

MWI 8715.8

REVISION A

EFFECTIVE DATE: June 25, 2001

EXPIRATION DATE: June 25, 2006

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# **MARSHALL WORK INSTRUCTION**

**QS01**

## **OPERATIONAL READINESS PROGRAM**

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**DOCUMENT HISTORY LOG**

Status (Baseline/ Revision/ Canceled)	Document Revision	Effective Date	Description
Baseline		2/24/00	
Revision	A	6/25/01	Added applicable documents to paragraph 3. Added definitions to paragraph 5. Deleted paragraph 5.3. Revised paragraph 6.1.x to provide a method of identification and determining the level of review. Revised responsibilities in paragraphs 6.2.1, 6.2.2, and 6.2.3. Added title of referenced document to paragraph 6.3.1.6. Added personnel certification to paragraph 6.3.2.4 and 6.3.3.2. Added NASA regulations to paragraph 6.3.3.5. Changed responsibilities in paragraph 6.4.2.2, 6.5.2, 6.5.3, 6.5.4, 6.6.5, 6.6.1 and 6.6.2. Added Acceptance of risk to paragraph 6.7. Deleted approval statement in paragraph 6.8 and moved to 6.8.1. Deleted 6.9, 6.9.1, and 6.9.2. Moved paragraph 6.9.3 to 6.8.2 and revised presentation levels. Paragraph 6.10 became 6.9. Deleted 6.10.3. Added 6.9.4, 6.10, 6.11, 6.12, 6.13, and 6.14 to provide TRR/ORR process. Revised 9.2, 9.4, and 9.5. Deleted 9.6. Added 10.1 for recommended training.

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## 1. PURPOSE

To establish guidance for the Marshall Space Flight Center (MSFC) Operational Readiness Program.

## 2. APPLICABILITY

These safety requirements and instructions apply to all facilities, equipment, operations, and processes controlled by MSFC.

## 3. APPLICABLE DOCUMENTS

3.1 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals"

3.2 MPD 1150.1, Charter MC-12, "Safety, Health, and Environmental Central (SHE) Committee"

3.3 MPD 1150.1, Charter MC-04, "Institutional Review Board (IRB) for Human Research Tests"

3.4 MPG 8715.1, "Marshall Safety, Health, and Environmental (SHE) Program"

3.5 MWI 3410.1, "Personnel Certification Program"

3.6 MWI 8715.15, "MSFC Safety Assessment Program"

3.7 NPD 7100.8, "Protection of Human Research Subjects"

3.8 NPG 1441.1, "NASA Records Retention Schedules"

## 4. REFERENCES

4.1 MWI 8715.6, "Hazardous Operations"

4.2 NASA-STD-8719.7, "Facility System Safety Guidebook"

4.3 NPG 8715.1, "NASA Safety and Health Handbook Occupational Safety and Health Programs"

4.4 NPG 8715.3, "NASA Safety Manual"

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## 5. DEFINITIONS

5.1 Baseline Assessment. The initial safety assessment performed of the work area including the facilities, equipment and/or jobs/tasks/operations/processes to identify all potential hazards.

5.2 Facility Risk Indicator (FRI). An indicator used to help determine the level of system safety effort required to meet NASA safety requirements. Reference NASA-STD-8719.7 for more information.

5.2.1 FRI 1 (HIGH RISK). There is a high probability that the hazards can cause loss of life. Hazards may result in loss of life, permanent disability, or serious occupational illnesses to one or more persons, three or more lost-time injuries, loss of facility operational capability for one month or greater, or damage to equipment or property in excess of \$500,000.

5.2.2 FRI 2 (MEDIUM RISK). There is a medium probability that the hazards can cause loss of life. Hazards may result in permanent disability to one or more persons, hospitalization (associated with illness or injury) of three or more persons, up to two lost-time injuries, loss of facility operational capability from 2 to 4 weeks, or damage to equipment or property from \$250,000 to \$500,000.

