



National Aeronautics and
Space Administration



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ARES I-X MISSION IMPLEMENTATION PLAN (MIP)

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1.0 ARES I-X MISSION OVERVIEW

The mission of Ares I-X is to conduct a successful developmental flight test in support of the CxP strategic flight test objectives and per the success criteria as defined in CxP 70127, Ares I-X Flight Test Plan (FTP). The scope of the mission includes development of a Flight Test Vehicle (FTV) and associated ground systems and operations. The mission culminates with a launch of the FTV, no earlier than August 30, 2009, followed by recovery of the booster and the data recorder. A Mission Management Office (MMO) has been formed to manage the mission.

1.1 INTRODUCTION

In September 2006 the FTP was baselined. The FTP includes flight test objectives, roles and responsibilities, mission constraints, a Certificate of Flight Test Readiness (CoFTR) Plan, and other requirements to achieve the strategic flight test needs per CxP 70085, CxP Integrated Flight Test Strategy (IFTS). In December 2007 the FTP was revised to reflect the establishment of Ares I-X as a mission. The new mission approach resulted in other changes to the FTP including revised roles and responsibilities, streamlining of the plan, and updates to technical approach.

The Ares I-X approach to mission management is modeled after NPR 7102.5D, Space Flight Program and Project Management Requirements. Mission planning that is not reflected in the FTP is documented herein this Mission Implementation Plan (MIP). The MIP also captures planning that was removed from the FTP in December 2007. The FTP, MIP, and supporting control documents reflect the primary planning documented for the Ares I-X mission.

1.2 OBJECTIVES

The vision of Ares I-X is to collect sufficient data from the flight test to meet the flight test objectives. Mission objectives other than the flight test objectives are to develop a validated flight test system, meet budget targets, and launch on schedule.

The validated test system will consist of a qualified Flight Test Vehicle (FTV) and ground systems. It also includes all ground operations and partnerships to launch and recover the vehicle. An important goal of the flight test team is to provide important data and information to our stakeholders from every step in the development process through post flight operations.

1.3 MISSION DESCRIPTION AND TECHNICAL APPROACH

The mission of Ares I-X is to conduct a flight test effectively and efficiently to meet the flight test objectives. In order to fulfill this mission and provide data to support the design of the Ares I, Orion, and supporting ground systems, a FTV and associated ground systems will be developed that can simulate the functions necessary to satisfy the flight test objectives. The CxP Manager has established the Ares I-X Mission Management Office (MMO) to complete this mission. The figures below depict the FTV ready for launch at KSC Launch Complex 39B (LC-39B). Figure 1.3-1, Flight Test Vehicle on the

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Launch Pad and the Ares I-X Launch Profile, depicts the suborbital flight of the FTV through recovery of the First Stage.

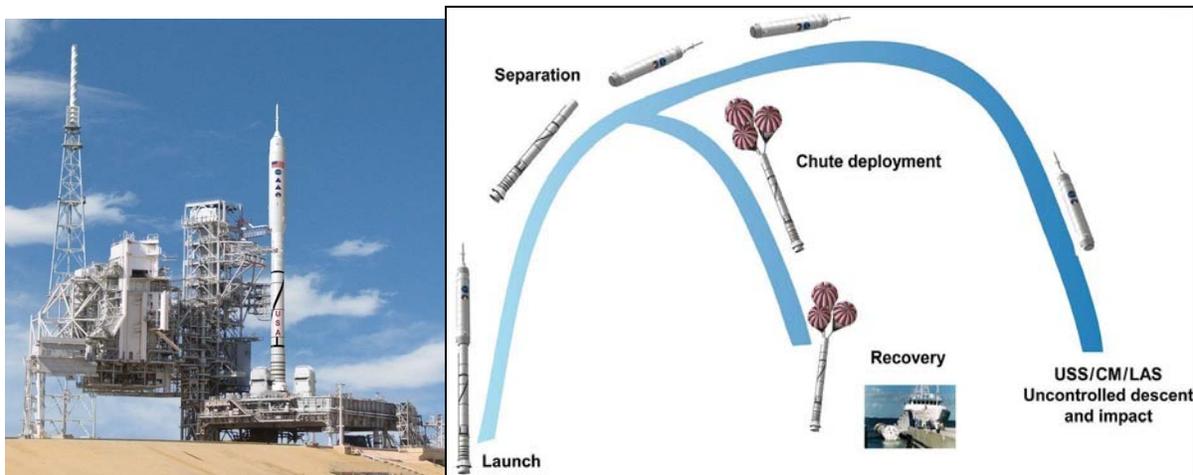


FIGURE 1.3-1 FLIGHT TEST VEHICLE ON THE LAUNCH PAD AND ARES I-X LAUNCH PROFILE

The technical approach for Ares I-X is based on the Systems Engineering Process (SEP) defined in the Systems Engineering and Management Plan (SEMP). The SEMP will be implemented and revised as required to provide the engineering products necessary to meet the system requirements. The Systems Engineering and Integration (SE&I) organization will also ensure that all lower level engineering processes are consistent and complementary of the SEP. To support tracking of progress in addition to the technical reviews, SE&I will establish and track Technical Performance Measures (TPMs), maintain and status top issues, and perform Continuous Risk Management (CRM).

The mission management approach is defined in this MIP using Integrated Project Management (IPM). Ares I-X IPM represents an integrated, disciplined approach to project management designed to ensure that scope, cost, schedule, and risk are all addressed in the planning and control process. Ares I-X management structure provides for regular status reporting and an “early warning” system for potential technical, safety, manufacturing, cost, and schedule performance problems. Mission performance will be assessed via recurring budget, technical and schedule surveillance and reporting to the Mission Manager. An Integrated Master Schedule (IMS) will be used as the primary tool to evaluate schedule progress. Cost to budget variances will be tracked by the Business Manager and reported to the Mission Manager. Earned Value Management (EVM) techniques will also be employed to support programmatic control and measure performance.

Ares I-X is the Constellation pilot test case for the Primavera planning tools where Cost Manager is the Primary tool used for cost management. Resources for NASA in-house

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discrete and level of effort work will be loaded into the Primavera summary schedule. The plan referred to as the Budgeted Cost Work Scheduled (BCWS) and "earned value" or performance, referred to as the Budgeted Cost Work Performed (BCWP) will be obtained from Primavera and inserted into the EVM calculator tool. The EVM indicators, BCWS and BCWP, for "prime" contractors who provide monthly Cost Performance Reports (CPRs) are manually loaded directly into Cost Manager from the contractor deliverables. Actual Costs Work Performed (ACWP) are loaded into the Cost Manager calculator via and actuate file directly for the official NASA financial system called SAP. Monthly reports of cost and schedule variances and variances at completion will be produced using the Cost Manager application.

In development of the systems and processes for the flight test a series of technical reviews will be successfully completed to progress through the system lifecycle. These reviews will help ensure that the technical products are adequate and sufficient to meet the mission needs and requirements. These reviews will also help measure programmatic status such as cost and schedule.

Technical and programmatic reviews will be preformed to meet the intent of NPR 7120.5D. These reviews will provide a programmatic means to assess the progress of the mission as it proceeds through the mission life cycle. The following table, Table 1.3-1, Ares I-X Reviews, provides a list of reviews and applicability. An 'X' denotes that a review plan will be written and approved, if the review is applicable. The Ares I-X Control Board (XCB) is responsible for approving review plans. Phased safety reviews are the responsibility of the Ares I-X Safety and Mission Assurance (SMA) Chief. The Safety and Mission Success Review (SMSR) is conducted prior to launch by the SR&QA Lead and Chief Engineer to prepare for SR&QA and engineering participation in the flight test readiness reviews. Reviews are further defined in Appendix C, Strategic Reviews Plan. Appendix B maps the reviews from System CDR to the Certificate of Flight Test Readiness (CoFTR) Reviews per the FTP.

Review	SE&I	IPT Level
Systems Requirements Review (SRR)	X	
Preliminary Design Review (PDR)	X	X
Critical Design Review (CDR)	X	X
IPT Design Certification Reviews (DCR)		X
IPT Product Acceptance Reviews		X
Pre-ship Reviews		X
System DCR	X	
IPT Integration Readiness Reviews (IRRs)		X
Systems Acceptance Review (SAR)	X	
Phased Safety Reviews		
Safety and Mission Success Review (SMSR)		
Pre-FTRR Dry Run	X	

TABLE 1.3-1 ARES I-X REVIEWS

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Reporting will be conducted on a routine basis. Weekly reports will be generated by the IPTs, SE&I, SMA, CEs, and MMO staff. The format for the status reports will be provided by the Project Integration Manager. These weekly reports will be used as a resource to generate status reports to the Cx Program Manager (Cx PM) and prepare the CxP Monthly Progress Reports (MPRs). Other means of reporting, status, team communication will include forums to discuss upcoming events (e.g. – calendar meeting), meetings to discuss schedule status, and meetings to discuss budget status.

Ares I-X will conduct special meetings such as off-sites, as-required, to assess the state of the mission and future planning efforts. The XCB will establish the mission baselines including requirements, schedules, resources, and configurations as well as control changes to those baselines. In addition, the XCB will resolve issues that cannot be resolved without XCB action through consensus between Ares I-X management and Integrated Product Teams (IPTs).

The basic organization for the mission is reflected in the FTP. The organization is shown in Figure 1.3-2, Ares I-X Organization Chart. The MMO will be led by the Mission Manager (MM) and supporting MMO staff. The system elements will be developed by seven (IPTs). The SE&I team will integrate the technical effort in its entirety. The system organization also includes participation by the Technical Authority (TA) per NPR 7120.5D. The TA via the NASA SMA and the NASA Office of the Chief Engineer (OCE) will interface at all levels of mission operations.

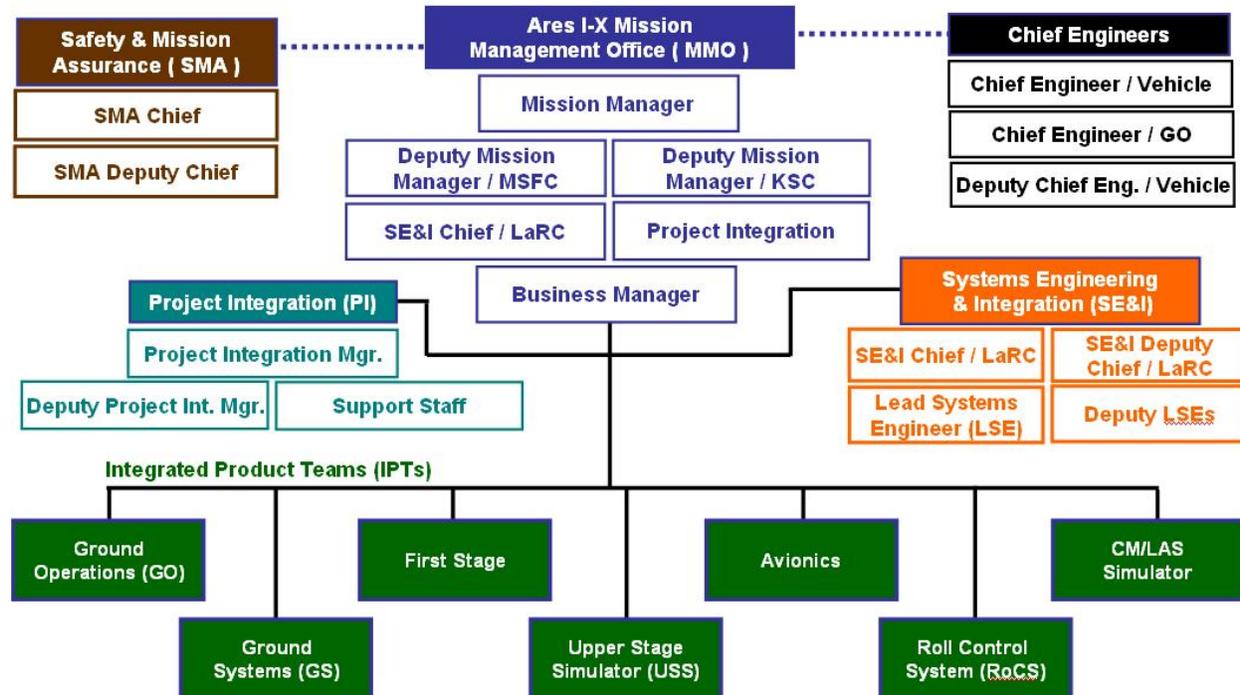


FIGURE 1.3-2 – ARES I-X ORGANIZATION CHART

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There will be a primary control board for Ares I-X called the XCB. The XCB will be chaired by the Mission Manager. The charter for the XCB will be the governing document for the XCB. The XCB will be the decision authority for Ares I-X. Specifically, the XCB will rule on matters of budget, schedule, technical requirements, IPT interfaces, similitude, range, assembly, integration, test, risk, and waivers. Stakeholder representatives will be invited as non-voting members to provide continuity with CxP, the Space Shuttle Program (SSP), KSC GO, and the MSFC Ares Program Office (APO). The Mission Manager may establish support boards as defined by charter per the Configuration Management Plan. The XCB is the top level board for the mission. Disputes will be resolved at the CxCB.

The primary deliverable/product from the flight test is data. After the day of launch operations Ares I-X is responsible for a series of final reports and delivery of data to the stakeholders. Disposal and clean-up will be defined in the Ares I-X Disposal Plan or individual IPT plans and as-required per the Operational Test Requirements, respectively. The MMO will perform closeout tasks supported by SE&I, the IPTs, SMA, and the Chief Engineers. The mission will conclude with a final briefing to the manager of Constellation.

The FTV, ground systems, and operational procedures are the tools, models, and systems used in the collection of the flight test data. These system products will be verified to meet the system requirements and validated as a system to meet the flight test objectives, requirements, and constraints as documented in the FTP.

The system will be integrated per the Assembly, Integration and Test (AIT) plan and Integrated Logistics Support Plan which includes all logistics associated with transportation of major elements, processing at KSC, launch, and recovery of First Stage and the data recorder, as well as disposal requirements for non-recoverable components such as the USS and CM/LAS.

The Mission Manager will assure that the CoFTR process is planned and implemented leading to a safe and successful day of flight operations.

1.4 AUTHORITY, STRUCTURE, AND APPROACH

1.4.1 MISSION AUTHORITY

Authority to proceed with the Ares I-X mission was provided by the CxP Program Manager. A budget and technical approach was documented and presented to the CxCB in March 2006 and revised in April 2006 and again in August 2006. Subsequent to the August 2006 briefing, the FTP was baselined in September 2006. The FTP provides specific authority and technical direction from the CxP to Ares I-X. After Ares I-X completed the preliminary design phase, the Cx PM restructured Ares I-X to form the MMO. The Mission Manager (MM) reports directly to the CxP PM. The FTP was revised after the restructure. Ares I-X was also chartered by CxP.

1.4.2 GOVERNANCE STRUCTURE

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The combination of the Ares I-X Charter, reference CxCB Directive MD-019, FTP, MIP, and control plans provide the programmatic approach as outlined in NPR 7120.5D. In the event of a conflict between the FTP and the MIP the FTP takes precedence. The following table, Table 1.4.2-1, NPR 7120.5D Applicability Matrix, traces the link between the outline in NPR 7120.5B and the FTP, MIP, and other Ares I-X plans.

NPR 7120.5D Section No.	NPR 7120.5D Project Plan Template Section Title	FTP	MIP	Control Plan or Other	Comments
1.00	Mission Overview	X	X	X	Mission and flight test overview.
1.10	Introduction	X	X	X	Ares I-X overview provided in the FTP, MIP, and other control documents.
1.20	Objectives	X			Flight test objectives per the FTP and the IFTS.
1.30	Mission Description and Technical Approach	X	X	X	The FTP provides a division of responsibility and the MIP provides detail description of work to be performed and roles & responsibilities.
1.40	Mission Authority/ Governance Structure/ Implementation Plan	X		X	The FTP is the governing document. The parent document for the FTP is the IFTS. There is also a letter of delegation from the Cx PM. The MIP and the charter letter expands upon the FTP.
1.50	Stakeholder Definition	X	X		The Cx PM is the implied primary stakeholder. The MIP provides additional insight.
2.0	Mission Baseline	X	X	X	Baseline defined via the objectives, requirements, and constraints in the FTP.
2.10	Requirements Baseline	X			The FTP provides flight test objectives, system constraints (e.g. - use Shuttle booster, LC39B, etc.) and requirements.
2.20	WBS Baseline		X		WBS and WBS dictionary included in the Mission Implementation Plan (MIP).
2.30	Schedule Baseline	X	X	X	The flight test date and reference major milestones provided in the FTP. Also, an

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					executive summary schedule is provided in the MIP. Detailed schedules provided by each IPT.
2.40	Resource Baseline	X	X	X	Division of responsibility provided in the FTP. Resource baseline is provided in the MIP. The budget and manpower estimates are maintained as separately controlled data and information by the Business Manager and summarized in the MIP.
3.0	Project Control Plans		X	X	See section 3.0 of the MIP.
3.10	Technical, Schedule, and Cost Control Plan			X	Technical Plans per the FTP and SEMP; Schedule per the "Integrated Master Schedule"; and EVM per the MIP.
3.20	Safety and Mission Assurance Plan			X	Ares I-X SMA Plan and IPT SMA Plans per the SR&QA requirements.
3.30	Risk Management Plan		X	X	Stand alone Ares I-X RM Plan based on the CxP RM Plan.
3.40	Acquisition Plan			X	See Section 3.4 for a summary of the acquisition approach.
3.50	Technology Development Plan				N/A
3.60	System Engineering Management Plan			X	The SEMP is developed the Ares I-X SE&I organization per NPR 7123.1A.
3.70	Software Management Plan			X	Avionics contractor is developing a Software Development Plan
3.80	Review Plan			X	Review plans will be developed for each review identified in the MIP and SEMP.
3.90	Mission Operations Plan			X	SE&I and the GO IPT are developing the necessary operations plans based on the operations test requirements.
3.10	Environmental Management			X	Ares I-X is covered by the EMP developed by CxP.

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	Plan				
3.11	Logistics Plan			X	SE&I and the GO IPT are performing the necessary logistics planning. This planning will be documented in the Integrated Logistics (ILS) Support Plan.
3.12	Data Plan			X	Post Flight Data Report is scheduled 60 days after mission per the FTP.
3.13	Configuration and Data Management Plans		X	X	Ares I-X will generate stand-alone Configuration and Data Management plans.
3.14	Security Plan			X	Ares I-X security per CxP, center, and home organizations.
3.15	Export Control Plan			X	Ares I-X export control per CxP, center, and home organizations.

TABLE 1.4.2-1 NPR 7120.5D APPLICABILITY MATRIX

1.4.3 MANAGEMENT STRUCTURE AND IMPLEMENTATION APPROACH

Ares I-X will be managed by the MM. The organization chart is shown in section 1.3. The MM will be assisted by two deputies, one from MSFC and one from KSC. Representatives from the OCE and SMA will also support the MM. All IPT leads report to the MM. Roles and responsibilities for the team are defined and allocated in the following paragraphs.

The flight test system will be integrated by SE&I. The products that SE&I integrates will be produced by seven Integrated Product Teams (IPTs). There are five IPTs responsible for developing elements of the FTV and two IPTs responsible for the ground segment of the mission. The ground segment IPTs are Ground Operations and Ground Systems (GS). The vehicle IPTs are First Stage, Upper Stage Simulator (USS), Avionics, Roll Control System (RoCS), and CM/LAS Simulator.

1.4.3.1 MISSION MANAGEMENT OFFICE

MMO is comprised of the MM, Deputy Mission Managers, Business Manager, Project Integration Manager, SE&I Chief, and support staff. The MM is the chief of the MMO and is responsible for mission planning, organizing, leadership, and control of the flight test development and mission activities. The MM ensures that Ares I-X is focused on meeting the flight test objectives, systems requirements, and mission requirements and constraints. The MM reports to the Cx PM. The MM is also responsible for approving the system requirements, interface requirements, flight test budget, IMS, design review plans, technical changes that affect cost and schedule, proposed changes to the FTP,

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mission planning documentation, task agreements, and other programmatic matters. The MM will chair the XCB. The MM will serve as the official Ares I-X interface.

The Deputy MMs are an extension of the Mission Manager. The Deputy MMs serve as backups to the MM and will be assigned specific tasks. Although the Deputy MMs are assigned from MSFC and KSC their duties are not limited to these centers. The Deputy MMs will assist the MM in all aspects of managing and leading the development of the flight test systems and mission operations. The Deputy MM from MSFC will be the day to day Liaison with MSFC Ares Project Office (APO) and with the IPTs managed at MSFC. The Deputy MM at KSC will be the day to day Liaison with KSC GO. The Deputy MM at KSC will also help coordinate activities at the range.

The MMO Project Integration Manager is responsible for mission integration at the mission management level. This includes major programmatic product deliverables and all associated planning for these functions. One of the programmatic products developed and maintained under the direction of the Project Integration Manager is the IMS which includes the detailed IMS, the Summary IMS, and an executive summary schedule. These schedules will be maintained and tracked to the baseline regularly including identifying variances, documenting rationale for major variances, and performing replanning as required to meet mission goals. The Project Integration Manager will also ensure the development and implementation/execution of the Configuration Management (CM), Data Management (DM), and Risk Management (RM) function including necessary plans and staffing. The Project Integration Manager will coordinate with SE&I and the IPTs to prepare mission activity status reports, maintain action item status, identify risks and issues, and present status to the MM.

The Business Manager will manage the budget in accordance with the Work Breakdown Structure (WBS). The Business Manager coordinates with resource managers in each IPT and SE&I. The Business Manager will provide integrated weekly, monthly, quarterly, and other status reports as required. The Business Manager will also support the XCB, preparation of task agreements, and EVM as defined in Section 1.3.

The MMO support staff will support risk, configuration, data, and records management. The staff will include support for scheduling, technical writing, Information Technology (IT), Information Security (IS), and other technical and programmatic support.

Additional roles, responsibilities, and products of MMO are listed in Section 1.4.3.6, Additional Roles and Responsibilities for MMO.

1.4.3.2 NASA TECHNICAL AUTHORITY

Ares I-X will be supported by the NASA Technical Authority (TA) as defined by NPR 7120.5D. Ares I-X will follow the TA process for Engineering and the TA processes for SMA. A Chief Engineer will implement the Engineering TA process and a Chief Safety Officer (CSO) will implement the TA process for SMA.

