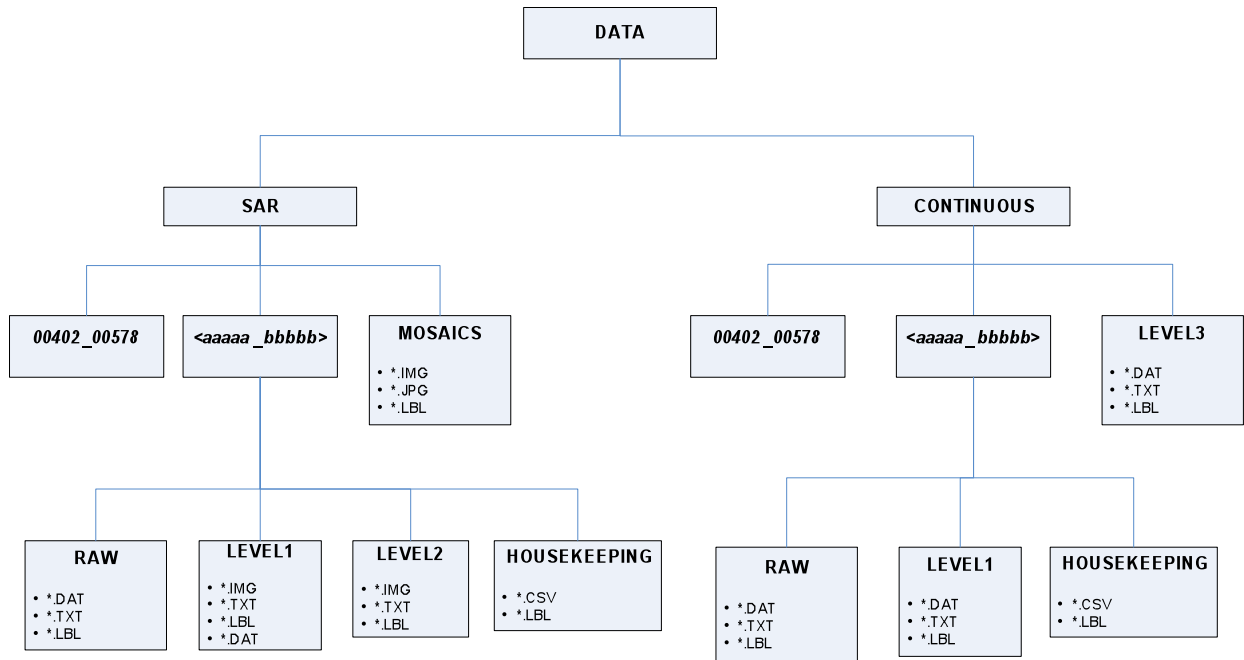


Figure 2 DATA subdirectory (under root) and its subdirectories. The subdirectories titled “00402_00578” are examples of what the orbit-associated product directories following the *aaaaa_bbbbbb* naming format would look like.

2.2.1. The Burst Mode SAR (**SAR**) Subdirectory

The **SAR** directory contains the science data collected by the LRO instrument while operating in “burst” mode. The orbit number subdirectories within this directory contain raw, level 1, and level 2 products. They do not contain level 0 products, as these are not archived at the PDS. The mosaic (**MOSAICS**) subdirectory contains the Level 3 SAR mosaics.

Subdirectory Name	Directory Contents	File Provided By
<aaaaa_bbbbbb>/RAW	The Raw data directory contains the Packetized Data Records (PDR) or “Raw” data. These data are unprocessed CCSDS packets. They are provided to the PDS in “safed” form and are accompanied by minimal PDS labels. No formatting is done on them.	POC
<aaaaa_bbbbbb>/HOUSEKEEPING	Housekeeping data associated with the collection period.	POC
<aaaaa_bbbbbb>/LEVEL1	The Level 1 SAR science data products including PDS labels. These contain processed binary data products and ancillary data in structured text files. This directory contains the original CDR image file produced by the Level 1 SAR processor and ancillary data files.	POC

<aaaaa_bbbbbb>/LEVEL2	The Level 2 SAR science data products including PDS labels. These contain processed binary data products and ancillary data in structured text files. This directory contains the original image file produced by the Level 2 SAR processor, 4 stokes parameter files, 3 derived parameter files (SSP, OSP, CPR) and ancillary data files.	POC
MOSAICS	The Level 3 (mosaic) SAR science data products including PDS labels. These contain binary images and JPEG image files.	POC

Table 3 Description of the contents of the numbered orbit subdirectories within the SAR directory.

