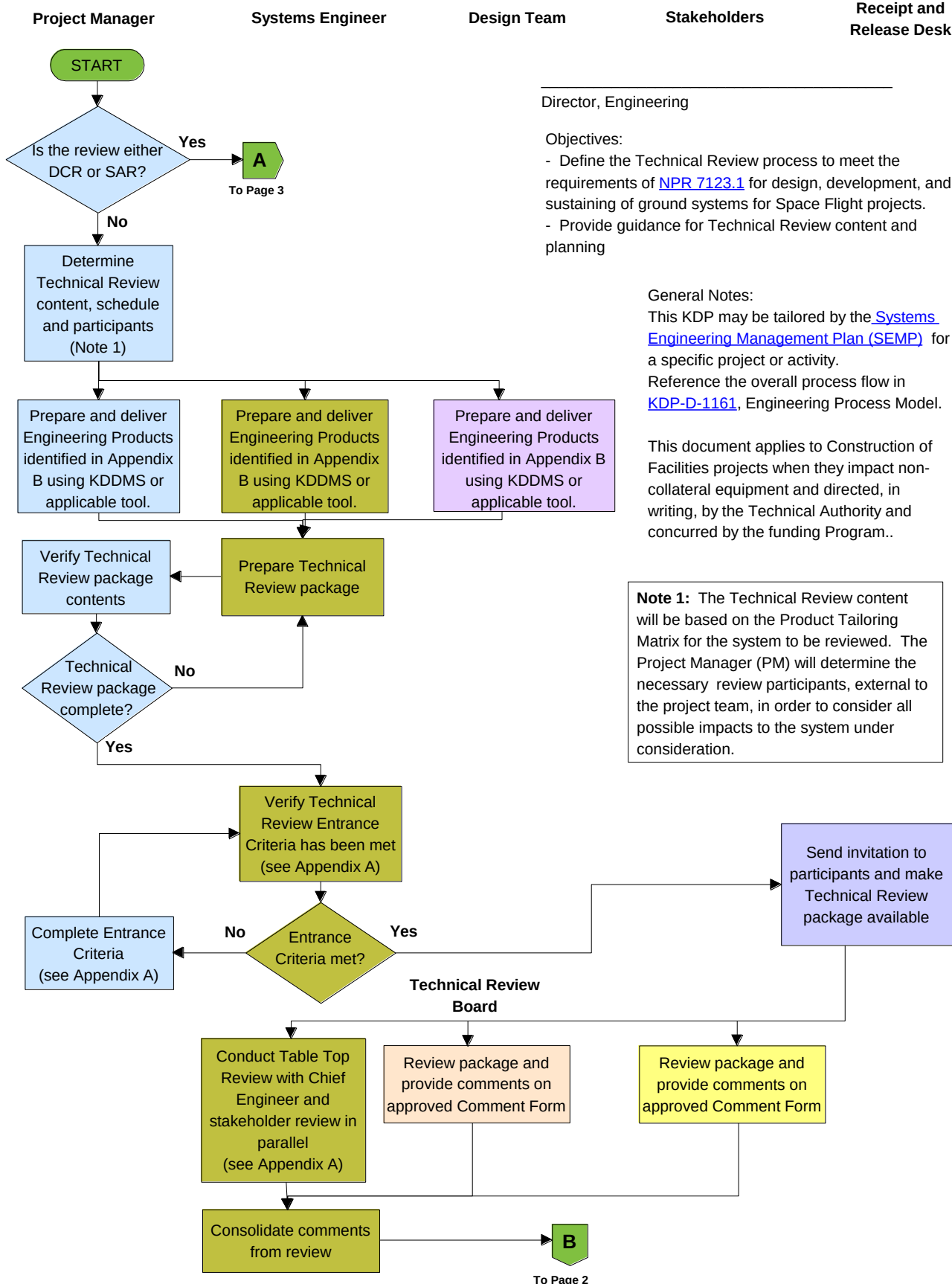
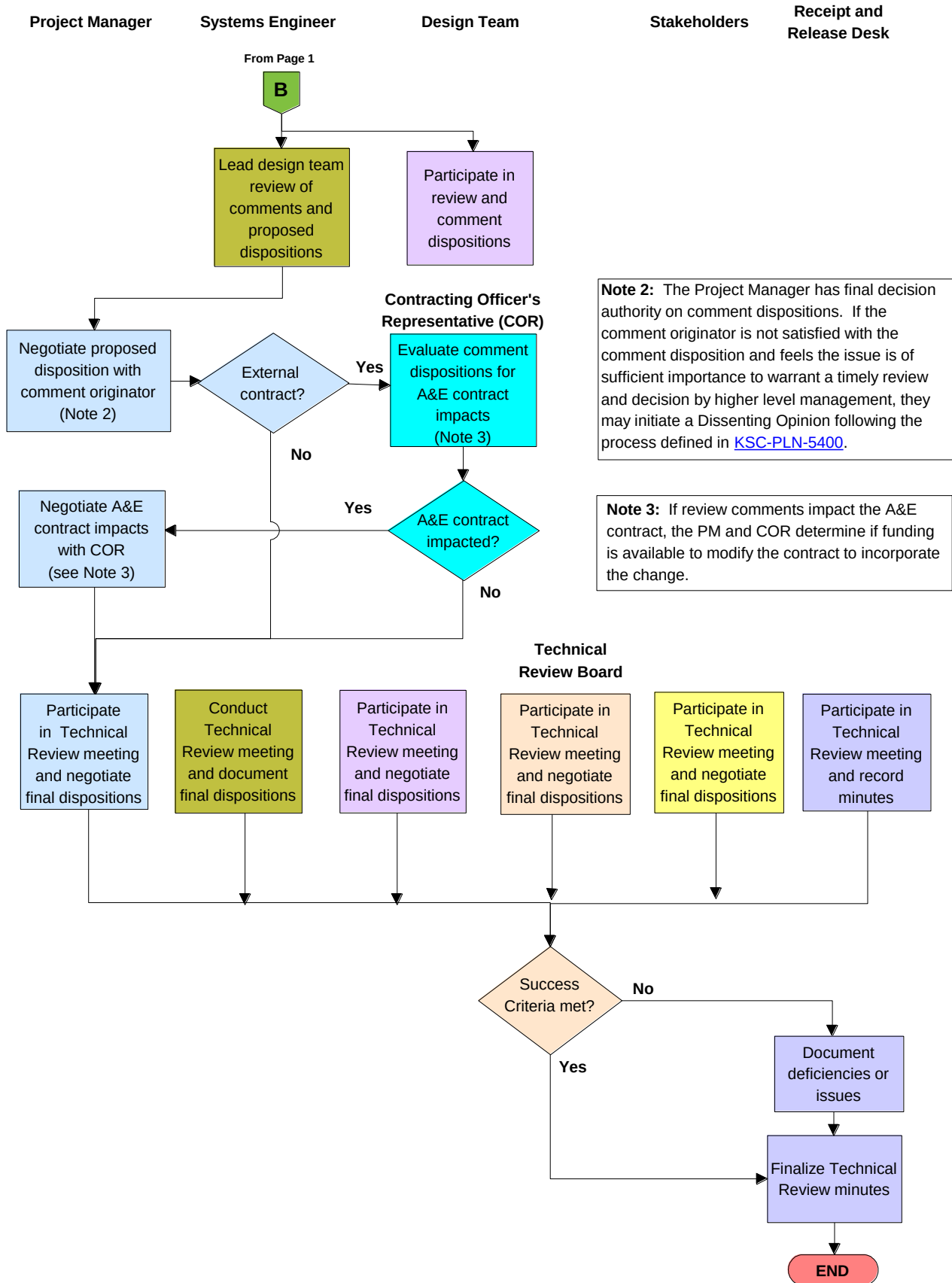
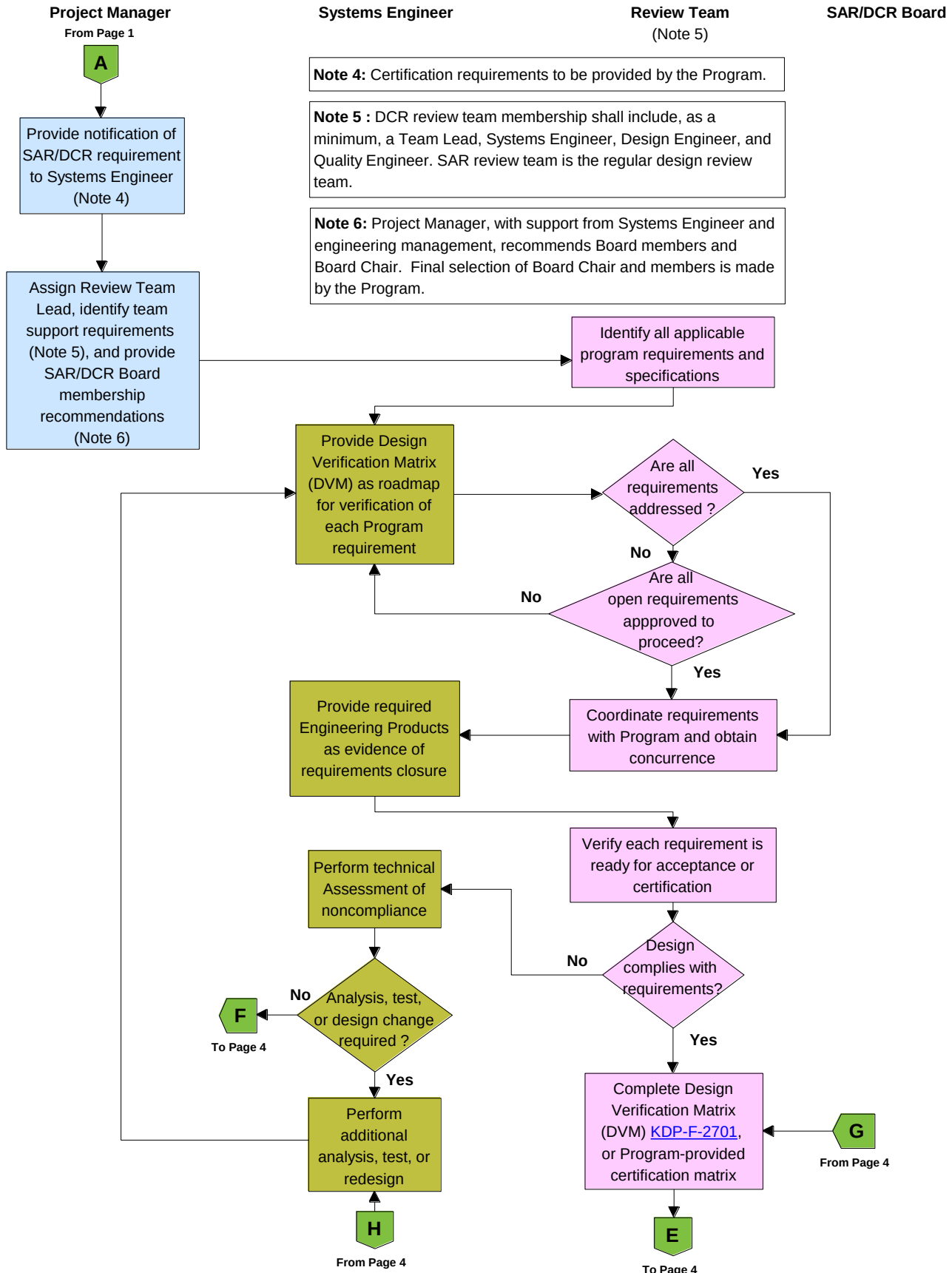
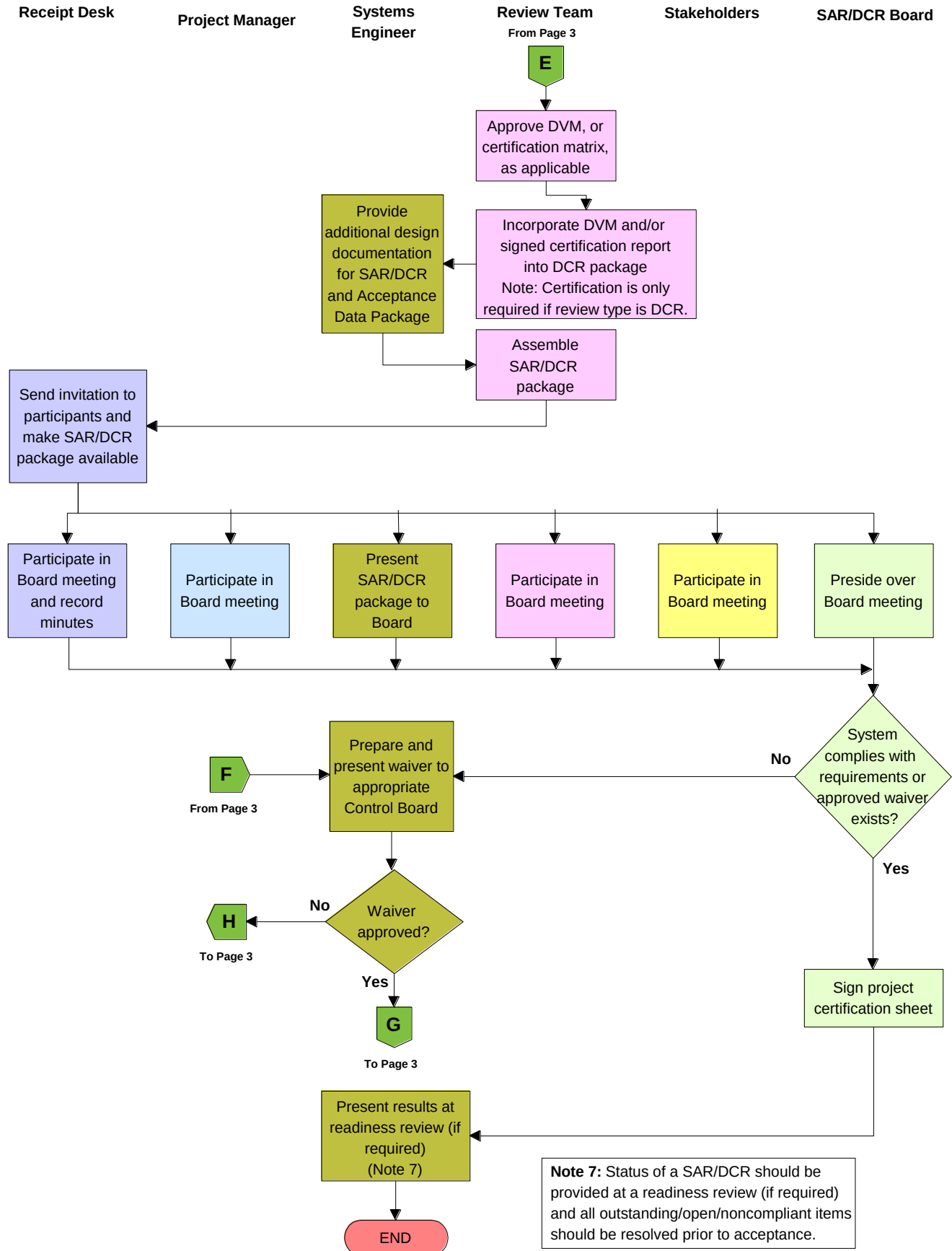










1. INTRODUCTION

1.1. SCOPE

This KSC Documented Procedure (KDP) describes the process for technical review of the engineering products produced during the design and development phase. This KDP supports the design and development portion of the project lifecycle as shown in [KDP-D-1161](#). For more information on Agency policy regarding Technical Reviews, reference [NPR 7123.1](#). This document applies to Construction of Facilities (CoF) projects when they impact non-collateral equipment as defined in [KSC-DE-512-SM](#), Facility Systems, Ground Support Systems, and GSE General Design Requirements if directed, in writing, by the Technical Authority and concurred by the funding Program customer. The references to [KDP-P-2718](#) in this document do not apply to CoF projects.

