DRYDEN PROCEDURAL REQUIREMENT	Directive:	DPR-7123.1-001 Revision C
	Effective Date:	March 9, 2011
	Expiration Date:	March 1, 2016

This document is uncontrolled when printed.
Before use, check the Master List to verify that this is the current version.
Compliance is mandatory.

SUBJECT: Systems Engineering Requirements Document

RESPONSIBLE OFFICE: R/Director of Research Engineering

CONTENTS

DISTRIBUTION: Dryden Document Library
This document may be distributed outside of Dryden.

PREFACE

P.1 Purpose

a. The purpose of this document is to establish the Center's requirements for the implementation of systems engineering practices in accordance with NPR 7123.1. Systems engineering is a logical systems approach performed by multidisciplinary teams to engineer and integrate the Center's systems to ensure products meet customers' needs. This systems approach is applied to all elements of a system and all hierarchical levels of a system over the complete project life cycle. In addition, the Center's interpretation of specific elements of AS9100 is defined to ensure that the Center's implementation incorporates the fulfillment of these requirements.

P.2 Applicability

a.This document and the requirements identified within it apply to all flight projects and major ground support system development projects managed by the Center. It applies to products that are intended to be flown as well as (to the greatest extent practical) products used in direct support of flight, including experiments, simulation, and software used for verification or validation of flight products. To the extent practical, it also applies to Center products affecting flight, such as office software tools. This includes products designed for flight research, such as analysis tools, corrective action systems, and configuration management systems, etc.

b. Through partnerships with industry, academia, other NASA Centers, and other government agencies, the Center enters into projects at various stages of their lifecycles, often just prior to the operations phase. The applicability of this DPR and other Center requirements will be identified during the negotiation of the partnership agreements. In cases where these requirements are not invoked, a suitable alternate systems engineering approach will be identified.

c. Many other discipline areas such as safety, medical, reliability, maintainability, quality assurance, information technology, security, logistics, and environmental, etc., perform functions during project life-cycle phases that influence or are influenced by the engineering organizations, and the requirements of those functions need to be fully integrated with the engineering functions. The interactions of the engineering processes with these enabling processes are described in the Dryden Management Systems Manual (DMSM).

P.3 Authority

a. NPR 7120.5, NASA Space Flight Program and Project Management Requirements

b. NPR 7123.1, NASA Systems Engineering Processes and Requirements

c. NPR 1280.1, NASA Management System Policy
d. NPR 7150.2, NASA Software Engineering Requirements

P.4 Applicable Documents

a. DCP-P-012, Project Approval & Execution

b. DCP-P-025, Project Managers' Manual

c. DCP-R-603, Flight Loads Laboratory Operations Requirements Document

d. DCP-R-604, Flight Load Laboratory Thermal-Structural Ground Test Hazard Analysis

e. DCP-S-007, Software Assurance

f. DCP-X-008, Tech Brief (T/B) & Mini Tech Brief (Mini T/B)

g. DCP-X-009, Airworthiness and Flight Safety Review Process

h. DCP-X-020, Flight Operational Readiness Review (ORR)

i. DCP-X-044, Processing of Agreements from Review to Signature

j. DHB-R-002, Objectives and Requirements Document Handbook

k. DHB-R-007, Project Chief Engineer's Handbook

l. G-7900.3-001, Airworthiness and Flight Safety Review, Independent Review, Mission Success Review, Technical Brief and Mini-Tech Brief

m. G-7900.4-002, Operations Engineer's Handbook

n. SAE AS9100, Aerospace Quality Management System Standard

P.5 Measurement/Verification

a. The methods to ensure compliance with this DPR and NPR 7123.1 will be documented in the Systems Engineering (SE) implementation procedures and through internal and external assessments and audits.

P.6 Cancellation

DPR-7123.1-001B, Systems Engineering Requirements Document- REDLINED, dated August 6, 2010.

/S/
David McBride
Director

March 9, 2011
Date

CHAPTER 1: INTRODUCTION

1.1 Project Lifecycle

1.1.1 The Dryden system engineering requirements are defined to establish a standard, disciplined engineering approach to systems development throughout the lifecycle of a project. In alignment with NPR 7120.5 and NPR 7123.1, the project lifecycle shown in Figure 1 has been defined for projects performed by the Center.

1.1.2 The lifecycle is intended to be a standard for the Center's projects, but it is common for the Center to enter into partnerships with external entities on existing projects at various stages of their lifecycles. The requirements of this DPR should be followed to ensure consistency between all projects being conducted at the Center.

