

**NOAA NESDIS
CENTER for SATELLITE APPLICATIONS
and RESEARCH (STAR)**

TASK GUIDELINE

**TG-6
PROJECT REQUIREMENTS (STEP 6)
TASK GUIDELINES**

Version 3.0

NOAA NESDIS STAR

TASK GUIDELINE TG-6

Version: 3.0

Date: October 1, 2009

TITLE: Project Requirements (Step 6) Task Guideline

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TITLE: TG-6: PROJECT REQUIREMENTS (STEP 6) TASK GUIDELINE VERSION 3.0

AUTHORS:

Ken Jensen (Raytheon Information Solutions)

VERSION HISTORY SUMMARY

Version	Description	Revised Sections	Date
1.0	No version 1		
2.0	No version 2		
3.0	New Task Guideline adapted from CMMI guidelines by Ken Jensen (Raytheon Information Solutions)	New Document	10/01/2009

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LIST OF ACRONYMS

ATBD	Algorithm Theoretical Basis Document
BB	Baseline Build
CDR	Critical Design Review
CI	Cooperative Institute
CICS	Cooperative Institute for Climate Studies
CIMSS	Cooperative Institute for Meteorological Satellite Studies
CIOSS	Cooperative Institute for Oceanographic Satellite Studies
CIRA	Cooperative Institute for Research in the Atmosphere
CL	Check List
CLI	Check List Item
CoRP	Cooperative Research Program
CM	Configuration Management
CMMI	Capability Maturity Model Integration
CREST	Cooperative Remote Sensing and Technology Center
DG	Document Guidelines
DM	Data Management
DPP	Development Project Plan
DPR	Development Project Report
EPG	Enterprise Process Group
EPL	Enterprise Product Lifecycle
G2RR	Gate 2 Review Report
G3D	Gate 3 Document
G3RR	Gate 3 Review Report
IPT	Integrated Product Team
NESDIS	National Environmental Satellite, Data, and Information Service
NOAA	National Oceanic and Atmospheric Administration
OCD	Operations Concept Document
PAR	Process Asset Repository
PBR	Project Baseline Report

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PDR	Preliminary Design Review
PG	Process Guidelines
PP	Project Proposal
PRD	Project Requirements Document
PRG	Peer Review Guidelines
PRR	Project Requirements Review
PRRR	Project Requirements Review Report
PSR	Project Status Report
QA	Quality Assurance
R&D	Research and Development
RAD	Requirements Allocation Document
RAS	Requirements Allocation Sheet
RNM	Requirements/Needs Matrix
SG	Stakeholder Guideline
STAR	Center for Satellite Applications and Research
SWA	Software Architecture Document
TD	Training Document
TG	Task Guideline
VVP	Verification and Validation Plan

1. INTRODUCTION

The NOAA/NESDIS Center for Satellite Applications and Research (STAR) develops a diverse spectrum of complex, often interrelated, environmental algorithms and software systems. These systems are developed through extensive research programs, and transitioned from research to operations when a sufficient level of maturity and end-user acceptance is achieved. Progress is often iterative, with subsequent deliveries providing additional robustness and functionality. Development and deployment is distributed, involving STAR, the Cooperative Institutes (CICS¹, CIMSS², CIOSS³, CIRA⁴, CREST⁵) distributed throughout the US, multiple support contractors, and NESDIS Operations.

NESDIS/STAR is implementing an increased level of process maturity to support the development of these software systems from research to operations. This document is a Task Guideline (TG) for users of this process, which has been designated as the STAR Enterprise Product Lifecycle (EPL).

1.1. Objective

The STAR EPL is designed as a sequence of 11 process steps that take a product from initial conception through delivery to operations. These steps are:

- Step 1 - Basic Research (TG-1)
- Step 2 - Focused R & D (TG-2)
- Step 3 - Project Proposal (TG-3)
- Step 4 - Resource Identification (TG-4)
- Step 5 - Development Project Plan (TG-5)
- **Step 6 - Project Requirements (TG-6)**
- Step 7 - Preliminary Design (TG-7)
- Step 8 - Detailed Design (TG-8)

¹ Cooperative Institute for Climate Studies

² Cooperative Institute for Meteorological Satellite Studies

³ Cooperative Institute for Oceanographic Satellite Studies

⁴ Cooperative Institute for Research in the Atmosphere

⁵ Cooperative Remote Sensing and Technology Center

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- Step 9 - Code & Test Data Development (TG-9)
 - Step 10 - Code Test And Refinement (TG-10)
 - Step 11 - System Integration and Test (TG-11)

The objective of this Task Guideline (TG-6) is to describe how to perform the standard tasks of STAR EPL process step 6, "Project Requirements".

The intended users of this TG are all participants in the STAR EPL process who are involved in performing the standard tasks of step 6. Participants are referred to as STAR EPL stakeholders.

To determine whether or not they should be involved with this step, the readers of this TG should first determine what stakeholder roles apply to their participation in a STAR research-to-operations development project. Generic stakeholder roles are listed in Section 3 of this TG and discussed in Section 3.2 of the EPL Process Guideline (PG-1)⁶. PG-1 and this TG will direct stakeholders to Stakeholder Guidelines (SG) that are pertinent to their roles.

1.2. Version History

This is the first version of TG-6. It is identified as version 3.0 to align it with the release of the version 3.0 STAR EPL process assets.

1.3. Overview

This TG contains the following sections:

- Section 1.0 - Introduction
- Section 2.0 - References
- Section 3.0 - Stakeholders
- Section 4.0 - Project Requirements Review
- Section 5.0 - Project Artifacts
- Section 6.0 - Task Descriptions

⁶ It is recommended that potential STAR EPL stakeholders either review PG-1 prior to using this TG or use it as a reference while using this TG.

2. REFERENCE DOCUMENTS

All of the reference documents for the STAR EPL process are STAR EPL process assets that are accessible in a Process Asset Repository (PAR) on the STAR website.

http://www.star.nesdis.noaa.gov/star/EPL_index.php.

Process assets include:

- Process Guidelines
- Stakeholder Guidelines
- Task Guidelines
- Peer Review Guidelines
- Review Check Lists
- Document Guidelines
- Training Documents

2.1. Process Guidelines

Process Guideline (PG) documents describe STAR's standard set of practices and guidelines for tailoring them to specific projects.

- STAR EPL Process Guidelines (PG-1)
- STAR EPL Process Guidelines Appendix (PG-1.A)
- STAR EPL Tailoring Guidelines (PG-2)

PG-1 and PG-1.A apply generally to each EPL step. Each stakeholder performing tasks during each step can benefit from a familiarity with these documents.

PG-2 is primarily useful for project planners and project plan reviewers during steps 4 and 5. It is also useful during steps 6-11 for project plan revision tasks.

2.2. Stakeholder Guidelines

A Stakeholder Guideline (SG) is a description of how to perform all STAR EPL standard tasks assigned to a given type of stakeholder. It should itemize the actions to be taken. It should contain appropriate standards, conventions, and (where appropriate) examples. It should point to the appropriate references and the required artifacts.

Stakeholder roles are identified in Section 3 of this TG. For each type of stakeholder, the appropriate SG provides that stakeholder with a complete description of the standard tasks for that stakeholder role, along with references to all appropriate process assets and project artifacts (c.f. Section 5 of this TG). This functions as a complement to the TGs (c.f. Section 2.3 of this TG), which provide a completion description of all stakeholder tasks for a specific process step.

Table 2.2.1 lists the Stakeholder Guidelines that are relevant to this step.

