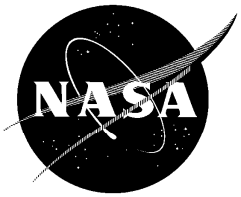
Safety Review Process

International Space Station Program

Revision B

February 2000

National Aeronautics and Space Administration
International Space Station Program
Johnson Space Center
Houston, Texas



REVISION AND HISTORY PAGE

REV.	DESCRIPTION	PUB. DATE
-	Baseline Issue (Reference SSCBD BB003229B EFF.)	10-93
A	Revision A (SSDBD 000085 EFF. 05-05-95) No cost change – ECP 85)	6-15-95
B	Revision B (per SSCD 003405, EFF. 01-07-02)	02-13-02

ERU: /s/ Mary C. Nooney 2-13-03

PREFACE

The contents of this document are intended to be consistent with the tasks and products to be prepared by Program participants. SSP 30599 shall be implemented on all new International Space Station (ISS) contractual and internal activities and shall be included in any existing contracts through contract changes. This document is under the control of the Space Station Program Control Board and any changes or revisions will be approved by the Program Manager unless change authority is delegated to a lower level board/panel.

/s/T. W. Holloway_____ 1-07-02____
Manager, Date
International Space Station Program

SAFETY REVIEW PROCESS FOR
INTERNATIONAL SPACE STATION PROGRAM

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\INTERNATIONAL SPACE STATION PROGRAM

SAFETY REVIEW PROCESS

LIST OF CHANGES

FEBRUARY 2000

All changes to paragraphs, tables, and figures in this document are shown below:

Board Name	Entry Date	Change	Paragraph(s)
SSPCB	October 1993	Baseline	All
SSPCB	June 15, 1995	Revision A	All
SSPCB	February 2000	Revision B	All

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1.0 INTRODUCTION

The International Space Station (ISS) Program has developed a safety review process to execute its responsibilities for the overall integrated safety of the ISS. This process will assess the design and operations of the ISS element hardware to the safety requirements established in SSP 50021(flight), KHB 1700.7 (ground), and SSP 50004 (ground support equipment [GSE]).

The safety review process is defined for: ISS elements (flight and ground), and ISS support equipment. This process includes an in-line safety review process and a phased safety review process. The in-line safety review process assures that ISS safety requirements are incorporated into the ongoing design activities. The requirements for conducting the phased safety reviews are applicable to launch package/stage (LP/S) safety assessments and for International Partner (IP) elements, and cover all mission phases of ISS equipment. The phased safety review process contained in this document is intended to be consistent with the tasks and products agreed to by the National Aeronautics and Space Administration (NASA) and IPs as specified in the appropriate Bilateral NASA/IP Safety and Mission Assurance (S&MA) Requirements documents. SSP 30309, Safety Analysis Requirements or its IP equivalent, provides the methodology for performing safety analysis. This document (SSP 30599) addresses preparation, maintenance, and reporting requirements of the safety analyses in support of the safety reviews.

1.1 PURPOSE

The purpose of SSP 30599 is to define the safety review process for ISS elements (flight and ground), support equipment, GFE, and ISS visiting vehicles. The Safety Review Panel (SRP) at JSC will execute this process for flight design and operations and the Ground Safety Review Panel (GSRP) at KSC for GSE design and ground operations. These flight and ground panels will address both ISS Program and Space Shuttle Program payload safety review responsibilities as part of a single integrated process that covers all mission phases of the hardware. Integration of ISS and Space Shuttle payload review requirements into a single process ensures effective identification and assessment of safety compliance involving ISS equipment, and minimizes any overlap that could exist if there were different review processes for the various mission phases of ISS hardware elements. The safety review process defined in this document is not applicable to ISS experiment payloads.

1.2 SCOPE

This document defines the process that NASA has implemented to assess compliance with the ISS safety requirements in SSP 50021, KHB 1700.7, and SSP 50004. The ISS safety reviews are conducted for all mission phases to review and assess the safety hazards related to the design, operations, and functional capabilities of ISS elements, GFE, ISS visiting vehicles, ISS crew return vehicles, support equipment, and the integration of all ISS elements.

The safety reviews of ISS experiment payloads are not included within the scope of the process defined by this document. ISS experiment payloads and the on-orbit increment payload complement will be reviewed by the Payload Safety Review Panel (PSRP) in accordance with the process and procedures defined in NSTS/ISS 13830, “Payload Safety Review and Data Submittal Requirements for Payloads using the Space Shuttle/ISS” for assessing compliance with NSTS 1700.7B (Addendum), and by the GSRP for assessing compliance with KHB 1700.7.

1.3 DELEGATION OF AUTHORITY

The ISS S&MA Office is responsible for preparation of changes to this document. However, approval of changes is maintained at the SSPCB.

1.4 WAIVER/DEVIATIONS

Any request for waiver or deviation from the requirements of this document shall be made to the ISS in accordance with Configuration Management (CM) requirements.

2.0 APPLICABLE DOCUMENTS

The following documents are applicable as specified herein. These include specifications, models, standards, guidelines, handbooks, and other special publications. An IP may substitute an alternate equivalent document for a cited "applicable" document in accordance with their Joint Management Plan (JMP) if the substitution has been reviewed by NASA and there is mutual agreement from NASA and the IP that the alternate equivalent document meets or exceeds the requirements of the cited document.

DOCUMENT NO.	TITLE
KHB 1700.7	Space Shuttle Payload Ground Safety Handbook
KHB 1860.1	Kennedy Space Center (KSC) Ionizing Radiation Protection Program
KHB 1860.2	KSC Non-Ionizing Radiation Protection Program
KHB 1710.2	KSC Safety Practices Handbook
SSP 30233	Space Station Requirements for Materials and Process
SSP 30309	Safety Analysis and Risk Assessment Requirements
SSP 30558	Fracture Control Requirements for Space Station
SSP 30559	Structural Design and Verification Requirements
SSP 30560	Glass, Window, and Ceramic Structural Design and Verification Requirements
SSP 30666, Volume 1	Program Master Verification Plan: Approach and Process
SSP 50004	Support Equipment Design Requirements
SSP 50005	International Space Station Flight Crew Integration Standard
SSP 50021	Safety Policy and Requirements
SSP 50038	Computer Based Control System Safety Requirements
SSP 50108	ISS Certification of Flight Readiness
SSP 50146	NASA/RSA Bilateral, S&MA Process Requirements for ISS System Safety Requirements

2.1 REFERENCE DOCUMENTS

NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the Space Transportation System
NSTS 1700.7B Addendum	Safety Policy and Requirements for Payloads Using the International Space Station
NSTS/ISS 13830**C**	Payload Safety Review and Data Submittal Requirements for Payloads using the Space Shuttle/ISS
JPD 5150.2H	Industry Presentations and Related Nondisclosure Agreements System Safety Requirements

3.0 SAFETY RESPONSIBILITIES

3.1 NASA

NASA by memorandum of understanding (MOU) agreements with each International Partner, is responsible for the overall integrated safety of the ISS and is required to provide the overall certification that the US elements, IP Elements, support equipment, Government Furnished Equipment (GFE), ISS visiting vehicles, ISS crew return vehicles, and payloads are safe. It is also the responsibility of NASA to establish the overall safety requirements of the Program. To successfully implement NASA's overall safety responsibility, the safety requirements of SP50021 (Safety Policy and Requirements), KHB 1700.7 (Space Shuttle Payload Ground Safety Handbook) and SSP50004 (Support Equipment Design Requirements) have been developed. NASA assures compliance with these overall safety requirements within the ISS Program by a structured safety review process. The Flight Safety Review Panel (SRP) is responsible for assessing the applicable design and operations for compliance with the requirements in SSP 50021. The Ground Safety Review Panel (GSRP) is responsible for assessing the integrated operations of ISS GSE used at KSC, and KSC launch and landing site operations for compliance with the requirements of SSP 50004 and KHB 1700.7. ISS equipment that returns on the Orbiter is reviewed by the Flight SRP for on-orbit operations and by the GSRP for reentry, KSC landing and post-landing operations. This review may be part of the LP/S or IP phase safety review if the return cargo has been adequately defined.

US On-orbit Segment (USOS) contractors will participate in formal phase safety reviews with the SRP that will address LP/S safety assessments. For ISS ground operations and GSE used at KSC and KSC launch and landing sites, the USOS contractor will participate in formal phase safety reviews conducted by the GSRP. There is also an in-line safety review process to assure ISS safety requirements are incorporated into the ongoing design activities of flight hardware. This in-line process is provided by ISS S&MA/Program Risk (PR) support of ISS design teams, by SRP special topic meetings, by the Safety Working Group (SWG) and by the safety reviews conducted by the S&MA Review Team (SMART) for GFE.

The formal phased safety review process with the SRP and GSRP is defined in section 5.0.

The USOS contractor assesses all USOS hardware provided by the USOS contractors, all IP segment interfaces with the USOS, and GFE items designated for USOS contractor integration as defined in the J2 GFE listing.

The ISS contractor performs the Integrated Hazard Analysis (IHA). This analysis ensures that systems that are interdependent for hazard control or failure tolerance are properly identified and interactions assessed. The ISS contractor performs this assessment for all USOS and IP elements/systems and for J2 listed GFE. If a GFE item relies on a hazard control provided by other ISS equipment, this must be assessed and captured in the integrated hazard analysis. Integrated hazard reports will be developed and presented by the ISS contractor at the appropriate Flight SRP meeting to support the overall assessment of the flight hardware.

A Maintenance Hazard Analysis (MHA) shall be performed on flight hardware to address the control of hazards during maintenance activities. The maintenance hazard analysis will be delivered with the systems hazards analysis unless otherwise negotiated with the SRP.

3.2 INTERNATIONAL PARTNERS (IPs)

It is the responsibility of the IPs to support the NASA safety review process and to certify that all applicable safety requirements have been met with respect to IP elements and payloads. The applicable safety requirements for IP elements are contained in the applicable IP segment specification. IP segment specifications are derived from the SSP 50021 (Flight) and KHB 1700.7 (Ground operation at KSC) safety requirements through bilateral negotiations with NASA . For IP segments and elements, the IPs will present the results of their safety assessments to the SRP and GSRP in formal phase safety reviews concurrent with, or in a time frame consistent with the schedule of major IP segment milestone reviews.

3.2.1 INTERNATIONAL PARTNERS - RUSSIAN SPACE AGENCY (RSA)

For Russian hardware and elements defined by the Russian segment specification, the processes and requirements of this document have been implemented through SSP 50146, NASA/RSA Bilateral S&MA Process Requirements for ISS.

4.0 ISS SAFETY REVIEW PROCESS

4.1 SAFETY ANALYSES AND DELIVERABLES

The safety review process was developed to evaluate and assess the results of the US and IP safety analyses conducted by developers, providers, and operators of ISS element hardware and software. Performance of hazard analyses (HAs) provides a means to systematically identify hazards and their causes and controls. SSP 30309 defines methodologies for traditional safety analysis techniques (i.e., preliminary hazard analyses [PHAs], system hazard analyses [SHAs], operation and support hazard analyses [OSHAs], software safety analyses [SSAs], and integrated hazard analyses [IHAs]). Safety analyses are typically performed on a flight-by-flight, stage-by-stage basis. Hazards identified through the safety analysis process are documented on a hazard report (HR) as defined by Appendix B and hazard controls are implemented in accordance with SSP 30309, paragraph 5.3.2, Hazard Reduction Precedence Sequence.

The safety assessments of all ISS systems and operations are provided to the applicable ISS Flight SRP and the GSRP or to the KSC AIT/IPTs as safety deliverables, including HRs and other applicable data. These deliverables are submitted in accordance with the applicable bilateral data exchange agreement (BDEA) for IPs or contractual data requirements defined in the contract statement of work (SOW) and depicted in Figure 4.3.3-1.

4.2 SAFETY REVIEW OBJECTIVES

The objective of the ISS safety program is to achieve the maximum degree of safety consistent with ISS objectives and operational requirements. The goal of the safety analysis is to identify all hazards and to assure that proper hazard controls have been developed and implemented for all hazard causes which have not been eliminated. The safety review meetings are held for the SRP and GSRP to assess the results of these safety assessments performed by US or IPs. The ISS Flight SRP (or SMART as delegated by the SRP) and GSRP will assess the results of these safety analyses for all phases of the ISS Program (i.e., from ground processing and launch [only applicable for Shuttle launches from KSC], to on-orbit assembly and operation, and return of hardware from orbit).

