NOAA NESDIS
CENTER for SATELLITE APPLICATIONS and RESEARCH (STAR)

STAKEHOLDER GUIDELINE

SG-17
TECHNICAL REVIEW LEAD GUIDELINES

Version 3.0

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 2 of 2

TITLE: SG-17: TECHNICAL REVIEW LEAD GUIDELINES VERSION 3.0

AUTHORS:

Ken Jensen (Raytheon Information Solutions)

VERSION HISTORY SUMMARY

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 3 of 3

TABLE OF CONTENTS

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 4 of 4

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 5 of 5

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 6 of 6

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 7 of 7

LIST OF FIGURES

LIST OF TABLES

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 8 of 8

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 9 of 9

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 10 of 10

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 11 of 11

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-17) is to provide a detailed description of the standard tasks of a **Technical Review Lead**. The intended users of this SG are those who have been assigned as the Lead of a STAR Technical Review.

A *Technical Review Lead* is responsible for leading the team of Technical Reviewers for one or more of the six Technical Reviews that are described in Section 3. The **Technical Review Lead** works with the **Development Lead** and the **Technical Reviewers** to ensure that the review is prepared for, conducted, and closed according to review standards.

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[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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 12 of 12

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-17. 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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 13 of 13

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 **Technical Review Leads** is SG-17 (this document).

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 14 of 14

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 **Technical Review Leads**.

TABLE 2.3.1 – Relevant Task Guidelines

ID	Step
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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 15 of 15

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 **Technical Review Leads**.

TABLE 2.4.1 – Relevant Peer Review Guidelines

ID	Review
PRG-6	Project Requirements Review
PRG-7	Preliminary Design Review
PRG-8.1	Critical Design Review
PRG-9	Test Readiness Review
PRG-10	Code Test Review
PRG-11.1	System Readiness 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 **Technical Review Leads**.

TABLE 2.5.1 – Relevant Review Check Lists

ID	Review
CL-6	Project Requirements Review
CL-7	Preliminary Design Review
CL-8.1	Critical Design Review
CL-9	Test Readiness Review
CL-10	Code Test Review
CL-11.1	System Readiness Review

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 16 of 16

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 **Technical Review Leads**.

TABLE 2.6.1 – Relevant Document Guidelines

ID	Document
DG-6.5	Project Requirements Review Report (PRRR)
DG-7.2	Preliminary Design Review Report (PDRR)
DG-8.3	Critical Design Review Report (CDRR)
DG-9.3	Test Readiness Review Report (TRRR)
DG-10.4	Code Test Review Report (CTRR)
DG-11.6	System Readiness Review Report (SRRR)

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 **Technical Review Leads**.

TABLE 2.7.1 – Relevant Training Documents

ID	Training Document
TD-11.1	FORTRAN Programming Standards and Guidelines
TD-11.2	C Programming Standards and Guidelines

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 17 of 17

3. REVIEWS

The relevant reviews for **Technical Review Leads** are:

- Project Requirements Review (PRR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Test Readiness Review (TRR)
- Code Test Review (CTR)
- System Readiness review (SRR)

3.1. 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:
  - o Basic Requirements
  - o Derived Requirements
  - o Requirements/Needs matrix
  - o Requirements Traceability matrix
  - o Requirements Quality Assurance plans and methods
  - o Requirements Allocation matrix

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 18 of 18

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 19 of 19

- 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.

3.2. 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:
    o Operations concept
    o Theoretical basis
    o Architecture, specifications, interfaces
    o Performance requirements, QA procedures, test data requirements
    o Verification and validation plans
    o Risks and benefits

- Provide an updated allocation of requirements to product components and system components of the preliminary design.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 20 of 20

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 21 of 21

- 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.

3.3. 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:
  - o Operations concept

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 22 of 22

- o Theoretical Basis

- o Architecture, specifications, interfaces, detailed design description

- o Performance requirements, QA procedures, test data requirements

- o 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 23 of 23

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 24 of 24

3.4. 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:

    o Pre-operational code and test data

    o 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 25 of 25

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 26 of 26

- 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.

3.5. 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:

    o Refined pre-operational code and test data

    o Unit test plan

    o Unit test report

    o System test plan

- Review the unit test plan, focusing on changes since the TRR.

- Review the unit test results

- Review the system test plan

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 27 of 27

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 28 of 28

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.

3.6. 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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 29 of 29

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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 30 of 30

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 31 of 31

- 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 32 of 32

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 the responsibility of **Technical Review Leads** are listed in Table 4.1.

TABLE 4.1 – Technical Review Lead Artifacts

Artifact	Type
Project Requirements Review Report	Report
Preliminary Design Review Report	Report
Critical Design Review Report	Report
Test Readiness Review Report	Report
Code Test Review Report	Report
System Readiness Review Report	Report

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

Preliminary Design Review Report: The PDR Report (PDRR) summarizes the PDR Reviewers' assessment of the preliminary design, including identified risks and risk mitigation actions. Refer to DG-7.2 for detailed PDRR guidelines.

Critical Design Review Report: Following the CDR presentation by the **Development Team**, the CDR Report (CDRR) is produced by the **CDR Reviewers**. The CDRR

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 33 of 33

summarizes the **CDR Reviewers'** assessment of the detailed design, including identified risks and risk mitigation actions. Refer to DG-8.3 for detailed CDRR guidelines.

Test Readiness Review Report: The TRR Report (TRRR) summarizes the TRR Reviewers' assessment of the project readiness for unit testing, including identified risks and risk mitigation actions. Refer to DG-9.3 for detailed TRRR guidelines.

Code Test Review Report: The CTR Report (CTRR) summarizes the CTR Reviewers' assessment of the unit test results, including identified risks and risk mitigation actions. Refer to DG-10.4 for detailed CTRR guidelines.

System Readiness Review Report: The SRR Report (SRRR) summarizes the SRR Reviewers' assessment of the readiness of the pre-operational system for installation in the operations environment, including identified risks and risk mitigation actions. Refer to DG-11.6 for detailed SRRR guidelines.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 34 of 34

5. TASK DESCRIPTION

Technical Review Leads participate in the following process steps:

- 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 **Technical Review Lead** tasks for each of these steps are described below. **Technical Review Leads** may also refer to the relevant TGs for a complementary task description.

5.1 Requirement Development Process

Technical Review Leads should read this section if they will be reviewing the PRR, PDR, or CDR.

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 5.1 illustrates the Requirements Development process, with step 6 highlighted.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 35 of 35
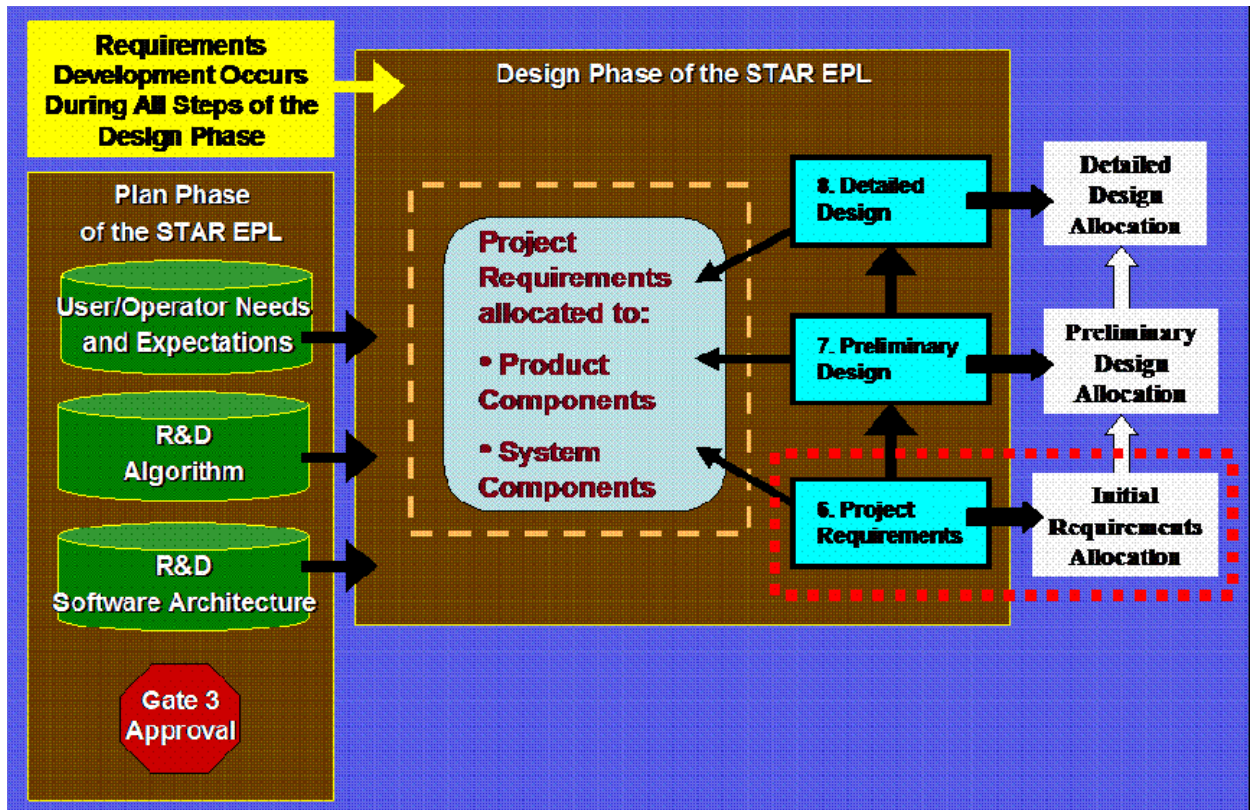
Figure 5.1 – Requirements Development Process

