AI1-PLN-SRQA

VERSION 1.00

National Aeronautics and
Space Administration

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ARES I-X

SAFETY, RELIABILITY, AND QUALITY ASSURANCE PLAN

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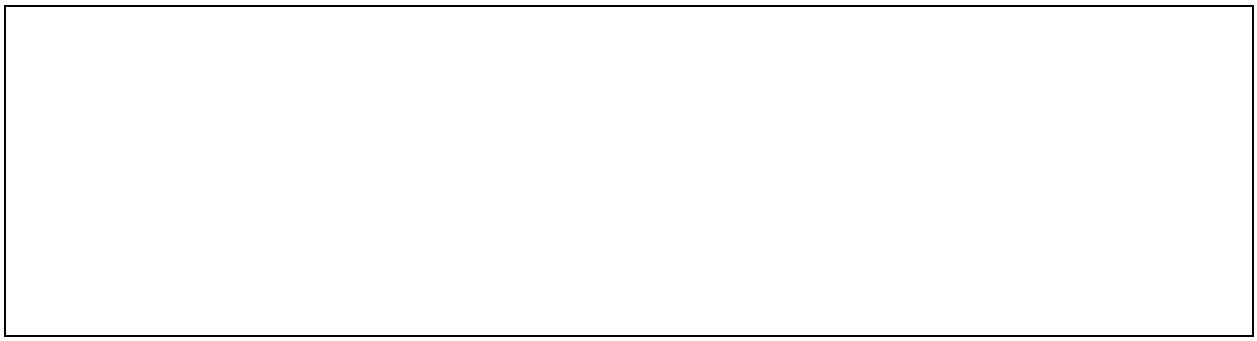

REVISION AND HISTORY PAGE

Status	Revision No.	Change No.	Description	Release Date
Draft	a		Initial release for Internal S&MA review	8/25/2008
Draft	b		Release for Ares I-X baseline with S&MA comments incorporated	9/22/2008
Baseline	1.00		CR AIX-0213 XCB 20081028	10/28/2008

NOTE: Updates to this document, as released by numbered changes (Change XXX), are identified by a black bar on the right margin.

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of the Safety, Reliability, and Quality Assurance (SR&QA) Plan is to define the approach to planning and executing the SR&QA requirements associated with the Ares I-X Mission.

1.2 SCOPE

This plan is applicable to the Ares I-X Mission, including the entire Ares I-X Mission team, during all phases of the life cycle. SR&QA requirements for Ares I-X are levied from AI1-SYS-SRQA, Ares I-X Safety, Reliability, and Quality Assurance (SR&QA) Requirements. The Ares I-X SR&QA Plan is intended to provide top-level detail on how the Ares I-X Mission team will implement the Ares I-X SR&QA requirements. Lower-level implementation details are provided in Integrated Product Team (IPT) level SR&QA Plans.

This Ares I-X SR&QA Plan will cover:

- The Ares I-X SR&QA Organizational Structure
- Roles and Responsibilities for implementing the Ares I-X SR&QA requirements
- Key external interfaces
- Ares I-X Readiness Reviews

1.3 CHANGE AUTHORITY/RESPONSIBILITY

Proposed changes to this document will be submitted by an Ares I-X Change Request (CR) to the XCB for consideration and disposition.

The appropriate NASA Office of Primary Responsibility (OPR) identified for this document is Ares I-X SR&QA.

2.0 DOCUMENTS

2.1 APPLICABLE DOCUMENTS

The documents listed in this paragraph are applicable to the extent specified herein.

AI1-SYS-MIP	Ares I-X Mission Implementation Plan
AI1-SYS-SRQA	Ares I-X Safety, Reliability, and Quality Assurance Requirements

2.2 REFERENCE DOCUMENTS

The following documents contain supplemental information to guide the user in the application of this document.

CxP 70038 Constellation Hazard Analyses Methodology

CxP 70127 Ares I-X Flight Test Plan

3.0 ORGANIZATIONAL STRUCTURES

3.1 ARES I-X

The Ares I-X Flight Test Plan (CxP 70127) describes the roles and responsibilities of the Ares I-X mission team. The mission team includes a Mission Management Office (MMO), a Chief Engineer function, a Safety, Reliability, and Quality Assurance (SR&QA) function, a Systems Engineering and Integration (SE&I) Office and seven Integrated Product Teams (IPTs). The Ares I-X mission is organized as depicted in Figure 1.

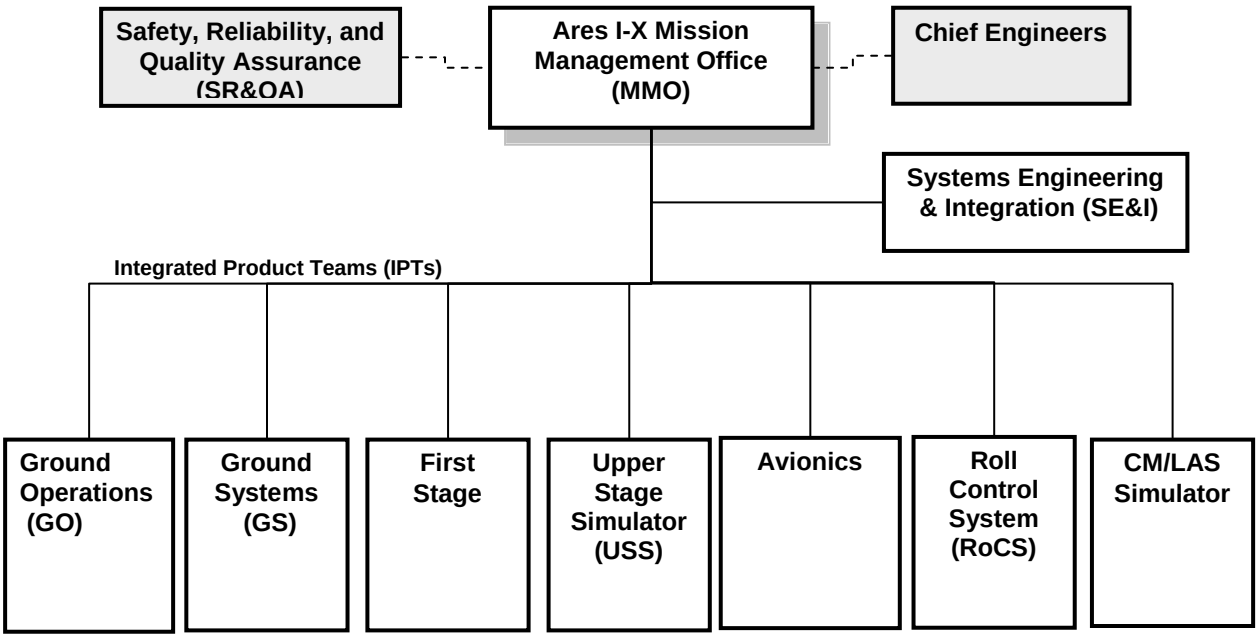

Figure 1 - Ares I-X Mission Organization

3.2 ARES I-X SR&QA ORGANIZATION

SR&QA personnel and functions are resident within each organizational element of the Ares I-X Mission's organization. Figure 2 shows the organizational structure of the SR&QA support to the Ares I-X Mission.

