Software Review Procedures for the GIFTS-IOMI Project

Version 1.1

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Langley Research Center

Hampton, Virginia

Approvals

Prepared by:

_____	August 16, 2001
Stephen D. Moulton	Date
Integrated Computer Engineering, Inc.	

Approved by:

_____	August 16, 2001
John C. Hinkle	Date
GIFTS-IOMI Software Architect	

Record of Changes

Issue Date	Description of Change(s)	Section(s) Affected	Prepared by	Approved by
06/19/01	Ver. 1.0 – Initial release	All	SDM	JCH
08/16/01	Ver. 1.1 – Implementation of reviewer comments and addition of Appendix A	All	SDM	JCH

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1 – Overview

This document describes the procedures that the Geosynchronous Imaging Fourier Transform Spectrometer – Indian Ocean METOC Imager (GIFTS-IOMI) project will follow in the conduct of software reviews. These procedures adhere generally to Flight Project and Experiments Review Planning and Implementation in Accordance with NPG 7120.5A, LMS-CP-5505 Rev C, although the scope of that document extends well beyond the software realm. Additionally, the methods presented in Software Requirements Capture and Management Version 2.3 are reflected in these procedures. These and other references that were consulted in the preparation of this document are listed in Appendix A.

The specific reviews that are addressed in these procedures are Software Requirements Reviews (SRRs), Preliminary Design Reviews (PDRs), and Critical Design Reviews (CDRs). Test Readiness Reviews (TRRs) and Functional Configuration Audits (FCAs) will be addressed at a later date. Checklists that may be used to facilitate the review process are located in the Instructional Handbook for Formal Inspections, available on the Langley Software Process Improvement web site at the following URL:

http://sw-eng.larc.nasa.gov/process/documents/pdfdocs/inspection.pdf

2 – Software Requirements Review

The SRR is the forum for presenting, discussing and agreeing upon the software requirements derived from GIFTS-IOMI system requirements and documented in the software requirements document. It provides an opportunity for necessary discipline interaction within the GIFTS-IOMI project, independent peer review, visibility into the software requirements, and education of the software team.

This review defines the software project objectives and confirms that the software system requirements are sufficient. A concept is presented that will identify software subsystems, interfaces, and their resource allocations. The SRR serves two purposes: 1) it ensures that the documented requirements are complete, accurate and in agreement with the system requirements, and 2) it ensures that the location(s) and method for testing each software requirement is specified. Successful completion of the SRR (and closure of corresponding action items) signifies approval of the software requirements and agreement to continue preliminary design.

Although it is a GIFTS-IOMI project goal to hold a single flight software SRR and a single ground software SRR, multiple SRRs may be scheduled.

2.1 Entrance Criteria

At least ten working days prior to the SRR, the NASA Software Manager must ensure that the draft agenda, Software Requirements Specification (SRS) and all relevant Interface Control Documents (ICDs) are made available to the SRR attendees for their comments. These comments must then be returned to the NASA Software Manager or designee at least two working days prior to the SRR. The NASA Software Manager or designee will then determine preliminary dispositions of the comments. Three working

days prior to the SRR, the NASA Software Manager will ensure that the final, reviewed agenda is sent to all attendees.

Additionally, the NASA Software Manager must ensure that all necessary supporting documents are available as reference material during the preliminary review and at the SRR. The parent Requirements Document (RD), the Software Development Plan (SDP), and other ICDs are examples of these reference documents.

All documents in the SRR package will have been previously peer reviewed and placed under configuration control in accordance with the approved CMP.

2.2 Attendees

All software project stakeholders should attend the SRR because this is the forum where the actual work to be accomplished is agreed upon. Specifically, the NASA Software Manager should preside over the SRR, and attendees should include:

- Project Manager or representative
- Functional sponsors or representatives
- Representatives of the user(s)/customer(s)
- Representatives of the organization(s) responsible for the design, development, and testing of the software and its associated test and support tools
- Representatives of hardware and/or software with which the software under review interfaces
- Software Quality Assurance (SQA)

It is important that the SRR participants attend in person rather than via teleconference or videoconference because of the highly interactive nature of the review, as well as the importance of obtaining complete consensus among the stakeholders.