1.2. PURPOSE

Technical Reviews are conducted for the purpose of informing all affected organizations of the progress of a system's development in preparation for key decision points in the formulation and implementation phases of the project life cycle. Technical Reviews are accomplished in progressive steps as the system is developed to allow those affected organizations to anticipate problems that could be avoided before the system development transitions to each subsequent lifecycle phase. The number of Technical Reviews required will depend on the significance and complexity of the system, or changes in requirements that affect the design of the system. Types of technical reviews include design reviews, readiness reviews, table top reviews, Technical Interchange Meetings (TIMs), and acceptance and certification reviews.

1.3. ROLES

The organizations responsible for each role in this KDP should be specified in the Project Plan or SEMP as they may vary by project (with the exception of Chief Engineer which is an Engineering Directorate responsibility). Roles to be performed by an A&E contractor, and expected deliverables, must be included in the Design Statement of Work. Roles to be performed by the fabricator, and expected deliverables, must be included in the Fabrication Statement of Work or Construction Specifications used in the procurement process. For some projects, an individual on a project may perform more than one role. This KDP is not organizational specific. Organizational specific roles will be defined on the project's Product Tailoring Matrix.

Individual roles in this KDP are as follows:

- a) Project Manager – The Project Manager (PM) manages the project team effort and is responsible for delivering the certified subsystem or applicable portion of the subsystem (CoF) and all associated products, in accordance with all technical requirements, on time and within budget at an acceptable level of risk. Project Manager is the lead of the project that is undergoing the review in this process. The official title may be different as set by the different Programs/Organizations.
- b) Systems Engineer – The Systems Engineer (SE) is the technical lead for the system development and is responsible for managing the technical effort for the PM across multiple engineering disciplines, including subsystems, and contracts. This includes ensuring quality and effectiveness of design solutions to meet stakeholder expectations, technical requirements and engineering products necessary to support certification or acceptance.
- c) Chief Engineer – The Chief Engineer (CE) manages the technical baseline of subsystems and

approves the documents outlined in [KDP-P-2718](#), and [NPR 7150.2](#) Compliance Matrix, if applicable. The Chief Engineer as referenced in this document is defined as the Design and Development Chief Engineer.

- d) Design/Technical Team – The Design/Technical Team is the core group of individuals responsible for generating the engineering products that define the system under development. The Design/Technical Team consists of the Design Engineers (electrical, fluids, mechanical, software, structural, architectural, civil and controls), Lead Design Engineers (electrical, fluids, mechanical, and software), Operations Engineers (OE), and Specialty Engineers (analysis, environmental, human factors, information technology, operational technology, logistics, materials and processes, quality, reliability, and safety). Design/Technical Team members are responsible for dispositioning review comments against their respective engineering products. The A&E contractor may perform any Design Engineer or Specialty Engineer role based on the work and deliverables specified in the contract.
- e) Contracting Officer's Representative (COR) –The COR provides the technical recommendation to the Contracting Officer.
- f) Contracting Officer (CO) – The CO has final decision authority on all issues related to the contract and determination of impacts to the contract.
- g) Stakeholders – Stakeholders have a vested interest in the system under development, and may include but are not limited to the Chief Engineer, Customer (outside organization funding the project), Operations Engineer, Operations & Management organization, Configuration Management, line management, regulatory agencies, and representatives of interfacing systems (ground, flight, and facility). Stakeholders may or may not have concurrence or approval authority on the engineering products (see [KDP-P-2718](#)). The stakeholders must ensure the stakeholder expectations flow into the technical requirements through the technical review process.
- h) Receipt and Release Desk – The Receipt and Release Desk is responsible for scheduling the review meetings, distributing review packages to the proper list of reviewers, and recording minutes of the review meetings. The Receipt and Release Desk task may be performed by another responsible party.
- i) Technical Review Board – The review board is responsible for identifying the appropriate review participants and verifying the contents of the review package

1.4. SUMMARY

The System Requirements Review (SRR) and Preliminary Design Review (PDR) are conducted during the formulation phase of a project. The Critical Design Review (CDR), Test Readiness Review (TRR), and System Acceptance Review (SAR)/Design Certification Review (DCR) are conducted during the implementation phase of a project culminating in transition from the design and development community to the operational community.

As determined by the Chief Engineer and Project Manager, some reviews may not be required. If agreed to by program/project management and engineering, 30-, 60-, and 90-percent Design Reviews will be held in place of PDR and CDR, but other formats may be used such as 45- and 90-percent Design Reviews.

Peer Reviews may be conducted at any time during system development at the discretion of the

Project Manager, Systems Engineer, Chief Engineer, or Design Engineer. Software Peer Reviews shall follow the process in [KDP-P-3931](#).

Prior to a design review, a documented peer review of the design package shall be conducted with individuals listed on the subsystem team roster to verify stakeholder concurrence of the products.

Products requiring IERB approval to release, as indicated by [KDP-P-2718](#), must be released within 10 working days of IERB release approval.

2. TECHNICAL REVIEWS

2.1. SCHEDULE AND CONTENT

Minimum requirements for Technical Reviews shall include, but not be limited to:

- a. The size and complexity of the system design shall influence the selection of organizations required to participate in Technical Reviews. Participation by other Centers shall be coordinated through the Program Office.
- b. Other Design Reviews may be conducted as considered necessary by the responsible design management organization:
 - (1) A Delta-90% Design Review (or Delta-CDR) if significant changes have been identified at or subsequent to the 90% review (or CDR). Typically, this review would be conducted the same as a 90% Design Review.
 - (2) A 45% Design Review may be conducted instead of the 30% and 60% design reviews as agreed to by the design/technical team, project manager, and engineering management.
 - (3) Peer Reviews may be conducted at any time during the design phase to present and resolve a specific technical problem.
 - (4) A 90% Design Review shall be conducted for procurement of lower-level system assemblies prior to system design completion (pre-90% drawings and/or models may be used for bid purposes only). Technical Products for lower-level system assembly Design Reviews shall consist of the drawings and/or models and analyses, as a minimum (if applicable).
- c. Tailoring of the required maturity of Technical Products identified in Appendix B should be documented in the Product Tailoring Matrix ([KDP-F-2713](#)) and included in the Technical Review package. All items in Appendix B are required unless they are tailored with justification on the PTM. Products may be combined through tailoring. The tailoring shall be agreed to by the Project Manager, Systems Engineer, and Design/Technical Team and approved by the Integrated Engineering Review Board (IERB) prior to the System Requirements Review. Products requiring IERB approval to release, as indicated by [KDP-P-2718](#), must be released within 10 working days of IERB release approval. Descriptions of each Engineering Product are provided in Appendix C. Removal or tailoring of products required by the [NPR 7150.2](#) NASA Software Engineering Requirements must be approved by the [Software Engineering Technical Authority](#).
- d. Contents of other or additional Design Review packages shall consist of the documentation necessary to properly define the subject matter to be reviewed and any special data or

instructions concerning problems planned for review by individuals invited to participate.

- e. Appeals on results of 30-, 45-, 60-, and 90-percent Design Reviews shall be processed through the Dissenting Opinion process defined in [KSC-PLN-5400](#).
- f. Comments to Technical Review packages shall be documented on a project approved Comment Form or tracking tool. Comments may also be RIDs (Review Item Dispositions).
- g. All Technical Reviews shall be conducted on the following minimum time allocation schedule unless otherwise agreed to by the design/technical team, Project Manager, and Systems Engineer:
 - (1) Ten working days will be allowed for the review of the data package. The cutoff date for submitting comments will be 10 working days after receipt of the data package.
 - (2) A Table Top Review will be conducted as described in Section 2.7 in parallel with the stakeholder review.
 - (3) Three working days will be allowed for collection and disposition of the comments by the Design/Technical Team. The responses will be put on the original comment form or an approved project format (e.g., *Excel* spreadsheet).
 - (4) One working day will be allowed for a review meeting to present responses to the comments to appropriate organizations.
 - (5) Two working days will be allowed to submit minutes to the Project Manager for approval.
 - (6) Two working days will be allowed for the Project Manager to approve minutes.
 - (7) Two working days will be allowed to post or distribute the approved minutes.
- h. The following is typical content of a Technical Review presentation:
 - (1) Agenda
 - (2) Entrance Criteria per this KDP
 - (3) System description
 - (4) Identification of the design/technical team membership
 - (5) Discussion of previous review's action items
 - (6) Review and discussion of assumed or approved requirements, whichever applies
 - (7) Design philosophy to satisfy requirements
 - (8) Technical data as defined in Appendix B of this KDP
 - (9) Review of disposition of documented comments
 - (10) Discussion and review of other comments or questions
 - (11) Resolution of any issues/problems identified
 - (12) Summary and documentation of decisions/actions
 - (13) Identification of risks
 - (14) Success Criteria per this KDP

2.2. RESPONSIBILITIES

- a. The Chair of the Technical Review Board shall perform the following functions/tasks for each Technical Review:
 - (1) Determine Technical Review Board membership and provide a list of participants, including the name and e-mail address of each participant
 - (2) Arrange for Receipt and Release Desk support for the Review.
 - (3) Ensure KSC organizations and other affected NASA and Government organizations provide support to and participate in Technical Reviews.
 - (4) Establish the Technical Review schedule.
 - (5) Assign actions with assigned actionees and due dates.
 - (6) Approve resolution of actions and minutes.
 - (7) Schedule the Review Board meeting at KSC to review all comments, responses, and other comments. Arrangements shall be made for a teleconference for those offsite participants who cannot attend at the meeting site. International Traffic in Arms Regulations (ITAR) restrictions must be met when establishing communications for the discussion of technical information.
 - (8) Approve the Technical Review package contents and meeting agenda.
- b. The Project Manager shall be responsible for:
 - (1) Ensuring that Technical Reviews are conducted in compliance with [NPR 7123.1](#) and this KDP.
 - (2) Completing the entrance criteria for the review
 - (3) Establishing schedule dates for Technical Reviews. Schedules must be coordinated with the customer, A&E contractor (if applicable), other support contractors, and all affected organizations.
 - (4) Identifying appropriate Technical Review team members.
 - (5) Approving review package contents prior to distribution for review and comments.
 - (6) Negotiating and approving final disposition of comments.
 - (7) Providing funding for any A&E contract changes required due to technical comments or other changes as a result of technical reviews.
 - (8) Approving minutes prior to distribution.
 - (9) Determining if the Technical Review meets the Success Criteria.
- c. The Systems Engineer shall be responsible for:
 - (1) Coordinating system interfaces end-to-end.
 - (2) Integrating the system design with other elements of the project.
 - (3) Providing technical assistance, inputs, and necessary technical documents for the review.
 - (4) Verifying that interfaces are identified and understood at each design review.
 - (5) Leading the Design/Technical Team in the review and disposition of submitted

comments prior to the review meeting.

- (6) Verifying Entrance Criteria for Technical Reviews, including the content and readiness of technical review packages.
 - (7) Presenting the technical review package at review meetings.
 - (8) Conducting the screening meeting to recommend disposition of comments and prepare the pre-Board meeting presentation.
 - (9) Supporting the Project Manager in the review and disposition of submitted comments during the pre-Board meeting.
- d. The Design/Technical Team shall provide support for conducting the Technical Reviews and negotiating the disposition of comments to engineering products they generate and perform follow-on studies and actions, as necessary. Personnel may fulfill multiple roles on the design/technical team.

