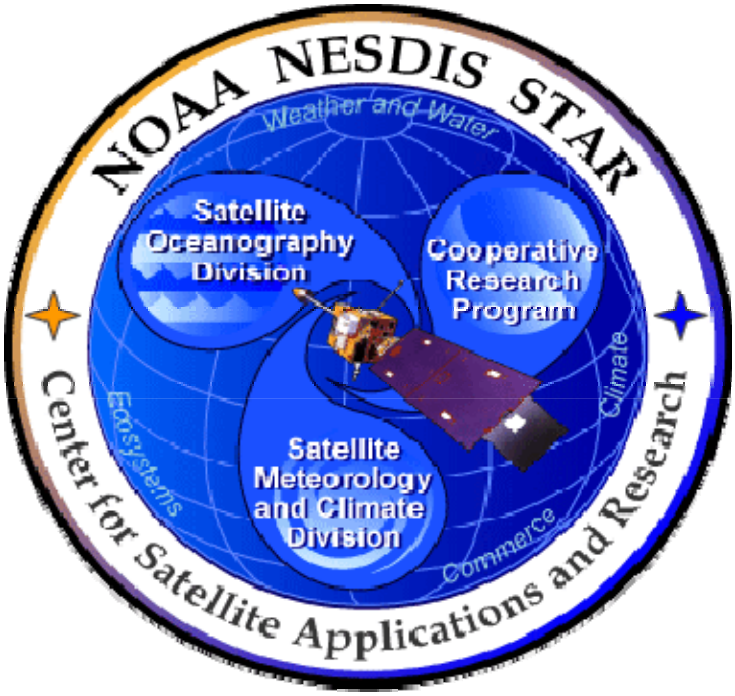

NOAA NESDIS
CENTER for SATELLITE APPLICATIONS and RESEARCH (STAR)

STAKEHOLDER GUIDELINE

SG-13
DEVELOPMENT LEAD GUIDELINES

Version 3.0

TITLE: SG-13: DEVELOPMENT LEAD GUIDELINES VERSION 3.0

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VERSION HISTORY SUMMARY

Version	Description	Revised Sections	Date
1.0	No version 1		
2.0	No version 2		
3.0	New Stakeholder Guideline adapted from CMMI guidelines by Ken Jensen (Raytheon Information Solutions)	New Document	12/31/2009

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LIST OF ACRONYMS

ATBD	Algorithm Theoretical Basis Document
BB	Baseline Build
CDD	Critical Design Document
CDR	Critical Design Review
CDRR	Critical Design Review Report
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/DM	Configuration Management/Data Management
CMMI	Capability Maturity Model Integration
CPI	Cost Performance Index
CREST	Cooperative Remote Sensing and Technology Center
CTD	Code Test Document
CTR	Code Test Review
CTRR	Code Test Review Report
DDD	Detailed Design Document
DG	Document Guidelines
DPP	Development Project Plan
DPR	Development Project Report
EPG	Enterprise Process Group
EPL	Enterprise Product Lifecycle
EUM	External Users Manual
EVMS	Earned Value Management System
G1R	Gate1 Review
G1RR	Gate1 Review Report
G2R	Gate 2 Review

G2RR	Gate 2 Review Report
G3R	Gate 3 Review
G3RR	Gate 3 Review Report
G4R	Gate 4 Review
G4RR	Gate 4 Review Report
G5R	Gate 5 Review
G5RR	Gate 5 Review Report
IMP	Integrated Master Plan
IMS	Integrated Master Schedule
IPT	Integrated Product Team
IT	Information Technology
IUM	Internal Users Manual
MDD	Metadata Document
MOU	Memorandum Of Understanding
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
PCOD	Pre-Operational Code
PDD	Preliminary Design Document
PDR	Preliminary Design Review
PDRR	Preliminary Design Review Report
PG	Process Guidelines
PP	Project Proposal
PRG	Peer Review Guidelines
PRD	Project Requirements Document
PRR	Project Requirements Review
PRRR	Project Requirements Review Report
PSR	Project Status Report
PTEST	Pre-Operational Test Data
QA	Quality Assurance
R&D	Research & Development
RAD	Requirements Allocation Document

RAS	Requirements Allocation Sheet
RCOD	Research Code
RNM	Requirements/Needs Matrix
RTEST	Research Test Data
SC	Steering Committee
SEI	Software Engineering Institute
SG	Stakeholder Guideline
SOW	Statement Of Work
SPI	Schedule Performance Index
SPSRB	Satellite Products and Services Review Board
SRD	System Readiness Document
SRR	System Readiness Review
SRRR	System Readiness Review Report
STAR	Center for Satellite Applications and Research
STP	System Test Plan
SWA	Software Architecture Document
TBD	To Be Determined
TD	Training Document
TG	Task Guideline
TRD	Test Readiness Document
TRR	Test Readiness Review
TRRR	Test Readiness Review Report
UTP	Unit Test Plan
UTR	Unit Test Report
VVP	Verification and Validation Plan
VVR	Verification and Validation Report
WBS	Work Breakdown Structure

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 (CICS[1], CIMSS[2], CIOSS[3], CIRA[4], CREST[5]) 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 Stakeholder Guideline (SG) for users of this process, which has been designated as the STAR Enterprise Product Lifecycle (EPL).

1.1. Objective

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.

The objective of this Stakeholder Guideline (SG-13) is to provide a detailed description of the standard tasks of a **Development Lead**. The intended users of this SG are those who have been assigned as the Lead of a STAR development project.

A **Development Lead** is nominally a STAR scientist who leads a project's development efforts after a Project Proposal (PP) has been approved by the Satellite Products and Services Review Board (SPSRB). The **Development Lead** is typically identified in the PP. The **Development Lead** works with STAR Management to tailor the STAR EPL process to

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

the project and leads the project's development efforts during the Design and Build phases as the lead of the Integrated Product Team (IPT).

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

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

1.2. Version History

This is the first version of SG-13. 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 SG contains the following sections:

Section 1.0 - Introduction
Section 2.0 - Reference Documents
Section 3.0 - Reviews
Section 4.0 - Project Artifacts
Section 5.0 - Task Descriptions

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)

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.

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. 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. This functions as a complement to the Task Guidelines (TGs), which provide a

completion description of all stakeholder tasks for a specific process step. The relevant SG for **Development Leads** is SG-13 (this document).

2.3. Task Guidelines

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
- Step 2 - Focused R & D
- Step 3 - Project Proposal
- Step 4 - Resource Identification
- Step 5 - Project Plan
- Step 6 - Project Requirements
- Step 7 - Preliminary Design
- Step 8 - Detailed Design
- Step 9 - Code & Test Data Development
- Step 10 - Code Test And Refinement
- Step 11 - System Integration and Test

A Task Guideline (TG) is a description of how to perform the tasks of a STAR EPL process step. There is one Task Guideline for each step in the STAR EPL. Table 2.3.1 lists the Task Guidelines that are relevant for **Development Leads**.

TABLE 2.3.1 – Relevant Task Guidelines

ID	Step
TG-4	Resource Identification
TG-5	Project Plan
TG-6	Project Requirements
TG-7	Preliminary Design
TG-8	Detailed Design

TG-9	Code and Test Data Development
TG-10	Code Test and Refinement
TG-11	System Integration and Test

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. Table 2.4.1 lists the Peer Review Guidelines that are relevant for **Development Leads**.

TABLE 2.4.1 – Relevant Peer Review Guidelines

ID	Review
PRG-5	Gate 3 Review
PRG-6	Project Requirements Review
PRG-7	Preliminary Design Review
PRG-8.1	Critical Design Review
PRG-8.2	Gate 4 Review
PRG-9	Test Readiness Review
PRG-10	Code Test Review
PRG-11.1	System Readiness Review
PRG-11.2	Gate 5 Review

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. Table 2.5.1 lists the Review Check Lists that are relevant for **Development Leads**.

TABLE 2.5.1 – Relevant Review Check Lists

ID	Review
CL-5	Gate 3 Review
CL-6	Project Requirements Review
CL-7	Preliminary Design Review
CL-8.1	Critical Design Review
CL-8.2	Gate 4 Review
CL-9	Test Readiness Review
CL-10	Code Test Review
CL-11.1	System Readiness Review
CL-11.2	Gate 5 Review

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 for **Development Leads**.

TABLE 2.6.1 – Relevant Document Guidelines

ID	Document
DG-0.1	Document Style Guideline
DG-5.1	Development Project Plan (DPP)
DG-5.2	Project Status Report (PSR)
DG-5.2.A	PSR Appendix
DG-5.3	Gate 3 Document (G3D)
DG-5.3.A	G3D Appendix
DG-6.1	Operations Concept Document

DG-6.2	Requirements Allocation Document
DG-6.3	Verification and Validation Plan
DG-6.4	Project Requirements Document (PRD)
DG-6.4.A	PRD Appendix
DG-7.1	Preliminary Design Document (PDD)
DG-7.1.A	PDD Appendix
DG-8.2	Critical Design Document (CDD)
DG-8.2.A	CDD Appendix
DG-8.4	Gate 4 Document (G4D)
DG-8.4.A	G4D Appendix
DG-9.2	Test Readiness Document (TRD)
DG-9.2.A	TRD Appendix
DG-10.3	Code Test Document (CTD)
DG-10.3.A	CTD Appendix
DG-11.5	System Readiness Document (SRD)
DG-11.5.A	SRD Appendix
DG-11.7	Gate 5 Document (G5D)
DG-11.7.A	G5D Appendix
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 for **Development Leads**.

TABLE 2.7.1 – Relevant Training Documents

ID	Training Document
TD-9	Project Requirements

3. REVIEWS

The relevant reviews for **Development Leads** are:

- Gate 3 Review (G3R)
- Project Requirements Review (PRR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Gate 4 Review (G4R)
- Test Readiness Review (TRR)
- Code Test Review (CTR)
- System Readiness review (SRR)
- Gate 5 Review (G5R)

3.1. Gate 3 Review

Gate 3 is a STAR review of the project's readiness for development. Its purpose is to determine whether the development plan is feasible, the identified resources are available, and the identified risks are manageable. If a project passes Gate 3, the project proceeds to the Design phase.

Standard Gate 3 Review objectives:

- Identify relevant stakeholders and their planned involvement according to the project plan.
- Review the planned work tasks and Work Breakdown Structure (WBS)
- Review the planned project lifecycle
- Review the planned review objectives, entry criteria, exit criteria, and check lists
- Review the planned work products and project artifacts
- Review the Integrated Master Plan (IMP) and Integrated Master Schedule (IMS)

- Review the expected costs and funding
- Provide an initial assessment of project risks

Standard Gate 3 Review entry criteria:

- Entry # 1 - A Development Project Plan (DPP) has been written. The Gate 3 reviewers have access to the current baseline version of the DPP.
- Entry # 2 - A Project Status Report (PSR) has been written. The Gate 3 reviewers have access to the current baseline version of the PSR.
- Entry # 3 - A Gate 3 Document (G3D) has been written. The Gate 3 reviewers have access to the current baseline version of the G3D.
- Entry # 4 - A Project Baseline Report (PBR) has been written. The Gate 3 reviewers have access to the current baseline version of the PBR.

Standard Gate 3 Review exit criteria:

- Exit # 1 - Project plan and DPP are satisfactory.
- Exit # 2 - Project status and PSR are satisfactory.
- Exit # 3 - Project baseline and PBR are satisfactory.
- Exit # 4 - Project risks are acceptable.
- Exit # 5 - Status of risk mitigation actions is acceptable
- Exit # 6 - Project is ready for the Design phase

Refer to PRG-5 for a more detailed description of the Gate 3 Review. The standard Gate 3 Review Check List Items (CLI) are documented in the process asset CL-5 (c.f. Section 2).

Gate 3 Review 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 Gate 3 Review.

3.2. 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.

- 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.

3.3. Preliminary Design Review

Preliminary Design Review (PDR) is a Design Phase Technical Review. Its purpose is to assess the preliminary design for the pre-operational system. Upon completion of this review, step 8 (Detailed Design) commences.

Standard PDR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.
- Identify requirements changes since the Project Requirements Review (PRR)
- Identify a set of alternative solutions to meet the requirements.
- Provide all applicable technical data for each alternative solution, including:
    - Operations concept
    - Theoretical basis
    - Architecture, specifications, interfaces
    - Performance requirements, QA procedures, test data requirements
    - Verification and validation plans
    - Risks and benefits
- Provide an updated allocation of requirements to product components and system components of the preliminary design.
- Identify and update project risks for the selected solution. Make recommendations for risk mitigation plans and actions.
- Document the closing of all action items since PRR. Make recommendations for open actions and new actions.

Standard PDR entry criteria:

- Entry # 1 - A Project Requirements Review Report (PRRR) has been written. The PDR reviewers have access to the current baseline version of the PRRR.
- Entry # 2 - A Development Project Plan (DPP) has been written. The PDR reviewers have access to the current baseline version of the DPP.

- Entry # 3 - An Operations Concept Document (OCD) has been written. The PDR reviewers have access to the current baseline version of the OCD.
- Entry # 4 - A Requirements Allocation Document (RAD) has been written. The PDR reviewers have access to the current baseline version of the RAD.
- Entry # 5 - An Algorithm Theoretical Basis Document (ATBD v2r0) has been written. The PDR reviewers have access to the current baseline version of the ATBD.
- Entry # 6 - A Software Architecture Document (SWA) has been written. The PDR reviewers have access to the current baseline version of the SWA.
- Entry # 7 - A Verification and Validation Plan (VVP) has been written. The PDR reviewers have access to the current baseline version of the VVP.
- Entry # 8 - A Preliminary Design Document (PDD) has been written. PDR review objectives are clearly stated in the PDD.
- Entry # 9 - A Project Baseline Report (PBR) has been written. The PDR reviewers have access to the current baseline version of the PBR.

Standard PDR exit criteria:

- Exit # 1 – PRR "Conditional Pass" items have been satisfactorily disposed of.
- Exit # 2 – PRR "Defer" items have been satisfactorily disposed of.
- Exit # 3 - Project plan and DPP are satisfactory.
- Exit # 4 - Operations concept and OCD are satisfactory.
- Exit # 5 – Requirements changes since PRR are approved.
- Exit # 6 – Algorithm theoretical basis and ATBD are satisfactory.
- Exit # 7 – Software architecture and SWA are satisfactory.
- Exit # 8 – Verification and validation plan and VVP are satisfactory.
- Exit # 9 - Requirements allocation and RAD are satisfactory.
- Exit # 10 - Project baseline and PBR are satisfactory.
- Exit # 11 - A selected solution has been consistently identified in the project artifacts.
- Exit # 12 - The selected solution is approved.
- Exit # 13 - The PDR reviewers' assessment of outstanding risks and actions is documented in the PDR Report.

- Exit # 14 - Project risks and actions are acceptable.

Refer to PRG-7 for a more detailed description of the PDR. The standard PDR Check List Items (CLI) are documented in the process asset CL-7 (c.f. Section 2).

PDR 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 PDR.

3.4. Critical Design Review

Critical Design Review (CDR) is the final Design Phase Technical Review. Its purpose is to assess the detailed design for the pre-operational system. Upon successful completion of this review, a Gate 4 Review is held to determine whether the project should proceed to the Build phase.

Standard CDR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.
- Identify requirements changes since PDR
- Provide all applicable technical data for the selected solution, including:
    - Operations concept
    - Theoretical Basis
    - Architecture, specifications, interfaces, detailed design description
    - Performance requirements, QA procedures, test data requirements
    - Verification and validation plans
- Provide an updated allocation of requirements to product components and system components of the detailed design.
- Identify and update project risks. Make recommendations for risk mitigation plans and actions.

- Document the closing of all action items since PDR. Make recommendations for open actions and new actions.

Standard CDR entry criteria:

- Entry # 1 - A Preliminary Design Review Report (PDRR) has been written. The CDR reviewers have access to the current baseline version of the PDRR.
- Entry # 2 - A Development Project Plan (DPP) has been written. The CDR reviewers have access to the current baseline version of the DPP.
- Entry # 3 - An Operations Concept Document (OCD) has been written. The CDR reviewers have access to the current baseline version of the OCD.
- Entry # 4 - A Requirements Allocation Document (RAD) has been written. The CDR reviewers have access to the current baseline version of the RAD.
- Entry # 5 - An Algorithm Theoretical Basis Document (ATBD) has been written. The CDR reviewers have access to the current baseline version of the ATBD.
- Entry # 6 - A Software Architecture Document (SWA) has been written. The CDR reviewers have access to the current baseline version of the SWA.
- Entry # 7 - A Detailed Design Document (DDD) has been written for each software unit in the software architecture. The CDR reviewers have access to the current baseline version of each DDD.
- Entry # 8 - A Verification and Validation Plan (VVP) has been written. The CDR reviewers have access to the current baseline version of the VVP.
- Entry # 9 - A Critical Design Document (CDD) has been written. CDR review objectives are clearly stated in the CDD.
- Entry # 10 - A Project Baseline Report (PBR) has been written. The CDR reviewers have access to the current baseline version of the PBR.

Standard CDR exit criteria:

- Exit # 1 - PDR "Conditional Pass" items have been satisfactorily disposed of.
- Exit # 2 - PDR "Defer" items have been satisfactorily disposed of.
- Exit # 3 – Project plan and DPP are satisfactory
- Exit # 4 - Operations concept and OCD are satisfactory.

- Exit # 5 - Requirements changes since PDR are approved.
- Exit # 6 - Algorithm theoretical basis and ATBD are satisfactory.
- Exit # 7 - Software architecture and SWA are satisfactory.
- Exit # 8 – Software detailed design and DDDs are satisfactory.
- Exit # 9 - Verification and validation plan and VVP are satisfactory.
- Exit # 10 - Requirements allocation and RAD are satisfactory.
- Exit # 11 - Project baseline and PBR are satisfactory.
- Exit # 12 - The CDRR documents the current status of project risks, actions and CDR exit criteria.
- Exit # 13 - Project risks and actions are acceptable. Project is ready for the Build phase.

Refer to PRG-7 for a more detailed description of the CDR. The standard CDR entry criteria, exit criteria, and check list is documented in the process asset CL-8.1 (c.f. Section 2).

CDR 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 CDR.

3.5. Gate 4 Review

Gate 4 is a review of the project status following the CDR, under the direction of STAR. Its purpose is to determine whether the project is ready to begin development of the pre-operational code and test data. If a project passes Gate 4, the project proceeds to the Build phase.

Standard Gate 4 Review objectives:

- Review the implementation of the Integrated Master Plan (IMP) and Integrated Master Schedule (IMS)
- Review the technical status and risks of the project
- Review the cost status and risks of the project

- Review the schedule status and risks of the project
- Determine whether corrective actions are needed to allow the project to proceed to the Build phase as planned
- Determine whether a re-plan and a delta Gate 4 Review are needed.

