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Report 10339
Final
20 June 1994

GENCORP
AEROJET

39

Earth Observing System/
Advanced Microwave Sounding Unit-A
EOS/AMSU-A
Software Management Plan

Contract No: NAS 5-32314
CDRL: 008

Submitted to:

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

Submitted by:

Aerojet
1100 West Hollyvale Street
Azusa, California 91702

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Aerojet
1100 Hollyvale Avenue
Azusa, CA 91702

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This document defines the responsibilities for the management of the life-cycle development of the flight software installed in the AMSU-A instruments, and the ground support software used in the test and integration of the AMSU-A instruments.

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Earth Observing System Advanced Microwave Sounding Unit-A

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Section 1

INTRODUCTION

1.1 Identification

This is the *Software Management Plan* for the software to be used in the Earth Observing System (EOS) Advanced Microwave Sounding Unit-A (AMSU-A) system. This document is submitted in response to Contract NAS 5-32314 as CDRL 008.

1.2 Scope

This document defines the responsibilities for the management of the life-cycle development of the flight software installed in the AMSU-A instruments, and the ground support software used in the test and integration of the AMSU-A instruments. The ground support software consists of the Computer Software Configuration Item (CSCI) installed in the internal ground support equipment (GSE) used to calibrate the AMSU-A at Aerojet and the CSCI installed in the GSE delivered to the spacecraft integration facility for use in final instrument checkout. The flight software (firmware) consists of the CSCI currently installed in the NOAA/AMSU-A instrument to provide instrument control, data input, and data output functions and the CSCI that will control the EOS-specific Command and Data Handling function. The existing (NOAA/AMSU-A) instrument control CSCI will be modified to interface with the new Command and Data Handling CSCI.

1.3 Purpose and Objectives

The purpose of the *Software Management Plan* is to provide the organization for the management, assurance, and development for all life-cycle phases for the EOS/AMSU-A software.

1.4 Document Status and Schedule

This submittal of the EOS/AMSU-A *Software Management Plan* resolves the comments included in Attachment 1 of NASA letter MSFC 284.4-614, dated May 9, 1994. It will be updated and again resubmitted prior to the Preliminary Design Review (PDR).

1.5 Documentation Organization

The EOS/AMSU-A Software Documentation Tree is as shown in Figure 1. Figure 2 provides the EOS/AMSU-A Software Management Plan Applicability and Pointers.

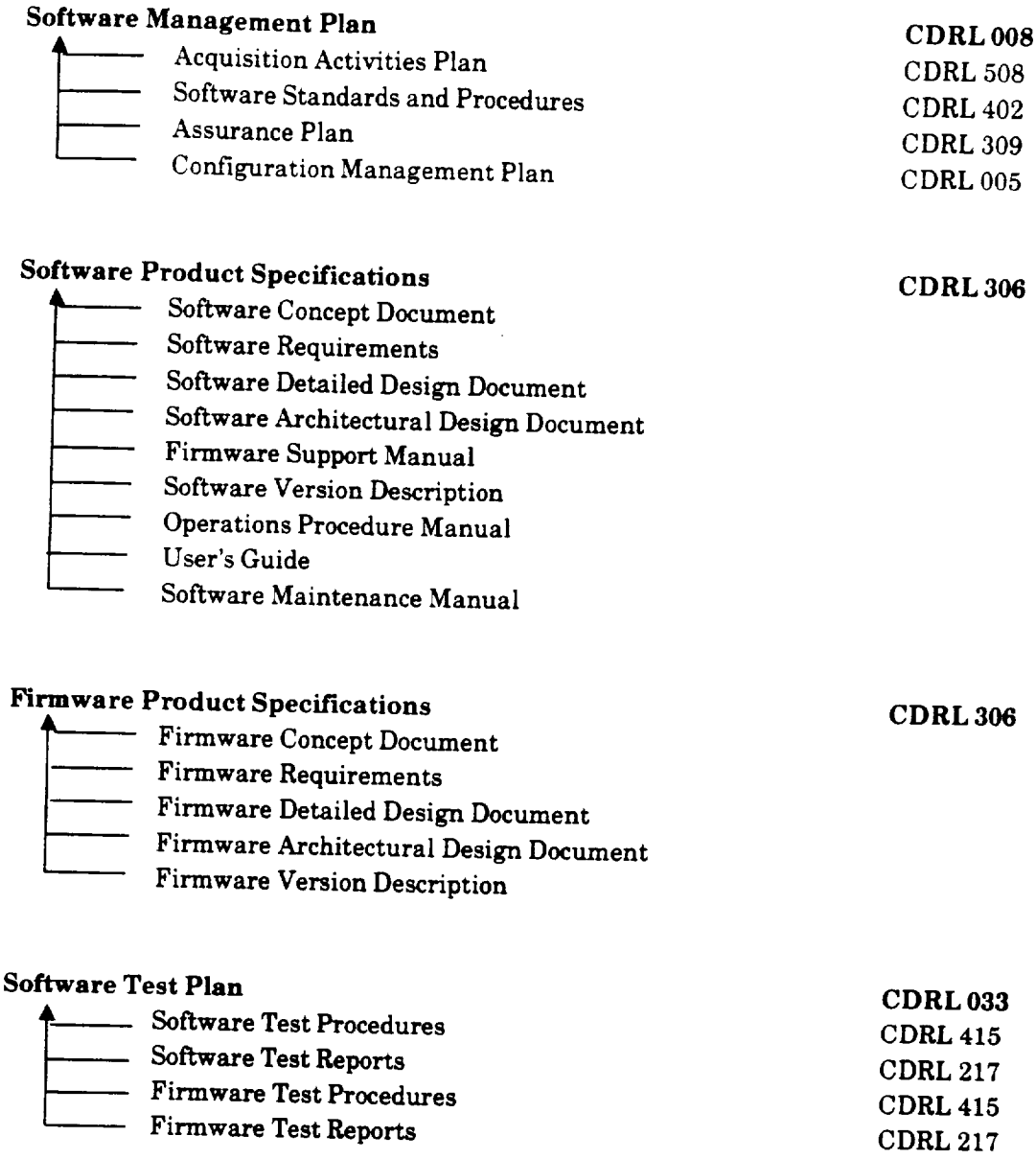


Figure 1 EOS/AMSU-A Software Documentation Tree

	Management Plan Section	Pointer/Applicability	
1.	Introduction	*	
2.	Related Documentation	*	
3.	Purpose and Description	**Pointer	CDRL 306
4.	Resources, Budgets, Schedules, and Orientation	**Pointer **Pointer	CDRL 402 CDRL 003
5.	Acquisition Activities Plan	Pointer	CDRL 508
6.	Development Activities Plan	Pointer	CDRL 402
7.	Sustaining Engineering and Operations Activities Plan	N/A	
8.	Assurance Plan	Pointer	CDRL 309
9.	Risk Management Plan	Pointer	CDRL 402
10.	Configuration Management Plan	Pointer	CDRL 005
11.	Delivery and Operational Transition Plan	*	
12.	Abbreviations and Acronyms	*	
13.	Glossary	*	
14.	Notes	N/A	
15.	Appendix	N/A	

* Fully included within this document

** Some portions marked with pointers.

Figure 2 Software Management Plan Applicability and Pointers

Section 2

RELATED DOCUMENTATION

2.1 Parent Documents

None.

2.2 Applicable Documents

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

Military

MIL-STD-1553	Digital Time Division Command/Response Multiplex Data

National Aeronautics and Space Administration

NASA-DID-M000	Management Plan Data Item Description
GSFC 422-12-12-01	Performance and Operation Specification for the AMSU-A EOS PM Project
GSFC 422-10-04	Earth Observing System (EOS) Instrument Project Software Acquisition Management Plan
GSFC 422-12-12-04	Contract Documentation Requirements List (CDRL) for the Advanced Microwave Sounding Unit-A (AMSU-A)
GSFC 422-11-12-01	General Interface Requirements Document (GIRD)
GSFC422-12-12-02	Unique Instrument Interface Document (UIID) for the Advanced Microwave Sounding Unit (AMSU-A)

Aerojet

Report 9803	Configuration Management Plan (NASA EOS/AMSU-A CDRL 005)
Report 10338	Performance Measurement System (PMS) Implementation Plan (NASA EOS/AMSU-A CDRL 003)

Report 10341	Acquisition Activities Plan (NASA EOS/AMSU-A CDRL 508)
Report 10345	Project Plan (NASA EOS/AMSU-A CDRL 001)
Report 10428	Software Assurance Plan (NASA EOS/AMSU-A CDRL 309)
Standards Manual Volume VI-A	Software Standards and Procedures (NASA EOS/AMSU-A CDRL 402)

(Copies of Aerojet documents may be obtained from Aerojet Electronics Plant, P.O. Box 296, Azusa, CA 91702, ATTN Data Center.)

2.3 Information Documents

None.