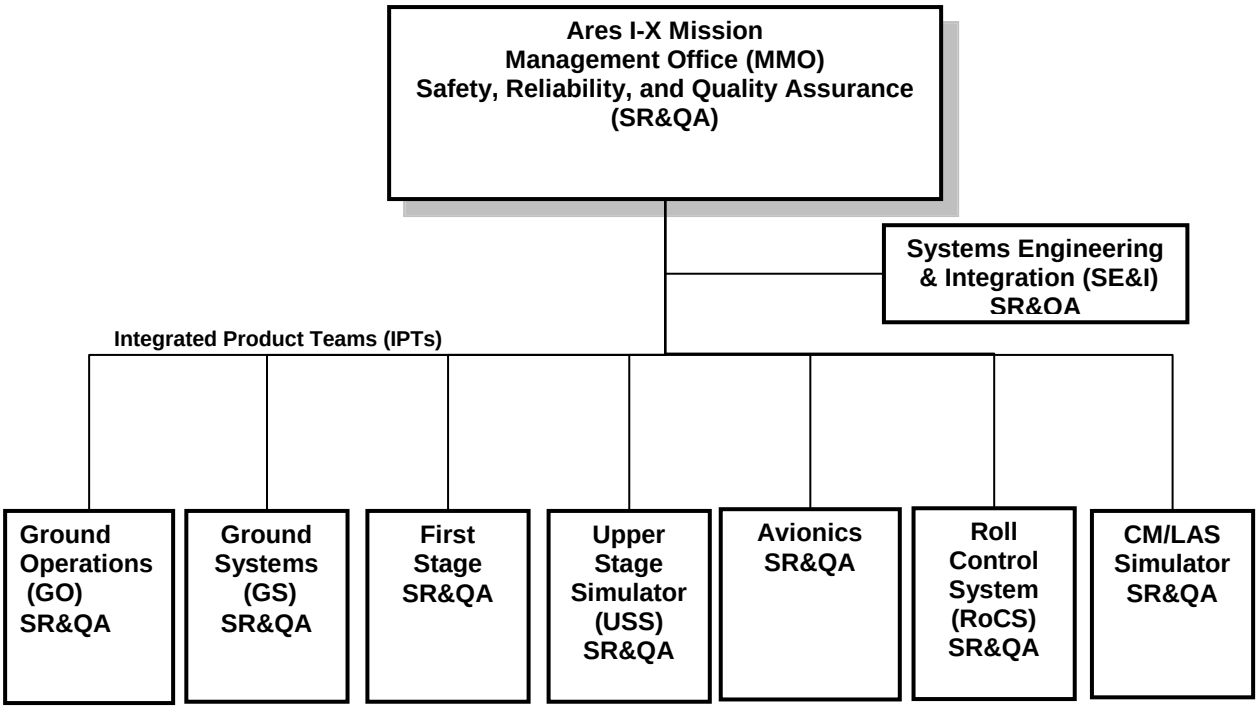

Figure 2 - Ares I-X SR&QA Organization

4.0 ROLES AND RESPONSIBILITES

4.1 MISSION MANAGEMENT OFFICE (MMO)

The MMO has overall responsibility for the Ares I-X mission, including providing the necessary planning and resources needed to implement the Ares I-X SR&QA Requirements. If it is deemed that NASA standards cannot be met for valid reasons, the MMO will work to obtain the deviations or necessary waivers. In addition, the MMO Manager will support programmatic Audit and Reviews as requested by the Office of Safety and Mission Assurance (OSMA).

4.1.1 MMO SR&QA

The SR&QA Lead for the flight test vehicle will serve as the primary interface to the Mission Manager for SR&QA and will coordinate overall SR&QA activities for the Ares I-X mission. The MMO level SR&QA Lead is independent from the Ares I-X mission management chain and funding. The SR&QA Lead is supported by the SE&I SR&QA

and IPT SR&QA personnel with appropriate technical expertise and resources from the applicable NASA Centers.

The MMO SR&QA has the responsibility to:

1. Provide overall leadership, direction, and coordination of SR&QA activities within Ares I-X.
2. Serve as the SR&QA member of the Ares I-X Control Board (XCB), System-level Material Review Board, and Engineering Review Board (ERB). Provide SR&QA recommendation to the XCB and ERB Chairs.
3. Provide the primary Ares I-X SR&QA interface to the CxP SR&QA Office, CxP Chief S&MA Officer (CSO), and the NASA Office of Safety and Mission Assurance (OSMA).
4. Elevate SR&QA issues that cannot be satisfactorily resolved at an Ares I-X mission level.
5. Perform mission-level oversight of SE&I and IPT activities
6. Participate in mission major design and readiness reviews
7. Serve as document owner to AI1-SYS-SRQA, Ares I-X SR&QA Requirement Document and the AI1-PLN-SRQA, Ares I-X SR&QA Plan.
8. Coordinate across the Ares I-X SR&QA community and with external customers (e.g., OSMA, SR&QA Directors, CxP SR&QA, etc.) and stakeholders to establish and implement necessary SR&QA communication channels to promote timely sharing of information and to discuss emerging issues
9. Sign endorsement of the Certificate of Flight Test Readiness (CoFTR) along with MMO management and Chief Engineer certifying that MMO tasks and products have been satisfactorily completed.

The MMO SR&QA Lead also serves in another role as the Ares I-X Chief Safety Officers (CSO), in which capacity the CSO acts as the S&MA Technical Authority. Consistent with the NASA Governance Model, the S&MA Technical Authority personnel are organizationally separate from the program/project, or in this case the Mission Management Office. The S&MA Technical Authority flow down for Ares I-X is depicted in Figure 3 below.

