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

# STAKEHOLDER GUIDELINE

**SG-10**
**RESEARCH TESTER GUIDELINES**

**Version 3.0**

# NOAA NESDIS STAR

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TITLE: SG-10: RESEARCH TESTER GUIDELINES VERSION 3.0


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## VERSION HISTORY SUMMARY

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

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## LIST OF ACRONYMS

| ATBD | Algorithm Theoretical Basis Document |
|---|---|
| BB | Baseline Build |
| CI | Cooperative Institute |
| CICS | Cooperative Institute for Climate Studies |
| CIMSS | Cooperative Institute for Meteorological Satellite Studies |
| CIOSS | Cooperative Institute for Oceanographic Satellite Studies |
| CIRA | Cooperative Institute for Research in the Atmosphere |
| CL | Check List |
| CLI | Check List Item |
| CoRP | Cooperative Research Program |
| CM | Configuration Management |
| CMMI | Capability Maturity Model Integration |
| CREST | Cooperative Remote Sensing and Technology Center |
| DG | Document Guidelines |
| DPR | Development Project Report |
| EPG | Enterprise Process Group |
| EPL | Enterprise Product Lifecycle |
| G1R | Gate1 Review |
| G1RR | Gate1 Review Report |
| G2R | Gate 2 Review |
| G2RR | Gate 2 Review Report |
| NESDIS | National Environmental Satellite, Data, and Information Service |
| NOAA | National Oceanic and Atmospheric Administration |
| PAR | Process Asset Repository |
| PG | Process Guidelines |
| PP | Project Proposal |
| PRG | Peer Review Guidelines |
| QA | Quality Assurance |
| R&D | Research & Development |
| RCOD | Research Code |
| RTEST | Research Test Data |

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| SC | Steering Committee |
|---|---|
| SEI | Software Engineering Institute |
| SG | Stakeholder Guideline |
| SPSRB | Satellite Products and Services Review Board |
| STAR | Center for Satellite Applications and Research |
| SWA | Software Architecture Document |
| TD | Training Document |
| TG | Task Guideline |

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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 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-10) is to provide a detailed description of the standard tasks of a **Research Tester**. The intended users of this SG are those who have been assigned to provide science activities on a research project.

A *Research Tester* is any person located at a research organization who has been assigned by the **Research Lead** to one or more of the tasks of identifying test data appropriate to a research algorithm as it is being developed, acquiring and integrating the

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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

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test data into the research product processing system, creating test plans, executing tests, and analyzing and reporting test results for review.

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-10. 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

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## 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

### 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 **Research Testers** is SG-10 (this document).

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## 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 **Research Testers**.

**TABLE 2.3.1 –** Relevant Task Guidelines

| ID | Step |
|------|------------------|
| TG-1 | Basic Research |
| TG-2 | Focused R&D |
| TG-3 | Project Proposal |

## 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 **Research Testers**.

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**TABLE 2.4.1 –** Relevant Peer Review Guidelines

| ID | Review |
|-------|----------------|
| PRG-1 | Gate 1 Review |
| PRG-3 | Gate 2 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 **Research Testers**.

**TABLE 2.5.1 –** Relevant Review Check Lists

| ID | Review |
|------|----------------|
| CL-1 | Gate 1 Review |
| CL-3 | Gate 2 Review |

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## 3. REVIEWS

The relevant reviews for **Research Testers** are:

- Gate 1 Review (G1R)
- Gate 2 Review (G2R)

### 3.1. 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.

Standard Gate 1 Review objectives:

- Review the algorithm theoretical basis, software architecture, research code and research test results to determine whether the algorithm should be developed to support a STAR/SPSRB Project Proposal.

Standard Gate 1 Review entry criteria:

- Entry # 1 - An Algorithm Theoretical Basis Document (ATBD) has been written.
- Entry # 2 - A Software Architecture Document (SWA) has been written.
- Entry # 3 – Research code to implement the algorithm has been written.
- Entry # 4 – Test data for the basic research code has been produced.