Standard Gate 4 Review entry criteria:

- Entry # 1 - A Gate 3 Review Report (G3RR) has been written. The Gate 4 reviewers have access to the current baseline version of the G3RR.
- Entry # 2 - A Critical Design Review Report (CDRR) has been written. The Gate 4 reviewers have access to the current baseline version of the CDRR.
- Entry # 3 - A Development Project Plan (DPP) has been written. The Gate 4 reviewers have access to the current baseline version of the DPP.
- Entry # 4 - A Project Status Report (PSR) has been written. The Gate 4 reviewers have access to the current baseline version of the PSR.
- Entry # 5 - A Gate 4 Document (G4D) has been written. The Gate 4 reviewers have access to the current baseline version of the G4D.
- Entry # 6 - A Project Baseline Report (PBR) has been written. The Gate 4 reviewers have access to the current baseline version of the PBR.

Standard Gate 4 Review exit criteria:

- Exit # 1 – CDR status and CDRR are satisfactory
- Exit # 2 - Project plan and DPP are satisfactory.
- Exit # 3 - Project status and PSR are satisfactory.
- Exit # 4 - Project baseline and PBR are satisfactory.
- Exit # 5 - Project risks are acceptable.
- Exit # 6 - Status of risk mitigation actions is acceptable
- Exit # 7 - Project is ready for the Build phase

Refer to PRG-8.2 for a more detailed description of the Gate 4 Review. The standard Gate 4 Review entry criteria, exit criteria, and check list is documented in the process asset CL-8.2 (c.f. Section 2).

Gate 4 Review 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 Gate 4 Review.

3.6. Test Readiness Review

Test Readiness Review (TRR) is a Build Phase Technical Review. Its purpose is to determine whether code and test data development are sufficient to allow testing of the pre-operational software components (unit testing). Upon successful completion of this review, step 10 (Code Test and Refinement) commences.

Standard TRR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.
- Review the software architecture, including external interfaces, and identify changes since CDR.
- Identify changes to the detailed design since CDR.
- Identify changes to the verification and validation plan since CDR.
- Demonstrate the test readiness of each unit in the software architecture.
- Provide all applicable technical data to support unit testing, including:
    - Pre-operational code and test data
    - Unit test plan
- Identify and evaluate risks. Recommend risk mitigation activities.
- Document the closing of all action items since CDR. Make recommendations for open actions and new actions.

Standard TRR entry criteria:

- Entry # 1 - A Critical Design Review Report (CDRR) has been written. The TRR reviewers have access to the current baseline version of the CDRR.
- Entry # 2 - A Development Project Plan (DPP) has been written. The TRR reviewers have access to the current baseline version of the DPP.
- Entry # 3 - A Requirements Allocation Document (RAD) has been written. The TRR reviewers have access to the current baseline version of the RAD.
- Entry # 4 - A Software Architecture Document (SWA) has been written. The TRR reviewers have access to the current baseline version of the SWA.
- Entry # 5 - A Detailed Design Document (DDD) has been written for each software unit in the software architecture. The TRR reviewers have access to the current baseline version of the DDDs.
- Entry # 6 - A Verification and Validation Plan (VVP) has been written. The TRR reviewers have access to the current baseline version of the VVP.
- Entry # 7 - A Unit Test Plan (UTP v1r0) has been written. The TRR reviewers have access to the current baseline version of the UTP.
- Entry # 8 – Pre-operational code to implement the detailed design is accessible to the TRR reviewers.
- Entry # 9 - Pre-operational test data, including "truth" data is accessible to the TRR reviewers.
- Entry # 10 - A Project Baseline Report (PBR v2r0) has been written. The TRR reviewers have access to the current baseline version of the PBR.
- Entry # 11 - A Test Readiness Document (TRD) has been written. The TRR reviewers have access to the current baseline version of the TRD.

Standard TRR exit criteria:

- Exit # 1 - CDR "Conditional Pass" items have been satisfactorily disposed of.
- Exit # 2 - CDR "Defer" items have been satisfactorily disposed of.
- Exit # 3 - Changes to the project plan since Gate 4 Review are approved.
- Exit # 4 - Requirements allocation changes since CDR are approved.
- Exit # 5 - Changes to external interfaces since CDR are approved.
- Exit # 6 - Changes to the software architecture since CDR are approved.

- Exit # 7 - Changes to the detailed design since CDR are approved.
- Exit # 8 - Changes to the verification and validation plan since CDR are approved.
- Exit # 9 - The unit test plan and UTP are satisfactory
- Exit # 10 - Pre-operational code to implement the detailed design has been written according to standards and has been built into executable units.
- Exit # 11 - Pre-operational test data, including "truth" data, are satisfactory.
- Exit # 12 - The project baseline and PBR are satisfactory.
- Exit # 13 - The project artifacts document all approved changes to requirements, requirements allocation, external interfaces, software architecture, detailed design, and verification and validation plan since the CDR.
- Exit # 14 - The TRRR documents the current status of project risks, actions and TRR exit criteria.
- Exit # 15 - Project risks and actions are acceptable. Project is ready for unit testing.

Refer to PRG-9 for a more detailed description of the TRR. The standard TRR entry criteria, exit criteria, and check list is documented in the process asset CL-9 (c.f. Section 2).

TRR 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 TRR.

3.7. Code Test Review

Code Test Review (CTR) is a Build Phase Technical Review. Its purpose is to determine whether the pre-operational software units are ready for integration unto a pre-operational system. Upon successful completion of this review, step 11 (System Integration and Test) commences.

Standard CTR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.
- Provide all applicable technical data, including:
    - Refined pre-operational code and test data
    - Unit test plan
    - Unit test report
    - System test plan
- Review the unit test plan, focusing on changes since the TRR.
- Review the unit test results
- Review the system test plan
- Identify and evaluate risks. Recommend risk mitigation activities.
- Document the closing of all action items since TRR. Make recommendations for open actions and new actions.

Standard CTR entry criteria:

- Entry # 1 - A Test Readiness Report (TRRR) has been written. The CTR reviewers have access to the current baseline version of the TRRR.
- Entry # 2 -A Development Project Plan (DPP) has been written. The CTR reviewers have access to the current baseline version of the DPP.
- Entry # 3 - A Requirements Allocation Document (RAD) has been written. The CTR reviewers have access to the current baseline version of the RAD.
- Entry # 4 - A Software Architecture Document (SWA) has been written. The CTR reviewers have access to the current baseline version of the SWA.
- Entry # 5 - Detailed Design Documents (DDDs) have been written for each software unit in the software architecture. The CTR reviewers have access to the current baseline version of each DDD.
- Entry # 6 – A Unit Test Plan (UTP) has been written. The CTR reviewers have access to the current baseline version of the UTP.

- Entry # 7 – Pre-operational code units, external interfaces, ancillary data, unit test data and unit test results are in the development test environment. The CTR reviewers have access to this code, test data and test results.
- Entry # 8 – A Unit Test Report (UTR) has been written. The CTR reviewers have access to the current baseline version of the UTR.
- Entry # 9 - A Verification and Validation Plan (VVP) has been written. The CTR reviewers have access to the current baseline version of the VVP.
- Entry # 10 - A System Test Plan (STP) has been written. The CTR reviewers have access to the current baseline version of the STP.
- Entry # 11 - A Project Baseline Report (PBR) has been written. The CTR reviewers have access to the current baseline version of the PBR.
- Entry # 12 - A Code Test Document (CTD) has been written. The CTR reviewers have access to the current baseline version of the CTD.

Standard CTR exit criteria:

- Exit # 1 - TRR "Conditional Pass" items have been satisfactorily disposed of.
- Exit # 2 - TRR "Defer" items have been satisfactorily disposed of.
- Exit # 3 – Changes to the project plan since TRR are approved.
- Exit # 4 - Requirements allocation changes since TRR are approved.
- Exit # 5 - Changes to external interfaces since TRR are approved.
- Exit # 6 - Changes to the software architecture since TRR are approved.
- Exit # 7 - Changes to the detailed design since TRR are approved.
- Exit # 8 - Changes to the verification and validation plan since TRR are approved.
- Exit # 9 – Code units and unit test data are satisfactory
- Exit # 10 – Unit test results and UTR are satisfactory
- Exit # 11 - The system test plan and STP are satisfactory
- Exit # 12 - The project baseline and PBR are satisfactory.
- Exit # 13 - The CTRR documents updated status of project risks and actions.
- Exit # 14 - Project risks and actions are acceptable. The project is ready for system integration and system testing.

Refer to PRG-10 for a more detailed description of the CTR. The standard CTR entry criteria, exit criteria, and check list is documented in the process asset CL-10 (c.f. Section 2).

CTR 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 CTR.

3.8. System Readiness Review

System Readiness Review (SRR) is the final Build Phase Technical Review prior to Gate 5. Its purpose is to determine whether the pre-operational product system satisfies its functional and performance requirements, and is ready for installation in the operations environment. Upon successful completion of SRR, preparations are made for a Gate 5 review of readiness for transition to operations.

Standard SRR objectives:

- Identify relevant stakeholders and document their involvement according to the project plan.
- Review the CTRR, identifying risks and actions to be addressed
- Review the system requirements, identifying requirements and requirements allocation changes since CTR.
- Review the system description, including external interfaces, software architecture and detailed design, identifying changes since CTR.
- Review and confirm the system readiness for operations and maintenance, based on the results of system testing and the availability of required code and operations documentation.
- Review and confirm the system readiness for users, based on the results of system testing and the availability of required user documentation.
- Identify and evaluate risks. Recommend risk mitigation activities.
- Review the status of all actions identified to mitigate risks. Make recommendations for open actions and new actions.

Standard SRR entry criteria:

- Entry # 1 - A Code Test Review Report (CTRR) has been written. The SRR reviewers have access to the current baseline version of the CTRR.
- Entry # 2 - A Development Project Plan (DPP) has been written. The SRR reviewers have access to the current baseline version of the DPP.
- Entry # 3 - An Operations Concept Document (OCD) has been written. The SRR reviewers have access to the current baseline version of the OCD.
- Entry # 4 - A Requirements Allocation Document (RAD) has been written. The SRR reviewers have access to the current baseline version of the RAD.
- Entry # 5 - An Algorithm Theoretical Basis Document (ATBD) has been written. The SRR reviewers have access to the current baseline version of the ATBD.
- Entry # 6 -A Software Architecture Document (SWA) has been written. The SRR reviewers have access to the current baseline version of the SWA.
- Entry # 7 - A Detailed Design Document (DDD) for each software unit has been written. The SRR reviewers have access to the current baseline version of the DDDs.
- Entry # 8 -An Internal Users Manual (IUM) has been written. The SRR reviewers have access to the current baseline version of the IUM.
- Entry # 9 - An External Users Manual (EUM) has been written. The SRR reviewers have access to the current baseline version of the EUM.
- Entry # 10 - A Metadata Document (MDD) has been written. The SRR reviewers have access to the current baseline version of the MDD.
- Entry # 11 - Pre-operational code units, external interfaces, ancillary data, and system test data have been integrated into a product processing system in the development test environment. The SRR reviewers have access to the product processing system.
- Entry # 12 – A Verification and Validation Plan (VVP) has been written. The SRR reviewers have access to the current baseline version of the VVP.
- Entry # 13 - A System Test Plan (STP) has been written. The SRR reviewers have access to the current baseline version of the STP.
- Entry # 14 - A Verification and Validation Report (VVR) has been written. The SRR reviewers have access to the current baseline version of the VVR.

- Entry # 15 - A System Readiness Document (SRD) has been written. The SRR reviewers have access to the current baseline version of the SRD.
- Entry # 16 - A Project Baseline Report (PBR) has been written. The SRR reviewers have access to the current baseline version of the PBR.

Standard SRR exit criteria:

- Exit # 1 - CTR "Conditional Pass" items have been satisfactorily disposed of.
- Exit # 2 - CTR "Defer" items have been satisfactorily disposed of.
- Exit # 3 - The project plan and DPP are satisfactory
- Exit # 4 - The requirements allocation and RAD are satisfactory.
- Exit # 5 - The algorithm and ATBD are satisfactory.
- Exit # 6 - The design documents (SWA and DDDs) are satisfactory.
- Exit # 7 - The metadata and MDD are satisfactory.
- Exit # 8 - The delivery procedures, tools, training, support services, and documentation available to the users are satisfactory.
- Exit # 9 - System test results and VVR are satisfactory.
- Exit # 10 - The project baseline and PBR are satisfactory.
- Exit # 11 - The SRRR documents updated status of project risks and actions. The risk status is acceptable.
- Exit # 12 - The integrated product processing system is ready for delivery to operations.

Refer to PRG-11.1 for a more detailed description of the SRR. The standard SRR entry criteria, exit criteria, and check list is documented in the process asset CL-11.1 (c.f. Section 2).

SRR 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 SRR.

3.9. Gate 5 Review

Gate 5 is the final review of the project status readiness before it is transitioned to operations, under the joint direction of STAR and SPSRB. Its purpose is to determine whether operations is ready to receive the pre-operational system from the developers. If a project passes Gate 5, the pre-operational system and all associated artifacts are delivered to operations.

Standard Gate 5 Review objectives:

- Review the implementation of the Integrated Master Plan (IMP) and Integrated Master Schedule (IMS)
- Review the technical status and risks of the project
- Review the cost status and risks of the project
- Review the schedule status and risks of the project
- Determine whether corrective actions are needed to allow the project to proceed to operations as planned.
- Determine whether a re-plan and a delta Gate 5 Review are needed.

Standard Gate 5 Review entry criteria:

- Entry # 1 - A System Readiness Review Report (SRRR) has been written. The Gate 5 reviewers have access to the current baseline version of the SRRR.
- Entry # 2 - A Development Project Report (DPR) has been written. The Gate 5 reviewers have access to the current baseline version of the DPR.
- Entry # 3 - A Project Status Report (PSR) has been written. The Gate 5 reviewers have access to the current baseline version of the PSR.

- Entry # 4 - A Gate 5 Document (G5D) has been written. The Gate 5 reviewers have access to the current baseline version of the G5D.
- Entry # 5 - A Project Baseline Report (PBR) has been written. The Gate 5 reviewers have access to the current baseline version of the PBR.

Standard Gate 5 Review exit criteria:

- Exit # 1 – SRR status and SRRR are satisfactory
- Exit # 2 – DPR is satisfactory.
- Exit # 3 - Project status and PSR are satisfactory.
- Exit # 4 - Project baseline and PBR are satisfactory.
- Exit # 5 - Project risks are acceptable.
- Exit # 6 - Status of risk mitigation actions is acceptable
- Exit # 7 - Project is ready for delivery to operations

Refer to PRG-11.2 for a more detailed description of the Gate 5 Review. The standard Gate 5 Review entry criteria, exit criteria, and check list is documented in the process asset CL-11.2 (c.f. Section 2).

Gate 5 Review 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 Gate 5 Review.

4. 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.

Responsibility for producing project artifacts is assigned to stakeholders during the Plan phase, and may be tailored from the standard assignment. The project artifacts that are usually the responsibility of **Development Leads** are listed in Table 4.1.

TABLE 4.1 – Development Lead Artifacts

Artifact	Type
Project Proposal	Presentation
Development Project Plan	Document
Project Status Report	Report
Project Status Report Appendix	Report
Gate 3 Document	Presentation
Project Requirements Document	Presentation
Preliminary Design Document	Presentation
Critical Design Document	Presentation
Gate 4 Document	Document
Test Readiness Document	Presentation
Code Test Document	Presentation
System Readiness Document	Presentation
Gate 5 Document	Presentation
Development Project Report	Report

Project Proposal: The Project Proposal (PP) is produced for the Gate 2 Review. SPSRB and STAR will review the project proposal to determine whether the project should be approved for transition from research to operations. SPSRB requires a User Request to initiate this review. STAR standards call for the project proposal to include this User Request, and describe the supporting artifacts (research code and test data, ATBD, SWA). The PP should provide the information needed for a Technical Assessment and Cost Assessment. Refer to DG-3.1 for detailed PP guidelines.

Development Project Plan: 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. Refer to DG-5.1 for detailed DPP guidelines.

Project Status Report: The Project Status Report (PSR) is used to manage and control the execution of the project. It complements the DPP by noting the current status of the project tasks, work products, cost, and schedule. Refer to DG-5.2 for detailed PSR guidelines.

Project Status Report Appendix: The PSR Appendix is a Microsoft Excel workbook that provides the current status of project risks and risk mitigation actions. Refer to DG-5.2.A for detailed PSR Appendix guidelines.

Gate 3 Document: The Gate 3 Document (G3D) consists of the presentation slides for the Gate 3 Review. Refer to DG-5.3 and DG-5.3.A for detailed G3D guidelines.

Operations Concept Document: The Operations Concept Document (OCD) is a technical document created by the development team to describe how the users' vision can be realized in an operational environment. Refer to DG-6.1 for detailed OCD guidelines.

Requirements Allocation Document: 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. Refer to DG-6.2 for detailed RAD guidelines.

Verification and Validation Plan: 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. 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.

Preliminary Design Document: The Preliminary Design Document (PDD) consists of the presentation slides for the Preliminary Design Review (PDR). Refer to DG-7.1 and DG-7.1.A for detailed PDD guidelines.

Critical Design Document: The Critical Design Document (CDD) consists of the presentation slides for the Critical Design Review (CDR). Refer to DG-8.2 and DG-8.2.A for detailed CDD guidelines.

Gate 4 Document: The Gate 4 Document (G4D) consists of the presentation slides for the Gate 4 Review. Refer to DG-8.4 and DG-8.4.A for detailed G4D guidelines.

Test Readiness Document: The Test Readiness Document (TRD) consists of the presentation slides for the Test Readiness Review (TRR). Refer to DG-9.2 and DG-9.2.A for detailed TRD guidelines.

Code Test Document: The Code Test Document (CTD) consists of the presentation slides for the Code Test Review (CTR). Refer to DG-10.3 and DG-10.3.A for detailed CTD guidelines.

System Readiness Document: The System Readiness Document (SRD) consists of the presentation slides for the System Readiness Review (SRR). Refer to DG-11.5 and DG-11.5.A for detailed SRD guidelines.

Gate 5 Document: The Gate 5 Document (G5D) consists of the presentation slides for the Gate 5 Review. Refer to DG-11.7 and DG-11.7.A for detailed G5D guidelines.

Development Project Report: The Development Project Report (DPR) provides the development team's assessment of their experience in implementing the project, including lessons learned and recommendations for process improvement. Refer to DG-11.9 for detailed DPR guidelines.

5. TASK DESCRIPTION

Development Leads participate in the following process steps:

- Step 4 - Resource Identification (TG-4)
- Step 5 - Project Plan (TG-5)
- Step 6 - Project Requirements (TG-6)
- Step 7 - Preliminary Design (TG-7)
- Step 8 - Detailed Design (TG-8)
- 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 standard **Development Lead** tasks for each of these steps are described below. **Development Leads** may also refer to the relevant TGs for a complementary task description.

5.1 Resource Identification Tasks

Figure 5.1 shows the process flow for step 4.

