

Project Management of GFE Flight Projects

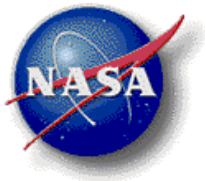
Work Instruction

Engineering Directorate
Project Management Office

Book Manager: EA2/Lauri Hansen

Verify this is the correct version before use

Revision C
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January 2002

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Change Record

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Rev.	Date	Originator	Approvals	Description
Base-line	6/99	Emily Strickler		Baseline Release
A	3/00	Emily Strickler		Change SEAT TO to SEAT TWP; delete EA-WI-024 reference; add reference to NT-GFE-012; editorial change to Table 7.2.5-1 for consistency with Table 7.1.2.3-1; correct web link reference to Flight GFE Projects Home page; Change reference to SEAT STOs to STs
B	6/01	Emily Strickler		Referred to EA-WI-002 for project approval; added annotated outline for feasibility assessment; clarified content of Ground Safety Analysis Report; updated hyperlinks; clarified SAR and firmware definitions; updated reference documents; revised software products; provided PRVD for merged PTRS and V&V Document for IVA non-critical projects; added editorial and explanatory details; defined role of EA PMO for signature approval and co-chair of SRR and SAR; updated required quality records; deleted standard use of product-oriented WBS; replaced 7.2.5 Summary Table; updated annotated outlines
C	01/02	Elena Huffstetler		Modify sections 7.2.3, Project Configuration Management and 7.2.6, Non-Conforming Product and provide a link/reference to the information contained in EA-WI-027, Configuration Management Requirements, Appendix B. Deleted CM related referenced documents and links that are no longer referenced in 023 due the changes to sections 7.2.3 and 7.2.6. Updated information about Acceptance Data Package (ADP) in several areas to clarify when JSC Project Parts Tag-JF 911 can be used instead of an ADP and clarified contents of ADP. Renamed Appendix C to ISO traceability; updated Appendix C to include traceability to AE-CWI-001 Work Instruction for Quality Management System Requirements for Project Planning. Updated SAR process/letter requirements to cover objective evidence of customer/sponsor acceptance of the product. Updated the Annotated Outline for the Verification and Validation (V&V) Document per PMCB action to reflect Generic ARM.

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1. PURPOSE

This work instruction defines the project management processes and associated products for the definition, planning and implementation of GFE Flight Development Projects. These processes and products are defined in association with specific life cycle phases. For each phase, required prerequisites, processes, products, and control gates are documented. In addition, this work instruction defines project configuration management, project contract procedures, and templates for key products and forms.

2. SCOPE

This work instruction is applicable to GFE Flight Development Projects managed by a division or office within the Engineering Directorate, including Engineering Directorate Support Contracting, as described in section 7.3.3. GFE Flight Development Projects contain flight hardware, firmware and/or software, including flight vehicle core systems, crew equipment, payloads, advanced flight systems, and flight experiments that require design and implementation work. Hereafter, this work instruction will refer to GFE Flight Development Projects as simply "GFE Flight Projects".

COTS GFE Flight Projects are defined in EA-WI-002 and the implementation of those projects is covered by EA-WI-002 Appendix C. COTS GFE Flight Project implementation is not a part of the scope of this work instruction.

This work instruction is applicable to project management processes and products for all life cycle phases of a GFE Flight Project, beginning with feasibility assessment and continuing through flight certification, deployment and operations. The planned approach for exceptions to this work instruction is described in section 7.4. Section 7.4 may be applied due to size, schedule, cost, or other circumstances for any project.

This work instruction supports the processes defined in NPG 7120.5A, "NASA Program and Project Management Processes and Requirements" and EA-WI-002, "Project Approval and Implementation Procedure". The traceability of this work instruction to JSC SLP 4.4 "Design Control" is found in Appendix C.

3. REFERENCES

The following documents of the latest revision/issue are referenced within this work instruction:

Document No.	Document Title	Document Location
AE-CWI-001	Quality Management System Requirements for Project Planning	AE Master List
EA-WI-002	Project Approval and Implementation Procedures	EA1 Master List
Form EA-002	Project Approval Form	EA1 Master List
EA-554	Test Operations Guidelines	EA1 Master List
EA-WI-016	Off-the-Shelf Hardware Utilization in Flight Hardware Development	EA1 Master List
EA-WI-018	Use of Off-the-Shelf Software in Flight Projects Work Instruction	EA1 Master List
EA-WI-025	GFE Flight Project Software and Firmware Development	EA1 Master List
EA-WI-027	Configuration Management Requirements	EA1 Master List
JPD 5335.1	Lyndon B. Johnson Space Center Quality Manual	JSC/QMS/Tier 1 List
JPG 8080.5	JSC Design and Procedural Standard Manual	JSC/QMS

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Document No.	Document Title	Document Location
JPG 8500.4	JSC Engineering Drawing System Manual	EA1 Master List
JSC 17038	Flight Equipment Non-Critical Hardware Program Requirements Document	https://ssveo.jsc.nasa.gov/nchwlist/17038.doc
JSC 26626	EVA Generic Design Requirements Document	http://www.jsc.nasa.gov/xa/index/gdrdreva.doc
JSC 27760	GFE Flight Projects Home Page Requirements Document	EA1 Master List
JSC 28484	Program Requirements Document for Johnson Space Center (JSC) Government Furnished Equipment (GFE) Non-critical Hardware	Joint Program Document List
JSC 28035	JSC Government Furnished Equipment (GFE) Problem Reporting and Corrective Action (PRACA) Requirements	NT Master List
JSC 28174	ISS Certification of Flight Readiness Implementation Plan for the Engineering Directorate	EA4 Master List
JSC 61360	Engineering Directorate Certified Parts Approval Process (EDCPAP)	EA1 Master List
JSC SLP 4.4	Design Control	SLP Master List
JSC SLP 4.6	Procurement	SLP Master List
JSC SLP 4.13	Control of Non-conforming Product	SLP Master List
JSC SLP 4.16	Control of Quality Records	SLP Master List
LA-CWI-02	Agreements	LA Master List
NASA STD-3000	NASA STD-3000 Man-Systems Integration Standards	NASA HQs Standards Library
NHB 4100.1	NASA Materials Inventory Management Manual	STI Center (Library)
NHB 4200.1	NASA Equipment Management Manual	STI Center (Library)
NPG 4200.2	Equipment Management Manual for Property Custodians	STI Center (Library)
NPG 7120.5A	NASA Program and Project Management Processes and Requirements	STI Center (Library)
NSTS 1700.7B	Safety Policy and Requirements for Payloads Using the STS	Payload Integration Library System (PILS)
NSTS 1700.7BAD	Addendum, Safety Policy and Requirements for Payloads Using the STS	Payload Integration Library System (PILS)
NSTS 22254	Methodology for Conduct of Space Shuttle Program Hazard Analyses	STI Center (Library)
NT-CWI-005	International Space Station (ISS) JSC Government Furnished Equipment (GFE) Safety Review Process	NT Master List

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Document No.	Document Title	Document Location
NT-QRC-005	Quality Assurance Record Center (QARC) Processing and Maintenance of Acceptance Data Packages	NT Master List
NT-GFE-005	Government-Furnished Equipment (GFE) Safety Analyses	NT Master List
NT-GFE-007	Certification Approval of JSC Government Furnished Equipment	NT Master List
NT-GFE-010	New/Modified JSC GFE SR&QA/Engineering Project Support Process	NT Master List
NT-GFE-012	Preparation of Risk Assessment Executive Summary Report (RAESR) and Risk Reports	NT Master List
NT-CWI-003	Quality Assurance Record Center Discrepancy Reporting and Tracking	NT Master List
SN-D-0007	Acceptance Data Package Requirements	Space Shuttle Program Documentation Center
SSP 30695	Acceptance Data Package Requirements Specification	PALS
SSP 50345	ISS Non-Integrated Criticality 3 Generic Requirements Document	PALS
SSP 41174	International Space Station Interface Control Working Group Operating Procedures	PALS
XA-ISO-002	EVA Hardware Board Work Instruction	XA Master List

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The following links are referenced in this document:

Item	Web Site Location
Flight GFE Projects Home Page	http://www4.jsc.nasa.gov/eaprojects/ea-projects/eaprojects2-flightgfe.htm
Government Certification Approval Request (GCAR, form 1296)	http://jsc-isd-lib15.jsc.nasa.gov/formsdata/wordform/jf1296.doc
Process for Obtaining JSC Document Numbers	http://stic.jsc.nasa.gov/services/jscdocs.html
Scientific and Technical Information (STI) Center home page	http://stic.jsc.nasa.gov/
STI Center Document Index System	http://stic.jsc.nasa.gov/dbase/dis/search.cgi

4. QUALITY RECORDS

The following items are quality records: Requirements Review (e.g. SRR) minutes (including review actions), Design Review minutes (PDR, CDR or SDR) (including review actions), and System Acceptance Review minutes (including review actions). The Engineering Directorate uses the Engineering Drawing System as defined in JPG 8500.4, "Engineering Drawing System Manual" to establish quality records for design and development change review records as specified by SLP 4.4. In addition, all Engineering Directorate initiated design Change Requests (CRs) to qualification or flight hardware, firmware and software will be maintained as quality records. Note: EA uses the Government Certification Request (GCAR, form 1296) as a quality record for V&V.

All other documents and forms cited herein are maintained as part of the project file.

5. DEFINITIONS

See Appendix A - Glossary

6. RESPONSIBILITIES

The GFE Flight Project customer or sponsor provides an Office of Primary Responsibility, approves project documents and products as defined by this work instruction, and defines the customer/sponsor approving and reporting mechanisms for the GFE Flight Project. Typical examples of a customer/sponsor are Engineering Directorate Management; a NASA program office, project office, or organization; or an organization external to the NASA. The customer/sponsor submits a "Request for GFE" (RFG) Form EA-012 (see section 7.5.2.1) as detailed in section 7.1.1 of this work instruction.

The Engineering Directorate is responsible for endorsement of the RFG Form EA-012 upon receipt from the customer/sponsor organization, and for authorizing a feasibility assessment to support Form EA-002, "Project Approval Form", as described in section 9.1 and 9.2 of EA-WI-002. The Engineering Directorate will designate the approving authority for the GFE Flight Project as defined in section 9.2 of EA-WI-002. The Engineering Directorate approves the Project Management Plan (PMP) and the Internal Task Agreement (ITA). The Engineering Directorate has delegated signature approval of the PMP and ITA to the Project Management Office/EA2, as well as monitoring of the overall implementation status of the project to assure customer/sponsor commitments are met.

The EA lead division or office for the GFE Flight Project will appoint a Project Manager, establish a project implementation team, and provide project configuration control as defined by this work instruction, section 9.3 of EA-WI-002, and associated directorate and division work instructions.

The Project Manager will implement the GFE Flight Project according to the procedures and products of this work instruction, section 9.3 of EA-WI-002, and associated directorate and division work instructions.

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7. PROCEDURE

7.1 Project Life Cycle Phases

The formulation, approval, implementation and evaluation of the GFE Flight Project is accomplished through the establishment of well defined project phases and associated processes, products and control gates. Figure 7.1-1 defines the eight life cycle phases for the GFE Flight Project and the associated control gates. These control gates establish successful completion of a phase and approval to proceed to the next phase.

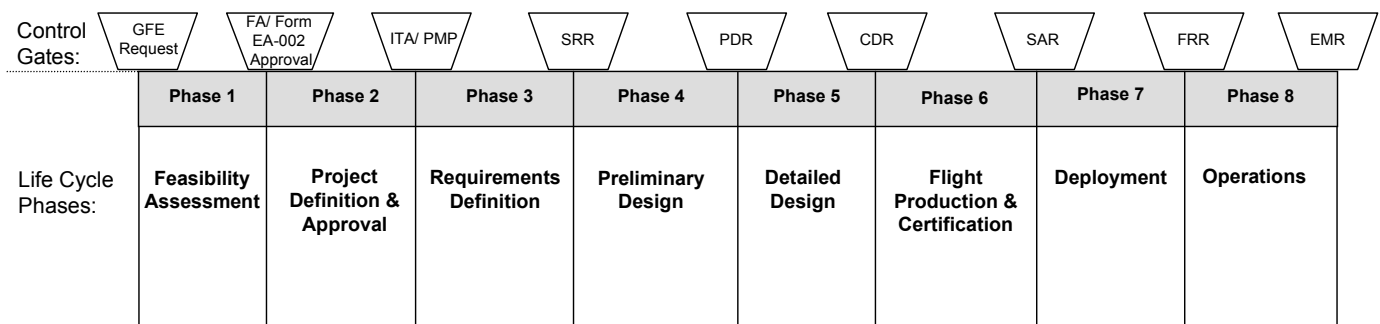


Figure 7.1-1 Project Life Cycle Phases/Control Gates

The following sub-paragraphs of section 7.1 provide details for each project life cycle phase, defining:

- The specific scope for each of the eight life cycle phases.
- The required prerequisites for entering each phase.
- The flow of processes (work) within each phase.
- The required products, including deliverables and non-deliverables, produced in each phase.
- The control points and control gate for each phase. A control point identifies an event or decision within a phase that must be completed before continuing that phase and is outside the control and/or approval of the Engineering Directorate. The control gate identifies the event or decision that must be successfully completed to continue to the next phase of the project.

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7.1.1 Feasibility Assessment Life Cycle Phase

The Feasibility Assessment phase ensures receipt of a documented set of high-level project requirements (or goals) from the customer/sponsor. The tasks performed during this phase determine the technical, resource, and schedule feasibility of the project, as well as associated risks including safety and reliability. Resource feasibility includes civil service availability, contractor availability (if using SEAT) and facility/manufacturing capability (if using EM).

7.1.1.1 Phase Prerequisites

The prerequisites for this phase are:

- The endorsing of a "Request for GFE" form (see RFG form EA-012, section 7.5.2.1) by the Engineering Directorate Project Management Office (EA2) and the customer/sponsor organization. The EA PMO may delegate endorsement of the RFG form (see section 9.1 of EA-WI-002).
- The identification of a customer/sponsor point of contact for responding to queries relative to the RFG.

All endorsed requests for new GFE flight projects (RFG form EA-012 or other customer initiated change requests) must be received through the Engineering Directorate's configuration management personnel for logging and routing to the EA organization that will lead the development of a feasibility assessment. This process does not preclude EA divisions or offices providing the customer/sponsor with technical advisement, a draft RFG, or initiating the RFG. Requests for changes to on-going GFE Flight Projects will follow the process described in section 7.2.3 "Project Configuration Management" and section 7.3 "Project Contractual Documentation". A copy of the signed RFG is provided to the Project Manager. The Engineering Directorate configuration management personnel maintain a database of endorsed RFG forms, available through the EA Flight GFE Projects Home Page.

7.1.1.2 Processes

The process flow for this phase is documented in Figure 7.1.1.2-1 and detailed below.

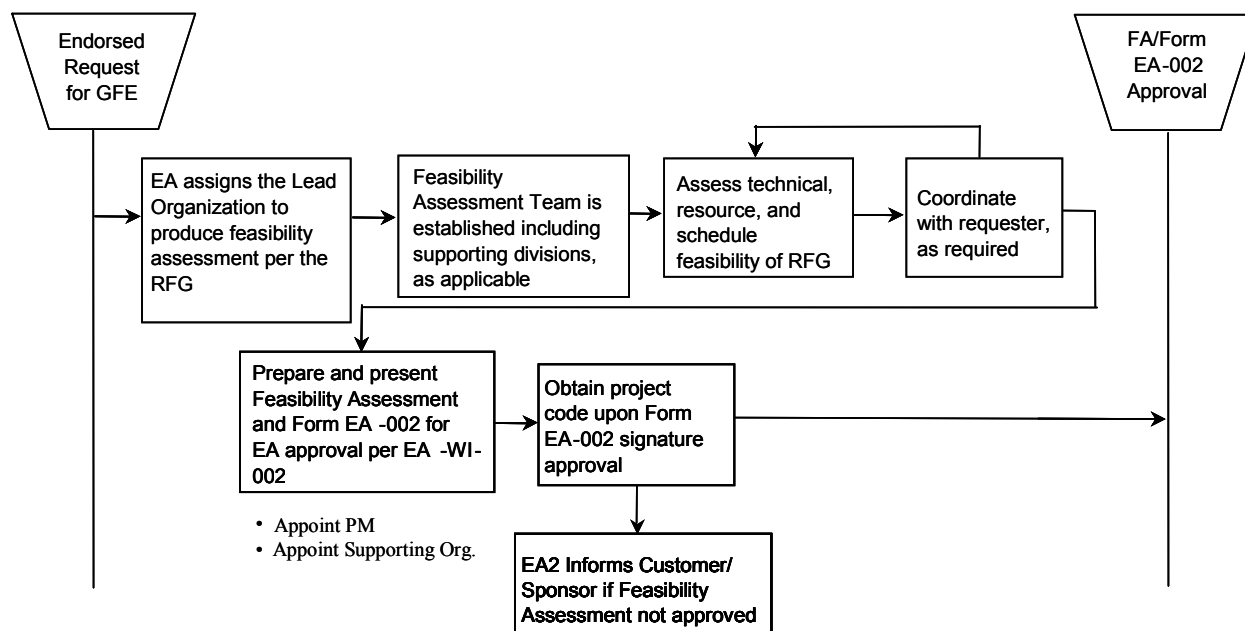


Figure 7.1.1.2-1 Feasibility Assessment Life Cycle Phase Process

Once a RFG is received and endorsed, an EA line organization is selected as lead for establishing the feasibility assessment team. This team prepares the feasibility assessment (FA) per the outline in section 7.5.2.2 and coordinates with the customer/sponsor for clarification of RFG content, as required. Supporting divisions or organizations external to the directorate may be assigned by EA management or through the lead division's request. This feasibility assessment team addresses key factors such as assumptions, ground rules, constraints, schedule, technical validity, civil service and

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support contractor skills and availability, facility/manufacturing, and associated risks including safety and reliability. A Form EA-002 is prepared with the attached FA and both are presented to the EA designated approval authority. Section 9.2 of EA-WI-002 defines the designated approval authority for the GFE flight project Form EA-002. If the designated approving authority for the feasibility assessment determines it is not feasible to establish a GFE project, the Project Management Office/EA2, notifies the customer/sponsor of the Engineering Directorate's decision to "no-bid" the project as GFE. A copy of the feasibility assessment is not provided to the customer/sponsor.

Upon approval of the Form EA-002 and attached FA by the EA designated approval authority (per EA-WI-002), the lead organization obtains the project code from the Project Management Office (EA2), entering this number on the specified area of the signed Form EA-002. Project lead resources are assigned, including the named Project Manager, to support the Project Definition and Approval phase.

The feasibility assessment is an internal EA product. Its content, including estimated cost, is necessary for the EA designated approving authority to determine the feasibility of beginning the next phase, "Project Definition and Approval" Phase. Its content, including estimated cost, is not mature enough to provide to the customer/sponsor. For example, the feasibility assessment may contain options regarding make/buy, civil service/contractor resource availability, etc. that are a "heads up" to the EA designated approving authority for upcoming decisions in the next project phase. This next phase, the Project Definition and Approval phase establishes definition and approval of the project with the customer/sponsor through development of the ITA and PMP, and is defined in section 7.2 of this work instruction.

The EA configuration management personnel are provided a copy of the approved Form EA-002 and attached feasibility assessment by the Project Manager. The original is kept with the project files.

7.1.1.3 Products

The feasibility assessment is prepared per the annotated outline contained in section 7.5.2.2, and is approved via the Form EA-002 signatures. It is important that the project manager understand that the feasibility assessment does not represent the ITA or the PMP, but provides EA management approval for resource commitments to perform the tasks associated with developing the ITA and the PMP for customer/sponsor approval of the project.

The documentation products for this phase are listed in Table 7.1.1.3-1. The documents are maintained as a part of the project file.

Table 7.1.1.3-1 Feasibility Assessment Phase Documentation Products

Products	Version	Data Package	RIDable (Y/N)	Approving Authority
Form EA-002 with attached feasibility assessment	Final	N/A	N/A	Per EA-WI-002

7.1.1.4 Control Points and Control Gate

There are no control points within this phase. The EA approval (per EA-WI-002) of the Form EA-002 with attached feasibility assessment is the control gate for this phase.