The SRP and GSRP will review the safety assessments performed by US or IPs. The results are reported to the Program after each safety review, Program milestone, and certification of flight readiness (CoFR) review. This is accomplished through presentations to the Safety and Mission Assurance Panel, the Program Manager, and through participation in the COFR process.

4.3 REVIEW PROCESS

The safety review process is an incremental process that will focus on: assuring that all hazards and hazard causes inherent in the design and operations have been identified; evaluating the means employed to control the hazard; and assessing the methods identified to verify all hazard controls. The process is implemented through safety reviews with the developers, providers, and operators of the ISS elements and end items. Paragraphs 4.3.1, 4.3.2, and 4.3.3 address the review process for flight design and operations. Paragraph 4.3.4 addresses the ground safety review process for KSC operations and GSE design.

4.3.1 IN-LINE SAFETY (Flight Only)

An in-line safety process has been developed in addition to those formal LP/S and IP safety reviews conducted by the SRP. The ISS S&MA/PR Office manages the in-line process. It is a concurrent engineering approach that facilitates the implementation of safety design changes to control and eliminate hazards in a timely manner. This in-line process is implemented by: the SRP through the conduct of special topic meetings to address US and IP issues and hazards resolutions; the ISS SWG through support of ISS design teams (the SWG consists of NASA JSC and Boeing S&MA/PR personnel acting in a support role to the ISS Program); and by the JSC Safety and Mission Assurance Review Team (SMART) through direct support to GFE providers. The SWG in-line process does not replace the phased safety reviews conducted by the SRP. However, the SRP has delegated HR review authority to the SMART for GFE. The SMART review process for each item of GFE and other ISS hardware, as defined in paragraph 4.3.2.3, will culminate with the submittal of a SDP and a GFE CoFR to the Chair, ISS SRP. The SRP is responsible for ISS safety requirement development and interpretation and will be available to assist the IPT/AITs, SWG, and SMART in resolving issues and in providing clarification and interpretation of safety requirements necessary for issue resolution.

4.3.1.1 SAFETY WORKING GROUP

The SWG is responsible for assuring the implementation of safety programmatic and technical requirements as defined in the safety plan. This activity is part of the in-line concurrent engineering process to address safety issues in a timely manner. The SWG supports the SRP by evaluating and providing recommendations on safety issues, noncompliance reports (NCRs), close calls and mishaps, and provides technical recommendations to the SRP on specific SRP action items (AIs) and issues.

4.3.1.2 SMART FOR GFE AND OTHER ISS HARDWARE

The SMART has both an in-line safety role for JSC GFE and a delegated review role for all GFE in general. For GFE and other ISS hardware (paragraph 4.3.2.3), the SMART will assess, document, and approve the results of the safety analyses performed by the developer/operator and will submit the final assessment to the SRP for Program acceptance. The scope of safety review delegation from the SRP to the SMART includes approval authority for all generic and unique GFE hazards and equivalent safety noncompliances after coordination with the SRP. The SMART approval authority does not include GFE hazards that contribute to integrated ISS hazards, control of ISS catastrophic hazardous functions, or where the GFE hazard control relies on ISS-based

hardware or software. The SMART will forward all safety noncompliances and those HRs which do not meet the delegation criteria stated above to the SRP for review and disposition. GFE ground safety analysis will be presented to the GSRP for approval.

4.3.1.2.1 GENERAL

The GFE provider is responsible for preparation of the safety analysis, documentation of compliance, and presentation to the SMART. In general, the data requirements and scheduling of reviews with the SMART shall be consistent with the requirements of this document. For specific details with respect to SMART procedures and data requirements, JSC GFE providers shall contact SMART Executive Secretary, mail code NT52, at the NASA/JSC, Houston, Texas 77058, or via e-mail at smartsec@ems.jsc.nasa.gov.

4.3.1.2.2 PRESENTATION TO THE SMART

The GFE provider shall be prepared to present information submitted in the data package to the SMART. For details on the data submittal and presentations, contact the SMART Executive Secretary. Presentation charts shall be submitted to the SMART Executive Secretary no less than 10 working days prior to the scheduled SMART meeting; otherwise, all transparencies, plus 15 copies of the additional charts must be provided by the presenter at the time of the SMART meeting. Data elements already incorporated into the data package need not be resubmitted with the previously submitted presentation charts.

4.3.2 FLIGHT SAFETY REVIEW PROCESS

Three phased safety reviews with the flight SRP are typically held for each element of the ISS**.** The procedures and data for the phased safety reviews are defined in the paragraph 5.0. For other equipment listed in paragraph 4.3.2.3, the safety review process may be with the SRP or delegated to the SMART. Delegation will be based upon the hazard potential of the hardware and its effects on the overall ISS integrated safety assessment. For visiting and crew return vehicles, the hardware provider and operator shall provide data addressing ISS proximity and attached operations and phases as pre-coordinated with the SRP.

4.3.2.1 INTERNATIONAL PARTNER SEGMENTS/ELEMENTS

For IPs, the data for these reviews will be provided as defined in the NASA/IP Bilateral Data Exchange Agreement (BDEA) and will be scheduled to correspond to the preliminary design review (PDR), critical design review (CDR), and design certification review. The depth and number of reviews is dependent on the complexity, technical maturity, and hazard potential of the equipment, and may be modified by the SRP in conjunction with IPs prior to the reviews.

4.3.2.2 US ON-ORBIT SEGMENT/ELEMENTS

The phased safety reviews for USOS and elements formally address the safety data, which was developed and assessed during the in-line process, for approval by the ISS Program. The disposition of HRs by the SRPs and GSRPs will be in accordance with paragraph 4.5. The schedule of safety reviews for the US elements is based upon the launch schedule. Safety reviews are scheduled for each stage on the Engineering Master Schedule (EMS).

4.3.2.3 OTHER ISS HARDWARE

Other ISS hardware includes: flight crew equipment; extravehicular (EVA) tools and equipment; GFE from NASA Centers; IP GFE and crew personal equipment; medical support equipment; ISS system spares; ISS supplies (consumables); and miscellaneous contractor-furnished equipment (CFE). The safety review process for these items will typically be through the SMART acting for the SRP in accordance with a letter of delegation of authority from the ISS Manager, S&MA/PR and through the GSRP for KSC ground processing.

4.3.3 LAUNCH PACKAGE/STAGE SAFETY REVIEWS (FLIGHT)

The LP/S safety reviews for ISS segments and elements formally address the safety data, which was developed and assessed during the in-line process and during the USOS and IP safety reviews. It is compiled to form a complete safety analysis for an LP/S and formally reviewed and approved by the ISS. The disposition of LP/S HRs by the SRP and GSRP will be in accordance with paragraph 4.5. The LP/S phase III safety review shall be completed 9 +/- 2 months prior to launch, the phase II review, 19 +/- 2 months prior to launch, and the phase I review, 36 +/- 4 months before launch. The phase I and II LP/S reviews for IP flights will be held concurrently with safety reviews for the first USOS flight following the IP flight. For phase III of an IP LP/S, the integrated assessment by NASA contractor will be completed and appropriate HRs submitted to the SRP to support the US CoFR. Figure 4.3.2-1, ISS Program Safety Review Process, defines the general ISS safety review process flow. The safety review process begins with the delivery of acceptable data submittals for the LP/S safety review, which are due at least 45 days prior to the safety review.

4.3.4 GROUND SAFETY REVIEW PROCESS FOR ISS ELEMENTS AND HARDWARE TRANSPORTED ON ORBITER

The design of ISS and KSC-developed GSE will be reviewed in both an in-line process and a phased review process. GSE is contract deliverable equipment (hardware/software) used at KSC to test, transport, access, handle, maintain, measure, calibrate, verify, service, and protect flight hardware/software.

GFE hardware developers and operators are responsible for the preparation of ground safety analysis, documentation of compliance, and presentation to the GSRP for pre-launch and post-landing operations that occur at KSC and contingency landing sites.

GSE used at IP facilities are subject to IP safety requirements and to review by the host country.

4.3.4.1 GSE PHASE REVIEW PROCESS (GROUND)

The GSRP will review and approve the design and ground operations of flight hardware, GSE and non-GSE. (Non-GSE includes commercial off-the-shelf [COTS] equipment, factory equipment [FE], test support equipment [TSE], and special test equipment [STE]). The GSRP reviews and approves the interfaces between flight hardware, GSE, non-GSE and KSC facilities. The GSRP will also review and approve GSE design safety verification procedures which were not closed during the IPT design review process. The phase III GSRP review shall be completed 30 days prior to hardware delivery on-dock at KSC.

4.3.4.2 NON GSE PHASE REVIEW PROCESS (GROUND)

For non-GSE, the design and operations will be reviewed by the GSRP through the phased review process. This phased review process is defined in section 5.0, “Procedures and Data for Phased Safety Reviews”. KSC will provide matrices to help expedite the GSRP process. The customer will provide a list of all non-GSE as soon as these items are identified. Those KHB 1700.7 technical requirements, which will not be met for that subset of non-GSE that will be sent to KSC, require an assessment to compare the non-GSE safety specification to KHB 1700.7. Non-GSE safety issues will be resolved on a case-by-case basis.

