NOAA NESDIS
CENTER for SATELLITE APPLICATIONS
and RESEARCH (STAR)

PROCESS GUIDELINE

PG-1
ENTERPRISE PRODUCT LIFECYCLE
PROCESS GUIDELINE

Version 3.0

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TITLE: PG-1: ENTERPRISE PRODUCT LIFECYCLE PROCESS GUIDELINE VERSION 3.0

AUTHORS:

Ken Jensen (Raytheon Information Solutions)

VERSION HISTORY SUMMARY

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

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LIST OF ACRONYMS

ATBD	Algorithm Theoretical Basis Document
AWC	Aviation Weather Center
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
CoRP	Cooperative Research Program
CM	Configuration Management
CMMI	Capability Maturity Model Integration
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
DM	Data Management
DPP	Development Project Plan
DPR	Development Project Report
EPG	Enterprise Process Group
EPL	Enterprise Product Lifecycle
EUM	External Users Manual
IUM	Internal Users Manual
JCSDA	Joint Center for Satellite Data Assimilation

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MDD	Metadata Document
NASA	National Aeronautics and Space Administration
NCEP	National Center for Environmental Prediction
NESDIS	National Environmental Satellite, Data, and Information Service
NHC	National Hurricane Center
NOAA	National Oceanic and Atmospheric Administration
NRC	National Research Council
NWS	National Weather Service
OCD	Operations Concept Document
OSDPD	Office of Satellite Data Processing and Distribution
PAR	Process Asset Repository
PBR	Project Baseline Report
PDD	Preliminary Design Document
PDR	Preliminary Design Review
PDRR	Preliminary Design Review Report
PG	Process Guidelines
POP	Product Oversight Panel
PP	Project Proposal
PRD	Project Requirements Document
PRG	Peer Review Guidelines
PRR	Project Requirements Review
PRRR	Project Requirements Review Report
PSR	Project Status Report
QA	Quality Assurance
R&D	Research & Development
R&DC	Research & Development Council
RAD	Requirements Allocation Document
SEI	Software Engineering Institute
SG	Stakeholder Guideline
SMCD	Satellite Meteorology and Climatology Division

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SOCD	Satellite Oceanography and Climatology Division
SOP	Service Oversight Panel
SPI WG	SPSRB Process Improvement Working Group
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
TD	Training Document
TG	Task Guideline
TRD	Test Readiness Document
TRR	Test Readiness Review
TRRR	Test Readiness Review Report
UG	Users Guide
UTP	Unit Test Plan
UTR	Unit Test Report
UW	University of Wisconsin
VVP	Verification and Validation Plan
VVR	Verification and Validation Report

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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 the Process Guideline (PG) for users of this process, which has been designated as the STAR Enterprise Product Lifecycle (EPL).

1.1. Objective

The objective of this PG is to serve as a first reference for users to understand the STAR EPL and their roles in the process, primarily by providing an overview of the process (c.f. Section 2) and by providing references to specific process assets (c.f. Section 4.1) that are targeted for specified users during specified stages of the EPL.

The intended users of this PG are all participants in the STAR EPL process. Participants are referred to as STAR EPL stakeholders (c.f. Section 3.2).

This PG is intended to be the first reference, but not a complete reference, for each user. The relevant process assets (c.f. Section 5) fill that purpose.

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[1] Cooperative Institute for Climate Studies (c.f. Section 3.2.2.1)

[2] Cooperative Institute for Meteorological Satellite Studies (c.f. Section 3.2.2.2)

[3] Cooperative Institute for Oceanographic Satellite Studies (c.f. Section 3.2.2.3)

[4] Cooperative Institute for Research in the Atmosphere (c.f. Section 3.2.2.4)

[5] Cooperative Remote Sensing and Technology Center (c.f. Section 3.2.2.5)

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The readers of this reference should first determine what stakeholder roles apply to their participation in a STAR research-to-operations development project. Generic stakeholder roles are discussed in Section 3.2 of this PG. This PG will direct stakeholders to Stakeholder Guidelines (SG) and Task Guidelines (TG) that are pertinent to them. The SGs and TGs will contain more detailed information to assist the stakeholders. See Section 4.2 for more details.

1.2. Version History

This is the first version of PG-1. It is numbered version 3.0 to align it with the release of the version 3.0 STAR EPL Process Asset Repository (PAR, c.f. Section 5.1). PG-1_v3r0, and its Appendix (PG-1.A_v3r0), replace the STAR EPL User's Guide (TD-00.1_UG_v2r0 and TD-00.1.A_UG_v2r0) of the version 2 process assets. Much of the material in TD-00.1 has been incorporated into PG-1_3.0, with substantial revisions and additions. The description of the process tasks in TD-00.1 Section 5 has been moved to pertinent TGs and SGs.

1.3. Overview

This PG contains the following sections:

Section 1.0 - Introduction
Section 2.0 - Reference Documents
Section 3.0 - Product Development Environment
Section 4.0 - STAR EPL Process Overview
Section 5.0 - STAR EPL Process Assets

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2. REFERENCE DOCUMENTS

All of the reference documents for the STAR EPL process are STAR EPL process assets (c.f. Section 5) that are accessible in a Process Asset Repository (PAR) on the STAR website:

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

Additional references:

1) **NRC (2003).** *Satellite Observations of the Earth's Environment – Accelerating the Transition from Research to Operations*, National Academies Press, Washington, D.C., 2003.

   This reference is a joint NASA/NOAA white paper that provides the joint agency vision for cooperation between satellite data providers, product development teams, and product users to facilitate the application of emerging algorithm technologies to provide operational data products of value to the wide remote sensing user community. The STAR EPL vision is to provide a standardized product lifecycle that responds to the NASA/NOAA vision. This document can be accessed from:

   http://www.nap.edu/catalog.php?record_id=10658

2) **CMMI-DEV-v1.2 (2006)**

   This reference contains the goals and practices of the current Capability Maturity Model Integration (CMMI) of the Carnegie-Mellon Software Engineering Institute (SEI). The STAR EPL is designed to achieve all CMMI goals and practices that are required for the organization to operate at a CMMI-DEV Maturity Level 3. This document can be accessed from the SEI website:

   (http://www.sei.cmu.edu/publications/documents/06.reports/06tr008.html).

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3. PRODUCT DEVELOPMENT ENVIRONMENT

3.1. STAR

The Center for Satellite Applications and Research (STAR) is the science arm of the National Environmental Satellite, Data and Information Service (NESDIS), which acquires and manages the nation's operational Earth-observing satellites. NESDIS provides data from these satellites, and conducts research to make that possible. STAR supports NESDIS and NOAA in their mission to assess current conditions and predict future changes on the Earth, and to understand long-term changes in the environment.

The STAR mission is to transfer satellite observations of the land, atmosphere, ocean, and climate from scientific research and development into routine operations, and to offer state-of-the-art data, products and services to decision-makers.

STAR is organized into Divisions and Branches. The organization charts can be found at:

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

3.2. SPSRB

The NESDIS Satellite Product and Services Review Board (SPSRB) provides oversight management for acquiring meteorological, climatic, terrestrial, oceanographic and solar-geophysical satellite products and services required to support civilian and national security missions.

The SPSRB was established for the following purposes:

1. The SPSRB shall review all new product and services efforts at the times when they are ready to move from the developmental phase to the operational test phase. It shall decide as a result of those reviews that (a) the effort enter the next phase, or (b) that it enter the next phase with specified limitations or changes, or that additional work be completed in the present phase in preparation for later reevaluation, or (c) that work on the product or service effort be terminated. This review will include an assessment of the required resources (including computer and staff resources) as an aid in establishing priorities for competing activities. The decisions of the SPSRB shall be recorded on the appropriate

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Product Development Certification.

2. The SPSRB shall review and approve changes and terminations, reviewing, at any member's option, updates.

3. The SPSRB shall review the product or service line for completeness, redundancy, and usefulness, and for identifying and approving major changes, additions, consolidations, and deletions. The SPSRB will maintain current lists of approved present and future products and services. The roles of the NESDIS SPSRB and the NESDIS Research and Development Council (R&DC) are highly complementary. The R&DC oversees and guides the research and development program at NESDIS. Development and operational oversight of new and existing products and services are carried out by the NESDIS Product Oversight Panels (POPs) and Services Oversight Panel (SOP) established by the SPSRB. The POPs and SOP provide end-to- end oversight for their assigned NESDIS product or service area. The SPSRB receives and reviews all information regarding new product and service plans and development. Each POP/SOP is responsible for relaying product and service requirements and future plans to the SPSRB throughout the development process.

The SPSRB has the responsibility for decisions involved in moving from one phase to another and the responsibilities for carrying out the work in the various phases. It is expected that written development, test, and milestone plans will serve as the basis for the SPSRB reviews.

For the STAR EPL process, the SPSRB has primary oversight responsibility for projects that are planned for operational production by the Office of Satellite Data Processing and Distribution (OSDPD). SPSRB enters the product lifecycle after EPL process step 3 (c.f. Section 4.4), where it is decided whether a project will be developed for OSDPD operations. SPSRB oversees all subsequent steps for projects planned for OSDPD.

The STAR EPL process has been designed to mesh smoothly with the SPSRB process. Many of the EPL gate reviews are intended to be joint STAR/SPSRB reviews. The SPSRB is therefore a major stakeholder in the STAR EPL process. It is critical that SPRSB process stakeholders, especially the SPRSB Process Improvement Working Group (SPI WG), communicate concerns and suggestions to the STAR EPG.

3.3. External Organizations

In addition to STAR and SPSRB, it is expected that there will be many other organizations that will be involved in the STAR EPL process. These organizations are identified as either "PUSH" users or "PULL" users, following the terminology of the National Research Council

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(NRC) joint NOAA/NASA Committee on NASA-NOAA Transition from Research to Operations report (NRC 2003).

NRC 2003 notes that the research-to-operations transition process should involve a "push-pull" dynamic in which research and technology development programs respond to the requirements (PULL) of the operational user and the operational system takes advantage of new research results and technologies (PUSH) that emerge as a result of science and technology evolution. The STAR EPL process is designed as the bridge between PUSH users and PULL users.

It is useful to make the distinction between PUSH users and PULL users, as they play different roles in the STAR EPL process. Most organizations tend to be primarily research (PUSH) or operational (PULL) in nature, allowing us to make the distinction, though it should be noted that some organizations contain both research and operational functions.

3.3.1. PUSH Users

PUSH Users are associated with organizations whose mission and personnel are research-oriented. These stakeholders make a valuable contribution to the STAR mission by identifying and developing new algorithm technologies that can be used either to improve existing products to satisfy new operational requirements or to exploit new satellite data to create new or improved operational products that satisfy NOAA mission requirements. PUSH users customarily gain entry to the STAR EPL development phase by submitting a Project Proposal that is approved at a Gate 2 Review. They are therefore primary stakeholders for the Research phases of the EPL. The Cooperative Research Program organizations http://www.star.nesdis.noaa.gov/star/CoRP_index.php are classic PUSH users.