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7.1.2 Project Definition and Approval Life Cycle Phase

The Project Definition and Approval phase ensures agreement of scope, products, responsibilities, cost, and schedule of the GFE project. This agreement is with both engineering management and the customer/sponsor management. The tasks performed during this phase define the project in terms of:

- a. Top level requirements or goals
- b. Work breakdown
- c. Resource requirements
- d. Facility requirements
- e. Budget requirements
- f. Major milestone schedule
- g. External interfaces and dependencies

7.1.2.1 Phase Prerequisites

The prerequisites for this phase are signature approval of Form EA-002 with attached feasibility assessment (FA) by the EA designated approval authority (per EA-WI-002). The Project Manager provides a copy of the approved Form EA-002 to the EA configuration management personnel. Supporting EA divisions/offices as well as other organizations may be appointed to partner with the lead division in the life cycle implementation of the GFE project.

7.1.2.2 Processes

The key processes performed during this life cycle phase produce the Project Management Plan and the Internal Task Agreement (ITA). The process flow for this phase is documented in Figure 7.1.2.2-1 and detailed below.

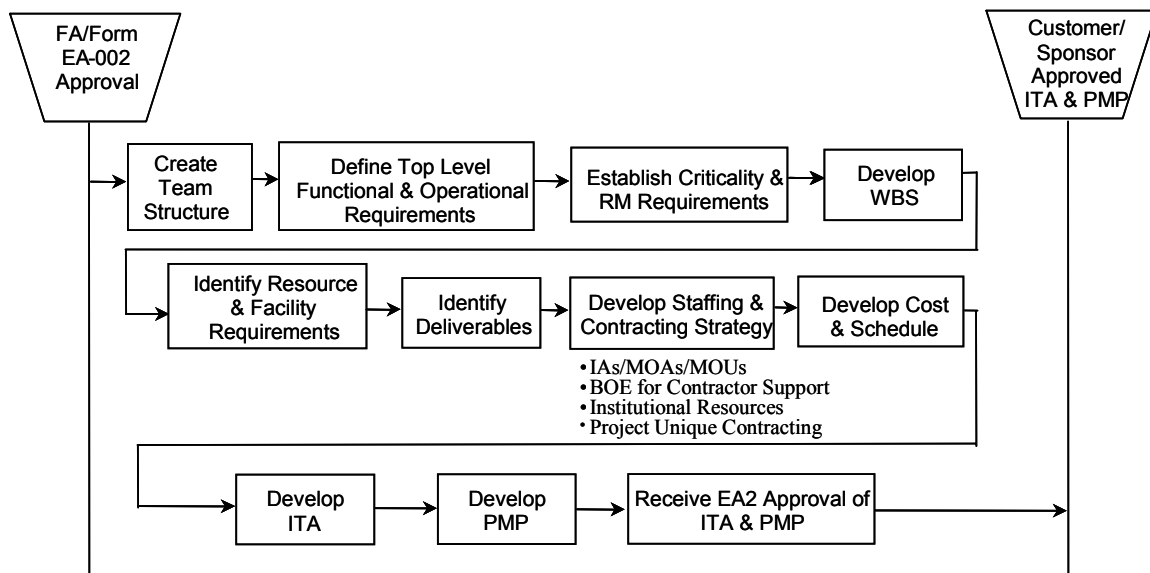


Figure 7.1.2.2-1 Project Definition and Approval Life Cycle Phase Processes

The Project Manager establishes a project team structure with key personnel assignments from the functional disciplines of the project, including SR&QA and MOD. The process for establishing NA/EA support for new and modified JSC GFE projects is documented in Work Instruction NT-GFE-010. Project leads are established for the functional disciplines. The project team roster is kept current and documented as a part of the project file. The Project Manager, with the project leads, defines top level functional, operational, criticality and redundancy management requirements for the project based on the customer/sponsor's RFG and the feasibility assessment. These top-level requirements will be detailed and documented in the following project phase through the development of the Project Technical Requirements Specification (PTRS). The PTRS documents the functional and performance requirements for the project.

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It is important that the Project Manager understand section 7.2, "Project Definition and Control" and section 7.3, "Project Contractual Documentation" at this phase of the project. The processes and products of this phase are detailed in those sections of this work instruction. The following paragraphs provide pointers to portions of those sections.

The Project Manager, with the project leads, develops a project Work Breakdown Structure (WBS). A product-oriented example template is provided for use, as appropriate, in section 7.2.1. The WBS is used to develop resource assignments, identify end items and deliverables, and create the project schedule (see section 7.2.2). The WBS and project schedule may require additional detail during the Requirements Definition phase, but the WBS structure accurately defines project end item work at this phase for developing the Internal Task Agreement (note ITA content below), the Project Management Plan (PMP), and for defining contract strategies.

The ITA documents the project description, deliverables, control milestones and costs associated with the project for customer/sponsor signature agreement. The ITA is developed per section 7.3.1, and is approved by the Engineering Directorate as delegated in section 6 of this document. Due to project complexity, unique dependencies, or technical risk, it may not be possible to commit to firm cost and/or schedule at this phase of the life cycle (pre-Requirements Definition phase). In these situations, it is appropriate to develop an ITA that provides pricing through the Preliminary Design phase and best estimate at completion costing through project completion. During the early stages of the project, requirements are established and understood, prototyping of some critical elements is performed, and the project team is augmented with experts from other EA organizations. All of these activities serve to provide the information required to develop an updated ITA with cost and schedule commitments for the full project life cycle. This updated ITA is developed and re-negotiated with the customer during the Preliminary Design phase of the life cycle (see section 7.1.4).

The development of project staffing and contracting strategies may include: Memorandums of Understanding (MOUs), Memorandums of Agreement (MOAs) and Interdivisional Agreements (IAs) (see section 7.3.2 and section 9.3 of EA-WI-002); Engineering Directorate support contracts, including SEAT and others (see section 7.3.3); project unique contracts (see section 7.3.4); and definition of resource requirements (see section 7.2.2).

The Project Management Plan serves as the documented approach for implementing the GFE Flight Project with signature agreement from the customer/sponsor. The PMP supports the cost, schedule and delivery agreement made in the ITA, providing implementation approach detail. The specific documentation products developed by the project are listed in the PMP. The plan for managing project risks is documented in section 7 of the PMP, and addresses the severity and likelihood of risks associated with schedule, budget, environment, safety, technical, people and configuration management, as appropriate. The annotated outline defining content of the PMP is in section 7.5.1.1. The PMP meets the criteria for developing a project plan per AE-CWI-001, "Quality Management System Requirements for Project Planning" for applicable projects as defined in EA-WI-002.

Note: for non-critical GFE projects, the lead division may choose to document the implementation approach in the ITA (including documentation deliverables). The decision to document the implementation approach in an ITA in place of the PMP should be documented as a part of the Form EA-002 approval process.

At this time, a project unique website is developed by EA configuration management personnel as a part of the Engineering Directorate Projects website, and provided to the Project Manager as a tool for managing data products. This project website serves as the information source for various types of project data. This website is developed per JSC 27760, "GFE Flight Projects Home Page Requirements Document".

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7.1.2.3 Products

The documentation products for this phase are listed in Table 7.1.2.3-1. The documents are maintained as a part of the project file.

Table 7.1.2.3-1 Project Definition and Approval Phase Documentation Products

Products	Version	Data Pkg.	RIDable (Y/N)	Approving Authority
Internal Task Agreement	*	N/A	N/A	Division/PM EA PMO (EA2) Customer/Sponsor
Project Management Plan	Final	N/A	N/A	Division/PM EA PMO (EA2) Customer/Sponsor Other DLOs, as appropriate
Memorandum of Agreement (MOA)	Final	N/A	N/A	Affected NASA Directorates
Interdivisional Agreements (IAs)	Final	N/A	N/A	Affected EA Divisions
Contractor Technical Work Plan/Change Mechanism for BOE	*	N/A	N/A	Division/PM (or TMR) COTR/CO
* Firm price through PDR; best estimate at completion (EAC)				

7.1.2.4 Control Points and Control Gate

There are no control points within this phase.

The control gate for this phase is the customer's/sponsor's authority to proceed through approval (signature) of the PMP and ITA and associated funding commitment. EA signature approval of the PMP and ITA is acquired prior to submitting to the customer/sponsor organization for approval. Entry into the Requirements Definition phase does not begin until these key project documents and associated funding receive full signature authority. Along with signature authority, a named customer/sponsor point of contact will be provided.

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7.1.3 Requirements Definition Life Cycle Phase

This phase defines, reviews, and approves the technical requirements for the project. Technical requirements include functional, performance, interface, physical, safety, quality, human engineering, and verification requirements. Upon completion of this phase, the project schedule, deliverables, and resource requirements documented in the ITA, PMP, and IAs may require updating to reflect previously undefined technical requirements.

7.1.3.1 Phase Prerequisites

The prerequisites for this phase are:

- Approved ITA, PMP, and MOAs/IAs, as required by the project
- Funding from the customer or sponsor
- Personnel and facility support from the required Engineering Directorate organizations
- Project point of contact from the customer/sponsor organization

7.1.3.2 Processes

The key processes performed during this life cycle phase will produce the Project Technical Requirements Specification (PTRS) and the Interface Control Documents (ICDs). The process flow for this phase is documented in Figure 7.1.3.2-1.

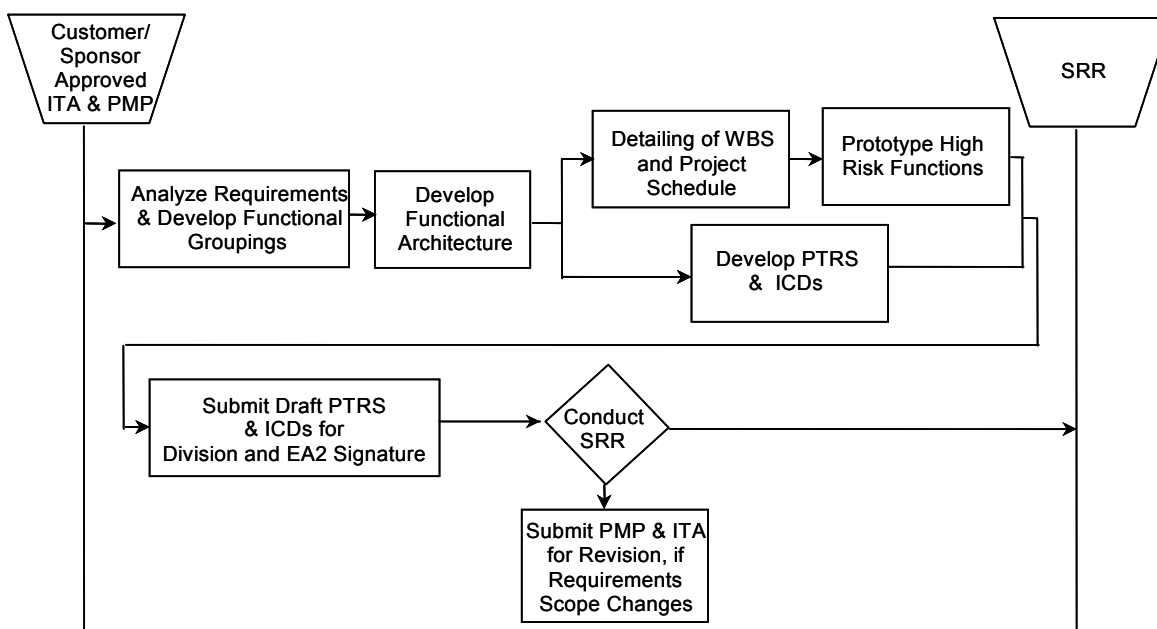


Figure 7.1.3.2-1 Requirements Definition Life Cycle Phase Process

The Project Technical Requirements Specification is developed per section 7.5.1.2. For non-critical IVA GFE flight projects, JSC 28484 “Program Requirements Document for JSC Non-Critical GFE” is an applicable document to the PTRS as a source for workmanship, safety and environmental requirements. For EVA GFE, JSC 26626 “EVA Generic Design Requirements Document” is applicable; for Shuttle GFE with external hardware (not used as EVA), JSC 17038 “Flight Equipment Non-Critical Hardware Program Requirements Document” is applicable; and for ISS GFE with external hardware (not used as EVA), SSP 50345 “ISS Non-Integrated Criticality 3 Generic Requirements Document” is applicable to the PTRS for workmanship, safety and environmental requirements.

For IVA non-critical GFE flight projects, the lead division, with concurrence from the EA PMO, may choose to develop a PTRS and V&V Document (V&VD) per the annotated outlines in section 7.5.1.2 and 7.5.1.4, or may choose to

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replace the PTRS and V&VD with a single document, the Project Requirements and Verification Document (PRVD), which is developed per the PRVD annotated outline in section 7.5.1.6. The decision to develop a PRVD in place of a PTRS and V&VD should be documented as a part of the Form EA-002 approval process. The requirements content of the PRVD is finalized as a part of the SRR process, the verification plan content of the PRVD is preliminary at the PDR and finalized as a part of the CDR process, and the verification results content of the PRVD is finalized prior to SAR. If the non-critical GFE flight project combines the Preliminary and Detailed Design Phases into a single System Design Phase with one System Design Review (see section 7.4), the verification plan portion of the PRVD is finalized as a part of the SDR process. JSC 28484 is the applicable standard to the PRVD for IVA non-critical GFE workmanship, safety and environmental requirements.

If a GFE flight project has an external interface to a flight system or vehicle, and the external interface is already defined by a program or project in an existing ICD, the project PTRS (or PRVD) should list that defined ICD as an applicable document, invoke it with a "shall" statement in the body of the PTRS (or PRVD), and no new project ICD need be developed. However, if no defined interface exists, or modifications must be made for the GFE interface, a GFE flight project ICD is developed per section 7.5.1.3.

The Work Breakdown Structure (WBS) and project schedule are detailed, as required, by the end item development leads (see section 7.2.1) and the Project Manager. The required documentation list (per PMP or ITA) is reviewed and reflected in the WBS and schedule.

The prototyping of high-risk functions provides confidence that requirements can be implemented. High risk functions may be associated with: COTS hardware meeting flight or launch environmental requirements (see EA-WI-016, "Off-the-Shelf Hardware Utilization in Flight Hardware Development"); COTS software (see EA-WI-018, "Use of Off-the-Shelf Software in Flight Projects Work Instruction"); first time use of technology or custom designs; or any other function which warrants confirmation prior to requirements commitment.

7.1.3.3 Products

The documentation products for this phase are listed in Table 7.1.3.3-1. The documents are maintained as a part of the project file.

Table 7.1.3.3-1 Requirements Definition Phase Documentation Products

Products	Version	SRR Data Pkg.	RIDable (Y/N)	Approving Authority
Project Technical Requirements Specification (PTRS) or Project Requirements and Verification Document (PRVD) for IVA non-critical GFE	Final* (see 7.1.3.2) *For PRVD, requirements portion only	Yes	Yes	Division/PM EA PMO (EA2) Customer/Sponsor* SR&QA *For PRVD, represents agreement with requirements only
Interface Control Documents (ICDs)	Final for Functional Characteristics content	Yes	Yes	Division/PM EA PMO (EA2) Interfacing Org. Customer/Sponsor
Configuration Management Plan	Final	Yes	No	Division/PM
Software Development Plan	Final	Yes	No	Division/PM

The Interface Control Documents (see section 7.5.1.3 for annotated outline) developed during this phase and reviewed at the SRR will contain the "Functional Characteristics" subsections of the ICD, while the "Detailed Specifications" subsections will remain "to be defined" (TBD). These "Functional Characteristics" subsections specify the high-level interface requirements (such as naming the specific hardware or software interface, the physical interface method, or the protocol that will be used over the interface), as stated in the annotated outline. The "Detailed Specifications"

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subsections of the ICDs are developed during the Preliminary Design and Detailed Design phases. These “Detailed Specifications” subsections of the ICDs are reviewed at the Preliminary Design Review (PDR) in preliminary form, and at the Critical Design Review (CDR) in final form. The “Detailed Specifications” subsections of the ICD provide the details of each interface requirement such as electrical connector pin assignments, plumbing fitting specifications, or packet/word/bit definitions for software and data. (See sections 7.1.4.3 and 7.1.5.3 of this work instruction.) The “Functional Characteristics” subsections of the ICD are RIDable at the SRR and the “Detailed Specifications” subsections are RIDable at the PDR and CDR.

The EA configuration control requirements are defined in EA-WI-027, “Configuration Management Requirements, Appendix B”. The project’s lead division will establish the specific Configuration Management Plan applicable to the project. Instructions for development of the Software Development Plan are defined in EA-WI-025, “GFE Flight Project Software and Firmware Development Work Instruction”.

7.1.3.4 Control Points and Control Gate

There are no control points within this phase. The System Requirements Review (SRR), and associated approval of the PTRS (or PRVD) and associated ICD(s) (with “Detailed Specifications” subsections TBD), is the control gate for this phase. Entry into the Preliminary Design phase does not begin until these key project documents receive full signature approval.

7.1.3.4.1 System Requirements Review (SRR)

The SRR ensures that the customer/sponsor, Engineering Directorate, SR&QA Office, and any external supporting organizations agree with the requirements for the project. The customer/sponsor and the EA PMO co-sponsor the SRR and co-chair the SRR RID Review Board.

Section 7.2.4.1 provides the detailed instructions for conducting the SRR.

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7.1.4 Preliminary Design Life Cycle Phase

The Preliminary Design phase begins the design-to baseline that will meet the approved requirements from the prior phase. The Preliminary Design phase will conclude with approximately ten percent of the engineering drawings and design documentation complete for the Preliminary Design Review (PDR).

7.1.4.1 Phase Prerequisites

Prior to entry into this phase, successful completion of the System Requirements Review must occur. This review produces the following products, including signature approval:

- PTRS
- ICDs, with "Detailed Specifications" subsections TBD

7.1.4.2 Processes

The key processes performed during this phase provide the basis of design for further detailed design in the following phase. The process flow is outlined in Figure 7.1.4.2-1 and detailed below.

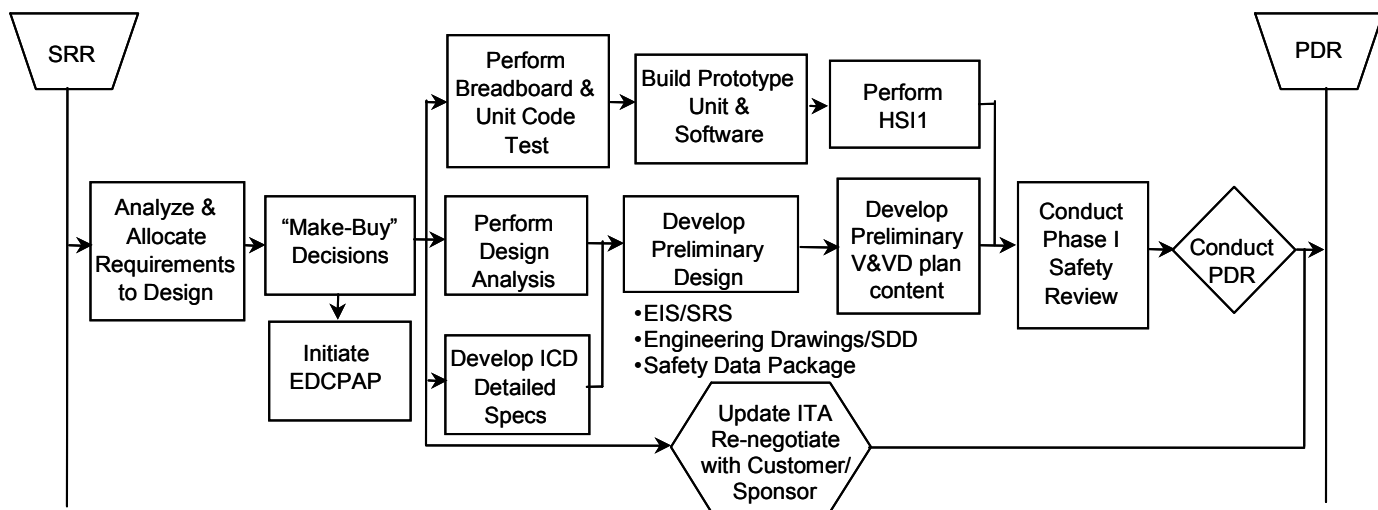


Figure 7.1.4.2-1 Preliminary Design Life Cycle Phase Process Flow

These processes support the early GFE design and produce the initial design documentation. Requirements are analyzed, make-buy decisions and part selections are initiated, early hardware and software prototypes are developed and tested, and preliminary design documentation is produced.

