



STAR JPSS Quality Assurance Plan

Version 1.0

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1. Introduction

This Quality Assurance Plan provides an overview of the organization, activities, overall tasks, and objectives of Quality Assurance as applied to the algorithm development and integration procedures adopted by STAR JPSS. Compiled documentation are to assist the management team (J-STAR), the Cal/Val algorithm science teams, and the STAR Algorithm Scientific Software Integration and System Transition Team (ASSISTT).

1.1 Background

The NOAA/NESDIS Center for Satellite Research and Applications (STAR) provides technical support of the Joint Polar Satellite System (JPSS) algorithm development and integration tasks in coordination with the JPSS Ground Project Data Products Engineering & Services (DPES) Team.

J-STAR brings management support and expertise, coordinating communication between the algorithm science teams and the NOAA JPSS Office (NJO). Management tracks milestones, funding, and risks for the JPSS project.

The ASSISTT brings technical expertise and support to product algorithms, primarily in testing and validating science algorithms. Deliveries to IDPS, NDE and other operational systems are performed as needed. ASSISTT assists JPSS science teams in implementing algorithm changes.

Cal/Val algorithm science teams develop and deliver science algorithms to meet the requirements of the JPSS project. ASSISTT and J-STAR support science teams in transitioning algorithms from research to operations (R2O).

1.2 Purpose

The purpose of this document is to identify and describe the overall practices and methods for QA to be used during the lifecycle of JPSS algorithm development and integration project, and will be updated progressively as the implementation of the components of this plan and the requirements / necessities arise. This QA Plan provides overall guidance and direction to establish unified document templates and procedures over algorithm deliveries and communications.

1.3 Scope

The *Quality Assurance Plan* identifies and describes the QA process for the STAR JPSS project. This document identifies procedural documentation inherent to activities relevant to J-STAR, ASSISTT, and the Cal/Val algorithm science teams.

1.4 Overview

This document is divided into eight sections covering the scope of QA activities. Section 1 is an introduction. Section 2 gives an overview of our organization and intercommunication. Section 3 identifies our configuration management plans. Section 4 covers our algorithm development process.

Section 5 covers our algorithm review process. Section 6 discusses the policy for delivered algorithm packages. Section 7 discusses the Cal/Val maturity process. Section 8 defines our publication procedures.

2. STAR JPSS Teams

2.1 STAR JPSS Management (J-STAR)

The STAR JPSS Management support team (J-STAR) acts as a liaison between the NJO program office and the Cal/Val science teams. J-STAR advocates on behalf of the STAR JPSS project, ensuring that product requirements are communicated to science teams, algorithm changes are reviewed and implemented, and decisions impacting the science teams reach concurrence prior to implementation.

J-STAR maintains schedules and budgets and tracks risks of the JPSS project. The team tracks algorithm maturity, organizes STAR JPSS meetings, and maintains the web site for the program.

<http://www.star.nesdis.noaa.gov/jpss/>

2.2 STAR JPSS Algorithm Scientific Software Integration Support and Transition Team (ASSISTT)

STAR JPSS ASSISTT members actively support the STAR JPSS science and Cal/Val teams with algorithm integration activities. ASSISTT communicates directly with science algorithm teams, Data Product Engineering & Services (DPES), J-STAR, and JPSS Algorithm Management Project (AMP) to facilitate algorithm integration.

ASSISTT has designated points of contact (POCs) for each team, as well as scripting and configuration management specialists for integration activities. ASSISTT is responsible for:

- Assisting teams with code updates, testing, and deliveries
- Providing technical support and expertise to teams
- Serving as experts in the Algorithm Development Library (ADL) Framework, which emulates the IDPS system
- Serving as experts in the NDE framework
- Providing avenue for effective configuration management
- Facilitating a structured test and review process for new algorithms

2.3 Algorithm Science Leads

Algorithm Science leads coordinate science activities within their team and act as primary point of contact between the team, STAR ASSISTT, and J-STAR. The leads are responsible, not only for maintaining and updating the science algorithms, but also keeping ATBDs and other documentation up to date. Additionally, the team leads are expected to keep J-STAR informed of team progress through regular weekly and quarterly reports, as well as presentations on algorithm maturity. Through coordination with J-STAR, the leads coordinate with their teams to review program related risks and changes such as instrument waivers, or upstream algorithm changes.