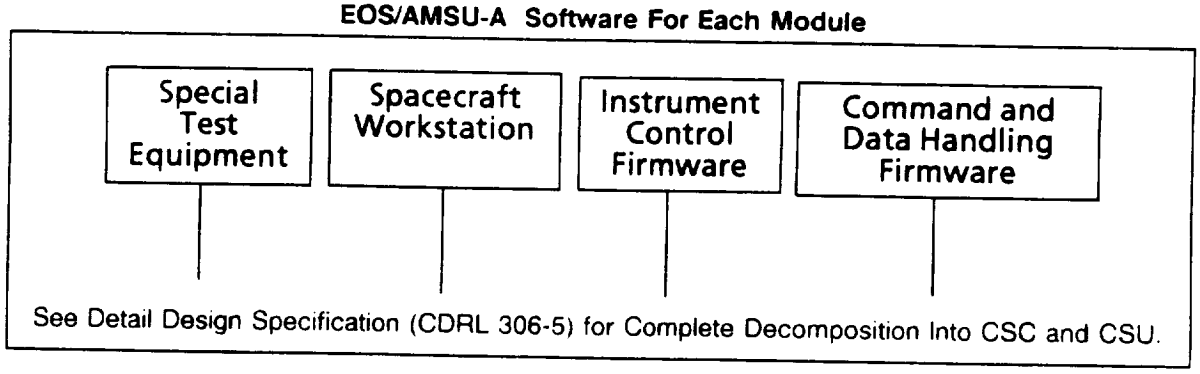
Section 3

PURPOSE AND DESCRIPTION OF THE EOS/AMSU-A SOFTWARE

The EOS/AMSU-A consists of two separate instrument modules: AMSU-A1 and AMSU-A2. The A1 module has 13 radiometric data channels and A2 has two radiometric data channels. The A1 module also has more components and thus, more housekeeping data channels than does the A2 module. For these reasons, separate but similar software CSCI must be produced for each instrument module.

The software being developed for the EOS/AMSU-A program consists of a total of eight CSCI. There are four CSCI for each of the two instrument modules, AMSU-A1 and AMSU-A2; two CSCI are embedded in Programmable Read Only memory (PROM) within the AMSU-A instrument modules, and two CSCI are for use in test and integration ground support equipment. One of the embedded flight software CSCI is a version of the existing AMSU-A flight software modified to accommodate the MIL-STD-1553 interface bus protocol. The other embedded flight software CSCI is the software to operate the MIL-STD-1553 interface itself.

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. The other GSE CSCI is the software written in the OASIS/CSTOL language and programming environment for the purpose of monitoring performance of the EOS/AMSU-A instruments at the spacecraft integration facility.



The CSCI numbers have been identified in the Configuration Management Plan and are as follows:

CSCI Name	CSCI No.
Special Test Equipment, EOS/AMSU-A1	N5
Spacecraft Workstation EOS/AMSU-A1	N6
Instrument Control Firmware, EOS/AMSU-A1	N7
Command and Data Handling Firmware, EOS/AMSU-A1	N8
Special Test Equipment, EOS/AMSU-A2	N9
Spacecraft Workstation EOS/AMSU-A2	N10
Instrument Control Firmware, EOS/AMSU-A2	N11
Command and Data Handling Firmware, EOS/AMSU-A2	N12

Section 4

RESOURCES, BUDGETS, SCHEDULES AND ORGANIZATION

4.1 Business Practices Definition and Revision Process

4.1.1 Definition of Activities

The tasks and activities to be accomplished that are the basis for the budgeting and scheduling functions are the creation of all the Contract Data Requirement List (CDRL) documentation for the flight and ground test software, the modification of the existing AMSU-A control firmware, the creation of a new Command and Data Handling (C&DH) firmware CSCI, the modification of the existing AMSU-A ground support test software, and the creation of an OASIS/CSTOL table population system to monitor AMSU-A performance when integrated into the spacecraft at the spacecraft integration facility. These tasks will all be accomplished by a software team of two people with some assistance from support personnel in the creation of the CDRL documentation. Many sections of this *Management Plan* point to other documents describing the software development process.

4.1.2 Method and Approach

All budgeting and scheduling is performed under the control of the *Performance Measurement System (PMS) Implementation Plan* Report 10338 (CDRL 003).

The EOS/AMSU-A project will utilize product teams to produce the AMSU-A products. The software will be developed under the control of the Software Product Team Leader who will have the responsibility of monitoring the schedule progress and costs on a weekly basis and will assure that the software development will be accomplished on schedule and within budget.

4.1.3 Reporting, Monitoring, and Revision

All reports to be used for monitoring and controlling the software development activities that are the subject of this plan are described in Aerojet's *Software Standards and Procedures Manual*, document TBD (CDRL 402).

4.2 Work Breakdown Structure (WBS)

4.2.1 Activity Definition

Figures 3 and 4 are detailed WBS breakdowns of the software related activities tied to the EOS/AMSU-A project WBS by WBS number.

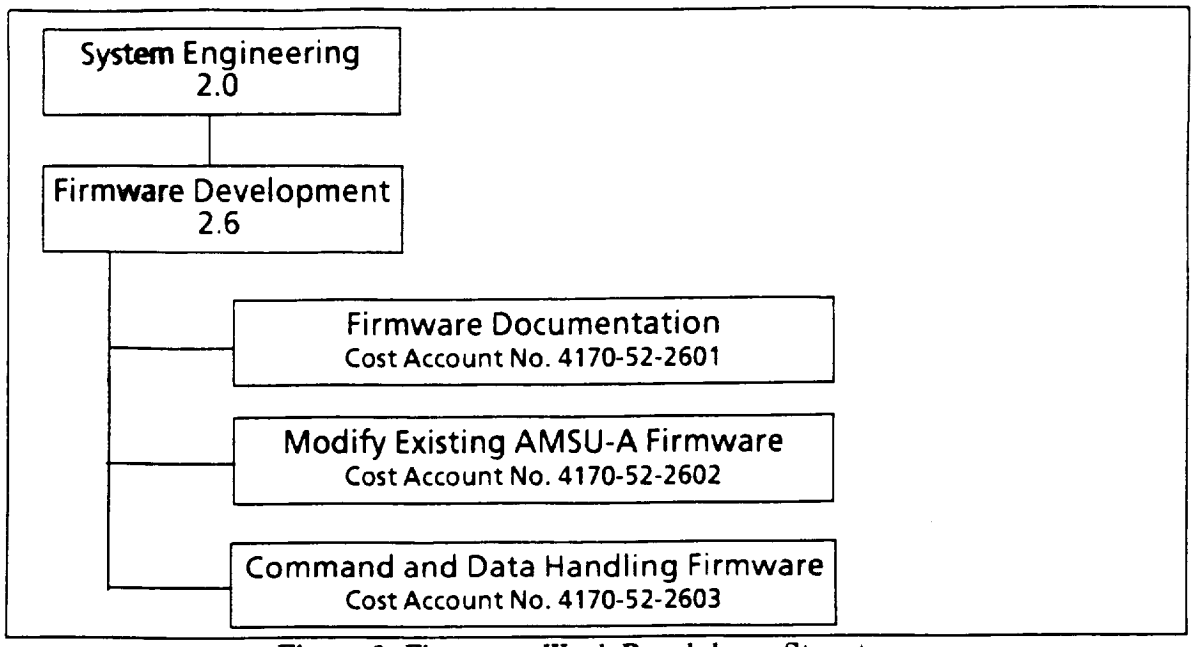


Figure 3 Firmware Work Breakdown Structure

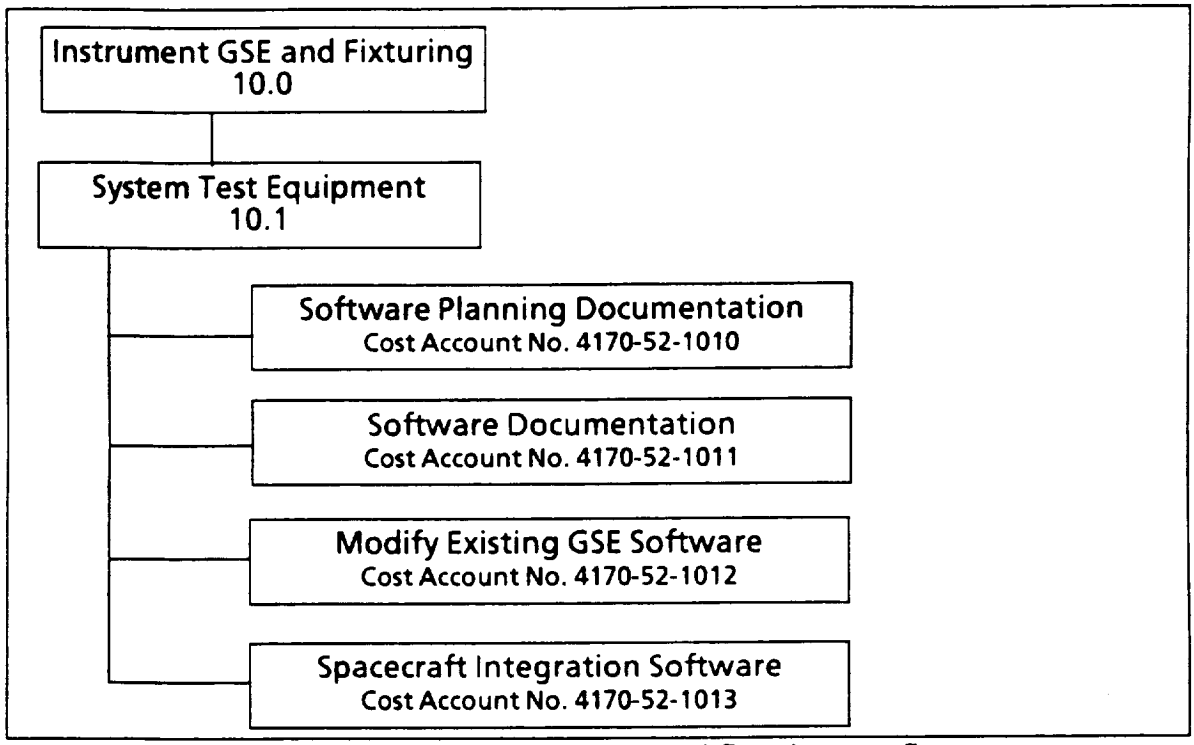


Figure 4 Software Work Breakdown and Cost Account Structure

4.2.2 Cost Account Definition

The Cost Accounts established for the EOS/AMSU-A software are shown on the WBS breakdowns in Figures 3 and 4. The specific cost accounting methods are described in the *PMS Implementation Plan*, report 10338 (CDRL 003)..

