



MISSION READINESS REVIEW

Practice:

Conduct a final pre-flight assessment of the operational readiness of a product, which may include flight hardware, software, support equipment, and other mission-essential resources. Review the satisfactory progress of launch vehicle processing and of all supporting elements required for mission launch.

Benefit:

This review verifies the mission readiness of a flight project. It assures that no unresolved problems exist with the flight systems and supporting elements, and that all systems, facilities, and teams are ready to support the launch and early cruise phases of a mission. It also supports mission assurance by providing a final opportunity for timely detection and correction of flight project deficiencies. Hardware reliability issues relating to deviations from design assumptions (for example, unanticipated lengthy pre-flight storage of flight hardware) may be examined for mission impact.

Programs That Certified Usage:

Mars Global Surveyor

Center to Contact for Information:

Jet Propulsion Laboratory (JPL)

Implementation Method:

The purpose of a Mission Readiness Review (MRR) is to assess the readiness status of spacecraft systems prior to launch. As the final review before launch, it provides a last opportunity to detect and correct “show-stoppers.” The MRR covers all activities required for a successful launch, including the flight preparedness of launch systems, flight systems, ground systems, supporting facilities, and operations personnel. MRR is distinguished from a *launch readiness review* in that MRR also evaluates the readiness of the mission plan to accomplish the mission objectives.

The review is held four to six weeks prior to launch, and it is conducted by the designated lead NASA center for the flight project. The convening authority for the MRR is one level above the flight project manager. The composition of the Mission Readiness Review Board includes technical experts from outside the project organization and, where appropriate, technical experts from outside the NASA center. The Chief Engineer is a voting member of the review board and any follow-up boards which may be required. Flight projects which are implemented with system contractors or industry partners may combine the MRR with a similar industry-led review as long as board functions and responsibilities are not compromised.

MRR planning includes the preparation of checklists specific to all flight and ground systems, facilities, and teams participating in the mission. Test results from all systems, facilities, and teams are provided for a final high-level review. Open

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problem/failure reports (PFRs), liens, waivers, deviations, change requests, and inspection reports related to the flight project are identified so they can be examined for their potential impact on the mission. The results of safety analyses and other related readiness reviews are summarized.

The success criterion for the review board is accurate establishment of the state of readiness of all systems prior to launch. This review covers all mission resources required for successful launch and operations and includes a summary of open work or liens yet to be resolved. The following topics are covered in a typical MRR:

- a. Update on open items from Pre-Ship Review
- b. Spacecraft launch campaign status
- c. Spacecraft flight software status
- d. Spacecraft appendages and deployables status
- e. Spacecraft consumables, power, and mass margins at launch
- f. Spacecraft-to-launch vehicle interface compliance
- g. Spacecraft product assurance status (waivers, PFRs, single-point failures, and product assurance readiness and mission risk statement)
- h. Payload flight readiness (instrument-by-instrument reports of performance issues, rework or retrofit actions, open items, red flag PFRs, interface and integration status, payload launch-hold criteria, and sensor product assurance, flight readiness, and mission risk statement)
- I. Launch vehicle flight readiness
- j. Launch control facility and countdown timeline flight readiness status
- k. Launch vehicle interface integration status
- l. Safety
- m. Project product assurance summary and risk assessment
- n. Science plan and science operations center
- o. Mission design status (conformance to project requirements)
- p. Mission operations system (MOS) status
- q. Ground system status (science data return requirements)
- r. Flight operations system status
- s. Satellite tracking and communications link status
- t. Space Communications Network Status
- u. MOS launch-hold criteria
- v. MOS command assurance summary and risk assessment statement.