5.2.3 FRI 3 (LOW RISK). There is a low probability that the hazards can cause loss of life. Hazards may result in hospitalization to one or two persons, occupational injury or illness resulting in a lost workday or restricted duty case, loss of facility operational capability from 1 day to 2 weeks, or damage to equipment or property from \$25,000 to \$250,000.

5.2.4 FRI 4 (ACCEPTABLE RISK). Loss of life as a result of the hazards is unlikely. Hazards may result in no lost workday injuries or no restricted duty cases, loss of facility operational capability of less than 1 day, or damage to equipment or property less than \$25,000.

5.3 Hazard. A potential condition that can result in or contribute to a mishap (injury, illness, death, or damage to systems, equipment, or facilities).

5.4 Hazardous Operation. Any operation involving material or equipment that has a high potential to result in loss of life,

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serious injury to personnel, or damage to systems, equipment, or facilities.

Examples are operations that involve explosives, propellants, high pressure, oxidizers, corrosives, high elevations, cryogenics, hostile atmosphere, flammables, high electrical energy, radiation, noise, hyperbaric or hypobaric environment, toxic material, and critical hardware.

5.5 Institutional Review Board (IRB) for Human Research Tests.  
An IRB is established to review human research activities with the primary responsibility for the safety of human research subjects (reference NPD 7100.8, "Protection of Human Research Subjects").

Membership: Membership is in accordance with MPD 1150.1, Charter MC-04, "Institutional Review Board (IRB) for Human Research Tests."

5.6 Inventory of Hazardous Operations (IHOPS). A listing of all identified hazardous operations on property controlled by MSFC.

5.7 Operational Readiness Inspection Committee (ORIC). An ORIC is established to review new or significantly altered equipment, facilities, or test activities/operations where there is a significant degree of risk of accident or misoperation which might cause personal injury or death, or where there is a high risk of serious damage to equipment, test articles, buildings, or adjoining areas. An ORIC may also be established to review high visibility or value projects, facilities, or operations.

Membership: The ORIC will consist of a chairperson, a recorder, and a minimum of three other members to assess all functional areas of the operation. Chairpersons and members of the ORIC are selected, to the extent possible, from organizations/departments without a vested interest in the activity for which the review is being conducted. Members are qualified to provide competent review by technical experience in areas related to the subject of the ORI. ORIC composition will normally include individuals from the responsible program/project office, Facilities Engineering Department, appropriate department or directorate, user, operating or staff representative, and a Safety and Mission Assurance (S&MA) representative who will serve as a consultant to the ORIC to ensure a complete and thorough review.

5.8 Safety, Health, and Environmental Central (SHE) Committee.  
The SHE is established to develop safety, health, and

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environmental policy and to ensure that line organizations implement the policy. The SHE will review and evaluate the adequacy of the ORIC efforts.

Membership: Membership is in accordance with MPD 1150.1, Charter MC-12, "MSFC Safety, Health, and Environmental (SHE) Central Committee."

5.9 Safety Review Team (SRT). An SRT is established to review and inspect equipment, facilities, or test activities/operations of a less hazardous nature, to review and inspect facility additions or modifications that result in a change in existing hazard levels, or to ensure that all hazards are identified and either eliminated, controlled, or the risk has been accepted.

Membership: Same as for the ORIC.

5.10 Test/Operational Readiness Review (TRR/ORR). A preoperational review of all risks associated with a specific hazardous test/operation to ensure test/operational objectives are met without property damage or personnel injury and to determine test/operational system and test article readiness. A TRR/ORR does not take the place of an ORI/SRT but is used in conjunction with these reviews, if they are required.

Membership: The TRR/ORR generally consists of representatives from the appropriate responsible organization's management structure, S&MA, test requester, test/operation conductor/engineer, and functional offices as appropriate.

## **6. INSTRUCTIONS**

6.1 Identification of facilities, equipment, and hazardous operational tests that require an ORI, SRT, and/or TRR/ORR.

6.1.1 Supervisors shall ensure a baseline assessment for each facility, equipment, or operation/process under their control or jurisdiction is performed and determine an FRI (reference section, 5 definitions).