3.3.2. PULL Users

PULL Users are organizations whose mission and personnel are operations-oriented. These stakeholders make a valuable contribution to the STAR mission by identifying operational needs of the user community that satisfy NOAA mission requirements and can be met by the development of products from environmental satellite data. PULL users will customarily produce and/or distribute the operational products to end users. Sometimes a PULL organization will have the resources to also provide the research solutions to the operational need they have identified. More often, the research resources will reside elsewhere. It is therefore highly beneficial for PULL users and PUSH users to communicate effectively.

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PULL organizations that are frequently users of STAR development products include the National Weather Service/National Centers for Environmental Prediction (NWS/NCEP), the Joint Center for Satellite Data Assimilation (JCSDA), the National Weather Service/National Hurricane Center (NWS/NHC), the National Weather Service/Aviation Weather Center (NWS/AWC), and NPOESS Data Exploitation (NDE).

The Office of Satellite Data Processing and Distribution (OSDPD) is a PULL organization that plays a unique role in the STAR EPL process as the primary operations organization for NESDIS.

3.4. The STAR CMMI Process

NESDIS research to operations is under stress today, challenged by increasing user needs, increasing size and complexity of satellite systems, and perpetual limitations of resources. This problem will only increase in the next decade, as even larger and more complex systems come on line. How can NESDIS prevent systemic failures under these conditions?

Process improvement improves efficiency and quality, providing a mechanism whereby NESDIS can optimally manage the challenges ahead.

Process improvement is the essential first component of a solution, since it provides the means to best identify and acquire the resources needed to control and meet requirements

STAR's process improvement objective is to insert the practices of the Capability Maturity Model Integration (CMMI) model for Development, CMMI-DEV v1.2, to achieve low-risk algorithm/code deliveries to operations. The goal is to achieve CMMI-DEV Maturity Level 3.

Figure 3.1 illustrates the scope of this effort.

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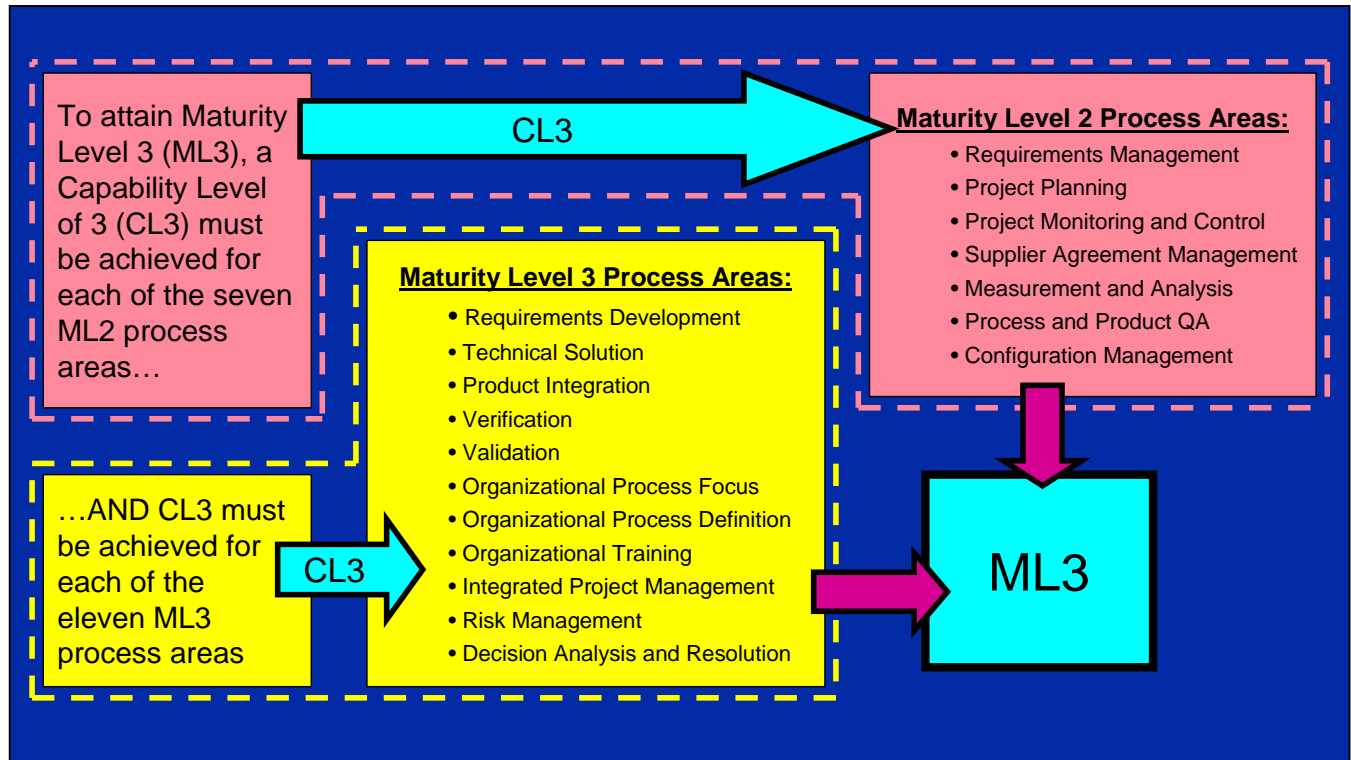
Figure 3.1 – Attaining CMMI-DEV Maturity Level 3

The practices needed for a CMMI Maturity Level 3 process can be found in the SEI publication "CMMI for Development Version 1.2". This document, and other CMMI information, is available from the Carnegie Mellon Software Engineering Institute at http://www.sei.cmu.edu/cmmi/tools/dev/download.cfm

To facilitate the implementation of these practices on its development projects, STAR has directed the development of a CMMI Maturity Level 3 process that is customized to its organization. This process, called the STAR Enterprise Product Lifecycle (EPL), has been developed, tested and refined on pilot programs. EPL version 3 is now ready for deployment on STAR development projects. The process is described in Section 4.

The STAR EPL is compliant with the required goals and expected practices of a CMMI-DEV V1.2 Maturity Level 3 process. Performance of the STAR EPL practices on STAR

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projects will enable STAR to develop systems for operations in a way that manages costs and risks, and minimizes surprises

It is important to note that stakeholders involved in a STAR EPL development project do not need to become familiar with the CMMI model to be able to implement the model practices, because the STAR Enterprise Process Group (EPG) has developed a set of training material, called the STAR EPL process assets, that provide stakeholders with the information they need without reference to the model. Figure 3.2 illustrates how this works.
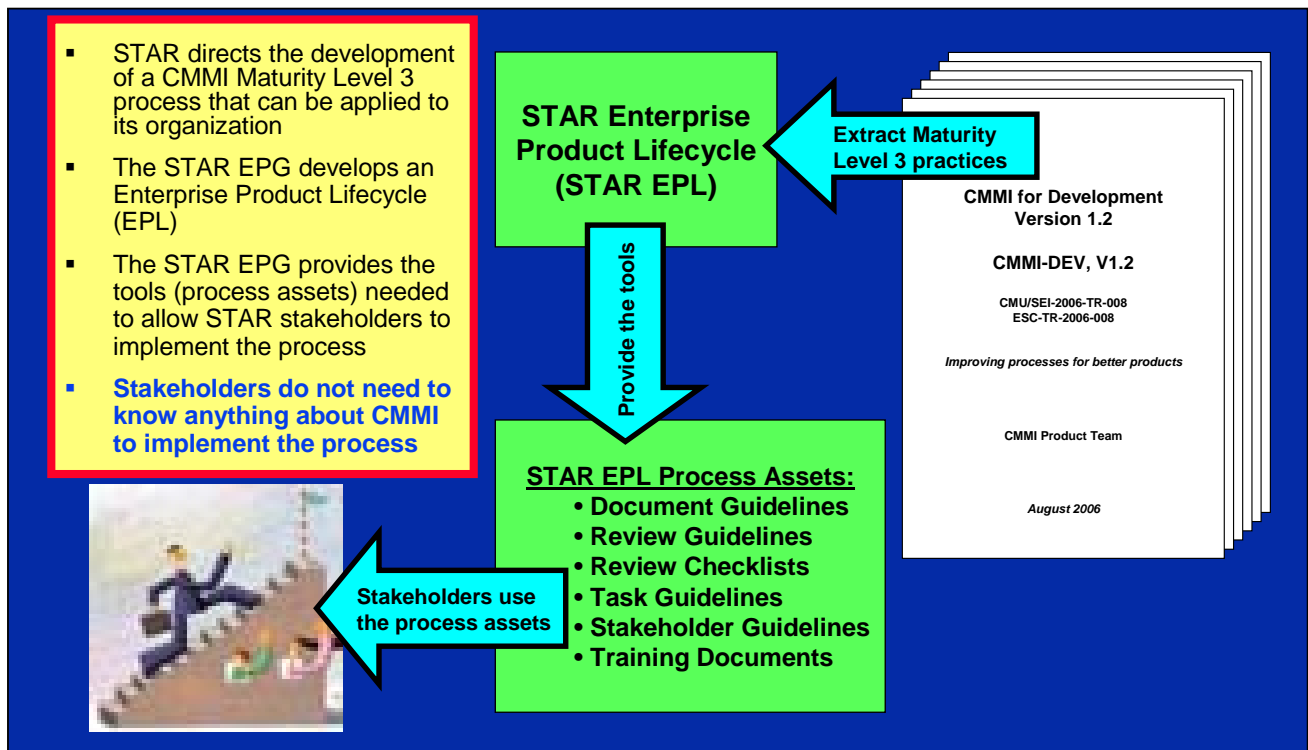

Figure 3.2 – The Use of STAR EPL Process Assets

The STAR EPL process assets are described in Section 5.

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4.   STAR EPL PROCESS OVERVIEW

This section provides an overview of the STAR EPL process, introducing the concepts of projects, standard and defined processes, stakeholders, process steps, reviews and project artifacts.

4.1. Projects

The STAR EPL is oriented toward the creation and maintenance of products. Each product is customarily developed as a distinct "project" with its own development lifecycle.

The essential purpose of the STAR EPL process is to provide a standard development environment for each distinct project that is developed by the STAR organization.

Projects may have a wide variety of requirements, determined by the number of participating organizations, the size and complexity of the required input and output data, the complexity of the processing algorithm and software, the algorithm risks and the needs of the intended product end users. The project teams will therefore have a wide variety of characteristics to meet the diverse requirements.

The goal and challenge of the STAR EPL process is to fit this wide variety of projects and project teams into a standard, repeatable process that provides the benefits of standardization, yet allows for project requirements to be tailored to the unique characteristics of the project.