2.4 Coordination between teams

2.4.1 ASSISTT and Science Teams

STAR ASSISTT's Integration Specialists coordinate directly with algorithm science teams, attending weekly meetings and working shoulder-to-shoulder with science algorithm developers during the discovery and development phase of an algorithm. ASSISTT works with the science team to generate functional and complete algorithm delivery packages, consistent with the operational system to which an algorithm is being delivered.

JPSS unique products are generated separately from Enterprise algorithms. JPSS SDR and Imagery products are produced in the IDPS, while Sounding, Ozone, Cloud, Aerosol, Cryosphere, and Land EDRs are produced at OSPO/NDE either as standalone algorithms or within the Framework (described in another document).

For algorithms going to the IDPS, integration specialists serve as ADL experts. ADL (the Algorithm Development Library) is a programming environment maintained by the JPSS Ground Project DPES. ADL emulates the operational IDPS system. ADL is recommended by DPES to ensure a common baseline between science developers and the operational code.

2.4.2 Quality Assurance Lead

2.4.2.1 J-STAR QA Lead

The J-STAR QA Lead is responsible for maintaining situational awareness of the JPSS project as a whole and coordinating with management and oversight teams. Responsibilities include:

- Establishing and maintaining the Cal/Val product delivery schedule.
- Tracking Code Change Request Packages through all review board stages.
- Representing the interest of J-STAR in review boards.
- Attending tag-up meetings.
- Maintaining open communication with ASSISTT and AMP.

2.4.2.2 ASSISTT QA Lead

The ASSISTT Quality Assurance Lead is responsible for maintaining situational awareness of the JPSS project as a whole and coordinating with management and oversight teams. Responsibilities include:

- Compiling the ASSISTT weekly report (program deliverable).
- Attending tag-up meetings.
- Maintaining open communication with J-STAR and AMP.

- Keeping apprised of activities of related Integration Teams (e.g., JPSS Risk Reduction team).
- Coordinating reviews and reports.

3. Configuration Management

3.1 Algorithm Configuration Management

As of 2016, Configuration Management has migrated to the GIT system from the previously utilized IBM ClearCase environment. Currently, baselines are synchronized in both ClearCase and GIT to ensure a smooth transition and no loss of configuration management capability.

The use of CM is vital to controlled testing, calibration, and validation of the JPSS Algorithms. CM:

- Protects software assets from corruption, unintentional changes, and unauthorized access.
- Controls the flow of changes among development branches.
- Provides the ability to reproduce the configuration of the entire development environment.

The CM Plan for the JPSS ASSISTT project is detailed in the “[JPSS Algorithm Integration Team Configuration Management Plan](#).”

This document is maintained by the CM Manager and stored with the JPSS ASSISTT Project in the both CM environments.

3.2 Requirements

ASSISTT compiles Requirements Allocation Documents for all algorithms transitioned into the Framework or delivered to NDE. This document is vetted during the algorithm review process and delivered to NDE with the document package. The OSPO PAL maintains this document.

3.3 Document Management

J-STAR managed documents are managed in the CM environment. Documents owned and managed by J-STAR include the Algorithm Theoretical Basis Documents (ATBDs), Cal/Val Plans, and User Guides, written and maintained by the Cal/Val Science teams. Current versions of these documents are linked on the JPSS STAR web page.

<http://www.star.nesdis.noaa.gov/jpss/Docs.php>

The online PDFs automatically synchronize with the latest version available in the CM. A Word document format is kept in CM and editing is controlled by the J-STAR QA lead.