The first Hardware/Software Integration (HSI1) testing establishes confidence that the GFE will meet the defined functional interfaces. Using the prototype unit, HSI1 provides proof of concept that the hardware, firmware and software components of the GFE perform as per the preliminary design. If the GFE does not incorporate software or firmware, the HSI1 testing is simply hardware testing of the prototype design.

The electrical, electronic, electromechanical (EEE) parts selection and evaluation process is initiated during this phase. The project will follow the requirements of JSC 61360, "Engineering Directorate Certified Parts Approval Process (EDCPAP)".

The safety review process is initiated during the Preliminary Design phase. The Phase I Safety Review is the first required safety meeting in which the safety of the GFE item and associated operations are assessed. The focus of the safety review is to identify all potential hazards and hazard causes inherent in the preliminary design, to evaluate the means of eliminating, reducing, or controlling the risk, and to establish the preliminary method for safety verification.

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Preliminary hazard analysis and failure modes and effects analyses are performed during this phase. The document required (by the SR&QA Office) to capture these analyses is the Risk Assessment Executive Summary Report (RAESR). The RAESR is prepared per NT-GFE-012. A Safety Data Package, including the RAESR, is prepared and submitted to the Phase 1 Safety Review Panel (hereafter referred to as the Safety and Mission Assurance Review Team (SMART)). (See NT-CWI-005 (for ISS) and NSTS 22254 (for Shuttle) for descriptions of the Safety Data Package and submittal process.) After approval, the Safety Data Package and results of the Phase 1 Safety Review results are included in the PDR data package and presented at the PDR. Note: For GFE payloads, the safety review is performed by the Payload Safety Review Panel (PSRP). This payload safety review may occur prior to, or after, the PDR as negotiated by the GFE payload project manager, the payload customer/sponsor and the PSRP. See NSTS 1700.7 “Safety Policy and Requirements for Payloads Using the STS” and NSTS 1700.7 Addendum “Safety Policy Requirements for Payloads Using the International Space Station”.

7.1.4.3 Products

The product listed as “Design Analyses Reports” is the set of studies for the acceptance of specific design criteria. These reports may be available in a preliminary draft form at this phase or may be fully developed in the following Detailed Design Phase. These reports might include but are not limited to stress reports, thermal analysis reports, and fracture control assessments, as available.

The documentation products for this phase are listed in Table 7.1.4.3-1. The documents are maintained as a part of the project file.

Table 7.1.4.3-1 Preliminary Design Phase Documentation Products

Products	Version	PDR Data Pkg.	RIDable (Y/N)	Approving Authority
End Item Specification	Preliminary	Yes	Yes	Division/PM
Software Requirement Specification	Final	Yes	Yes	Division/PM
Engineering Drawings	Preliminary	Yes	Yes	Project Manager JPG 8500.4 specified signatures
Software Design Document	Preliminary	Yes	Yes	Division/PM
Verification and Validation Document (V&VD) or Project Requirements and Verification Document (PRVD) for IVA non-critical GFE	Preliminary for verification plan content	Yes	Yes	Division/PM SR&QA
ICDs	Preliminary for Detailed Specification content	Yes	Yes	Division/PM EA PMO (EA2) Interfacing Org. Customer/Sponsor
ITA with cost to complete	Final	No	No	Division/PM EA PMO (EA2) Customer/Sponsor
Safety Data Package	Phase I	Yes	Yes	Division/PM S&MA Review Team (SMART) or PSRP

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Products	Version	PDR Data Pkg.	RIDable (Y/N)	Approving Authority
EEE Parts Analysis	Preliminary	Yes	Yes	Division/PM EDCPAP Rep. SR&QA
Design Analyses Reports	Preliminary	Yes	Yes	Division/PM

From the table above, the set of documents that capture the design and flow down of PTRS requirements comprise the End Item Specification(s) (EIS), Software Requirement Specification (SRS), engineering drawings, and the Software Design Document (SDD). The need to develop an EIS is determined by the Project Manager and lead division/office management based on the need to flow down requirements from the PTRS and ICD(s) to project end items. Engineering drawings document the hardware and are managed according to JPG 8500.4. The preliminary End Item Specification(s) and preliminary engineering drawings (including the drawing tree) are developed during this phase. Final End Item Specification(s) and engineering drawings are completed during the Detailed Design phase and released prior to Flight Production and Certification.

The SRS and SDD are required by EA-WI-025, “GFE Flight Project Software and Firmware Development Work Instruction” for projects which contain flight software and/or flight firmware. The SRS captures the flow down of PTRS and ICD(s) requirements to software and/or firmware. The SDD will document the software and/or firmware design and the allocation of requirements to design modules.

The annotated outlines and required formats for the EIS, ICDs and the V&VD are found in section 7.5.

The V&V Document: Plan and Report (hereafter referred to as the V&V Document or V&VD) defines the plan for, and documents the results of, the verification and validation activities for the GFE Flight project. These activities confirm that the GFE flight items comply with their specifications, function properly as an integrated unit when interfaced with program/vehicle components, and are ready for use as a part of the flight system. (See section 7.1.3.2 for use of the PRVD to replace the V&VD for IVA non-critical projects.) Appendices C&D of the V&VD include a “Results” column for documenting the objective evidence (results) of verification activities performed during the Flight Production and Certification Phase. The first baseline of the V&VD is finalized at CDR to establish the plan for V&V, and all columns of the appendices are completed except the “Results” column (i.e., results are TBS). During the Flight Production and Certification Phase, the planned V&V activities are performed and the “Results” column is documented (including TPS #, “use as is” DR # or waiver, memo or report, etc., as appropriate). The V&VD, with the appendices “Results” column documented, is released with the appropriate revision number and change record information. This revised release of the V&V Document: Plan and Report, with associated “Results” documentation attached, form a part of the Certification Data Package.

The progressive development of the ICDs is defined in section 7.1.3.3, with development of the “Detailed Specifications” subsections of the ICD beginning in this phase and completed during the Detailed Design phase. Only the “Detailed Specifications” subsections of the ICD are RIDable at PDR and CDR.

7.1.4.4 Control Points and Control Gate

The control points for this phase are:

- Customer/sponsor signature approval of the updated ITA with firm cost to complete.
- The SMART approval of the Safety Data Package presented at the Phase I Safety Review.

The PDR serves as the control gate for this phase and is detailed below.

7.1.4.4.1 Preliminary Design Review (PDR)

Section 7.2.4.1 provides the detailed instructions for conducting the PDR.

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Project preliminary design is assessed for meeting the baseline requirements. The GFE lead division or office sponsors the PDR and chairs the PDR RID Review Board.

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7.1.5 Detailed Design Life Cycle Phase

The Detailed Design phase completes the design-to baseline that began in the Preliminary Design phase. As a minimum, ninety percent of the engineering drawings, design documentation, and associated development testing are completed prior to the Critical Design Review (CDR).

7.1.5.1 Phase Prerequisites

Prior to entry into this phase, successful completion of the PDR must occur. The project team begins this phase with preliminary design and verification documentation, HSI1 results, and PDR actions that reflect confidence for detailed design.

7.1.5.2 Processes

The process flow is outlined in 7.1.5.2-1 and detailed below.

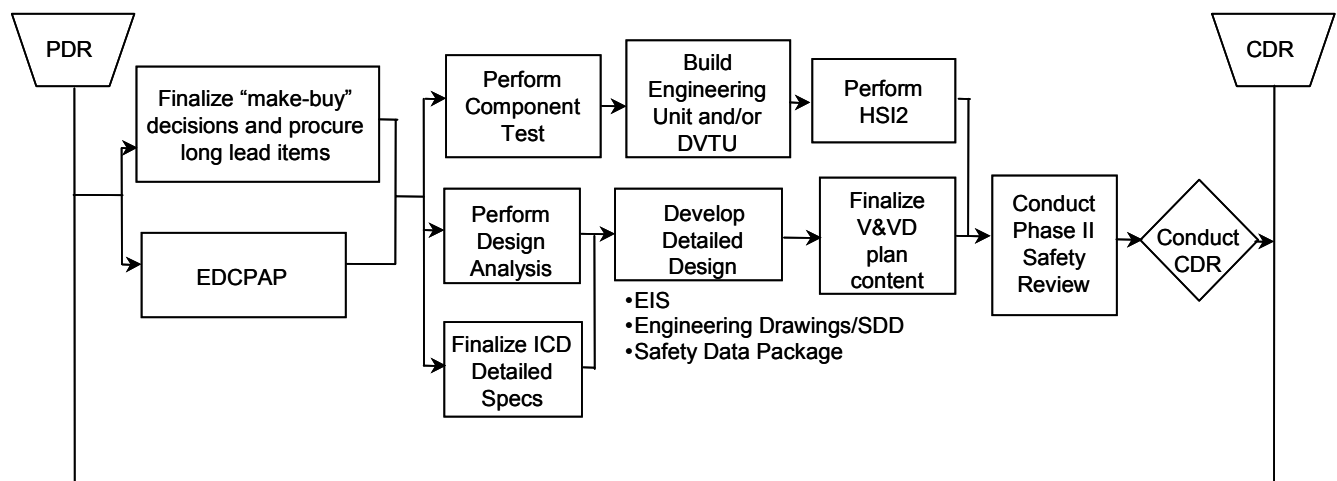


Figure 7.1.5.2-1 Detailed Design Life Cycle Phase Process Flow

The processes performed during this life cycle phase support the final design decisions and produce the detailed design documentation. PDR products are refined, make-buy decisions and part selections are finalized, the engineering unit and associated software is developed and tested, and detailed design documentation is produced. The need for an Acceptance Data Package (ADP), Vs an JSC Project Parts Tag- JF 911, on each project deliverable is determined, and if needed the PMP or ITA are updated to reflect ADP requirements (refer to sections 7.2.4 and 7.1.6.3). If an ADP is needed, the required contents are agreed to and documented on the checklists provided in SSP 30695 ISS Acceptance Data Package Requirements Specification Appendix E, checklists E-2 and E-3.

Hardware/Software Integration 2 (HSI2) is the development testing which builds on the HSI1 testing of the Preliminary Design phase. Using the Engineering Unit or Design Verification Test Unit (DVTU), HSI2 provides proof of concept that the hardware, firmware and software components of the GFE perform as per the detailed design. If the GFE does not incorporate software or firmware, the HSI2 test is simply an integrated hardware test. The Engineering Unit is commonly used when functional equivalence only is required (i.e. software development) and the DVTU is more commonly used when form, fit and functional equivalence is required (i.e. hardware development).

The safety analysis and review process is continued during the detailed design phase with the completion of the Phase II Safety Review. The purpose of the safety review is to evaluate the updated assessment that reflects the detailed design and operations of the GFE to assure that all appropriate hazard controls have been implemented and that acceptable methods of verifying the controls have been identified.

A detailed hazard analysis and failure modes and effects analysis is completed during this phase. The PDR Safety Data Package is updated and completed such that all hazards and hazard causes have been identified, and a means for

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eliminating, reducing, or controlling associated risks are defined and implemented. The document required (by the SR&QA Office) to capture these analyses is the Risk Assessment Executive Summary Report (RAESR). (See NT-GFE-012) The Safety Data Package, including the RAESR, is prepared and submitted to the Phase II Safety Review for approval by the SMART. (See NT-CWI-005 (for ISS) and NSTS 22254 (for Shuttle) for descriptions of the Safety Data Package and submittal process.) After approval, the Safety Data Package and results of the Phase II Safety Review are included in the CDR data package, and presented at the CDR. Note: For GFE payloads, the safety review is performed by the Payload Safety Review Panel (PSRP). This payload safety review may occur prior or after the CDR as negotiated by the GFE payload project manager, the payload customer/sponsor and the PSRP. See NSTS 1700.7 "Safety Policy and Requirements for Payloads Using the STS" and NSTS 1700.7 Addendum "Safety Policy Requirements for Payloads Using the International Space Station".

7.1.5.3 Products

The set of documents produced during this phase includes the final versions of those developed during the Preliminary Design phase. Refer to section 7.1.4.3 for information regarding the development of the V&VD (or PRVD) and the other products listed in Table 7.1.5.3-1 below. Only the "Detailed Specifications" subsections of the ICD are RIDable at PDR and CDR. The product listed as "Design Analyses Reports" is the cumulative set of studies for the acceptance of specific design criteria. These might include but are not limited to stress reports, thermal analysis reports, and fracture control assessments.

The documentation products for this phase are listed in Table 7.1.5.3-1. The documents are maintained as a part of the project file.

Table 7.1.5.3-1 Detailed Design Phase Documentation Products

Products	Version	CDR Data Pkg.	RIDable (Y/N)	Approving Authority
Engineering Drawings	Final	Yes	Yes	Division/PM JPG 8500.4
ICDs	Final for Detailed Specification content	Yes	Yes	Division/PM EA PMO (EA2) Interfacing Org. Customer/Sponsor
Safety Data Package	Phase II	Yes	Yes	Division/PM S&MA Review Team (SMART) or PSRP
Design Analyses Reports	Final	Yes	Yes	Division/PM
Verification and Validation Document (V&VD) or Project Requirements and Verification Document (PRVD) for IVA non-critical GFE	Final for verification plan content	Yes	Yes	Division/PM SR&QA
Software Design Document	Final	Yes	Yes	Division/PM
End Item Specification	Final	Yes	Yes	Division/PM
Sustaining Engineering Plan	Preliminary	No	No	Division/PM EA PMO (EA2) Customer/Sponsor
EEE Parts Analysis	Final	Yes	Yes	Division/PM EDCPAP Rep.
Appendix E Checklist E-2 and E-3 (if ADP is required)	Final	Yes	Yes	Customer, Division/PM, SR&QA

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In addition to the products listed in Table 7.1.5.3-1, a secondary list of highly desired project products warrants consideration/mention. Project managers have developed these products over the years and although not requirements, they have the potential to enhance the quality and success of the end product. These products are listed below for project management determination if all or some subset be considered prior to completion of the Detailed Design phase.

- a. Parts shortage listing and schedule for completion
- b. Flight hardware Detailed Design Document (provides functional and detailed design information in addition to the drawings)
- c. Training Plan (MOD Product regarding utilization of GFE for training)
- d. Training Materials (lesson plans) coordinated with MOD (MOD Product)
- e. Test Facility Plan/Schedule
- f. Detailed schedule that tracks completion of each remaining drawing by drawing number
- g. Manufacturing Plan
- h. Procurement Plan

7.1.5.4 Control Points and Control Gate

The control point for the Detailed Design phase is the SMART approval of the Safety Data Package presented at the Phase II Safety Review. The control gate is the CDR, as detailed below.

7.1.5.4.1 Critical Design Review (CDR)

Section 7.2.4.1 provides the detailed instructions for conducting a CDR.

The CDR provides the detailed design data package and establishes the design baseline for fabrication and certification of the GFE flight project. Project detailed design is assessed for meeting the baseline requirements. The GFE lead division or office sponsors the CDR and chairs the CDR RID Review Board.

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7.1.6 Flight Production and Certification Life Cycle Phase

The Flight Production and Certification phase requires successful completion of the Critical Design Review (CDR) and will culminate in conductance of a System Acceptance Review (SAR). In this phase, the GFE products are fabricated, tested, and certified for flight delivery. As a by-product of this phase, experience will be gained from the testing of the GFE and its support equipment.

7.1.6.1 Phase Prerequisites

The prerequisite for this phase will be the successful completion of the project CDR.

7.1.6.2 Processes

The key processes performed during this phase are the fabrication and certification of the GFE flight products. The process flow is outlined in Figure 7.1.6.2-1 and detailed below.

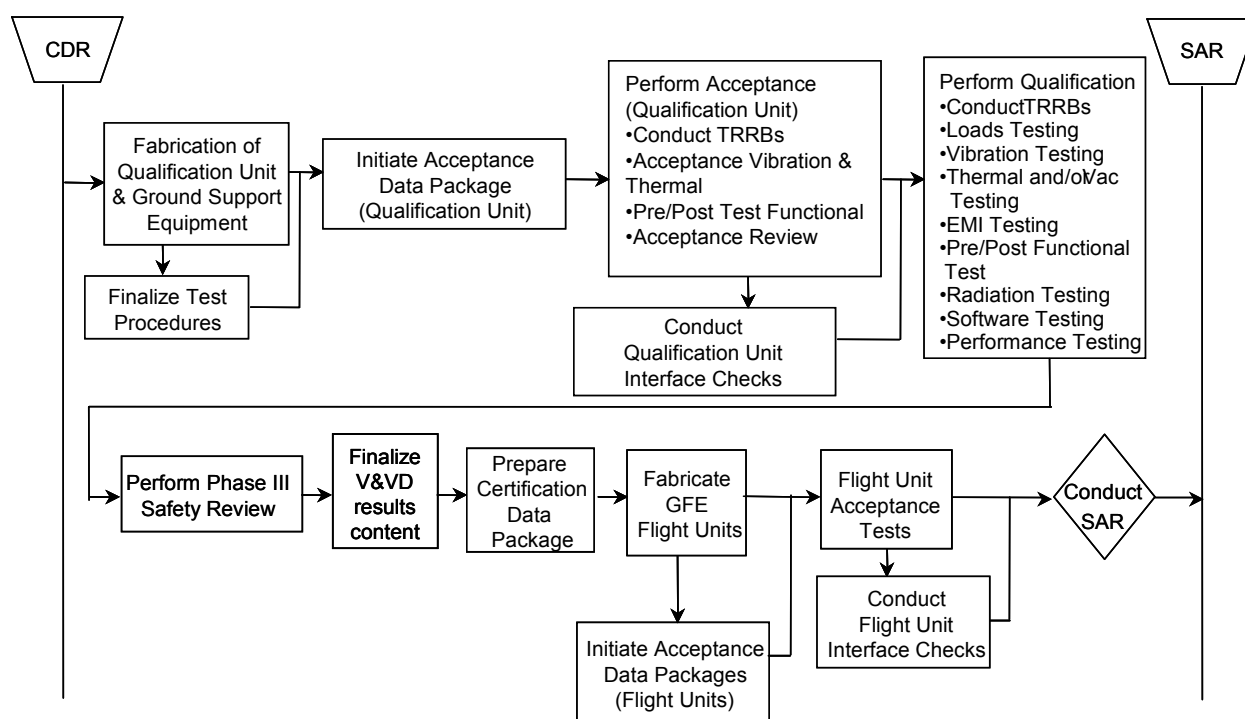


Figure 7.1.6.2-1 Flight Production and Certification Life Cycle Phase Process Flow

The Flight Production and Certification phase completes remaining design prior to fabrication of the qualification unit and ground support equipment (GSE). Software coding is completed and an integrated build of the complete set of software is produced. Test procedures for all certification and acceptance testing are finalized. Software verification and validation is performed on a platform that is the functional equivalent of the flight hardware. Completion of the qualification unit fabrication includes initiation of an Acceptance Data Package (ADP) for the qualification unit, as required. (See section 7.1.6.3 and NT-QRC-005 for information on acceptance data packages.) Verification and acceptance testing is performed with a Test Readiness Review (TRR) according to EA-554, "Test Operations Guidelines."

Prior to use of EA facilities for acceptance testing of the qualification unit, Test Readiness Review Boards (TRRB) are conducted to review the planned tests and appropriate ADP items (i.e., begin the historical log, pressure vessel data, pyrotechnics information, calibration records, etc.). The acceptance testing will include testing the GFE to vibration and thermal levels for workmanship, as well as functional testing. Qualification Unit interface checks will be conducted and may represent a control point if the interface check involves non-EA provided hardware. An acceptance review of these tests will verify the GFE is ready to proceed to qualification testing.

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Prior to use of EA facilities for qualification testing using the qualification unit, Test Readiness Review Boards (TRRB) are required to verify the GFE readiness for qualification testing and the associated test procedures. Qualification testing will subject the GFE to a series of tests to verify the GFE performs acceptably in its launch and operational environment, per the criteria documented in the Verification Matrix (Appendix C) of the Verification and Validation Document

Upon completion of qualification testing the safety review process is completed with the Phase III Safety Review. The final Safety Data Package, including the RAESR, is prepared (see NT-GFE-012) and submitted to the Phase III Safety Review for approval by the SMART. (See NT-CWI-005 (for ISS) and NSTS 22254 (for Shuttle) for descriptions of the Safety Data Package and submittal process.) After approval, the Safety Data Package and results of the Phase III Safety Review are included in the SAR data package, and presented at the SAR.