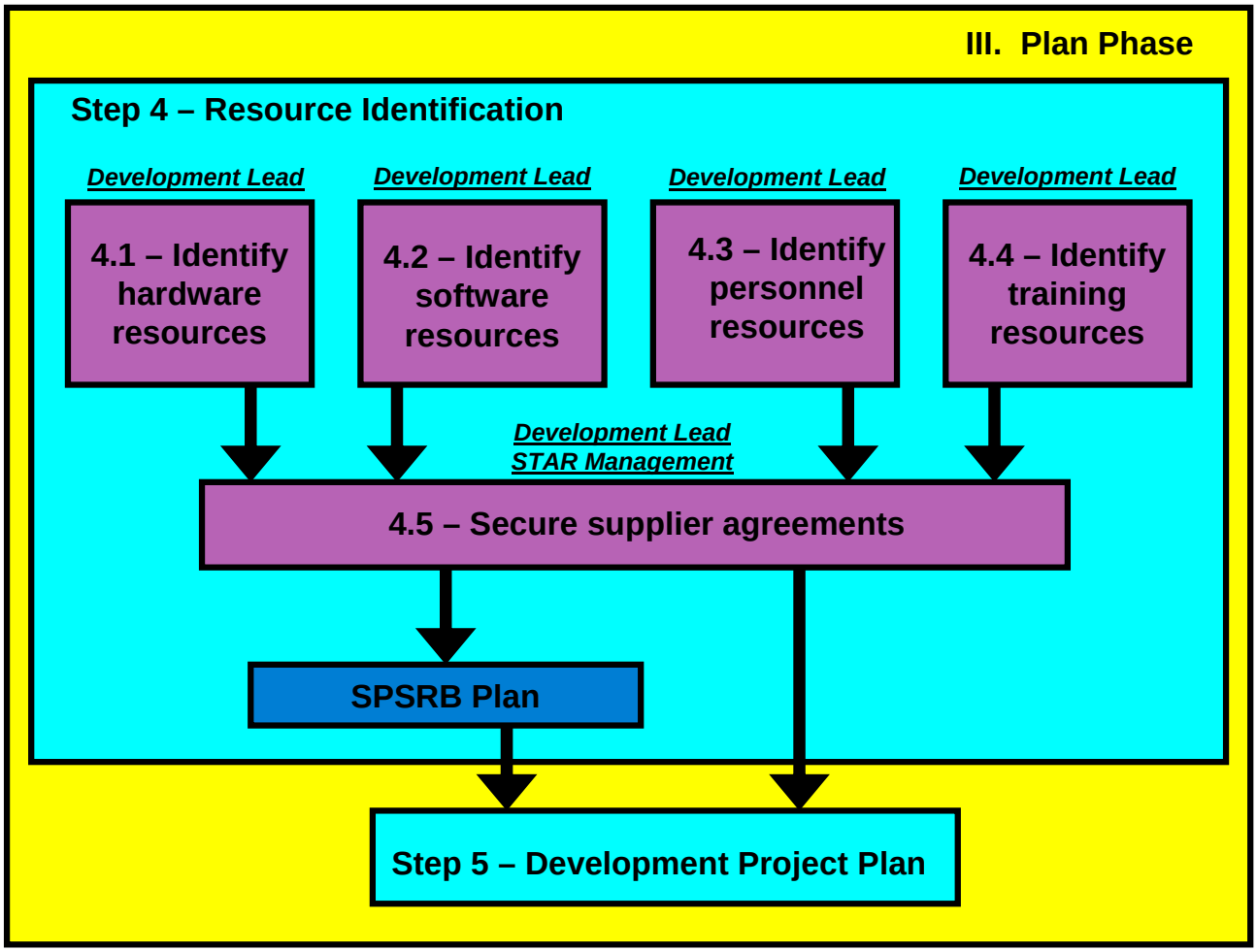

Figure 5.1 – Step 4 Process Flow

5.1.1 Expected BEGIN State

- The research algorithm has been matured and documented in ATBD v1r1
- A software architecture has been matured and documented in SWA v1r1
- R&D code test results, documented in ATBD v1r1, demonstrate that the algorithm's operational potential warrants development.

- A STAR Division and Branch has been selected to implement Development.
- A Development Lead has been selected.
- A Project Proposal has been presented to SPSRB
- The project has received SPSRB approval for development

5.1.2 Task Inputs

Project Proposal: The Project Proposal (PP) is produced for the Gate 2 Review. SPSRB and STAR will review the project proposal to determine whether the project should be approved for transition from research to operations. SPSRB requires a User Request to initiate this review. STAR standards call for the project proposal to include this User Request, and describe the supporting artifacts (research code and test data, ATBD, SWA). The PP should provide the information needed for a Technical Assessment, a Cost Assessment, and Resource Identification.

5.1.3 Desired END State

- Required and available resources (hardware, software, personnel, and training) have been identified.
- An SPSRB Project Plan that identifies these resources has been written

5.1.4 Task Outputs

- Identified hardware resources
- Identified software resources
- Identified personnel resources
- Identified training resources
- Supplier agreements
- SPSRB Plan

5.1.5 Stakeholder Activities

The designated **Development Lead** leads the “Resource Identification” step:

The **Development Lead** and **STAR Management**, in consultation with the **SPSRB**, should identify resources for implementation of the Development Project. Resource identification includes hardware, software, personnel, and training resources.

The **Development Lead** and **STAR Management** should determine which resources can be obtained internally and which should be acquired from external suppliers. The latter should be secured with supplier agreements. These can be formal agreements (e.g., Contracts and Statement of Work (SOW) with contractors, Memorandum of Understanding (MOU) with other Government agencies) or informal agreements. Informal agreements may introduce risk, depending upon the reliability and history of the suppliers.

The **Development Lead**, in consultation with the **SPSRB**, should produce an SPSRB Plan. The identified resources should be included in the SPSRB Plan. The SPSRB Plan, produced in collaboration with the SPSRB, follows SPSRB guidelines and is therefore not a STAR EPL artifact.

Once all resources have been identified and supplier agreements secured, **STAR Management** directs the **Development Lead** to proceed with step 5 (Development Project Plan).

Each stakeholder who performed activities during step 4 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).

5.2 Project Plan Tasks

Figure 5.2 shows the process flow for step 5.

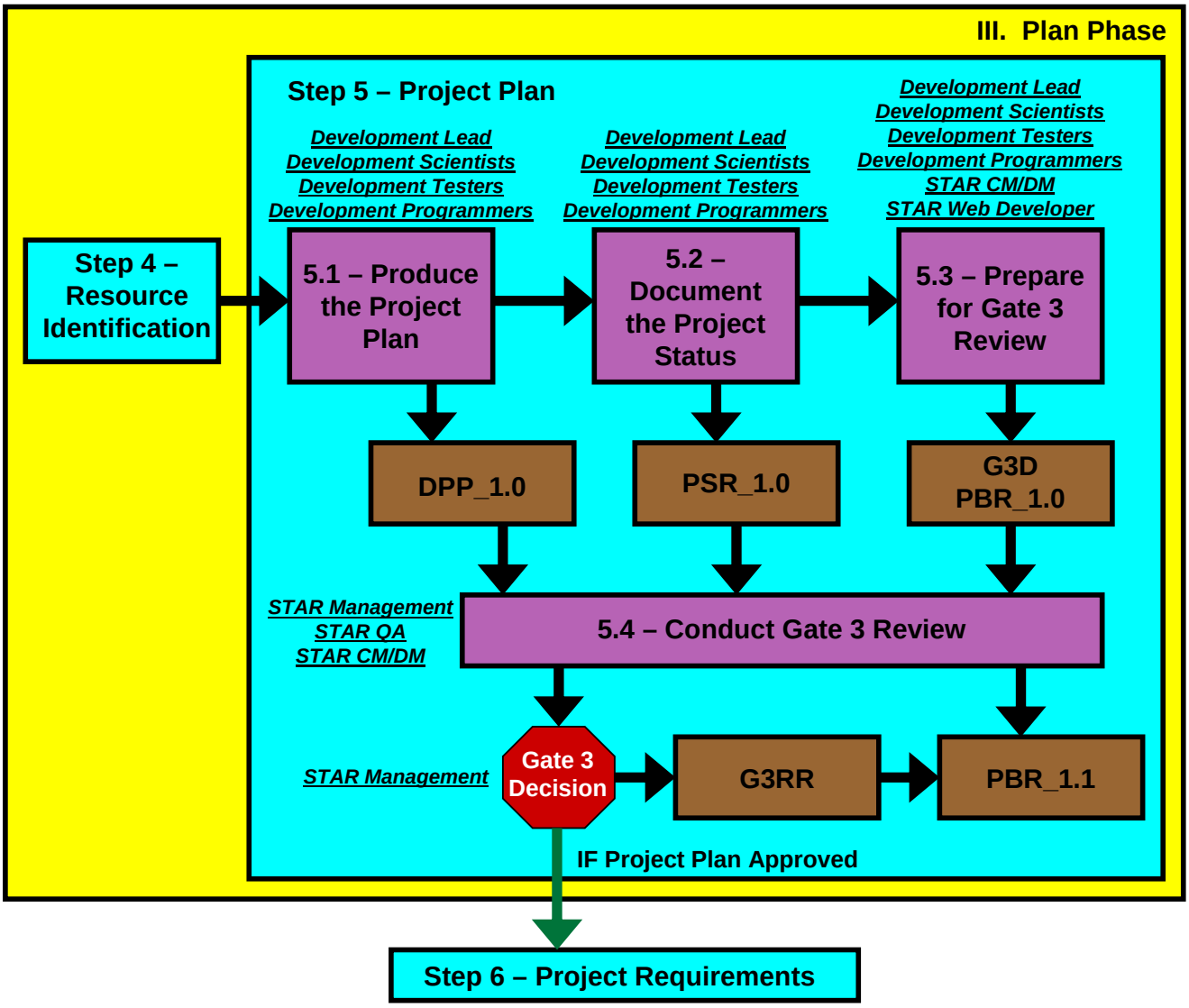

Figure 5.2 – Step 5 Process Flow

5.2.1 Expected BEGIN State

- REQUIRED: A project proposal (PP) that includes a User Request has been reviewed at a Gate 2 Review
- REQUIRED: The project has been approved for development by STAR and SPSRB.
- REQUIRED: A STAR Division and Branch has been selected to implement Development, and a Development Lead has been identified.
- REQUIRED: Required and available resources (hardware, software, personnel, and training) have been identified.
- REQUIRED: An SPSRB Project Plan that identifies these resources has been written.
- EXPECTED: The research algorithm has been matured and documented in an Algorithm Theoretical Basis Document (ATBD).
- EXPECTED: A software architecture has been matured and documented in a Software Architecture Document (SWA).
- EXPECTED: Research and Development (R&D) code has been written.
- EXPECTED: R&D code has been run with research test data to produce proxy data products.
- EXPECTED: R&D code test results are documented in the ATBD.

The **Development Lead** should confirm that the REQUIRED items of the expected BEGIN state are in place at the commencement of step 5. If there are deficiencies, actions must be taken to correct this.

The **Development Lead** should determine whether there are any missing EXPECTED items. If so, risk should be assessed and actions assigned as deemed necessary to correct this. Corrective actions on the EXPECTED items are at the discretion of the **Development Lead**, and may be performed during step 5 or later, but the **Development Lead** should consider that the Gate 3 Review of project status may determine that missing EXPECTED items must be produced prior to Gate 3 Review approval.

5.2.2 Task Inputs

- Algorithm Theoretical Basis Document
- Software Architecture Document
- R&D Code
- R&D Test Data
- Project Proposal
- Gate 2 Review Report
- SPSRB Project Plan

5.2.3 Desired END State

- Project objectives and concept of operations have been derived from user/customer needs and expectations
- Project stakeholders have been identified
- The project's process has been defined, by tailoring the STAR EPL set of standard processes. The defined process includes the project lifecycle steps, project reviews, review artifacts, work products, and Baseline Builds (BB).
- The planned work has been organized into an Integrated Master Plan (IMP) and Integrated Master Schedule (IMS).
- Expected project costs and cost schedule have been identified
- Project risks have been identified and assessed
- Risk mitigation actions have been identified
- The initial version of the DPP has been written
- Project status has been documented in the initial version of the PSR
- Risks and actions have been documented in an Appendix to the PSR
- A Gate 3 Review of the project plan and project status has been conducted
- A Gate 3 Review Report (G3RR) has been written, approving the project for the Design phase.

- Baseline Build (BB) 1.1 has placed the required items in the project artifact repository
- PBR_1.1 documents the status of the BB 1.1 project baseline

5.2.4 Task Outputs

Task outputs consist of the following BB 1.1 items:

- Development Project Plan (DPP)
- Project Status Report (PSR)
- Project Risks and Actions (PSR Appendix)
- Gate 3 Document (G3D)
- Gate 3 Review Report (G3RR)
- Project Baseline Report (PBR)

5.2.5 Stakeholder Activities

Step 5 activities include:

1) Produce the project plan
2) Document the project status
3) Prepare for Gate 3 Review
4) Conduct Gate 3 Review

5.2.5.1 Produce Project Plan

The **Development Lead** oversees the preparation of a DPP. The DPP is a required artifact for the Gate 3 Review. The process flow for producing the project plan is shown in Figure 5.3.

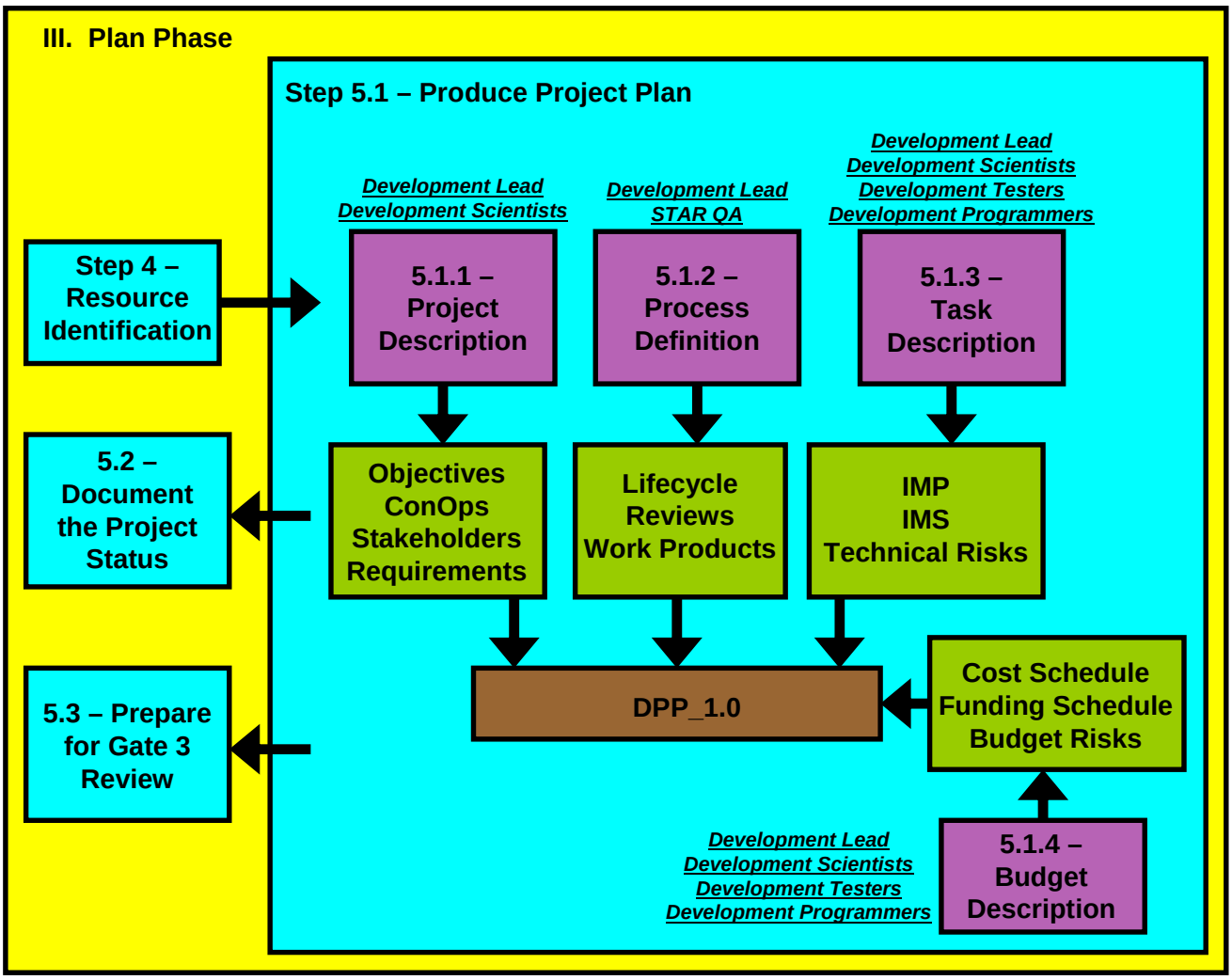

Figure 5.3 – "Produce Project Plan" Process Flow

Step 5.1 activities include:

1) Project description
2) Process definition
3) Task description
4) Budget description

The **Development Lead** provides the project description, with assistance from **Development Scientists**.

The project description should include project objectives, derived from user needs and expectations. The SPSRB Project Plan and the PP should contain this information.

Provide an initial description of the customer/user's concept of operations (ConOps) from which requirements will be derived. If a customer ConOps document exists, use it as a reference. Review the ATBD, which may contain this information. Consult with the Research phase stakeholders and with PUSH users to ensure that ConOps information is adequately captured in the DPP.

Identify project stakeholders. For each stakeholder, note the rationale for their involvement, their roles and their responsibilities. Consult with the stakeholders throughout step 5 to ensure that they understand their planned involvement in the development phases. Secure stakeholder commitment to the plan.

Provide an initial description of project requirements. At this step of the lifecycle, requirements are primarily basic product requirements. These should be derived from customer/user documents (User Request, ConOps). The PP and the SPSRB Project Plan should have captured these. Consult with the customers and users to ensure that basic product requirements are adequately captured in the DPP.

The **Development Lead** provides the process definition, with assistance from **STAR QA**.

The project's process is defined by tailoring the STAR EPL set of standard processes.

The defined process begins with the project lifecycle steps. The standard process includes 11 steps that take a product from initial conception through delivery to operations. Steps 1-4 should have already occurred. The **Development Lead** should examine the project

status at the commencement of step 5 to determine whether the step 5 BEGIN state is acceptable, and assign corrective actions as needed to backfill the steps 1-4 practices.

The standard project reviews for steps 5-11 are an important component of the defined process. The standard process defines review objectives, entry criteria, exit criteria, and CLI. These are documented in the process assets (PRGs and CLs). **Development Lead** should consult with **STAR QA** to determine if the reviews should be tailored. Possible tailoring includes:

- Combining reviews. This can save time and money, for projects under tight budget and/or schedule constraints. This introduces risk, as each review is designed so that the accomplishment of the review objectives helps to lower risk factors for the next review. The balance of cost/schedule savings with risks is something that depends on the unique characteristics of each project. Refer to the process tailoring guidelines (PG-2) for help in achieving this balance.
- Modifying review objectives. This will occur if reviews are combined, as the combined review must meet combined objectives. This is a relatively benign modification. Greater care should be taken when considering the deletion of review objectives. Risk must be carefully assessed and a rationale for incurring such a risk must be clear and convincing.
- Waiving review artifacts. This can also save time and money, but will also introduce risk. The balance of cost/schedule savings with risks is something that depends on the unique characteristics of each project. Refer to the process tailoring guidelines (PG-2) for help in achieving this balance.
- Revising entry criteria, exit criteria, and CLIs. These are customarily revised to accommodate the tailoring of review objectives and review artifacts. It is important to ensure that the tailored review objectives will be met if these revisions are made.