Figure 1. Dryden Project

KDP – Key Decision Point
SMB – Strategic Management Board
PMB – Program Management Board
MCR – Mission Concept Review
SRR – Systems Requirement Review
PDR – Preliminary Design Review
CDR – Critical Design Review
SIR* – Systems Integration Review
FRR – Flight Readiness Review
AFSRB – Airworthiness and Flight Safety Review Board
TB – Tech Brief
ORR – Operational Readiness Review
DR – Data Review and/or Decommissioning Review
TRR* – Test Readiness Review

* Not required unless specified in the Project Plan

1.2 DPR Scope

1.2.1 Establishes a set of systems engineering activities to be performed during each phase of the lifecycle. These activities include, but are not necessarily limited to:

a. Planning and Documentation

b. Reviews/Briefs

c. Products

1.2.2 Milestones/Activities

a. Defines the entry and exit criteria for the lifecycle reviews

b. Identifies how the required activities can be supplemented and tailored to achieve specific project requirements

c. Identifies SAE AS9100, Aerospace Quality Management Systems Standard, requirements related to systems engineering functions

d. Describes the NPR common technical processes with the goal of NPR requirements traceability to the DPR processes during Dryden's life-cycle phases.

1.3 Roles and Responsibilities

1.3.1 Per NPR 7123.1, Section 2.3, the Designated Governing Authority (DGA) for the technical effort described in this DPR begins with the Dryden Center Director. From there, authority is delegated to the Director of Flight Operations or Director of Research Engineering. Authority for issues that relate to the application of aircraft airworthiness standards for modification, operation, or maintenance of aircraft are further delegated through the Director of Flight Operations to a project's Lead Operations Engineer. Authority for issues related to the application of technical requirements and standards, including the approval of waivers, are delegated to the Project's Chief Engineer through the Director for Research Engineering. See Figure 2 for a graphical representation of this process.

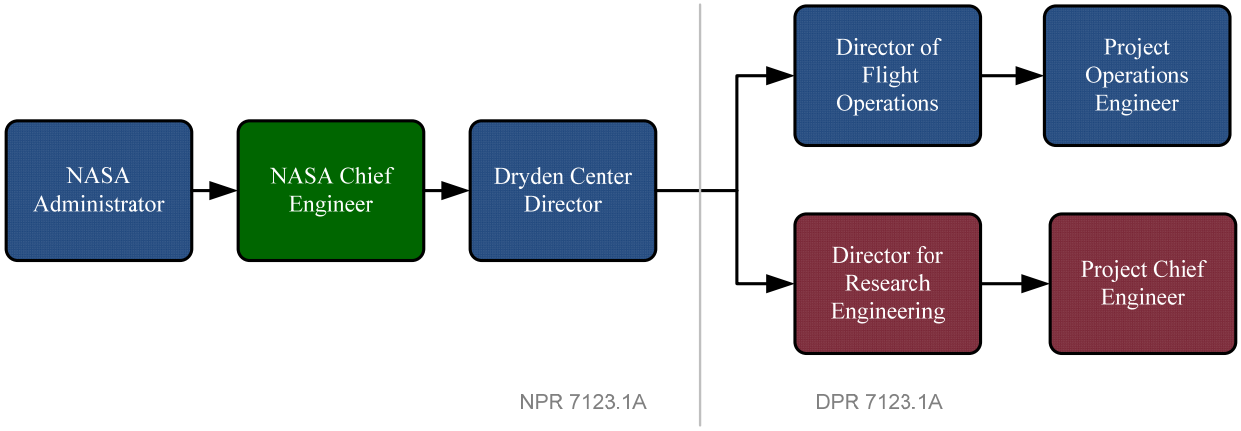

Figure 2. Flow of Technical Designated Governing Authority at Dryden

1.4 Systems Engineering Management Plan

1.4.1 A Systems Engineering Management Plan (SEMP) is used to document the technical content of each project and is a "living" document, updated throughout the project's lifecycle.

Guidance for the creation of a SEMP and a template are found in DHB-R-007, Project Chief Engineer's Handbook.

1.5 Risk Management

1.5.1 Risk Management at all program levels must be an inherent part of all systems management program planning and lifecycle activities. The project's overall approach to managing technical risk should be described in the SEMP. In addition, a project Risk Management Plan should be developed that describes:

a. The project's overall risk policy and objectives.

b. The programmatic aspects of the risk management activities (roles and responsibilities, resources, and schedules, etc.)

c. A description of the methodologies, processes, and tools to be used for risk identification, characterization, tracking, and mitigation.

d. Documentation requirements for each risk management product and action.

CHAPTER 2: ENGINEERING LIFE CYCLE REQUIREMENTS

2.1 Pre-Phase A & Phase A: Advocacy and Formulation

2.1.1 As stated in Chapter 1, Dryden enters into projects at various stages of their development lifecycle. Regardless of their maturity, all Dryden projects are required to follow a standard advocacy and formulation process as described in DCP-P-012, Project Approval & Execution. While many of the activities and products of the advocacy and formulation process are programmatic in nature, there are systems engineering activities (i.e., planning) that occur during this phase that are critical to the ultimate success of a project.