2.3 Conduct of the Review

During the review, an overview of the software and operational environment will be provided, along with discussions of software functionality that result from satisfying the requirements. Other discussion topics include system and software requirement traceability, key performance requirements, initial timing and sizing estimates, external interfaces, and planning for testing the software. Specific items to be presented include but are not limited to:

- Overview of software functional requirements
- Software system performance requirements
- Software subsystem allocations (requirements to CSCIs)
- Risk areas
- Trade-off studies

- Verification and validation approach
- Software development plan and metrics
  - Work breakdown structure (WBS)
  - Cost
  - Schedule
  - Resources
  - Configuration Management Plan
- Procurement plan and metrics
  - Subcontracts
  - Components (*e.g.*, COTS)
- Development approach
- Safety considerations
- An operational overview of how the software will be utilized
- Organizational interfaces

Following the overview presentation, working sessions will be conducted to discuss the disposition of comments that were submitted by the attendees. The meeting will then reconvene to present the results of the working sessions. The goal of the proceeding will be to adopt changes to the SRS and ICDs that will then be implemented in an agreed-upon timeframe. These changes will ultimately result in baselined requirements that can be revisited, if necessary, at the PDR.

2.4 Pass/Fail Criteria

For the SRR to be deemed successful, the following milestones must be met:

- An action plan that will provide for 95% definition of the software requirements and interfaces has been documented and agreed upon, including:
  - Assigned responsibilities
  - Due dates
- Development issues and risk areas have been identified
- Trade-off studies that support the proposed concept have been presented or identified
- Agreement that the proposed concept will satisfy the requirements has been achieved
- Performance requirements and software subsystem allocations have been established
- The verification and validation approach has been agreed upon

Any of the above items that are not complete should result in the creation of one or more action items. These action items will be assigned with due dates to appropriate personnel by the NASA Software Manager. They will be statused at the next iteration of the SRR or at the PDR. The final pass/fail determination is the responsibility of the NASA Software Manager.

2.5 Maintenance and Dissemination of Records

During the review, a designated recorder provided by the authoring organization will take minutes and document action items that arise during the course of the meeting. These documents will be distributed to attendees within 10 working days of the end of the SRR.

The updated SRS and ICDs will be placed under configuration control in accordance with the approved Configuration Management Plan (CMP) and will be made available to the attendees. The NASA Software Manager will track action items through resolution.

3 – Preliminary Design Review

The purpose of the GIFTS-IOMI Software PDR is to describe the architectural design of the GIFTS-IOMI software that was developed from the approved set of requirements. PDRs will be held to demonstrate that architectural designs meet system requirements with acceptable risk. They may be held at the software system, software subsystem, or (if applicable) software component levels. All verification and validation methodologies and interfaces must be defined. Successful completion of a PDR results in the approval of that portion of the baselines for the software performance allocations and the preliminary design, and it serves as a confirmation of the software development plan. It also serves as a prerequisite to proceeding with the detailed design.

3.1 Entrance Criteria

At least ten working days prior to the PDR, the NASA Software Manager must ensure that the draft agenda, SDP, updated SRS, updated relevant ICDs, and all pertinent preliminary design documents are made available to the PDR attendees for their comments. These comments must then be returned to the NASA Software Manager or designee at least two working days prior to the PDR. The NASA Software Manager or designee will then determine preliminary dispositions of the comments. Three working days prior to the PDR, the NASA Software Manager will ensure that the final, reviewed agenda is sent to all attendees.

Additionally, the NASA Software Manager must ensure that all necessary supporting documents are available as reference material during the preliminary review and at the PDR.

All documents in the PDR package will have been previously peer reviewed and placed under configuration control in accordance with the approved CMP.