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A sample MRR agenda from a recent, successful launch is provided as Figure 1. The MMR for Mars

Introduction	
Scope and Objectives	
Program/Project Overview	
<ul style="list-style-type: none">• Schedule• Previous reviews	<ul style="list-style-type: none">• Program/project plans to launch• Environmental compliance
Spacecraft Readiness	
<ul style="list-style-type: none">• Pre-Ship Review results and action item closure• Summary of activities since Pre-Ship Review• Operating hours• Kennedy Space Center system test results• Kennedy Space Center anomalies and their resolution• Update of system performance parameters• System verification update and non-compliances• Mission critical single point failures• Deployables verification• Flight software: recent changes and total verification• Mission assurance issues	<ul style="list-style-type: none">• Unverified failures• Open waivers and deviations• Red flag PFRs, significant PFRs, open PFRs• Significant Material Review Board actions• Electronic parts issues• Safety summary and issues• Launch, separation, and deployment sequence• Activities to launch• Launch vehicle interface verification• Spacecraft Readiness Statement• Risk mitigation and residual risks
Payload Readiness (Separate 10-minute reports for each instrument team:)	
<ul style="list-style-type: none">• Testing summary since Pre-Ship Review• Covers, cover removal plans, and testing• Anomalies since Pre-Ship Review, and their resolution	<ul style="list-style-type: none">• Red flag PFRs• Instrument Readiness Statement• Risk mitigation and residual risks
Mission Design Readiness	
<ul style="list-style-type: none">• Mass, delta-V, fuel loading, ballasting strategy & process• Mission plan status• Injection Trajectory Certification• Risk mitigation and residual risks	<ul style="list-style-type: none">• Delta-V budget• Monthly Management Review status• Readiness Statement
Flight Operations Readiness	
<ul style="list-style-type: none">• Operations Readiness Review results and• Operations Readiness Review action item close-outs• Telecommunications and Mission Operations readiness• Readiness Statement	<ul style="list-style-type: none">• Status of near-Earth sequences• Ground data system readiness• Test and training results and status• Risk mitigation and residual risks
Launch Vehicle Readiness	
Launch Hold Criteria	
<ul style="list-style-type: none">• Advanced Range Instrumentation Aircraft (ARIA) launch support waiver status	
Launch Management Structure	
Project Launch Readiness	

Figure 1. Sample MRR Agenda: Mars Global Surveyor

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Global Surveyor was conducted in two parts. On October 10, 1996, JPL conducted the main review at the prime contractor facility in conjunction with the contractor's senior management review. An update review (FRDR) was held by JPL at Kennedy Space Center (KSC) on November 4, 1996-- three days prior to launch. A Flight Readiness Review (FRR) was conducted by KSC on November 5, 1996.

Upon successful conclusion of the MRR, NASA policy requires the director of the lead center to transmit a "Readiness to Fly" letter to NASA headquarters. This action requires that a consensus on a final readiness assessment be reached within the following launch management structure:

SPACECRAFT

Project Manager
Spacecraft Manager
Contractor Program Manager
Contractor Test Director (Control)
Spacecraft Subsystems

MISSION OPERATIONS

Project Manager
Flight Operations Manager
Spacecraft Team
Navigation Team
Sequence Team
Telecommunications & Mission Operations Directorate

Technical Rationale:

Major mission elements-- the spacecraft, science instruments, and the launch vehicle-- are brought together on the launch pad, typically for the first time. Launch support crews and mission operations staff are then provided limited opportunities to perform critical mission preparation and control functions which they have only simulated for the specific mission. As the timeline approaches launch, the window of opportunity for the lead NASA center to correct mission discrepancies further narrows, and outstanding liens present an increasing schedule and mission impact. MRR provides the lead NASA center, in cooperation with the sponsor and industry partners, with a timely status check on all systems and functions affecting mission readiness.

Related Practices:

1. *Hardware Review/Certification Requirement*, Practice No. PD-ED-1215.2.
2. *Common Review Methods for Engineering Products*, Practice No. PD-ED-1215.4.
3. *Pre-Ship Review*, Practice No. PD-ED-1215.5.

References:

1. "Reviews," Laboratory Policy 4-16.
2. "JPL Standard for Reviews," Jet Propulsion Laboratory document JPL-D-10401 (Initial Issue), May 5, 1995.
Reissue date?
3. "Cassini Project: Spacecraft System Review Program," Jet Propulsion Laboratory document JPL-D-9926, December 1992.
4. "Mars Global Surveyor Combined LMA Presidents Review and JPL Mission Readiness Review," JPL, October 10, 1996.

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5. "Mars Global Surveyor Mission Readiness Summary," JPL, October 14, 1996.