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SYSTRAN CORP DAYTON OH
DIGITAL AVIONICS INFORMATION SYSTEM (DAIS) DOCUMENTATION.(U)
SEP 81 F FORSTER, R GREGORY

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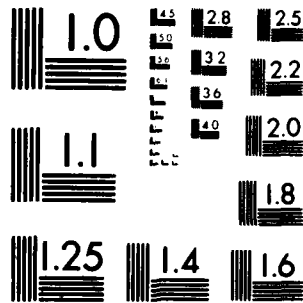
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DIGITAL AVIONICS INFORMATION SYSTEM (DAIS)
DOCUMENTATION



SYSTRAN CORPORATION
4126 Linden Avenue
Dayton, Ohio 45432

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September 1981

FINAL REPORT FOR PERIOD: August 1979 - June 1981

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AIR FORCE WRIGHT AERONAUTICAL LABORATORIES
AIR FORCE SYSTEMS COMMAND
WRIGHT-PATTERSON AIR FORCE BASE, OHIO 45433

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This technical report has been reviewed and is approved for publication.

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4. TITLE (and Subtitle) DIGITAL AVIONICS INFORMATION SYSTEM (DAIS) DOCUMENTATION	5. TYPE OF REPORT & PERIOD COVERED FINAL REPORT 1 AUG 79 - 1 JUNE 81	6. PERFORMING ORG. REPORT NUMBER
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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report covers the work performed by SYSTRAN Corporation in providing Configuration control, technical editing and generation of documentation for the DAIS Program Branch. This effort encompassed the following functions: (1) maintaining the DAIS library, (2) generating certain specifications, plans, drawings and/or test reports, (3) performing configuration audits per MIL-STD-1521, (4) assuring that DAIS documents conformed to MIL-STD-490 and 483, (5) technical editing and		

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configuration control over all DAIS documentation. The DAIS documentation effort was highly successful and could set an example for other R&D programs on how to properly document their efforts in MIL-STD format.

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GLOSSARY

<u>ACRONYM</u>	<u>DEFINITION</u>
AAAS	System Integration Branch
AR	Awaiting Review
AVSAIL	Avionics System Analysis and Integration Laboratory
BMU	Bus Monitor Unit
C&D	Controls and Displays
CCB	Configuration Control Board
CCBD	Configuration Control Board Directive
CDRL	Contract Data Requirements List
CI	Configuration Item
CM	Configuration Management
CMO	Configuration Management Office
CMP	Configuration Management Plan
CPC	Computer Program Components
CPCI	Computer Program Configuration Item
CWBS	Contract Work Breakdown Structure
DAIS	Digital Avionics Information System
DCB	Documentation Control Board
DCN	Document Change Notice
DS/MU	Display Switch/Memory Unit
ECP	Engineering Change Proposal
ICD	Interface Control Drawing/Document
IR	In Review
ITB	Integrated Test Bed
MPDG	Modular Programmable Display Generator
PC	Problem Coordinator
PCA	Physical Configuration Audit
PCB	Product Control Board
PR	Problem Report
PRB	Problem Report Board
PRG	Problem Report Group
PRWG	Problem Report Working Group
PMIU	Program Monitor Interface Unit
SCN	Specification Change Notice
SITC	System Integration and Test Coordination
SSDF	Simulated Subsystem Data Formatter

TCB	Test Control Board
TD	Test Director
TWG	Test Working Group
URT	Universal Remote Terminal
WBS	Work Breakdown Structure

DAIS DOCUMENTATION

1. INTRODUCTION

The Digital Avionics Information System (DAIS) has developed standardized core elements, support hardware and support software. By using these elements as a standardized system the life cycle cost of conventional avionics systems can be reduced. However, a most important aspect of the DAIS program is documentation, because the DAIS specifications, manuals, plans, drawings and test reports permit the dissemination to industry and to other government agencies the knowledge and experience gained from the program. Using MIL-STD 483, Configuration Management Practices for Systems, Equipment, Munitions and Computer Programs and 490, Specification Practices as guidelines, the objective of this effort was to provide configuration control, technical editing and generation of DAIS documentation. The AFWAL/AAAS functional organization established to carry out these tasks is outlined in Figure 1.

Implementation of a configuration management program as an integral part in the development of a system/program provides the means of complete and concise management controls. Each item of hardware, software and supporting data, which initially generates the concepts and criteria in overall system development and deployment, receives full management visibility. Normally, there are three basic elements of configuration management to consider when planning the evolution of a system/program: (1) configuration identification, (2) configuration control, and (3) configuration status accounting. These three elements, applied in a uniform interrelated pattern, assure maximum control of all items within a system through the conceptual, design and development, test, production phases and the subsequent deploy-

AFWAL/AAAS FUNCTIONAL ORGANIZATION

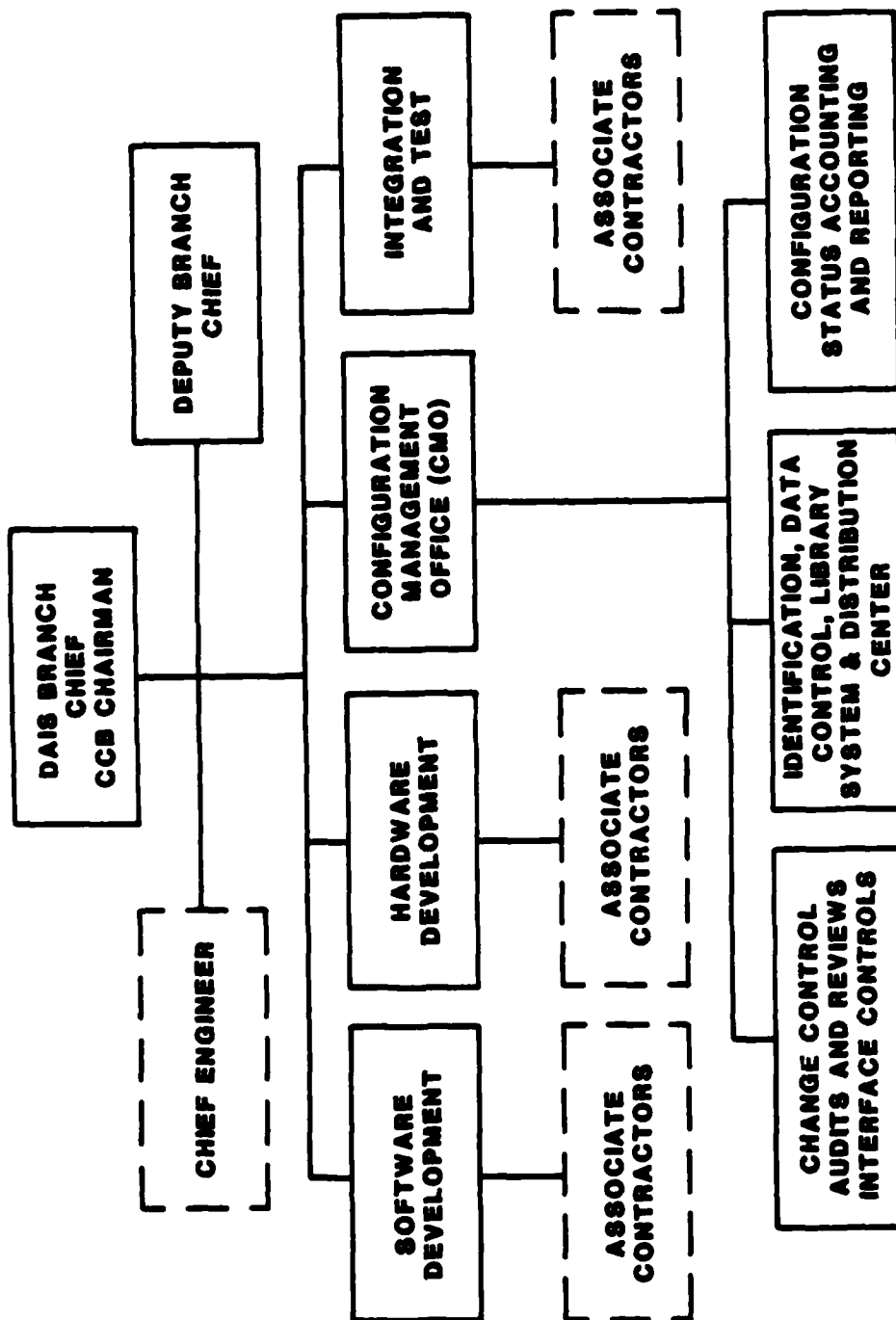


Figure 1. AFWAL/AAAS FUNCTIONAL ORGANIZATION

ment of the system. At all times, a control or management tool is available to assure the high level of confidence which is required and expected. Figure 2 shows the flow and activity required to bring the Digital Avionics Information System (DAIS) Program into phase with the standard program principles of configuration management and individual item(s) controls.

1.1 DAIS Configuration Management Implementation Plan

To obtain control of the DAIS configuration items of hardware and software, two major phases were necessary. The first phase involved documentation and the second related to the hardware and software and their relationship to the documentation.

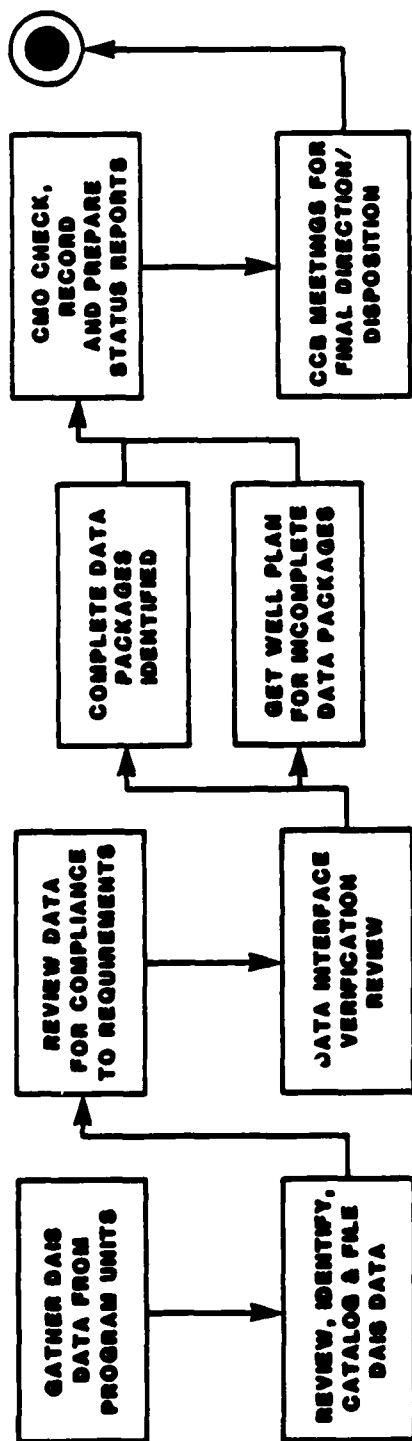
1.1.1 Phase I - Documentation Control

This phase required a continuing effort in gathering, reviewing, cataloging, and filing all DAIS specifications, interface control documents, user's manuals, engineering drawings, and the test plans and procedures. An important feature of this phase was the review which resulted in the development of document status with respect to past, present, and/or scheduled approval.