There will be two Chief Engineers. One Chief Engineer will focus on FTV development (i.e. – the Vehicle Chief Engineer (VCE)) and the other CE will focus on ground

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operations and systems (i.e. – the Ground Chief Engineer (GCE)). The VCE will serve as the overall mission Chief Engineer. The VCE and GCE will be supported by Lead Engineers (LEs). The LEs, also known as Lead Discipline Engineers (LDEs) per NPR 7120.5D, will be assigned at the IPT level.

The VCE, GCE, and CSO will help the MM and the SE&I Chief ensure that the system is developed to a feasible set of requirements. They will also provide assistance during the development process to help make sure the products meet the requirements. Their assessment of the system will be paramount as defined by the flight test readiness process per the CoFTR plan. The LEs and IPT SMA representatives will play an important role in ensuring the fidelity of IPT products. The VCE, GCE, and CSO will serve on the XCB.

The CEs will coordinate with center/‘home’ engineering organizations and other technical authorities such as Ares, GO, and CxP technical panels, working groups, and boards in order to fully understand technical issues, resolve problems, mitigate risks, and ensure compliance with the flight test objectives. The CEs will also help assure compliance to applicable standards across all mission elements. The CEs have the responsibility and authority to organize reviews, meetings, and other technical forums in order to facilitate formulation of informed engineering recommendations and dispositions. The Engineering Review Board (ERB) meeting will be held in conjunction with the Systems Engineering Review Forum (SERF) to the maximum extent possible. The ERB is chaired by the Chief Engineer to enable Technical Authority (TA) to evaluate technical performance. The SERF is an SE&I operated board that is defined in the SEMP.

The CSO is also the SMA Lead for the mission. The SMA Lead will help assure that NASA SMA policy and requirements are met. The Ares I-X SMA Technical Authority, working closely with the CxP SR&QA Office, develops the Ares I-X SR&QA requirements. These requirements were initially baselined at the CxSR&QA Board. Subsequent revisions are approved at the XCB; an Ad Hoc member from the CxP SR&QA Office participates in these XCB’s. The Ares I-X S&MA TA mission responsibilities include the following:

- Assure establishment of Ares I-X SR&QA requirements.
- Monitor lower level development of SR&QA products (e.g. – Hazard Analyses and FMEA/CIL) per the SR&QA Requirements.
- Work closely with S&MA personnel assigned to AIX SE&I and IPT’s, conduct surveillance of Ares I-X activities to assess compliance with the Ares I-X SR&QA requirements
- Serve as a member of the Ares I-X XCB. Elevate issues to the CxSR&QA Board or CxCB as warranted.
- Serve as the S&MA community’s representative on any milestone review boards chaired by the Mission Manager.

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- Review and recommend dispositions on waivers/deviations that require CxCB approval (i.e., waiver/deviation is to a higher requirement than baselined at the XCB).
- Participate in the Ares I-X Risk Management process.
- Review and recommend disposition of non-conformances that have been elevated to the Ares I-X Chief Engineer's Review Board (CERB) or to the Mission Managers level at the XCB. Elevate issues to the Cx SR&QA Board or CxCB as warranted.
- Provide a path for dissenting opinions to be elevated within and external to Ares I-X.
- Participate in all reviews leading up to FTRR.
- In conjunction with the Ares I-X Chief Engineers schedule and conduct a Safety & Mission Success Review (SMSR) with NASA's OSMA, Chief S&MA Officer and OCE, Chief Engineer to assess the Ares I-X readiness for flight. This requires the participation of the Ares I-X SE&I and IPT S&MA and engineering personnel.
- Provide endorsement for CoFTR.

1.4.3.3 SYSTEMS ENGINEERING AND INTEGRATION (SE&I)

SE&I will lead the technical development of the system through the entire system life cycle of the mission per the SEP as defined in the SEMP. The SE&I organization will be led by the SE&I Chief. The SE&I Chief will be supported by a Deputy Chief and Lead Systems Engineer (LSE). The SE&I Chief will be appointed by and report to the Mission Manager as well as serve on the XCB. General duties and responsibilities for the SE&I organization include the following:

- Develop the SEMP.
- Manage the SE&I budget including acquisition of resources required to perform SE&I tasks.
- Plan and implement system level reviews.
- Develop system level requirements which include the FTV system requirements and the ground system requirements.
- Develop interface requirements which include all inter-IPT IRDs and ICDs, and all external IRDs and ICDs.
- Develop the Developmental Flight Instrumentation (DFI) requirements including allocation to the IPTs.
- Develop the tailored version of range requirements (AFSCM 91-710).
- Allocate requirements to the IPTs and review element verification of allocated requirements.
- Perform system design and development which includes environments definition, system analyses, assembly, integration, and test.
- Perform verification of system, interface, and DFI requirements.
- Generate the final Guidance, Navigation, and Control (GN&C) algorithms (i.e. – derive filters, gains, etc.).
- Develop the Launch Commit Criteria (LCC) and flight rules.

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- Prepare the Post Flight Data Analysis Plan.
- Establish working groups including an integration forum to discuss and resolve integration issues.
- Provide an SE&I liaison to each IPT.
- Support system level CM and DM in cooperation with MMO.
- Perform continuous risk management.
- Other responsibilities as defined herein.

1.4.3.4 INTEGRATED PRODUCT TEAM MANAGERS

The seven IPTs (First Stage, USS, CM/LAS, Avionics, RoCS, GS, and GO) are responsible for meeting and delivering products per the requirements flowed down to the IPTs in accordance with applicable task agreements. The IPTs will perform the necessary planning, organizing, and control to accomplish IPT tasks including the appropriate level of CM, DM, and RM. Specifically, the IPTs will manage to baselined IPT schedules within approved budgets. IPT Leads will make day to day decisions to manage their IPT products. The IPT Leads report to the MM.

IPT decisions that affect the overall technical capability of the system, cost, and schedule will be approved by the XCB and potentially the CxCB. Issues will be presented to the MM in a timely manner in order to avoid or reduce the impact to the overall Ares I-X budget and/or integrated schedule. General duties and responsibilities for IPTs include the following:

- Identify and obtain needed resources which include acquisition of support from contractors.
- IPTs organization will include representatives from the Chief Engineer's Officer, SMA, SE&I, and GO.
- Provide programmatic and technical data and information to SE&I as requested.
- Develop IPT specific requirements using SP-6105, NASA Systems Engineering Guidebook, as a guide in deriving levels of requirement specifications. Note: the top level IPT/element specification will be approved by the XCB in that this document defines the products to be delivered.
- Develop and deliver products including verification products.
- Conduct IPT level reviews (e.g. – SRR, PDR, and CDR).

The IPTs are responsible for delivering IPT hardware and software that is verified and validated per the IPT element requirements. All products will be on-time and within budget. In the event of a conflict or issue, the MM will be notified as soon as the discrepancy is known. The IPTs are solely responsible for implementation of flowed down systems requirements and development of IPT specific requirements and associated products to ensure compliance with the requirements and task agreements.

1.4.3.5 EXTERNAL INTERFACES

Ares I-X will interface with many non-Ares I-X organizations to fulfill the mission objectives. These organizations include other CxP organizations as well as entities

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external to CxP and NASA. For each interface MMO or SE&I, with MM concurrence, will assign an Ares I-X Point-of-Contact (POC). The following is a list of external entities defined in the FTP that Ares I-X will interface with to complete the mission. Note: all assignments noted herein are subject to further delegation per MM concurrence.

- **Cx Program Manager** – The MM reports to the Cx Program Manager.
- **Cx Control Board (CxCB)** – The CxCB approves the budget, the FTP, and waivers to the FTP. The MM will also provide reports to the CxCB as required such as the Top Risk Review.
- **NASA Engineering Technical Authority** – Ares I-X via the Chief Engineer(s) will maintain the Engineering Technical Authority per NPR 7120.5D.
- **NASA Safety Technical Authority** – Ares I-X via the SMA Lead will maintain the Safety Technical Authority per NPR 7120.5D.
- **CxP Safety and Engineering Review Panel (CSERP)** – The MM via the SMA Lead will provide a briefing to the CSERP and obtain approval of the system level hazard reports and other products per the SR&QA requirements.
- **Launch Constellation Range Safety Panel (LCRSP)** – The MM via the SE&I SMA Lead and SE&I Range POC will coordinate issues concerning range safety.
- **U.S.A.F. 45th Space Wing Range Safety** – The MM via LCRSP will coordinate with the Air Force to ensure that range requirements are being met.
- **CxP Test and Evaluation (T&E)** – The MM will maintain open communications with CxP T&E to assure T&E management that progress is being made to meet the flight test strategic objectives.
- **CxP SE&I** – The MM via the SE&I Chief will provide data that is requested from CxP SE&I that is needed to satisfy requirements in the FTP. Ares I-X and CxP SE&I will work together to establish success criteria for the mission.
- **CxP Operation Integration Office (OIO)** – The MM via the Deputy MM from KSC will ensure that OIO is represented in top level operations planning.
- **CxP PP&C Office** – The MM via the MMO Business Manager will coordinate budget activity with the CxP PP&C Office.
- **MSFC Ares Project Office (APO)** – The MM via the Deputy MM from MSFC will communicate needs to ensure that Ares I-X has the data and financial resources it needs to develop the FTV and that APO is cognizant of the Ares I-X approach to satisfy the flight test objectives relative to expectations of APO.
- **KSC GO CxP Project Office** – The MM via the Deputy MM from KSC will communicate needs to ensure that Ares I-X has the data and financial resources it needs to develop the ground systems and processes and that KSC GO is cognizant of the Ares I-X approach to satisfy the flight test objectives relative to expectations of KSC GO.
- **JSC Orion Project Office** - The MM via the CM/LAS IPT Lead will communicate needs to ensure that Ares I-X has the data it needs to develop the CM/LAS

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Simulator and that Orion is cognizant of the Ares I-X approach to satisfy the flight test objectives relative to expectations of Orion.

- **JSC Mission Operation Directorate (MOD)** – The MM via the SE&I Chief will solicit help from MOD as required to support the mission and to ensure that MOD needs from this flight test are understood and implemented.
- **Space Shuttle Program (SSP)** – The MM via the First Stage IPT Lead will interface with SSP for development of First Stage as required (e.g. – transfer of booster, recovery, technical exchange, etc.), and the MM via the GO IPT and First Stage IPT will communicate during processing of the First Stage at KSC.
- **TEL-4 and JDMTA** – The MM via the SE&I Chief and Deputy MM for KSC will ensure that telemetry agreements and resources are in place to support the mission.
- **Atlas Space Operations Center (ASOC)** – GC3 platforms supported by the ASOC.

1.4.3.6 ADDITIONAL ROLES AND RESPONSIBILITIES (R&R)

1.4.3.6.1 MMO ADDITIONAL R&R

Additional R&R for MMO include the following:

- Develop and maintain the IMS.
- Develop and maintain the Executive Summary Schedule.
- Ensure the development, maintenance, and coordination of linkages within the detailed schedules of IPTs, SE&I, and S&MA.
- Maintain overall budget including allocation and spending authority within the limits of the budget.
- Manage overall mission progress using IPM approach.
- Provide status to Cx PM including weekly, monthly, and special reports.
- Perform CRM of overall mission and top risks.
- Provide mission level CM and DM.
- Develop system level CoFTR Plan per Appendix C of the FTP.
- Approve Launch Commit Criteria (LCC) and flight rules.
- Obtain agreements with external support entities.
 - Obtain services of MSFC to receive and archive telemetry data during the flight test.

1.4.3.6.2 SE&I ADDITIONAL R&R

Additional R&R for SE&I include the following:

- Generate systems and operations requirements via three main documents; FTV SRD, GS SRD, and the AIT.

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- Allocate systems and operational requirements to the IPTs.
- Ensure development of all FTV to External Systems IRDs and ICDs and manage all changes to the baseline.
- Ensure development of all inter-element IRDs and ICDs and manage all changes to the baseline.
- Develop FTV and Ground systems integrated assembly drawings.
- Generate verification requirements for SE&I developed requirements.
- Generate Master Test Plan for the system.
- Perform the overall system design activities that deliver performance and functional allocations and attributes such as mass properties, modal characteristics, outer mold line, and development of sensor locations and element interfaces.
- Lead the flight design activities
 - Coordinate with JSC-MOD for range safety related flight design products.
- Identify the hardware interface (e.g. – bolts, etc.) materials that require special attention for negotiation of budget and schedule allocation.
- Partner with GO to assemble the FTV in cooperation with the IPTs and SMA.
- Ensure contingency capability is included in the system design to provide on-pad safing and VAB roll back.
- Assure data gathered from the flight test to approved stakeholders list.
- Conduct system level technical design reviews.
- Support GO IPT in the generation and maintenance of Operational Test Requirements (OTRs).

1.4.3.6.3 COMMOM SE&I AND IPT R&R

Common R&R for SE&I and the IPTs include the following:

- Perform problem reporting per the SR&QA PRACA requirements.
- Generate control documents per the MIP Control Documents table.
- Prepare a workforce plan and obtain needed resources.
- Operate within budget and manage cost threats.
- Perform CRM.
- Perform CM and DM.
- Perform necessary acquisitions, in cooperation with the Contracts Officer and per the FAR, and manage prime contractors.
- Perform audits, as required, on primes and subcontractors per the FAR.
- Support the development of the LCC and flight rules.
- Prepare post flight data reports.
- Develop the SMA deliverables per the SR&QA requirements document.

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- Conduct DCRs.
- Support GO IPT in the generation and maintenance of Operational Test Requirements (OTRs).
- Provide SMA personnel to support all functions and phases of the mission.
- Prepare all FMEAs per the SR&QA requirements.
- Prepare all fault trees per the SR&QA requirements.
- Prepare all hazard analyses per the SR&QA requirements.
- Perform safety reviews.
- Perform all duties to meet the SR&QA requirements.
- Provide CoFTR endorsements.

1.4.3.6.4 COMMON FTV IPT ADDITIONAL R&R

Common R&R for the FTV IPTs include the following:

- Support SE&I in development of ICDs and IRDs that affect the IPT element.
- Deliver a flight qualified element per the IPT ERD.
- Supports GO in assembly of the element at KSC.
- Install DFI per approved XCB list.
- Coordinate with the GO IPT during processing at KSC.
- Support SE&I and GO during integration (stacking and destacking) of the FTV.
- Supply unique Ground Support Equipment (GSE) required for element transportation, assembly, and test. In the event of a conflict the MM will decide.
- Provide liaisons with SE&I and the GO IPT.

1.4.3.6.5 FIRST STAGE IPT ADDITIONAL R&R

Additional R&R for the First Stage IPT include the following:

- Recover the First Stage.
- Remove the Data Recorder and specified Atlas hardware from the First Stage, after the flight and recovery of the First Stage, and provide to the Avionics IPT.
- Develop an element ERD based on allocated system requirements.
- Develop ERD verification requirements and provide verification data to SE&I.
- Generate a master test plan for the element.
- Install First Stage Avionics Module (FSAM) provided by Avionics IPT.
- Install DFI.
- Install RRGU, provided by the Avionics IPT, into the Aft Skirt.
- Install cable harnesses provided by the Avionics IPT.

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1.4.3.6.6 USS IPT ADDITIONAL R&R

Additional R&R for the USS IPT include the following:

- Support the installation of RoCS into the USS.
- Support the installation of avionics into the USS.
- Support adjustment of ballast during assembly of the FTV.
- Develop an element ERD based on allocated system requirements.
- Develop ERD verification requirements and provide verification data to SE&I.
- Generate a master test plan for the element.
- Install DFI.
- Install cable harnesses provided by the Avionics IPT.

1.4.3.6.7 CM/LAS IPT ADDITIONAL R&R

Additional R&R for the CM/LAS IPT include the following:

- Develop an element ERD based on allocated system requirements.
- Develop ERD verification requirements and provide verification data to SE&I.
- Generate a master test plan for the element.
- Install DFI.
- Install cable harnesses provided by the Avionics IPT.

1.4.3.6.8 AVIONICS IPT ADDITIONAL R&R

Additional R&R for the Avionics IPT include the following:

- Obtain all DFI and deliver to the FTV IPTs.
- Support checkout of DFI after installation.
- Provide all GC3 avionics hardware and software per the GC3 requirements.
- Develop an element ERD based on allocated system requirements.
- Develop ERD verification requirements and provide verification data to SE&I.
- Generate a master test plan for the element.
- Obtain all cable harnesses, with the exception of Flight Termination System (FTS) associated wiring, and deliver to the FTV IPTs.
- Deliver best source post flight data to MSFC within 30 days after launch.

1.4.3.6.9 ROCS IPT ADDITIONAL R&R

Additional R&R for the RoCS IPT include the following:

- Develop an element ERD based on allocated system requirements.

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- Develop ERD verification requirements and provide verification data to SE&I.
- Generate a master test plan for the element.
- Install DFI.

1.4.3.6.10 GS IPT ADDITIONAL R&R

Additional R&R for the Ground Systems IPT include the following:

- Provide qualified ground systems, including the following major ground systems at a minimum, to launch the FTV at KSC. Note: the GS IPT is not responsible for IPT unique GSE and EGSE.
 - Launch pad (LC39B) adapted for Ares I-X.
 - SSP provided Mobile Launch platform (MLP) modified for Ares I-X.
 - Vehicle Assembly Building (VAB) adapted for Ares I-X.
 - Rotation Processing and Surge Facility (RPSF).
 - Hypergolic Maintenance Facility (HMF).
 - Ground Control Systems (GCS)/GC3 platforms.
 - Launch Control Center
- Support SE&I in development of ICDs and IRDs that affect the IPT.
- Develop ground element ERDs based on allocated system requirements.
- Develop ERD verification requirements and provide verification data to SE&I.
- Generate a master test plan for the element.
- Provide a liaison with SE&I.

1.4.3.6.11 GO IPT ADDITIONAL R&R

Additional R&R for the Ground Operations IPT include the following:

- Launch the FTV from LC39B with support from all IPTs.
 - Provide launch director.
- Support receipt of flight system components and supporting GSE at KSC.
- Support assembly, testing, and checkout of the flight system at KSC.
- Rollout and rollback operation from/to the VAB/LC39B.
- Support air-to-ground communications during flight.
- Support interface with the Range/45th Space Wing.
- Develop launch operations concept from receipt of hardware through stacking, rollout, and launch pad operations.
- Generate a Launch Operations Plan.
- Coordinate facilities use with SSP and obtain associated agreements.
- Provide a representative to the LCRSP.

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- Obtain weather forecasting from the 45th Space Wing.
- Obtain ground-based imagery services from the 45th Space Wing.
- Obtain sea surveillance service from the 45th Space Wing.
- Obtain radar tracking service from the 45th Space Wing.
- Obtain telemetry and data distribution agreements with TEL-4 and JDMTA.
- Provide a liaison with SE&I.
- Conduct mission countdown training.
- Conduct launch operations training including simulations.
- Support SE&I in development of ICDs and IRDs that affect the IPT.
- Install, test and provide readiness of the flight termination system and provide access to the 45th Space Wing, as required.
- Develop and maintain the GO development and processing schedule.

1.4.3.6.12 IPT and SE&I SMA R&R

The R&R for the SR&QA includes the following:

1.5 STAKEHOLDER DEFINITION

The primary stakeholder for Ares I-X is the Cx PM. The Cx PM through the Cx T&E Office has identified this mission a strategic flight test in the overall development of the Cx system of systems. The other explicit stakeholders are the users of the flight test data. Users of data include Ares, Orion, and Cx Ground Operations.

Success of the mission is dependent on providing data and information to Ares I, Orion, and Ground Operations in order to support development of those systems. Data will be gathered from every technical review and from hardware fabrication through integration, launch, recovery, and processing of the flight data. Every data point is a potential key to ensuring the safety of future operational missions.

The success criteria are listed in the FTP. Two important Figures of Merit (FOMs) are controlling the FTV through maximum dynamic pressure (Max Q) and exercise of the separation mechanisms after the Max Q event. Other key FOMs are launch operations, controlling the roll of the FTV, deploying the parachutes, recovery of the First Stage, and recovery of the data recorder.

Data collected via the onboard instrumentation will be secured, archived, and distributed per the Post Flight Data Analysis Plan.

1.6 LAUNCH AUTHORITY TEAM (LAT)

The LAT is managed by the Launch Director. This team is responsible for authorizing launch after the L-1 review based on approved procedures and LCC.

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2.0 MISSION BASELINE

2.1 REQUIREMENTS BASELINE

The CxP Program Plan includes Ares, Orion, and Ground Operations. Ares I-X is modeled to produce data for these projects. The Program Plan also references the strategic flight test objectives. To meet some of these objectives the Ares I-X FTP was written and baselined.

The FTP includes a set of primary and secondary flight test objectives, a set of technical constraints, and other miscellaneous requirements. These objectives, constraints, and requirements are used to derive the Ares I-X systems requirements and the Ares I-X SR&QA requirements. The FTP also provides roles and responsibilities that are expanded upon in this MIP and the SMA Plan. The technical approach in the SEMP provides the plan for decomposing the systems requirements down to the element level and lower.

In summary, Ares I-X will baseline six key requirements documents. The driving requirements documents are the FTV SRD, the Ground SRD, SR&QA requirements, DFI requirements, Flight-to-Ground IRD, and the Assembly Integration and Test (AIT) Plan. Many lower levels documents will also be derived from these documents including, but not limited to ERD, IRDs, ICDs, test, and verification requirements.

2.2 WBS BASELINE

The top level WBS is listed in Table 2.2-1, Ares I-X WBS. A detailed lower level WBS will be baselined as a separate product at the XCB. The following WBS provides the number hierarchy, but does not provide the official numbering.

