Report 10428A
August 1994

Earth Observing System (EOS)/
Advanced Microwave Sounding Unit-A (AMSU-A)
Software Assurance Plan

Contract No: NAS 5-32314
CDRL: 309

Submitted to:

National Aeronautics and Space Administration
Goddard Space Flight Center
Greenbelt, Maryland 20771

Submitted by:

Aerojet
1100 West Hollyvale Street
Azusa, California 91702

TABLE OF CONTENTS

TABLE OF CONTENTS (CONT.)

TABLE OF CONTENTS (CONT.)

FIGURES

TABLES

Section 1

INTRODUCTION

1.1 Identification

This is the *Software Assurance Plan* of the Earth Observing System/ Advanced Microwave Sounding Unit-A (EOS/AMSU-A) System. This document is submitted in response to Contract NAS 5-32314, CDRL 309.

1.2 Scope

This document defines the responsibilities of Software Quality Assurance (SQA) for the development of the flight software installed in EOS/AMSU-A instruments, and the ground support software used in the test and integration of the EOS/AMSU-A instruments.

The software being developed for the EOS/AMSU-A program consists of the eight CSCI identified below. There are four CSCI for each of the two instrument modules, EOS/AMSU-A1 and EOS/AMSU-A2. See Appendix A for a detailed description of the EOS/AMSU-A CSCI.

CSCI NAME	EOS/AMSU-A1	EOS/AMSU-A2
Command and Data Handling Firmware	CSCI N8	CSCI N12
Instrument Control Firmware	CSCI N7	CSCI N11
Special Test Equipment Software	CSCI N5	CSCI N9
Spacecraft Workstation Software	CSCI N6	CSCI N10

1.3 Purpose and Objectives

The purpose of the *Software Assurance Plan* is to:

a. Identify the CSCI and the documentation (collectively referred to as software products) being developed for this project and the types and characteristics of each.

b. State the software development processes to be evaluated.

c. Identify the software products to be evaluated

d. Identify the software audits to be performed

e. State the quality assurance engineering responsibilities, tasks, and functions to be implemented by Software Quality Engineering in coordination with the Software Team Leader, the Program Manager, and the other product teams and organizational managers as required to assure software quality assurance requirements are met.

f. Demonstrate the role of the Software Quality Assurance Organization and its relationship to the Product Teams

1.4 Document Status and Schedule

This is the Final submittal of the EOS/AMSU-A Software Assurance Plan.

1.5 Documentation Organization

The sections in this document are:

Section 1 Introduction
Section 2 Related Documentation
Section 3 Quality Assurance Planning
Section 4 Verification and Validation Planning
Section 5 Quality Engineering Assurance Planning
Section 6 Safety Assurance Planning
Section 7 Security and Privacy Assurance
Section 8 Certification Planning
Section 9 Abbreviations and Acronyms
Section 10 Glossary
Section 11 Notes
Section 12 Appendices

The Software Quality Assurance documents developed for EOS/AMSU-A are this Software Assurance Plan and the Software Quality Assurance Procedures.

The EOS/AMSU-A Software Documentation Tree is as shown in Figure 1.

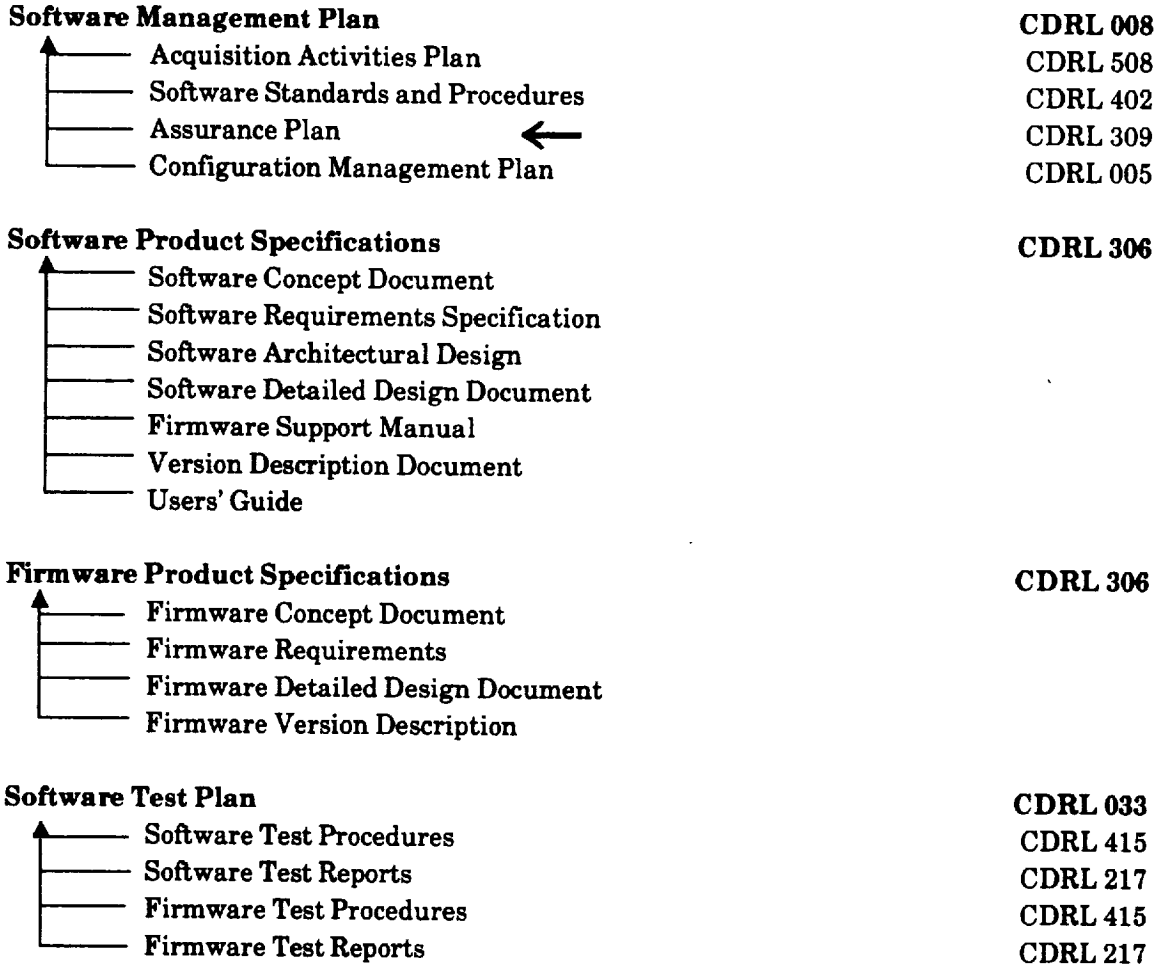


Figure 1 EOS/AMSU-A Software Documentation Tree

Section 2

RELATED DOCUMENTATION

2.1 Parent Documents

Report 10339 Jan 94	Software Management Plan (NASA EOS/AMSU-A CDRL 008)

2.2 Applicable Documents

The following documents are referenced in or are applicable to this report. Unless otherwise specified, the latest issue is in effect.

National Aeronautics and Space Administration

CDRL Mar 93	Software Assurance Specifications
NASA-DID-M400	Management Plan DIDs Assurance Plan
420-05-01 Aug 91	Earth Observing System (EOS) Performance Assurance Requirements for EOS General Requirements
422-10-01 Feb 91	Earth Observing System (EOS) Instrument Project Software Acquisition Management Plan

Aerojet

Report 10339 Jan 94	Software Management Plan (NASA EOS/AMSU-A CDRL 008)
Report 10341 Feb 94	Acquisition Activities Plan
Report 9803 May 91	Configuration Management Plan (NASA EOS/AMSU-A CDRL 005)
SQA Procedure 100	Software Product Evaluations
SQA Procedure 101	Software Process Evaluations

SQA Procedure 102	Reviews and Audits
SQA Procedure 103	Software Problem Reporting and Corrective Action
SQA Procedure 104	Software Quality Records
SQA Procedure 105	Software Development Library
SQA Procedure 106	Software Testing
SQA Procedure 107	Non-Deliverable Software
SQA Procedure 108	Acceptance Inspection and Preparation for Delivery

2.3 Information Documents

None

Section 3

QUALITY ASSURANCE PLANNING

3.1 Approach and Activities

3.1.1 Organization

This Software Assurance Plan shows the Software Assurance Management Organization and the relationship of Software Assurance to the other Product Teams (see Figure 2). It also shows that Software Assurance personnel are independent of Systems Engineering, Software Engineering, and Program Management and therefore have the freedom and authority to accomplish software quality requirements (see Figure 3).

The following paragraphs, in conjunction with the flow diagram in Appendix B, describe and pictorially illustrate the Software Quality Assurance and Software Quality Engineering approach, activities, and methods that will be used in the development of CSCI for EOS/AMSU-A. Software Quality Engineering will perform the activities in the flow diagram in accordance with the detailed program schedule.

3.1.2 General Approach to Software Engineering Planning

There are five fundamental activities that Software Quality Engineering shall perform to assure that quality software products are produced. They are:

a. Product Evaluations
b. Process Evaluations
c. Audits
d. Software Problem Reporting & Corrective Action
e. Software Product Team Meetings.

After Software Development Engineering develops the required documentation and performs the software development engineering processes, Software Quality Engineering shall perform the Product Evaluations, Process Evaluations and Audits in accordance with SQA Procedures. Software Quality Engineering shall implement problem reporting and corrective action for any discrepancies found during the evaluations or audits performed during the Software Development Cycle. Software Quality Engineering shall attend Software Product Team Meetings to assure that the status of actions in progress, completed, and open actions are communicated to the Product Team. Any major problems shall be elevated to the Software Product Team Leader up through the Program Manager for resolution. The goal of this approach is to assure that, through a team effort, all evaluations and audits have been satisfactorily completed and that all problems are resolved in a timely manner and approved by Software Quality Engineering before moving to the next development phase.