1.1.2 Phase II - Product Control

All existing items of hardware and software being used for the development of the DAIS program should have undergone an audit (functional and/or physical) to determine if: (1) the hardware met the criteria established in the specifications and was compatible with the associated engineering drawing package; (2) all software had been developed as required by the specifications and was compatible with the associated listing documents; and (3) both hardware/software and data were in direct relationship

PHASE I-DATA CONTROL



PHASE II-PRODUCT CONTROL

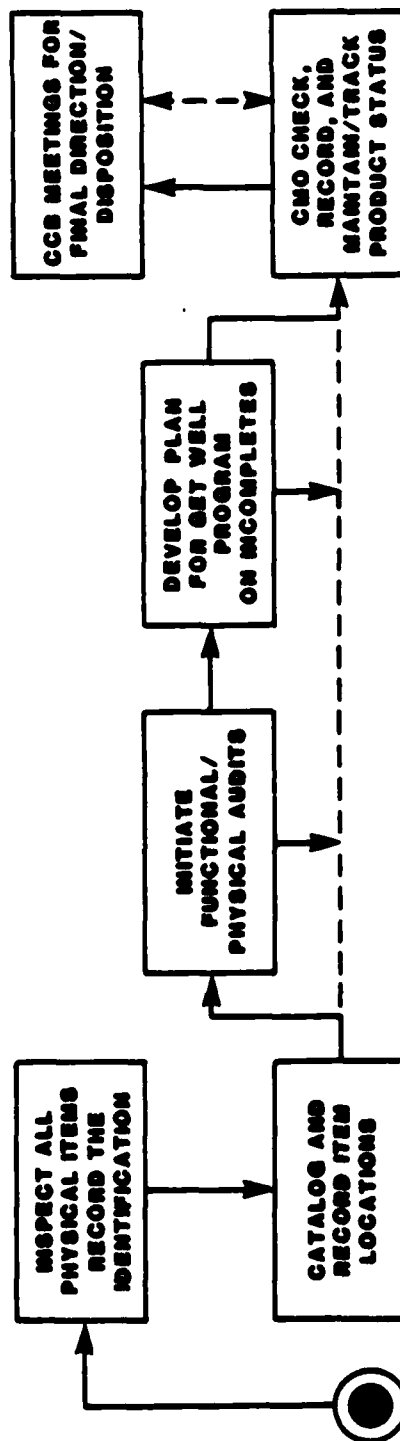


Figure 2. DAIS PROGRAM CONFIGURATION IMPLEMENTATION

to the acceptance test plans and subsequent test reports.

Time and money constraints prevented audits on all of the items. However, of the items audited any and all discrepancies were logged, and directives for corrective actions were issued to correct the inconsistencies.

2. SCOPE

The documentation effort encompassed the following functions:

(1) maintaining the DAIS library; (2) generating certain specifications, plans, drawings and or test reports; (3) performing configuration audits per MIL-STD 1521; (4) Assuring the DAIS documents conformed to MIL-STD 483 and 490; (5) technical editing; (6) maintaining configuration control over all DAIS documents. Table I shows the Work Breakdown Structure (WBS) for work performed on this contract. This report will address the tasks in the sequential order of the WBS by stating the task, how it was approached and what the results of each effort were.

This report will cover the activities of the contractor support of the Configuration Management Office (CMO) for the period of 1 Aug 1979 to 1 June 1981.

Table I

Work Breakdown Structure (WBS)

WBS Levels

1 2 3

DAIS Documentation

Library Maintenance

Printing of DAIS Documents

Distribution of DAIS Documents

Inventory Maintenance

Master File Maintenance

Preparation of Bus Monitor Specification

Drafting Support

Editing

Technical Editing/Rewrite

Format Editing/Proofreading

Audits

Physical Audit of Universal Remote Terminal (URT)

Physical Audit of Modular Programmable Display Generator (MPDG)

Physical Audit of Bus Monitor Unit (BMU)

Software Audit of Simulated Subsystem Data Formatter (SSDF)
Program

DAIS Control Board Support

Copying Support

Program Management

DAIS Information Booklet

3. BACKGROUND

3.1 Past and Present Status

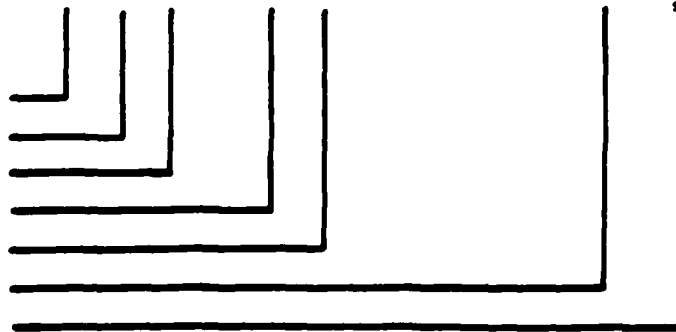
At the start of the contract the DAIS documentation system had 156 specifications, 23 drawings, 29 manuals, 54 plans and 19 test reports for a total of 281 and of these, 113 specifications, 12 drawings, 23 manuals, 26 plans and 8 test reports had been released. A growth of about 40% in the total number of documents was anticipated by 30 Sep 80. This growth and more did take place due to the conversion of the baseline documents to the new MIL-STDs of 1553B Aircraft Internal Time Division Command/Response Multiplex Data Bus, 1589A Jovial J-73, and 1750A Sixteen-Bit Computer Instruction Set Architecture. The total number of documents at 30 April 1981 was 410, comprised of 216 specifications, 24 drawings, 49 manuals, 81 plans, and 40 test reports for a growth of 146%.

3.2 DAIS Document Description Manual

A list of existing and planned DAIS documents is given in MA100100, DAIS Document Description Manual. This document includes a scope statement for each document, an explanation of the DAIS document numbering system (Figure 3), and a breakdown of the different classes of documents. SYSTRAN updated the document to a "C" revision in May of 1980 with an addition of over 80 new documents, to a "D" revision in April of 1981, and to an "E" revision in May of 1981. In excess of 240 MA100100 documents have been distributed to government agencies and civilian contractors who have an interest in the DAIS concept.

DOCUMENT NUMBERING

S A 1 00 1 00 A (EXAMPLE)



NONE - ORIGINAL ISSUE

REVISION STATUS: A = 1ST REVISION

B = 2ND REVISION, ETC.

SPECIFICATION/DRAWING DESIGNATOR WITHIN THE PARTICULAR SUBSYSTEM LEVEL. (TWO DIGITS FROM 00 TO 99).

SPECIFICATION/DRAWING TIER LEVEL

1 - DAIS SYSTEM

2 - FIRST SUBSYSTEM

3 - NEXT SUBTIER, ETC.

SPECIFICATION/DRAWING DESIGNATOR WITHIN A MAJOR AREA. (TWO DIGITS FROM 00 TO 99).

MAJOR SPECIFICATION/DRAWING APPLICATION

0 - DAIS MANAGEMENT SYSTEM DOCUMENTS

1 - DAIS SYSTEM DOCUMENTS

2 - SOFTWARE

3 - MULTIPLEX SYSTEM

4 - PROCESSOR

5 - CONTROLS AND DISPLAYS

6 - FACILITY SUPPORT EQUIPMENT

7 - SENSOR EQUIPMENT

8 - INTERFACE CONTROL DOCUMENTS

9 - (TO BE ASSIGNED AS REQUIRED)

DOCUMENT ORIGINATING AGENCY:

F = PROJECT 2049 (AFDL) H = PROJECT 2051 (AFHRL)

M = PROJECT 2050 (AMRL) A = PROJECT 2052 (AFAL)

DOCUMENT TYPE:

8 = SPECIFICATION

0 = DRAWING

M = MANUAL

P = Plans/Procedures

T = TEST REPORT

* DOCUMENT TYPE DESIGNATION WILL BE EXPANDED AS REQUIRED TO ASSURE PROPER IDENTIFICATION OF ALL DAIS PROGRAM DOCUMENTS WITH EASE OF REFERENCE AND RETRIEVAL OF PARAMOUNT CONCERN.

Figure 3. DAIS DOCUMENT NUMBERING

4. TECHNICAL TASKS

The following technical tasks were called out in the contractual instrument. The paragraphs subsequent to the statement of the technical task will describe how the task was approached, carried out and the results of the effort.

4.1 Library Maintenance (Task 1)

The contractor shall maintain the DAIS library located in Bldg 620, WPAFB. The library will have approximately 180 documents at contract start and estimated total of 250 documents at contract end. However, due to the decision to convert the baseline documents to the new MIL-STDs, the total number of documents at contract end was 410.

4.1.1 Printing of DAIS Documents

The contractor shall arrange to have 1,500,000 pages of approved and draft DAIS documents printed by the Air Force printing office.

4.1.1.1 Printing Request

This task was accomplished by the initiation of DD Form 843, Request for Printing by the librarian. (Figure 4). This form was then approved by the CMO and Branch Chief, routed through Air Force channels for approval before going to the printing office. Normal turn-around time for the printing was ten working days.