3.2 Attendees

All software project stakeholders should attend the PDR because this is the forum where the software design suitability is agreed upon. Specifically, the NASA Software Manager

should preside over the PDR, and attendees should include:

- Project Manager or representative
- Functional sponsors or representatives
- Representatives of the user(s)/customer(s)
- Representatives of the organization(s) responsible for the design, development, and testing of the software and its associated test and support tools
- Representatives of hardware and/or software with which the software under review interfaces
- SQA

It is important that the PDR participants attend in person rather than via teleconference or videoconference because of the highly interactive nature of the review, as well as the importance of obtaining complete consensus among the stakeholders.

3.3 Conduct of the Review

The task structure, external hardware and operational interfaces, and operating system usage will be reviewed. Other discussion topics include the flowdown of CSCI-level requirements to the software component-level and formal qualification tests, refined timing and sizing estimates, and test plans. Specific items to be presented include but are not limited to:

- Changes to the software functional requirements since the SRR
- Software system performance requirements
- Design solution
  - Architectural design description
  - Satisfaction and traceability of requirements
  - Resource margins
  - Changes from the SRR development approach
  - Supporting analyses and tests
  - Acceptable risk
  - System architecture
  - External interfaces
  - Technical standards used and impacts of revisions/changes
- Safety considerations
- Software development planning
  - Status

  - Cost
  - Schedule
  - Resources
  - Configuration management
  - Product assurance
  - Risk management
- Procurement plan status
  - Subcontracts
  - Components (*e.g.*, COTS)
- Operations changes since the SRR
- Trade-off studies
- Test planning
  - Software verification and validation plan
  - Integrated test plan
- Logistics
  - Installation
  - Maintenance
  - Testing
- Lessons learned

Following the overview presentation, working sessions will be conducted to discuss the disposition of comments that were submitted by the attendees. The meeting will then reconvene to present the results of the working sessions. The goals of the proceeding will be to come to agreement on the architectural design and to adopt changes to the SRS and ICDs. This design and the associated changes will then be implemented in an agreed-upon timeframe and will ultimately result in a baselined design that will be revisited in more detail at the CDR.

3.4 Pass/Fail Criteria

For the PDR to be deemed successful, the following milestones must be met:

- 95% of the software requirements and interfaces have been documented and agreed upon
- Software design meets execution time, size, and other design constraints
- All inputs, processes, and outputs are described in the architectural design
- Control and data flow have been defined
- All requirements have been allocated to the appropriate CSCI(s) and on to the

software component level

- Test environment and approach have been defined

Any of the above items that are not complete should result in the creation of one or more action items. These action items will be assigned with due dates to appropriate personnel by the NASA Software Manager. They will be statused at the next iteration of the PDR or at the CDR. The final pass/fail determination is the responsibility of the NASA Software Manager.

3.5 Maintenance and Dissemination of Records

During the review, a designated recorder provided by the authoring organization will take minutes and document action items that arise during the course of the meeting. These documents will be distributed to attendees within 10 working days of the end of the PDR.

Any documents updated as a result of the PDR will be placed under configuration control in accordance with the approved CMP and will be made available to the attendees. The NASA Software Manager will track action items through resolution.

4 – Critical Design Review

A software CDR serves two purposes: 1) it ensures that the proposed software detailed design satisfies all of the CSCI and CSC requirements, and 2) the detailed design is examined to ensure high software design quality. The CDR demonstrates successful completion of the detailed software design phase and readiness to proceed with the software development. All technical problems and software design anomalies must be resolved without compromising software requirements, reliability, safety, cost, and schedule.

4.1 Entrance Criteria

At least ten working days prior to the CDR, the NASA Software Manager must ensure that the draft agenda, updated SDP, SRS, relevant ICDs, and all pertinent software design documents are made available to the CDR attendees for their comments. These comments must then be returned to the NASA Software Manager or designee at least two working days prior to the CDR. The NASA Software Manager or designee will then determine preliminary dispositions of the comments. Three working days prior to the CDR, the NASA Software Manager will ensure that the final, reviewed agenda is sent to all attendees.

Additionally, the NASA Software Manager must ensure that all necessary supporting documents are available as reference material during the preliminary review and at the CDR.

All documents in the CDR package will have been previously peer reviewed and placed under configuration control in accordance with the approved CMP.

