Software Quality Assurance Plan Document

Alt-F4

BUSTALK

Foreword

This document is a Bustalk Project controlled document and adheres to IEEE 730-2002, the IEEE Standard for Software Quality Assurance Plans. Changes to this document require prior approval of the Bustalk Project Configuration Control Board (CCB). Proposed changes shall be submitted to the Bustalk Systems Assurance Manager (SAM), along with supportive material justifying the proposed change.

Questions or comments concerning this document should be addressed to the Assurance Management Office:

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Purpose

The purpose of this Software Quality Assurance (SQA) Plan is to establish the goals, processes, and responsibilities required to implement effective quality assurance functions for the Bustalk project.

The Bustalk Software Quality Assurance Plan provides the framework necessary to ensure a consistent approach to software quality assurance throughout the project life cycle. It defines the approach that will be used by the SAM and Software Quality (SQ) personnel to monitor and assess software development processes and products to provide objective insight into the maturity and quality of the software. The systematic monitoring of Bustalk products, processes, and services will be evaluated to ensure they meet requirements and comply with AltF4, Global system of flying cars (GSFC), and Bustalk policies, standards, and procedures, as well as applicable Institute of Electrical and Electronic Engineers (IEEE) standards.

Scope

This plan covers SQA activities throughout the development, testing and deployment of the system onto the customer's system, providing a comprehensive understanding of the methodologies and scenarios that shall be employed by the company as we achieve our vision of tracking buses.

Reference Documents

The following documents were used or referenced in the development of this plan:

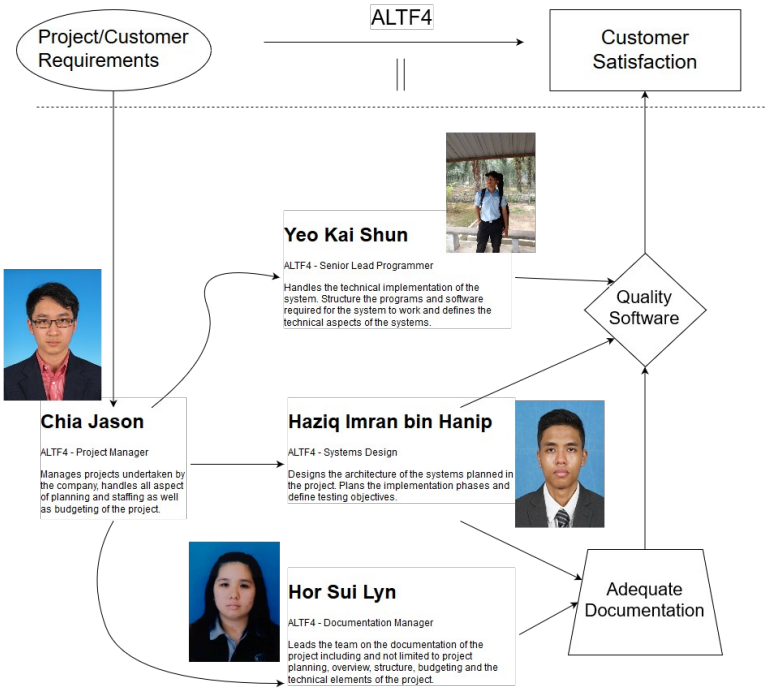
- AltF4 Company Profile
- Bustalk Project Proposal
- Bustalk Project Plan Document

Management

This section describes the management organizational structure, its roles and responsibilities, and the software quality tasks to be performed.

Management Organization

Bustalk efforts are supported by numerous entities, organizations and personnel (see Bustalk internal website for a detailed organizational chart). Relevant entities/roles that are of interest and applicable to this SQA Plan and the software assurance effort are described at a high level below.



Bustalk Project Office

The Bustalk Project Office at AltF4 is responsible for management of project objectives within the guidelines and controls prescribed by AltF4 Headquarters, GSFC Management, and the Bustalk Project Plan. The Project Manager (PM) from GSFC Code <enter Code> is specifically responsible for the success of the Bustalk Project, including but not limited to cost, schedule, and quality.

Assurance Management Office

The Assurance Management Office (AMO), Code 303, provides mission assurance support to AltF4 GSFC programs and projects (Reference 303-PG-1060.1.2). The AMO is comprised of civil service Systems Assurance Managers (SAMs), Quality Assurance Specialists (QASs), and Product Assurance Engineers (PAEs). The SAM assigned to a project is an AMO civil service representative responsible for supporting the Project Manager in the coordination of the definition and implementation of a Project Mission Assurance Program.