4.3 Resource Estimation and Allocation to WBS

4.3.1 Schedules

Figure 5 is the master schedule for all software related activities. Figures 6A through 6E are ARTEMIS detailed schedules showing the time frames for all software-related activities, scheduled to completion. CSCI N5 and N9 are developed concurrently as shown on schedule Figure 6B. CSCI N6 and N10 are developed concurrently as shown on schedule Figure 6A. CSCI N7 and N11 are developed concurrently as shown on schedule Figure 6E, lines 15 through 20. CSCI N8 and N12 are developed concurrently as shown on schedule Figure 6E, lines 10 through 14. The documentation schedule for the CSCI N5, N6, N9, and N10 is shown on Figure 6C. The documentation schedule for the CSCI N7, N8, N11, and N12 is shown on Figure 6E, lines 1 through 9. The software development for the Command and Data Handling firmware, CSCI N8 and N12, will utilize a rapid prototype approach during the time frame shown on schedule Figure 6E lines 10 through 14. The integration of this firmware will be done together with CSCI N7 and N11 as shown on line 20 of Figure 6E.

4.3.2 Funds and Budgets

The funding and budgeting for the software tasks are described in detail in the *Project Funding Plan* and summarized in Table I. Aerojet has developed a computer program to estimate software project costs.

The tool 'PC COCOMO' estimates software project costs based on the COnstructive COst MOdel developed by Barry Boehm at TRW and described in detail in his book Software Engineering Economics (Prentice-Hall, 1981). The tool estimates the required manpower, cost, and schedule for a given software project. The tool uses project size and a number of additional development parameters as the basis of estimate. PC COCOMO project data bases contain proprietary Aerojet-specific project cost models. PC COCOMO is the only tool approved for use in making software project manpower, cost, and schedule estimates at Aerojet and was used for the EOS/AMSU-A software cost estimate.

4.3.3 Organization

Figures 7, 8, 9 are Aerojet organization charts showing the relationship of the functions involved in the development of the EOS/AMSU-A software. The EOS/AMSU-A organization, Figure 7, shows the Program Management/Support Team in the upper shaded box, and the Integrated Product Development Team in the lower shaded box.

The Program Management Team roles are to: 1) provide overall management and direction to the program, 2) provide the primary communication channel with the customer, and 3) provide resources and support to the Product Teams to accomplish the "real work" (i.e., provision of a technically compliant EOS/AMSU-A, on-schedule and in-budget).