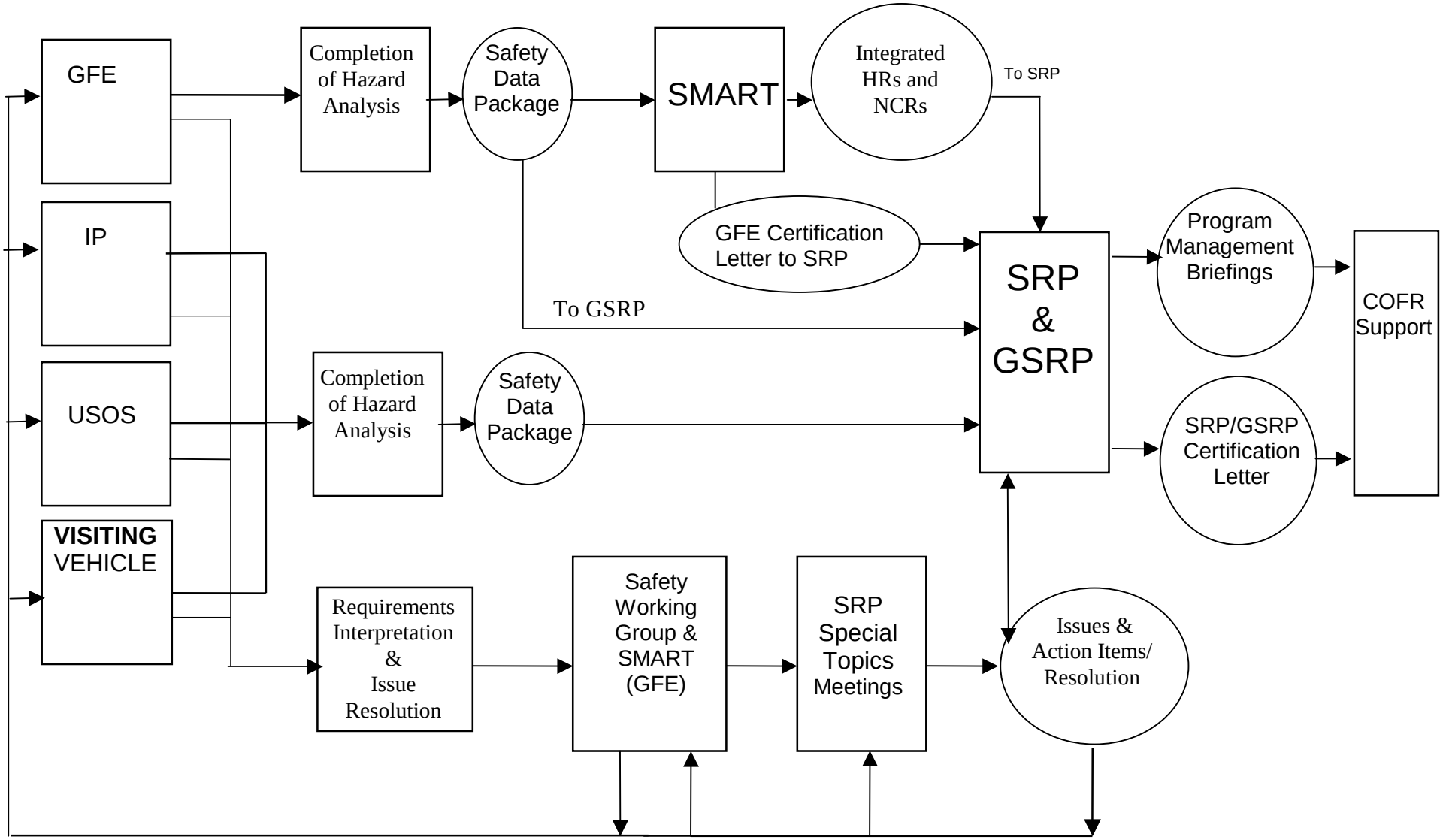

Figure 4.3.2-1 ISS PROGRAM SAFETY REVIEW PROCESS

Phase	Timing	General Safety Effort Required to Support Review	Purpose of Review
I	Preliminary Design Established L-3 yrs. (+- 4 mon.)	1. Develop safety analysis/ assessment report to reflect the preliminary design: a. Define hazards. b. Define hazard causes. c. Evaluate action for eliminating, reducing, or controlling hazards. d. Identify approach for safety verification. 2. Prepare a description of ground, assembly, maintenance, and nominal/contingency operations. 3. Determine compliance with SSP 50021, KHB 1700.7 requirements.	1. Assess preliminary design against SSP 50021 and KHB 1700.7 requirements. 2. Evaluate preliminary hazard controls and safety verification methods. 3. Identify interface hazards and requirement inconsistencies.
II	Final Design Established L-19 mon. (+- 2)	1. Refine and expand safety analysis/assessment report. a. Evaluate interfaces and mission (for ground) operations procedures, plans, and timeline. b. Update hazard descriptions, causes, and controls. c. Finalize test plans, analysis procedures, or inspections for safety verification. 2. Finalize description of ground, assembly, maintenance, and nominal/contingency scenarios. 3. Determine compliance with SSP 50021, KHB 1700.7 requirements.	1. Assess final design against SSP 50021 and KHB 1700.7 requirements. Identify potential non-compliances. 2. Concur on specific hazard controls and safety verification methods.
III	Fabrication and Testing Complete L-9 mon. (+-2)	1. Complete safety analysis. 2. For SRP, Complete all significant safety verification test, analyses, and/or inspections. Open standard safety verification items are documented on the safety verification-tracking log (SVTL). 3. For GSRP, Complete all verifications or transfer to SVTL. 4. Prepare final SDP. 5. For GSRP, Submittal of Certificate of Compliance to KSC	1. Approval of final SDP. 2. Identify and resolve open safety items. 3. Certificate of Compliance for Ground Processing
Post III	Verification Complete L-30 days	1. Close open SVTL items. 2. Assess real time changes 1. 3. For Flight - Submittal of SRP Safety Certification Letter to OE	1. Support ISS Safety CoFR endorsement

TABLE 4.3.3-1 SUMMARY OF SAFETY REVIEW PROCESS

4.4 SAFETY REVIEW MEETINGS AND AGENDA

More than one S/LP may be reviewed at a single review. All actions generated at the review will be logged and tracked. A single set of actions and minutes are generated and sent to attendees. An SRP coordination teleconference will typically be held 1 to 2 weeks prior to the review to finalize the meeting agenda. The minimum agenda for the phase safety review is defined as follows:

a. Introduction by the Chair.

b. Management overview of areas of responsibility, the hardware/software status and schedule.

c. Status of pre-review activities, as applicable, by hardware provider.

d. A design overview, including enough information to allow the panels to gain a general technical understanding of the systems and safety critical subsystems involved. Highlight any design changes since previous safety reviews.

e. An operations overview, including a description of planned operations and known contingencies. Highlight any operations that impact safety or are hazard controls.

f. A summary of all safety-related problem reports, accidents, and significant technical issues.

g. Detailed presentation of HRs (and NCRs if applicable) including phase-specific topics.

h. Presentations of any proposed NCRs.

i. Status of safety review meeting Action Items (Ais) as assigned during the review.

k. Verification tracking log status (phase III).

l. Concluding remarks.

4.5 HAZARD REPORT DISPOSITION

After the technical discussion is held, the Chairs provide a disposition of the HRs. Chair(s) assign AIs and the list of AIs are documented. The disposition may take one of these forms:

a. Approval as written.

b. Approval with changes.

c. Approval with an action to be performed by the responsible organization.

d. Rejection with an action to be performed by the responsible organization.

4.6 PROGRAM HAZARD REPORT ACCEPTANCE

Phased safety reviews provide the Program with safety assessments of ISS design and operations. The ISS Program manager is responsible for the acceptance of safety risk. This safety risk responsibility has been delegated to the ISS S&MA/PR manager and to the chairs of the SRP and GSRP where the level of risk is in compliance with or equivalent to the requirements of SSP 50021or KHB 1700.7.

The signature of the phase III HRs by the SRP chairs is the basis for the Manager, ISS S&MA/PR CoFR 1 and 2 endorsements in accordance with SSP 50108. The criteria for chairs of the SRP signing HRs is adequate implementation and verification of hazard controls for each hazard cause in accordance with the safety requirements of SSP 50021. Where the requirements of SSP 50021 are not met, the HRs will not be signed until the appropriate safety NCR has been approved by ISS Program management. ISS Approval authority for flight equivalent safety Noncompliance Reports (NCRs) has been delegated to the ISS SRP Chairs. The GSRP chair has been delegated the authority to approve HRs by the ISS Program manager.

Phase III HRs which meet acceptance criteria will be approved by the chairs of the SRP/GSRP; this will serve as the final approval of the HR.

4.7 READINESS FOR GROUND PROCESSING PRE/POST-FLIGHT CERTIFICATION

Following successful completion of the phased ground safety reviews, the GSRP will approve the flight hardware/GFE as safe to begin ground processing at KSC. The certification shall note any open safety verifications that exist which must be closed prior to the start of ground operations involving the open items. As a part of the phase III data package submittal, the LP Integrator (LPI) shall certify that the flight hardware is safe and that the support equipment and pre-launch and post-flight ground operations at the launch site comply with the requirements of SSP 50021 and KHB 1700.7.

4.8 CERTIFICATION OF FLIGHT READINESS PROCESS

In preparation for launch of an ISS element, the safety review panels (SRP, GSRP, and SMART) participate in the CoFR process. The S&MA/PR Office shall coordinate with all S&MA participants to assure successful completion of the safety review process before certifying the ISS element as safe.

4.9 SAFETY REVIEW DATA SUBMITTALS

Required safety review data for the phase safety reviews shall be submitted 45 days prior to the scheduled meeting. The safety review data is to be submitted to the following individuals:

a. At JSC:
For SRP:
Coordination Office
ISS SRP
Mail Code NE42
Johnson Space Center, Houston, TX 77058
or via email at srpcoof@ems.jsc.nasa.gov

b. At KSC:
For all submittals (3 Copies are required)
Chair, GSRP
Mail Code EC-G1
Kennedy Space Center, FL 32899
For electronic submittals, contact the Chairman, GSRP.

A signed original of each completed HR must be available to the safety review panels for signature at the time of each review. Only one copy of the safety deliverable must be sent to each addressee except as noted. Electronic copies of HRs should also be provided prior to safety review meetings to facilitate distribution of the SDP, and post meeting to facilitate the update of the Vehicle Master Database (VMDB) and SRP web site. The ISS SRP web site URL is: http://www.jsc.nasa.gov/srp/,

4.9.1 SMART DATA SUBMITTAL

Required safety data for the GFE safety reviews with the SMART shall be submitted 45 days prior to the scheduled meeting. The safety review data package shall contain as a minimum: GFE definition; purpose of package review; safety products commensurate with phase; VTL (phase III); and potential NCRs. The safety review data is to be submitted to:
SMART Executive Secretary
Mail Code NT52, Johnson Space Center
Houston, Texas 77058
or via e-mail at smartsec@ems.jsc.nasa.gov

An original safety product package with project team signatures must be available to the SMART at the time of the review.

4.10 MODIFIED SAFETY PROCESS (FLIGHT ONLY)

To make more efficient use of safety review panel time and to minimize safety documentation issues a modified safety review process has been developed. The principle that defines this modified process is that hardware whose design and operations are of recognized low hazard potential or whose hazards are controlled by standard hazard controls and verification methods, could be adequately assessed for safety compliance without use of complex SDP's. To implement this modified approach agreement must first be reached that the hardware qualifies for a modified process. The definition of complex, intermediate, and basic, as defined in Table 4.10-1, were prepared to help define these qualifying criteria. Complex system safety compliance assessment is accomplished using a phased safety review process as illustrated by table 4.3.3-1. Successful completion of each safety phase is documented by SDP/HR submittals to and approval by the SRP.

Hardware that meets the criteria of basic and intermediate categories, as defined in table 4.10-1, may be reviewed in accordance with the modified process, as defined in paragraphs 4.10.1 and 4.10.2.

Panel endorsement of developer hardware categorization as basic or intermediate shall be obtained as early as possible to avoid impact to hardware safety certification.

If after a hardware item category has been assigned, the developer identifies previously undefined hazards or implements design changes that may create new hazards, the hardware provider must submit a revised SDP, which may result in a reclassification of the hardware category.

Category	Defined Hazards
Basic	Safety analysis indicates hardware and operations have a very low hazard potential. The identified hazards and hazard causes are controlled in accordance with ISS safety requirements and utilize standard hazard controls and verification methods as defined in JSC Form 1366.
Intermediate	The identified hazards and hazard causes mostly meet the criteria of the basic category but require some unique hazard reports as: 1. The item has unique hazards (i.e., hazards not found on the JSC Form 1366) but has controls and verification methods that have been historically accepted by the SRP use App. B HR format, or 2. The item has "standard" hazards (i.e., hazards identified on the JSC Form 1366) but uses controls and verification methods other than those identified on the JSC Form 1366. Use App. B HR format.
Complex	The item has unique hazards with hazard controls that are: 1. Active "must work" functions, such as critical power systems, electromechanical devices, life support systems, inhibits or actuators/mechanisms providing structural load paths, or 2. Are nonstandard or have nonstandard verification methods that depart from historically accepted techniques, or 3. Operationally complex requiring flight or ground personnel intervention to assist in controlling the hazard.

TABLE 4.10-1 HARDWARE ITEM CATEGORIES

4.10.1 REVIEW PROCESS FOR BASIC HARDWARE ITEMS (FLIGHT ONLY)

Basic hardware items have a very low level of complexity, which may allow the item to complete the modified safety process. These might include logistical items, spares, and simple GFE. The developer will submit an SDP that will document the applicable hazards, controls, and verifications. Submittal will follow the standard procedure detailed in section 4.9, and approval may be obtained without a formal SRP meeting. The following data are required for the simplified SDP for hardware design and flight operations:

1) Brief description of the hardware design and flight operations with schematics and block diagrams, as appropriate.

Summary of the safety analysis results that document compliance with the applicable safety requirements. Document using JSC .Form 1366

2) VTL for open verifications, as applicable.

3) Certificate of safety compliance signed by the Program Manager.

4.10.2 REVIEW PROCESS FOR INTERMEDIATE HARDWARE (FLIGHT ONLY)

For hardware which meets the definition of intermediate, the developer shall submit JSC Form 1366 for the standard hazards and prepare unique HRs, as necessary, for the remainder (per Appendix B). The number and scope of HRs and reviews will be determined by the complexity of hardware. Submittal will follow the standard procedures detailed in section 4.9, and approval may be obtained without a formal SRP meeting. The following data are required for the simplified SDP for hardware design and flight operations:

1) Brief description of the hardware design and flight operations with schematics and block diagrams, as appropriate.

2) Summary of the safety analysis results that document compliance with the design, verification, and applicable on-orbit verification/re-verification requirements for the identified standard hazards.

3) Documentation of all applicable standard hazards, controls, and verifications on HR JSC Form 1366).

4) Documentation of unique hazards on HRs with supporting data per Appendix B.

5) VTL for open verifications, as applicable.

6) Certificate of safety compliance signed by the Program manager.

4.11 GROUND SAFETY DATA SUBMITTALS FOR GOVERNMENT FURNISHED EQUIPMENT (GFE)

GFE developers shall prepare a GFE checklist, which shall be used by the GSRP to determine if a ground SDP is required for the GFE operations performed at KSC. Contact the SMART Team or the GSRP Chairman for a sample of the checklist. Ground SDPs shall be submitted in accordance with Table 4.3.3-1.