As Figure 5.1 shows, the objective of step 6 is to produce an initial requirements allocation that consists of requirements derived from user/operator needs and expectations and the allocation of these requirements to product components and system components that have been identified in the Research and Development (R&D) algorithm and software architecture.

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

The process of producing an increasingly mature and complete requirements allocation involves an iterative development of the requirements, solution, design, and requirements allocation. Figure 5.2 illustrates this.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 36 of 36
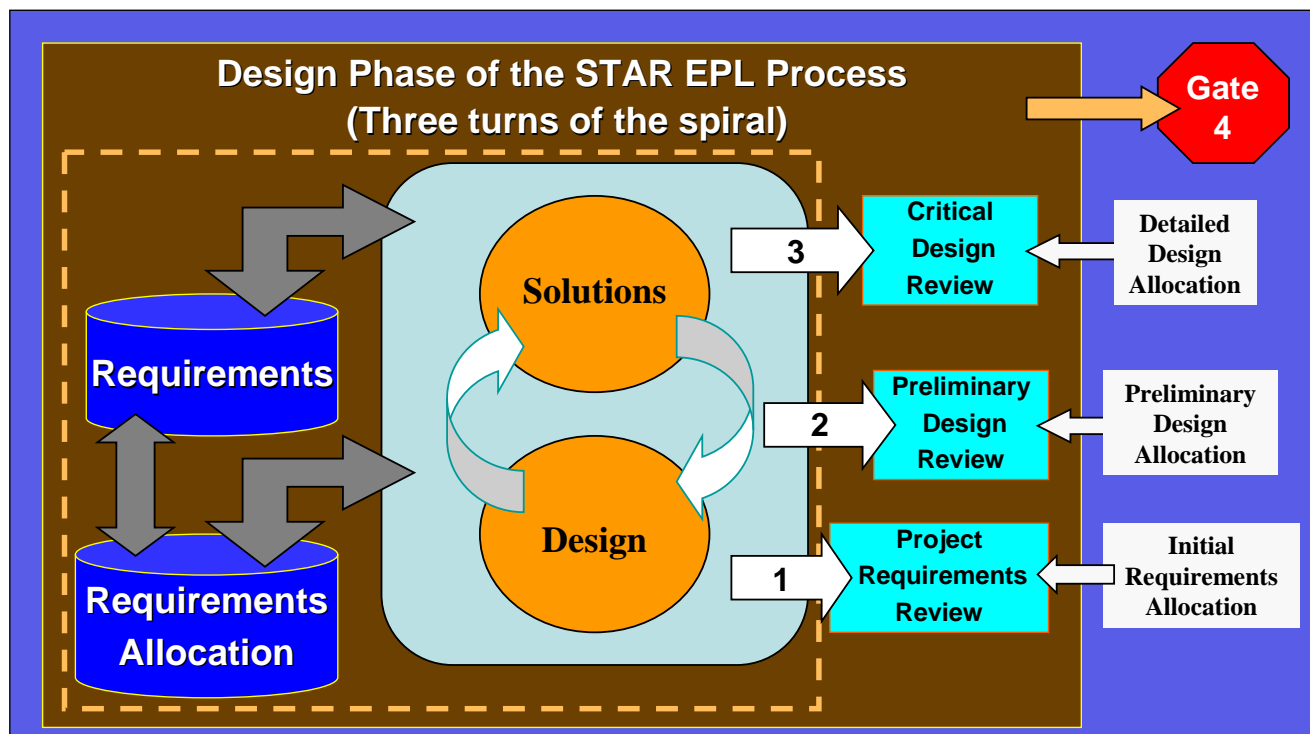
Figure 5.2 – Iterative (Spiral) Development of Requirements Allocation

As shown in Figure 5.2, requirements drive solutions, solutions drive design, and design determines requirements allocation. Gaps and/or inconsistencies between the requirements and the requirements allocation will then drive revisions to solutions and design. Revised solutions and design then drive revisions to requirements and/or requirements allocation, etc.

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

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

1) The Initial Requirements Allocation is achieved when it is determined that the set of stated requirements is complete. That is, it is not expected that additional

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 37 of 37

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.

5.2 Project Requirements Tasks

Technical Review Leads and **Technical Reviewers** should read this section if they will be reviewing either the PRR or the PDR.

Figure 5.3 shows the process flow for step 6.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 38 of 38
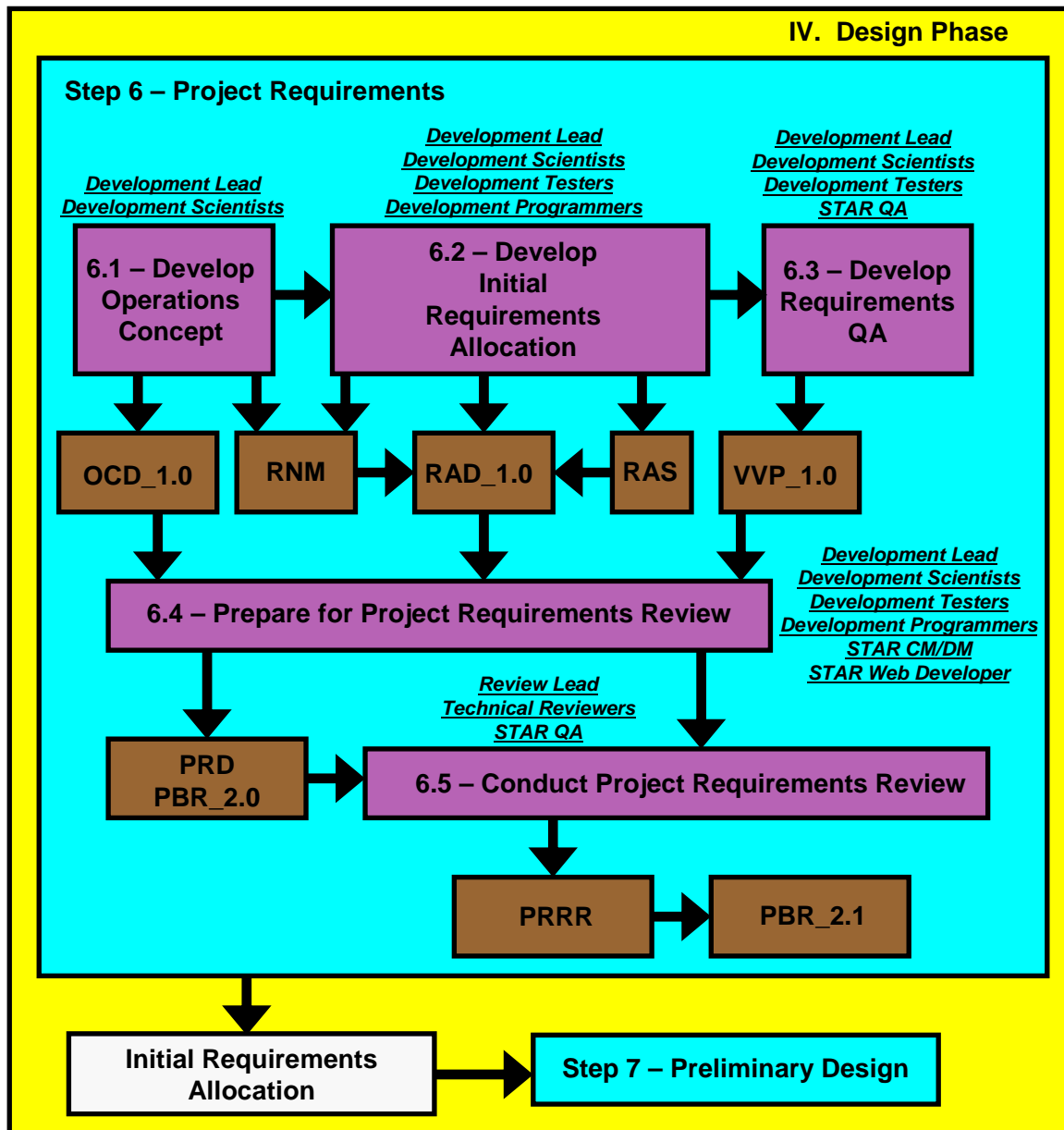
Figure 5.3 – Step 6 Process Flow