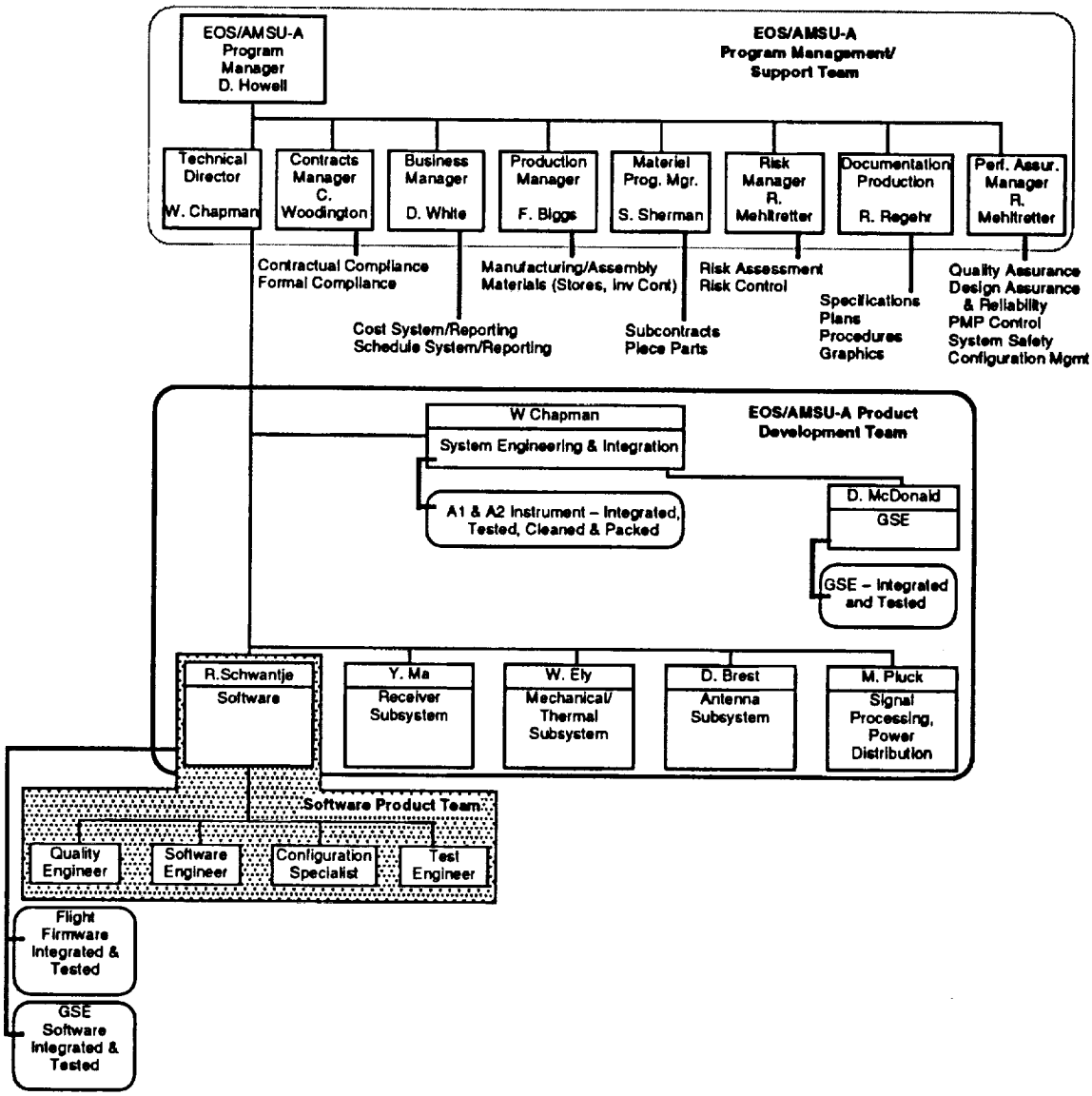


Figure 2 Software Product Team Chart

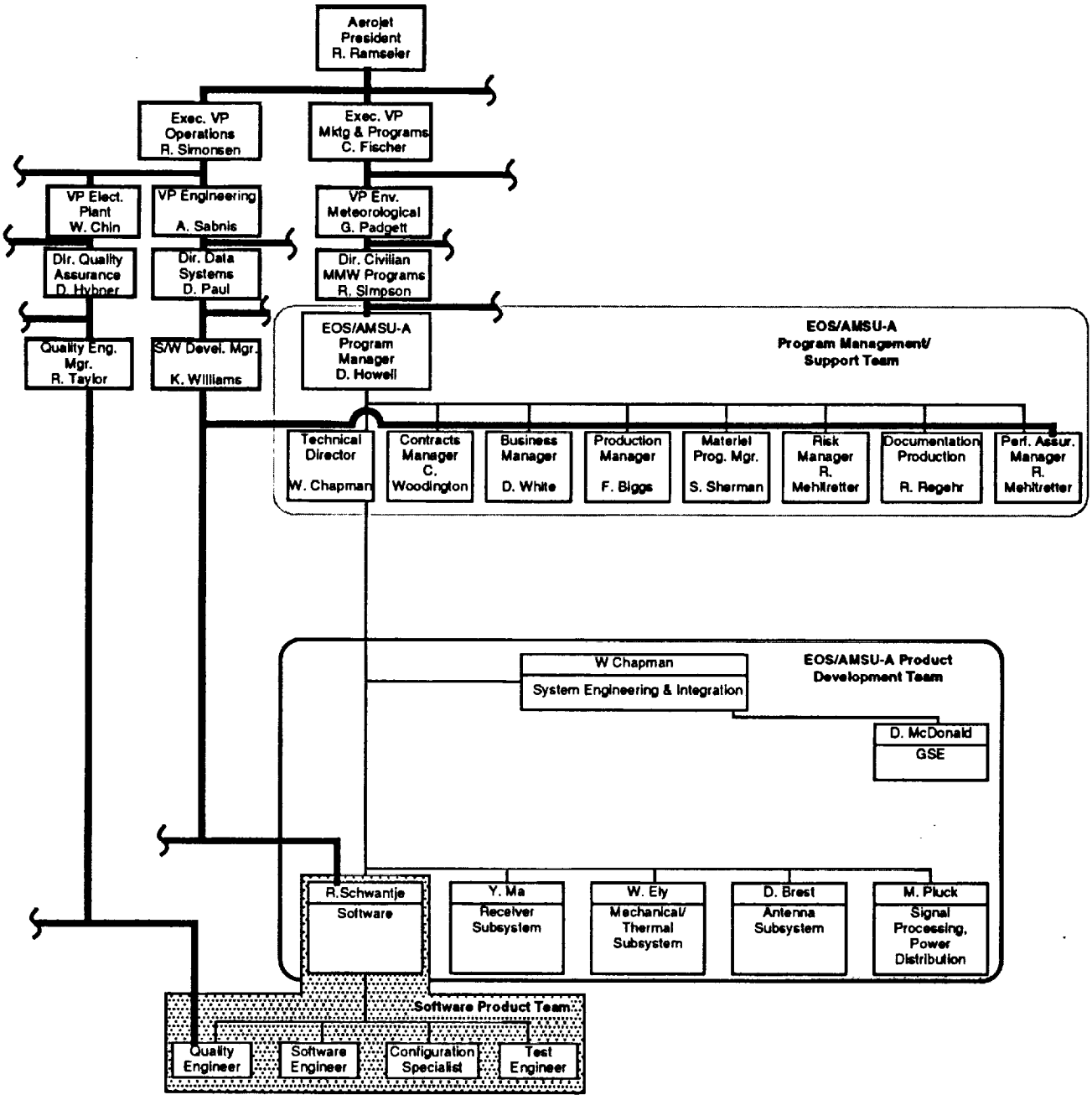


Figure 3 Software Quality Assurance Organizational Charts

3.1.2.1 Product Evaluations - The products to be evaluated are the documents and the CSCI identified in Table I. Software Quality Engineering shall evaluate the identified documentation in accordance with Software Quality Assurance Procedures (SQAP) to assure adequate quality assurance requirements are included and for compliance to the contract. Software Quality Engineering will also verify the baselined CSCI through product evaluations per SQA Procedures described herein.

3.1.2.2 Process evaluations - The processes to be evaluated are: (1) Preparation Maintenance of Software Development Folders (SDF), (2) Preparation and conduct of CSCI Design Reviews, (3) Code Walk-Throughs, (4) Formal Design Reviews, (5) Configuration and change process, (6) FQT Testing (e.g., pre-test review, testing, and post-test data reviews), and (7) Software Acceptance Reviews. Software Quality Engineering shall conduct process evaluations of these processes in accordance with the appropriate SQA Procedures. These evaluations shall be performed in the applicable development phases. The software development processes are shown in Tables II and III.

3.1.2.3 Audits - The management and technical audits shown in Table IV shall be performed. Audits of other disciplines such as Configuration Management, Software Development Engineering, and Test Engineering shall be performed by Software Quality Engineering in accordance with SQA Procedures. Software Quality Engineering shall also attend the formal reviews shown in Table IV.

3.1.2.4 Software Problem Reporting and Corrective Action - Discrepancy reports shall be generated for any discrepancies found during these evaluations or audits. These reports contain documented cause and corrective action. Software Quality Engineering shall assure, through a team approach and team effort, that these discrepancy reports are generated, properly documented, and are resolved in a timely manner. Closure of these discrepancy reports requires Software Quality Engineering approval. Any discrepancy report that cannot be resolved at the Software Quality Engineering level shall be elevated to the Director of Product Assurance and reported to the Program Manager in order to assure timely and effective corrective action. All discrepancies shall be satisfactorily resolved with Software Quality Engineering approval prior to the software development effort moving to the next development phase.

3.1.2.5 Software Product Team Meetings - Software Quality Engineering shall attend formal or informal team meetings with the Software Team Leader as required. These meetings shall be used to communicate the status of Software Quality Engineering activities and problems as well as the other Product Team members' concerns or problems requiring Software Quality Engineering action or support. Any major problems identified by Software Quality Engineering during any development phase shall be reported to the Performance Team Leader, Software Team Leader, and Program Manager through these meetings and through as required status reports.

TABLE I SOFTWARE PRODUCTS

I. DOCUMENTS - DELIVERABLE CDRL	CDRL
SOFTWARE STANDARDS & PROCEDURES	008
TEST DOCUMENTS	--
S/W TEST PLAN	033
S/W TEST PROC	415
S/W TEST REPORT	217
F/W TEST PLAN	033
F/W TEST PROC	415
F/W TEST REPORT	217
II. SOFTWARE - DELIVERABLE CSCI	**VERIFICATION METHOD**
CMD AND DATA HANDLING FIRMWARE, EOS/AMSU-A1 N8	FORMAL FQT TESTING
CMD AND DATA HANDLING FIRMWARE, EOS/AMSU-A2 N12	FORMAL FQT TESTING
INSTRUMENT CONTROL FIRMWARE, EOS/AMSU-A1 N7	FORMAL FQT TESTING
INSTRUMENT CONTROL FIRMWARE, EOS/AMSU-A2 N11	FORMAL FQT TESTING
SPECIAL TEST EQUIPMENT, EOS/AMSU-A1 N5	FORMAL FQT TESTING
SPECIAL TEST EQUIPMENT, EOS/AMSU-A2 N9	FORMAL FQT TESTING
SPACECRAFT WORKSTATION, EOS/AMSU-A1 N6	FORMAL FQT TESTING
SPACECRAFT WORKSTATION, EOS/AMSU-A2 N10,	FORMAL FQT TESTING

TABLE II FIRMWARE CSCI DEVELOPMENT PROCESSES

COMMAND AND DATA HANDLING FIRMWARE			CSCI N8, N12
INSTRUMENT CONTROL FIRMWARE			CSCI N7, N11
PROCESS	**YES**	**NO**	**COMMENTS**
SDF	X		MANUAL FOLDER
RQMTS	X		POINTER TO SPEC
PRELIM DESIGN	X		POINTER TO SPEC
DETAIL DESIGN	X		POINTER TO SPEC
CODE W/T	X		MEMO/WALK-THRU MINUTES
UNIT TEST		X	ENGIN TEST INFORMAL - FQT PREP
INTEG TEST		X	ENGIN TEST INFORMAL - FQT PREP
REQUIREMENTS & DESIGN REVIEWS	X		ONLY NEW OR MODIFIED RQMTS & DESIGN WILL BE REVIEWED PER SQA PROCEDURES/ CHECKLISTS
PRODUCT EVALUATIONS	X		EVALUATE PRODUCTS CDRL DOCUMENTS & CSCI SOFTWARE SEE TABLE I
CODE/CODE W/T	X		ALL NEW OR MOD SOFTWARE AND FIRMWARE ONLY. NOT HERITAGE SOFTWARE
UNIT & INTEGRATION TESTING	X		UNIT ENGIN TESTING INFORMAL - PREP FOR FQT. INTEGRATION TESTING AND FORMAL FQT TESTING ARE TO BE PERFORMED ON ALL SOFTWARE NOTE: *
FORMAL REVIEWS	X		ATTEND DCR, PDR, CDR, TRR, & AR
AUDITS	X		SEE TABLE IV
CONFIGURATION CONTROLS	X		CM CONTROLS INITIATED BY SQA TO BEGIN AT START OF QA DRY RUN FQT
SDR	X		SOFTWARE DISCREPANCY REPORTS (SDR)
SCR	X		SOFTWARE CHANGE REQUESTS (SCR)
CSCI TESTING FQT	X		*NOTE
ENGIN DRY RUN	X		PROOF PROC AND SOFTWARE FUNCTIONALITY
QA DRY RUN	X		SQA WITNESS FQT PER RELEASED PROCEDURES
FORMAL RUN	X		FORMAL RUN WITH SQA AND CUSTOMER
SOFTWARE ACCEPTANCE REVIEW (SWAR)	X		PARTICIPATE IN THE REVIEW AND RESOLVE AND CUSTOMER CONCERNS/SOFTWARE ASSURANCE ACTION ITEMS (REF CDRL 028/SOW SECTION IV M)
DD250 REVIEW	X		REVIEW DD250 FOR CORRECTNESS/ COMPLETENESS AND SIGN PRIOR TO PRESENTING TO THE CUSTOMER (REF SOW SECTION B1 & E1)
DELIVERY AND SHIPPING	X		THIS SOFTWARE IS DELIVERED AS EMBEDDED FIRMWARE WITH THE DELIVERABLE HARDWARE
* ALL CSCI WILL BE SUBJECTED TO FQT			

