Mars Exploration Rover (MER) Project

Archive Generation, Validation and Transfer Plan

Revision A

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CHANGE LOG

DATE	SECTIONS CHANGED	REASON FOR CHANGE	REVISION
9/12/00	All	First draft	Draft
1/2/01	All	Incorporated comments from DAWG; added discussion of validation, Planetary Atlas and Analyst's Notebook	Draft
1/8/01	Title page	Added signature line for Mission System Manager	Draft
12/20/01	1.4 Applicable Documents and Constraints	Fixed incomplete references	Draft
12/20/01	Title page	Added signature line for Science Manager	Draft
12/20/01	2.1, Tables 1, 4, 5	Removed Suncam references	Draft
12/20/01	2.2 Data Flow	Revised discussion of data release dates	Draft
12/20/01	2.3 Data Validation and Peer Review	Revised discussion of peer review in accordance with new PDS policy of beginning review early, during design phase	Draft
12/20/01	2.4 Integrated Archives 3.2 Planetary Data System Responsibilities	Changed "Planetary Atlas" to "PDS Online Services" to reflect new services to be offered by PDS	Draft
12/20/01	4 Detailed Archive Generation, Validation, and Release Schedules	Replaced section 4 with Table 6, MER Archive Generation, Validation, and Release Schedule	Draft
12/20/01	Table 2. Definitions of Processing Levels for Science Data Sets	Removed NASA Level 1C, since not used	Draft
1/15/02	Table 3, Components of MER Archives, and Table 4, MER Archive Component Suppliers	Revised and expanded to make the two tables consistent	Draft
1/28/02	2.3 Data Volume	Section added	Draft
1/28/02	Table 5, MER Standard Data Products	Removed Data Volume column	Draft
2/18/02	2.2 Data Flow	Described OSS and SSS access and use for storing EDRs and RDRs. New requirement for Project to deliver 3 copies of archives on hard digital media to the PDS (consistent with the new Mars Program Data Management Plan)	Draft
2/18/02	2.3 Data Volume	Increased the total data volume estimate	Draft
2/18/02	Fig.1	Added a Figure showing the Mission Timeline	Draft
3/22/02	Section 3.3 NSSDC	Added a sentence: NSSDC may also provide support for distribution of MER data to the general public, although this is beyond the domain of this MER Archive Generation, Validation, and Transfer Plan.	Draft

5/12/03	2.2 Data Flow	Added paragraph about delivery of special products	Rev. A
5/12/03	Tables 3, 4, and 5	Added specific rover engineering products	Rev. A
5/12/03	Table 5, MER Standard Data Products	Revised to match John Callas' list of standard products; added NASA processing levels	Rev. A
5/12/03	Section 3.2 Planetary Data System Responsibilities	Revised description of PDS Central Node participation based on comments from PDS Mars Data Engineer	Rev. A
6/25/03	Section 2.2 Data Flow	Revised description of science team access to data products	Rev. A
6/25/03	Figure 1, Mission Timeline	Replaced with revised timeline figure	Rev. A
8/25/03	Table 5, MER Standard Data Products	Revised to match John Callas' list (again)	Rev. A
9/3/03	Section 1.4, Applicable Documents Section 2.2, Data Flow	Added requirements for Data Product and Archive Volume SISs	Rev. A
9/29/03	Section 3.2, Planetary Data System Responsibilities	Clarified archiving of RDRs between Imaging and Geosciences Node	Rev. A

TBD ITEMS

SECTION	DESCRIPTION
None	

CONTENTS

FIGURES

TABLES

ACRONYMS

APXS	Alpha Particle X-ray Spectrometer
DAWG	Data and Archives Working Group
DOM	Distributed Object Manager
EDR	Experiment Data Record
FOV	Field of View
GDS	Ground Data System
JPL	Jet Propulsion Laboratory
LAN	Local Area Network
MB	Mössbauer Spectrometer
MER	Mars Exploration Rover
MI	Microscopic Imager
Mini-TES	Miniature Thermal Emission Spectrometer
MIPL	Multi-mission Image Processing Laboratory
MMO	Mission Management Office
NAIF	Navigation and Ancillary Information Facility
NSSDC	National Space Science Data Center
OSS	Operations Storage Server
PDS	Planetary Data System
RAT	Rock Abrasion Tool
RDR	Reduced Data Record
RPIF	Regional Planetary Image Facility
SDVT	Science Data Validation Team
SIS	Software Interface Specification
SOWG	Science Operations Working Group
SPICE	Spacecraft, Planet, Instrument, Camera matrix, and Event kernels (historical acronym for navigation and ancillary data)
SSS	Science Storage Server
TBD	To Be Determined
VPN	Virtual Private Network