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 39 of 39

5.2.1 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.

5.2.2 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)

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 40 of 40

5.2.3 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

5.2.4 Task Outputs

Task outputs consist of the following BB 2.1 items:

- DPP_1.x

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 41 of 41

- 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

5.2.5 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

5.2.5.1 Develop Operations Concept

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

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 42 of 42

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.

5.2.5.2 Develop Initial Requirements Allocation

The **Development Lead** leads the development of the initial requirements allocation assisted by the **Development Scientists, Development Testers, Development Programmers,** and **STAR QA.** The Initial Requirements Allocation includes a set of identified process requirements and product requirements, and their allocation to product components of the product processing system.

The Initial Requirements Allocation is documented in the Requirements Allocation Document (RAD), following guidelines in DG-6.2.

5.2.5.3 Develop Requirements QA

The **Development Lead** leads the development of the requirements QA plan, with assistance from **Development Scientists, Development Testers,** and **STAR QA**.

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. Vertical traceability of all requirements should be established for PRR and documented in RAD v1r0.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 43 of 43

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.

Requirements Validation is concerned with ensuring 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. For PRR, validation of requirements should include a demonstration that a balance has been established between the basic requirements statements, customer/user needs and expectations, and constraints on the production, distribution and performance of products. This demonstration can be extended to derived requirements and requirements allocations that have been developed by PRR. Any identified conflicts between customer needs and expectations must be addressed and resolved before requirements development is completed.

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

The plan for tracking, validating and verifying requirements should be documented in the Verification and Validation Plan (VVP), in accordance with guidance in DG-6.3.

5.2.5.4 Prepare For PRR

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 **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.

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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 44 of 44

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 **Technical Review Lead** and **Technical Reviewers** are encouraged to 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.

5.2.5.5 Conduct PRR

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

The **Technical Review Lead** and the **Technical Reviewers** conduct the PRR to determine whether the PRR artifacts have established the requirements to be satisfied by the project and the means to validate them. Reviewers should be familiar with the PRR guidelines (PRG-6) and check list (CL-6). Refer to the DPP to determine whether the PRR check list has been tailored for a specific project's PRR.

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

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

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 45 of 45

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.

When the project passes its PRR, the project proceeds to preliminary design. The final version of the PRRR should include approval for the project to proceed to step 7, and will indicate all open actions that have been deferred to step 7.

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 **Technical Review Lead** and **Technical Reviewers** are encouraged to communicate their assessments to the **Development Lead**. 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 Preliminary Design Tasks

Technical Review Leads and **Technical Reviewers** should read this section if they will be reviewing either the PDR or the CDR.

Figure 5.4 shows the process flow for step 7.

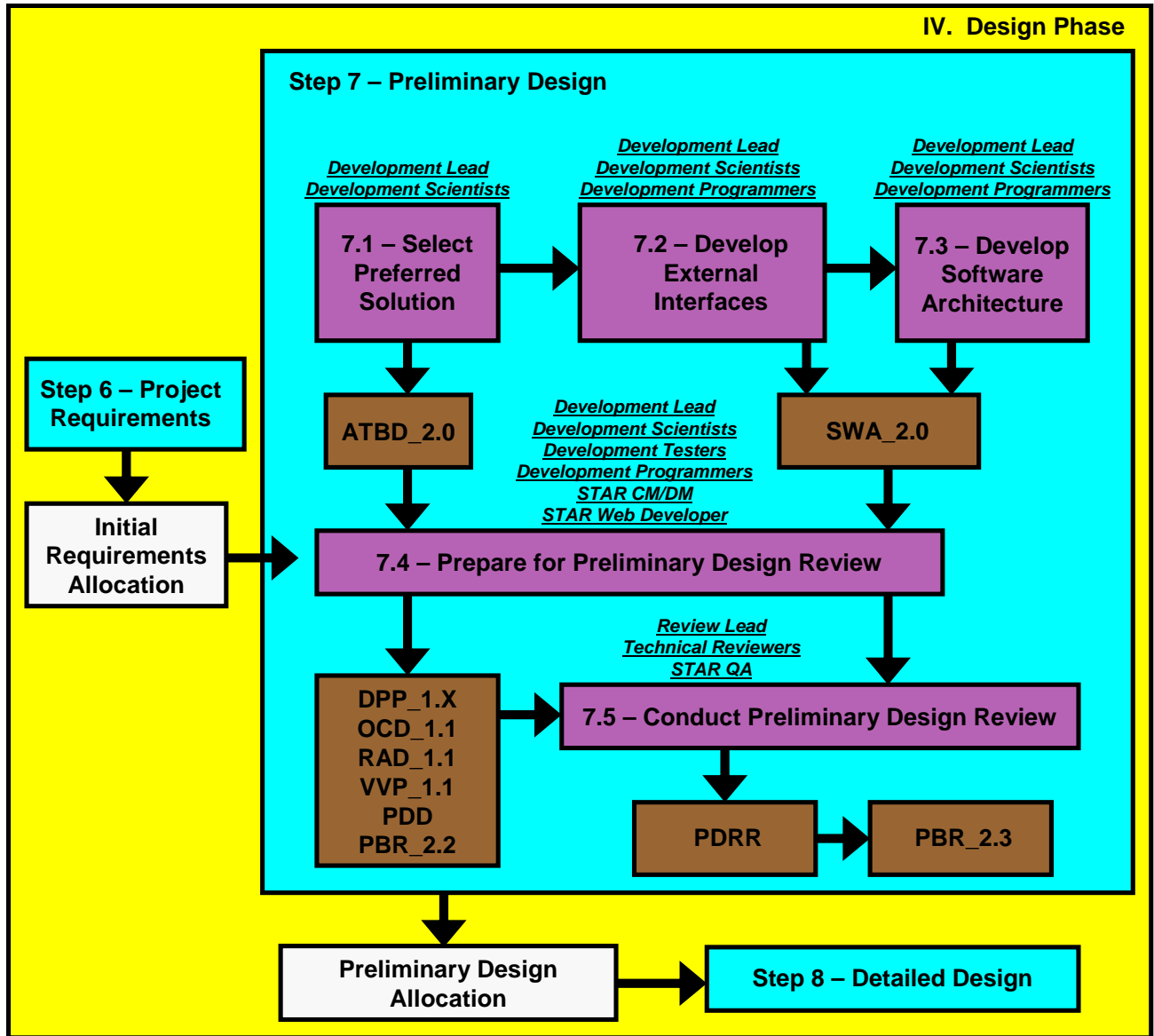# NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 46 of 46

Figure 5.4 – Step 7 Process Flow

5.3.1 Expected BEGIN State

- REQUIRED: A PRR has been conducted

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 47 of 47

- 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:
  - o DPP, including Appendices
  - o OCD
  - o RAD, including Appendices
  - o VVP
  - o Project Requirements Document (PRD)
  - o Project Requirements Review Report (PRRR)

- EXPECTED: BB 2.1 has placed the following items in the project artifact repository:
  - o R&D code
  - o R&D test data
  - o ATBD
  - o SWA
  - o PP
  - o Gate 2 Review Report (G2RR)
  - o 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.