2.1.2 Required Documentation

2.1.2.1 The following items shall be documented in the formulation process by the project team. The format for the documentation of these items may vary depending on the scope and complexity of the project and the formulation timeline. The following items should be identified in a draft Project Plan (see DCP-P-025, Project Managers' Handbook, for a description) prior to project implementation approval:

a. Project technical objectives – Determined by negotiation with the stakeholders / customers. Includes project success and failure criteria.

b. Preliminary technical approach – Initial identification of the technical work required to meet the project objectives.

c. Preliminary technical risk assessment – Identification of the risk associated with the preliminary technical approach.

d. Preliminary Ops Concept

2.1.2.2 The following items should be identified in the draft SEMP:

a. Draft top-level Work Breakdown Structure (WBS) – An organized identification of top-level project technical elements aligned with the preliminary technical approach.

b. Preliminary review plan – A plan for technical reviews will be negotiated with the Dryden Chief Engineer during the formulation process.

2.1.3 Configuration Control

2.1.3.1 The draft SEMP should define (or refer to a separate Configuration Management Plan that defines) a project configuration control process for the project that will manage, document, and communicate changes to objectives, requirements, design, and plans, as well as all hardware and software elements of the system. Participation by entities outside of Dryden, including interfaces with other configuration control processes, must be clearly stated.

2.2 Phase B: Requirements Development and Preliminary Design

2.2.1 Requirements Development

2.2.1.1 Following project approval, the technical team is responsible for identification of technical requirements to accomplish the project objectives and comply with Center and Agency process and product standards. While simple in concept, the process of requirements development is different for every project. Regardless of the scope and complexity of the project, the process of system requirements development will:

a. Identify customer needs, stakeholder requirements, and mission objectives. (Includes Program Commitment Agreements (PCAs))

b. Ensure there is a common understanding of the operational concept of the system, including nominal and off-nominal mission scenarios. This is usually documented in a Concept of Operations Document (ConOps).

c. Use a top-down approach, flowing from the mission objectives.

d. Identify required functional and physical characteristics that are measurable and verifiable.

e. Identify requirements that must be considered for compliance with Agency and Center process standards. Requirements should address institutional disciplines including, but not limited to, hardware and software quality assurance, reliability, manufacturing, maintenance, operational safety, environmental safety, range and public safety.

f. Fully define the requirements at the system level, including user requirements (What is the concept of operation?), functional requirements (What must the system do?), performance requirements (How well must the system perform?) and constraints (How is the design, development, or operation limited?).

g. Identify those requirements that describe key characteristics, as defined later in this document.

h. Ensure each requirement is correct, clear, consistent, complete, unambiguous, verifiable, independent, and traceable.

i. Include the appropriate rationale for each requirement.

j. Perform requirements management, an iterative process of defining, allocating, tracking, collecting metric, controlling, and verifying technical requirements, that meet all the customer's expectations.

k. Culminate with a review of the requirements at a System Requirements Review (SRR). Criteria for the SRR will be defined later in this document.

2.2.2 Requirements Documentation

2.2.2.1 The process used to collect and document the various requirements will vary depending on system size and complexity. A common practice at Dryden is the utilization of an Objectives and Requirements Document (ORD) to collect system requirements, flight test requirements, and research requirements from the various technical disciplines. The ORD process is defined in DHB-R-002, Objectives and Requirements Document Handbook, and DCP-P-025, Project Managers' Manual. Use of the ORD is accepted practice, but other methods of collecting multidisciplinary requirements may be acceptable.

2.2.2.2 For more complex systems, the collected set of requirements should be documented in a single "living", configuration-controlled System Requirements Document (SRD).

2.2.2.3 The Requirements Document will include information on requirement traceability and identify those requirements that reflect key characteristics.

2.2.2.4 The Project Chief Engineer, the Project Operations Engineer, and the Project Manager shall approve the SRD.

2.2.2.5 The approved SRD shall be considered the baseline, entered into the project's configuration control system and changes managed in accordance with the SEMP or Configuration Management Plan.

2.2.3 Preliminary Design

2.2.3.1 During the Preliminary Design phase, the decomposition of subsystem requirements continues and design concept trade studies are performed. A preliminary design is defined and evaluated against all defined system requirements. The preliminary design is utilized to determine top-level verification and validation plans for each of the system requirements.