1. INTRODUCTION

1.1 Purpose

The purpose of this document is to provide a plan for generation, validation, and transfer to the Planetary Data System (PDS) of archives from the 2003 Mars Exploration Rover (MER) Mission. The archives will contain raw and reduced data, documentation, and algorithms or software.

1.2 Scope

The plan covers archiving of raw and reduced data sets and related information to be acquired or derived during the MER mission.

Specific aspects addressed in this plan are:

- Generation of high-level mission, spacecraft and instrument documentation, instrument calibration reports, and documentation of algorithms and/or software used to produce reduced data records.
- Reduction of science packet data to reduced data records, including generation of data sets expressed in geophysical units, with associated documentation that records when and where the data were acquired and for what purpose.
- Generation of SPICE archives for use with software from the Jet Propulsion Laboratory's Navigation and Ancillary Information Facility (NAIF).
- Generation and validation of archive volumes containing MER science and engineering data, software, algorithms, documentation, and ancillary information.
- Delivery to the PDS of validated MER archives.

1.3 Contents

This plan begins with a summary of MER mission phases and an overview of the archiving flow. This section is followed by a description of the roles and responsibilities for organizations and personnel associated with generation, validation, and archiving of MER data. The document ends with specific archiving plans.

1.4 Applicable Documents and Constraints

This Archive Generation, Validation, and Transfer Plan is responsive to the following Mars Exploration Program and MER documents:

1. Mars Exploration Program Data Management Plan, R. E. Arvidson and S. Slavney, Rev. 3, March 20, 2002.
2. Mars Exploration Rover Project Plan, P. C. Theisinger, MER 420-1-100, JPL D-19374.
3. Mars Exploration Rover Mission Plan, J. Ludwinski, MER 420-1-300, JPL D-19659.

4. Mars Exploration Rover Project Athena Science Implementation Plan, S. Squyres, MER 420-1-201, JPL D-20458.
5. Mars Exploration Rover Project Science Management Plan, J. Crisp, MER 420-1-103, JPL D-19637.
6. Mars Exploration Rover Analyst's Notebook Functional Requirements Document, E. A. Guinness et al., Draft 1.0, April 26, 2001.

The plan is consistent with the principles delineated in the following National Academy of Sciences reports:

7. Data Management and Computation, Volume 1, Issues and Recommendations, 1982, National Academy Press, 167 p.
8. Issues and Recommendations Associated with Distributed Computation and Data Management Systems for the Space Sciences, 1986, National Academy Press, 111 p.

The plan is also consistent with the following Planetary Data System documents:

9. Planetary Data System Data Preparation Workbook, February 17, 1995, Version 3.1, JPL D-7669, Part 1.
10. Planetary Data System Data Standards Reference, June 15, 2001, Version 3.4, JPL D-7669, Part 2.

The plan requires the generation of the following Project documents:

11. Data Product Software Interface Specification (SIS) for all Standard Products.
12. Archive Volume Software Interface Specification (SIS) for all Standard Products.

Finally, the plan is meant to be consistent with the contract negotiated between the MER Project and the Athena Principal Investigator (PI) in which reduced data records and documentation are explicitly defined as deliverable products.

2. MER ARCHIVE GENERATION, VALIDATION, AND TRANSFER TO THE PDS

2.1 The Mission

The Mars Exploration Rover Mission consists of two launches of identical spacecraft in May/June of 2003, with placement of a lander and rover in two different localities on Mars in January of 2004. Each rover will conduct traverses and acquire scientific data using the Athena payload and rover engineering systems. Each rover will operate for at least a 90-sol primary mission, with a possible extended mission of perhaps up to another 90 sols. Figure 1 shows the mission timeline.