J-STAR managed documents can be updated during the standard code change process as follows:

1. Science teams update the document in synchronization with code changes
2. Science teams deliver updated document to ASSISTT as part of a Delivered Algorithm Package (DAP), who will deliver the DAP to AERB for CCR review

3. Once AERB approved, the code and document change, the new document will be integrated into JSTAR CM system, and the PDF version of the document will be posted on STAR JPSS web server

New and modified algorithms delivered to NDE require ATBDs that follow the SPSRB standards. The Guideline and template are found below:

- [Algorithm Theoretical Basis Document Guideline](#)
- [Algorithm Theoretical Basis Document Template](#)

4. Algorithm Development

4.1 ADL Procedures

STAR ASSISTT serves as ADL experts to science team during the code development stage and as liaisons to DPES as algorithms are transitioned to operations. The algorithm change process is defined in the “*Algorithm Change Management Plan*” (ACMP; 474-00058). This document is written and maintained by DPES. This document specifies the procedures for initiating an algorithm change as well as the content of the delivered algorithm package.

STAR ASSISTT follows the standards and practices established in the ACMP to ensure smooth transition from research to operations.

4.2 The Framework Procedures

As part of the JPSS Risk Reduction Project, STAR ASSISTT has developed and maintained a Framework that produces Aerosol, Cloud, Cryosphere, and Land Products in the NDE system, with attention to ordered process flow. STAR ASSISTT serves as Framework experts to science team during the code development stage and as liaisons to the OSPO PAL as algorithms are transitioned to operations.

4.3 Stand-alone Code Procedures

In some instances, STAR ASSISTT will deliver a science algorithm to NDE as a stand-alone code. STAR ASSISTT acts as experts in the algorithm integration procedure, assuring that appropriate wrapper scripts are in place and that the science code has all needed inputs and produces an output of the appropriate format. STAR ASSISTT serves as Framework experts to science team during the code development stage and as liaisons to the OSPO PAL as algorithms are transitioned to operations.

4.3 JPSS Coding Standards

STAR ASSISTT is responsible for the content of new code and changed code. All processing code developed by STAR ASSISTT follows the JPSS software coding standards as described in the JPSS Algorithm Integration and Test Standard Operational Procedures (474-00443).

Additionally, STAR ASSISTT conforms to the Software and Coding Standards detailed by the SPSRB. These standards exist for general programming as well as specific programming languages. These standards are found online at: http://projects.osd.noaa.gov/SPSRB/standards_software_coding.htm

SPSRB (NESDIS Satellite Products and Services Review Board) Software & Coding Standards:

- [General Programming Standards](#)
- [FORTRAN 77 Programming Standards](#)
- [FORTRAN 90/95 Programming Standards](#)
- [C Programming Standards](#)
- [C++ Programming Standards](#)

JPSS eRoom:

- [JAVA Coding Standards and Guidelines](#)

4.4 ASSISTT Scripts

STAR ASSISTT creates and utilizes several in-house scripts for algorithm development, processing, and review. Scripts are shared among STAR ASSISTT team members and often between different algorithm integration teams. All scripts are stored in CM along with documentation. Documentation is listed in the *Document List*. Principle scripts include:

ADL Chain Run Script	Used to stage and run multiple algorithms in ADL. This script is modified to ensure functionality in every delivered version of ADL, and maintained in the CM.
Dark OMPS GRAVITE Script	Used to generate OMPS Dark Tables. (Delivered to GRAVITE.)
SASQUATCH	Used to convert a spreadsheet of requirements to presentation format or requirements document format
Risk-QUATCH	Used to convert a Review Item Disposition into presentation format

5. Algorithm Development Review Process

STAR ASSISTT follows the standards and practices of the Satellite Products and Services Review Board (SPSRB). ASSISTT directs and supports the development of algorithms from conception to operations using the Capability Maturity Model Integration (CMMI) process. This process shows that we understand algorithm requirements and can develop algorithms that meet those requirements. The CMMI process involves five major reviews:

- Algorithm Design Review
- Critical Design Review
- Test Readiness Review

- Code Unit Test Review
- Algorithm (System) Readiness Review

For these reviews, ASSISTT, in conjunction with the science teams, prepares documents and slide presentations. The science team validates the content prior to the review.