4.2. Standard and Defined Processes

The STAR EPL consists of practices that enable it to attain CMMI-DEV Maturity Level 3. The ensemble of these practices is called the EPL set of standard processes. This set of standard processes results in a process that is performed, managed, and defined. The STAR Enterprise Process Group (EPG) establishes and maintains this set of standard processes.

A performed process accomplishes the needed work to produce work products. In practice, a process is performed by implementing specific practices of the set of standard processes.

A managed process is a performed process that is planned and executed in accordance with policy; employs skilled people having adequate resources to produce controlled outputs; involves relevant stakeholders; is monitored, controlled, and reviewed; and is evaluated for adherence to its process description.

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A defined process is a managed process that is tailored from the organization's set of standard processes according to the organization's tailoring guidelines; has a maintained process description; and contributes work products, measures, and other process improvement information to the organizational process assets. In practice, a defined process is established for each individual project. The project's Development Lead, with assistance from EPG, STAR Quality Assurance (QA), and project stakeholders, produces a project's defined process by tailoring the organization's standard process to the unique conditions and needs of the project. STAR Management reviews and approves this defined process at the Gate 3 Review and subsequent reviews (see Section 4.5), with project QA assistance.

4.3. Stakeholders

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

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 (c.f. Section 4.5).

An overview of the stakeholder roles is provided in this section. A more detailed description can be found in the Stakeholder Guidelines (SG, c.f. Section 5.3).

Stakeholder roles are organized into 6 groups:

1) STAR Organization-Level stakeholders

- Enterprise Process Group (SG-1)
- Steering Committee (SG-2)
- STAR IT (SG-3)
- STAR CM/DM (SG-4)
- STAR Web Developer (SG-5)
- STAR QA (SG-6)

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- STAR Management (SG-7)

2) Research stakeholders

- Research Lead (SG-8)
- Research Scientist (SG-9)
- Research Tester (SG-10)
- Research Programmer (SG-11)
- Research Management (SG-12)

3) Development stakeholders

- Development Lead (SG-13)
- Development Scientist (SG-14)
- Development Tester (SG-15)
- Development Programmer (SG-16)

4) Review Stakeholders

- Technical Review Lead (SG-17)
- Technical Reviewer (SG-18)

5) Operations stakeholders

- Operations Lead
- Operations Management
- Integration Programmer
- Maintenance Programmer
- Operations CM/DM
- Operations QA

6) Users

- PUSH Users
- PULL Users

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Note that there are no Stakeholder Guidelines (SG) for Operations stakeholders or Users, as these stakeholders are recipients of the development process end products rather than participants in the development process. Nevertheless, Operations stakeholders and Users may be involved in the process as researchers, developers, and/or reviewers. In that case, they should consult the appropriate SG.

4.3.1. STAR Organization-Level Stakeholders

The Enterprise Process group (EPG) is responsible for establishing and maintaining the STAR EPL set of standard processes, the process assets, and the process measures. EPG is responsible for ensuring the effective implementation of the process throughout the organization. Refer to SG-1 for a complete description of how to perform the standard EPG tasks.

The Steering Committee (SC) is responsible for management oversight of the STAR EPL. The SC has approval authority for any changes to the set of standard processes. Refer to SG-2 for a complete description of how to perform the standard SC tasks.

STAR Information Technology (IT) is responsible for the maintenance of IT systems for STAR projects and personnel. Refer to SG-3 for a complete description of how to perform the standard STAR IT tasks.

STAR Configuration Management/Data Management (CM/DM) is responsible for establishing and maintaining project baselines for code, test data, documentation, and reports. STAR CM/DM works with each Development Lead to ensure that project artifacts are maintained in accordance with STAR standards. STAR CM/DM works with Operations CM/DM on the transition of the project baseline from pre-operational development to operations. Refer to SG-4 for a complete description of how to perform the standard STAR CM/DM tasks.

STAR Web Developer is responsible for maintenance of the STAR EPL Research-to-Operation Transition Portal. Works with STAR CM/DM to ensure that all project baseline items are posted to the portal in a timely fashion and project stakeholders have timely access to the project baseline. The STAR Web Developer works with the STAR EPG to ensure that all stakeholders have access to all approved process assets through the portal.

STAR Quality Assurance (QA) is responsible for ensuring that each project's tailored process meets STAR EPL process standards and ensuring that each project meets its

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process requirements during its pre-operational development phases. Refer to SG-6 for a complete description of how to perform the standard STAR QA tasks.

STAR Management consists of the STAR Division Chiefs and Branch Chiefs. STAR management is responsible for management oversight of all STAR projects. Refer to SG-7 for a complete description of how to perform the standard STAR Management tasks.

4.3.2. Research Stakeholders

Research Lead is responsible for oversight of scientists, programmers, and testers working on preparing an algorithm for a STAR Research Project proposal. Refer to SG-8 for a complete description of how to perform the standard Research Lead tasks.

Research Scientists develop new or improved algorithms and prepare research project proposals. Refer to SG-9 for a complete description of how to perform the standard Research Scientist tasks.

Research Testers identify test data appropriate to a research algorithm as it is being developed, acquire and integrate the test data into the research product processing system, create test plans, conduct tests, analyzing test results, and report test results for review. Refer to SG-10 for a complete description of how to perform the standard Research Tester tasks.

Research Programmers design and write research code and support the testing of research code. Refer to SG-11 for a complete description of how to perform the standard Research Programmer tasks.

Research Management is responsible for oversight of basic research, focused R&D and research project proposals for projects initiated by Research Scientists. Refer to SG-12 for a complete description of how to perform the standard Research Management tasks.

4.3.3. Development Stakeholders

Development Lead guides the project's product development efforts from research to operations. Customarily, these are the STAR Project Leads. Development Lead is responsible for ensuring that the organization's process objectives are appropriately addressed in the project's defined process. Refer to SG-13 for a complete description of how to perform the standard Development Lead tasks.

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Development Scientists mature a research algorithm into an operational algorithm, developing project requirements, supporting product design, coding and testing, and providing science maintenance. Refer to SG-14 for a complete description of how to perform the standard Development Scientist tasks.

Development Testers identify pre-operational test data, acquire and integrate the test data into the pre-operational product processing system, create pre-operational unit and system test plans, execute unit and system tests, analyze test results, and report test results for review. Refer to SG-15 for a complete description of how to perform the standard Development Tester tasks.

Development Programmers design and write pre-operational code and support the testing of pre-operational code. Refer to SG-16 for a complete description of how to perform the standard Development Programmer tasks.

4.3.4. Review Stakeholders

Technical Review Lead is responsible for the assignment and oversight of preparations for a Technical Review, conducting the review, and closing the review, by leading a Review Team. Refer to SG-17 for a complete description of how to perform the standard Technical Review Lead tasks.

Technical Reviewers are responsible for reviewing and approving project status at Technical Reviews, under the direction of the Technical Review Lead. Refer to SG-18 for a complete description of how to perform the standard Technical Reviewer tasks.

4.3.5. Operations Stakeholders

Operations Lead is responsible for the planning and oversight of the installation and acceptance testing of code in the operations environment, routine operational production, monitoring and reactive maintenance. Customarily, these are the OSDPD Product Area Leads (PALs).

Operations Management consists of the OSDPD Division Chiefs and Branch Chiefs. OSDPD management is responsible for management oversight of all OSDPD projects

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Integration Programmer is responsible for the operational installation and acceptance testing of pre-operational software systems, routine operational production, monitoring and reactive maintenance.

Maintenance Programmer is responsible for monitoring and reactive maintenance of operational software systems.

Operations CM/DM is responsible for maintaining a project baseline for code, test data, documentation, and reports during operations and maintenance. Operations CM/DM works with STAR CM/DM on the transition of the project baseline from pre-operational development to operations.

Operations QA is responsible for ensuring that each project meets its process requirements during operations and maintenance, divestiture or retirement.

Note that there are no Stakeholder Guidelines for Operations stakeholders, as their functions occur after the last step (step 11) of the version 3 STAR EPL. SGs may be added in the future, if the STAR and OSDPD processes are unified.

4.3.6. Users

PUSH Users were described in Section 3.3.1. PUSH users typically fill the roles of Research Lead (SG-8), Research Scientist (SG-9), Research Tester (SG-10), Research Programmer (SG-11), and Research Manager (SG-12).

PULL Users were described in Section 3.3.2. Although there are no formal stakeholder roles for PULL users, they may be invited to serve on review teams (SG-18), and they should be consulted by the Development stakeholders during the three Development phases (Plan, Design, Build) to ensure that user needs and expectations are being met as the product system is developed.

4.4. EPL Process Flow

The STAR EPL version 3 is designed as a sequence of 11 process steps that take a product from initial concept through development of a pre-operational system that is ready for transition to operations. The process steps are organized into two "Research" phases and three "Development" phases. Each phase culminates with a management review that determines whether the project should proceed to the next phase. These reviews, called "Gates" are discussed in Section 4.5. In this lifecycle, project stakeholders (c.f. Section 4.3)