Operations Engineer: – Operations and Maintenance, training, and validation products

Design Engineers:

- (1) Lead Design Engineer (CoF Design Manager) – Technical adequacy of discipline engineering drawings, models and products
- (2) Electrical Engineer – Electrical engineering drawings, models and products
- (3) Fluids Engineer – Fluids engineering drawings, models and products
- (4) Mechanical Engineer – Mechanical engineering drawings, models and products
- (5) Software Engineer – Software design description and products
- (6) Structural Engineer – Structural engineering drawings, models and products
- (7) Architectural Engineer – Architectural engineering drawings, models and products
- (8) Civil Engineer – Civil engineering drawings, models and products
- (9) Controls Engineer – Controls engineering drawings, models and products

Specialty Engineers:

- (1) Analyst – Engineering analysis/models
 - (2) Environmental Engineer – Environmental impacts and regulations
 - (3) Human Factors Engineer – Human interfaces and ergonomics
 - (4) Information Technology (IT)/Operational Technology (OT) Security Representative – IT/OT security assessment/analysis
 - (5) Logistics Engineer – System supportability, transportation, and storage
 - (6) Materials and Processes Engineer – Materials and processes
 - (7) Quality Engineer – Quality assurance
 - (8) Reliability Engineer – Reliability, maintainability, and availability (RMA) analyses
 - (9) Safety Engineer – Safety-related analyses
- e. The Contracting Officer's Representative (COR) shall be responsible for:

- (1) Determining if accepted technical review comments have an impact on the A&E contract.
- (2) Providing written recommendations to the Contracting Officer to implement changes to the A&E contract.
- (3) The COR provides the technical recommendation to the Contracting Officer.
- f. Contracting Officer (CO) – The CO has final decision authority on all issues related to the contract and determination of impacts to the contract.
- g. Stakeholders shall provide support for Technical Reviews relative to their area of expertise as follows:
 - (1) Chief Engineer – Technical Authority for system design and development.
 - (2) Operations Engineer – Operations and Maintenance, Training and Validation
 - (3) Other Systems Engineers – Impacts to interfacing systems
 - (4) Configuration/Data Management Representative – Configuration/Data Management
 - (5) External Discipline Experts – Experts in applicable disciplines external to the design/technical team (e.g., [KSC Pressure Systems Manager](#))
- h. The Receipt and Release Desk, or approved alternate entity shall be responsible for:
 - (1) Making the technical review packages available and distributing the review notice to affected organizations.
 - (2) Receiving technical review comments. Comments should be submitted using a project-approved format (e.g., Excel spreadsheet) or form [KSC19-21](#).
 - (3) Consolidating comments for the Design/Technical Team to disposition prior to the review.
 - (4) Preparing the invite, scheduling the review, participating in the review, capturing action items, preparing the minutes, and distributing approved minutes.
 - (5) Maintaining the status of all action items throughout closeout.
 - (6) Performing other administrative functions, as required.

2.3. SYSTEM REQUIREMENTS REVIEW (SRR)

2.3.1. PURPOSE

The SRR examines the functional and performance requirements defined for the system and the preliminary project plan and ensures that the requirements and the selected concept will satisfy the mission.

2.3.2. ENTRANCE CRITERIA

- a. A preliminary SRR agenda, success criteria, and charter for the review board have been agreed to by the design/technical team, project manager, and review chair prior to the SRR.
- b. SRR technical products listed in Appendix B of this KDP are reviewed for export control and made available to the participants prior to the review.

- c. Lessons Learned System has been researched and applicable lessons learned have been incorporated into the requirements and planning. Reference [KDP-KSC-P-2393](#).
- d. Appropriate specifications and standards have been identified and incorporated into the requirements.

2.3.3. SUCCESS CRITERIA

- a. The project utilizes a sound process for the allocation and control of requirements throughout all levels, and a plan has been defined to complete the definition activity within schedule constraints.
- b. Requirements definition is complete with respect to the identification of specifications and standards, lessons learned, top-level program or project requirements, and interfaces with external entities and between major internal elements have been defined.
- c. Requirements allocation and flow down of key driving requirements have been defined down to the assembly level.
- d. Preliminary approaches have been determined for how requirements will be verified and validated (if applicable) down to the assembly level (analysis, test, demonstration, or inspection verification method identified for each individual requirement).
- e. The project risks (programmatic and technical) are understood and have been credibly assessed, and a plan exists to effectively manage them. This plan may be at the project level or at a higher Program level as directed by the funding customer.

2.4. 30-PERCENT DESIGN REVIEW (30%)

2.4.1. PURPOSE

The 30% Design Review demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

2.4.2. ENTRANCE CRITERIA

- a. Successful completion of the SRR and responses made to all SRR comments, or a timely closure plan exists for those remaining open.
- b. Requirements (including applicable specifications and standards) have been baselined through the Board process. All requirements which are To Be Determined (TBD) and To Be Resolved (TBR) must be listed and identified in the requirements database or document
- c. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the design. Reference [KDP-KSC-P-2393](#).
- d. A 30% Design Review agenda, success criteria, and list of participants have been agreed to by the Project Manager, Systems Engineer and Chief Engineer prior to the 30% Design Review.
- e. The technical products listed in Appendix B of this KDP for the 30% Design Review have reached the prescribed maturity level and have been reviewed for export control, put under configuration control (if baselined at the previous review per Appendix B), and made available to the participants prior to the review.

2.4.3. SUCCESS CRITERIA

- a. The preliminary design is adequate and expected to meet the requirements.
- b. The flow down of verifiable requirements is complete and proper or, if not, a plan exists for timely resolution of open items. Requirements are traceable to program or project goals and objectives.
- c. Definition of the technical interfaces is consistent with the overall technical maturity.
- d. Technical margins and associated rationale are documented.
- e. Any required new technology has been developed to an adequate state of readiness, or back-up options exist and are supported to make them a viable alternative.
- f. The project risks (programmatic and technical) are understood, have been credibly assessed, and a plan exists to effectively manage them.
- g. Safety and mission assurance have been addressed in preliminary designs. This includes safety, reliability, maintainability, availability, quality, and electrical, electronic and electromechanical (EEE) parts
- h. The operational concept is technically sound, includes (where appropriate) human factors, and includes the flow down of requirements for its execution.

2.5. 45-PERCENT DESIGN REVIEW (45%)

2.5.1. PURPOSE

The 45% Design Review may be conducted in lieu of the 30% and 60% Design Reviews. This review demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

2.5.2. ENTRANCE CRITERIA

- a. Successful completion of the SRR and responses made to all SRR comments, or a timely closure plan exists for those remaining open.
- b. Requirements (including applicable specifications and standards) have been baselined through the Board process. All requirements which are To Be Determined (TBD) and To Be Resolved (TBR) must be listed and identified in the requirements database or document.
- c. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the design. Reference [KDP-KSC-P-2393](#).
- d. A 45% Design Review agenda, success criteria, and list of participants have been agreed to by the Project Manager, Systems Engineer and Chief Engineer prior to the 45% Design Review.
- e. 45% Design Review technical products listed in Appendix B of this KDP have reached the prescribed maturity level and have been reviewed for export control, put under configuration control (if baselined at the previous review per Appendix B), and made available to the participants prior to the review.

2.5.3. SUCCESS CRITERIA

- a. The preliminary design is adequate and expected to meet the requirements.
- b. The flow down of verifiable requirements is complete and proper or, if not, a plan exists for timely resolution of open items. Requirements are traceable to program or project goals and objectives.
- c. Definition of the technical interfaces is consistent with the overall technical maturity.
- d. Technical margins and associated rationale are documented.
- e. Any required new technology has been developed to an adequate state of readiness, or back-up options exist and are supported to make them a viable alternative.
- f. The project risks (programmatic and technical) are understood and have been credibly assessed, and a plan exists to effectively manage them.
- g. Safety and mission assurance have been addressed in preliminary designs. This includes safety, reliability, maintainability, availability, quality, and electrical, electronic and electro-mechanical (EEE) parts
- h. The operational concept is technically sound, includes (where appropriate) human factors, and includes the flow down of requirements for its execution.

2.6. 60 PERCENT DESIGN REVIEW (60%)

2.6.1. PURPOSE

The 60% Design Review demonstrates that significant progress has been made in the design since the 30% review and that the design meets all system requirements with acceptable risk within the cost and schedule constraints and confirms readiness to proceed with detailed design. It will show that the design is sound, interfaces have been defined to a significant extent, and verification methods have been confirmed.

2.6.2. ENTRANCE CRITERIA

- a. Successful completion of the 30% Design Review and responses made to all 30% Design Review comments, or a timely closure plan exists for those remaining open.
- b. All requirements are defined (including applicable specifications and standards) and have been baselined through the Board process. No TBDs exist in the released requirements and any TBRs must be listed with at least a defined acceptable range for design.
- c. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the design. Reference [KDP-KSC-P-2393](#).
- d. A 60% Design Review agenda, success criteria, and list of participants have been agreed to by the Project Manager, Systems Engineer and Chief Engineer prior to the 60% Design Review.
- e. 60% Design Review technical products listed in Appendix B of this KDP for the 60% Design Review have reached the prescribed maturity level and have been reviewed for export control, put under configuration control (if baselined at the previous review per Appendix B), and made available to the participants prior to the review.

2.6.3. SUCCESS CRITERIA

- a. All requirements have been baselined and are consistent with the current design.
- b. The flow down of verifiable requirements is complete. Requirements are traceable to program or project goals and objectives.
- c. Technical interfaces are mature, consistent with the overall technical maturity.
- d. Technical margins and associated rationale are documented.
- e. Any required new technology has been incorporated into the design.
- f. The project risks (programmatic and technical) are understood and have been credibly assessed, and a plan exists to effectively manage them.
- g. Safety and mission assurance have been addressed in the current design. This includes safety, reliability, maintainability, availability, quality, and electrical, electronic and electromechanical (EEE) parts.
- h. The Concept of Operations has been updated as required and includes (where appropriate) human factors and the flow down of requirements for its execution.

2.7. 90 PERCENT DESIGN REVIEW (90%)**2.7.1. PURPOSE**

The 90% Design Review establishes the system design baseline and is conducted just before committing the design to procurement. It allows all affected customers and organizations to review the design to ensure their requirements have been satisfied.

2.7.2. ENTRANCE CRITERIA

- a. Successful completion of the previous 45% or 60% Design Review and responses made to all 45% or 60% comments, or a timely closure plan exists for those remaining open.
- b. All requirements are defined and have been baselined through the Board process. No TBDs or TBRs exist in the released requirements.
- c. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the design or fabrication/construction/procurement. Reference [KDP-KSC-P-2393](#).
- d. A 90% Design Review agenda, success criteria, and list of participants for the review have been agreed to by the Project Manager, Systems Engineer and Chief Engineer prior to the review.
- e. The 90% technical work products listed in the Appendix B of this KDP have reached the prescribed maturity level and have been reviewed for export control, put under configuration control (if baselined at the previous review per Appendix B), and made available to the participants prior to the review.

2.7.3. SUCCESS CRITERIA

- a. The detailed design is expected to meet the requirements with appropriate margins shown for design/technical team review and concurrence.

- b. Interface control documents (ICDs) are sufficiently matured (signed and released by affected stakeholders) to proceed with fabrication/construction, assembly, integration, and test, and plans are in place to manage any open items.
- c. High confidence exists in the product baseline, and documentation exists or will exist in a timely manner, to allow proceeding with fabrication/construction, assembly, integration, and test.
- d. The product verification and product validation requirements and plans are complete.
- e. The verification/validation testing approach is comprehensive and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase.
- f. The project risks (programmatic and technical) are understood and have been credibly assessed, and a plan exists to effectively manage them.
- g. Safety and mission assurance have been addressed in system and operational designs. This includes safety, reliability, maintainability, availability, quality, and EEE parts.

2.8. TABLE TOP REVIEW

A Table Top Review will be conducted in parallel with the 30%, 45%, 60%, and 90% Design Reviews, at the discretion of the Chief Engineer. The Table Top Review will be a page-by-page review of a subset of the technical design products specified in Appendix B.

- a. The participants will include the Chief Engineer(s) for the System under review, appropriate members of the Design/Technical Team, and other key Stakeholders. The Chief Engineers, System Project Engineer, Systems Engineer, and owners of the products to be reviewed are required to be present at the meeting. The Chief Engineers may determine other participants at their discretion, in coordination with the Project Manager.
- b. The key products that will be reviewed at the Table Top Review will be the drawings and/or models, design analysis, software design documents, and safety analysis. Limited hard copies of the documentation (1 set per Chief Engineer) will be made available to the Chief Engineers at least 2 days prior to the review.

NOTE: Following the 90% Table Top Review, the Chief Engineer will identify to the A&E COR the critical shop drawings and/or models in the project specifications that will require Chief Engineer review and final disposition during fabrication/construction. This will be documented on an engineering technical concurrence form.

- c. Comments from the Table Top Review will be consolidated with the Design Review comments, tracked, and reported at the Design Review meeting.
- d. The Table Top Review will be held in parallel with the 10-day external Design Review and may require one or more days depending on the complexity of the System under review and the number of products to be reviewed.
- e. The Systems Engineer shall notify the Receipt Desk at least 10 days prior to the start of the review in order to allow time to schedule the conference room and invite attendees. The Systems Engineer is responsible for the following activities for the Table Top Review:
 - (1) Delivering hardcopies of the products to be reviewed to the Chief Engineers
 - (2) Determining the start and end dates of the review

- (3) Coordinating with the Chief Engineers and determining which Chief Engineers should participate for their subsystem
 - (4) Determining who should be invited from the Design/Technical Team and Stakeholders
 - (5) Setting the agenda and ensuring the right people are present at the meeting
 - (6) Ensuring that the authors of the products under review capture the comments and follow-up to make sure they are documented and incorporated into the engineering products. For CoF projects, this will be performed by the COR.
- f. The author of the product for which comments are received shall be responsible for documenting the comments and incorporating them into their engineering product.

Any engineering change during fabrication/construction and testing that affects form, fit, or function, as determined by both the Lead Design Engineer and Systems Engineer, including evaluation of the A&E RFIs, shall require a review with the Chief Engineers for concurrence. This requirement does not apply to collateral facility subsystem projects. For these projects, RFI reviews will be requested at the Design Manager's discretion in coordination with the Chiefs. The Systems Engineer will coordinate integrated impacts to other disciplines within the Subsystem and other Subsystems with an interface affected by the changes.

2.9. PRELIMINARY DESIGN REVIEW (PDR)

2.9.1. PURPOSE

The PDR demonstrates that the preliminary design meets all system requirements with acceptable risk and within the cost and schedule constraints and establishes the basis for proceeding with detailed design. It will show that the correct design options have been selected, interfaces have been identified, and verification methods have been described.

2.9.2. ENTRANCE CRITERIA

- a. Successful completion of the SRR and responses made to all SRR comments and action items, or a timely closure plan exists for those remaining open. Comments may also be RIDs.
- b. Requirements (including applicable specifications and standards) have been baselined through the Board process. All TBDs and TBRs must be listed and identified in the requirements database or document.
- c. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the design.
- d. A PDR agenda, success criteria, and Review Board charter have been agreed to by the design/technical team, project manager, and review chair prior to the PDR.
- e. PDR technical products listed in the Appendix B of this KDP have met prescribed maturity levels and have been reviewed for export control, put under configuration control (if baselined at the previous review per Appendix B) and made available to the participants prior to the review.