TABLE III SOFTWARE CSCI DEVELOPMENT PROCESSES

SPECIAL TEST EQUIPMENT FIRMWARE			CSCI N5, N9
SPACECRAFT WORKSTATION SOFTWARE			CSCI N6, N10
PROCESS	**YES**	**NO**	**COMMENTS**
SDF	X		MANUAL FOLDER
RQMTS	X		POINTER TO SPEC
PRELIM DESIGN	X		POINTER TO SPEC
DETAIL DESIGN	X		POINTER TO SPEC
CODE W/T	X		MEMO/WALK-THRU MINUTES
UNIT TEST		X	ENGIN TEST INFORMAL - FQT PREP
INTEG TEST		X	ENGIN TEST INFORMAL - FQT PREP
REQUIREMENTS & DESIGN REVIEWS	X		ONLY NEW OR MODIFIED RQMTS & DESIGN WILL BE REVIEWED PER SQA PROCEDURES/ CHECKLISTS
PRODUCT EVALUATIONS	X		EVALUATE PRODUCTS CDRL DOCUMENTS & CSCI SOFTWARE SEE TABLE I
CODE/CODE W/T DATA BASE TABLE	X *		ALL NEW OR MOD SOFTWARE AND FIRMWARE ONLY. NOT HERITAGE SOFTWARE *NOTE: SPACECRAFT WORKSTATION SOFTWARE N/A PSEUDO WALK-THRU DATA BASE
UNIT & INTEGRATION TESTING	X		UNIT ENGIN TESTING INFORMAL - PREP FOR FQT. INTEGRATION TESTING AND FORMAL FQT TESTING ARE TO BE PERFORMED ON ALL SOFTWARE NOTE: *
FORMAL REVIEWS	X		ATTEND DCR, PDR, CDR, TRR, & AR
AUDITS	X		SEE TABLE IV
CONFIGURATION CONTROLS	X		CM CONTROLS INITIATED BY SQA TO BEGIN AT START OF QA DRY RUN FQT
SDR	X		SOFTWARE DISCREPANCY REPORTS (SDR)
SCR	X		SOFTWARE CHANGE REQUESTS (SCR)
CSCI TESTING FQT	X		*NOTE
ENGIN DRY RUN	X		PROOF PROC AND SOFTWARE FUNCTIONALITY
QA DRY RUN	X		SQA WITNESS FQT PER RELEASED PROCEDURES
FORMAL RUN	X		FORMAL RUN WITH SQA AND CUSTOMER
SOFTWARE ACCEPTANCE REVIEW (SWAR)	X		PARTICIPATE IN THE REVIEW AND RESOLVE AND CUSTOMER CONCERNS/SOFTWARE ASSURANCE ACTION ITEMS (REF CDRL 028/SOW SECTION IV M)
DD250 REVIEW	X		REVIEW DD250 FOR CORRECTNESS/ COMPLETENESS AND SIGN PRIOR TO PRESENTING TO THE CUSTOMER (REF SOW SECTION B1 & E1)
DELIVERY AND SHIPPING	X		THIS SOFTWARE WILL BE DELIVERED TO THE SPACE INTEGRATOR SITE ALREADY INSTALLED AND FULLY TESTED IN THE GSE COMPUTERS. BACK-UP COPIES OF THE GSE SOFTWARE STORED ON MAG TAPE. USER AND OPERATOR MANUALS WILL BE SHIPPED ALSO.
* ALL CSCI WILL BE SUBJECTED TO FQT			

TABLE IV SOFTWARE AUDITS

Audits	Comments
Initial Contract	Completed 1 Mar 94 as part of preparation of this plan.
Management	
Configuration Mgt Initial Follow-up	These audits will be performed to Software Quality Assurance Procedures which contain checklists to be used. An initial and follow-up audit(s) will be performed.
SW Development Mgt Initial Follow-up	These audits will be performed to Software Quality Assurance Procedures which contain checklists to be used. An initial and follow-up audit(s) will be performed.
Technical	
Requirements and Design Reviews	Evaluate requirements, preliminary, and detail design per SQA Procedures. Reference paragraph 3.1 herein.
Code Walk-thrus	Review Code for compliance with standards. Reference 3.1 herein.
SDF Audits	Perform audit per SQA Procedure/checklist. Reference 3.1 herein.
Configuration Baseline	Verify the Configuration Baseline of the Deliverable CSCI prior to the SWAR in coordination with the local SQA customer representative.
Formal Reviews	Attend the formal reviews (DCR, PDR, CDR, TRR, AR) to interface with the customer and resolve any problems/software quality assurance action items. Reference 3.1 herein.
Software Problem Reporting and Corrective Action System	Audit the SDR and SCR Controls/System per Software Quality Assurance Procedures. The procedures contain checklists to be used for this audit. Correctness, completeness, and effective and timely closure of these documents will be audited.

3.1.3 Time-phased Approach

The Software Development Cycle Milestones, as shown in the flow diagram in Appendix B, are the Implementation Phase, Design Concept Review (DCR), Preliminary Design Review (PDR), Critical Design Review (CDR), Test Readiness Review (TRR), and Acceptance Review (AR).

3.1.3.1 Initial Contract Review-Pre-Implementation Phase - Software Quality Engineering tasks start with a complete review of the Contract, attachments, SOW, and CDRL to determine Software Quality Assurance requirements. Software Quality Engineering shall coordinate with the Software Development Engineering Team Leader and other product team members to determine the products, processes, methods, and techniques to be used for the Software Development Cycle Phases and to assure continuity between the various product team disciplines.

3.1.3.2 Implementation Phase through DCR Phase - During this phase, Software Quality Engineering shall review the contract and shall generate a Software Assurance Plan. This plan incorporates the software quality assurance contractual requirements and the planning to implement them. Software Quality Engineering shall start generating project-unique SQA Procedures that contain detailed how to instructions that will be followed by Software Quality Engineering. These procedures will be completed, as required, to support the Software Quality Engineering tasks for each phase. All SQAP will be completed by PDR. Additionally, Configuration Management and Software Development Engineering, in parallel with Software Quality Assurance, perform a review of the contract and develop their respective management plans in a similar manner. These activities are shown in the flow diagram in the applicable area for each discipline.

Systems Engineering and Software Development Engineering generate the Software Management Plan, Configuration Management Plan, and Software Assurance Management Plan. Technical documents for this phase are the preliminary Standards and Procedures Manual and Firmware and Software Test Plans. These are shown in the flow diagram in Appendix B in the Software Development Engineering area.

After Software Development Engineering generates the above documents, Software Quality Engineering shall perform Product Evaluations of these documents in accordance with SQAP 100. Any discrepancies found by Software Quality Engineering during these product evaluations are documented, dispositioned, and closed per SQAP 103.

Software Development Engineering now initiates Software Development Folders (SDF) for each CSCI. Software Quality Engineering shall audit this process in accordance with SQA Procedures which include program-unique checklists (Reference SQAP 102). Any discrepancies found by Software Quality Engineering during this process evaluation are documented, dispositioned, and closed per SQAP 103.

The goal for this phase is to obtain Software Quality Engineering approval of all the above evaluations and audits with no open discrepancies. This will assure that sound Software Engineering Management, Configuration Management, and Software Quality Assurance Management Plans are in place and that the documents generated, and processes performed, are acceptable so that the development of the software is ready to move to the next phase. Additionally, Software Development Folders shall be in place with the required requirements and preliminary design documents and data. The completion of these activities will assure timely and effective development of quality software products. The status of Software Quality Assurance activities shall be reported at weekly meetings and and in weekly activity reports to the Product Team Leader, Performance Assurance Team Leader, and the Program Manager.

Software Quality Engineering shall attend the DCR and interface with the customer to assure that any software quality problems or issues are resolved in a timely manner. This phase is completed upon satisfactory completion of the formal DCR meeting and when all software quality action items closed.

3.1.3.3 DCR through PDR Phase - Software Quality Engineering shall perform an initial audit of Configuration Management and Software Engineering Management, in accordance with SQAP 102, to verify adherence to their respective plans. This assures that satisfactory management is in place and implemented to assure tasks are assigned and completed in a timely manner to not only meet project schedule but also to produce quality software products.

The documents generated for this phase are the preliminary Software and Firmware Test Procedures, and the Software Design and Code Standards.

After Software Engineering generates these documents, Software Quality Engineering shall perform product evaluations of these documents in accordance with SQAP 100. Any discrepancies found by Software Quality Engineering during these product evaluations are documented, dispositioned, and closed per SQAP 103.

In this phase, Software Development Engineering performs the following processes on the software for the CD&H breadboard.

a. generates software Design and Code for the Command and Data Handling (C&DH) and the Instrument Control CSCI.

b. performs Design and Code Walk-Throughs of the C&DH and Instrument Control CSCI.

c. updates the CSCI SDF with the Design and Code data.

When complete, Software Development Engineering and Software Quality Engineering shall jointly perform a Design and Code walk-through of each CSCI in

accordance with SQAP 101. Any discrepancies found by SQA Engineering during the process evaluation shall be documented, dispositioned, and closed per SQAP 103.

After Software Development Engineering updates the SDF folders, Software Quality Engineering shall perform an audit of the SDF in accordance with SQAP 102. Any discrepancies found by Software Quality Engineering during the SDF Audits are documented, dispositioned, and closed per SQAP 103.

The goal for this phase is to obtain Software Quality Engineering approval of all the above evaluations and audits with no open discrepancies. This will assure that the documents generated, and the processes and audits performed, are acceptable so that the development of the software is ready to move to the next development phase. Additionally, Software Development Folders are in place with current design documents and code data. The completion of these activities assure timely and effective development of quality software products. The status of Software Quality Assurance activities shall be reported at weekly meeting and in weekly activity reports to the Product Team Leader, Performance Assurance Team Leader, and the Program Manager.

Software Quality Engineering shall attend the PDR and interface with the customer to assure that any software quality problems or issues are resolved in a timely manner. This phase is completed upon satisfactorily completion of the formal review meeting and when all software quality action items closed.

3.1.3.4 PDR through CDR Phase - Software Development Engineering generates the preliminary Firmware and Software Test Procedures.

After Software Development Engineering generates the above documents, Software Quality Engineering shall perform product evaluations of these documents in accordance with SQAP 100. Any discrepancies found by SQA Engineering during these product evaluations are documented, dispositioned, and closed per SQAP 103.

In this phase, Software Development Engineering performs the following processes.

a. code and unit testing of the Instrument Control CSCI.

b. code and unit testing of the Special Test Equipment (STE) CSCI.

c. code walk-throughs of the Instrument Control, STE CSCI.

d. updates the CSCI SDF with the Code and walk-through data.

When complete, Software Development Engineering and Software Quality Engineering shall jointly perform a Code walk-through of each CSCI in accordance with SQAP 101. Any discrepancies found by SQA Engineering during the process evaluation shall be documented, dispositioned, and closed per SQAP 103.

After Software Engineering updates the SDF folders, Software Quality Engineering shall perform an audit of the SDFs in accordance with SQAP 102. Any discrepancies found by SQA Engineering during the SDF Audits are documented, dispositioned, and closed per SQAP 103.

The goal for this phase is to obtain Software Quality Engineering approval of all the above evaluations and audits with no open discrepancies. This will assure that the documents generated, and the processes and audits performed, are acceptable so that the development of the software is ready to move to the next development phase. Additionally, Software Development Folders are in place with current design documents and code data. The completion of these activities assure timely and effective development of quality software products. The status of Software Quality Assurance activities shall be reported at weekly meeting and in weekly activity reports to the Product Team Leader, Performance Assurance Team Leader, and the Program Manager.

Software Quality Engineering shall attend the CDR and interface with the customer to assure that any software quality problems or issues are resolved in a timely manner. This phase is completed upon satisfactorily completion of the formal review meeting and all software quality action items closed.