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work together to enable a product to predictably mature as it progresses through the lifecycle steps. The process flow for the 11 Development steps is shown in Figure 4.1.
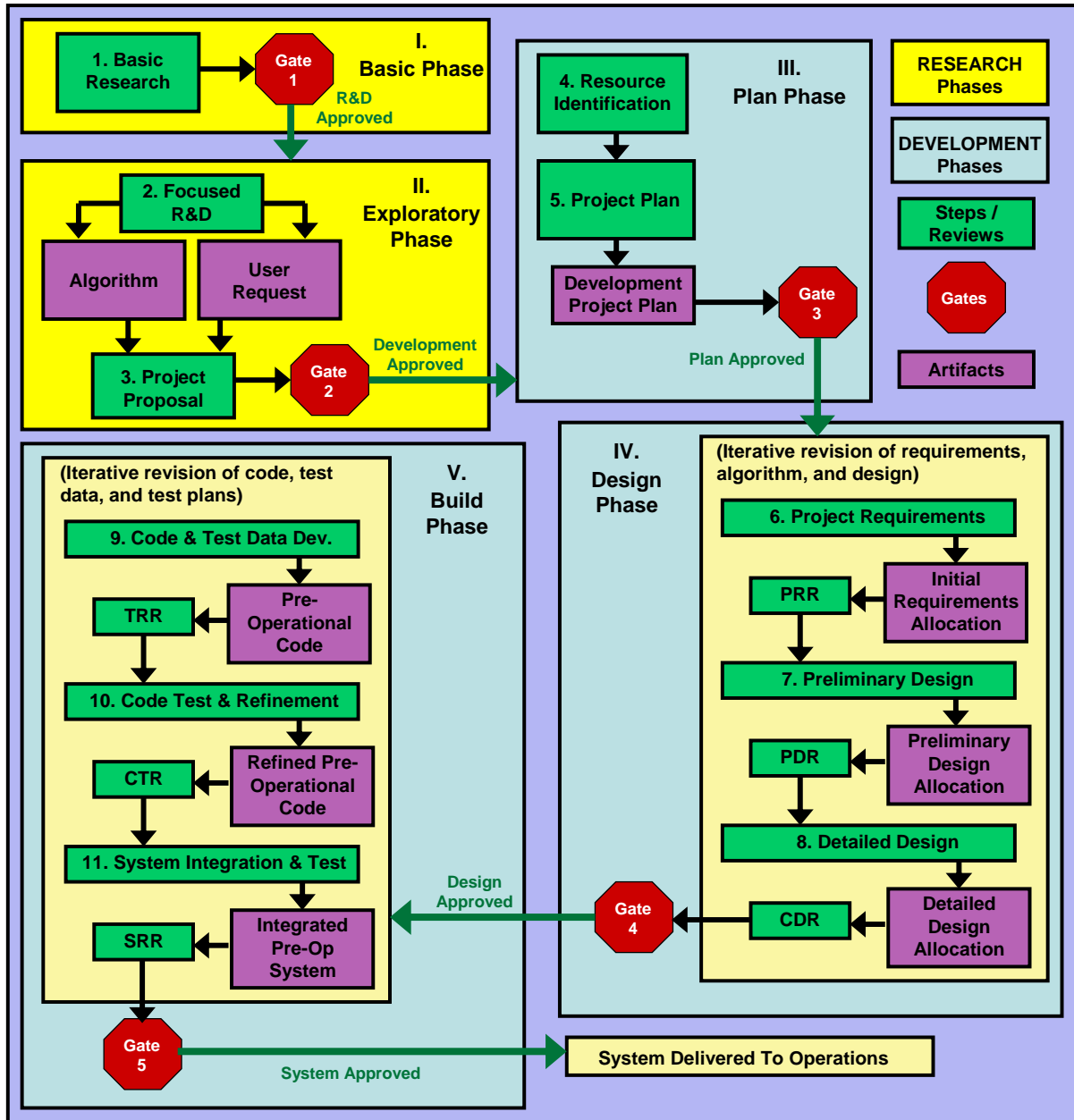

Figure 4.1 – EPL Development Process Flow

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Figure 4.1 shows the flow of the 11 EPL process steps. A detailed description of these flows can be found in the Task Guidelines (see Section 5).

The implementation of the process steps can be tailored to be appropriate for the characteristics of a given project, but all steps must be followed to ensure that the products are developed from research to operations by a standard, repeatable process.

4.4.1. Basic Phase

The objective of the *Basic* phase is to conceptualize new or improved algorithms that may have operational potential and to develop the algorithm theoretical basis to a maturity sufficient for reviewers at the algorithm developer's organization to make an assessment that it has operational potential. Rudimentary code and test data may be developed to help demonstrate an operational potential.

Stakeholders for this phase include:

- Research Lead (SG-8)
- Research Scientists (SG-9)
- Research Testers (SG-10)
- Research Programmers (SG-11)
- Research Managers (SG-12)
- PULL Users
- PUSH Users

The *Basic* phase consists of the following step:

- Step 1 - Basic Research (TG-1)

Basic phase activities are described in detail in TG-1 (c.f. Section 5.4).

4.4.2. Exploratory Phase

The objective of the *Exploratory* phase is to develop the algorithm to a maturity sufficient for STAR reviewers to make an assessment that it should be developed under STAR direction as a STAR Development Project, with the intention of transitioning to operational

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production. Research grade code and test data are expected to help demonstrate an operational potential.

Stakeholders for this phase include:

- STAR QA (SG-6)
- STAR Managers (SG-7)
- Research Lead (SG-8)
- Research Scientists (SG-9)
- Research Testers (SG-10)
- Research Programmers (SG-11)
- Research Managers (SG-12)
- PUSH Users

The *Exploratory* phase consists of the following steps:

- Step 2 - Focused R & D (TG-2)
- Step 3 - Project Proposal (TG-3)

Exploratory phase activities are described in detail in TG-2 and TG-3 (c.f. Section 5.4).

4.4.3. Plan Phase

The objective of the *Plan* phase is to identify the resources (material and personnel) that will be needed for development of the project, produce a Development Project Plan, and determine whether the plan is feasible for development of a pre-operational system.

Stakeholders for this phase include:

- STAR CM/DM (SG-4)
- STAR QA (SG-6)
- STAR Managers (SG-7)
- Development Lead (SG-13)
- PULL Users
- PUSH Users

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The **Plan** phase consists of the following steps:

- Step 4 - Resource Identification (TG-4)
- Step 5 - Project Plan (TG-5)

Plan phase activities are described in detail in TG-4 and TG-5 (c.f. Section 5.4).

4.4.4. Design Phase

The objective of the **Design** phase is to establish the requirements to be satisfied by the project and the means to validate them, develop the design for the product processing system, and determine whether the project is ready to begin development and testing of pre-operational code.

Stakeholders for this phase include:

- STAR CM/DM (SG-4)
- STAR QA (SG-6)
- STAR Managers (SG-7)
- Development Lead (SG-13)
- Development Scientists (SG-14)
- Development Testers (SG-15)
- Development Programmers (SG-16)
- Technical Review Lead (SG-17)
- Technical Reviewers (SG-18)

The **Design** phase consists of the following steps:

- Step 6 - Project Requirements (TG-6)
- Step 7 - Preliminary Design (TG-7)
- Step 8 - Detailed Design (TG-8)

Design phase activities are described in detail in TG-6, TG-7, and TG-8 (c.f. Section 5.4).

4.4.5. Build Phase

The objective of the **Build** phase is to develop, test, refine, and integrate the components of the pre-operational system, determine whether the algorithm performance meets all

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project requirements and confirm that all required documentation is ready for delivery to operations.

Stakeholders for this phase include:

- STAR CM/DM (SG-4)
- STAR QA (SG-6)
- STAR Managers (SG-7)
- Development Lead (SG-13)
- Development Scientists (SG-14)
- Development Testers (SG-15)
- Development Programmers (SG-16)
- Technical Review Lead (SG-17)
- Technical Reviewers (SG-18)

The **Build** phase consists of the following steps:

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

Build phase activities are described in detail in TG-9, TG-10, and TG-11 (c.f. Section 5.4).

A useful overview illustration of the STAR EPL process can be presented as a matrix that indicates the roles of each stakeholder for each process step. This matrix is included in an Appendix to this PG (PG-1.A). An illustration is shown as Figure 4.2.

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Figure 4.2 – Global View of the STAR EPL (Version 3.0)

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The matrix shown in Figure 4.2 consists of 15 rows that correspond to 15 stakeholder roles, and 11 columns that correspond to the 11 process steps. Process steps are grouped by process phase. Process phases are delimited by Gate Reviews. Each cell in the matrix contains the required actions for a particular stakeholder during a particular process step.

Figure 4.2 shows a global view of the process that makes it look more complex than it really is. For any individual stakeholder working on individual process steps, the tasks are a small subset of the global view. Figure 4.3 shows how Stakeholder Guidelines (SG) and Task Guidelines (TG) provide one-dimensional views into the process.
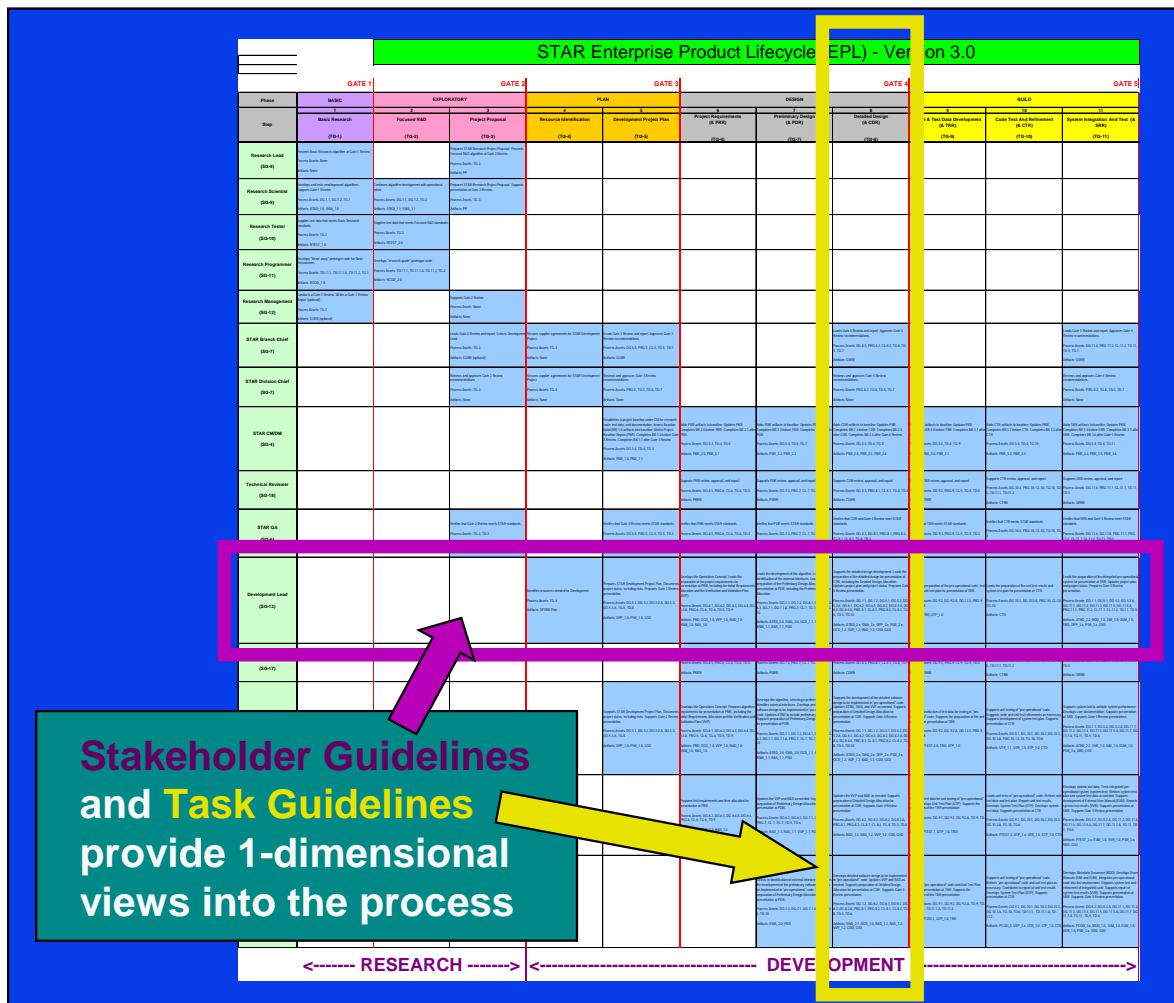
Figure 4.3 – One-Dimensional Views of the EPL