Development Lead should consult with **STAR QA** to determine if the standard set of work products should be tailored. The set of work products is closely related to the tailored set of review artifacts. If there are waived artifacts, the work products that contribute to or constitute the artifacts may also be waived. Consider the risk of waiving the work products at the same time that the risk of waiving review artifacts is considered. Customarily, the standard set of work products is tailored by reduction, but there may be cases where work products that are not included in the standard set are selected for the project. Work products may be added either to respond directly to customer-derived basic requirements or to reduce risk. **Development Lead** should be alert to this possibility.

The standard process includes 16 Baseline Builds (BB) during steps 5-11. The contents of each build may be tailored to accommodate the tailored set of review artifacts and work products.

The **Development Lead** provides the description of the tasks that have been identified to accomplish the defined process, with assistance from **Development Scientists, Development Testers,** and **Development Programmers**.

The task description begins with the listing of tasks that are identifiable from the point of view of customers and end users. High-level tasks from the user's point of view are typically oriented to creation, delivery and maintenance of products. They can also include validation of products. These should be obtainable from the PP and from customer requirements documents. These tasks are called the "work tasks", as they are typically the kind of tasks that are stated in a Statement of Work (SOW).

The work tasks should be translated into "major tasks". These are the highest-level tasks that will be included in the Integrated Master Plan (IMP) and entered into a Microsoft Project file. Examples of high level tasks: "Develop requirements", "Develop interfaces", "Develop software units".

Once the major tasks have been identified, they can be organized into the IMP. The IMP provides a detailed roadmap for meeting project requirements. For each major task:

- Identify the project objective, project requirement and/or SOW item that is satisfied, completely or partially, by the accomplishment of the task.
- Identify the stakeholders that are affected by the activity and those who have expertise that is needed to conduct the activity
- Identify predecessor tasks and successor tasks.
- Identify the criteria for initiating the task. Typically, this will consist of satisfying the accomplishment criteria for predecessor tasks.
- Identify subtasks, to the extent possible.
- Identify the task's work products
- Identify the criteria for task accomplishment
- Identify the review or reviews at which the task's accomplishment's will be verified

Create an Integrated Master Schedule (IMS) by mapping the IMP to a calendar-based schedule, based on the estimate of effort and available resources for each task and its sub-tasks. The IMS is used to track day-to-day progress and includes the continual assessment of the technical parameters required to support each IMP task/event.

The IMS should be in a separate file that is an Appendix to the DPP. It is very useful to translate the IMS into a resource-loaded schedule in a Microsoft Project file. This file should include all of the major tasks, subtasks and milestones that were identified in the IMP, with their identified linkages. An alternative to a Project file is a Microsoft Excel file that puts each task in a row on a spreadsheet and includes associated data (predecessor tasks, successor tasks, assigned stakeholders, start data, end date) in distinct columns. An Excel file can be more accessible, but lacks the project control features of a Project file.

Identify potential risks to the successful technical implementation of the tasks. For each identified risk, provide a plan for managing the risk. A detailed assessment of risks and risk mitigation actions will be provided in the Project Status Report (PSR) Appendix (c.f. Section 6.4.2).

The **Development Lead** provides the budget description. The budget description includes the estimate of the costs that will be incurred during the implementation of the IMP, the cost schedule that is expected to correspond to the IMS, and the funding schedule that has been established or is expected. The costs are estimated by use of historical models and/or projections of the effort. In either case, the description of the tasks and the attributes of the defined work products are used as data to make the cost estimates. The cost schedule is determined by mapping the costs of the tasks and work products to the scheduled implementation of these tasks and work products. Refer to DG-5.1 for suggestions and guidelines.

The budget description also includes the expected schedule of funding. Identify the funding sources and the mechanisms for delivering the required funding in a timely manner. This information should be available from the SPSRB Project Plan. Ensure that all funding agreements between stakeholders are understood and documented. Compare the available funding schedule to the cost schedule. Identify the difference between the two. This difference (available funding minus the cost) is the “real cost margin”. Negative cost margins should be identified as a cost risk.

The DPP Document Guidelines (DG-5.1) are strongly recommended to the DPP writers. DG-5.1 provides the standard DPP Table of Contents and guidelines for each standard DPP section.

In addition to DG-5.1, the STAR PAR should include examples of DPPs from other projects. These will be very helpful to DPP writers who have not previously written a DPP.

DPP writers should also use the SPSRB Project Plan and SPSRB User Request as resources for the DPP. These artifacts typically include information that can be adopted for the DPP.

5.2.5.2 Document Project Status

The **Development Lead** oversees the preparation of a PSR in accordance with PSR guidelines DG-5.2 and DG-5.2.A. The PSR is a required artifact for the Gate 3 Review. **Development Scientists, Development Testers,** and **Development Programmers** assist the **Development Lead** in the PSR preparation.

Project status includes:

1) Stakeholder Involvement
2) Task Progress
3) Schedule
4) Budget
5) Risks

The planned involvement of the stakeholders should be documented in the DPP. The PSR should report the status of stakeholder involvement with respect to the plan. The **Development Lead** should communicate with each stakeholder who has a role in the current phase of the project to ensure that the stakeholders are involved as planned. **Development Lead** should Identify instances of non-involvement, assess the impact of the non-involvement, and determine corrective actions.

The PSR should report the status of task progress for each task that is documented in the DPP. The **Development Lead** should request task status from the **Development Scientists, Development Testers,** and **Development Programmers** on a regular basis. If task progress is falling behind schedule, determine what factors are responsible (e.g., unexpected technical difficulty, delays in predecessor tasks, non-involvement of stakeholders, training gaps). **Development Lead** should record updated task status in a Microsoft Project file and/or Microsoft Excel IMS file.

The PSR should report the status of task progress with respect to the task schedule that is documented in the DPP. The **Development Lead** should record updated task progress against the task schedule in the Microsoft Project file and/or Microsoft Excel IMS file. If an EVMS is being used, determine the Schedule Performance Index (SPI). The **Development Lead** should ensure that any significant schedule delays are captured as schedule risks.

The PSR should report the status of cost expenditures with respect to the cost schedule that is documented in the DPP. The **Development Lead** should request cost expenditure data from program managers on a regular basis. If an EVMS is being used, determine the Cost Performance Index (CPI). The **Development Lead** should also ensure that project funds are being allocated according to the expected funding schedule that is documented in the DPP. Any significant deviations in cost and/or funding schedule should be captured as budget risks.

The PSR includes an Appendix that reports the current status of project risks and associated risk mitigation actions. The **Development Lead** has the primary responsibility for documenting this status. Risk status includes the identification of risks, quantitative risk assessment, identification of actions to mitigate the risks, action closure criteria, assignment of responsibility for closing the action, and an action closure plan. The **Development Lead** should request assistance from **Development Scientists, Development Testers,** and **Development Programmers**.

The PSR Document Guidelines (DG-5.2 and DG-5.2.A) are strongly recommended to the PSR writers. DG-5.2 provides the standard PSR Table of Contents and guidelines for each standard PSR section. DG-5.2.A provides the guidelines for the PSR Appendix, which is a Microsoft Excel workbook that documents the status of project risks and risk mitigation actions.

In addition to DG-5.2 and DG-5.2.A, the STAR PAR should include examples of PSRs from other projects. These will be very helpful to PSR writers who have not previously written a PSR. Note that the final project PSR will reflect status at the completion of a project, when most issues have been resolved, most risks have been closed, and most actions have been completed. Examine the STAR PAR for examples of PSR versions that were produced for a Gate 3 Review. These are more indicative of what a PSR should look like at this stage of the project lifecycle.

PSR writers should also use the G2RR as a resource for the PSR Appendix. The G2RR typically documents risks and actions that are identified at the Gate 2 Review. The risks and actions identified in the PSR Appendix should be built from these.

5.2.5.3 Prepare Gate 3 Review

The **Development Lead** leads the preparation of the Gate 3 Review presentation. The presentation slide package is the Gate 3 Document (G3D). The G3D is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with G3D guidelines DG-5.3. DG-5.3.A provides G3D slide templates that can be adapted for the project's G3D. The G3D developers should examine the DPP to determine whether the Gate 3 Review objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the G3D slide templates must be adapted to accommodate the tailoring.

The **Development Lead** determines which members of the development team will present the G3D sections. These presenters should be noted in Section Title slides. See DG-5.3.A for examples.

The **Development Lead** informs the **Gate 3 Reviewers** when the Gate 3 Review artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

STAR Managers 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 **STAR Management** concerns.

5.2.5.4 Conduct Gate 3 Review

The "Project Plan" step culminates with a Gate 3 Review.

The Gate 3 Review consists of the presentation of the project plan and project status 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 (**STAR Management**).

On the basis of its disposition of the G3R CLI, the **STAR Management** determines whether the project is ready to proceed to the next step, “Project Requirements”. If not, the Gate 3 Review Report (G3RR) should direct the **Development Lead** to revise the G3R artifacts through specified actions.

Each stakeholder who performed activities during step 5 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).

5.3 Requirement 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 5.4 illustrates the Requirements Development process, with step 6 highlighted.

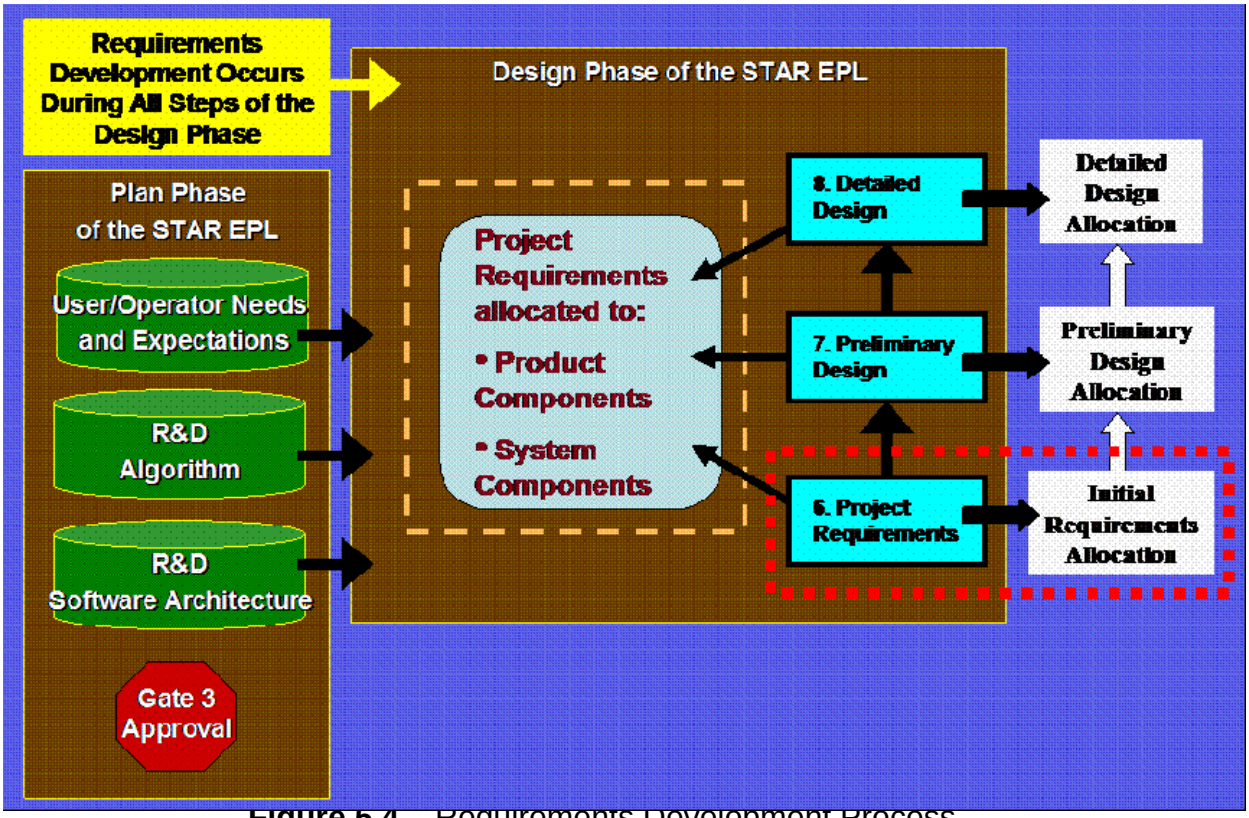

Figure 5.4 – Requirements Development Process

As Figure 5.4 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 5.5 illustrates this.

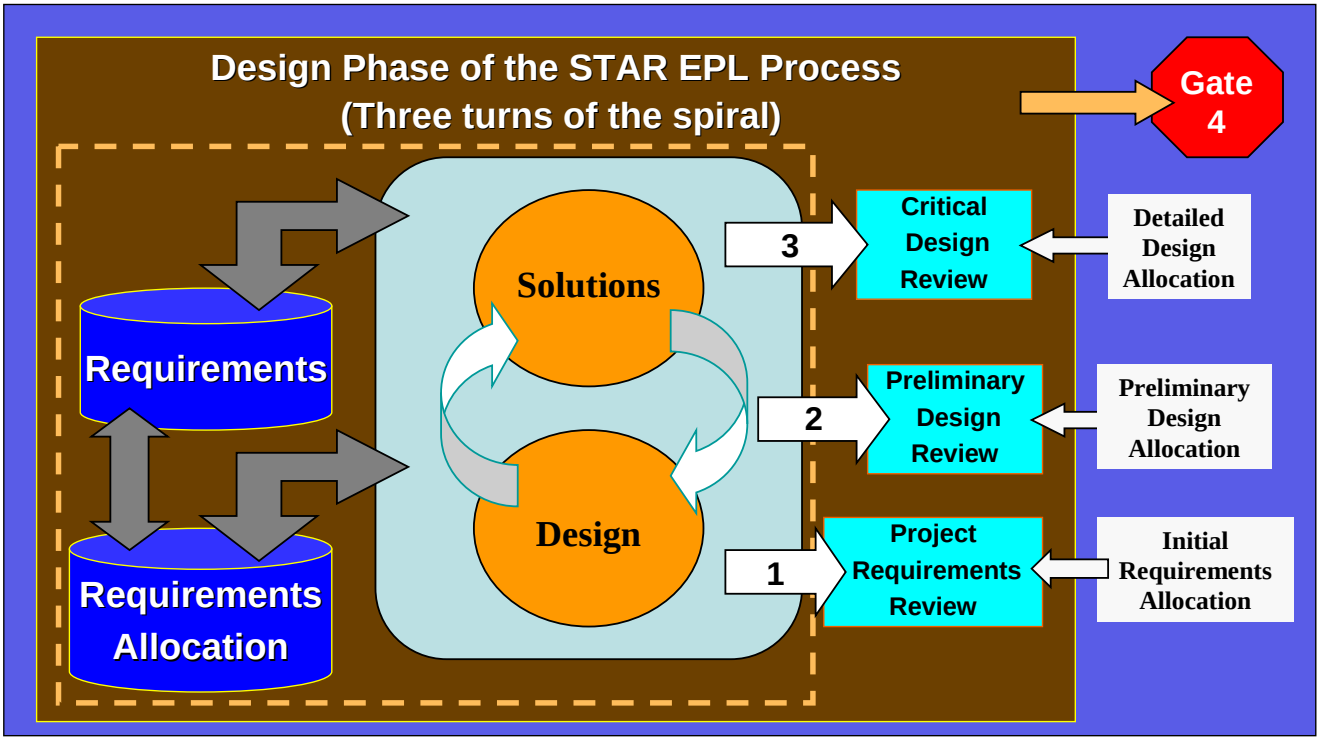

Figure 5.5 – Iterative (Spiral) Development of Requirements Allocation

As shown in Figure 5.5, 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.

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..

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.

5.4 Project Requirements Tasks

Figure 5.6 shows the process flow for step 6.

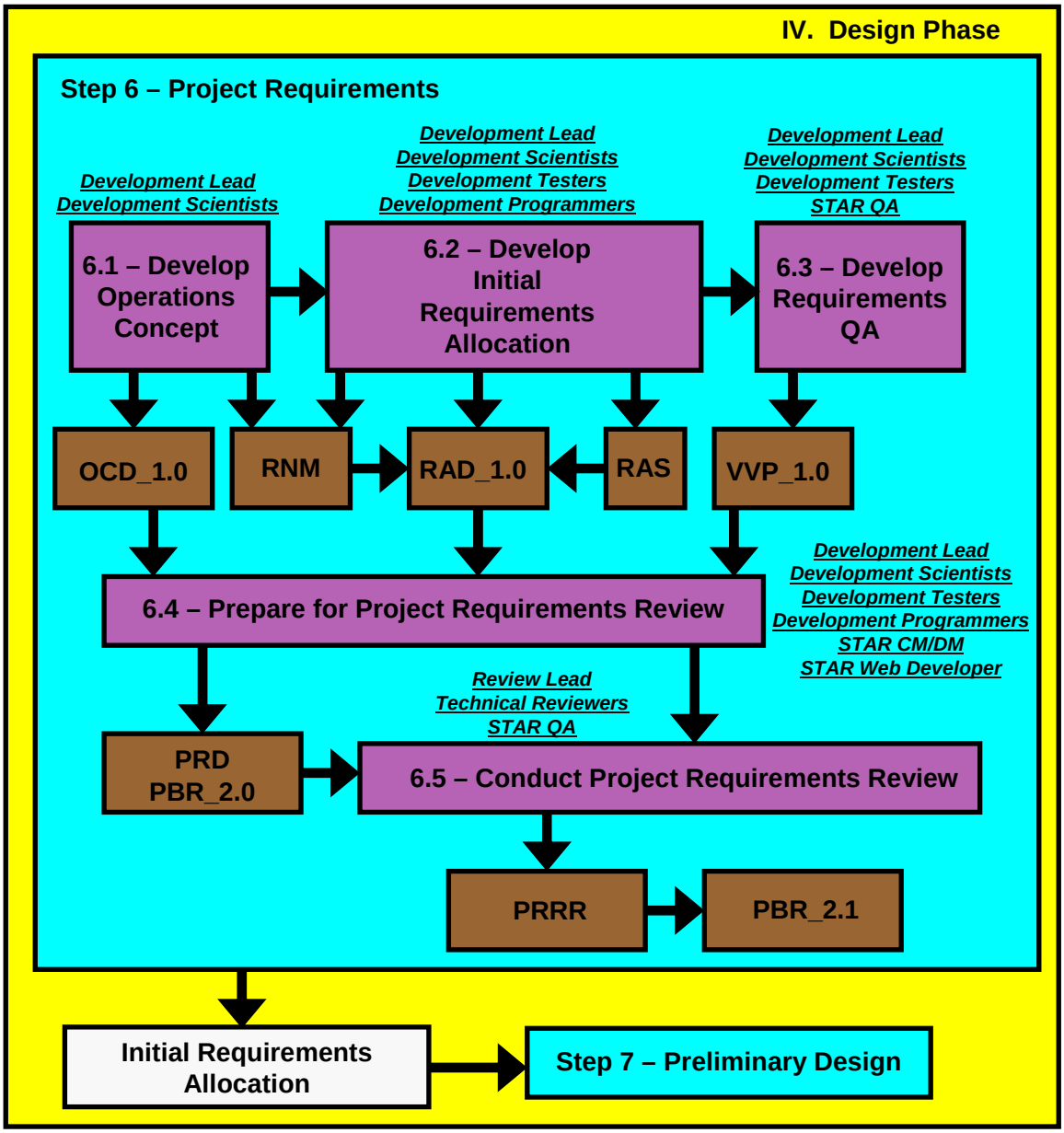

Figure 5.6 – Step 6 Process Flow

5.4.1 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.