Standard Gate 1 Review exit criteria:

- Exit # 1 – Algorithm and ATBD are satisfactory
- Exit # 2 – Software architecture and SWA are satisfactory.
- Exit # 3 – Basic research code is satisfactory.
- Exit # 4 – Research test results, documented in the ATBD, demonstrate that the algorithm has operational potential.
- Exit # 5 - Project is ready for the Exploratory phase

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Refer to PRG-1 for a more detailed description of the Gate 1 Review. The standard Gate 1 Review Check List Items (CLI) are documented in the process asset CL-1 (c.f. Section 2).

Note that the standard Gate 1 Review objectives, entry criteria, and exit criteria are only recommendations. The research organization is completely free to determine objectives, entry criteria, and exit criteria unique to the organization and/or project. In fact, there is no requirement for the organization to even conduct a Gate 1 Review.


### 3.2. Gate 2 Review

Gate 2 is a STAR review of a Project Proposal (PP). Its purpose is to determine whether the proposal is compatible with the NESDIS mission and strategic plan, and is technically feasible for development into an operational product. Resource issues are not considered at this time. If a project passes Gate 2, the PP is forwarded to SPSRB for consideration in accordance with the SPSRB process.

Standard Gate 2 Review objectives:

- Review the project proposal and supporting artifacts (algorithm theoretical basis, software architecture, R&D code and R&D test results) to determine whether the algorithm has operational potential.

- Identify a STAR Division and Branch to implement Development

Standard Gate 2 Review entry criteria:

- Entry # 1 - An Algorithm Theoretical Basis Document (ATBD v1r1) has been written.
- Entry # 2 - A Software Architecture Document (SWA v1r1) has been written.
- Entry # 3 – Research code to implement the algorithm has been written.
- Entry # 4 – A Project Proposal (PP) has been submitted to STAR
- Entry # 5 – A User Request has been attached to the PP

Standard Gate 2 Review exit criteria:

- Exit # 1 – Algorithm and ATBD are satisfactory
- Exit # 2 – Software architecture and SWA are satisfactory.

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- Exit # 3 – Research test results, documented in the ATBD, demonstrate that the algorithm has operational potential.

- Exit # 4 – Proposed operational products support the NESDIS mission and strategic plan

- Exit # 5 -  A STAR Division and Branch has been identified to implement Development

- Exit # 6 - Project is recommended for Development

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

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## 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 (SC).

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

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

**TABLE 4.1 –** Relevant Artifacts

| Artifact | Type |
|---|---|
| Basic Research Test Data | Test Data |
| R&D Test Data | Test Data |

***Basic Research Test Data:*** Basic Research Test Data (RTEST v1) are the data files used to test the Basic Research code, including the input data and output data identified in the ATBD and SWA.

***R&D Test Data:*** R&D Test Data (RTEST v2) are the data files used to test the R&D code, including the input data and output data identified in the ATBD and SWA. They may be upgraded from the Basic Research Test Data, if the upgraded R&D code requires this.

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## 5.  TASK DESCRIPTION

**Research Testers** participate in the following process steps:

- Step 1 - Basic Research (TG-1)
- Step 2 - Focused R & D (TG-2)

The standard tasks for each of these steps are described below. **Research Testers** may also refer to the relevant TGs for a complementary task description.