The SAM provides Project Management with visibility into the processes being used by the software development teams and the quality of the products being built. The SAM is matrixed to the Bustalk project and maintains a level of independence from the project and the software developers. Risk escalation begins at the project level, and extends to the AMO and the Office of Systems Safety and Mission Assurance (OSSMA), Code 300.

In support of software quality assurance activities, the SAM has assigned and secured Software Quality personnel from the Mission Assurance Services Contract (MASC) to coordinate and conduct the SQ activities for the project and identify and document noncompliance issues. In the future and on an as needed basis, SQ personnel support from the Supplier Assurance Contract (SAC) and/or Defense Contract Management Agency (DCMA) may be utilized to support the SQ activities at remote (non-GSFC) locations.

Additional support personnel may also include OSSMA Safety and Reliability and AltF4 Independent Verification and Validation (IV&V) personnel from the AltF4 IV&V Facility in Fairmont, WV. For additional details on IV&V activities, reference the IV&V Memorandum of Agreement (MOA) and/or the IV&V Project Plan (IVVP).

Tasks

This section summarizes the tasks (product and process assessments) to be performed during the development, operations, and maintenance of software. These tasks are selected based on the developer's Project Schedule, Software Management Plan (SMP) (and/or Software Maintenance Plan) and planned deliverables, contractual deliverables, and identified reviews. Reference 303-PG-7120.2.1, Procedure for Developing and Implementing Software Quality Programs, for additional information on the various process and product assessments. Reference 303-WI-7120.2.2, Software Quality Assessment Process, for specific instructions on conducting process and product assessments.

Reference the AltF4 GSFC Software Assurance web site, http://sw-assurance.gsfc.altf4.com.my to retrieve software quality checklists and forms. This site is owned and maintained by the AltF4 GSFC Software Assurance Lead, located in the OSSMA.

Product Assessments

The following are typical product assessments that may be conducted by SQ personnel. See the SQ Activity Schedule for the planned assessments:

- Peer Review packages
- Document Reviews (see Section 4, Documentation)
- Software Development Folders
- Software Configuration Management (e.g., configuration baselines, configuration change requests, and change control records)
- Test results (e.g., requirements traceability matrix, test reports)

Process Assessments

The following are typical process assessments that may be conducted by SQ personnel. See the SQ Activity Schedule for the planned assessments:

- Project Planning
- Project Monitoring and Control
- Measurement and Analysis
- System/Subsystem Reviews
- Peer Reviews
- Requirements Management
- Software Configuration Management and Configuration Audits (FCA/PCA)
- Test Management (Verification & Validation)
- Software Problem Reporting and Corrective Action
- Risk Management

Roles and Responsibility

This section describes the roles and responsibilities for each assurance person assigned to the Bustalk Project.

SAM

Responsibilities include, but are not limited to:

- Secure and manage SQ personnel resource levels
- Ensure that SQ personnel have office space and the appropriate tools to conduct SQ activities
- Provide general guidance and direction to the SQ personnel responsible for conducting software quality activities and assessments
- Issue Letters of Delegation, MASC Service Orders, and SAC task orders to initiate software support services (as required)
- Provide AMO with weekly and quarterly software status (per 303-PG-1060.1.1, Systems Assurance Manager Reporting)
- Assist SQ personnel in the resolution of any noncompliances, issues and/or risks identified as a result of software quality activities
- Escalate any noncompliances to project management

Software Quality Personnel

Responsibilities include, but are not limited to:

- Develop and maintain the project software quality assurance plan
- Generate and maintain a schedule of software quality assurance activities
- Conduct process and product assessments, as described within this plan, using objective criteria
- Interface with Safety, Reliability, and IV&V personnel on software assurance activities
- Identify and document noncompliances, observations, and risks from all software assurance related activities to the SAM
- Communicate results from assessments with relevant stakeholders
- Ensure resolution of noncompliances and escalate any issues that cannot be resolved within the project
- Identify lessons learned that could improve processes for future products
- Develop and maintain metrics

Other OSSMA Personnel

The Systems Safety and Reliability Office, Code 302, provides AltF4 GSFC projects with Safety and Reliability support. The following are the primary responsibilities for Safety and Reliability personnel in support of software assurance.

Safety Personnel

Responsibilities include, but are not limited to:

- Provide system software safety expertise to the SQ personnel and/or project personnel, as required
- Assist in the assessment of the various software development efforts in terms of meeting applicable software safety standards and requirements
- Assist in the resolution of any software safety related issues, concerns, and/or risks identified throughout the project life cycle
- Assist in the review of various life cycle related artifacts as they pertain to system software safety

For additional support information, reference the project's System Safety Plan.