The documents were tracked by means of the DAIS Document Distribution Status Report to insure timely return from the printing office. When the document was returned from printing, the Printing Request form was annotated with the return date and filed in the permanent section of the Status book. If a subsequent request was initiated, the original quantity

REQUISITION FOR PRINTING AND BINDING SERVICE		PLANT ☒ APPROPRIATE ☐ NON-APPROPRIATE	DATE	ACTIVITY ORDER NUMBER	PLANT USE ONLY	JOB NUMBER	
VEN: 2750 DARR-2		THRU: (Appropriate Printing Control Authority) AFM/DA-AA		FROM: (Originator Agency and Form to be used & telephone extension) AFM/AAAS R. JONES X54822			
1. TITLE OF PUBLICATION				2. NUMBER AND DATE			
3. PURPOSE, FUNCTION, ORIGINATOR'S OFFICE AND COMMISSIONS ORIGINAL DAIS DOCUMENT MAJOR REVISION TO DAIS DOCUMENT RESUPPLY DAIS LIBRARY							
4. QUANTITY: ☐ COPIES ☐ SETS ☐ BOOKS ☐ PAGES ☐ OTHER (Specify in box 13)				5. SIZE OF PUBLICATION		6. NUMBER OF PAGES	
7. MATERIAL DELIVERY REQUESTED		8. COMPLETE DELIVERY REQUESTED		9. TIME DUE		10. FOLDED TO	
DATE	QUANTITY	DATE	QUANTITY	WIDTH	LENGTH	WIDTH	LENGTH
11. ORIENT (Use box 13 for additional instructions)				12. PAPER STOCK		13. FINISH	
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14. POSITION				15. MATERIAL DESCRIPTION		16. CLASSIFICATION	
NO. PAGES: 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31, 32, 33, 34, 35, 36, 37, 38, 39, 40, 41, 42, 43, 44, 45, 46, 47, 48, 49, 50, 51, 52, 53, 54, 55, 56, 57, 58, 59, 60, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 85, 86, 87, 88, 89, 90, 91, 92, 93, 94, 95, 96, 97, 98, 99, 100 POSITION: LEFT HAND SIDE				HOLD ☐ NO ☐ OTHER TO		UNCLASSIFIED	
17. ADDITIONAL INSTRUCTIONS, DRAWING ATTACHED ☐ YES ☒ NO (Particulars, drawing, attachments, etc.) MARGINS AS PER ORIGINAL 2 STAPLES LEFT HAND SIDE							
18. DISTRIBUTION INSTRUCTIONS (If desired, also include place to be mailed when job is completed) AFM/AAAS R. JONES X54822 BLDG 620 AREA B WPAFB, OHIO				19. APPROPRIATION CHARGEABLE BMO-AV CERTIFICATION THAT THE USE OF MORE THAN ONE COLOR IS IN ACCORDANCE WITH DEPARTMENTAL REGULATIONS. THAT THE ILLUSTRATIONS USED IN THIS PUBLICATION ARE NECESSARY AND RELATE ENTIRELY TO THE PUBLIC SERVICE. THAT THIS WORK IS AUTHORIZED BY REGULATIONS AND IS NECESSARY TO THE CONDUCT OF OFFICIAL BUSINESS			
20. SIGNATURE (Typed Name, if signed and dated) TERRANCE A. BRIM - Chief, System Integration Branch, Avionics Laboratory				21. ACTION BY PRINTING CONTROL AUTHORITY ☐ APPROVED ☐ DISAPPROVED TYPED NAME, SIGNATURE AND DATE			
22. FOR PLANT USE ONLY		23. DATE RECEIVED		24. PRIORITY		25. NUMBER OF COPIES	
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						95. NUMBER OF COPIES	
						96. NUMBER OF COPIES	
						97. NUMBER OF COPIES	
						98. NUMBER OF COPIES	
						99. NUMBER OF COPIES	
						100. NUMBER OF COPIES	

DD FORM 843

U.S. GOVERNMENT PRINTING OFFICE: 1965 - 544445

Figure 4. REQUISITION FOR PRINTING AND BINDING SERVICE

and order date was entered on the file copy of the second request. Through this mechanism it was possible to maintain a complete history of when and how many copies of a particular document were printed.

Documents that required fast turn-around, had a small number of pages, or less than the standard number of copies, were reproduced at the SYSTRAN main office. This provided timely service especially for review team activities which were operated on a short time span. During the contract, 139,321 copies were reproduced at the contractor facility.

4.1.1.2 Printed Documents

The stated goal to have 1,500,000 pages of DAIS documents printed by the Air Force printing office was not attained. This figure was based on historical data which subsequently was proven inaccurate. Also, the standard distribution list for DAIS documents was reduced from twenty three to twelve copies. 6133 copies of documents were printed by the Air Force printing office totaling 608,590 pages.

4.1.2 Distribution of DAIS Documents

The contractor shall distribute approximately 40 copies of 100 DAIS documents (4000 copies) to contractors and other government agencies. This distribution shall be via government postage-free mail. Records of who receives the documents are to be maintained by the contractor.

4.1.2.1 Master Distribution List

A master standard distribution list that was approved by the chief of the DAIS Program Branch was maintained in the Document Distribution Register. (Table II). This list was reviewed and revised periodically to reflect the current desires of the users. As stated above, this list was reduced from twenty three from September 1979 to twelve in

Table II

STANDARD DISTRIBUTION

**AFATL/DLMM, CAPT. R. BUTLER,
EGLIN AFB, FLORIDA 32542**

**ADTC/DLJA, ATTN: JOHN GAVIN,
EGLIN AFB, FLORIDA 32542**

**AFFTC/TEESD, MR. JIM UNDERWOOD,
STOP 239, EDWARDS AFB, CALIFORNIA 93523**

AFWAL/FIGX, CAPT. K. RACE

AFWAL/AAD, W. EDWARDS

ASD/ENAL, E. GANGL

ASD/AER, CAPT. WHITMAN

ASD/XER, T. PIENBOWSKI

AFWAL/AAAS-3, CAPT. DROBOT

AFWAL/AAAS-1, D. SNYDER

SYSTRAN CORP.

INTERMETRICS, A. WOLFE

TRW/SITC, R. MASON

December 1980.

Upon return of the copies from the printer, the standard distribution was made. The information was recorded on the Document Register which included date, number of copies, organization, name and mailing address. (Figure 5). Through this method it was possible to know who had what documents and what the remaining inventory count was at any given time.

4.1.2.2 Distribution of Revisions

Upon receipt of the copies from the printer, the distribution record of the affected document was used as a mailing list. Proper entries were made next to the individual organization to insure that all holders of the baseline document received all updates to that document. Normally extra copies of the revisions were printed to insure complete update in the event the holders of the basic document lost their revision prior to incorporation into their document.

4.1.2.3 Special Requests for Distribution

Request for particular documents were honored and the documents were distributed via government postage-free mail under cover of Transmittal of DAIS Document form letter. If the request was not definitive as to a particular document, then MA100100, DAIS Document Description Manual, was sent to the requestor. Not only does this manual contain a short descriptive summary of what is in each document but it also contained the DAIS Specification Tree and instructions on how to order any of the DAIS Documents.

4.1.2.4 Documents Distributed

This task set a goal of 40 copies of 100 DAIS Documents (4000 copies). During the life of the contract, a total of 5114 copies of over 295 documents were distributed, and at contract end there were 3649

DOCUMENT NUMBER _____

DATE	COPIES	ORGANIZATION	NAME AND ADDRESS	CHANGES			

Figure 5. Document Register

copies of DAIS Documents on hand in the library.

4.1.3 Inventory Maintenance

The contractor shall maintain extra copies of documents in an easily accessible manner in office space to be provided in Building 620 at WPAFB. Additional copies shall be ordered as required to maintain an inventory. File cabinets and bookcases for storage will be provided by the government.

4.1.3.1 Quantity of Copies

An adequate quantity of extra copies was maintained in an easily accessible manner in the library. The distribution register was the prime source of the number of copies that were on hand.

When the number of copies dropped to a one month supply based on previous consumption, a printing re-order was initiated. The responsible engineer was contacted in order to determine if there were any revisions to the document being planned. If there was a revision planned, the minimum number of copies were ordered and if there were no changes planned, then a six month supply was ordered.

During the period of the contract there were 915 copies reordered involving 62 documents.

4.1.4 Master File Maintenance

The contractor shall maintain a master file of documents both released and under review. It was estimated that 200-300 documents would be maintained. However, due to the MIL-STD conversion effort, the total number of documents grew to 410 by 30 April 1981.

4.1.4.1 Master Document File

One of the most important aspects of configuration control is traceability, the single thread that allows tracing the genesis of a CI,

its documentation baselines and all changes that have been made. To accomplish this, the DAIS library established a folder for each document that the Program Branch controlled.

Each folder provided a complete chronological history of the document which was recorded on DAIS Form 78-03, Document for CCB Review (Figure 6). In addition, the folder contained the originating letter, with scope statement, that requested the document be incorporated into the DAIS system (Figure 7); the review team letter recommending approval of the document; (Figure 8) and any other correspondence regarding the history of changes made to the document.

4.1.4.2 Library Files

A filing system was developed using the designated document type identifier for specification, drawings, manuals and program documents. Document type designations were filed alphabetically to aid in expediting retrieval actions. A master list of the documents was maintained in PA000400, DAIS Document Status Plan. (Figure 9). This document was a computer printout that listed all specifications, drawings, manuals, plans and test reports in relation to their draft due dates/release dates, Documentation Control Board review status and responsible engineer and/or contractor.

4.1.4.3 Library Functions

Associated functions of the library filing system included:

a) Receipt and recording of all Configuration Control Board Directives (CCBD) (Figure 10) that related to the data in the file (i.e. revisions or new document approval, recommended or directed actions of agencies or contractors involved with specific documentation).

DOCUMENT FOR CCB REVIEW			
DOCUMENT NO. _____		TYPE _____	
TITLE _____			
RESPONSIBLE ENGINEER _____			
PROJECTED DUE DATE _____		DATE RECEIVED _____	
DATE SUBMITTED TO CMO _____ NO. OF COPIES _____			
RECOMMENDED REVIEW TEAM:			
TEAM LEADER _____			
TEAM MEMBERS _____			
GROUP LEADER'S INITIALS _____		COMMENTS _____	
DATE TO CCB _____		DATE REVIEW TEAM ACTIVATED _____	
INITIAL REVIEW		CCB APPROVAL	
S. _____		S. _____	
A. _____		A. _____	
PRELIMINARY REVIEW		DATE TO PRINTING	
S. _____		_____	
A. _____		DATE RETURNED	
FINAL REVIEW		DATE DISTRIBUTED	
S. _____		_____	
A. _____			
COMMENTS _____			

FORM NO. DAIS 78-03			

Figure 6. DOCUMENT FOR CCB REVIEW

MEMO FOR THE RECORD

SUBJECT: Request for a Document Number

TO: CMO (R. Jones)

1. It is requested that (document title) be placed under DCB control and a number assigned. A tentative number is _____.
(Specify a number only if received from CMO) The responsible engineer for this document is _____ and a draft copy for review will be available during (Month and Year).
2. The scope statement is as follows:

XXXXX
(Responsible Engineer)

Cy to: F. Forster
(Group Leader)

Figure 7. ORIGINATING LETTER WITH SCOPE STATEMENT

MEMO FOR THE RECORD

SUBJECT: (Document Title and Number)

TO: DCB (T. Brim)

1. The DAIS DCB review team has completed its review of the subject document. The following changes were incorporated:

or

This document is being rejected for the following reasons:

- a. (List major changes or reasons for rejection.)
- b.
- c.