5.4.2 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)

5.4.3 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.

5.4.3.1 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.

5.4.4 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

5.4.5 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

5.4.6 Stakeholder 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

5.4.6.1 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.

5.4.6.2 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 5.7 shows the process flow for developing the initial requirements allocation.

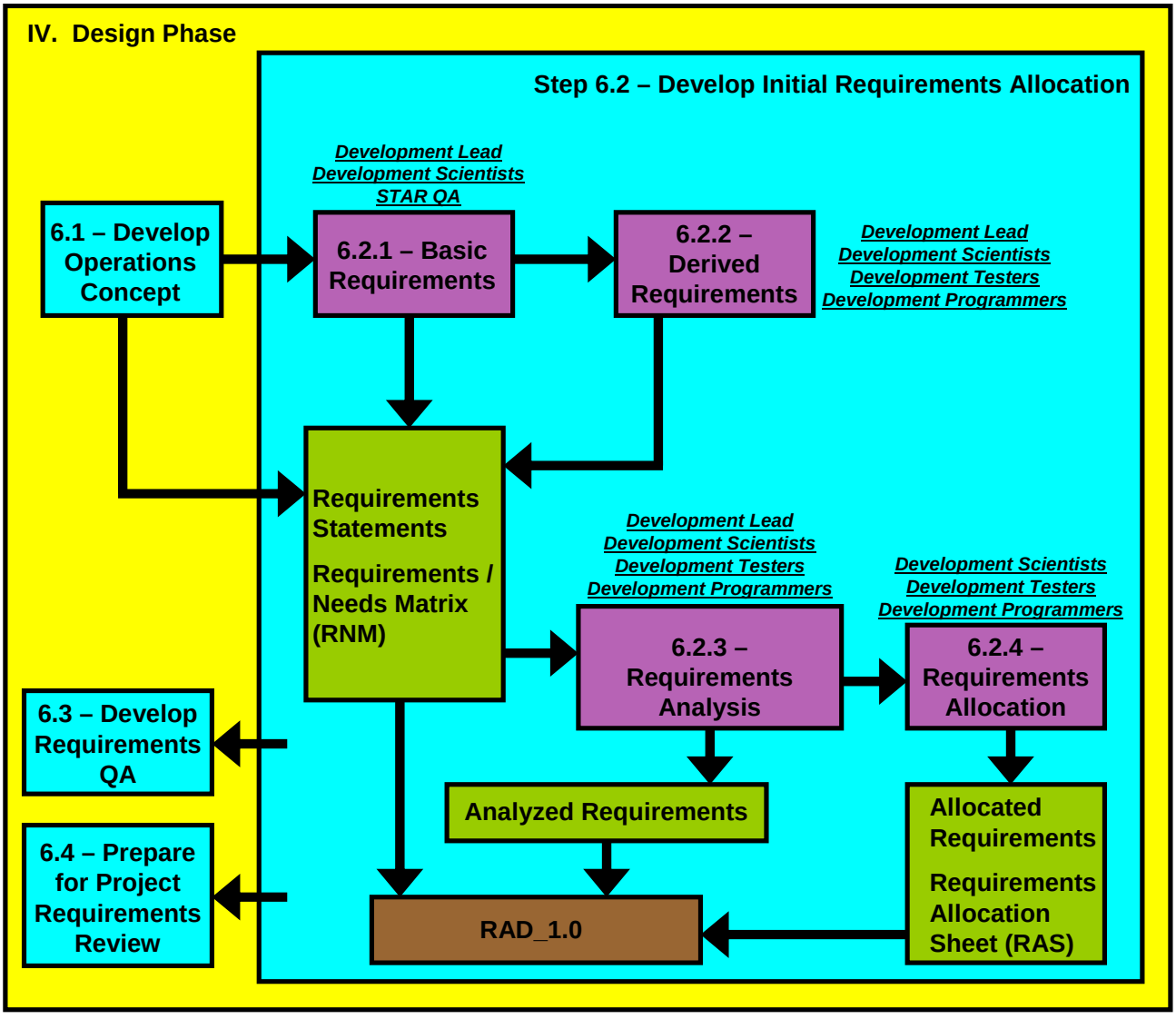

Figure 5.7 – "Develop Initial Requirements Allocation" Process Flow

Step 6.2 activities include:

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

The **Development Lead** leads the identification of the project's basic requirements, with assistance from **Development Scientists** and **STAR QA**.

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.

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.

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 **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 5.8 illustrates the relation between basic requirements and derived requirements.

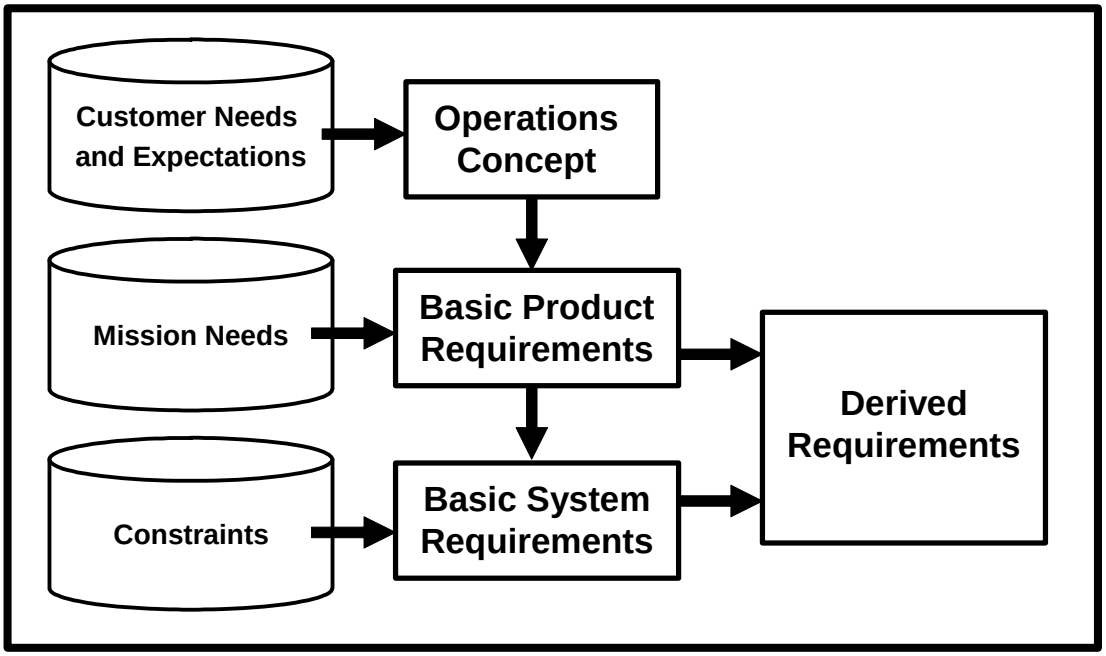

Figure 5.8 – Basic and Derived Requirements

Derived requirements are typically determined by analysis of basic requirements.

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.

The **Development Lead** leads the analysis of the project requirements, with assistance from **Development Scientists, Development Testers,** and **Development Programmers**. 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.

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 and the system architecture of design components that will be developed during the next step of the product lifecycle.

5.4.6.3 Develop Requirements QA

The **Development Lead** leads the development of the requirements QA plan, with assistance from **Development Scientists, Development Testers,** and **STAR QA**. 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, vertical traceability is a straightforward combination of the RNM (relating basic requirements to their drivers) 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.

5.4.6.4 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.

The **Development Lead** informs the **PRR Reviewers** when the PRR artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

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**).

5.4.6.5 Conduct PRR

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).

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 Project Requirements Review Report (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.

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.

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).

5.5 Preliminary Design Tasks

Figure 5.9 shows the process flow for step 7.

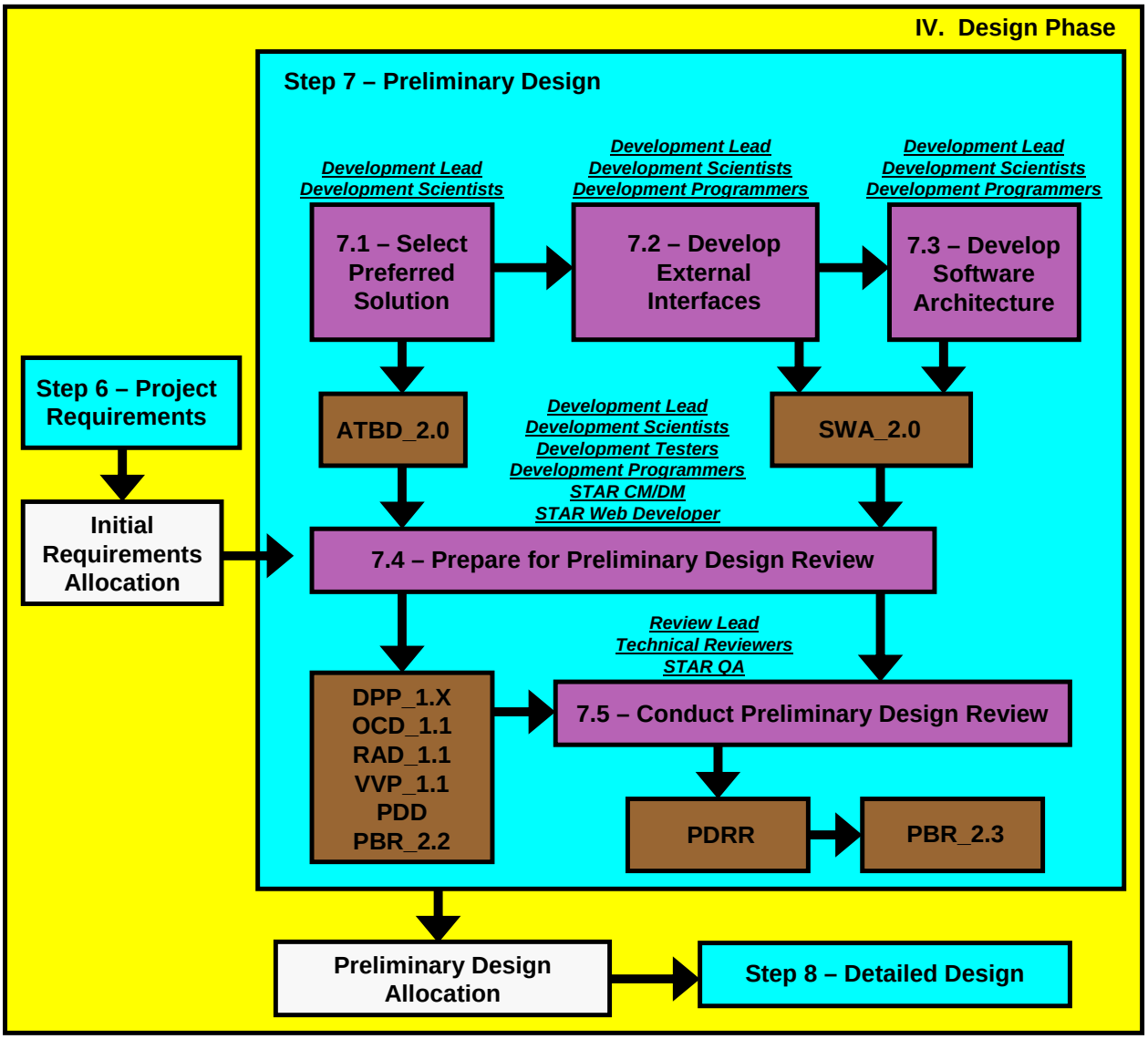

Figure 5.9 – Step 7 Process Flow

5.5.1 Expected BEGIN State

- REQUIRED: A PRR has been conducted
- REQUIRED: An Initial requirements Allocation has been developed and approved
- REQUIRED: Baseline Build (BB) 2.1 has placed the following items in the project artifact repository:
    - DPP, including Appendices
    - OCD
    - RAD, including Appendices
    - VVP
    - Project Requirements Document (PRD)
    - Project Requirements Review Report (PRRR)
- EXPECTED: BB 2.1 has placed the following items in the project artifact repository:
    - R&D code
    - R&D test data
    - ATBD
    - SWA
    - PP
    - Gate 2 Review Report (G2RR)
    - Gate 3 Review Report (G3RR)
- REQUIRED: PBR_2.1 documents the status of the BB 2.1 project baseline
- REQUIRED: PRR reviewers have approved the project to proceed to the Preliminary Design step, and have documented this approval in the PRRR.

5.5.2 Task Inputs

Task inputs 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
- ATBD_1.1
- SWA_1.1
- Project Risks and Actions (PSR_1.x Appendix)
- PRD
- PRRR
- PBR_2.1

5.5.3 Corrective Actions

The PRRR will document any actions that are needed to reduce risk during step 7. Usually, these actions should be closed before the PDR.

Additional corrective actions are typically generated during step 7, to mitigate project risks that are identified during preliminary design. 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.

5.5.3.1 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 7 activities under the new plan.

5.5.4 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
- A preferred solution to meet the requirements has been identified and approved.
- A Context-Layer software architecture has been developed.
- A System-Layer software architecture has been developed.
- A preliminary design allocation of the requirements identifies product and system components down to the System-Layer, and traces each component to one or more requirement so that a detailed 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 detailed design is developed.
- 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 PDR of the project plan, operations concept, requirements, software architecture, and requirements allocation has been conducted
- A PDRR has been written
- Baseline Build 2.3 has placed the required items in the project artifact repository
- PBR_2.3 documents the status of the BB 2.3 project baseline

5.5.5 Task Outputs

Task outputs consist of the following BB 2.3 items:

- DPP_1.x
- ATBD_2.0
- SWA_2.0
- OCD_1.1
- RAD_1.1, including RNM and RAS
- VVP_1.1
- Project Risks and Actions (PSR_1.x Appendix)
- PDD
- PDRR
- PBR_2.3

5.5.6 Stakeholder Activities

Step 7 activities include:

1) Select preferred solution
2) Develop external interfaces
3) Develop software architecture
4) Prepare for PDR
5) Conduct PDR

5.5.6.1 Select Preferred Solution

The **Development Lead** selects a preferred solution, assisted by **Development Scientists**.

First, a defined set of potential solutions should be identified. A wider range of alternatives can surface by soliciting as many stakeholders as practical for input. Input from stakeholders with diverse skills and backgrounds can help teams identify and address assumptions, constraints, and biases. Brainstorming sessions may stimulate innovative

alternatives through rapid interaction and feedback. A literature search may provide a deeper understanding of the problem, alternatives to consider, barriers to implementation, existing trade studies, and lessons learned from similar decisions.

Some of this may have occurred during the Basic and Exploratory phases, Refer to ATBD version 1 to see whether the Research Scientists have identified and evaluated alternatives.

Selection criteria would typically address costs (e.g., time, people, money), benefits (e.g., performance, capability, effectiveness), and risks (e.g., technical, cost, schedule). Alternative solutions need to be analyzed to enable the selection of a balanced solution across the life of the product in terms of cost, schedule, and technical performance. Considerations for detailed alternative solutions and selection criteria include the following:

- Ability to meet product-component requirements
- Cost (development, procurement, support, product life cycle)
- Performance reliability
- Reliability of the required inputs
- Complexity of the product component and product-related life-cycle processes
- Testability
- Robustness to product operating and use conditions, operating modes, environments, and variations in product-related life-cycle processes
- Technology limitations
- Capabilities and limitations of end users and operators

Often, the preferred solution is apparent from a brief analysis of the criteria. In that case, there is no need to proceed further than documenting the rationale for this clear selection in the ATBD. If this is not the case, perform a more comprehensive analysis by ranking each viable solution with respect to each of the selection criteria. This ranking may be qualitative (e,g, Good, Better, Best) or quantitative (e.g., scale of 1-10). If necessary, prioritize and/or weight the selection criteria.

Obtain a complete requirements allocation for each viable alternative solution, as a means of analyzing cost, complexity, testability and robustness.

Identify and resolve issues with each viable alternative solution.

Alternative solutions may require alternative inputs. Risks associated with these inputs should be a factor in the selection of the preferred solution.

Document the results from the analysis, noting the solution that scores best, alternatives whose scores are close, and the critical discriminators between the preferred solution and the higher scoring alternatives.

When a preferred solution is selected, identify its requirements allocation as the preferred allocation. This establishes the Preliminary Design Allocation. Upon PDR approval of the solution, this will become the starting point for the development of the Detailed Design Allocation during step 8.

5.5.6.2 Develop External Interfaces

The **Development Lead** leads the identification of the external interfaces to the product processing system, assisted by **Development Scientists** and **Development Programmers**.

An external input is defined as a data source needed by the system that is produced or made available by a process external to the system. Examples are raw sensor data, ancillary data, etc.

External inputs are often identified prior to the Design phase. These will be documented in the DPP and the Satellite Products and Services Review Board (SPSRB) plan. Identify the inputs that are needed for the preferred solution. Confirm that these external inputs are identified correctly in the DPP. Confirm that any needed supplier agreements are in place and that the suppliers identified in the DPP understand the agreements and are committed to and capable of supplying the needed inputs on schedule.

Additional external inputs may be identified during the process of requirements development and preliminary design. This will occur as the functional requirements and functional architecture uncover the need for additional input to support the designed functionality of the product processing system. It is important that risks associated with these additional inputs are identified and considered as a factor in selecting the preferred solution (c.f. Section 6.5.1). This feedback between the design and the solution is an example of the iterative nature of the requirements development process that was discussed in Section 6.1. Consider the possibility that newly identified risks should cause a reconsideration of the selected solution.

The identification of additional inputs will typically result in the generation of additional derived requirements associated with the inputs. It is important that the requirements

allocation be revised and documented in the RAD to capture the new external input requirements.

Identify risks associated with the external inputs. Document these in the RAD, the PSR Appendix, and the PDD.

External output is defined as a data sink that is produced by the system for an external user; for example, archived environmental products (e.g. Sea Surface Temperature).

External outputs are often identified prior to the Design phase. These will be documented in the DPP and the SPSRB plan. Confirm that these external outputs are identified correctly in the DPP. Confirm that any needed end user agreements are in place and that the end users identified in the DPP understand the agreements. Note that end users include the customers for the products and the operators that will produce the products.

Additional external outputs may be identified during the process of requirements development and preliminary design. This will occur if additional requirements are identified to respond to additional requests from approved end users. It is important that risks associated with these additional requests be identified and evaluated as soon as possible. This is essential to the containment of requirements creep. If additional end user requests are received during step 7, the **Development Lead** should consult with **STAR Management** to determine whether a delta PRR is needed to approve or reject them. A delta PRR is recommended if the additional requirements may affect the selection of a preferred solution. A delta PRR may also be decided upon if the additional requirements are determined to add significant cost, schedule, and/or technical risk. If a delta PRR is not conducted, it is still important to document the changes to the requirements allocation for review at the PDR.