5.0 PROCEDURES AND DATA FOR PHASE SAFETY REVIEWS

The purpose of the safety review process is to assess the design and operations of the flight and ground elements for compliance with the safety requirements of SSP 50021 and KHB 1700.7, and to obtain panel approval of the completed safety compliance data. The responsible Safety and Engineering managers, and the Program Manager shall sign and date each Hazard Report before submittal.

5.1 PHASE I SAFETY REVIEW

The phase I safety review is the first safety meeting among the appropriate safety and engineering personnel representing NASA, IPs, contractors, and the ISS safety review panels in which safety of the ISS equipment and associated operations are addressed. The objective of the meeting is to identify all hazards and hazard causes inherent in the preliminary design, evaluate the means of eliminating, reducing, or controlling the risk, and establish a preliminary method for safety verification.

5.1.1 PHASE I DATA REQUIREMENTS

The following data is required for the phase I safety reviews:

a. GSE and Ground Operations at KSC

(1) Flight Element description based on subject mission.
(2) Descriptions of GSE and payload subsystems that present a potential hazard during ground processing, and the ground operations involving these items. Schematics and block diagrams with safety features and inhibits identified should be included. Design data for hazardous systems (pressure, lifting, etc.) shall be summarized in a matrix. Contact the GSRP Chair for sample formats.
(3) Ground operations scenarios including post-flight ground operations at the primary, alternate, and contingency landing sites. The scenarios should highlight unique requirements, such as continuous power through a T-0 umbilical.
(4) Ground HRs and appropriate support data.
(5) Ordnance data required by KHB 1700.7
(6) Demonstration that the preliminary design is in compliance with design requirements of KHB 1700.7. The following are basic hazard groups applicable to ground operations: structural failure of support structures and handling equipment; collision during handling; inadvertent release of corrosive, toxic, flammable, or cryogenic fluids; loss of habitable/breathable atmosphere; inadvertent activation of ordnance devices; ignition of flammable atmosphere/material; electrical shock/burns; personnel exposure to excessive levels of ionizing or nonionizing radiation; use of hazardous/incompatible GSE materials; inadvertent deployment of appendages; working under suspended loads; and rupture of composite epoxy overwrap pressure vessels.
(7) Planned on-dock arrival date at KSC.

b. Flight System Design and Operations

(1) An overview description of the design and flight operations of the hardware being addressed in the review. This includes descriptions of: hardware elements; flight and ground systems related to ISS on-orbit manned and unmanned operations; airborne support equipment; operational scenarios related to assembly, start-up sequences, and orbital operations; and LP, assembly, and stage configurations of the hardware. Briefly describe the hardware and operations in terms of significant characteristics and functions. Include figures or illustrations to show all major configurations and identify all hazardous systems and subsystems.

(2) Detailed descriptions and schematics/block diagrams (at a PDR level of detail) for safety-critical systems and subsystems and their operations. In lieu of uniquely generated safety descriptive data, and with prior coordination with the SRP, references can be made to other ISS descriptive documentation made available to the SRP.

a. The schematics and block diagrams should be prepared with safety features, inhibits, etc., identified. Describe the major elements of the end item or segment with the information organized by technical disciplines (See below).

b. Describe the design, function, planned operation, and safety features of each system/subsystem.

c. The following list of technical disciplines may be used to organize the data: structures, materials, mechanical systems, pyrotechnics and ordnance systems, pressure systems, propulsion and propellant systems, avionics systems (including electrical power distribution, computer-controlled systems), command and control systems, optical and laser systems, human factors, hazardous materials, thermal control systems, and interfaces and provided services.

(3) Flight HRs and appropriate support data (see paragraph 5.1.2).

(4) A summary listing in the description section, of safety-critical services provided by other ISS segments or the orbiter.

5.1.2 PHASE I HAZARD REPORTS

A phase I HR shall be prepared for each hazard identified as a result of the safety analysis on the preliminary design and operations. The focus shall be on cause description and controls. Instructions for completion of phase I HR forms are contained in Appendix B.

5.1.3 SUPPORT DATA - PHASE I HAZARD REPORTS (FLIGHT ONLY)

Critical procedures/processes, which require special monitored verification, shall be identified in preliminary fashion. Also, for those hazards controlled by "design for minimum risk," rather than failure tolerance requirements, a minimum set of support data, defined herein for phase I are required. (Appendix B contains the complete list of data elements for design for minimum risk hazards.)

a. **Unpressurized Structures:**

(1) Preliminary plan for structural verification in accordance with SSP 30559, Structural Design and Verification Requirements, (including beryllium, glass [in accordance with SSP 30560, Glass, Window, and Ceramic Structural Design and Verification Requirements], and composite/bonded structure) (Note 1)
(2) Fracture Control Plan in accordance with SSP 30558, Fracture Control Requirements for Space Station (Note 1)

b. **Pressurized Systems:**

(1) Fracture Control Plan (Note 1)
(2) Summary of design conditions for each pressurized system and certification approach

c. **Pyrotechnic Devices:**

(1) Identification of pyrotechnic devices and functions performed

d. **Ionizing Radiation:**

(1) Ionizing radiation data sheet for each source (JSC Form 44, See Appendix E)

e. **Electrical Systems:**

(1) Top level wiring diagrams illustrating the approach to wire sizing and circuit protection

f. **Components and Elements of Mechanisms in Critical Applications:**

(1) Identification of critical procedures and processes related to compliance with letter JSC, TA-94-041, Mechanical Systems Safety, June 9, 1994. This letter is available on the ISS SRP web page at http://www.jsc.nasa.gov/srp/

Note 1 - Reference to submitted and approved document by number and title is sufficient unless given specific request.

5.2 PHASE II SAFETY REVIEW

The purpose of the phase II safety review is to present to the panels the updated Hazard Reports that reflect the completed design and operations of the ISS equipment to assure that all appropriate hazard controls have been implemented and that acceptable methods of verifying the controls have been identified in detail. The Phase II safety review is to correspond to the data maturity level of the Critical Design Review (CDR) for the flight hardware and GSE. The Hazard Reports shall be completed such that: all hazards and hazard causes have been identified; a means for eliminating, reducing, or controlling the risk has been defined and implemented; and specific safety verification methods (i.e., test plans, analysis, inspection requirements, or demonstration plans) have been finalized. Interfaces to be assessed shall include those between the Orbiter and the LP, among the various elements and distributed systems in the cargo bay, and the integrated systems and elements that comprise the ISS stage configuration. Newly identified hazards shall be documented in additional Hazard Reports. If review phases are combined the hardware provider will need to provide all the data requirements that apply to the appropriate phases (i.e., phase I and phase II)

5.2.1 PHASE II DATA REQUIREMENTS

The following data is required for the phase II safety review:

a. GSE and Ground Operations at KSC

1) Flight Element description based on subject mission.
2) Updated descriptions and matrices of the GSE, the subsystems that present a potential hazard during ground processing, and their ground operations. Include updated schematics and block diagrams with safety features and inhibits identified. Electrical schematics must show all hardware/GSE grounding.

3) Updated ground operations scenarios, including post-flight ground operations at the primary, alternate, and contingency landing sites.
4) Updated and additional ground HRs and appropriate support data (see paragraph 5.2.2).
5) Updated ordnance data required by KHB 1700.7.
6) Updated on-dock delivery date at KSC.
7) Engineering drawings and stress analyses of safety critical subsystems when specifically requested.
8) A list of safety-related failures and mishaps that have occurred.
9) The status of action items assigned during phase I.
10) A list of technical operating procedures for ground processing with a preliminary designation showing which ones are hazardous.
11) Demonstration that design is in compliance with the design requirements of KHB 1700.7.

b. Flight System Design and Operations

(1) Updated overview descriptions of hardware items and flight operations specified in paragraph 5.1.1b1. Individual stage descriptions as well as Assembly, Nominal, and Contingency Operation descriptions.
(2) Updated detailed descriptions and schematics/block diagrams (at a CDR level of detail) for safety-critical systems and subsystems and their operations. The electrical schematics for safety critical circuits should depict the entire circuit from power source through the end function and to the power return. When shown in diagrams the inhibits and their controls should be clearly labeled. In lieu of uniquely generated safety descriptive data, and with prior coordination with the SRP, references can be made to other ISS descriptive documentation that will be made available to the SRP.
(3) HRs and appropriate support data (see paragraphs 5.2.2 and 5.2.3).
(2) Updated summary listing in the description section, of Orbiter or other ISS segment provided critical services. Critical services used to control and/or monitor hazards should be defined in appropriate HRs.
(3) Engineering drawings and stress analyses of safety critical sub-systems when specifically requested.
(4) A list of safety related failures and accidents.
(7) Status of action items assigned during phase I safety reviews.

5.2.2 PHASE II HAZARD REPORTS

The phase II HRs shall be prepared by updating the safety hazards analysis to reflect the CDR level of detail and by providing new and updated HRs to reflect the completed equipment design and flight/ground operating procedures. If the equipment design is changed from phase I to phase II such that a phase I HR may be deleted, a brief statement of rationale for deleting the report shall be presented in the phase II assessment report. Instructions for completion of phase II HR forms are contained in Appendix B. All current changes to the HRs are to be identified by a bar in the right-hand margin. The responsible safety and engineering managers, and the Program Manager shall sign and date each HR before submittal.

5.2.3 SUPPORT DATA - PHASE II HAZARD REPORTS (Flight Only)

All critical procedures/processes must be addressed, including the plan for verification. For hazards controlled by "design for minimum risk," the following listed set of support data in addition to that provided for phase I, are required for phase II.

a. **Unpressurized Structures:** Structural verification plan (Note 2) in accordance with SSP 30559 including:

(1) Summary of design loads derivation leading to critical load cases (Note 2)
(2) Math model verification plan (Note 2)

b. **Pressurized System:**

(1) Qualification and acceptance test plan

c. **Pyrotechnic Devices:**

(1) For pyrotechnic devices which must operate reliably in order to meet safety requirements, an acceptance and qualification plan to verify fault tolerance, including margin demonstration, is required (Note 2)

d. **Materials:**

(1) Fluids compatibility analysis (Note 2)

e. **Flight Ionizing Radiation:** JSC Form 44

f. **Ground Commanding:**

(1) Training plan for command controllers (Note 2)
(2) List of hazardous commands including procedures used to preclude inadvertent commanding
(3) Description of command hardware

g. **Components and Elements of Mechanisms in Critical Applications:**

(1) Mechanism verification plan related to demonstrating compliance with SRP Mechanical Systems Safety (Note 2)

Note 2 - Reference to submitted and approved document by number and title is sufficient unless given specific request

5.3 PHASE III SAFETY REVIEW

The focus of the Phase III review will be the closure of significant safety verification test, analyses, inspections or demonstrations and review of the status of open standard verification items documented on the VTL. The phase III review provides the final safety assessment of equipment and operations.