Fabrication of the GFE flight products begins in accordance with the fabricator's work instructions. Each product will be subjected to acceptance testing and will have an Acceptance Data Package (ADP) as required (refer to 7.1.6.3). Flight Unit interface checks may be conducted and may represent a control point if the interface check involves non-EA provided hardware. Criteria for acceptance testing are documented in the Verification Matrix (Appendix C) of the Verification and Validation Document. Only one Certification Data Package (CDP) is delivered. This life cycle phase will conclude with the System Acceptance Review (SAR).

7.1.6.3 Products

The major products from this phase are flight hardware, flight software and/or firmware, ground support equipment, and completion of a System Acceptance Review (SAR).

The documentation products developed during this phase are listed in Table 7.1.6.3-1. The documents are maintained as a part of the project file.

Table 7.1.6.3-1 Flight Production and Certification Phase Documentation Products

Products	Version	SAR Data Pkg.	RIDable (Y/N)	Approving Authority
Version Description Document (software and/or firmware; see EA-WI-025 for details)	Final	Yes	N/A	Division/PM
Verification and Validation Document (V&VD) Or Project Requirements and Verification Document (PRVD) for IVA non-critical GFE	Final for verification results content	Yes	N/A	Division/PM SR&QA
Ground Safety Analysis Report (as required by KSC)	Final	Yes	N/A	Division/PM KSC
Certification Data Package (see details below)	N/A	Yes	N/A	Division/PM SR&QA
Acceptance Data Package (or JSC Project Parts Tag- JF 911, see details below)	N/A	Yes	N/A	Division/PM SR&QA ISS SR&QA for ISS GFE
Safety Data Package	Phase III	Yes	N/A	Division/PM S&MA Review Team (SMART) or PSRP

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Products	Version	SAR Data Pkg.	RIDable (Y/N)	Approving Authority
ISS Functional Configuration Audit/Physical Configuration Audit (FCA/PCA)	N/A	Yes	N/A	EA PMO SR&QA Customer/sponsor
Flight Rule Inputs (input to MOD product if MOD product is available)	Preliminary	Yes	N/A	EA Systems Engineering (EA4)
User's Guide (as described below)	Final	Yes	N/A	Division/PM
Sustaining Engineering Plan	Final	Yes	N/A	Division/PM EA PMO Customer/Sponsor
Qualification & Acceptance Procedures	Final	Yes	N/A	Division/PM

The planned verification and validation activities to be performed during this phase were documented in the V&VD (or PRVD, see section 7.1.3.2) and finalized at CDR with the "Results" columns of Appendices C and D left blank. During this phase the planned V&V activities are performed and the "Results" column is documented (including TPS #, "use as is" DR # or waiver, memo or report, etc., as appropriate). The V&VD, with the appendices "Results" column documented, is released with the appropriate revision number and change record information. This revised release of the V&VD, with associated "Results" documentation attached, form a part of the Certification Data Package. See section 7.1.3.2 for use of the PRVD in place of the V&VD for IVA non-critical GFE Flight projects.

The Version Description Document (VDD) is used to document the "as built" configuration of flight software and/or firmware. EA-WI-025 provides the template for the VDD, details on the use of the VDD, and information on the integration of the VDD content with the Engineering Drawing System.

The "Ground Safety Analysis Report" referenced in the above product listing is an analysis required to alert the vehicle integrators to any specific safety related design features of the project. Normally this involves integrating your project through the KSC that is covered in the KSC Payload Ground Safety Handbook (KSC 1700.7 paragraph 3.2) and is also defined further in the Payloads Safety Review and Data Submittal Requirements document (NSTS 13830 paragraphs 4.2 and 4.3). The paragraphs identified in KSC 1700.7 and NSTS 13830 will provide information on the intent and contents of this analysis report. These documents are specific to KSC operations but cover a majority of typical project safety related delivery scenarios. If an organization other than the KSC is integrating the GFE flight hardware onto a vehicle/flight article, a review of these referenced paragraphs should ensure an understanding of necessary material to support negotiations with the organization's safety group.

The ADP and the CDP are both comprised of significant supporting documentation. This supporting documentation provides the evidence that the GFE has been adequately developed and certified against the verification and validation criteria as documented in the V&VD. The specifics of each package are described below.

The ADP provides necessary support data to the operational users of the GFE flight hardware and/or software. Each qualification and flight unit will be delivered with its own ADP, as required.

The need for the ADP is determined at CDR and the appropriate documents (PMP or ITA) updated as required. In general, an ADP is required for all flight hardware and software. Hardware items that typically do not require an ADP, unless specifically requested by the customer in their list of deliverables, are un-serialized items, piece parts, or any non-complex item meeting all of the following criteria:

- a. Criticality of the hardware and its usage is 3/3;
- b. The hardware does not interface with ISS or Shuttle vehicle systems (note: signal and low voltage cables are exceptions and thus can be included in this criteria);
- c. The hardware does not contain traceable subassemblies or parts.
- d. There are no associated controlled critical or catastrophic hazards;

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- e. The hardware has no limited life or age sensitive/time cycle requirements including maintenance requirements;
- f. Failure would not have significant impact to flight objectives or crew operations;
- g. There are no "non-standard" calibrations required;
- h. There are no pressure vessels or pyrotechnics;
- i. The hardware does not contain software;
- j. There are no special instructions required to maintain safety and functionality of the GFE;
- k. There is no pre-planned or deferred open work*;
- l. The hardware is shipped complete, e.g. not shipped with temporarily installed non-flight hardware or with out all of its parts (i.e. ship short)*;
- m. There were no unexplained anomalies during testing*;
- n. There were no requirements waived during testing*; and
- o. There are no repair limitations on the hardware.

*Some other approach which provides for documentation of these items (open work, ship short, etc.) perhaps on a tag 911 – but does not require assembly of an ADP.

The ADP is designed to provide a complete status of GFE hardware and software (if software is a separate deliverable) at point of delivery and contains that information pertinent to the operational site (launch or Integrated Test Facility) that enables the continuation of required activities. Items which may be contained in the ADP are given below. Refer to SSP 30695 "Acceptance Data Package Requirements Specification" for more details regarding the ADP contents. The Space Shuttle Program will accept the ISS requirements for ADPs.

- a. DD Form 250/1149 or equivalent
- b. Historical Log/note/comments (see JSC Form 772 "Functional Equipment Historical Record")
- c. Waivers/deviations
- d. Unexplained Anomalies
- e. List of Shortages
- f. Unplanned/Deferred Work
- g. Pre-planned Assigned Work
- h. Identification –As-Designed List; As-Built List
- i. Operating Time/Cycle (if certification limited)
- j. Age-Sensitive/Time-Action Items
- k. Non-Standard Calibration Record
- l. Repair Limitations
- m. Pressure Vessel Data, including pressure cycle data (if certification limited)
- n. Pyrotechnics Information/lot certificate
- o. Non-Flight Hardware Temporary Installation (e.g. CAPS for shipping which are removed before flight)
- p. MSDS Sheets
- q. * Selected Engineering drawings (e.g., assembly level drawings)
- r. Software/Firmware Version Description Document (VDD) (see EA-WI-025)
- s. * Special instructions to maintain safety and functionality of the GFE during storage, handling, maintenance and disposal
- t. Certifications (including reference to documentation that qualification and acceptance requirements have been satisfied, acceptance test procedures (ATP) numbers and ATP report numbers)
- u. For software: Users Guide or Systems Operating Manual

* Note that these items were added by EA that are not in SSP30695, "Acceptance Data Package Requirements Specification"

The CDP provides necessary support data for approval of the Government Certification Approval Request (GCAR, form 1296) and the ISS Non-Prime Functional Configuration Audit/Physical Configuration Audit Certification Forms (FCA/PCA) (see section 7.5.2.7, Form 1276 completion instructions). Only one CDP is delivered. The CDP contains the following items:

- a. Government Certification Approval Request (GCAR, form 1296)
See <http://www.srqa.jsc.nasa.gov/gcars/gcar.htm> for additional information and instructions)
- b. Safety Data Package (see sections 7.1.4.2, 7.1.5.2 and 7.1.6.2)

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- c. The revision of the V&VD, with the “Results” column of the appendices completed (listing the TPS#, memo or report, any “use as is” DR# or waiver, etc.), and associated “Results” documentation attached.
- d. Materials Certification
- e. Fracture Control Report
- f. Materials Usage Agreement
- g. Stress Analysis
- h. Thermal Analysis
- i. EEE Parts Stress Analysis/De-rating Analysis
- j. Qualification Test Reports
- k. Waivers
- l. Limited Life Items List
- m. Engineering Drawings (electronic or hardcopy as required by NT-GFE-007, “Certification Approval of JSC GFE”)
- n. Software/Firmware Version Description Document (VDD) (see EA-WI-025)

The User’s Guide is developed to provide a descriptive explanation of the GFE for the intended end user. This guide should indicate how to use the GFE to accomplish the operational requirements and to stay within any operational constraints to maintain the safety and functionality of the GFE. It is often used by the Mission Operations Directorate for development of the training curriculum related to the GFE.

7.1.6.4 Control Points and Control Gate

The control points for this phase are successful completion of the ADP (or JSC Project Parts Tag- JF 911), the Phase III Safety Review, Qualification and Acceptance Procedures, and the CDP. The control gate for this phase is successful completion and customer approval of the System Acceptance Review (SAR).

7.1.6.4.1 System Acceptance Review (SAR)

Section 7.2.4.2 provides the detailed instructions for conducting the SAR. The SAR examines the results of verification and validation and the readiness of flight end items, documentation, and data that support flight delivery and certification. The SAR is co-chaired by the EA PMO and the customer/sponsor.

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7.1.7 Deployment Life Cycle Phase

The Deployment phase requires successful completion of the System Acceptance Review (SAR) and will culminate in conductance of a Flight Readiness Review (FRR). In this phase the GFE flight items are configured and prepared for operation. Pre-flight GFE functional checkouts are performed, flight readiness documentation prepared, transportation documentation submitted, and flight vehicle interface activities supported.

7.1.7.1 Phase Prerequisites

The prerequisite for this phase is the successful completion of the project SAR.

7.1.7.2 Processes

The key processes performed during this phase are outlined in Figure 7.1.7.2-1 and detailed below. The order of processes associated with the CoFR and the Crew Equipment Interface Test (CEIT) is frequently tailored for each project.

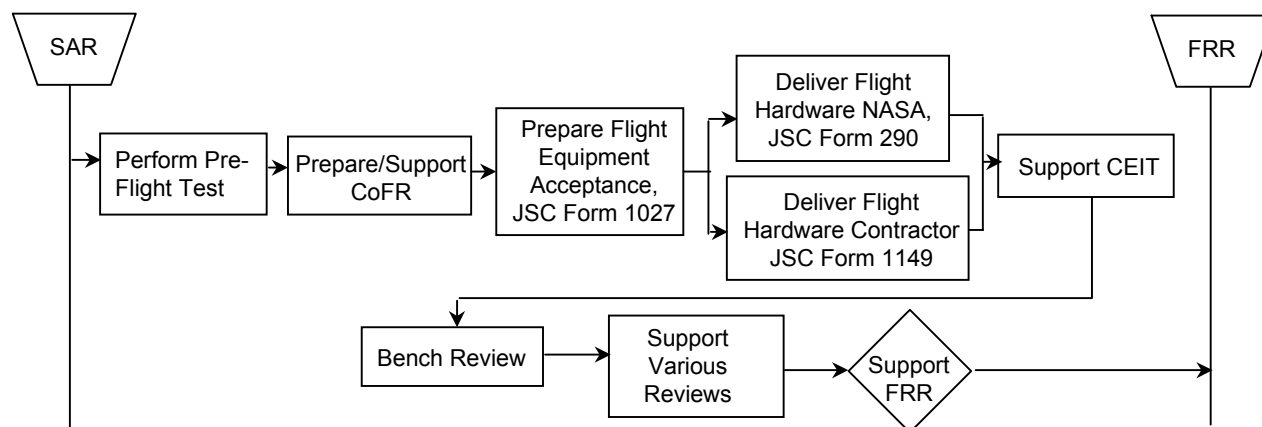


Figure 7.1.7.2-1 Deployment Life Cycle Phase Process Flow

After successful completion of the SAR, the GFE product is ready to support the assigned mission. After mission assignment, the flight approval process begins. The GFE is functionally checked with a pre-flight test. Preparation of the Certification of Flight/Launch Readiness (CoFR) begins as well as form 1027 "JSC Flight Equipment Acceptance". Form 1027 is generated by the quality engineer and documents any open items. Upon approval of form 1027, the GFE is shipped and delivered to its destination via a form 290 "Shipping Document" for government shipment or form DD1149 "Requisition and Invoice/Shipping Document" for contractor shipments.

If the GFE interfaces with the crew and vehicle, it is required to support a Crew Equipment Interface Test (CEIT). This test is required only if it is the GFE's first flight or first flight with that vehicle. If the GFE requires crew operational interface, it is required to support a Bench Review.

7.1.7.3 Products

The major products from this phase are completion of the Flight Readiness Review (FRR), delivery of the GFE and the associated ADP or JSC Project Parts Tag- JF 911.

The documentation products for this phase are listed in Table 7.1.7.3-1. The documents are maintained as a part of the project file.

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Table 7.1.7.3-1 Deployment Phase Documentation Products

Products	Version	Data Pkg.	RIDable (Y/N)	Approving Authority
Flight Rule Inputs (input to MOD product if MOD product is available)	Final	N/A	N/A	EA Systems Engineering (EA4)
GFE Certification of Flight/Launch Readiness (CoFR) (input as required)	Final	N/A	N/A	Division/PM SR&QA
JSC Flight Equipment Acceptance (Form 1027)	Final	N/A	N/A	Division/PM SR&QA
Shipping Documentation (Form 290 or 1149)	Final	N/A	N/A	Division/PM SR&QA

7.1.7.4 Control Points and Control Gate

The control points for this phase are successful completion of the CEIT, the hardware Bench Review, and the CoFR. The control gate for this phase is successful completion of the Flight Readiness Review (FRR).

7.1.7.4.1 Flight Readiness Review (FRR)

The FRR confirms operational readiness of hardware, software, personnel, procedures, and ground facilities as applicable. The purpose is to demonstrate that the system and support elements are properly configured and ready for launch. The objectives are as follows:

- a. Ensure that all parts of the GFE flight items and supporting elements are in a state of readiness to support the launch of the vehicle/mission.
- b. Gain consensus that the launch can proceed.

At the FRR, all software, hardware and ground support equipment and procedures are completed and all verification data is sufficient to give complete confidence that the system is ready to begin operations.

A Certification of Flight Readiness (CoFR) must be prepared and approved prior to the FRR. This readiness endorsement certifies that the completed activities and remaining open work required for flight were reviewed and approved by the responsible organizations. For ISS GFE projects, JSC 28174, "ISS Certification of Flight Readiness Implementation Plan for the Engineering Directorate", is followed.

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7.1.8 Operations Life Cycle Phase

The Operations phase includes the operational use and sustaining engineering of the deployed GFE. The project's PMP and ITA will define the GFE deliverable flight items as wholly or partially expendable, targeted for sustained use, or targeted for interim use with planned upgrades. Each of these scenarios requires at least some steps of the Operations phase.

7.1.8.1 Phase Prerequisites

Prior to entry into this phase, successful completion of the FRR must occur. The following documents must have signature approval:

- Crew Procedures and Flight Rules
- Certification of Flight Readiness

7.1.8.2 Processes

The Operations phase will be highly tailorable and depend largely upon the GFE's characteristics and specific mission objectives. Key processes performed during this phase are outlined in Figure 7.1.8.2-1 and detailed below.

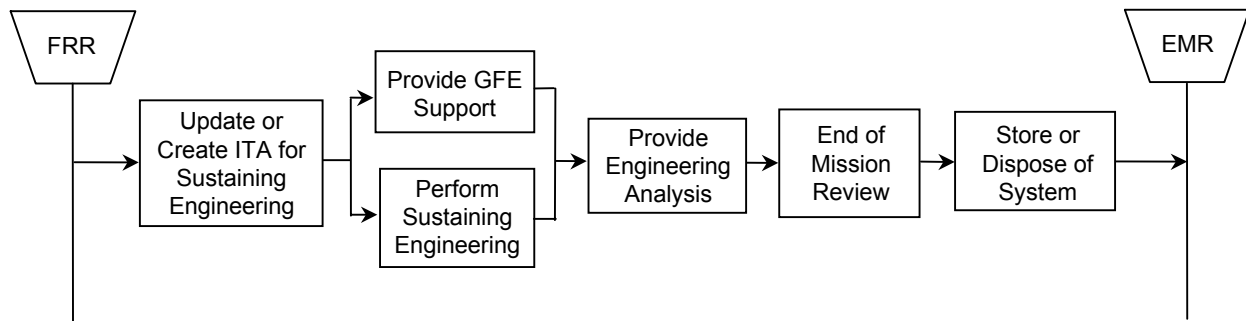


Figure 7.1.8.2-1 Operations Life Cycle Phase Process

Mission operations may or may not involve the GFE project team. However, the GFE project team frequently supports the Mission Evaluation Room (MER), providing engineering analysis and other types of support to the mission operations personnel.

From the GFE implementation perspective, it is important to retain the Project Manager's many "lessons learned" from the GFE project development experience. The project manager, with inputs from the project team, documents a "Lessons Learned Report" early in the Operations phase. This information, collected throughout the life cycle phases of the project, should be compiled into a report and/or presentation format. The Lessons Learned Report is widely disseminated within the Engineering Directorate to benefit all directorate project personnel. Any new methods, procedures, or policies that are developed should be considered for inclusion in the "Project Management of GFE Flight Projects" Work Instruction.

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7.1.8.3 Products

The documentation products for this phase are listed in Table 7.1.8.3-1. The documents are maintained as a part of the project file.

Table 7.1.8.3-1 Operations Phase Documentation Products

Products	Version	Data Pkg.	RIDable (Y/N)	Approving Authority
Sustaining Engineering ITA	Final	N/A	N/A	Division/PM EA PMO (EA2) Customer/Sponsor
Lessons Learned Report	Final	N/A	N/A	Division/PM

7.1.8.4 Control Points and Control Gate

There are no control points for this phase. The control gate for this phase is the End of Mission Review (EMR).

7.1.8.4.1 End of Mission Review (EMR)

The EMR is held at the end of the mission/GFE life. The GFE may be decommissioned and placed in storage, disposed of as excess, or it may be destroyed.

A successful EMR must demonstrate that:

- a. Removal of the GFE from service is acceptable.
- b. Required decommissioning plan and procedures are in place.
- c. Preparations for storage, refurbishment, or disposal are made.

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7.2 Project Definition and Control

7.2.1 Work Breakdown Structure (WBS)

The work breakdown structure (WBS) serves as the tool for defining the entire scope of the project both from a life cycle phase perspective and a product perspective. A WBS is created for GFE flight projects, serving as the basis for development of the project schedule (see section 7.2.2.1). Projects governed by NPG 7120.5 must develop a product-oriented WBS. A product perspective of the WBS emphasizes the grouping of work to products, or “End Items” that may be deliverables, components within a deliverable, or non-deliverables such as ground support equipment. A phase perspective of the WBS provides the grouping of work as delineated in the process sections of 7.1, beginning with the Requirements Definition phase. A WBS phase perspective would probably merge the Preliminary and Detailed Design Phases into a single WBS element called “Design” to prevent artificial break out of work on the project WBS and schedule. For example, work to produce drawings would appear as a single line item under the appropriate WBS elements for “Design”, and show milestone readiness to support PDR and CDR (or SDR). Work performed prior to the beginning of the Requirements Definition Phase of a project (i.e. work related to project approval: Form 002, ITA and PMP) would not be a part of the project’s WBS since the WBS serves as the tool to develop the project implementation schedule (see section 7.2.2.1). In addition, the WBS provides a starting point for assigning resources and responsibilities, and determining the project cost. The WBS will be updated (via updates to the project schedule) to track the work changes associated with the maturing design and implementation.