2.9.3. SUCCESS CRITERIA

- a. The preliminary design is adequate and expected to meet the requirements.

- b. The flow down of verifiable requirements is complete and proper or, if not, a plan exists for timely resolution of open items. Requirements are traceable to program or project goals and objectives.
- c. The preliminary design is expected to meet the requirements.
- d. Technical interfaces are consistent with the overall technical maturity.
- e. Technical margins and associated rationale are documented.
- f. Any required new technology has been developed to an adequate state of readiness, or back-up options exist and are supported to make them a viable alternative.
- g. The project risks (programmatic and technical) are understood and have been credibly assessed, and a plan exists to effectively manage them.
- h. Safety and mission assurance (e.g., safety, reliability, maintainability, quality, and EEE parts) have been addressed in preliminary designs and any applicable S&MA products (e.g., Reliability and Safety Assessment Report, System Assurance Analysis, etc.) have been identified.
- i. The operational concept is technically sound, includes (where appropriate) human factors, and includes the flow down of requirements for its execution.

2.10. CRITICAL DESIGN REVIEW (CDR)

2.10.1. PURPOSE

The CDR establishes the program/project design baseline. It is conducted just before committing the design to procurement. It allows all affected customers and organizations to review the design to ensure their requirements have been satisfied.

2.10.2. ENTRANCE CRITERIA

- a. Successful completion of the PDR and responses made to all PDR comments and action items, or a timely closure plan exists for those remaining open. Comments may also be RIDs.
- b. All requirements are defined and have been baselined through the Board process. No TBDs or TBRs exist in the released requirements.
- c. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the design or fabrication/construction/procurement.
- d. A CDR agenda, success criteria, and charter for the Board have been agreed to by the design/technical team, project manager, and review chair prior to the CDR.
- e. CDR technical work products listed in the table in Appendix B of this KDP have met prescribed maturity levels and have been reviewed for export control, put under configuration control (if baselined at the previous review per Appendix B) and made available to the participants prior to the review:

2.10.3. SUCCESS CRITERIA

- a. The detailed design is expected to meet the requirements with appropriate margins shown with rationale for design/technical team review and concurrence.
- b. Interface control documents are sufficiently matured to proceed with procurement, fabrication/construction, assembly, integration, and test; and plans are in place to manage any open items.

- c. High confidence exists in the product baseline, and documentation exists or will exist in a timely manner to allow proceeding with fabrication/construction, assembly, integration, and test.
- d. The product verification and product validation requirements and plans are complete.
- e. The testing approach is comprehensive, and the planning for system assembly, integration, test, and launch site and mission operations is sufficient to progress into the next phase.
- f. Technical margins and associated rationale are documented.
- g. The project risks (programmatic and technical) are understood and have been credibly assessed, and a plan exists to effectively manage them.
- h. Safety and mission assurance (e.g., safety, reliability, maintainability, availability, quality, and EEE parts) have been addressed in system and operational designs, and any applicable S&MA products (e.g., Reliability and Safety Assessment Report, System Assurance Analysis, etc.) have been approved.

2.11. TEST READINESS REVIEW (TRR)

2.11.1. PURPOSE

A Test Readiness Review (TRR) ensures that the article under test (hardware/software), test facility, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control.

2.11.2. ENTRANCE CRITERIA

- a. All previous design review success criteria have been met and key issues resolved.
- b. The objectives of the testing have been clearly defined and documented and all of the test plans, procedures, environment, and configuration of the test item(s) support those objectives.
- c. Configuration of the system under test has been defined, agreed to, and all interfaces have been placed under configuration management or have been defined in accordance with an agreed-to plan.
- d. All applicable functional, unit-level, subsystem, system, and qualification testing has been conducted successfully.
- e. TRR technical products listed in the table in Appendix B of this KDP have reached the designated level of maturity and been reviewed for export control, put under configuration control if baselined per Appendix B, and made available to the participants prior to the review.
- f. [Lessons Learned Information System](#) has been reviewed for any applicable data that may influence the testing. Reference [KDP-KSC-P-2393](#).
- g. All known system discrepancies have been identified and resolved.
- h. All required test resources: properly trained and certified people (including a designated test director), facilities, test articles, test instrumentation, and other test enabling products have been identified and are available to support required tests.
- i. Roles and responsibilities of all test participants are defined and agreed to.

- j. Test contingency planning has been accomplished and all personnel have been trained.
- k. Processes exist for documenting, troubleshooting, and resolving discrepancies during the test and for procedural or test-case changes involving verification of requirements or interfaces as a result.
- l. Safety procedures are in place that define emergency response procedures. Appropriate emergency response organizations have been notified and personnel have been briefed on the procedures.
- m. Warning limits have been established for test parameters and written instructions exist for each warning alarm.
- n. Redline limits for stopping test operations have been identified with written instructions on how to safe the article under test and the test equipment.

2.11.3. SUCCESS CRITERIA

- a. Test plans are completed and approved for the system under test.
- b. Identification and coordination of required test resources are completed.
- c. Previous component, subsystem, and system test results form a satisfactory basis for proceeding into planned tests.
- d. Risk level is identified and accepted by program/competency leadership as required.
- e. Plans to capture any lessons learned from the test program are documented.
- f. The objectives of the testing have been clearly defined and documented, and the review of all test plans (as well as the procedures, environment, and configuration of the test item) provide a reasonable expectation that the objectives will be met.
- g. The test cases have been reviewed and analyzed for expected results and the results are consistent with the test plans and objectives.
- h. Test and test support personnel are properly trained and certified in their subject area and have received appropriate training in test operation and safety procedures including emergency response.

2.12. SYSTEM ACCEPTANCE REVIEW (SAR)

2.12.1. PURPOSE

The System Acceptance Review (SAR) verifies the completeness of the specific end item products in relation to their expected maturity level for turnover from the development phase owner to the operational phase owner and assesses compliance to stakeholder expectations. The SAR examines the system, its end items and documentation, test data, and analyses that support verification. It also ensures that the system has sufficient technical maturity to authorize transition to the operational organization and its shipment to the designated operational facility or launch site. A Design Certification Review (DCR) may be conducted in lieu of the SAR when agreed to by the project management and engineering.

2.12.2. ENTRANCE CRITERIA

- a. All verification and validation testing has been successfully completed and all open issues have been resolved or a timely closure plan exists for those remaining open. For CoF, validation may be completed by other entities after turnover and SAR completion.
- b. A preliminary agenda has been coordinated prior to the SAR.
- c. SAR technical products listed in the table in Appendix B of this KDP have met prescribed maturity levels and have been reviewed for export control, put under configuration control (if baselined following the previous review per Appendix B), and made available to the participants prior to the review.
- d. Lessons learned have been submitted to the [Lessons Learned Information System](#). Reference [KDP-KSC-P-2393](#).
- e. Any audits or assessments required by the Quality Assurance Plan or organizational assessment plan (e.g., CMMI Appraisal) have been performed and all findings and observations have been resolved, or a timely closure plan exists for those remaining open.

2.12.3. SUCCESS CRITERIA

- a. Required tests and analyses are complete and indicate that the system will perform properly in all expected operational environments.
- b. Risks are quantified, documented, and agreed to by the customer.
- c. System meets the established acceptance criteria as documented in the Design Verification Matrix.
- d. Required shipping, handling, checkout, and operational plans are complete.
- e. The Acceptance Data Package (ADP) is complete and reflects the delivered system.
- f. All applicable lessons learned for organizational improvement and system operations are entered in the [Lessons Learned Information System](#).

2.13. DESIGN CERTIFICATION REVIEW (DCR)**2.13.1. GENERAL PROVISIONS**

- a. If one or more of the following criteria are met, the Project Manager, in conjunction with program representatives and the Chief Engineer, may decide that a Design Certification Review (DCR) is required:
 - Affects Launch Commit Criteria
 - Adds or eliminates a single failure point
 - Implements a new system with a single failure point
 - Represents a significant modification to an existing certified system
 - Affects systems baselined in the customer's master verification plan
 - Affects systems/facilities that provide protection of flight hardware
 - Interfaces directly with flight hardware

- b. The DCR evaluates the engineering documentation to ensure that the system has been verified to meet all program requirements, validated to meet all stakeholder expectations, and that traceability exists to the evidence supporting certification. DCRs shall be conducted prior to system turnover to support flight hardware processing or readiness reviews for designated activities (e.g., return-to-flight). DCRs may also be conducted for major design changes as determined by the Project Manager.
- c. The DCR is a detailed technical review conducted in a series of meetings by the DCR Review Team (reference [KTI-2713C](#)) of the engineering products and data to certify the system meets all requirements, culminating in a presentation of the final results to the DCR Board.
- d. The following program/project design requirements shall be reviewed during the DCR:
 - (1) Program/project requirements and stakeholder expectation documents
 - (2) Interface Control Documents (ICDs)
 - (3) Design requirements, as applicable, (e.g., [KSC-DE-512-SM](#), [NASA-STD-5005](#))
 - (4) Operations and Maintenance Requirements and Specifications (OMRS).
- e. The following system design documents shall be reviewed for conformance to program/project requirements:
 - (1) Drawings and/or models and specifications
 - (2) Design criteria/requirements documents
 - (3) Design Verification Matrix.
 - (4) Analysis documents (DAR, RSAR, LSA, RMA, etc.)
 - (5) Operations and Maintenance Requirements Specification Documents (OMRSD)
 - (6) Test requirements documents and test reports (if applicable)
 - (7) Analyses (if applicable)
 - (8) Acceptance Data Packages (ADPs)

2.13.2. RESPONSIBILITIES

- a. The Project Manager shall have the primary responsibility for the orderly and timely completion of the DCR, in accordance with this KDP. Specifically, the Project Manager shall perform the following tasks:
 - (1) Determine if a DCR is required, in conjunction with the Chief Engineer and Program Management.
 - (2) Designate a DCR Team lead.
 - (3) Provide DCR Team resources.
 - (4) Provide DCR notification to DCR Board Chair.
 - (5) Recommend DCR Board membership.
 - (6) Conduct the DCR pre-Board meeting.
 - (7) Release the results of the DCR through KSC Design Data Management System ([KDDMS](#)) (in accordance with [KDP-P-2718](#)) or through other appropriate means.

- b. The DCR Review Team shall perform the following tasks (reference [KTI-2713C](#)):
- (1) Identify applicable program requirements, specifications, and stakeholder expectations.
 - (2) Coordinate requirements with program and obtain concurrence.
 - (3) Certify verification of each requirement and validation of each stakeholder expectation.
 - (4) Prepare and submit Design Verification Matrix (DVM), [KDP-F-2701](#) or program-provided certification matrix.
 - (5) Assemble DCR package (include DVM, or program-provided certification matrix).
 - (6) Sign project certification sheet (select members) after successful completion of the DCR review prior to the DCR Board.
- c. The Systems Engineer (with support from the Design/Technical Team) shall perform the following tasks:
- (1) Serve as the lead of the DCR Review Team.
 - (2) Provide data in support of the project DCR and provide support to the DCR Board.
 - (3) Review the design for conformance with applicable program requirements.
 - (4) Certify that the design satisfies all program/project design requirements.
 - (5) Provide the status of the certification progress on the system, when requested.
 - (6) Conduct the screening meeting prior to the DCR pre-Board meeting.
 - (7) Obtain signatures on the DCR certificate after successful completion of all DCR Review Team activities.
 - (8) Present the results of the DCR Review Team to the DCR Board.
 - (9) Initiate redesign activities (if required).
 - (10) Prepare waivers and present to appropriate control board (if required).
 - (11) Present DCR results at program readiness reviews (if required).
- d. The DCR Board shall perform the following tasks:
- (1) Review the DCR package and determine whether the system complies with applicable program requirements.
 - (2) Accept DCR Review Team certification of the system or define open work to be completed before accepting certification.
 - (3) Track all open work identified at the DCR to closure.

2.13.3. CONTENTS OF DCR PRESENTATION

Items presented should reflect the Product Tailoring Matrix and may include:

- DCR Purpose and Authority
- DCR Review Team
- Design Certification Process

- Entrance Criteria
- System History
- System Description/Overview
- Design Verification Matrix
- Interface Control Documentation
- Design Analysis Summary
- Verification and Validation Testing Summary
- Safety & Mission Assurance Summary
- Human Factors Engineering Assessment Summary
- Logistics Supportability Analysis Summary
- Configuration Status
- Operations and Maintenance (O&M) Documentation Status
- Deviations/Waivers
- Open Work/Issues
- Forward Work
- Success Criteria
- Statement of Certification
- Recommendation
- Backup Charts

2.13.4. ENTRANCE CRITERIA

- a. All verification and validation testing has been successfully completed and all open issues have been resolved or a timely closure plan exists for those remaining open.
- b. A preliminary agenda has been coordinated prior to the DCR.
- c. DCR engineering products listed in the table in Appendix B of this KDP have met prescribed maturity levels and have been reviewed for export control, put under configuration control (if baselined following the previous review per Appendix B), and reviewed by the DCR Review Team prior to the DCR Board meeting (reference [KTI-2713C](#)).
- d. Lessons learned have been submitted to the [Lessons Learned Information System](#). Reference [KDP-KSC-P-2393](#).
- e. Any audits or assessments required by the Quality Assurance Plan or organizational assessment plan (e.g., CMMI Appraisal) have been performed and all findings and observations have been resolved, or a timely closure plan exists for those remaining open.

2.13.5. SUCCESS CRITERIA

- a. Required tests and analyses are complete and indicate that the system meets all design requirements.

- b. Risks are known and manageable.
- c. Certification of the system by the DCR Review Team is complete and approved by the DCR Board.
- d. Required shipping, handling, checkout, and operational plans are complete.
- e. The Acceptance Data Package (ADP) is complete and reflects the delivered system.
- f. All applicable lessons learned for organizational improvement and system operations are entered into the [Lessons Learned Information System](#). Reference [KDP-KSC-P-2393](#).