TABLE 2.2.1 – Stakeholder Guidelines for Step 6

ID	Stakeholder
SG-4	STAR CM/DM
SG-5	STAR Web Developers
SG-6	STAR Quality Assurance
SG-13	Development Leads
SG-14	Development Scientists
SG-15	Development Testers
SG-16	Development Programmers
SG-17	Technical Review Leads
SG-18	Technical Reviewers

2.3. Task Guidelines

A Task Guideline (TG) is a description of how to perform the tasks of a STAR EPL process step. It should itemize the actions to be taken. It should contain appropriate standards, conventions, and (where appropriate) examples. It should point to the appropriate

references and the required artifacts. There is one Task Guideline for each step in the STAR EPL. The relevant TG for this step is TG-6 (this document).

2.4. Peer Review Guidelines

For each review (c.f. Section 4), there is a Peer Review Guideline (PRG) that describes the objectives of the review, the required artifacts, standards for reviewers, requirements for approval, and options other than approval. For step 6, the relevant PRGs include:

- Project Requirements Review Guidelines (PRG-6)

2.5. Review Check Lists

For each review (c.f. Section 4), there is a Review Check List (CL) that captures all the objectives for a review as a set of check list items. Each item in the check list should have a "Disposition" column that contains "Pass", "Conditional Pass", "Defer", "Waive", or "N/A" (Not Applicable). Each item will also have columns for Risk Assessment and for Actions generated. For step 6, the relevant CLs include:

- Project Requirements Review Check List (CL-6)

2.6. Document Guidelines

There is a Document Guideline (DG) for each standard STAR EPL document. Each DG includes a description of the purpose for the document, a standard document outline (table of contents), a brief description of each subsection in the outline, and an Appendix containing an example document.

Table 2.6.1 lists the Document Guidelines that are relevant to this step.

TABLE 2.6.1 – Document Guidelines for Step 6

ID	Document
DG-5.1	Development Project Plan (DPP)
DG-5.4	Project Baseline Report (PBR)

DG-6.1	Operations Concept Document (OCD)
DG-6.2	Requirements Allocation Document (RAD)
DG-6.3	Verification and Validation Plan (VVP)
DG-6.4	Project Requirements Document (PRD)
DG-6.4.A	PRD Appendix
DG-6.5	Project Requirements Review Report (PRRR)
DG-11.9	Development Project Report (DPR)

2.7. Training Documents

Training Documents (TD) assist the stakeholders (c.f. Section 3) in performing the process tasks. By using the TDs, the stakeholders should be able to perform the tasks more effectively.

Table 2.7.1 lists the Training Documents that are relevant to this step.

TABLE 2.7.1 – Training Documents for Step 6

ID	Training Document
TD-9	Project Requirements

3. STAKEHOLDERS

The STAR Enterprise is comprised of a large number of organizations that participate and cooperate in the development and production of environmental satellite data products and services. Individual project teams are customarily composed of personnel from these organizations, supplemented by contractor personnel. These organizations and project teams are referred to as the STAR Enterprise stakeholders.

An overview of the stakeholder roles is provided in the STAR EPL Process Guidelines (PG-1, c.f. Section 2). A more detailed description can be found in the Stakeholder Guidelines (SGs, c.f. Section 2).

Stakeholders who have a role during step 6 include:

- STAR CM/DM (SG-4)
- STAR Web Developer (SG-5)
- STAR QA (SG-6)
- Development Lead (SG-13)
- Development Scientist (SG-14)
- Development Tester (SG-15)
- Development Programmer (SG-16)
- Technical Review Lead (SG-17)
- Technical Reviewer (SG-18)

STAR CM/DM is the Configuration Management (CM) and Data Management (DM) group for the STAR organization. CM/DM is responsible for establishing and maintaining project baselines for code, test data, documentation, and reports. CM/DM works with each Development Lead to ensure that project artifacts are maintained in accordance with STAR standards. CM/DM works with Operations CM/DM on the transition of the project baseline from pre-operational development to operations.

STAR Web Developer is responsible for maintenance of the STAR web pages. The Web Developer works with STAR CM/DM to ensure that all project baseline items are posted to the appropriate project artifact repository in a timely fashion. The Web Developer works with the STAR EPG and STAR CM/DM to ensure that all STAR EPL process assets are posted to the PAR, and to ensure that all process measures are posted to the STAR Measurement Repository.

STAR QA is the quality assurance (QA) group for the STAR organization. QA is responsible for ensuring that each project's tailored process meets STAR EPL process standards and ensuring that each project meets its process requirements during its pre-operational development phases. QA works with the STAR EPG to ensure effective implementation of the process throughout the organization.

Development Lead is nominally a STAR scientist who leads a project's development efforts after a Project Proposal (PP) has been approved. The Development Lead is typically identified in the PP and is often the same person who was the Research Lead. The Development Lead works with STAR Management to tailor the STAR EPL process to the project and leads the project's development efforts during the Design and Build phases as the lead of the Integrated Product Team (IPT).

Development Scientist is nominally a STAR scientist who has been assigned by the Development Lead to one or more of the tasks of reviewing the technical content of project proposals, maturing a research algorithm into an operational algorithm, developing project requirements, supporting product design, coding and testing, and providing product validation and science maintenance.

Development Tester is any person located at a research organization who has been assigned by the Development Lead to one or more of the tasks of identifying pre-operational test data, acquiring and integrating the test data into the pre-operational product processing system, creating pre-operational unit and system test plans, executing unit and system tests, and analyzing and reporting test results for review.

Development Programmer is a programmer who has been assigned by the Development Lead to one or more of the tasks of preliminary design and detailed design of pre-operational code, writing pre-operational code, integrating code into a pre-operational system, and supporting Development Testers in testing pre-operational code.

Technical Review Lead is responsible for leading the team of Technical Reviewers for one or more of the six Technical Reviews. The Technical Review Lead works with the Development Lead and the Technical Reviewers to ensure that the review is prepared for, conducted, and closed according to review standards.

Technical Reviewer is responsible for reviewing and approving project artifacts and project status at one or more of the six Technical Reviews. Technical Reviewers work with the Technical Review Lead to ensure that the review is prepared for, conducted, and closed according to review standards.

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Stakeholder satisfaction is a critical component of the process. The intention is for the process to be more of a benefit than a burden to stakeholders. If stakeholders are not satisfied that this is the case, the process will require improvement.

Stakeholders are strongly encouraged to provide feedback to the EPG. Comments and suggestions for improvement of the process architecture, assets, artifacts and tools are always welcome. Stakeholders can provide feedback by contacting:

Ken.Jensen@noaa.gov

4. PROJECT REQUIREMENTS REVIEW

Project Requirements Review (PRR) is a Design Phase Technical Review. Its purpose is to establish the requirements to be satisfied by the project and the means to validate them. Upon completion of this review, step 7 (Preliminary Design) commences.

Standard PRR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.
- Identify changes to the project plan and project status since the Gate 3 Review
- Translate user and operator needs and expectations into an operations concept for the product processing system
- Develop and describe the initial set of project requirements, including:
 - Basic Requirements
 - Derived Requirements
 - Requirements/Needs matrix
 - Requirements Traceability matrix
 - Requirements Quality Assurance plans and methods
 - Requirements Allocation matrix
- Identify and update project risks. Make recommendations for risk mitigation plans and actions.
- Document the closing of all action items since the Gate 3 Review. Make recommendations for open actions and new actions.

Standard PRR entry criteria:

- Entry # 1 - A Development Project Plan (DPP) has been written. The PRR reviewers have access to the current baseline version of the DPP.
- Entry # 2 - A Project Status Report (PSR) Appendix has been written. The PRR reviewers have access to the current baseline version of the PSR Appendix.
- Entry # 3 - An Operations Concept Document (OCD) has been written. The PRR reviewers have access to the current baseline version of the OCD.

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- Entry # 4 - A Requirements Allocation Document (RAD) has been written. The PRR reviewers have access to the current baseline version of the RAD.
 - Entry # 5 – A Verification and Validation Plan (VVP) has been written. The PRR reviewers have access to the current baseline version of the VVP.
 - Entry # 6 - A Project Requirements Document (PRD) has been written. The PRR reviewers have access to the current baseline version of the PRD.
 - Entry # 7 - A Project Baseline Report (PBR) has been written. PRR reviewers have access to the current baseline version of the PBR.