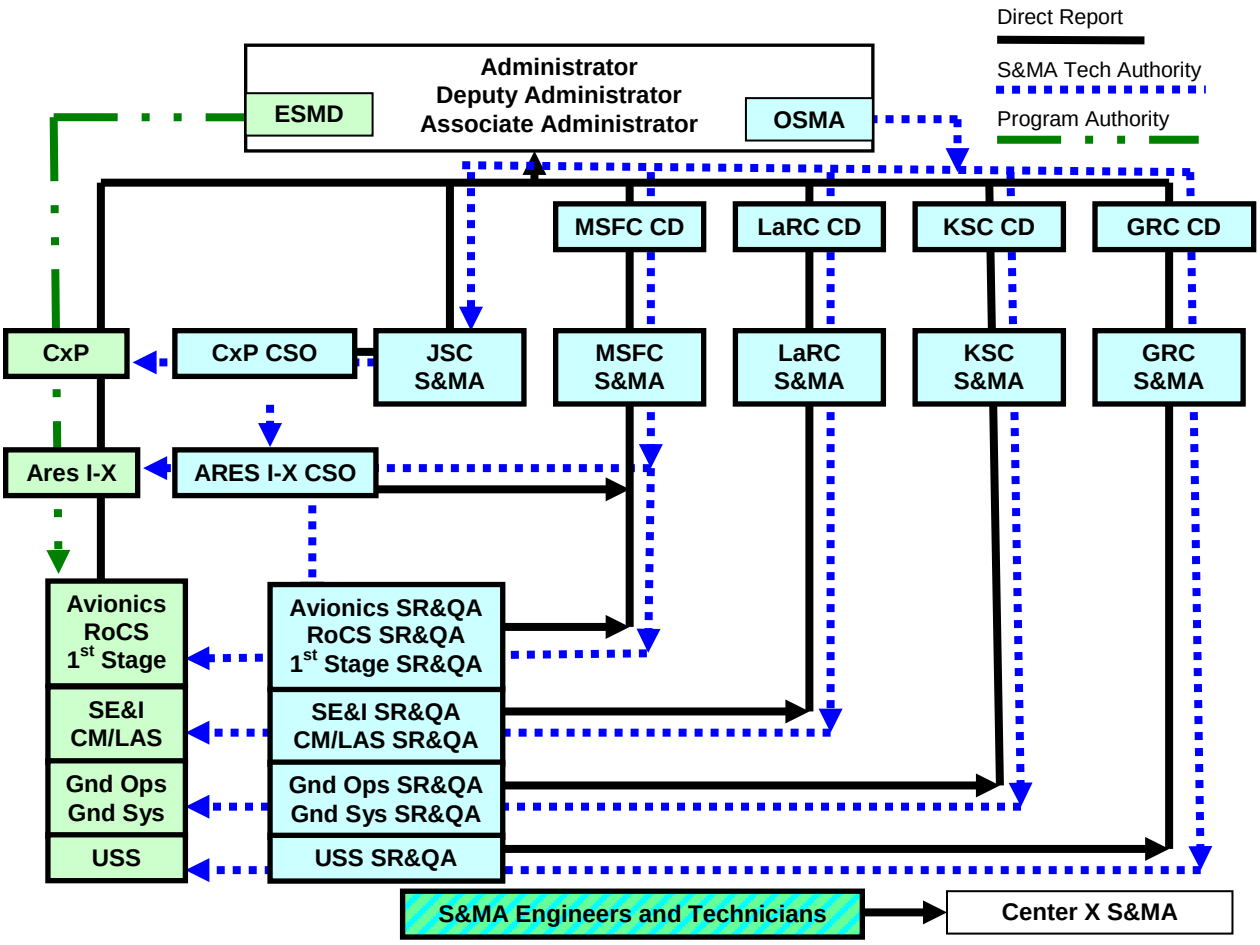

Figure 3 – Ares I-X S&MA Technical Authority Flow Down

4.2 SYSTEMS ENGINEERING AND INTEGRATION (SE&I)

The SE&I management is responsible for vehicle integration management, independent verification and ensuring delivery of the flight test vehicle and performing the flight test.

4.2.1 SE&I responsibilities with respect to SR&QA activities include the following, but are not limited to:

1. Assure that CxP Ares I-X SR&QA requirements are flowed down and implemented
2. Assure Mission requirements applicable to SE&I have been flowed down and implemented
3. Acquire the level of SE&I SR&QA support needed to implement CxP Ares I-X SR&QA requirements and provide an infrastructure to support the day-to-day management of the SE&I SR&QA operations
4. Support programmatic Audit and Reviews as requested by the Office of Safety and Mission Assurance (OSMA), CxP SR&QA, and/or the Ares I-X CSO.
5. Approve the SE&I products that are required by AI1-SYS-SRQA, the Ares I-X SR&QA requirement document, prior to submittal to the CSERP. Approval will include the concurrence from the SE&I Lead Engineer and SE&I SR&QA Lead.
6. Support CSERP reviews of the SE&I Integrated Hazard Reports and assure all CSERP actions have been satisfactory closed.
7. Assure that controls/verifications associated with integrated hazard reports are included in the implementing documents (e.g. Operational Test Requirements (OTRs), Launch Commit Criteria (LCC), Verification Data Requirement Sheets (VRDS), Work Authorization Documents (WAD), etc.).
8. In addition to supporting the SE&I activities above, SE&I SR&QA will provide the technical focal point for the system level or cross cutting activities, such as:
    - Participation in SE&I led working groups, including establishing and leading the Ares I-X Hazard Analysis Working Group (HAWG)
    - Perform, in conjunction with SE&I engineering, the Integrated Hazard Analyses, produce integrated hazard reports, and coordinate overall Ares I-X hazard analysis efforts with IPTs via the HAWG
    - Review IPT level Safety Analyses and FMEA/CILs to assure that the integrated effects are properly considered and reflected in the integrated hazard analysis
    - Baseline Safety Analysis as specified in Section 6.2
    - Assist the Ares I-X Range Safety point of contact to assure all Ares I-X Range Safety requirements have been satisfied and to provide general Range Safety coordination

- Actively participate in Ares I-X Risk Management
- Integrate SE&I SR&QA evaluations of changes and deliver recommended dispositions to the Ares I-X SR&QA Lead
- Assure all applicable SE&I design and performance verifications are satisfactorily completed
- Review and concur with any deviations or waivers to an Ares I-X requirement contained in an XCB controlled requirement document
- Participate in the various Ares I-X milestone reviews and flight test readiness reviews to assure integration requirements/issues/concerns are satisfactorily addressed. Prior to flight test readiness reviews and SE&I led milestone reviews, provide the Ares I-X CSO with a briefing on the review readiness.
- Participate in failure investigations as required
- Coordinate SE&I and IPT SR&QA inputs into KSC processing such as Assembly, Integration, and Test Plan, Operational Test Requirements (OTRs), and Launch Commit Criteria
- Keep the Ares I-X SR&QA community and SE&I organization routinely informed of SE&I SR&QA status, emerging issues / concerns. This includes communicating emerging SE&I SR&QA issues/concerns to the Ares I-X CSO in a timely manner.
- Present SE&I SR&QA assessment of SE&I readiness at the Engineering and Safety and Mission Assurance Readiness Review (ESMARR) and Safety and Mission Success Review (SMSR). See sections 7.1 and 7.2 for descriptions of materials to be presented.
- Sign Endorsement of Certificate of Flight Test Readiness (CoFTR) along with SE&I management and Engineering certifying that SE&I tasks and products have been satisfactorily completed

4.3 INTEGRATED PRODUCT TEAMS

Several NASA Centers and contractors are providing products (deliverables) and services at an Integrated Product Team (IPT) level for the Ares I-X Mission. These IPTs are Ground Operations, Ground Systems, First Stage, Roll Control System, Upper Stage Simulator, Crew Module /Launch Abort System Simulator, and Avionics.