2. The review team recommends:

- a. That the subject document be approved or rejected and rewritten, etc.
- b. That the review team be disbanded.

XXXXXX
Team Leader

XXXXXX

XXXXXX

XXXXXX

Cy to: M. O'Connor
D. Snyder
Capt O'Brien
R. Jones
R. Mason
M. Thullen

R. Price
Capt DeSanto
F. Forster
R. Bailey
N. Kopchick

Figure 8. REVIEW TEAM LETTER

DOCUMENT	TITLE	DAIS INCIDENT STATUS PLAN			PAU00400		7-JAN-81		RESPONSIBLE
		TYPE	PRUJ	STATUS	APPROVE	SCN			
SA221309-2	DAIS MISSION S/W EXEC BUS COUNT (1553R, AN/AYK-15A, J73/I)	CS			JUL80				SZADUY/SITC
SA221310-1 T	DAIS MISSION S/W EXEC LOCAL (1553R, AN/AYK-15A, J73)	CS	JAN81						SZADUY
SA221310-2 T	DAIS MISSION S/W EXEC BUS CONTROL (1553R, AN/AYK-15A, J73)	CS	JAN81						SZADUY
SA221310-3 T	DAIS MISSION S/W EXEC STARTUP/LOADUP (1553R, AN/AYK-15A, J73)	CS	DEC80						SZADUY/SITC
SA222200	PALEFAC PROGRAM (1553R, J73/I, AYK-15)	CS			DEC/9				BUHLARUFF
SA222200-1	PALEFAC PRE-PROCESSOR (1553R, AN/AYK-15A, J73/I)	CS			AUG80				SZADUY
SA222200-2 T	PALEFAC (1553R, AN/AYK-15A, J73)	CS	DEC80						SZADUY/SITC
SA222201	PALEFAC PME-PROC COMPUTER PROG COMPONENT (1553R, J73/I, AN/AYK-15)	CS			DEC/9				BUHLARUFF
SA222201-1 T	PALEFAC PME-PROCESSOR (1553R, AN/AYK-15A, J73/I)	CS	NOV80	D					SZADUY/SITC
SA222600 C	MSN RFTA EXEC/PALEFAC AT SOFTWARE (1553R, AN/AYK-15, J73/I)	BS			FEB80				BUHLARUFF/SITC
SA222600 T	MSN RFTA EXEC/PALEFAC AT SOFTWARE (1553R, AYK-15, J73)	CS	MAR81						SZADUY/SITC
SA222600-1	MSN RFTA EXEC/PALEFAC AT SOFTWARE (AYK-15A, 1553R, J73/I)	BS			JUL80				SZADUY
SA222600-2	MSN RFTA EXEC/PALEFAC AT SOFTWARE (AYK-15A, 1553R, J73)	BS	UCT80	IM					SZADUY
SA222701	PME S/W FOR AYK-15A	CS	JAN81						TEMPAS
SA222702	SSOP/URT SOFTWARE (1553R)	CS			JUN80				KEENEH/SITC
SA222800	SYSTEM READINESS TEST (1553R)	CS	DEC80R	AK					KEENEH/SITC
SA222800-1	SYSTEM READINESS TEST (1553R, AYK-15A)	CS	MAR81						KEENEH/SITC

Figure 9. DAIS DOCUMENT STATISTICS PLAN

b) Recorded and incorporated all approved specification change notice packages received. Replaced data with superseding data when approved by the CCB.

c) A master copy of all software components was made, identified and secured. When approved changes were authorized to a software component, the copy was used for implementation of the changes. Subsequent to the necessary functional tests, the new version was entered into the library, reidentified, and a master copy was again made for the secure file.

d) A master file was created and maintained for all ECP/SCNs (Figures 11 & 12) received from agencies or contractors. Numbers for ECP/SCNs were consecutively assigned, beginning with number one and on, for each document. The ECP/SCNs were maintained in separate folders from the time they were received, until final action of the CCB (approval or disapproval). Also included in these folders were all follow-up and implementation directions, such as delivery dates of final SCNs, engineering modification kits or other required information.

e) A deletion/historical file was maintained for all documents deleted from the system and other documents that had an association with the development of DAIS. A master listing of these documents was contained in PA000500, DAIS Deletion/Historical Document List (Figure 13). This printout contained the deleted document number, title and date. The historical documents were assigned sequential code by calendar year of publication.

f) A reference file of DOD Directives, AF Regulations, AFSC Regulations and Pamphlets and Military Standards for use by branch engineering and supporting contractors was maintained. When personal copies of MIL Standards were required, they were ordered from the Engineering Data Support Center

FACILITY/DAIS ENGINEERING CHANGE PROPOSAL ENGINEERING CHANGE PROPOSAL, PAGE 1 DATE PREPARED:		FOR CMO USE ECP NO: _____ DATE LOGGED: _____ INITIALS: _____																					
PROCURING ACTIVITY NO. N/A																							
1. ORIGINATOR NAME AND ADDRESS		2. CLASS OF ECP	3. PRIORITY																				
4. CONFIGURATION INDEX N/A	5. BASELINE AFFECTED ☐ YES ☐ NO	6. OTHER SYS./CONFIG. ITEMS AFFECTED ☐ YES ☐ NO																					
7. DOCUMENTS AFFECTED-TEST PLAN		8. DRAWINGS AFFECTED																					
<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 15%;">DOCUMENT NUMBER</th> <th style="width: 15%;">SCH/DCN</th> </tr> <tr> <td>A. SYSTEM</td> <td></td> </tr> <tr> <td>B. ITEM</td> <td></td> </tr> <tr> <td>C. TEST PLAN</td> <td></td> </tr> </table>		DOCUMENT NUMBER	SCH/DCN	A. SYSTEM		B. ITEM		C. TEST PLAN		<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 40%;">NUMBER</th> <th style="width: 20%;">REV.</th> <th style="width: 40%;">DCN</th> </tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> <tr><td> </td><td> </td><td> </td></tr> </table>		NUMBER	REV.	DCN									
DOCUMENT NUMBER	SCH/DCN																						
A. SYSTEM																							
B. ITEM																							
C. TEST PLAN																							
NUMBER	REV.	DCN																					
9. TITLE OF CHANGE		10. CONTRACT NO. & LINE ITEM																					
11. ORGANIZATIONAL DESIGNATION																							
12. DESCRIPTION OF CHANGE																							
13. NEED FOR CHANGE																							
14. EFFECT ON DELIVERY SCHEDULE																							
15. APPROVAL /DISAPPROVAL																							
A. CLASS I ☐ APPROVAL ☐ RECOMMENDED	B. CLASS II ☐ APPROVED ☐ DISAPPROVED	☐ CONCUR IN CLASSIFICATION OF CHANGE	☐ DO NOT CONCUR CLASSIFICATION OF CHANGE																				
C. GOVERNMENT ACTIVITY		SIGNATURE	DATE																				
EFFECTS ON FUNCTIONAL/ALLOCATED CONFIGURATION IDENTIFICATION																							
16. OTHER SYSTEMS AFFECTED																							
17. OTHER CONTRACTS/ACTIVITIES AFFECTED																							
18. CONFIGURATION ITEMS AFFECTED																							

Figure 11. ENGINEERING CHANGE PROPOSAL

ENGINEERING CHANGE PROPOSAL, PAGE 2		PROCURING ACTIVITY NO. N/A																																																							
ORIGINATOR NAME AND ADDRESS																																																									
19. EFFECTS ON PERFORMANCE ALLOCATIONS AND INTERFACES IN SYSTEM SPECIFICATIONS N/A																																																									
20. EFFECTS ON CONFIGURATION ITEM																																																									
21. DEVELOPMENTAL REQUIREMENTS AND STATUS N/A																																																									
22. TRADEOFFS AND ALTERNATIVES SOLUTIONS																																																									
23. DATE BY WHICH CONTRACTUAL AUTHORITY IS NEEDED																																																									
24. ALTERNATIVE SOLUTIONS																																																									
25. DEVELOPMENTAL STATUS																																																									
26. THIS CHANGE MUST BE ACCOMPLISHED ☐ BEFORE ☐ WITH ☐ AFTER THE FOLLOWING CHANGES:																																																									
27. IS CONTRACTOR FIELD SERVICE ENGINEERING REQUIRED? ☐ YES ☐ NO	28. OUT OF SERVICE TIME	29. EFFECT OF THIS ECP AND PREVIOUSLY APPROVED ECP'S ON ITEM																																																							
30. MILESTONE CHART																																																									
DATE AUTHORIZATION TO PROCEED RECEIVED BY CONTRACTOR		SYMBOL EXPLANATION Start Date End Date Progress Point																																																							
<table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <tr> <td style="padding: 2px;">NO. OF MONTHS</td> <td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td><td>13</td><td>14</td><td>15</td><td>16</td><td>17</td><td>18</td><td>19</td><td>20</td><td>21</td><td>22</td><td>23</td><td>24</td><td>25</td><td>26</td><td>27</td><td>28</td><td>29</td><td>30</td><td>31</td><td>32</td><td>33</td><td>34</td><td>35</td><td>36</td><td>37</td><td>38</td><td>39</td><td>40</td><td>41</td><td>42</td><td>43</td><td>44</td><td>45</td><td>46</td><td>47</td><td>48</td><td>49</td><td>50</td> </tr> </table>	NO. OF MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="padding: 2px;">CONFIGURATION ITEM</td> <td style="height: 20px;"></td> </tr> <tr> <td style="padding: 2px;">TECH. MANUALS/ PROG. TAPES</td> <td style="height: 20px;"></td> </tr> </table>		CONFIGURATION ITEM		TECH. MANUALS/ PROG. TAPES	
NO. OF MONTHS	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50							
CONFIGURATION ITEM																																																									
TECH. MANUALS/ PROG. TAPES																																																									

Figure 11. ENGINEERING CHANGE PROPOSAL (con't)

SPECIFICATION CHANGE NOTICE

(See MIL-STD-490 For Instructions)

Date Prepared

1. Originator Name and Address		2.	3. Code Ident.	4. Spec. No.
		☐ Proposed	5. Code Ident.	6. SCN No.
		☐ Approved		
7. System Designation	8. Related ECP No.	9. Contract No.	10. Contractual Activity	
11. Configuration Item Nomenclature		12. Effectivity		
This notice informs recipients that the specification identified by the number (and revision letter) shown in block 4 has been changed. The pages changed by this SCN being those furnished herewith and carrying the same date as this SCN. The pages of the page numbers and dates listed below in the summary of changed pages, combined with non-listed pages of the original issue of the revision shown in block 4, constitute the current version of this specification.				
13. SCN No.	14. Pages Changed (Indicate Deletions)	*S	*A	15. Date
16. Technical Concurrence		Date		

* "S" indicates supersedes earlier page. "A" indicates added page.