Standard PRR exit criteria:

- Exit # 1 - Project plan and DPP are satisfactory.
- Exit # 2 – Operations concept and OCD are satisfactory.
- Exit # 3 – Requirements identification is satisfactory.
- Exit # 4 – Requirements analysis is satisfactory.
- Exit # 5 – Requirements traceability plan is satisfactory.
- Exit # 6 – Requirements tracking plan is satisfactory.
- Exit # 7 - Requirements validation plan and VVP are satisfactory.
- Exit # 8 - Requirements allocation and RAD are satisfactory.
- Exit # 9 - Project baseline and PBR are satisfactory.
- Exit # 10 - The PRR reviewers' assessment of outstanding risks and actions is documented in the PRR Report.
- Exit # 11 - Project risks and actions are acceptable.

Refer to PRG-6 for a more detailed description of the PRR. The standard PRR Check List Items (CLI) are documented in the process asset CL-6 (c.f. Section 2).

PRR objectives, entry criteria, exit criteria, and check list may be tailored. Tailoring guidelines are provided in the process asset PG-2 (c.f. Section 2). Refer to the Development Project Plan (DPP) Section 5 to determine whether there has been any project-specific tailoring for the PRR.

5. PROJECT ARTIFACTS

Project Artifacts are a set of items that must be produced by the appropriate stakeholders during the product life cycle to support the reviews. They are established and maintained under Configuration Management (CM) by an Enterprise Process Group (EPG) under the direction of a Steering Committee.

The project artifacts are maintained in a project artifact repository. This is a complete set of configuration-managed artifacts developed by each project in accordance with STAR standards. When a project artifact has been approved at a Technical Review or Gate Review, it is placed in the project artifact repository under CM.

Project artifacts that are recommended for development during step 6 are listed in Table 5.1.

TABLE 5.1 – Step 6 Artifacts

Artifact	Type	Review	Baseline Build
Development Project Plan v2.0	Document	PRR	2.0
Operations Concept Document v1.0	Document	PRR	2.0
Requirements Allocation Document v1.0	Document	PRR	2.0
Verification and Validation Plan v1.0	Document	PRR	2.0
Project Requirements Document	Presentation	PRR	2.0
Project Baseline Report v2.0	Report	PRR	2.0
Project Requirements Review Report	Report	PDR	2.1
Project Baseline Report v2.1	Report	None	2.1

Development Project Plan v2.0: The Development Project Plan (DPP) documents the plan for the development, testing, review, and transition to operations for the project, including stakeholders, tasks, work breakdown structure (WBS), schedule and resources. The initial DPP v1.0 should have been produced in step 5 for the Gate 3 Review, and may be revised as a result of Gate 3 Review actions. DPP version 2 is typically produced for PRR. Refer to DG-5.1 for detailed DPP guidelines.

Operations Concept Document v1.0: The Operations Concept Document (OCD) is distinct from a concept of operations (ConOps). A ConOps may be generated by a potential user to provide an overview of how the user envisions a potential product system to operate. It provides a mechanism for users to describe their expectations of the target system in terms that need not be quantifiable and testable. The ConOps is typically used as input to the development of formal testable system and software requirements specifications. The OCD is a technical document created by the development team to describe how the users' vision can be realized in an operational environment. It should build on the users' ConOps, if available, and on the organization's ConOps, where relevant. OCD v1.0, produced for the PRR, describes the customer/user needs and expectations from which the project requirements are derived and provides an initial development team concept of how the products will be produced in an operational environment. Refer to DG-6.1 for detailed OCD guidelines.

Requirements Allocation Document v1.0: The Requirements Allocation Document (RAD) contains the basic and derived requirements for the work products and the allocation of the requirements to system components and product components. RAD v1.0, produced for the PRR, should establish the project requirements, provide a requirements analysis sufficient to allow for comprehensive review and approval of the requirements, and provide a preliminary allocation of requirements to system and product components. Refer to DG-6.2 for detailed RAD guidelines.

Verification and Validation Plan v1.0: The Verification and Validation Plan (VVP) describes the work products to be verified and validated, the requirements for each selected work product and the verification and validation methods for each selected work product. VVP v1.0, produced for the PRR, includes the plans for verification of work products, validation of requirements, and validation of products at the level of maturity of the requirements and requirements allocations that are documented in the project's Requirements Allocation Document (RAD). Refer to DG-6.3 for detailed VVP guidelines.

Project Requirements Document: The Project Requirements Document (PRD) consists of the presentation slides for the Project Requirements Review (PRR). Refer to DG-6.4 and DG-6.4.A for detailed PRD guidelines.

Project Baseline Report v2.0: The Project Baseline Report (PBR v2.0) is the document that describes the status of the configuration items that comprise the project baseline at the PRR. Refer to DG-5.4 for detailed PBR guidelines.

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Note that these artifacts are typically included in STAR Baseline Build (BB) 2.0. BB 2.0 provides the artifacts for the PRR. **STAR CM/DM** executes BB 2.0, in consultation with the developers of the BB 2.0 artifacts.

Project Requirements Review Report: The PRR Report (PRRR) summarizes the PRR Reviewers' assessment of the project requirements, including identified risks and risk mitigation actions. Refer to DG-6.5 for detailed PRRR guidelines.

Project Baseline Report v2.1: When the PRRR is completed, it is added to the baseline for BB 2.1. The PBR is updated to v2.1 to include the addition of the PRRR as well as any PRR artifacts that are revised as the result of PRR actions.

6. TASK DESCRIPTION

6.1 Requirements Development Process

Requirements development is an iterative process that occurs throughout the Design phase of the product lifecycle. This phase includes three steps that produce a detailed requirements allocation through an iterative (spiral) development of requirements, solutions, and design:

- **Project Requirements (step 6 of the STAR EPL)**
- Preliminary Design (step 7 of the STAR EPL)
- Detailed Design (step 8 of the STAR EPL)

Figure 6.1 illustrates the Requirements Development process, with step 6 highlighted.