5.3.2 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)

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 48 of 48

- PRD
- PRRR
- PBR_2.1

5.3.3 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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 49 of 49

- 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

5.3.4 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

5.3.5 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

5.3.5.1 Select Preferred Solution

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 50 of 50

When a preferred solution is selected, its requirements allocation becomes 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.

Development Scientists produce version 2 of the project ATBD, in accordance with DG-1.1. This version of the ATBD should identify and fully describe the preferred solution.

5.3.5.2   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**.

5.3.5.3   Develop Software Architecture

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

The software system is an integrated collection of software elements, or code, that implements a solution, producing well-defined output products from a well-defined set of input data. The software architecture describes the structure of the system software elements and the external and internal data flows between software elements.

The preliminary design software architecture consists of the Context Layer and the System Layer.

The Context Layer describes the flows between the system and its external interfaces.

The System Layer expands upon the Context Layer, describing the first layer of decomposition. In addition to the System Layer inputs and outputs, the major processing units are identified along with their inputs and outputs.

When the software units are identified and traced to the functional requirements, the Preliminary Design Allocation can be completed by tracing the functional requirements to the other system requirements. The Requirements Allocation Sheet (RAS) should match each requirement to a system component. The highest layer of system components consists of the software units. Allocation of the requirements to the software units completes the Preliminary Design Allocation.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 51 of 51

Once the Preliminary Design Allocation is completed, the **Development Scientists** and **Development Programmers** produce version 2 of the project Software Architecture Document (SWA), in accordance with DG-1.2. This version of the SWA should provide a complete description of the preliminary design software architecture.

5.3.5.4 Prepare For PDR

Development Scientists assist in a revision of the OCD, following the guidelines in DG-6.1. OCD v1r1 adds to v1r0 by providing operational scenarios for product operation and user interaction for each alternative solution under consideration at PDR.

Development Scientists and **Development Testers** assist in a revision of the RAD, following the guidelines in DG-6.2. RAD v1r1 adds to v1r0 by updating the allocation of requirements to system and product components, based on the maturing of solutions and design since PRR, as documented in SWA v2r0.

Development Scientists and **Development Testers** assist in a revision of the VVP, following the guidelines in DG-6.3. VVP v1r1 adds to v1r0 by updating the listing and description of verification and validation items and plans, based on the maturing of the requirements allocation, solutions and design since PRR, as documented in RAD v1r1 and SWA v2r0.

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

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 **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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 52 of 52

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** are encouraged to 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.

5.3.5.5   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**).

The **Technical Review Lead** and the **Technical Reviewers** conduct the PDR to determine whether the project preliminary design is complete and sufficiently mature to proceed to detailed design. Reviewers should be familiar with the PDR guidelines (PRG-7) and check list (CL-7). Refer to the DPP to determine whether the PDR check list has been tailored for a specific project's PDR.

The PDR reviewers complete a Preliminary Design Review Report (PDRR), following guidelines in DG-7.2. The PDRR will include the reviewers' assessment of the status of the PDR artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers' disposition of each PDR CLI.

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 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 53 of 53

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.

When the project passes its PDR, the project proceeds to detailed design. The final version of the PDRR should include approval for the project to proceed to step 8, and will indicate all open actions that have been deferred to step 8.

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 **Technical Review Lead** and **Technical Reviewers** are encouraged to communicate their assessments to the **Development Lead**. 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).

5.4 Detailed Design Tasks

Technical Review Leads and **Technical Reviewers** should read this section if they will be reviewing the CDR.

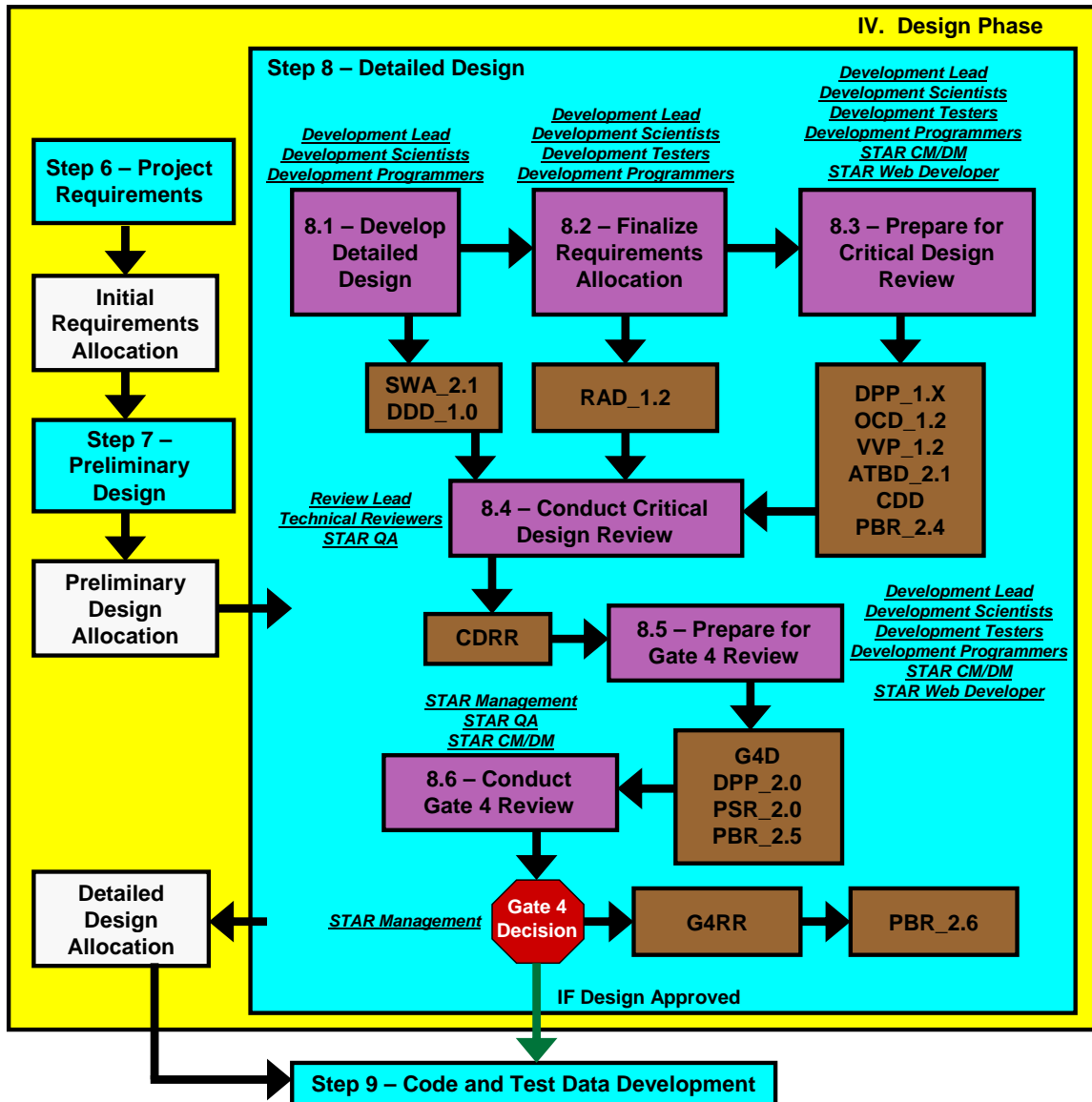Figure 5.5 shows the process flow for step 8.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 54 of 54

Figure 5.5 – Step 8 Process Flow

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 55 of 55

5.4.1 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.