2.2.2. The Continuous Mode (**CONTINUOUS**) Subdirectory

The **CONTINUOUS** directory contains the science data collected with the Mini-RF instrument was operating in “continuous” mode. These are the data sets that can be used for generating interferometric products. The orbit number subdirectories within this directory contain raw and Level 1 products. They do not contain Level 0 products as these are not archived at the PDS and there are no Level 2 continuous mode products. The LEVEL3 directory contains the SAR Stereo Level 3 derived data products produced by Sandia National Laboratory and accompanying parameter files.

Subdirectory Name	Directory Contents	File Provided By
<aaaaa_bbbbbb>/RAW	The Raw data directory contains the Packetized Data Records (PDR) or “Raw” data. These data are unprocessed CCSDS packets. They are provided to the PDS in “safed” form and are accompanied by minimal PDS labels. No formatting is done on them.	POC
<aaaaa_bbbbbb>/LEVEL1	The Level 1 continuous mode science data products including PDS labels. These contain processed binary data products and ancillary data in spreadsheet (CSV) and structured text files. This directory contains the original continuous mode CDR file produced by the Level 1 processor and ancillary data files.	POC
<aaaaa_bbbbbb>/HOUSEKEEPING	Housekeeping data associated with the collection period.	POC
LEVEL3	The SAR Stereo data products and accompanying parameter files.	POC

Table 4 Description of the contents of the numbered orbit subdirectories within the CONTINUOUS directory. <aaaaa_bbbbbb> indicates the number of the first orbit represented in the directory aaaaa and the number of the last orbit represented in the directory bbbbbb.

2.3. INDEX Directory Contents

Files in the INDEX Directory are provided to help the user locate products on this archive volume and on previously released volumes in the archive. The following files are contained in the Index Directory.

File Name	File Contents	File Provided By
INDXINFO.TXT	A description of the contents of this directory.	POC
INDEX.TAB	Table listing all data products on this volume. Table 6 below describes this file.	POC
INDEX.LBL	A PDS detached label that describes INDEX.TAB	POC
MD5.TAB	MD5 checksum file.	POC
MD5.LBL	A PDS detached label that describes the MD5.TAB file.	

Table 5 Contents of the Index directory. The FILE_SPECIFICATION_NAME is the name of the PDS label.

Column	Format	Length (bytes)	Example
VOLUME_ID	CHARACTER	15	"LROMRF_1001"
DATA_SET_ID	CHARACTER	33	"LRO-L-MRFLRO-3-CDR-V1.0"
PRODUCT_ID	CHARACTER	27	"LSL_CDR_LV1_00310_1Q"
PRODUCT_TYPE	CHARACTER	15	"CDR"
FILE_SPECIFICATION_NAME	CHARACTER	150	"LROMRF_0XXX/DATA/SAR/00000_00499/LEVEL1/LSL_CDR_LV1_00310_1Q.LBL"
PRODUCT_CREATION_TIME	TIME	20	"2008-01-06T16:33"
START_TIME	TIME	30	"2007-11-01T19:03:13.462283"
STOP_TIME	TIME	30	"2007-11-01T19:04:28.3802"
SPACECRAFT_CLOCK_START_COUNT	CHARACTER	30	"1/1234567890.54321"
SPACECRAFT_CLOCK_STOP_COUNT	CHARACTER	30	"1/1234568890.12345"
ORBIT_NUMBER	CHARACTER	7	"310"

Table 6 The contents and format of the INDEX.TAB file. Each record in the table will be composed of these fields and there will be one record for every product file in the archive.

2.4. DOCUMENT Directory Contents

The DOCUMENT Directory contains documentation to help the user understand and use the archive data. The following files are contained in the Document Directory. Files linked to the HTML (*.HTM) version of the documents will be stored in subdirectories of the same name as the document (without the file suffix). Each document is stored in its own subdirectory.