A product-oriented WBS example template is shown in Figure 7.2.1-1. If used as a template by the project manager, tailoring or modification of this WBS example template will be necessary to provide the best partitioning of work in developing the GFE project’s specific WBS. This work breakdown example template begins at the GFE project level, then flows down work to the end item level, and continues to flow down work to the component and sub-component levels within the end items. Each tier of work delineates the project phases that may be applicable to the end item or component. This format allows the Project Manager to determine the appropriate level of tiers to define for the GFE project’s specific WBS

The project WBS should include a level of detail that captures:

- a. Allocation of work to supporting divisions/contractors
- b. Visibility of end items or lower tier components that map to the project detailed schedule
- c. Visibility for cost reporting for end item or sub-tier contracts

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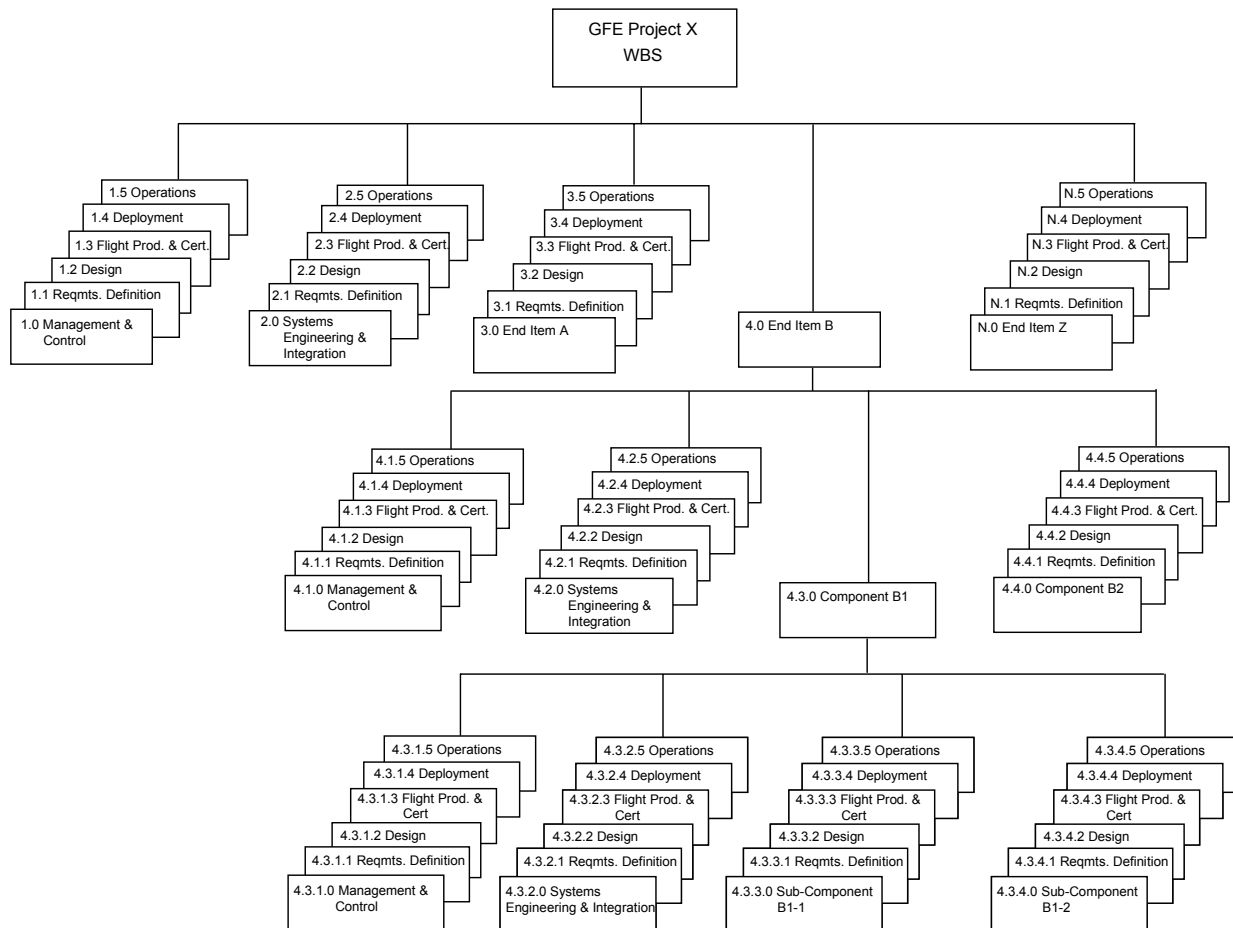


Figure 7.2.1-1 Work Breakdown Schedule

In this example template, the WBS elements group the work by product with sub-groupings by life cycle phase. This grouping allows work associated with an end item, component or sub-component to be allocated to the appropriate life cycle phase for each product, which provides direct mapping to a Microsoft Project™ schedule “waterfall” format.

The WBS numbering associated with this grouping:

- provides repeatable numbering of work type (i.e. qualification testing would always be found in a X.3 element) which is especially useful when viewing the WBS in a schedule format,
- supports marking particular element numbers as “not applicable” if no project work is associated with that element, or
- allows tailoring the numbers to delete elements rather than marking them as “not applicable”. This choice loses the advantages associated with repeatable numbering.

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The WBS element numbering for this example template is outlined below, and is followed by a WBS dictionary. An understanding of this dictionary is important to correct allocation of project work to this WBS example format.

1.0 Management and Control

- 1.1 Requirements Definition
- 1.2 Design
- 1.3 Flight Production and Certification
- 1.4 Deployment
- 1.5 Operations

2.0 Systems Engineering and Integration

- 2.1 Requirements Definition
- 2.2 Design
- 2.3 Flight Production and Certification
- 2.4 Deployment
- 2.5 Operations

3.0 End Item A

- 3.1 Requirements Definition
- 3.2 Design
- 3.3 Flight Production and Certification
- 3.4 Deployment
- 3.5 Operations

4.0 End Item B

- 4.1.0 Management and Control
 - 4.1.1 Requirements Definition
 - 4.1.2 Design
 - 4.1.3 Flight Production and Certification
 - 4.1.4 Deployment
 - 4.1.5 Operations

4.2.0 Systems Engineering and Integration

- 4.2.1 Requirements Definition
- 4.2.2 Design
- 4.2.3 Flight Production and Certification
- 4.2.4 Deployment
- 4.2.5 Operations

4.3.0 Component B1

- 4.3.1.0 Management and Control
 - 4.3.1.1 Requirements Definition
 - 4.3.1.2 Design
 - 4.3.1.3 Flight Production and Certification
 - 4.3.1.4 Deployment
 - 4.3.1.5 Operations
- 4.3.2.0 Systems Engineering and Integration
 - 4.3.2.1 Requirements Definition
 - 4.3.2.2 Design
 - 4.3.2.3 Flight Production and Certification
 - 4.3.2.4 Deployment
 - 4.3.2.5 Operations

4.3.3.0 Sub-Component B1-1

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- 4.3.3.1 Requirements Definition
- 4.3.3.2 Design
- 4.3.3.3 Flight Production and Certification
- 4.3.3.4 Deployment
- 4.3.3.5 Operations

- 4.3.4.0 Sub-Component B1-2
- 4.3.4.1 Requirements Definition
- 4.3.4.2 Design
- 4.3.4.3 Flight Production and Certification
- 4.3.4.4 Deployment
- 4.3.4.5 Operations

- 4.4.0 Component B2
- 4.4.1 Requirements Definition
- 4.4.2 Design
- 4.4.3 Flight Production and Certification
- 4.4.4 Deployment
- 4.4.5 Operations

N.0 End Item Z

- N.1 Requirements Definition
- N.2 Design
- N.3 Flight Production and Certification
- N.4 Deployment
- N.5 Operations

The WBS dictionary for the example WBS template is shown below. The WBS dictionary defines the activities that occur within the specific element of the WBS.

1.0—1.5 Management and Control

This WBS element includes all activities associated with management and control of the project at the project level throughout the project's life cycles. Examples of work defined in this element include resource and schedule management at the project level; project reporting to upper management and configuration management of project documentation.

2.0—2.5 Systems Engineering and Integration

This WBS element includes all activities associated with systems engineering and integration of the project at the project level throughout the project's life cycles. Examples of work in this element include generation of the Project Technical Requirements Specification, project ICDs, the Verification and Validation Document; preparing and conducting project life cycle reviews, project to vehicle integration activities; systems analysis; project integration and test (i.e., integration and test of End Item A with other End Items); deployment and operations support for the project, etc.

3.0—3.5 End Item A

This WBS element includes all work associated with the life cycle development of End Item A. WBS element "3.1 End Item A Requirements Definition" may not have any unique work to End Item A, or it may include the prototyping of high-risk functions of End Item A functions (see section 7.1.3.2 of this work instruction). WBS elements 3.2 and 3.3 would include the work for generation of the End Item A Specification, design and fabrication of End Item A and any unique End Item A certification. Integration of End Item A with other end items of the GFE Project is located in WBS elements "2.0—2.5 Systems Engineering and Integration" above. The WBS dictionary for element 4.0 below shows the work breakdown below the end item level.

4.0 End Item B

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If an end item contains two or more components, and there is distinct work breakdown for the development and integration of these components, the WBS will include a lower tier for the end item element to show: the management and control, systems engineering and integration, and development of each unique component. When an end item is defined at this lower level, the end item element number becomes the placeholder for the next tier. The life cycle breakdown of work is shown at this level.

For example, Figure 7.2.1-1 depicts End Item B at the component level. End Item B is depicted as the placeholder element 4.0 (with no life cycle elements as for “3.0—3.5 End Item A”) and the elements below 4.0 show the life cycle work associated with each lower element. The work associated with these tiers is described below.

4.1.0—4.1.5 Management and Control

This WBS element includes all activities associated with management and control of the project at the End Item B level throughout the project’s life cycles. Examples of work in this element include generation of any contracting or procurements specific to End Item B; resource and schedule management unique to End Item B; and any unique configuration management of End Item B.

4.2.0—4.2.5 Systems Engineering and Integration

This WBS element includes all activities associated with systems engineering and integration of End Item B throughout the project’s life cycles. Examples include generation of the End Item Specification, developing and conducting any unique reviews at the End Item B level; and integration and verification tasks which integrate and certify End Item B components.

4.3.0 Component B1

If a component contains two or more sub-components, and there is distinct work breakdown for the development and integration of these sub-components, the WBS will define the component element at the next level to show: the management and control, systems engineering and integration, and development of each unique sub-component. When a component is defined at this lower level, the component element number becomes the placeholder for the next tier. The life cycle breakdown of work is shown at this level.

For example, Figure 7.2.1-1 depicts Component B1 at the sub-component level. Component B1 is depicted as the placeholder element 4.3.0 (with no life cycle elements as for “4.4.0—4.4.5 Component B2”) and the elements below 4.3.0 show the life cycle work associated with each lower element. The work associated with these tiers is described below.

4.3.1.0—4.3.1.5 Management and Control

This WBS element includes all activities associated with management and control of the project at the Component B1 level throughout the project’s life cycles. Examples of work in this element include generation of any contracting or procurements specific to Component B1; resource and schedule management unique to B1; and any unique configuration management of Component B1. If Component B1 is tiered to show unique sub-components, but there is no unique management and control of B1 distinct from elements “4.1.0—4.1.5 Management and Control of End Item B”, then this element number may simply read “not applicable”.

4.3.2.0—4.3.2.5 Systems Engineering & Integration

This WBS element includes all activities associated with systems engineering and integration of Component B1 throughout the project’s life cycles. Examples of work in this element include production of a Software Requirements Specification if Component B1 is a software component with multiple sub-components; developing and conducting any unique reviews for Component B1; and integration and verification tasks which integrate and certify Component B1 as necessary.

4.3.3.0—4.3.3.5 Sub-Component B1-1

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This WBS element includes all activities associated with the life cycle development of Sub-Component B1-1. The requirements phase may be “not applicable” with requirements work captured in “4.3.2.1”. The drawing development and fabrication of B1-1 may be uniquely identified in this element in the design and fabrication phases (4.3.3.2-4.3.3.3).

4.3.4.0—4.3.4.5 Sub-Component B1-2

This WBS element includes all activities associated with the life cycle development of Sub-Component B1-2. The requirements phase may be “not applicable” with requirements work captured in “4.3.2.2”. The drawing development and fabrication of B1-2 may be uniquely identified in this element in the design and fabrication phases (4.3.3.2-4.3.3.3). Or if Sub-Component B1-2 is software, the code development and verification may be uniquely identified.

4.4.0—4.4.5 Component B2

The WBS element includes all activities associated with the life cycle development of Component B2. For example, if component B2 is software, generation of Component B2 Software Requirements Specification would be defined in elements “4.4.2 Design”—(note: the SRS is developed during the Preliminary Design Phase of work and therefore is captured under “Design” related work). If Component B2 is hardware, drawing development would be defined in elements 4.4.2. Integration of Component B1 with other End Item B components is located in elements 4.2.0-4.2.5 above.

N.0 End Item Z

See above end item dictionary element 3.0-3.5.

Note: The level of detail for the project’s WBS will be determined by value added assistance to the project manager for managing project work, resources and budget. It is important that the project manager understand that the WBS is used for development of the project schedule (see 7.2.2.1). Most experienced project managers believe it is important that work is grouped to products (i.e. end items), mapped to life cycle phases, and uniquely numbered in such a manner that supports development of a useful project schedule. There are many examples of appropriate tailoring, and the project manager is encouraged to draw on the experience of other experienced project managers who have successfully developed and used work breakdown structures and schedules.

If using the provided WBS example template, an important example of tailoring involves the understanding that not all sub-tier elements of a WBS are applicable to all end items or lower sub-tiers. . For example, the “4.3.1.0—4.3.1.5 Management and Control” elements of Component B1 (see Figure 7.2.1-1) could be “not-applicable” if no unique “Management and Control” is required beyond that defined in the “4.1.0—4.1.5 Management and Control” of End Item B. Or if End Item “A” is subcontracted for design, all work related to element “3.2 End Item A Design” may be “not-applicable” or simply listed as “subcontracted”.

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7.2.2 Resource Definition and Control

Resources are required to perform the project work specified in the project WBS. Schedule, budget and human resources must be defined, approved, and controlled to ensure project success. Section 7.2.7 “Metrics and Reporting” specifies the minimum required metrics for these resources. Section 7.3 “Project Contractual Documentation” specifies the required binding documentation associated with these resources. The following sub-paragraphs define these resources.

7.2.2.1 Schedule Definition and Control

The project schedule must be developed and maintained in order to account for time required and sequencing of all work associated with the project. The project schedule will document accomplishment of tasks (work) within the project time frame, will link preceding task (work) dependencies, and will identify critical path as well as high-risk activities (work).

It is important that the project schedule be developed and maintained using the work breakdown identified by the project WBS (see section 7.2.1 for WBS information). The schedule is developed from the GFE project’s WBS with the use of the Engineering Directorate’s standard tool, Microsoft Project™. The project’s WBS structure is used, with additional detail, precedence, milestones, and critical path defined, as appropriate, to fully describe the project schedule. The project manager periodically updates the schedule for current progress, projected completion dates, or for rearranging activities (work) as necessary to reflect current plans. If major work changes are made, the WBS will be updated to reflect changes shown on the schedule. The tracking features of Microsoft Project™ will be used to track changes from the baseline.

A portion of the schedule, including control milestones, visibility milestones and summary progress, is reported to the customer on a periodic basis. This external reporting milestone schedule is constructed by linking to (or filtering) the detailed project schedule.

7.2.2.2 Budget Definition and Control

Once the project WBS is mapped into the project schedule using Microsoft Project™, the schedule is assessed to construct the budget estimate for submittal to the customer/sponsor. Cost estimating is accomplished through a variety of methods, each with enough fidelity and documentation to clearly define the required funding for the life cycle of the project. Customer/sponsor funding is defined on a fiscal year basis by the ITA. The ITA process and form is defined in section 7.3.1 of this document. Once the baseline is established, changes must be specifically tracked and approved using the ITA Agreement Modification Record (AMR) process defined in LA-CWI-02, “Agreements”. The budget baseline may be impacted by CRs to project documents such as the PMP or PTRS, and the ITA modification should occur with the CR change.

7.2.2.3 Human Resource Definition and Control

The project schedule, using the features of Microsoft Project™, allows mapping of required skills and resources to specific tasks. The project schedule with mapped resources serves as the design and development plan for the project. During the Project Definition and Approval Life Cycle Phase, the Project Manager with support from the project leads, identifies project resource needs including matrixed personnel and contracted personnel. These resource needs may require modifications or additions through later phases of the project life cycle. The Project Manager tracks and coordinates these needs with the resource managers supplying the matrixed and contracted personnel.

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7.2.3 Project Configuration Management

Configuration management takes place across all life cycle phases of the project. Configuration management applies to project deliverables (hardware, software and documentation), as well as internal project products. See [EA-WI-027, Configuration Management Requirements, Appendix B](#) for project configuration management requirements.

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7.2.4 Project Control Gate Reviews

The control gate for each project phase, beginning with the Requirements Definition Phase, requires a review process that demonstrates the project's successful completion of that life cycle phase and readiness to begin the next phase. These control gates require successful completion of the review process prior to project advancement to the next life cycle phase. The control gates for the feasibility assessment phase and the Project Definition and Approval phase are uniquely defined in sections 7.1.1 and 7.1.2. The control gate for the Deployment phase (the FRR) is uniquely defined in section 7.1.7.

Beginning with the System Requirements Review (SRR), a review process is required to demonstrate the project's success of the review objectives and to achieve necessary review approval. The SRR and the SAR are customer/sponsor and EA PMO co-sponsored reviews. These two reviews require co-chairs for the Review Board, representing the customer/sponsor and the EA PMO organizations. The GFE team sponsors the PDR and CDR, with the Review Board chaired by the GFE team's management.

The following sections define the minimum processes and records for the GFE project SRR, PDR, CDR, and SAR.

7.2.4.1 SRR, PDR, and CDR Process

The project SRR, PDR and CDR (or SDR for a single design phase, see section 7.4) follow the process as described in Figure 7.2.4.1-1 and detailed below.

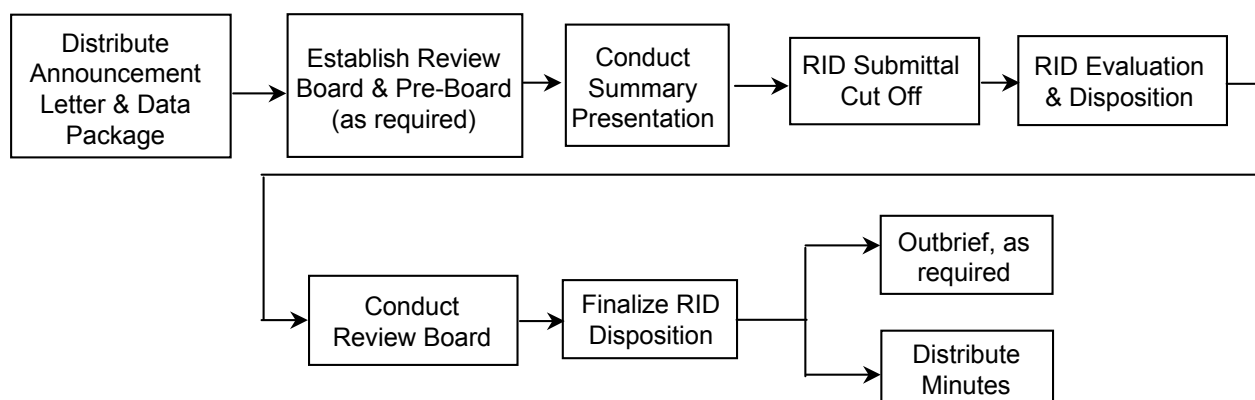


Figure 7.2.4.1-1 SRR, PDR, and CDR Process

The review announcement letter is distributed in a timely manner (e.g. two weeks) prior to the review (see section 7.5.2.4 for the template). The letter announces the review date and logistics, defines the contents of the review data package, defines the Review Item Disposition (RID) process, and establishes the participants (by organization) for the Review Board. The letter and data package are posted on the Flight GFE Projects Home page. Data package products not available electronically are accessible in a location defined by the announcement letter. The review announcement letter and all responses to the letter are maintained in the project file. The EA PMO signs the SRR announcement letter. The lead division management sign the PDR and CDR (or SDR) announcement letters.