5.5.6.3 Develop Software Architecture

Development Scientists usually develop the preliminary design software architecture for the product processing system, possibly assisted by **Development Programmers**.

5.5.6.4 Prepare For PDR

The PDR review lead (**Technical Review Lead)** and review team (**Technical Reviewers)** should have been selected during step 5 or 6, and listed in the DPP. If this selection was not completed in step 6, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 7.

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

The PDR slide package is the PDD. The PDD is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with PDD guidelines DG-7.1. DG-7.1.A provides PDD slide templates that can be adapted for the project's PDD. The PDD developers should examine the DPP to determine whether the PDR objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the PDD slide templates must be adapted to accommodate the tailoring. The PDD developers should use the project's PRD as a source for PDD slides, as many PRD slides can be re-used or adapted.

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 PDD 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 PDD sections. These presenters should be noted in Section Title slides. See DG-7.1.A for examples.

The **Development Lead** informs the **PDR Reviewers** when the PDR artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

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.

5.5.6.5 Conduct PDR

The "Preliminary Design" step culminates with a PDR. The PDR consists of the presentation of the Preliminary Design 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**).

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

If a delta review is required, the **Development Lead** and support team upgrade the PDR artifacts as requested by the PDR reviewers and present them at a delta PDR. This is repeated until the **Technical Reviewers** pass the project to step 8.

If a delta review is not required, the revision of the PDR artifacts will be deferred to actions performed during step 8 for review at the CDR, or during later steps for review at later reviews. All of this should be documented in the final version of the PDRR.

Each stakeholder who performed activities during step 7 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).

5.6 Detailed Design Tasks

Figure 5.10 shows the process flow for step 8.

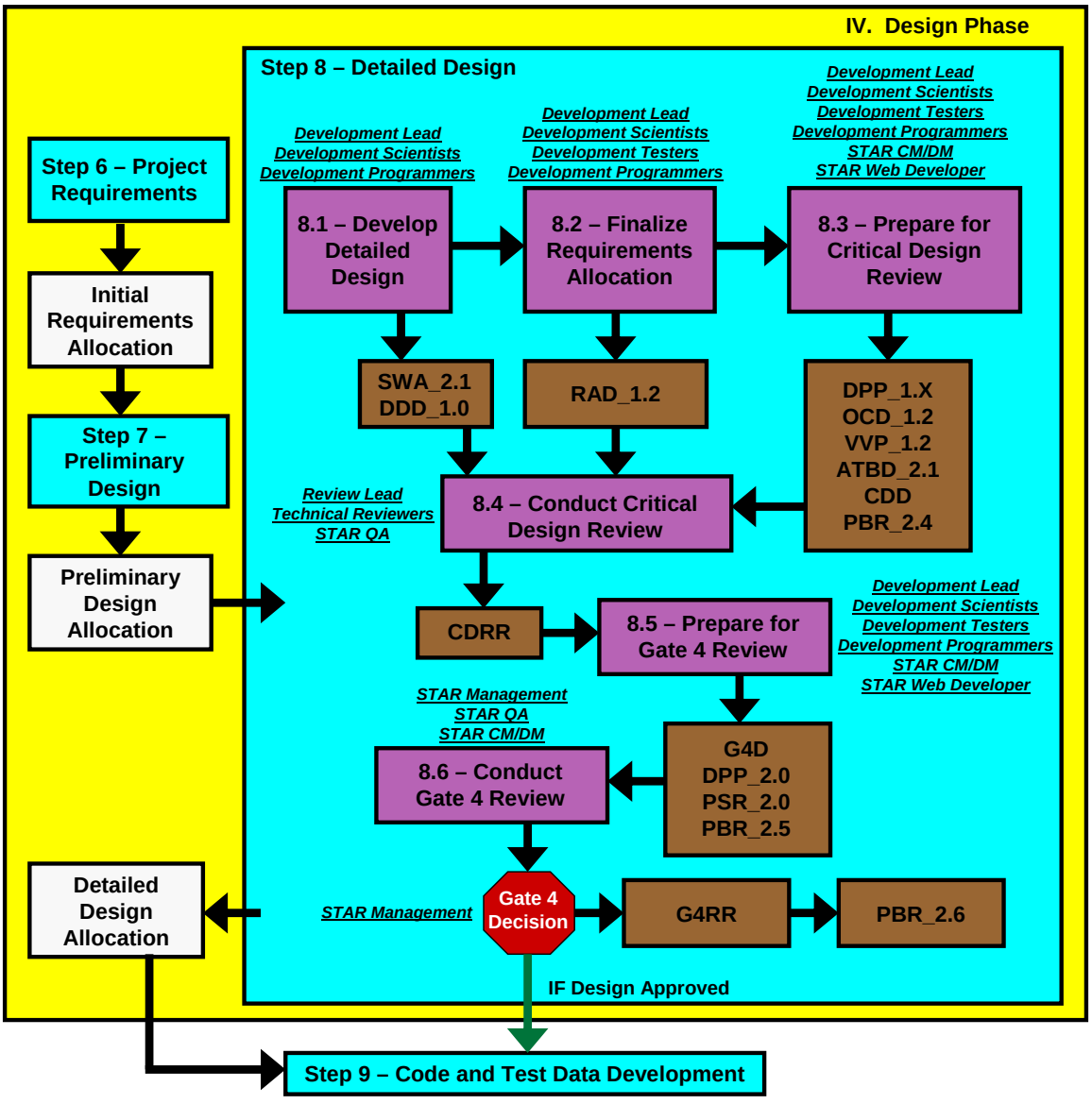

Figure 5.10 – Step 8 Process Flow

5.6.1 Expected BEGIN State

- REQUIRED: A PDR has been conducted
- REQUIRED: A preferred solution to meet the requirements has been selected and approved.
- REQUIRED: A Preliminary Design Allocation for the selected solution has been developed and approved
- REQUIRED: Baseline Build (BB) 2.3 has placed the following items in the project artifact repository:
    - DPP, including Appendices
    - OCD
    - RAD, including Appendices
    - VVP
    - ATBD
    - SWA
    - Preliminary Design Document (PDD)
    - Preliminary Design Review Report (PDRR)
- EXPECTED: BB 2.3 has placed the following items in the project artifact repository:
    - R&D code
    - R&D test data
    - PP
    - Gate 2 Review Report (G2RR)
    - Gate 3 Review Report (G3RR)
    - Project Requirements Document (PRD)
    - Project Requirements Review Report (PRRR)
- REQUIRED: PBR_2.3 documents the status of the BB 2.3 project baseline
- REQUIRED: PDR reviewers have approved the project to proceed to the Detailed Design step, and have documented this approval in the PDRR.

5.6.2 Task Inputs

Task inputs consist of the following BB 2.3 items:

- DPP_1.x,

- OCD_1.1
- RAD_1.1, including Requirements/Needs Matrix (RNM) and Requirements Allocation Sheet (RAS)
- VVP_1.1
- ATBD_2.0
- SWA_2.0
- Project Risks and Actions (PSR_1.x Appendix)
- PDD
- PDRR
- PBR_2.3

5.6.3 Corrective Actions

The PDRR will document any actions that are needed to reduce risk during step 8. Usually, these actions should be closed before the CDR.

Additional corrective actions are typically generated during step 8, to mitigate project risks that are identified during detailed design. 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.

5.6.3.1 Delta Gate 3 Review

If it is determined that a re-plan is needed, the **Development Lead** should consult STAR Management to determine whether there should be a delta Gate 3 Review. This determination should depend upon whether the re-plan will significantly affect the Detailed Design Allocation. If not, consideration of the re-plan may be deferred to the Gate 4 Review. If so, 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 8 activities under the new plan.

5.6.4 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
- A detailed software architecture has been developed.
- A Detailed Design Allocation of the requirements identifies product and system components down to the Sub-Unit-Layer, and traces each component to one or more requirement.
- 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 implementation of the detailed design proceeds through the Build phase.
- 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 CDR of the project plan, operations concept, requirements, software architecture, and requirements allocation has been conducted
- A CDRR has been written
- A Gate 4 Review of the project plan and project status has been conducted.
- A Gate 4 Review Report (G4RR) has been written, approving the project for the Build phase.
- Baseline Build 2.6 has placed the required items in the project artifact repository

- PBR_2.6 documents the status of the BB 2.6 project baseline

5.6.5 Task Outputs

Task outputs consist of the following BB 2.6 items:

- DPP_2.0
- ATBD_2.1
- SWA_2.1
- OCD_1.2
- RAD_1.2, including RNM and RAS
- VVP_1.2
- DDD_1.0
- CDD
- CDRR
- PSR_2.0, including Appendix
- G4D
- G4RR
- PBR_2.6

5.6.6 Detailed Design Activities

Step 8 activities include:

1) Develop detailed design
2) Finalize requirements allocation
3) Prepare for CDR
4) Conduct CDR
5) Prepare for Gate 4 Review
6) Conduct Gate 4 Review

If additional end user requests are received during step 8, the **Development Lead** should consult with **STAR Management** to determine whether a delta PRR is needed to approve

or reject them. A delta PRR is recommended if the additional requirements may affect the selection of a preferred solution. A delta PRR may also be decided upon if the additional requirements are determined to add significant cost, schedule, and/or technical risk. If a delta PRR is not conducted, it is still important to document the changes to the requirements allocation for review at the CDR.

If a delta PRR results in the approval of new requirements that may affect the selection of the preferred solution, the **Development Lead** should consult with **STAR Management** to determine whether a delta PDR should be conducted to re-evaluate the preferred solution. In any case, the Preliminary Design Allocation will have to be revised to accommodate the changed set of requirements.

5.6.6.1 Develop Detailed Design

The development of the detailed design for the product processing system is usually a collaboration between **Development Scientists** and **Development Programmers**, with **Development Scientists** usually taking the lead.

5.6.6.2 Finalize Requirements Allocation

The Detailed Design Allocation represents the culmination of the iterative development of requirements, solutions, and design during the Design phase (c.f. Section 6.1). 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, including all four layers of the software architecture, and a detailed code description.

Development Scientists and **Development Testers** assist in a revision of the RAD, following the guidelines in DG-6.2. RAD v1r2 adds to v1r1 by updating the allocation of requirements to system and product components, based on the maturing of solutions and design since PDR, as documented in SWA v2r1. It is possible that the requirements themselves must be changed by addition, deletion, or modification, based on feedback from the development of solutions and design during step 8. In that case, the RAD update should document the changes and the CDD should note what has been changed and provide a rationale for the changes.

The **Development Lead** reviews RAD_1.2 to confirm that all requirements have an allocation to one or more components (product and system) of the detailed design, and that all product components and system components of the detailed design are traceable to the requirements.

5.6.6.3 Prepare for CDR

The CDR review lead (**Technical Review Lead)** and review team (**Technical Reviewers)** should have been selected during steps 5, 6, or 7, and listed in the DPP. If this selection was not completed in step 7, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 8.

If the project plan has been modified since the PDR, the **Development Lead** prepares a revision to the DPP for presentation at the CDR.

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

The CDR slide package is the CDD. The CDD is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with CDD guidelines DG-8.2. DG-8.2.A provides CDD slide templates that can be adapted for the project's CDD. The CDD developers should examine the DPP to determine whether the CDR objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the CDD slide templates must be adapted to accommodate the tailoring. The CDD developers should use the project's PDD as a source for CDD slides, as many PDD slides can be re-used or adapted.

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 CDD 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 CDD sections. These presenters should be noted in Section Title slides. See DG-8.2.A for examples.

The **Development Lead** informs the **CDR Reviewers** when the CDR artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

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.

5.6.6.4 Conduct CDR

The CDR consists of the presentation of the Detailed Design 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**).

On the basis of its disposition of the CDR CLI, the **Technical Review Lead** and the **Technical Reviewers** determine whether the project is ready to proceed to the Gate 4 Review, If not, the Critical Design Review Report (CDRR) should direct the **Development Lead** to revise the CDR artifacts through specified actions. These actions may include a new assessment of revised CDR artifacts at a delta review.

If a delta CDR is required, the **Development Lead** and support team upgrade the CDR artifacts as requested by the CDR reviewers and present them at a delta CDR. This is repeated until the **Technical Reviewers** pass the project to Gate 4 Review.

If a delta review is not required, the revision of the CDR artifacts will be deferred to actions performed during step 9 for review at the Test Readiness Review (TRR), or during later steps for review at later reviews. All of this should be documented in the final version of the CDRR.

5.6.6.5 Prepare Gate 4 Review

Once the project passes its CDR, it is referred to the Gate 4 Review. The Gate 4 review is included in step 8 because the project status and plan will usually be modified significantly during the Design phase, so a management review of the project plan and status is typically desirable.

Development Lead updates the PSR to version 2.0, assisted by **Development Scientists, Development Testers,** and **Development Programmers.** Version 2 of the PSR, along with its Appendix, documents the status of project tasks, cost, schedule, risks, and actions at the conclusion of the Design phase. Refer to PSR guidelines in DG-5.2 and DG-5.2.A.

The **Development Lead** leads the preparation of the Gate 4 Review presentation. The presentation slide package is the Gate 4 Document (G4D). The G4D is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with G4D guidelines DG-8.4. DG-8.4.A provides G4D slide templates that can be adapted for the project's G4D. The G4D developers should examine

the DPP to determine whether the Gate 4 Review objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the G4D slide templates must be adapted to accommodate the tailoring.

The **Development Lead** determines which members of the development team will present the G4D sections. These presenters should be noted in Section Title slides. See DG-8.4.A for examples.

The **Development Lead** informs the **Gate 4 Reviewers** when the Gate 4 Review artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

STAR Management may at its 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 **STAR Management** concerns.

5.6.6.6 Conduct Gate 4 Review

The “Detailed Design” step culminates with a Gate 4 Review. The Gate 4 Review consists of the presentation of the project plan and project status 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 (**STAR Management**).

On the basis of its disposition of the G4R CLI, the **STAR Management** determines whether the project is ready to proceed to the next step, “Code and Test Data Development”. If not, the Gate 4 Review Report (G4RR) should direct the **Development Lead** to revise the G4R artifacts through specified actions.

Each stakeholder who performed activities during step 8 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, and 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).

5.7 Pre-Operational System Development Process

Pre-operational system development is an iterative process that occurs throughout the Build phase of the product lifecycle. This phase includes three steps that produce an integrated product processing system through an iterative (spiral) development of code, test data and test plans.

- Code & Test Data Development (step 9 of the STAR EPL)
- Code Test & Refinement (step 10 of the STAR EPL)
- System Integration & Test (step 11 of the STAR EPL)

Figure 5.11 illustrates the pre-operational system development process, with step 9 highlighted.

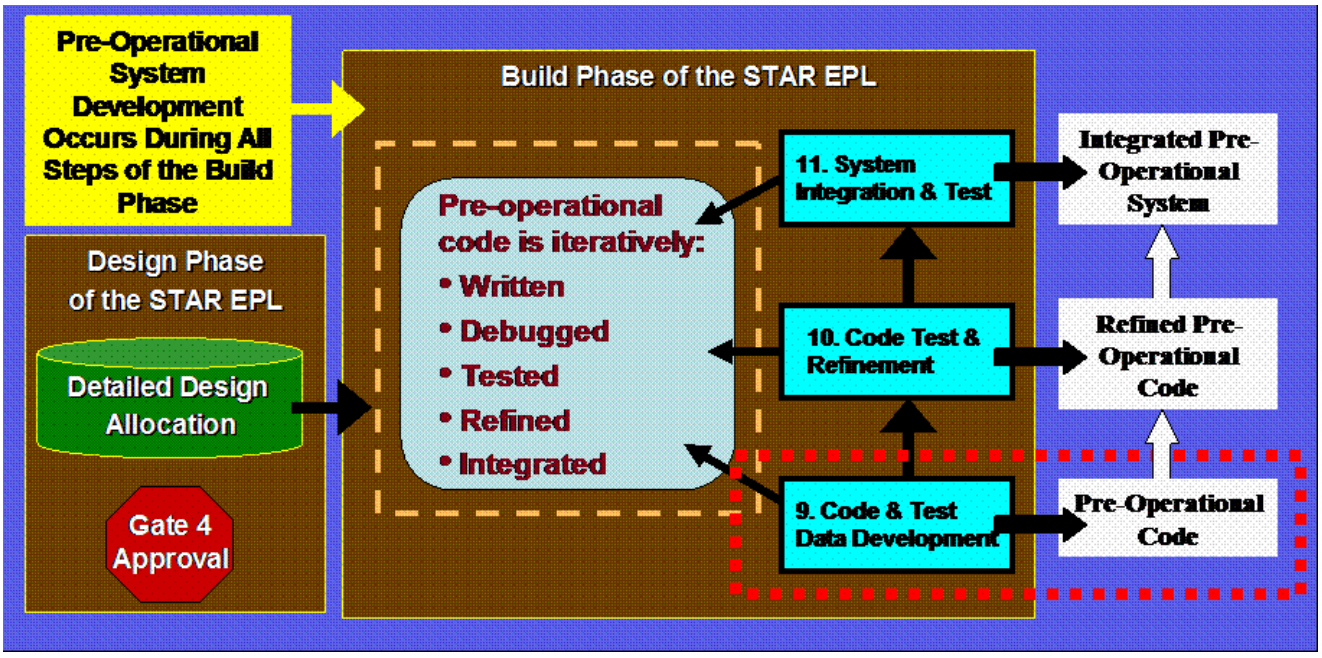

Figure 5.11 – Pre-Operational System Development Process

As Figure 5.11 shows, the objective of step 9 is to produce pre-operational code. Pre-operational code consists of the system components in the detailed design (software units and sub-units). This code will be written and debugged, and ready for unit testing, but not formally tested.

The process of producing a complete pre-operational product processing system involves writing, debugging, testing, refining, and integrating the code. Because these functions affect each other, the process is inherently iterative. Figure 5.12 illustrates this.