6.1.1.1 MWI 8715.15, "MSFC Safety Assessment Program," describes the baseline assessment process and how the FRI classification is used to help the supervisor determine the level of system safety effort required to meet NASA safety requirements.

6.1.2 The decision to conduct or not to conduct an ORI/SRT/TRR/ORR is based on the FRI classification and/or the

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recommendation of the responsible program/project office or the directorate/department management. S&MA may also recommend an ORI/SRT/TRR/ORR based on the overall degree of potential risk to employees and equipment.

6.1.3 An ORI is required for all new or modified equipment, facilities, operations/processes, or test activities with an FRI 1 (High Risk).

6.1.4 An SRT is required for all new or modified equipment, facilities, operations/processes, or test activities with an FRI 2 (Medium Risk).

6.1.4.1 An SRT is required for equipment, facilities, operations/processes, or test activities with an FRI 3 (Low Risk) if determined necessary by the appropriate program/project office, directorate or department manager, or S&MA.

6.1.5 TRR/ORR are normally performed for all hazardous operations/processes and test activities with an FRI 1 or 2.

6.1.6 The responsible program/project managers and/or department managers shall coordinate ORI/SRT/TRR/ORR activities, required by MWI 8715.15, with S&MA.

6.1.7 The responsible program/project managers and/or department managers provide a review plan to the ORIC or SRT that identifies the requirements the facility or operation must meet, documentation that will satisfy the general requirements of this instruction, and a schedule for submittal of the documentation

## 6.2 Establishing the ORIC

6.2.1 The director of the responsible directorate/office selects an ORI Chairperson.

6.2.2 The ORI Chairperson and the director of the responsible directorate/office establish functional membership and consultants. When any of these individuals have a vested interest in the facility or operation under review, rationale is provided for their selection.

NOTE: A recorder will be provided by the organization responsible for the facility/equipment/operation or process under review. S&MA provides a safety representative to serve as a consultant to the ORIC.

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6.2.3 The ORI Chairperson prepares a management announcement for the director of the responsible directorate/office approval, which establishes the ORIC and identifies the functional membership of the ORIC accompanied by rationale for, and recommendation of, any chairperson or members with a vested interest in the facility or operation under review.

### 6.3 ORIC Review Activities

The primary function of the ORIC is to ensure that all hazards are identified and either eliminated, controlled, or acceptance of risk is recommended, and to ensure safe operations relative to personnel and property. This will include reviewing data or performing tasks in the following areas:

#### 6.3.1 Design Data

6.3.1.1 Interfaces - ensure compatibility of test article to test facility/equipment (physical, functional, materials).

6.3.1.2 Materials - ensure compatibility of medium to system, system to system.

6.3.1.3 Hazards - review facility and system designs to identify hazards and ensure elimination or control of hazards. This includes identification and review of systems and devices for warning and control, such as fire detection and suppression systems, leak detection systems, air contamination monitors, blast and shock protection, and lightning protection systems.

6.3.1.4 Safety Factors - ensure appropriate safety factors exist for all structural systems (e.g., fluid piping systems, pressure vessels, and thrust structures).

6.3.1.5 Facility Hazard Analysis and Failure Modes and Effects Analysis (FMEA) - review planned/accomplished facility hazard analyses and FMEAs for adequacy and identify additional reliability or safety analyses if deemed necessary. Ensure proper retention rationale and controls are implemented for all failure modes and hazards.

6.3.1.6 Process Hazard Analysis - review process hazard analyses for highly hazardous chemicals as defined in OSHA 29 CFR 1910.119, "Process Safety Management of Highly Hazardous Chemicals," for adequacy. Ensure proper retention rationale and controls are implemented for all hazards.

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6.3.1.7 Specifications - ensure proper application of controlling specifications and standards for all critical systems and operations (e.g., welding, cleaning, hazardous and toxic materials, etc.).