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In Figure 4.3, the Development Lead stakeholder row and the step 8 column are highlighted. All process activities for the Development Lead are documented in SG-13. All process activities for step 8 are documented in TG-8. By reference to these two process assets, Development Leads can find all the information they need to perform the process activities assigned to them for step 8. Figure 4.4 shows this intersection.
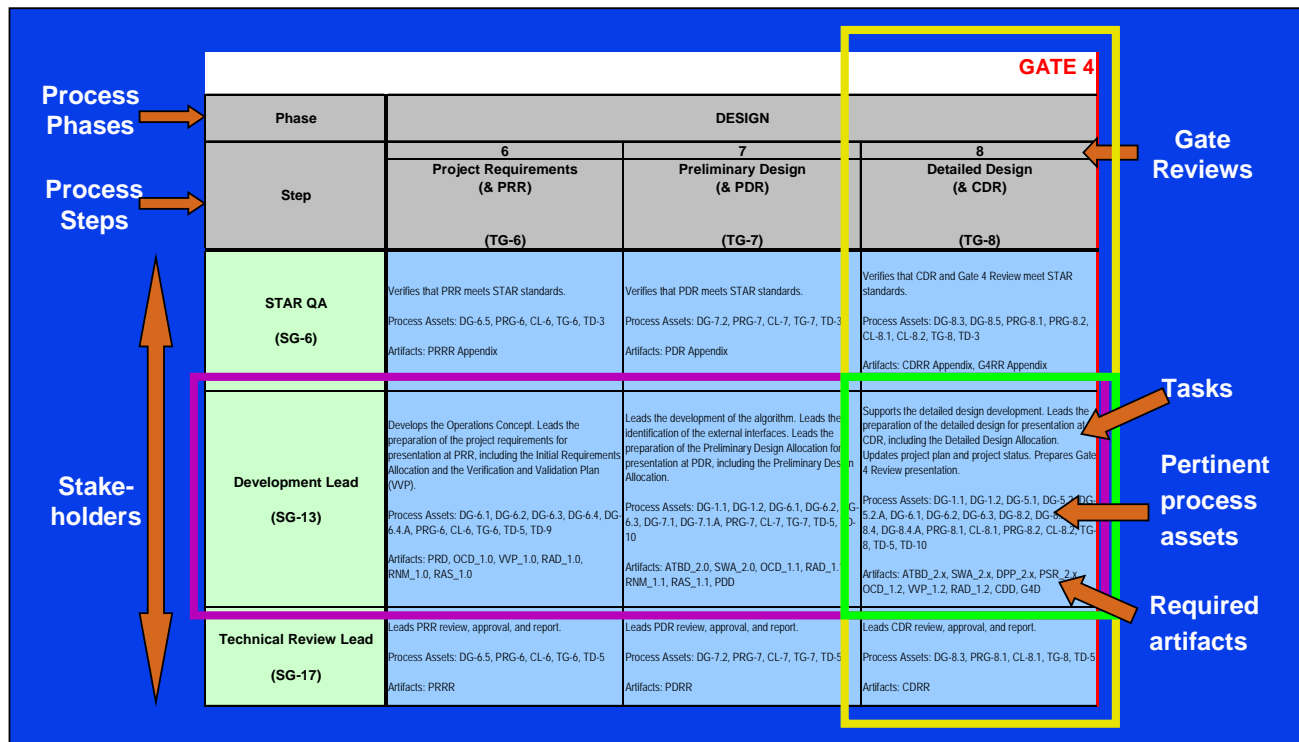
Figure 4.4 – Intersection of Stakeholder and Process Step

The intersection forms a cell of the matrix. Each cell contains the activities, pertinent process assets, and required artifacts for a particular stakeholder for a particular process step, as shown in Figure 4.5.

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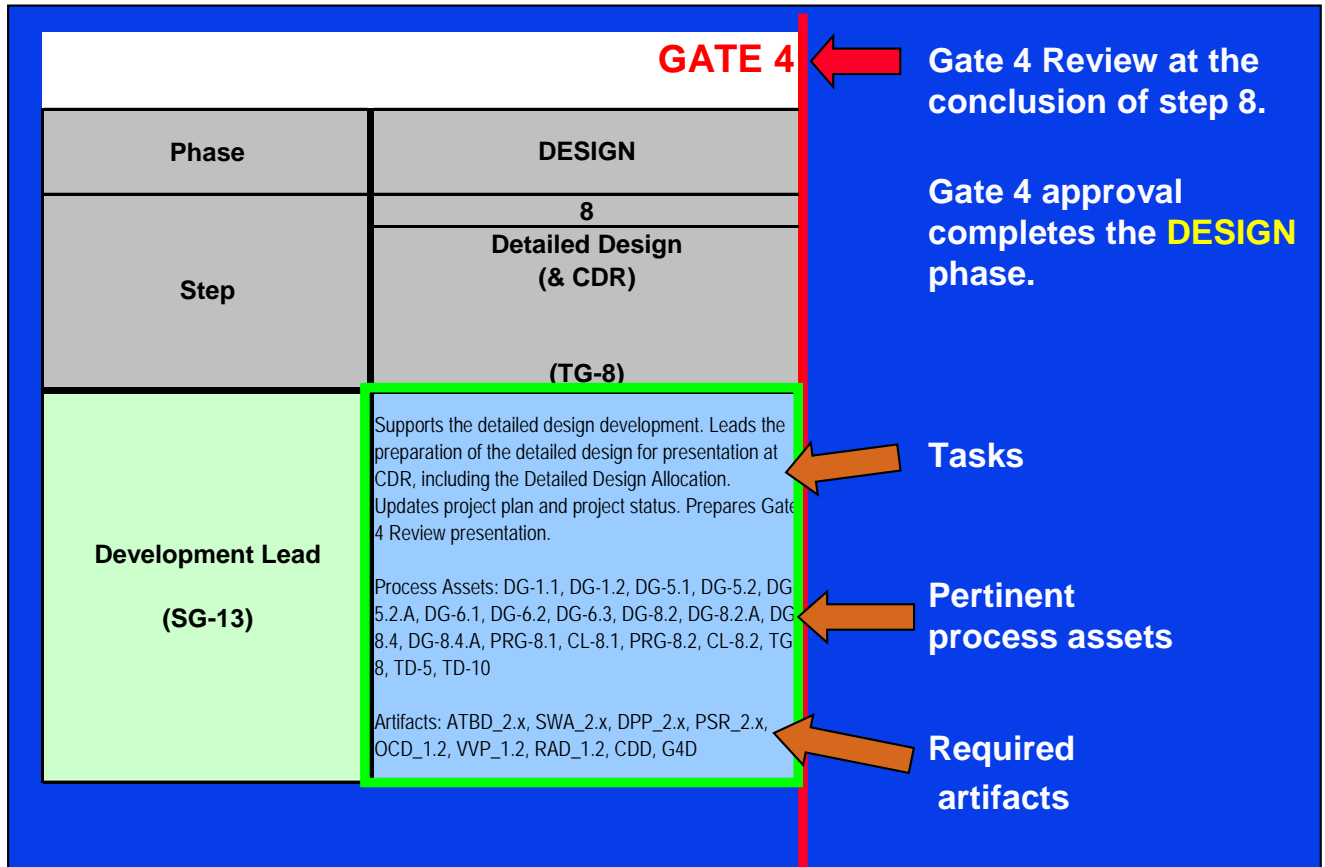
Figure 4.5 – Step 8 Activities for Development Leads

To implement the process for a particular step (e.g., step 8), a particular stakeholder (e.g., Development Lead) refers to the appropriate Task Guideline (e.g., TG-8) and Stakeholder Guideline (e.g., SG-13) that will provide all the information needed to perform the activities shown in the cell, provide references to the pertinent process assets, and describe the required artifacts.

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4.4.6. Lifecycle Model

The EPL features a hybrid Waterfall / Iterative lifecycle model, illustrated in Figure 4.6.
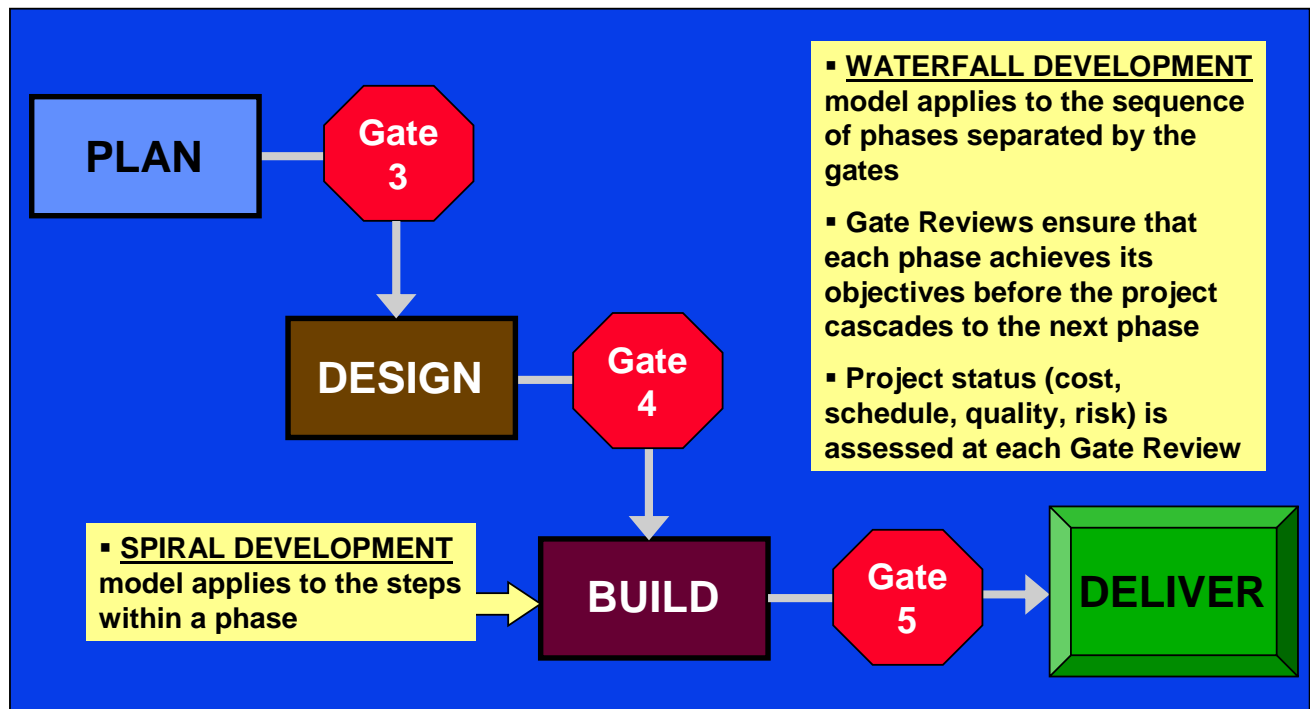
Figure 4.6 – STAR EPL Lifecycle Model

As Figure 4.6 shows, waterfall development applies to the phases, while Iterative (or Spiral) development applies to the steps within a phase.