136905	Ares I Project
136905.10	Ares I Flight and Integrated Test Office
136905.10.10	Ares I-X FTV

136905-10-10-10	Project Planning and Control (Mission Management)
136905-10-10-10-10,11	Task (Mission) Management
136905-10-10-10-20	Business Management
136905-10-10-10-30	Risk Management
136905-10-10-10-40	Configuration and Data Management
136905-10-10-10-50	Special Studies

136905-10-10-20	Flight Test Vehicle (and System Eng. &) Integration
136905-10-10-20-01	Project Planning and Control
136905-10-10-20-03	Risk Management
136905-10-10-20-01	Configuration and Data Management
136905-10-10-20-10,18	System Requirements and Verification
136905-10-10-20-20	Integrated Design and Analysis
136905-10-10-20-30,31	Vehicle Integration and Operations
136905-10-10-20-40	Avionics Integration and Operations

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136905-10-10-20-50	Systems Integration and Control
136905-10-10-30,40	Safety and Mission Assurance (SMA)
136905-10-10-50	SE&I/VI Support
136905-10-10-60	Payload Management
136905-10-10-70	Flight Test Activities
136905-10-10-70-10	Pre-flight Test Integration
136905-10-10-70-20	Post-flight Test Integration
136905-10-10-70-30	Physical Recovery of Assets
136905-10-10-80-10	First Stage
136905-10-10-80-10-10	IPT Management and Engineering
136905-10-10-80-10-20	Flight Test Vehicle First Stage Prime
136905-10-10-80-20	Upper Stage Simulator (USS)
136905-10-10-80-20-10	IPT Management
136905-10-10-80-20-20	SE&I
136905-10-10-80-20-30	SMA
136905-10-10-80-20-40	Engineering Design and Analysis
136905-10-10-80-20-41	Interstage Separation Analysis
136905-10-10-80-20-42	Fabrication, Assembly, and Integration
136905-10-10-80-20-43	Separation System Proc Fabrication Integration
136905-10-10-80-20-50	Ground Systems Process
136905-10-10-80-20-60	Transportation and Logistics
136905-10-10-80-20-70	System Test and Integration
136905-10-10-80-20-80	Launch Processing at KSC
136905-10-10-80-30	CM/LAS Simulator
136905-10-10-80-30-10	Procurements
136905-10-10-80-30-20	IPT Management
136905-10-10-80-30-30	SE&I
136905-10-10-80-30-40	Manufacturing and Assembly
136905-10-10-80-30-50	Test and Verification
136905-10-10-80-30-60	Super Stack
136905-10-10-80-30-70	Launch Processing at KSC
136905-10-10-80-30-80	Logistics
136905-10-10-80-40	Roll Control System
136905-10-10-80-40-10	IPT Management and Engineering Support
136905-10-10-80-40-20	Contract Management Support
136905-10-10-80-40-30	White Sands Test Facility (WSTF)
136905-10-10-80-40-40	Prime Contractor
136905-10-10-80-50	Avionics
136905-10-10-80-50-10	IPT Management

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136905-10-10-80-50-20	Insight
136905-10-10-80-50-30	First Stage Avionics
136905-10-10-80-50-40	Avionics Task Order
136905-10-10-80-50-50	Avionics GN&C
136905-10-10-80-60	Aerodynamic Model Testing
136905-10-10-80-60-10	Model Fabrication
136905-10-10-80-60-20	Wind Tunnel Facility
292360	Ground Operations Project
2923610.07	KSC Integrated Operations
292360.07.30	Ares I-X KSC Integrated Operations
292360.07.30.01	KSC Integrated Ops LV Integration & Testing
292360.07.30.02	KSC Integrated Ops Integrated Testing (FEIT)
292360.07.30.03	KSC-Ares I-X Int. Operations Launch Operations
292360.07.30.04	KSC Integrated Operations Planning
292360.09	Ground Systems Development and Sustaining
292360.09.30	Ares I-X Development
292360.09.30.01	Ares I-X Development Project Support
292360.09.30.02	Ares I-X Development SE&I
292360.09.30.03	Ares I-X Dev. Integrated Activation & Validation
292360.09.30.04	Ares I-X Dev. Engineering Support Contract
292360.09.30.05	Ares I-X Development S&MA
292360.09.30.06	Ares I-X O&M Development
292360.09.30.07	Ares I-X Modifications Pad B
292360.09.30.08	Other Ground Systems Modifications Ares I-X
292360.09.30.09	Ares I-X Command, Control & Communication (CCC)
292360.09.30.40	Ares I-X Development Labor
292360.09.31	JSC-Ares
292360.09.60	KSC Ground Systems - SPOC

TABLE 2.2-1 ARES I-X WBS

A WBS dictionary is provided in Appendix B. The WBS describes the tasks necessary to perform the Ares I-X mission. The customer for the products produced per this WBS is the Mission Manager. The main product of the flight test is the flight test data.

2.3 SCHEDULE BASELINE

An IMS and Executive Summary Schedule (ESS) will be prepared and maintained by MMO. The IPTs, SE&I, and SMA will generate detailed schedules that will be used to create the IMS and ESS. The following table, Table 2.3-1, Ares I-X Major Milestones, lists the key events and planned dates for these events. The only fixed timeframe, controlled by higher level boards outside of Ares I-X, is the launch. All review dates list the timeframe of the board meeting. Refer to the IMS for a list of XCB-controlled milestones.

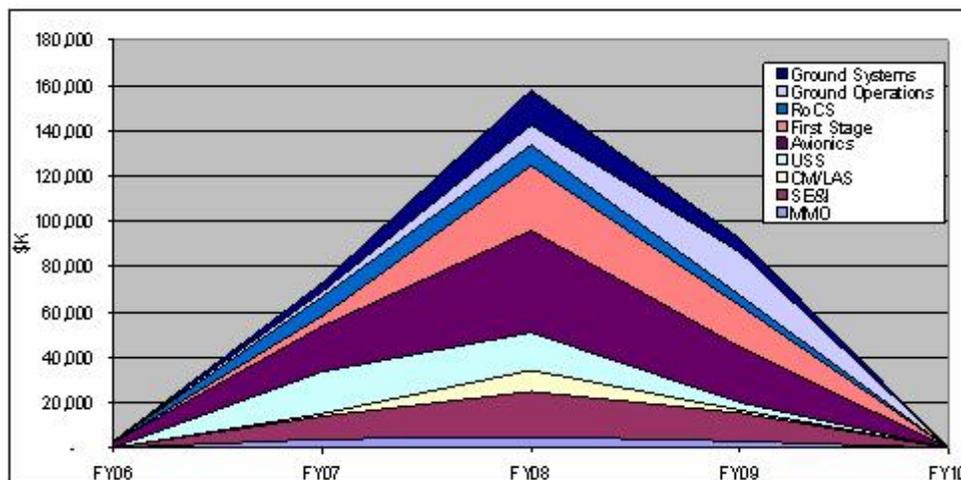
Event	Date
System SRR	November 2006
System PDR	May 2007
Software CDR	March 2008
System CDR Part I	March 2008
System CDR Part II	July 2008
Launch Site Requirements Review	Multiple ORRs
Phased Safety Reviews	Multiple CSERP
IPT DCRs	Multiple at AR
Acceptance Reviews and Pre-ship Reviews	Multiple
IPT IRRs	Multiple
System DCR	To be announced
Pre-FTRR Dry Run	To be announced
Mate Review	June/July 2009
Pre-FTRR	14 days prior to launch (TBR)
FTRR	7 days prior to launch (TBR)
Rollout Review	3 days prior to launch (TBR)
Day Before Launch Review (L-1 Review)	1 day prior to launch
Launch	To be announced

NOTE: DATES MAY CHANGE AND ARE CONTROLLED BY THE IMS.

TABLE 2.3-1 ARES I-X MAJOR MILESTONES

2.4 RESOURCE BASELINE

The following is the mission funding budget by fiscal year. Note: Budget figures in the section are not intended to be updated. The baseline will be maintained by the Ares I-X Business Manager as approved by the CxCB. The profiles provide the NOA in real-year dollars for all years including prior, current, and remaining.

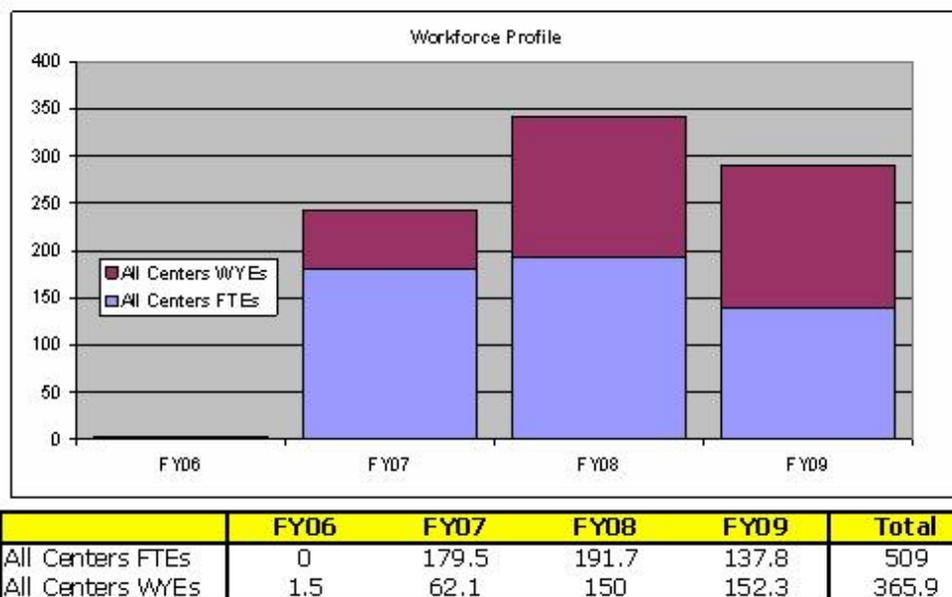


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The following is a breakdown of the mission's funding requirements at WBS Level 2.

	FY06	FY07	FY08	FY09	FY10	TOTAL
MMO	40	3,851	4,960	2,910	-	\$ 11,761
SE&I	22	10,042	19,803	12,425	-	\$ 42,291
CMLAS	14	1,219	9,525	1,388	-	\$ 12,145
USS	100	18,628	16,606	3,397	-	\$ 38,732
Avionics	2,253	20,073	45,145	24,391	-	\$ 91,863
First Stage	-	4,441	28,540	18,395	-	\$ 51,376
RoCS	343	8,518	9,079	4,504	-	\$ 22,444
Ground Operations	306	2,219	8,753	19,085	-	\$ 30,363
Ground Systems	9	3,890	15,547	5,919	-	\$ 25,365
Total Budget Baseline	3,087	72,881	157,959	92,414		\$ 326,340

The following is an estimate of the mission's workforce by fiscal year. It includes both FTEs and WYE.



Note: FY06 FTEs were charged to "Available for New Work" codes.

Ares I-X mission infrastructure requirements (e.g. – acquisition, renovations, and/or use of real property/facilities, aircraft, personal property, and information technology) primarily consist of ground assets identified by KSC (e.g. – VAB, MLP, Pad, etc.). Modifications to these assets will be performed by the Ground Systems IPT.

3.0 MISSION CONTROL PLANS

The MIP is supported by a host of control plans. Each control plan has a specific purpose. These plans are intended to be updated to reflect current strategy and

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planning. The following table, Table 3-1, Mission and Mission Control Documentation, provides a list of all applicable control plans. Each document will be prepared by the specified responsible organization and approved by the specified approval authority. The intent of each document is also listed in the table.

Mission and Mission Control Documentation	Responsible Organization	Approval Authority
<p>Flight Test Plan (FTP) (CxP 70127) The FTP is the parent document for the MIP. It provides the flight test objectives, roles and responsibilities, mission requirements, mission constraints, and other direction provided by the Cx PM. This document is driven by the CxP Strategic Flight Test Objectives.</p>	CxP T&E	CxCB
<p>MIP (AI1-SYS-MIP) The MIP complements the FTP. These two documents combined provide the equivalent of a project plan as defined in NPR 7120.5D. The MIP provides a detail level of planning to enable day to day mission management.</p>	MMO	XCB
<p>SR&QA Requirements (AI1-SYS-SRQA) The SR&QA requirements are derived and tailored from the CxP's SR&QA requirements. Tailoring is based on several primary constraints for Ares I-X: Ares I-X is not human rated; the booster is a 4-segment Space Shuttle RSRM with its linear shaped charge (LSC) extended across all motor segments; and range safety requirements apply per a tailored version of AFSPCMAN 91-710. SR&QA requirements also flow from the FTP.</p>	SMA	XCB
<p>SR&QA Plan (AI1-SRQA-PLN) The SR&QA Plan is written by the SMA Lead for Ares I-X. This plan is not a requirements document, but it is a controlled plan.</p>	SMA	XCB
<p>Configuration Management (CM) Plan (AI1-SYS-CMP) The CM Plan is written by the MMO CM Manager in cooperation with the MMO Project Integration Manager. This is a unique document written to fulfill the Ares I-X mission. CxP practices should be used to the maximum extent possible, but tailored to meet the limited life of Ares I-X. Also, processes applied by the IPTs will be in compliance with the Ares I-X CM Plan, although broad discretion by the IPTs is permissible in developing IPT products. Note: MMO, SE&I, SMA, and the IPTs will use Windchill as the document repository.</p>	MMO	XCB
<p>Data Management (DM) Plan (AI1-SYS-DMP) The DM Plan is the responsibility of the Project Integration Manager. This is a unique document written to fulfill the Ares I-X mission. CxP practices should be used to the maximum</p>	MMO	XCB

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<p>extent possible, but tailored to meet the limited life of Ares I-X. Also, processes applied by the IPTs will be in compliance with the Ares I-X DM Plan, although broad discretion by the IPTs is permissible in developing IPT products. Note: MMO, SE&I, SMA, and the IPTs will use Windchill as the data repository.</p>		
<p>Risk Management (RM) Plan (AI1-SYS-RMP) The RM Plan is written by the MMO RM Management Officer in cooperation with the MMO Project Integration Manager. The RM Plan for Ares I-X will follow the CxP model in that Ares I-X risks will be reported to the Cx PM and the CxCB.</p>	MMO	XCB
<p>Integrated Master Schedule (IMS) The IMS will be developed by the Lead Scheduler in cooperation with the Project Integration Manager. The IMS is a tool used to support schedule planning and control. The Ares I-X IMS will be created at a low enough level of detail where the mission is informed of progress of major IPT and SE&I milestones and tasks. IPT's and SE&I will maintain their portion of the IMS and logically tie to the appropriate other IPT's portion of the IMS. The IMS will be baselined and controlled through the XCB. The schedule will be developed and maintained using Primavera.</p>	MMO	XCB
<p>Summary IMS The Summary IMS will be statused twice a month and electronically compared to the Baseline IMS. Variances between the Current and Baseline states will be identified in the Current IMS. Within the Baseline IMS there are a set Controlled Milestones. The Controlled Milestones are made up of major deliverables between IPT's and fall into three categories: ID&A Products, DFI, and Hardware. IPT's and SE&I will explain any variances to non-Controlled Milestones for slips more than two weeks. For Controlled Milestones, IPT's and SE&I will explain any slips. If the slip is not expected to be pulled back, it will be taken to the XCB under a Change Request (CR) for approval. If the CR is approved, the Baseline IMS will be updated with the new XCB approved date and reissued with a minor revision number change. The Baseline IMS will go to the XCB under a CR in two other circumstances: when there is a significant scope change or addition of scope to the IMS and when enough small changes to the IMS warrant a re-baselining. In the case of a complete re-baselining the Baseline IMS will be reissued with a major revision number change. The intention is to not re-baseline with every change. The Current IMS reflects the most recent information and status. It changes continually. The Baseline</p>	MMO	XCB

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<p>IMS changes in a very disciplined way via the XCB. In summary, there are three reasons to propose a revision to the Baseline IMS to the XCB: When a Controlled Milestone slips and cannot be recovered. When there is a major scope change to the mission or additional scope is added/removed from the IMS, or when the Baseline IMS and Current IMS have diverged to the point that warrants a complete re-baselining.</p>		
<p>IPT, SE&I, and SMA Detailed Schedules To support and track the progress of IPT, SE&I, and SMA products, detailed schedules are required. Schedules should be baselined. Variances should be tracked on an incremental basis. Schedules will be developed and maintained using Primavera.</p>	<p>IPTs, SE&I, and SMA</p>	<p>IPT, SE&I, and SMA Leads</p>
<p>Ares I-X Mission/Project Budget The mission budget is a tool used to support cost control. The budget is maintained by the MMO Business Manager. Input is provided by MMO, SE&I, SMA, and the IPTs. The Mission Manager is responsible for reviewing the budget and forming agreements with each spending organization. The budget is formulated and sent to CxCB for approval. Allocation within the mission is the sole discretion of the MM, but the total funding cap including reserves is the responsibility of the Cx PM.</p>	<p>MMO</p>	<p>CxCB</p>
<p>Systems Engineering Management Plan (SEMP) (AI1-SYS-SEMP) The SEMP is prepared by the SE&I Chief and the SE&I organization Leads (e.g. – LSE, Requirements Manager, Design Lead, Analysis Lead, Logistics, etc). The SEMP will follow the outline per NPR 7123.1A, NASA Systems Engineering Processes and Requirements. The SEMP provides the SE&I organization including working groups and interfaces. It defines the Systems Engineering Processes (SEP) including Design Analysis Cycles (DACs) to be implemented throughout the lifecycle of the mission. It also provides a list of expected technical analyses and reports (e.g. – Thermal Databook).</p>	<p>SE&I</p>	<p>XCB</p>
<p>FTV System Requirements Documents (SRD) (AI1-SYS-SRD) The FTV SRD defines the design characteristics, performance requirements, and other requirements (e.g. – workmanship) in which the FTV will be designed and built. The format and exact content for this document will be defined in the SEMP. Each requirement will have a corresponding verification method (i.e. – Test, Analysis,</p>	<p>SE&I</p>	<p>XCB</p>

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and/or Inspection). A separate verification requirement document will be written to specify what type of test, analysis and/or inspection to perform. The FTV SRD will also denote how each individual requirement will be allocated to the IPT elements. The primary parent documents are the FTP and SR&QA Requirements.		
<p>Ground SRD (AI1-SYS-GSRD)</p> <p>The Ground SRD defines the top ground operations requirements and ground systems for the mission. The format and exact content for this document will be defined in the SEMP. Each requirement will have a corresponding verification method (i.e. – Test, Analysis, and/or Inspection). A separate verification requirement document will be written to specify what type of test, analysis and/or inspection to perform. The Ground SRD will also denote how each individual requirement will be allocated to the IPT elements. The primary parent documents are the FTP and SR&QA Requirements.</p>	SE&I	XCB
<p>Interface Requirements Documents (IRDs)</p> <p>An IRD will be derived for all IPT interfaces (e.g. – Avionics to First Stage; First Stage to USS; First Stage to a ground system; etc.). The number of documents and exact content will be defined in the SEMP by SE&I. An IRD will also be derived for external interfaces such as telemetry requirements between the vehicle and TEL-4 and perhaps between the flight system and the range. Document titles other than IRD may be used as long as the intent to bind one or more parties to an agreement is forged.</p>	SE&I	XCB
<p>Interface Control Documents (ICDs)</p> <p>An ICD will be written for each IRD. SE&I has broad discretion to combine ICDs, IRDs, and other documents to define an interface and forge binding agreements between the interfacing parties.</p>	SE&I	XCB
<p>Element Requirements Documents (ERDs)</p> <p>ERDs will be derived based upon the SRDs and SR&QA Requirements document. The IPTs products will be designed, built, and verified against the requirements in the ERDs. All requirements allocated to the IPT elements will be accounted for by an appropriate ERD requirement. The ERDs are the documents that the IPT products will meet in order to deliver an acceptable product, therefore the XCB will review and approve every ERD to establish an agreement between the system and the system elements. Exceptions will be approved by the XCB. For example, the GS ERD may be combined with the Ground SRD.</p>	IPTs	XCB

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<p>Subsystem and Lower level Specifications and Documents Requirements that are derived from an ERD are subsystem and lower level specification documents. The intent of these documents is to decompose the system into levels that are easier to manage and design to. The IPTs are responsible for the subdivision and allocation of the ERD requirements. In some cases a prime contractor may also decompose the requirements levied on them into lower level specifications.</p>	IPTs	IPT Lead or as delegated or contracted
<p>Verification Requirements Document (SRD) (AI1-SYS-VRD) A system Verification Requirement Document (VRD) will be written to specify what type of test, analysis and/or inspection to perform for each system requirement in the FTV and Ground SRDs. Separate VRDs will also be written for the ERDs.</p>	SE&I	XCB
<p>Developmental Flight Instrumentation (DFI) Requirements (AI1-SYS-DFI) DFI requirements are derived from the Flight Test Objectives. These requirements will be used to select instrumentation such as accelerometers and temperature sensors to satisfy a DFI requirement. For example, a video camera may be selected to satisfy a DFI requirement such as 'monitor the separation event' that was derived from the flight test objective to separate First Stage from Upper Stage.</p>	SE&I	XCB
<p>Software Requirements Document (SWRD) Software requirements are derived from the control algorithms, health and monitoring, data collection, ground control and other needs. Software requirements will be formulated in accordance with the SR&QA requirements and FTV SRD.</p>	Avionics IPT	XCB
<p>Assembly, Integration, and Test Plan (AIT) (AI1-SYS-AIT) The AIT is comprised of three main parts: Assembly Sequence Roles and Responsibilities; Operational Test Requirements (OTR); and a reference copy of the Integrated Assembly Drawings. This document is the <i>master plan</i> for assembly of the FTV and integration with the ground systems. This document is key to defining the roles and responsibilities for who is doing what work and where. This document supports system verification via outlining tests that are needed to close system verification as well as define miscellaneous checkout tests. Note: work planned by the IPTs in preparing the IPTs products for integrated stacking is the responsibility of the IPTs in separate documents, although the AIT will reference these IPT plans and will</p>	SE&I	XCB

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clearly delineate who is responsible for pre-stack assembly such as DFI installation and miscellaneous IPT early part installation into another IPT product. The AIT coupled with the ILS Plan (AI1-SYS-ILS) and CoFTR Plans will enable a successful launch and then recovery of the First Stage and the Data Collection Unit.		
Integrated Logistics Support (ILS) Plan The ILS Plan is written to compliment the AIT Plan. Although logistics is limited for Ares I-X, there is still a need to plan for limited inventory, maintenance, and contingencies. The mission will plan for events that delay the launch as well as shipping, ground support equipment, resources, shift changes, etc.	SE&I	XCB
System Level Technical Plans and Databooks The SEMP will define technical plans such as EMI Control Plan, EEE Parts Plan, Material Processing, etc. to help meet the technical requirements levied on the system. Databooks and reports will provide the means to document results, conclusions, and recommendations of analyses and studies performed by SE&I.	SE&I	XCB
IPT and Lower Level Technical Plans and Databooks The IPTs are responsible for baselining any plan that is specific to IPT needs or if the system level plan is insufficient to support the IPT. IPTs are also responsible for documenting analyses, studies, and findings from IPT initiated efforts. Documents used to satisfy ERD or SRD requirements will be reviewed and approved by SE&I unless otherwise planned by SE&I.	IPTs	SE&I or as-delegated
Disposal Plans Disposal plans will define the transition of remaining hardware and software, and expected condition upon transfer. Plans will also describe what hardware is expended from the flight test.	IPTs	IPT Leads
Mission CoFTR Plan A Flight Test Readiness Review (FTRR) approach and an associated CoFTR Plan is provided in the FTP. A Mission CoFTR Plan will be derived from the FTP that further defines activities planned by Ares I-X to establish flight readiness.	MMO	CxCB
Launch Commit Criteria (LCC) To support the decision to launch a set of LCC will be prepared to inform the launch director. Safety and mission success will be the primary FOMs for selection of the LCC.	SE&I	XCB
Work Breakdown Structure (WBS) MMO will prepare a WBS that coincides with division of responsibility established by the FTP. The WBS is listed in	MMO	XCB