2.2.3.2 The following systems engineering activities will occur during the preliminary design phase:

a. Perform design trade studies to identify a candidate architecture that best satisfies the defined requirements within the defined constraints, while at the same time carrying an acceptable level of risk.

b. Perform modeling and simulation as required for risk reduction activities.

c. Create a top-level physical system architecture baseline depiction of the system.

d. Assign configuration items to the major hardware and software elements as appropriate based on the design concept.

e. Allocate system requirements to the hardware and software configuration items based on the chosen architecture.

f. Continue the definition and decomposition of requirements for each of the defined subsystems until a level of definition is reached where each element can either be procured or fabricated. Ensure that traceability between parent and child requirements is maintained and key characteristics are identified.

g. Produce draft versions of hardware and software development and integration plans.

h. Produce draft versions of system verification and validation plans describing how the system will be tested and evaluated against the requirements.

i. Identify those requirements that will be verified by analysis, and determine the type and scope of analyses to be performed.

j. Conduct preliminary hazard analysis and risk reduction activities.

k. Conduct a Preliminary Design Review (PDR). Criteria for the PDR will be defined later in this document. For complex systems, multiple PDRs may be required to cover all subsystems.

2.3 Phase C: Detailed (or Critical) Design Phase

2.3.1 During the detailed design phase (also known as Critical Design phase), the system and subsystem design continues in preparation for the release of procurement or fabrication orders in accordance with the appropriate software or hardware design processes defined in the Dryden Management System.

2.3.2 The following systems engineering activities will occur during the detailed design phase:

2.3.2.1 Finalize and approve architecture (physical and functional).

2.3.2.2 Finalize and approve all hardware and software development and integration plans.

2.3.2.3 Finalize and approve system verification and validation plans.

2.3.2.4 Finalize hazard and technical risk analysis.

2.3.2.5 Maintain configuration control of all approved documents.

2.3.2.6 Perform requirements management, update requirements documentation as required if new or changed requirements are identified, and provide traceability to the top WBS model requirements.

2.3.2.7 Coordinate design configurations to integrated schedule.

2.3.2.8 Maintain configuration control over the system design to verify continued compliance with approved requirements.

2.3.2.9 Conduct the Critical Design Review (CDR), the culmination of the engineering activity in this phase. The criteria for the CDR are defined later in this document.

2.3.2.10 Finalize design drawings, part list, materials, and engineering instructions that enable fabrication and builds.

2.3.3 Upon successful completion of the CDR, the design shall be considered the baseline,

entered into the project's configuration control system and changes managed in accordance with the SEMP or Configuration Management Plan.

2.4 Phase D: Fabrication, System Integration, and Test

2.4.1 Systems engineering diligence is key to the success of this critical phase, during which the system is produced and qualified for flight through analysis and test. Close coordination between the system designers, fabricators, and testers is vitally important during this phase.

2.4.2 Systems engineering tasks during this phase will:

a. Ensure that design documents are properly approved and submitted to the fabricators, coders, and/or suppliers in accordance with Center procedures.

b. Maintain active configuration control of the interfaces for external and internal interfaces of the system, subsystem, and components.

c. Ensure that key characteristics of the design are monitored and checked appropriately.

d. Maintain active configuration control during the production effort, ensuring that discrepancies noted during production are properly identified and dispositioned.

e. Ensure that components, subsystems, and systems are tested in accordance with the approved testing and verification/validation plans.

f. Ensure the planned analyses are performed, documented, and reviewed.

g. Maintain active configuration control during the testing efforts, ensuring that discrepancies noted during tests are properly identified and dispositioned.

h. Ensure that requirements changes, test plan changes, or waiver requests are properly documented and approved.

i. Ensure that test results are properly documented and controlled.

j. Prepare for the Airworthiness and Flight Safety Review process as defined by the Dryden Chief Engineer and the guidelines described in G-7900.3-001, Airworthiness and Flight Safety Review, Independent Review, Mission Success Review, Technical Brief and Mini-Tech Brief.

2.5 Phase E: Operations

2.5.1 During the operations phase, systems engineering efforts are focused largely on configuration control, compliance with test plans, and coordination of data reviews and independent reviews.

2.5.2 Phase E systems engineering efforts will:

a. Ensure that configuration control is maintained, with discrepancies and configuration changes properly identified and documented.

b. Perform Tech Briefs as required.

c. Ensure that ground and/or flight test plans are followed and results analyzed.

d. Ensure that ground and/or flight data is properly reviewed and stored.

e. Ensure that ground and/or flight test results are properly documented.

2.6 Phase F: Disposal

2.6.1 The primary systems engineering tasks during this phase are to properly archive project technical data, hardware, and software. Specific tasks will:

a. Ensure that all design data, qualification test data, and flight test data is properly archived in the appropriate manner.

b. Ensure that all hardware is stored or disposed of in the proper manner in accordance with Center processes.

CHAPTER 3: LIFECYCLE REVIEW CRITERIA

3.1 Project Development Review or Mission Concept Review (MCR)

3.1.1 The Project Development Review process affirms the mission need and examines the proposed mission's objectives and the concept for meeting those objectives. Guidelines for the Mission Concept Review can be found in DHB-R-007. The MCR at Dryden is accounted for in the Dryden Project Approval & Execution process, as described in DCP-P-012. Agreements are developed and presented to the Strategic Management Board (SMB) and Project Management Board (PMB) to obtain approval as described in DCP-X-044, Processing of Agreements from Review to Signature.