5.3.1 PHASE III DATA REQUIREMENTS

The following data is required for the phase III safety review:

a. GSE and Ground Operations at KSC

(1) Final as-built hardware description and brief mission scenario.
(2) Updated descriptions and matrices defining the final configuration of the GSE, the hardware subsystems that are potentially hazardous during ground processing, and their ground operations. Include updated schematics and block diagrams with the as-built safety features and inhibits identified.
(3) Updated and finalized ground operations scenario, including post-flight ground operations at the primary, alternate, and contingency landing sites.
(4) Updated and additional ground hazard reports, including support data that reflect the final configuration of the as-built GSE and planned hardware/GSE use.
(5) Updated and finalized ordnance data required by KHB 1700.7.
(6) Updated and finalized on-dock delivery date at KSC.
(7) Engineering drawings and stress analyses of safety critical subsystems when specifically requested.
(8) A summary of all safety related failures and accidents.
(9) Status of action items assigned during the phase II safety review.
(10) Finalized list of technical operating procedures that will be used at KSC with the hazardous procedures clearly identified. The list shall also state the proposed first use date of the procedure at KSC.
(11) Verification that each flight system pressure vessel has a pressure vessel logbook showing pressurization, history, fluid exposure, and other applicable data. This verification shall account for the planned testing at KSC.
(12) ISS Safety VTL for ground operations only, in accordance with Appendix C (Figure C.1-1, Safety Verification Tracking Log) for a specific mission.
(13) Certificate of Safety Compliance (JSC Form 1114A) signed by the responsible LP/mission manager for GSE design and ground operations. Demonstration that the design is in compliance with design requirements of KHB 1700.7.
(14) Procedural hazard control matrix that identifies hazard control criteria within the associated work-authorization documents for all procedural hazards. Contact GSRP Chair for format.
a. (15) Identification of ground safety noncompliances. Ground safety noncompliances must be approved as either a waiver or a deviation before the phase III safety review can be completed. A signed copy of each approved waiver/deviation shall be included in the phase III SDP (see paragraph 6.0).

b. Flight System Design and Operation

(1) A final overview description of the design and operations of the hardware being addressed in the review. This includes descriptions of: elements; flight and ground systems related to ISS on-orbit manned and unmanned operations; airborne support equipment; operational scenarios related to assembly, start-up sequences, and orbital operations; and LP, assembly, and stage configurations of the hardware. Briefly describe the hardware and operations in terms of significant characteristics and functions. Include figures or illustrations to show all major configurations and identify all hazardous systems and subsystems.
(2) Final detailed descriptions and schematics/block diagrams that reflect the as-built design for safety-critical systems and subsystems and their operations.
(3) HRs and appropriate support data (see paragraphs 5.3.2 and 5.3.3).
(4) A final summary listing of Orbiter or other ISS segment provided safety-critical services. Orbiter services or other ISS segment provided critical services used to control and/or monitor hazards should be defined in appropriate HRs.
(5) Closure of action items assigned during the phase II safety review.
(6) A summary of all safety related failures and accidents.
(7) A list of all pyrotechnic initiators installed or to be installed. For each initiator the list identifies the function to be performed, the part, lot and serial numbers.
(10) Engineering drawings and stress analyses of safety critical subsystems when specifically requested.
(11) Listing of NCRs to safety requirements. A signed copy of each approved NCR shall be included. (see paragraphs 6.0).
(12) ISS Safety Verification Tracking Log (for flight hardware only) in accordance with Appendix C (Figure C. 1-1) for a specific mission.

5.3.2 PHASE III HAZARD REPORTS

The phase III HRs shall reflect the as-built design and operations of the equipment design and operation. Ideally all safety analysis efforts are completed by phase III. The phase II HRs shall be updated to reflect this final equipment design and operations, and document the status and results of all completed verification work. All open verifications must be listed on a safety verification tracking log. This log allows the panel chairs to sign the HRs indicating completion of the safety analyses, but with the understanding that approval for flight or corresponding ground operations will be withheld until all applicable verification activity is complete. Approval for flight will not be withheld for open verification activities that are part of nominal on-orbit activation activities, but failure to successfully accomplish these activities on orbit may constrain subsequent on-orbit operations. Open ground and flight verifications that have been identified as a constraint against ground processing must be closed before the applicable ground operation can be performed.

Instructions for completion of phase III HR forms are contained in Appendix B. All changes to the HRs since phase II should be indicated by a bar in the right-hand margin. The HRs providers safety manager and Program manager shall sign and date each HR before submittal to the panels.

5.3.3 SUPPORT DATA - PHASE III HAZARD REPORTS (Flight Only)

For hazards controlled by "design for minimum risk," the following listed set of support data in addition to that provided for phases I and II, are required for phase III.

a. **Unpressurized Structures:**

(1) Fracture summary report (Note 3)

b. **Pressurized Systems:** Fracture summary report (Note 3)

(1) Summary of results of verification tests/analyses

c. **Pyrotechnic devices:**

(1) Summary of results of verification test/analyses

d. **Materials:**

(1) Flammability assessment per SSP 30233 (Note 3)
(2) Fluids compatibility analysis (Note 3)

e. **Flight Ionizing Radiation**

(1) JSC Form 44, if required - update

f. **Components and Elements of Mechanisms in Critical Applications**:

(1) Summary of verification results

a. Trade/special studies supporting HRs
b. Flight HRs and appropriate support data (see paragraph 5.1.2)
c. A summary listing in the SDP description section, of safety-critical services, and an explanation in the appropriate HRs of the ISS/orbiter services used to control and/or monitor hazards

Note 3 - Reference to submitted and approved document by number and title is sufficient unless given specific request.

5.4 SAFETY VERIFICATION TRACKING LOG

The safety verification tracking log (SVTL) is used to formally document and status ISS safety verification work that is not completed at the time the final safety assessment report is prepared. (All completed verification work is documented on the appropriate HRs.) These verification requirements will be acted on in accordance with the process described in the Program Master Verification Plan. If all activities associated with the safety analyses (other than the open verification) are completed, the panel chairs may sign the HRs indicating panel acceptance of the safety work, but with the understanding that final approval of the hazard is not complete until all applicable verification activity is completed. Items requiring on-orbit verification will be incorporated in approved assembly and checkout procedures. The procedure numbers will be referenced in the log. The status of SVTL closure may be presented at the SWG, final closure or verification closure issues shall be coordinated with the SRP.

5.5 POST PHASE III SAFETY ACTIVITY

When changes to the design or operation of a stage are required subsequent to the phase III safety review but prior to launch, the ISS participants shall assess those changes for possible safety implications, including their effect on all interfaces. The assessment shall be forwarded to the panels for approval. New or revised HRs and support data shall be prepared, where applicable, and submitted for review. If the safety of the stage is affected, the Safety panel chairs may require a delta safety review.

5.6 SUBMITTAL OF PROPRIETARY DATA

The safety review process does not easily accommodate proprietary data, but reasonable efforts can be made if necessary to properly handle proprietary data. Non-disclosure requirements for JSC programs including the SRP are defined in JSC Policy Directive (JPD) 5150.2H, Industry Presentations and Related Nondisclosure Agreements. Contact the SRP Coordination Office for assistance in these procedures.

In addition to the proper submittal of proprietary information, the submitting organization should be aware of the following while attending SRP/GSRP safety reviews, technical interchange meetings (TIMs), and AI closure meetings:

- SRP/GSRP meetings are not conducted in secure facilities. Thus, when it is necessary to recess meetings (e.g., lunch and breaks), the presenting organization will be responsible for protecting any proprietary data distributed during the meeting (other than that logged and distributed by NASA as part of the SDP).

- If any proprietary data are to be presented or discussed during the meeting, prior to the meeting the presenting organization will notify the SRP Coordination Office/GSRP Chair who will then make arrangements to monitor attendance, close the doors, and post a sign noting that access to the meeting is controlled. Panel members/alternates and support staffs have non-disclosure agreements and will not be restricted from panel meetings.

- The presenting organization will be responsible for retrieval and disposition of any proprietary material distributed at the meeting (other than that logged and distributed by NASA as part of the SDP), with the exception that two copies of proprietary material distributed by the presenting organization at the meeting that will be retained by the SRP/GSRP in a protected file.

When the SRP/GSRP receives proprietary data included in the SDPs, such data will be handled in a manner that will protect the interests of the submitting organization. These procedures include tracking distributed materials, protecting files, and restricting reproduction. In order to exercise reasonable care in protecting proprietary data in connection with the payload safety review process, NASA will ensure that proprietary data are distributed only to persons who have a need to review such data in support of panel functions. Furthermore, distributed data that is returned to the SRP Coordination Office/GSRP Chair after use will be destroyed via the NASA secure disposal process.

The protection of material marked “PROPRIETARY” creates an added burden on the SRP/GSRP review support system, so the submitting organization should mark only those items that are proprietary. The submitting organization should coordinate with the SRP Coordination Office/GSRP Chair to explore such alternatives as providing the proprietary material in a separate package when it is a very small portion of the overall SDP. If a separate, proprietary briefing package (not contained in the SDP) is to be presented to the SRP/GSRP during the review, the submitting organization shall provide at least 20 copies of such material for distribution at the review and will retrieve it after the review as stated above.

If the submitting organization discovers that some portion of the SDP marked “PROPRIETARY” is no longer considered such, the organization must inform the SRP Executive Secretary and/or the GSRP Chair in writing.

5.7 SUBMITTAL OF COPYRIGHTED DATA

Organizations submitting SDPs are hereby informed that documentation submitted to NASA must be reproduced and distributed to the members of the SRP/GSRP and to associated technical support personnel. Accordingly, copyrighted data shall not be included in the submitted documentation unless the submitting organization: 1) identifies such copyrighted data, and 2) grants to the Government, or acquires on behalf of the Government, a license to reproduce and distribute the data to these necessary recipients.

5.8 SUBMITTAL OF TRANSLATED DATA

For all documents submitted to the SRP/GSRP that have been translated into English, the English translation shall be the official document.

5.9 SUBMITTAL OF TOXICOLOGICAL DATA FOR ISS (FLIGHT ONLY)

The Shuttle/ISS safety review process requires biomedical safety assessments of potentially hazardous materials, such as chemicals, microorganisms, and radioisotopes. See JSC 27472 Rev A, Requirements for submission of Data Needed for Toxicological Assessments of Chemicals and Biologicals to be flown on Manned Spacecraft, for the toxicological data requirements. In order for these assessments to be available for the safety reviews, the JSC Toxicology Group requires submittal

of test sample data substantially in advance of the phase safety reviews, see JSC 27472, Appendix B for data submission timelines. The developer must attach both the data submitted to JSC Toxicology Group and the JSC response (when available) to the applicable HR that is a part of the SDP. Should toxicology submittals involve proprietary data, see section 5.6.

6.0 NONCOMPLIANCE WITH ISS SAFETY REQUIREMENTS

Elements of the ISS shall meet all the applicable safety requirements or obtain specific approval for each case of noncompliance. A compilation of the ISS safety requirements is in SSP 50021, SSP 50004, and KHB 1700.7. The applicable safety requirements for an element of the ISS are those requirements of SSP 50021, SSP 50004, and KHB 1700.7 which have been allocated to the item via the applicable system, segment, prime item development, or end item specification.

If the developer identifies a non-compliant condition efforts should be taken to bring the item into compliance. If a solution cannot be found, then notification of the SRP about the noncompliant condition should be made as soon as possible.

When the design of the ISS hardware or its operations do not comply with an applicable safety requirement, a safety Noncompliance Report (NCR) form shall be processed by the developer to obtain approval of the noncompliant condition. Prior to the submittal of the NCR, appropriate rationale must be developed that defines the design features and/or procedures used to conclude that the noncompliant condition is safe. This rationale with supporting data shall be documented on the NCR. Approval of an NCR for the design or operation of one element, subsystem, or component of the design will not relieve the developer of the responsibility to meet the requirement in any other element, subsystem, or component of the design.

Flight NCRs must be approved before the associated hazard report will be approved by the SRP.

Ground NCRs must be approved prior to the start of associated KSC ground operations that are impacted by the NCR.

6.1 NONCOMPLIANCE DEVELOPMENT AND PROCESSING

All NCRs should be coordinated with the SRP or the GSRP, as appropriate, prior to submittal and should be submitted as soon as it is determined that the safety requirement cannot be met. The hardware manager prior to submittal must sign all NCRs. The developer must ensure that the NCRs are processed through the appropriate technical panel or working group prior to submittal. The developer must also ensure that the NCRs are processed through the appropriate control board(s).

The NCR will contain the following information: title, applicable segment, system or subsystem, applicable safety requirements, description of the noncompliance, description of the hazard or hazard cause affected by the noncompliance condition, reason the requirement cannot be met or fulfilled, and rationale for acceptance.

The NCR shall be provided by the developer for an initial review by the responsible technical panel or working group (EVA, Crew, Operations, Materials, etc.). Once concurrence of the technical community has been documented, the NCR will be submitted to the Flight SRP or GSRP for disposition. The developer will present the NCR and supporting data to the applicable panel. To obtain Space Station Program manager approval, the NCRs with S&MA/PR concurrence will be attached to an ISS NCR or JSC NCR for ground, and forwarded to the appropriate board (DCB, SSICB, JPRCB) in accordance with ISS Configuration Management requirements. Both the NCR and the request for deviation/waiver forms shall be prepared and approved by the safety representative (e.g., Boeing Safety manager for CFE, and IP Safety manager for IP segments) and Program Manager of the responsible organization. The developer will technically sponsor the NCR through the appropriate boards.

Approval authority for flight “equivalent safety” type NCRs (where the intent of the requirement has been met) has been delegated by the ISS Program Manager to the Chairs of the ISS SRP. Specific requirements and details with respect to this delegated authority and the scope of noncompliant conditions to which it applies will be addressed during the conduct of flight safety review meetings when an applicable noncompliant condition is identified. Under these circumstances, the NCR condition shall be documented on the HR, and the SRP chairs will disposition the NCR.

The GSRP has been granted the authority to approve NCRs that impact only GSE or ground processing and have no impact to the flight hardware design, flight operations, or flight safety.