4.3.1 IPTs responsibilities with respect to SR&QA activities include the following, but are not limited to:

1. Develop and maintain an IPT-level SR&QA Plan describing how the IPT will comply with AI1-SYS-SRQA and assure that CxP Ares I-X SR&QA requirements have been flowed down.

2. Assure Mission requirements applicable to their IPT have been flowed down and implemented
3. Acquire the level of IPT SR&QA support needed to implement CxP Ares I-X SR&QA requirements and provide an infrastructure to support the day-to-day management of the IPT SR&QA operations
4. Support programmatic Audit and Reviews as requested by the Office of Safety and Mission Assurance (OSMA), CxP SR&QA, and/or the Ares I-X CSO.
5. Approve the IPT products required by AI1-SYS-SRQA, the Ares I-X SR&QA requirement document, prior to submittal to the CSERP. Approval will include the concurrence from the IPT Lead Engineer and IPT SR&QA Lead.
6. Approve and manage FMEA/CILs in accordance with the Ares I-X SR&QA Requirements.
7. Support CSERP reviews of the respective IPTs Hazard Reports and assure that all CSERP actions have been satisfactorily closed.
8. Assure that controls/verifications associated with hazard reports and CILs are included in the implementing documents (e.g. manufacturing build paper, acceptance tests, Operational Test Requirements (OTRs), Launch Commit Criteria (LCC), Verification Data Requirement Sheets (VRDS), Work Authorization Documents (WAD), etc.).
9. For existing hardware and software, re-assess existing as-built to the Ares I-X Mission requirements. This includes re-assessing any existing heritage nonconformance, deviations or waivers compared to the Ares I-X requirements.
10. Participate in IPT Material Review Board (MRB) (See section 5.0)
11. Define and maintain records, storage media and method of retrieval for the life of the Ares I-X flight test plus 5 years.
12. Develop and implement an EEE Parts Control Plan(s) that discusses the selection, acquisition, traceability, testing, handling, packaging, storage, and application of EEE parts.
13. Implement a closed-loop problem reporting and corrective action system for all problems concerning flight, test, simulator, and training hardware/software where that hardware/software is representative of flight hardware, and GSE. Assure that any departures from released engineering are documented in the applicable non-conformance system. The Ares I-X hardware developers must utilize the CxPRACA system for activities at KSC. [Note: This does not include the Assembly and Refurbishment Facility (ARF).]

14. Establish a systematic approach to evaluate and respond to all NASA ALERTS, safe-alerts, problem advisories, agency action notices, and NASA advisories and to investigate, resolve, and document parts and materials problems.

    When the IPT encounters a significant problem with a part, material, or software which may adversely affect equipment, the IPT will initiate an ALERT and submit it to their center's NASA ALERT coordinator.

15. Identify limited life items (this does not include consumables), which require control from equipment date of manufacture throughout operational use, including storage and assure that limited life items are within their time, cycle, and age life.

16. In addition to supporting the IPT activities above, the IPT SR&QA will provide the technical focal point for the system level or cross cutting activities, such as:

    - Perform, in conjunction with SE&I engineering, the Hazard Analyses, produce hazard reports, perform Failure Mode & Effect Analysis (FMEA), and produce Critical Item Lists (CILs) per the Ares I-X SR&QA Requirements located in AI1-SYS-SRQA.
    - Baseline Safety Analysis as depicted in section 6.2
    - Actively participate in Ares I-X Risk Management
    - Assure that the failure modes captured in a FMEA, CIL, fish bone diagram, etc. that result in a hazard are documented in a hazard report. FMEA/CILs will be approved and managed at the IPT level.
    - Define Quality Assurance program implementation for their IPT
    - Assist the IPT in assuring any hardware and software As-built meets As-Designed.
    - Assure all applicable IPT design and performance verifications are satisfactory completed
    - Review and concur with any applicable IPT deviations or waivers
    - Conduct audits and surveillance of manufacturing and assure that any audit/surveillance findings have been satisfactory dispositioned.
    - Identify and perform Government Mandatory Inspection Points (GMIPs).
    - Integrate IPT SR&QA evaluations of changes, deviations, and waivers and deliver recommended dispositions to the Ares I-X SR&QA Lead via the MMO SR&QA Change Coordinator
    - Assist the IPT in identifying any Assembly, Integration, and Test Plan requirements and Operational Test Requirements (OTRs) for KSC processing
    - Assist the IPT in identifying any Launch Commit Criteria (LCC) and provide recommendations to the CSO concerning concurrence with the LCCs.

- Participate in applicable Ares I-X milestone reviews and flight test readiness reviews to assure integration requirements/issues/concerns are satisfactorily addressed. Prior to milestone and flight test readiness reviews, provide the Ares I-X CSO with a briefing on the review readiness.
- Participate in failure investigations as required.
- Provide technical support to Ares I-X Range Safety activities as requested
- Participate in IPT Acceptance Reviews, such as Hardware Reviews, First Article Inspection Reviews, Pre-Ship Reviews, Acceptance Data Package (ADP) Reviews
- Keep the Ares I-X SR&QA community and IPT organization routinely informed of IPT SR&QA status, emerging issues / concerns. This includes communicating emerging IPT SR&QA issues/concerns to the Ares I-X CSO in a timely manner.
- Provide parallel notification to appropriate Center management and the Ares I-X CSO if an Ares I-X related mishap occurs
- Present IPT SR&QA assessment of IPT readiness at the Engineering and Safety and Mission Assurance Readiness Review (ESMARR) and Safety and Mission Success Review (SMSR). See sections 7.1 and 7.2 for descriptions of materials to be presented.
- Sign Endorsement of CoFTR, along with IPT Management and Engineering, to certify that the IPT's products and processes meet the Ares I-X requirements and are ready for flight

5.0 MATERIAL REVIEW BOARD

The Material Review Board (MRB) system is the process through which technical review of nonconforming product that cannot or will not be returned to drawing/specification is conducted and after entry into the appropriate non-conformance system, the nonconformity is formally dispositioned.

The Ares I-X IPTs will establish a Material Review Board (MRB) at their respective centers and/or with their contractors (in accordance with AS9100 unless governed by NSTS 5300.4(1D-2)). If the IPT contractor has a heritage MRB system which complies with NSTS 5300.4 (1D-2), they may utilize this system in lieu of complying with the new system specified below as long as the MRB membership includes NASA Engineering and NASA SR&QA representatives, or their delegated representatives, from the applicable IPT.

The NASA Ares I-X IPTs will approve the establishment of any Contractor Material Review Board (MRB) for dispositioning non-conformances associated only with that IPT and their Contractor's products. In either case, the MRB membership requirements are specified in AIX-SYS-SRQA, the Ares I-X SR&QA Requirement Document.

IPTs that are processing hardware whose design responsibility falls under the responsibility of a different Ares I-X IPT will include the "Design" IPT Engineering and SR&QA representatives as part of the MRB. The processing IPT shall notify the SE&I Lead Engineer and Lead SE&I S&MA representative of any Joint IPT MRB that will be held.

The IPT MRB process will be defined in the respective Quality Assurance Plan.