3.2 System Requirements Review (SRR)

3.2.1 The SRR is used to ensure that the program requirements are properly formulated and correlated with the Agency and mission directives and strategic objectives. Guidelines for the System Requirements Review, including entrance and exit criteria, and documented in DHB-R-007, Appendix D, "System Requirements Review."

3.3 Preliminary Design Review (PDR)

3.3.1 The PDR demonstrates that the preliminary design meets all the system requirements with acceptable risk and within the cost and schedule constraints. The PDR also establishes the basis for proceeding with the detailed design. It will show that the correct design options have been selected, interfaces have been properly allocated, and verification methods have been described. Guidelines for the Preliminary Design Review, including entrance and exit criteria, are documented in DHB-R-007, Appendix D, "Preliminary Design Review."

3.4 Critical Design Review (CDR)

3.4.1 CDR demonstrates that the maturity of the design is appropriate to support proceeding with full-scale fabrication, assembly, integration, and test. CDR determines that the technical effort is on track to complete the flight and ground system development and that mission operations will meet mission performance requirements within the identified cost and schedule constraints. Guidelines for the Critical Design Review, including entrance and exit criteria, are documented in DHB-R-007, Appendix D, "Critical Design Review."

3.5 Test Readiness Review (TRR)

3.5.1 TRR ensures that the test article (hardware/software), test facilities, support personnel, and test procedures are ready for testing and data acquisition, reduction, and control. A TRR is held prior to commencement of the verification testing. TRR Guidelines are called out in the following Dryden documents: DCP-R-603, Flight Loads Laboratory Operations Requirements; DCP-R-604, Flight Load Laboratory Thermal-Structural Ground Test Hazard Analysis; and DCP-S-007 Software Assurance.

3.6 Flight Readiness Review (FRR)

3.6.1 An FRR is held to ensure that a vehicle is ready for flight and the hardware is deemed

acceptably safe for flight (i.e., meeting the established acceptable risk criteria or documented as being accepted by the Program Manager (PM) and DGA). The FRR also is used to establish that the flight and ground software elements are ready to support flight and flight operations and interfaces are checked and found to be functional. Additionally, the FRR will review and establish that open items and waivers have been examined and found to be acceptable and all open safety and mission risk items have been addressed. FRR guidelines are described in G-7900.3-001; DHB-R-007, Appendix D; DCP-X-009, Airworthiness and Flight Safety Review Process; and G-7900.4-002, Operations Engineer's Handbook.

3.7 Airworthiness and Flight Safety Review Board (AFSRB)

3.7.1 At Dryden, the AFSRB process is part of the FRR processes. AFSRB guidelines are called out in G-7900.3-001 and DCP-X-009, Airworthiness and Flight Safety Review Process and also discussed in DCP-P-025, Project Managers' Manual.

3.8 Tech Briefs

3.8.1 At Dryden, the Tech Brief process is part of the overall Flight Readiness Review process. The Tech Brief process is an on-going review of the FRR and AFSRB process and should be treated with the same gravity and due process. Guidance on the Tech Brief process can be found in G-7900.3-001; DHB-R-007; and DCP-X-008, Tech Brief (T/B) and Mini Tech Brief (Mini T/B). Tech Briefs are also discussed in DCP-P-025, Project Managers' Manual.

3.9 Operational Readiness Review (ORR)

3.9.1 The ORR is held prior to deployed flights and includes a review of FRR activities and information and also includes a review of deployed location information, activities, and routes, no go procedures, and mission rules. ORR guidelines are shown in DCP-X-020, Flight Operational Readiness Review (ORR).

3.10 Decommissioning Review (DR)

3.10.1 A DR confirms the decision to terminate or decommission the system and assesses the readiness of the system for the safe decommissioning and disposal of system assets. It is also known as a disposal review.

CHAPTER 4: AS9100 (AEROSPACE QUALITY MANAGEMENT SYSTEM STANDARD) REQUIREMENTS

4.1 First Article (AS9100)

4.1.1 SAE AS9100, Aerospace Quality Management System Standard, has two unique additional requirements that must be addressed in the implementation of DPR-7123.1. The first requirement has to do with independent verification and validation of the first unit produced prior to handover to manufacturing.

4.1.2 Dryden's definition of "first article" is "First unit produced for full compliance to requirements meeting final intended purposes of the customer. At Dryden, this is defined as the output from a research design and development environment."

4.1.3 Dryden does not process products in volume production runs, and therefore does not perform independent first article inspections. The intent of first article inspection will be accomplished through the verification and validation activities of the design and development lifecycle.

4.2 Key Characteristics (AS9100)

4.2.1 The second unique SAE AS9100 requirement has to do with the identification of key characteristics during the design and development process and the flowdown of key characteristics to the in-house manufacturing organizations and/or suppliers through the purchasing processes.