Waterfall development means that all of the objectives and processes for a Phase are expected to be completed and approved at a Gate Review before the project proceeds to the next phase. Phases are distinct systems engineering entities. Once a project proceeds to a phase, it is not expected that it will return to the activities of a previous phase. The Gate Reviews are described in Section 4.5.

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Iterative (Spiral) development is different. In this model, activities are repeated in successive steps, because the output from these activities affects other activities within the Phase. This is illustrated in Figures 4.7 (Design phase) and 4.8 (Build phase).
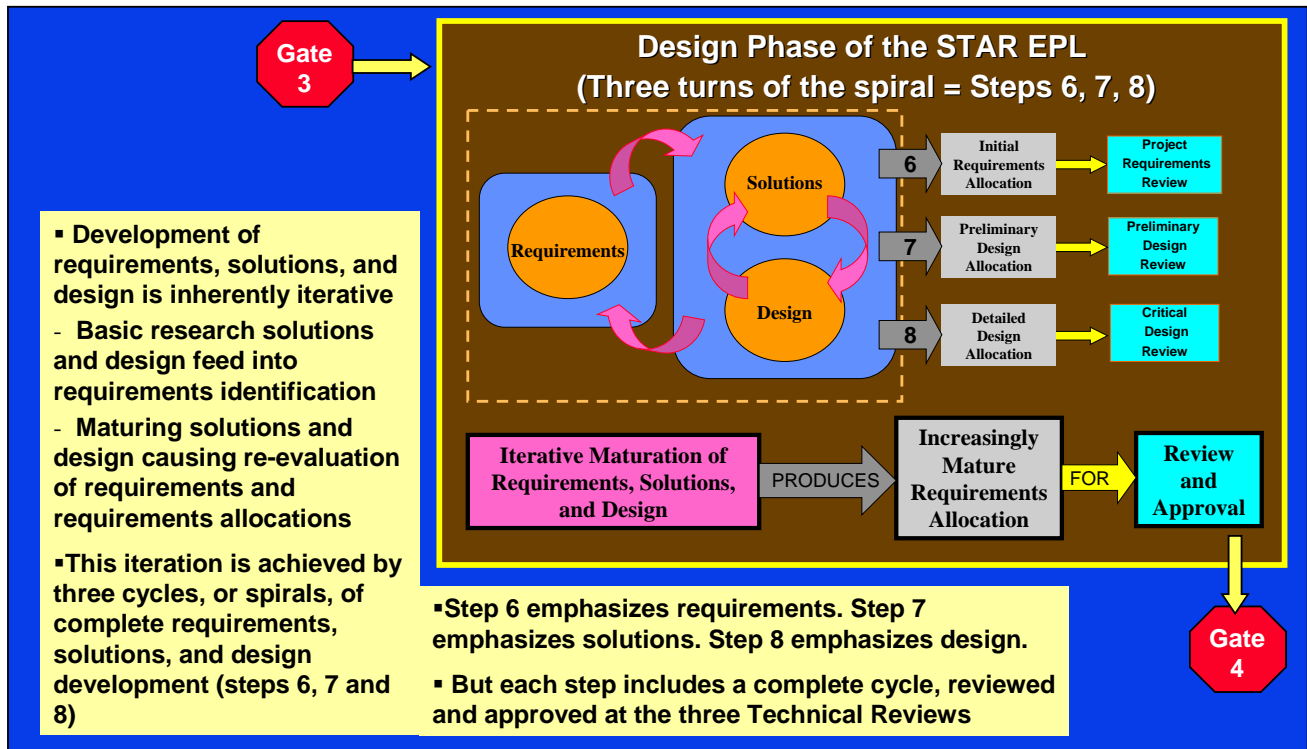
Figure 4.7 – STAR EPL Design Phase

As Figure 4.7 shows, the development of requirements, solutions (algorithm), and design are systems engineering activities that are inherently iterative. The process therefore places these activities within a distinct phase, the Design phase. Nevertheless, there is a logical order to these activities. In general, requirements drive solutions and solutions drive design. Therefore, the Design phase consists of three distinct steps that sequentially emphasize requirements, solutions, and design. Note that a Technical Review is conducted at the conclusion of each step. The purpose of each review is to ensure that technical progress is satisfactory, work products are being produced as planned, and technical risks are well understood and manageable as the requirements, solution, and design mature. The Technical Reviews are described in Section 4.5.

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Figure 4.8 – STAR EPL Build Phase

As Figure 4.8 shows, the development, testing, and refinement of pre-operational code are systems engineering activities that are inherently iterative. The process therefore places these activities within a distinct phase, the Build phase. Nevertheless, there is a logical order to these activities. In general, pre-operational code is developed as a set of testable software units, unit testing uncovers problems that drive code refinement, and units that have demonstrated satisfactory functionality and performance are integrated into a pre-operational software system. Therefore, the Build phase consists of three distinct steps that sequentially emphasize code and test data development, unit testing / code refinement,

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and integration / system testing. Note that a Technical Review is conducted at the conclusion of each step. The purpose of each review is to ensure that technical progress is satisfactory, work products are being produced as planned, and technical risks are well understood and manageable as the pre-operational software system matures. The Technical Reviews are described in Section 4.5.

4.5. Project Reviews

As noted in the previous section, the standard process includes a series of reviews that form the primary milestones of a project's development lifecycle. There are two types of reviews:

1) GATE REVIEWS are a series of reviews that review project status to determine whether a project should proceed to the next phase in the product life cycle. Gate Reviews are management reviews of the project status, focusing on cost and schedule status with respect to the project plan and the evaluation of program risks. Gate Review standards are established and maintained u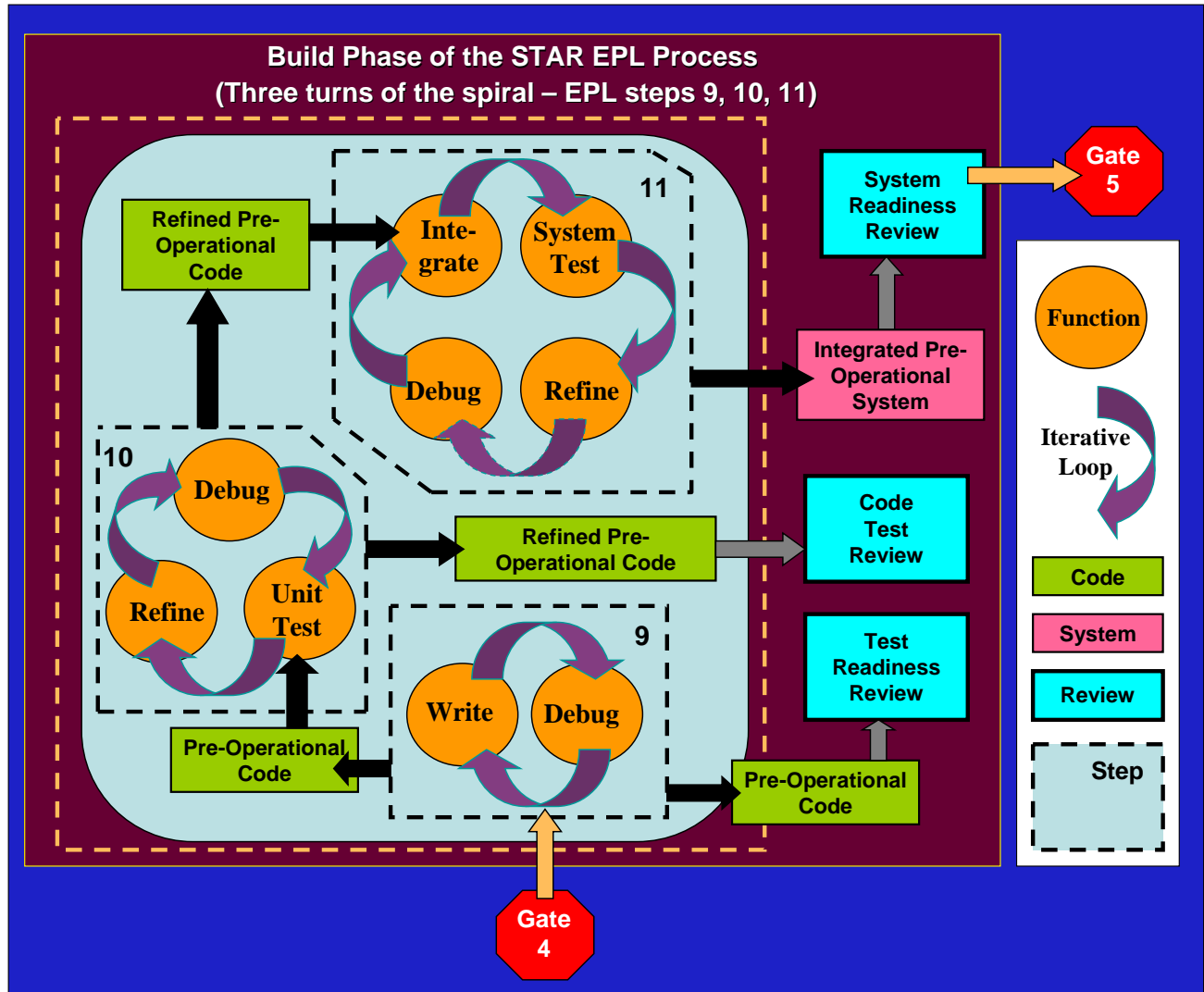nder Configuration Management by an Enterprise Process Group under the direction of a Steering Committee. They are contained in a Process Asset Repository (PAR) that is accessible to all stakeholders via the STAR EPL Web portal (c.f. Section 5.1).

2) TECHNICAL REVIEWS are a series of reviews that review the technical progress of a project with respect to standard criteria. Technical Review standards are established and maintained under Configuration Management by an Enterprise Process Group under the direction of a Steering Committee. They are contained in a PAR that is accessible to all stakeholders via a Web portal (c.f. Section 5.1).

The reviews are a critical component of the process. They are the primary mechanism to accomplish Project Monitoring and Control. Each of the five EPL phases culminates with a Gate Review that determines whether the project proceeds to the next phase (c.f. Figure 4.1). Six of the 11 EPL steps culminate with a Technical Review that determines whether the project proceeds to the next step (c.f. Figures 4.7 and 4.8).

Each review has entry criteria and exit criteria to manage risk and maintain quality control. STAR standard entry and exit criteria are established and maintained in documented Peer Review Guidelines (PRG, c.f. Section 5.5) and Review Check Lists (CL, c.f. Section 5.6).