6.3.1.8 Performance - ensure the facility affords the ability to control and monitor the test or operation in a safe mode.

6.3.1.9 Support Services - ensure that support services, such as electrical power, are adequate for safe conduct of the planned tests or operations.

### 6.3.2 Construction and Installation

6.3.2.1 Configuration - ascertain that all new or modified facilities conform to approved design documentation and deviations are properly documented and dispositioned. Ascertain that the configuration of the facility is established and adequate configuration controls will be maintained.

6.3.2.2 Quality Control/Inspection - review quality controls and inspections that were exercised during the procurement, receiving, in-process inspection of the construction, installation, and checkout phases, including adequacy and maintenance of inspection records, disposition of nonconformances, log books, etc.

6.3.2.3 Facility Inspection - as a minimum, conduct a facility inspection at 75 percent completion and at 100 percent completion of new facility construction or existing facility modifications.

6.3.2.4 Personnel Qualification - ascertain that fabrication and assembly personnel, such as welders, are qualified and, if required by MWI 3410.1, "Personnel Certification Program," are certified.

### 6.3.3 Activation and Operation

6.3.3.1 Plans and Procedures - review all plans and procedures for activation, checkout, and tests or operations. Plans shall be reviewed to ensure that appropriate tests are planned that will result in a high level of confidence in the integrity of the facilities and systems prior to initiation of testing or operations.

6.3.3.2 Personnel Qualifications and Training - evaluate the adequacy of the experience and training of the operating

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personnel. Personnel performing operations which require MSFC certification will be certified per MWI 3410.1, "Personnel Certification Program." If additional training is required, the ORIC will assist the director/manager in establishing the training requirements and retain completion of training as a constraint to activation as appropriate.

6.3.3.3 Change Control - ensure that a system exists to control changes to the facility, Ground Support Equipment (GSE), technical systems, and procedures so the safety of personnel and operations will not be compromised.

6.3.3.4 Work Control - review the adequacy of procedures for controlling all work on the facility, GSE, and test article. Shift change procedures shall also be reviewed.

6.3.3.5 Safety and Health - ensure compliance with NASA, OSHA, and applicable Federal, State, and local regulations pertaining to safety and health.

6.3.4 Other areas, tasks, data, etc., as deemed necessary by the ORIC.

#### 6.4 ORIC Reporting Requirements

##### 6.4.1 Discrepancies and Recommendations

6.4.1.1 The ORIC notes discrepancies and recommendations in writing. The recorder assigns a control number to each discrepancy/recommendation for future disposition. Recommendations are deliberated in a meeting of the full committee.

6.4.1.2 The ORIC reviews proposed recommendations with appropriate operational personnel to ensure that recommendations are understood and that the ORIC has not acted on the basis of inaccurate or incomplete information. The ORIC establishes time or event deadlines associated with each recommendation or discrepancy.

##### 6.4.2 Final Written Report

6.4.2.1 The ORIC prepares a report. The responsible organization maintains the report for the life of the facility/operation per NPG 1441.1.

6.4.2.2 The report is prepared in two parts as follows:

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a. Part I - Executive Summary. Includes a copy of the management announcement establishing the ORIC, a brief summary of the activities (number of meetings, identification of the number of action items and status by ORIC), residual risks, conclusions, recommendations, and signature page for the ORIC members. Distribution includes the director of the responsible directorate/office, SHE (appropriate subcommittee members), Director, S&MA Office, IRB (if required), ORIC members, and affected program managers and directorate managers.

b. Part II - Supporting Data and Information. Includes minutes of meetings, presentation charts, directly related correspondence, and other information judged to be appropriate to support any future investigation or review.

#### 6.5 ORI Closing Reviews and Presentations

6.5.1 S&MA reviews ORIC final reports for completeness and forwards to the responsible organization.

6.5.2 The director of the responsible directorate/office and IRB, if required, performs status reviews and evaluates the activities of ORIC as they are assigned, and provides recommendations for additional activities as determined necessary.