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the MIP. The WBS will be used to allocate funding and help track progress of mission development.		
<p>Technical Control Plan A Technical Control Plan will <u>not</u> be written for Ares I-X, but technical requirements, design, safety, certification, and flight readiness reviews, as listed herein, will be conducted to assess technical fidelity of the system. Technical Performance Measures (TPMs) as defined in the SEMP will be used to track and assess the progress of system development. Weekly reporting of issues and risks will be required by the IPTs, SE&I, and SMA. The Technical Authority via the Chief Engineer, CSO, and their teams will provide a continual independent assessment of technical progress. Ares I-X will also work with the organizations listed in Section 1.4.3.5, External Interfaces, to help answer questions and support review of documentation. Reviewers from CxP SE&I, APO, and others will be assigned to Ares I-X to provide an external review of all of the technical documents. Other organizations such as SSP will be consulted should questions or issues arise concerning SSP derived hardware.</p>	n.a.	n.a.
<p>Schedule and Cost Control Plan IPM techniques will be employed to support programmatic control. The IMS will be used as the primary tool to evaluate schedule progress. Cost to budget variances will be tracked by the Business Manager and reported to the Mission Manager. See paragraph 1.3 for additional information.</p>	MMO	XCB
<p>Technology Development Plan New technology development is not planned for Ares I-X. The only identified technology effort is for the parachutes being developed by the APO First Stage Office. The FTP requires the use of the highest fidelity Ares chutes available. Should Ares chutes not be available the off-ramp is Shuttle chutes. Should a need for new technology be identified, the MM will brief the impact to the Cx PM.</p>	n.a.	n.a.
<p>Acquisition Plans Acquisition of material and resources will primarily be performed by the IPTs. The IPTs will follow their center and home organization processes to procure parts and services. MMO, SE&I, and SMA will use existing support contract mechanisms to staff their teams as required. In the event a new procurement is required, MMO will assess the impact and brief the Cx PM. See Section 3.4 for a summary of the acquisition approach.</p>	All Orgs.	Home Organizations
Software Management Plan	Avionics	Avionics

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A Software Management Plan will be prepared by the Avionics IPT via its engineering team or contractor. The plan will reflect the software requirements and SR&QA requirements. It will also reflect the division of responsibility for software to be generated by the GO/GS IPTs.	IPT	Manager
System Level Review Plans (SRR, PDR, etc.) For all system level reviews identified by the MIP and the SEMP, the SE&I Chief will prepare a review plan or equivalent (e.g. – Terms of Reference) per the Designated Government Authority's (DGA) NASA center requirements per NPR 7123.1A. The plans will at a minimum define entrance criteria, success criteria, board members by function, the review process, and the documentation to be reviewed.	SE&I	XCB
IPT Level Review Plans For all IPT Level reviews identified by the MIP and the IPTs, the IPT managers will prepare a review plan or equivalent (e.g. – Terms of Reference) per Designated Government Authority's (DGA) NASA center requirements per NPR 7123.1A. The plans will at a minimum define entrance criteria, success criteria, board members by function, the review process, and the documentation to be reviewed.	IPTs	IPT Leads and CE or LE
Post Flight Data Analysis Plan (A11-SYS-DAP) The purpose of the DAP is to define the processes for gathering, archiving and disseminating the Ares I-X post flight data that will be used to perform post flight data analysis. The plan also defines the data required to validate each one of the primary and secondary objectives. In addition, the plan will define the analysis required for those objectives whose validation does not involve telemetry and video.	SE&I	XCB
Mission/Launch Operations Plan Based on the OTR in the AIT a corresponding plan will be written.	GO IPT	XCB
Environmental Management Plan (EMP) Ares I-X will <u>not</u> write a stand alone EMP. The plan written by CxP will encompass Ares I-X.	CxP	CxCB
Security Plan Ares I-X will operate and abide by established CxP, NASA, and home organization security plans.	CxP and Centers	CxCB & Center Directors
Export Control Plan Ares I-X will operate and abide by established CxP, NASA, and home organization export plans including Information Technology (IT) rules and regulations. For example, MSFC team members will adhere to MPR 2190.1, MSFC Export Control Program.	CxP and Centers	CxCB and Center Directors

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TABLE 3-1 MISSION AND MISSION CONTROL DOCUMENTATION

3.1 TECHNICAL, SCHEDULE, AND COST CONTROL PLAN

See Table 3-1, Mission and Mission Control Documentation.

3.2 SAFETY AND MISSION ASSURANCE PLAN

See Table 3-1, Mission and Mission Control Documentation, SR&QA Requirements and SR&QA Plan.

3.3 RISK MANAGEMENT PLAN

See Table 3-1, Mission and Mission Control Documentation, Risk Management Plan.

3.4 ACQUISITION PLAN

The acquisition of IPT hardware and software will be performed independently by each IPT. The First Stage IPT will obtain products and services from prime contractor ATK via the Ares Project Office First Stage contract with ATK. The Avionics IPT will obtain products and services from Lockheed Martin via a competitively bid process through MSFC prime contractor Jacobs. The RoCS IPT will provide products and services from prime contractor Teledyne Brown through MSFC's technical services contract. The USS, CM/LAS, and GS IPTs will obtain parts and services from suppliers on an as needed basis via GSA or other appropriate procurement options. The GO IPT will obtain services for ground operations from prime contractor USA via the KSC SPOC contract. Each IPT is responsible for documenting acquisition plans and results, and managing these contracts in cooperation with the Government Contracts Officer.

See also Table 3-1, Mission and Mission Control Documentation, Acquisition Plans.

3.5 TECHNOLOGY DEVELOPMENT PLAN

See Table 3-1, Mission and Mission Control Documentation, Technology Development Plan.

3.6 SYSTEMS ENGINEERING MANAGEMENT PLAN (SEMP)

See Table 3-1, Mission and Mission Control Documentation, SEMP.

3.7 SOFTWARE MANAGEMENT PLAN

See Table 3-1, Mission and Mission Control Documentation, Software Requirements Document and Software Management Plan.

3.8 REVIEW PLAN

See Table 3-1, Mission and Mission Control Documentation, System Level Review Plans, and IPT Level Review Plans.

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3.9 MISSION OPERATIONS PLAN

See Table 3-1, Mission and Mission Control Documentation, Mission/Launch Operations Plan.

3.10 ENVIRONMENTAL MANAGEMENT PLAN

See Table 3-1, Mission and Mission Control Documentation, Environmental Management Plan (EMP).

3.11 LOGISTICS PLAN

See Table 3-1, Mission and Mission Control Documentation, Assembly, Integration, and Test Plan (AIT).

3.12 SCIENCE DATA MANAGEMENT PLAN

A Science Data Management Plan is not applicable.

3.13 INFORMATION AND CONFIGURATION MANAGEMENT PLAN

See Table 3-1, Mission and Mission Control Documentation, CM Plan and DM Plan.

3.14 SECURITY PLAN

See Table 3-1, Mission and Mission Control Documentation, Security Plan.

3.15 EXPORT CONTROL PLAN

See Table 3-1, Mission and Mission Control Documentation, Export Control.

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APPENDIX A ACRONYMS AND ABBREVIATIONS AND GLOSSARY OF TERMS

ACWP	Actual Costs Work Performed
AFSCM	Air Force Systems Command Manuals
AIT	Assembly, Integration, and Test
APO	Ares Project Office
ASOC	Atlas Space Operations Center
ATVC	Avionics Thrust Vector Control
BCWP	Budgeted Cost Work Performed
BCWS	Budgeted Cost Work Scheduled
BOE	Basis of Estimate
CCC	Command, Control, & Communications
CDR	Critical Design Review
CE	Chief Engineer
CIL	Critical Item List
CLV	Crew Launch Vehicle
CM	Crew Module
CM	Configuration Management
CM/LAS	Crew Module/Launch Abort System
CoFTR	Certificate of Flight Test Readiness
CPR	Cost Performance Reports
CR	Change Request
CRM	Continuous Risk Management
CSERP	Constellation Safety and Engineering Review Panel
CSO	Chief Safety Officer
CSR	Constellation Program Safety Review Panel
Cx	Constellation
CxCB	Constellation Control Board
CxP	Constellation Program
CxSECB	Constellation Systems Engineering Control Board
DAC	Design Analysis Cycle
DCR	Design Certification Review
DDT&E	Design, Development, Test, and Evaluation
DFI	Developmental Flight Instrumentation
DGA	Designated Government Authority
DM	Data Management

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EGSE	Electrical Ground Support Equipment
EIS	Environmental Impact Statement
EMP	Environmental Management Plan
ESS	Executive Summary Schedule
ESTS	Engineering Support and Technical Services
FAR	Federal Acquisition Regulation
FMEA	Failure Mode and Effects Analysis
FOM	Figures of Merit
FSAM	First Stage Avionics Module
FTP	Flight Test Plan
FTRR	Flight Test Readiness Review
FTS	Flight Termination System
FTV	Flight Test Vehicle
EEE	Electronic, Electrical, and Electromagnetic
EMI	Electromagnetic Interference
ERD	Element Requirements Document
EVM	Earned Value Management
FTE	Full Time Equivalent
GC3	Ground Command, Control and Communications
GCE	Ground Chief Engineer
GCEL	Ground Control Experimental Laboratory
GCS	Ground Control Systems
GFE	Government Furnished Equipment
GN&C	Guidance, Navigation, and Control
GO	Ground Operations
GRC	Glenn Research Center
GS	Ground Systems
GSE	Ground Support Equipment
HMF	Hypergolic Maintenance Facility
HWL	Hardware in the Loop
ICD	Interface Control Document
IDA	Integrated Design and Analysis
IDOS	Integrated Development and Operations System
IFTS	Integrated Flight Test Strategy
ILS	Integrated Logistics Support
IMS	Integrated Master Schedule
IPM	Integrated Project Management

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IPT	Integrated Product Team
IRD	Interface Requirements Document
IS	Information Security
IT	Information Technology
JDMTA	Jonathan Dickinson Missile Tracking Annex
JSC	Johnson Space Center
KSC	Kennedy Space Center
LaRC	Langley Research Center
LAS	Launch Abort System
LC	Launch Complex
LC39B	Launch Complex 39B
LCC	Launch Commit Criteria
LCSRSP	Launch Constellation Range Safety Panel
LDE	Lead Discipline Engineer
LE	Lead Engineer
LSC	Linear Shape Charge
LSE	Lead Systems Engineer
Max Q	Maximum Dynamic Pressure
MCC	Mission Control Center
MIP	Mission Implementation Plan
MLP	Mobile Launch Platform
MM	Mission Manager
MOD	Mission Operations Directorate
MMO	Mission Management Office
MPR	Monthly Progress Report
MSFC	Marshall Space Flight Center
MVP	Master Verification Plan
NASA	National Aeronautics and Space Administration
NISN	NASA Integrated Services Network
NPR	NASA Procedural Requirement
O&M	Operations and Maintenance
OCE	Office of the Chief Engineer
OFI	Operational Flight Instrumentation
OIO	Operation Integration Office
OTR	Operations Test Requirement
PBM	Performance Measurement Baseline
PDR	Preliminary Design Review

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PM	Project Management
POC	Point of Contact
POP	Program Operating Plan
PP&C	Program Planning and Control
PRACA	Problem Reporting and Corrective Action
R&R	Roles and Responsibilities
RM	Risk Management
RoCS	Roll Control System
RPSF	Rotation Processing and Surge Facility
RSRM	Reusable Solid Rocket Motor
SA	Spacecraft Adapter
SAP	System Application and Product
SDP	Safety Data Package
SE&I	Systems Engineering and Integration
SECB	Systems Engineering Change Board
SEMP	System Engineering Management Plan
SEP	System Engineering Process
SERF	Systems Engineering Review Forum
SIL	Systems Integration Laboratory
SM	Service Module
SMA	Safety and Mission Assurance
SMSR	Safety and Mission Success Review
SPOC	Shuttle Payload Operations Contractor
SR&QA	Safety, Reliability and Quality Assurance
SRD	Systems Requirements Document
SRM	Solid Rocket Motor
SRR	Systems Requirements Review
SSP	Space Shuttle Program
SWRD	Software Requirements Document
T&E	Test and Evaluation
TA	Technical Authority
TBD	To Be Determined
TBR	To Be Resolved
TPM	Technical Performance Measurement
TVC	Thrust Vector Control
USAF	United States Air Force
US	Upper Stage

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USS	Upper Stage Simulator
VAB	Vehicle Assembly Building
VCE	Vehicle Chief Engineer
VI	Vehicle Integration
WBS	Work Breakdown Structure
WSTF	White Sands Test Facility
WYE	Work Year Equivalent
XCB	Ares I-X Control Board

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APPENDIX B WBS DICTIONARY

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10 Project Planning and Control (Mission Management Office)

10-10 and 11 Task (Mission) Management

The Mission Management Office (MMO) is responsible for planning, organizing, leading, and controlling the activities and processes used to develop and delivery the products and services identified in the Mission Implementation Plan (MIP). MMO roles include a Mission Manager (MM), deputies, Systems Engineering and Integration (SE&I) representative, business manager, project integrator, scheduler, risk manager, configuration manager, data manager, support staff, and technical advisors. Mission management encompasses the typical project management type duties described in NPR 7120.5D, NASA Program and Project Management Processes and Requirements.

The governing document for Ares I-X is CxP 70127, CxP Ares I-X Flight Test Plan. The MM is responsible for ensuring that all participants have the necessary information, resources, and budget to perform the activities identified in the WBS. The MM will enable and facilitate communication within the organization and ensure that technical issues are coordinated with the Ares I-X Chief Engineer and SMA Chief. The MM will allocate responsibilities, resources, and budget to the Integrated Product Teams (IPTs) and enable the SE&I team to lead and perform all system integration activities.

A deputy MM will be appointed from MSFC. Personnel and resources from MSFC will also be required to assist the MM and deputy MMs to develop and maintain programmatic documentation such as status reports, plans, schedules, EVM, and special studies. MSFC personnel assigned to support the MMO will serve an important role in maintaining effective communications with MSFC Ares Project Office.

A deputy MM will be appointed from KSC. Personnel and resources from KSC will also be required to assist the MM and deputy MMs to develop and maintain programmatic documentation such as status reports, plans, schedules, EVM, and special studies. MSFC personnel assigned to support the MMO will serve an important role in maintaining communications with KSC and CxP ground and launch operations.

10-20 Business Management

Business management is the management of mission budget and schedule management is the management of the baselined Integrated Master Schedule (IMS). The budget and planned schedule will be used in conjunction with actual data that is collected on a routine basis to monitor the performance of the task.

The business office is responsible for collecting and integrating a task budget. The budget will be supported by a detailed cost estimate and a Basis of Estimate

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(BOE). The budget will be reviewed and submitted to the Cx Control Board (CxCB) for approval. The budget will be reviewed at least annually and during the Program Operating Plan (POP) cycle.

The budget and the schedule will be used as inputs for determining the Earned Value Management (EVM) Performance Measurement Baseline (PMB). The business office will perform a monthly EVM analysis of actual performance compared to the PMB. The business office is also responsible for the generation of performance and status reports as required by the MM.

The IMS will provide sufficient fidelity to assess the critical path, quantify slack, and perform uncertainty analysis. EVM analyses will be performed using Primavera Project Management and Cost Manager. The budget will also be captured and maintained using Primavera Cost Manager.

10-30 Risk Management

Risk management (RM) is the responsibility of the MM. Day to day RM will be the responsibility of the Project Integrator and the Risk Manager. Risk management will be performed in accordance with the Ares I-X RM Plan.

The Risk Manager is responsible for implementation of the RM Plan. Top risks will be reviewed weekly and status provided to the MM. Mitigation activities will be determined on a case by case basis per the guidelines in the RM plan. Mitigation plans that are not within the scope of the Ares I-X budget will be presented to the XCB prior to expending any resources for mitigation activities.

10-40 Configuration and Data Management

Configuration Management (CM) and Data Management (DM) will be performed per the Ares I-X CM and DM Plans, respectively. Tracking and archiving will be defined in the plans. Ares I-X will use Windchill as the electronic repository. All design drawings, baseline documents, and software will be placed under control. Design documents, software, and other controllable documents produced by contractors will be placed under configuration status. Data produced by the flight test is the responsibility of DM.

A CM manager will be responsible for implementing the CM Plan and a DM manager will be responsible for implementing the DM Plan. The CM manager is also responsible for supporting all task reviews such as the Systems Requirements Review (SRR), Critical Design Review (CDR), and other reviews listed in the MIP. Secretariat functions for reviews and MMO control board meeting support will be performed by CM personnel.

10-50 Special Studies

Special studies and systems analyses are tasks (i.e. – problem definition, alternative solution identification, research, modeling, analysis, and recommendations) performed in response to a mission threat. Should a threat be identified the MM will authorize the execution of the study. Each alternative will be properly assessed. After a thorough assessment of the threat the results of the assessments will be evaluated and a recommendation will be prepared for

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the MM. A study that is out of scope will be approved by the MM prior to beginning the study.

20 Flight Test Vehicle (and systems engineering) Integration (SE&I)

Ares I-X will perform SE&I activities to develop the flight test systems and support the flight test activities. Systems engineering will define the Systems Engineering Processes (SEP) to be applied throughout the life cycle of the mission. The planning for SE&I will be documented in a Systems Engineering Management Plan (SEMP). SE&I functions include development of the FTV and ground systems requirements and verification of these requirements; design of the integrated FTV and overall system architecture; generation of interface requirements and control documents; perform systems analyses and analytical assessments; develop plans and procedures for physical assembly, integration, and operation of the system; and supporting operations and logistics activities.

20-01 (SE&I) Project Planning and Control

Perform PP&C for SE&I budgeted.

20-03 (SE&I) Risk Management

Perform CRM for SE&I.

20-04 (SE&I) Configuration and Data Management

Perform CM/DM for SE&I developed drawings and models.

20-10 and 18 Systems Requirements and Verification

A pair of Systems Requirements Documents (SRD) will be derived for the FTV and the ground segment. SE&I requirements activities also includes preparation of Interface Requirements Documents (IRDs) and/or Interface Control Documents (ICDs). IRDs/ICDs will be used to support assembly of the FTV elements and for integration of the FTV with the ground segment and other external entities. The system requirements and interface requirements will be verified per approved verification requirements in accordance with a SE&I developed Master Verification Plan (MVP). Requirements generation will be based on the requirements analysis process (i.e. – derivation of system requirements based on customer needs, concept of operations, and functional decomposition) which includes allocation of requirements to the IPTs and ensuring that allocated requirements are met.

20-20 Integrated Design and Analysis (IDA)

The integrated system is comprised of FTV elements, ground systems, and associated ground operations. SE&I is responsible for the design of the integrated FTV and for the integration of the FTV with ground systems such as the launch pad. Design encompasses analytical analyses, interface definition and control, mass properties analysis and management, design trades, and development testing as required. Analytical analysis for mechanical systems includes but is not limited to thermal, aerothermal, aerodynamic, static, dynamic, and vibro-acoustics. Interface definition and control includes development of physical interfaces including selection and/or approving the hardware, pyro

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systems, and breakaways used between the elements, the separation planes, and external systems.

20-30 and 31 Vehicle (and system) Integration and Operations

Integration and operations is the SE&I role in planning the assembly of the integrated FTV and the integrated system. It includes integration with external systems, logistics, maintainability, and supporting verification activities. Integration and operations plans will be documented in the Assembly, Integration, and Test (AIT) Plan and the Integrated Logistics (ILS) Plan.

20-40 Avionics Integration and Operations

This WBS element documents the integration of the avionics into the flight test vehicle including test and checkout.

20-50 Integration and Control

Integration and control encompasses the management efforts associated with the Design, Development, Test, and Evaluation (DDT&E) of the FTV and flight system including management of interfaces and the vehicle's environment. Integration and control also includes management of vehicle integration functions, integrated system risk management, configuration management of vehicle integration products, identification and proper use of technology and information, systems engineering working groups, and systems management.

Systems management includes cooperation with MMO and coordination with the technical authority via the Chief Engineers and SMA, preparation and implementation of major milestone reviews, identification and reporting of Technical Performance Measures (TPMs), and communication of system details with team members and stakeholders. The processes followed for integration and control will be defined in the SEMP.

Integration and system test includes planning for verification and checkout tests of the FTV and the entire flight system per the system requirements. Integration ensures that element test activities that are conducting during system integration and/or in support of system integration are properly planned and implemented including test readiness reviews. Integration and system test plans will be documented in the AIT Plan and ILS Plan.

30 and 40 Safety and Mission Assurance (SMA)

Safety and Mission Assurance (SMA) activities are defined by the SR&QA Requirements and SR&QA Plan. A summary of SMA activities includes, but is not limited to, is safety, quality assurance, reliability, and maintainability. A special task of SMA is to coordinate and participate with other organizations in understanding and ensuring that the range requirements are clearly understood and implemented.

50 SE&I/Vehicle Integration Support

Personal from the MSFC engineering directorate will support SE&I. They will also provide assistance to the Chief Engineer for the Flight Test Vehicle (FTV). Support will be provided on an as needed basis to perform analyses, review

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documentation, serve as subject matter experts, and support operations. A cadre of engineers from MSFC will be matrixed to Ares I-X. They will serve as liaisons and work real time engineering problems to assist in the development of the FTV and help ensure that Ares I-X models are sufficient to satisfy Ares needs per the flight test objectives.

Personal from the KSC engineering and operations will support SE&I. They will also provide assistance to the Chief Engineer for Ground Operations (GO). Support will be provided on an as needed basis to perform analyses, review documentation, serve as subject matter experts, and support development of the ground systems. A cadre of engineers from KSC will be matrixed to Ares I-X. They will serve as liaisons and work real time engineering problems to assist Ares I-X in development of it's GO and ground systems, and help ensure that I-X models are sufficient to satisfy CxP GO needs per the flight test objectives.