4.2.2 Dryden's definition of key characteristics is "Key characteristics are defined as the features of a material, process, or part whose variation has a significant influence on product fit, performance, service life, manufacturability, or with a clear and imminent safety impact if it is not complied with (e.g., output voltage, shields/covers, warning markings, etc.)."

4.2.3 Key characteristics will be identified and evolved throughout the DFRC project lifecycle.

4.2.4 Functional key characteristics are the features of a system, subsystem, or assembly whose attributes are more suitably verified through analysis and/or test.

4.3.5 A customer is more likely to define the objectives and goals of what they desire in terms of function, features, performance, and data. The prioritization of customer requirements and objectives by the project manager defines the customer's key characteristics. The Project Manager shall document these requirements in an appropriate project agreement document (e.g., Objectives and Requirements Document, System Requirements Document, etc.).

4.2.6 The design organization shall specify and document physical key characteristics for material, hardware, and systems. Appropriate testing will be formulated and documented to verify that the key characteristics have been achieved.

4.2.7 For parts that are designed and fabricated by an off-site vendor, the vendor shall be

provided by the purchasing organization with sufficient documentation, including identification of key characteristics, to ensure that the vendor provides the desired product.

4.2.8 Design and development organizations shall transmit key characteristics to the internal fabrication function(s) via drawings, associated inspection plans, or other applicable documents. A Quality Engineering (QE) function shall perform a risk-based review of the drawings and specification documents and, in conjunction with the design organization, may identify additional key characteristics that would be added to drawings or other applicable documents as appropriate.

4.2.9 The Quality Assurance organization shall verify adherence to key characteristics for all on-site and off-site fabricated parts prior to release for delivery.

CHAPTER 5: COMMON TECHNICAL PROCESS

5.1 NPR 7123.1 Requirements for Common Technical Processes

5.1.1 NPR 7123.1, establishes a core set of common technical process to be used by NASA projects in engineering system products during applicable product-line life-cycle phases to meet the phase exit criteria and project objectives. The 17 common technical processes are presented in the NASA system engineering model shown in Figure 3.

5.1.2 The System Engineering common technical processes model illustrates the use of :

a. the system design processes for “top down” design of each product in the system structure,

b. the product realization processes for “bottom up” realization of each product in the system structure, and

c. the technical management processes for planning, assessing, and controlling the implementation of the system design and product realization processes and to guide technical decision making (decision analysis).

5.1.3 The System Engineering common technical processes model is referred to as the “System Engineering engine” to stress that these common technical processes are used to drive the development of the system products and associated work products.