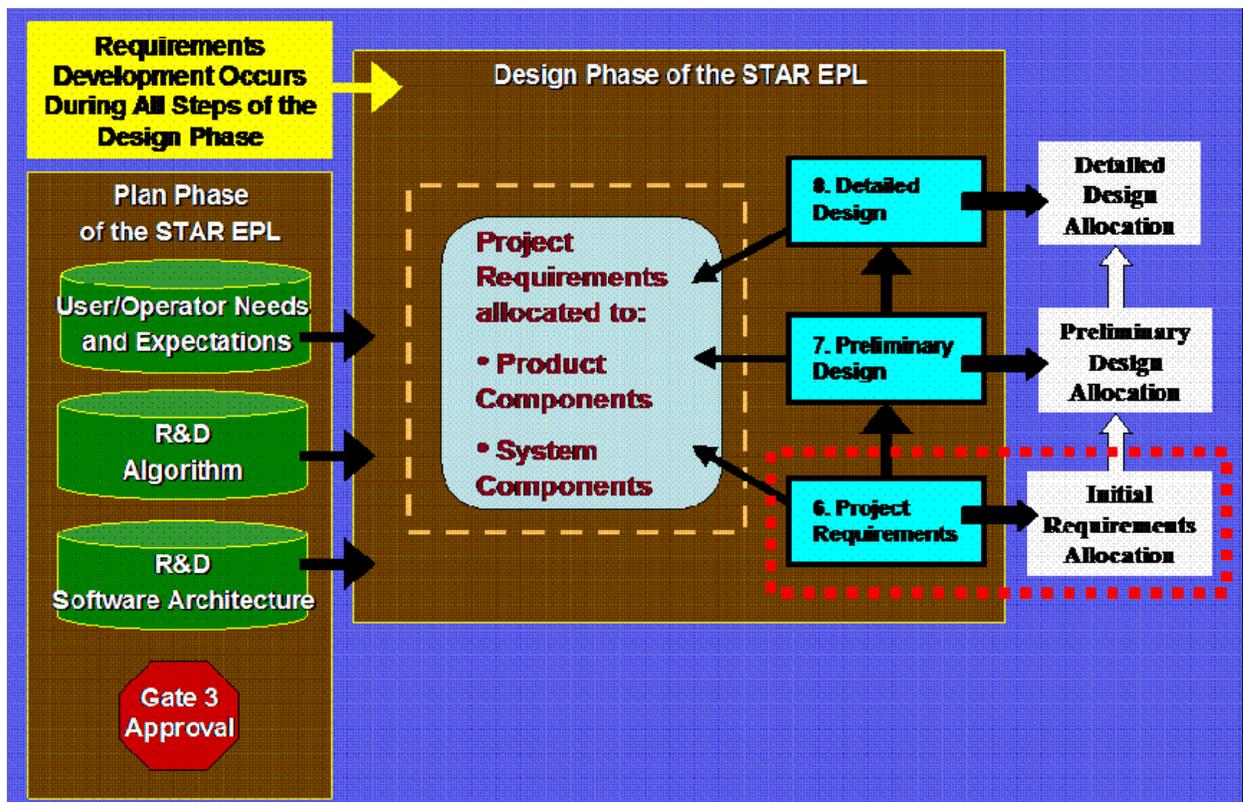


Figure 6.1 – Requirements Development Process

As Figure 6.1 shows, the objective of step 6 is to produce an initial requirements allocation that consists of requirements derived from user/operator needs and expectations and the allocation of these requirements to product components and system components that have been identified in the Research and Development (R&D) algorithm and software architecture.

Note that steps 7 and 8 continue the requirements development process. This is because the requirements development process produces the requirements statements **and** their allocation to product components and system components of a design that is matured to an increasing amount of detail and completeness throughout the Design phase.

The process of producing an increasingly mature and complete requirements allocation involves an iterative development of the requirements, solution, design, and requirements allocation. Figure 6.2 illustrates this.

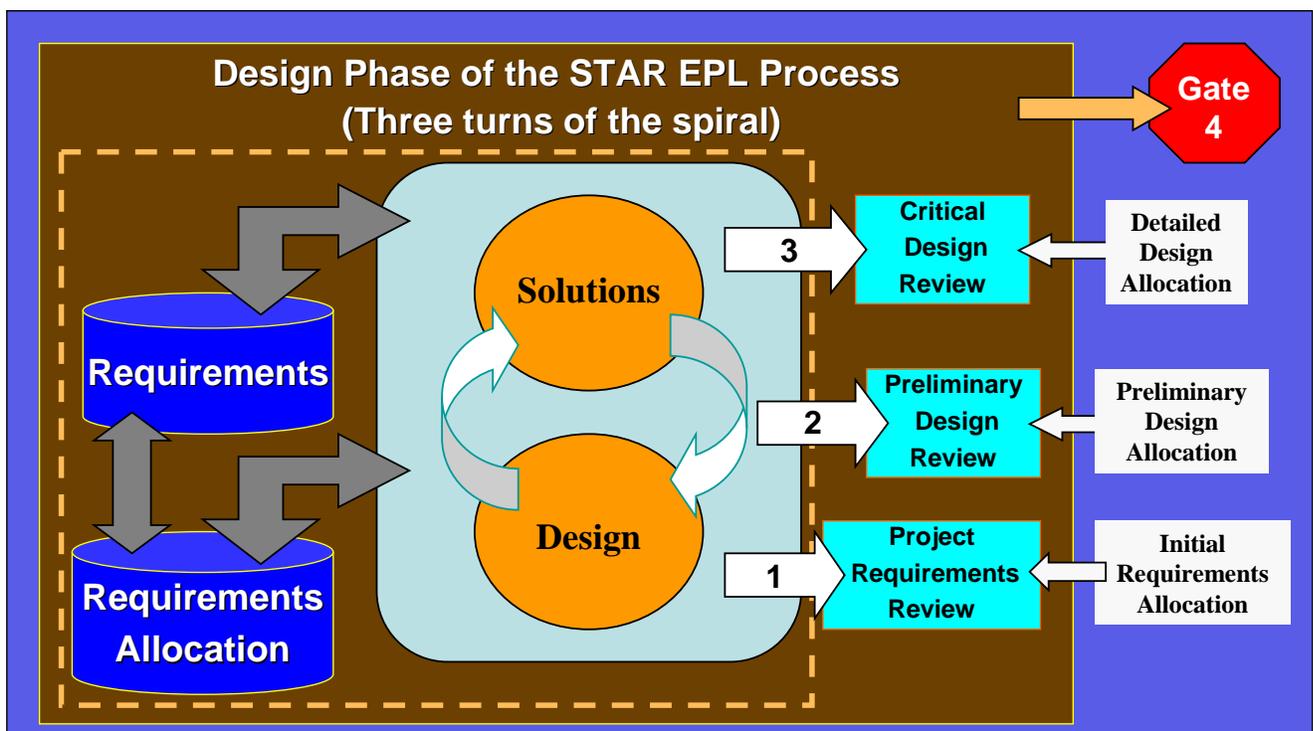


Figure 6.2 – Iterative (Spiral) Development of Requirements Allocation

As shown in Figure 6.2, requirements drive solutions, solutions drive design, and design determines requirements allocation. Gaps and/or inconsistencies between the requirements and the requirements allocation will then drive revisions to solutions and design. Revised solutions and design then drive revisions to requirements and/or requirements allocation, etc.

As the project matures throughout the Design phase, an increasingly comprehensive and mature requirements allocation is reviewed at each of the three technical reviews of this phase (PRR, Preliminary Design Review (PDR), and Critical Design Review (CDR)).

This process is continuous and iterative, but is also characterized by three distinct milestones:

- 1) The Initial Requirements Allocation is achieved when it is determined that the set of stated requirements is complete. That is, it is not expected that additional maturation will result in additional requirements. At that point, a PRR is conducted to complete step 6.
- 2) The Preliminary Design Allocation is achieved when it is determined that a preferred solution has been identified to meet the set of requirements that were approved at the PRR. That is, it is not expected that additional maturation will result in a different solution. At that point, a PDR is conducted to complete step 7. This does not preclude the possibility that the set of requirements will be revised during step 7, as a result of issues discovered during the preliminary design development. This will be discussed in TG-7.
- 3) The Detailed Design Allocation is achieved when it is determined that a complete design has been developed to implement the preferred solution that was approved at the PDR. At that point, a CDR is conducted to complete step 8. This does not preclude the possibility that the set of requirements will be revised during step 8, as a result of issues discovered during the detailed design development. This will be discussed in TG-8.

The iterative nature of this development means that requirements are not expected to be finalized until the complete convergence of requirements, solution, and design is finalized at the end of step 8, resulting in the detailed design allocation. Once this is accomplished, the project is ready to proceed to a Gate 4 Review and the Build phase.

6.2 Project Requirements Process Flow

Figure 6.3 shows the process flow for step 6.