3.1.3.5 CDR through TRR Phase - Software Development Engineering generates or updates the final Firmware & Software Test Procedures and the preliminary Software Test Reports.

After Software Development Engineering generate the above documents, Software Quality Engineering shall perform product evaluations of these documents in accordance with SQAP 100. Any discrepancies found by SQA Engineering during these product evaluations are documented, dispositioned, and closed per SQAP 103.

Software Engineering performs the following processes during this phase:

a. codes and performs unit and integration testing of the Spacecraft Workstation CSCI

b. develops STE integration code and test

c. conducts integration code walk-through of STE and Spacecraft Workstation CSCI

d. updates the SDF for STE and Spacecraft Workstation CSCI

e. develops integration code for the Spacecraft Workstation CSCI

f. performs code walk-through of Spacecraft Workstation integration code

g. updates SDF with integration code data for the Spacecraft Workstation CSCI

h. integrates and tests the STE, Instrument Control, and C&DH CSCI and performs engineering dry run FQT testing

i. perform QA dry run FQT testing of the STE, Instrument Control and C&DH CSCI

When complete, Software Development Engineering and Software Quality Engineering shall jointly perform a Code walk-through of each CSCI in accordance with SQAP 101. Any discrepancies found by Software Quality Engineering during the process evaluation shall be documented, dispositioned, and closed per SQAP 103.

After Software Development Engineering updates the SDF folders, Software Quality Engineering shall perform an audit of the SDF in accordance with SQAP 102. Any discrepancies found by SQA Engineering during the SDF Audits are documented, dispositioned, and closed per SQAP 103.

The FQT process is performed during this phase. This is accomplished by Software Test Engineering performing and satisfactorily completing the engineering FQT dry run for the STE, Instrument Control, and C&DH CSCI. Then the QA FQT dry run for these CSCI shall be performed by Software Test Engineering with Software Quality Engineering witnessing the FQT testing. Software Quality Engineering shall perform this activity in accordance with SQAP 106. Any discrepancies found by Software Quality Engineering during this FQT shall be documented, dispositioned, and closed per SQAP 103. Software Problem Reporting and the use of Software Discrepancy Reports (SDR) and Software Change Requests (SCR) for configuration control is initiated at this point in the software development cycle.

During this phase, Quality Software Engineering shall perform a follow up Audit of Configuration Management and Software Development Engineering in accordance with SQAP 102 to verify implementation of the respective plans and compliance thereto. Any discrepancies found by Software Quality Engineering during these audits shall be documented, dispositioned, and closed per SQAP 103.

Software Quality Engineering shall attend and participate in the TRR along with the Software Test Engineer and shall interface with the customer to assure any testing or software quality testing problems or issues are resolved in a timely manner. Software Quality Engineering activities for the TRR shall be performed in accordance with SQAP 106. This phase is completed upon satisfactorily completion of the formal TRR meeting and when all software quality action items are closed.

3.1.3.6 TRR through AR Phase - Software Test Engineering and Software Quality Engineering shall perform the FQT processes for the STE, Instrument Control, and C&DH CSCI during this phase. The process includes pre-test reviews, FQT testing and post-test reviews in accordance with SQAP 106 for each FQT test series. To accomplished this, Software Test Engineering and SQA Engineering shall jointly perform a pre-test readiness review with Software Quality Engineering and the Customer witnessing the formal FQT testing. Software Test Engineering and Software Quality Engineering shall jointly perform a post-test readiness review for the STE, C&DH, and Instrument Control CSCI with the Customer attending. The Program Manager and Performance Assurance Team Leader and other customer personnel may be invited as coordinated and agreed upon by the Program Manager and the Customer. Any discrepancies found by Software Quality Engineering during this Formal Qualification Testing shall be documented, dispositioned, and closed per SQAP 103.

The same test engineering dry run and QA dry run testing process is performed for the Spacecraft Workstation CSCI. After Software Test Engineering satisfactorily completes the engineering FQT dry run for the Spacecraft Workstation CSCI, the QA FQT dry run for this CSCI shall be performed by Software Test Engineering with Software Quality Engineering witnessing the FQT testing. Software Quality Engineering shall perform this activity in accordance with SQAP 106. Any discrepancies found by SQA Engineering during this FQT testing shall be documented, dispositioned, and closed per SQAP 103.

The documents generated in this phase are the final Software & Firmware Test Reports, and any Software Change Requests or Software Discrepancy Reports as required.

After Software Development Engineering generates the above documents, Software Quality Engineering shall perform product evaluations of these documents in accordance with SQAP 100. Any discrepancies found by Software Quality Engineering during these product evaluations are documented, dispositioned, and closed per SQAP 103.

During this phase, Software Test Engineering and Software Quality Engineering shall perform the FQT process for the Spacecraft Workstation CSCI. To accomplish this Software Test Engineering and Software Quality Engineering shall jointly perform a pre-test readiness review. Then Software Test Engineering shall perform the formal FQT testing with Software Quality Engineering and the Customer witnessing the formal testing. Software Test Engineering and Software Quality Engineering shall jointly perform a post-test readiness review for the Spacecraft Workstation CSCI with the Customer attending. The Program Manager and Performance Assurance Team Leader and other customer personnel may be invited to attend the formal pre-test, testing, and post-test activities as coordinated and agreed upon by the Program Manager and the Customer. Any discrepancies found by SQA Engineering during this formal testing shall be documented, dispositioned, and closed per SAP 103.

Software Quality Engineering shall prepare for, and participate in, the formal Acceptance Review (AR) along with the Software Test Engineer, in coordination with Configuration Management, and the Program Manager. Software Quality Engineering shall interface with the customer to assure that any testing, test requirements verification, and software quality issues are resolved in a timely manner. Software Quality Engineering activities for the AR shall be performed in accordance with SQAP 108. Software Test Engineering, the Program Manager, and Software Quality Engineering shall perform an AR internal dry run to verify all software requirements including interface requirements are met. This activity is performed in accordance with SQAP 108. This phase is completed upon satisfactorily completion of the formal AR meeting and when all software quality action items are closed.

Software Quality Engineering shall review and approve the CSCI DD-250 after verifying compliance to the contract. Software Quality Engineering shall present the DD-250 to the customer for signature.

The final Software Quality Engineering task is to perform preparation for delivery of the CSCI and the supporting documentation in accordance with SQAP 108. This completes the software development cycle.

3.1.4 Quality Records

SQA Engineering shall maintain Quality Records on file as quality objective evidence. These records shall be available for internal audits and customer review in accordance with SQAP 104.

3.1.5 Reliability

There are no reliability contract requirements.

3.1.5.1 Firmware CSCIs

Reliability for the Firmware CSCI is 100 tested during FQT Testing.

3.1.5.2 STE Software

There is no reliability requirement for the STE because it is not mission critical. The GSE is easily revised and it is used for ground testing only.

3.1.6 Maintainability

3.1.6.1 Software Maintainability

There are no maintainability contract requirements for the soltware.

The firmware cannot be maintained once it is burned in, therefore this requirement is not applicable. Maintainability for the STE is satisfied through compliance to Design and Coding Standards that assure ease of maintenance by any programmer.

3.1.6.2 Hardware Maintainability

Maintainability is done through a maintenance contract. The system disks have been replaced by the vendor more than once with no adverse effect on the system operation. Similar STE software for other projects run on a Microvax II using VMS 4.4 and a Vax 4000/200 using VMS 5.5 with no source code changes. Only requirement is to link the object modules on the target computer. No maintenance problem if new computers are required in the future.

3.2 Methods and Techniques

The methods and techniques to be used for the Software Development of the EOS/AMSU-A CSCI have been identified and addressed in detail in 3.1.

3.3 Products

As described in 3.1, product evaluations will be performed per Software Quality Assurance Procedures which will include checklists. Products to be evaluated are the deliverable documents and software described in Table I.

Section 4

VERIFICATION AND VALIDATION PLANNING

The requirements identified in the Software Requirements Specification and the Software Interface Requirements Specification will be verified by test, demonstration, inspection, or analysis per the Software Test Plan. The Software Assurance Review (SWAR) is held to demonstrate to the customer that all requirements have been verified. Software Quality Engineering is a major contributor to this review along with Software Development Engineering and Test Engineering. Software Quality Engineering shall verify in coordination with the Software Project Team Leader and Program Manager that all requirements are verified prior to conducting this review with the customer.

The only validation required is of the Software Test Beds for all Formal Testing of the CSCI. This will be done in coordination with the Software Test Engineer using the Software Test Plan and Software Test Procedures.

4.1 Approach and Activities

As a part of verification and validation, Software Quality Engineering shall review, per SQA Procedures, the Software Requirements Specification, Interface Requirements Specification, Software and Firmware Test Plans, Software and Firmware Test Procedures, and Software and Firmware Test Reports for requirements traceability, adequate quality assurance requirements, and for compliance to the CDRL/DID.

In addition to all the software development activities throughout the development phases, the primary activity involved with verification and validation tasks is the Formal Qualification Testing (FQT) per the Software Test Plan and Test Procedures. Software Quality Engineering shall perform the following activities:

a. Witness the FQT QA Dry Run and formal FQT per SQAP 106

b. Review the test results and verify that all software requirements are met in preparation for the SWAR per SQAP 108

c. Participate in the formal SWAR per SQAP 108.

Unit and Integration tests will be informal, engineering tests in preparation for the Engineering and QA Dry Run FQT testing. Unit, integration, and acceptance testing are defined in Tables II and III for each CSCI.

Software Quality Engineering shall assure that Software Standards and Procedures exist and are followed by Software Development Engineering in developing

the requirements, design, and code. This will be evaluated through reviews and code walk-throughs.

For Reliability and Maintainability requirements refer to 3.1.5 and 3.1.6, respectively.

SQAP 106 and 103 contain Software Quality Engineering responsibilities and instructions that define action to be taken for test anomalies and failures such as initiating SDR/SCR. The disposition of these documents may require rerunning tests or portions thereof as approved by Software Quality Engineering.

The Software and Firmware Test Reports shall be reviewed by Software Quality Engineering for compliance with the CDRL/DID, for completeness, correctness, and for adequate quality assurance requirements per SQAP 100.

As discussed above, initial audits of the contract itself and functional management will be performed per SQAP 102. The completion of the defined audits, evaluations, and reviews of the development processes and products shall be performed per the SQA Procedures defined in 3.1. The combination of all these activities shall assure verification and validation of the CSCI.

4.2 Methods and Techniques

The method for verification of the software CSCI is for Software Engineering, Test Engineering, Program Manager, and Software Quality Engineering to perform an internal requirements verification review of the formal FQT testing results. Upon successful completion of the internal review, Aerojet will perform the formal Software Assurance Review (SWAR) with the customer. Also, verification of the Deliverable Documents is accomplished by Software Quality Engineering reviewing, and approving, the Software and Interface Requirements Specifications, Software and Firmware Test Plans, and the Software and Firmware Test Procedures prior to the SWAR.

The techniques to be used are Formal Qualification Testing of the Software in accordance with released test procedures. The test bed will be validated using the released test procedures in coordination with the Test Engineer.

Software Quality Engineering will assure that Software Problem Reports are generated for test anomalies starting at the QA FQT Dry Runs and for all subsequent FQT. This includes use of Software Discrepancy Reports (SDR), identifying cause and corrective action, and close out of all anomalies/failures. Software Quality Engineering will assure that Software Change Requests (SCR) are initiated and controlled per SQA and Configuration Management procedures.

Software Quality Engineering will perform audits of Configuration Management (CM) as required, and scheduled, to verify compliance to the contract and the Configuration Management Plan. These audits will include audits of CM change

controls, CM Software Change Control Board procedures, and CM media controls, including storage. These audits will be performed in accordance with SQA Procedures which will include applicable checklists. The checklists will contain characteristics derived from previous experience on similar projects, NASA-DID-M400, and the PAR Section 10, as applicable to the particular evaluation being performed.

4.3 Products

The products are the FQT test results, any SDR generated during formal testing, the Software Test Report, and the Firmware Test Report. Software Quality Engineering will review these products in accordance with SQA Procedures.