6.5.3 The director of the responsible directorate/office IRB, if required, specifies the degree of approval authority granted to the ORIC for activation milestone events.

6.5.4 The SHE subcommittee or IRB, if required, conducts a final review to evaluate and ensure adequacy of the total ORIC effort.

6.5.5 The SHE subcommittee or IRB, if required, reports the readiness of the facility/operation to the Center Director and provides the data required to support restrictions and limitations to be imposed.

#### 6.6 Establishing the SRT

6.6.1 Program/project managers or the appropriate directorate/department managers appoint SRTs in coordination with the responsible directorate/office director.

6.6.2 Responsible program/project managers or the appropriate directorate/department managers prepare an announcement

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(memorandum) for SRTs, as required. The memorandum specifies team members of the SRT, scope of the review, approval authority granted to the SRT, and the SRT reports required to be presented at the completion of the evaluation.

## 6.7 SRT Review Activities

The primary function of the SRT is to ensure that all hazards are identified and either eliminated, controlled, or acceptance of risk is recommended, and to ensure safe operations relative to personnel and property. This will include reviewing data or performing tasks in the following areas:

6.7.1 Perform a safety review within the requirements established in the announcement issued by the affected manager.

6.7.2 Utilize the functions identified for the ORIC as guidelines for performing a review and evaluation. The formality and depth of the review should be consistent with the concern for the probability of a mishap and the possible seriousness of the mishap.

## 6.8 SRT Reporting Requirements

6.8.1 The SRT prepares reports required by the announcement, lists all discrepancies and recommendations noted by the SRT.

6.8.2 The SRT presents to appropriate management, including the affected program/project and/or affected directorate/department manager and an S&MA Office representative, the results of the safety review and obtains the approval of the affected program/project and/or directorate/department manager and the S&MA Office, to proceed with the operation.

## 6.9 Post ORIC/SRT Activities

6.9.1 Responsible management ensures that appropriate analyses are accomplished when facility, procedure, and equipment modifications are made.

6.9.2 Changes or modifications that may create new hazards are to be reported to the S&MA Office.

6.9.3 As required, the responsible organization management re-establishes the ORIC/SRT or prepares a new announcement. Ideally, for new facilities being constructed in pre-announced phases over several years, ORIC/SRT membership should remain the

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same. Major changes or modifications to the same facility that create new hazards may require a new announcement.

6.9.4 Responsible management ensures that the IHOPS data base has been updated to reflect that an ORI/SRT has been performed.

#### 6.10 TRR or ORR Activities

6.10.1 A TRR/ORR is required for hazardous operations with an FRI 1 or 2.

6.10.2 A TRR/ORR would not be required for routine hazardous facility operations such as filling a cryogenic tank. Operations that involve a test article but are not hazardous to it (e.g., GN2 leak checks) may be performed prior to the TRR/ORR with the agreement of the test requester, the responsible engineer, and the safety/quality representative.

6.10.3 A single TRR/ORR can cover many operations in a series. However, any operation that is distinctly different (e.g., higher risk level) than others in the series will require a Delta-TRR/ORR. If an operation will be conducted much later than others in the series, it might require a Delta-TRR/ORR.

6.10.4 The responsible manager of the department performing the operation shall determine the level of the TRR/ORR.

#### 6.11 Establishing the TRR/ORR

6.11.1 Managers of the responsible department appoint TRR/ORR members in coordination with the director of the responsible directorate/office and prepares an announcement that specifies TRR/ORR team members, scope of the TRR/ORR, approval authority granted to the TRR/ORR, and the TRR/ORR reports required to be presented at the completion of the evaluation.

6.11.2 After the TRR/ORR level has been determined, the responsible manager shall choose the Chair and general team members.

6.11.3 A representative from the MSFC S&MA Office will be a general team member.

6.11.4 If an ORIC/SRT has any actions to be addressed by the TRR/ORR, the Chair (or a member) of the ORIC/SRT is recommended to be a general team member.