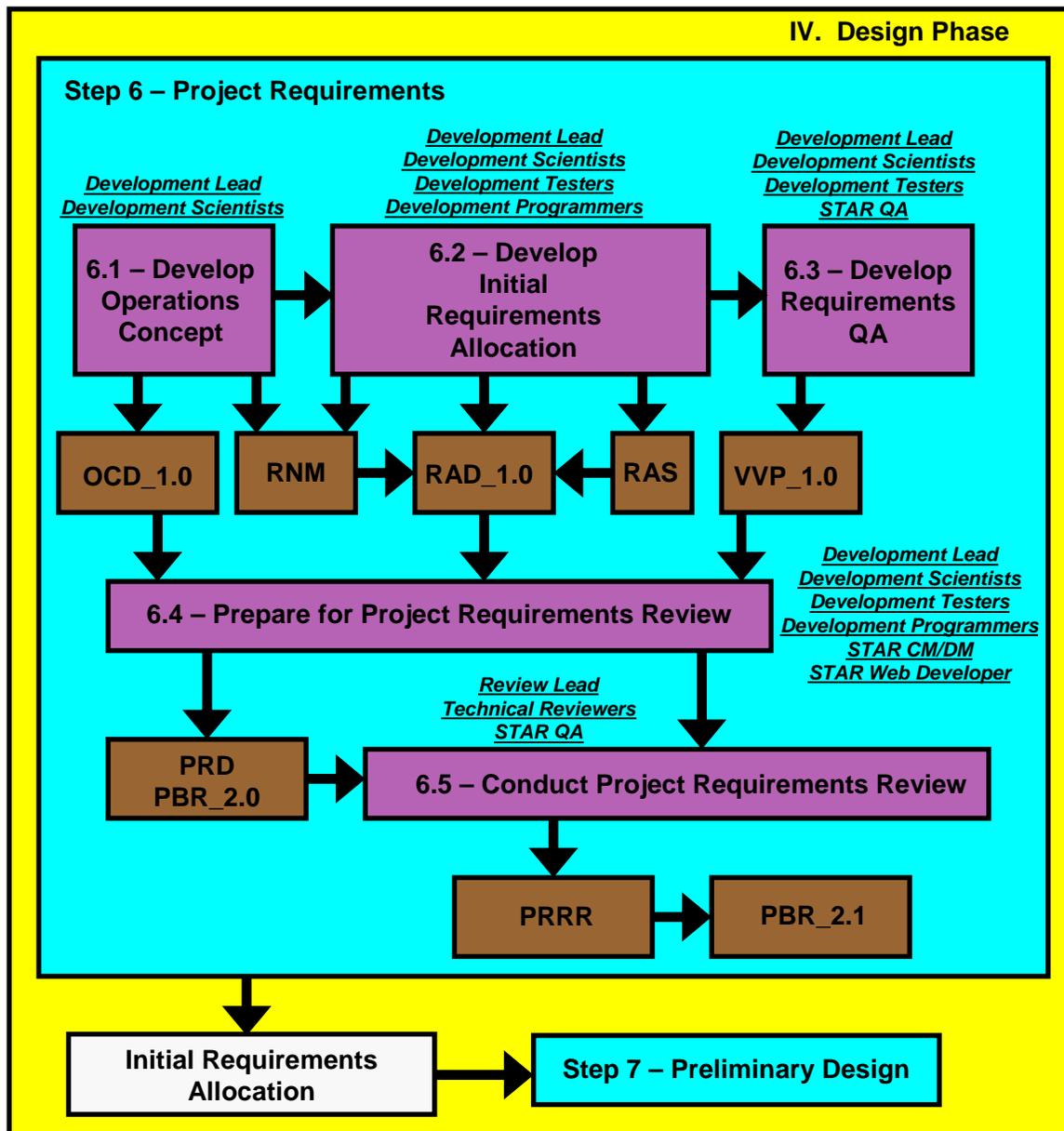


Figure 6.3 - Step 6 Process Flow

6.3 Expected BEGIN State

- REQUIRED: A Gate 3 Review of the DPP and PSR has been conducted
- REQUIRED: Baseline Build (BB) 1.1 has placed the following items in the project artifact repository:
 - DPP, including Appendices
 - PSR, including Appendix
 - Gate 3 Document (G3D)
 - Gate 3 Review Report (G3RR)
- EXPECTED: BB 1.1 has placed the following items in the project artifact repository:
 - R&D code
 - R&D test data
 - Algorithm Theoretical Basis Document (ATBD)
 - Software Architecture Document (SWA)
 - PP
 - Gate 2 Review Report (G2RR)
- REQUIRED: PBR_1.1 documents the status of the BB 1.1 project baseline
- REQUIRED: Gate 3 Reviewers have approved the project to proceed to the Design phase.

6.3.1 Task Inputs

Task inputs consist of the following BB 1.1 items:

- PP, including User Request
- DPP_1.0
- PSR_1.0
- Project Risks and Actions (PSR_1.0 Appendix)
- G3RR
- Project Baseline Report (PBR_1.1)

6.3.2 Corrective Actions

The G3RR will document any actions that are needed to reduce risk during step 6. Usually, these actions should be closed before the PRR.

Additional corrective actions are typically generated during step 6, to mitigate project risks that are identified during requirements development. Project risks and risk mitigation actions should be identified in the PSR Appendix.

The needed corrective actions may require revisions to the project plan, typically by the addition of sub-tasks and revisions to the task schedule. The **Development Lead** should determine whether these revisions are manageable or are so significant that a re-plan is needed. If necessary, the **Development Lead** should consult STAR Management on the advisability of a re-plan. Re-planning is expected to be a rare event, but it may occur if the project requirements have added significant scope or if unexpected technical issues have been discovered.

6.3.2.1 Delta Gate 3 Review

If it is determined that a re-plan is needed, actions should be taken to conduct a delta Gate 3 Review. A delta Gate 3 Review should be prepared for and conducted in the same manner as the normal Gate 3 Review. Refer to the step 5 Task Guideline (TG-5) and the Gate 3 Peer Review Guideline (PRG-5) for guidance. Following approval of the re-plan, the project can return to its step 6 activities under the new plan.

6.4 Desired END State

- An operations concept, developed from user/customer needs and expectations, explains what products are to be produced, why they are being produced, and how they will be produced in an operational environment,
- Basic project requirements have been developed from the operations concept
- Requirements have been analyzed in light of the customer's needs, mission objectives, system constraints, and design constraints to develop more specific product, system, and process requirements for the system.
- Derived project requirements have been developed from analysis of the basic requirements and other derived requirements

- An initial allocation of the requirements identifies product and system components and traces each component to one or more requirement so that a system architecture that will meet all project requirements can be designed.
- A plan has been developed for monitoring the status of the requirements and their allocation to ensure that the integrity of the requirements allocation is preserved as the solutions, design and implementation matures through the Design and Build phases.
- A plan has been developed to verify the identified work products, validate the identified requirements, and validate the identified products.
- The project plan has been updated as necessary
- The status of project risks and actions has been updated
- A PRR of the project plan, operations concept, requirements, and requirements allocation has been conducted
- A PRRR has been written
- Baseline Build 2.1 has placed the required items in the project artifact repository
- PBR_2.1 documents the status of the BB 2.1 project baseline

6.4.1 Task Outputs

Task outputs consist of the following BB 2.1 items:

- DPP_1.x
- OCD_1.0
- RAD_1.0, including Requirements/Needs Matrix (RNM) and Requirements Allocation Sheet (RAS)
- VVP_1.0
- Project Risks and Actions (PSR_1.x Appendix)
- PRD
- PRRR
- PBR_2.1

6.5 Project Requirements Activities

Step 6 activities include:

- 1) Develop operations concept
- 2) Develop initial requirements allocation
- 3) Develop requirements QA
- 4) Prepare for PRR
- 5) Conduct PRR

6.5.1 Develop Operations Concept

The **Development Lead** leads the development of the operations concept, assisted by the **Development Scientists**. The operations concept describes the customer/user needs and expectations from which the project requirements are derived and provides an initial development team concept of how the products will be produced in an operational environment. This forms the basis for the initial development of the basic project requirements.

The operations concept developers should start with the information in the User Request, PP, DPP, and any user/customer ConOps, either documented or communicated to the development team. The operations concept should answer the following questions:

- WHY are the products being produced?
- HOW will they be used?
- HOW should they be produced?

The operations concept developers should answer these questions, using the available resources. To fill in any gaps, the developers should consult with the designated operations agency to ensure that user/customer needs and expectations can be met by a product processing system that can be implemented in the operations environment.