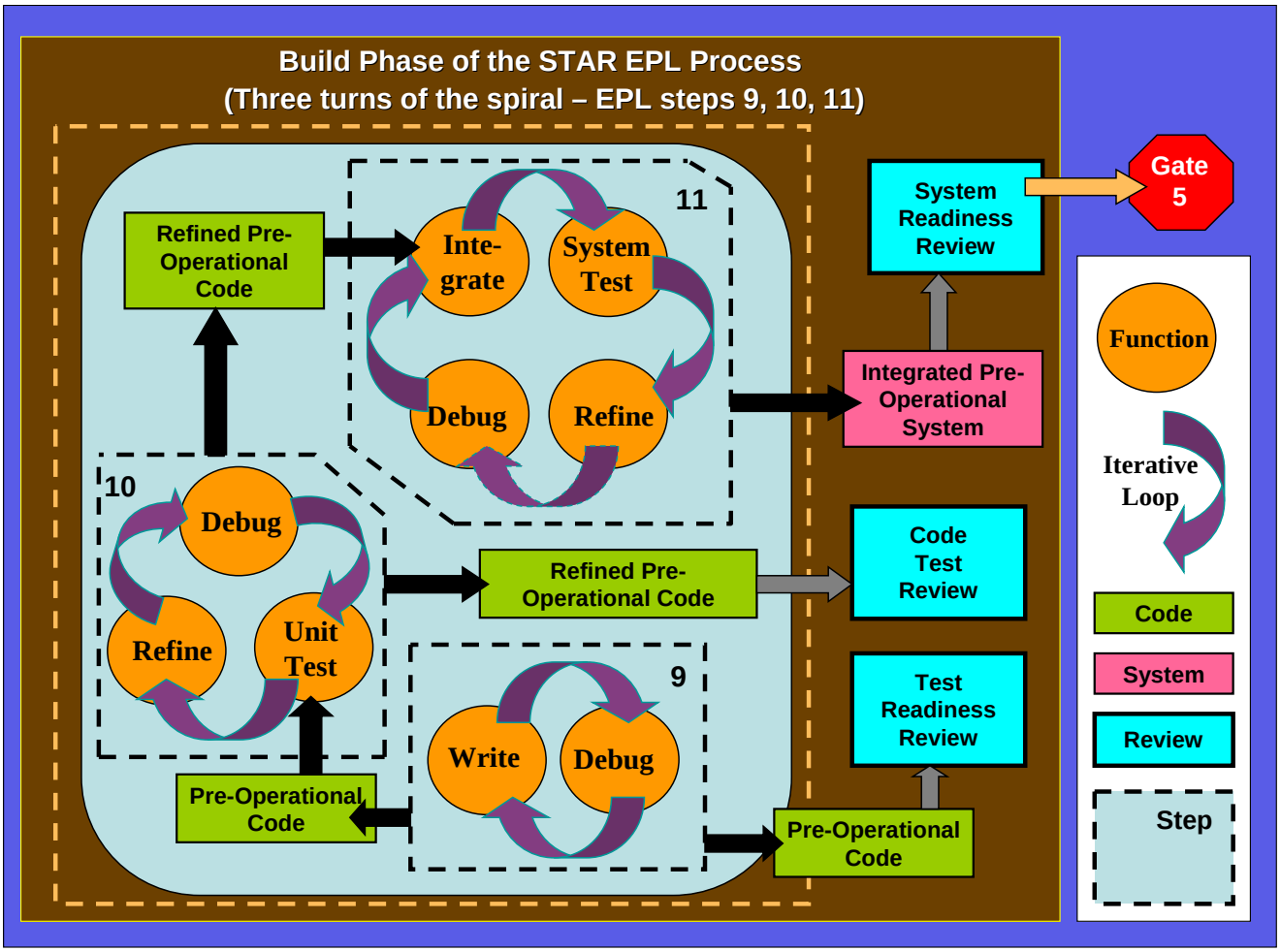

Figure 5.12 – Iterative (Spiral) Development of Pre-Operational System

Note that steps 10 and 11 continue pre-operational system development. The refinement of the step 9 pre-operational code and integration into a complete pre-operational product processing system is expected during these steps. Therefore, the objective of the step 9 activities is limited to producing code that is sufficiently mature and complete to allow unit testing. This is illustrated in Figure 5.12 as the output from step 9 is pre-operational code that is input to the Unit Test function of step 10.

5.8 Code & Test Data Development Tasks

Figure 5.13 shows the process flow for step 9.

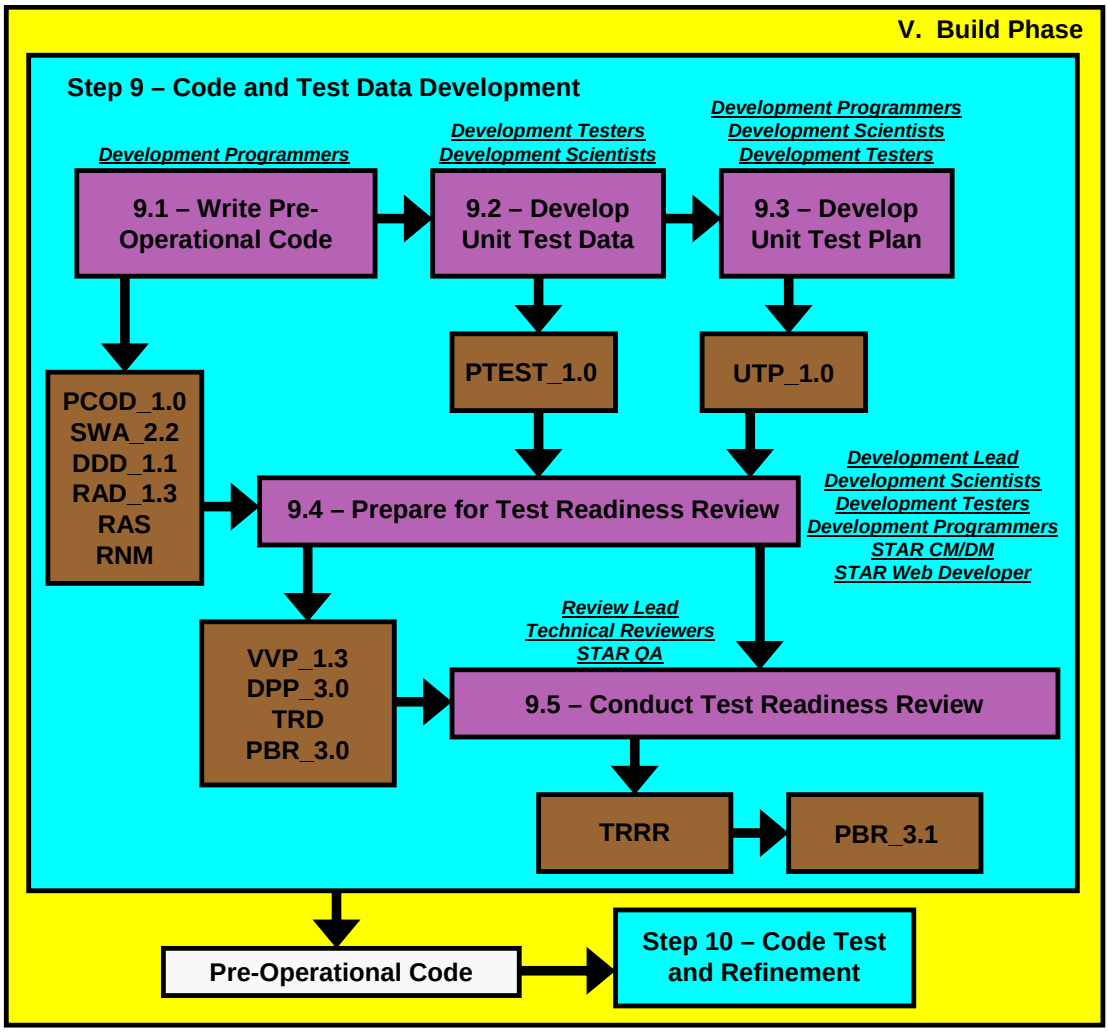

Figure 5.13 – Step 9 Process Flow

5.8.1 Expected BEGIN State

- REQUIRED: A CDR has been conducted
- REQUIRED: A Gate 4 Review has been conducted

- REQUIRED: A Detailed Design Allocation has been developed and approved
- REQUIRED: Baseline Build (BB) 2.6 has placed the following items in the project artifact repository:
    - DPP, including Appendices
    - RAD, including Appendices
    - VVP
    - SWA
    - DDD
    - Critical Design Document (CDD)
    - Critical Design Review Report (CDRR)
    - Gate 4 Document (G4D)
    - Gate 4 Review Report (G4RR)
    - PSR, including Appendix
    - PBR
- EXPECTED: BB 2.6 has placed the following items in the project artifact repository:
    - R&D code
    - R&D test data
    - Project Proposal (PP)
    - Gate 2 Review Report (G2RR)
    - Gate 3 Review Report (G3RR)
    - Operations Concept Document (OCD)
    - ATBD
    - Project Requirements Document (PRD)
    - Project Requirements Review Report (PRRR)
    - Preliminary Design Document (PDD)
    - Preliminary Design Review Report (PDRR)
- REQUIRED: PBR_2.6 documents the status of the BB 2.6 project baseline
- REQUIRED: Gate 4 reviewers have approved the project to proceed to the Code and Test Data Development step, and have documented this approval in the G4RR.

5.8.2 Task Inputs

Task inputs consist of the following BB 2.6 items:

- DPP_2.0
- SWA_2.1
- RAD_1.2
- Requirements/Needs Matrix (RNM)
- Requirements Allocation Sheet (RAS)
- VVP_1.2
- DDD_1.0
- CDD
- CDRR
- PSR_2.0, including Appendix
- G4D
- G4RR
- PBR_2.6

5.8.3 Corrective Actions

The CDRR and G4RR will document any actions that are needed to reduce risk during step 9. Usually, these actions should be closed before the TRR.

Additional corrective actions are typically generated during step 9, to mitigate project risks that are identified during code and test data 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.

5.8.3.1 Delta Gate 4 Review

If it is determined that a re-plan is needed, the **Development Lead** should consult STAR Management to determine whether there should be a delta Gate 4 Review. This determination should depend upon whether the re-plan will significantly affect the pre-operational code. If so, a delta Gate 4 Review should be prepared for and conducted in the same manner as the normal Gate 4 Review. Refer to the step 8 Task Guideline (TG-8) and the Gate 4 Peer Review Guideline (PRG-8.2) for guidance. Following approval of the re-plan, the project can return to its step 9 activities under the new plan.

5.8.4 Desired END State

- A Detailed Design Allocation of the requirements identifies product and system components down to the Sub-Unit-Layer, and traces each component to one or more requirement.
- 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 implementation of the detailed design proceeds through the Build phase.
- The functionality of all system components in the detailed design (software units and sub-units) has been implemented in pre-operational code that meets coding standards.
- Pre-operational code has been debugged, compiled, and built into executable software units, ready for unit testing in the designated test environment.
- A plan for unit testing has been developed. The plan ensures that the unit tests will address all required code functionality and code outputs.
- All data required for implementation of the unit test plan has been acquired or developed, and is available in the designated test environment.
- The project plan has been updated as necessary
- The status of project risks and actions has been updated
- A TRR of the project plan, software architecture, and unit test readiness has been conducted

- A TRRR has been written. The TRRR approves the project to proceed to the next step, Code Test and Refinement.
- Baseline Build 3.1 has placed the required items in the project artifact repository
- PBR_3.1 documents the status of the BB 3.1 project baseline

5.8.5 Task Outputs

Task outputs consist of the following BB 3.1 items:

- Pre-Operational Code
- Pre-Operational Test Data
- DPP_3.x
- SWA_2.2
- RAD_1.3, including RNM and RAS
- VVP_1.3
- DDD_1.1
- UTP_1.0
- TRD
- TRRR
- PBR_3.1

5.8.6 Stakeholder Activities

Step 9 activities include:

1) Write pre-operational code
2) Develop unit test data
3) Develop unit test plan
4) Prepare for TRR
5) Conduct TRR

5.8.6.1 Write Pre-Operational Code

Development Programmers write the pre-operational code to implement the detailed design. Pre-operational code consists of the system components in the detailed design (software units and sub-units). This code will be written and debugged, and ready for unit testing, but not formally tested.

5.8.6.2 Develop Unit Test Data

Development Testers and **Development Scientists** collaborate to produce test data for unit testing of the pre-operational code.

5.8.6.3 Develop Unit Test Plan

Development Programmers, Development Scientists and Development Testers collaborate in the development of a unit test plan.

5.8.6.4 Prepare for TRR

The TRR review lead (**Technical Review Lead)** and review team (**Technical Reviewers)** should have been selected during steps 5, 6, 7, or 8, and listed in the DPP. If this selection was not completed in step 8, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 9.

Cost and schedule variance will often occur during step 9. Therefore, the EPL process calls for an update of the project plan during this step. The **Development Lead** should produce DPP version 3, with assistance from the **Development Scientists, Development Testers,** and **Development Programmers**.

The **Development Lead** leads the preparation of the TRR presentation. The TRR slide package is the Test Readiness Document (TRD). The TRD is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with TRD guidelines DG-9.2. DG-9.2.A provides TRD slide templates that can be adapted for the project's TRD. The TRD developers should examine the DPP to determine whether the TRR objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the TRD slide templates must be adapted to accommodate the tailoring. The TRD developers should use the project's CDD as a source for TRD slides, as many CDD slides can be re-used or adapted.

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 TRD. Risk management guidelines can be found in PG-1.

The **Development Lead** determines which members of the development team will present the TRD sections. These presenters should be noted in Section Title slides. See DG-9.2.A for examples.

The **Development Lead** informs the **TRR Reviewers** when the TRR artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

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.

5.8.6.5 Conduct TRR

The TRR consists of the presentation of the pre-operational code, test data, and test plan 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**).

On the basis of its disposition of the TRR CLI, the **Technical Review Lead** and the **Technical Reviewers** determine whether the project is ready to proceed to the next step, “Code Test and Refinement”. If not, the Test Readiness Review Report (TTRR) should direct the **Development Lead** to revise the TRR artifacts through specified actions. These actions may include a new assessment of revised TRR artifacts at a delta review.

If a delta TRR is required, the **Development Lead** and support team upgrade the TRR artifacts as requested by the TRR reviewers and present them at a delta TRR. This is repeated until the **Technical Reviewers** are satisfied that the project is ready for the next step.

Each stakeholder who performed activities during step 9 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).

5.9 Code Test and Refinement Tasks

Figure 5.14 shows the process flow for step 10.

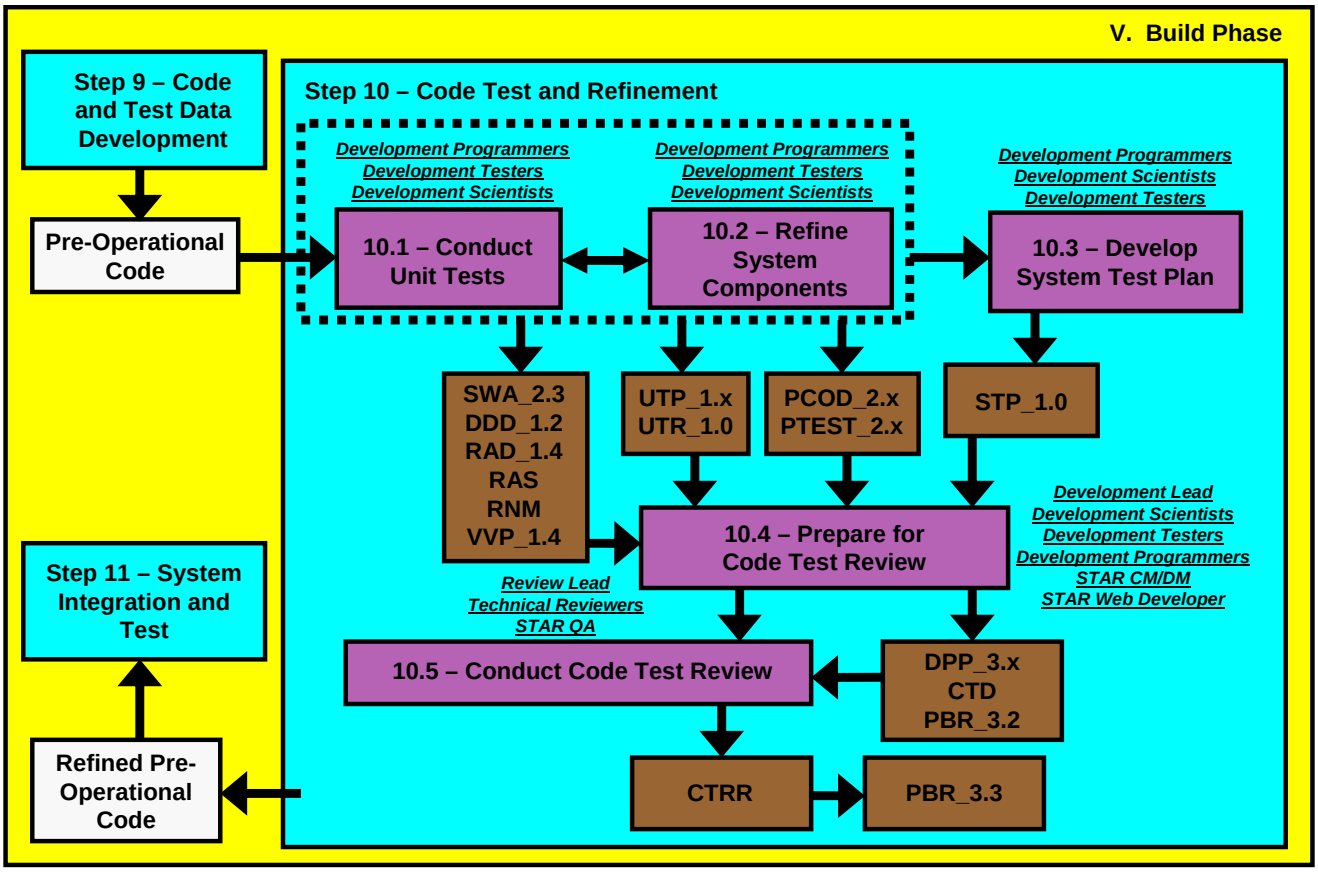

Figure 5.14 – Step 10 Process Flow

Note that processes 10.1 and 10.2 are enclosed by a common dashed border. This is to indicate that the processes are iterative, as explained in Section 5.7.

5.9.1 Expected BEGIN State

- REQUIRED: Pre-operational code has been debugged, compiled, and built into executable software units, ready for unit testing in the designated test environment.
- REQUIRED: A plan for unit testing has been developed. The plan ensures that the unit tests will address all required code functionality and code outputs.
- REQUIRED: All data required for implementation of the unit test plan has been acquired or developed, and is available in the designated test environment.
- REQUIRED: A TRR has been conducted
- REQUIRED: TRR reviewers have approved the project to proceed to the Code Test and Refinement step, and have documented this approval in the Test Readiness Review Report (TRRR).
- REQUIRED: Baseline Build (BB) 3.1 has placed the following items in the project artifact repository:
    - Pre-operational code
    - Unit test data
    - DPP, including Appendices
    - RAD, including Appendices
    - VVP
    - ATBD
    - SWA
    - DDD
    - UTP
    - Test Readiness Document (TRD)
    - TRRR
- EXPECTED: BB 3.1 has placed the following items in the project artifact repository:
    - R&D code
    - R&D test data
    - Project Proposal (PP)
    - Gate 2 Review Report (G2RR)

- Gate 3 Review Report (G3RR)
- Operations Concept Document (OCD)
- Project Requirements Document (PRD)
- Project Requirements Review Report (PRRR)
- Preliminary Design Document (PDD)
- Preliminary Design Review Report (PDRR)
- Critical Design Document (CDD)
- Critical Design Review Report (CDRR)
- Gate 4 Document (G4D)
- Gate 4 Review Report (G4RR)
- Project Status Report (PSR), including Appendix

- REQUIRED: PBR_3.1 documents the status of the BB 3.1 project baseline

5.9.2 Task Inputs

Task inputs consist of the following BB 3.1 items:

- Pre-operational code (PCOD_1.x)
- Pre-operational test data (PTEST_1.x)
- SWA_2.2
- DDD_1.1
- UTP_1.0
- DPP_3.x
- RAD_1.3
- Requirements/Needs Matrix (RNM)
- Requirements Allocation Sheet (RAS)
- VVP_1.3
- TRD
- TRRR
- PSR_2.x Appendix
- PBR_3.1

5.9.3 Corrective Actions

The TRRR will document any actions that are needed to reduce risk during step 10. Usually, these actions should be closed before the CTR.