5.4.2 Task Inputs

Task inputs consist of the following BB 2.3 items:

- DPP_1.x,

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 56 of 56

- 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

5.4.3 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 57 of 57

- 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

5.4.4 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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 58 of 58

5.4.5 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

5.4.5.1 Develop Detailed Design

The detailed design consists of the detailed software architecture, developed by the **Development Scientists**, and a detailed code description, developed by the **Development Programmers**.

The detailed design software architecture adds a Unit Layer and Sub-Unit Layer to the Context Layer and System Layer of the preliminary design software architecture.

The Unit Layer expands upon the System Layer, describing the second layer of decomposition. In this layer, the data flows within units are described.

The major elements of each unit are known as the Sub-Units. The Sub-Units constitute the third, most detailed layer of decomposition. The level of detail in this description should be sufficient to enable the Development Programmers to write the pre-operational code.

Upon completion of the detailed design software architecture, the SWA should be updated to version 2.1. This update will include any revisions to the Context Layer and System Layer that were made during step 8 and add the Unit Layer and Sub-Unit Layer descriptions.

The detailed design for each software unit should be documented in its own Detailed Design Document (DDD). The DDD should provide the information needed for **Development Programmers** to write fully functional pre-operational code.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 59 of 59

5.4.5.2   Finalize Requirements Allocation

The Detailed Design Allocation represents the culmination of the iterative development of requirements, solutions, and design during the Design phase. 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 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. The RAD should demonstrate 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.

5.4.5.3   Prepare for CDR

Development Scientists assist in a revision of the OCD, following the guidelines in DG-6.1. OCD v1r2 adds to v1r1 by providing a refinement of the operations concept for the preferred solution that was approved at the PDR.

Development Scientists and **Development Testers** assist in a revision of the VVP, following the guidelines in DG-6.3. VVP v1r2 adds to v1r1 by updating the listing and description of verification and validation items and plans, based on the maturing of the requirements allocation, solutions and design since PDR, as documented in RAD v1r2 and SWA v2r1.

Development Scientists produce a revision (v2r1) of the project ATBD, in accordance with DG-1.1. This version of the ATBD should demonstrate that the algorithm detailed design provides for an implementation that is consistent with the theoretical basis and meets requirements.

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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 60 of 60

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 **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** informs the **CDR 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** are encouraged to 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.

5.4.5.4 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**).

The **Technical Review Lead** and the **Technical Reviewers** conduct the CDR to determine whether the project detailed design is complete and sufficiently mature to proceed to the Build phase. Reviewers should be familiar with the CDR guidelines (PRG-8.1) and check list (CL-8.1). Refer to the DPP to determine whether the CDR check list has been tailored for a specific project's CDR.

The CDR reviewers complete a Critical Design Review Report (CDRR), following guidelines in DG-8.3. The CDRR will include the reviewers' assessment of the status of the CDR artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers' disposition of each CDR CLI.

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 next step,

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 61 of 61

"Code and Test Data Development". If not, the 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.

When the project passes its CDR, the project proceeds to code and test data development. The final version of the CDRR should include approval for the project to proceed to step 9, and will indicate all open actions that have been deferred to step 9.

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, how it can be improved. The **Technical Review Lead** and **Technical Reviewers** are encouraged to communicate their assessments to the **Development Lead**. 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).

5.4.5.5 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 62 of 62

5.4.5.6 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**).

5.5 Pre-Operational System Development Process

Technical Review Leads should read this section if they will be reviewing the TRR, CTR, or SRR.

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 5.6 illustrates the pre-operational system development process, with step 9 highlighted.
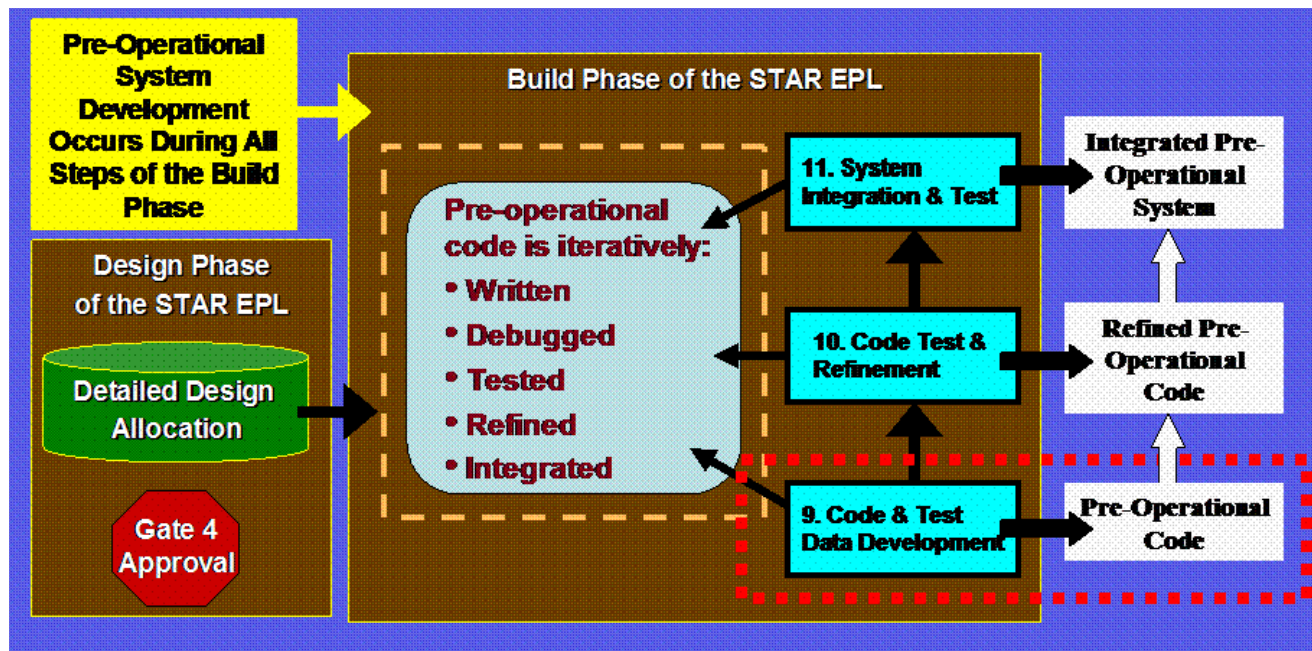
NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 63 of 63