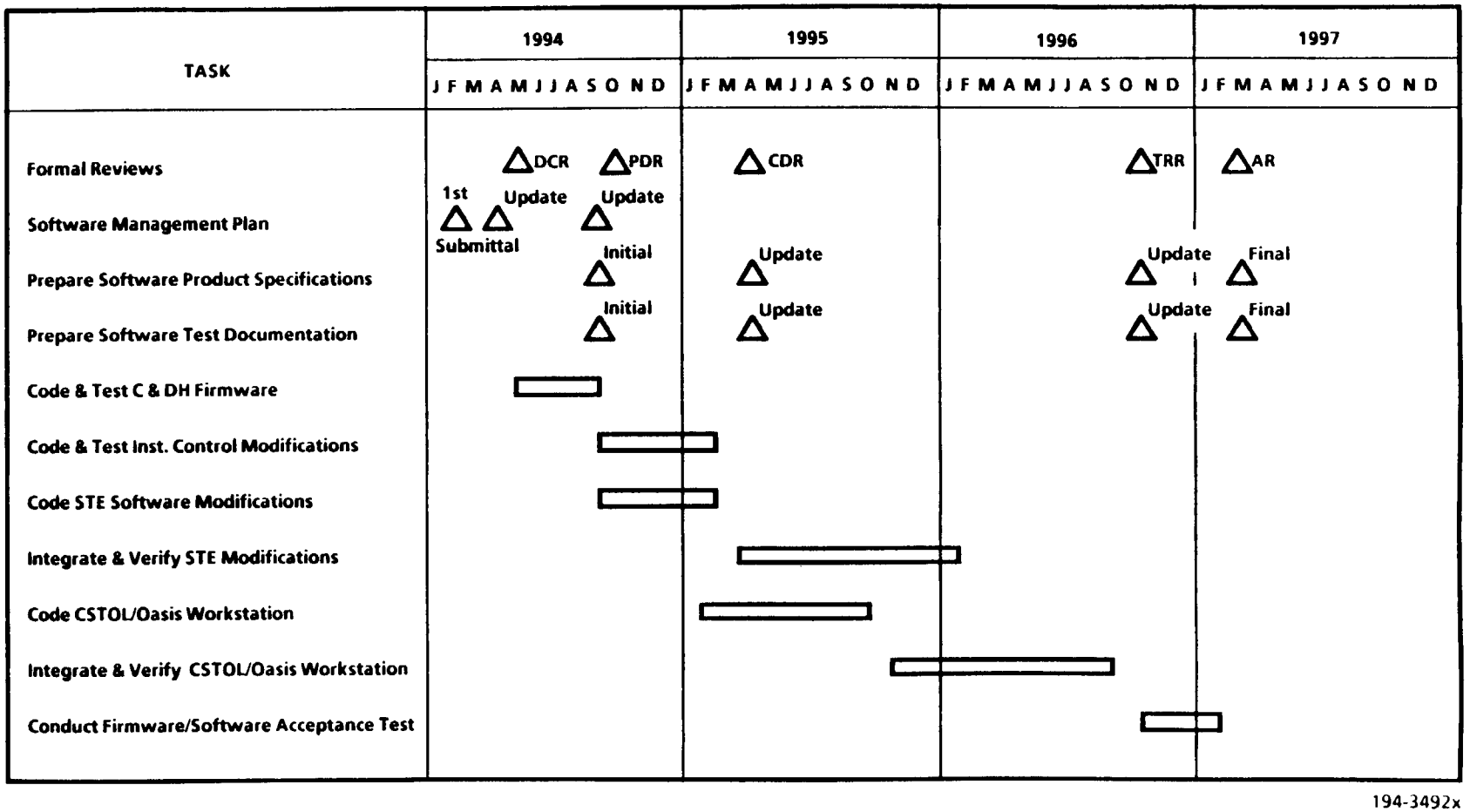


Figure 5 Master Program Schedule

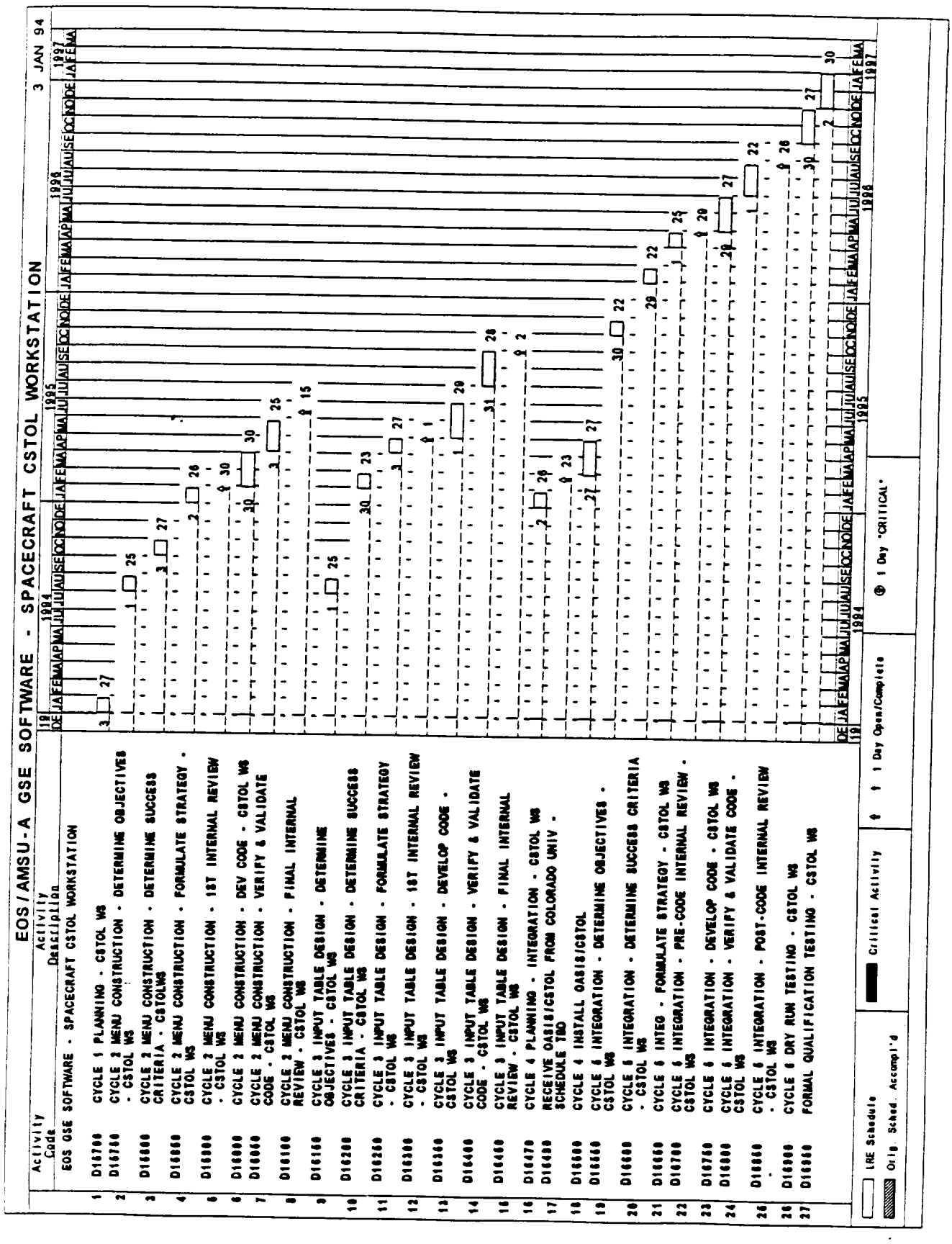


Figure 6A ARTEMIS Schedule

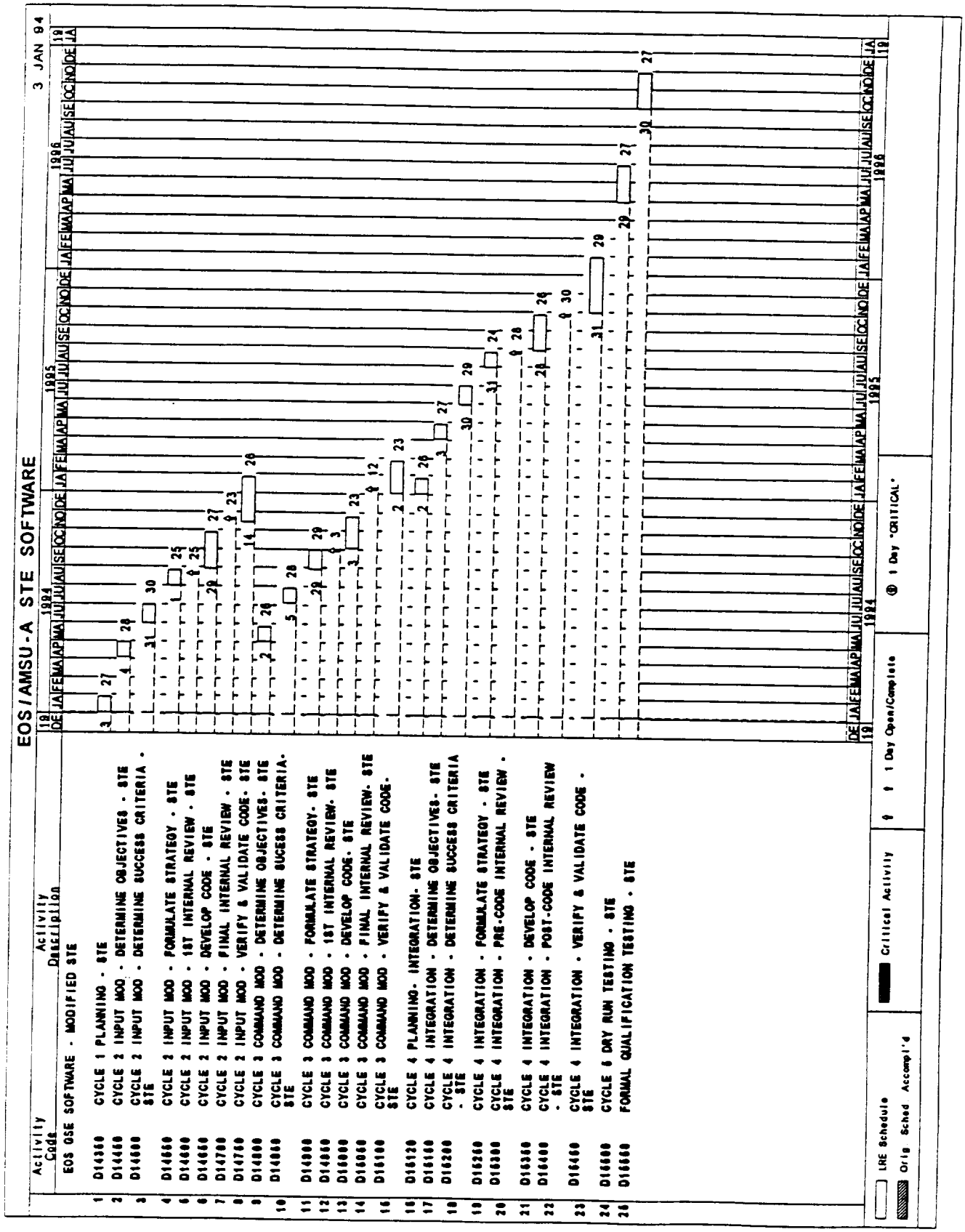


Figure 6B ARTEMIS Schedule

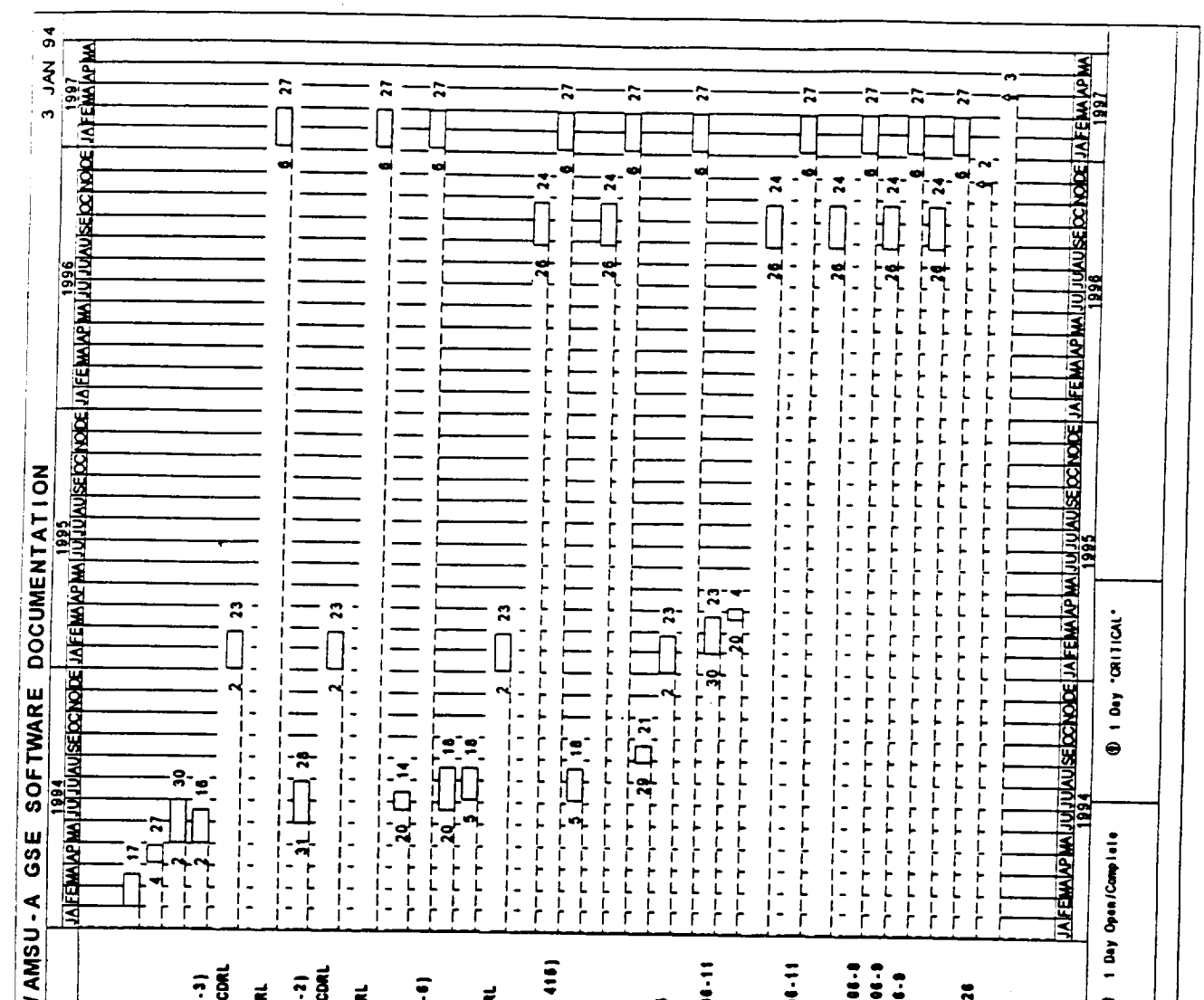


Figure 6C ARTEMIS Schedule

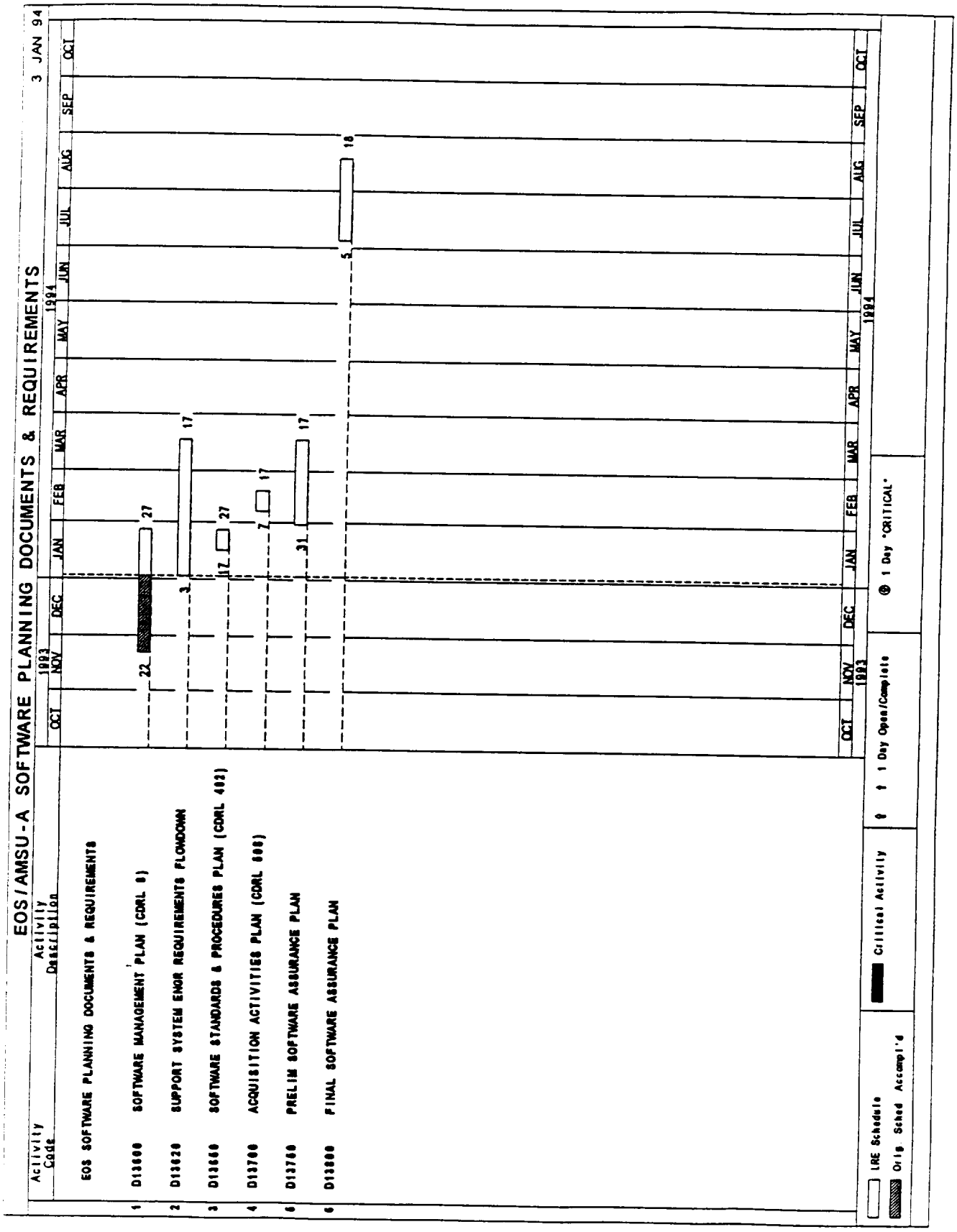


Figure 6D ARTEMIS Schedule

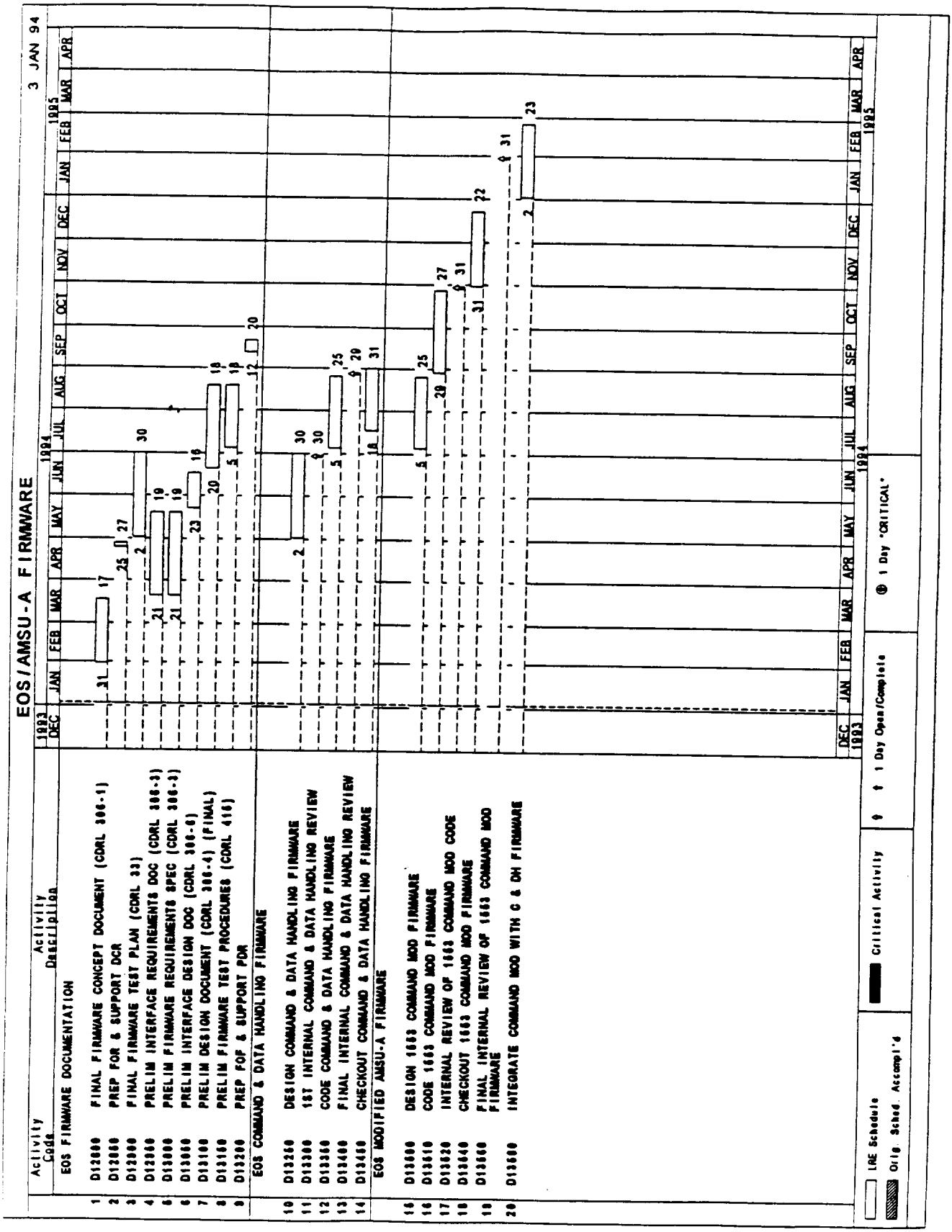


Figure 6E ARTEMIS Schedule

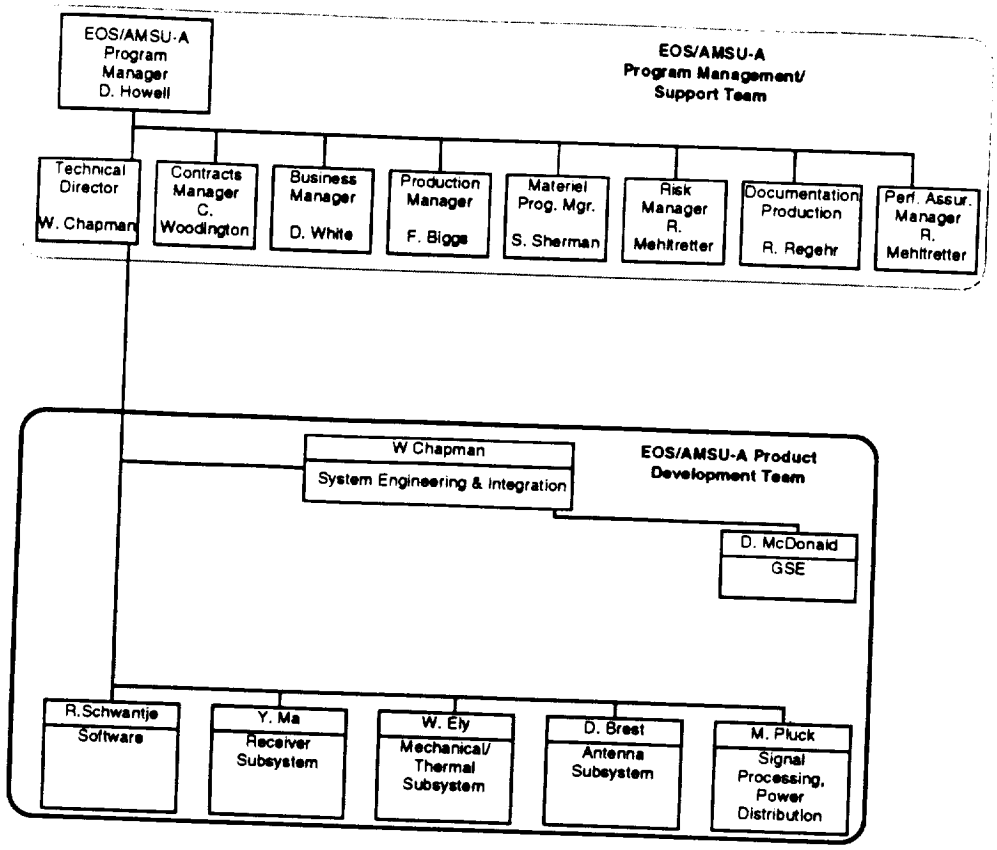


Figure 7 EOS/AMSU-A Integrated Product Team Organization

Table I Software Funding Summary

Firmware Task	Man Hours
Documentation	1180
Modify Existing Firmware	290
Create Command and Data Handling Firmware	360
Software Task	
Planning Documentation	510
Software Documentation	2460
Modify Existing STE Software	1160
Create CSTOL/OASIS Software	960
Software Management	400

The Program Manager has the primary responsibility for conduct of the program. The Program Manager and the Technical Director work in concert to accomplish the program objectives.

The lower shaded block on Figure 7 is the Product Development Team (PDT). This is the core organization for EOS/AMSU-A. The PDT is made up of six Product Teams (PT). The Systems Engineering and Integration PT is shown near the top of the shaded