6.2 EFFECTIVITY of SAFETY NCRS

When a safety NCR is granted, it is applicable for only the period specified on the approved NCR. For those NCRs with limited effectivity the developer has the responsibility to correct the noncompliant condition prior to reflight of the same item, or prior to the flight of subsequent items of the same series. A NCR may be approved for unlimited use. NCRs considered for this effectivity will be those where the design, procedure, configuration, etc., does not comply with the safety requirement in the exact manner specified, but the intent of the requirement has been satisfied and a comparable or higher degree of safety is achieved.

7.0 SERIES AND REFLOWN EQUIPMENT

Series and Reflown Equipment is ISS flight equipment that was previously launched and utilized on orbit and is manifested for reflight and reuse, or GSE equipment that has been previously utilized and reviewed by the GSRP. "Series Equipment" is hardware/software of the same or similar design to hardware/software, which has been previously certified safe by the appropriate safety review panel. Variances to the basic procedures of paragraph 5.0 have been developed for similar and reflown equipment to eliminate unnecessary duplication of effort from previously accomplished safety activity.

The user of the reflown/series equipment (i.e., NASA, the ISS Contractor, or an IP) is responsible for the safety of the series/reflown equipment and associated interfaces. To fulfill this responsibility, the user shall assess the previously approved safety data of the series/reflown equipment for applicability to the new application and make all appropriate changes. The number and depth of the phase safety reviews to be conducted to assess series/reflown equipment shall be discussed at an early safety review meeting.

The following unique data for the series/reflown equipment shall be submitted:

a. Identification of all series/reflown equipment to be used and the baseline safety analyses.
b. Assessment of each piece of series/reflown equipment to indicate that the proposed use is the same as that analyzed and documented.
c. New or revised HRs, additional data, and identification of deleted HRs. Identification and assessment of changes in hardware/software and operations, which have safety impact. A copy of the approved baseline Phase III Hazard Reports (attachments not required) shall also be submitted.
d. An assessment of the safety verification methods contained in the baseline safety analysis to determine which verification must be re-accomplished. Open verification items are to be tracked on a VTL (see Appendix C).
e. A list and description of safety noncompliances including the acceptance rationale for each.
f. Assessment of limited life items for reflown hardware.
g. Description of maintenance, structural inspections, and refurbishment of reflown hardware and assessment of safety impact.
h. Assessment of all failures and anomalies during previous usage of the series/reflown element with corrective action taken and rationale for extended use.
i. For ground review: Verification that each flight system pressure vessel has a pressure vessel logbook showing pressurization history, fluid exposure, and other applicable data. This verification shall account for the planned testing at KSC.
j. For flight reviews: A list of all pyrotechnic initiators installed or to be installed. The list will identify for each initiator the function to be performed, the part number, and the lot number and the serial number.
k. Ionizing radiation data sheet for each source (See Appendix E, JSC Form 44, KSC Forms) as applicable.
l. Non-ionizing radiation data sheet for each source (See appendix E, JSC Form 44, KSC Forms) as applicable.
m. A final list of procedures for ground processing (ground only).
n. On-dock date at KSC.
o. Certificate of Safety Compliance signed by the appropriate Program Manager.

APPENDIX A ABBREVIATIONS AND ACRONYMS

AI	Action Item
AIT	Analysis and Integration Team
CDR	Critical Design Review
CE	Cargo Element
CoFR	Certification of Flight Readiness
CR	Change Request
DCB	Development Control Board
EMS	Engineering Master Schedule
e.g.	Example
etc.	Etcetera
FRR	Flight Readiness Review
GFE	Government-furnished Equipment
GSE	Ground Support Equipment
GSRP	Ground Safety Review Panel
HAR	Hazard Assessment Report
HR	Hazard Report
IHA	Integrated Hazard Analysis
IP	International Partners/ Participant
IPT	Integrated Product Team
ISS	International Space Station
JPDRD	Joint Program Definition and Requirements Document
JSC	Johnson Space Center
KSC	Kennedy Space Center
L-2	Launch Minus 2 Day
LP	Launch Package
LP/S	Launch Package/Stage
LPI	Launch Package Integration
LPM	Launch Package Manager
MUA	Material Usage Agreement
NASA	National Aeronautics and Space Administration
NCR	Noncompliance Report
NSTS	National Space Transportation System
PCB	Parts Control Board
PDR	Preliminary Design Review
PSRP	Payload Safety Review Panel
RAD	Radiation Absorbed Dose
S&MA	Safety and Mission Assurance
S&MA/PR	Safety and Mission Assurance/Program Risk
SDP	Safety Data Package

SMART	Safety and Mission Assurance Review Team
SOW	Statement of Work
SR&QA	Safety, Reliability, and Quality Assurance
SRP	Safety Review Panel
SSCB	Space Station Control Board
SSICB	Space Station Integrated Control Board
SSP	Space Shuttle Program
SVTL	Safety Verification Tracking Log
TBD	To Be Determined
UF	Utilization Flight
US	United States
VCN	Verification Completion Notice
VTL	Verification Tracking Log

APPENDIX B INSTRUCTIONS FOR ISS HAZARD REPORT FORM

B.1 SCOPE

The information required to complete a ISS HR form is defined herein. The ISS HR Form (Figure B.1-1) and HR legend will be used as the standard form for all ISS equipment. An equivalent form may be used as long as the form contains the same content fields as the ISS form and has been coordinated with the appropriate panel.

B.2 SUPPORT DATA

Each HR shall stand alone. Data required to understand the hazard, the hazard controls, and the safety verification methods shall be attached to the report. Examples of such data include block diagrams, descriptions of the applicable flight/support system and its operation, a listing of the sequence of events, a list of critical procedures/processes that require special verification, lists of mechanisms, lists of connects made or broken, lists of penetrations to space and associated seals and summaries of proposed tests or test results. When functional diagrams or schematics are supplied, the pertinent information shall be clearly identified (e.g., controls, inhibits, monitors, etc.). HRs that address identified safety requirements as "design for minimum risk" areas of design must be supported by a minimum set of supporting data as listed below

a. Unpressurized Structures:

(1) Preliminary plan for structural verification in accordance with SSP 30559, (including beryllium, glass [in accordance with SSP 30560], and composite/ bonded structures).#
(2) Fracture Control Plan in accordance with SSP 30558.#
(3) Structural verification plan in accordance with SSP 30559 including:#
a. Summary of design loads derivation leading to critical load cases.#
b. Math model verification plan.#
(4) Fracture summary report.#

b. Pressurized Systems:

(1) Fracture control plan in accordance with SSP 30558.#
(2) Summary of design conditions for each pressurized system and certification approach.
(3) Qualification and acceptance test plan.
(4) Fracture summary report.#
(5) Summary of results of verification tests/analyses.

c. Pyrotechnic Devices:

(1) For pyrotechnic devices, which must operate reliably in order to meet safety requirements, the following data is required:
a. Identification of pyrotechnic devices and functions performed.
b. Acceptance and qualification plans to include margin demonstration.#
c. Summary of results of verification test/analyses.

d. Materials:

(1) Flammability assessment in accordance with SSP 30233.#
(2) Fluids compatibility analysis.#

e. Ionizing Radiation:

(1) Ionizing Radiation data sheet for each source (JSC Form 44).
(2) Forms in KHB 1860.1, If required.

f. Non-Ionizing Radiation:

(1) List of equipment generating non-ionizing radiation.
(2) Forms in KHB 1860.2, if required.

g. Ground Commanding:

(1) List of hazardous commands including procedures used to preclude inadvertent commanding.
(2) Description of command hardware.
(3) Training plan for command controllers.#

h. Electrical Systems:

(1) Wire sizing and circuit protection diagram.
(2) Connector mate and demate table showing compliance to the requirements of letter MA3-94-002, Crew Mating/Demating of
powered connectors, November 18, 1994.

i. Components and Elements of Mechanisms in Critical Applications:

(1) Identification of critical procedures and processes.
(2) Mechanism verification plan demonstrating approach to compliance with Letter JSC, TA-94-041, Mechanical Systems Safety, June 9, 1994. #
(3) Summary of verification results.

Data marked by # symbol will be referred to by document number, title, and reference data on the applicable HRs and shall be submitted for review as in section 5.0.

B.3 APPROVAL

The ISS HRs will be approved in accordance with paragraph 4.6. The appropriate management personnel must sign and date the HR to signify agreement with the content prior to its submittal to the safety panel. The panel chairs will provide a disposition for each HR.

TEAM NAME
International Space Station

Hazard Report Number

---

1. HAZARD TITLE:

a. Review Level:
b. Revision Date:
c. Scope:

2. HAZARD CONDITION DESCRIPTION:

3. CAUSE SUMMARY:

1. Title:
2. Title:
3. Title:

4. PROGRAM STAGE(S):

5. INTERFACES:

6. STATUS OF OPEN WORK: (PHASE III ONLY)

7. REMARKS:

FIGURE B.1-1 HAZARD REPORT LEGEND (PAGE 1 OF 6)

8. SUBMITTAL CONCURRENCE:

(a) NASA Contractor

_____ _____
Safety Manager Date

_____ _____
Mission Integration Manager Date

_____ _____
Program Manager Date

(b) International Partners

_____ _____
Safety Manager Date

_____ _____
Program Manager Date

---

9. APPROVAL:

(a) Safety Review Panel

_____ _____
Panel Chair Date

_____ _____
Panel Chair Date

FIGURE B.1-1 HAZARD REPORT LEGEND (PAGE 2 OF 6)

Hazard Report Number

Cause 1

1. HAZARD CAUSE DESCRIPTION:

SEVERITY: **LIKELIHOOD:**

2. CONTROL(S):

Control 1
Control 2
.
.
Control n

3. METHOD FOR VERIFICATION OF CONTROLS:

Verification for Control 1
Verification for Control 2
.
.
Verification for Control n

4. SAFETY REQUIREMENT(S):

Document: Paragraph:

Title:

Document: Paragraph:

Title:

FIGURE B.1-1 HAZARD REPORT LEGEND (PAGE 3 OF 6)

5. MISSION PHASE(S):

____ Launch Processing:
____ Launch:
____ Rendezvous/Docking:
____ Deployment:
____ Orbital Assembly and Checkout:
____ On-orbit Operation:
____ On-orbit Maintenance:
____ Return/Decommissioning:
____ Landing
____ Post-landing

---

6. PROGRAM STAGE(S):

---

7. DETECTION AND WARNING METHOD(S) (Including verification):

---

8. CAUSE REMARKS:

---

9. CIL REFERENCE:

---

10. POINT OF CONTACT:

Name: **Telephone:**

FIGURE B.1-1 HAZARD REPORT LEGEND (PAGE 4 OF 6)

Hazard Report Number

Cause *n*

1. HAZARD CAUSE DESCRIPTION:

SEVERITY: **LIKELIHOOD:**

2. CONTROL(S):

Control 1
Control 2
.
.
.
Control n

3. METHOD FOR VERIFICATION OF CONTROLS:

Verification for Control 1
Verification for Control 2
.
.
Verification for Control n

4. SAFETY REQUIREMENT(S):

Document: Paragraph:

Title:

Document: Paragraph:

Title:

FIGURE B.1-1 HAZARD REPORT LEGEND (PAGE 5 OF 6)

5. MISSION PHASE(S):
____ Launch Processing:
____ Launch:
____ Rendezvous/Docking:
____ Deployment:
____ Orbital Assembly and Checkout:
____ On-orbit Operation:
____ On-orbit Maintenance :
____ Return/Decommissioning:
____ Landing
____ Post-landing

_____

6. PROGRAM STAGE(S):

_____

7. DETECTION AND WARNING METHOD(S) (Including Verification):

_____

8. CAUSE REMARKS:

_____

9. CIL REFERENCE:

_____

10. POINT OF CONTACT:

Name: **Telephone:**

FIGURE B.1-1 HAZARD REPORT LEGEND (PAGE 6 OF 6)

HAZARD REPORT LEGEND FOR TOP LEVEL PAGES

HAZARD REPORT NUMBER: AAAA-NNNN-RR

An alphanumeric designation that is unique to the ISS element and the hazard, for example:

A. Identification of originator:

N. Sequential number. The number must be unique to the originator and identify entries associated with a single category of hazard.