Any discrepancies identified during these product reviews, formal testing, or test data reviews will be documented and maintained per SQAP 103 for evaluation by Software Development Engineering and Software Quality Engineering for future project lessons learned and future project usage.

Section 5

QUALITY ENGINEERING ASSURANCE PLANNING

5.1 Approach and Activities

5.1.1 See 3.1 and the Software Assurance Flow Diagram in Appendix B.

There are no reliability contract requirements.

5.1.3 The only maintainability issue is maintenance of the code during development (i.e., in case of corrections, revisions, or replacement of the original software development engineer). Maintainable design and code is accomplished by the software developer complying with the Software Development Manual section on Design and Code Standards. Software Quality Engineering will verify compliance to these standards by performing design and code walk-thrus per SQA Procedures. Once the software is burned into the PROM there are no maintainability requirements since the software cannot be changed at this point. Refer to 3.1.6 for hardware maintainability.

5.2 Methods and Techniques

The method used for Software Quality Engineering planning is discussed in detail in 3.1 and shown in the Software Assurance Flow Diagram in Appendix B.

For techniques, see 3.1 and 3.2. Additional techniques to be used include evaluations of the design and code for maintainability. The evaluations are to be performed per SQA Procedures which detail responsibilities and tasks to be performed by Software Quality Engineering.

All CSCI for EOS/AMSU-A are being developed by Aerojet personnel. Note: Per the Acquisition Activities Plan (CDRL 508) the only software being procured for the EOS software development is the OASIS/CSTOL software for the Spacecraft Workstation. All Quality Assurance and Configuration Management for the OASIS/CSTOL Software is performed by NASA.

5.3 Products

See 3.1 for a detailed discussion on products. The Software Assurance products are the Software Quality Assurance Plan and the Software Quality Assurance Procedures. Additionally, any SDR or other evaluation reports, generated by Software Quality Engineering as a result of witnessing formal testing, performing evaluations, or audits, are products and will be assessed by Software Quality Engineering and maintained in the SQA files. All other products are generated or developed by Software Development Engineering.

Section 6

SAFETY ASSURANCE PLANNING

None. The operating or malfunctioning of the EOS/AMSU-A software CSCI poses no potential hazards to personnel or deliverable hardware instruments. Additionally, any command or any number of commands can be sent in any sequence with no potential damage to the hardware. The only concern is that if someone was to command the instrument to move with a person or object in the way there is a potential for damage to the hardware or possible harm to personnel. This potential hazard is controlled by use of procedures.

6.1 Approach and Activities

N/A

6.2 Methods and Techniques

N/A

6.3 Products

N/A

Section 7

SECURITY AND PRIVACY ASSURANCE PLANNING

7.1 Approach and Activities

N/A

7.2 Methods and Techniques

N/A

7.3 Products

N/A

Section 8

CERTIFICATION PLANNING

8.1 Approach and Activities

After successful completion of formal FQT testing, certification of the software will be performed by Software Quality Engineering in accordance with Software Quality Assurance Procedures. Software Quality Engineering will certify, in coordination with Software Test Engineering, the deliverable CSCI baseline configuration.

8.2 Methods and Techniques

After successful completion of formal FQT testing, Software Quality Engineering will bond the baselined software, identify, and label the media in coordination with Configuration Management per SQA and Configuration Management Procedures. Configuration Management then will control and store the media until delivery.

Software Development Engineering in participation with Software Test Engineering will obtain a listing of the baselined CSCI software and verify that is is the correct version.

8.3 Products

The products produced are the baselined CSCI and the current listing of the CSCI which will be approved and certified by Software Test Engineering and Software Quality Engineering. This media and listing of the CSCI will be delivered as stated in Tables II and III.

Section 9

ABBREVIATIONS AND ACRONYMS

AR	Acceptance Review
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CM	Configuration Management
CSCI	Computer Software Configuration Item
DCR	Design Concepts Review
EOS/AMSU-A	Earth Observing System/Advanced Microwave Sounding Unit-A
FQT	Formal Qualification Test
NASA	National Aeronautics and Space Administration
PAR	Performance Assurance Requirements
SAP	Software Assurance Plan
SCR	Software Change Request
SDR	Software Discrepancy Report
SQA	Software Quality Assurance
SWAR	Software Assurance Review
TBD	To Be Determined at some future date

Section 10

GLOSSARY

None.

Section 11

NOTES

11.1 Plan compliance with CDRL 309

This plan incorporates the requirements of CDRL 309, NASA-DID-M400, NASA-DID-999 Sections 1, 2, 9, 10, 11, and 12, and the EOS Performance Assurance Requirements (PAR) for EOS General Requirements (GSFC #420-05-01) Section 10. A matrix is included in Appendix C which cross references this plan to the EOS Performance Assurance Requirements (PAR) for EOS General Requirements (GSFC #420-05-01) Section 10. The relationship of this plan to the NASA-DID-M400 is not included since the paragraphs are one-to-one with this plan.

11.1.1 Compliance with NASA-DID-999

The following table identifies the NASA-DID-999 Sections contained within this document as shown:

NASA-DID-999 Contents

Section		In This Doc.	N/A	Added	Marked with Pointer
1.0	Introduction	X			
2.0	Related Documentation	X			
3.0-N.0	Major Subsections		X		
9.0	Abbreviations and Acronyms	X			
10.0	Glossary	X			
11.0	Notes	X			
12.0	Appendices	X			

Appendix A

Overall SW Description

The software being developed for the EOS/AMSU-A program consists of the eight CSCI identified below and in Figure A-1. There are four CSCI for each of the Two instrument modules, EOS/AMSU-A1 and EOS/AMSU-A2.

CSCI Name	EOS/AMSU-A1	EOS/AMSU-A2
1. Command and Data Handling Firmware	CSCI N8	CSCI N12
2. Instrument Control Firmware	CSCI N7	CSCI N11
3. Special Test Equipment Software	CSCI N5	CSCI N9
4. Spacecraft Workstation Software	CSCI N6	CSCI N10

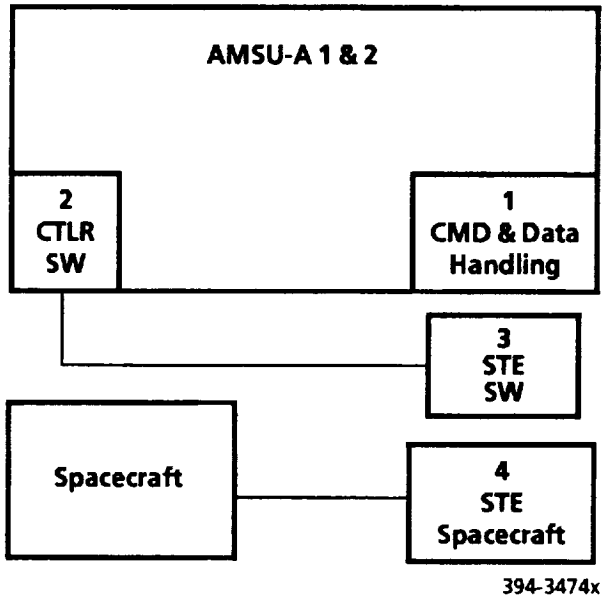


Figure A-1 Description of EOS/AMSU-A CSCI

Two CSCI are embedded Programmable Read Only Memory (PROM) within the AMSU-A instrument modules. One of the embedded flight CSCI is a version of the existing AMSU-A flight software modified to accommodate the MIL-STD-1553 interface bus protocol (Refer to Table A-I). The other embedded flight CSCI is the software to operate the MIL-STD-1553 interface itself (Refer to Table A-II).

Table A-I Command and Data Handling Firmware CSCI

CSCI NAME	COMMAND AND DATA HANDLING FIRMWARE, EOS/AMSU-A1/A2
CSCI No.	N8/N12
CHARACTERISTIC	COMMENTS
Type	Deliverable-Mission Critical-Developed (S/W Acquisition Management Plan Para 4.6)
Category	Flight Firmware
Language	Assembly
New Code	Yes
Mod Code	No
Development Host	HP 64000-UX
Firmware	Yes
Software	No
@ LOC	100 - 500

Table A-II Instrument Control Firmware CSCI

CSCI NAME	INSTRUMENT CONTROL FIRMWARE, EOS/AMSU-A1/A2
CSCI No.	N7/N11
CHARACTERISTIC	COMMENTS
Type	Deliverable-Mission Critical-Developed (S/W Acquisition Management Plan Para 4.6)
Category	Flight Firmware
Language	Assembly
New Code	Yes
Mod Code	No
Development Host	HP 64000-UX
Firmware	Yes
Software	No
@ LOC	1K

Two of the CSCI are support software programs. One of the CSCI used in the GSE is a version of the existing AMSU-A GSE software modified to accommodate the MIL-STD-1553 interface bus protocol (refer to Table A-III). The other GSE CSCI is the software written in OASIS/CSTOL language and programming environment for the purpose of monitoring performance of the EOS/AMSU-A instruments at the spacecraft integration facility (refer to Table A-IV). See the Software Management Plan Report 10339 (NASA-EOS/AMSU-A CDRL 005) for more information about the software.

Table A-III Special Test Equipment Software CSCI

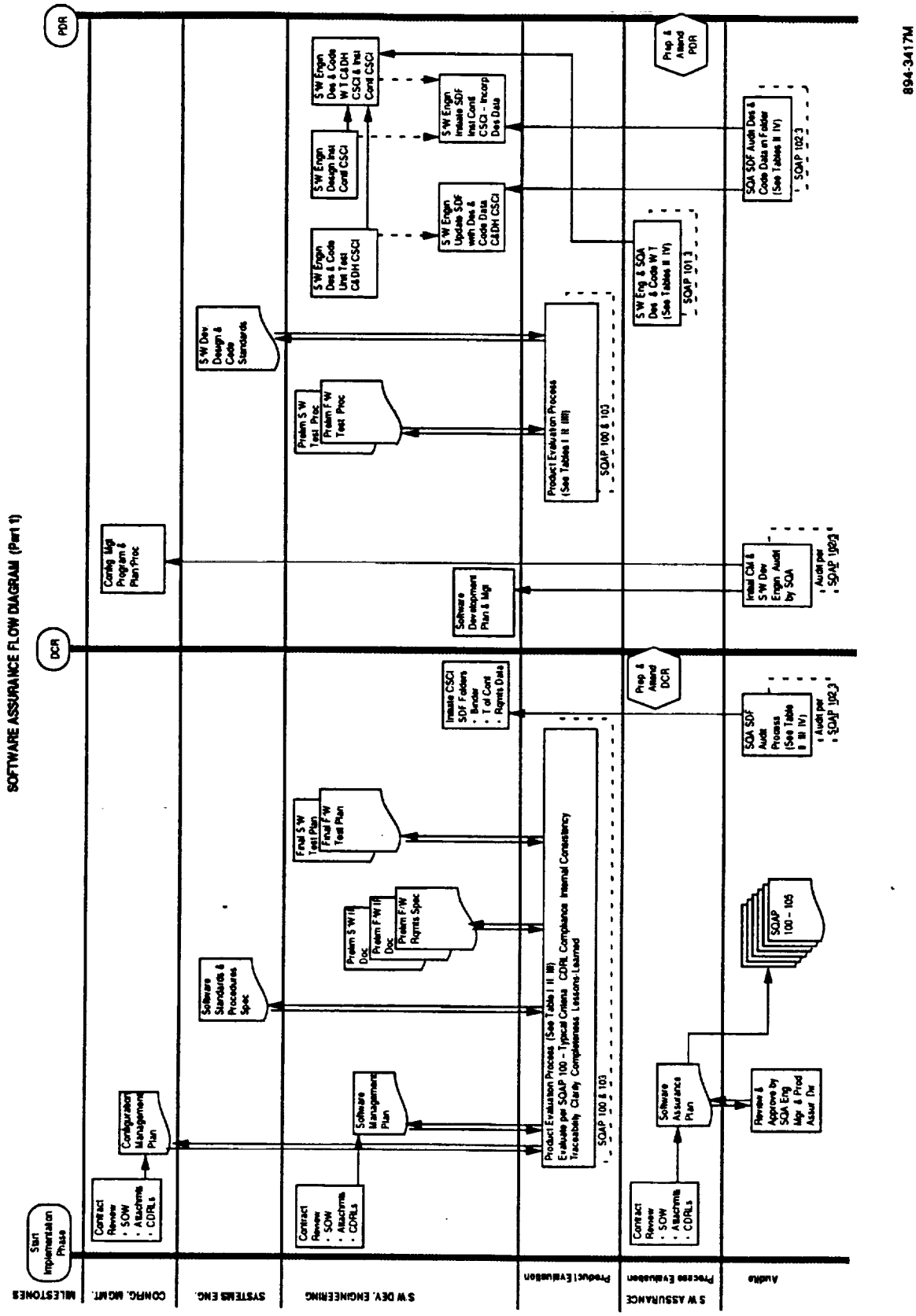
CSCI NAME	SPECIAL TEST EQUIPMENT, EOS/AMSU-A1/A2
CSCI No.	N5/N9
CHARACTERISTIC	COMMENTS
Type	Deliverable-Mission Support-Heritage (S/W Acquisition Management Plan Para 4.6)
Category	Support GSE Software
Language	FORTRAN
New Code	No
Mod Code	Yes
Development Host	VAX/DEC
Firmware	No
Software	Yes
@ LOC	25K