Figure 12. SPECIFICATION CHANGE NOTICE

DAIS HISTORICAL FILE 25 AUGUST 1980

68-01	AFAL-TN-68-131	TOP COMPUTER PROGRAMS FOR THE STUDY OF CORRELATION PROPERTIES OF PRIMARY REFERENCES.	AUG 68
70-01	AFAL-TN-70-206	STUDY OF THE INFORMATION MANAGEMENT ASPECTS OF INTEGRATED AVIONICS	FEB 71
72-01	AFAL-TN-72-411	AFAL SIMULATION LAB STUDY-111	NOV 72
72-02	AFAL-TN-72-209	VOL 1 - THE APPLICATION OF INFORMATION TRANSFER TECHNIQUES FOR SOLVING THE INTERNAL COMMUNICATION REQUIREMENTS OF AN ADVANCED MANEUVER BOMBER.	SEP 72
72-03	W-1 CITS		UNKNOWN
72-04	MHC-89866	F-4 AVIONICS MODERNIZATION TECH FEASIBILITY STUDY MCDONNELL	JUN 72
72-05	AFAL-TN-72-400	MULTILATERATION S/W DEVELOPMENT MACNAVUA	MAY 72
72-06	AFAL-TN-72	ALL SEMICONDUCTOR DISTRIBUTED AEROSPACE PROCESSOR/MEMORY STUDY	NOV 72
73-02	AFAL-TN-73-102	AVIONICS SUBSYSTEM MECHANIZATION ANALYSIS & RECOMMENDATION-LTV AEROSPACE	MAY 73
73-03	AFATL-TN-73-214	STUDIES INTERFACE DATA HANDLING ANALYSIS PHASE I, HI SHEAR CUMP	DEC 73
73-04		AVIONIC COMPUTER DESIGN CONSIDERATIONS DIGITAL DEVELOPMENT GROUP, ORADEN LAB	JUN 73
73-05	UD-DKE (AM) 637	DEVELOPMENT PLAN FOR ADP-DATS	APR 73
73-06	AFAL-TN-73-104	A CONCEPTUAL DEFINITION STUDY FOR DATS APPROACH 1, GENERAL DYNAMICS VOL 1, II, III	DEC 73
73-07	AFAL-TN-73-427	A CONCEPTUAL STUDY FOR DIGITAL AVIONICS INFORMATION SYSTEM APPROACH II, VOL. III	MAY 79
73-08		DATS STUDY REPORT	NOV 74
73-09	MCS DD-DRE (AM) 637	DEVELOPMENT PLAN FOR DATS	APR 73
73-10	AFAL TR-73-01-1921501	DEFINITION STUDY OF DATS TYPES INSTRUMENTS	DEC 73
73-11	DATS	A MAJOR CROSSROAD IN DEV OF AVIONICS SYSTEMS	JAN 73
73-12	DATS	THE FIRST STEP BY L/C J. MUTH	
73-13	UNIV OF ILLINOIS A-507	ASYNCHRONOUS CONTROL MODULES	MAY 73

Figure 13. DATS DELETION/HISTORICAL DOCUMENT LIST

maintained by AFALC/PTD.

g) A master file was maintained for Configuration Control Board Meeting Minutes, Problem Report Board Meeting Minutes, Test Control Board Meeting Minutes, Product Control Board Meeting Minutes, Open Problem Reports and Closed Problem Reports. (Figure 14).

h) A master of DA100100, DAIS Document Tree (Figure 15) was maintained. This is a drawing that contained all specifications, manuals, and plans in relation to seven functions in the system. 1) Core Elements, 2) Non-Real-Time Support Software, 3) Real-Time Support Software, 4) Test Software, 5) Support Hardware, 6) Interfaces and 7) Mission-Dependent. In addition the diagram reflected whether the document was released or not. In order to facilitate the updates to this diagram it was put on the Applicon, which is a computer-generated diagram. This reduced the time to update the diagram from weeks to days. The diagram was updated four times and grew from one to two sheets to accommodate the increase in the number and type of documents included.

4.2 Preparation of DAIS C/D Subsystem Application S/W (Task 2)

The contractor shall develop the specifications, SA501360-1 and SA501360-2, DAIS C/D Subsystem Application S/W, MPDG-1, MPDG-2, type C-5 / specifications. Actual software listings will be provided. There are approximately 65,000 lines of assembly level code (data included) including comment lines for the program. The number of pages for each specification is estimated at 400.

4.2.1 Specification Preparation

The following paragraphs describe, in summary form, the major steps of the process taken to develop a software specification, and examples are shown of some of the results of the steps in this process.

SYSTEM SPEC
FOR
DAIS TYPE A

SA 100100

DAIS
DOCUMENT DESCRIPTION
MANUAL

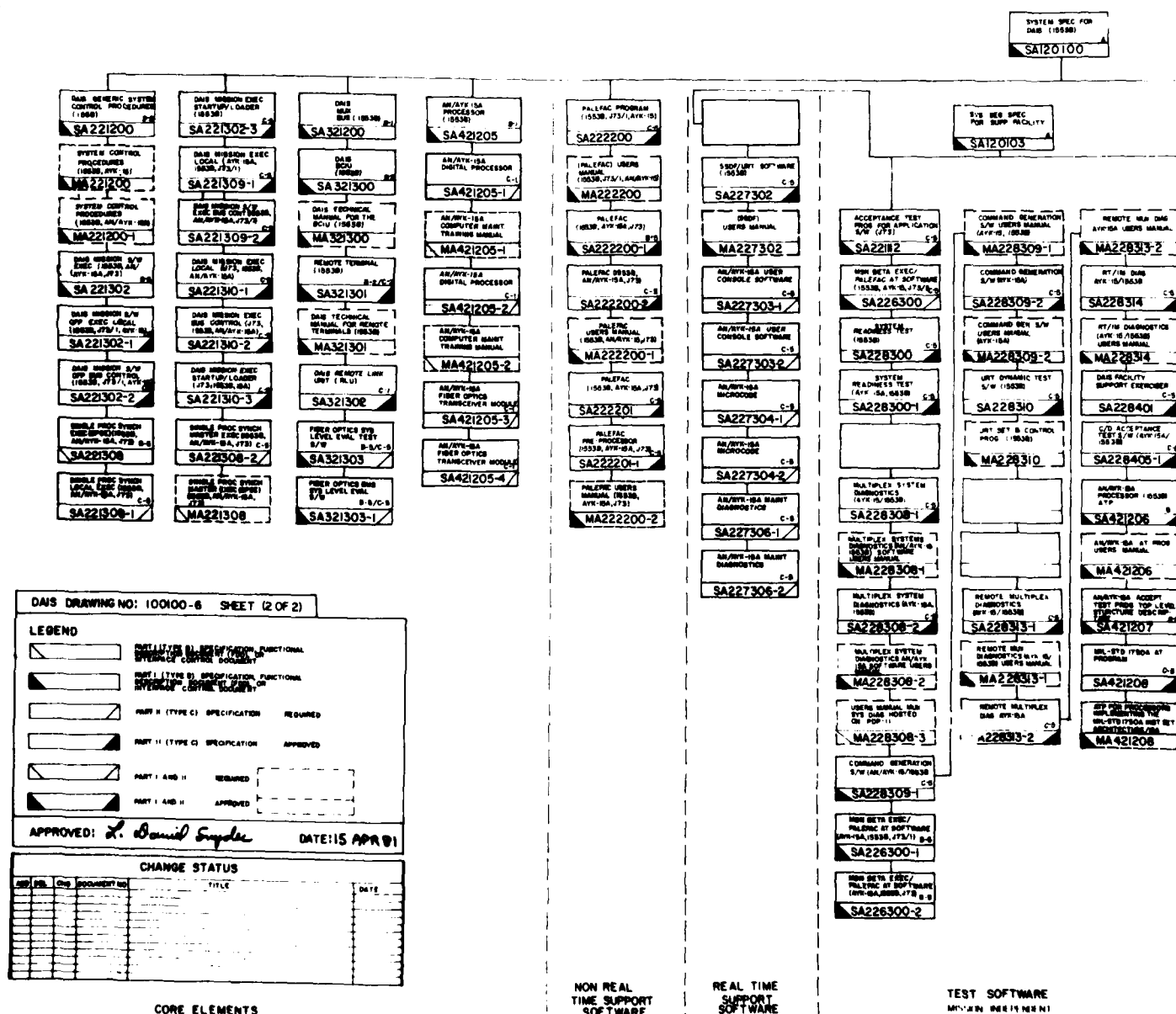
MA 100100



SA 100100



DAIS SPECIFICATIONS



SAI20100



4.2.2 Phase I, Preparation

- a. Obtained and reviewed all available manuals, Government and Non-Government documents (e.g., language manuals and development specifications) used in the preparation of the software from the AAAS engineer. This supplied the writer with technical background which afforded him a better understanding of the overall mechanics of the program.
- b. Obtained a program listing and acquired a thorough understanding of the code in which the program was written. Consulted the AAAS engineer for information as to the most appropriate reference material.

4.2.3 Phase II, Initial Review and Schedule Development

- a. Reviewed the listings of the software and compiled an overall detailed description of the function of the computer program as a whole.
- b. Prepared a block diagram of the overall software/hardware configurations.
- c. Delineated conventions of the various register usages in regards to the individual Computer Program Components (CPC).
- d. Listed a breakdown of separate stages of the software, such as any main modules and files, internal testing routines and the supporting subroutines of the package.
- e. Prepared a rough draft outline, using the outline in Appendix VI of MIL-STD-483 and the information gathered during the initial preparation. Included the topics to be covered within each

paragraph. Reviewed this draft outline with the responsible engineer who provided the documentation team with essential comments, suggestions and guidelines. Figure 16 shows a typical outline of a software product specification.

- f. Established the time required for each of the following tasks:

Development of text and flowcharts

Typing of text

Drafting of flowcharts

Corrections

Review of final draft

A schedule was then developed considering the number of lines and number of CPCs to be documented. This schedule not only allowed for the calculation of a completion date, but also provided the documentation team with a basis against which to measure its progress.

- g. Prepared a format for constructing figures and tables which provided consistency across all CPCs.
- h. Drafted an outline of the proposed method of formatting the final document and submitted this for review by the AAAS engineer.