5.1 Major Reviews

The review process is well-defined, but is adaptable depending on project goals and schedule.

Review	Purpose	Details
Preliminary Design Review	Choose the best algorithm that will meet requirements.	Candidate algorithms are presented and vetted. Science teams discuss the advantages and disadvantages of new and heritage algorithms. ASSISTT focuses on quality assurance, schedule, and risks for each candidate algorithm.
Critical Design Review	Describe the chosen algorithm that will meet requirements.	Begin drafting the Algorithm Theoretical Basis document. This document covers the physical and mathematical description of the chosen algorithm, and proves that the algorithm meets all requirements.
Test Readiness Review	Show that the algorithm is ready for end-to-end testing.	Show that the algorithm within the operational framework meets coding standards and gives the same results as the offline research code. Show that the ASSISTT is prepared for an end to end test of the algorithm with full product precedence. Establish the extended datasets that will be used to show that the algorithm will meet the 80% requirements. This validation may be tied to the offline algorithm validation.
Code Unit Test Review	Verify software readiness	Ensure that software meets coding standards; error messaging has been standardized; interfaces have been finalized; common libraries are used; common missing values are used.
Algorithm (System) Readiness Review	Describe tests that show the algorithm will be ready for delivery	Verify that all scientific dependencies have been addressed and the algorithm has been tested on full seasonal data and will meet the requirements.

5.2 Templates

Templates for review presentations are managed by the ASSISTT QA Lead and made available to team members once the review process is initiated.

Required review documentation is discussed and either standard SPSRB templates are used or templates are provided by the JPSS Program Office. (<http://projects.osd.noaa.gov/SPSRB/index.htm>) Templates are also linked here-in.

5.3 Risk Tracking

Within the review process, risk tracking is performed by the ASSISTT QA Lead. Each algorithm product or project conducted by STAR ASSISTT has an associated Review Item Disposition (RID). The RID is updated and reviewed by all stakeholders.

Risks that need to be promoted to the project office are shared with the AMP/STAR Risk Management Board, headed by AMP.

6. Delivered Algorithm Packages

Delivered Algorithm Packages (DAPs) include processing code, test data and results, and comprehensive documentation. By establishing a standard format for these packages, we ensure that operational engineers have all the information they need to integrate and test a new algorithm into the operational system.

STAR ASSISTT DAPs will meet the requirements of the receiving party. Currently, JPSS SDRs and Imagery algorithms are running in the IDPS system, while Aerosol, Cloud, Cryosphere, and Land EDR algorithms are delivered to NDE.

6.1 IDPS Deliveries

Algorithms delivered to IDPS are developed in ADL. DAPs follow the practices outlined in the ACMP. The DAP is delivered to DPES for testing on GRAVITE, and once functional tests are complete, the algorithm is delivered to IDPS. The DAP includes an Algorithm Change Package (ACP) and Document Package.

The Algorithm Package includes:

- baseline and updated science algorithm source code, including makefiles and scripts
- input to functional tests, including input test data and temporary files
- outputs to functional tests
- common inputs such as coefficient files, look-up tables, and configuration files

The Documentation Package includes relevant/applicable documentation such as:

- Relevant/applicable documentation such as an updated Algorithm Theoretical Basis Document (ATBD)
- A guidance document including a package description and processing steps.

6.2 NDE Deliveries

STAR ASSISTT transitions a DAP to the NDE development environment for testing. The DAP shall include both the integrated pre-operational demonstration system and a document package.

The integrated pre-operational demonstration system includes:

- Processing code and ancillary files
- Input data
- Output data

The document package includes:

- A read-me text file listing items in the pre-operational system baseline
- Review Item Disposition
- Algorithm Theoretical Basis Document
- Requirements Allocation Document
- System Maintenance Manual
- External User Manual
- Critical Design Review Report
- Algorithm Readiness Review Document
- Any additional/relevant documents deemed necessary during the review process.