60 Payload Management

Payloads developers that have an interest in being manifested on the Ares I-X FTV will submit a proposal in response to a call that will be sent out by Ames Research Center. The payload will be self-sufficient and only require a bolt pattern as a physical interface. No additional resources will be expended for the payloads. Payload will be ready to fly when delivered to KSC for integration. Interface definition and payload characteristics such as bolt pattern, mass properties, and other requirements will be provided by the payload developer per the manifest agreement so that the vehicle integrator and the affected vehicle elements can accommodate the payload's needs.

The MMO staff will develop the Payload Manifest Agreement. Every effort will be done to accommodate all payloads on a noninterference bases only. Bandwidth is limited on Ares I-X, therefore payload data streams cannot be in competition with the required Ares I-X test data requirements. All payload allocations are subject to being overridden by the required Ares I-X test data. The MM in cooperation with the Cx PM will approve and prioritize the selection of payloads based on feasibility and cost.

70 Flight Test Activities

A flight test activity is an activity other than development of the flight test systems that will be conducted to enable the flight test. This includes designing the flight test trajectory, supporting day-of-flight operations, training for the mission, and post flight operations. The MMO will identify and implement the execution of all flight test activities defined in this WBS.

A flight test activity is any Ares I-1 activity that will be conducted to enable the flight test not including developing the FTV. Supporting the development of flight test objectives, concept of operations, flight and trajectory design, day-of-flight operations, training, and post flight operations is an example of flight test activities. The project/task office in cooperation with SE&I is responsible for accomplishing these activities. Ares I-1 is a developmental flight test that will consider all aspects of the test from test planning, to test article acquisition, to

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day-of-flight, and post flight operations. This section of the WBS dictionary is dedicated to defining all flight test activities other than the development of the FTV.

70-10 Pre-Flight Test Activities

Pre-flight test activities include supporting the development of the flight test objectives and concept of operations. The major task is identifying the developmental flight instrumentation (DFI) requirements based on the flight test objectives. DFI requirements development is included in this section of the WBS, called flight activities, because the process of deciding what measurements are needed is directed related to the flight test objectives and not the FTV design. The actual instrumentation is part of the FTV design, but DFI is an extension of the flight test objectives. Other pre-flight activities include flight design consisting of the ascent trajectory and lift-off time and launch window analysis. Also, telemetry planning, telemetry requirements, training, simulations in support of the mission, certificate of flight readiness preparation support, coordination with the launch service provider, coordination with the range, and day of flight operations support. Day of flight operations support includes console staffing and engineering on call. Any last day(s) activities support for propellant loading and checkout is also included in pre-flight operations.

SE&I is solely responsible for all pre-flight activities noted above.

The MSFC MMO office is responsible for coordinating with CxP to filter requests down to SE&I for action. MMO will also support SE&I as required to gather information and respond to the actions. MSFC operations is responsible for engineering flight support room.

70-20 Post-flight Test Integration

Post-flight test integration includes securing the data from both telemetry and the data recorder sources, and delivering the data to CxP and CLV for post flight analysis. Final reports are required including a lessons learned section.

SE&I will provide the resources that enable and secure all flight test data that is collected, recovered, and delivered. SE&I will provide a method to account for the data collected and verification that it was generated and collected as planned. In the event of an anomaly, this team will perform an investigation and document all findings.

The MSFC SE&I and operations teams will assist SE&I in securing, delivering and analyzing the data collected. MSFC operations will provide provisions at MSFC for collecting, securing, and distributing flight test data.

70-30 Physical Recovery of Assets

Physical recovery of the assets includes all activities necessary for planning, procedure development, training, practice, and the actual recovery of the recoverable components of the Booster/First Stage from the Atlantic Ocean. This task also encompasses the collection of data and information from Shuttle, including participation in current Shuttle recovery operations as required in

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support of Ares I-1 planning, and determining if dredging or other needs and services are required.

The asset recovery prime contractor is responsible for the actual physical recovery of the assets. This includes supporting the government in planning, training, and day of launch/recovery operations. Day of launch/recovery services include activities from pre-launch preparation, launch, securing the assets in the ocean, towing the assets to KSC, lifting the assets ashore, and transporting the assets to a storage facility where the data recorder is extracted from the SE&I compartment, and then delivered to the systems analysts for evaluation.

The MSFC First Stage office is responsible for planning and managing the recovery task. This team will procure support from an asset recovery prime and control cost, schedule, and resources in accord with Ares I-1 requirements. This team will also coordinate with KSC to make arrangements for the recovery operations. In addition, the MSFC team will determine the feasibility of recovering the Booster/First Stage with existing assets and procedures, and identifying any changes and other needs to ensure that recovery is successful.

80-10 First Stage

The First Stage is one of five elements of the FTV. The First Stage is the booster rocket for the FTV. The First Stage utilizes a Space Shuttle 4-segment Solid Rocket Motor (SRM) per the FTP. The First Stage IPT is responsible for the DDT&E activities to deliver a First Stage element that meets the First Stage Element Requirements Document (ERD).

80-10-10 IPT (First Stage) Management and Engineering

The NASA Government First Stage IPT Office located at MSFC is responsible for managing the DDT&E of the Ares I-X First Stage. The Government First Stage IPT Office will ensure that the hardware delivered from the First Stage Prime Contractor meets the First Stage requirements and can be integrated into the FTV stack and prepared for launch. Government management and engineering includes overseeing activities of the First Stage prime contractor, control of the First Stage DDT&E budget, planning and tracking of the First Stage schedule, approval of the element requirements, approval of all interface requirements, and review of all contractor documentation. Government activities also include conducting and/or supporting reviews, coordination with SE&I and the IPTs, supporting integration, and supporting MMO by managing risk, reviewing changes, participating in technical interchanges and MMO led studies, and serving on the XCB.

The Government will support the Prime Contractor by providing technical expertise to understand and solve complex engineering problems. Engineering collaboration between the Government and Prime Contractor will be conducted as planned and as required to meet the technical and programmatic requirements. The Government is responsible for coordinating between all participants in the DDT&E of the First Stage. Specifically, the Government is charged with coordinating with KSC to ensure all facilities and resources are

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available and adequate to meet the mission of First Stage. The Government will support and approve of all DFI and it's installation on the First Stage. Although SE&I is responsible for the Ares I-X system requirements, the First Stage should be an active participant in defining system requirements that affect First Stage. The Government First Stage Office will provide status to the Ares First Stage Office and ensure that all information between Ares and Ares I-X First Stage is communicated and recorded. The Government First Stage IPT Office should generate a Task Plan to document how the IPT plans to meets it's requirements.

Management by the Government also includes providing status reports as required to the MM. The First Stage IPT will also perform risk management and coordinate all risk management activities with the MMO risk manager. Reporting on cost and schedule will be to the level as agreed with MMO. Review plans will be written for all technical reviews such as PDR and CDR and provided to the XCB for review.

80-10-20 Flight Test Vehicle First Stage Prime (Contractor)

The First Stage Prime Contractor is responsible for meeting the contract requirements by providing products and services that enable the DDT&E of the First Stage. General expectations from the Prime Contractor include delivering products per approved requirements, specifications, processes, and procedures. The Prime Contractor should in good faith provide all necessary data and information to meet the objectives of the flight test. The Prime Contractor should set itself apart from the development of the Ares First Stage, but should be informed of changes to the Ares First Stage that affect Ares I-X. The Prime Contractor should comply with all insight/oversight responsibilities defined in its contract and ensure that all required reports meet content and format.

80-20 Upper Stage Simulator (USS)

The USS is one of the five elements that comprises an integrated FTV. The USS is composed of a model of the Ares Upper Stage (US), a model of the Orion Service Module (SM), a Spacecraft Adapter (SA) that attaches the SM to the US, and an Interstage that is used to mate with the First Stage. The USS will not include a model of the US engine.

Final assembly of the USS and integration with the FTV will be at KSC. The USS will also accommodate mounting of the RoCS, DFI, and select avionics. Other products and services include a pathfinder of the USS, analytical integration support, and physical integration support. Integration includes internal integration with USS subsystems and external integration with subsystems and components mounted to the USS as well as interface management between the First Stage and CM/LAS Simulator.

80-20-10 IPT (USS) Management

Management of the USS DDT&E and integration work is the responsibility of the USS IPT Manager. The task includes the definition, estimating, baselining, integration, tracking, reporting, auditing, measurement, closure, and management of IPT tasks. The USS IPT manager should generate a Task Plan

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to document how the IPT plans to meet its requirements. Management of the task also includes generating an IMS for the USS, organizational management, product delivery, report generation, coordination of USS reviews. USS will provide tracking and analysis of budget vs. actual cost, planned schedule vs. actual schedule, risk management, CM management, DM management, status reporting, and support of MMO special studies.

80-20-20 (USS) SE&I

SE&I for USS will include requirements development, DDT&E, and support of system integration activities. The USS SE&I SEP will enable the delivery of a qualified USS element. The USS SE&I approach should be documented in a SEMP. SE&I is responsible for coordination with USS subsystem organizations and other IPTs to ensure USS element design and manufacturing schedules are compatible with Ares I-X assembly and test schedules. SE&I will also ensure that all design features needed to interface with the launch and test facilities are incorporated into the design.

USS is responsible for preparing an ERD based on the Ares I-X system requirements allocated to the USS. SE&I will generate verification requirements and support the implementation of verification effort. SE&I will support the definition of interfaces, and plan for and facilitate the integration of the USS with the FTV.

80-20-30 (USS) Safety and Mission Assurance (SMA)

SMA support for USS simulator development encompasses the element's entire life cycle from requirements development to disposal. SMA will generate a Product or Mission Assurance Plan to document how the USS SMA team will meet the Ares I-X SR&QA requirements allocated to the USS IPT. SMA support includes analyzing the USS design for safety hazards. SMA will prepare ground and flight Safety Data Packages (SDP) to support the integrated safety analysis. Other support activities include participating in design reviews, providing fabrication insight, testing insight, CIL development, hazard report development, problem reporting, quality assurance, and other responsibilities as delegated by the Ares I-X SMA Chief.

80-20-40 (USS) Engineering Design and Analysis

USS engineering design and analysis captures all activities to transform USS requirements into a flight qualified design. Design is complimented by analytical assessments, systems analyses, and trade studies. Specific analyses include structural analysis and thermal analysis where structural analysis includes development of the coupled loads model. Other design tasks include managing mass properties and sustaining engineering during fabrication, assembly, and test. The design and analysis team members will work closely with SE&I and the other IPTs to ensure integration and compliance of all required design features.

80-20-41 (USS) Interstage Design, and Analysis

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This Interstage is one of the major segments of the USS. It is used to mate the USS to the First Stage and the RoCS. In addition, this WBS element captures preliminary design work to support the severance system.

80-20-42 (USS) Fabrication, Assembly, and Integration

The USS design will be transformed into hardware via the fabrication, assembly, and integration steps. Parts will be fabricated and procured and then assembled into assemblies that can be shipped to the integration site. Final assembly will be completed upon integration of the USS with the FTV including attachment of DFI. The USS IPT will develop manufacturing plans including prototyping parts and assemblies as required.

80-20-43 (USS) Separation System Procurement, Fabrication and Integration

This WBS element captures concept and preliminary design work to design and develop the separation system in order to separate the First Stage from the USS during flight. The work performed by the Severance System prime contractor is tracked by this WBS element.

80-20-50 (USS) Ground Systems Process

The USS IPT will prepare the ground facilities and processes in order to perform procurement, fabrication, assembly, and integration of the USS. This includes facility preparation, transportation development, equipment purchases, and training. This task includes development of all GSE required to support procurement, fabrication, assembly, and integration of the USS.

80-20-60 (USS) Transportation and Logistics

The USS IPT will provide transportation plans and transportation mechanisms to move the USS assemblies from location to location for assemble and integration. This task includes design of the transportation mechanisms, testing, and demonstration. Transportation operations is also included as part of this WBS element.

80-20-70 System Test and Integration

The USS requirements will be verified per the verification requirements which include testing. Integration includes integration of other IPT parts into the USS. Integration also includes integration of the USS into the FTV by attaching to the First Stage and the CM/LAS. System tests will be performed for qualification, acceptance, and checkout of the USS per the requirements.

80-20-80 Launch Processing at KSC

This WBS element consists of integration at the launch site after turnover. This includes stacking, roll out, launch pad operations, final checkouts, mission operations, and post flight operations.

80-30 CM/LAS Simulator

The CM/LAS Simulator is one of five elements of the Ares I-X FTV. The CM/LAS is a physical model of the Orion CM and LAS. The model will be designed based on requirements allocated and derived from the Ares I-X FTV system

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requirements. The CM/LAS Simulator will be transported to the launch site for integration into the integrated FTV.

80-30-10 (CM/LAS) Procurement

CM/LAS procurements comprise the acquisition of material and resources for design, fabrication, and assembly of CM/LAS.

80-30-20 (CM/LAS) IPT Management

The CM/LAS IPT Manager is responsible for planning, organizing, and control of the activities to develop and deliver CM/LAS products. The CM/LAS IPT Office should generate a Task Plan to document how the IPT plans to meet its requirements. Management tasks include tracking and analyzing the budget vs. actual costs and evaluating planned schedule vs. actual schedule. Other activities include risk management, CM management, reviews, status reporting, and support of MMO special studies and programmatic planning activities.

80-30-30 (CM/LAS) SE&I

Systems engineering and integration (SE&I) for CM/LAS includes requirements development, design, analysis, verification, analytical assessments, and physical integration. Sustaining engineering and manufacturing support will be provided during production, shipping, verification, and physical integration. Analytical integration will include interface management through technical interchange meetings, ICDs, and coordination with SE&I.

SE&I will develop element requirements based on requirements allocated from the FTV SRD. The design will be based on concepts formulated from the element requirements. Integration will be coordinated with Ares I-X SE&I.

80-30-40 (CM/LAS) Manufacturing and Assembly

The CM/LAS will be manufactured and assembled per engineering drawings. Qualification, acceptance, and checkout tests will be performed to verify conformity to the requirements.

80-30-50 (CM/LAS) Test and Verification

This WBS element captures the activities to perform verification activities such as test and analysis. Verification also including generating verification requirements based on the CM/LAS element requirements and tracking completion of verification steps and activities. Verification data will be used to support design certification and system acceptance.

80-30-60 (CM/LAS) Super Stack

The CM/LAS is a large structure that will be assembled during processes. The operations to complete stacking at the manufacturing site and at KSC are part of this WBS element.

80-30-60 (CM/LAS) Launch Processing at KSC

This WBS element consists of integration at the launch site after turnover. Launch site activities include stacking, rollout, launch pad operations, final checkouts, mission operations, and post flight operations.

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80-30-80 (CM/LAS) Logistics

This WBS element captures the logistics of handling, packing and shipping.

80-40 Roll Control System (RoCS)

The Roll Control System (RoCS) for the Ares I-X FTV is a propulsion system with multiple low force thrusters and propellant supply that are housed in the USS. RoCS is one of five elements of the FTV. The hardware and software for control of the RoCS is provided by the Avionics IPT and integrated by Ares I-X SE&I. RoCS is required to control the roll of the FTV during flight and help provide data to satisfy the primary flight test objective for quantifying roll torque.

80-40-10 (RoCS) Management and Engineering Support

NASA is responsible for managing the task of transforming RoCS requirements into a deliverable roll control system. The RoCS IPT management team will provide insight/oversight of the RoCS Prime Contractors to ensure design, development, test, evaluation, shipping, integration, and testing. The RoCS IPT manager is responsible for planning, organizing, and control of the activities to develop and deliver RoCS products. The RoCS IPT Office should generate a Task Plan to document how the IPT plans to meet its requirements. Insight and oversight activities include assessment of the contractor's budget to actual cost, assessment of the contractor's planned schedule to the actual schedule, approval of the element requirements and review of contractor DDT&E plans and reports.

80-40-20 (RoCS) Contract Management Support

RoCS contract management support is the support provided by a contractor via the MSFC Engineering Support and Technical Services (ESTS) contract. This Contractor will assist the government by reviewing documentation, performing engineering analysis, and other support roles as specified in contract tasks plans.

80-40-30 (RoCS) Whites Sands Test Facility (WSTF)

White Sands Test Facility (WSTF) Peacekeeper is the WBS element that encompasses the acquisition of RoCS hardware. It also includes utilization of WSTF for assembly and testing. The propulsion system identified for use will be acquired, shipped, inspected, and tested per approved documentation.

80-40-40 (RoCS) Prime Contractor

The RoCS Prime Contractor is responsible for DDT&E activities per specific contract requirements. General responsibilities include the design and development of a RoCS element based on requirements allocated from the FTV SRD. Other tasks include development of element requirements, modification of procured RoCS hardware, verification activities, support reviews, testing at WSTF, integration at the launch site. The RoCS Prime Contractor will deliver RoCS hardware per allocated element requirements.

80-50 Avionics

Avionics is one of five elements of the Ares I-X FTV. The Avionics element is responsible for providing the FTV with flight control, power, data recording, range

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safety, tracking, telemetry, and Electrical Ground Support Equipment (EGSE). Other major tasks under the Avionics WBS are First Stage Avionics, Avionics SE&I, Data Recording, and Guidance, Navigation, and Control (GN&C).

This WBS element includes avionics hardware and software for the FTV, and the hardware/software for the Ground Command, Control, and Communications (GC3) system. Other items include telemetry, data recording, Operational and Development Flight Instrumentation (OFI/DFI) and video. The Avionics controls the First Stage Thrust Vector Control (TVC) system known as the Avionics TVC (ATVC), the thrusters for roll control, separation, and recovery.

The Avionics IPT Manager will lead the avionics effort in delivering the flight products to both the responsible IPT and KSC for integration into the FTV. DFI will be delivered to other IPTs for pre-FTV integration activities. Avionics also includes development of a Systems Integration Laboratory (SIL) for hardware-in-the-loop (HWIL) testing.

80-50-10 Avionics IPT Management

The Avionics IPT manager is responsible for planning, organizing, and control of the activities to develop and deliver the Avionics products. Management also includes managing the Avionics Prime Contractor to ensure design, development, test, evaluation, shipping, integration, and testing. The Avionics IPT Office should generate a Task Plan to document how the IPT plans to meet its requirements. Insight and oversight activities include assessment of the contractor's budget to actual cost, assessment of the contractor's planned schedule to the actual schedule, approval of the element requirements and review of contractor DDT&E plans and reports. The Avionics IPT Manager will ensure that the final product, as defined by Flight Test Plan and the Avionics element requirements, can be delivered, assembled, and tested at KSC, and then integrated with the other Ares I-X elements to form a FTV that is ready and cleared for launch.

80-50-20 (Avionics) Insight

The WBS element includes insight and oversight activities focused at providing requirements to the Prime contractor, supporting the design analysis cycle, and participating in verification activities. Specialty teams will provide a level of insight in the areas of power, DFI, and telemetry through formal and informal technical reviews.

80-50-30 First Stage Avionics

This WBS captures work to ensure development and delivery of the avionics used for First Stage control.

80-50-40 Avionics Task Order

The Avionics contractor (Jacobs) is required to design, develop, test and deliver Avionic flight hardware and software for the Ares 1-X demonstration flight.

This includes the necessary labor, materials, tooling, equipment and facilities and service for the design, fabrication, data preparation, maintenance and delivery of

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all Avionic flight hardware and software and including all avionics required ground support equipment (GSE) that is not provided by KSC or part of the IPT avionics hardware integration and test process.

This task also includes the effort to (a) implement Ares I-X specific model and vehicle data into the IDOS 6-degree of freedom simulation structure, (b) update IDOS trajectory tool to support analysis and definition of Ares I-X guidance characteristics, and (c) integration of Ares I-X specific GN&C algorithms into the flight software modules of the IDOS tool. The effort will focus on evaluation of these GN&C algorithms in both development (non real-time) and real time environments providing an independent flight software development and validation path for the program.

80-50-50 Avionics GN&C

This WBS element includes development of the GN&C systems based on algorithms provided by the Ares Project.

80-60 Aerodynamic Model Testing

Aerodynamic model testing includes first stage descent testing, stage separation testing, ascent transonic rigid buffet load testing, and ground wind loads aeroelastic testing. Testing is needed to provide experimental data on potential bending loads and dynamic instabilities due to ground winds. Preparation for testing includes model fabrication. The test will be conducted in transonic dynamics tunnels.

80-60-10 Aero Model Fabrication

The WBS includes fabrication of the aero models. A model will be fabricated that meets the requirements in the aero test plan and/or test procedure.

80-60-20 Wind Tunnel Facility

The wind tunnel facilities will be selected in accordance with the test plan and/or test procedure. Alternate test facilities will be identified to minimize project risk.

WBS Number 292360.07.

30 KSC Integrated Operations

Integrated operations include all Ares I-X ground and launch operations at KSC.

30. 01 KSC Integrated Operations Launch Vehicle Integration & Testing

Integrated operations launch vehicle integration and testing includes physical stacking of the FTV and IPT level assembly. Checkout testing during integration is included as part of this WBS element.

30. 02 KSC Integrated Operations Integrated Testing

Integrated operations integrated testing includes testing after FTV and MLP assembly in preparation for rollout. This WBS element also includes rollout operations.

30.03 KSC Integrated Operations Launch Operations

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Integrated operations launch operations includes ground operations at the pad to prepare for launch such as closeout. The WBS element also includes all launch operations at the pad, the launch control center, and supporting facilities.

30.04 KSC Integrated Operations Planning

Integrated operations planning is the total planning effort to process the elements and integrated vehicle. Operations planning include assembly, testing, transportation, launch, mission, and post mission.

WBS Number 292360.09.

30 Ares I-X Development

This WBS element captures the development and maintenance of the ground systems used at KSC to support assembly, integration, launch, and post launch operations.

30.01 Ares I-X Development Project Support

This WBS element captures management of ground systems design, development, test, and evaluation. The GS IPT will perform the planning, organizing, leading, and controlling to meet the GS requirements.

30.02 Ares I-X Development SE&I

This WBS element captures the engineering work to design, develop, and test the ground systems. SE&I is responsible for requirements derivation to verification.

30.03 Ares I-X Development Integrated Activation & Validation

This WBS element captures the integration of the ground systems and the flight system.

30.04 Ares I-X Development Engineering Support Contract

This WBS element captures specialty engineering to support SE&I to develop the ground systems.

30.05 Ares I-X Development S&MA

This WBS element captures development of an S&MA Plan per the SR&QA requirements. Quality control and safety activities are tracked under this WBS element.