Additional corrective actions are typically generated during step 10, to mitigate project risks that are identified during code test and refinement. 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.

5.9.3.1 Delta Gate 4 Review

If it is determined that a re-plan is needed, the **Development Lead** should consult STAR Management to determine whether there should be a delta Gate 4 Review. This determination should depend upon whether the re-plan will significantly affect the pre-operational code. If so, a delta Gate 4 Review should be prepared for and conducted in the same manner as the normal Gate 4 Review. Refer to the step 8 Task Guideline (TG-8) and the Gate 4 Peer Review Guideline (PRG-8.2) for guidance. Following approval of the re-plan, the project can return to its step 10 activities under the new plan.

5.9.4 Desired END State

- A Detailed Design Allocation of the requirements identifies product and system components down to the Sub-Unit-Layer, and traces each component to one or more requirement.
- 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 implementation of the detailed design proceeds through the Build phase.

- The functionality of all system components in the detailed design (software units and sub-units) has been implemented in pre-operational code that meets coding standards.
- A plan for unit testing has been developed. The plan ensures that the unit tests will address all required code functionality and code outputs.
- Pre-operational code has been tested in accordance with the unit test plan.
- Pre-operational code has been refined and debugged as necessary until it passes all unit tests.
- Unit test results have been documented in a report.
- A plan for system testing has been developed. The plan ensures that the system test will address all system requirements and product requirements.
- The project plan has been updated as necessary
- The status of project risks and actions has been updated
- A CTR of the project plan, unit test results, and system test plan has been conducted
- A CTRR has been written. The CTRR approves the project to proceed to the next step, System Integration and Test.
- Baseline Build 3.3 has placed the required items in the project artifact repository
- PBR_3.3 documents the status of the BB 3.3 project baseline

5.9.5 Task Outputs

Task outputs consist of the following BB 3.3 items:

- Refined Pre-Operational Code
- Refined Pre-Operational Test Data
- DPP_3.x
- SWA_2.3
- DDD_1.2
- RAD_1.4, including RNM and RAS
- VVP_1.4

- UTP_1.x
- STP_1.0
- CTD
- CTRR
- PBR_3.3

5.9.6 Stakeholder Activities

Step 10 activities include:

1) Conduct unit tests
2) Refine system components
3) Develop system test plan
4) Prepare for CTR
5) Conduct CTR

5.9.6.1 Conduct Unit Tests

Development Programmers prepare the unit test environment and build the unit test configuration, in accordance with the unit test plan.

Development Testers run the unit tests, assisted by **Development Programmers**. **Development Scientists** assist in evaluating the unit test results.

5.9.6.2 Refine System Components

Development Programmers iteratively refine, debug and re-test the pre-operational code as needed, based on the unit test results.

Development Testers refine the test data as necessary until the unit test requirements are satisfied. **Development Scientists** assist in refining the unit test data.

5.9.6.3 Develop System Test Plan

Development Programmers, Development Scientists and Development Testers collaborate in the development of a system test plan,

5.9.6.4 Prepare for CTR

The CTR review lead (**Technical Review Lead)** and review team (**Technical Reviewers)** should have been selected during steps 5, 6, 7, 8, or 9, and listed in the DPP. If this selection was not completed in step 9, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 10.

The DPP should be updated to address any changes to the project plan since the TRR. The **Development Lead** updates the DPP to version 3.x, with assistance from the **Development Scientists, Development Testers,** and **Development Programmers**.

The **Development Lead** leads the preparation of the CTR presentation. The CTR slide package is the Code Test Document (CTD). The CTD is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with CTD guidelines DG-10.3. DG-10.3.A provides CTD slide templates that can be adapted for the project's CTD. The CTD developers should examine the DPP to determine whether the CTR objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the CTD slide templates must be adapted to accommodate the tailoring. The CTD developers should use the project's TRD as a source for CTD slides, as many TRD slides can be re-used or adapted.

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 CTD. Risk management guidelines can be found in PG-1.

The **Development Lead** determines which members of the development team will present the CTD sections. These presenters should be noted in Section Title slides. See DG-10.3.A for examples.

The **Development Lead** informs the **CTR Reviewers** when the CTR artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

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.

5.9.6.5 Conduct CTR

The CTR consists of the presentation of the pre-operational code, test data, and test plan 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**).

On the basis of its disposition of the CTR CLI, the **Technical Review Lead** and the **Technical Reviewers** determine whether the project is ready to proceed to the next step, “System Integration and Test”. If not, the Code Test Review Report (CTRR) should direct the **Development Lead** to revise the CTR artifacts through specified actions. These actions may include a new assessment of revised CTR artifacts at a delta review.

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

If a delta review is not required, the revision of the CTR artifacts will be deferred to actions performed during step 11 for review at the System Readiness Review (SRR). All of this should be documented in the final version of the CTRR.

When the project passes its CTR, the project proceeds to system integration and system testing. The final version of the CTRR should include approval for the project to proceed to step 11, and will indicate all open actions that have been deferred to step 11.

Each stakeholder who performed activities during step 10 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).

5.10 System Integration and Test Tasks

Figure 5.15 shows the process flow for step 11.

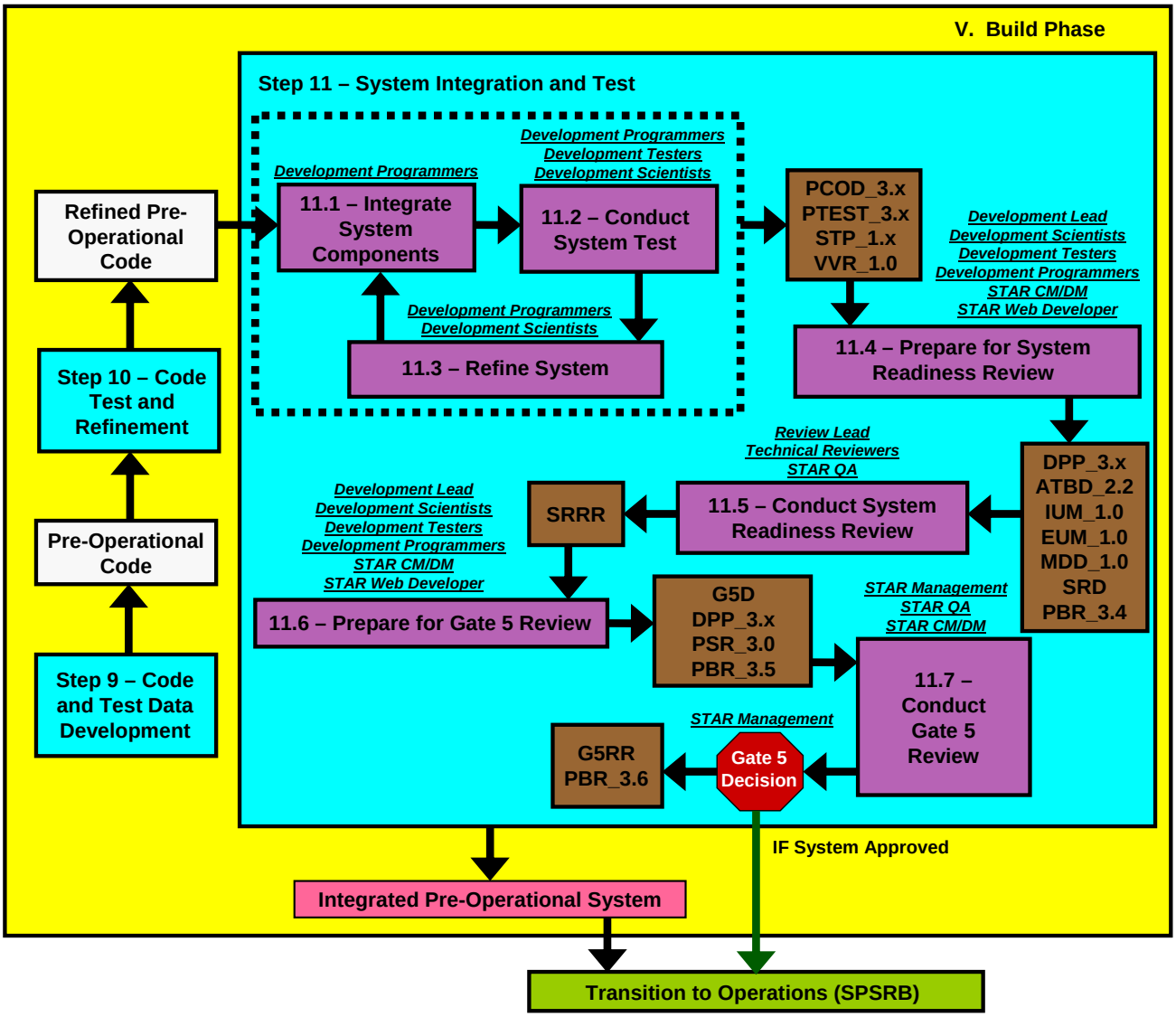

Figure 5.15 – Step 11 Process Flow

Note that processes 11.1, 11.2, and 11.3 are enclosed by a common dashed border. This is to indicate that the processes are iterative, as explained in Section 5.7.

5.10.1 Expected BEGIN State

- REQUIRED: Pre-operational code has been refined and debugged as necessary until it passes all unit tests.
- REQUIRED: Unit test results have been documented in a report.
- REQUIRED: A plan for system testing has been developed. The plan ensures that the system test will address all system requirements and product requirements.
- REQUIRED: All data required for implementation of the system test plan has been acquired or developed, and is available in the designated test environment.
- REQUIRED: A CTR has been conducted
- REQUIRED: CTR reviewers have approved the project to proceed to the System Integration and Test step, and have documented this approval in the Code Test Review Report (CTRR).
- REQUIRED: Baseline Build (BB) 3.3 has placed the following items in the project artifact repository:
    - Refined pre-operational code
    - System test data
    - DPP, including Appendices
    - RAD, including Appendices
    - VVP
    - ATBD
    - SWA
    - DDD
    - UTP
    - UTR
    - STP
    - Code Test Document (CTD)
    - CTRR
- EXPECTED: BB 3.3 has placed the following items in the project artifact repository:
    - R&D code

- R&D test data
- Project Proposal (PP)
- Gate 2 Review Report (G2RR)
- Gate 3 Review Report (G3RR)
- Operations Concept Document (OCD)
- Project Requirements Document (PRD)
- Project Requirements Review Report (PRRR)
- Preliminary Design Document (PDD)
- Preliminary Design Review Report (PDRR)
- Critical Design Document (CDD)
- Critical Design Review Report (CDRR)
- Gate 4 Document (G4D)
- Gate 4 Review Report (G4RR)
- Test Readiness Document (TRD)
- Test Readiness Review Report (TRRR)
- Project Status Report (PSR), including Appendix

- REQUIRED: PBR_3.3 documents the status of the BB 3.3 project baseline

5.10.2 Task Inputs

Task inputs consist of the following BB 3.3 items:

- Refined pre-operational code (PCOD_2.x)
- Refined pre-operational test data (PTEST_2.x)
- SWA_2.3
- DDD_1.2
- UTP_1.1
- UTR_1.0
- STP_1.0
- DPP_3.x
- RAD_1.4

- Requirements/Needs Matrix (RNM)
- Requirements Allocation Sheet (RAS)
- VVP_1.4
- CTD
- CTRR
- PSR_2.x Appendix
- PBR_3.3

5.10.3 Corrective Actions

The CTRR will document any actions that are needed to reduce risk during step 11. Usually, these actions should be closed before the SRR.

Additional corrective actions are typically generated during step 11, to mitigate project risks that are identified during code test and refinement. 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.

5.10.3.1 Delta Gate 4 Review

If it is determined that a re-plan is needed, the **Development Lead** should consult STAR Management to determine whether there should be a delta Gate 4 Review. This determination should depend upon whether the re-plan will significantly affect the pre-operational system. . If not, consideration of the re-plan may be deferred to the Gate 5 Review. If so, a delta Gate 4 Review should be prepared for and conducted in the same manner as the normal Gate 4 Review. Refer to the step 8 Task Guideline (TG-8) and the Gate 4 Peer Review Guideline (PRG-8.2) for guidance. Following approval of the re-plan, the project can return to its step 11 activities under the new plan.

5.10.4 Desired END State

- The Detailed Design Allocation of the requirements that identifies product and system components down to the Sub-Unit-Layer, and traces each component to one or more requirement, has been verified.
- The functionality of all system components in the detailed design (software units and sub-units) has been implemented in pre-operational code that meets coding standards.
- Unit testing of the code has ensured that all required code functionality and code outputs have been satisfied.
- The code and system test data have been integrated into a complete pre-operational product processing system.
- The pre-operational system has been refined and debugged as necessary until it satisfies all system requirements and product requirements, as determined by system testing.
- System test results have been documented in a report.
- All required documentation has been produced.
- The project plan has been updated as necessary
- Project status, including project risks and actions, has been updated
- An SRR of the project plan, system test results, and supporting documentation has been conducted
- An SRRR has been written. The SRRR approves the readiness of the product processing system and supporting documentation to be delivered to operations.
- A Gate 5 Review of project status has been conducted.
- A Gate 5 Review Report (G5RR) has been written. The G5RR approves the project for transition to operations.
- Baseline Build 3.6 has placed the required items in the project artifact repository
- PBR_3.6 documents the status of the BB 3.6 project baseline

5.10.5 Task Outputs

Task outputs consist of the following BB 3.6 items:

- Integrated Pre-Operational Code
- System Test Data
- DPP_3.x
- ATBD_2.2
- STP_1.1
- IUM_1.0
- EUM_1.0
- MDD_1.0
- SRD
- SRRR
- PSR_3.0
- G5D
- G5RR
- PBR_3.6

5.10.6 Stakeholder Activities

Step 11 activities include:

1) Integrate system components
2) Conduct system test
3) Refine system
4) Prepare for SRR
5) Conduct SRR
6) Prepare for Gate 5 Review
7) Conduct Gate 5 Review

5.10.6.1 Integrate System Components

Development Programmers prepare the system test environment, in accordance with the system test plan, and perform the system integration.

5.10.6.2 Conduct System Test

Development Programmers build the system test configuration, in accordance with the system test plan.

Development Testers run the system test, assisted by **Development Programmers**. **Development Scientists** assist in evaluating the system test results.

5.10.6.3 Refine System

Development Programmers iteratively refine, debug and re-test the integrated pre-operational system as needed, based on the system test results.

Development Testers refine the system test data as necessary until the system test requirements are satisfied. **Development Scientists** assist in refining the system test data.

5.10.6.4 Prepare for SRR

The SRR review lead (**Technical Review Lead)** and review team (**Technical Reviewers)** should have been selected during steps 5, 6, 7, 8, 9, or 10, and listed in the DPP. If this selection was not completed in step 10, the **STAR Branch Chief**, in consultation with the **Development Lead**, should make this selection as soon as possible during step 11.

The DPP should be updated to address any changes to the project plan since the CTR. The **Development Lead** updates the DPP to version 3.x, with assistance from the **Development Scientists, Development Testers,** and **Development Programmers**.

The **Development Lead** leads the preparation of the SRR presentation. The SRR slide package is the System Readiness Document (SRD). The SRD is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with SRD guidelines DG-11.5. DG-11.5.A provides SRD slide templates that can be adapted for the project's SRD. The SRD developers should examine the DPP to determine whether the SRR objectives, entry criteria, exit criteria

and/or CLI have been tailored. If so, the SRD slide templates must be adapted to accommodate the tailoring. The SRD developers should use the project's CTD as a source for SRD slides, as many CTD slides can be re-used or adapted.

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 SRD. Risk management guidelines can be found in PG-1.

The **Development Lead** determines which members of the development team will present the SRD sections. These presenters should be noted in Section Title slides. See DG-11.5.A for examples.

The **Development Lead** informs the **SRR Reviewers** when the SRR artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

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.

5.10.6.5 Conduct SRR

The SRR consists of the presentation of the integrated pre-operational product processing system and supporting documentation 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**).

On the basis of its disposition of the SRR CLI, the **Technical Review Lead** and the **Technical Reviewers** determine whether the project is ready for delivery to operations, If not, the SRRR should direct the **Development Lead** to revise the SRR artifacts through specified actions. These actions may include a new assessment of revised SRR artifacts at a delta review.

If a delta SRR is required, the **Development Lead** and support team upgrade the SRR artifacts as requested by the SRR reviewers and present them at a delta SRR. This is repeated until the **Technical Reviewers** pass the project to the Gate 5 Review.

5.10.6.6 Prepare Gate 5 Review

Once the project passes its SRR, it is referred to the Gate 5 Review, the final STAR review prior to delivery of the pre-operational system to operations. The purpose of the Gate 5 Review is to ensure **STAR Management** approval of the project status prior to delivery.

Development Lead updates the PSR to version 3.0, assisted by **Development Scientists, Development Testers,** and **Development Programmers.** Version 3 of the PSR, along with its Appendix, documents the status of project tasks, cost, schedule, risks, and actions at the conclusion of the Build phase. Refer to PSR guidelines in DG-5.2 and DG-5.2.A.

The **Development Lead** leads the preparation of the Gate 5 Review presentation. The presentation slide package is the Gate 5 Document (G5D). The G5D is prepared by the **Development Lead**, **Development Scientists, Development Testers,** and **Development Programmers,** in accordance with G5D guidelines DG-11.7. DG-11.7.A provides G5D slide templates that can be adapted for the project's G5D. The G5D developers should examine the DPP to determine whether the Gate 5 Review objectives, entry criteria, exit criteria and/or CLI have been tailored. If so, the G5D slide templates must be adapted to accommodate the tailoring.

The **Development Lead** determines which members of the development team will present the G5D sections. These presenters should be noted in Section Title slides. See DG-11.7.A for examples.

The **Development Lead** informs the **Gate 5 Reviewers** when the Gate 5 Review artifacts are available for their assessment. Review artifacts should be available at least 1 week in advance of the review, though this interval may be tailored.

STAR Management may at its 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 **STAR Management** concerns.

5.10.6.7 Conduct Gate 5 Review

The “System Integration and Test” step culminates with a Gate 5 Review.

The Gate 5 Review consists of the presentation of the project plan and project status at the conclusion of the Build phase 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 (**STAR Management**).

On the basis of the Gate 5 Review, **STAR Management** determines whether the project can be delivered to operations, based on information in the SRRR, DPP and PSR. If not, **STAR Management** should direct the **Development Lead** to revise the G5R artifacts through specified actions. This process is iterated until the Gate 5 Reviewers are satisfied with the technical, cost and schedule status of the project.

Each stakeholder who performed activities during step 11 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). The **Development Lead** should refer to DG-11.9 and SG-13 for guidelines

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