Table A-IV Spacecraft Workstation Software CSCI

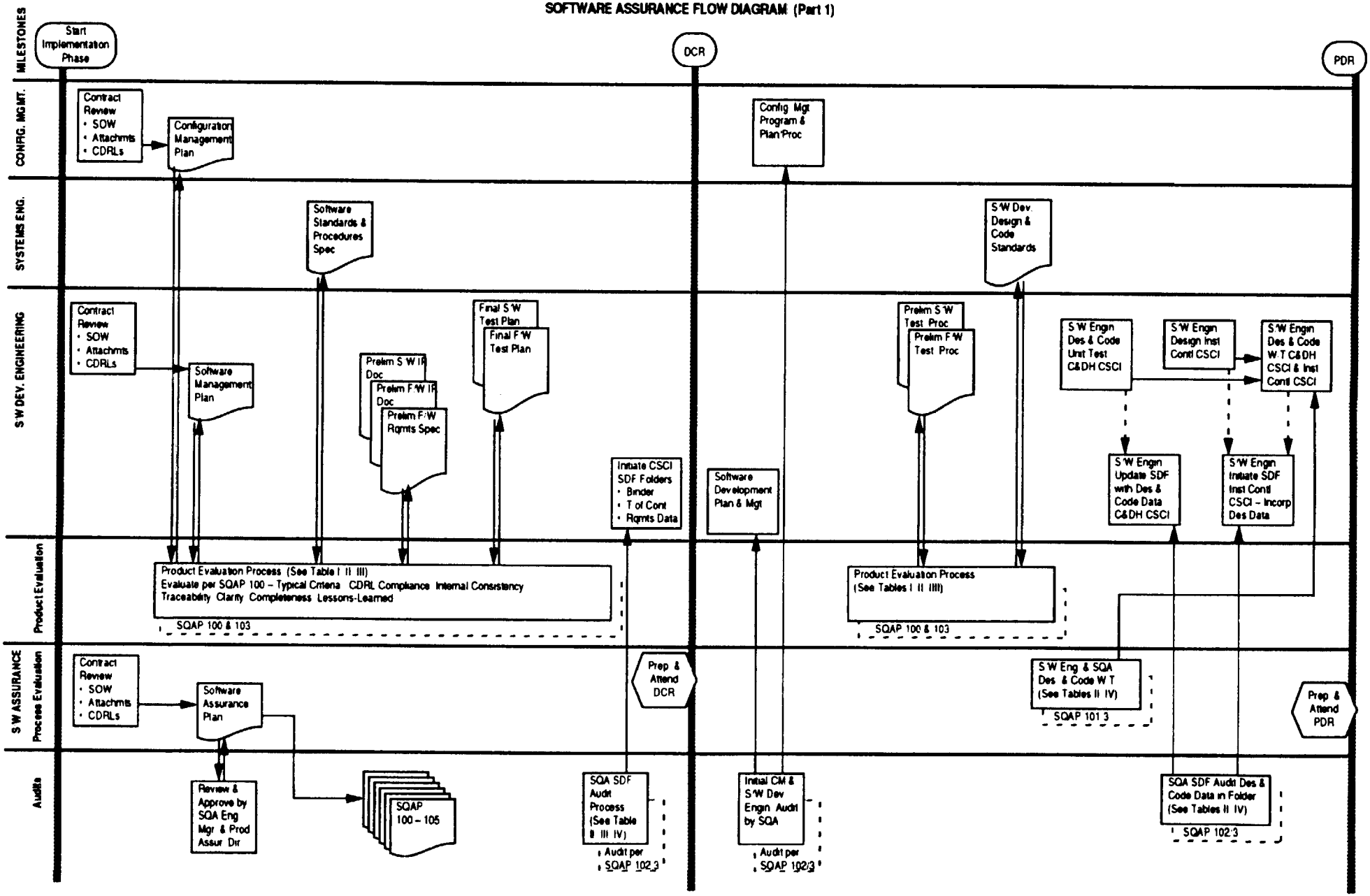
CSCI NAME	SPACECRAFT WORKSTATION, EOS/AMSU-A1/A2
CSCI No.	N6/N10
CHARACTERISTIC	COMMENTS
Type	Deliverable-Mission Support-Developed (S/W Acquisition Management Plan Para 4.6)
Category	Support GSE Software
COTS	**OASIS** – (Operations and Science Instru Support) Software System (Ada) **CSTOL** – (Colo Sys Test & Ops Language) CMD Language (Ada) **SOLARIS** – OPS System **MOTIF** – Windows Application **TAE** – (Trans Applications Envir) Workbench Interface With OASIS **DATA BASE BUILDER** – User Interface With DB
New Code	Yes
Mod Code	No
Development Host	Sun Sparc 10
Firmware	No
Software	Yes
Procedures	IN CSTOL – MACRO/CMD Sequence (Aerojet Develop)
@ LOC	None Data Base – Table

Appendix B

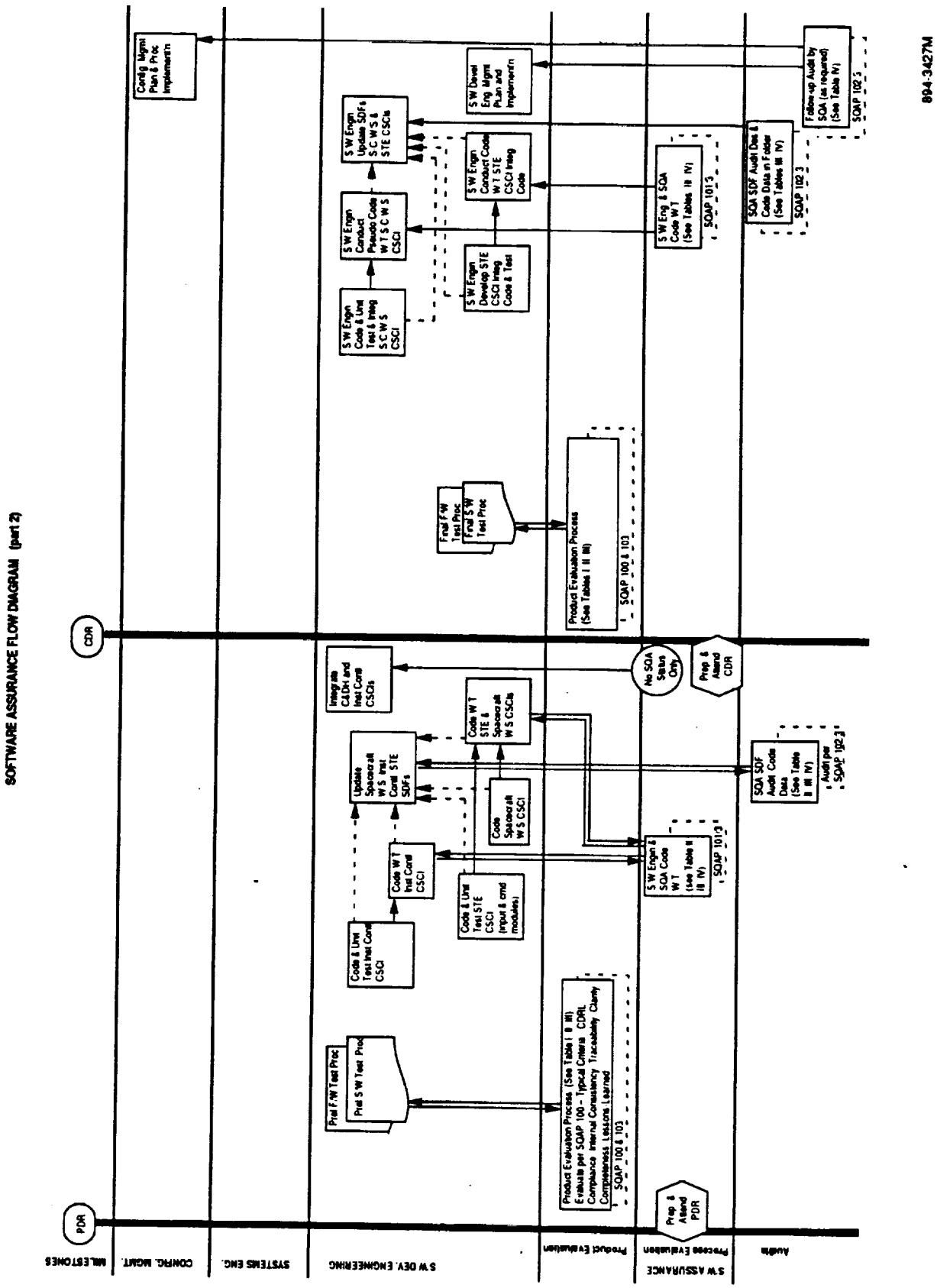
SOFTWARE ASSURANCE FLOW DIAGRAM


SOFTWARE ASSURANCE FLOW DIAGRAM (Part 1)
894-3417M
MILESTONES
CONFIG. MGMT.
SYSTEMS ENG.
S/W DEV. ENGINEERING
Product Evaluation
S/W ASSURANCE
Process Evaluation
Audits
PDR
DCR
Start Implementation Phase
Contract Review • SOW • Attachmts • CDRLs
Configuration Management Plan
Config Mgt Program & Plan Proc
S/W Dev Design & Code Standards
Software Standards & Procedures Spec
Contract Review • SOW • Attachmts • CDRLs
Software Management Plan
Prelim S/W Test Proc
Prelim F/W Test Proc
Prelim S/W II Doc
Prelim F/W II Rqmts Spec
Final S/W Test Plan
Final F/W Test Plan
S/W Engn Des & Code Unit Test C&DH CSCI
S/W Engn Design Inst Cond CSCI
S/W Engn Des & Code W/ I C&DH CSCI & Inst Cond CSCI
S/W Engn Update SDF with Des & Code Data C&DH CSCI
S/W Engn Initiate SDF Inst Cond CSCI - Incorp Des Data
Software Development Plan & Mgt
Product Evaluation Process (See Tables I II III)
SOAP 100 & 103
Initiate CSCI SDF Folders • Binder • Tst Cont • Rqmts Data
Product Evaluation Process (See Table I II III)
Evaluate per SOAP 100 - Typical Criteria CDRL Compliance Internal Consistency
Traceability Clarity Completeness Lessons Learned
SOAP 100 & 103
Contract Review • SOW • Attachmts • CDRLs
Software Assurance Plan
S/W Eng & SQA Des & Code W/ I (See Tables II IV)
SOAP 101 3
Prep & Attend DCR
Prep & Attend PDR
SQA SDF Audit Process (See Table II III IV)
Audit per SOAP 102 3
SQA SDF Audit Des & Code Data on Folder (See Tables II IV)
SOAP 102 3
Initial CM & S/W Dev Engrn Audit by SQA
Audit per SOAP 102g
SOAP 100 - 105
Review & Approve by SQA Eng Mgr & Prod Assur Dir