30.06 Ares I-X Operations and Maintenance (O&M) Development

This WBS element includes generation and implementation of operations and maintenance to support system development.

30.07 Ares I-X Modifications Pad B

This WBS element captures the design, manufacturing, and rework to the launch pad.

30.08 Other Ground Systems Modifications Ares I-X

This WBS element captures the rework of all GS other than the launch pad (e.g. – VAB, MLP, etc.)

30.09 Ares I-X Command, Control & Communications (CCC)

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This WBS element captures integration and utilization of the CCC hardware and software provided by the Avionics IPT.

30.09 Ares I-X Development Labor

This WBS element captures the technicians to support GS verification activities.

31 JSC – Ares

This WBS element captures preparation for CoFTR and support of validation of the flight test objectives.

60 KSC Ground Systems – SPOC

This WBS element includes is for KSC Ground Systems IPT support of the Shuttle Payload Operations Contractor (SPOC).

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APPENDIX C

ARES I-X ACCEPTANCE AND READINESS REVIEWS PLAN

The purpose of the Appendix C, Ares I-X Acceptance and Readiness Reviews Plan, is to define each post CDR review. This appendix also provides a detailed list and description of the data contents for a Design Certification Review (DCR), Acceptance Data Package, and an Integrated Readiness Review (IRR). The products for CoFTR are described in Appendix D, CoFTR Products Plan. The contents of Appendix C include the following:

- C1.0** Introduction/Background
- C2.0** Design Certification Reviews
- C3.0** Acceptance/Pre-shipment Reviews
- C4.0** IPT Integrated Readiness Reviews
- C5.0** Technical Authority Reviews
- C6.0** Mate Review
- C7.0** Pre-FTRR Dry Run

C1.0 Introduction/Background

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 System Critical Design Review (CDR) will be the pivotal review that transitions the mission from design to implementation.

Prior to System CDR there will be a series of reviews conducted by Systems Engineering and Integration (SE&I) and the Integration Product Teams (IPTs). These reviews will define the requirements and control the design. Following the System CDR, reviews will be conducted to assess verification progress, accept hardware and software, approve shipping, prepare for integration, ensure safety, and status flight readiness.

Late in the life cycle a final set of reviews will be conducted, as defined in CxP 70127, Flight Test Plan (FTP), Appendix C, Certificate of Flight Test Readiness (CoFTR) Plan. The totality of reviews which include reviews led by the NASA centers and the mission directorate, and support sites provide data and information needed to complete the mission. Post CDR Reviews are shown in Figure C1.0, Ares I-X Integration and CoFTR Review Process.

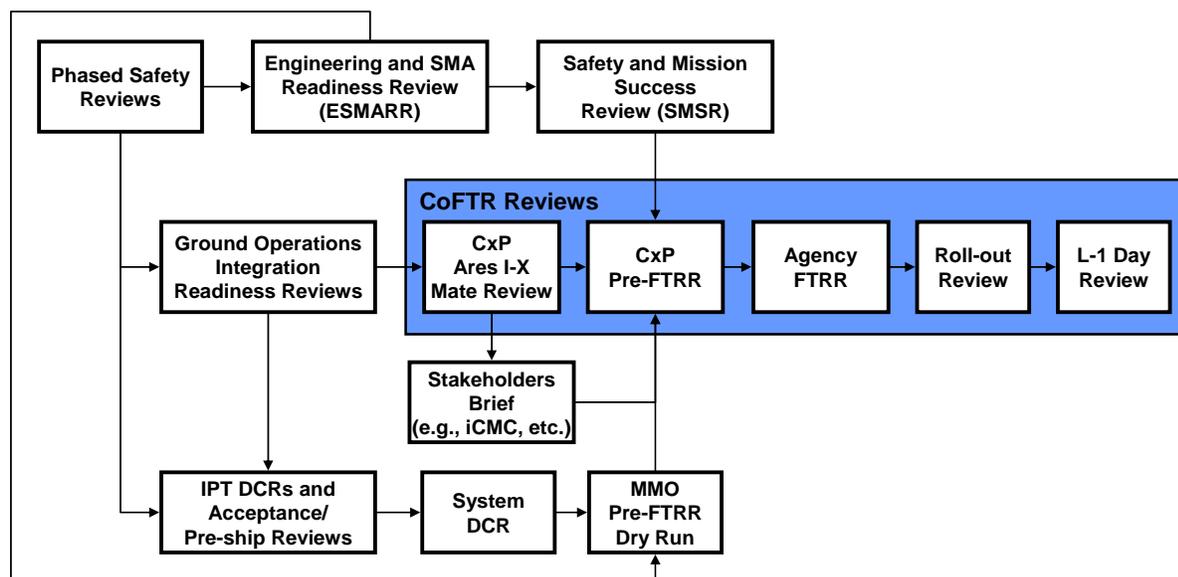


FIGURE C1.0 ARES I-X INTEGRATION AND COFTR REVIEW PROCESS

C1.1 Pre-System CDR Reviews

Pre-System CDR reviews include the Systems Requirements Review (SRR), System Preliminary Design Review (PDR), software reviews, IPT PDRs or equivalent, and IPT CDRs or equivalent. The system reviews are defined in the Systems Engineering Management Plan (SEMP). Additional details (e.g. – entrance/exit criteria) for these reviews are documented in detailed review plans and/or Terms of Reference (TOR) documents. Reviews are scheduled and controlled by Integrated Master Schedule (IMS).

C1.2 CoFTR Reviews

The CoFTR reviews include the Mate Review, pre-Flight Test Readiness Review (Pre-FTRR), FTRR, Rollout Review, and L-1 Review. The CoFTR reviews bring together all Ares I-X participating NASA organizations (e.g. – Headquarters, Constellation Program Directorates, and Technical Authority) and supporting organizations (e.g. – 45th Space Wing and the Space Shuttle Program (SSP)) to help ensure that Ares I-X systems and supporting resources are ready to finalize integration, rollout, pre-launch operations, launch, recovery, and post flight activities.

C1.3 Post CDR Reviews

Following the System CDR, the IPTs and SE&I will conduct Design Certification Reviews (DCRs) per the FTP. DCR is a process that is used to formally review and approve verification results for ERD and SRD requirements, examine SR&QA products, and status risk mitigation. The IPTs will also perform Acceptance/Pre-Shipping Reviews. The Acceptance Reviews (ARs) allow the Mission Manager (MM) to accept IPT products. The ARs also allow IPT

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managers to accept contractor products. The shipping reviews define the condition of the IPT products and open work prior to shipping or transferring major items to the GO IPT at KSC for final assembly and/or system integration. The shipping reviews also ensure that none of the open work is a constraint to ship. The GO IPT will conduct IRRs prior to the start of processing of flight hardware elements. Other reviews include phased safety reviews, Engineering and S&MA Readiness Review (ESMARR), a Safety and Mission Success Review (SMSR), Ground Systems Operational Readiness Reviews (ORRs), and a mission level Pre-FTRR dry run.

The IRRs will support the preparation for the integration of the major elements at KSC. The ESMARR is co-chaired by the Ares I-X Chief Safety and Mission Assurance Officer (CSO) and the Ares I-X Chief Engineer. ESMARR is performed to obtain flight readiness certification from each IPT S&MA lead and their associated Center S&MA and Engineering Directors prior to the Ares I-X pre-FTRR and the Agency's SMSR. SMA and mission level-Engineering will conduct the SMSR in preparation for the Pre-FTRR. The flow of the post System CDR reviews is shown in Figure C1.3, Ares I-X Integration Reviews. Note: IPT Reviews may be combined at the discretion of the IPT Managers with approval of Mission Manager.

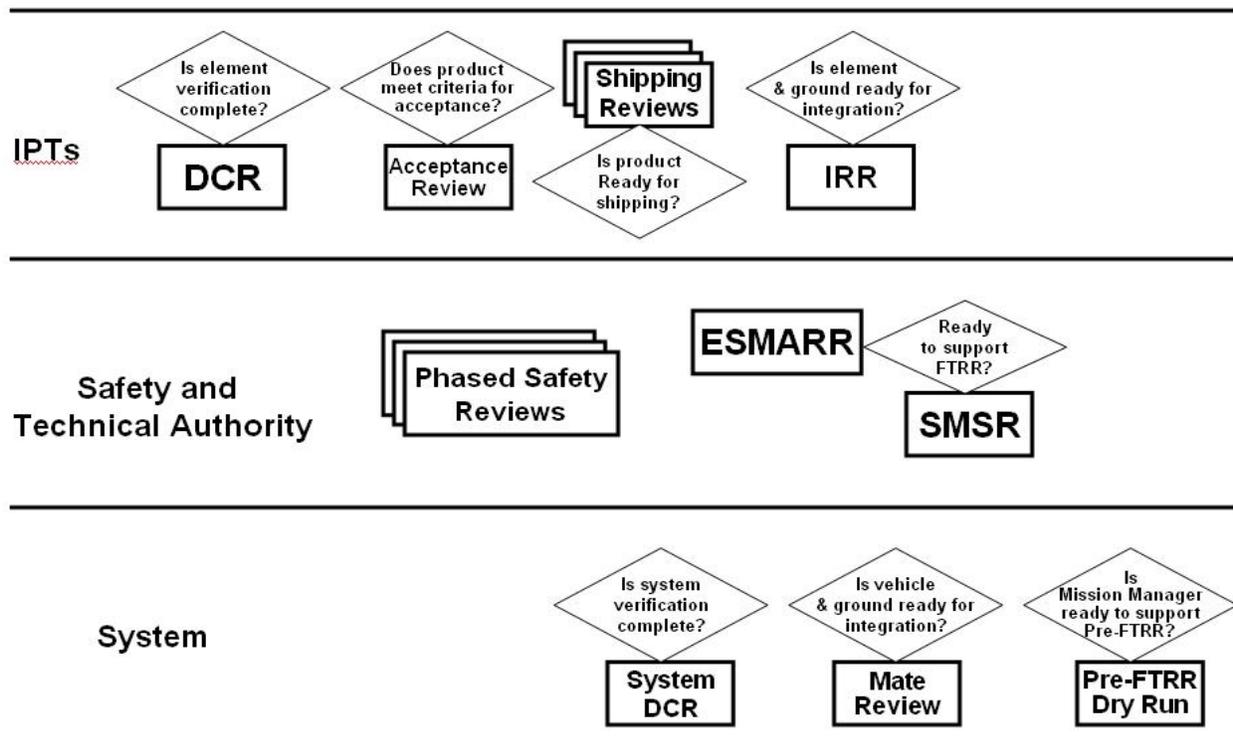


FIGURE C1.3 ARES I-X INTEGRATION REVIEWS

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C1.4 Acceptance Review Panel Membership

The following is the minimum panel membership for mission level acceptance review boards. Board membership for pre-ship reviews will be defined in IPT review plans.

Panel Members

- Ares I-X Mission Manager (Co-Chair)
- Center Management Representative (Co-Chair)
- Ares I-X Systems Engineering and Integration (SE&I) Chief
- Ares I-X Chief Engineer
- Ares I-X CSO
- Ground Operations (GO) IPT Manager
- IPT Manager
- Center Engineering Representative
- Center S&MA Representative

Additional Members (invited as non-voting support members)

- Avionics IPT Manager
- Cx SE&I Representative
- Cx OTI Representative
- Cx SR&QA Representative
- Ares Project Office
- Contractor Representative (if applicable)

C2.0 Design Certification Reviews (DCRs)

The FTP requires the completion of IPT and system level DCRs. The purpose of a DCR is to review progress of verification products being used to certify conformance to element and system level requirements. IPT DCRs will be conducted prior to or in conjunction with IPT Acceptance Review processes. The System DCR meeting will be conducted when system verification is approximately 90% complete (i.e., 90% Verification Review), but prior to the Pre-FTRR Dry Run Note: The DCR process is used to collect data for the Functional Configuration Audits (FCA) as defined by the NASA Systems Engineering Handbook, SP-6105, Revision 1, page 189, or equivalent. An FCA is defined as the formal examination of functional characteristics of a configuration item to verify that the item has achieved the performance specified in its approved configuration documentation. The DCR process accomplishes the intent of a FCA.

The process for DCR (i.e., ERD and SRD requirements verification process) is defined by SE&I. The basic process will ensure that verification of element and system requirements are approved at the XCB. A DCR is not a CDR type review, therefore does not require sending out a data package for review unless determined necessary to obtain a reasonable assessment.

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At the conclusion of an IPT DCR process, the Mission Manager will obtain an assessment and/or recommendation from the SE&I Chief and IPT Manager. SE&I is responsible for validating that the ERD requirements have been properly verified. The IPT Manager is responsible for delivering the DCR data and validating that the Prime Contractor requirements are properly verified. The Mission Manager in cooperation with the SE&I Chief, IPT managers, and Technical Authority will utilize information from DCR to help assess readiness for hardware acceptance and flight.

At the conclusion of the System DCR process, the Mission Manager will obtain an assessment and/or recommendation from the independent team, Technical Authorities and the SE&I Chief. The team is responsible for validating that the SRD requirements have been properly verified. The SE&I Chief is also responsible for delivering the DCR data and validating that that lower levels requirements are properly verified. The Mission Manager will determine if the mission is progressing as planned for the flight test readiness reviews commencing with the Mission Manager's pre-FTRR dry run.

Note: Open work from a DCR is expected (e.g. issues identified for resolution by the DCR review process). Open work will vary by IPT. Open work will be tracked and status provided at subsequent reviews to ensure closeout per approved open item plans. The minimal data requirements for DCRs are defined in Figure C2.0 - Exhibit 1, Requirements for Design Certification Reviews.

DCR Purpose - The purpose of DCR is to ensure that qualification and acceptance verifications activities are sufficient to demonstrate design compliance with the functional and performance requirements.

DCR Timing – DCR follows CDR and completion of a majority of verification activities. IPT DCRs should occur prior to shipping major hardware to KSC unless otherwise approved by the Mission Manager. In the event that a DCR is planned after shipment a shipping review is still required. The System DCR must occur prior to or in conjunction with the Mission/Pre-FTRR dry run.

DCR Requirements if not tailored and approved at the XCB:

- Demonstrate that design meets all requirements (i.e. - SRD for System DCR, ERD for Element DCR, and other applicable requirements such as IRD, verification, OTRs, etc.).
- Confirm that verification results meet functional and performance requirements.
- Confirm that test plans were implemented as planned and/or justify deviations from the plan.
- Confirm that procedures were executed correctly in the specified environments.
- Certify traceability between the test requirement and test article, including name, identification number, and current listing of all waivers
- Discuss additional tests required or conducted due to anomalies, design modification, or requirements changes.
- Show resolution of issues regarding unexpected results.
- Validate compliance of hardware/software constraints in the Flight Test Plan.
- In the event of open work define open work and provide plan to complete.

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<ul style="list-style-type: none"> • Demonstrate that mechanical and electrical interfaces have been or will be verified against the applicable Interface Control Documentation (ICD). • Demonstrate that all applicable functional, unit-level, subsystem, and qualification testing has been conducted successfully.
<p>DCR Products: Products required for DCR, if not tailored and approved by the XCB, include the following:</p>
<ul style="list-style-type: none"> • Verification plan(s) • Verification requirements • Verification Requirements Data Sheets or Equivalent • Verification Matrix • ERD and ICDs for IPT DCRs (for reference) • SRD for System DCR (for reference) • OTRs (for reference if used to close ERD/SRD verification requirements) • Phase III Safety Analyses if used to close ERD/SRD verification requirements • Analysis reports • Test reports • Final design baseline (for reference) • Deviations and waivers • Open items from CDR • Launch Commit Criteria (LCC) (system DCR only) • Significant action status since CDR – at DCR; Assign “go forward” actions initiated from review • Interface verification status (system DCR only)Qualification report
<p>DCR Exit Criteria:</p> <ul style="list-style-type: none"> • Were all requirement documents, plans, and procedures approved? • Do requirements, design, and verification documentation correlate? • Do the test procedures and environments used comply with those specified in the requirements and plan? • Do verification results satisfy functional and performance requirements? • Were all verification reports reviewed, discrepancies recorded, and resolved? • Are there any changes in the test article configuration or design resulting from the as-run tests? Did the changes affect previous verification results? Have the changes been re-verified without affecting previous verification results? • Have design and specification documents been audited? • Has all open work been defined, including a plan to close this work based on this review? <p>DCR Conclusion – As a result of a successful DCR the Mission Manager will provide authorization to proceed. All open issues must be closed per the approved closure plan.</p>

FIGURE C2.0 EXHIBIT 1: REQUIREMENTS FOR DESIGN CERTIFICATION REVIEWS

IPTs will determine if one or more DCRs are required to address all subsystems. In the event that multiple IPT DCRs are necessary, the last DCR will status the entire element. Ground Systems DCRs will be accomplished at ground ORRs. Handover/transfer of applicable ground systems or systems to the GO IPT will occur at that time.

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C3.0 Acceptance/Pre-Ship Reviews

C3.1 Acceptance Reviews

The IPT Acceptance Reviews (ARs) will leverage data and reports produced for the DCRs and shipping reviews. An acceptance review may be performed after shipment or transfer to the GO IPT at KSC with approval of the Mission Manager. The level of detail for the IPT ARs will be different for each product. The main objective of the acceptance reviews is to assure that the deliverable state of the products are in accordance with the product specifications and configuration requirements and that departures from the requirements as documented (e.g. – nonconformance reports, deviations and waivers) have comprehensive rationale and prior approval to support acceptance and transfer of responsibility and/or ownership. Final acceptance will be determined by the Mission Manager. Acceptance is not a requirement for shipment. Authorization for shipment of products in the custody of the Government from location to location (e.g. - GRC to KSC or MSFC to KSC or LaRC to KSC or RPSF to ARF) will be determined at the XCB or out of board by the Mission Manager. No shipment or transfer will be made to the GO IPT at KSC without the approval of the Mission Manager, and notification to the Technical Authorities, other than shipment/transfer of subassembly and lower level items such as instrumentation, cables, harnesses, support structures, and other lower level components. Note: shipment/transfer of lower level items between the IPTs is also permissible without a formal acceptance review and without the Mission Managers approval. Completion of an AR does not constitute final acceptance. Signature endorsement by the Mission Manager and closure of acceptance constraints constitutes final acceptance.

Acceptance of IPT hardware is a formality that confirms that an IPT product meets requirements (except in the case of an approved waiver/deviation) and is acceptable for use. The definition and expectation for an Acceptance Data Package (ADP) is listed in Figure C3.1 - Exhibit 2, Acceptance Data Package (ADP). Acceptance Review Plans must be submitted to the XCB for approval.

IPT primary responsibilities are defined in the FTP and decomposed further in the MIP. Note: IPT technical requirements are flowed down through the ERDs and IRDs. Special Note: An IPT product that meets its technical requirements, but is not usable may not be acceptable. The Mission Manager is not required to accept any product with known discrepancies (e.g. – the specification required white paint, but what was needed was black paint). Differences of this nature should be elevated to the CxCB for resolution.

An Acceptance Data Package (ADP) is a set of documents that provides unambiguous evidence that the product was produced in accordance with the requirements. Types of documentation include management, engineering, safety, quality, reliability, and maintainability. ADP data and information is collected and formed into a complete package by the IPT. The ADP can be segmented into proprietary and non-proprietary data. Data that are classified as proprietary will be processed per the Configuration and Data Management Plan. The ADP can be provided in

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paper form and/or electronic form. Use of paper vs. electronic may require a waiver to CxP archival requirements. Refer to the CM/DM Plan for processing instructions. The IPTs will determine what products (e.g., transfer forms) must be provided in paper format. Electronic media includes Compact Disk (CD), DVD, Windchill or other approved web based repository (e.g. - contractor intranet). If any part of the ADP is located on Windchill or another approved web site, then the IPT must provide links and access directions. Not all documentation is required to be in the ADP paper document folder or on CD; documentation can be stored on a data or configuration controlled medium of storage that is readily accessible by authorized personal. Not storing on Windchill may require a waiver to CxP archival requirements. Refer to the CM/DM Plan for processing instructions. The data package must provide a list of the data package contents and where to obtain the data. The location of the ADP must be verified by Quality Assurance. All data will be reviewed, approved, and stored in accordance with approved CM/DM and quality control procedures.

ADP documentation will have approver signatures and date. Time stamps will be used, as required, to chronicle multiple changes in a single day. Acceptance data shall be retained and made available for updates during the active life of the item. The ADP will include, at a minimum, a record of the following hardware and software attributes:

- Deliverable Item Name and/or Nomenclature
- Part Number
- Serial Number, if applicable
- Lot Number, if applicable
- Hardware Type (e.g., flight, ground, test, tool, etc.)
- Contract Number for deliveries by a Prime Contractor
- Name of the Provider
- Unique Software Identification Number (i.e., identify the version to be used with the hardware.)

The ADP will include, at a minimum, the following documentation, data, and information. The final ADP will be provided electronically and will be stored on the Ares I-X System Windchill area (for access during the acceptance process and afterwards) as a record if not a waiver must be processed. All ADP information shall be accessible by NASA for NASA use.