Guidelines for delivered documentation are found on the SPSRB page or are provided by ASSISTT during the review process.

http://projects.osd.noaa.gov/SPSRB/standards_data_mtg.htm

6.3 Deliveries to Other Operational Systems

STAR ASSISTT can support the development and delivery of JPSS products going to other operational systems. Their expertise and experience are available to algorithm science teams as needed.

7. Data Product Cal/Val Maturity Readiness Review Process

Algorithm science teams are responsible for developing and maintaining a Cal/Val plan that will progress their product through maturity and readiness. The Cal/Val Plan follows the template found at:

<http://www.star.nesdis.noaa.gov/jpss/Docs.php>

The algorithms progress through the following maturity levels:

Beta Maturity Level:

- Early release product
- Minimally validated
- May still contain significant errors
- Versioning not established until a baseline is determined

- Available to allow users to gain familiarity
- Product is not appropriate as the basis for quantitative scientific publications studies and applications

Provisional Maturity Level:

- Product quality may not be optimal
- Incremental product improvements are still occurring
- Version control is in affect
- General research community is encouraged to participate in the QA and validation of the product, but need to be aware that product validation and QA are ongoing
- Users are urged to consult the EDR product status document prior to use of the data in publications
- Ready for operational evaluation

Validated Maturity Level:

- Product performance is well defined and documented over a wide range of representative conditions via numerous and ongoing ground-truth and validation efforts
- Clear documentation of product performance exists that includes all known product anomalies and their recommended remediation strategies, regardless of severity level
- Product analyses are sufficient for full qualitative and quantitative determination of product fitness-for-purpose
- Testing has been fully documented
- Ready for long term monitoring
- Product improvements continue through the lifetime of the instrument

8. Publications

JPSS STAR management, ASSISTT, and science teams attend and present several at conferences featuring both our collaborative work and our internal milestones. First, abstracts or presentations are circulated internally for quality assurance. Next, we follow the standard NOAA/SMCD practice of obtaining a Publication Release. The abstract and publication process and related forms are found at: <https://www.star.nesdis.noaa.gov/intranet/SMCDPubProcess.php>

Appendix: Acronyms

- ACMP Algorithm Change Management Plan
- ACP Algorithm Change Package
- ADL Algorithm Development Library
- ASSISTT Algorithm Scientific Software Integration Support and Transition Team
- AMP Algorithm Management Project
- ATBD Algorithm Theoretical Basis Document
- ATMS Advanced Technology Microwave Sounder
- CCR Code Change Request
- CDR Critical Design Review
- CrIS Cross-track Infrared Sounder
- CM Configuration Management
- CMMI Capability Maturity Model Integration
- DAP Delivered Algorithm Package
- DOORS Dynamic Object Oriented Requirements System
- DPES Data Products Engineering and Services
- DR Discrepancy Report
- EDR Environmental Data Record
- EPL Enterprise Product Lifecycle
- IDPS Interface Data Processing Segment
- J1 JPSS-1 (Satellite)
- JPSS Joint Polar Satellite System
- J-STAR STAR JPSS Management
- GRAVITE Government Resource for Algorithm Verification, Independent Testing, and Evaluation
- LUT Look Up Table
- NDE NPOESS Data Exploitation
- NJO NOAA JPSS Office
- NUCAPS NOAA Unique CrIS/ATMS Processing System
- OMPS Ozone Mapping & Profiler Suite
- PDR Preliminary Design Review
- POC Point of Contact
- QA Quality Assurance
- R2O Research-to-Operations
- RID Review Item Disposition
- Risk-QUATCH Risk-tracking Quality Assurance Through Coding Help
- SADIE Science Algorithm Development and Integration Environment
- SASQUATCH Simplified and Streamlined Quality Assurance Through Coding Help
- SDR Sensor Data Record
- SMCD Satellite Meteorology and Climatology Division
- SPSRB Satellite Products and Services Review Board
- SR System Review

- SRR System Readiness Review
- STAR Center for Satellite Applications Research
- UTRR Unit Test Readiness Review
- VIIRS Visible Infrared Imaging Radiometer Suite