### 5.1 Basic Research Tasks
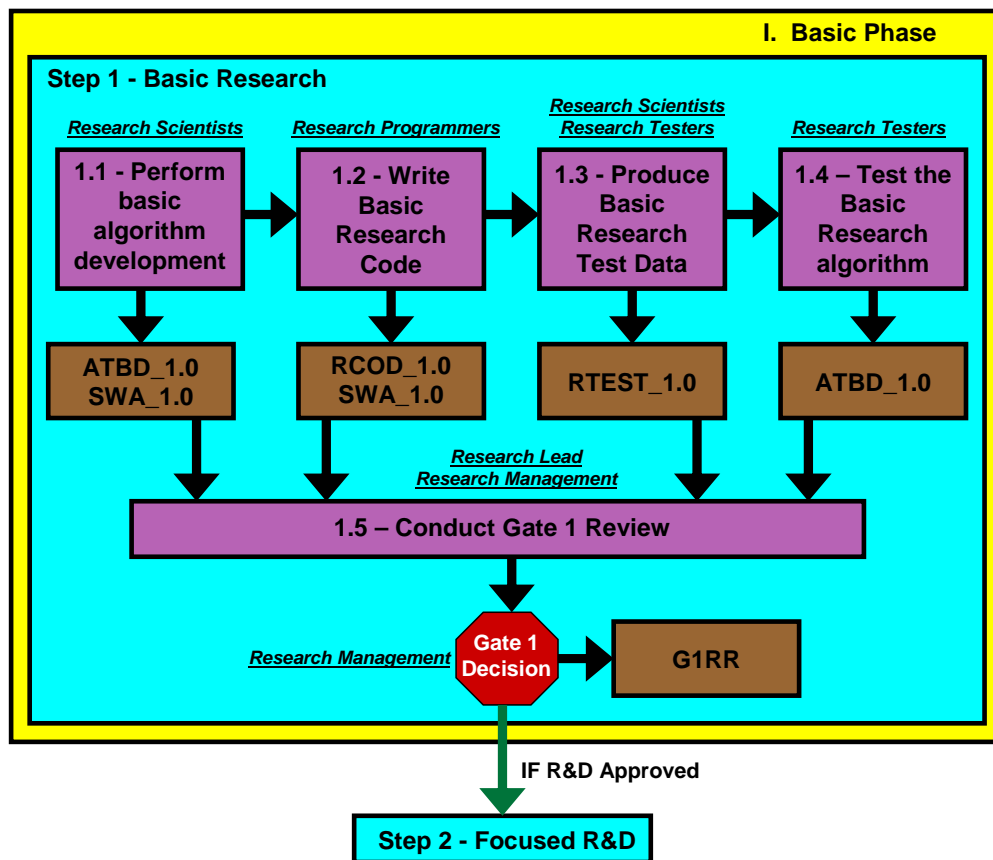
Figure 5.1 shows the process flow for step 1.



**Figure 5.1** – STEP 1 Process Flow

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### 5.1.1 Expected BEGIN State

- Research Scientists are prepared to perform basic research to develop an algorithm that may have operational potential.

- Research Management is aware of this effort, and has provided the resources needed for basic research coding and testing

- A Research Lead has been identified.

- If needed, Research Testers and Research Programmers have been identified

- Step 1 stakeholders understand and accept their tasks

### 5.1.2 Task Inputs

None

### 5.1.3 Desired END State

- An algorithm has been developed and documented in an ATBD.

- A software architecture has been developed and documented in a SWA.

- Research code has been written that implements the algorithm well enough to produce prototype data products.

- Research code has been run with research test data to produce data products.

- Research code test results, documented in the ATBD, demonstrate whether or not the algorithm has operational potential.

- A Gate 1 Review decision has been made and documented in a G1RR.

### 5.1.4  Task Outputs

- Algorithm Theoretical Basis Document v1.0

- Software Architecture Document v1.0

- Basic Research Code

- Basic Research Test Data

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- Gate 1 Review Report

### 5.1.5  Stakeholder Activities

The Basic Research algorithm may be developed in one of three venues:

- STAR. **Research Managers** include STAR Division Chiefs and Branch Chiefs. **Research Lead** is a STAR scientist. **Research Scientists** are STAR scientists. **Research Testers** are STAR scientists. **Research Programmers** may be STAR scientists, or **Research Managers** may designate contractor personnel for these tasks.

- A Cooperative Institute (CI). **Research Managers** are provided by the CI. **Research Lead** is a CI Scientist. **Research Scientists** are CI scientists. **Research Testers** are CI scientists. **Research Programmers** may be CI scientists, or **Research Managers** may designate contractor personnel for these tasks.

- A research organization other than STAR and the CIs (PUSH User). Compliance with STAR EPL standards is at the discretion of the research organization, but the organization should understand that Gate 2 approval shall depend on a demonstration that the algorithm can be developed according to STAR EPL standards.

At a minimum, initial versions of an Algorithm Theoretical Basis Document (ATBD) and a Software Architecture Document (SWA) should be produced for the Gate 1 Review. The purpose is to demonstrate to the Gate 1 reviewers that the algorithm has operational potential and should be further developed. ATBD v1r0 should include results of limited testing of the algorithm, using prototype code and a number of regional scenes. SWA v1r0 should document the algorithm inputs and outputs and at least one level of processing flow. The **Research Lead** and **Research Scientists** should produce these documents, using DG-1.1 and DG-1.2 as assets.