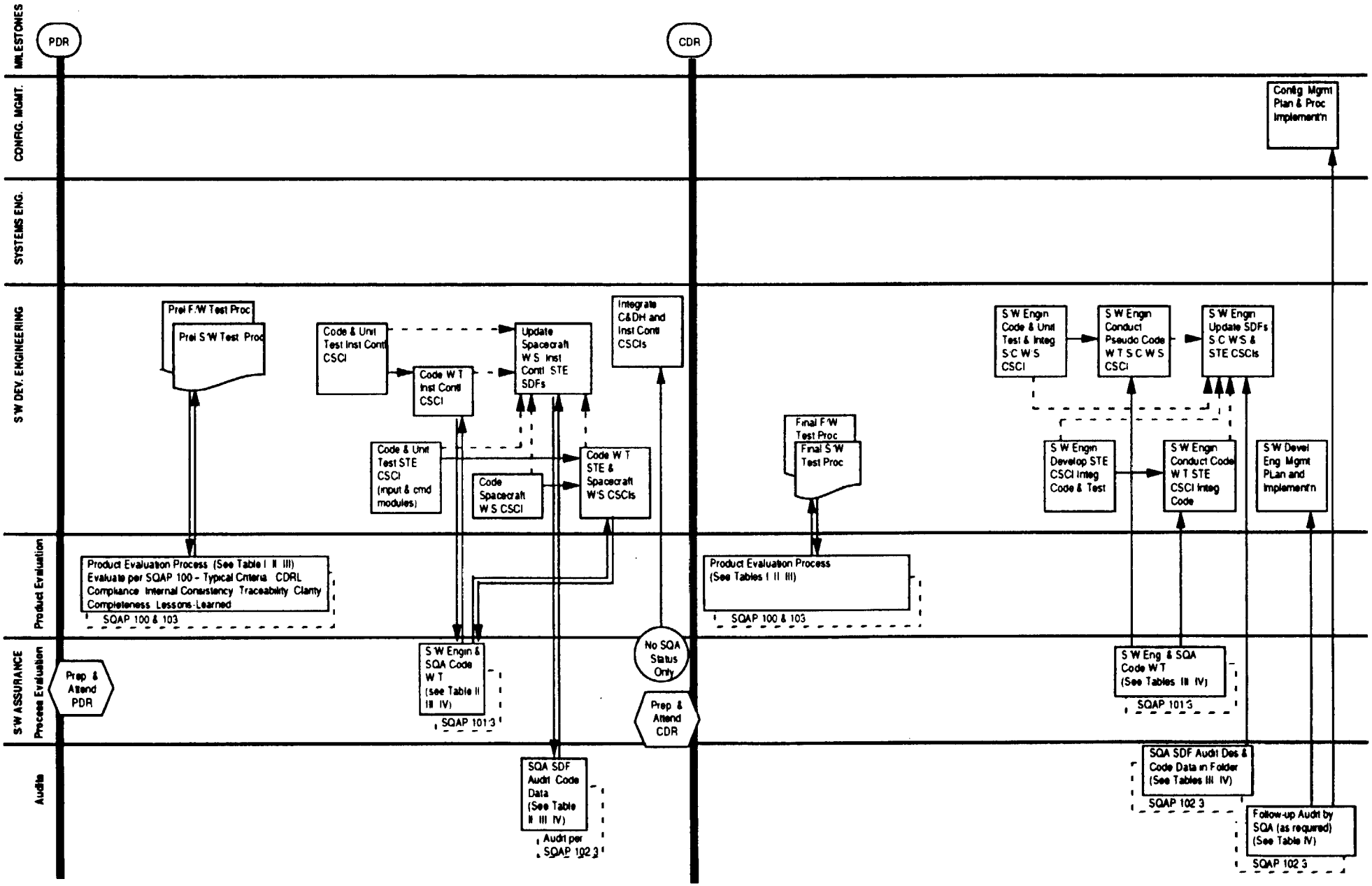
SOFTWARE ASSURANCE FLOW DIAGRAM (Part 1)



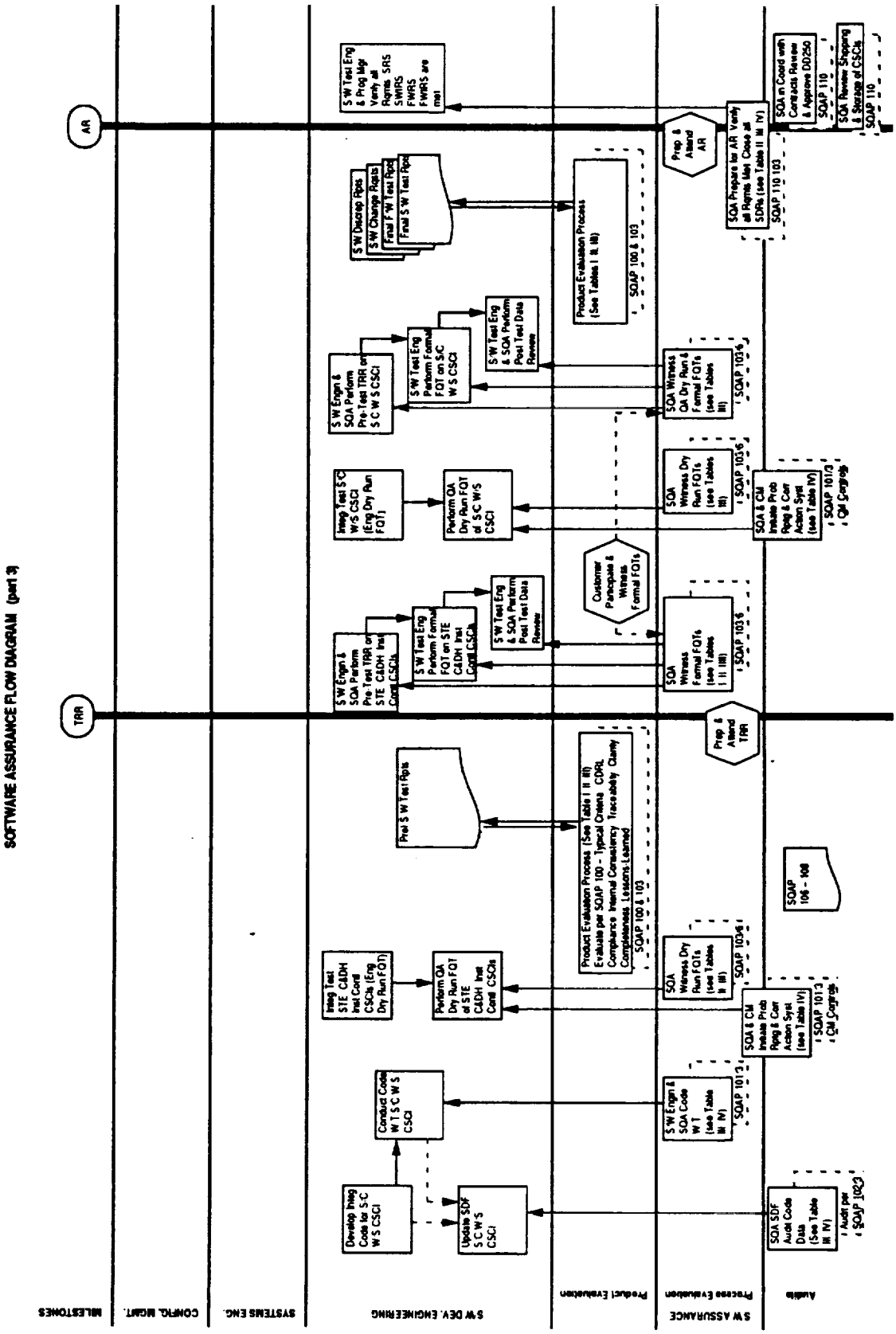
894-3417M


SOFTWARE ASSURANCE FLOW DIAGRAM (part 2)
MILESTONES
CONFIG. MGMT.
SYSTEMS ENG.
S/W DEV. ENGINEERING
Product Evaluation
S/W ASSURANCE
Process Evaluation
Audits
PDR
CDR
Config Mgmt Plan & Proc Implementn
S/W Devel Eng Mgmt Plan and Implementn
Follow-up Audit by SQA (as required) (See Table IV)
SOAP 102.5
S/W Engrn Update SDFs S/C/W/S & STE CSCIs
S/W Engrn Conduct Code W/T STE CSCI Integ
SOA SDF Audit Doc & Code Data in Folder (See Tables III IV)
SOAP 102.3
S/W Engrn Conduct Pseudo Code W/T/S/C/W/S CSCI
S/W Eng & SQA Code W/T (See Tables III IV)
SOAP 101.5
S/W Engrn Code & Unit Test & Integ S/C/W/S CSCI
S/W Engrn Develop STE CSCI Integ Code & Test
Final F/W Test Proc
Final S/W Test Proc
Product Evaluation Process (See Tables I II III)
SOAP 100 & 103
Integrate C&DH and Inst Comp CSCIs
No SQA Status Only
Prep & Attend CDR
Code W/T STE & Spacecraft W/S CSCIs
Update Spacecraft W/S Inst Comp STE SDFs
SQA SDF Audit Code Data (See Table III IV)
Audit per SOAP 102.3
Code Spacecraft W/S CSCI
Code W/T Inst Comp CSCI
S/W Engrn & SQA Code W/T (See Table III IV)
SOAP 101.3
Code & Unit Test STE CSCI (input & cmd modules)
Code & Unit Test Inst Comp CSCI
Prel F/W Test Proc
Prel S/W Test Proc
Product Evaluation Process (See Tables I II III) Evaluate per SQAP 100 - Typical Criteria: CDRL Compliance, Internal Consistency, Traceability, Clarity Completeness, Lessons Learned
SOAP 100 & 103
Prep & Attend PDR
894-3427M

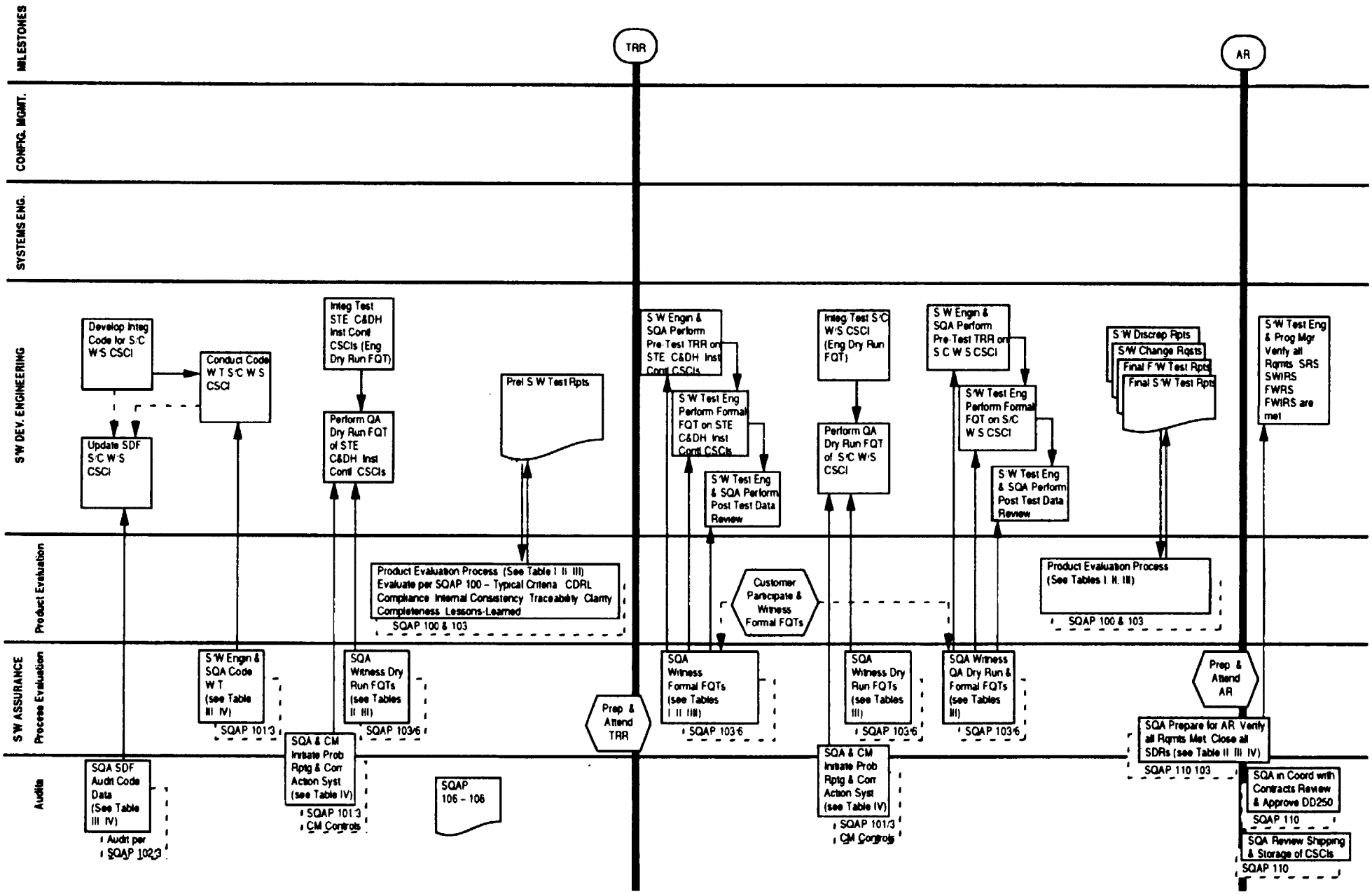
SOFTWARE ASSURANCE FLOW DIAGRAM (part 2)