The **Development Lead** and **Development Scientists** should produce the initial version of the Operations Concept Document (OCD v1r0), following the guidelines in DG-6.1, to document the developed operations concept.

6.5.2 Develop Initial Requirements Allocation

The **Development Lead** leads the development of the initial requirements allocation assisted by the **Development Scientists**, **Development Testers**, **Development Programmers**, and **STAR QA**. Figure 6.4 shows the process flow for developing the initial requirements allocation.

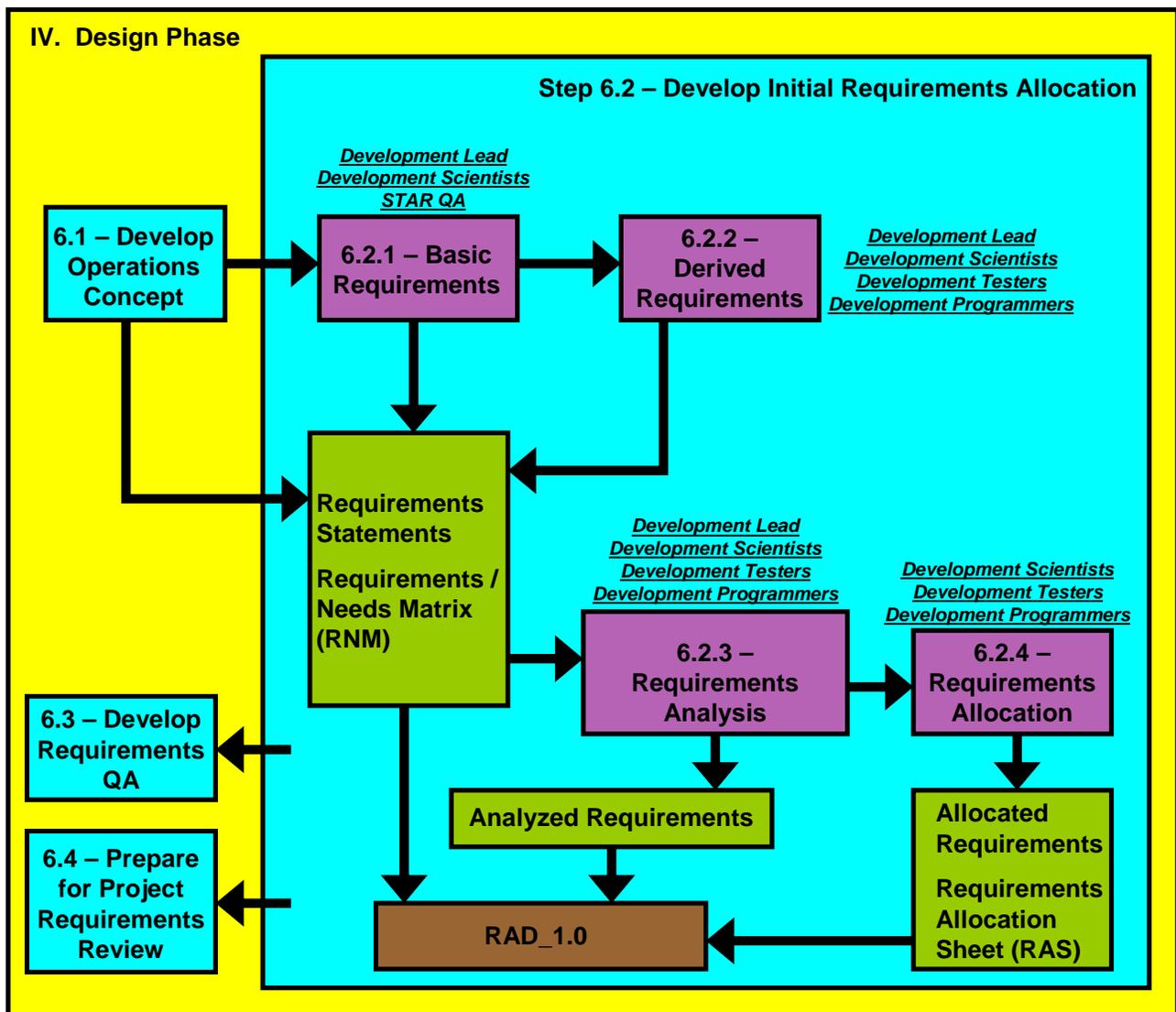


Figure 6.4 – “Develop Initial Requirements Allocation” Process Flow

Step 6.2 activities include:

- 1) Basic requirements
- 2) Derived requirements
- 3) Requirements analysis
- 4) Requirements allocation

6.5.2.1 Basic Requirements

The **Development Lead** leads the identification of the project's basic requirements, with assistance from **Development Scientists** and **STAR QA**. Refer to Section 4 of TD-9 for a detailed description of the requirements identification process.

The **Development Lead** should assemble a list of approved sources for project requirements. Refer to the DPP, which should document the approved sources. Confirm that you have the correct contact information for these sources.

STAR QA assists with the identification of basic process requirements, following the guidelines in Section 4.2 of TD-9. There should be one and only one basic process requirement. It should be numbered 0.0 and should be stated in one of the following two ways:

- 1) Requirement 0.0: "The STAR organization's set of standard processes shall be followed."
- 2) Requirement 0.0: "The STAR organization's set of standard processes shall be followed, except as specified in requirements 0.1, 0.2, etc."

The latter statement should be used if there is any tailoring of the standard processes to fit a project's unique needs. In that case, there should be derived requirements (as many and down to whatever level necessary) that describe the tailoring.

Development Scientists assist with the identification of basic product requirements, following the guidelines in Section 4.4 of TD-9. Basic product requirements address the satisfaction of customer needs, customer expectations, and project objectives derived from these needs and expectations or from the NESDIS mission and strategic plan. Each basic product requirement should be traceable to the operations concept or the NESDIS mission and strategic plan. This trace should be identified as the driver for the requirement. The

driver for each basic product requirement should be identified in a Requirements/Needs Matrix (RNM) that will be an Appendix to the RAD.

Development Scientists assist with the identification of basic system requirements, following the guidelines in Section 4.5 of TD-9. Examples of system requirements include:

- External interface requirements
- Security requirements
- Development environment requirements
- Test environment requirements

Basic system requirements are directly traceable to system constraints (e.g. security, portability, external interfaces) or basic product requirements. The driver for each basic system requirement should be identified in the RNM.

The basic requirements statements are documented in the initial version of the RAD (v1r0), following guidelines in DG-6.2.

6.5.2.2 Derived Requirements

The **Development Lead** leads the identification of the project's derived requirements, with assistance from **Development Scientists, Development Testers, and Development Programmers**.

Derived requirements are those requirements that are not directly traceable to a customer/user need or expectation, or a NESDIS mission goal, but instead are directly traceable to a basic requirement or to another derived requirement.

Figure 6.5 illustrates the relation between basic requirements and derived requirements.