4.2 Attendees

All software project stakeholders should attend the CDR because this is the forum where

the level of satisfaction of software requirements by the detailed design is agreed upon. Specifically, the NASA Software Manager should preside over the CDR, and attendees should include:

- Project Manager or representative
- Functional sponsors or representatives
- Representatives of the user(s)/customer(s)
- Representatives of the organization(s) responsible for the design, development, and testing of the software and its associated test and support tools
- Representatives of hardware and/or software with which the software under review interfaces
- SQA

It is important that the CDR participants attend in person rather than via teleconference or videoconference because of the highly interactive nature of the review, as well as the importance of obtaining complete consensus among the stakeholders.

4.3 Conduct of the Review

The detailed software design will be discussed, including the task structure, external hardware and operational interfaces, and operating system usage will be reviewed. Other discussion topics include the status of the flowdown of CSCI-level requirements to the software component-level and formal qualification tests, refined timing and sizing estimates, and test plans. Specific items to be presented include but are not limited to:

- Changes to the software functional requirements since the PDR
- Detailed design
  - Changes from PDR design
  - Supporting analyses
  - Performance requirements
  - External interfaces
  - Resource margins
  - Reliability analysis (Target software reliability and how we expect to achieve it)
  - Traceability to requirements
- Safety considerations
- Software development plan metrics
  - Cost
  - Schedule

  - Resources
  - Configuration management status
  - Product assurance
  - Risk management
- Procurement status
  - Subcontracts
  - Components (*e.g.*, COTS)
- Operations changes
- Development planning
  - Build plan and status
  - Software verification and validation plan and status
  - Calibration plan and status
- Logistics
  - Installation
  - Maintenance
  - Testing
- Data retrieval and analysis
- Lessons learned

Following the overview presentation, working sessions will be conducted to discuss the disposition of comments that were submitted by the attendees. The meeting will then reconvene to present the results of the working sessions, and comments from the floor will also be entertained. The goal of the proceeding will be to adopt changes to the design that will then be implemented in an agreed-upon timeframe. These changes will ultimately result in a finalized design.

4.4 Pass/Fail Criteria

For the CDR to be deemed successful, the following milestones must be met:

- 98% of the software requirements have been documented and agreed upon
- 95% of the software design is complete
- Detailed design satisfies the requirements set forth in the SRS
- Detailed design satisfies the interface criteria set forth in the ICDs
- Detailed design meets execution time, size, and other design constraints
- Detailed design addresses all inputs, processes, and outputs necessary to meet functional requirements

- All tests necessary to establish that requirements have been satisfied are documented
  - Test approach has been agreed upon
  - Test environment has been identified
  - Each requirement can be traced to a test that will ensure that the requirement has been satisfied

Any of the above items that are not complete should result in the creation of one or more action items. These action items will be assigned with due dates to appropriate personnel by the NASA Software Manager. They will be statused at the next iteration of the CDR or at the discretion of the NASA Software Manager. The final pass/fail determination is the responsibility of the NASA Software Manager.

4.5 Maintenance and Dissemination of Records

During the review, a designated recorder provided by the authoring organization will take minutes and document action items that arise during the course of the meeting. These documents will be distributed to attendees within 10 working days of the end of the CDR.

Any documents updated as a result of the CDR will be placed under configuration control in accordance with the approved CMP and will be made available to the attendees. The NASA Software Manager will track action items through resolution.

Appendix A – References

The following references were consulted in the preparation of this document:

CMMI for Systems Engineering/Software Engineering, Version 1.02, CMU/SEI-2000-TR-028.

Facility Systems Project Review Requirements, LMS-OP-5694 Rev A.

Flight Project and Experiments Review Planning and Implementation in Accordance with NPG 7120.5A, LMS-CP-5505 Rev C.

IEEE/EIA 12207.0-1996 (ISO/IEC 12207), Standard for Information Technology – Software Life-Cycle Processes.

Instructional Handbook for Formal Inspections.

International Space Station Program Software Development Plan, D684-10017-1 Rev B.

Software Requirements Capture and Management Version 2.3.