The Review Board members are appointed by name from their respective organizations. It is mandatory that the board members participate in the review summary presentation. The Review Board will review and disposition all RIDs that have impacts to the PTRS (or PRVD) or ICD requirements (beginning with PDR), or project scope (PMP or ITA content). These RID dispositions which affect baselined documents (PTRS (or PRVD), ITA, etc.) will be processed with appropriate change paper to the approving authority organizations as listed in Table 7.2.5-1. The Review Board will also review and disposition a RID if the project team and RID initiator cannot agree on the proposed RID disposition. All other RIDs are dispositioned by the project team and presented in summary to the Review Board. Board membership consists of the following:

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- a. The GFE Project Review Board Co-Chair for the SRR is a representative of the EA PMO. The GFE Project Review Board Chair for the PDR and CDR (or SDR) is a branch or higher-level manager, appointed by the division/office manager, from the lead EA division implementing the GFE.
- b. The Customer/Sponsor Review Board Co-Chair (SRR only) is a senior member of the customer/sponsor organization.
- c. The Review Board members are senior members from the following organizations as applicable: the customer/sponsor office of primary responsibility, SR&QA Office, Mission Operations Directorate, Astronaut Office, and the Project Management Office of the Engineering Directorate. Note: Board members should be civil service personnel that are not assigned to the project team. Additional members may be appointed as necessary (e.g., representative from other EA divisions/offices performing significant work on the project; other Program Office members).

The Project Manager leads the summary presentation with support from project team members. This presentation summarizes the applicable project phase work, which is detailed in the associated data package.

The summary presentation for the SRR includes the:

- a. **Introduction.** The Introduction includes the review's purpose and scope, the data package overview with specifics for the RID process, the GFE team organization chart, as applicable, and the project milestone summary.
- b. **System Overview.** The System Overview includes: the description of the system objectives and groups these objectives to project end items (deliverable); the documentation tree for the project; a listing of the required deliverables; and any known ground rules or constraints.
- c. **Summary of Requirements.** The Summary of Requirements provides the key information documented in the PTRS (or PRVD) and associated ICDs.
- d. **Verification and Validation Overview.** The V&V Overview will provide information on the V&V life cycle process and an overview of the V&V approach. (Note: the V&VD (or equivalent PRVD sections) is a part of the PDR.)
- e. **Use of Standard Development Processes.** An overview of key development processes is included, as required. Mechanical, structural and electronic part development standards are presented. Example content would include an overview of the EDCPAP, the EDRS, or the materials certification process.

The summary presentation for the PDR and CDR includes the:

- a. **Introduction.** The Introduction includes the review's purpose and scope, the data package overview with specifics for the RID process, the GFE team organization chart, the project milestone summary, and status of any open RIDs or review actions from prior reviews.
- b. **System Overview.** The System Overview includes the GFE system architecture, definition of end items (deliverables), and location of end items on the integrating vehicle (if applicable).
- c. **(Preliminary or Detailed) Design.** The Design presentation includes a summary of how the design meets the system level requirements, and details the design for each major component of each end item. These details include allocation of requirements to the component, functional block diagram, EMI control plan, design architecture, enclosure and interfacing components, and component hardware and software design. HSI1 and HSI2 results may be summarized.
- d. **Safety Data Package and Phase (I or II) Safety Review Results.** The SR&QA member of the GFE team will present these results.
- e. **The Verification and Validation Document.** The V&VD (preliminary at PDR and final at CDR for verification planning content; final prior to SAR for verification results content) is summarized. (Or equivalent sections of the PRVD.)
- f. **EDCPAP Report.**
- g. **Other Process Reports.**
- h. **Design Assessment for Requirements.** This assessment includes a summary of any analyses, trade studies, or supporting material that assures the project design will meet baseline requirements. Risk factors and risk mitigation plans should be included.
- i. **Operational Overview.** The MOD member of the GFE team will present this overview.

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Significant items of discussion, actions assigned during the review, and attendance are recorded for the review records and inclusion in the review minutes.

In parallel with the summary presentations, review attendees submit RIDs prior to the cut-off date specified in the review announcement letter or as modified by the Review Board Chair. The EA RID form (see section 7.5.2.5 for form) and RID database (on the Flight GFE Projects Home page) are used to track discrepancies against the SRR, PDR, and CDR data packages. RID status is updated in the database throughout the project phases.

The Project Manager and project team evaluate and screen RIDs, recommend RID disposition, and coordinate and negotiate RID disposition with the RID initiator. The RID initiator concurs on the RID disposition or requests that the RID be forwarded to the Review Board. This process may use informal review splinter meetings or the Project Manager may assemble a Review Pre-Board. All RIDs with PTRS (or PRVD) or ICD requirement, or cost or schedule impacts to the ITA are forwarded by the Project Manager to the Review Board for final review disposition. If the Review Board approves a cost and/or schedule impacting RID, the Review Board Chair and project manager sponsor changes to the ITA or other customer approved documentation, as appropriate. Note: RID initiators not satisfied with the final Review Board's disposition may appeal to the appropriate customer/sponsor board. The Review Board Chair is responsible for assuring the coordination of significant disagreements or open issues with the customer/sponsor's management in a timely manner. The RIDs and associated action status are posted on the Flight GFE Projects Home page for tracking and reporting.

The Review Board assesses the success of the review, approving this phase gate for project entry into the next project phase. Disapproval by the Review Board requires re-planning of the project with specific actions, and an associated briefing to directorate and customer/sponsor management.

The Project Manager develops and issues minutes (with EA PMO signature for SRR minutes), including review actions (see section 7.5.2.6 for the minutes template). The minutes are posted on the Flight GFE Projects Home page and a hard copy is maintained as a quality record. The review documentation is maintained in the project file.

If requested by EA management or the customer/sponsor organization, the project manager will develop a presentation synopsis of the review, including a summary of Review Board RID dispositions, significant issues and open actions, and lessons learned. (Note: ISS requires an out-briefing presentation of the PDR and the CDR results to the Developmental Control Board (DCB)).

Successful completion of the review and entry into the next project phase may include RID dispositions with open actions. After Project Manager approval of RID closure, the RID initiator is provided two weeks to review closure rationale and provide response. The RID initiator indicates concurrence with the RID closure or indicates non-concurrence with specific rationale. If RID concurrence is received (or no response is received within 2 weeks), the RID status will be closed. The Project Configuration Manager files RID closure with attached concurrence as applicable. If non-concurrence is received, the Project Manager notifies the Review Board Chair and the Review Board may need to be reconvened or the issue forwarded to the appropriate customer/sponsor's board. Periodic review of the RID database is conducted by the project manager to ensure implementation of actions and RID closure.

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7.2.4.2 SAR Process

The project SAR follows the process as described in Figure 7.2.4.2-1 and detailed below.

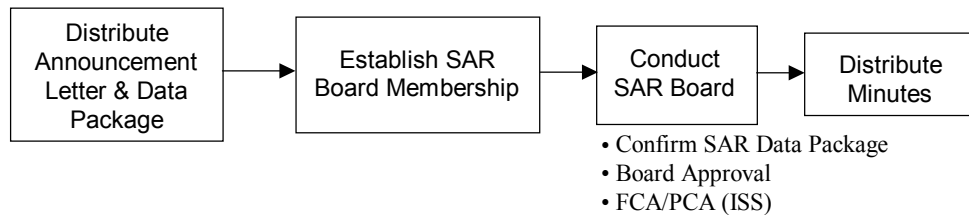


Figure 7.2.4.2-1 SAR Process

The SAR announcement letter is distributed in a timely manner prior to the review (see section 7.5.2.4 for the template). The letter announces the review date and logistics, defines the contents of the review data package, and establishes the participants (by organization) for the SAR Board. The letter and data package are posted on the Flight GFE Projects Home page. Data package products not available electronically are accessible in a location defined by the announcement letter. The EA PMO signs the SAR announcement letter.

The SAR differs from prior reviews in that no RIDs are involved. The SAR Board convenes to confirm data package contents, and formally approve or reject the acceptance of the GFE deliverable products. The SAR is co-chaired by the customer/sponsor organization and the EA PMO.

The SAR Board members are appointed by name from their respective organizations. Board membership consists of the following:

- a. The SAR Board Co-Chair is a representative from the EA PMO.
- b. The SAR Board Co-Chair (customer/sponsor management) is a senior member of the customer/sponsor organization.
- c. The SAR Board members are senior members from the following organizations as applicable: the SR&QA Office, the Mission Operations Directorate, the Astronaut Office, and the lead EA division implementing the GFE. Note: Board members should be civil service personnel that are not assigned to the project team. Additional members may be appointed as necessary (e.g., representative from other EA divisions/offices performing significant work on the project; other Program Office members).

The SAR Board begins with the Project Manager confirming the data package content. In addition, the Project Manager may provide a summary presentation that includes an overall introduction of the SAR's purpose and scope, summary of the system requirements, a description of the GFE architecture, flight products, and/or relevant vehicle integration information. The confirmation of the data package includes:

- a. **Data Deliverables:** The data deliverables includes a listing of deliverables defined in the PMP, any significant design changes since CDR, confirmation of closure of project RIDS and PDR/CDR actions and any open project DRs and FIARs. The RIDs and associated action closure are posted on the Flight FGE Projects Home page for tracking and reporting.
- b. **Safety Data Package and Phase III Safety Review Results:** The SR&QA member of the GFE team will present these results.
- c. **Verification and Validation Document:** A summary of significant verification and validation results are provided. The Acceptance Data Package and Certification Data Package are presented in terms of content and results.
- d. **FCA/PCA:** The FCA/PCA is reviewed and signed (ISS projects only i.e., ITA is with ISS).
- e. **List of Open Items:** Issues and actions identified at the SAR are captured and a due date for closure is established.

At the end of the SAR the co-chairs will poll the board members for confirmation of product acceptance/delivery (or rejection) and the list of issues and actions. The results of the board's decision are documented in the minutes. Significant items of discussion, actions assigned during the review, and attendance are also recorded for the review records and inclusion in the review minutes. The Project Manager develops and issues minutes (with signatures from

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both co-chairs; see section 7.5.2.6 for the Review Minutes Letter template). The minutes are posted on the Flight GFE Projects Home page and a hard copy is maintained as a quality record. The review documentation is maintained in the project file. If the board determines that the product is not ready for acceptance/delivery, the review board will determine if a delta SAR is required to review closure rationale and acceptance readiness, or if it can be determined out of board by the co-chairs. The board co-chairs will review action closure rationale and provide acceptance, in-writing via letter similar to the SAR minutes letter, by either reconvening the board or outside of board.

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7.2.5 Summary Table of Phase Documentation Products

The documentation products for each phase of the project are defined in the “Product” section (7.1.X.3) of each of the eight life cycle phases defined in section 7.1. Table 7.2.5-1, which is a summary table of these product tables, is provided below. The following terms are used in this table:

First Review Release – First formal review-version of the document. Content is commensurate with project phase, suitable for RIDs.

Second Review Release – Second formal review-version of the document. Content is in essentially final form, suitable for RIDs.

Review Release – The only formal review-version of the document. Content is in essentially final form, suitable for RIDs.

Final Release – Final version of the document, which has all signature approvals and is released under configuration control.

Table 7.2.5-1 Summary Table of Phase Documentation Products

Product/Documentation	Approving Authority	RID-able	Prior to Reqs Defn Phase	Prior to SRR	Prior to Prelim Design Phase	Prior to PDR	Prior to Detailed Design Phase	Prior to CDR	Prior to Flight Production & Cert Phase	Prior to Cert	Prior to SAR	Prior to Deployment Phase
Request for GFE Form (EA-012)	EA2, & Cust/Sponsor	No	Final Release									
EA Project Approval Form (EA-002) with attached Feasibility Assessment	Lead Division Chief, EA2, EA Director	No	Final Release									
Internal Task Agreement (ITA)	Division/PM, EA2, Cust/Sponsor	No	Final Release Firm price thru PDR, with est. to complete.				Final Release Updated with firm cost to complete					
Project Management Plan (PMP)	Division/PM, EA2, Cust/Sponsor Other DLOs as appropriate	No	Final Release									
Memorandum of Agreement (MOA)	Affected NASA DLOs	No	Final Release									
Interdivisional Agreements (IAs)	Affected EA Divisions	No	Final Release									

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Product/Documentation	Approving Authority	RID-able	Prior to Reqs Defn Phase	Prior to SRR	Prior to Prelim Design Phase	Prior to PDR	Prior to Detailed Design Phase	Prior to CDR	Prior to Flight Production & Cert Phase	Prior to Cert	Prior to SAR	Prior to Deployment Phase
Project Technical Requirements Specification (PTRS)	Division/PM, EA2, Cust/Sponsor SR&QA	Yes SRR		Prelim Release	Final Release							
Project Requirements and Verification Doc (PRVD) for IVA non-critical GFE	Division/PM, EA2, Cust/Sponsor SR&QA	Yes SRR PDR CDR		Review Release (reqmts portion only)	Final Release (reqmts portion only)	First Review Release (verification plan content)	First Review Release Updated (verification plan content)	Second Review Release Updated (verification plan content)	Final Release (verification plan content)		Final Release of verification results content	
Interface Control Documents (ICDs)	Division/PM, EA2, Interfacing Org, Cust/Sponsor	Yes SRR PDR CDR		Review Release of functional characteristics only	Final Release of functional characteristics only	First Review Release of detailed specifications	First Review Release Updated	Second Review Release of detailed specifications	Final Release of detailed specifications			
Configuration Management Plan (if one does not exist within the division)	Division/PM	No		Final Release								
Software Development Plan	Division/PM	No		Final Release								
End Item Specification	Division/PM	Yes PDR CDR				First Review Release	First Review Release Updated	Second Review Release	Final Release			
Software Requirements Specification	Division/PM	Yes PDR				Review Release	Final Release					

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Product/Documentation	Approving Authority	RID-able	Prior to Reqs Defn Phase	Prior to SRR	Prior to Prelim Design Phase	Prior to PDR	Prior to Detailed Design Phase	Prior to CDR	Prior to Flight Production & Cert Phase	Prior to Cert	Prior to SAR	Prior to Deployment Phase
Engineering Drawings	Division/PM JPG 8500.4 specified signs	Yes PDR CDR				Prelim Release (~10%)	Prelim Release Updated (~10%)	Prelim Release (~90%)	Prelim Release Updated (~90%)	Final Release (100%)		
Verification and Validation Document	Division/PM SR&QA	Yes PDR CDR				First Review Release of plan content	First Review Release of plan content Updated	Second Review Release of plan content	Final Release of plan content		Final Release of results content	
Software Design Document	Division/PM	Yes PDR CDR				First Review Release	First Review Release Updated	Second Review Release	Final Release			
Safety Data Package (which includes the prelim hazard analysis and failure modes & effects analyses for Phase 1 and a final version for Phase 2 & 3)	Division/PM, S&MA Review Team or PSRP	Yes PDR CDR				Phase 1 Final Release		Phase 2 Final Release			Phase 3 Final Release	
EEE Parts Analysis	Division/PM, EDCPAP Rep. SR&QA	Yes PDR CDR				First Review Release	First Review Release Updated	Second Review Release	Final Release			
Design Analyses Reports	Division/PM	Yes PDR CDR				First Review Release	First Review Release Updated	Second Review Release	Final Release			
Sustaining Engineering Plan	Division/PM, EA2, Cust/Sponsor	No							Review Release		Final Release	
Version Description Document (Software and/or firmware; see EA-WI-025 for details)	Division/PM	No								Final Release		
Ground Safety Analysis Report (as required by KSC)	Division/PM KSC	N/A									Final Release	

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Product/Documentation	Approving Authority	RID-able	Prior to Reqs Defn Phase	Prior to SRR	Prior to Prelim Design Phase	Prior to PDR	Prior to Detailed Design Phase	Prior to CDR	Prior to Flight Production & Cert Phase	Prior to Cert	Prior to SAR	Prior to Deployment Phase
Certification Data Package w / GCAR (See Section 7.1.6.3 for list of required documents)	Division/PM SR&QA	N/A									Completed	
Acceptance Data Package or JSC Project Parts Tag- JF 911 (See Section 7.1.6.3 for list of required documents)	Division/PM SR&QA ISS SR&QA (for ISS GFE)	N/A								Completed for Cert Unit	Completed for each unit available	Completed for remaining units
ISS Functional Configuration Audit Physical Configuration Audit (FCA/PCA) for ISS projects only i.e., ITA is with ISS	EA2, SR&QA Cust/Sponsor	N/A										Completed
Flight Rules (inputs to MOD product if MOD product is available)	EA Systems	N/A										Final Input
User's Guide	Division/PM	N/A									Final Release	
Qualification & Acceptance Procedures	Division/PM	N/A								Final Release		
GFE Certification of Flight Readiness (CoFR) (inputs as required)	Division/PM SR&QA	N/A										Final Release
JSC Flight Equipment Acceptance (Form 1027)	Division/PM SR&QA	N/A										Final Release
Shipping Documents (Form 290 or 1149)	Division/PM SR&QA	N/A										Final Release
Lessons Learned Report	Division/PM	N/A										Final Release

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7.2.6 Non-Conforming Product

Non-conforming products, as defined in JSC SLP 4.13, “Control of Non-conforming Product”, are those that do not conform to specified requirements. Non-conformances against GFE flight project related hardware, software, or firmware are tracked via Discrepancy Reports (DRs, per NT-CWI-003, “Quality Assurance Record Center Discrepancy Reporting and Tracking”) whenever there is a problem during Flight Production and Certification, Deployment, and Operations phases. Use of DR’s during these phases will cover problems experienced during testing, fabrication, handling or operating the qualification or flight hardware and the certification release or flight release software. In addition to DRs, a FIAR (form 2174) is generated to document failures that meet the criteria of JSC 28035, “JSC GFE Problem Reporting and Correction Action (PRACA) Requirements”. All FIARs are tracked in the JSC Problem Reporting and Corrective Action (PRACA) center. See EA-WI-027, Configuration Management Requirements, Appendix B for further requirements on non-conforming products; or for direct access utilize the following link:

7.2.7 Metrics and Reporting

This section describes the minimum set of performance metrics that the Project Manager collects, maintains and reports.

For GFE Flight Projects of value less than \$25M, cost and schedule metrics are maintained using:

- a. Full cost accounting of the accrued cost, including project unique contracting cost, in-house contractor project cost and civil service cost (to the maximum extent practical).
- b. Schedule management to ensure establishment, management, and control of the baseline project schedule and associated revisions to meet the project milestone schedule commitments documented in the ITA.

Earned value management (EVM), the integrated evaluation of cost, schedule, and technical performance against the baseline, is to be implemented for the following:

- a. Non-criteria-based EVM on GFE Flight Projects of value greater than \$25M, but less than \$60M
- b. EVM on GFE Flight Projects of value greater than \$60M

Refer to NPG 7120.5A for specific requirements of earned value management.

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7.3 Project Contractual Documentation

7.3.1 Internal Task Agreement (ITA)

The ITA serves as the cost and delivery commitment between the GFE Flight Project and the customer/sponsor. (The PMP serves as the documented approach for implementation of this commitment.) Section 7.5.2.3 provides the ITA template per LA-CWI-02, "Agreements".

The ITA documents the project task description, deliverables, control milestones and costs associated with the project. The costs should break out the work associated with sustaining engineering. The original project ITA is developed and approved in the Project Definition and Approval phase. However, due to project complexity, unique dependencies, or technical risk, it may not be possible to commit to firm cost and/or schedule at this phase of the life cycle (pre-Requirements Definition). In these situations, it is appropriate to develop an ITA that provides pricing through the Preliminary Design phase and best estimate at completion costing through project completion. During the early stages of the project, requirements are established and understood, prototyping of some critical elements is performed, and the project team is augmented with experts from other EA organizations. All of these activities serve to provide the information required to develop an updated ITA with cost and schedule commitments for the full project life cycle. This updated ITA is developed and re-negotiated with the customer during the Preliminary Design phase of the life cycle.

7.3.2 Memorandum of Understanding/Memorandum of Agreement/Interdivisional Agreement (MOU/MOA/IA)

A Memorandum of Understanding (MOU), Memorandum of Agreement (MOA) or Interdivisional Agreement (IA) will be used to define the roles and responsibilities between organizations when multiple organizations contribute directly to the project. (See LA-CWI-02) A MOU is required in the event that project responsibilities cross NASA centers or include other government agencies. A MOA is required in the event that project responsibilities cross directorates. An IA is required to document the agreement between two or more Engineering Directorate divisions cooperating on a joint project, unless the support is for testing (such as EMI, vibration, or other similar task) covered by a test/service request form. (See section 9.3 of EA-WI-002)

The MOU, MOA and IA will state the agreed to roles, responsibilities, and tasks for each organization involved in the management, design, development, integration, testing and/or operations of the project hardware and software. The MOU, MOA and IA specify the beginning and ending dates of the agreement and the agreed to cost allocation, products, and schedule for the project and its associated deliverables.