R. Alpha character indicating the revision of the report.

1. TITLE: Enter a brief description of the hazard in terms of hazard initiator, action, or consequence.

a. REVIEW LEVEL: Enter: phase I, phase II, or phase III

b. REVISION DATE: Enter the date the HR was prepared or revised.

c. SCOPE: Describe the scope of the hazards being addressed including, as appropriate, the end item, system, subsystem, Orbital Replacement Unit (ORU), and operation.

2. HAZARD CONDITION DESCRIPTION: The hazard description shall define the risk situation including the unsafe act or conditions and its effect on Station, Shuttle, or personnel. Hazards exist (and HRs are needed) whenever an energy source and/or hazardous materials exists. For example, the provider of a Station element containing a hazardous toxic/flammable fluid should prepare an HR for release of that fluid, regardless of the controls provided to prevent release, since it is the verification of those controls that is the primary purpose of the HR.

3. CAUSE SUMMARY: List the titles of causes associated with this hazard.

4. PROGRAM STAGES: Using the ISS Assembly Sequence Manifest, identify the Stage(s) in which the hazard manifests itself.

5. INTERFACES: Identify the segments of the Space Station that may be associated with detection or control of the identified hazard.

6. STATUS OF OPEN WORK: Indicate the status of each open verification method. (phase III only)

7. REMARKS: Entries here should include any information relating to the hazard but not fully covered in any other item field.

8. SUBMITTAL CONCURRENCE: The indicated managers from the applicable End Item developer shall sign the HR prior to release outside of the company. Signature indicates agreement with the content at the current phase or level of program maturity and accuracy. It is important that both safety and engineering disciplines approve the technical content of the HR.

9. APPROVAL: The appropriate Panel Chair shall sign the hazard report. The signature indicates agreement with the content at the current phase or level of program maturity and accuracy.

HAZARD REPORT LEGEND

FOR EACH CAUSE PAGE

1. HAZARD CAUSE DESCRIPTION: Describe the identified causes for the risk situation and the unsafe act or condition listed under the hazard description. Hazard causes may be environmental, personnel error, design characteristics, procedural deficiencies, or subsystem malfunctions. Causes should be established at a level of detail necessary to explain the event path to the hazard.

SEVERITY: This index quantifies the worst-case accident or undesired event resulting from this cause. Severity levels are I (Catastrophic), II (Critical), and III (Marginal) as specified in Table B.1-1, Severity Category. Hazard potential classification should be established based on an uncontrolled or unmitigated worst-case hazardous event. The fact that a causal event must occur in conjunction with another causal event to result in a hazardous consequence does not lessen the severity, but will affect the controls required by ISS safety requirements to prevent the individual causal event. In such cases, the hazard cause and hazard control linkage should be stated on the HR.

LIKELIHOOD: The likelihood (probability of occurrence) of this hazard cause manifesting itself after controls have been implemented. Likelihood levels are A, B, C, and D, with A being the most probable as specified in Table B.1-2, Likelihood of Occurrence.

2. CONTROL (S): Provide a description of all the necessary design/operational controls needed to mitigate this hazard cause, including documentation references, if applicable. Identify the design features, safety devices, warning devices, and/or special procedures that will reduce, safe, or counter the hazards resulting from the hazard cause. If procedures or processes in manufacturing or assembly are critical elements in controlling hazards, the procedures and/or processes must be so identified and addressed individually. The order of precedence for reducing hazards is defined in SSP 50021. This section of the HR shall be initially completed for the phase I submittal and updated as required for each subsequent phase safety review. A direct correlation (indexing) between each hazard cause and the corresponding hazard control(s) and the corresponding method of verification of controls must be clearly shown on the HR. The hazard controls should be defined to a level of detail that clearly indicates compliance with the Safety Requirement.

3. METHOD FOR VERIFICATION OF CONTROL (S): Identify for each control method the method of verification (procedure/processes), including document number (if applicable), used to assure the effectiveness of the hazard controls. Each control verification method must link with its corresponding control, and when more than one method of verification is listed for a control; the verification methods will be listed separately (e.g., 1a, 1b, 2, 3a, 3b, 3c). Each verification method description shall include sufficient detail or explanation of the testing, inspection, or analysis, which mitigates the hazard to support hazard closure or risk acceptance. For phase II, this section should be updated to refer to specific test (or analysis) procedures and a summary of criteria to be used. For phase III, all safety verifications should be completed and a definitive statement of verification status shall be provided (i.e., “Open with Estimated Completion Date of …,” “Closed (with reference to supporting data),” or “Transferred for Closure via VTL”). This section shall be updated to reflect any changes in the verification methods made after the phase II review.

4. SAFETY REQUIREMENT (S): Identify the design safety requirements applicable in this cause. The detailing of safety requirements on the HR indicates what requirements are to be satisfied within the hazard controls. These requirements should be specified by document and paragraph. It is the responsibility of the originator of the HR to indicate the requirements that are being applied to their design based upon their hazard analysis. For flight Reference should be made to requirements at the segment and system level or the requirements in SSP 50021. References shall be made to KHB 1700.7 for ground hazard reports.

5. MISSION PHASE (S): Identify the phase of the mission in which the hazard manifests itself. An (X) indicates that the identified phase is affected by the hazard. An (O) indicates that it has been considered but is not affected.

Launch Processing covers the time period where the hardware arrives at the launch site, is processed into the launch vehicle, and extends to T-0.

Launch covers the time period from T-0 through orbital insertion.

Rendezvous/Docking covers the time period from orbital insertion until launch vehicle is docked to the Stage.

Deployment covers the time period from launch vehicle docking through detachment of the segment or end item from the launch vehicle.

Orbital Assembly and Checkout covers the time period from detachment from the launch vehicle, mating to the pre-existing stage, checkout, and launch vehicle demate.

On-orbit Operations covers Stage operations from launch vehicle demate until the next launch vehicle mates to the on-orbit stage.

On-orbit Maintenance covers the maintenance tasks and the tests required for verification of maintenance action completion.

Return/Decommissioning, Return covers the time period from launch vehicle demate from the on-orbit stage through element removal from launch vehicle on the ground. Decommissioning covers the time period from element disassembly from the on-orbit stage through final disposal of the elements.

Landing covers the period of Shuttle landing until flight hardware is removed from the Shuttle.

Postlanding covers the period after the flight hardware is removed from the Shuttle until the flight hardware leaves KSC or the contingency/alternate-landing site.

6. PROGRAM STAGES: Using the ISS Assembly Sequence Manifest, identify the Stage(s) in which the hazard manifests itself.

7. DETECTION AND WARNING METHOD (S): When applicable, describe the technique(s) used to detect the hazardous condition. This section is especially critical when detection and warning is required to implement required controls, which might not be effective without such detection. Identify, for each, the method of verification (procedure/processes), including document number (if applicable) used to assure the effectiveness of the detection and warning method(s).

8. CAUSE REMARKS: Entries here should include any information relating to the hazard cause but not fully covered in any other item field.

9. CIL REFERENCE: Provide the CIL numbers used in this analysis broken out by cause.

10. POINT OF CONTACT: Provide the name and telephone number of the individual to be used as a point of contact for this cause.

Description	**Category**	**Mishap Definition**
Catastrophic	I	Any condition which may cause a disabling or fatal personnel injury or cause loss of one of the following: the orbiter or ISS loss of a major ground facility of the ISS is to be limited to those conditions resulting from failures or damage to elements in the critical path of the ISS that render the ISS unusable for further operations, even with contingency repair or replacement of hardware, or which render the ISS in a condition which prevents further rendezvous and docking operations with ISS launch elements.
Critical	II	Any condition, which may cause a non-disabling personnel injury, severe occupational illness, loss of an ISS element, or involves damage to the orbiter or a major ground facility**.** For safety failure tolerance considerations, critical hazards include loss of ISS elements that are not in the critical path for Station survival or damage to an element in the critical path, which can be restored through contingency repair.
Marginal	III	Any condition which may cause major damage to an emergency system, damage to an element in a non-critical path, minor personnel injury, or minor occupational illness.

TABLE B.1-1 SEVERITY CATEGORY

Description	**Category**	**Mishap Definition**
Probable	A	Expected to happen in the life of the Program.
Infrequent	B	Could happen in the life of the Program. Controls have significant limitations or uncertainties.
Remote	C	Could happen in the life of the Program, but not expected. Controls have minor limitations or uncertainties.
Improbable	D	Extremely remote possibility that it will happen in the life of the Program. Strong controls are in place.

TABLE B.1-2 LIKELIHOOD OF OCCURRENCE

APPENDIX C INSTRUCTIONS FOR ISS SAFETY VERIFICATION TRACKING LOG

C.1 SCOPE

This appendix describes the usage of the ISS safety VTL (Figure C.1-1), and provides instructions for its completion.

C.2 USAGE

The verification-tracking log is used to formally document and status ISS safety verification work that is not completed at the time the final safety assessment report is prepared. (All completed verification work is documented on the appropriate HRs.) See paragraph 5.3.4.

C.3 INSTRUCTIONS

Instructions for the completion of the ISS Safety VTL are as follow:

a. TITLE

The title is used to identify whether or not the tracking log is for a mission or specific equipment verification.

b. PAGE

The specific page number followed by the total number of pages.

c. ELEMENT/MISSION

The name of the element, end item, etc., or the mission number.

d. DATE

Date completed or updated.

e. LOG NO.

An alphanumeric designation used to identify and track each verification item. These designations will be assigned by the project organization when the log is first submitted.

f. HAZARD REPORT NUMBER

The number of the HR containing the verification item.

g. SAFETY VERIFICATION NUMBER

The number from the applicable HR (Safety Verification Method block) for the specific verification item.

h. DESCRIPTION

The specific verification remaining open. Procedures will be identified by number and title.

i. GROUND OPERATION (S) CONSTRAINED

For Flight SVTLs:
Indicate “yes” or “no” as to whether this safety verification constrains any ground operations. If “yes”, provide an attachment that identifies which ground operation is constrained. Notification to the GSRP of the constraint shall be provided.

For Ground SVTLs:
Indicate which ground operation is constrained by this verification. Indication may be specific (e.g. a step in a procedure) or general (e.g., arrival or first use).

j. INDEPENDENT VERIFICATION REQUIRED (YES/NO)

The need (Yes/No) for an independent verification of the specific item.

k. SCHEDULED DATE

The date planned for completion of the verification.

l. COMPLETION DATE

The date this verification was completed.

m. METHOD OF CLOSURE/COMMENTS/VERIFICATION COMPLETION NOTICE (VCN)

The method by which this open verification has been confirmed closed, including additional information or remarks.

Page_____ of_____

International Space Station

Mission Element

Safety Verification Tracking Log

Mission/Element: Flight: Ground: Date:_____

Log Number	Hazard Report Number	Safety Verification Number	Description (Identify Procedures by: Number and Title)	Operation(s) Constrained	Independent Verification Required (Yes/No)	Scheduled Date	Completion Date	Method of Closure Comments/Verification Completion Notice (VCN)

FIGURE C.1-1 SAFETY VERIFCATION TRACKING LOG

APPENDIX D INSTRUCTIONS FOR COMPLETION OF ISS FORM 1366 (Flight Only)

A. NUMBER	B. PHASE	C. DATE
STD-	**Phase**	

ISS FLIGHT HARDWARE STANDARDIZED HAZARD CONTROL REPORT

D. ISS BASIC AND INTERMEDIATE HARDWARE, DTO, or GFE *(Include Part Number(s), if applicable)*

HAZARD TITLE

STANDARD HAZARDS

E. VEHICLE

ISS

F. DESCRIPTION OF HAZARD:	G. HAZARD CONTROLS: *(complies with)*
1. Structural Failure *(Item must comply with the listed requirements for all phases of flight)*	a) SSP 30559 section 3.0 and SSP 50021, 3.2.10, or b) SSP 50094, 6.4; or c) Designed to meet the standard modular locker stowage requirements of NSTS 21000-IDD-MDK or equivalent IDD, or d) Stowed in SPACEHAB per MDC91W5023
2. Structural Failure of Sealed or Vented Containers causes fragmentation hazard to crew or adjacent equipment	a) Sealed containers must meet the criteria of SSP 50559, 3.1.9.4, Secondary Volumes or SSP 50094, 7.1.1.8. b) For intentionally vented containers, vents are sized to maintain a 1.5 factor of safety for Station with respect to pressure loads.
3. Sharp Edges causes injury to IVA or EVA crewmember	Meets the intent of one or more of the following: a) SSP 50021, 3.3.6.12.3, External corner and edge protection, b) SSP 50021, 3.3.6.12.4, Internal corner and edge protection, c) NASA-STD-3000 / SSP 50005, d) SSP 50094, 6.3.3.1, 6.3.3.2, 6.3.3.3, 6.3.3.1.1.
4. Shatterable Material Release *[limited to contained and non-stressed (no delta pressure) optical glass]*	a) SSP 50021, 3.3.6.11.14 (New) All materials contained and/or b) Non-stressed (no delta pressure) lenses, filters, etc., which pass a vibration test at flight levels and a post- test visual inspection, or c) SSP 50094, 7.1.2.1.2