The two identical flight systems will each consist of a cruise stage, an entry, descent, and landing system, and a rover. The Athena Payload on each rover will include a mast-mounted stereo color panoramic imager (Pancam) and a mid-IR spectrometer (Mini-TES), arm-mounted Mössbauer and Alpha-Particle X-ray Spectrometers (MB and APXS), a microscopic surface imager (MI), and a Rock Abrasion Tool (RAT). Navigation and hazard avoidance cameras will also be included on the rover. Table 1 summarizes the MER rover payload. In addition, physical

properties experiments will be conducted using the rover wheels to dig into soils and characterizing the exposed materials with the Athena instruments.

2.2 Data Flow

As part of the MER Ground Data System (GDS), the JPL Multi-Mission Image Processing Laboratory (MIPL) will generate Experiment Data Records (EDRs) from telemetry data from the Athena science instruments. The EDRs will be stored on the MER Operations Storage Server (OSS). Both MIPL and members of the Science Team will generate Reduced Data Records (RDRs) for some instruments. The MIPL RDRs will be stored directly on the OSS. (Table 2 defines processing levels associated with Reduced Data Records.)

EDRs and RDRs will be generated according to designs specified in Data Product Software Interface Specification (SIS) documents. Every MER standard product is described in a Data Product SIS.

Access to the OSS is restricted by a network firewall to users on workstations within the Mission Support Area Flight LAN. To allow science team members and other authorized users outside the firewall to access the EDRs and RDRs, a copy of the OSS will be created on the MIPL Alternate Storage Server (MASS). Additionally, users outside the network firewall may use FEI (File Exchange Interface) subscriptions or Smart Cards (and VPN, if outside of the JPL Institutional network) to access files on the OSS. For analysis performed outside of the network firewall, science team members may download EDR and RDR products for processing from the MASS using the Image Atlas front-end (web page). RDRs intended to support operations may be uploaded to the OSS, as necessary via FEI or SSH using Smart Cards.

The MASS will be the primary repository for science EDR and RDR data products produced during operations to be archived with PDS. The Analyst Notebook (AN) will be the repository for externally produced science data products to be archived with PDS. The AN will contain additional archive materials such as documentation, software, calibration data, engineering data, and SPICE kernels. Table 3 lists the elements that comprise the MER archives, Table 4 lists the suppliers of data and information for the archives, and Table 5 lists the standard and special data products expected to be produced.

The MER Project is required to generate, validate, and deliver all of the mission raw and derived data and supporting documentation to the Planetary Data System within six months of data acquisition. In keeping with this requirement, the MER Project will deliver to the PDS two integrated archives for each rover mission, the first one no later than six months after Sol 30 data are received on Earth, and the second one no later than six months after Sol 90 data are received on Earth. If there is an extended mission, then a third release will occur no later than six months after the last data from the extended mission are received on Earth. Table 6 shows dates for archive data acquisition and release.

In addition to the standard products in Table 5, special products may be generated by some data suppliers as time and other resources permit. Those special products that are completed and validated in time for a scheduled release to PDS may be delivered along with the standard products. PDS will continue to accept special products after the end of the mission as long as they are documented and validated according to PDS standards.

Payload Element Leads are responsible for preparing data from their payload elements, along with supporting materials, for release to the PDS. A data release may take the form of electronic transfer or delivery on physical media to the appropriate PDS Node (section 3.2). PDS personnel will work closely with science team members to ensure a smooth transfer. When data products have been released to the PDS, they are regarded as publicly available. It is expected that the data will be made available to the public online through the PDS online distribution system, and in the form of an Analyst's Notebook (section 2.5).

All MER archive collections will be assembled according to designs specified in Archive Volume Software Interface Specification (SIS) documents.

Although online access will be the primary distribution method for MER archives, the PDS requires that archives be stored on appropriate physical media (e.g. CDs, DVDs) for long-term maintenance at the PDS and at the National Space Science Data Center (NSSDC). The MER Project is responsible for generating and delivering to PDS three copies of MER EDR and RDR archives on physical media. PDS will deliver one of those copies to NSSDC.