File Name	File Contents	File Provided By
DOCINFO.TXT	A description of the contents of this directory	POC
DP_SIS/MRFLRO_DP_SIS.HTM	The Data Product SIS as hypertext. This may be several files.	POC
DP_SIS/MRFLRO_DP_SIS.PDF	The Data Product SIS as a PDF file	POC

DP_SIS/MRFLRO_DP_SIS.LBL	A PDS detached label that describes both MRFLRO_DP_SIS.HTM and MRFLRO_DP_SIS.PDF	POC
AV_SIS/MRFLRO_AV_SIS.HTM	The Archive Volume SIS (this document) as hypertext. This may be several files.	POC
AV_SIS/MRFLRO_AV_SIS.PDF	The Archive Volume SIS (this document) as a PDF file	POC
AV_SIS/MRFLRO_AV_SIS.LBL	A PDS detached label that describes both MRFLRO_AV_SIS.HTM and MRFLRO_AV_SIS.PDF.	POC
CAL/MRF_CAL_MCKERRACHER_ET_AL2010.PDF	A description of Mini-RF calibration as a PDF file	POC
CAL/MRF_CAL_MCKERRACHER_ET_AL2010.HTM	The calibration description as an HTML document (this will actually be a set of files containing both HTML text and images).	POC
CAL/MRF_CAL_MCKERRACHER_ET_AL2010.LBL	A PDS detached label that describes both MRF_CAL_MCKERRACHER_ET_AL2010.HTM and MRF_CAL_MCKERRACHER_ET_AL2010.PDF	POC
GBTCAL/MRFLRO_CAL_GBT_JENSEN2009.PDF	A description of Mini-RF calibration activities using data from the Greenbank Radio Telescope (GBT) as a PDF file	POC
GBTCAL/MRFLRO_CAL_GBT_JENSEN2009.HTM	The GBT calibration description as an HTML document (this will actually be a set of files containing both HTML text and images).	POC
GBTCAL/MRFLRO_CAL_GBT_JENSEN2009.LBL	A PDS detached label that describes both MRFLRO_CAL_GBT_JENSEN2009.HTM and MRFLRO_CAL_GBT_JENSEN2009.PDF	POC
PDSDD.FUL	Identifies and describes the data object and data element definitions contained in the Planetary Science Data Dictionary (PSDD).	PDS
PDSDD.IDX	An index of the PDSDD.FUL and is currently used by the PDS validation tools to quickly locate individual elements in the PSDD.	PDS
PDSDD.LBL	A detached PDS label describing the PDSDD.FUL and PDSDD.IDX files.	PDS

Table 7 Contents of the Document directory.

2.5. Catalog Directory Contents

The files in the Catalog Directory provide a top-level understanding of the mission, spacecraft, instruments, and data sets. The files in this directory are coordinated with the PDS data engineer, who is responsible for loading them into the PDS catalog. The following files are found in the Catalog Directory.

File Name	File Contents	File Provided By
CATINFO.TXT	A description of the contents of this directory	POC

*_DS.CAT	Data set information for the PDS catalog (one file per data set). The file name will reflect the DATA_SET_ID, but will comply with PDS file naming standards. It will be composed of the DATA_SET_ID minus the "LRO-L-" prefix, all dashes and periods replaced with underscores, and _DS.CAT appended to the end. For example, the catalog file for the data set <i>LRO-L-MRFLRO-4-CDR-V1.0</i> would be named MRFLRO_4_CDR_V1_0_DS.CAT .	POC
INSTHOST.CAT	Instrument host (i.e., spacecraft) information for the PDS catalog	POC
INST.CAT	Instrument information for the PDS catalog	POC
MISSION.CAT	Mission information for the PDS catalog	POC
PERSON.CAT	Personnel information for the PDS catalog (Team and PDS personnel responsible for generating the archive)	POC
REF.CAT	References mentioned in other *.CAT files	POC
DSMAP.CAT	Contains the map projection equations for the Level 2 products.	POC

Table 8 Contents of the Catalog directory.

2.6. EXTRAS Directory

The delivered Digital Elevation Model (DEM) files which were used in science product generation and the orbit number files that associate orbit numbers with lunar location and time will be provided in the EXTRAS directory.

File Name	File Contents	File Provided By
EXTRINFO.TXT	A description of the contents of this directory	POC
DEM/LUNAR_DEM_<data>_<ver>.DAT	Project-generated lunar DEM files.	POC
ORBNUM/*.ORB	A text file that associates the orbit numbers with a location on the Moon and the start times of the orbit.	POC
QUICKVIEW	A set of JPEG images of the Level 2 ST1 and CPR product files.	POC

Table 9 Contents of the Extras directory.

2.7. Calibration (CALIB) Directory Contents

The Calib Directory contains calibration files used to process the data products, or calibration data needed to use the data products. The following files are contained in the **CALIB** Directory. There may be multiple versions of each file distinguished by the <date> section of the file name. The calibration files are associated with the Level 1 products data set (LRO-L-MRFLRO-4-CDR-Vn.n). See the data product SIS document for the naming conventions applied to these files.