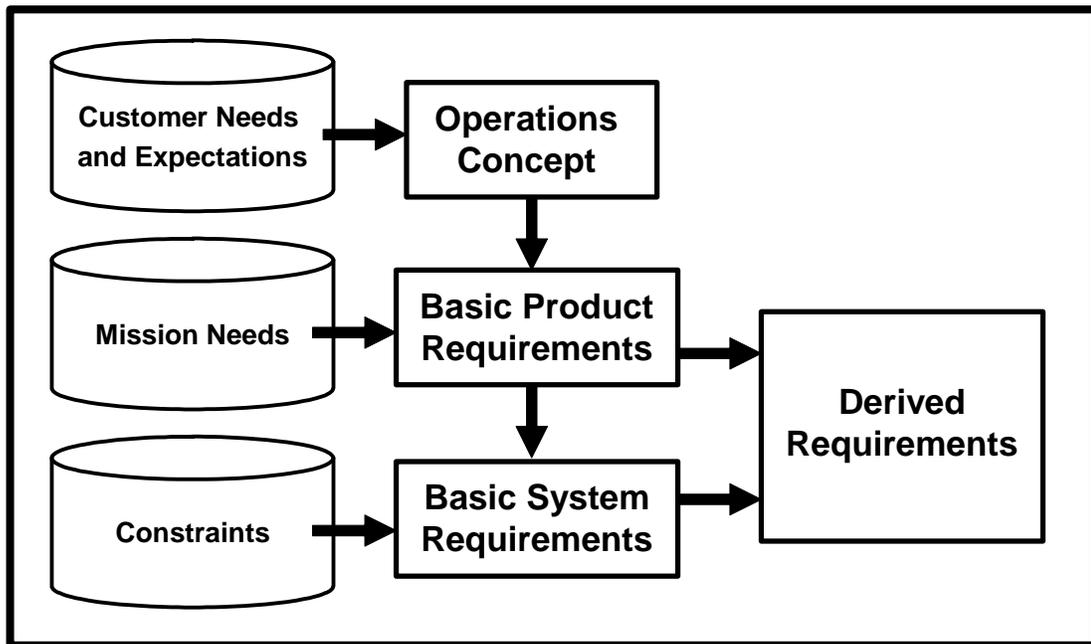


Figure 6.5 – Basic and Derived Requirements

Derived requirements are typically determined by analysis of basic requirements (c.f. Section 6.5.2.3 of this TG).

Derived requirements traceable to a basic product requirement are derived product requirements. Derived product requirements address the cost and performance of other life-cycle phases (e.g., production, operations, and disposal) to the extent compatible with business objectives.

Derived requirements traceable to a basic system requirement are derived system requirements.

The structure of derived requirements may include multiple levels. That is, a derived requirement may be directly traceable to a basic requirement or another derived requirement. This trace should be documented in the RAD (c.f. DG-6.2).

The derived requirements statements are documented in RAD (v1r0), following guidelines in DG-6.2.

6.5.2.3 Requirements Analysis

The **Development Lead** leads the analysis of the project requirements, with assistance from **Development Scientists, Development Testers, and Development Programmers**. Refer to Section 5 of TD-9 for a detailed description of requirements analysis.

Requirements analysis follows the identification of requirements. Requirements identifiers should provide a list of identified requirements to the analysts. Requirements analysts should work from this list and other relevant project artifacts (e.g. DPP, OCD).

Conduct analyses of the requirements with the requirements provider(s) to ensure that a compatible, shared understanding is reached on the meaning of the requirements so the project participants can commit to them.

Requirements analysis includes:

- Acceptance analysis
- Technical analysis
- Quantitative analysis
- Functional analysis

Perform an **acceptance analysis** of the requirements, using standard acceptance quality criteria. Requirements should be clearly and properly stated, complete with respect to customer needs and project goals, consistent with the NESDIS strategic and mission plan, internally consistent with each other, uniquely identified, traceable to their sources, and completely traceable to higher level requirements.

Perform a **technical analysis** of the requirements to ensure that they are feasible and verifiable. While design determines the feasibility of a particular solution, technical requirements analysis addresses knowing which requirements affect feasibility. Identify key requirements that have a strong influence on cost, schedule, functionality, risk, or performance. Identify technical performance measures that will be tracked during the development effort. Technical analysis requires an in-depth understanding of not just the

customer requirements, but also the capabilities and limitations of hardware and software from which the product will be developed.

Requirements technical analysis is closely linked with the development of basic and derived requirements, also known as requirements identification. The links between the two are intended to be iterative, with analysis refining identification, until a satisfactory convergence is reached on a set of requirements that balances customer needs and NESDIS mission needs with constraints, including the capabilities and limitations of hardware and software from which the product will be developed.

Perform a **quantitative analysis** of the requirements. Quantitative analysis is a specialized subset of technical analysis that is focused on performance requirements. Performance requirements must be specific and quantitative. Analysis should strike a balance between customer needs and expectations, whether quantitative or qualitative, and anticipated constraints. Consider cost, schedule and technical constraints. Consider the importance of the product performance to the NESDIS strategic and mission plan.

Quantitative analysis of performance requirements may require testing of the performance of solutions, and therefore may need to be extended into the Build phase (steps 9-11) of the STAR EPL. In that case, the versions of the RAD developed during the Design phase (RAD v1r0 and its revisions) should explicitly state that the quantitative analysis of the performance requirements is provisional. This provisional status should be noted as a project risk that will require careful monitoring as coding and testing proceed.

Perform a **functional analysis** of the requirements. The purpose of functional analysis is to identify, describe, and relate the functions a system (or subsystem) must perform. The definition of functionality can include actions, sequence, inputs, outputs, or other information that communicates the manner in which a product will be produced and used. This is needed to allow for an effective allocation of requirements to product components and system components (c.f. Section 6.5.2.4 of this TG).

For PRR, it is expected that functional analysis will result in a decomposition of basic requirements into derived functional requirements in sufficient detail so that preliminary design solutions can be synthesized during the next step of the product lifecycle. Functional requirements describe “what” the system must do independent of the physical or actual implementation. It is important to maintain this independence in order to objectively evaluate alternative solutions during synthesis.

The definition of functions, their logical groupings, and their association with requirements is referred to as a functional architecture. Functional architecture is the hierarchical

arrangement of functions, their internal and external (external to the aggregation itself) functional interfaces and external physical interfaces, their respective functional and performance requirements, and their design constraints. Functional architecture serves as the bridge between the operations concept (c.f. Section 6.5.2.1 of this TG) and the system architecture of design components that will be developed during the next step of the product lifecycle.

6.5.2.4 Requirements Allocation

Development Scientists, Development Testers, and Development Programmers

allocate each project requirement to product components and system components. Refer to the guidelines in Section 6 of TD-9.

Allocate requirements to product components that have been identified in the system architecture, as documented in the latest version of the SWA. Product components are defined as any item that will be integrated to form the end-use product, i.e. these are the deliverable items.

Allocate requirements to system components that have been identified in the system architecture, as documented in the latest version of the SWA. System components are defined as any item that is necessary or useful for building the end-use product, but will not be delivered to customers and/or end users.

The version 1 system architecture is developed prior to requirements development solely for the purpose of supporting research coding and typically will not be mature enough for a complete allocation. For PRR, it is sufficient to identify those product and system components in the architecture that are likely to be retained in the version 2 architecture, and allocate pertinent requirements to those components. As previously noted, requirements allocation will be developed iteratively with design development (version 2 system architecture).

Make a complete requirements allocation for each alternative approach. Establish the requirements associated with the selected set of alternatives as the set of allocated requirements to those product components. Selecting product components that best satisfy the criteria establishes the requirement allocations to product components. Lower level requirements are generated from the selected alternative and used to develop the product-

component design. Interface requirements among product components are described, primarily functionally.

There may be cases where a project does not wish to analyze alternative solutions. In that case, the PRR should decide whether a trade study of alternative solutions should be conducted for PDR. If a project wishes to bypass the analysis of alternative solutions, it must provide a convincing rationale (e.g., strong algorithm heritage).

Summarize the requirements allocations in a Requirements Allocation Sheet (RAS). The RAS is a matrix. The rows consist of the requirements, with one row for each requirement. It is recommended that the requirements be listed in numerical order, with derived requirements listed after their basic requirements, as follows:

Requirement 0.0

Requirement 0.1

Requirement 0.1.1

Requirement 0.1.2

Requirement 0.2

Requirement 0.2.1

.....

Requirement 1.0

Requirement 1.1

etc.

The columns consist of the product and system components of the system architecture. It is helpful to number the components. In fact, it is the standard practice to number each component in the system architecture. The component numbers can be obtained from the latest version of the SWA. The requirements developers should consult with the developers of the system architecture to ensure that the correct component numbers are used in the RAS.