5.1 ELEVATION OF NON-CONFORMANCES

Nonconformances will be elevated from the IPT(s) Level MRB to the Ares I-X System Level MRB for approval, which is composed of the Ares I-X Engineering Review Board membership and the SE&I Lead System Engineer (LSE), when the nonconformance meets one or more of the following criteria. If a non-conformance meets any of the criteria below, the IPT will not proceed with irreversible work until there is System-level MRB concurrence:

1. When an unanimous agreement cannot be achieved at the IPT(s)-level MRB level
2. Any substitution of parts/hardware deviating from drawing allowances. This does not include substitution of parts/hardware with the same part number(s).
3. Any MR that affects a characteristic controlled by an ICD, IRD, or affects the outer mold line (OML).
4. At the request of any MRB member (i.e., increased visibility even if the IPT-level MRB member agrees with the proposed disposition). Example could be due to anticipated risk increase.
5. Requires a waiver to an Ares I-X requirement contained in an XCB controlled requirement document
6. Are a result of an unexplained anomaly
7. Required IPT(s) Level MRB actions are outside the cost/schedule capability of the affected IPT(s)

Nonconformance will be elevated from the System Level MRB to the Ares I-X Control Board (XCB) for approval when the nonconformance meets one or more of the following criteria:

1. When an unanimous agreement cannot be achieved at the System Level MRB level
2. At the request of any System Level MRB member (i.e., increased visibility even if the System Level MRB member agrees with the proposed disposition). Example could be due to anticipated risk increase.

3. Requires a waiver to an Ares I-X requirement contained in an XCB controlled requirement document
4. Required System Level MRB actions are outside the cost/schedule capability of the affected IPT(s)

The elevation process is depicted in figure 4 below.

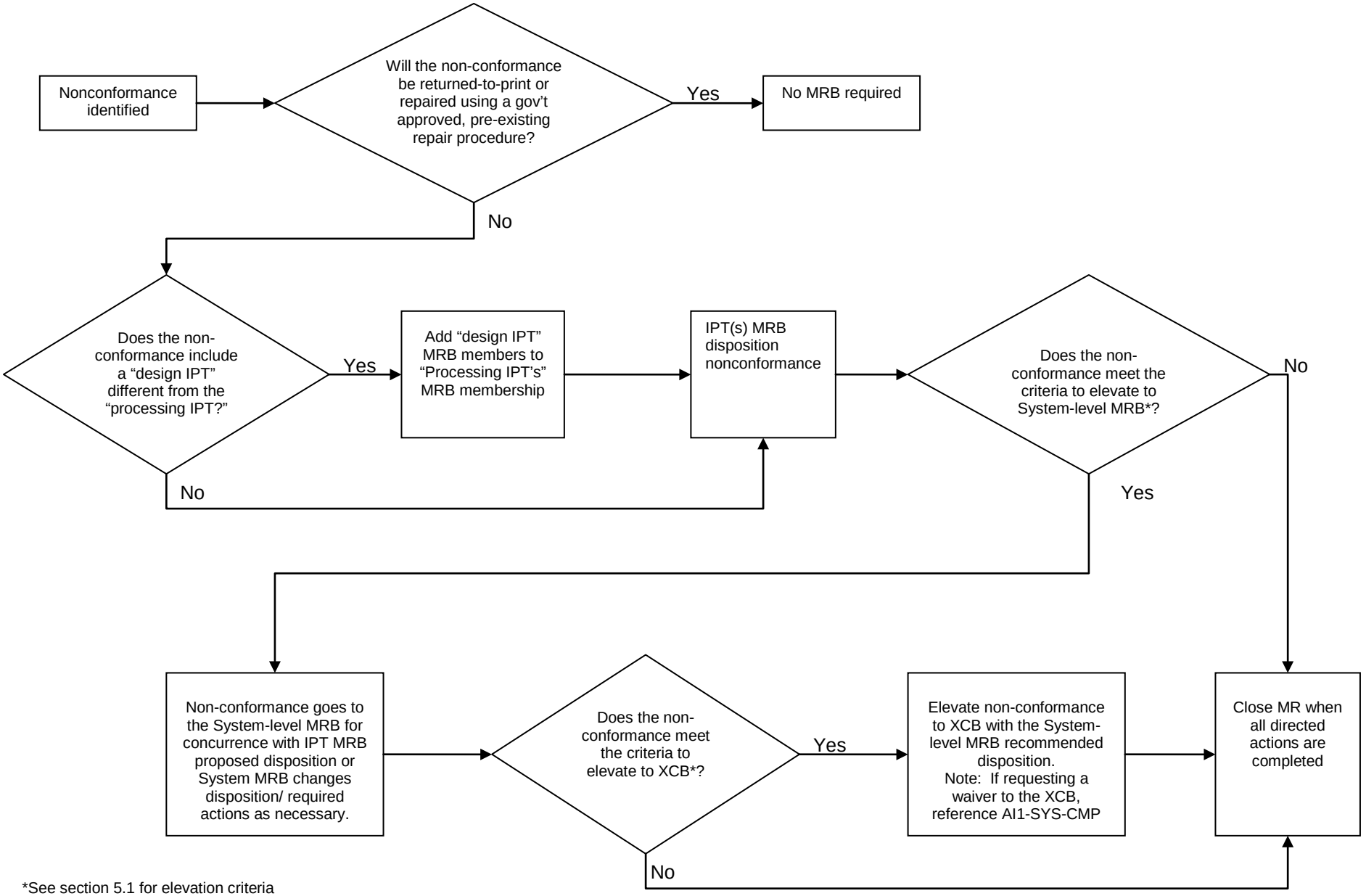

Figure 4 - MRB Process Flow

6.0 EXTERNAL INTERFACES

6.1 CONSTELLATION PROGRAM (CXP) SR&QA BOARD

The CxP SR&QA Board was established for assuring the development and implementation for SR&QA programmatic and technical requirements within the Constellation Program. The SR&QA Board also reviews technical and programmatic issues associated with risks to safety and mission success and coordinated the Program SR&QA position on those issues. Furthermore, the SR&QA Board will hear alternate/dissenting opinions on issues within its purview and elevate as required.

For the Ares I-X mission, the primary point of contact with the CxP SR&QA Board will be the Ares I-X SR&QA Lead. The Ares I-X SR&QA Lead will elevate SR&QA issues that cannot be resolved at an Ares I-X mission level.

When changes and requests for deviations or waivers to the Ares I-X SR&QA Requirement document are presented to the XCB, the XCB will include a supplemental member, selected by the CxP SR&QA Director, to serve as an ad hoc member. Also, requested changes, deviations, or waivers to the Ares I-X SR&QA Requirement document that do not receive consensus at the XCB will be elevated to the CxP SR&QA for approval.

6.2 CXP SAFETY AND ENGINEERING REVIEW PANEL (CSERP)

The CSERP was established to provide the CxP with an independent review of technical activities and products associated with safety technical risk.

