

Mars Reconnaissance Orbiter (MRO)
CTX and MARCI
EDR Archive Volume
Software Interface Specification (SIS)

Version 1.0

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Appendix A – MRO CTX EDR ARCHIVE VOLUME CONTENTS

Appendix B – MRO MARCI EDR ARCHIVE VOLUME CONTENTS

DOCUMENT CHANGE LOG

Change	Date	Affected Portions
Initial Release, Version 1.0	05-02-07	All
Added MARCI EDR SIS, Calib directory, finalized DATA dir structure	05-16-07	Section 1.3, Appendix A, Appendix B

TBD ITEMS

Section	Description

ACRONYMS AND ABBREVIATIONS

ASCII	American Standard Code for Information Interchange
CODMAC	Committee On Data Management And Computation
CTX	Context Camera
DVD	Digital Video Disc
EDR	Experiment Data Record
HTML	HyperText Markup Language
IMG	Image
ISO	International Standards Organization
JPEG, JPG	Joint Photographic Experts Group
JPL	Jet Propulsion Laboratory
MARCI	Mars Color Imager
MRO	Mars Reconnaissance Orbiter
MIPL	Multi-mission Image Processing Laboratory
MSSS	Malin Space Science Systems
NASA	National Aeronautics and Space Administration
NSSDC	National Space Science Data Center
PDF	Adobe® Portable Document Format
PDS	Planetary Data System
SIS	Software Interface Specification
TBD	To Be Determined

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.

1. Introduction

1.1. Purpose and Scope

This Software Interface Specification is intended to be used by those who wish to understand the format and content of the Mars Reconnaissance (MRO) Archives. Typically, these individuals would be software engineers, data analysts, or planetary scientists.

The specifications in this document apply to the MRO Context Camera (CTX) Experiment Data Record (EDR) standard product archive volumes, and the MRO Mars Color Imager (MARCI) Experiment Data Record (EDR) standard product archive volumes that are generated by the MRO Project.

The MRO Archives are intended to be stored online for electronic distribution. The online version will conform to the structure described in this document. In addition, copies of the archives will be stored on physical media such as DVDs for long-term preservation. The requirements for these physical copies are described in section 4.

1.2. Content Overview

The MRO CTX and MARCI EDR Archive volume sets consists of the MRO EDR data products acquired and used during the mission. All archives contain documentation and other ancillary material.

The MRO CTX and MARCI data products are EDRs, produced from telemetry data acquired by the CTX and MARCI instruments onboard the MRO Project spacecraft. Telemetry data is processed into data records (CODMAC Level 2), with attached PDS labels, by Malin Space Science Systems (MSSS).

MSSS is the producer of all CTX and MARCI EDRs and is responsible for assembling the archives. The PDS is responsible for validating the archives for compliancy of structure and format against PDS specifications. The CTX and MARCI instrument science teams are responsible for reviewing the archive in terms of science validity and integrity.

This Software Interface Specification (SIS) describes the format, content, and generation of the Mars Reconnaissance Orbiter (MRO) CTX and MARCI Data Archives. Section 2, Archive Volume Contents, describes the general structure of 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 archive media. Section 5, Support Staff and Cognizant Persons, lists the individuals and institutions responsible for generating the archive volumes. Finally, Appendices A and B, describe the specific identifiers, specifications, and structure of the archive volumes produced along with a listing of any relevant documentation such as the Data Product SISs and schedules for release of data products.

1.3. Applicable Documents and Constraints

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

1. Mars Exploration Program Data Management Plan, R. E. Arvidson and S. Slavney, Rev. 3, March 20, 2002.
2. Mars Reconnaissance Orbiter Project Data Archive Generation, Validation, and Transfer Plan, R. E. Arvidson, S. J. Noland and S. Slavney, JPL D-22246 Ver. 1.0, March 1, 2005.
3. Mars Reconnaissance Orbiter Software Interface Specification Context Camera (CTX) Standard Data Product, M. Caplinger, April 2007.
4. Mars Reconnaissance Orbiter Software Interface Specification Mars Color Imager (MARCI) Standard Data Product, M. Caplinger, April 2007.
5. Planetary Data System Archive Preparation Guide, January 20, 2005, Version 0.050120, DRAFT, JPL D-31224.
6. Planetary Data System Standards Reference, August 1, 2003, Version 3.6, JPL D-7669, Part 2.