Product ID	Product Title	Product Attributes		Technical Reviews													
		Owner	Author	SRR	AND	30%	60%	OR	45%	AND	90%	OR	PDR	CDR	AND	TRR	SAR or DCR
1	Team Roster ¹	PM	PM	P		U	U		U		U		U	U		U	U
2	Stakeholder Expectations ¹	SE	OE	B		F			F				F				
3	Concept of Operations (ConOps)	SE	OE	B		U	U		U		F		U	F			
4	System Requirements	SE	SE	F													
5	Design Verification Matrix	SE	SE	B		U	U		U		U		U	U		U	F
6	Product Tailoring Matrix	PM	SE	B		U	U		U		U		U	U		U	F
7	Design Statement of Work	PM	SE/LDE	F													
8	Cost Estimate ²	PM	PM	B		U	U		U		U		U	U		U	U
9	Schedule ¹	PM	PM	B		U	U		U		U		U	U		U	U
10	Project Plan	PM	PM	B		F			F				F				
11	Systems Engineering Management Plan (SEMP)	SE	SE	B		F			F				F				
12	Risk Management Plan (RMP)	PM	PM	B		F			F				F				
13	Configuration Management Plan (CMP)	SE	SE	B		F			F				F				
14	Quality Assurance Plan (QAP)	PM	SPE	B		F			F				F				
15	Acquisition Plan	PM	PM	B		F			F				F				
16	Logistics Support Analysis Development Plan	SPE	SPE	B		U	U		U		F		U	F			
17	Software Assurance Classification Assessment (SACA) Report	SE	SPE	NA		F			F				F				
18	Software Development/Management Plan (SDP/SMP) and NPR 7150.2 Compliance Matrix	SE	SPE	B		F			F				F				
19	Software Assurance Plan	SE	SPE	B		F			F				F				
20	Software Safety Plan	SE	SPE	B		F			F				F				
21	Software Test Plan	SE	DE	NA		P	B		B		F		B	F			
22	Trade Study Plan/Report	SE	DE	NA		B	U		B		F		B	F			
23	Product Structure/Indentured System Documentation List	SE	LDE	NA		B	U		B		U		B	U		U	F
24	Risk Matrix	PM	SE	NA		P	U		U		U		U	U		U	U
25	Lessons Learned Plan/Report	SE	SE	NA		P	U		P		U		P	U		U	F
26	Prototype Plan/Report	LDE	DE	NA		B	U		B		F		B	F			
27	Interface Control Document (ICD) ¹	SE	SE	NA		B	U		B		F		B	F			
28	Interface Table ³	SE	SE	NA		P	B		B		F		B	F			
29	Reliability and Safety Assessment Report (RSAR)	SE	SPE	NA		P	U		P		F		P	F			
30	IT/OT Security Assessment	SE	SPE	NA		NA	P		P		F		P	F			
31	System Assurance Analysis (SAA)	SE	SPE	NA		P	U		P		B		P	B		U	F
32	Software Safety Analysis (SSA)	SE	SPE	NA		P	U		P		B		P	B		U	F
33	Environmental Checklist ²	SE	SE	NA		P	U		P		U		P	U		U	U
34	Human Factors Engineering Assessment	SPE	SPE	NA		P	U		P		B		P	B		U	F
34.1	Human-in-the-Loop Evaluation	SPE	SPE	NA		P	U		P		B		P	B		U	F
34.2	Human Error Analysis	SPE	SPE	NA		P	U		P		B		P	B		U	F
34.3	Workload Assessment	SPE	SPE	NA		P	U		P		B		P	B		U	F
35	Verification Plan	SE	DE	NA		P	U		P		B		P	B		F	
36	Validation Plan	SE	OE	NA		P	U		P		B		P	B		F	
37	Integration Plan	SE	SE	NA		P	U		P		B		P	B		U	F

Product ID	Product Title	Product Attributes		Technical Reviews													
		Owner	Author	SRR	AND							OR			AND	TRR	SAR or DCR
						30%	60%	OR	45%	AND	90%		PDR	CDR			
38	Transition Plan	SE	SE	NA		P	U		P		B		P	B		U	F
39	Transportation Plan	SE	SPE	NA		P	U		P		B		P	B		U	F
40	Engineering Drawings and/or Models	LDE	DE	NA		P	U		P		B		P	B		U	F
41	Software Requirements Specification (SRS)	SE	DE	NA		P	U		P		B		P	B		U	F
42	Requirements Traceability Matrix (RTM)	SE	DE	NA		P	U		P		B		P	B		U	F
43	Software Design Description/Interface Design Description (SDD/IDD)	LDE	DE	NA		P	U		P		B		P	B		U	F
44	Software Data Dictionary	LDE	DE	NA		P	U		P		B		P	B		U	F
45	Software Maintenance Plan	SE	DE	NA		P	U		P		B		P	B		U	F
46	Design Analysis Report ⁴	SPE	DE	NA		P	U		P		F		P	F			
46.1	Engineering Math Models ⁴	SPE	DE	NA		P	U		P		F		P	F			
47	Procurement Specification	LDE	DE	NA		P	U		P		F		P	F			
48	Reliability, Maintainability, and Availability (RMA) Analysis	SE	SPE	NA		P	U		P		B		P	B		U	F
49	Operations & Maintenance Requirements Specification Document (OMRSD)	SE	DE	NA		P	U		P		B		P	B		U	F
50	Design Data Manual	LDE	DE	NA		P	U		P		F		P	F			
51	Logistics Support Analysis (LSA)	SE	SPE	NA		NA	P		P		B		P	B		U	F
52	IT/OT System Security Plan	SE	SPE	NA		P	U		P		B		P	B		U	F
53	Electromagnetic Compatibility Management Plan	SE	DE	NA		P	B		B		F		B	F			
54	Quality Assurance Surveillance Plan (QASP)	PM	SPE	NA		NA	P		P		B		P	B		U	F
55	Sneak Circuit Analysis	LDE	DE	NA		NA	P		P		F		P	F			
56	Component Qualification Plan	LDE	DE	NA		NA	B		B		F		B	F			
57	Operating Criteria	LDE	DE	NA		NA	P		P		B		P	B		U	F
58	Training Plan	SE	OE	NA		NA	P		P		B		P	B		U	F
59	Pressure System Certification Report ¹	LDE	DE	NA		NA	NA		NA		P		NA	P		U	F
60	Software User Manual	SE	DE	NA		NA	NA		NA		P		NA	P		U	F
61	Verification Procedures	SE	DE	NA		NA	NA		NA		P		NA	P		B	F
62	Validation Procedures	SE	OE	NA		NA	NA		NA		P		NA	P		B	F
63	Engineering Instructions (EI) ²	SE	DE	NA		NA	NA		NA		F		NA	F			
64	Fabrication Statement of Work	SPM	SE/LDE	NA		NA	NA		NA		F		NA	F			
65	Version Description Document ¹	LDE	DE	NA		NA	NA		NA		NA		NA	NA		B	F
66	Verification Report ¹	SE	SE	NA		NA	NA		NA		NA		NA	NA		NA	F
67	Validation Report ¹	SE	OE	NA		NA	NA		NA		NA		NA	NA		NA	F
68	System Acceptance Data Package (ADP) ^{1 2 5}	PM	SE	P		U	U		U		U		U	U		U	F

<u>KDP-P-5031</u>	<u>KDP-P-5032</u>	<u>KDP-P-5032</u> & <u>KDP-P-5033</u>	<u>KDP-P-5033</u>	<u>KDP-P-5034</u>	<u>KDP-P-5035</u>
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Footnotes	
¹	Product is not subject to comment during reviews
²	Product is not included in reviews
³	The Interface Tables for interfacing systems shall also be provided in the review package as reference, but are not subject to comment during the review. Comments to Interface Tables for these interfacing systems must be made during that system's review.
⁴	Product may be delegated to a Design Engineer
⁵	The system ADP is composed of all the engineering data generated during system development. Vendor ADPs for procured items are a subset of the system ADP and may be available for subassemblies/components prior to SAR/DCR. (Reference KDP-P-5042)

Product Attributes	
Owner/Author	
PM	Project Manager
SE	Systems Engineer
DE	Design Engineer (electrical, fluids, mechanical, software, structural, architectural, civil and controls). May be performed by A&E per SOW
LDE	Lead Design Engineer
OE	Operations Engineer
SPE	Specialty Engineer (analysis, environmental, human factors, information technology, operational technology, logistics, materials and processes, quality, reliability, safety, pressure systems manager)
The roles are not organizational specific. Organizational specific roles will be defined on the project's PTM.	
Product ID numbers and the PTM product organization above may not reflect the folder structure in KDDMS.	

Product Maturity		
P	Preliminary	An initial version of the product which provides an overview of how the subject matter will be addressed and incorporated into the design.
B	Baselined	An approved version of the product against which changes may be assessed and tracked. The product is baselined following incorporation of comments from the indicated technical review and released.
U	Updated	The latest version of the product based on the existing maturity and level of detail in the design at the time of the indicated technical review. If previously baselined, the product should be revised and re-released following the technical review after incorporating any comments accepted during the technical review.
F	Final	The final version of the product which requires no more updates before transition to Operations. The product is finalized by incorporating comments from the indicated technical review and released. NOTE: This is the expected Final version, but the product may be updated during subsequent phases.

1. Team Roster: A list of team members and their roles, including stakeholders, contractors, and off-site team members.
2. Stakeholder Expectations: Stakeholder expectations are the user needs and are used to develop the technical requirements and design solution. They must be baselined at SRR. Reference [NPR 7123.1](#) for additional information.
3. Concept of Operations (ConOps): The ConOps describes the overall high-level concept of how the system will be used to meet stakeholder expectations, usually in a time sequenced manner. It describes the system from an operational perspective and helps facilitate an understanding of the system goals. It stimulates the development of the requirements and architecture related to the user elements of the system and serves as the basis for subsequent definition documents. The ConOps provides the foundation for the long-range operational planning activities. ConOps elements may include: discussion of stakeholder relationships and goals, overview of operational system or problem to be solved, a list of operationally desired features, a list of operational constraints, a list of desired operational performance enhancements, essential operational features, context diagrams, interface diagrams, use cases, and system scenarios as required to explain the system. The ConOps should clearly indicate the human-system interfaces from which human factors criteria may be established.
4. System Requirements: System Requirements are developed from the baselined stakeholder expectations and should include both hardware and software requirements. These should include functional requirements that are solution independent and technical requirements that are specific to the design concept (selected by architecture trade studies, if required). Each requirement shall have traceability to a parent requirement and a planned verification method (analysis, test, demonstration, or inspection). Requirements may be in a requirements database/tool or in a document format. The System Requirements may be combined with the Design Verification Matrix (DVM) and updated throughout the lifecycle.
5. Design Verification Matrix: The DVM provides evidence that the system-level design requirements have been verified. The DVM provides bi-directional traceability, identifies the verification method (test, analysis, inspection, or demonstration), and points to the evidence for verification for each applicable requirement. For systems containing software, the Requirements Traceability Matrix (RTM) may be used to supplement the DVM to trace software requirements below the system level. The DVM must be presented at SAR or DCR as evidence that the system requirements have been verified as part of the verification/certification process. The Design Verification Matrix (DVM) may be combined with the System Requirements and updated throughout the lifecycle. (Reference [KDP-F-2701](#)).
6. Product Tailoring Matrix (PTM): The PTM consists of the engineering products listed in Appendix B with an additional column to add justification for tailoring of the products (see [KDP-F-2713](#)). If any engineering product in Appendix B will not be developed, rationale will be provided in the justification column as to why the product will not be provided (N/A is insufficient as a rationale). Rationale will also be provided for any product whose maturity level will not be in accordance with the applicable technical review. All items in Appendix B are required unless they are tailored on the PTM. Products may be combined through tailoring. The PTM will be reviewed and approved by the Integrated Engineering Review Board (IERB) prior to the SRR. At that time the PTM will be updated to clarify the owner and author organizations responsible for each product. This matrix may also be used to tailor Appendix B for lower-level assembly reviews which may not require all the products in Appendix B. Product ID numbers and the PTM product organization in Appendix B may

not reflect the folder structure in KDDMS.

7. Design Statement of Work (SOW): The design SOW is a contracting document which defines the design work to be performed, period of performance, deliverable schedule, applicable performance standards, schedule for planned design reviews, type of contract/payment schedule, and any special requirements (e.g., security clearances, travel, special knowledge). The design SOW should be performance-based to the maximum extent practical. Reference [NASA Federal Acquisition Regulations \(FAR\) Supplement](#).
8. Cost Estimate: The Cost Estimate identifies the costs associated with system development from the Concept Development phase through the SAR/DCR, to include any development spares (verification/validation, burn-in, etc.). The cost estimate should break out procurement costs as well as FTE (NASA personnel) and WYE (contractor personnel) support phased over the development life of the system. These costs should be broken out by the Work Breakdown Structure (WBS) defining the system. The level of detail should be sufficient to enable Earned Value Management (EVM), if required. The Cost Estimate should show phasing by Fiscal Year for both Obligations and Costs. Reference the [NASA Cost Estimating Handbook](#) for more information. The cost estimate is required for management of the project effort but is not to be included in the Technical Review package.
9. Schedule: The Schedule defines all activities required to support system development from project start through the SAR/DCR. The schedule identifies design activities associated with the system being developed and significant activities required for design review products. The schedule should contain fabrication/construction and testing activities. Interdependencies with other system schedule milestones should be included. The schedule should consider constraints from stakeholders and other systems/subsystems. More detailed schedules for system development may be maintained for specific design engineering activities by supporting organizations but are not reportable or reviewable unless desired by the project management organization. Reference [NASA/SP-2010-3403](#) for more information on schedule management. The schedule is not subject to comments during the Technical Review.
10. Project Plan: The Project Plan is a document used to guide both project execution and project control. The Project Plan documents planning assumptions and decisions, facilitates communication among stakeholders, and documents scope, cost, and schedule baselines. Reference [NPR 7120.5](#) for more information on the project plan for Space Flight projects.
11. Systems Engineering Management Plan (SEMP): The SEM identifies the roles and responsibility interfaces of the technical effort and how those interfaces will be managed. The SEM is the vehicle that documents and communicates the technical approach, including the application of the common technical processes; resources to be used; and key technical tasks, activities, and events along with their metrics and success criteria. If a system is covered in sufficient detail by a higher-level SEM in the program/project architecture or in the Project Plan, a stand-alone SEM is not required. Reference [NPR 7123.1](#) for more information on the SEM.
12. Risk Management Plan (RMP): The RMP summarizes how the NASA risk management process will be implemented in accordance with [NPR 8000.4](#) including risk-informed decision making (RIDM) and continuous risk management (CRM) as applicable. The risk management plan may be either a stand-alone document or a component of the Project Plan or SEM. If a system is covered in sufficient detail by a higher-level RMP in the program/project architecture, a stand-alone RMP is not required. See [NASA/SP-2010-576](#) for more information on RIDM and CRM.