2.3 Data Volume

For planning purposes, the total downlinked data volume from both rovers is estimated at approximately 4 Gigabytes for the primary mission, based on sample mission scenarios. The total volume of EDR products after decompression is estimated to be the downlink volume times 16. The total volume of RDR products is not yet determined, but could be as much as 25 times the EDR volume, which would correspond to a total archive data volume (EDR and RDR) of 1.6 Terabytes. Extremely optimistic outcomes could result in twice as much downlinked data.

2.4 Data Validation and Peer Review

MER science archives will be validated before being released to the PDS. Validation is accomplished in two parts: validation for scientific integrity and validation for compliance with PDS standards. The progress of archive generation, validation and transfer will be monitored independently by the MMO Science Data Validation Team (SDVT). The SDVT will provide advice and expertise as necessary in the archive generation, validation and delivery process.

Science team members are expected to conduct validation for scientific integrity in the course of their analysis of EDRs and their production of RDRs. The details of the science validation process are the responsibility of the Payload Element Leads.

Validation for compliance with PDS standards is also the responsibility of each Payload Element Lead, with help from the PDS Node that will receive the data products. PDS will provide software tools, examples, and advice to help make this part of the validation as efficient as possible. This validation includes a peer review of the design and labeling of data products as laid out in the Data Product Software Interface Specification (SIS) documents, and validation of the PDS labels using sample data. The review will take place well before the start of operations, to allow sufficient time to correct problems. Reviewers will consist of a small group of scientists who represent typical users of the data; for example, Participating Scientists would be good candidates for reviewers. After the start of operations, when generation of standard products has begun, each individual product will be validated to see that it conforms to the design specified in the SIS. Validation of individual products will be automated as much as possible.

2.5 Integrated Archives

The concept of integrated archives is the key to making the best use of the data returned by the various science instruments on MER. Unlike previous orbital and landed missions in which instruments were operated mostly independently of one another, in a rover mission the instruments must operate in close coordination. Furthermore, a rover mission is non-deterministic; a decision to conduct a sequence of observations may be driven by recently acquired data rather than by a plan determined in advance. The Athena Team and the general science community will require access to science data archives that are integrated across instruments by time, by location, and by observation target, at a minimum. Two complementary systems, PDS online services (such as the Planetary Image Atlas) and the Analyst's Notebook, will provide the desired accessibility.

2.5.1 PDS Online Services

PDS will offer a Web-based system of access to MER science data products. It will allow selection based on various search criteria, browsing of data, and downloading in various formats. A version of the online system adapted specifically to the needs of the MER mission will be available for use by mission personnel. The system can also be used by the general science community to view and download data products that have been made public.

2.5.2 The Analyst's Notebook

The Analyst's Notebook is a Web-based tool for correlating data products from various Athena instruments based on time, location, observation target, and other criteria. The Notebook will provide detailed views into operational decisions, results, and access to raw and derived data and instrument calibration information. Using the Notebook, a scientist can virtually replay mission events to better select and understand data products of interest. The Analyst's Notebook will be designed and implemented by the Deputy Principal Investigator at Washington University, based in part on the Experimenter's Notebooks built to support analyses of data collected during the FIDO rover field trials. The Analyst's Notebook is a deliverable to the MER Project.

The PDS online system and the Analyst's Notebook are intended to be complementary tools. The PDS system will probably be used to satisfy most requests for locating and downloading data products by MER mission personnel and the general science community. The Analyst's Notebook will probably be used by a smaller set of scientists who need access to the most detailed information available about the data.

3. ROLES AND RESPONSIBILITIES

In this section the roles and responsibilities for personnel and organizations involved in MER archive generation, validation, transfer, and distribution are summarized.

3.1 Mars Exploration Rover Project Responsibilities

The MER Project has overall responsibility for generation and validation of archives for release to the PDS. The Project is also responsible for distribution of data and associated information to MER personnel.

The Project Scientist co-chairs the Project Science Group and provides oversight of the archiving process from a science perspective. The Project Scientist will review data analysis plans to assure timely and adequate analysis of spacecraft data and delivery of documented, complete data to the PDS. The MER Science Manager is responsible for the administrative management of data archive planning and implementation.