894-3427M


SOFTWARE ASSURANCE FLOW DIAGRAM (part 3)
MILESTONES
CONFIG. MGMT.
SYSTEMS ENG.
S/W DEV. ENGINEERING
Product Evaluation
S/W ASSURANCE
Audits
AR
TRR
Develop Integ Code for S/C W/S CSCI
Update SDF S/C W/S CSCI
Conduct Code W/T S/C W/S CSCI
Integ Test STE CADH Inst Contr CSCIs (Eng Dry Run FOT)
Perform QA Dry Run FOT at STE CADH Inst Contr CSCIs
Prod S/W Test Rpts
Product Evaluation Process (See Table I II III) Evaluate per SOAP 100 - Typical Criteria: CDRL Compliance, Internal Consistency, Traceability, Clarity, Completeness, Lessons Learned
SOAP 100 & 103
S/W Engrg & SOA Perform Pre-Test TRR on STE CADH Inst Contr CSCIs
S/W Test Eng Perform Formal FOT on STE CADH Inst Contr CSCIs
S/W Test Eng & SOA Perform Post Test Data Review
Integ Test S/C W/S CSCI (Eng Dry Run FOT)
Perform QA Dry Run FOT of S/C W/S CSCI
S/W Engrg & SOA Perform Pre-Test TRR on S/C W/S CSCI
S/W Test Eng Perform Formal FOT on S/C W/S CSCI
S/W Test Eng & SOA Perform Post Test Data Review
S/W Develop Rpts
S/W Change Rpts
Final F/W Test Rpts
Final S/W Test Rpts
Product Evaluation Process (See Tables I II III)
SOAP 100 & 103
S/W Test Eng & Prog Mgr Verify all Rqmts, SRS, SWIRS, FWIRS are met
Prep & Attend TRR
Customer Participate & Witness Formal FOTs
Prep & Attend AR
SOA Witness Formal FOTs (see Tables I, II, III)
SOAP 1036
SOA Witness Dry Run FOTs (see Tables III)
SOAP 1036
SOA Witness QA Dry Run & Formal FOTs (see Tables III)
SOAP 1036
SOA Witness Dry Run FOTs (see Tables II, III)
SOAP 1036
S/W Engrg & SOA Code W/T (see Table III IV)
SOAP 1013
SOA & CM Initiate Prob Rptg & Corr Action Syst (see Table IV)
SOAP 1013
CM Congrats
SOA & CM Initiate Prob Rptg & Corr Action Syst (see Table IV)
SOAP 1013
CM Congrats
SOA SDF Audit Code Data (See Table III IV)
Audit per SOAP 1023
SOAP 106 - 108
SOA Prepare for AR Verify all Rqmts Met Close all SDRs (see Table II III IV)
SOAP 110 103
SOA to Coord with Contracts Review & Approve DD250
SOAP 110
SOA Review Shipping & Storage of CSCIs
SOAP 110
894-3428M

SOFTWARE ASSURANCE FLOW DIAGRAM (part 3)



894-3428M

Appendix C

This Appendix is a cross reference matrix to show the relation of this plan to the Performance Assurance Requirements 420-05-01 Document Section 10.0.

Cross Reference Matrix

Oar Sec. 10 420-05 01 Rqmt. Para.	Requirement	Aerojet SAP Para.	Comments
10.1	GENERAL REQUIREMENTS	1.2, 1.3	
10.1a	Brief Description of the Software	1.2	
10.1b	Management Organization, Structure and Responsibilities	1.3	
10.1c	Software Development and Control Process	1.2, 1.3, 3.1	Also see Tables I, II, III, IV, A-I, A-II, A-III, and A-IV
10.1d	Software Design and Implementation Process	3.1, 3.2	Also see Table II, II, and IV
10.1c	General Assurance Process for Software Development	3.1, 4.0, 5.0	There is no special management or assurance practices. (see Tables I through IV, and A-I through A-IV.)
10.1.1	DOCUMENTATION	3.1, 4.0	See Table I
10.2	VERIFICATION AND VALIDATION	4.0, 4.1, 4.2	
10.2.1	SOFTWARE TEST PLAN	3.1, 3.3, 4.1	See Table I
10.2.2	SOFTWARE TEST PROCEDURES	3.1, 3.3, 4.1	See Table I
10.2.3	SOFTWARE TEST REPORTS	4.1, 4.3	See Table I
10.2.4	SOFTWARE WALK-THROUGHS OR INSPECTIONS	3.1, 3.2, 4.1, 5.1, 5.2	See Tables I through IV
10.2.5	SOFTWARE REVIEWS	3.1	
10.2.5a	REQUIREMENTS REVIEW	3.1, 4.1	See Tables II, III, IV
10.2.5b	PRELIMINARY DESIGN REVIEW	3.1, 3.2, 4.1, 5.2	See Tables II, III, IV
10.2.5c	CRITICAL DESIGN REVIEW	3.1, 3.2, 4.1, 5.2	See Tables II, III, IV
10.2.5d	ADDRESS AT REVIEWS ANY SAFETY ISSUES	6.0	
10.2.5.e	ADDRESS AT REVIEW SECURITY ISSUES/CONCERNS	7.0	
10.3	SOFTWARE QUALITY ASSURANCE Title Only	N/A	
10.3.1	STANDARDS	4.1	See Table IV
10.3.2	ASSURANCE FUNCTION	3.1, 4.1, 4.2	See Tables I through IV and A-I through A-IV
10.4	SOFTWARE CONFIGURATION MANAGEMENT Title Only	N/A	
10.4a	Identification of CSCI and Baseline Control	3.1, 3.3, 4.2	See Table IV
10.4b	Change Classification and Impact Process	3.1, 4.2	See Table IV
10.4c	CCB Process	3.1, 4.2	See Table IV
10.4d	Version Control and Media Labeling Methods	3.1, 4.2	See Table IV
10.4e	A Media Control Process	3.1, 4.2	See Table IV
10.5	SOFTWARE NONCONFORMANCE REPORTING AND CORRECTIVE ACTION PROCESS	4.,1, 4.2, 4.3, 4.4	See Table IV

REPORT DOCUMENTATION PAGE

Form Approved
OMB No. 0704-0188

1. AGENCY USE ONLY (*Leave blank*)	2. REPORT DATE	3. REPORT TYPE AND DATES COVERED
	November 1993	Final 1 February 1994 - 28 February 1994

4. TITLE AND SUBTITLE
Earth Observing System/Advanced Microwave Sounding Unit-A (EOS/AMSU-A), Software Assurance Plan

5. FUNDING NUMBERS
NAS 5-32314

6. AUTHOR(S)
Robert Schwantje/Claude Smith

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES)
Aerojet
1100 W. Hollyvale
Azusa, CA 91702

8. PERFORMING ORGANIZATION REPORT NUMBER
CDRL 309
10428A
August 1994

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) — **10. Type of Report and Period Covered**
Final

12. Sponsoring Agency Name and Address
NASA
Goddard Space Flight Center
Greenbelt, Maryland 20771

14. Sponsoring Agency Code

15. Supplementary Notes
- - -

16. ABSTRACT (*Maximum 200 words*)

This document defines the responsibilities of Software Quality Assurance (SQA) for the development of the flight software installed in EOS/AMSU-A instruments, and the ground support software used in the test and integration of the EOS/AMSU-A instruments.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
EOS Microwave System	Unclassified --- Unlimited

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of pages	22. Price
Unclassified	Unclassified	51	- - -

NASA FORM 1626 OCT 86

PREPARATION OF THE REPORT DOCUMENTATION PAGE

The last page of a report facing the third cover is the Report Documentation Page, RDP. Information presented on this page is used in announcing and cataloging reports as well as preparing the cover and title page. Thus, it is important that the information be correct. Instructions for filing in each block of the form are as follows:

Block 1. Report No. NASA report series number, if preassigned.

Block 2. Government Accession No. Leave blank.

Block 3. Recipient's Catalog No. Reserved for use by each report recipient.

Block 4. Title and Subtitle. Typed in caps and lower case with dash or period separating subtitle from title.

Block 5. Report Date. Approximate month and year the report will be published.

Block 6. Performing Organization Code. Leave blank.

Block 7. Authors. Provide full names exactly as they are to appear on the title page. If applicable, the word editor should follow a name.

Block 8. Performing Organization Report No. NASA installation report control number and, if desired, the non-NASA performing organization report control number.

Block 9. Performing Organization Name and Address. Provide affiliation (NASA program office, NASA installation, or contractor name) of authors.

Block 10. Work Unit No. Provide Research and Technology Objectives and Plants (RTOP) number.

Block 11. Contract or Grant No. Provide when applicable.

Block 12. Sponsoring Agency Name and Address. National Aeronautics and Space Administration, Washington, D.C. 20546-0001. If contractor report, add NASA installation or HQ program office.

Block 13. Type of Report and Period Covered. NASA formal report series; for Contractor Report also list type (interim, final) and period covered when applicable.

Block 14. Sponsoring Agency Code. Leave blank.

Block 15. Supplementary Notes. Information not included elsewhere: affiliation of authors if additional space is required for Block 9, notice of work sponsored by another agency, monitor of contract, information about supplements (file, data tapes, etc.) meeting site and date for presented papers, journal to which an article has been submitted, note of a report made from a thesis, appendix by author other than shown in Block 7.

Block 16. Abstract. The abstract should be informative rather than descriptive and should state the objectives of the investigation, the methods employed (e.g., simulation, experiment, or remote sensing), the results obtained, and the conclusions reached.

Block 17. Key Words. Identifying words or phrases to be used in cataloging the report.

Block 18. Distribution Statement. Indicate whether report is available to public or not. If not to be controlled, use "Unclassified-Unlimited." If controlled availability is required, list the category approved on the Document Availability Authorization Form (see NHB 2200.2, Form FF427). Also specify subject category (see "Table of Contents" in a current issue of STAR) in which report is to be distributed.

Block 19. Security Classification (of the report). Self-explanatory.

Block 20. Security Classification (of this page). Self-explanatory.

Block 21. No. of Pages. Count front matter pages beginning with iii, text pages including internal blank pages, and the RDP, but not the title page or the back of the title page.

Block 22. Price Code. If Block 18 shows "Unclassified-Unlimited," provide the NTIS price code (see "NTIS Price Schedules" in a current issue of STAR) and at the bottom of the form add either "For sale by the National Technical Information Service, Springfield, VA 22161-2171" or "For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402-0001," whichever is appropriate.