File Name	File Contents	File Provided By
CALINFO.TXT	A description of the contents of this directory	POC
LfB_RPD_yyyymmddhhmm_Vv.DAT	Raw calibration data. <i>f</i> is the band S or X, <i>yyyymmddhhmm</i> is the date and time, <i>v</i> is the version number.	POC
LfB_RPD_yyyymmddhhmm_Vv.LBL	Minimal PDS label describing the calibration file.	POC
ARECIBO/LfA_RPD_yyyymmddhhmm_Vv.DAT	Raw Arecibo calibration data. <i>f</i> is the band S or X, <i>yyyymmddhhmm</i> is the date and time, <i>v</i> is the version number.	POC
ARECIBO/LfA_RPD_yyyymmddhhmm_Vv.LBL	Minimal PDS label describing the Arecibo calibration file.	POC

Table 10 Contents of the CALIB calibration data directory.

3. Archive Volume Format

This section describes the format of MRFLRO Archive Volumes. Data that comprise the Archive will be formatted in accordance with Planetary Data System specifications [Applicable Documents 4 and 5]. There will be only one archive volume, and its VOLUME_ID is **LROMRF_0XXX**.

Archive Volumes are delivered to the PDS electronically through a secure file transfer protocol (sftp) connection.

3.1. File Formats

This section describes file formats for the kinds of files contained on Archive Volumes.

3.1.1. Document File Format

Document files with the .TXT suffix exist in the Root, Index, Software, Catalog, and Label directories. They are ASCII files which may have embedded PDS labels. Lines in a .TXT file end with a carriage return character (ASCII 13) and a line feed character (ASCII 10). This allows the files to be readable under various 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 Mozilla, Apple Safari, or Microsoft Internet Explorer. The hypertext file is accompanied by referenced files such as images that are incorporated into the document by the Web browser. The second format, PDF (Portable Document Format) is a format from Adobe Systems Incorporated that is frequently used for distributing documents. Adobe offers free software, Acrobat Reader, for viewing PDF files.

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

3.1.3. Spreadsheet File Format

Some ancillary text data are provided in spreadsheet format. A spreadsheet file is a comma-delimited ASCII text file (.CSV suffix). Spreadsheet files are designed to be easily read by third-party spreadsheet software such as Microsoft Excel, Open Office, and others. Unlike Tabular files, spreadsheet files are not of fixed record length and character fields are not padded with spaces and no left or right justification is done. As with all delivered text files, the last two bytes of each record contain the ASCII carriage return and line feed characters.

All spreadsheet files are described by detached PDS labels. The PDS label file has the same name as the data file it describes, with the extension .LBL. The PDS label gives a complete description of every field in the spreadsheet (see *Planetary Data System Standards Reference* [3], section A.28).

3.1.4. Raw Format

The Raw or Packetized Data Records (PDR) files contain binary and unprocessed CCSDS packet data. These are provided with only minimal PDS labels. The PDS label file has the same name as the data file it describes, with the extension .LBL.

3.1.5. Binary File Format

The RAW data and certain supporting products are provided as binary tables. These products consist of numerical data in big-endian format. They are accompanied by detached full PDS labels.

3.1.6. Mosaic Format

The Level 3 mosaics are created using the Integrated Software for Imaging Spectrometers (ISIS) software from the USGS. These are images comprised of calibrated data from multiple orbits. They are single band raw binary images consisting of 32-bit floating point pixels. They are also provided as TIFF images. They are accompanied by detached full PDS labels.

3.1.7. Image Format

The primary Level 1 and Level 2 science data products as well as some of the supporting data are provided as binary image files. They contain data of both numeric and character types. The data are written in little-endian (PC_REAL) format.

All binary files are described by detached PDS labels. The PDS label file has the same name as the data file it describes, with the extension .LBL. The PDS label gives a complete description of every field in the data file.

Mosaics will also be provided as image files in JPEG-compressed format. All JPEG files are described by detached PDS labels, which comply with the PDS standard regarding images. Quickview images will be provided as JPEG files.

3.1.8. SPICE Kernels Format

Geometry, ephemeris, and attitude information are provided in SPICE kernels. SPICE kernels can contain either binary or text data.