The Interdivisional Agreement (IA) is developed per LA-CWI-02.

7.3.3 Engineering Directorate Support Contracting

7.3.3.1 SEAT Contract Technical Work Plan Management

The Technical Work Plan (TWP) is the mechanism for the GFE Flight Project Manager to task the SEAT contractor to provide products and services as a part of the project team. The project manager (referred to as Technical Monitor when a TWP has been issued to the contractor) will issue the TWP through the TWP Tracking Tool to define specific project products and services within the scope of the SEAT contract. The designated Technical Monitor should contact their respective division/office SEAT Technical Manager Representative or Alternate to gain access to the TWP Tracking Tool. This Flight Project TWP shall include references to this work instruction as an applicable document. The subtasks (subset of the TWP) may be produced for allocating the work to clearly match the project's WBS. As part of the TWP content, the SEAT contractor develops a high level WBS for the work associated with the TWP. For a detailed TWP WBS, it is highly advised for the contractor to follow the WBS template as defined in section 7.2.1 of this document. The SEAT contractor is required to provide a Basis of Estimate (BOE) prior to the TWP being approved by the SEAT Technical Monitor. Therefore, it is crucial for the GFE Flight Project Manager to closely coordinate with the SEAT contractor in planning the TWP and the intended areas of responsibility. For specific information on development and approval of a SEAT contract TWP, or for information regarding the current SEAT contract related work instructions, contact the SEAT COTR.

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7.3.3.2 Other Engineering Support Contracts

For project use of other Engineering Directorate support contracts, the contract mechanism will vary depending on the contractor, the lead division for that contractor, and the type of work to be performed. These project support contracts will include references to this work instruction as an applicable document for work associated with GFE Flight Projects. Contact the Business Management Directorate for assistance and direction.

7.3.4 Project Unique Contracting

Project unique contracts for procurement of all or part of a GFE project are managed in close coordination with the Projects Acquisition Office (BH) and are performed in accordance with SLP 4.6, "Procurement". Figure 7.3.4-1 shows the overall process that can be tailored to provide the most efficient contract management for each project. As depicted, a decision must be made to pursue full and open competition or if justification exists to procure the GFE through a single source.

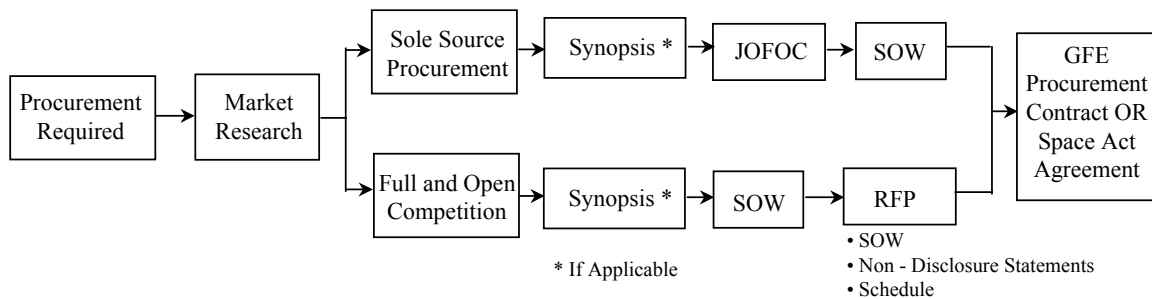


Figure 7.3.4-1 Contract Management Process Flow

7.3.4.1 Market Research

After requirements are established, market research is conducted to identify commercial, military, or government products that meet the requirements or could be modified to meet the requirements. Market research may include contacting knowledgeable individuals, reviewing recent market research, publishing requests for information through publications (e.g. Internet) or in the Commerce Business Daily, querying government data bases relevant to the acquisition, participating in industry communications, obtaining source lists of similar items, reviewing catalogs and related literature; and conducting interchange meetings.

7.3.4.2 Synopsis

Prior to awarding a contract in excess of \$25,000, a synopsis of the procurement is placed in the Commerce Business Daily. The synopsis is a short description of requirements. With the exception of commercial items, it must be published 15 days ahead of the release of the request for proposal. For commercial procurements the solicitation and synopsis can be combined, allowing a shortened advertisement period.

7.3.4.3 Justification for Other Than Full and Open Competition (JOFOC)

When procurement with other than full and open competition benefits the government, Engineering writes the justification. It may include identification of the only one responsible source with rationale or a description of compelling urgency. Engineering furnishes that information to the procurement office upon completing of market research. The procurement office will put the justification into the appropriate format for approval. Approval of JOFOCs less than a value of \$500,000 can often be handled with only the contracting officer and technical office representation. These two offices will serve as the selecting board in many cases for JOFOCs in this dollar range. Coordination with the CO's office is encouraged as the budget level limitations/restrictions can fluctuate based upon the latest government regulations. Approval for JOFOCs in the range of \$500,000 to \$10,000,000 is normally the responsibility of the Center Competition Advocate. Where JOFOCs above \$10,000,000 typically require the approval of the Agency Competition Advocate, advanced planning is required in order to allow time for review and approval.

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7.3.4.4 Statement of Work (SOW)

The statement of work is a delineation of the requirements of the procurement. These requirements include workmanship standards, V&V requirements, as well as project unique function and performance requirements. The Statement of Work also includes a list of the products (hardware, software, and data requirements, meetings, etc.) to be delivered and the schedule. It must be correct, clear, unambiguous, and comprehensive.

7.3.4.4.1 Letter of Delegation

The Letter of Delegation (LOD) for Quality Assurance and/or Quality Engineering is issued to a Government agency, normally Defense Contract Management Command (DCMC), to oversee contractor activities and perform mandatory government inspections. LODs are written after the contract is let but the decision to issue an LOD is made prior to this to ensure the appropriate clauses are inserted in the contract. Procurement Quality Assurance within SR&QA will determine the requirement for the LOD and write it for the contract officer's signature. The Project Manager may be asked to provide inputs. See section 7.5.2.8 for a template of a LOD for government inspections.

7.3.4.5 Request for Proposal (RFP)

The request for proposal is the formal document that the government issues to solicit offers. The RFP includes the statement of work and contract terms and conditions. For competitive procurement, it also includes the proposal instructions, evaluation procedures, and the proposal delivery date, time, and place. Procurements under \$50,000 can be made for GFE via an OAPR or PR. Coordination with the business office is required because government limitations on the dollar levels change periodically. Procurements under \$2 million per year for 5 years are evaluated under the NASA midrange procedures where either price or best value can be used to determine the sources selected. Procurements in excess of the midrange criteria are conducted using the JSC's Source Evaluation Board procedures.

7.3.4.6 Unique Contract Clauses

The following sections define contractual clauses that are common in procurement activities for GFE and must be understood by project managers.

7.3.4.6.1 Rights in Data Clause

A contractor cannot hold proprietary items or information developed with government funding. If information is developed under a contract funded by the government, it must be properly disclosed in the contract documentation products so that it is available to the general public. The Rights in Data Clause is a standard clause put in by the procurement organization. The GFE Flight Project team ensures that the data products called out in the statement of work include the products to capture and document any new information that may be generated by the contract.

7.3.4.6.2 March in Clause

There are unique situations where the government is best served by requiring the free disclosure of proprietary information by a definitive statement in the statement of work or a specific clause in the contract even though the general rule is that a contractor cannot hold proprietary items or information funded by the government.

In a case where a contractor states in his proposal that he intends to use proprietary technology to accomplish the contract and there is an expected long-term use of the contract products or high dollar investment being made under the contract, the government will require that technology be available in the event the contractor can not or will no longer continue to supply the technology for government use. If the contractor fails to be an effective supplier then under the provisions of a March in Clause, the government can require the technology be revealed to an effective supplier.

7.3.4.6.3 Space Act Agreements

Space Act Agreements allow the government and a contractor to work together on something of common interest to both in a team environment without the transfer of money between the parties. Hardware and software can be loaned by either party to each other, but it cannot be left in the possession of the other party at the end of the agreement. Such agreements are non-binding in the sense that if either party loses interest or cannot continue to fund their part of the agreement, they can step out of the agreement without consequences.

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7.4 Planned Approach for Exceptions

GFE Flight Projects should conform to the procedures and products defined by this work instruction. However, due to the varying types of projects in terms of cost, schedule, complexity, criticality classification, etc., it is recognized that deviations from these procedures and products might be appropriate or necessary. Accordingly, GFE Flight Projects requesting deviation or waiver from the life cycle phase products or life cycle control points and control gates defined by this work instruction will present the proposed deviations as a part of the feasibility assessment and Form EA-002 approval process (see EA-WI-002 for project approval criteria). Life cycle products not applicable to a project (i.e. software documentation on a hardware only project) do not need waiver. The PMP will document the planned approach for managing the project, including any planned exceptions that require customer agreement. If the planned exceptions require other Directorate Level Organization (DLO) approval, such as SR&QA approval for delivering the qualification unit as flight equipment, the PMP must include that DLO's signature approval.

An example deviation is the combination of the Preliminary Design and Detailed Design phases into a single "System Design" phase with a System Design Review as the control gate. The criteria considered for this deviation include system complexity and criticality, a mostly COTS versus in-house developed solution, minimal number of interfaces, minor or no software or firmware development required. There may be other circumstances for combining these phases as well. The PMP would reflect a single SDR for the Visibility Milestone (section 9.0 of PMP annotated outline).

Another common exception exercised is the practice of using the qualification unit for flight equipment. This flight approach will require a different set of verification criterion during the Flight Production and Certification phase. The test levels required will be unique for each specific qualification unit based upon numerous variables, so specifics will need to be negotiated with the SR&QA Office, and this negotiated agreement is documented in the PMP. This unit is commonly referred to as a protoflight unit.

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7.5 Templates for Documentation, Key Products, and Forms

7.5.1 Documentation Product Outlines

7.5.1.1 Annotated Outline for the Project Management Plan (PMP)

The PMP defines the implementation strategy for the GFE project, including management and development approach, identification of roles and responsibilities, and definition of project deliverables with associated visibility and control milestones. The PMP includes the project's Risk Management Plan and documents any implementation constraints for the safe and proper functioning of the product.

The PMP annotated outline is a part of this work instruction and is viewed by opening the "PMP Outline" icon below:



PMP Outline

7.5.1.2 Annotated Outline for the Project Technical Requirements Specification (PTRS)

The PTRS defines the contractually binding requirements between the customer/sponsor organization, the SR&QA Office and the Engineering Directorate GFE project team. The PTRS contains the performance, functional, environmental, interface, maintainability, reliability and safety requirements for the GFE. Requirements standards, such as NASA STD-3000 "Man-Systems Integration Standards" and JPG 8080.5 "JSC Design and Procedural Standard Manual", will be considered in preparation of the PTRS as applicable. For GFE projects with significant external interfaces, separate Interface Control Documents (ICDs) should be developed per section 7.5.1.3.

The PTRS annotated outline is a part of this work instruction and is viewed by opening the "PTRS Outline" icon below:



PTRS Outline

7.5.1.3 Annotated Outline for the Interface Control Document (ICD)

The ICD(s) define the GFE's external interface requirements that pertain to the requirements of the PTRS. The ICD(s) are a contractually binding document between the customer/sponsor organization, the interfacing organization, and the Engineering Directorate GFE project team.

The ICD annotated outline is a part of this work instruction and is viewed by opening the "ICD Outline" icon below:



ICD Outline

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7.5.1.4 Annotated Outline for the Verification and Validation (V&V) Document: Plan and Report

The V&V Document: Plan and Report (hereafter referred to as the V&V Document) defines the plan for, and documents the results of, the verification and validation activities for the GFE Flight project. These activities confirm that the GFE flight items comply with their specifications, function properly as an integrated unit when interfaced with program/vehicle components, and are ready for use as a part of the flight system. Appendices C&D of the V&V Document (V&VD) include a “Results” column for documenting the objective evidence (results) of verification activities performed during the Flight Production and Certification Phase. The first baseline of the V&VD is finalized at CDR to establish the plan for V&V, and all columns of the appendices are completed except the “Results” column (i.e., results are TBS). During the Flight Production and Certification Phase, the planned V&V activities are performed and the “Results” column is documented (including TPS #, “use as is” DR # or waiver, memo or report, etc., as appropriate). The V&VD, with the appendices “Results” column documented, is released with the appropriate revision number and change record information. This revised release of the V&VD, with associated “Results” documentation attached, form a part of the Certification Data Package.

The V&VD annotated outline is a part of this work instruction and is viewed by opening the “V&VD ” icon below:



7.5.1.4 Annotated Outline for the End Item Specification (EIS)

The EIS is a GFE project team document that captures the flow down of requirements from the PTRS, ICD(s) and requirements derived from the project design.

The EIS annotated outline is a part of this work instruction and is viewed by opening the “EIS Outline” icon below:



7.5.1.4 Annotated Outline for the Project Requirements & Verification Document

The PRVD is an IVA non-critical (Criticality 3) GFE project team document that merges the PTRS and V&VD into a single document. Lead division management may elect (and document the decision on Form EA-002), for IVA non-critical projects, to develop a PRVD instead of a PTRS and V&VD. (See section 7.1.3.2 of this work instruction for details.) Requirements standards, such as NASA STD-3000 “Man-Systems Integration Standards” and JPG 8080.5 “JSC Design and Procedural Standard Manual”, will be considered in preparation of the PRVD as applicable.

The PRVD annotated outline is a part of this work instruction and is viewed by opening the “PRVD Outline” icon below:



PRVD Outline

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7.5.2 Key Forms and Templates

7.5.2.1 Request for GFE (RFG) Form

The Request for GFE form can be accessed electronically by opening the “RFG Form” icon below:



RFG Form

Engineering Directorate Request for GFE (RFG)

1. Requestor: <i>Name</i>	2. Organization: <i>Org. Code</i>	3. Phone:	4. Date: <i>Request Date</i>	5. RFG #: <i>EA Reserved</i>
6. E-mail Address:	7. Sponsoring Organization: <i>Organization authoring request</i>			
8. Program(s) Supported: <i>List by Program Titles</i>				
9. Functional and Performance Description: <i>High level description of functional and performance requirements.</i>				
10. Assumed Criticality: Criticality 1 ☐ Criticality 2 ☐ Criticality 3 ☐				
11. Interfaces: <i>High level description of interfacing elements/systems.</i>				
12. Operational Environment/Constraints: <i>High level description of launch/flight environment and any significant constraints.</i>				
13. Operational Lifetime: <i>Describe expectations for operational life.</i>				
14. Physical Constraints: <i>Describe any known physical constraints for the flight environment.</i>				
15. Delivery Requirements: <i>Specify delivery quantities and delivery dates.</i>				
16. Additional Information:				
17. Customer/Sponsor Signature: _____ <i>Authorizing signature of customer/sponsor organization.</i>			Date: _____	
Print Name:				
18. Engineering Directorate Signature: _____ <i>Authorizing signature of the Engineering Directorate</i>			Date: _____	
Print Name:				
Form EA-012, Rev. B – January 2002				

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7.5.2.2 Feasibility Assessment Outline

The feasibility assessment presentation is attached to Project Approval Form EA-002. The FA Outline is part of this work instruction and can be accessed using the following icon:



FA Outline

7.5.2.3 Internal Task Agreement (ITA) Template

The current version of the ITA form is available in LA-CWI-02, "Agreements". This ITA form may be accessed using a link on the EA Projects Web Site.



ITA Form

7.5.2.4 Review Announcement Letter Template

7.5.2.4.1 SRR, PDR, or CDR Announcement Letter Template

The following templates can be tailored for the SRR, PDR, or CDR announcement letter:



SRR Letter



PDR, CDR Letter

7.5.2.4.2 SAR Announcement Letter Template

The following template can be tailored for the SAR announcement letter:



SAR Letter

7.5.2.5 RID Form

The RID form (EA-013) can be accessed electronically by opening the "RID Form" icon below:



RID Form

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7.5.2.6 Review Minutes Letter Template

The following templates may be tailored for the review minutes letter:



SRR Minutes



PDR, CDR Minutes



SAR Minutes

7.5.2.7 ISS Certificate of Functional Configuration Audit/Physical Configuration Audit (FCA/PCA) Form Completion Instructions

The ISS FCA/PCA form (JSC form 1276) is required only for ISS projects i.e., ITA is with ISS. The following are instructions for completing the ISS FCA/PCA form (JSC form 1276).

- Obtain copy of the form from the JSC STI Center (Library) - Electronic Collections on the JSC Home Page.
- Complete top of page 1 of the form (signature page) prior to the SAR.
- The signatures will be obtained at the SAR.
 - For GFE developer signatures:
 - Engineering Panel <Project Manager>
 - Quality Assurance Panel <the GFE SR&QA team member>
 - Configuration Management Panel <Project Manager's Designee>
 - FCA/PCA Co-chair <GFE SAR Co-chair>
 - For ISS Program Office:
 - Engineering Panel <ISS OPR for the project - usually the ISS SAR Co-chair>
 - Quality Assurance Panel <the ISS Quality Assurance SAR board member> If ISS CM supports the GFE project
 - Configuration Management Panel <the ISS configuration management SAR board member>
 - FCA/PCA Co-chair <ISS SAR Co-chair>
- Complete top of pages 2-4 prior to the SAR; do not check any of the boxes on pages 2-4, since this will be completed at the SAR by the Co-chairs.
- Page 5: Qualification Test Procedures and Test Result - under "description" enter the document number and title for the Qualification test procedures; under "test result" enter the document number and title for the qualification test report.
- Page 6 Deviations and Waivers - list any or indicate none.
- Page 7 Documents Listing of Product Baseline - list all documents included as part of the SAR data package.
- Page 8 Documentation/Drawings Reviewed - list all drawings.
- Page 9 Shortages and Unincorporated Design Changes - list any pending changes not yet incorporated in the documents/drawings or indicate none.
- Pages 10 and 11 Action Items - these actions are documented at the SAR.
- Page 12 Action Item Log - to be completed after the SAR.
- Pages 13 and 15 FCA/PCA Issues - to be completed at the SAR.