The Data and Archives Working Group (DAWG) will coordinate the planning of the generation, validation, and release of PDS-compliant archives to the PDS. The DAWG is a subgroup of the MER Project Science Group and reports to the PSG Co-Chairs (MER Project Scientist and MER Program Scientist). The DAWG Chair is the MER Interdisciplinary Scientist for Data and Archives (also the Athena Deputy Principal Investigator). DAWG membership includes the MER Project Scientist, the Athena Principal Investigator and Payload Element Leads, representatives from NAIF and MIPL, the SDVT Chair, and project personnel selected to ensure that raw packets, engineering data sets, and documentation are included in archives. Representative PDS personnel will be liaison members of the DAWG. For the most part, the DAWG's work will take place before mission operations begin. During the active mission the DAWG will remain ready to meet if necessary.

The Science Data Validation Team (SDVT), organized under the auspices of the MMO, will assume the responsibility of implementing the DAWG's archiving plans during the active mission. The SDVT chair will be appointed by the MMO. The members will include representatives from the Athena Payload Element Leads, PDS, NAIF, and MIPL; in fact the membership may be similar to that of the DAWG. The SDVT is responsible for overseeing the generation, validation, and release of standard data products according to a Project-approved schedule.

MIPL is responsible for generating validated, PDS-compatible archives containing Experiment Data Records (Level 0) from the Athena science instruments.

The Athena Principal Investigator is responsible for generating validated, PDS-compatible archives containing derived data products (Level 1 and above) from Athena data, along with documentation, algorithms or software for generating derived data products, calibration data and reports, and other supporting materials.

3.2 Planetary Data System Responsibilities

The PDS is the designated point of contact for MER on archive-related issues. The PDS is also the interface between MER and the National Space Science Data Center (NSSDC). The PDS will work with the DAWG to ensure that the MER archives are compatible with PDS standards and formats. Personnel from the PDS Geosciences, Imaging, Atmospheres, NAIF and Central Nodes will be liaison DAWG Members.

The PDS will provide funds for generation, distribution, and maintenance of MER archives for the NASA planetary science community once the archives have been released by MER.

Primary responsibility for archiving will be shared between the PDS Geosciences and Imaging Nodes, as follows. The Geosciences Node will provide overall coordination of PDS activities for MER. The Imaging Node will work with MIPL to archive EDRs from all Athena science instruments, both imaging and non-imaging instruments. The Imaging and Geosciences Node will work together to archive RDRs from all Athena science instruments as a set of integrated

archives using the PDS online services and the Analyst's Notebook. The Imaging Node will archive all camera RDRs, while the Geosciences Node will archive Mössbauer, APXS, and Mini-TES RDRs. The Geosciences Node will also archive rover engineering data from the MER Project.

The PDS will be responsible for generating copies of MER archives on physical media for long-term storage. EDR and RDR archives will be captured on physical media, probably DVDs.

The Mars Data Engineer from the PDS Central Node will work with the PDS Discipline Nodes involved with MER throughout the archive planning, generation, and validation phases.

The PDS NAIF Node will archive MER telemetry packet data and SPICE files. SPICE files will also be included in the MER integrated archives at the Geosciences Node.

3.3 National Space Science Data Center Responsibilities

The National Space Science Data Center will maintain a "deep archive" of MER data for long-term preservation and for filling large delivery orders to the science community. The PDS will deliver at least one copy of MER archive volumes to NSSDC. NSSDC may also provide support for distribution of MER data to the general public, although this is beyond the domain of this MER Archive Generation, Validation, and Transfer Plan.