1.4. Relationships with Other Interfaces

This Archive Volume SIS could be affected by changes to the design of any of the MRO standard data products (Applicable Document #3 or #4).

2. Archive Volume Contents

This section describes the general contents of the MRO CTX and MARCI EDR Archive volumes, including directory names, file names, file contents, file types, and organization responsible for providing the files. Volume set specific MRO CTX and MARCI archive contents can be found in the appendices.

The MRO CTX and MARCI Archives are organized with each volume set on a separate logical volume (Several small data sets may be stored together on one physical volume, and a particularly large data set may span more than one physical volume). Each logical volume includes the required directories listed below, and may or may not include some or all of the optional directories.

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	Data provider
AAREADME.HTM	Hypertext version of AAREADME.TXT (optional)	Data provider
AAREADME.LBL	A PDS detached label that describes both AAREADME.TXT and AAREADME.HTM (optional, could be attached to AAREADME.TXT).	PDS Node
ERRATA.TXT	A cumulative listing of comments and updates concerning all archive volumes published to date	Data provider

VOLDESC.CAT A description of the contents of this volume in a PDS format PDS Node
 readable by both humans and computers

2.2. Data Directory Contents and Naming

Contents of the data directories for specific instruments is described in the appendices. Data file naming format and nomenclature is described in the Data Product SIS [Applicable Document #3 or #4].

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	PDS Node
INDEX.TAB	A table listing all data products on this volume	Data Provider
INDEX.LBL	A PDS detached label that describes INDEX.TAB	Data Provider
CUMINDEX.TAB	A cumulative listing of all data products on this volume and on previous volumes in this set	Data Provider
CUMINDEX.LBL	A PDS detached label that describes CUMINDEX.TAB	Data Provider

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.

File Name	File Contents	File Provided By
DOCINFO.TXT	A description of the contents of this directory	PDS Node
DPSIS.TXT or .HTM	The Data Product SIS as text or hypertext	Data Provider
DPSIS.PDF	The Data Product SIS as a PDF file	Data Provider
DPSIS.LBL	A PDS detached label that describes both DPSIS.TXT(HTM) and DPSIS.PDF	PDS Node
ARCHSIS.TXT or .HTM	The Archive Volume SIS (this document) as text or hypertext	Data Provider
ARCHSIS.PDF	The Archive Volume SIS (this document) as a PDF file	Data Provider
ARCHSIS.LBL	A PDS detached label that describes both ARCHSIS.TXT(HTM) and ARCHSIS.PDF.	PDS Node
[*.TXT files]	Other Documents	Data Provider

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	PDS Node
DATASET.CAT	Data set information for the PDS catalog	Data Provider
INSTHOST.CAT	Instrument host (i.e., spacecraft) information for the PDS catalog	MRO Project
INST.CAT	Instrument information for the PDS catalog	Data Provider
MISSION.CAT	Mission information for the PDS catalog	MRO Project
PERSON.CAT	Personnel information for the PDS catalog (Team and PDS personnel responsible for generating the archive)	Data Provider
REF.CAT	References mentioned in other *.CAT files	Data Provider

2.6. 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.

File Name	File Contents	File Provided By
CALINFO.TXT	A description of the contents of this directory	PDS Node
CALDOC.TXT	A text file describing the calibration algorithm	Data Provider
Calibration files	Image Calibration Files	Data Provider

3. Archive Volume Format

This section describes the format of the MRO CTX and MARCI EDR Archive Volumes. Data that comprise the Archive will be formatted in accordance with Planetary Data System specifications [Applicable Documents #5 and #6].

3.1. Disk Format

Archive Volumes have a digital video disk (DVD) format. The volume format is in accordance with ISO 9660 level 1 Interchange Standard or level 2, if any file names are longer than 8.3.