13. Configuration Management Plan (CMP): The CMP should describe the overall configuration management approach that the design/technical team will implement, including software. The plan should describe the structure of the CM organization and any CM tools to be used. The plan should define the methods and procedures to be used for configuration identification, configuration control, interface management, configuration traceability, and configuration status accounting to meet the requirements of [SAE/EIA 649-2](#). The CMP may be either a stand-alone document or a component of the Project Plan or SEMP. If a system is covered in sufficient detail by a higher-level CMP in the program/project architecture, a stand-alone CMP is not required. Reference [NPR 7123.1](#) and [NPR 7150.2](#) for more information on the CMP.
14. Quality Assurance Plan (QAP): The QAP defines how quality assurance activities will be implemented during the design, development, fabrication/construction, and testing phases for a given system. The QAP should identify the Quality Assurance Surveillance Plan (QASP) that will be necessary for procurement activities. It should also define how quality assurance activities will be performed during installation and testing (including engineering modifications as a result thereof) prior to turnover. The QAP may be either a stand-alone document or a component of the Project Plan or SEMP. If a system is covered in sufficient detail by a higher-level QAP in the program/project architecture, a stand-alone QAP is not required.
15. Acquisition Plan: The Acquisition Plan should contain the following items:
- Long Lead Procurement Item List – This list documents all procurement items that need to be ordered before completion of the CDR or 90% Design Review in order to meet the development schedule. The list should include the manufacturer's part number for each item, a brief description of the item, an estimated cost per unit, the quantity required to be ordered in advance, and an estimated delivery time from when the order is placed.
 - Major Item Procurement List – This list identifies all items that need to be procured as a part of system development that have an estimated cost of more than \$500K. The list includes the manufacturer's part number, item description, estimated item cost, and quantity required.
 - Make/Buy Decisions – Each make/buy decision is documented with a short description of content, rationale for make vs. buy, and cost of the chosen approach.
- If a system is covered in sufficient detail by a higher-level Acquisition Plan in the program/project architecture, a stand-alone Acquisition Plan is not required. The Acquisition Plan may be either a stand-alone document or a component of the Project Plan. Acquisition planning shall meet the requirements of [NASA Federal Acquisition Regulations \(FAR\) Supplement \(NFS\)](#), Part 1807.
16. Logistics Support Analysis Development Plan: This plan specifies LSA products and data to be developed, assigns organizational responsibilities and establishes delivery dates.
17. Software Assurance Classification Assessment (SACA) Report: The SACA Report identifies and evaluates the characteristics of software in determining the software's classification as defined in [NPR 7150.2](#). The resultant classification (Class A through E for engineering software) will determine the level of software assurance to be applied during development of the software. SACA Reports are performed in accordance with [NASA-STD-8739.8](#) using [KDP-KSC-F-3631](#). The software classification is initially determined by the Design Engineer and then a SACA report is generated independently by a Safety and Mission Assurance (S&MA) representative who then reconciles the two into a single assessment. If a system is covered in sufficient detail by a higher-level SACA in the program/project architecture, a stand-alone SACA is not required.

18. Software Development Plan/Software Management Plan (SDP/SMP) and [NPR 7150.2 Compliance Matrix](#): The SDP/SMP provides insight into, and a tool for monitoring, the processes to be followed for software development activities, including the method and approach to be followed for each activity. This plan details the project planning and monitoring activities, project documentation, project schedules, organizational structure, resource requirements and constraints, metrics collection, risk management, etc. Projects may use either a single SDP or SMP, or they may use both types of documents (with different scope and/or focus) as needed to cover all aspects of the project. A compliance matrix for [NPR 7150.2](#) requirements shall be provided as an Appendix in the SDP/SMP, or as a stand-alone document. Approval of the [NPR 7150.2 Compliance Matrix](#) by the [Software Engineering Technical Authority](#) is required, whether it be stand-alone or in the SDP/SMP. Reference [KNPR 7150.2](#), KSC Software Engineering Requirements and [KDP-T-7150.2 EPG SDP SMP](#) template for more information on the SDP/SMP and associated compliance matrix.
19. Software Assurance Plan (SAP): The SAP provides the details on the plans, roles and responsibilities associated with software assurance. The plan can be combined with the SDP/SMP but the independent software assurance organizer must sign off on the plan. Reference [NPR 7150.2](#) and [NASA-STD-8739.8](#) for additional details. If a system is covered in sufficient detail by a higher-level SAP in the program/project architecture, a stand-alone SAP is not required.
20. Software Safety Plan (SSP): The SSP is required when a project contains software identified as safety critical and the requirements of [NASA-STD-8719.13](#) must be implemented. The Software Safety Plan outlines the software safety process, including organizational structure, interfaces, and the required criteria for analysis, reporting, evaluation, and data retention to provide a safe product. The plan describes forms of analysis and provides a schedule for performing a series of analyses throughout the development cycle. It also addresses how the results of software safety analyses and the sign-off and approval process should be handled. This plan provides the foundation for all future software safety activities. The SSP may be a separate document or included within other documents, such as the SDP/SMP. Reference [NPR 7150.2](#) and [NASA-GB-8719.13](#) for additional details.
21. Software Test Plan (STP): The STP ensures the appropriate planning for all test activities are considered. It provides insight into the types and levels of testing, how testing will be handled from an activity perspective, recording of data, analysis of data and traceability of requirements. The STP plan can be a stand-alone document or part of the SDP/SMP. Reference [NPR 7150.2](#) for additional details. If a system is covered in sufficient detail by a higher-level STP in the program/project architecture, a stand-alone STP is not required.
22. Trade Study Plan/Report: The Trade Study Plan/Report is a document that initially defines the plan for performing trade studies on the system and later summarizes the results of the trade studies conducted during the definition of the system. The document should include a summary of the structured decision analysis, including selection criteria, used to conduct the trade studies.
23. Product Structure/Indentured System Documentation List: The Product Structure represents the physical assemblies, component parts, and standard parts that go into the design and manufacturing of the Product. In a Product Lifecycle Management (PLM) system such as Windchill, Product Structure consists of the objects that represent the actual physical parts that are designed, purchased, and manufactured, as well as the services for the Products that are to be delivered to the customer. Specifically, the organization of the objects within the Product Structure are defined according to hierarchical and other relationship requirements. If a PLM system is not used during design and development, an Indentured System Documentation List will serve as an alternate method to represent the system's physical structure and associated documentation.

24. Risk Matrix: The Risk Matrix documents system-specific technical risks that exist as a result of the system requirements, allocated cost and schedule, and other imposed constraints. The identification of a risk should include the undesirable event the risk presents as well as the consequences if that event occurs. Risks shall be reviewed by the Integrated Engineering Review Board (IERB) to determine if they should be elevated to the Program.
25. Lessons Learned Plan/Report: The Lessons Learned Plan/Report documents how Lessons Learned found in the NASA [Lessons Learned Information System](#) (LLIS), historical information, and/or consultation with experts are applied during the design and development of a system as well as how Lessons Learned gathered during the design and development process are added into the LLIS for the benefit of future development efforts. Refer to [NASA/SP-2016-6105](#) for more information on how to apply Lessons Learned.
26. Prototype Plan/Report: The Prototype Plan/Report is a document that initially defines the plan for the prototyping effort and later includes the report of the results of the prototyping effort.
27. Interface Control Document (ICD): The ICD depicts physical and functional interface engineering requirements between systems and is used as a design control document that delineates interface engineering data for the purpose of: (1) establishing and maintaining compatibility, (2) controlling interface designs, thereby preventing changes to system requirements that would affect compatibility, and (3) communicating design decisions and changes to participating activities. Level II/III ICDs that define interfaces between the flight and ground systems are typically the responsibility of the flight system and are reference documents for the ground system and, therefore, not subject to comment during Technical Reviews. However, ground system design/technical team participation in the development of Level II/III ICDs is crucial.
28. Interface Table: The Interface Table contains the parameters that define an interface between two systems and is agreed to by both sides of the interface. For example: a table containing measurements and/or commands needed by a system being monitored and controlled by a control system, a table containing measurements needed by a system that is being monitored by a data acquisition system, weight and space information needed by a system that is accommodating another system, or a table containing the power needs of a system that is utilizing a power system. In addition to the Interface Table, review packages for a system shall include the Interface Tables for interfacing systems as reference material not subject to comments.
29. Reliability and Safety Assessment Report (RSAR): The RSAR is an assessment of the system's functions to determine where on the risk spectrum the potential hazards associated with the system fall and to recommend further safety and reliability analyses needed to assess if the system design mitigates risks to safety of personnel and KSC assets. The RSAR will list and describe all functions of the system, the hazardous attributes of the system, and the subsequent analysis to be performed to assess if the system design mitigates safety-related risks. Reference [KNPR 8700.2](#) for more information on the RSAR.
30. Information Technology (IT)/Operational Technology (OT) Security Assessment: The IT/OT Security Assessment is used to determine the IT/OT security requirements of the system design for technical, operational, and management security controls. The IT/OT Security Assessment includes the security categorization (assessment of the information sensitivity), Information System Description (system owner interview to define system function and description) and Information System component inventory. Operational technology includes hardware and software that is physically part of, dedicated to, or essential in real time to: the performance, monitoring or control of physical devices and processes. An Operational Technology (OT) System is a collection of OT

within an identified boundary under the control of a single authority and security policy. The system may be structured by physical proximity or by function, independent of location. Examples of OT at NASA include: Industrial Control Systems (ICS), Supervisory Control And Data Acquisition (SCADA) systems, Launch Control, Ground Support Equipment (GSE) Distributed Control Systems, Process Control Systems, Building Automation/Control Systems, Safety Instrumented Systems, and other similar control systems that contain devices, such as programmable logic controllers (PLCs), telemetry units, pumps, valves, sensors, dampers, badge readers, actuators, etc. Reference [NPR 2810.1](#) for more information on conducting an IT/OT Security Assessment and completing KSC NASA form [KSC50-387](#) EGS IT Security Assessment.

31. System Assurance Analysis (SAA): The SAA is a summary of all the safety engineering analyses performed to identify hazards and critical items associated with a system design. From these analyses, risk data is obtained and used to identify changes in the design of the system and associated equipment to eliminate or minimize risks. As determined by the RSAR, the SAA may be comprised of the analyses listed below. Reference [KNPR 8700.2](#) for more information on analyses which compose an SAA.

- Criticality Assessment (CA): The CA determines the consequences of the loss of or improper performance of the system's functions. An initial evaluation is performed of each subsystem's/item's function to identify the effect of loss or improper performance of that function and determine if the effect could result in loss of life and/or flight vehicle, damage to a flight vehicle system, or loss of mission.
- Hazard Analysis (HA): The HA is intended to identify and address the hazards that arise in the design, development, manufacturing, construction, facilities, transportation, operations and disposal activities associated with hardware, software, maintenance, operations and environments. Therefore, it is imperative that they are performed and updated during each phase of a development project's lifecycle. They are invaluable tools to assure that hazards are eliminated or mitigated to acceptable levels in the design.
- Fault Tree Analysis (FTA): The FTA is a deductive (top-down) method that generates a symbolic-logic model that traces and analyzes the failure paths from a predetermined, undesirable condition or event (called the top event) of a system to the failures or faults (fault tree initiators) that could act as causal agents. An FTA can be carried out either qualitatively or quantitatively. A quantitative FTA determines the top event's probability of occurrence. The FTA is an event-oriented analysis in contrast to Reliability Block Diagram Analysis (RBDA) which is a structural-oriented analysis.
- Common Cause Failure Analysis (CCFA): The CCFA is an analysis to identify the failure of two or more components, subsystems, or structures due to a single specific event which bypasses or invalidates redundancy or independence. Special consideration of common cause failures is given when redundancy is provided by identical components, locations, or channels
- Failure Modes and Effects Analysis (FMEA): The FMEA is an inductive (bottom-up) method that generates a table that explores the way or modes in which each system component can fail and assesses the consequences of each of these failures. An FMEA is used during the design phase to determine hardware criticality, identify failure modes that do not meet applicable program reliability requirements, identify the potential for single point failures, and identify areas where the design does not meet the failure tolerance requirements. The FMEA is updated throughout the life of the program/project as design modifications and/or upgrades are made to

ensure that the design meets program requirements, and to ensure new risks are eliminated and/or mitigated.

32. Software Safety Analysis (SSA): The Software Safety Analysis (SSA) supplements the RSAR and SAA by assessing the software performing critical functions serving as a hazard cause or control. This analysis identifies the safety-critical components within the system and assures that these software components have been developed in accordance with NASA Software Engineering requirements. The SSA is a phased deliverable that is updated throughout the development lifecycle and assesses the software requirements, design, implementation, and verification to assure compliance to the levied functional software requirements, the software doesn't violate the independence of hazard inhibits, and the software doesn't violate the independence of hardware redundancy. Reference [NASA-STD-8739.8](#) for more information on the SSA.
33. Environmental Checklist: The Environmental Checklist is a tool that assists in identifying environmental issues that may affect the proposed project and provides points of contact at KSC for assistance in addressing these issues. It does not relinquish the project from obtaining and complying with any other internal NASA permit or directives necessary to ensure all organizations potentially impacted by the project are notified and concur with the project. The checklist should be submitted when sufficient information is available to answer the items on the checklist. The checklist should be submitted early in the design process to identify any items that may present time constraints. An updated checklist can be re-submitted at a later date if any changes to the project plans are proposed. See [KDP-P-1727](#) on how to process an Environment Checklist (form [KSC21-608](#)). The Environmental checklist is not to be included in the Technical Review package.
34. Human Factors Engineering Assessment (HFEA): The HFEA reviews aspects of the system design such as operator interaction, accessibility, lifting and careful placement, work environment (heat, light, noise, etc.), controls and display interface, warning annunciation, and other factors utilized to derive the applicable human factors requirements to a given system based on the [KSC-DE-512-SM](#) requirement, to develop human factors criteria from the [Federal Aviation Administration \(FAA\) Human Factors Design Standard \(HFDS\)](#). The HFEA documents the relevant human factors criteria for hardware and software based on human interaction with the system. The hardware and software HFEA can be a combined document or can be separate HFEA documents. The HFEA is updated as the project matures to indicate the evidence that each requirement has been verified at SAR/DCR. The assessments for Workload, Human-in-the-Loop, and Human Error can be included in one HFEA or can be created as separate documents. Reference [NPR 8705.2](#).
 - 34.1. Human-in-the-Loop Evaluation (HITL): An evaluation of human interaction with hardware and software, to assess things such as design of displays and controls or prototypes/mockups of hardware. HITL evaluations evolve designs by identifying areas for design improvement through the gathering of quantitative and qualitative data. Reference [NPR 8705.2](#).
 - 34.2. Human Error Analysis (HEA): An analysis to evaluate human actions, identify potential human error, model human performance, and qualitatively characterize how human error affects a system. HEA provides an evaluation of human actions and error in an effort to generate system improvements that reduce the frequency of error, criticality of error and improved recovery from error which improve the overall system. Refer to [NPR 8705.2](#).
 - 34.3. Workload Assessment: An assessment of the mental and physical effort exerted by subjects to satisfy the requirement of a given task or scenario. Workload is a component of crew interaction with systems that designers must consider when designing hardware and software with crew interfaces, procedures, and operations. Low workload levels have been associated

with boredom and decreased attention to task, whereas high workload levels have been associated with increased error rates. Refer to [NPR 8705.2](#).