3.3.3.2 Reliability Personnel

Responsibilities include, but are not limited to:

- Provide software reliability expertise to the SQ personnel and/or project personnel, as required. Assist in the assessment of the various software development efforts in terms of meeting applicable software reliability standards and requirements
- Assist in the resolution of any software reliability related issues, concerns, and/or risks identified throughout the life cycle
- Assist in the review of various life cycle related artifacts as they pertain to software reliability

Software Assurance Estimated Resources

Staffing to support software assurance (i.e., quality, safety, and reliability) activities must be balanced against various project characteristics and constraints, including cost, schedule, maturity level of the providers, criticality of the software being developed, return on investment, perceived risk, etc.

The staffing resource levels provided in the table below represent what has currently been agreed upon between Project Management and the SAM. For applicable IV &V resources, see the Bustalk IV&V MOA or IVVP. As the project's efforts progress, these staffing resource levels may be revisited and updated as necessary to complete the activities/tasks described within this plan. [NOTE: Table 3-2 can be omitted from the SQAP so long as a reference to the information is provided and the resource information is maintained.]

Table 3-2 Software Assurance Resources

Support Personnel	FY16	FY17	FY18
SQ Personnel	1.2 FTE	1.4 FTE	2.4 FTE
Safety Personnel	1.5 FTE	2.4 FTE	1.6 FTE
Reliability Personnel	2.4 FTE	0.4 FTE	1.6 FTE
DCMA	0.5 FTE	0.5 FTE	2.0 FTE
SAC	2.0 FTE	1.5 FTE	3.5 FTE

See Section 9 for a list of additional resources for performing process and product quality assurance activities.

Documentation

Purpose

This section identifies the minimum documentation governing the requirements, development, verification, validation, and maintenance of software that falls within the scope of this software quality plan. Each document below shall be assessed (reviewed) by SQ personnel.

Minimum Documentation Requirement

- Quality Manual
- Software Assurance Plan
- Software Management Plan
- Configuration Management Plan
- Software Requirements Specification
- Risk Management Plan
- Software Safety Plan
- Test Plans (Verification and Validation)
- Software User's Guide
- Software Maintenance Plan
- Interface Control Document(s)
- Test Reports and Artifacts
- Software Version Description Document (VDD)
- Software Requirements Traceability Matrix
- Software Development Records
- Peer Review data packages

Standards, Practices, Conventions, and Metrics

Purpose

This section highlights the standards, practices, quality requirements, and metrics to be applied to ensure a successful software quality program.

Software Quality Program

Software Quality Programs at GSFC are governed by the AltF4 Software Assurance Policies, the AltF4 Software Assurance Standard, and the AltF4 Software Safety Standard. Together, these AltF4 documents establish a common framework for software processes and products throughout the life of the software. In addition, SQ personnel are governed by software quality procedures, work instructions, checklists, and forms developed and approved by the AMO. These practices and conventions are tools used to ensure a consistent and objective approach to software quality for all GSFC programs/projects. SQ personnel are also experienced in the Software Engineering Institute Capability Maturity Model Integration (SEI-CMMI) methodology and are applying generic and specific practices for Process and Product Quality Assurance (PPQA) in support of GSFC's Software Process Improvement Program.

For details on the development standards for documentation, design, code, and test, reference http://www.altf4.com

Standard Metrics

The following standard metrics are the minimum planned metrics that will be collected, reported, and maintained in the area of software quality assurance:

- SQ effort and funds expended (Planned vs. Actual)
- Number of SQ Assessments (Planned vs. Actual)
- Number of SQ Assessment Findings or noncompliances (Open vs. Closed)
- Number of SQ Assessment Observations
- Number of Risks identified as a result of an SQ Assessment

Additional Project metrics may also be collected, reported, and maintained, as required by the SAM. Sample metrics include:

- Number of Peer Reviews (Planned vs. Actual)
- Number of Open vs. Closed Action Items from peer reviews
- Number of Open vs. Closed Software Problem Reports, with aging and trending over a specified time frame
- Number of Open vs. Closed IV&V issues (via the Facility's Project Issue Tracking System (PITS))
- Number of Open vs. Closed software Requests for Action (RFAs) or Action Items from project-level reviews (e.g., mission PDR or CDR)

Software Reviews

Purpose

This section identifies the number and type of system/subsystem reviews and engineering peer reviews that will be supported by the SQ Personnel. The Software Management Plan (SMP), the project milestone chart, the project's Engineering Peer Review Plan, and the SQ Personnel resource levels determine the reviews that are supported.

Minimum Software Reviews

For each review, SQ will assess the review products to assure that review packages are being developed according to the specified criteria, the review content is complete, accurate, and of sufficient detail, and Requests for Action are captured, reviewed, and tracked to closure. In addition, SQ will assess the processes used to conduct the reviews to determine if appropriate personnel are in attendance, correct information is presented, entry and exit criteria are met, and appropriate documents are identified for update.

The following software reviews may be assessed by SQ:

- System Concept Review (SCR)
- Software Specification Review (SSR)
- Preliminary Design Review (PDR)
- Critical Design Review (CDR)
- Test Readiness Review (TRR)
- Acceptance Review (AR)
- Operational Readiness Review (ORR)
- Peer Reviews (EPR) [Be specific. -- for example, code walkthroughs, design reviews, etc.]

See the SQ Activity Schedule for the planned reviews to be supported.

General Guidelines

Software quality assurance (SQA) is planned to be implemented throughout the software process in order to reduce the amount of rework, which will result in the reduction of costs and improved time to market. This activity is crucial to maximize the user satisfaction and minimize the cost spent on the product in terms of money, effort and time.

There will be formal technical reviews conducted to uncover defects in the software effectively. Meetings will be held on a weekly basis to facilitate the development of (releases of) the software product besides to uncover quality problems. These meetings will focus on discussing the tasks to be assigned, dividing the tasks and confirming the job scope of every member, updating the progress of development, uncovering potential bugs in the software and producing possible fixes for the bugs. Any enquiries regarding the subject of matter can also be raised during these meetings. All the issues encountered during the meetings will be recorded and reported after each meeting session.

Besides that, all the versions of software produced will be tested so that the errors in the software can be identified and corrected to ensure its quality. Test strategies will be developed to uncover all the possible errors. Alpha testing, in both white box and black box, will be conducted by the members of this project team and black box beta testing will be done by netizens on the functional part of the software which is uploaded and published anonymously on software developing forums on the Internet.

Moreover, there will be enforcement of standards specified by the company to control changes. The online platform GitHub will be used by the project team to perform version control. All the software versions, once finalized (tested and ensured to be error free), will be archived and set as baselines to serve as backup in case changes done later cause (unrecoverable) error.

Furthermore, software metrics will be collected to track quality. Measurements (length of code in kilo lines of code (kLOC), errors uncovered etc) will be taken to allow the software metrics to be calculated and recorded, in order to assess the impact of methodological and procedural changes on the improved software quality besides to set a standard or reference for future projects of similar complexity.

Other than that, report keeping and reporting will be done to provide procedures for the collection and dissemination of SQA information. The historical record for this project, such as the result of technical reviews, testing and other SQA activities, will be documented and disseminated to the development staff on a need-to-know basis besides to be used as a future reference.

Test

SQ personnel will assure that the test management processes and products are being implemented per the Software Management Plan and /or Test Plan(s). This includes all types of testing of software system components as described in the test plan, specifically during integration testing (verification) and acceptance testing (validation).

SQ personnel will monitor testing efforts to assure that test schedules are adhered to and maintained to reflect an accurate progression of the testing activities. SQ will assure that tests are conducted using approved test procedures and appropriate test tools, and that test anomalies are identified, documented, addressed, and tracked to closure. In addition, SQ will assure that assumptions, constraints, and test results are accurately recorded to substantiate the requirements verification/validation status.

SQ personnel will review post-test execution related artifacts including test reports, test results, problem reports, updated requirements verification matrices, etc…

Problem Reporting and Corrective Action

SQ personnel generate, track, and trend assessment findings/nonconformances and observations in the centralized Software Quality Engineering Repository Database (SQERD), available via http://sqerd/gsfc.nasa.gov/. Reference the SQ Assessment Process WI for details on tracking and trending of assessment findings and observations and the reporting escalation process.

Tools, Techniques and Methodologies

SQ personnel will require access to the following:

AltF4 GSFC Tools

- Automated Requirements Measurement (ARM) Tool
- AltF4 Lessons Learned Information System (LLIS)
- Goddard Directives Management System (GDMS)

Software Quality Tools

- Microsoft Office tools (i.e., Word, Excel, and PowerPoint)
- Access to the GSFC Software Assurance web site http://sw-assurance.gsfc.nasa.gov
- Access to the Software Quality Engineer Reporting Database (SQERD)
- Access to the OSSMA internal server for SQA records
- GitHub
- Google Drive

Project Tools

- Bustalk Server
- Bustalk Risk Management System

Media Control

SQ deliverables will be documented in one of the following Microsoft software applications: Word, Excel, or PowerPoint. Deliverables will be in soft copy, unless specified otherwise. See Section 12 for additional details on the collection and retention of key records.

Software Quality deliverables, work products, and data items shall be maintained in accordance with the OSSMA Software Quality Assurance Data Management Plan. This plan provides information on the data item, data category, owner, location, collection frequency, and data retention period.

Record Collection, Maintenance, and Retention

SQ personnel will maintain records that document assessments performed on the project. Maintaining these records will provide objective evidence and traceability of assessments performed throughout the project's life cycle. Example records include the process and product assessments reports, completed checklists, the SQ Activity Schedule, metrics, weekly status reports, etc. For more details on SQ records, their location, and data retention, reference the OSSMA Software Quality Assurance Data Management Plan.

Training

SQ personnel shall have fundamental knowledge in the following areas/disciplines through prior experience, training, or certification in methodologies, processes, and standards:

- Software Quality Assurance:
- Audits and Reviews
- Risk Management
- Configuration Management
- Software Safety
- Contracts/Contractor Surveillance
- CMMI
- ISO 9001
- Project-specific Training
- ISD Software Engineering Discussions

It is the responsibility of the SQ personnel to acquire the necessary skills or knowledge in each of the above disciplines. An SQ Training log has been prepared that specifies the type of training and/or on-the-job experience that has been completed, along with the source of the training, and the date of completion.

Risk Management

SQ personnel will assess the project's risk management process against the Bustalk Risk Management Plan and GPG 7120.4. SQ participates in <weekly/monthly> risk management meetings and reports any software risks to the SAM and the project's Risk Manager.

[Provide any additional detail regarding review of risks and the SQ relationship with the risk review team. Provide link to project's risk management system, if applicable.]

Glossary

Reference 303-PG-7120.2.1, Procedure for Developing and Implementing Software Quality Programs or the GSFC Software Assurance web site, http://sw-assurance.gsfc.nasa.gov for the Glossary and software quality acronyms.

SQA Plan Change Procedure and History

SQ personnel are responsible for the maintenance of this plan. It is expected that this plan will be updated throughout the life cycle to reflect any changes in support levels and SQ activities. Proposed changes shall be submitted to the Bustalk Systems Assurance Manager (SAM), along with supportive material justifying the proposed change. Changes to this document require prior approval of the Bustalk Project CCB Chairperson.

Appendix A – Abbreviations & Acronyms

Abbreviation/ Acronym	DEFINITION
AMO	Assurance Management Office
AR	Acceptance Review
ARM	Automated Requirements Management
CCB	Configuration Control Board
CDR	Critical Design Review
CDRL	Contract Deliverable Requirements List
CMMI	Capability Maturity Model Integration
CMP	Configuration Management Plan
DCMA	Defense Contract Management Agency
EPR	Engineering Peer Review
FCA	Functional Configuration Audit
FOR	Flight Operations Review
FTE	Full Time Equivalent
GDMS	Goddard Directives Management Systems
GDS	Ground Data System
GOV	Government
GPG	Global Procedures and Guidelines
GSFC	Global System of Flying Cars
IEEE	Institute of Electrical and Electronic Engineers
IV&V	Independent Verification and Validation
LLIS	Lessons Learned Information System
MAG	Mission Assurance Guidelines
MASC	Mission Assurance Services Contract
MOA	Memorandum of Agreement
MOR	Mission Operations Review
AltF4	National Aeronautics and Space Administration
NPD	AltF4 Policy Directive

Abbreviation/ Acronym	DEFINITION
NPG	AltF4 Program Guideline, AltF4 Policies and Guidelines
NRRS	AltF4 Record Retention Schedule
ORR	Operational Readiness Review
OSSMA	Office of Systems Safety and Mission Assurance
PAE	Product Assurance Engineer
PCA	Physical Configuration Audit
PDR	Preliminary Design Review
PG	Procedures and Guidelines
PM	Project Manager
PPQA	Process and Product Quality Assurance
QAS	Quality Assurance Specialist
QMS	Quality Management System
REV	Revision
SAC	Supplier Assurance Contract
SAM	Systems Assurance Manager
SCR	System Concept Review
SEI	Software Engineering Institute
SIP	System Implementation Plan
SMP	Software Management Plan
SOW	Statement Of Work
SQ	Software Quality
SQA	Software Quality Assurance
SQAP	Software Quality Assurance Plan
SSR	Software Specifications Review
STD	Standard
SW	Software
TRR	Test Readiness Review
VDD	Version Description Document

Abbreviation/ Acronym	DEFINITION
VER	Version
Vs.	Verses
WI	Work Instruction
WV	West Virginia