4.2.4 Phase III, Detailed Development

- a. Prepared a detailed description of the functions of each of the CPCs, identifying these by titles and programmer-assigned mnemonics.
- b. Prepared a detailed flowchart for each individual CPC.
- c. Listed, with a detailed description of each, all interfaces to each CPC and the relationships to one another.

COMPUTER PROGRAM SPECIFICATION (PART 2)

1.0 SCOPE

2.0 APPLICABLE DOCUMENTS

2.1 GOVERNMENT DOCUMENTS

2.2 NON-GOVERNMENT DOCUMENTS

3.0 REQUIREMENTS

3.1 FUNCTIONAL ALLOCATION DESCRIPTION

3.2 FUNCTIONAL DESCRIPTION

3.2.1 COMPUTER PROGRAM COMPONENT (CPC) #1 TITLE

3.2.1.1 CPC #1

DESCRIPTION

3.2.1.2 CPC #1

FLOWCHART

3.2.1.3 CPC #1

INTERFACES

3.2.1.4 CPC #1

SUPPORTING SUBROUTINES

3.2.1.5 CPC #1

REGISTER USAGE

3.2.1.6 CPC #1

GLOBAL DATA

3.2.1.7 CPC #1

CONSTANTS

3.2.1.8 CPC #1

LIMITATIONS

3.2.1.9 CPC #1

LISTING

3.2.2 COMPUTER PROGRAM COMPONENT (CPC) #2

TITLE

3.3 STORAGE ALLOCATION

3.4 COMPUTER PROGRAM

FUNCTIONAL FLOW DIAGRAM

4.0 QUALITY ASSURANCE

5.0 PREPARATION FOR DELIVERY

6.0 NOTES

10.0 APPENDIX

FIGURE 16

SOFTWARE PRODUCT SPECIFICATIONS

- d. Compiled a list of all subroutines called by each CPC and gave a brief description of each.
- e. Listed all global data relevant to each CPC. Prepared a brief description of each and its word lengths.
- f. Listed the limitations, if any, that each CPC may have, such as timing requirements, error checks programmed into the routine or any other restrictions that applied to the individual CPCs. The AAAS engineer was consulted when the writer felt there was insufficient data concerning the limitations listed in the initial reference manuals.
- g. A table of contents applicable to the individual CPC's was made with a brief description of each.

4.2.5 Document Review

When the draft of the document was completed, it was submitted for an initial review by the AAAS responsible engineer. The author of the document went through the document with the responsible engineer to make notes on desired changes. After this review, the document was put in final form and delivered to the Air Force. When the document was put into the review cycle, the author served on the review team and kept a master copy of all changes made during the review cycle. The document was then updated for the final approval sign-off. SA 501 360-1, MPDG-1, in final form contained 394 pages and SA 501-360-2, MPDG-2 contained 336 pages.

4.3 Drafting Support (Task 3)

The contractor shall provide drafting support for figures, tables, and layouts for documents under review as well as drawings, layouts and

illustrative material for use by the Configuration Management Office (CMO).

It is estimated that an average of 10 hours per week shall be required.

The average number of drawings per week is estimated at 5 small drawings or 1 large drawing. Development of 100 view-graphs or presentation aids shall be required.

4.3.1 Support Provided

During the period of the contract the following drafting support was provided:

Drawings	78
View-graphs	91
Prints	57
Tables/Figures	214

4.4 Editing (Task 4)

The contractor shall perform the editing function as defined below. Documents may be in draft form, released, under revision or submitted by contractors. Change notices to released documents may also be edited.

4.4.1 Technical Editing/Rewrite

The contractor shall technically edit and rewrite 1000 pages of hardware and software specifications, manuals and plans. Normally an engineer/tech writer from the documentation contractor will work closely with the DAIS responsible engineer in this task.

4.4.1.1 Editing/Rewriting

When editing or rewriting a document, it was first determined exactly what information the document contained, then it was studied carefully and thoroughly understood. The information was then organized to follow the outline presented in the appropriate appendix of MIL-STD-490. The text sometimes was more clearly presented and, thus, more easily understood when some information was reorganized into tables and figures. A table is an arrangement of data in lines and columns, whereas a figure is a picture or graphic representation of a concept. References in the text were sufficiently detailed to make the purpose of the table or figure clear. The documentation staff worked closely with the engineer to assure that the information was represented correctly and was included within the appropriate sections.

As the document was reorganized it became apparent whether additional information was needed to satisfy all the requirements of MIL-STD-483 and -490. Once the source of the needed information was identified, the documentation team and the responsible engineer proceeded to acquire and include the additional information.

The format established by MIL-STD-490 was followed in all phases of the preparation of the document. Close attention was paid to the numbering, identification and placement of all paragraphs, figures and tables.

The editing staff then submitted a draft of the rewritten document for the responsible engineer's appraisal. This event was very significant because the personnel who were involved with building the hardware or software that was being documented provided valuable

comments and criticisms that truly improved the quality of the document. After these suggestions had been incorporated, the final copy was prepared, including a title page, table of contents, list of figures and list of tables. Each page was numbered and identified in the upper right corner with the specification number and date. The document was printed, and the copies necessary for the review team members were delivered.

Generally, a member of the documentation team participated in the review of the document, attending the initial, preliminary and final review meetings. Careful records of the comments and suggestions of the review team members were kept, and the document was revised accordingly before the final review and acceptance of the document.

4.4.1.2 Documents Edited/Rewritten

During the contract forty-nine documents were edited and then partially or totally rewritten.

4.4.2 Format Editing/Proofreading

The contractor shall edit and proofread pages of DAIS hardware and software specifications, manuals and plans. Primary emphasis is on format, compliance with MIL-STD 483 and 490 and the correction of figures and drawings.

4.4.2.1 Editing/Proofreading

Using the standards established by the Configuration Management Office (CMO) and MIL-STD-483 and -490, the editing team examined the appointed document page by page.

Each document was assigned a specification number and an approved

title by the CMO. Revisions were denoted by the addition of a letter to the specification number (e.g., SA123456A - meaning first revision). The specification heading, title, number, date and appropriate signatures were checked on the title page. The documents were checked for a detailed table of contents, list of figures and list of tables, noting accurately the corresponding pages. Each page of the document must have the specification number and date at the top right, a page number at the lower center and must fit into the specified DAIS margins.

The text was checked to insure it contained the sections generally outlined in MIL-STDs. The paragraphs had to conform in numbering, identification and contents to the requirements further delineated in the appendices of MIL-STD-483 and - 490. The proofreader had to be satisfied that all the essential information was present.

Figures and tables should be placed within or immediately following the paragraphs containing reference to them. If this interfered with correct sequencing of paragraphs and caused difficulty in understanding or interpretation, they were placed in numerical sequence at the end of the specification. Tables had to be boxed, ruled and numbered consecutively with Roman numerals. The table number and title had to be placed above the table. Figures had to be titled and numbered consecutively with Arabic numerals in the order in which they are initially referenced in the text. The figure number and title had to be at the bottom of the figure.

Any deviation from the established standards was fully explained in section 6.0, NOTES.

After the proofreading of the document had been completed, a letter of comment was sent to the contract monitor. An example of this

letter is contained in Figure 17.

4.4.2.2 Documents Edited/Proofread

During the contract, fifty-three (53) documents were edited/proofread to insure compliance with the appropriate MIL-STD.

4.5 Audits (Task 5)

The contractor shall perform the hardware and software audits listed below. All audits are to conform to MIL-STD 1521 Technical Reviews and Audits for Systems Equipment and Computer Programs for Systems Equipment and Computer Programs. A separate report will be written at conclusion of each audit in accordance with the data item specification, the CDRL.

4.5.1 Physical Audit of Universal Remote Terminal (URT)

The contractor shall perform a physical audit on the URT or its equivalent. The URT has four 6" by 12" cards with approximately 175 to 200 chips per board.

This physical audit was performed on the Controls and Display Control Panel which has twelve 4" by 6" cards with approximately 40 chips per board and associated wire lists. The drawing package contained 101 sheets.

4.5.1.1 Hardware Physical Configuration Audit

To accomplish the physical audit the audit team developed a physical cross-check list. In general, this was accomplished by reviewing all documentation on the CI and locating any information about the physical aspects of the hardware, such as; number of parts, type of parts, connection of parts, mountings, etc.

The hardware drawings were checked for accuracy to ensure that they adequately described the equipment. For this check the following

MEMO FOR THE RECORD

TO: Contractor Monitor

SUBJECT: Audit of the Bus Monitor Unit

An audit of the Bus Monitor Unit SA000000A has revealed the following discrepancies:

- 1a. Title page is incorrect. A revision shall be denoted with an alphabetic letter starting with "A" for the first revision. Type designator code is missing.
- b. All paragraph identification lines shall be underlined.
- c. Footnotes to a table or figure shall be placed below the table or figure.
- d. All tables shall be blocked and ruled.
- e. Table numbers shall be in Roman numerals.
- f. Some paragraph numbering is out of sequence.
- g. The flowchart in paragraph 3.2.7 does not have the direction of flow labeled, nor was there a figure number, title or page number.
- h. Section 6.0, "Notes", shall contain a specific paragraph concerning the revision as outlined MIL-STD-490.

(Contractor Name)
DAIS Project Manager

cc: (responsible engineer)

Figure 17. LETTER OF COMMENT

minimum information was recorded for each drawing:

Drawing number
Revision number
Date of drawing approval
Number of sheets
Discrepancies/Comments

As a minimum, the following inspections were accomplished for each drawing:

- (1) Examination of the CI to ensure that current nomenclature descriptions, part numbers and serial numbers agreed with the drawings.
- (2) Physically checked the number of pieces of material shown on the drawing with the number actually in the equipment; e.g., if the drawing called for four transistors of a certain type within the end item, this information was checked.
- (3) Recorded the number and date of each attached drawing change notice.
- (4) Noted if the drawing was "marked up."
- (5) Checked the drawings of a major assembly of the CI for continuity from top drawing to piece-part drawing.
- (6) In addition, the auditors checked the drawings against the specification to see if the drawings agreed with major subsystem discussions of the specification.

4.5.1.2 Physical Comparison of Hardware With Drawings

The hardware was then compared to each drawing in the drawing package for it is imperative that the drawings agree with the actual hardware. When discrepancies were found during the comparison, then they were reported in the Hardware Audit Report.

4.5.1.3 Audit Summary. Control/Display Control Panel. DA501100

The audit revealed over one hundred and fifteen discrepancies on the drawings. These discrepancies were corrected either by revisions to the original drawings or, if there were too many, the drawing was completely redrawn. After the revised drawings were reviewed and approved two copies of the large size drawings were reproduced and delivered to the DAIS library. The drawing package was reduced to booklet size and five copies delivered to the DAIS library.