3.2. File Formats

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

3.2.1. Document File Format

Document files with the .TXT suffix exist in the Root, Index, Software, Catalog, Document, and Label directories. They are ASCII files which may have embedded PDS labels. Lines in a .TXT file end with a carriage return character, <CR> (ASCII 13) and a line feed character, <LF> (ASCII 10). PDS recommends plain text files have line length restricted to 80 characters or fewer, including the <CR><LF>. This allows the files to be readable under various operating systems.

Documents in the Document directory may 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.

3.2.2. Tabular File Format

Tabular files (.TAB suffix) exist in the Index directory and in any data directory where the data consists of ascii tables. 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 that are 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 INDEX.TAB is accompanied by the detached label file INDEX.LBL in the same directory.

3.2.3. PDS Label Format

All data files in the archive have PDS labels as detached files or embedded at the beginning of the file. For examples of PDS labels for each type of data product, see the Data Product SISs [Applicable Document #3 or #4].

A PDS label, 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 to (e.g. IMAGE, TABLE, etc.) is denoted by a statement of the form:

^object = location

in which the caret character (^, also called a pointer in this context) indicates where to find the object. The location is an integer representing the starting record number of the object (the first record in the file is record 1). Below is the format for the ^object definition.

^object = n

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

3.2.4. 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.

Each line in a catalog file must be terminated by the two-character carriage-return/linefeed, <CR><LF>, sequence (ASCII decimal character codes 13 and 10, respectively). PDS requires catalog files have line length restricted to 72 characters or fewer including the <CR><LF>, to accommodate PDS' internal database requirements.

3.2.5. Science Data File Formats

See the Data Product SIS for EDR product descriptions of the data file formats.

4. Archive Volume Generation

4.1. Data Transfer, Validation Methods, and Peer Review

The MRO CTX and MARCI EDRs will be generated by MSSS. The MRO CTX and MARCI science teams, with the assistance of the PDS Imaging Node, are responsible for the documentation and ancillary files pertaining to their data. MSSS is responsible for the assembly and production not only of PDS formatted data, but of complete, PDS-compliant archive volumes.

MSSS will deliver the data volumes via external hard disk, e.g. data brick, or make them available for electronic transfer to the Imaging Node in accordance with the delivery schedule described in the MRO Archive Plan document. The Imaging Node will validate each data delivery to verify that each volume adheres to PDS standards, the EDR SIS and to this Archive Volume SIS. The Engineering Node may perform additional validation once the volume has been received.

Before delivery of the first archive volume, the PDS Imaging Node will conduct a peer review. The purpose of the peer review is to confirm that the data products adhere to PDS standards and that they be useable by members of the science community who may not be familiar with the mission and/or instrument. Reviewers include members of the PDS, a distributed representation of the project science teams, and members of the science community not associated with the mission.

4.2. Interface Media Characteristics

All volumes in the MRO CTX and MARCI Standard Product Archive will be delivered on hard disk, e.g. data brick, or made available through electronic transfer to the Imaging Node.

4.3. Backup and Duplicates

Each archive volume delivery acquired by the Imaging Node will be stored on hard disk. Copies of the archive volumes will be forwarded via electronic transfer to the PDS Engineering Node and the NSSDC.

4.4. Labeling and Identification

Please refer to appendices for instrument specific labeling scheme of archive volumes.

5. Support Staff and Cognizant Persons

5.1. Data Providers

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5.2. PDS Contacts

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Appendix A.

MRO CTX EDR ARCHIVE VOLUME CONTENTS

A.1 Applicable Documents

1. Mars Exploration Program Data Management Plan, R. E. Arvidson and S. Slavney, Rev. 3, March 20, 2002.
2. Mars Reconnaissance Orbiter Project Data Archive Generation, Validation and Transfer Plan, R.E. Arvidson, S.J. Noland and S. Slavney, JPL D-22246 Ver. 1.0, March 1, 2005.
3. Mars Reconnaissance Orbiter Software Interface Specification Context Camera (CTX) Standard Data Product, M. Caplinger, April 2007.