Basic research code and test data may be developed to help demonstrate an operational potential. In that case, **Research Programmers** and **Research Testers** at the research organization may be assigned to the project by **Research Managers** and/or the **Research Lead**. The extent and maturity of this code and test data is at the discretion of the organization that is developing the Basic algorithm, as it is their decision whether to approve the project for the next phase at the Gate 1 Review.

The **Research Testers** should work with **Research Scientists** to develop test data that will enable the algorithm to produce prototype data products and to create a test environment and test results that demonstrate the algorithm's potential to satisfy Gate 1 Review requirements (c.f. PRG-1).

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**Each stakeholder** who performed activities during step 1 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 **Research Lead** should remind the stakeholders to do this. At the conclusion of Development (step 11), the **Development Lead** will collect the final edited personal stakeholder records and incorporate them into a Development Project Report (DPR).

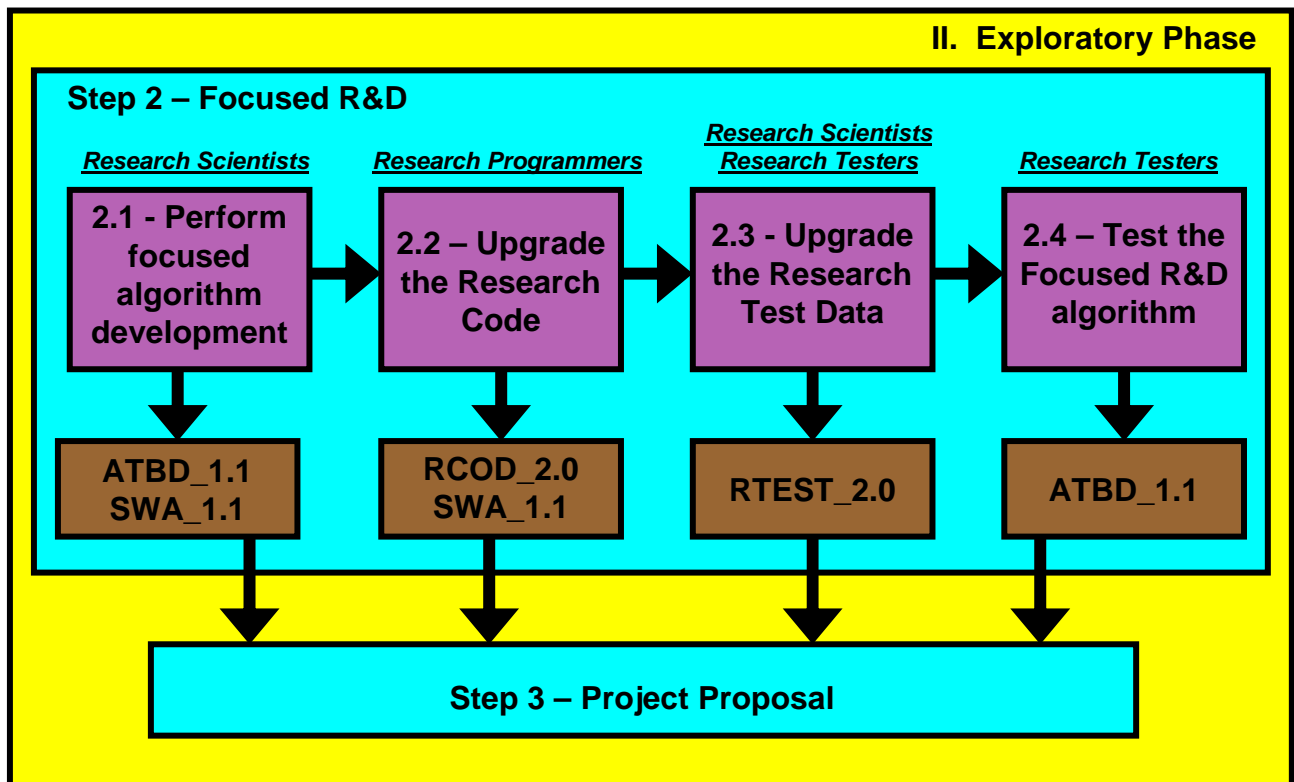## 5.2 Focused R&D Tasks

Figure 5.2 shows the process flow for step 2.