box to indicate that the products of the five subsystem PT flow up to the SE&I PT for integration, and the final product is delivered by the SE&I PT. The software PT shown in the lower-left corner is responsible for both the EOS/AMSU-A firmware and software.

Figure 8 is an Aerojet organization chart showing the position of the EOS software functions within both the EOS/AMSU-A project and the company. *Software Test* is an organization independent of software development, and *Quality Assurance* is an organization responsible for conducting formal software acceptance testing and is completely independent of all engineering and production. *Configuration Management* is an organization within engineering responsible for all configuration management, including software, and will operate in accordance with Configuration Management (CM) Plan. Within the *Software Development Organization*, R.S. Schwantje is the Project Team Leader (PTL) for the development of the EOS/AMSU-A software and firmware and will be supported by others within the *Software Development* organization.

The flowdown and allocation of customer specifications (and all other requirements) through subsystem specifications, is as shown in Figure 9. The SE&I PT initially allocates all NASA requirements to the Individual PT. These allocations are reviewed and any required modifications are negotiated between the subsystem PT and the SE&I PT. Once the subsystem specification is mutually accepted, it becomes the development requirement of the subsystem PT.

The SE&I PT controls software requirements allocations through the software segments of the Signal Processing Subsystem Specification (for mission firmware) and the Ground Support Equipment Specification (for GSE software). This ensures that the Software PT is fully servicing the two PT that they support, while maintaining a high level of visibility and documentation quality.

4.3.4 Equipment

	Deliverable Status
HP-64000-UX Development System (for 8085)	Aerojet Capital/nondeliverable
AMSU-A STE	Deliverable
New SUN SPARC 10	Deliverable
C&DH Breadboard	Deliverable
AMSU-A CPU & Memory Circuit Boards	Deliverable
PC Computer Configured as a MIL-STD-1553 Bus Analyzer	PC - Deliverable Bus Analyzer Card & Software Capital/non-Deliverable

4.3.5 Materials, Facilities, and Other Resources

TBS

4.3.6 Management Reserves

Not applicable to this contract.

4.4 Work Authorization

The work authorization process for the EOS/AMSU-A program is described in the *Project Plan* Report 10345 (CDRL 001).