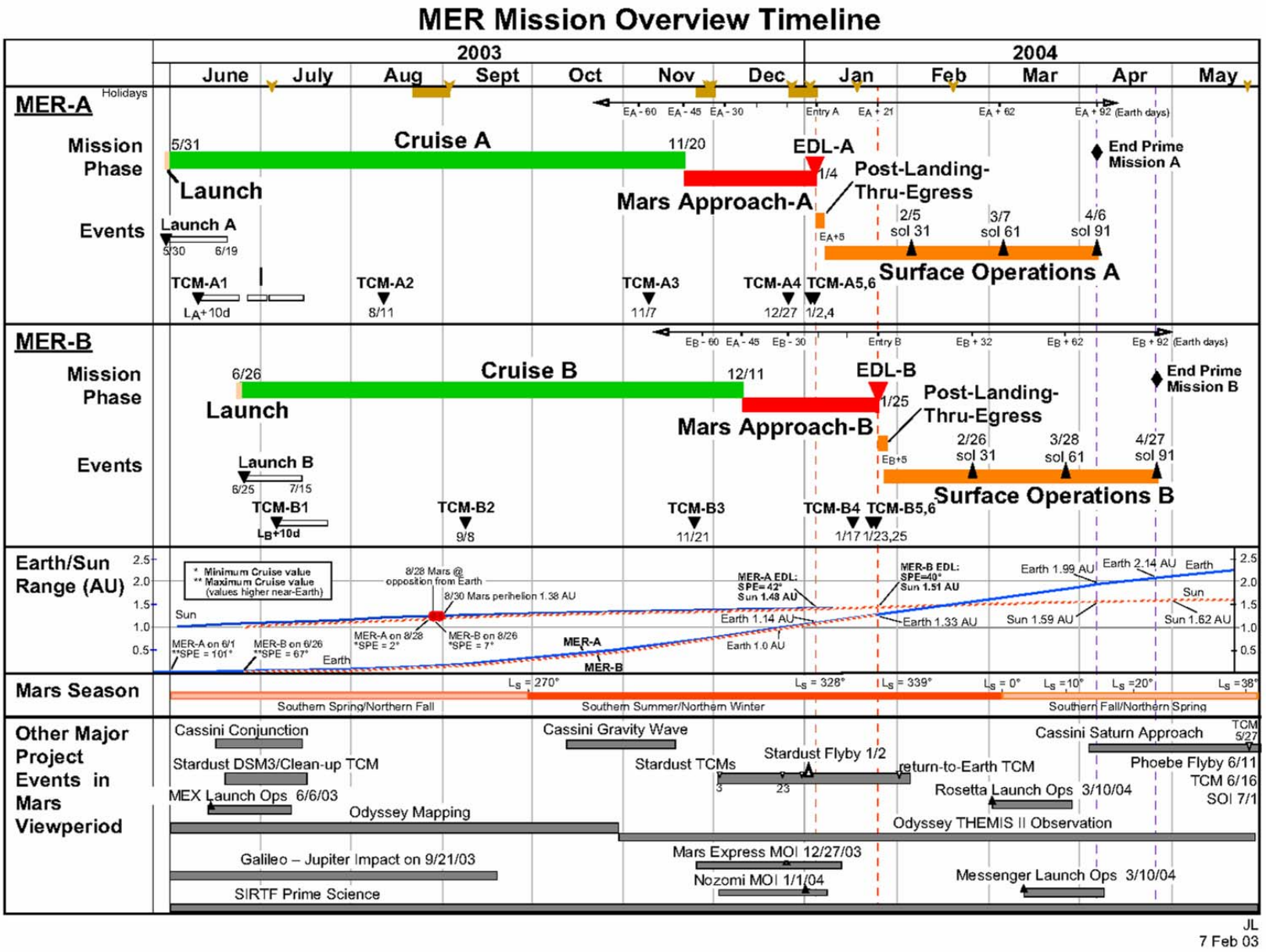

Figure 1. Mission Timeline

Table 1. MER Athena Rover Payload

Instrument	Key Parameters	Purpose
Mast-Mounted		
Pancam	Eleven filters (0.4 to 1.0 μm) for stereoscopic multispectral imaging plus two color solar ND filter imaging; 0.28 mrad IFOV; 16.8° by 16.8° FOV; 1024x1024 pixel CCD detector	Detailed imaging of surface for geologic and topographic characterization; atmospheric optical depth and scattering properties
Mini-TES (Thermal Emission Spectrometer)	Emission spectra (5 to 29 μm, 10 cm^{-1} resolution) with 8 or 20 mrad FOV	Mineralogical mapping of key targets identified using imaging data; thermophysical properties of surfaces; determination of pressure, temperature, water vapor profiles
Arm-Mounted *In-Situ* Package		
APXS (Alpha Particle X-Ray Spectrometer)	^{244}Cm alpha particle and X-ray sources, solid-state alpha and X-ray detectors, FOV 4 cm in diameter	Elemental abundances for rock and soil targets
MB (Mössbauer Spectrometer)	^{57}Fe spectrometer in backscatter mode; Co/Rh source and Si-PIN diode detectors; field of view approximately 1.5 cm^2.	Identification of iron-bearing minerals and iron oxidation states
MI (Microscopic Imager)	Monochrome imaging, 30 μm per pixel, 3x3 cm FOV, 6 mm depth of focus	Close-up imaging of texture and mineralogy of surfaces
RAT (Rock Abrasion Tool)	Capable of removing up to 5 mm of rock from a circular region 4.5 cm in diameter	Remove dust, loose debris, weathered material, and surface coatings from rock, exposing fresh rock for analysis by instruments
Engineering Instruments to be Included in Archives		
Hazcams, body-mounted	Monochrome stereo imaging, 2.0 mrad IFOV, 123°x123° FOV; 1024x1024 pixel CCD detector	Front and rear stereo cameras used for hazard avoidance during traverses and for planning purposes
Navcam, mast-mounted	Monochrome stereo imaging, 0.77 mrad IFOV, 45°x45° FOV; 1024x1024 pixel CCD detector	Acquire images and panoramas for traverses and Instrument Arm deployment support