Figure 5.6 – Pre-Operational System Development Process

As Figure 5.6 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 5.7 illustrates this.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 64 of 64
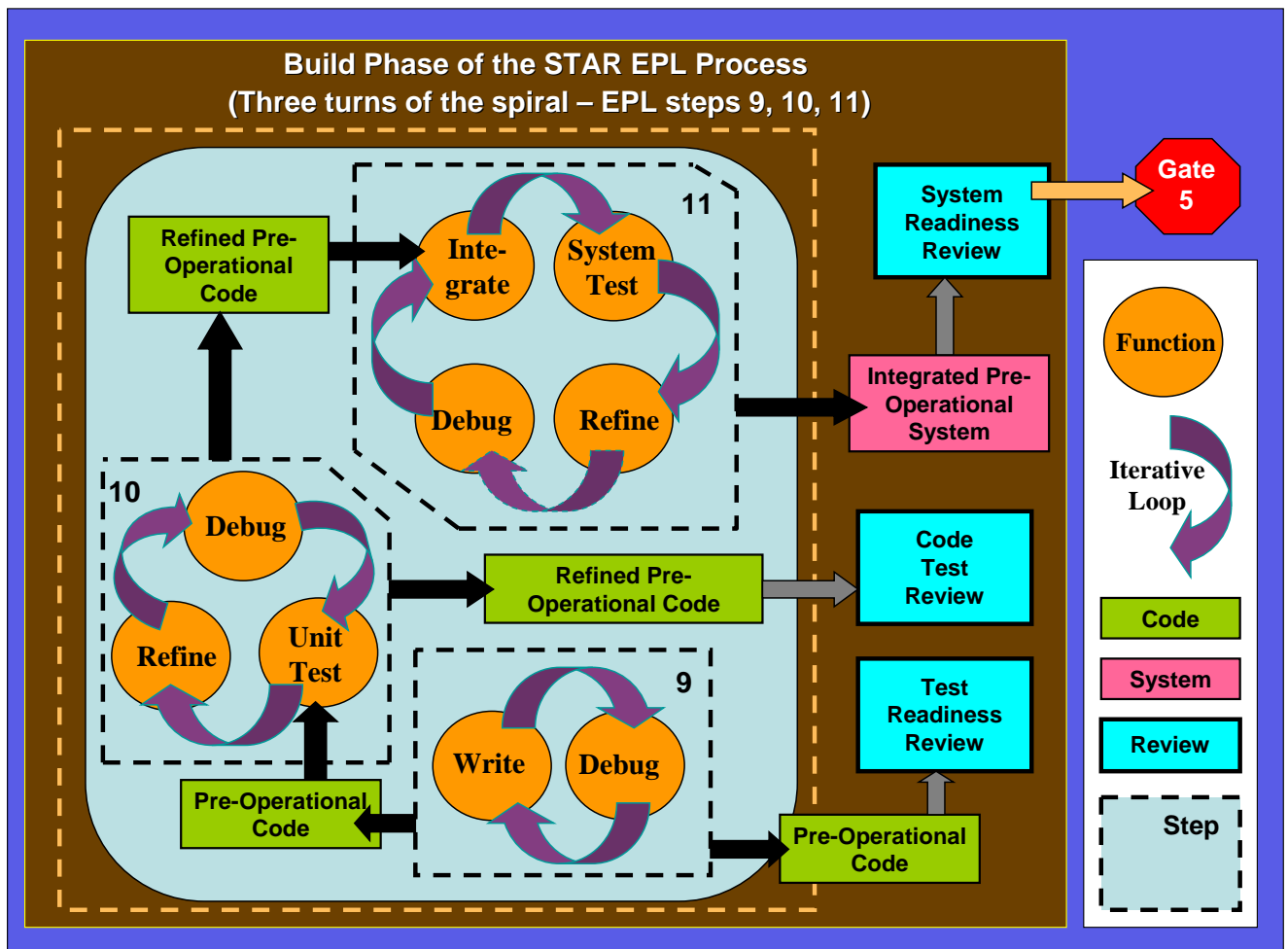
Figure 5.7 – Iterative (Spiral) Development of Pre-Operational System

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 (write and debug code) is limited to producing code that is sufficiently mature and complete to allow unit testing. This is illustrated in Figure 5.7 as the output from step 9 is pre-operational code that is input to the Unit Test function of step 10.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 65 of 65

5.6 Code & Test Data Development Tasks

Technical Review Leads and **Technical Reviewers** should read this section if they will be reviewing either the TRR or the CTR.
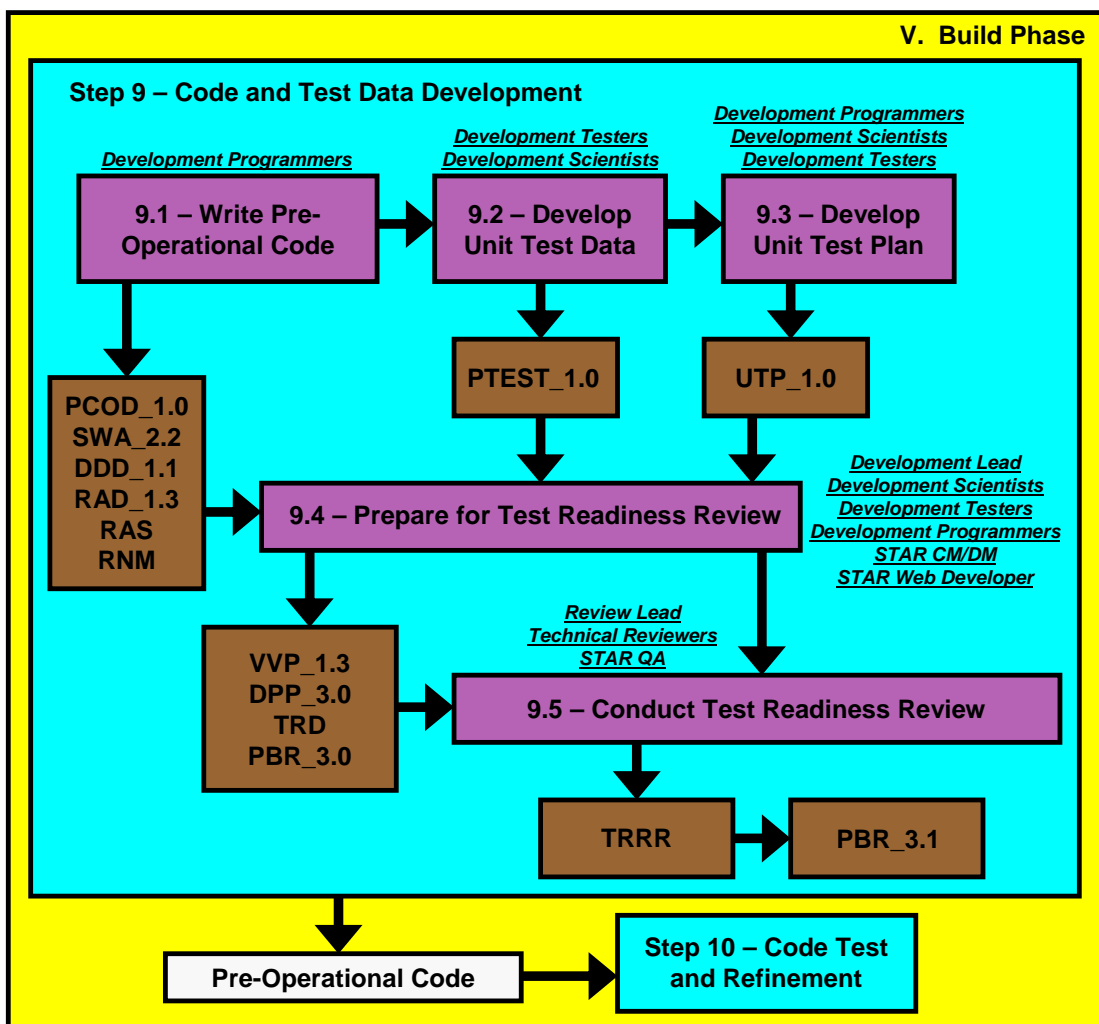
Figure 5.8 shows the process flow for step 9.

Figure 5.8 – Step 9 Process Flow

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 66 of 66

5.6.1 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 67 of 67

5.6.2 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

5.6.3 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 68 of 68

- 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

5.6.4 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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 69 of 69

5.6.5 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

5.6.5.1 Write Pre-Operational Code

Development Programmers write the pre-operational code to implement the detailed design, following coding standards provided in TD-11.1 (FORTRAN code) and TD-11.2 (C 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.

5.6.5.2 Develop Unit Test Data

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

5.6.5.3 Develop Unit Test Plan

Development Programmers, Development Scientists and Development Testers collaborate in the development of a unit test plan, documented in UTP v1r0.

5.6.5.4 Prepare for TRR

Development Scientists and **Development Testers** assist in a revision of the VVP, following the guidelines in DG-6.3. VVP v1r3 adds to v1r2 by updating the listing and description of verification and validation items and plans, based on changes to the Detailed Design Allocation since CDR, as documented in RAD v1r3.

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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 70 of 70

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 **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** 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** are encouraged to 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.

5.6.5.5   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**).

The **Technical Review Lead** and the **Technical Reviewers** conduct the TRR to determine whether the pre-operational code conforms to coding standards and is ready for unit testing. Reviewers should be familiar with the TRR guidelines (PRG-9) and check list (CL-9). Refer to the DPP to determine whether the TRR check list has been tailored for a specific project's TRR.

The TRR reviewers complete a Test Readiness Review Report (TRRR), following guidelines in DG-9.3. The TRRR will include the reviewers' assessment of the status of the

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 71 of 71

TRR artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers' disposition of each TRR CLI.

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 TRRR 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** pass the project to the next step.

If a delta review is not required, the revision of the TRR artifacts will be deferred to actions performed during step 10 for review at the Code Test Review (CTR), or during later steps for review at later reviews. All of this should be documented in the final version of the TRRR.

When the project passes its TRR, the project proceeds to code unit testing and refinement. The final version of the TRRR should include approval for the project to proceed to step 10, and will indicate all open actions that have been deferred to step 10.