35. Verification Plan: The Verification Plan identifies the process that will be used to verify both the system and software requirements in accordance with the DVM and RTM. The plan shall provide sufficient detail to enable determination of which process or procedure will be used to verify each requirement, including those done by analysis, inspection, and demonstration as well as test. If a system is covered in sufficient detail by a higher-level Verification Plan in the program/project architecture, a stand-alone Verification Plan is not required. Verification addresses, “Are we building the system right”; that is, “Does the system conform to the specifications?”
36. Validation Plan: The Validation Plan identifies the procedures that will be used to validate that the system meets the stakeholder expectations addressed in the ConOps and that it operates in its intended operational environment to the satisfaction of the user organization. If a system is covered in sufficient detail by a higher-level Validation Plan in the program/project architecture, a stand-alone Validation Plan is not required. Validation addresses, “Are we building the right system”; that is, “Does the system do what the customer requires?”
37. Integration Plan: The Integration Plan defines how major subassemblies of the system will be coordinated, organized, and brought together as an overall system. The plan should address any design, fabrication/construction, and transportation considerations required to facilitate the overall integration as well as resources such as personnel, facilities, cranes, fixtures or jigs, etc.
38. Transition Plan: The Transition Plan identifies the intended method and schedule to transition ownership and responsibilities from the design organization to the user organization for activation and O&M. If a system is covered in sufficient detail by a higher-level Transition Plan in the program/project architecture, a stand-alone Transition Plan is not required.
39. Transportation Plan: The Transportation Plan defines how the system or its components will be transported during the manufacturing or construction phase, as well as the operations phase, including any special monitoring devices to record levels were within acceptable limits during the actual transport (when applicable). Commercially available transportation should be used when possible. The plan should include any research and analysis for considerations such as wheel loading, width and height limitation, dynamic loading, humidity and temperature exposure, etc.
40. Engineering Drawings and/or Models: To include the various files, in their native software applications, used to create/maintain the information required to support the product’s lifecycle. These are typically associable with the product’s requirements, design, analysis, certification, etc. deliverables (i.e. include native and any neutral formatted files representing items such as requirements) (e.g. SysML, LML), design (CAD – 2D and/or 3D), analyses (CAE – FEM, HF, etc.), manufacturing (CAM), Logistics, etc. that the various discipline engineering create and are associable to drawings, reports, ICDs, etc. Refer to [KSC-GP-435 Vol. 1](#) for drawing practices. Depending on the given product being produced, engineering drawings and/or models may include one or more of the following:

40.1. Electrical Drawings and/or Models:

- 40.1.1. Ground Integrated Schematic (GIS): The GIS combines a system block diagram with its related advanced electrical schematic, cable interconnect diagram, and system mechanical schematic/electromechanical control diagram. However, a system mechanical schematic/electromechanical control diagram is not required for an electrical system that contains no mechanical components.

- 40.1.1.1. System Block Diagram: The system block diagram depicts the overall system from end-to-end, including major system boundaries and interfaces, with single line connectivity between major interfaces. The subsystem for each dedicated GIS drawing is highlighted within the system block diagram.
- 40.1.1.2. Electrical Single-Line Diagram: The electrical single-line diagram shows, by means of single lines and graphic symbols, the course of each electrical circuit and the component devices or parts used. It omits much of the detailed control and monitoring information shown on an advanced electrical schematic. The operational and maintenance interfaces of the system with other support or service systems is shown, including all functions required to operate and maintain the system.
- 40.1.1.3. Cable Interconnect Diagram (CID): The CID is a graphic presentation of the arrangement of controlled electrical elements or assemblies necessary for a system to perform its intended function without necessarily considering actual physical size, shape, or detailed locations. CIDs are electrical block diagrams that identify controlled elements or assemblies by listing the drawing or document number that currently defines each one. The system specifications and all system interface control documents are identified by their current document number. In addition, the block diagram format shows the functional relationship of system elements as well as the functional location of interfaces.
- 40.1.1.4. Advanced Electrical Schematic (AES): The AES illustrates and defines electrical signal and power paths, detailed electrical connections, and functions of component items used within a specific circuit or system of circuits by means of graphical symbols. Complete and formal titles and reference designators of each component are identified. Indication of physical size, shape, or relative location of components is not required. An AES is used to support system testing, troubleshooting, and operating procedure preparation.
- 40.1.2. Electrical Assembly Drawing: The electrical assembly drawing depicts the assembly relationship of two or more parts, a combination of parts and subassemblies, or a group of subassemblies. The electrical assembly drawing contains sufficient views to show the relationships between parts and subassemblies. Subassemblies and parts are called out in the field of the drawing by find numbers cross-referenced to the identifying numbers in the parts list. Electrical assembly drawings contain references to pertinent installation drawings, wiring and schematic diagrams, and electrical wire running lists as applicable.
- An electrical assembly drawing can be used to depict the construction of a rack or junction box, and contains the following details:
- Modifications to the rack enclosure or junction box, including knockout locations and sizes for cable or conduit entry.
 - Dimensional layout of components on a back panel, callouts for mounting hardware, and mounting instructions.
 - A detailed schematic or wiring diagram covering all connections within the assembly.
- 40.1.3. Electrical Wire Running List: The electrical wire running list is a tabular drawing specifying wiring data that is pertinent to manufacturing and supplements the information

contained on an advanced electrical schematic. The electrical wire running list is referenced on its associated electrical assembly drawing. If wiring information is provided clearly on the schematics, an electrical wire running list is not required.

- 40.1.4. Cable Assembly Drawing: The cable assembly drawing is a listing of single or branched cable assemblies and/or wire bundles or harnesses that provides information about the configuration of cables within a piece of ground support equipment or system. A cable assembly drawing is used in conjunction with a cable subassembly drawing and for the fabrication/construction of a new cable assembly installed in a piece of ground support equipment or system. A cable assembly drawing specifies part numbers, reference designator numbers, materials, end configurations, and lengths in tabular form. A sketch of a typical cable with dimensions and cable markings is also to be included.
- 40.1.5. Cable Subassembly Drawing: The cable subassembly drawing provides information about the characteristics of a cable assembly or harness. Each subassembly is a standard item and may be used on many cable assembly drawings. Used in conjunction with a cable assembly drawing, a cable subassembly drawing is used for the fabrication/construction of new cables and/or harness assemblies. A cable subassembly drawing specifies cables, connectors, accessories, wiring schematic, and fabrication/construction instructions that are needed to build a cable assembly and/or harness assembly. Length of cable and marking information are contained in the cable assembly drawing.
- 40.1.6. Electrical Arrangement Drawing: The arrangement/location/layout of electrical assemblies should be depicted in the Mechanical Installation drawing.
- 40.1.7. Cable Installation Drawing: The cable installation drawing shows the installed and assembled position of electrical cable assemblies relative to the supporting structure or to an associated item. A cable installation drawing is used to route, locate, position, attach, and mount electrical cables on ground support equipment. A cable installation drawing shows adequate information to identify electrical cables, mating connectors, terminations, and critical clearances or support points. Information necessary for lacing, taping, protective coating, electrical bonding, etc., is specified on the drawing or by reference to applicable documents.

40.2. Mechanical/Fluids Drawings and/or Models:

- 40.2.1. Mechanical System Block Diagram: The mechanical system block diagram is a single-line diagram depicting interconnections and flow between elements of a system or assembly with the intent of providing an end-to-end system management overview to support vehicle operations. The system should be laid out left to right where possible. Fluid flow should be horizontal where possible and electrical flow should be from top to bottom where possible. The program model number, element title, and schematic and reference designator numbers should be identified in each block, as applicable. The diagram should be structured to place the components in the same relative location as the actual equipment to the maximum extent possible.
- 40.2.2. Mechanical Layout Drawing: The mechanical layout drawing depicts the concept of the design and does not have the details necessary for fabrication/construction. As such, mechanical layout drawings are not to be used for fabrication/construction and should include the note "DO NOT USE FOR FABRICATION/CONSTRUCTION" in the title block.

- 40.2.3. Mechanical Installation Drawing: The mechanical installation drawing shows the general configuration, attaching hardware, and information to locate, position, and install an item relative to its supporting structure or to associated items and represents the as-built configuration. An installation drawing is used when a fully assembled item, such as a panel or distributor, is to be installed in a larger unit and should show miscellaneous attaching hardware, components, and electrical connections as required.
- 40.2.4. Mechanical Assembly Drawing: The mechanical assembly drawing depicts the assembly relationship of two or more parts, a combination of parts and subassemblies, or a group of subassemblies. The mechanical assembly drawing contains sufficient views to show the relationships between parts and subassemblies. Subassemblies and parts are called out in the field of the drawing by find numbers cross-referenced to the identifying numbers in the parts list. Mechanical assembly drawings contain references to pertinent installation drawings and schematic diagrams, as applicable.
- 40.2.5. System Mechanical Schematic (SMS)/Electromechanical Control Diagram (EMCD): The system may have either a system mechanical schematic, an electromechanical control diagram, or both. When both an SMS and an EMCD are necessary, they can be combined into a single SMS/EMCD drawing.
- An SMS is purely a mechanical drawing with no electrical references shown. An SMS shows all mechanical and electromechanical components (both active and passive) that make up the piping system involved. Offline components (e.g., solenoid valves, controllers, etc.) are shown within the outline of the cabinet or container and are restricted to an area or location.
- An EMCD shows mechanical and electromechanical components with electrical interfaces defined. Many passive components (e.g., flex lines, hoses, non-flow hand valves, test and calibration ports, etc.) may be omitted. All components are shown relative to flow or position as related to functional use. Offline components are not restricted to the cabinet or container outline and area or location.
- 40.2.6. Mechanical Part Drawing: The mechanical part drawing is a drawing of an individual part that includes detail sufficient to manufacture the part such as dimensions, materials, and finishes. The drawing should include overall views of the part and key sections.
- 40.2.7. Structural/Mechanical Assembly Drawing: An assembly drawing defines the configuration and contents of the assembly or assemblies depicted thereon. See ASME Y14.24. It establishes item identification for each assembly. Where an assembly drawing contains detailed requirements for one or more parts used in the assembly, it is a detail assembly drawing and establishes item identification for each part detailed.
- 40.2.8. Installation Drawing: An installation drawing provides information for properly positioning and installing items relative to their supporting structure and adjacent items, as applicable. This information may include dimensional data, hardware descriptions, and general configuration information for the installation site. An installation drawing does not establish item identification except for a work package or kit.
41. Software Requirements Specification (SRS): The SRS establishes the software requirements for the system. It is a description of the required external behavior of software components in terms of functions, performance, design constraints, external interfaces and quality attributes within a

specified environment. Requirements may be in a requirements database/tool or in a document format. The SRS and SDD/IDD may be combined in one document. See [NPR 7150.2](#).

42. Requirements Traceability Matrix (RTM): The RTM contains the software requirements for the system and provides bi-directional traceability between the system and software requirements, between the software requirements and the software design, between the software requirements and the software test procedures, and between the software design and the software units (code). A verification method is identified for each applicable requirement (test, analysis, inspection, or demonstration). The RTM supplements the DVM and must be presented at SAR or DCR as evidence that the software requirements have been verified as part of the verification/certification process.
43. Software Design Description/Interface Design Description (SDD/IDD): The SDD/IDD describes the design of a Computer Software Configuration Item (CSCI). The Software Design Description may also be referred to as the Software Design Document. It describes the CSCI-wide design decisions, the software architectural design, and the detailed design needed to implement the software. The IDD describes the interface characteristics of one or more systems, subsystems, Hardware Configuration Items (HWCIs), CSCIs, manual operations, or other system components. An IDD may describe any number of interfaces. The software IDD document may be a stand-alone entity, part of the Software Design Description document, or part of an electronic data system. The SDD/IDD should contain the preliminary design of the software architecture and content of the IDD at the 30%, 45% design reviews or PDR, with detailed design and interfaces baselined in subsequent updates at the 90% Design Review or CDR. The SDD/IDD contains a detailed description of how the software satisfies the specified requirements, including algorithms, data structures, and process timing requirements. The SDD/IDD and SRS may be combined in one document. Reference [NPR 7150.2](#) for additional details.
44. Software Data Dictionary (SDD): The SDD may contain data through a software tool, documents or tables. The data provide definition of data elements to communicate information on configurations to be used by the developers, operations and users of the system. Reference [NPR 7150.2](#) for additional details.
45. Software Maintenance Plan (SMP): The SMP provides details for each system element on standards, methods, tools, actions, procedures and responsibilities associated with the maintenance of software. In addition information on sustaining support to the operations phase of the software is required. Reference [NPR 7150.2](#) for additional details. If a system is covered in sufficient detail by a higher-level SMP in the program/project architecture, a stand-alone SMP is not required.
46. Design Analysis Report (DAR): The DAR is an engineering analysis of a system's technical characteristics and functional capability (e.g., design for mechanical loads and stress, thermal effects, fluids analyses, electrical loads and transients, etc.). Design analyses may be performed using hand calculations or analysis software (e.g., finite element analysis (FEA), computational fluids dynamics (CFD), etc.). All inputs and ground rules and assumptions must be listed in the formal analysis report and associated analysis tool models/data sets. The design analysis shall address technical margins and the basis for establishment and acceptability of such margins. Analyses are minimally performed by the design engineer. However, analyses may be delegated to a discipline Lead Analyst.
- 46.1. Engineering Math Models (EMM): An EMM is an analytical model based on mathematical calculations used to assist in the design, development, or sustaining functions of a system and are used to verify the system meets codes and requirements. These may be hand calculations, or computer generated and may be validated against a real-world system. Math models shall

be called out in a DAR stating the requirements they are used to satisfy, and will be under configuration management. An EMM must meet the minimum documentation guidelines as outlined in [KSC-STD-Z-0015](#).