Table 2. Definitions of Processing Levels for Science Data Sets

NASA	CODMAC	Description
Packet data	Raw – Level 1	Telemetry data stream as received at the ground station, with science and engineering data embedded.
Level 0	Edited - Level 2	Instrument science data (e.g., raw voltages, counts) at full resolution, time ordered, with duplicates and transmission errors removed.
Level 1A	Calibrated - Level 3	Level 0 data that have been located in space and may have been transformed (e.g., calibrated, rearranged) in a reversible manner and packaged with needed ancillary and auxiliary data (e.g., radiances with the calibration equations applied).
Level 1B	Resampled - Level 4	Irreversibly transformed (e.g., resampled, remapped, calibrated) values of the instrument measurements (e.g., radiances, magnetic field strength).
Level 2	Derived - Level 5	Geophysical parameters, generally derived from Level 1 data, and located in space and time commensurate with instrument location, pointing, and sampling.
Level 3	Derived - Level 5	Geophysical parameters mapped onto uniform space-time grids.

Table 3. Components of MER Archives

Component	Contents
SPICE Archives	SPICE Kernels NAIF Software
Science Data Archives	Experiment Data Records and Reduced Data Records with PDS Labels High-level mission, spacecraft, instrument, data set, software, and personnel descriptions for the PDS Catalog Data Product Software Interface Specification (SIS) Documents Archive Volume Software Interface Specification Documents Processing Descriptions, Algorithms, and Software (to use in understanding reduced data product generation) Instrument Calibration Plans and Reports and associated data needed to understand level 1 product generation Analyst's Notebooks for primary and extended missions SOWG and Science Theme Group Documentarian Notes
Engineering Data Archives	Software Interface Specification Documents Uplink sequences and uplink reports Battery Control Board reports Mobility reports Channelized engineering reports Calibration reports for IDD and mobility system