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 **Technical Review Lead** and **Technical Reviewers** are encouraged to communicate their assessments to the **Development Lead**. 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 Code Test and Refinement Tasks

Technical Review Leads and **Technical Reviewers** should read this section if they will be reviewing either the CTR or the SRR.

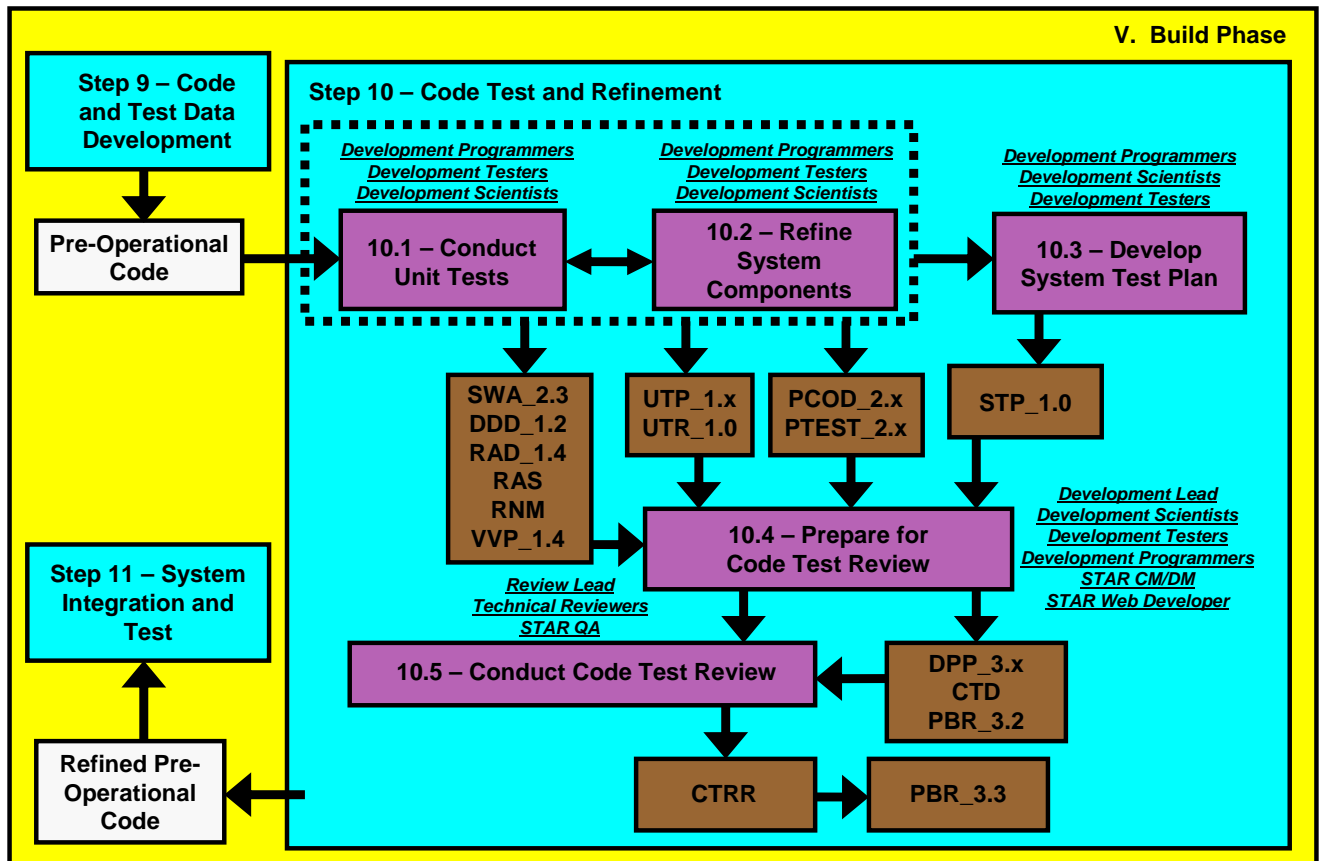Figure 5.9 shows the process flow for step 10.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 72 of 72

Figure 5.9 – 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 5.5.

5.7.1 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 73 of 73

- 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:
    o Pre-operational code
    o Unit test data
    o DPP, including Appendices
    o RAD, including Appendices
    o VVP
    o ATBD
    o SWA
    o DDD
    o UTP
    o Test Readiness Document (TRD)
    o TRRR

- EXPECTED: BB 3.1 has placed the following items in the project artifact repository:
    o R&D code
    o R&D test data
    o Project Proposal (PP)
    o Gate 2 Review Report (G2RR)
    o Gate 3 Review Report (G3RR)
    o Operations Concept Document (OCD)
    o Project Requirements Document (PRD)
    o Project Requirements Review Report (PRRR)
    o Preliminary Design Document (PDD)
    o Preliminary Design Review Report (PDRR)
    o Critical Design Document (CDD)
    o Critical Design Review Report (CDRR)
    o Gate 4 Document (G4D)
    o Gate 4 Review Report (G4RR)
    o Project Status Report (PSR), including Appendix

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 74 of 74

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

5.7.2 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

5.7.3 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 75 of 75

- 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

5.7.4 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

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 76 of 76

- CTD
- CTRR
- PBR_3.3

5.7.5 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

5.7.5.1 Conduct Unit Tests

Development Testers, Development Programmers and **Development Scientists** conduct the unit tests, in accordance with the unit test plan, and document the results in a Unit Test Report (UTR). The purpose of UTR v1r0 is to document the results of testing of each software unit to verify that the requirements allocated to the unit's software components are satisfied.

5.7.5.2 Refine System Components

Development Programmers, Development Testers and **Development Scientists** refine the code, test data, and unit test plan as necessary, based on the unit test results. The VVP, UTP, and RAD are updated as necessary to reflect any changes.

5.7.5.3 Develop System Test Plan

Development Programmers, Development Scientists and Development Testers collaborate in the development of a system test plan, documented in STP v1r0, following guidelines in DG-10.2. The purpose of STP v1r0 is to present the plan for testing to ensure that the requirements specified for the product processing system (PPS) are satisfied by the completed system (Verification) and that the final developed system will satisfy the users' needs and expectations (Validation). The purpose of the system test is to

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 77 of 77

demonstrate, using verification and validation methods, system readiness for operations. The STP builds on the project's VVP and UTP.

5.7.5.4 Prepare for CTR

The **Development Lead** updates the DPP to version 3.x to address any changes to the project plan since the TRR, 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 **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** 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** are encouraged to 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.

5.7.5.5 Conduct CTR

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

NOAA NESDIS STAR

The **Technical Review Lead** and the **Technical Reviewers** conduct the CTR to determine whether the refined pre-operational code has satisfied unit test criteria and is ready for integration into a pre-operational product processing system. Reviewers should be familiar with the CTR guidelines (PRG-10) and check list (CL-10). Refer to the DPP to determine whether the CTR check list has been tailored for a specific project's CTR.

The CTR reviewers complete a Code Test Review Report (CTRR), following guidelines in DG-10.4. The CTRR will include the reviewers' assessment of the status of the CTR artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers' disposition of each CTR CLI.

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 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 code unit testing and refinement. 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 **Technical Review Lead** and **Technical Reviewers** are encouraged to communicate their assessments to the **Development Lead**. 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).