The CSERP is authorized to approve risks identified in hazard reports as delegated in the CSERP Charter, CxP MD-013, and shown below in Figure 5. The CSERP has concurrence authority on the Hazard Reports and will forward all Hazard Reports outside of their risk delegation authority to the Constellation Control Board (CxCB).

LIKELIHOOD \ SEVERITY	NEGLIGIBLE	MINOR	MARGINAL	CRITICAL	CATASTRO-PHIC
VERY HIGH	Project Approval	Project Approval	Project Approval	*CxCB Approval	Agency Approval
HIGH	Project Approval	Project Approval	Project Approval	*CxCB Approval	*CxCB Approval
MODERATE	Project Approval	Project Approval	Project Approval	*CxCB Approval	*CxCB Approval
LOW	Project Approval	Project Approval	Project Approval	CSERP Approval	*CxCB Approval
VERY LOW	Project Approval	Project Approval	Project Approval	CSERP Approval	CSERP Approval

Figure 5 - Hazard Risk Acceptance Delegation Matrix

The Ares I-X IPTs and SE&I will present their respective hazard analysis to the CSERP through the phased review process described in CxP 70038, Constellation Hazard Analyses Methodology. Ares I-X will perform hazard analyses is accordance with CxP 70038. Requests to work to an alternate format/content will be presented to the CSERP for approval. The request will include supporting rationale.

6.2.1 Phase III CSERP review

Prior to each IPT's and SE&I's Phase III review the internal Ares I-X review process will occur per the timeline shown in Figure 6. Any deviations to the review flow below must be approved by MMO S&MA.

MMO S&MA will coordinate the CSERP scheduling utilizing inputs from the IPTs and SE&I.

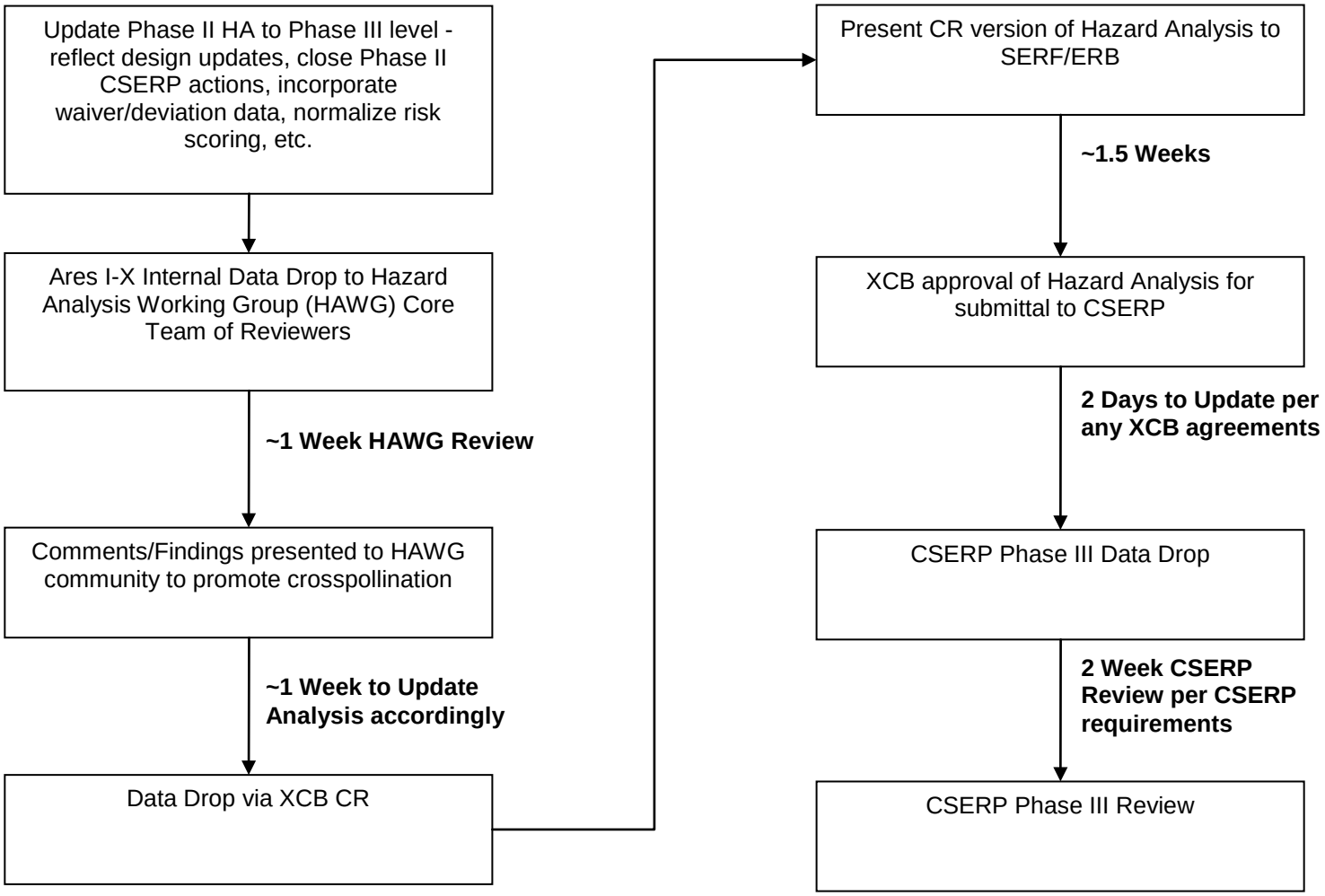

Figure 6 – Ares I-X Hazard Analysis Review flow to prepare for Phase III CSERP review

The focus of the Phase III CSERP review will be to assess the safety verification testing and analysis results. The CSERP reserves the right to keep Phase III hazard reports open if verifications that have been moved to the Safety Verification Tracking Log which are critical for establishing the acceptability of the design for safety are not completed prior to the Phase III review. Subsequent reviews may be required prior to hazard report approval.

The purpose and scope of the HAWG review in the Phase III CSERP process is to provide an internal SR&QA review of all hazard analyses prior to submittal to the CxP Level II Panel, the CSERP. The intent is to help assure consistency across the IPTs and SE&I hazard analysis in the product's technical content and level of detail. The review will also assure of hazard risk scoring consistent across the Ares I-X mission.

The HAWG core hazard analysis review team is responsible for providing comments and recommendations to the respective IPT or SE&I hazard analyses author(s). The core review team will also provide an out brief to the larger SR&QA community to facilitate lessons learned and discussion between the teams regarding improvements to the HA products.

Specific areas of emphasis for the HAWG core team review include:

1. Assure the hazard risk matrix risk score is consistent within the analysis and across the Ares I-X mission. This includes assuring the risk score is based on the worst case severity, the likelihood is assessed assuming the stated controls are in place, etc.
2. Assure that the Likelihood Justification section highlight the weaknesses in the control strategies that render the Cause to be Low or higher likelihoods.
3. Assure that any waivers, deviations, or significant nonconformances are included in each hazard analysis and have been taken into account in establishing the hazard risk score.
4. Help assure the hazard analysis contains the appropriate Level III content (as stated below) and make recommendations to the hazard analysis owner.