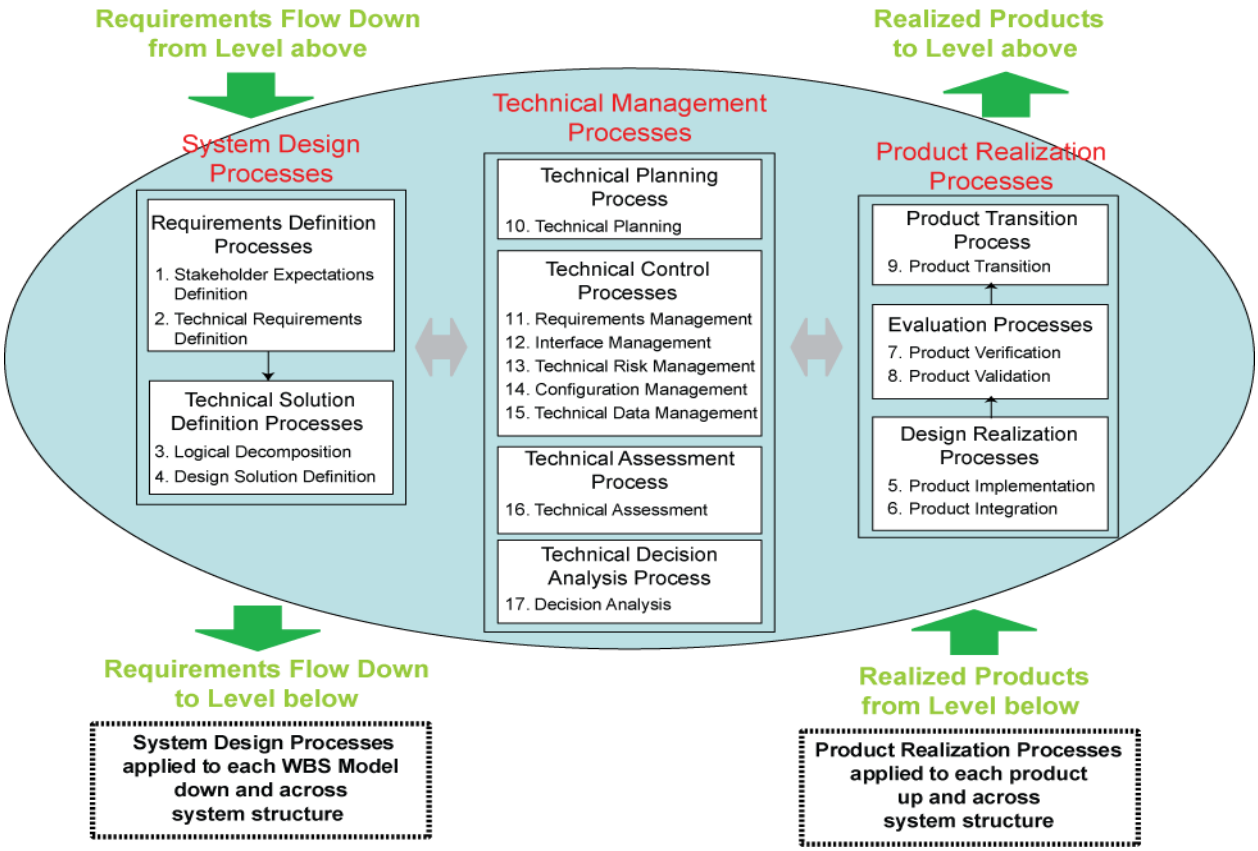

Figure 3 – NPR 7123.1 Common Technical Processes

5.1.4 The common technical processes are applied by assigned technical teams and individuals of the DFRC workforce trained in the requirements of this Systems Engineering DPR. The Project technical teams shall define in the project SEMP how the required 17 common technical processes, as implemented by Center documentation, will be applied during each applicable life-cycle phase and have their approach approved by the DGA. This SEMP guidance process is traced to sections 1.4 and 2.1.2.2 of this DPR.

5.2 Process Requirements

5.2.1 Appendix C establishes traceability of the NPR 7123.1 Common Technical Processes requirements to sections of this DPR.

Appendix A. Definitions

A.1 First Article. First unit produced for full compliance to requirements meeting final intended purposes of the customer. At Dryden, this is defined as the output from a research design and development environment.

A.2 Formulation Phase. See NPR 7120.5 for definitions of program phases.

A.3 Key Characteristics. Key characteristics are defined as the features of a material, process, or part whose variation has a significant influence on product form, fit, function, performance, service life, manufacturability, or with a clear and imminent safety impact if it is not complied with (e.g., output voltage, shields/covers, warning markings, etc.).

A.4 Verification. Proof by examination of objective evidence that the product complies with specifications. Verification is performed to ensure the product complies with requirements and may be determined by test, analysis, demonstration, inspection, or a combination of these.

A.5 Validation. Proof by examination of objective evidence that the product accomplishes the intended purpose. Validation is performed to ensure that the product is ready for a particular use, function, or mission, and may be determined by test, analysis, demonstration, or a combination of these.

Appendix B. Acronyms.

AFSRB	Airworthiness and Flight Safety Review Board
CDR	Critical Design Review
ConOps	Concept of Operations Document
DGA	Designated Governing Authority
DR	Data Review and/or Decommissioning Review
FRR	Flight Readiness Review
KDP	Key Decision Point
MCR	Mission Concept Review
ORD	Objectives and Requirements Document
ORR	Operational Readiness Review
ORRP	Operational Readiness Review Panel
PCA	Program Commitment Agreement
PDR	Preliminary Design Review
PM	Program Manager
PMB	Program Management Board
QE	Quality Engineer
SAE	Society of Automotive Engineers
SE	Systems Engineering
SEMP	Systems Engineering Management Plan
SIR	Systems Integration Review
SMB	Strategic Management Board
SRD	System Requirements Document
SRR	Systems Requirement Review
TB	Tech Brief

TRR	Test Readiness Review
WBS	Work Breakdown Structure

Appendix C: Mapping of NPR 7123.1 Common Technical Processes

C.1 The goal of this Appendix is to establish traceability of NPR 7123.1 Common Technical Process requirements with elements in this DPR and additional guidance information.

C.2 For the statements below “establish” means developing policy, work instructions, or procedures to implement process activities. “Maintain” includes planning the process, providing resources, assigning responsibilities, training people, managing configurations, identifying and involving stakeholders, and monitoring and controlling the process.

C.3 Stakeholder Expectations Definition Process

C.3.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for the definition of stakeholder expectations for the applicable WBS model. This process is traced to section 2.2.2.a of this DPR.

C.3.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.1.1.

C.4 Technical Requirements Definition Process

C.4.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for definition of the technical requirements from the set of agreed upon stakeholder expectations for the applicable WBS model. This process is traced to section 2.2.1, 2.2.2, and 2.2.3 of this DPR.

C.4.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.1.2.

C.5 Logical Decomposition Process

C.5.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for logical decomposition of the validated technical requirements of the applicable WBS model. This process is traced to section 2.2.4.1 of this DPR.