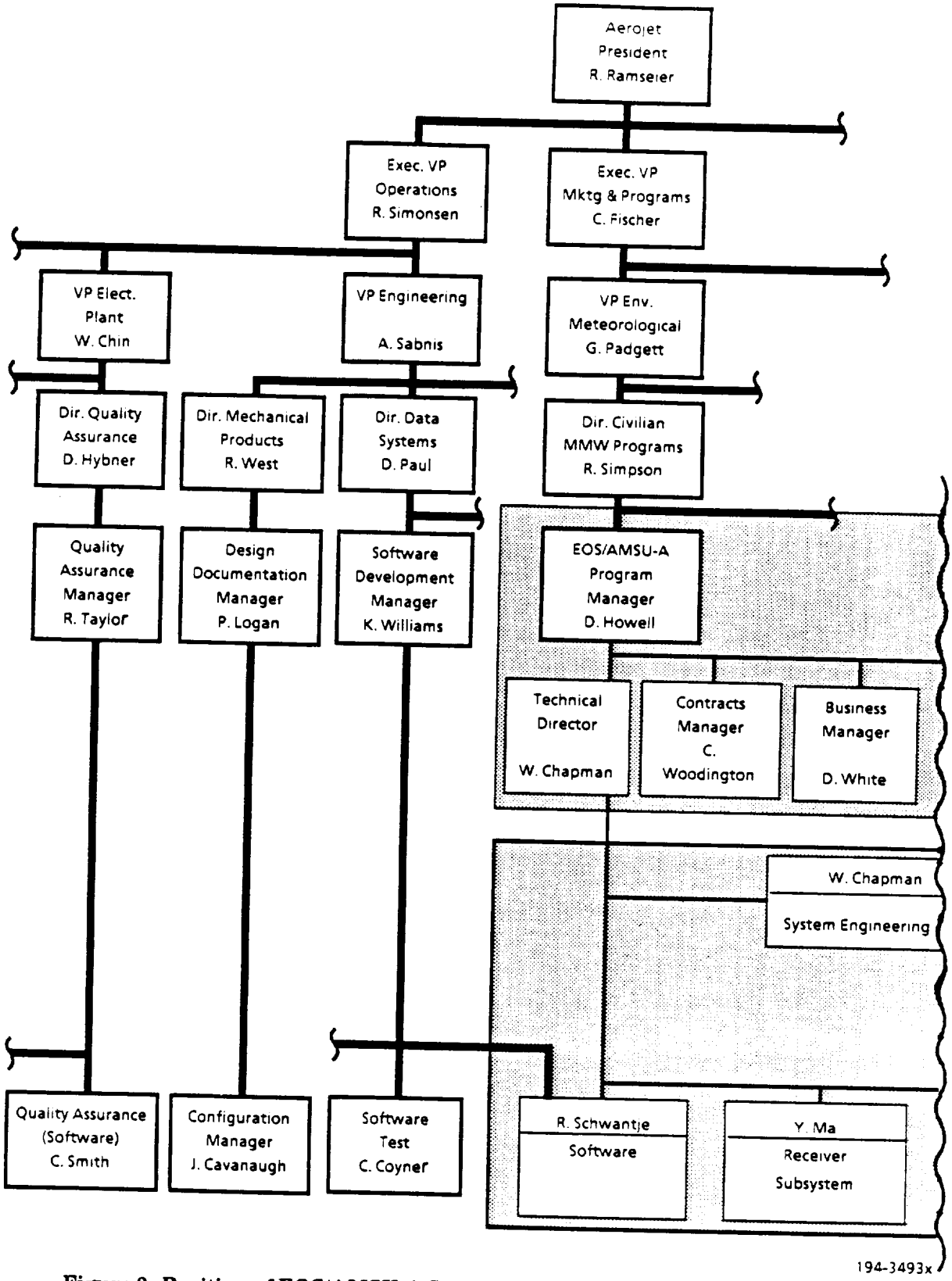


Figure 8 Position of EOS/AMSU-A Software within Aerojet Organization

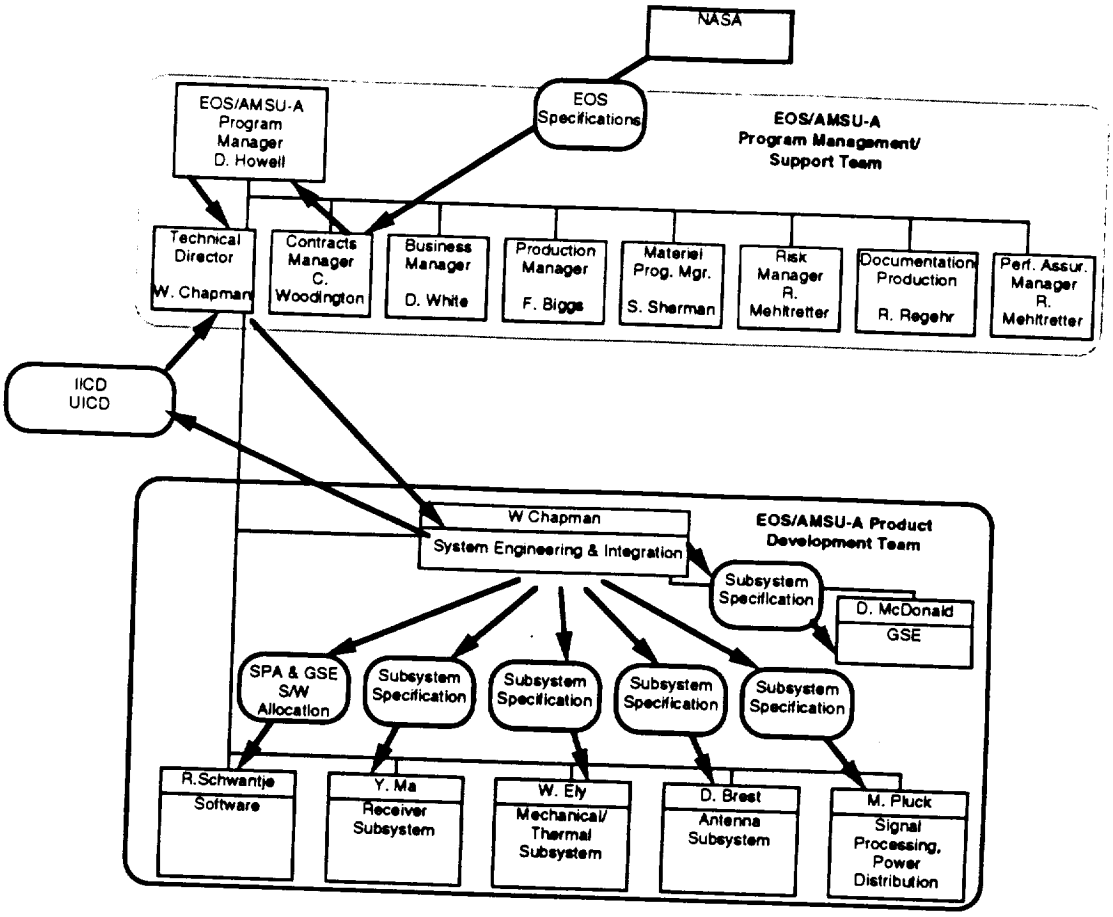


Figure 9 Flowdown of Requirements Drives Product Development

Section 5

ACQUISITION ACTIVITIES PLAN

The *Acquisition Activities Plan* is submitted as a separate document, Report 10341 as CDRL Item 508. Submittal of this plan is due 60 days after start of the Implementation Phase (3 March 1994).

Section 6

DEVELOPMENT ACTIVITIES PLAN

The software will be developed in accordance with Aerojet *Standards and Procedures Manual*, Volume IV, submitted 30 January 1994 as CDRL 402. Aerojet is in the process of revising this manual and will release it in two parts as shown in the following schedule.

Document Title	Probable Release Date
Aerojet Software Development Process Manual	(Released)
Aerojet Software Development Standards and Procedures Manual	5 August 1994

The new manuals will incorporate the Evolutionary Spiral Process management model for software development which will be used for EOS/AMSU-A software development. These new manuals are to serve as guides to the software development process and shall encompass all customer requirements for documentation. In so doing, no duplication of documentation is required if the appropriate development process is followed and the customer documentation is an adequate representation of what is described in the Software Development Process Manual. In the case of the EOS/AMSU-A program, the only products to be produced in addition to the customer CDRL documents will be the Estimate of the Situation and Cycle Plan, as described in 6.2, and Software Development Folders which shall consist of notebooks in which items such as requirements, notes, and code walk-through results shall be filed. Certain elements of development activity that are EOS program-specific are as described below.

6.1 Methodology and Approach

The software/firmware task for EOS/AMSU-A involves the modification of existing code and the writing of new code to delete the existing AMSU-A interface bus, to add the new MIL-STD-1553 interface, and to populate OASIS/CSTOL tables for the spacecraft integration computer. The approach to the software development for EOS/AMSU-A will be to fully understand how the selected MIL-STD-1553 hardware functions to then develop the firmware and software to incorporate the hardware interface requirements, and finally to integrate these routines into the existing AMSU-A programs. This task is anticipated to use the same personnel who designed and developed the existing programs and who designed and developed several previous MIL-STD-1553 systems.

The software development will utilize a top-down-structured programming approach and will include rapid prototyping of input/output (I/O) functions for the MIL-STD-1553 interface. The Command and Data Handling firmware will be coded and then will utilize a breadboard hardware system on which to integrate and test the I/O functions before Preliminary Design Review (PDR). The GSE software will also follow this early prototyping of I/O processes to prove the validity of the initial design concepts. The Evolutionary Spiral Process Software Management tool provides the means for

continuous assessment and timely development of the software in accordance with the overall program plan.

The software support environment utilized in the Aerojet STE software development was procured for the NOAA/AMSU-A project and will be used without change for the EOS/AMSU-A software development. It consists of the VAX/VMS Version 4.4 operating system and a Fortran V compiler. This support environment is installed on the STE system disk, and will be delivered with the STE hardware when such delivery is scheduled. No complete set of documentation for this environment was ever purchased. It is now out of date and unavailable from the computer manufacturer. The software support environment for the workstation to be used at the spacecraft contractor facility will consist of a SUN Solaris Version 2.3 (or later) operating system, a "C" compiler, TAE+, MOTIF, and OASIS-CC/CSTOL. This support environment is a deliverable. The workstation software will be written utilizing the OASIS-CC/CSTOL programming environment with any necessary subprograms written in the "C" language. The Aerojet STE software was written in Fortran and all modifications will also be written in Fortran. The firmware embedded in Programmable Read Only Memory (PROM) devices within the instrument consists of an existing program written in assembler language which will be modified using the same assembler language and a new Command and Data Handling program utilizing the same microprocessor hardware as the existing firmware and will be programmed in the same assembler language. The development environment for this firmware is an HP8400-UX development system which is Aerojet property and will not be deliverable.

The criticality level and software type of each of the CSCI included in the EOS/AMSU-A project are as follows:

CSCI No.	Name	Level and Type
N5	Special Test Equipment EOS/AMSU-A1	Mission Support - Heritage Software
N6	Spacecraft Workstation EOS/AMSU-A1	Mission Support - Developed Software
N7	Instrument Control Firmware EOS/AMSU-A1	Mission/Science Critical - Heritage Software
N8	C&DH Firmware EOS/AMSU-A1	Mission/Science Critical - Developed Software
N9	Special Test Equipment EOS/AMSU-A2	Mission Support - Heritage Software
N10	Spacecraft Workstation EOS/AMSU-A2	Mission Support - Developed Software
N11	Instrument Control Firmware EOS/AMSU-A2	Mission/Science Critical - Heritage Software
N12	C&DH Firmware EOS/AMSU-A2	Mission/Science Critical - Developed Software

Each of these CSCI will be developed in an identical manner in accordance with Aerojet's Process, Standards of Procedures Manuals (CDRL 402) and will be audited by Quality Assurance in accordance with the Quality Assurance Plan (CDRL 309) and tested in accordance with the Test Plan (CDRL 033).

The following software waivers have been approved and are incorporated into the Unique Instrument Interface Document for the AMSU-A (UIID), GSFC 422-12-12-02.

GIRD Paragraph	GIRD Requirement	Waiver
8.2	Flight firmware shall be Ada, FORTRAN, or C language	Assembly language will be used
8.3.3	Flight firmware should be on-orbit updatable	Flight firmware is not on-orbital updatable
8.1	ESTOL to be used for instrument test procedures	CSTOL is required for software that interfaces with the spacecraft and associated STE but not all instrument test software

6.2 Products and Reports

As an output of the Evolutionary Spiral Process, an Estimate of the Situation and Cycle Plan are prepared and periodically updated to provide the means to track the software development process for each CSCI and for the total EOS/AMSU-A software project. The appendix to this Software Management Plan will contain copies of the estimate of the situation and cycle plans as they are developed in the course of the program. All CDRL documentation will also be prepared and submitted as shown on the schedules in Figures 6A through 6E. After final submittal of this Software Management Plan at PDR, the updated Estimate of the Situation and Cycle Plan will be submitted as part of the Monthly Report of Work, CDRL 529.

Beginning with the initiation of the software coding phase of software development, the following set of software metrics will be submitted also as part of the Monthly Report of Work, CDRL 529.

1) Predicted and completed delivered source instructions.
2) Number of modules completed.
3) Number and status of Discrepancy Reports. (Non-Conformance reports).
4) Number and status of Change Requests.
5) Predicted and actual staff hours for software development.
6) Number of errors discovered during integration testing.
7) Number of errors discovered during acceptance testing.