For the Phase III review, each IPT and SE&I will be responsible for the following information:

- Updated descriptions that define the final configuration of the system
- Status of all action items assigned through the Phase II review
- Updated (and additional, if required) hazard reports reflecting the final design, operations, status/results of all completed verification work. By Phase III, all safety analysis effort should be completed.
- Updated hazard risk scoring based on updated design. All waivers, deviations and significant non-conformances are taken into account for final score purposes.
- Updated likelihood justifications. Any likelihoods that are ranked low, moderate, high, or very high will highlight the weaknesses in the control strategy. For example “controls are highly dependent on human interaction,” “new design solution that will not undergo testing before first flight,” “waiver approved for reduced factor of safety,” etc.
- Completed verification information to include summarized results of the completed tests, analyses, and/or inspections. Reference to particular test reports by document number, title, and date

- All hazard report verifications that are still incomplete at Phase III will be "closed" on the hazard report and transferred to the Safety Verification Tracking Log (SVTL) for further tracking. The SVTL will include at a minimum the:
    - Tracking number
    - Hazard number
    - Hazard Title
    - Verification ID #
    - Verification Method (test, analysis, inspection, etc.)
    - Documentation location (OTR, LCC, WAD, VRDS, etc.)
    - Status (open or closed)
    - Closure date
- Updated record of any test failures, anomalies, or accidents involving flight hardware or software that have been assessed to have safety impacts
- Identification of flight safety noncompliances, waivers and/or deviations

6.2.2 Post Phase III CSERP Review

The post Phase III safety activity includes the following:

- When changes to the design, configuration, or operations of the hardware or software are required subsequent to the Phase III review, the associated IPT or SE&I SR&QA representative will assess those changes for possible safety implications. Based on the change assessment, if new Hazard Reports are required, they will be submitted to the CSERP. The need for a delta Phase III review will be determined by the CSERP chair.
- Any test failures, anomalies, or accidents involving flight hardware or software that have been assessed to have safety impacts, occurring between the Phase III review and launch, must be promptly reported to the Ares I-X SR&QA Lead. The SR&QA Lead will communicate the safety assessment to the CSERP chair.
- Open Hazard Report verifications will be tracked on a Safety Verification Tracking Log (SVTL). All verifications will be completed prior to launch.

Following the Phase III CSERP review, the Hazard Risk will be accepted per the flow chart in figure 7 below.

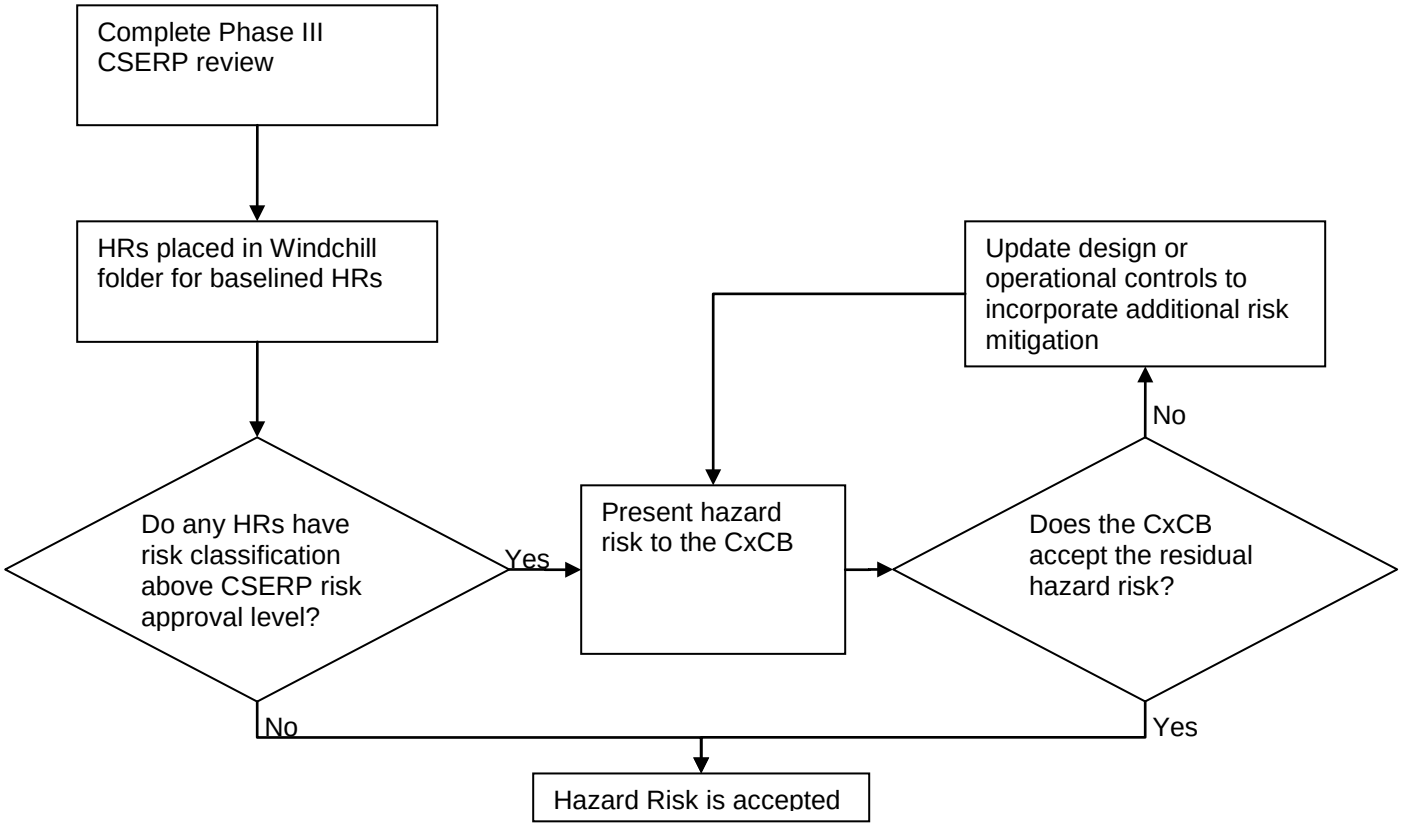

Figure 7 –Hazard Risk Acceptance Flow

7.0 READINESS REVIEWS

Ares I-X will conduct an objective set of technical and programmatic reviews to thoroughly scrutinize system development and flight test readiness. Reviews will start early in the life cycle of Ares I-X and proceed through launch readiness. The Ares I-X internal reviews following the Critical Design Review (CDR) are defined in Appendix C of the Ares I-X Mission Implementation Plan, AI1-SYS-MIP. The status items required for the Engineering and Safety and Mission Success Readiness Review (ESMARR) will also be reported at the Pre-ship/Acceptance Reviews.