A.2 Volume Sets

The MRO CTX EDR Archive is composed of 1 volume set, described in this appendix. The volume set consists of 1 data set pertaining to the CTX instrument onboard the MRO Project spacecraft.

A.2.1 Identifiers

DATA_SET_ID = "MRO-M-CTX-2-EDR-L0-V1.0"
DATA_SET_NAME = "MRO MARS CONTEXT CAMERA 2 EDR L0 V1.0"
VOLUME_ID = MROX_0XXX
VOLUME_SET_ID = USA_NASA_PDS_MROX_0XXX

A.2.2 Responsibilities

TASK	RESPONSIBLE PARTY
Data products produced by:	MSSS
Ancillary files and documentation produced by:	MRO Project, Instrument Teams, and PDS
Archive volume assembled by:	MSSS
Data and volume validated by:	PDS Imaging Node and PDS Engineering Node
Data distributed by:	PDS Imaging Node

A.2.3 Data Release Dates

EVENT	DATE
Data release schedule:	Please see the Mars Reconnaissance Orbiter Project Data Archive Generation, Validation and Transfer Plan

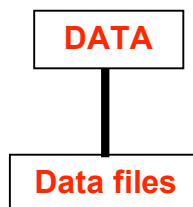
A.2.4 Volume Structure

DIRECTORY	FILE	DESCRIPTION
ROOT	AAREADME.TXT	Textual information describing the volume content and format.
	ERRATA.TXT	Textual information describing errors and/or anomalies found on the current or previous volumes.
	VOLDESC.CAT	A description of the contents of the archive volume in a human and machine readable format.
CALIB	CALINFO.TXT	A textual description of the contents of the CALIB directory.
	CALDOC.TXT	A text file describing the calibration algorithm.
	Calibration data and/or files	Image calibration files.
CATALOG	CATINFO.TXT	A textual description of the contents of the CATALOG directory.
	DATASET.CAT	Data set catalog object for the MRO CTX instrument EDRs. This is a detailed textual description including: an overview of the data; descriptions of the primary measured parameters, the processing history, and the data format, ancillary information necessary to understand the data; any applicable coordinate systems, software necessary for the use of the data, and an analysis of the quality and limitations of the data.
	INST.CAT	Instrument catalog object for the MRO CTX instrument. This is a detailed textual description of the instrument including scientific objectives, calibration information, operational considerations, a description of the detectors and electronics (and filters and optics, if appropriate), the operational modes, subsystems, and measured parameters.
	INSTHOST.CAT	A textual description providing an overview of the MRO spacecraft.
	MISSION.CAT	A detailed description of the MRO mission.
	PERSON.CAT	Personnel catalog object. Contact information for people responsible for producing the science data and archive volume and its component data sets.
	REF.CAT	Reference catalog object. This is a complete list of references of papers

		providing further information about the data set and instrumentation on this volume.
DATA		Please see “Data Directory Structure” section below for a description of the DATA directory structure.
DOCUMENT	DOCINFO.TXT	A textual description of the contents of the DOCUMENT directory.
	CTXSIS.{PDF,TXT,LBL}	Data Product Software Interface Specification for the CTX and MARCI instruments.
	ARCHSIS.{PDF,TXT,LBL}	Volume Organization Software Interface Specification for the MRO CTX and MARCI data archives.
	MRO_ARCH_PLAN.{PDF,TXT,LBL}	MRO Project Archive Generation, Validation, and Transfer Plan document.
INDEX	INDXINFO.TXT	A textual description of the contents of the INDEX directory.
	INDEX.{TAB,LBL}	A tabular summary of the data files on this volume.
	CUMINDEX.{TAB,LBL}	A cumulative tabular summary of the data files on all (previous) volumes in this volume set.

A.2.4.1 Data Directory Structure

Immediately beneath the DATA directory are the data product files. They are not subdivided into any subdirectories. The following diagram shows the DATA directory structure:



Appendix B.

