

**Mars Global Surveyor Project
Archive Generation, Validation, and
Transfer Plan**

**ADDENDUM
Updated Plan for Release of
Mapping Phase Data**

Prepared by:

R. Arvidson, E. Guinness and S. Slavney
Department of Earth and Planetary Sciences
Washington University
St. Louis, MO 63130

R. J. Springer
Jet Propulsion Laboratory
Pasadena, California 91109

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1. INTRODUCTION

The MGS mission encountered unexpected delays during the spacecraft's insertion into orbit and during the early part of the Mapping Phase. This Addendum to the Mars Global Surveyor Project Archive Generation, Validation, and Transfer Plan documents changes in the mission time line and their impact on delivery of science products from the Mapping Phase of the MGS mission.

2. MISSION HISTORY

An overview of the MGS mission can be found in section 2 of the MGS Archive Plan. What follows is a description of mission events during the Orbit Insertion and Mapping Phases taken from the Archive Plan and expanded to include significant events that occurred after that writing.

In the Orbit Insertion Phase, the MGS spacecraft used aerobraking to gradually slow down and circularize the orbit in preparation for systematic mapping of the planet (Table 1). During aerobraking, at the low point of orbit 15, October 8, 1997, the spacecraft experienced difficulties later diagnosed as due to excess vibrations of one of the solar panels. The problem was interpreted to be associated with a fracture of a panel damper arm [Albee et al., Mars Global Surveyor mission: Overview and status, *Science*, 279, 1998]. While an evaluation of the solar array problem was underway, periapsis was raised to about 172 km on October 13, 1997, and remained near that altitude until November 7, 1997 (orbits 19 through 36). During this 26-day period the spacecraft instrument panel was pointed towards Mars during close approach (i.e., near periapsis) and the first extensive set of science observations from MGS was collected. Orbits 19 through 36 are known as the assessment orbits, and the time period is known as the Aerobraking Hiatus of the Orbit Insertion Phase. The science observations were acquired during the descending leg of each orbit; that is, as the spacecraft moved from north to south.

Aerobraking was restarted on November 8, 1997 (orbit 37), but with a periapsis approximately 10 km higher than that previously used. Aerobraking was continued at about 1/3 the rate originally planned, placing the spacecraft in a 2 AM Sun-synchronous mapping orbit in March 1999 rather than the planned 2 PM mapping orbit in March 1998. As part of the revised aerobraking plan, a second aerobraking hiatus began on March 27, 1998, extending through April 28, 1998. This period is termed the Science Phasing Orbit 1 (SPO-1). A second Science Phasing Orbit (SPO-2) extended from May 28, 1998, until September 23, 1998. SPO-1 and SPO-2 were necessary to ensure that the final two-hour circular orbit had an equatorial crossing time of 2 AM.

A final period of aerobraking began in September, 1998, and ended on February 4, 1999. At that time MGS had achieved a sun-synchronous 1.97 hour orbital period with an equatorial crossing at 2:04 AM local solar time. The spacecraft then completed a two-week-long gravity calibration experiment followed by a week of MOC calibrations.

The Mapping Phase began on March 8, 1999, at which time the orbit number count was reset to 1. The first three weeks of mapping were conducted in contingency mode, with the high gain antenna (HGA) in a fixed position. The HGA was finally deployed on March 28, 1999, and normal mapping operations began on April 5, 1999. On April 15, 1999, the spacecraft again went into contingency mode when a problem with the HGA azimuth gimbal was discovered. The spacecraft was therefore reduced to fixed-HGA mapping on April 28, 1999. It was determined that the problem with the azimuth gimbal would

not interfere with normal mapping for the time being, so normal mapping was resumed on May 6, 1999. If the problem is not resolved, the spacecraft will return to fixed-HGA mapping in February 2000.

The Geodesy Science Campaign occurred May 6 – June 6, 1999, and focused on acquisition of MOC stereo and MOLA data for geodesy purposes. The Gravity Science Campaign took place August 19-26, 1999. Other science campaigns are planned for the remainder of the mission. The mapping phase of the mission is scheduled to end on January 31, 2001. After that the spacecraft will be used for radio relay by other missions or for an extended mission. The nominal end of the MGS mission is January 1, 2003.

3. ARCHIVING OF ORBIT INSERTION DATA

The reduced rate of aerobraking caused the Orbit Insertion Phase to last a full year longer than originally planned, ending in March 1999. The science instruments acquired data during the aerobraking hiatus (October 13 to November 7, 1997) and the two Science Phasing Orbit periods, SPO-1 (March 27 to April 28, 1998) and SPO-2 (May 28, 1998 to September 23, 1998). Some instruments also acquired data during the aerobraking periods. Radio Science data were collected throughout orbit insertion.