7.1 ENGINEERING AND SAFETY AND MISSION SUCCESS READINESS REVIEW (ESMARR)

In preparation for the CoFTR reviews and the Headquarters' chaired Safety and Mission Success Review, the Ares I-X Chief S&MA Officer (CSO) and Ares I-X Chief Engineers will conduct an Ares I-X Engineering and SMA Readiness Reviews (ESMARR). The objective of this review is to obtain readiness certification from SE&I/IPT S&MA Leads and SE&I/IPT Lead Engineers and their associated Center S&MA Director and Center Engineering Director prior to CoFTR and the Headquarters' SMSR. An ESMARR may also be conducted prior to the Ares I-X Mate Review.

At these readiness checkpoints, each IPT S&MA and SE&I S&MA will certify readiness for the applicable items below:

- Hazard Analysis Reports have been satisfactorily completed in accordance with the Ares I-X SR&QA Requirements (AI1-SYS-SRQA).
- Formal Safety Reviews have been completed with the CSERP. All Hazard Reports have been approved and all CSERP actions have been successfully closed.
- All safety verifications have been satisfactorily completed.
- FMEA/CILs have been satisfactorily completed in accordance with the Ares I-X SR&QA Requirements.
- Limited Life Items - concur that any limited life items are within time, cycle, and age life.
- Design Verification – concur that the design has been satisfactorily verified.
- Hardware / Software Acceptance
    - concur that hardware and software conforms to released engineering and that any departures have been documented in the applicable nonconformance reporting system (e.g., Cx PRACA)
    - concur that all nonconformances have been satisfactorily dispositioned in accordance with Ares I-X SR&QA Requirements
    - GMIPs have been completed

  - Deviations / Waivers – have reviewed and concur with any deviations or waivers.
  - Audits / Surveillance – concur that any audit / surveillance findings have been satisfactorily dispositioned.
- ALERTS - concur that all ALERTS have been satisfactorily dispositioned
- Operational Test Requirements (OTRs) -have reviewed and concur with OTRs
- Launch Commit Criteria (LCCs) - have reviewed and concur with LCCs
- Range Safety – concur that all Ares I-X Range Safety Requirements have been satisfied (SE&I S&MA only).

SE&I and each IPT S&MA lead and Lead Engineers will also brief:

- Open issues and resolution plan
- Key technical risks such as waivers/deviations, significant non-conformances, and a summary of hazards with risk scores of 2x5 or higher.
- Any proposed constraints to rollout or launch. Rationale will be provided for any proposed constraint.

7.2 SAFETY AND MISSION SUCCESS REVIEW (SMSR)

The SMSR is conducted prior to launch to prepare OSMA and OCE for their participation in the ESMD-chaired FTRR. The SR&QA lead and lead Chief Engineer are the internal Ares I-X focal points for planning and coordinating this review.

The SE&I and IPT SR&QA Lead and Lead Engineers along with the Ares I-X CSO and CE will present their respective launch readiness assessment to the OSMA/OCE chairs at the SMSR.

7.3 CERTIFICATE OF FLIGHT TEST READINESS (COFTR)

The CoFTR process, documented in Appendix C of CxP 70127, CxP Ares I-X Flight Test Plan, is structured to assure readiness for flight by defining the applicable CoFTR Review, Products, and endorsement requirements. It provides expectations for commitment by participants to provide CoFTR products and endorsements for flight readiness.

The CoFTR process will help ensure that the as-built hardware and software met their requirements. The CoFTR reviews provide a means to establish readiness for successful assembly, integration, system test, launch, and completion of the flight test. The process will address all major and critical operations, design, certification, analyses, testing, documentation, and requirements definition necessary for a successful launch.

The Ares I-X S&MA Leads for SE&I and the IPTs will provide their respective CoFTR SR&QA position to SE&I/IPTs, as well as to the Ares I-X SR&QA Lead. The Ares I-X SR&QA Leads for SE&I and the IPTs CoFTR endorsement provides concurrence that

their respective SR&QA community has satisfactorily completed or accomplished the products and tasks listed below:

a. Hazard Analysis Reports have been satisfactorily completed in accordance with the Ares I-X SR&QA Requirements
b. Formal Safety Reviews have been completed with the CSERP. All Hazard Reports have been approved and all CSERP actions have been successfully closed
c. Safety verifications have been satisfactorily completed
d. Limited Life Items - Concur that any limited life items are within time, cycle, and age life
e. Hardware/Software Acceptance
    - Concur that hardware and software conforms to released engineering and that any departures have been documented in the applicable nonconformance reporting system (e.g., Cx PRACA)
    - Concur that all non-conformances have been satisfactorily dispositioned in accordance with Ares I-X SR&QA Requirements
    - Concur that Government Mandatory Inspection Points (GMIPs) have been completed
    - Concur that any manufacturing audit/surveillance findings have been satisfactorily closed
    - Reviewed and concur with any deviations or waivers
f. Acute Launch Emergency Reliability Tips (ALERTs) - Concur that all ALERTs have been satisfactorily dispositioned
g. Operational Test Requirements (OTRs) - Review and concur with OTRs and concur that all necessary OTRs were considered.
h. Launch Commit Criteria (LCCs) - Review and concur with LCCs and concur that all necessary LCCs are in place.
i. Range Safety - Concur that Ares I-X Range Safety Requirements have been satisfied
j. Provide endorsement for CoFTR

Any deltas after the CoFTR endorsement will be provided to the SE&I/IPTs, as well as to the Ares I-X SR&QA Lead for both the Flight Test Readiness Review and the Launch Readiness Review.

APPENDIX A
ACRONYMS AND ABBREVIATIONS AND GLOSSARY OF TERMS

A1.0 ACRONYMS AND ABBREVIATIONS

ALERT	Acute Launch Emergency Reliability Tips
CIL	Critical Safety List
CM/LAS	Crew Module/Launch Abort System
CoFTR	Certificate of Flight Test Readiness
CSERP	Constellation Program Safety and Engineering Review Panel
CxP	Constellation Program
ERB	Engineering Review Board
ESMARR	Engineering and Safety and Mission Success Readiness Review
ESMD	Exploration Systems Mission Directorate
FMEA	Failure Modes and Effects Analysis
FTRR	Flight Test Readiness Review
GO	Ground Operations
GS	Ground Systems
HAWG	Hazard Analysis Working Group
IPT	Integrated Product Team
LCC	Launch Commit Criteria
MMO	Mission Management Office
MR	Material Review
MRB	Material Review Board
OCE	Office of Chief Engineer
OSMA	Office of Safety and Mission Assurance
OTR	Operational Test Requirement
R&M	Reliability and Maintainability
RoCS	Roll Control System
SE&I	Systems Engineering and Integration
SMSR	Safety and Mission Success Review
SR&QA	Safety, Reliability, and Quality Assurance
SVTL	Safety Verification Tracking Log
USS	Upper Stage Simulator
VRDS	Verification Requirement Data Sheet
WAD	Work Authorization Document
XCB	Ares I-X Control Board