H. APP. **I. VERIFICATION METHOD, REFERENCE AND STATUS:**

ISS FLIGHT HARDWARE STANDARDIZED HAZARD CONTROL REPORT		**A. NUMBER** STD-	**B. PHASE** **Phase**	**C. DATE**
D. ISS BASIC AND INTERMEDIATE HARDWARE, DTO, or GFE *(Include Part Number(s), if applicable)*		**HAZARD TITLE** STANDARD HAZARDS	**E. VEHICLE** ISS	
F. DESCRIPTION OF HAZARD:	**G. HAZARD CONTROLS:** *(complies with)*	**H. APP.**	**I. VERIFICATION METHOD, REFERENCE AND STATUS:**	
5. Flammable Materials	a) SSP 50021 3.2.9, Materials; A-rated materials selected from MAPTIS, or b) Flammability assessment per SSP 30233, 4.1, 4.2 (NHB 8060.1B), or c) SSP 50094, 4.3.3.1.3			
6. Materials Offgassing	a) SSP 50021, 3.2.9.1; SSP 30233; Offgassing tests of assembled article per NHB 8060.1B			
7. Nonionizing Radiation 7.1 Non-transmitters	a) SSP 50021, 3.2.7.9, Electromagnetic Radiation; 3.2.7.10, EMC; 3.2.7.11, EMI ; SSP 30237 EMI compatibility testing, or a) NSTS/MS2 approved analysis, or b) SSP 50094, 3.4			
7.2 Lasers	a) SSP 50021, 3.3.6.7.1, Lasers b) Beams are totally contained at the maximum possible power and there is no crew access, or c) Meet ANSI Z136.1-1993 for class 1, 2, or 3a Lasers (as measured at the source). Lasers are designed such that light intensities and special wavelengths at the eyepiece of direct viewing optical systems are limited to levels below the maximum permissible exposure (MPE) limit.			

ISS FLIGHT HARDWARE STANDARDIZED HAZARD CONTROL REPORT		**A. NUMBER** STD-	**B. PHASE** **Phase**	**C. DATE**
D. ISS BASIC AND INTERMEDIATE HARDWARE, DTO, or GFE *(Include Part Number(s), if applicable)*		**HAZARD TITLE** STANDARD HAZARDS	**E. VEHICLE** ISS	
F. DESCRIPTION OF HAZARD:	**G. HAZARD CONTROLS:** *(complies with)*	**H. APP.**	**I. VERIFICATION METHOD, REFERENCE AND STATUS:**	
a) Battery Failure *(use of this form is limited to small commercial batteries as listed below)* 8.1 Alkaline-MnO_2, Carbon- Zn, or Zn-Air in sizes D or smaller having 6 or fewer cells either all in parallel or all in series (series/parallel combinations require a unique hazard report), no potential charging source, and cells are in a vented compartment. 8.2 Li-CFx, Li-Iodine, Li-MnO_2, Ni-Cd, Ni-MH, or Ag-Zn which have a capacity of 200 mAh or less, and no more than 2 cells per common circuit.	a) Pass acceptance tests which include open circuit & loaded voltage measurements, visual examination, and leakage check under vacuum (e.g., 6 hours at 0.1 psia). *Note: Above acceptance testing for button cells in Section 8.2 which are soldered to a circuit board in commercial equipment (not applicable to those button cells in a spring-loaded clip) is limited to a functional check of the equipment utilizing the subject battery., or* b) SSP 50094, 5.6 Note: SSP 50021, 3.3.6.8.4, Batteries must be met for batteries that do not meet the criteria of 8.1 and 8.2.		[N1] *Note1: Application and schematic reviewed and approved by JSC/EP5.*	
9. Touch Temperature causes IVA or EVA injury	a) SSP 50021, 3.3.6.12.1. Internal touch temperature SSP 50094, b) SSP 50021, 3.3.6.12.2 External touch temperature SSP 50094.			
b) Electrical Power Distribution as cause for ignition source (Circuit loading, ignition sources, grounding, connnector design)	a) SSP 50021, 3.3.6.8.1, Electrical Power Circuit Overload (Meets all circuit protection requirements of Letter TA-92-038), or b) SSP 50094, 6.5.1.10, 4.3.4.6.3, 4.3.4.6.7, 3.4.8, 4.3.4.5.5, 4.3.4.6.3			

		A. NUMBER	B. PHASE	C. DATE
ISS FLIGHT HARDWARE STANDARDIZED HAZARD CONTROL REPORT		STD-	**Phase**	
D. ISS BASIC AND INTERMEDIATE HARDWARE, DTO, or GFE *(Include Part Number(s), if applicable)*		**HAZARD TITLE**		**E. VEHICLE**
		STANDARD HAZARDS		ISS
F. DESCRIPTION OF HAZARD:	**G. HAZARD CONTROLS:** *(complies with)*	**H. APP.**	**I. VERIFICATION METHOD, REFERENCE AND STATUS:**	
11. Cargo flown in the Orbiter payload bay causes ignition of flammable atmosphere in Payload Bay	c) Cargo launched in the payload bay is unpowered or normal operating condition does not cause ignition sources for potential flammable atmosphere in payload bay. d) MLI grounded per ICD 2-19001.			
12. Rotating Equipment injures crewmember (Low energy machinery/ propelled debris)	Low energy rotating machinery (shrouded/enclosed air circulating fans, conventional electric motors, shafts, gearboxes, pumps) meet criteria of: a) SSP 50021, 3.3.6.14, or b) SSP 50021, 3.3.6.12.18, EVA , or c) SSP 50094, 7.1.2.4			
13. Mating/demating power connectors injures IVA or EVA crew	Meets all requirements of Letter MA3-94-002 and a) SSP 500021, 3.3.6.8.2 crew protection from electrical shock b) SSP 50021, 3.3.6.11.6, Component hazardous energy provision. c) SSP 50021, 3.2.7.12 d) SSP 50094, 3.4.8.1, 3.4.8.2			
14. Contingency Return and Rapid Safing	a) SSP 50021, 3.3.6.13.5 Contingency Return and Rapid Safing (Shuttle payload - meets all rapid safing requirements of Letter MA2-96-190). b) Station payload - Meets rapid safing requirements of Letter MA2-96-190, and design shall not impede emergency IVA egress to the remaining adjacent pressurized volumes.			
15. Noise Exposure	For continuous noise exposure: a) SSP 50021, 3.2.6.1, and SSP 5005, 5.4, or b) SSP 50094, 6.5.2.4.1 For intermittent noise sources: a) SSP 5005, 5.4, or b) SSP 50094, 6.5.2.4.2			

ISS FLIGHT HARDWARE STANDARDIZED HAZARD CONTROL REPORT		**A. NUMBER** STD-	**B. PHASE** **Phase**	**C. DATE**
D. ISS BASIC AND INTERMEDIATE HARDWARE, DTO, or GFE *(Include Part Number(s), if applicable)*		**HAZARD TITLE** STANDARD HAZARDS	**E. VEHICLE** ISS	
F. DESCRIPTION OF HAZARD:	**G. HAZARD CONTROLS:** *(complies with)*	**H. APP.**	**I. VERIFICATION METHOD, REFERENCE AND STATUS:**	
16. Interference with Translation Paths	Hardware designed to comply with traffic flow and translation paths: a) SSP 5005, 8.7, 8.8 b) SSP 50021, 3.3.6.12.17.1, 3.3.6.12.17.2			
17. Pinch Points, Snags, and Burrs	Levers, cranks, hooks, controls, exposed surfaces, threaded ends of screws and bolts, screws, bolts, protrusions, and equipment requiring EVA handling are designed in accordance with: a) SSP 50021, 3.3.6.12.9 (SSP 5005, 6.3.3.8) Levers, etc. b) SSP 50021, 3.3.6.12.10 (SSP 5005, 6.3.3.9) Burrs c) SSP 5005, 6.3.3.6 Threaded ends d) SSP 50021, 3.3.6.12.7 Screws and bolts e) SSP 50021, 3.3.6.12.12 Protrusions f) SSP 50021, 3.3.6.12.13, EVA equipment handling			
18. Appendage Entrapment in holes or latches	g) Holes are rounded or slotted in the range of 0.4 to 1.0 inches in diameter are covered, in accordance with SSP 50021, 3.3.6.12.11.1 (SSP 5005, 6.3.3.4) h) Latches that pivot, retract, or flex so that a gap of less than 1.4 inches exists are designed to prevent entrapment of a crewmembars appendage,in accordance with SSP 5005, 6.3.3.5 i) Equipment requiring EVA handling is designed in accordance with SSP 50021, 3.3.6.12.11.2			
19. Ionizing Radiation	The system is design in accordance with: a) SSP 50021, 3.2.7.15 and SSP 5005, 5.7.2.2 b) SSP 50021, 3.2.7.1 for the USL habital volume limitations, or c) SSP 50094, 3.6, 13.4			
APPROVAL	**HARDWARE ORGANIZATION**		**ISS**	
PHASE I				
PHASE II				
PHASE III				

JSC Form 1366 (March 21, 2000) (MS Word March 2000

INSTRUCTIONS FOR REPORT JSC Form 1366, ISS FLIGHT HARDWARE STANDARDIZED HAZARD REPORT

This form is applicable to all hardware as well as Developmental Test Objectives (DTOs), and GFE. Instructions for the completion of JSC Form 1366, Flight Hardware Standardized Hazard Report follow:

A. NUMBER
A unique alphanumeric designation provided by the hardware developer used to track this hazard report. These designations will be assigned when the report is first submitted and must be retained for all future updates of the hazard report. The prefix “STD” is used to identify this report as a standardized hazard report.

B. PHASE
Identify the appropriate phase safety review number.

C. DATE
Date that this form was completed or revised.

D. ISS HARDWARE, DTO, or GFE *(Include part number(s), if applicable)*
Name of hardware, DTO, or GFE *(including number).* When GFE is used, use a separate Form for each item and include part number. Top assembly groupings may be used if acceptable to the SRP.

E. VEHICLE
Identify the appropriate vehicle.

F. DESCRIPTION OF HAZARD
A hazard is defined as a potential risk situation caused by an unsafe act or condition. The ISS SRP identified the applicable standard hazards which can be documented on this hazard report form.

G. HAZARD CONTROLS/VERIFICATION METHODS
Identified design feature/method used to assure the effectiveness of the hazard control.

H. APPLICABLE
Check the applicable box for each hazard and hazard control consistent with the design of the hardware.

I. VERIFICATION METHOD, REFERENCE, AND STATUS
This block should summarize the results of the completed tests, analyses, and/or inspections; refer to particular test reports by document number and title; and crossreference unique hazard reports when applicable. The status of the activity should be indicated. Use a continuation sheet if required. If the cause is not applicable, rationale must be given in this section and controls should not be marked. Any additional comments may be added in this section (NCR#’s, Unique Hazard #’s, etc.)

APPENDIX E LIST OF FORMS

This section contains a list of the forms a developer may use in the flight and ground safety review processes.

1.0 JSC FORMS

Current versions of the JSC forms are available on the NASA/ISS SRP home page. Contact the ISS SRP Executive Secretary for the electronic address.

JSC Form 44	Ionizing Radiation
JSC Form 542C	Noncompliance Report

2.0 KSC FORMS

Contact the KSC GSRP Chair for the KSC forms and matrices.

KSC Form 16-295	Radiation Use Request/Authorization (Radioactive Materials)
KSC Form 28-34	Radiation Use Request/Authorization (Ionizing Machine/Device)
KSC Form 16-294	Radiation Training and Experience Summary (Ionizing radiation)
KSC Form 16-353	Modification of Radiation Use Authorization
KSC Form 16-447	Laser Device Use Request/Authorization
KSC Form 28-626	Optical Device Use Request/Authorization
KSC Form 16-451	Radio Frequency/Microwave System Use Request/Authorization
KSC Form 16-450	Training and Experience Summary (Nonionizing Radiation Users)