The RAS should be included as an Appendix document to the RAD. The RAS can be created as a table or imported from a Microsoft Excel spreadsheet to a Microsoft Word Object.

6.5.3 Develop Requirements QA

The **Development Lead** leads the development of the requirements QA plan, with assistance from **Development Scientists**, **Development Testers**, and **STAR QA**. Refer to Section 7 of TD-9 for a detailed description of requirements QA.

Requirements QA is an activity that oversees all of the requirements sub-processes. Its purposes are:

- to ensure that all process requirements, product requirements and system requirements are developed according to standards
- to ensure that all requirements are traceable to drivers and other requirements
- to ensure that the requirements and requirements allocation provide a satisfactory balance between customer/user needs and expectations, NESDIS mission goals, technical feasibility, the available resources and external constraints.
- to ensure that all requirements are verifiable

Requirements QA consists of:

- 1) Requirements Traceability, performed by the **Development Lead** and **Development Scientists**
- 2) Requirements Tracking, performed by the **Development Lead** and **STAR QA**
- 3) Requirements Validation, performed by the **Development Testers** and **Development Scientists**
- 4) Requirements Verification, performed by the **Development Testers** and **STAR QA**

Requirements Traceability includes traceability from a basic requirement to its driver and to its lower level derived requirements and from the lower level requirements back to their higher level sources. This traceability is called vertical traceability because it moves across levels. If the requirements are numbered according to the standard numbering convention (c.f. Section 4.6 and Figure 4.4 of TD-9), vertical traceability is a straightforward combination of the RNM (relating basic requirements to their drivers, c.f. Section 4.7 of TD-9) and the requirements numbers (relating each requirement to its higher and lower level

requirements). That is, each basic requirement can be traced to its driver through the RNM and each derived requirement can be traced to higher level requirements that contain the same higher level number (e.g. Requirement 3.2.7.5 can be traced to Requirements 3.2.7, 3.2, 3.0 and the driver of 3.0). Vertical traceability of all requirements should be established for PRR and documented in RAD v1r0.

Requirements Tracking involves the monitoring of the status of the requirements and their allocation to ensure that the integrity of the requirements allocation is preserved as the solutions, design and implementation matures through the Design and Build phases of the STAR EPL. The **Development Lead** should ensure that a system is in place for tracking requirements and requirements changes. **STAR QA** should ensure that the system is followed during the project lifecycle.

Requirements Validation is concerned with ensuring that the requirements and requirements allocation (c.f. Section 6 of this TD) provide a satisfactory balance between customer/user needs and expectations, NESDIS mission goals, technical feasibility, the available resources and external constraints. For PRR, validation of requirements should include a demonstration that a balance has been established between the basic requirements statements, customer/user needs and expectations, and constraints on the production, distribution and performance of products. This demonstration can be extended to derived requirements and requirements allocations that have been developed by PRR. Any identified conflicts between customer needs and expectations must be addressed and resolved before requirements development is completed. Because an operations concept may not be developed until the PRR, it is possible that conflicts will be discovered after the Gate 3 Review. In that case, it is a top priority that the requirements developers consult with project management and customers to resolve these conflicts as soon as possible. It is not acceptable for a project to go to its PRR with unresolved conflicts.

Requirements Verification is concerned with ensuring that the requirements are identified, analyzed, validated and allocated in accordance with standard processes. In addition to the requirements being necessary, stated clearly and unambiguously, the requirements must be verifiable by a technique satisfactory to the customer.

Document the plan for validating and verifying requirements in the Verification and Validation Plan (VVP), in accordance with guidance in DG-6.3.

6.5.4 Prepare for PRR

The PRR review lead (**Technical Review Lead**) and review team (**Technical Reviewers**) should have been selected during step 5, and listed in the DPP. If this selection was not completed in step 5, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 6.

The **Development Lead** leads the preparation of the PRR presentation.

The PRR slide package is the PRD. The PRD is prepared by the **Development Lead**, **Development Scientists**, **Development Testers**, and **Development Programmers**, in accordance with PRD guidelines DG-6.4. DG-6.4.A provides PRD slide templates that can be adapted for the project's PRD. The PRD developers should examine the DPP to determine whether the PRR objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the PRD slide templates must be adapted to accommodate the tailoring.

The **Development Lead**, assisted by the **Development Scientists**, **Development Testers**, and **Development Programmers**, updates the status of the project risks and associated risk mitigation actions for inclusion in the PRD and the PSR Appendix. Risk management guidelines can be found in PG-1.

The **Development Lead** determines which members of the development team will present the PRD sections. These presenters should be noted in Section Title slides. See DG-6.4.A for examples.

If the project plan has been modified since the Gate 3 Review, the **Development Lead** prepares a revision to the DPP for presentation at the PRR.

STAR CM/DM inserts the standard BB 2.0 items in the baseline, and updates the Project Baseline Report (PBR) to version 2.0, in accordance with PBR guidelines DG-5.4.

The **Development Lead** informs the **STAR Web Developer** that the PRR artifacts are ready for posting on the STAR EPL website. The **STAR Web Developer** works with **STAR CM/DM** to acquire the project baseline items and post them on the website.

Once these are posted the **STAR Web Developer** informs the **Development Lead**, who then informs the **Technical Review Lead** that the PRR artifacts are available for review.

The **Technical Review Lead** then informs all review team members that the artifacts are available to them.

The **Technical Review Lead** and **Technical Reviewers** may at their discretion examine the artifacts and communicate issues to the **Development Lead** prior to the review date, so that the artifacts and/or review presentation may be revised to respond to reviewer concerns.

6.5.5 Conduct PRR

The “Project Requirements” step culminates with a PRR.

The PRR consists of the presentation of the Initial Requirements Allocation by the development team (**Development Lead, Development Scientists, Development Testers, and Development Programmers**) and the disposition of the review CLI, including entry and exit criteria, by the reviewers (**Technical Review Lead and Technical Reviewers**).

The **Technical Review Lead** and the **Technical Reviewers** conduct the PRR to determine whether the PRR artifacts have established the requirements to be satisfied by the project and the means to validate them. Reviewers should be familiar with the PRR guidelines (PRG-6) and check list (CL-6).

The PRR reviewers complete a Project Requirements Review Report (PRRR), following guidelines in DG-6.5. The PRRR will include the reviewers’ assessment of the status of the PRR artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers’ disposition of each PRR CLI.

On the basis of its disposition of the PRR CLI, the **Technical Review Lead** and the **Technical Reviewers** determine whether the project is ready to proceed to the next step, “Preliminary Design”. If not, the PRRR should direct the **Development Lead** to revise the PRR artifacts through specified actions. These actions may include a new assessment of revised PRR artifacts at a delta review.

If a delta review is required, the **Development Lead** and support team upgrade the PRR artifacts as requested by the PRR reviewers and present them at a delta PRR. This is repeated until the **Technical Reviewers** pass the project to step 7.

NOAA NESDIS STAR

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If a delta review is not required, the revision of the PRR artifacts will be deferred to actions performed during step 7 for review at the PDR, or during later steps for review at later reviews. All of this should be documented in the final version of the PRRR.

STAR QA verifies that the PRR was conducted in accordance with STAR EPL standards.

STAR CM/DM updates the project baseline via BB 2.1, and updates the Project Baseline Report (PBR) to version 2.1, in accordance with PBR guidelines DG-5.4. BB 2.1 will include all post-PRR revisions to the PRR artifacts, the PRRR, and PBR_2.1.

Each stakeholder who performed activities during step 6 is encouraged to document an assessment of the experience in a personal record. This assessment should include: what was good, what was bad, what worked, what did not work, what can be improved, how it can be improved.

The **Development Lead** should remind the stakeholders to do this. At the conclusion of Development (step 11), the **Development Lead** will collect the final edited personal stakeholder records and incorporate them into a Development Project Report (DPR).

END OF DOCUMENT