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6.11.5 When deemed necessary, representatives from other MSFC organizations (e.g., Center Operations Directorate or Engineering Directorate) and non-MSFC organizations can serve as general committee members.

## 6.12 TRR/ORR Review Activities

6.12.1 Review the operational requirements and determine the ability of the facility to meet requirements. Ascertain that adequate configuration control has been implemented. Review test team staffing plans and training/certification.

6.12.2 Review the safety assessment and evaluate the effectiveness of steps taken to mitigate hazards. Summarize the risks in three separate categories and judge the acceptability of incurring these risks to accomplish objectives:

- (1) Risk of major damage to the facility.
- (2) Risk of damage to the test article.
- (3) Risk to personnel.

6.12.3 Determine the adequacy of safety procedures and shutdown modes. Review the list of all procedures needed to perform the test operation. Review test procedures to the extent necessary. Review any open action items and assign action items as needed.

6.12.4 Decide whether or not to conduct test operations.

## 6.13 Reporting Requirements

The TRR/ORR team prepares reports required by the announcement, lists all discrepancies and recommendations noted, and has the report approved by the affected manager and the S&MA Office.

## 6.14 Post TRR/ORR Activities

6.14.1 Managers ensure that appropriate analyses are accomplished when facility, procedure, and equipment modifications are made prior to testing activities.

6.14.2 Changes or modifications that may create new hazards are reported to the S&MA Office for review and incorporation into the safety assessment as required.

6.14.3 Major changes or modifications to the same facility, procedure, or equipment may require a new announcement to re-establish the TRR/ORR.

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6.14.4 Responsible managers/supervisors ensure that the IHOPS data base has been updated to reflect that an TRR/ORR has been performed. Reference MWI 8715.15, paragraph 6.2, for IHOPS data-entry instructions.

## **7. NOTES**

None

## **8. SAFETY PRECAUTIONS AND WARNING NOTES**

None

## **9. RECORDS**

9.1 Facility Hazard Analysis and FMEAs will be maintained by the owner of the facility for the life of the facility, then destroyed or maintained for historical purposes.

9.2 The final written ORI/SRT/TRR/ORR report and supporting data will be maintained by the responsible organization for the life of the facility, equipment, test, or operation/process plus 5 years, then maintained for historical purposes.

9.3 Record of any recommended safety training for supervisors and employees shall be forwarded to the Employee and Organizational Development Department. This record shall be maintained for the length of the employee's employment, then destroyed or maintained for historical purposes.

9.4 The IHOPS will be maintained in accordance with MPG 8715.1, "Marshall Safety, Health, and Environmental (SHE) Program."

## **10. PERSONNEL TRAINING AND CERTIFICATION**

The level of expertise shall be commensurate with the membership requirements described in Section 5, Definitions.

10.1 Recommended safety training for supervisors and employees.

10.1.1 NSTC 050, "Operational Readiness Inspection (ORI) Criteria," or equivalent course which focuses on delivering a structure, system, or process with maximum safety within the operational requirements.

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10.1.2 NSTC 001, "Facility System Safety," or equivalent course which focuses on system safety and how it applies to facility acquisition, modification, and operations.

10.1.3 NSTC 002, "System Safety Fundamentals," or equivalent course which focuses on system safety management and hazard analysis of hardware and operations.

10.1.4 "System Safety Workshop," or equivalent course which teaches fundamentals of hazard recognition for hardware and operations.

10.1.5 NSTC 048, "System Safety for Managers," or equivalent course which provides an overview of system safety.

10.1.6 NSTC 020, "Basic System Safety Practice," or equivalent course which focuses on methods for finding hazards and assessing their safety risk.

10.1.7 NSTC 021, "Advanced System Safety Practice," or equivalent course which focuses on the fundamentals of safety risk management concepts.

## **11. FLOW DIAGRAM**

None

## **12. CANCELLATION**

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Original Signed by  
Sidney P. Saucier for

A. G. Stephenson  
Director