To establish and maintain project control, risks are identified during project planning and periodically evaluated and revised. In particular, risk evaluation and identification of new

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risks is a standard part of each review. Review exit criteria require an acceptable mitigation plan for each risk. The STAR EPL risk management process is based on quantitative risk assessment. The Probability of a risk occurring is rated on a scale of 0 (0% probability) to 10 (100% probability). The Severity of a risk occurring is rated on a scale of 1 to 10. The product of Probability and Severity produces a Risk Score on a scale of 0 – 100. Risks are categorized by applying thresholds to the Risk Score. The standard thresholds are:

- Risk Score = 0 (NONE)
- Risk Score = 1 – 19 (LOW)
- Risk Score = 20 – 39 (MEDIUM)
- Risk Score = 40 – 100 (HIGH)

Risk evaluation will generate risk mitigation actions. Review exit criteria require that the risk mitigation plans have identified the necessary actions to implement the plans. Actions are examined at each review. Satisfactory completion of the action closure plan must be demonstrated for approval of closed actions, Review exit criteria require that a satisfactory closure plan be defined for each open or new action.

An overview of the STAR EPL Gate Reviews and Technical Reviews is presented in the following subsections. More detailed descriptions are found in the Peer Review Guidelines (PRG), Review Check Lists (CL), and Task Guidelines (TG) that are listed in Section 5.

4.5.1. Gate 1 Review

Gate 1 is an internal review of Basic Research by the research organization. Its purpose is to determine whether organization funds and resources should be expended on Focused R&D of a new/improved algorithm, leading to a Project Proposal to develop a product for transition to operations.

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the Gate 1 Review can be found in the Basic Research Task Guideline (TG-1).

Standard review Check List Items (CLI) can be found in the Gate 1 Review Check List (CL-1).

4.5.2. Gate 2 Review

Gate 2 is a STAR review of a STAR Research Project Proposal. Its purpose is to determine whether the proposal is compatible with the NESDIS mission and strategic plan, and is

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technically feasible for development into an operational product. If a project passes Gate 2, a Development Lead is assigned and the Plan phase commences. For projects that will be authorized by OSD, the Gate 2 Review is superseded by the proposal evaluation activities of the SPSRB process.

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the Gate 2 Review can be found in the Project Proposal Task Guideline (TG-3).

Standard review CLI can be found in the Gate 2 Review Check List (CL-3).

All information needed to prepare for, conduct, and close the Gate 2 Review can be found in the Gate 2 Review Guideline (PRG-3).

4.5.3. Gate 3 Review

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

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the Gate 3 Review can be found in the Project Plan Task Guideline (TG-5).

Standard review CLI can be found in the Gate 3 Review Check List (CL-5).

All information needed to prepare for, conduct, and close the Gate 3 Review can be found in the Gate 3 Review Guideline (PRG-5).

4.5.4. Project Requirements Review

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

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the PRR can be found in the Project Requirements Task Guideline (TG-6).

Standard review CLI can be found in the PRR Check List (CL-6).

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All information needed to prepare for, conduct, and close the PRR can be found in the PRR Review Guideline (PRG-6).

4.5.5. 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.

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the PDR can be found in the Preliminary Design Task Guideline (TG-7).

Standard review CLI can be found in the PDR Check List (CL-7).

All information needed to prepare for, conduct, and close the PDR can be found in the PDR Review Guideline (PRG-7).

4.5.6. 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.

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the CDR can be found in the Detailed Design Task Guideline (TG-8).

Standard review CLI can be found in the CDR Check List (CL-8.1).

All information needed to prepare for, conduct, and close the CDR can be found in the CDR Review Guideline (PRG-8.1).

4.5.7. Gate 4 Review

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

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STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the Gate 4 Review can be found in the Detailed Design Task Guideline (TG-8).

Standard review CLI can be found in the Gate 4 Review Check List (CL-8.2).

All information needed to prepare for, conduct, and close the Gate 4 Review can be found in the Gate 4 Review Guideline (PRG-8.2).

4.5.8. 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 TRR, step 10 (Code Test and Refinement) commences.

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the TRR can be found in the Code and Test Data Development Task Guideline (TG-9).

Standard review CLI can be found in the TRR Check List (CL-9).

All information needed to prepare for, conduct, and close the TRR can be found in the TRR Review Guideline (PRG-9).

4.5.9. 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.

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the CTR can be found in the Code Test and Refinement Task Guideline (TG-10).

Standard review CLI can be found in the CTR Check List (CL-10).

All information needed to prepare for, conduct, and close the CTR can be found in the CTR Review Guideline (PRG-10).

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4.5.10. System Readiness Review

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

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the SRR can be found in the System Integration and Test Task Guideline (TG-11).

Standard review CLI can be found in the SRR Check List (CL-11.1).

All information needed to prepare for, conduct, and close the SRR can be found in the SRR Review Guideline (PRG-11.1).

4.5.11. Gate 5 Review

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

STAR EPL standard review objectives, review artifacts, entry criteria, and exit criteria for the Gate 5 Review can be found in the System Integration and Test Task Guideline (TG-11).

Standard review CLI can be found in the Gate 5 Review Check List (CL-11.2).

All information needed to prepare for, conduct, and close the Gate 5 Review can be found in the Gate 5 Review Guideline (PRG-11.2).

4.5.12. Delta Reviews

At each review, the project risks are evaluated to determine whether corrective actions are needed to mitigate the risks. If corrective actions can be made within the parameters of the project plan, they may be deferred to a future step to be considered at a future review. If, however, the needed corrective actions require revisions to the project plan, typically by the addition of sub-tasks and revisions to the task schedule it may be necessary to conduct a

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delta review to ensure that the risks are manageable and that open actions may be deferred to subsequent lifecycle steps and reviews.

Re-planning is expected to be a rare event, but it may occur if the project requirements have added significant scope or if unexpected technical issues have been discovered.

If it is determined that a re-plan is needed, actions may be taken to conduct a delta Gate Review. A delta Gate Review should be prepared for and conducted in the same manner as the normal Gate Review. Following approval of the re-plan, the project can proceed under the new plan.

4.6 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. They are contained in a project Artifact Repository.

There are five distinct types of standard project artifacts:

- Code
- Test Data
- Documents
- Presentation
- Reports

4.6.1. Code and Test Data

The product processing code is expected to develop throughout the product lifecycle from basic code that supports scientific research to mature, validated, pre-operational code that reliably delivers data products that meet requirements.

As the code matures, the test data that is used for verification of the code and validation of the output products is expected to be comparably developed to meet the requirements of maturing, increasingly rigorous test requirements and test plans.

Table 4.5.1 lists the STAR EPL standard code and test data.

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TABLE 4.5.1 – STAR EPL Code and Test Data

Artifact	Steps	Training Documents
Basic Research Code	1	None
Basic Research Test Data	1	None
R&D Code	2	TD-11.1, TD-11.1.A, TD-11.2
R&D Test Data	2	TD-6 *
Pre-Operational Code	9, 10	TD-11.1, TD-11.1.A, TD-11.2
Unit Test Data	9, 10	TD-6 *
Integrated Pre-Operational Code	11	TD-11.1, TD-11.1.A, TD-11.2
System Test Data	11	TD-6 *

* TD-6 will be produced for a future version of the process assets.

STAR EPL standards for code and test data can be found in the pertinent Training Documents (TDs).

4.6.2. Documents

The STAR EPL documents contain technical information that supports the planning and implementation of project tasks, and the use of data products. Table 4.5.2 lists the standard STAR EPL documents.

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TABLE 4.5.2 – STAR EPL Documents

Artifact	Steps	Document Guideline
Algorithm Theoretical Basis Document	1, 2, 7, 8, 11	DG-1.1
Software Architecture Document	1, 2, 7, 8, 9, 10	DG-1.2
Development Project Plan	4, 5, 6, 7, 8, 9, 10, 11	DG-5.1
Operations Concept Document	6, 7, 8	DG-6.1
Requirements Allocation Document	6, 7, 8, 9, 10	DG-6.2
Verification and Validation Plan	6, 7, 8, 9, 10	DG-6.3
Detailed Design Document	8, 9, 10	DG-8.1
Unit Test Plan	9, 10	DG-9.1
System Test Plan	10, 11	DG-10.2
Internal Users Manual	11	DG-11.1
External Users Manual	11	DG-11.2
Metadata Document	11	DG-11.3

The "Steps" listed for each document indicates the steps of the STAR EPL during which a version of the document is typically written. Note that many documents have more than one version. Details are in the pertinent Task Guidelines.

The "Document Guideline" listed for each document indicates which process asset (c.f. Section 5.7) contains the guidelines for writing the document.

4.6.3. Presentation Documents

The presentation documents are the Microsoft PowerPoint slide packages for the reviews. Table 4.5.3 lists the standard STAR EPL presentation documents.

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TABLE 4.5.3 – STAR EPL Presentation Documents

Artifact	Step	Document Guidelines
Gate 3 Document	5	DG-5.3, DG-5.3.A
Project Requirements Document	6	DG-6.4, DG-6.4.A
Preliminary Design Document	7	DG-7.1, DG-7.1.A
Critical Design Document	8	DG-8.2, DG-8.2.A
Gate 4 Document	8	DG-8.4, DG-8.4.A
Test Readiness Document	9	DG-9.2, DG-9.2.A
Code Test Document	10	DG-10.3, DG-10.3.A
System Readiness Document	11	DG-11.5, DG-11.5.A
Gate 5 Document	11	DG-11.7, DG-11.7.A

The "Step" listed for each presentation document indicates the step of the STAR EPL during which the document is written. Details are in the pertinent Task Guidelines.

The "Document Guidelines" listed for each document indicates which process assets (c.f. Section 5.7) contains the guidelines for writing the document. Note that there are two DGs for each presentation document. The second DG consists of template presentation slides.

4.6.4. Reports

Reports are a special set of documents that provide information on the status of the project, its work products, or its test results. Table 4.5.4 lists the standard STAR EPL reports

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TABLE 4.5.4 – STAR EPL Reports

Artifact	Steps	Document Guideline
Project Status Report	5, 8, 11	DG-5.2
Project Baseline Report	5, 6, 7, 8, 9, 10, 11	DG-5.4
Gate 3 Review Report	5	DG-5.5
Project Requirements Review Report	6	DG-6.5
Preliminary Design Review Report	7	DG-7.2
Critical Design Review Report	8	DG-8.3
Gate 4 Review Report	8	DG-8.5
Test Readiness Review Report	9	DG-9.3
Unit Test Report	10	DG-10.1
Code Test Review Report	10	DG-10.4
System Readiness Review Report	11	DG-11.6
Gate 5 Review Report	11	DG-11.8
Development Project Report	11	DG-11.9

The "Steps" listed for each report indicates the steps of the STAR EPL during which a version of the report is typically written. Note that two of the reports have multiple versions. Details are in the pertinent Task Guidelines.