6.3 Formal Reviews

A formal in-house review will be conducted after design and prior to coding each major element of software/firmware, and after checkout of each major element prior to its integration into the full CSCI. The review will be presented by the developer and reviewed by persons from the software development department with experience in similar systems, together with the persons responsible for the hardware development and an EOS/AMSU-A Systems Engineering representative. The results of these reviews, including specific action items, will be documented and directed to the software developer. All action items will become part of the Program Management Action Item System, and therefore *tracked* to resolution.

In addition to the in-house reviews, a formal Design Concept Review (DCR), Preliminary Design Review (PDR), Critical Design Review (CDR), Test Readiness Review (TRR), and Acceptance Review (AR) will be held at the dates shown on the schedules (Figures 5 and 6).

6.4 Interface Control Plan

The General Interface Requirements Document (GIRD) identifies the external interface to the workstation (CSTOL/OASIS) software as via a local area network (for example, ETHERNET) and the external interface to the EOS/AMSU-A flight firmware as a CCSDS compliant MIL-STD-1553B interface. This also implies the same type MIL-STD-1553B interface within the Aerojet GSE special test equipment.

The firmware Requirements Document and Architectural Design Document, together with the Software Requirements Document and Architectural Design Document (part of CDRL 306), will define, in detail, these internal interfaces and interface control.

6.5 Training for Development Personnel Planning

Since the same personnel who developed the existing programs will be utilized in the EOS/AMSU-A program, no program specific training of Development Personnel is planned.

Section 7

SUSTAINING ENGINEERING AND OPERATIONS ACTIVITIES PLAN

This plan is not applicable to the EOS/AMSU-A software and has been deleted from the Contract Data Requirements List.

Section 8

ASSURANCE PLAN

The *Software Assurance Plan* is the subject of a separate submittal as Report 10428, (CDRL 309) and was submittal at the DCR (April 1994).

Section 9

RISK MANAGEMENT PLAN

Risk Management is an inherent part of the Evolutionary Spiral Process used at Aerojet for software development. The risk assessment and new management techniques to be utilized for the EOS/AMSU-A software project will be as described in the new Aerojet Software Standards and Procedures Manual.

The software risk assessments will be integrated in the overall program Risk Management System (see Project Plan, CDRL 001, Section 5.2) by the Software Product Team Leader and Program Risk Manager.

Section 10

CONFIGURATION MANAGEMENT PLAN

The *Configuration Management Plan* is the subject of a separate submittal as Report 9803 (CDRL 008).

Section 11

DELIVERY AND OPERATIONAL TRANSITION PLAN

11.1 Support Preparation

All GSE software will be delivered to the spacecraft integrator site already installed and fully tested in the GSE computers. Backup copies of the software on magnetic tape will be shipped under separate cover together with copies of the user and operator manuals. No other support preparation will be required.

The flight firmware will be delivered with the EOS/AMSU-A instruments incorporated in Programmable Read Only Memory (PROM) devices soldered to their circuit card assemblies. No means exist to change this firmware except to disassemble the instrument, remove the existing PROM devices, solder in new PROM, perform subsystem level environmental testing, install the subsystem in the EOS/AMSU-A instrument, and perform system-level environmental and system tests.

11.2 Delivery and Installation Planning

The operations personnel will have been fully trained and experienced in the use of the GSE hardware and software prior to its delivery to the Spacecraft Integration Facility.

11.3 User Training

It is not anticipated that any spacecraft integrator personnel will operate the Aerojet GSE; thus no user training is planned. The CSTOL procedures for inclusion in the spacecraft GSE will be fully tested during Spacecraft Integration Simulator testing at Aerojet. During this time the Integration and Test personnel accompanying the simulator will be fully trained in the use of the EOS/AMSU-A CSTOL procedures.

Section 12

ABBREVIATIONS AND ACRONYMS

AMSU-A	Advanced Microwave Sounding Unit-A
AR	Acceptance Review
C&DH	Command and Data Handling
CDR	Critical Design Review
CDRL	Contract Data Requirements List
CM	Configuration Management
CPU	Central Processing Unit
CSCI	Computer Software Configuration Item
DCR	Design Concept Review
EOS	Earth Observing System
F/W	firmware
GSE	ground support equipment
GSFC	Goddard Space Flight Center
MIL-STD	Military Standard
NASA	National Aeronautics and Space Administration
PC	Personal Computer
PDR	Preliminary Design Review
PMS	Performance Measurement System
PTL	Product Team Leader
STE	special test equipment
S/W	software
TBD	to be determined
TBS	to be supplied
TRR	Test Readiness Review
WBS	Work Breakdown Structure

Section 13

GLOSSARY

NONE

Section 14

NOTES

NONE.

Section 15

APPENDIX

NONE.

NASA
National Aeronautics and Space Administration

Report Documentation Page

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15. Supplementary Notes

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13. ABSTRACT *(Maximum 200 words)*

This document defines the responsibilities for the management of the life-cycle development of the flight software installed in the AMSU-A instruments, and the ground support software used in the test and integration of the AMSU-A instruments.

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G	-	Grant	TA	-	Task
PE	-	Program Element	WU	-	Work Unit Accession No.

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ERRATA

ATTACHMENT 1
Ref: 284.4-614
Dated: May 9, 19
Contract: NAS5-3231

CHANGED

SMP Section 1.2 Scope

Page 1, Section 1.2

The two GSE CSCIs are listed. It would be helpful to also give a one sentence description of the two Firmware CSCIs.

SMP Section 2.2 Applicable Documents

Page 4, Section 2.2

The document number for the Performance and Operation Specification should be 422-12-12-01, not 422-12-12-0.

Add the AMSU CDRL, document number 422-12-12-04.

Add the General Interface Requirements Document (GIRD), document number 422-11-12-01.

SMP Section 3 Purpose and Description of the EOS/AMSU-A S/W

Page 6, 1st Paragraph

Aerojet should briefly explain the differences (if any) between the AMSU-A1 CSCIs and the AMSU-A2 CSCIs.

SMP Section 4.3.1 Schedules

Page 10, Section 4.3.1

Detailed ARTEMIS schedules are provided for the development of CSCI N6 and the documentation for N5 and N6. Why were the schedules not included for CSCIs N7 and N8? Are CSCIs N9 through N12 developed simultaneously? When will the rapid prototyping of CSCI N8 occur? Although the SWAMP requirement of section 4.2.4.1 does not specify that these schedules must appear in the SMP, Aerojet has implied that they will by including two of them.

SMP Section 4.3.2 Funds and Budgets

Page 10, Section 4.3.2

Table I lists the estimated labor hours for the WBS tasks, but does not discuss the cost and resource estimation techniques as required by SWAMP section 4.2.4.2. Is this discussion covered in the Project Funding Plan?

SMP Section 4.3.4 Equipment

Page 18, Section 4.3.4

Which equipment in this list is capital equipment, and thus not deliverable to the Project?

Page 24, Section 6.1, 3rd Paragraph

Is the software support environment a deliverable, as required in SWAMP section 4.3.2?

SMP Section 6.2 Products and Reports

Page 25, SEction 6.2, 1st Paragraph

There is mention of the Estimate of the Situation and Cycle Plan being an appendix of the SMP, and that it will be periodically updated to provide a means to track the software development process for each CSCI. The final update to the SMP is prior to PDR. What is the avenue for getting updated copies of the applicable appendix after this time?

SMP Section 6.4 Interface Control Plan

Page 26, Section 6.4

The GIRD discusses external interface requirements on the AMSU software and firmware, and should be mentioned in this section.

CHANGED

Section 11 Delivery and Operational Transition Plan

Page 31, Section 11.1

This section should also discuss the delivery of the flight firmware, covering the following issues:

1. What provisions are available to change the flight firmware at any time prior to launch?

Page 31, Section 11.3

2. Some type of training will have to be provided to the spacecraft contractor's I&T team who will be sending commands to, and monitoring telemetry from, the instrument.

Cover Letter

3. Some type of training will have to be provided to the AIRS/AMSU/MHS Science Team who will assume the responsibility of operating the instrument after launch.

The following topics were not found in the SMP. They should be addressed with a paragraph, or pointed to if they reside in another document.

Page 24, Section 6.1, 3rd Paragraph

1. A discussion of the support environments, as required by SWAMP section 4.1.2.

Page 24, Section 6.1, 3rd Paragraph

2. A discussion of the programming language(s) to be used, as required in SWAMP section 4.1.3.

Page 25, Section 6.2

3. SWAMP section 4.2.5 lists the software metrics to be gathered and reported in Monthly Status Reports. Since Monthly Status Reports are not a specific software deliverable, I would like to see confirmation in the SMP of Aerojet's plans to meet this requirement for the software and firmware.

Page 24, Section 6.1, Table

4. A brief summary of the assignment of a Criticality Level (SWAMP section 4.6.1.1) and Software Type (SWAMP section 4.6.1.2) for the AMSU CSCIs, and how the management methods differ for these different levels and types. Although Aerojet has included the CSCI criticality assignments in their Software Assurance Plan, I believe a brief discussion is warranted in the SMP.

Page 25, Section 6.1, Table

5. The SMP should discuss any existing software Waivers (SWAMP section 4.1.5) which have been approved or are in process at the time of SMP publication.

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