47. Procurement Specification: The procurement specification is an engineering drawing or document that establishes the functional, performance, design, test, and configuration requirements (including maintainability, safety, reliability, and quality assurance) to the extent necessary to procure an item on the commercial market.
48. Reliability, Maintainability, Availability (RMA) Analysis: The RMA is an analysis that predicts reliability (uptime) and/or maintainability (downtime) and availability (mission readiness being a function of uptime and downtime). If a system is non-repairable, only reliability is estimated since the measures of maintainability and availability are not applicable. The RBDA method is used to estimate and analyze the reliability and availability for systems containing at least two or more elements. For more information on RMA's, visit the KSC Systems and Reliability Engineering website at: <https://kscddms.ksc.nasa.gov/Reliability/>.
49. Operations & Maintenance Requirements Specification Document (OMRSD): The OMRSD is a document that defines the operations and maintenance requirements that are imposed on a system by the design organization. ([KDP-T-5444](#) may be used as a template)
50. Design Data Manual: The Design Data Manual includes historical data assembled during the course of the design work (as applicable). The Design Data Manual should be formatted in accordance with [KSC-DF-107](#) and should include the following, at a minimum:
 - All hand calculations, sketches, and other manually produced documentation shall be scanned for electronic inclusion into the Design Data Manual.
 - Project Description – Provide a general description of the overall project with a definitive description.
 - Applicable Documents – List all codes, specifications, technical publications, and other documentation used in the design (many are already covered in the requirements/checklists).
 - Historical Record – Document the changes/deletions/additions made during the design cycle. Include reference copies of Change Requests, Configuration Control Board Directives, etc.
 - Design Philosophy – Document the design approach and the reasons for selecting the design concept implemented.
 - Design Considerations – Provide a description of all significant design parameters selected.
 - Concept Sketches – Include working sketches of all concepts, whether selected or not, that depict the functional flow, clearances, and tolerances required (may be in separate trade studies).
 - Vendor Data – Catalog cuts information including any relevant correspondence with vendors
 - Calculations. Calculations maybe contained in a “stand-alone” analysis report that shall be referenced in the data manual.
 - Spares Parts List (may be a separate product).
 - Investigations, Reports, Studies, Certifications.
 - Long lead procurement items.

51. Logistics Support Analysis (LSA): A product consisting of selected logistics data tailored to meet the scope and complexity of the specific program or project and individual program or project needs. The LSA format may range from raw data in table format to a formal comprehensive Logistics Support Analysis (LSA). Logistics data and an LSA can contain information pertaining to maintenance (preventive, predictive and corrective) planning, supply (spare parts and consumables) support, support and test equipment, workforce requirements, training and training support, technical documentation, computer resources support, facility requirements, and packaging, handling, storage and transportation (PHS&T). Product and data needs are tailored for each subsystem consistent with the Logistics Support Analysis Development Plan.
52. Information Technology (IT)/Operational Technology (OT) System Security Plan: The IT/OT System Security Plan is required if the IT/OT Security Assessment determines IT/OT security controls are warranted. A template for the IT/OT System Security Plan is provided in [ITS-HBK-2810.03-02](#). Reference [NPR 2810.1](#) for IT/OT security requirements.
53. Electromagnetic Compatibility Management Plan: A plan that defines imposed electromagnetic compatibility requirements to ensure operational suitability in its anticipated environment. It contains a detailed Electromagnetic Interference (EMI) test plan including any proposed tailoring. The plan includes a description of the equipment or subsystem, criticality, function, electromagnetic characteristics, concept of operations, use of data, intended installation and location, operational environment, restrictions and controls (i.e., EMI clear zones) as well as design mitigations. See [KSC-STD-E-0022](#) for more information on electromagnetic compatibility testing, tailoring and Electromagnetic Compatibility Management Plan content.
54. Quality Assurance Surveillance Plan (QASP): The QASP defines the actions necessary for the performance of Government contract quality assurance related to all in-house fabrication/construction or external procurement activities (e.g., lists of engineering documents, data, and records to be reviewed; products and product attributes to be examined; processes and process attributes to be witnessed; quality system elements/attributes to be evaluated; sampling plans; and requirements related to quality data analysis, nonconformance reporting and corrective action tracking/resolution, and final product acceptance). The QASP also defines quality assurance activities required during installation and testing (including engineering modifications as a result thereof) prior to turnover. Reference [NPR 8735.2](#) for additional details.
55. Sneak Circuit Analysis: The sneak circuit analysis is a detailed system analysis to identify any unexpected path or logic flow within a system which, under certain conditions, can initiate an undesired function or inhibit a desired function. The path may consist of hardware, software, operator actions, or combinations of these elements. Sneak circuits are not the result of hardware failure but are latent conditions, inadvertently designed into the system, programmed into the software, or triggered by human error.
56. Component Qualification Plan: The component qualification plan defines the tests and/or analyses required to verify that components meet the design specification requirements necessary to ensure operational suitability in their anticipated environments for the full lifecycle prior to incorporation into the system design. This includes verification of operational/vendor and performance parameters. See [KSC-STD-G-0003](#) for more information on component qualification requirements, including when components require qualification.
57. Operating Criteria: The operating criteria captures all of the operational sequences required to assemble, operate and maintain the system as designed. The operating criteria must include any warning or redline limit values.

58. Training Plan: The training plan is a phased plan that includes a training needs analysis that captures required training needed for test team members during design and development as well as the training necessary for those who will perform O&M functions following turnover to the user organization. It also provides a tentative schedule for delivery of training support materials required by the O&M organization to develop and/or incorporate new curriculum into existing training programs. This may include delivery of onsite/in-person training, developer created curriculum/courseware, reference materials, training aids as well as opportunities to obtain the required training prior to the SAR/DCR.
59. Pressure System Certification Report: The pressure system certification report documents the inspections, testing, and analyses performed to verify pressure systems are certified to [NASA-STD-8719.17](#). The requirements for the Pressure System Certification Report are determined by the [KSC Pressure Systems Manager](#) (PSM). See [KDP-KSC-P-3621](#) for more information on the process for certification of pressure vessels and pressurized systems (PVS). The report is developed and approved through the pressure system community and PSM and is not subject to comment during Technical Reviews.
60. Software User Manual: The software user manual provides a means for communicating to the user or customer pertinent information about the software being delivered including an overview, start-up/execution instructions, modes of operation, limitations, issues, etc. Preparing this information prior to testing ensures that information is checked and updated based on testing information. Reference [NPR 7150.2](#) for additional details.
61. Verification Procedures: The verification procedures identified in the Verification Plan are used to verify the design solution meets the technical requirements. Each procedure will document which technical requirements they verify, the step in the procedure which verifies each technical requirement, and provide sufficient detail to permit closed-loop tracking, thereby enabling the levels above to verify that all children of their technical requirements have been satisfied.
62. Validation Procedures: The validation procedures identified in the Validation Plan are used to validate that the design solution meets the user's functional requirements, thus satisfying the stakeholder expectations addressed in the ConOps. Each procedure will document which functional requirements they validate, the step(s) in the procedure which validates each functional requirement, and provide sufficient detail to permit closed-loop tracking, thereby enabling the levels above to verify that all children of their functional requirements have been satisfied.
63. Engineering Instructions (EI): An EI is an issuance (see form [KSC21-122](#)) comprised of instructions, drawings and/or models, and other documents as required to provide direction for in-house fabrication/construction work. The EI should include quality assurance provisions as defined in the QASP. A Time Compliance Technical Instruction (TCTI) may be used in addition to an EI. A TCTI includes all elements of an EI, and also includes a Material Requirements List (MRL) for parts and materials.
64. Fabrication Statement of Work (SOW): The Fabrication SOW is a contracting document which defines the work to be performed, location of work, period of performance, deliverable schedule, applicable performance standards, acceptance criteria, type of contract/payment schedule, and any special requirements (e.g., security clearances, travel, special knowledge) for fabrication/construction. The Fabrication SOW should include quality assurance provisions as defined in the QASP. The SOW should be performance-based to the maximum extent practical. Reference [NASA Federal Acquisition Regulations \(FAR\) Supplement](#).

65. Version Description Document (VDD): The VDD identifies a given version of a software system or component. Typical contents include an inventory of system or component parts, identification of changes incorporated into this version, and installation and operating information unique to the version described. The VDD is not subject to comment during Technical Reviews.
66. Verification Report: The verification report is a summary of the results of the verification inspection, analysis, and testing. It highlights any failures during the test procedures and identifies the corrective actions taken. It also documents the successful completion to verify the design solution does meet the approved technical requirements. The report should include analysis or interpretation of test data outlining compliance to technical requirements, when applicable. The verification report is not subject to comment during Technical Reviews.
67. Validation Report: The validation report is a summary of the results of the validation testing. It highlights any failures during the test procedures and identifies the corrective actions taken. It also documents the successful test completion to validate that the design solution does meet the user's functional requirements and that stakeholder expectations are met. The validation report is not subject to comment during Technical Reviews.
68. System Acceptance Data Package (ADP): The ADP consists of all of the engineering products required to design, analyze, certify, fabricate, assemble, and eventually operate, maintain, and sustain the system and/or equipment. This includes all of the engineering products listed in Appendix B of this KDP (or tailored in the PTM), vendor catalog cuts, vendor or fabrication/construction certification papers, personnel certifications, shop drawings and/or models, deviations/waivers, open items lists, and other documentation specifically identified in program requirements. The ADP may be in electronic format. **NOTE:** This requirement shall flow down the supply chain such that components or subassemblies procured from vendors shall require that their vendor or supplier provide an ADP for products obtained through contract. This vendor ADP would become a part of the overall system ADP to be delivered at turnover (SAR/DCR). Reference [KDP-P-5042](#) for more information on ADPs. The ADP is not subject to comment during Technical Reviews.

Acronym	Definition
A&E	Architectural and Engineering
ADP	Acceptance Data Package
AES	Advanced Electrical Schematic
CA	Criticality Assessment
CCFA	Common Cause Failure Analysis
CDR	Critical Design Review
CE	Chief Engineer
CFD	Computational Fluids Dynamics
CID	Cable Interconnect Diagram
CMP	Configuration Management Plan
CoF	Construction of Facilities
ConOps	Concept of Operations
CRM	Continuous Risk Management
CSCI	Computer Software Configuration Item
DAR	Decision Analysis Report
DCR	Design Certification Review
DVM	Design Verification Matrix
ECMD	Electromechanical Control Diagram
EEE	Electrical, Electronic, and Electromechanical
EI	Engineering Instructions
EMI	Electromagnetic Interference
EVM	Earned Value Management
FAA	Federal Aviation Administration
FAR	Federal Acquisition Regulations
FEA	Finite Element Analysis
FMEA	Failure Modes and Effects Analysis
FTA	Fault Tree Analysis
FTE	Full Time Equivalent
GIS	Ground Integrated Schematic
GSE	Ground Support Equipment
HA	Hazard Analysis
HEA	Human Factor Analysis
HFDS	Human Factors Design Standards
HFEA	Human Factors Engineering Assessment
HITL	Human-In-The-Loop
HWCI	Hardware Configuration Item
ICD	Interface Control Document
ICS	Industrial Control Systems
IDD	Interface Design Description
IERB	Integrated Engineering Review Board

Acronym	Definition
IT	Information Technology
ITAR	International Traffic in Arms Regulations
KDDMS	Kennedy Design Data Management System
KDP	Kennedy Document Procedure
LLIS	Lessons Learned Information System
LSA	Logistics Support Analysis
MRL	Material Requirements List
NFS	NASA Federal Acquisition Regulations (FAR) Supplement
O&M	Operations and Maintenance
OE	Operations Engineer
OMRS	Operations and Maintenance Requirements Specifications
OMRSD	Operations and Maintenance Requirements Specification Document
OT	Operational Technology
PDR	Preliminary Design Review
PHS&T	Packaging, Handling, Storage and Transportation
PLC	Programmable Logic Controller
PLM	Product Lifecycle Management
PSM	Pressure System Manager
PTM	Product Tailoring Matrix
PVS	Pressure Vessels and Pressurized Systems
QAP	Quality Assurance Plan
QASP	Quality Assurance Surveillance Plan
RDBA	Reliability Block Diagram Analysis
RID	Review Item Disposition
RIDM	Risk-Informed Decision Making
RMA	Reliability, Maintainability, and Availability
RMP	Risk Management Plan
RSAR	Reliability and Safety Assessment Report
RTM	Requirements Traceability Matrix
S&MA	Safety and Mission Assurance
SAA	System Assurance Analysis
SACA	Software Assurance Classification Assessment
SAP	Software Assurance Plan
SAR	System Acceptance Review
SCADA	Supervisory Control and Data Acquisition
SDD	Software Design Description
SDP	Software Development Plan
SE	System Engineer
SEMP	Systems Engineering Management Plan
SMP	Software Management Plan
SMS	System Mechanical Schematic

Acronym	Definition
SOW	Statement of Work
SRR	System Requirements Review
SRS	Software Requirements Specification
SSA	Software Safety Analysis
SSP	Software Safety Plan
STP	Software Test Plan
TBD	To Be Determined
TBR	To Be Resolved
TCTI	Time Compliance Technical Instruction
TRR	Test Readiness Review
VDD	Version Description Document
WBS	Work Breakdown Structure
WYE	Work Year Equivalent