4.5.2 Physical Audit of Modular Programmable Display Generator (MPDG)

The contractor shall perform a physical audit on the MPDG or its equivalent. The MPDG has sixteen different 4" by 6" boards with approximately 55 chips per board.

4.5.2.1 Hardware Physical Configuration Audit

This audit was conducted in a manner similar to that of the Control Panels. The drawing package consisted on sixty-five sheets.

4.5.2.2 Audit Summary

The audit revealed over two hundred and eighty-one discrepancies on the drawings. These discrepancies were corrected either by revisions to the original drawings or, if there were too many, the drawing was

completely redrawn. After the revised drawings were reviewed and approved, two copies were reproduced and delivered to the DAIS Library. The entire drawings package was reduced to booklet size and five copies delivered to the DAIS Library.

4.5.3 Physical Audit of Bus Monitor Unit (BMU).

The contractor shall perform a physical audit on the BMU or its equivalent. The BMU is of the same complexity as the URT. There are four 6" by 12" cards with 175 to 200 chips per board. This audit was performed on the Control and Displays, Display Switch Memory Unit (DSMU). The DSMU has thirteen 4" by 6" cards with approximately 95 chips per board.

4.5.3.1 Hardware Physical Configuration Audit (DSMU).

This physical audit was conducted in a manner similar to that of the Control Panels. The drawing package contained thirty six sheets.

4.5.3.2 Audit Summary (DSMU).

The audit revealed over two hundred and ninety-one discrepancies on the drawings. These discrepancies were corrected either by revisions to the original drawings or, if there were too many, the drawing was completely redrawn. After the revised drawings were reviewed and approved, two copies were reproduced and delivered to the DAIS Library. The entire drawing package was reduced to booklet size and five copies delivered to the DAIS Library.

4.5.4 Physical Audit of AN/AYK-15A DAIS DIGITAL PROCESSOR.

The contractor shall perform a physical audit on the AN/AYK-15A Processor or its equivalent. The processor has 9 different printed circuit boards with approximately 130 chips per board. The printed circuit cards are multi-layer.

4.5.4.1 Audit Summary.

The audit was performed on both the Westinghouse Processor and Univac Performance Monitor Interface Unit (PMIU). These audits revealed one hundred fifty-seven discrepancies on the processor and three hundred thirty on the PMIU.

4.5.5 Software Audit of the Modular Programmable Display Generator (MPDG)

The contractor was originally to perform a software audit of the Simulated Subsystem Data Formatter (SSDF) computer program. The program is resident on a Digital Equipment Corp. (DEC) PDP 11/40 computer consisting of about 4,000 lines of assembly language code.

At the request of the Air Force for reasons of priority, the software audit was performed on the MPDG computer programs. The MPDG software is resident on the DECSYSTEM-10 computer and has approximately 65,000 combined lines of assembly language code and corresponding data.

The procedures and findings of the Physical Configuration Audit (PCA) are described in the following paragraphs.

4.5.5.1 Preparatory Audit Procedures

All documentation associated with the MPDG software such as the Part I Development Specification, Part II Product Specification, User's Manual, Interface Control Drawing, Flowcharts and listing were reviewed for content to gain an understanding of the system in total and the functions it was to perform. A brief description of each item is given below.

4.5.5.2 Product Specification (Part II or C5)

The product (or Part II type) specification contains technical information about the software CI, including a description of its logic structure and functions, data organization, and interrupt structure. The level of detail should be sufficient to enable a programmer, with no previous exposure to the software, to understand readily the internal operation of the software.

4.5.5.3 User's Manual

The User's Manual is to provide potential software CI users with the necessary instructions for operating the software CI. The manual content and format are specifically designed to meet the needs of the intended user. User's Manuals are typically written to be as self-contained as possible with few references to other documents. They are written at the level of understanding and comprehension appropriate to the intended users and usually consist of lists of steps and procedures to be followed. The audit of the User's Manual is performed prior to or in conjunction with the final acceptance testing.

4.5.5.4 Interface Control Document (ICD)

The Interface Control Document contains the physical and functional interface requirements of a software CI which affect the design or operation of co-functioning software CIs to control interface designs for the purpose of minimizing changes to software CI requirements, and to communicate design decisions and changes to participating groups.

4.5.5.5 Flowcharts

The flowcharts submitted for audit should be from the latest release of the product specification and must reflect the source code of the software's most current version. The flowcharts should conform to the military standards in format. Flowcharts should easily show the structure and function of the source code.

4.5.5.6 Listings

Listings submitted for audit shall be of the latest software version in use. Listings should be commented in such a way that someone unfamiliar

with the program language used can examine the listing and the flowcharts and understand the function of the code.

4.5.5.7 Audit Procedures

The PCA effectiveness greatly depended on the content of the documentation of the software CI to be audited. The software CI could only audited in as much detail as the documentation provided.

The PCA consisted of four procedures (Figure 18): (1) data gathering, (2) developing an audit checklist, (3) physical cross-checking, and (4) algorithm analysis. These procedures were followed for each document related to the software CI to be audited.

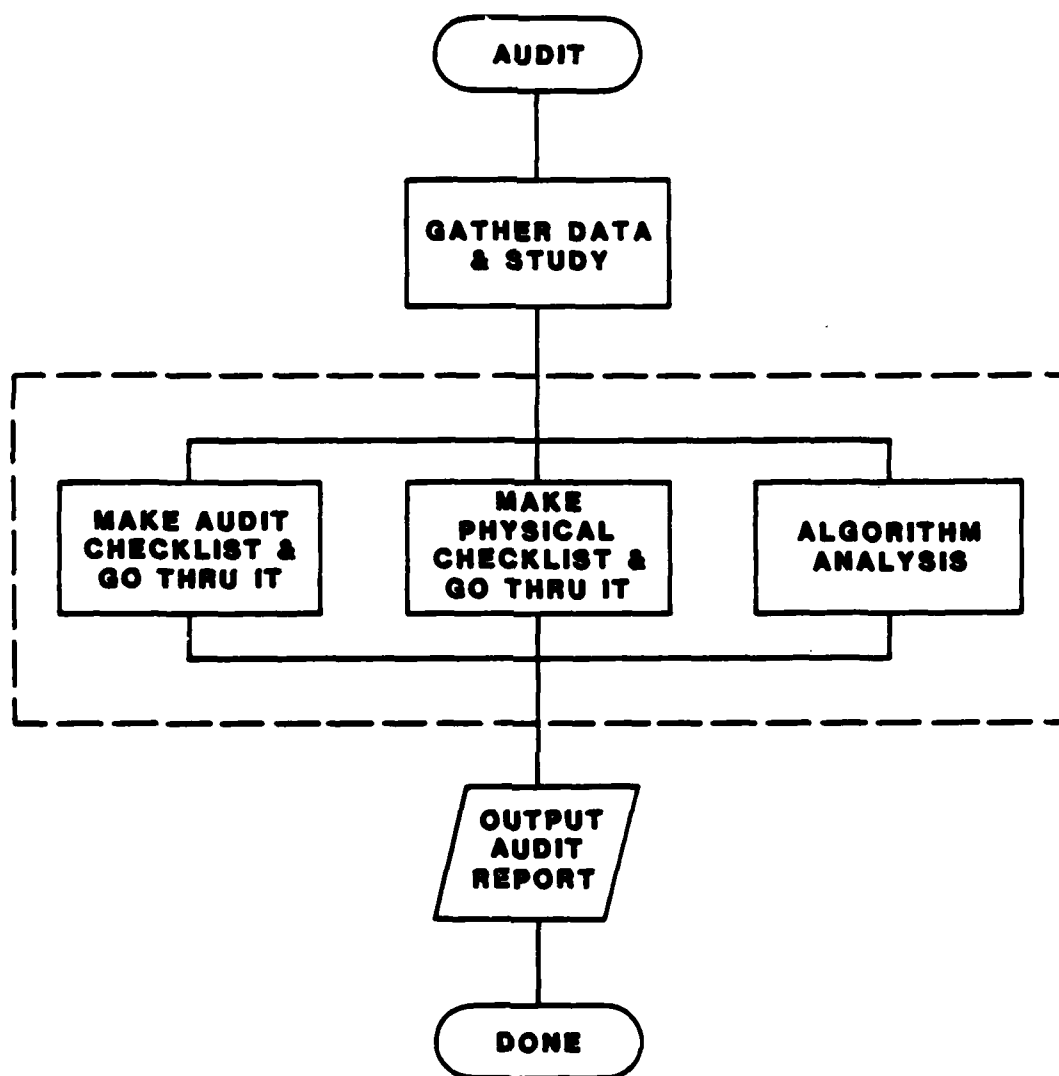
4.5.5.7.1 Data Gathering

To audit the software CI against a particular document, it was necessary to gather two data items. The first was a final copy of the document. It was important that draft copies and preliminary versions of the document not be used for a formal PCA. This ensured that the entire document was audited in the form in which it had been released.

The second data item required was the most current listing of the source code for the software CI. This was an assembler listing generated by the audit team from the software CI's allocated baseline, which was used for the final acceptance testing. The data and time at which the copy was made, along with the date and time at which the source code was last modified (if available), was also recorded. This then represented an informal baseline to which all audit results were related.

4.5.5.7.2 Developing the Audit Checklist for Software

The audit checklist was created from the Product Specification being used in the audit. It consisted of a list of specific elements of the



NOTE: THE TASKS WITHIN THE BROKEN LINED BOX CAN BE PERFORMED IN PARALLEL BUT MUST BE DONE BEFORE THE OUTPUT AUDIT REPORT

Figure 18. AUDIT FLOW DIAGRAM

code which were examined to determine their relationship to the document.

The contents of the product specification were audited against the latest software version to determine the accuracy of the specification.

The following items in particular were checked for validity:

- 1) All file names
- 2) Variable names
- 3) Subroutine mnemonics
- 4) Algorithms
- 5) Data Set Definitions
- 6) Data Tables
 - Matrix sizes
 - Word values and proper index
 - Base Page items
 - Non-Base Page items
- 7) Flowcharts for accurate representation of source code.
- 8) Text for accurate descriptions.

4.5.5.7.3 Physical Cross-Checking

Physical cross-checking of the Part I type and Part II type specifications and ICDs consisted of two activities. The first was to go through the document and verify that each of the routines described corresponded to routines which actually existed within the source code. The second was to verify that the storage allocations described in the document (i.e., common block names, variable names, etc-) corresponded to those actually used in the source code. All discrepancies found during the physical cross-check were noted in the Audit Report.