Table 4. MER Archive Component Suppliers

Product	Supplier
EDRs for all Athena instruments	MIPL
Pancam RDRs	*J. Bell, Cornell Univ.
Navcam RDRs	*J. Bell, Cornell Univ.
Hazcam RDRs	*J. Bell, Cornell Univ.
MI RDRs	K. Herkenhoff, USGS/Flagstaff
Mini-TES RDRs	P. Christensen, Arizona State Univ.
APXS RDRs	R. Rieder, Max Planck Inst., Germany
MB RDRs	G. Klingelhöfer, Gutenberg Univ., Germany
RAT RDRs	S. Gorevan, Honeybee Robotics
EDR and RDR Data Product SIS documents for all cameras	MIPL
Mini-TES EDR and RDR Data Product SIS documents	P. Christensen, Arizona State Univ.
APXS EDR and RDR Data Product SIS documents	R. Rieder, Max Planck Inst., Germany
MB EDR and RDR Data Product SIS documents	G. Klingelhöfer, Gutenberg Univ., Germany
RAT EDR and RDR Data Product SIS documents	S. Gorevan, Honeybee Robotics
Archive Volume SIS documents	Athena Team Payload Element Leads
Processing descriptions, algorithms, and software	Athena Team Payload Element Leads
Instrument calibration plans, reports, and associated data for each instrument and for IDD and mobility systems	Athena Team Payload Element Leads, MER Project
High-level descriptions of instruments, data sets, software, and personnel for PDS Catalog	Athena Team Payload Element Leads
High-level descriptions of mission and spacecraft for PDS Catalog	MER Project
Data Product SIS documents, uplink sequences and reports, and downlink reports, Battery Control Board reports, mobility reports, channelized engineering reports	MER Project
SPICE kernels and NAIF software	NAIF
Raw telemetry	MER Project
SOWG and Science Theme Group documentarian notes	MER SOWG

*Coordinates generation of RDRs among Cornell, Ames, USGS, and MIPL participants

Table 5. MER Standard and Special Data Products

Instrument	Product	Type	NASA Level
Pancam, Navcam, Hazcam	Experiment Data Records (EDRs)	Standard	0
	Radiometrically calibrated images	Standard	1A
	Terrain maps	Standard	3
	Atmospheric opacity determinations	Standard	2
	ViSTA terrain map	Special	3
	Performer mesh product	Special	3
Microscopic Imager	Experiment Data Records (EDRs)	Standard	0
	Geometrically and radiometrically calibrated images	Standard	1B
	Merged focal sections	Standard	3
Mini-TES	Experiment Data Records (EDRs)	Standard	0
	Calibrated spectral radiances	Standard	1A
	Mineral abundance maps and associated spectral libraries	Special	3
Mössbauer and APX Spectrometers	Experiment Data Records: counts per energy (APXS) or velocity (MB) channel	Standard	0
	Merged and summed spectra in units of counts/channel	Standard	1B
	Merged and summed spectra in units of counts per energy (APXS) or velocity (MB)	Standard	2
	APXS-based tables of peak area and element abundances	Standard	3
	MB-based tables of intensities of iron compounds, iron oxide ratios, and mineral abundances	Standard	3
Rock Abrasion Tool	Experiment Data Records: time-ordered actuator current measurements, temperatures, and encoder values	Standard	0
Rover engineering data	Time series of telemetry together with uplink sequences, uplink reports, and downlink reports	Special	0
	Battery Control Board reports	Special	n/a
	Mobility reports	Special	n/a
	Channelized engineering reports	Special	n/a
NAIF / SPICE	SPK kernels	Standard	n/a
	PcK kernels for times of interest	Standard	n/a
	I kernels for instruments	Standard	n/a
	C kernels for spacecraft and instrument rotations	Standard	n/a
	E kernels showing sequences and Analyst's Notebook depicting events	Standard	n/a

Table 6. MER Archive Generation, Validation, and Release Schedule

Event	MER-A	MER-B
Launch Window Opens	May 31, 2003	June 25, 2003
Sol 1: Start of operations	January 4, 2004	January 25, 2004
Sol 31	February 4, 2004	February 25, 2004
Sol 91: Start of extended mission	April 5, 2004	April 26, 2004
First data release, including data acquired Sols 1-30	August 3, 2004	August 24, 2004
Sol 180: end of extended mission*	July 6, 2004*	July 27, 2004*
Second data release, including data acquired Sols 31-90	October 4, 2004	October 25, 2004
Third data release, including data acquired Sols 91-180	January 6, 2005*	January 27, 2005*

* The Project shall deliver the Third data release, which includes data acquired from Sols 91 through the end of the mission, no later than 6 months after the end of mission, for each rover. Table 6 shows what those delivery dates will be, if the end of the extended mission is at Sol 180.