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 79 of 79

5.8 System Integration and Test Tasks

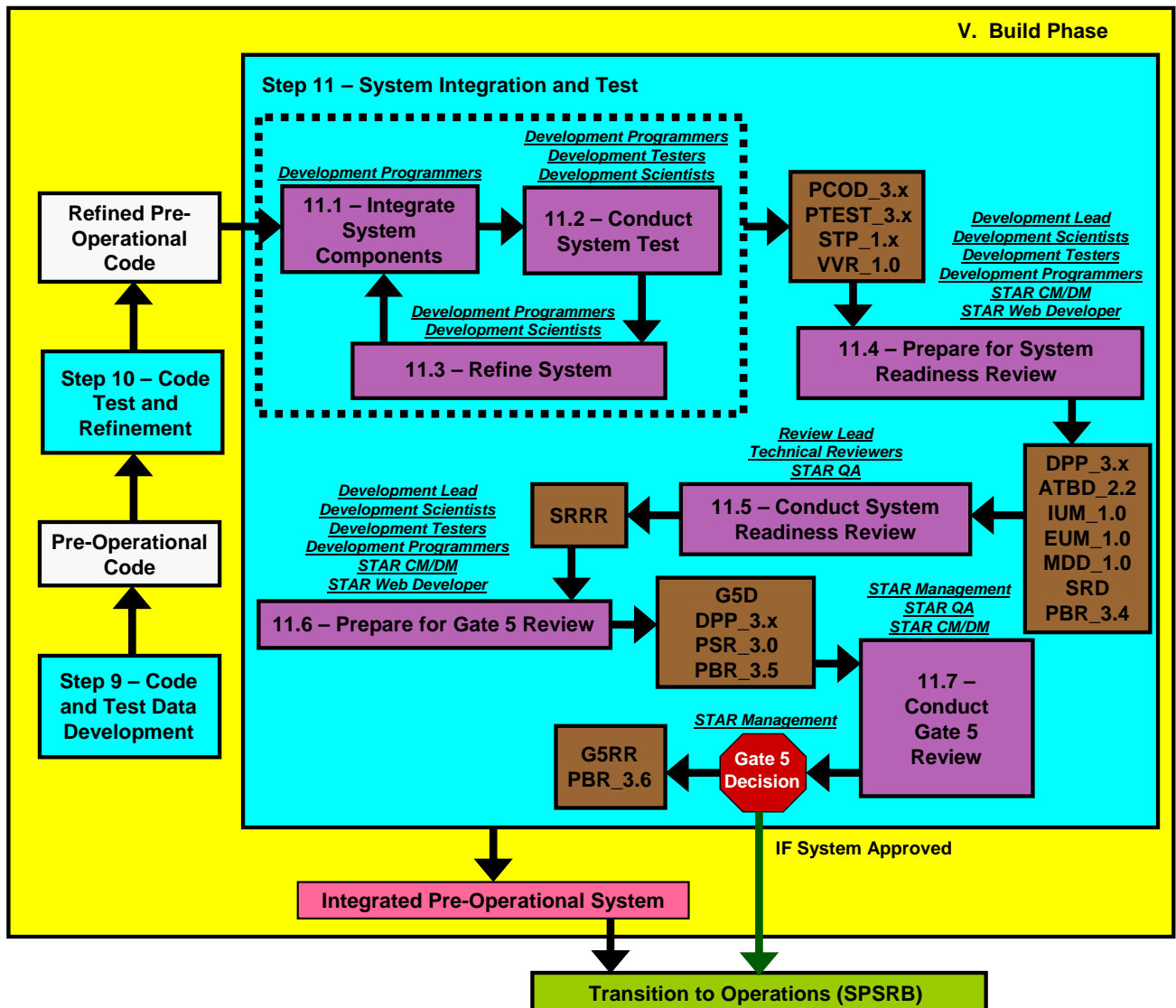Figure 5.10 shows the process flow for step 11.

Figure 5.10 – 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 5.10.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 80 of 80

5.8.1 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:
  - o Refined pre-operational code
  - o System test data
  - o DPP, including Appendices
  - o RAD, including Appendices
  - o VVP
  - o ATBD
  - o SWA
  - o DDD
  - o UTP
  - o UTR
  - o STP
  - o Code Test Document (CTD)
  - o CTRR

- EXPECTED: BB 3.3 has placed the following items in the project artifact repository:
  - o R&D code
  - o R&D test data

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 81 of 81

- o Project Proposal (PP)
- o Gate 2 Review Report (G2RR)
- o Gate 3 Review Report (G3RR)
- o Operations Concept Document (OCD)
- o Project Requirements Document (PRD)
- o Project Requirements Review Report (PRRR)
- o Preliminary Design Document (PDD)
- o Preliminary Design Review Report (PDRR)
- o Critical Design Document (CDD)
- o Critical Design Review Report (CDRR)
- o Gate 4 Document (G4D)
- o Gate 4 Review Report (G4RR)
- o Test Readiness Document (TRD)
- o Test Readiness Review Report (TRRR)
- o Project Status Report (PSR), including Appendix
- REQUIRED: PBR_3.3 documents the status of the BB 3.3 project baseline

5.8.2 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)

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 82 of 82

- Requirements Allocation Sheet (RAS)

- VVP_1.4

- CTD

- CTRR

- PSR_2.x Appendix

- PBR_3.3

5.8.3 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 83 of 83

- 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

5.8.4 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

5.8.5 Stakeholder Activities

Step 11 activities include:

1) Integrate system components
2) Conduct system test
3) Refine system

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 84 of 84

4) Prepare for SRR

5) Conduct SRR

6) Prepare for Gate 5 Review

7) Conduct Gate 5 Review

5.8.5.1 Integrate System Components

Development Programmers integrate the system components that have passed unit testing into a complete end-to-end product processing system.

Note that the system integration function is iterative with system testing (Section 6.5.2) and refinement (Section 6.5.3). If system testing uncovers problems that require refinement of the code, test data, and/or scripts, these will have to be re-integrated and re-tested.

5.8.5.2 Conduct System Test

Development Testers and Development Programmers conduct the system test, in accordance with the system test plan, and document the results in a Verification and Validation Report (VVR). The purpose of VVR v1r0 is to document the results of system testing to ensure that the requirements specified for the product processing system are satisfied by the completed system (Verification) and that the final developed system will satisfy the users' needs and expectations (Validation).

5.8.5.3 Refine System

Development Programmers, Development Testers and **Development Scientists** refine the code, test data, and system test plan as necessary, based on the system test results. The STP and VVR are updated as necessary to reflect any changes.

5.8.5.4 Prepare for SRR

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

Development Programmers produce IUM v1r0. The IUM is intended for OSDPD/SAB analysts of a product processing system such as an interactive tool/GUI. The IUM provides

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 85 of 85

information on the system that is necessary to ensure the effective and reliable operation of the application.

Development Scientists produce EUM v1r0, assisted by **Development Testers** and **Development Programmers**. The EUM is intended for users of one or more of the products delivered by the system, including end users (customers) and testers (V&V teams). The EUM provides product users with information that will enable them to acquire the product, understand its features, and use the data.

Development Programmers produce MDD v1r0, following guidelines in DG-11.4. The MDD addresses NESDIS (ISO) guidelines for data providers to describe the content, quality, condition and characteristics of data generated by the product application system.

Development Scientists upgrade the ATBD to produce ATBD v2r2. ATBD v2r2 upgrades performance estimates based on unit testing and system testing to demonstrate to product users that the integrated pre-operational system satisfies all requirements for transition to operations.

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 **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** 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** are encouraged to 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.

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 86 of 86

5.8.5.5 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**).

The **Technical Review Lead** and the **Technical Reviewers** conduct the SRR to determine whether the integrated pre-operational system has satisfied system test success criteria and is ready for delivery to operations. Reviewers should be familiar with the SRR guidelines (PRG-11.1) and check list (CL-11.1). Refer to the DPP to determine whether the SRR check list has been tailored for a specific project's SRR.

The SRR reviewers complete a System Readiness Review Report (SRRR), following guidelines in DG-11.6. The SRRR will include the reviewers' assessment of the status of the SRR artifacts, the project risks, and associated risk mitigation actions, and an Appendix that consists of the reviewers' disposition of each SRR CLI.

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.

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 **Technical Review Lead** and **Technical Reviewers** are encouraged to communicate their assessments to the **Development Lead**. 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).

5.8.5.6 Prepare Gate 5 Review

NOAA NESDIS STAR

STAKEHOLDER GUIDELINE SG-17
Version: 3.0
Date: December 31, 2009

TITLE: Technical Review Lead Guidelines

Page 87 of 87

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.

5.8.5.7   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, recommendations are made for correcting deficiencies. Deficiencies can be technical, based on the SRRR and PSR Appendix, or cost/schedule, based on the DPP and PSR. This process is iterated until the Gate 5 Reviewers are satisfied with the technical, cost and schedule status of the project.

END OF DOCUMENT