7.5.2.8 Letter of Delegation Template

The LOD template can be accessed electronically by opening the "Letter of Delegation Template" icon below:



LOD Outline

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7.5.3 Forms

For most of the activities surrounding GFE Flight Projects at JSC there is a form to be filled out and approval obtained. Those forms most commonly needed for managing a JSC project are listed in Table 7.5.3-1 below. Forms can be obtained electronically by visiting the Scientific and Technical Information (STI) Center home page (<http://stic.jsc.nasa.gov>). For those forms not available electronically, a form 614 "Request for Publication and Blank Forms" can be submitted to the Program Document Center (PDC). Forms can be viewed and copied by visiting one of the following JSC Library locations:

STI Center
Bldg. 45, rm. 100

Medical Sciences Library
Bldg. 37, rm. 183

Space Station Library
Bldg. 4S, rm. 1718

Table 7.5.3-1 Forms

FORM NUMBER	FORM TITLE	AVAILABLE ELECTRONICALLY
DD1149	Requisition and Invoice/Shipping Document	Yes
DD1149C	Requisition and Invoice/Shipping Document (Continuation Sheet)	Yes
DD1694	Request for Deviation/Waiver (RFD/RDW)	Yes
DD250	Material Inspection and Receiving Report	Yes
DD250C	Material Inspection and Receiving Report (Continuation Sheet)	No
JF224	Portable On-board Computer Control Board (POCCB) Change Request Form	Yes
JF482B1	Crew Procedures Change Request	Yes
JF552	Shuttle Software/Data Change Request	Yes
JF686	Shuttle Software Change Request	Yes
JF686A	Shuttle Software Change Request Modification Log	Yes
JF1027	JSC Flight Equipment Acceptance	Yes
JF1081	Bioengineering Support Laboratory Work Request	No
JF1081A	Bioengineering Support Laboratory Work Request (Continuation Sheet)	No
JF1090	NSTS Payload Safety Requirements Applicability Matrix	No
JF1090A	NSTS Payload Safety Requirements Applicability Descriptive Data	No
JF1114A	Certificate of NSTS Payload Safety Compliance	No
JF114	EVA Project Office - EVA Configuration Control Board Change Request	Yes
JF1197	JSC Space Shuttle Orbiter CFE Certification Review Sheet	No
JF1215	Publications and Graphics Work Request	Yes
JF1230	Flight Payload Standardized Hazard Control Report	Yes
JF1237	Drawing Signature Authority Form	Yes
JF1257	JSC Close Call Reporting Form	Yes
JF1264	Material Test Request	No
JF1276	ISS Non-Prime Functional Configuration Audit/Physical Configuration Audit Certification Forms (FCA/PCA)	Yes
JF1296	Government Certification Approval Request (GCAR)	Yes
JF130	Space Station Change Request	Yes
JF130A	Space Station Change Request (Continuation Sheet)	Yes
JF132	Advanced Materials Laboratory Work Request	Yes
JF1425	NASA Johnson Space Center - GFE Problem Control Sheet	Yes
JF1431A	Configuration Control Board Directive	Yes
JF1431B	Configuration Control Board Directive (Continuation Sheet)	No
JF1467	Support Software Change Request	No
JF1490	Support Software Change Request	Yes
JF1595	Flight Rules Change Request	Yes
JF1595A	Flight Rules - Real Time Change Request	Yes

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FORM NUMBER	FORM TITLE	AVAILABLE ELECTRONICALLY
JF1606	Support Contractor Task Order	Yes
JF1606A	Support Contractor Task Order (Continuation Sheet)	Yes
JF1606B	Support Contractor Task Order Estimated Resources Summary	Yes
JF1606C	Support Contractor Task Order Estimated Resources Summary (Cont'd)	Yes
JF1615	Clean Room Work Request and Laboratory Report	Yes
JF180	Manufacturing Work Authorization Document	Yes
JF1850	Test Readiness Review Summary Sheet	No
JF1850A	Test Readiness Review Summary Sheet (Continuation Sheet)	No
JF2174	Failure Investigation Analysis Report - Initiation Sheet	Yes
JF2174A	Failure Investigation Analysis Report - Final Closure Sheet	Yes
JF2174B	Failure Investigation Analysis Report - Continuation Sheet	Yes
JF2174C	Failure Investigation Analysis Report - Non Flight Constraint	Yes
JF2176	Discrepancy Report/Material Review Record	Yes
JF2176A	Discrepancy Report/Material Review Record (Continuation Sheet)	Yes
JF2323	JSC Data Requirements List (DRL)	Yes
JF2323A	JSC Data Requirements List (DRL) (Continuation Sheet)	Yes
JF2341	Data Requirements Description (DRD)	Yes
JF246	Photographic Work Request	No
JF290	Shipping Document	Yes
JF290	Shipping Document (Continuation Sheet)	
JF38	Systems Engineering Analysis Request	Yes
JF38A	CTSD Advanced Materials Laboratory Work Request	Yes
JF38d	CTSD Design group Work Request	Yes
JF542C	Payload Safety Noncompliance Report	Yes
JF614	Request For Publication and Blank Forms	Yes
JF84	Waiver/Deviation Approval Request	Yes
JF911	JSC Project Parts Tag	Yes
JF954A	EVA and Crew Equipment Project Office - EVA and Crew Equipment Configuration Control Board Change Request/Directive	Yes
JF954B	EVA and Crew Equipment Project Office - EVA and Crew Equipment Configuration Control Board Change Request/Directive (Cont'd)	Yes
JF984	Design Group Work Request	Yes

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APPENDIX A GLOSSARY

Advanced Flight System - Flight hardware and/or software developed for use in experimental concept vehicles (e.g., X-38 and TransHab).

Agreement - Typically used to document requirements (deliverables and quantities, budget plans, and schedule) and responsibilities; examples include an Internal Task Agreement (ITA), Memorandum of Agreement (MOA) and Interdivisional Agreement (IA).

Approved - Documentation that has been submitted through the review process and received all required approval signatures.

Baseline - Official version of a configuration controlled item; can only be changed through a formal review, evaluation, or approval procedure.

Baselined - Process by which an item is reviewed, approved, and controlled via configuration management process.

Breadboard - An arrangement in which components are fastened temporarily to a board for experimental work.

Component - An elementary device or piece of equipment that is a basic part of a system or program.

Control Gate - Identifies the event or decision that must be successfully completed to continue to the next phase of the project.

Control Points - Identifies an event or decision within a phase that must be completed before continuing that phase and is outside the control and/or approval of EA.

Certification - The audit process by which the body of evidence that results from the verification activities presented are provided to the appropriate certifying authority to indicate all requirements are met.

Customer/sponsor - As used by this work instruction, the customer/sponsor is the requester and purchaser of the GFE, and provides approval authority for the requirements, cost, delivery schedule and use of the GFE. The term "customer" applies to organizations external to JSC; the term "sponsor" applies to organizations internal to JSC.

Design Review - Documented, comprehensive, and systematic examination of a design to evaluate its capability to fulfill the requirements for quality; identify problems, if any; and propose the development of solutions. A design review can be conducted at any stage of the design process, but will, in any case, be conducted at the completion of the design stage.

DVTU (Design Verification Test Unit) - The hardware, firmware, and software unit that is form, fit and functional equivalent to the flight unit, but may not be manufactured using the exact flight parts. This unit is used for design proof of concept.

End Item - a major component or functional area of the GFE flight project; the end item may or may not be separated physically from the other end items that comprise the GFE.

Engineering Unit - The hardware, firmware, and software unit that is functionally equivalent to the qualification unit, but not necessarily form and fit equivalent. This unit is used for proof of concept testing of the detailed design. It may be used for software verification credit after CDR with quality controls as defined in the Software Development Plan.

Flight Unit - The hardware, firmware and software unit that is used operationally in the flight environment. This unit is designed and manufactured under strict quality control, with complete records of unit manufacturing, testing, shipping and handling.

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Firmware - Computer programs and data that when imprinted on a hardware component cannot be altered without physically removing the hardware component from the target system. (See EA-WI-025)

Ground Support Equipment - All equipment (implements, tools, test equipment devices, simulations, etc.) required on the ground to support appropriate ground testing or training.

HSI1 - Hardware/software integration (HSI) that is performed, prior to PDR. This testing establishes confidence that the hardware and software design concepts are adequate to meet functional interfaces.

HSI2 - Hardware/software integration that is performed prior to CDR on the engineering unit or the DVTU unit. This testing establishes confidence that the hardware and software detailed designs meets requirements.

Objective evidence - Information which can be proved true, based on facts obtained through observation, measurement, test or other means.

Problem Reporting System (PRS) - A generic term for a system that is used for reporting, tracking, investigating, and dispositioning process, product, or quality system nonconformances.

Project Manager (PM) - the individual responsible for overall technical and administrative direction of all aspect of the GFE flight project.

Prototype Unit - The breadboard, generic component or developmental assembly of hardware and software that roughly performs the basic functions of the engineering unit, but is not fully functional equivalent. This unit is used for proof of concept testing of the preliminary design.

Protoflight Unit - A flight unit used for qualification testing in lieu of a dedicated test article. This use of the flight unit for qualification testing often requires reduced test levels and/or duration and post-test hardware refurbishment where required.

Qualification Unit - A hardware, firmware and software unit which is identical to the flight unit in form, fit and function, as well as in manufacturing processes, parts, and quality control. This unit is used for verification and certification credit for all environmental requirements and performance requirements as needed.

Released Drawing - A drawing that has been through the review process, received approval, and placed under control by the Engineering Drawing Control Center (EDCC).

System – the physically or functionally integrated flight end items that operationally comprise the GFE; the PTRS is the system level requirements specification, with “System X GFE” the placeholder title for the project name; “System X Verification and Validation” includes end item integration in the “System X GFE” V&VD.

Validation - The process that ensures a system meets the customer/sponsor's expectations for intended use. Unique validation activities may not be required if validation is satisfied through verification or acceptance testing activities.

Verification - A formal process, using the method of test, analysis, inspection or demonstration, to confirm that a system and its hardware and software components satisfy all specified performance and operational requirements.

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APPENDIX B ACRONYM LISTING

ADP	Acceptance Data Package
AMR	Agreement Modification Report
BOE	Basis of Estimate
CSCI	Computer Software Configuration Items
CDR	Critical Design Review
CEIT	Crew Equipment Interface Test
CF	Completion Form
CM	Configuration Management
CO	Contracting Officer
CoFR	Certification of Flight/Launch Readiness
COTR	Contracting Officer's Technical Representative
COTS	Commercial Off the Shelf
CR	Change Request
DCB	Developmental Control Board
DCMC	Defense Contract Management Command
DCN	Drawing Change Notice
DDT&E	Design, Development, Test, and Evaluation
DLO	Directorate Level Organization
DR	Discrepancy Report
DVTU	Design Verification Test Unit
EA	Engineering Directorate
EAC	Estimate at Completion
EARB	Engineering Directorate Review Board
EDCC	Engineering Drawing Control Center
EDCPAP	Engineering Directorate Certified Parts Approval Process
EDRS	European Data Relay Satellite
EIS	End Item Specification
EMR	End of Mission Review
FA	Feasibility Assessment
FCA/PCA	Functional Configuration Audit/Physical Configuration Audit
FIAR	Failure Investigation Analysis Report
FRR	Flight Readiness Review
GCAR	Government Certification Approval Request
GFE	Government Furnished Equipment
HSI	Hardware Software Integration
IA	Interdivisional Agreement
ICD	Interface Control Document
IP&CL	Instrument Program and Control List
ISO	International Organization for Standardization
ISS	International Space Station
ISSPO	International Space Station Program Office
ITA	Internal Task Agreement
JOFOC	Justification for Other than Full and Open Competition
KSC	Kennedy Space Center
LM	Lockheed-Martin
LOD	Letter of Delegation
LOE	Level of Effort
MER	Mission Evaluation Room

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MOD	Mission Operations Directorate
MOA	Memorandum of Agreement
MSDS	Material Safety Data Sheet(s)
OAPR	Obligation Authority Purchase Request
OPR	Office of Primary Responsibility
PDR	Preliminary Design Review
PM	Project Manager
PMP	Project Management Plan
PRACA	Problem Reporting and Corrective Action
PR	Purchase Request
PRS	Problem Reporting System
PRVD	Project Requirements and Verification Document
PSRP	Payload Safety Review Panel
PTRS	Project Technical Requirements Specification
QE	Quality Engineer
RAESR	Risk Assessment Executive Summary Report
RFG	Request for GFE
RFP	Request for Proposal
RID	Review Item Disposition
SAR	System Acceptance Review
SEAT	Science Engineering, Analysis, and Test
SDD	Software Design Document
SDP	Software Development Plan
SMART	Safety and Mission Assurance Review Team
SOW	Statement of Work
SR&QA	Safety Reliability & Quality Assurance
SRR	System Requirements Review
SRS	Software Requirements Specification
SSP	Space Shuttle Program
SSPO	Space Station Program Office
STI	Scientific and Technical Information
TMR	Technical Manager's Representative
TPS	Task Performance Sheet
TRRB	Test Readiness Review Board
TWP	Technical Work Plan
V&V	Verification and Validation
V&VD	Verification and Validation Document: Plan and Results
VDD	Version Description Document
WBS	Work Breakdown Structure
WSTF	White Sands Test Facility

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APPENDIX C ISO TRACEABILITY

This Appendix provides traceability to the JSC ISO requirements.

Table C-1 Traceability to jsc SLP 4.4 “Design Control”

SLP 4.4 PARAGRAPH	EA-023 PARAGRAPH
7.1 Procedure	
7.1.1 Project Type	7.1.1.2 (Form EA-002 and EA-WI-002)
7.1.2 Project Implementation	7.1 (Life Cycle) 7.4 (Exception) 7.2.2.3 Human Resources & Project Schedule
7.2.1	(WBS in PMP)
7.2.1.1	7.2.1 7.2.2.3
7.2.1.2	7.2.1 7.2.2.3
7.2.1.3	7.2.1 7.2.2.3
7.2.2	7.1.2.2 7.1.2.3 7.1.3.2 (Figure 7.1.3.2-1) 7.2.1 EA-WI-027, Appendix B, Section 3.1
7.3.1	7.1.3.2 (PTRS and ICDs)
7.3.2	7.1.3.2 (ICD) 7.1.4.2 7.1.5.2 7.5.1.2 (PTRS) 7.5.1.3 (ICD)
7.4.1	7.1.1.2 (FA) 7.1.2.2 (PTRS)
7.4.2	7.1.2.2 (ITA) 7.1.3.2 PTRS Annotated Outline, section 3.2.3 7.1.4.2 (V&VD) 7.5.1.4
7.4.3	7.1.1.2 (Figure 7.1.1.2-1)

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SLP 4.4 PARAGRAPH	EA-023 PARAGRAPH
	7.1.2.2 (Figure 7.1.1.2-1) 7.1.3.2 (Figure 7.1.3.2-1)
7.4.4	7.1.2.2 (ITA) 7.1.3.2 (PTRS, and Figure 7.1.3.2-1) 7.1.4.2 (Figure 7.1.4.2-1)
7.5.1	7.1.4 (PDR) 7.1.5 (CDR) 7.1.6 (Production)
7.6.1	7.1.5.3 (Detail Design Products) 7.1.6.3 (Flight Production and Certification Products) 7.5.1.2 (PTRS Requirements) 7.5.1.4 (V&VD)
7.6.1.1	7.1.6.2 (Qualification Testing and V&VD)
7.6.1.2	7.1.6.2 V&VD (Appendix C)
7.6.1.3	7.5.1.1 (PMP) PMP (Para. 6.1 – Requirements) PMP (Para. 6.3 – Requirements)
7.6.2	7.2.4.1 (SRR, PDR and CDR)
7.7	7.1.3.4.2 (SRR) 7.1.4.4.1 (PDR) 7.1.5.4.1 (CDR) 7.2.4.1 (Process)
7.7.1	7.1.2.2 (PMP) PMP (section 9)
7.7.2	7.2.4.1 7.5.2.4
7.7.3	7.2.4.1 7.5.2.6
7.7.3 a	7.5.2.6
7.7.3 b	7.5.2.6
7.7.3 c	7.2.4.1 7.5.2.6
7.7.3 d	7.2.4.1 7.5.2.6
7.7.3 e	7.2.4.1 7.5.2.6

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SLP 4.4 PARAGRAPH	EA-023 PARAGRAPH
7.7.3 f	7.2.4.1 7.5.2.6
7.7.4, para. 1	7.2.4.1 7.5.2.6
7.7.4, para. 2	7.1.3.4.1
7.7.4, para. 3	7.1.4 7.1.4.4.1
7.7.4, para. 4	7.4
7.7.4, para. 5	7.1.5
7.8	7.1.4.2 (Preliminary V&VD) 7.1.5.2 (Final V&VD) 7.1.6.3 (ADP and CDP) 7.5.1.4 (V&VD)
7.8.1	7.1.4.2 (Preliminary) 7.1.5.2 (Final V&VD) V&VD (Appendix C)
7.8.2	7.1.6.2
7.8.3	7.1.6.3 V&VD (Appendix C)
7.8.3 a	7.1.6.3 V&VD (Appendix C)
7.8.3 b	7.1.6.3 V&VD (Appendix C)
7.8.3 c	7.1.6.3 V&VD (Appendix C)
7.8.3 d	7.1.6.2 7.1.6.3 V&VD (Appendix C)
7.8.3 e	7.1.6.3 V&VD (Appendix C)
7.8.4	7.1.6.3
7.9, para. 1	7.1.4.3 (Preliminary V&VD) 7.1.5.3 (Final V&VD) 7.1.6.2 (Conduct) V&VD (section 4.3) V&VD (Appendix D)

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SLP 4.4 PARAGRAPH	EA-023 PARAGRAPH
7.9, para. 2	7.1.5.3
7.9.1	V&VD (Appendix D)
7.9.2	7.1.6.2
7.9.3	7.1.6.3 V&VD (4.3)
7.9.3 a	7.1.6.3 V&VD (Appendix D)
7.9.3 b	7.1.6.3 V&VD (Appendix D)
7.9.3 c	7.1.6.3 V&VD (Appendix D)
7.9.3 d	7.1.6.3 V&VD (Appendix D)
7.9.3 e	7.1.6.3 V&VD (Appendix D)
7.9.4	7.1.6.3
7.10	7.1.3.3 (CM Plan) EA-WI-027, Appendix B, Section 1
7.10.1	EA-WI-027, Section 8
7.10.2	EA-WI-027, Appendix B, Section 3
7.10.3	EA-WI-027, Appendix B, Section 3

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Table C-2 Traceability to AE-CWI-001 Work Instruction for Quality Management System Requirements for Project Planning

JSC QUALITY MANAGEMENT SYSTEM ELEMENT	WHERE QUALITY MANAGEMENT SYSTEM ELEMENT IS ADDRESSED IN THE PROJECT PLANNING DOCUMENTATION
CUSTOMER FOCUS	
1. Are the controlling Work Instructions and System Level Procedures related to Customer Focus referenced?	EA-WI-023 para 7.3.1 & 7.3.2 references LA-CWI-02 Agreements
2. How are the external and internal customers identified?	EA-WI-023 sections 7.3.1 & 7.3.2
3. How are the customer's needs and expectations determined and converted to requirements?	EA-WI-023 section 7.1.3 (PTRS – entire document)
4. How are customer agreements documented, maintained, and changes tracked?	EA-WI-023 sections 7.3.1 & 7.3.2 references LA-CWI-02 Agreements
5. How are customer requirements reviews conducted?	EA-WI-023 para 7.1.3.4.1 (SRR) and para 7.2.4.1
6. What is the process for assuring on-going customer communication?	EA-WI-023 para 7.1.3.4.1 & 7.2.4.1
7. How is customer feedback obtained?	EA-WI-023 para 7.1.3.4.1, 7.1.6.4.1, 7.2.4.1 & 7.2.4.2
DESIGN PROCESS	
1. Are the controlling Work Instructions and System Level Procedures related to the Design Process referenced?	EA-WI-023 Appendix C ISO Traceability to JSC SLP 4.4 Design Control
2. Is the design verification process documented?	EA-WI-023 section 7.5 (V&V or PRVD)
3. Is the design validation process documented?	EA-WI-023 section 7.5 (V&V or PRVD)
4. Are the number, type, and scope of the design reviews identified?	EA-WI-023 section 7.2.4
5. Is the configuration control process to accommodate design changes identified?	EA-WI-023 section 7.2.3 references EA-WI-027 Configuration Management Requirements
PRODUCT QUALITY	

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JSC QUALITY MANAGEMENT SYSTEM ELEMENT	WHERE QUALITY MANAGEMENT SYSTEM ELEMENT IS ADDRESSED IN THE PROJECT PLANNING DOCUMENTATION
1. Are the controlling Work Instructions and System Level Procedures related to Product Quality referenced?	EA-WI-023 sections 3.0, 7.3.3 & 7.3.4
2. What is the project's inspection and testing process?	EA-WI-023 section 7.1.6 references EA-554 Test Operations Guidelines
3. What is the project's process for identification and maintenance of the inspection and test status of the product?	EA-WI-023 section 7.1.6 references EA-554 Test Operations Guidelines
4. What is the process to ensure that products that do not conform to specified requirements are prevented from unintentionally being used by the project?	EA-WI-023 section 7.2.6 references JSC SLP 4.13, NT-CWI-003, & JSC 28035
5. Are the procedures for the handling, storage, packaging, preservation, and delivery of the products identified?	EA-WI-023 para 7.5.1.2 (PTRS para 5.0)
ACQUISITION PLANNING AND OVERSIGHT	
1. Are the controlling Work Instructions and System Level Procedures related to Acquisition Planning and Oversight referenced?	EA-WI-023 section 7.3 refers to SLP 4.6 Procurement, LA-CWI-02 Agreements and SEAT TWP's
2. Is the process for acquisition of products and services that conform to the project's specified requirements identified?	EA-WI-023 para 7.1.2.2 & section 7.2.2
ACQUISITION PLANNING AND OVERSIGHT (CONTINUED)	
3. Do you have a method to ensure the quality of the products and/or services provided by your contractor?	EA-WI-023 section 7.3 refers to SLP 4.6 Procurement, LA-CWI-02 Agreements and SEAT TWP's
BUDGET PLANNING	
1. Are the controlling Work Instructions and System Level Procedures related to the JSC budget process referenced?	EA-WI-023 para 7.1.2.2 & section 7.2.2
2. Is the method for the formulation and submission of the project's budget identified?	EA-WI-023 para 7.1.2.2 & section 7.2.2