- Certificate of Conformance (COC) records of prime contractor to government
- As-Built Records
 - Invoices, receiving inspection reports, manufacturing and assembly records with completed inspection points (i.e., WADs), test and checkout records other than verification data, MRB reports, and other records that trace the hardware/software from materials to complete product. Records also include an indentured parts list to identify and compare the as-designed configuration to the as-built configuration
- Verification Records as defined by the DCR process
- CoFTR Endorsement
 - CoFTR endorsements as defined in the Ares I-X Cx CoFTR Process Plan (ref: CxP 70127, Flight Test Plan, Appendix C).
- Engineering Drawings
 - Engineering drawings used to manufacture and assemble the product. Also, specification, source, integration, and interface control drawings, if applicable. A detailed drawing tree is also needed to identify all drawings which define the configuration of the deliverable hardware item.
- Waivers and Deviations
 - Approved and pending waivers/deviations including contract authority signatures and rationale data package. Approved waivers/deviations authorizing hardware use or variations as applicable to the physical/functional parameters of the hardware item being delivered.
- Non-conformances, Unexplained Anomalies (UA), and Investigation/Closeout Reports

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- Reports include records of all identified problems, including non-conformances, UAs, unsatisfactory conditions, and suspect conditions that were identified during fabrication, testing, operation, or other event.
- Status of GIDEP ALERTS
- Historical Log
 - Data relating to the historical events associated with the deliverable hardware/software item commencing with the first inspection of the completed item. The historical data includes a listing of tests, inspections, problems that occurred during fabrication and testing, and other events involving the Ares I-X development life cycle.
- Pressure Vessel Data
 - Pressure vessel data includes a log of each pressure vessel's exposure to materials and pressures at time of delivery. The pressure vessel log lists the pressure vessel's part name, part number, serial number, as well as limited life requirements, threshold pressure (e.g., pounds per square inch differential [psid] at Mean Sea Level [MSL]), pressure limitations (e.g., threshold pressure, maximum operating pressure, and proof pressure), cycle limitations for threshold pressure, maximum operating pressure, and proof pressure, and chronological test and checkout history.
- Pyrotechnic Certification
 - Certification is evidence that representatives of NASA and the procuring agency have reviewed and accepted the described pyrotechnic devices on the basis of applicable NASA and procuring agency specification and requirements. This documentation consists of the lot certificate with certification statement for each lot. The lot certificate reflects the current status of the device lot at the time of acceptance.
- Battery Data
 - Battery data includes the cell/battery name, part number, serial and lot number if applicable, cell/battery voltage, capacity, shelf/calendar life, and service/cycle life. Other data and documentation for batteries includes the following:
 - Toxicological Hazard Assessment to indicate the toxicity of the cell and/or battery being delivered.
 - Materials Compatibility Assessment to indicate that the electrolyte vapors or battery offgassing will not cause a materials compatibility hazard.
 - Storage requirements for cells and/or batteries which include temperature and state-of-charge.
 - Evidence that the delivered cells and/or batteries meet all Department of Transportation (DoT) requirements for the appropriate chemistry. (e.g., lithium primary and lithium-ion rechargeable cells or batteries have to meet 49 CFR, Transportation, Parts 171, 172, 173, and 175).
 - Material Safety Data Sheet (MSDS) for the cells and/or batteries will be included in the ADP for transportation and handling purposes.
 - Evidence of successful completion of lot sample testing for each new build or procurement of batteries. Data furnished correlated to approved battery acceptance test plan for each type of battery.
 - Evidence that acceptance testing was successfully completed for loose cells and batteries before they were installed in battery-powered flight hardware.
- Age-Sensitive/Time-Action Items
 - Identification of limited-life items that can affect the performance of the product. Specifically, parts that are subject to replacement when specified limits are reached or exceeded. Included are time-action control items having a minimum periodic functional operating limit and are subject to replacement when one or more specified limits are exceeded. Identification of maintenance activities which are required based on Age-Sensitive/Time-Action Items. Other important data includes date manufactured, date by which the item requires action taken, type of action to be taken on or before the expiration date, the date the last operation or servicing occurred, and the date the next operation shall occur on or before. If calibration is required then the calibration data

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- needed includes item name, part number, serial number or lot number, calibration identification number, date of most recent calibration, and calibration due date.
- Non-flight Hardware/Temporary Installations
 - Listing of installed hardware which is not part of the deliverable item configuration and must be removed prior to subsequent operations or flight. This listing includes the temporarily installed part name, part number, serial number, physical location of the temporarily installed part, and identification of when the part is to be removed.
 - Shortages
 - Identification of physical hardware shortages existing at the time of delivery including inspection and test/retest requirements. Shortage data includes the quantity short, description, part number, serial number, affected next-higher assembly, and expected delivery date.
 - Open/Deferred/Transferred Work
 - List of incomplete fabrication, assembly, test, inspection, and integration activities to be completed at a later defined date. Includes open work from shortages, lack of schedule time, MRB actions, open nonconformance reports, recurrence control actions, unincorporated engineering changes, mod kits, and other driving forces. The ADP will include a copy of inspection and test/retest requirements, test procedures, and other documentation required to complete open/deferred work.

ADP EXEMPTIONS

Some ADP products may not apply to untraceable items / piece parts (e.g., nuts, non fracture critical fasteners, and washers), consumables, unmodified Commercial-off-the-Shelf (COTS) items, and control center hardware or equipment. An exemption is not required for these items. However, for custom manufactured hardware, all of the listed items that apply should be provided or an exemption is required. Requests for exemptions must be made in sufficient time to allow for the preparation of acceptance data. Exemptions should be negotiated with the receiving IPT and approved by XCB.

FIGURE C3.1 EXHIBIT 2: ACCEPTANCE DATA PACKAGE

Acceptance Review Check:

- End products complete or listed as open work. All open work is clearly identified with supporting rational/justification including identification of new issues and risks as a result of the open work.
- Is the acceptance letter signed by the Mission Manager, IPT Manager, and NASA Center Representative?
- Is all verification complete or listed as open work? All open work is clearly identified with supporting rational/justification including identification of new issues and risks as a result of the open work. Any verifications identified as constraints to processing must be identified?
- Have all Waivers/Deviations been approved or listed as open work? All open work for closure of open waivers/deviations is clearly identified with supporting rational/justification including identification of new issues and risks as a result of the open work?
- Have all open work been identified with suitable closure plans??

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- All hardware transfer paperwork complete. All open work is clearly identified with supporting rational/justification including identification of new issues and risks as a result of the open work.
- Have Nonconformance Reports been satisfactorily closed or listed as open work? All open work for closure of open NCRs is clearly identified with supporting rational/justification including identification of new issues and risks as a result of the open work.
- Have Nonconformance Reports been satisfactorily closed or listed as open work? All open work for closure of open NCRs is clearly identified with supporting rational/justification including identification of new issues and risks as a result of the open work.
- Is issues closure plan sufficient to support go forward plan?
- Was ADP uploaded to authorized Windchill site?
- Is Open work list complete?

C3.2 Pre-Shipment

IPTs are responsible for ensuring that products are ready for shipment. This includes obtaining the endorsement of a cognizant quality assurance representative or representatives in accordance with Safety, Reliability and Quality Assurance (SR&QA) requirements, SR&QA Plan, and applicable quality manuals.

In the event of a discrepancy the Ares I-X SMA Chief and the Ares I-X Chief Engineer shall be notified to support problem resolution. The Mission Manager reserves the right to authorize shipment and accept the risk of an early shipment in the event of an open discrepancy. Risks of this nature will be reported to the Cx Program Manager and the Technical Authority. Note: Every IPT shipment will be unique, therefore requiring various levels of preparation and review.

Shipments should be coordinated well in advance to ensure that all required documentation is in place to support shipment. In the event of conflict between the MIP and the AI1-SYS-SRQA, Ares I-X SR&QA Requirements, Section 7.11, Final Acceptance, the SR&QA requirements take precedence.

The IPT manager is solely responsible for developing a shipping plan. The IPT manager will coordinate with the IPT SMA Representative, the shipping destination personnel, and the Mission Manager to ensure that the shipping plan is acceptable. Shipping plans do not require XCB approval, but they will be checked by the SE&I Logistics Manager to ensure compliance with overall system plans. For products produced at KSC a shipping plan is not required, but the acceptance process is still required.

Shipping reviews may be formal or informal (i.e., checklist and signatures only). The goal of a shipping review is to complete the checklist, meet packing and shipping requirements, and ensure that no open work is a constraint to ship.

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Coordination between the QA Representative, IPT Manager, and Mission Manager will enable on time shipments. Due to the complexity and volume of shipments, the DFI sensors and harnesses will not require a pre-ship review for each shipment.

IPTs will determine if acceptance and pre-ship reviews need to be conducted at the different times.

The following is a list of additional products and steps necessary to support shipments:

- Material Safety Data Sheet (MSDS)
 - Any MSDS used to convey information about the potential health and physical hazards of materials/substances used in the work environment with each deliverable hardware item (Reference: 29 CFR 1910.1200(G), Occupational Safety and Health Standards, Hazard Communication, Material Safety Data Sheets.) will be provided.
- Packaging, Handling, Storage, and Transportation (PHS&T) Requirements
 - Detailed description of any special PHS&T requirements necessary for transportation.
 - Hardcopy of packaging, handling, and transportation documents, NASA DD Form 1426 or equivalent, or other forms that satisfy contractual transfer requirements such as a DD 250, modified DD 250, or Customer Supplied Product Agreement (CSPA).
- Transfer Forms (e.g., DD Form 250 and/or DD Form 1149 or Equivalent)
 - The ADP and pre-ship package will contain a copy of a DD Form 250, modified DD 250, DD Form 1149, or Customer Supplied Product Agreement (CSPA) to document the Government's acceptance of the delivered or transferred hardware. The form must be acceptable to the organization accepting the hardware/software and meet contractual requirements.
 - Signature authority must be clear.
- Design Status including Review Item Discrepancy (RIDs) or Request for Information (RFA) Update and verification accounting.
- GIDEP ALERT Status
- Nonconformance Reports Status
- Audit/Surveillance Finding Status
- Transportation/Handling Plans
- Receiving Inspection Requirements
- Determine if issues closure plan sufficient to support shipment.
- Determine if IPT OTRs and WADs in place to support GO IPT.
- Determine if all open work is identified in an open work report.

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- Other information as required by shipping and receiving authorities.

C4.0 IPT Integrated Readiness Reviews (IRRs)

An IRR will ensure that KSC facilities, personnel, and procedures are in place to conduct assembly and integration activities at KSC. This review will be held for a facility (or facilities), prior to the start of processing in that facility. Any unique flight element portion of the IRR will be summarized by the flight element IPT..

The GO IPT will conduct the IRR and verify that all products are in place and ready to support the start of operations. The IRR will be chaired by a GO IPT representative and/or co-chaired by a GO IPT representative and the Mission Manager, at the discretion of the Mission Manager:

IRR Purpose – The purpose of an IRR is to ensure that KSC facilities, personnel, and procedures are in place to conduct assembly and integration activities.

IRR Timing – An IRR occurs prior to the start of processing in the affected KSC facility. For VAB High Bay 3 and the Launch Pad IRR will be prior to the start of stacking and prior to FTRR, respectively. IRRs can be combined with other GO and IPT reviews.

IRR Products Stated:

- Concept of Operations (Overview)
 - Project Schedule
 - Work Flow and Responsibilities
- Schedule (Detailed Assessment)
- Open Work
 - Modifications
 - Validations
 - PMIs/Calibration (Maintenance Status)
 - Non-Conformances (Corrective Maintenance, MRB Actions, Unexplained Anomalies)
 - Nonstandard Work
 - Issue/Problems/Concerns
- Constraints
- Security Plan
- Ground Systems Modifications
 - Completed Projects
 - Completion Plans for Open Projects
 - Hardware Certifications (GSE)
- Business Systems (Solumina/Cradle Functions)

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- Operational Requirements
 - OTR Status/Open RCNs
 - System Drawings
 - Work Procedure Development
 - OPs
- Deviations/Waivers/Variances
- SQMA Requirements
 - O&SHAs
 - ALERTs/GIDEP
 - Quality Audits
 - Risk Assessments
- Logistics readiness / plan
- Critical Spares Status
- Support Requirements PRD/KPRD
- Significant Process Sampling/Escapes/Changes
- Documentation (i.e., Transportation Plan, QPRD, ICDs, etc.)
- Significant Issues/Concerns
- Closure plans for all current open issues including remaining liens or unclosed actions and plans for closure
- Personnel Training and Certification Status
- Readiness Statement

IRR Entrance Criteria:

- Approved Launch Site Support Plan (LSSP)
- Approved system level AIT Plan and Logistics Plan
- Approved Operating Procedures / Business Plan
- Approved KSC SRQA Plan
- Approved GO IPT Quality Planning and Requirements Document (QPRD)
- Approved applicable Operational Test Requirements (OTR's)
- Safety Analyses are complete and acceptable
- Any required variances or waivers are approved
- All ground systems validation testing has been completed

KSC is responsible for the following:

- Set-up work areas, including networks, for off-site/visiting personnel.
- Provide products allocated to the FTV IPT
- Verify processing personnel and other resources will be available to support IPT element processing.

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- Ensure that GO personnel have been adequately trained and certified
- Review processing schedule and verify that there are no conflicts between the Ares I-X schedule and the Shuttle schedule.
- Assure that the following support systems are validated and ready to support processing:
 - Configuration Management
 - Nonconformance Reporting, Dispositioning and Constraints systems
 - Scheduling
 - OTR closed loop accounting
 - Logistics Processing
- Verify that the Launch Simulation Training Plan is in place or on-track to support launch readiness
- Verify operating procedures and other controlling documents are complete and approved
- Ensure that integration facilities, including GSE, handling fixtures, overhead cranes, and electrical test equipment, are ready and available
- Ensure that GO SRQA issues, operational risks, and hazards are resolved and/or mitigated
- Verify that handling and safety requirements will be met.
- Demonstrate that all previous design review success criteria and key issues have been satisfied in accordance with an agreed-upon plan.
- Plan and coordinate the IRR

FTV IPTs are responsible for the following:

- Demonstrate that all previous design review success criteria and key issues have been satisfied in accordance with an agreed-upon plan.
- Verify that Flight hardware/software is ready to be shipped or has been shipped.
- Provide products allocated to the FTV IPT
- Ensure FTV personnel are trained to support activities at KSC

IRR Exit Criteria:

- Are personnel and facilities ready to support?
- Are data products in place (QPRD, OPs, etc as listed under products stasured)?
- Are WADs released, at least for initial processing?
- Have all discrepancies and open work been identified, including a plan to close this work?

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IRR Conclusion – As a result of a successful IRR authorization to proceed will be provided. All open issues from an IRR must include an approved closure plan.

C5.0 Technical Authority Reviews

C5.1 Phased Safety Reviews

Ares I-X and the Cx Safety & Engineering Review Panel (CSERP) will conduct phased safety reviews in accordance with the Ares I-X SR&QA Requirements (AI1-SYS-SRQA) and Cx Program Hazard Analyses Methodology, CxP 70038.

C5.2 Ares I-X Engineering and Safety & Mission Assurance Readiness Review (ESMARR)

In preparation for the CoFTR reviews and the Headquarters' chaired Safety & Mission Success Review (see 5.3 below), 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 these reviews is to obtain readiness certification from each IPT S&MA lead and Lead Engineers and their associated Center S&MA Director and Center Engineering Director prior to CoFTR and the Headquarters' SMSR.

At ESMARR 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.

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- 👤 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)
- 👤 Material review board (MRB) summary and status
- 👤 Specs and standards – have reviewed proper utilization in the design and completed proper documentation of the surveillance process
- 👤 Open technical issues

In addition, at ESMARR, each IPT Lead Engineer and SE&I Lead Engineer will certify readiness for the applicable items below:

- 👤 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
- 👤 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
- 👤 Material review board (MRB) summary and status
- 👤 Specs and standards – have reviewed proper utilization in the design and completed proper documentation of the surveillance process
- 👤 Open technical issues
- 👤 Risks
- 👤 Interface Readiness Statement (for SEI LE only)

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-  Launch Site Major Ground Support Assets (e.g. – MLP, Launch Pad, Launch Control Center, and GC3 readiness) and Ground Operations Readiness (e.g. contingency planning, open work) ready to support remaining operations at KSC (for GS LE only)
-  First Stage Recovery Operations Readiness Statement (for First Stage LE only)
-  Telemetry Readiness Statement (for SEI LE only)

C5.3 Safety & Mission Success Review (SMSR)

Ares I-X CSO and CE will conduct a SMSR which will be chaired by Headquarters Office of Chief Engineer and Office of Safety and Mission Assurance.

C6.0 Mate Review

The Mate Review will be conducted before stacking of IPT Elements in the VAB High Bay 3 (i.e, stack First Stage motor segments and Aft Skirt to the MLP; Stack 1 to First Stage/Motors; Stack 2 to Stack 1; Stack 3 to Stack 2; Stack 4 to Stack 3; and Stack 5 to Stack 4).. Offline assembly of IPT Elements prior to inter-element stacking is permissible prior to the Mate Review in accordance with the approved IMS. The Mate Review will evaluate the readiness of the flight and ground elements to be integrated with available resources. The Mate Review will also assess the capability of processing the Ares I-X hardware in conjunction with Space Shuttle processing activities. The Mate Review will be chaired by the Ares I-X Mission Manager and will include representatives from the Cx Program Office, Ares I-X Chief Engineer, Ares I-X Chief Safety Officer, and SSP. A final summary of the VAB integrated operations will be presented. Information and results from the Mate Review will be used to satisfy intent of a Systems Integration Review, also known as Key Decision Point (KDP) D per NPR 7120.5D.

The IPT Elements will provide a status of requirements compliance and integration readiness. The IPTs will submit a summary of the deliverables associated with integrated assembly and processing that have been completed prior to the review. Integration activities will be identified, assessed, and planned as part of the VAB integration schedule. The Ares I-X Ground Operations (GO) IPT will provide status ensuring that the VAB, Mobile Launch Pad, Launch Control Center, and other ground resources and facilities are ready for integration with the flight elements. Ares I-X SE&I will provide the supporting analysis to demonstrate compliance with the system requirements. Other deliverables, but not limited to, for this review include the Assembly, Integration, and Test (AIT) Plan and the Integrated Logistics (ILS) Plan that are provided by the MMO.

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The Mate Review will include the following products, data, and information:

- Integration plans and procedures, complete and approved
- Verification that segments and/or components are available for integration.
- AIT Plan
- Operational Test Requirements (OTR's)
- Assembly Drawings
- Work Instructions and/or WADs
- SR&QA Requirements and Plans
 - KSC SR&QA Plan
 - Baseline Quality Planning and Requirements Document (QPRD)
 - Variances to KNPR 8715.3, Safety Practices Procedural Requirements
 - GO O&SHA including GO Hazard Analysis and FMEA CIL's
- Baseline KSC Training Requirements
- Launch Commit Criteria (LCC)
- Review significant Ground and Flight design deviations since CDR's
- Review of significant action status since CDR
 - Assign "go forward" actions initiated from review
- Baseline requirement loaded schedule
- Baseline Integrated Logistics Plan
- Verification that LSSP is complete
- Verification that CM/Business systems validated
- Test Team/Launch Team/LAT certification plan
- SRD verification status
- IRD verification status
- Status of open work from previous reviews

C7.0 Pre-FTRR Dry Run

The Pre-FTRR Dry Run will be conducted to ensure that all products needed for the Pre-FTRR are complete. The dry run will help determine the state of the CoFTR endorsements, address unresolved issues, and assess system (i.e., all flight, ground, and support systems) readiness for launch and post flight activities.

The SE&I Manager will be responsible for providing a state of the system. The Technical Authority and the IPT Managers must address open issues. This review will be chaired by the Mission Manager. Members of this board will include all members of the XCB. At the conclusion of the dry run, the Mission Manager will inform the CxP Program Manager if the mission team is prepared to support the Pre-FTRR.

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APPENDIX D COFTR IMPLEMENTATION PLAN

D1.0 INTRODUCTION

Certification of Flight Test Readiness (CoFTR) requirements are defined in CxP 70127, Flight Test Plan, Appendix C, CoFTR Process Plan and Flight Test Readiness Review (FTRR). The CoFTR Process Plan defines CoFTR products that are used to assess readiness for flight. This implementation plan allocates CoFTR products to the Ares I-X organizations for development and status purposes. This appendix also addresses the steps and responsibilities for preparing and signing a CoFTR endorsement.

The status of a CoFTR product is used to inform stakeholders over time as to the progress being made towards flight test readiness. Status of a CoFTR product also allows stakeholders, early in the development cycle, to engage in the process as well as make an informed decision concerning readiness at one or more of the CoFTR reviews. CoFTR reviews comprise the Mate, pre-FTRR, FTRR, Roll out, and L-1 Day reviews.

The purpose of this appendix is to outline a plan for collecting, synthesizing, and reporting data and information in a timely manner to the Mission Manager, CxP Manager, Technical Authority, and stakeholders.

D2.0 CoFTR ENDORSEMENT PROCESS

A key CoFTR product identified in the Flight Test Plan is the CoFTR Endorsement. Organizations required to provide an endorsement are also defined in the Flight Test Plan. Endorsement forms will be prepared by and/or coordinated with the CxP Operations, Test, and Integration Directorate. The following two figures, Figure D2.1 and D2.2, shows the CoFTR endorsement process with respect to the mission life cycle and organizational CoFTR responsibilities.

The first group of CoFTR endorsers comprise the IPT Lead Engineers, IPT SMA Leads, and Prime Contractors. Each party in this group provides a CoFTR endorsement to their respective IPT manager as early as the IPT acceptance reviews, but before the Pre-FTRR Dry Run (i.e., System Acceptance Review). IPT Lead Engineers and SE&I Lead Engineer provide a copy of their CoFTR endorsements to the Ares I-X Chief Engineer and their respective center directorate manager at the ESMARR. All exceptions and dissenting opinions will be documented in the CoFTR Endorsement for the IPT Manager and the Chief Engineer to resolve. The nominal target date for this endorsement is the 90% System Verification Review. In the event that an endorsement cannot be provided at this time special arrangements will be made with the Mission Manager. IPT SMA Leads provide a copy of their CoFTR endorsements to the CSO and their respective center directorate manager at the ESMARR. All

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exceptions and dissenting opinions will be documented in the CoFTR Endorsement for the IPT Manager and CSO to resolve.

The second group of CoFTR endorsers comprise the IPT managers, Ares I-X Chief Engineer (CE), and the Ares I-X Chief SMA Officer (CSO). Each party in this group provides a CoFTR endorsement to the Mission Manager before or at the Pre-FTRR Dry Run. In the event an endorsement cannot be provided at this time special arrangements will be made with the Mission Manager.