C.5.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.1.3.

C.6 Design Solution Definition Process

C.6.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines and documentation, for designing product solution definitions within the applicable WBS model that satisfy the derived technical requirements. This process is traced to section 2.2.4.2 of this DPR.

C.6.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.1.4.

C.7 Product Implementation Process

C.7.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for implementation of a design solution definition by making, buying, or reusing an end product of the applicable WBS model. This process is traced to section 2.3 of this DPR.

C.7.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.2.1

C.8 Product Integration Process

C.8.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation for the integration of lower level products into an end product of the applicable WBS model in accordance with its design solution definition. This process is traced to section 2.4 of this DPR.

C.8.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.2.2.

C.9 Product Verification Process

C.9.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for verification of end products generated by the product implementation process or product integration process against their design solution definitions. This process is traced to section 2.4 of this DPR.

C.9.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.2.3.

C.10 Product Validation Process

C.10.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for validation of end products generated by the product implementation process or product integration process against their stakeholder expectations. This process is traced to section 2.4 of this DPR.

C.10.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.2.4.

C.11 Product Transition Process

C.11.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines and documentation, for transitioning end products to the next higher level WBS-model customer or user. This process is traced to sections 2.5 and 2.6 of this DPR.

C.11.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.2.5.

C.12 Technical Planning Process

C.12.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for planning the technical effort. This process is traced to sections 1.4 and 2.1 of this DPR.

C.12.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.1.

C.13 Requirements Management Process

C.13.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for management of requirements defined and baselined during the application of the system design processes. This process is traced to sections 2.2.1 and 2.3.2 of this DPR.

C.13.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.2.

C.14 Interface Management Process

C.14.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for management of the interfaces defined and generated during the application of the system design processes. This process is traced to section 2.4.2.b of this DPR.

C.14.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.3.

C.15 Technical Risk Management Process

C.15.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for management of the technical risk identified during the technical effort. (NPR 8000.4, Risk Management Procedural Requirements, is to be used as a source document for defining this process, and NPR 8705.5, Probabilistic Risk Assessment (PRA) Procedures for NASA Programs and Projects, provides one means of identifying and assessing technical risk.) This process is traced to section 1.5 of this DPR.

C.15.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.4.

C.16 Configuration Management Process

C.16.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for configuration management. This process is traced to sections 2.1.3, 2.2.3.5 and 2.3.3 of this DPR.

C.16.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.5.

C.17 Technical Data Management Process

C.17.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for management of the technical data generated and used in the technical effort. This process is traced to section 2.6.1 of this DPR.

C.17.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.6.

C.18 Technical Assessment Process

C.18.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines, and documentation, for making assessments of the progress of planned technical effort and progress toward requirements satisfaction. This process is traced to section 3.0 of this DPR

C.18.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.7.

C.19 Decision Analysis Process

C.19.1 The Center Director or designee shall establish and maintain a process to include activities, requirements, guidelines and documentation, for making technical decisions. This process is traced to section 2.2.4 of this DPR.

C.19.2 Typical best practices of this process are defined in NPR 7123.1 Appendix C.3.8.

Document History Log
Review Date: January 24, 2011

This page is for informational purposes and does not have to be retained with the document.

Status Change	Document Revision	Effective Date	Page	Description of Change
Baseline		11-09-07		
Admin Change	Baseline-1	05/04/09		Redline version created to satisfy NCR deadline. To be updated by August 3, 2009.
Admin Change	Baseline-2	07/23/09	All	**NOTE:** This document was originally approved as DPR-1420.1. The signature page in this minor revision still shows the original number. The content of the document has not changed. The minor revision applies only to the addition of the document serial number. • Changed document number from DPR-7123.1 to DPR-7123.1-001. • Removed references to cancelled document DOP-M-106A, Western Aeronautical Test Range (WATR) Mission Control Center (MCC) Systems Software Acceptance Testing, on pages 3 &12.
Revision	A		6, 8, 10	• Redlined to answer NCR
Revision	B	08/06/10		• Extended expiration date by 6 months
Revision	C	03/09/11	All	• Formatted to comply with Agency requirements. • Removed references to cancelled documents DCP-P-005, DCP-P-006, DHB-P-002, DOP-P-003. • Changed DHB-O-001 to G-7900.4-002 • Changed DHB-X-001 to G-7900.3-001 • Incorporates Section 5.0, description of the SE engine processes and mapping to the DPR processes. • Addresses the audit finding; NPR 7123.1A requirements not flowed to center documentation. • Updated the Dryden lifecycle to include the SMB and PMB project development review process. • Added Appendix B. Acronyms. • Added Appendix C Mapping of NPR 7123.1 Common Technical Processes • Updated Figure 2, Designated Governing Authority at Dryden, which eliminates the associate director of operations.