The MGS project requires investigators to release standard data products within six months of receipt of raw data. During this time standard products are generated, validated, and assembled into archive volumes. Data products are released by delivering logical and/or physical archive volumes to the Planetary Data System, which distributes them to the science community, as discussed in the MGS Archive Plan.

Some data from the aerobraking hiatus were released on July 1, 1998, in the form of the MGS Science Sampler, a single CD-ROM containing MOC, MOLA, TES, MAG/ER, and Radio Science data. Data from the SPO-1 and SPO-2 periods were released at various times from July 1999 to the time of this writing. At present all instrument teams have released some data products either on CD-ROMs, on write-once CDs, or via the Web, and most teams have released a complete or nearly complete set of Orbit Insertion data products.

4. ARCHIVING OF MAPPING PHASE DATA

The first formal release of data from the Mapping Phase is scheduled for October 1, 1999, roughly six months after the start of normal mapping (Table 2). The October 1 delivery includes, at minimum, data acquired from March 8, 1999, the start of fixed-HGA mapping, up to May 6, 1999, when normal mapping began with the Geodesy Campaign.

An exception to the recommended delivery schedule is made for the MAG/ER Team. Because of the problems encountered by the spacecraft at the beginning of the mapping phase, planned calibration measurements necessary for processing MAG/ER data were not acquired. These measurements will not be obtained until March 2000, so MAG/ER cannot produce fully calibrated data products until after that time. The Project has granted the team a postponement in delivering their mapping phase data products.

Because of the widespread interest in MGS data, the Project has recommended delivery of archives to the PDS every three months rather than every six months. The six-month delivery schedule is the

baseline stated in the MGS Archive Plan. The MOLA, TES, RS and NAIF/SPICE Teams agree to this schedule. The MOC Team prefers to stay on the six-month schedule. The MAG/ER Team is TBD.

TABLE 1. MGS Mission Phases and Events

Phase Name	Start date	End date	Start orbit	End orbit
Prelaunch Phase	1994-10-12	1996-11-06		
Launch Phase	1996-11-06	1996-11-07		
Cruise Phase	1996-11-07	1997-09-12		
Inner Cruise Subphase	1996-11-07	1997-01-09		
Outer Cruise Subphase	1997-01-09	1997-09-12		
Orbit Insertion Phase	1997-09-12	1999-03-09	1	1683
Aerobraking Phase 1A	1997-09-12	1997-10-12	1	18
Aerobraking Hiatus	1997-10-13	1997-11-07	19	36
Aerobraking Phase 1B	1997-11-08	1998-03-27	37	201
Science Phasing Orbit 1 (SPO-1)	1998-03-27	1998-04-28	202	268
Solar conjunction	1998-04-29	1998-05-27	269	328
Science Phasing Orbit 2 (SPO-2)	1998-05-28	1998-09-23	329	573
Aerobraking Phase 2	1998-09-24	1999-02-04	574	1284
Transition to mapping	1999-02-04	1999-03-07	1285	1683
Gravity calibration	1999-02-04	1999-02-19		
MOC calibration	1999-03-01	1999-03-07		
Mapping Phase	1999-03-08	2001-01-31	1	TBD
Fixed-HGA mapping (contingency mode)	1999-03-08	1999-03-28		
Normal mapping begins	1999-04-05			
Contingency mode	1999-04-15	1999-04-27		
Fixed-HGA mapping	1999-04-28	1999-05-05		
Normal mapping resumes	1999-05-06			
Science Campaign A (Geodesy)	1999-05-06	1999-06-06		
Science Campaign B (Gravity)	1999-08-19	1999-08-26		
(Other Science Campaigns)	TBD	TBD		
Radio Relay Phase	2001-01-31	2003-01-01		

TABLE 2. Schedule for Deliveries of Early Mapping Phase Data

Instrument / Product	Data Acquisition Period	Delivery Date	PDS Node Responsible for Archiving Data
MAG/ER *	TBD – TBD	TBD	PPI
MOC level 1 image data	1999-03-08 – 1999-05-05 1999-05-06 – 1999-10-01	1999-10-01 2000-04-01	Imaging
MOLA profiles	1999-03-08 – 1999-05-31 1999-06-01 – 1999-08-31	1999-10-01 2000-01-01	Geosciences
MOLA gridded product	1999-03-08 – 1999-05-31	1999-10-01	Geosciences
Radio Science raw data	TBD – 1999-05-05 1999-05-06 – 1999-06-06	1999-10-01 2000-01-01	Geosciences, Atmospheres
Radio Science derived data	TBD – 1999-05-05 1999-05-06 – 1999-06-06	1999-10-01 2000-01-01	Geosciences, Atmospheres
TES calibrated radiance	1999-03-08 – 1999-05-05 1999-05-06 – 1999-06-06	1999-10-01 2000-01-01	Geosciences
SPICE kernels	TBD – TBD	1999-10-01	NAIF

* MAG/ER will not release calibrated mapping phase data until April 2000. See Section 4.