MRO MARCI EDR ARCHIVE VOLUME CONTENTS

B.1 Applicable Documents

1. Mars Exploration Program Data Management Plan, R. E. Arvidson and S. Slavney, Rev. 3, March 20, 2002.
2. Mars Reconnaissance Orbiter Project Data Archive Generation, Validation and Transfer Plan, R.E. Arvidson, S.J. Noland and S. Slavney, JPL D-22246 Ver. 1.0, March 1, 2005.
3. Mars Reconnaissance Orbiter Software Interface Specification Mars Color Imager (MARCI) Standard Data Product, M. Caplinger, April 2007.

B.2 Volume Sets

The MRO MARCI EDR Archive is composed of 1 volume set, described in this appendix. The volume set consists of 1 data set pertaining to the MARCI instrument onboard the MRO Project spacecraft.

B.2.1 Identifiers

DATA_SET_ID = "MRO-M-MARCI-2-EDR-L0-V1.0"
DATA_SET_NAME = "MRO MARS MARS COLOR IMAGER 2 EDR L0 V1.0"
VOLUME_ID = MROM_0XXX
VOLUME_SET_ID = USA_NASA_PDS_MROM_0XXX

B.2.2 Responsibilities

TASK	RESPONSIBLE PARTY
Data products produced by:	MSSS
Ancillary files and documentation produced by:	MRO Project, Instrument Teams, and PDS
Archive volume assembled by:	MSSS
Data and volume validated by:	PDS Imaging Node and PDS Engineering Node
Data distributed by:	PDS Imaging Node

B.2.3 Data Release Dates

EVENT	DATE
Data release schedule:	Please see the Mars Reconnaissance Orbiter Project Data Archive Generation,

B.2.4 Volume Structure

DIRECTORY	FILE	DESCRIPTION
ROOT	AAREADME.TXT	Textual information describing the volume content and format.
	ERRATA.TXT	Textual information describing errors and/or anomalies found on the current or previous volumes.
	VOLDESC.CAT	A description of the contents of the archive volume in a human and machine readable format.
CALIB	CALINFO.TXT	A textual description of the contents of the CALIB directory.
	CALDOC.TXT	A text file describing the calibration algorithm.
	calibration data and/or files	Image calibration files.
CATALOG	CATINFO.TXT	A textual description of the contents of the CATALOG directory.
	DATASET.CAT	Data set catalog object for the MRO MARCI instrument EDRs. This is a detailed textual description including: an overview of the data; descriptions of the primary measured parameters, the processing history, and the data format, ancillary information necessary to understand the data; any applicable coordinate systems, software necessary for the use of the data, and an analysis of the quality and limitations of the data.
	INST.CAT	Instrument catalog object for the MRO MARCI instrument. This is a detailed textual description of the instrument including scientific objectives, calibration information, operational considerations, a description of the detectors and electronics (and filters and optics, if appropriate), the operational modes, subsystems, and measured parameters.
	INSTHOST.CAT	A textual description providing an overview of the MRO spacecraft.
	MISSION.CAT	A detailed description of the MRO mission.
	PERSON.CAT	Personnel catalog object. Contact information for people responsible for producing the science data and archive volume and its component data sets.
	REF.CAT	Reference catalog object. This is a

		complete list of references of papers providing further information about the data set and instrumentation on this volume.
DATA		Please see “Data Directory Structure” section below for a description of the DATA directory structure.
DOCUMENT	DOCINFO.TXT	A textual description of the contents of the DOCUMENT directory.
	MARCISIS.{PDF,TXT,LBL}	Data Product Software Interface Specification for the CTX and MARCI instruments.
	ARCHSIS.{PDF,TXT,LBL}	Volume Organization Software Interface Specification for the MRO CTX and MARCI data archives.
	MRO_ARCH_PLAN.{PDF,TXT,LBL}	MRO Project Archive Generation, Validation, and Transfer Plan document.
INDEX	INDXINFO.TXT	A textual description of the contents of the INDEX directory.
	INDEX.{TAB,LBL}	A tabular summary of the data files on this volume.
	CUMINDEX.{TAB,LBL}	A cumulative tabular summary of the data files on all (previous) volumes in this volume set.

B.2.4.1 Data Directory Structure

Immediately beneath the DATA directory are the data product files. They are not subdivided into any subdirectories. The following diagram shows the DATA directory structure:

