Template No.
CEMILAC_SYSGRP_SQAP_04

Software Quality Assurance Plan

of <LRU/SYSTEM Name>
for
<Platform Name>

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Title:	**Project/ System :**
Software Quality Assurance Plan **of** **<LRU Name> for <Platform name>**	**<System/Project Name>**
	LRU/System Part No.:
	<No.>
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Approved for Release By	<Project Leader Name>, <Designation> <Design Agency>	

<Design Agency Name & Address>

Disclaimer:

This document is a guidance document. Applicable section / table rows may be considered. Any additional details may be added. Any not applicable section/ table rows may be deleted. The template is very general and vary with process to process followed by Development Agency. The document may be fine-tuned with the TAA for finalization.

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01	Head of Design Agency	Design Agency Name
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Amendment History

Issue, Rev. No.	Issue, Rev Date	Change Request Ref.	Brief Description of Amendment	Affected Pages/ Section	Changed By	Change Effective Date
01, 00		NA	Initial Issue	NA	NA	Initial

Table of Contents

1. Introduction

The Software Quality Assurance Plan is used by Software Quality Assurance process group to provide an evidence that SQA group of Design agency has used SQA practices in proposed software development life as per standard.

1.1 Purpose

The purpose of this document is to provide the details of Software Quality Assurance process for the project <LRU_NAME>. This document provides the plan for SQA activities as per Section 11.5 defined in DO-178C.

1.2 Scope

This document describes the SQA Process for the project <LRU_Name>. This SQAP Plan establishes the methods to be used to achieve the objectives of the Software Quality Assurance process. The <QA group of Design agency> shall ensure the activities and methods listed in this plan to meet the Quality objectives.

1.3 Applicable documents

Define the list of all applicable documents in following sections:

1.3.1 External documents

Define the list of all applicable documents of external origin, relevant for this project.

1.3.2 Internal documents

Define the list of all applicable documents of internal origin, relevant for this project.

1.4 Part Number and Nomenclature

Define the details of all software components having unique part number and nomenclature to identify them through the software development life cycle.

1.5 Acronyms and Abbreviations

Define all the abbreviations and acronyms with their expanded names in this section.

2. System Overview

This section provides an overview of the system, including a brief description of its major functions.

3. Software Overview

This section provides an overview of the software, including a brief description of its major functions.

4. SQA Environment

<Describes the SQA Environment including Scope, Organizational responsibility and Interfaces, Standards, Procedures, Tools and Methods>.

4.1 Software Quality Assurance Process Objectives

The objectives of the SQA Process are to obtain Assurance that:

- Software Development processes and integral processes comply with approved software plans and standards.
- The Transition Criteria for the Software life cycle processes are satisfied.
- All SOI reviews and the Conformity review of the software product is conducted.

4.2 Organizational Responsibilities and Interfaces

4.2.1 QA Structure of <Design Agency>

<Define the hierarchy structure of the QA persons involved and responsibility of each members in hierarchy>

4.2.2 Organizational Interfaces/Communication

<Define the interaction of QA team with Design group, Design QA, DGAQA, RCMA, IV&V team etc through interface diagram>

4.2.3 Responsibilities

Head of <DESIGN QA> shall ensure the Quality aspects interfacing with all the concerned agencies. Communications related to technical correspondence and the artifacts would originate from the Designs team.

Head of <Design QA>:

- Involvement in various Technical reviews for ensuring quality.
- Verification of the status of software development activities as per the defined process.
- Manage Software Quality Assurance personnel resource levels.
- Resolving bottle necks in Software Quality Assurance processes.
- Adaptation of the latest software verification methodologies to meet quality assurance objectives.
- Provide general guidance and direction to the SQ personnel responsible for conducting software quality activities and assessments.
- Approval of all software related artifacts.
- Project and Escalate any non-compliance issues to Project Leader / Top Management.

QA Personnel:

- 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.
- Interact with Certification agencies on Software Assurance activities.
- Identify and document non-compliances, observations, and risks from all software assurance related activities to the QA Head
- Communicate results from assessments with relevant stakeholders.
- Ensure resolution of non-compliances and escalate any issues that cannot be resolved within the project to QA Head
- Participation in Technical Reviews Ensuring the implementation of the decisions made during the technical reviews.
- Performing the software code testing & other Integration testing of systems.
- Ensuring the Design and Development is carried out as per the standard process.
- Streamlining and controlling the software documents as per standards.

4.3 Standards

<Define applicable standard and the list of guidelines that SQA Process adheres to follow.>

The Software Assurance Plan shall adhere to the RTCA DO-178C Process Guidelines. The QA shall also ensure that the Software Quality Assurance is in line and comply with the other QMS implemented in the organization (Like AS9100D, CMMI etc).

4.4 Procedures

< Define the organizational procedure to follow Software Quality Assurance procedure>

4.5 Tools and Methods

< Define the tools and methods to be used by QA personnel during each stage of Software Development Life Cycle >

Document Review Management System

- Guidance on the preparation of the software documents.
- Standardization, Preparation of document templates for streamlining the documentation

5. Authority

5.1 SQA Authorization

The QA Head shall be authorized to approve and control all the Quality Issues related to the Projects. <Describe the details of SQA authority in this section.>

5.2 SQA Independence

<Define SQA Independence as below:>

a) QA department/group is independent of Project team.

b) Authorized to conduct audits and reviews of project to verify the Quality processes are followed.

c) Findings of QA activities shall be communicated to Project Leader through QA Head.

d) Unresolved issues with the Project Manager shall be escalated to <DESIGN AGENCY> Top Management.

5.3 Responsibilities

<Define the responsibilities related to Design QA in this section. (E.g. activities to be carried out, documents to be prepared).>

The responsibilities of <DESIGN QA> Representative are:

a) The <DESIGN QAY> Representative shall have the responsibility and authority of verifying compliance to processes, standards, procedures and plans referenced in project specific Plans (PSAC, SVP, SQAP, SCMP and SDP)

b) Carry out Software Quality Assurance activities as listed in this document.

c) The SQA Representative shall prepare the following:

- Software Quality Assurance Plan
- Software Quality Assurance Audit Records

d) The SQA Representative shall review various documents generated in the Development Life Cycle.

e) Co-ordination with RCMA and IV&V team members to Carry out Phase Transition Checks and Software Conformity Reviews.

f) The SQA Representatives shall participate in various reviews conducted for the projects.

5.4 Authority for Software Products

Software Certification is the responsibility of CEMILAC/RCMA. For ensuring this, CEMILAC/RCMA shall take inputs from SQA and IV&V group members to take final decision on the ability of the software to achieve its intended function.

6. SQA Activities

SQA personnel has to ensure that all Software Quality Assurance Process Activities as per Sec 8.2 has been completed and evidence is generated.

6.1 Software Quality Assurance Activities

This section describes reviews, audits, reporting and monitoring methods used during the software quality assurance process.

Observations/Review Report (RR) or the Minutes of Review meeting will be raised for capturing Review and audit findings. Findings captured in review report will be tracked for closure. Review Report will be closed once all findings are implemented / justified.

6.1.1 Reviews

a) Reviews are carried out to ensure compliance with RTCA DO-178C and Planning documents.

b) List all the documents/items that shall be reviewed by Design QA

- Plans

- Standards
- Software Documents
- Phase Transition checks
- Process/Spec Deviation Records
- Software Change Notices
- Software Configuration Index
- Software Accomplishment Summary
- Baseline Description Proforma/ Version Description Document.

6.1.2 Audits

a) The SQA audits shall be conducted to

- Ensure objectives as defined in section 4.1 of this document are achieved
- Ensure Compliance with Plans and Standards referenced in project specific PSAC

b) Project Audit covers Software Development Life Cycle (SDLC) processes as described in the project specific SDP and integral processes.

6.1.3 Reporting

<Define reporting mechanism for SQA personal to report about SQA activities to project manager in this section.>

6.1.4 Inspection

<Define QA inspection related information in this section >

6.1.5 Monitoring of the Software Life Cycle Processes

<Define methods, how SQA personnel shall monitor software life cycle activities to ensure that activities of all SDLC phases are executing as defined in SDP.>

6.2 Problem Reporting Tracking and Corrective Action Activities

Problem Reports are a means to identify and record the resolution to software product anomalous behavior, process non-compliance with software plans and standards, and deficiencies in Software Life Cycle Data.

The Problem Report (PR) system shall be audited to assure that problem reports are completely filled out, corrective action is documented, change review and change control are performed, and they are properly closed.

6.2.1 Problem Reporting Method:

Problem shall be reported through Software Problem Request (SPR) form as defined in form no. 22B of IMTAR Forms and guidelines given in Sec 11.17 of DO178C.

<Define when the Problem was reported (e.g. LRU Lab testing, Rig integration, System integration, Aircraft integration, Development Flight Trials etc) Problem Description, Severity of the Problem, Confirmation of the Software Problem on bench and rigs etc as per from no 22B.>

Software Change Request (SCR):

<Define Software Problem Report Reference, Software modification necessitated due to (Hardware/Software, others), Brief Problem Statement, Identified causes, Suggested solutions, Documents affected, Change evaluation tests, Any other subsystem/ external system / test environment affected by this change of version, LCCB/ SCCB status etc as per form no 22A of IMTAR>

Based on the Change/Problem analysis Software Change Request is prepared for the changes relevant to software or for the problems which could be mitigated through a software change and shall be approved by the Change Control Board members.

Software Change Note (SCN)

Competent authority for approval of Software Change Note (as per form no 22J of IMTAR Forms) shall be RD RCMA, Chairman of IV&V team or Chairman of Software Evaluation Committee, as decided in the certification plan approved by RCMA/CEMILAC. SQA has to ensure the same.

6.2.2 Tracking

< Define the tracking method to ensure that problem has been reported and resolved correctly as per SQA and SCM Practices.>

6.2.3 Corrective Action Activities

Problem Reports that require corrective action of the software product or outputs of software life cycle processes should invoke the change control activity.

<Define corrective Action Activities related information at this section >

6.3 Software Conformity Review

<Define activities Software conformity review as per sec 8.3 of DO-178C and artifacts is to be ensured through the various phases of Do-178B by maintaining checklists which could record the conformities and non-conformities. Attach checklist in Annexure.

7. Transition Criteria

Software Quality Assurance process is entered under every activity within the entire Software Development Life Cycle. With Reference to the DO-178C Considerations, the Transition Criteria shall be evaluated for the transition of the processes from Planning to Development to Integral Process.

In general, the Stage of Involvement Reviews shall be conducted at the end of each Process. The reviews shall check for the pre-conditions required for transition in terms of Artifacts and activities, closure of previous action items and readiness for transition to next Process. The table below indicates the SOI reviews.

Software Quality Assurance process is entered under the following conditions:

- When an item/artifact is configured, baselined and/or updated.
- When a process is put in place.
- On receipt of data from Customer either in the form of Requirements Documents or Review Comments/Feedback.

Sl. No	Reviews	Documents
1	**SOI#1** **Software Planning Review**	1. Plan for Software Aspects of Certification 2. Software Development Plan 3. Software Verification Plan 4. Software Configuration Management Plan 5. Software Quality Assurance Plan 6. Software Requirements Standards 7. Software Design Standards 8. Software Code Standards
2	**SOI#2 Software Development Review**	1. Software Requirements Data 2. Software Design Description 3. Source Code
	SOI#3 **Software Verification**	1. Software Requirements Data / Document 2. Software Design Description 3. Source Code 4. Object Code

3	**Review**	5. Software Verification Cases and Procedures 6. Software Verification Results 7. Software Configuration Index (test baseline) 8. Problem Reports
4	**SOI#4 Final Software Certification Review**	1. Software Configuration Index 2. Problem Reports 3. Software Accomplishment Summary

Approval Authority of above documents/artefacts shall be as per approved PSAC/ACP.

8. Timing

Define the timing required to complete Software Quality Assurance activities of each phase with all artefacts of that phase.

<e.g.>

Software Process	SQA Activity	Time Required
Requirements	Clearance of Requirements Phase documents	5 Days (max)

9. SQA Records

The SQA records comprises of as per section 11.19 DO-178C and SDLC Data of PSAC:

<e.g.>

- Compliance to PSAC, SDP, SQAP, SVP, SCMP, SRS, SDS, SCS.
- SQA Review Reports of all Software documents reviewed by SQA Rep as per PSAC.

  (Define the complete List here)
- Minutes of Meeting/Discussion Records of PDR, CDR, SRSS, TARB and others
- Compliance of objectives as per Table A1 to A10 of DO178 C.
- Deviation Records, SPRs, SCRs and SCNs.
- Software Quality Assurance Project Audit Reports.
- Software Conformity Review Checklist.
- etc

10.Supplier Control

Wherever applicable, the <DESIGN QA> shall ensure that the Supplier has a Software Quality Assurance Plan in place. The <DESIGN QA> shall also audit the Suppliers related to the Software Quality.

Appendix-A SQA Audit Review Checklist

Project	Platform Name	Date of Audit	Audited by

Sl. No	Check Item	DO178C	Status
1.	Is it software plans are available as specified in section 4.2?	8.2, d-1	
2.	Deviations from the software plans and standards are detected or recorded?	8.2, d-2	
3.	Deviations from the software plans and standards are evaluated, tracked, and resolved?	8.2, d-2	
4.	Is this approved deviations are recorded?	8.2, d-3	
5.	Is this software development environment has been provided as specified in the software plans?	8.2, d-4	
6.	The problem reporting, tracking, and corrective action process activities comply with the Software Configuration Management Plan?	8.2, d-5	
7.	Is this inputs provided to the software life cycle processes by the system processes?	8.2, d-6	
8.	Is this system safety assessment process, have been addressed?	8.2, d-6	

Appendix-B Software Conformity Review

Project	Platform Name	Date of Audit	Audited by

Sl. No	Check Item	DO178C	Status
1.	Planned software life cycle process activities for certification credit, including the generation of software life cycle data, have been completed and records of their completion are retained?	8.3 a	
2.	Is Software lifecycle data traceable to requirements (system requirements, safety related requirements or software requirements) from which software is developed?	8.3 b	
3.	Are all software Life Cycle data complying with the plans & standards?	8.3c	
4.	Are all software Life Cycle Data as required by the plans & standards controlled as per SCM plan?	8.3c	
5.	Are all deviations with respect to approved plans and standards recorded in Software Accomplishment Summary?	8.3c	
6.	Are all Review Reports closed or status defined and justified?	8.3c	
7.	Are all Change Requests closed or status defined and justified?	8.3c	
8.	Are all Problem Reports closed or status defined and justified?	8.3d	
9.	Are software requirement deviations recorded & approved?	8.3e	
10.	Can the executable object code be regenerated from configured source code through the use of build instructions?	8.3f	
11.	Can the approved software be loaded successfully through the use of released instructions?	8.3g	
12.	Is the status of Problem reports deferred from previous software conformity review determined through re-evaluation?	8.3h	
13.	If certification credit is sought for use of previously developed software, is the current software product baseline traceable to the previously baseline & the approved changes to that baseline?	8.3i	
14.	Any other specific issues related to projects to be listed.	-	

Annexure –C: SQA Checklist for Software Requirement Data

Sl.	Check Points	Status
1.	Does SRD conforms to SRD Template?	
2.	Is forward traceability from TS to SRD is established?	
3.	Is backward traceability from SRD to TS is established?	
4.	Does SRD is traceable to Technical Specification, no ambiguity is there?	
5.	Does the SRD conforms to Software Requirement Standard?	
6.	Does the use cases in SRD have taken care of abnormal situation/conditions?	
7.	Are all Operating Modes defined in SRD?	
8.	Is there no contradictions in SRD? (No Requirement is repeated and proper flow is there)	
9.	Are the specified models, algorithms and numerical techniques compatible?	
10.	Does SRD use standard terminology and definition throughout?(consistency is maintained)	
11.	Algorithm if any in use should be supported by scientific literature ?	
12.	Does in SRD, requirements are implanted to handle all kind of error, anomalies or failure?	
13.	Does in SRD each use cases has define the external interfaces in terms of input and output?	
14.	Does in SRD for each use cases covers all ifs	
15.	Are use cases defined are sufficient and complete?	
16.	Does the constraints (if any)have justified logic behind it?	
17.	Does SRD is prepared like, it can adjust new modifications without major change in design?	
18.	Is configuration of SRD is maintained as per guidelines defined SCMP?	
19.	Are all the requirements are properly distributed in use case?	
20.	Are all use case covers 100 % of its requirements?	
21.	Are all requirements of each use case are understandable, testable and implementable?	
22.	Does SRD have safety requirements?	
23.	If any feedback received from PDR review, CDR review, user etc., SRD has been updated?	
24.	Is SOI#1 completed with review and recommendations of SOI# 1 is implemented and closed?	
25.	Are the documents of planning phase are approved as per definition in ACP document?	
26.	Is transition criteria as per PSAC is complied ?	
27.	Does the input documents mentioned in section 5.2 are available for SRD review e.g. TS,SRD,ICD,BIT Philosophy , DFF etc.	
28.	Is peer level review is completed and observations are closed?	
29.	Whether TS, ICD,DFF,BIT philosophy documents referred in various section of SRD are base lined and releases as per SCMP?	
30.	Does Software Requirement Review SRR is planned with all stakeholders?	
31.	Are there glossary of terms?	

Annexure - D SQA Checklist for Software Design Document

Sl. No.	Check Points	Status
1.	Does the SDD conforms to Software Design Standard?	
2.	Does SDD conforms to define SDD Template?	
3.	Is forward traceability from SRD to SDD is established?	
4.	Is backward traceability from SDD to SRD is established?	
5.	Does the design is in alignment with the high level requirement?	
6.	Does the terminology use is consistent within the document?	
7.	Does SDD covers the architecture level definition?	
8.	Are the classes name and function name are sensible/easy to define?	
9.	Does the input and output for each task/function is defined?	
10.	Does the algorithms used are reviewed at various level?	
11.	Does the architecture defined in SDD is reviewed by peer group and IV&V group?	
12.	Are state diagram, sequence diagrams, interaction diagrams, algorithm and pseudo code included?	
13.	Are data structure defined ?	
14.	Whether any change that occurs due to user feedback, PDR review, CDR review etc. are reflected in updated SDD?	
15.	Is transition criteria as per section 5.3.3 is complied ?	
16.	Does the input documents mentioned in section 5.3 are available for SDD review e.g. SRD,SRD,SDD,ICD,BIT Philosophy , DFF etc.	
17.	Is peer level review is completed and observations are closed?	
18.	Whether TS, ICD,DFF,BIT philosophy documents referred in various section of SDD are base lined and releases as per SCMP?	
19.	Are there glossary of terms?	

Annexure - E SQA Checklist for Source Code

Sl. No.	Check Points	Status
1.	Does the inputs defined for this phase is available?	
2.	Does recommendation made during SOI#2 is considered?	
3.	Are the documents of SOI#2 phase are approved as per definition in ACP document?	
4.	Does the terminology use is consistent within the document?	
5.	Is Source code is forward traceable from SDD to source code?	
6.	Is backward traceability is established between Source code to SDD?	
7.	Source code should be well structured, consistent in style and consistently formatted?	
8.	Does there exist any unreachable code, procedures?	
9.	Does the tool for software development is same as declared in SDP document?	
10.	is the software development environment is same as defined in SDP?	
11.	Does every/ procedures are dealing with unique and particular requirement(may be sub requirement)?	
12.	Are the comments in code is understandable and correct?	
13.	Check quality review report generated via LDRA for quality check (if any)?	
14.	Does source code is checksum controlled?	
15.	Does source code is under configuration controlled, with well-defined issue/version?	
16.	Is source code is in alignment with SDD?	
17.	Are files /devices are well arranged?	
18.	Is code clearly and adequately defined and easy to maintain?	
19.	Is function name and class name is meaningful, consistent and easy to understand the purpose of the particulars?	
20.	Is there any function/ performing same function or duplication in coding?	

Annexure -F SQA Checklist for SVCP Document

Sl. No.	Check Points	Status
1.	Does the input for this phase is available?	
2.	Does the recommendation of SOI#2 has been considered and closure report been prepared?	
3.	Are the documents of SOI#2 phase are approved as per definition in ACP document?	
4.	Does the source code is under configuration controlled with checksum and version?	
5.	Is scope and depth of the review or analysis methods to be used are described in STP/STD?	
6.	Are test cases are forward traceable from SRD to SVCP at CSCI Level?	
7.	Are test cases are forward traceable from SDD to SVCP at CSU Level?	
8.	Are test cases backward traceable from STD to SRD?	
9.	Does the test cases have pre-requisite conditions?	
10.	Does the test cases have mentioned the inputs for test?	
11.	Are the test procedure is understandable enough to start the testing?	
12.	Does the test cases talks about expected output of the test being carried out?	
13.	Is there any error reported during hardware – software integration?	
14.	Is software compatible with target system and it functions without any error and warnings?	
15.	Are every requirements mentioned in SRD are verifiable and it is demonstrated in STD?	
16.	Is peer review report with closure is provided to SQA and IV&V?	
17.	Are there glossary of terms?	