All SPICE files are described by detached PDS labels. The PDS label file has the same name as the data file it describes, with the extension .LBL. The PDS standards provide a label standard for SPICE kernels (see *Planetary Data System Standards Reference* [1.3], section A.27). This standard will be followed for the LRO SPICE kernels archived by the POC. LRO SPICE kernels are delivered directly to the NAIF PDS node and are not part of this archive. They are mentioned here only for informational purposes.

3.1.9. PDS Label Format

All data files in the archive have PDS labels, either embedded at the beginning of the file or detached in a separate file. For examples of PDS labels for each type of data product, see the Data Product SIS [Applicable Document 3].

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 27 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.

A reference to an external text file would be indicated by the `^TEXT` keyword. For example:

`^TEXT = ("FILENAME.TXT")`

A reference to a separate spreadsheet (CSV) file would be indicated by the `^SPREADSHEET` keyword. For example:

`^SPREADSHEET = ("L_CAL_PPF_20070011000_01.CSV")`

Lines of text in detached labels end with a carriage return character (ASCII 13) and a line feed character (ASCII 10). This allows the files to be readable under various operating systems.

3.1.10. Catalog File Format

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

4. Archive Volume Generation

4.1. Data Transfer and Validation Methods

Initially, the entire data archive is produced at the Payload Operations Center (POC) and delivered to the PDS Geosciences node on a detachable hard drive or through electronic transfer.

The POC will make multiple deliveries to the PDS. Only new or changed files will be delivered in subsequent deliveries. If the POC generates any SPICE kernels, it will deliver them separately to the NAIF PDS node.

4.2. Data Product Sizes and Delivery Rates

There are two parts to the SAR/interferometry data collects:

1. Monthly four-minute collect
2. Semi-annual four two-minute collects on consecutive orbits

It is three months after the latter that data are submitted to the PDS. This will include, however, many monthly four-minute data takes in addition to the set of four two-minute takes.

Product	Product Size Per Day	Expected Number of Products for Primary 1-Year Mission	Expected Total Data Volume for Primary Mission
Raw SAR	29 GB	2130	10 TB
Level 1	46 GB	2130	16 TB
Level 2	52 GB	2130	18 TB
Level 2 Stokes & Polarization products	24 GB	14910	9 TB
Level 3 (mosaic)	N/A	16	4 GB
Ancillary data	5 MB	2130	2 GB
Quick View JPEG Image Files	4 GB	4260	2 TB
Pre-Mission Collection*	N/A	N/A	5 TB
Total	155 GB	27706	60 TB

Table 11 Summary of the estimated sizes and production rates for the LRO standard products. Note that product sizes are based on estimated upper limits, so the expected total is not the product of the size per day and the number of products. This assumes 355 collection days during the regular mission and an average of 6 collections per day.

***Includes data taken prior to the September 20, 2009 official beginning of the science mission. These were not collected continuously.**

5. Support Staff and Cognizant Persons

Name	Affiliation	Role on Project	Address	e-mail
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Susan Slavney	PDS Geosciences Node, Washington University in St. Louis	PDS Representative	1 Brookings Drive Campus Box 1169 St. Louis, MO 63130	Susan.Slavney@wustl.edu
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Table 12 List of key personnel on the LRO/Mini-RF project.

6. 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 or DVD-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 – 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*.

7. Acronyms

APL	(The Johns Hopkins University) Applied Physics Laboratory
ASCII	American Standard Code for Information Interchange
CCSDS	Consultative Committee for Space Data Systems
CDR	Calibrated Data Record
DEM	Digital Elevation Model
GB	Gigabyte (2^{20} bytes)
GSFC	Goddard Space Flight Center
IK	Instrument Measurement Kernel (SPICE)
ISIS	Integrated Software for Imaging Spectrometers (USGS software)
JHU/APL	The Johns Hopkins University Applied Physics Laboratory
JPEG	Joint Photographic Experts Group (image compression algorithm)

LRO	Lunar Reconnaissance Orbiter
NAIF	Navigation and Ancillary Information Facility
NASA	National Aeronautics and Space Administration
NAWC	Naval Air Warfare Center
ODL	Object Description Language
PDF	(Adobe) Portable Document Format
PDR	Packetized Data Records
PDS	(NASA) Planetary Data System
POC	Payload Operations Center
PVL	Parameter Value Language
SAR	Synthetic Aperture Radar
SCLK	Spacecraft Clock Kernel (SPICE)
SFTP	Secure File Transfer Protocol
SPICE	Spacecraft, Planet, Instrument, C-matrix Events
TB	Terabyte (2^{30} bytes)
USGS	United States Geological Survey
UTC	Coordinated Universal Time