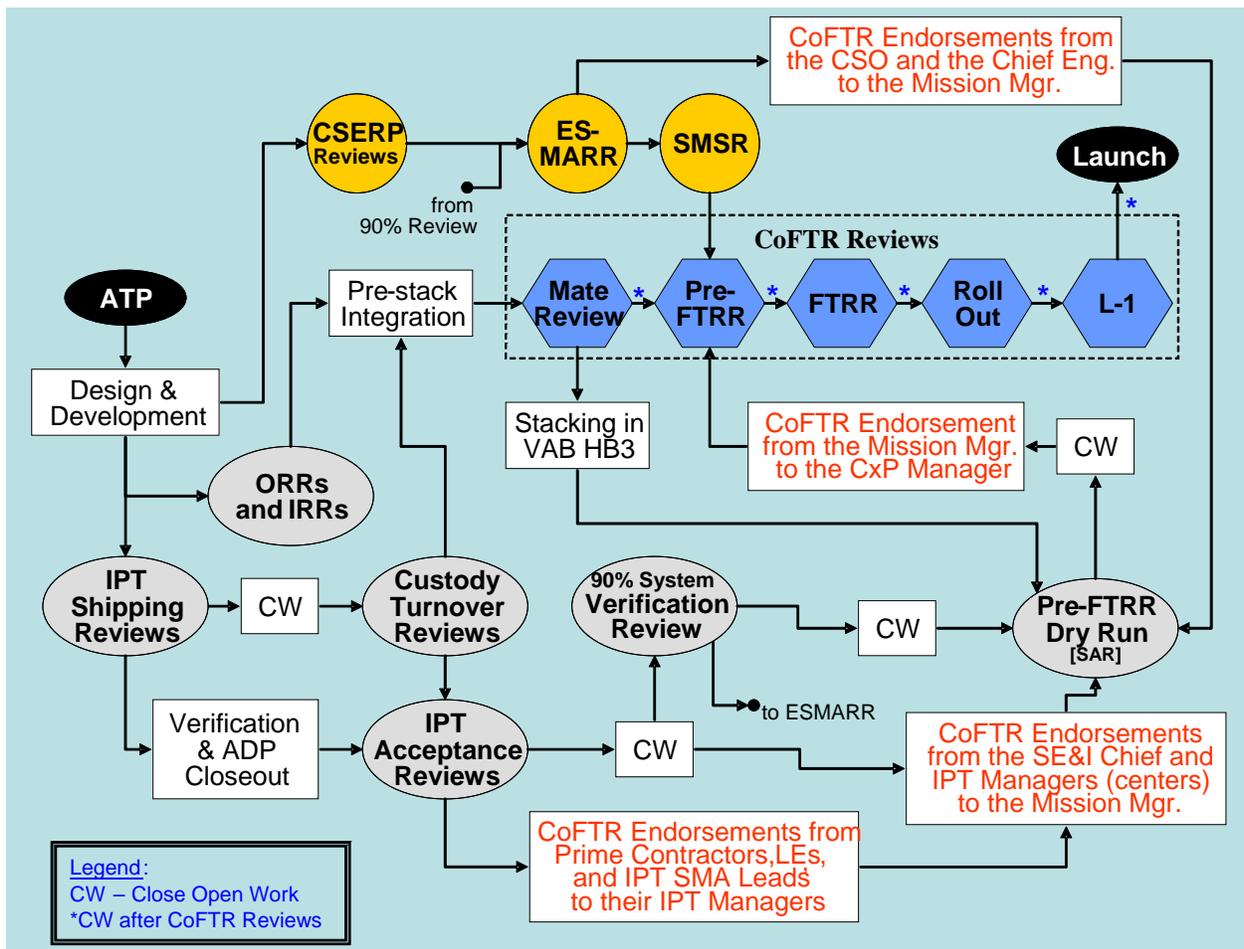


Figure D2.1 Timing of Ares I-X Mission CoFTR Endorsements

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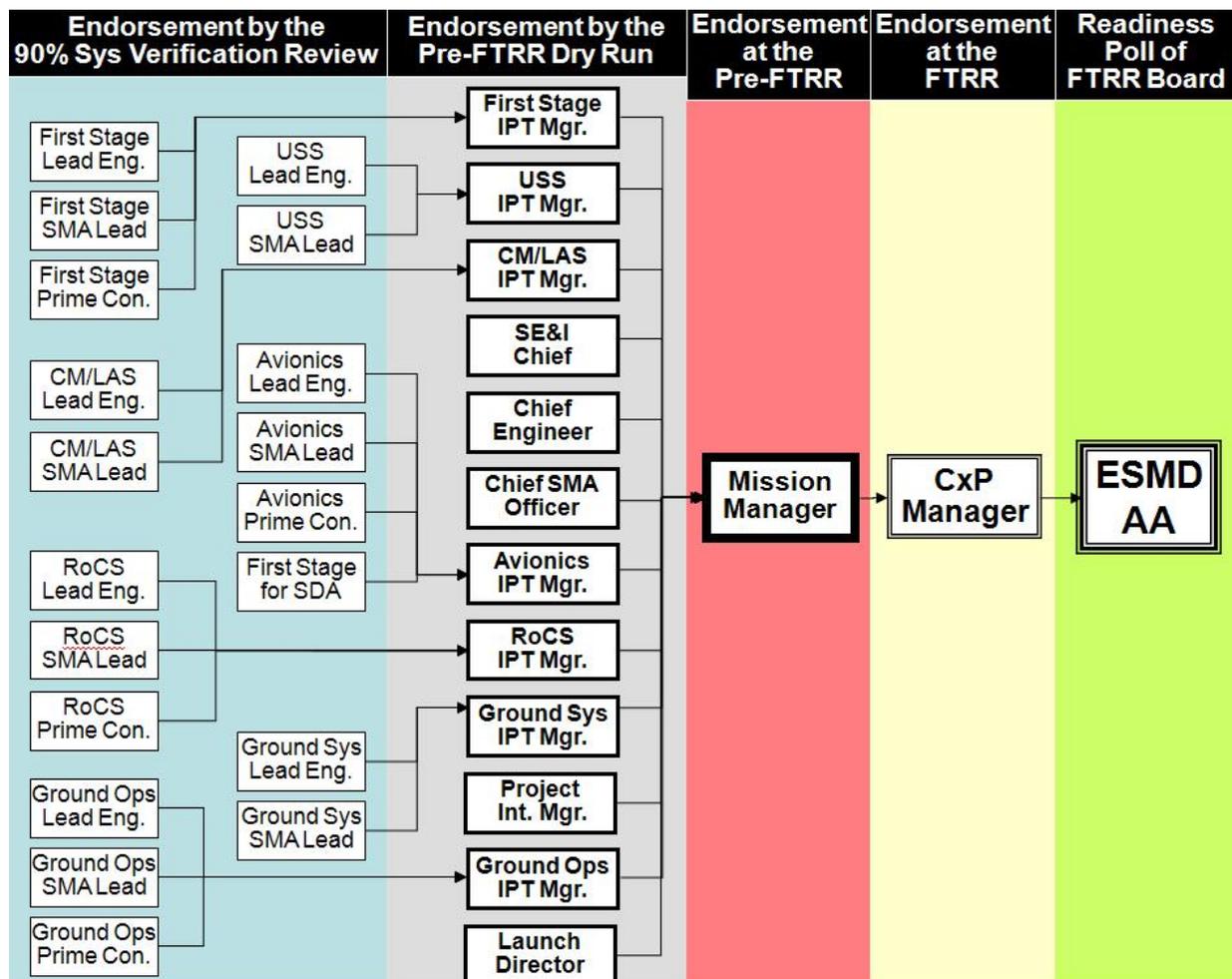


Figure D2.2 Levels of Ares I-X CoFTR Endorsements

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The Mission Manager and other CxP organizations, as defined in the Flight Test Plan, provide CoFTR endorsements to the CxP Manager. The final CoFTR endorsement is from the CxP Manager to the ESMD Associate Administrator (AA). At the FTRR the AA will poll the FTRR Board.

D3.0 Product Responsibility Matrix

Tables D3.1 through D3.7 lists the CoFTR products defined in the Flight Test Plan. Products are grouped by type (e.g., mission, system, SMA) and discipline/assignee. This approach allows allocation and tracking of products down to the IPT level. The table provides information on the products including, but not limited to, the products nomenclature and responsibilities.

Special CoFTR Endorsement Instructions: Every CoFTR Endorser is responsible for endorsing compliance for every CoFTR product to the extent to which the product applies. For example, SE&I under the SE&I Chief is responsible for developing the Launch Commit Criteria, but all CoFTR endorsers are responsible for providing a CoFTR endorsement that they do not have an objection to the LCC. In the event that there exists an issue, the CoFTR Endorser will document an exception on the CoFTR form. If a CoFTR product is not applicable then the CoFTR Endorser shall note not applicable. The CoFTR Endorser is also free to list the level of applicability on the CoFTR form. For example, the Lead Engineer for the Upper Stage Simulator (USS) IPT, in review of waivers/deviations, would note “concur with USS approved waivers/deviations”.

CoFTR Product	Assignee	Description of Responsibility
Progress Report to the CxP Manager	Mission Manager	Report weekly to the CxCB starting two months prior to the Mate Review
Master Open Issues List	Mission Manager	Provide status of top open issues at the CxCB weekly and all open issues at CoFTR reviews.
Risk Management Report of Open and Accepted Risks	Mission Manager	Participate in the CxP monthly Top Risk Review. Provide status of top open risks at the CxCB weekly and all open and accepted risks at CoFTR reviews.
Contingency Action Plan (Mishap Response and Contingency Plan)	Mission Manager	Provide status of the Mishap Response and Contingency Plan (MRCP) development at the CxCB. This CoFTR product is complete when MRCP is baselined with no TBDs or TBRs.
Approved Waivers/ Deviations	Mission Manager	Provide accounting of waivers including number of waivers and those still in review or planned. These are waivers approved by the XCB, DXCB, TRCB, and other mission level boards authorized by the Mission Manager except for waivers/deviations for requirements levied on Ares I-X (e.g., Flight Test Plan).
IPT Hardware and Software Acceptance Forms	Mission Manager, IPT Managers, and Center Rep	Sign the Certificate of Acceptance.

Table D3.1 Mission Level CoFTR Products

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CoFTR Product	Assignee	Description of Responsibility
System Verification	SEI	Prepare and submit all system level verification for approval. Provide accounting of verification closure (e.g., x of y SRD requirements verified and closed) on a weekly basis.
FTV Function Configuration Audit (FCA) (NASA/SP 6105, Rev. 1, NASA Systems Eng. Handbook, page 189 or equivalent)	SEI	Review and approve all element level verification. Coordinate closure of system verification with the CSO, Chief Engineer, and Independent Reviewers. Sign a Certificate of Qualification (COQ) with respect to the SRD
FTV Physical Configuration Audit (PCA) (NASA/SP 6105, Rev. 1, NASA Systems Eng. Handbook, page 189 or equivalent)	GO, SEI, and GO SMA	Review IPT ADPs. Also, SEI prepares the System ADP with the system as-built data package provided by the GO IPT for the following system configurations: FTV-VAB configuration, FTV-rollout/back configuration, FTV launch configuration, and FTV in-flight configuration, and other applicable system configurations.
Launch Commit Criteria (LCC) approved by the XCB	SEI and GO	Prepare and submit the LCC document for approval. Provide status of LCC development. This CoFTR product is complete when baselined with no TBDs or TBRs.
Integrated Logistic Support (ILS) Plan approved by the XCB	SEI and GO	Prepare and submit the ILS Plan for approval. Provide status of ILS Plan development. This CoFTR product is complete when baselined with no TBDs or TBRs.
Trajectory Design	SEI	Provide written status upon request.

Table D3.2 System, Ground, and Flight Operations CoFTR Products

CoFTR Product	Assignee	Description of Responsibility
Element Verification	IPTs	Prepare and submit all ERD verification reports and supporting material for approval. Provide accounting of verification closure (e.g., x of y ERD requirements verified and closed).
Hardware/Software Transfer of Ownership (e.g. – DD-250 or other)	IPTs	Provide scheduled transfer date and status. Provide turnover documentation from contractors to the government. Track, close, and status all open work.
Operational Test Requirements (OTR)	GO	Provide accounting of OTR closure (e.g., x of y OTRs closed). Ensure OTR documents are baselined with no TBDs or TBRs.
OTRs	All IPTs	Prepare and submit OTRs for approval.
FTV PCA	IPTs including IPT S&MA and IPT LE	Obtain Certificate of Conformance from prime contractors and other vendors as applicable. Prepare and submit ADP for approval and archiving. Sign acceptance letter. PCA of installed Avionics will be conducted by cognizant installer IPT.
Approved Dispositions of Unexplained Anomalies (UAs) and Relevant In-Flight Anomalies (IFAs)	First Stage, Avionics, and RoCS in cooperation with the Chief Engineer	Ensure IFAs are from previous flights for legacy hardware/software have been technically reviewed and appropriately dispositioned. This requirement is applicable to Shuttle, Atlas, and Department of Defense (e.g., Peacekeeper) derived hardware and software. Definition for IFA (ref: NSTS 08126) – An IFA is as any problem occurring or identified from ignition through the

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	end of a design element/project's mission cycle life (including postflight data review and reconstruction) that meets any of the PRACA reportable problem criteria or at least one of the following criteria: 1. Affected or could have affected crew safety. 2. Affected or could have affected successful mission completion. 3. Caused or could have caused a launch scrub or abort. 4. Caused a delay that resulted in not meeting the planned T-0 time (excludes any weather related delays) 5. A violation of flight crew on-orbit scheduling constraints. Definition for UA'S ON FLIGHT HARDWARE, FLIGHT SOFTWARE, OR GSE/GSS/IDS - A UA disposition is required when a test problem cannot be repeated or a failure cause cannot be isolated to a Line Replaceable Unit.
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Table D3-3 IPT Level CoFTR Products

CoFTR Product	Assignee	Description of Responsibility
Critical Items List (CIL)	IPTs in cooperation with IPT SMA	Prepare and submit CIL or approved alternatives. Provide status of CIL development. This CoFTR product complete when approved by the CSO and no open actions or issues identified by the CSERP.
FTV Integrated Hazard Analysis (IHA) Reports and Controls approved by the Constellation Safety Engineering Review Panel (CSERP)	SEI in cooperation with IPTs and SE&I SMA	Prepare and submit system IHA for approval. Provide status of integrated FTV hazard analysis development. This CoFTR product complete when baselined with no TBDs or TBRs and no open actions or issues identified by the CSERP.
Hazard Analysis Reports and Controls approved by the CSERP	GS IPT in cooperation with other IPTs and SMA	Prepare and submit for approval. Provide status of hazard analysis development. This CoFTR product complete when baselined with no TBDs or TBRs and no open actions or issues identified by the CSERP.
Material Review Board (MRB) Reports	IPT and GO	Report MRBs to the Mission Manager. Provide status of at acceptance reviews.
Government Industry Data Exchange Program (GIDEP)	IPTs or SMA in cooperation	Report GIDEP issues to the Mission Manager. Provide status of ALERTS processing at acceptance reviews.
Problem Reporting and Corrective Action (PRACA) Summary	GO	Report major issues to the Mission Manager. Provide status weekly and as-required.

Table D3-4 SMA Type CoFTR Products

CoFTR Product	Assignee	Description of Responsibility
Launch Site Major Ground Support Assets (e.g. – MLP, Launch Pad, Rotation Processing and Storage	GS IPT	Report Ground Systems readiness to support operations. Complete and submit applicable verification for approval. Conduct ORRs.

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Facility (RPSF), and VAB).		
Certified Ground Support Equipment (GSE) and approved KSC Special Test Equipment (STE).	GS IPT	Ensure personnel are trained and certified. Ensure all GSE and STE are certified.
Ground Based Telemetry and Imagery Support Assets (e.g. – TEL-4 and JDMTA), Communications, and Weather Bureau	SEI in cooperation with GO and the Range	Demonstrate that these entities are ready to support flight and recovery operations.
Launch Site Support Infrastructure (e.g. – fire rescue, security, etc.)	GO IPT	Assure via statement or appropriate notification at the FTRR that these institutional entities are ready to support flight and recovery operations.

Table D3.5 Ground Systems and Launch Support Type CoFTR Products

CoFTR Product	Assignee	Description of Responsibility
Post Flight Data Review Plan	SEI	Prepare and submit Post Flight Data Review Plan for approval. This CoFTR product is complete when it is baselined with no TBDs or TBRs.
First Stage Recovery Operations Readiness Review	First Stage IPT	Ensure and provide statement of readiness. Report on readiness of the recovery asset, procedures, training, etc. to support recovery activities from First Stage splashdown to securing of First Stage in Hanger AF.
Data Recovery Systems	Avionics IPT and SEI	Ensure and provide statement of readiness. Provide status of the Data Recovery Systems as required.

Table D3.6 Recovery and Post Flight CoFTR Products

CoFTR Product	Assignee	Description of Responsibility
CoFTR Endorsements. Endorsement from the Mission Manager to the CxP Manager	Mission Manager	Prepare and sign CoFTR endorsement before or at the Pre-FTRR.
CoFTR Endorsements from IPT Managers to the Mission Manager	IPT Managers	Prepare and sign CoFTR endorsement before or at the Pre-FTRR dry run.
Endorsement from the SE&I Chief to the Mission Manager	SE&I Chief	Prepare and sign CoFTR endorsement before or at the Pre-FTRR dry run.
Endorsement from the Ares I-X Chief Engineer (ground and flight) to the Mission Manager	Ares I-X Chief Engineer	Prepare and sign CoFTR endorsement before or at the Pre-FTRR dry run.
Endorsement from the Ares I-X CSO to the Mission Manager	Ares I-X CSO	Prepare and sign CoFTR endorsement before or at the Pre-FTRR dry run.
Endorsements from IPT	Prime	Prepare and sign CoFTR endorsement per IPT timeline,

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Prime Contractors to the IPT Managers	Contractors	but no later than the pre-FTRR dry run.
Endorsements from IPT Lead Engineers to the IPT Managers. IPT Lead Engineers will also provide a copy of their CoFTR endorsements to the Ares I-X Chief Engineer and their respective center directorate manager	Lead Engineers	Prepare and sign CoFTR endorsement before the pre-FTRR dry run and ESMARR (for Ares I-X Chief Engineer) or as arranged with the Mission Manager.
Endorsements from IPT SMA Leads to the IPT Managers and the Ares I-X CSO	IPT SMA Leads	Prepare and sign CoFTR endorsement before the pre-FTRR dry run or as arranged with the Mission Manager and the Ares I-X CSO.
Endorsements from SEI Lead Engineer to the SEI Chief. SEI Lead Engineer will also provide a copy of their CoFTR endorsements to the Ares I-X Chief Engineer and their respective center directorate manager.	SE&I Lead Engineer	Prepare and sign CoFTR endorsement before the pre-FTRR dry run and ESMARR (for Ares I-X Chief Engineer) or as arranged with the Mission Manager.
Endorsements from SEI SMA Lead to the SEI Chief and the Ares I-X CSO	SE&I Lead	Prepare and sign CoFTR endorsement before the pre-FTRR dry run or as arranged with the Mission Manager and the Ares I-X CSO.
Endorsement from the Launch Director to the Mission Manager	Launch Director	
Endorsement from the Project Integration Manager to the Mission Manager	Project Integration Manager	

Table D3.7 CoFTR Endorsements

D4.0 Reporting

Written summary reports will be developed by the MMO Project Integration Office on a weekly basis and as-required to inform the Mission Manager and the CxP Manager. Reports will be generated manually to ensure that the data is reviewed and organized for the appropriate forum. For example, reports briefed to the CxCB will be per CxCB guidelines.

An electronic dashboard will be developed at approximately L-6 months to provide status of all CoFTR products. The fidelity of reporting will increase as the mission approaches the CoFTR reviews. For products that can be tracked by the number of items complete, such as number of verification items or OTRs

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complete, the dashboard will indicate x complete out of y total. For products that have a specific function such as a certificate, the status should read complete or incomplete. If incomplete then the status should list issues and concerns, if applicable, in addition to the plan for completion. In the event that an electronic dashboard cannot be developed in time to support reporting needs a manual report will be prepared weekly and posted to Windchill.

The mission office will also employ the KSC Collaborative Integrated Processing System (CIPS) to provide a status of integration activities at KSC. The CIPS Portal provides real-time processing status at <http://usa98.usa-spaceops.com/CIPS/faces/Solumina.jspx>. CIPS will report on work plans, as shown in the example in Figure D4.1, initiated in the Solumina authoring process and it will provide work orders status. A Work Plan defines a prescribed assembly, maintenance, or test procedure authored by Process Engineers and Quality Engineers bringing together operation sequences, work instructions, inspection plans, bills of parts and materials, drawings, 3D models, videos, specifications, tooling, time standards, etc. A work order is a specific instance of a Work Plan that is dispatched into the work execution environment and scheduled for execution. Evaluation of processing health will be performed using six processing arenas to monitor vehicle mate, vehicle rollout, and vehicle launch. The six processing arenas include OTRs, flight hardware parts, Solumina work plans, transferred work, non-standard work, and non-conformances. Real-time access to CIPS data will be used to determine health of flight preparation readiness. Positions in each arena will be determined by Project Integration, Engineering, and Operations per agreed upon evaluation criteria.

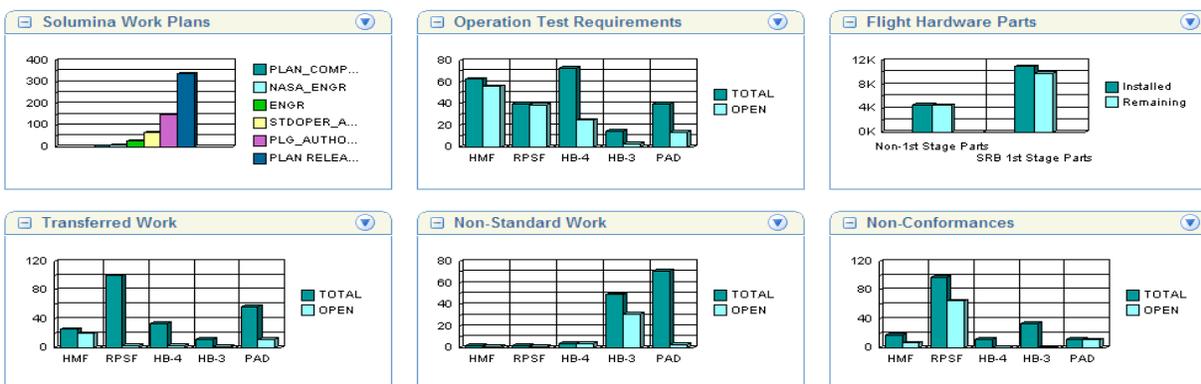


Figure D4.1 Example of CIPS Reporting

D5.0 COFTR Product Notes

Most CoFTR products are development products (i.e., existing products or products being developed as part of the hardware/software development cycle). Several products are CoFTR unique. CoFTR unique products include CoFTR endorsements, CoFTR reporting, and UA/IFA assessments. For development products extra work is not required to convert these products into CoFTR

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deliverables. For unique CoFTR products only a modicum level of work is expected to prepare these deliverables.

D6.0 Conclusion

The main purpose of the CoFTR Implementation Plan is to ensure appropriate status is provided to the stakeholders. This plan is also intended to inform and facilitate the preparation of CoFTR Endorsements.

The MMO Project Integration Office is responsible for preparing written status reports. The GO IPT is responsible for maintaining CIPS. All other parties, referenced in the responsibility matrix, are responsible for providing status and ensuring the accuracy of the data delivered. The Mission Manager or designee will ensure that this information is vetted appropriately and briefed to the stakeholders.