The "Document Guidelines" listed for each document indicates which process asset (c.f. Section 5.7) contains the guidelines for writing the document.

4.6.5. Project Artifact Repository

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 artifact repository under CM.

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Standards for project documents and reports can be found in the Document Guidelines (DGs).

Standard practices for creating, testing, and reviewing the project artifacts can be found in the pertinent Task Guidelines (TGs), Stakeholder Guidelines (SGs), and Peer Review Guidelines (PRGs).

4.7 Process Improvement

The STAR EPL process is designed to be improvable. The EPG and the stakeholders will learn lessons as they implement the process.

Stakeholders are strongly encouraged to provide feedback to the EPG. Comments and suggestions for improvement of the process architecture, assets, artifacts and tools are always welcome. A Suggestion Box will be implemented on the STAR EPL web portal (c.f. Section 5.3). Until this is activated, stakeholders can provide feedback by contacting:

Ken.Jensen@noaa.gov

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5. STAR EPL PROCESS ASSETS

This section provides an overview of the process assets that are available to help the STAR EPL stakeholders in the implementation of their tasks

5.1. Process Asset Repository

Process Assets are a set of documents that define the enterprise standards and best practices. They are established and maintained under Configuration Management (CM) by an Enterprise Process Group (EPG) under the direction of a Steering Committee. They are contained in a STAR Process Asset Repository (PAR) on the STAR EPL web portal:

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

The PAR provides a central process knowledge base that is easily accessible and contains all approved process assets. These best practices improve the quality of products and services to the customer and end users.

Process assets include:
- Process Guidelines
- Stakeholder Guidelines
- Task Guidelines
- Peer Review Guidelines
- Review Checklists
- Document Guidelines
- Training Documents

5.2. Process Guidelines

The STAR EPL process assets include Process Guidelines (PGs) that define the STAR organizational set of standard practices and guidelines for tailoring these practices to a given project. The PGs are primarily intended for the STAR EPG and project planners, but

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all EPL stakeholders may benefit from a familiarity with them. Table 5.1 lists the STAR EPL PGs that are available with version 3.

TABLE 5.1 – STAR EPL Process Guidelines

ID	Guideline
PG-1	STAR EPL Process Guidelines
PG-1.A	STAR EPL Process Guidelines Appendix
PG-2	STAR EPL Tailoring Guidelines

5.3. Stakeholder Guidelines

The standard tasks of the STAR EPL are distributed among the large number of different types of stakeholder (c.f. Section 3.2). For each type of stakeholder, there is a Stakeholder Guideline (SG) that describes the standard tasks that are relevant for that stakeholder. The SG describes how to perform the tasks, itemizes the actions to be taken, and includes references to the appropriate process assets and the required artifacts.

The STAR EPL process can be visualized as a matrix of Stakeholder tasks and Process Step tasks. An SG is a one-dimensional (horizontal) view into the process that should be used as the primary process asset for the relevant type of stakeholder. Table 5.2 lists the STAR EPL SGs that are available with version 3.

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TABLE 5.2 – STAR EPL Stakeholder Guidelines

ID	Stakeholder
SG-4	STAR CM/DM
SG-7	STAR Managers
SG-8	Research Leads
SG-9	Research Scientists
SG-10	Research Testers
SG-11	Research Programmers
SG-12	Research Managers
SG-13	Development Leads
SG-14	Development Scientists
SG-15	Development Testers
SG-16	Development Programmers
SG-17	Technical Review Leads
SG-18	Technical Reviewers

5.4. Task Guidelines

Each distinct task in the STAR EPL process has a Task Guideline (TG) associated with it. The TG is a description of how to perform the task. It itemizes the actions to be taken. It contains appropriate standards, conventions, and (where appropriate) examples. It includes references to the appropriate process assets and the required artifacts.

The STAR EPL process can be visualized as a matrix of Stakeholder tasks and Process Step tasks. A TG is a one-dimensional (vertical) view into the process that should be used as the primary process asset for all stakeholders who are performing tasks for the relevant process step. The TG serves as a complement to the SG. A given stakeholder working on a given process step can find all the needed information from the relevant SG, but can use the relevant TG to learn what other stakeholders are doing. Table 5.3 lists the STAR EPL TGs that are available with version 3.

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TABLE 5.3 – STAR EPL Task Guidelines

ID	Guideline
TG-1	Basic Research Task Guideline
TG-2	Focused R&D Task Guideline
TG-3	Project Proposal Task Guideline
TG-4	Resource Identification Task Guideline
TG-5	Project Plan Task Guideline
TG-6	Project Requirements Task Guideline
TG-7	Preliminary Design Task Guideline
TG-8	Detailed Design Task Guideline
TG-9	Code and Test Data Development Task Guideline
TG-10	Code Test and Refinement Task Guideline
TG-11	System Integration and Test Task Guideline

5.5. Peer Review Guidelines

The STAR EPL process includes two organization-level reviews, 5 project-level Gate Reviews and 6 project-level Technical Reviews (c.f. Section 3.4). For each review, there is a document that provides the STAR review guidelines. The Peer Review Guideline (PRG) will describe the purpose of the review, the required artifacts, standards for reviewers, requirements for approval, and options other than approval.

The intended users of the PRGs are STAR EPL stakeholders who are responsible for participation on a review team. The PRGs are also beneficial to STAR EPL stakeholders who are responsible for preparing a presentation for a review, to help them understand what the reviewers will expect from their presentation. Stakeholders will be able to identify the PRGs relevant to their tasks by consulting the relevant Stakeholder Guideline or Task Guideline. In addition, references to the relevant PRGs for each process step are included in the Task Guidelines. Table 5.4 lists the STAR EPL PRGs that are available with version 3.

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TABLE 5.4 – STAR EPL Peer Review Guidelines

ID	Peer Review Guideline
PRG-5	Gate 3 Review Guidelines
PRG-6	Project Requirements Review (PRR) Guidelines
PRG-7	Preliminary Design Review (PDR) Guidelines
PRG-8.1	Critical Design Review (CDR) Guidelines
PRG-8.2	Gate 4 Review Guidelines
PRG-9	Test Readiness Review (TRR) Guidelines
PRG-10	Code Test Review (CTR) Guidelines
PRG-11.1	System Readiness Review (SRR) Guidelines
PRG-11.2	Gate 5 Review Guidelines

5.6. Review Check Lists

A Review Check List (CL) is a check list that is used to ensure that are review requirements are satisfied. There is a separate CL for each of the EPL reviews. Each CL contains the STAR EPL standard check list items for the specified review.

The intended users of the CLs are STAR EPL stakeholders who are responsible for participation on a review team. The CLs are also beneficial to STAR EPL stakeholders who are responsible for preparing a presentation for a review, to help them understand what the reviewers will expect from their presentation. The stakeholders will be able to identify the CLs relevant to their tasks by consulting the relevant Stakeholder Guideline or Task Guideline. Table 5.5 lists the STAR EPL CLs that are available with version 3.

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TABLE 5.5 – STAR EPL Peer Review Check Lists

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

5.7. Document Guidelines

The STAR EPL process includes the creation and review of a large number of documents. Without a standard for selecting the required documentation for a given project and for writing a given document, the process of creating, reviewing, and using these documents becomes unnecessarily complex and time consuming, leading to cost and schedule overruns. Therefore, each document in the STAR EPL standard set has its own guidelines, captured in its own separate Document Guideline (DG).

The intended users of the DGs are STAR EPL stakeholders who are responsible for creating or reviewing one or more of the documents defined in the STAR EPL process.

By following the standards in the DGs, the creators of STAR EPL documents will produce documentation that maximizes the benefit to the reviewers and users.

Stakeholders will be able to identify the DGs relevant to their tasks by consulting the relevant Stakeholder Guideline or Task Guideline. Table 5.6 lists the STAR EPL DGs that are available with version 3.

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TABLE 5.6 – STAR EPL Document Guidelines

ID	Document
DG-0.1	Document Style Guideline
DG-1.1	Algorithm Theoretical Basis Document (ATBD)
DG-1.2	Software Architecture Document (SWA)
DG-5.1	Development Project Plan (DPP)
DG-5.2	Project Status Report (PSR)
DG-5.2.A	PSR Appendix
DG-5.3	Gate 3 Document (G3D)
DG-5.3.A	G3D Appendix
DG-5.4	Project Baseline Report (PBR)
DG-5.5	Gate 3 Review Report (G3RR)
DG-6.1	Operations Concept Document (OCD)
DG-6.2	Requirements Allocation Document (RAD)
DG-6.3	Verification and Validation Plan (VVP)
DG-6.4	Project Requirements Document (PRD)
DG-6.4.A	PRD Appendix
DG-6.5	Project Requirements Review Report (PRRR)
DG-7.1	Preliminary Design Document (PDD)
DG-7.1.A	PDD Appendix
DG-7.2	Preliminary Design Review Report (PDRR)
DG-8.1	Detailed Design Document (DDD)
DG-8.2	Critical Design Document (CDD)
DG-8.2.A	CDD Appendix
DG-8.3	Critical Design Review Report (CDRR)

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DG-8.4	Gate 4 Document (G4D)
DG-8.4.A	G4D Appendix
DG-8.5	Gate 4 Review Report (G4RR)
DG-9.1	Unit Test Plan (UTP)
DG-9.2	Test Readiness Document (TRD)
DG-9.2.A	TRD Appendix
DG-9.3	Test Readiness Review Report (TRRR)
DG-10.1	Unit Test Report (UTR)
DG-10.2	System Test Plan (STP)
DG-10.3	Code Test Document (CTD)
DG-10.3.A	CTD Appendix
DG-10.4	Code Test Review Report (CTRR)
DG-11.1	Internal Users Manual (IUM)
DG-11.2	External Users Manual (EUM)
DG-11.3	Metadata Document (MDD)
DG-11.4	Verification and Validation Report (VVR)
DG-11.5	System Readiness Document (SRD)
DG-11.5.A	SRD Appendix
DG-11.6	System Readiness Review Report (SRRR)
DG-11.7	Gate 5 Document (G5D)
DG-11.7.A	G5D Appendix
DG-11.8	Gate 5 Review Report (G5RR)
DG-11.9	Development Project Report (DPR)

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5.8. Training Documents

The STAR EPL process assets include Training Documents (TDs) to assist the stakeholders in performing the process tasks. By using the TDs, the stakeholders should be able to perform the tasks more effectively. Stakeholders will be able to identify the TDs relevant to their tasks by consulting the relevant Stakeholder Guideline or Task Guideline. Table 5.7 lists the STAR EPL TDs that are available with version 3.

TABLE 5.7 – STAR EPL Training Documents

ID	Training Document
TD-9	Project Requirements
TD-11.1	FORTRAN Programming Standards and Guidelines
TD-11.1.A	Transition from Fortran 77 to Fortran 90
TD-11.2	C Programming Standards and Guidelines

END OF DOCUMENT