**Figure 5.2** – STEP 2 Process Flow

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### 5.2.1 Expected BEGIN State

Algorithm and supporting artifacts have passed a Gate 1 Review.

### 5.2.2 Task Inputs

***Algorithm Theoretical Basis Document v1.0:*** The Algorithm Theoretical Basis Document (ATBD) provides a theoretical description (scientific and mathematical) of the algorithm that is used to create a product that meets user requirements. For v1.0, the algorithm is at a "concept" stage and its operational potential has not been assessed. The purpose of ATBD v1.0 is to demonstrate that the algorithm has operational potential and should be further developed to demonstrate operational capability. Refer to DG-1.1 for detailed ATBD guidelines.

***Software Architecture Document v1.0:*** The Software Architecture Document (SWA) complements the ATBD by providing the software architecture for the processing code that will implement the algorithm. Refer to DG-1.2 for detailed SWA guidelines.

***Basic Research Code:*** Basic Research Code (RCOD v1) is research code that implements the algorithm. It should use input data and produce output data that is described in the ATBD and SWA. It should include the processing functionality described in the ATBD and SWA.

***Basic Research Test Data:*** Basic Research Test Data (RTEST v1) are the data files used to test the Basic Research code, including the input data and output data identified in the ATBD and SWA.

***Gate 1 Review Report:*** Gate 1 Review Report (G1RR) is the report of the Gate 1 Reviewers. The G1RR should consist of an assessment of the Gate 1 Review artifacts and a yes/no decision on proceeding to the next phase of the EPL. Refer to DG-1.3 for G1RR document guidelines.

### 5.2.3 Desired END State

- The research algorithm has been matured and documented in ATBD v1r1
- A software architecture has been matured and documented in SWA v1r1

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- R&D code has been written that implements the algorithm well enough to produce proxy data products to support a PP to STAR and the SPSRB.

- R&D code has been run with research test data to produce the proxy data products

- R&D code test results, documented in ATBD v1r1, demonstrate whether or not the algorithm's operational potential warrants the submission of a PP.

### 5.2.4  Task Outputs

- Algorithm Theoretical Basis Document v1.1

- Software Architecture Document v1.1

- R&D Code

- R&D Test Data

### 5.2.5  Stakeholder Activities

The Focused R&D algorithm may be developed in one of three venues:

- STAR. **Research Managers** include STAR Division Chiefs and Branch Chiefs. **Research Lead** is a STAR scientist. **Research Scientists** are STAR scientists. **Research Testers** are STAR scientists. **Research Programmers** may be STAR scientists, or **Research Managers** may designate contractor personnel for these tasks.

- A Cooperative Institute (CI). Research Management is provided by the CI. **Research Lead** is a CI Scientist. **Research Scientists** are CI scientists. **Research Testers** are CI scientists. **Research Programmers** may be CI scientists, or **Research Managers** may designate contractor personnel for these tasks.

- A research organization other than STAR and the CIs (PUSH User). Compliance with STAR EPL standards is at the discretion of the research organization, but the organization should understand that Gate 2 approval shall depend on a demonstration that the algorithm can be developed according to STAR EPL standards.

The initiating event for this step is Gate 1 approval, as documented in the Gate 1 Review Report.

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The **Research Testers** should work with **Research Scientists** to develop test data that will enable the algorithm to produce proxy data products and to create a test environment and test results that demonstrate the algorithm's potential to satisfy Gate 2 Review requirements (c.f. PRG-3).

**Research Scientists**, **Research Programmers**, and **Research Testers** should collaborate to run tests on the Focused R&D algorithm. The tests shall meet Gate 2 requirements as given in the Gate 2 Review guidelines (PRG-3) and Check List (CL-3).

The **Research Lead** determines when the algorithm is sufficiently developed for Gate 2 review, using PRG-3 and CL-3 as guides. At this point, the **Research Lead** directs the development team to proceed to step 3 "Project Proposal".

**Each stakeholder** who performed activities during step 2 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. 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).

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