4.5.5.7.4 Algorithm Analysis

The purpose of the algorithm analysis was to verify that the logic presented in the flowcharts of a Part I type of Part II type specification correctly represented the logic implemented in the source code. Algorithm analysis was also used to verify that formulas and equations were properly implemented. The results of this analysis were in the Audit Report.

4.5.5.8 Summary of Audit Results

Below is a partial listing of some typical errors which were noted during the PCA:

1) Flowcharts:

- a) Some were totally inaccurate indicating the software had been greatly modified since the creation of the flowchart.
- b) Subroutines were either omitted or were functionally described but not denoted as subroutines.
- c) Typos were noted in algorithms.
- d) In some cases, only 1 flowchart was given for 2 different routines (MPDG1/MPDG2) that were similar but not identical.

2) Erroneous matrix size values.

3) Table word lengths were found in error as were some word values.

4) Only 1 base page table was given to represent both MPDG1 and MPDG2 which proved inadequate.

4.5.5.9 Audit Report

The findings of the PCA were compiled into a final report and delivered to the Air Force. Due to the significant error factor, especially in flowcharts (greater than 50%), the following contractor recommendations were made:

- 1) Retire the original C-5 spec.
- 2) Generate an individual C-5 spec. for MPDG1 and another for MPDG2.
- 3) Prepare an alphabetized cross reference table for file names with their associated subroutines and vice-versa.
- 4) Rewrite all flowcharts and place the subroutine file name with the flowchart title.

(Note: Items 3 and 4 were prompted due to an innumerable number of sub-routines, many with similar mnemonics, which made source tracking very difficult.)

Upon concurrence of the responsible engineer and the program office, production of the new C-5 specifications was begun, correcting all discrepancies noted in the PCA and generating new flowcharts for all routines.

4.6 DAIS Control Board Support

The contractor shall have the responsibility of providing the Recording Secretary for the DAIS Configuration Control Board, Problem Report Board and the Test Control Board. The contractor shall write, type and distribute the minutes of all three boards.

4.6.1 General

Configuration Control is a major CM function. It is the process of documenting changes to established baselines to provide the necessary visibility into the development process at a given moment. Once a baseline is frozen, proposed and approved, changes to it must be well-identified and fully considered within the perspective of the total program. When the product baseline is established, all changes, no matter how small, must be processed through a well-defined and duly constituted change control process. Any change when viewed by itself may seem trivial, but numerous changes require orderly procedures and careful bookkeeping to maintain knowledge and control of the actual configuration.

The contractor performed this function for the DAIS Program Branch by providing the recording secretary for the Control Board activities. In order to fully understand the magnitude of this effort, it would be wise to review the structure of the Control Board function as practiced by the DAIS Program Branch.

4.6.2 DAIS Control Boards & C.M.O.

Within the DAIS Program Branch, the group that administered change control was known as the Configuration Control Board (CCB). The CCB was the only agency authorized to act on proposed changes to the baseline

configuration. The primary function of the CCB was to control the baseline, and in the DAIS Branch it was carried out by the following:

- Document Control Board (DCB)
- Problem Report Board (PRB)
- Test Control Board (TCB)
- Product Control Board (PCB)
- Configuration Management Office (CMO)

The DAIS Program Branch organizational functions are shown in Figure 19. The activities and procedures utilized by the CCB and the CMO to carry out these functions will be discussed in the following sections.

4.6.3 Documentation Control Board (DCB)

The Documentation Control Board's principal responsibility centered around the final approval of all documents that were in the DAIS system. Additional responsibilities of the Board included the selection of review teams, approval of changes to documents via SCN/DCN, review of audit reports of both hardware and software, and the appointment of ad hoc committees, as required (e.g., Life Cycle Cost Committee).

The membership of the Board consisted of:

- Branch Chief - Chairman
- CMO Manager - Secretary
- DAIS Group Leaders
- SITC Contractor
- Documentation Contractor
- AAF Representative
- DAIS Contractors (as required)

This board met every two weeks and/or as required to review urgent subjects.

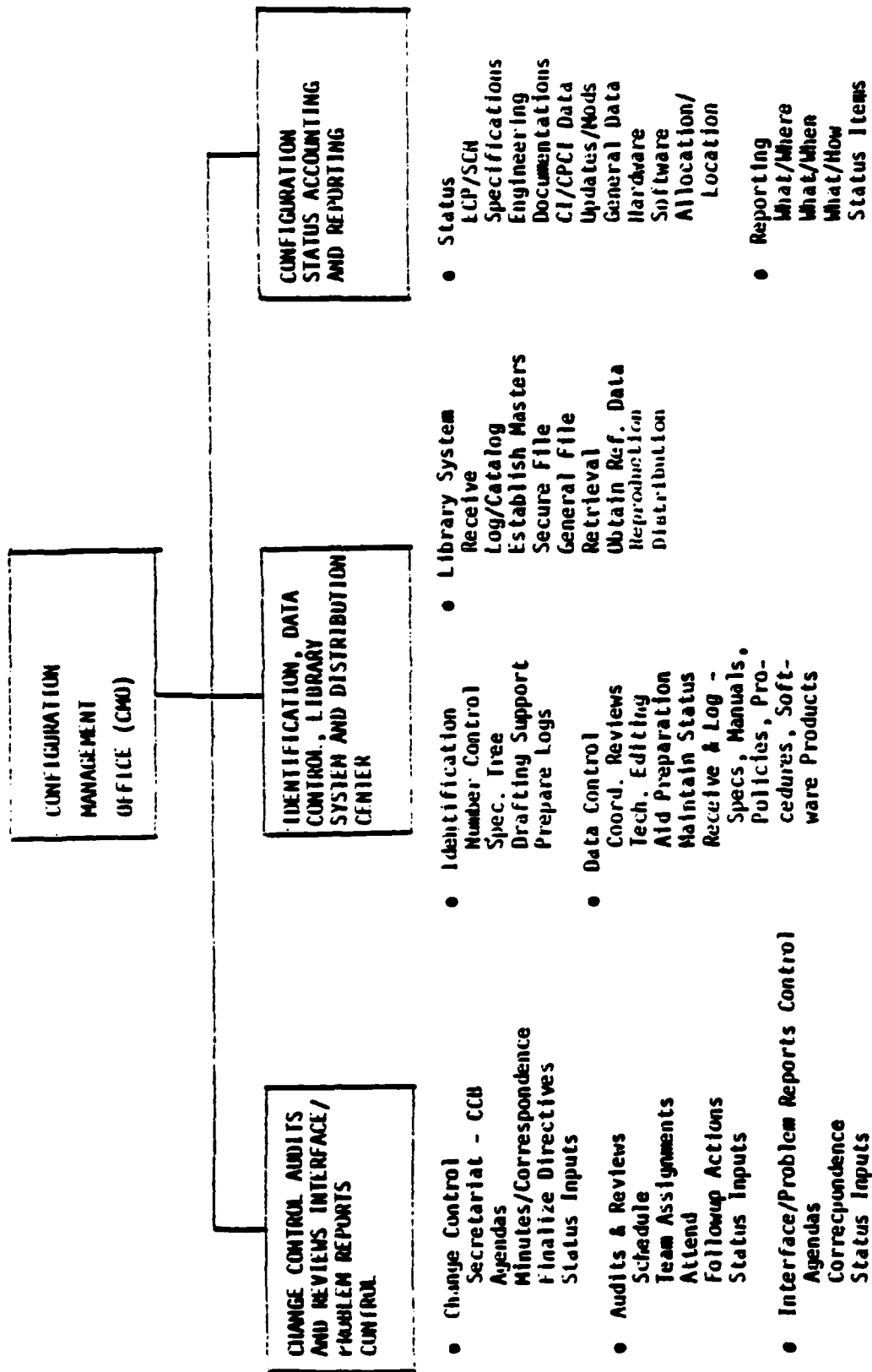


FIGURE 19 CMO ORGANIZATIONAL FUNCTIONS

4.6.3.1 Documentation Data Flow

Specifications prepared by in-house elements or by DAIS contractors were submitted to the DCB for review and approval action. Each specification underwent extensive analysis, which involved considerable time. Upon becoming an action item for the DCB agenda, the DCB would review the schedules and general needs for the document within the system. The DCB would then appoint a review team and assign the scheduled initial review date. Formal correspondence, signed by the DAIS Branch Chief, would be issued, identifying the team members and schedule involved. Final DCB action would result from the review team recommendations. Concurrent with review team effort, the specification would also be given an editorial review (for compliance with MIL-STD-490) by the CMO technical editor.

4.6.3.2 DCB Submission Guidelines

In order to have a document accepted into the DAIS documentation system, there were definite procedures to be followed. The detailed steps were as follows. The responsible engineer had to obtain a DAIS document number, which required him to submit a written request containing the document title, scope statement, draft due date and responsible engineer/contractor. When the CMO received the request, a number was assigned and a CCB Directive would be submitted for approval by the Board. Once approved, the CMO then updated MA 100100, DAIS Document Description Plan, PA 000400, DAIS Document Status Plan, and DA 100100, DAIS Specification Tree. After the document was developed, the steps as listed below had to be accomplished to initiate the document review cycle.

Documents/SCNs/DCNs/for initial submission

● Submit to CMO:

- Original Document/SCN/DCN
- Completed Form DAIS 78-03
- Completed Form DD 1696 for SCN
- Completed Form DAIS 78-02 for DCN
- Copy of Document/SCN/DCN for each Review Team Member plus one for DCB

4.6.3.3 Document Review Cycle

The actions taken by the DCB upon receipt of the document are outlined in Figure 20. Depending upon the workload and the priority assigned to the document, the DCB would activate the review team which placed the document in the review cycle. The details of the review cycle are shown in Figure 21. Depending upon the size and complexity of the document, this cycle could take up to six months to complete. The key to efficient, successful completion of the cycle was the review team leader. His duties are contained in Figure 22. The progress of the document through its review cycle was tracked by the DCB through means of Attachment 1 to the DCB minutes, which was reviewed and updated at each DCB meeting.

4.6.3.4 Document Control Board Support

The contractor provided the secretariat support for the DCB and all of its allied functions described above. This responsibility included the establishing and maintaining of all configuration control procedures. It was most important that each document be tracked from initiation through receipt to document approval and publication. For this purpose, the tracking system had to be maintained to give real-time status of documents processed by the DCB. This included preparing the agenda for the DCB meeting, recording all actions taken during the meeting, coordination with other contractors and DAIS personnel (to insure that accurate and timely data were included

DOCUMENT REVIEW CYCLE

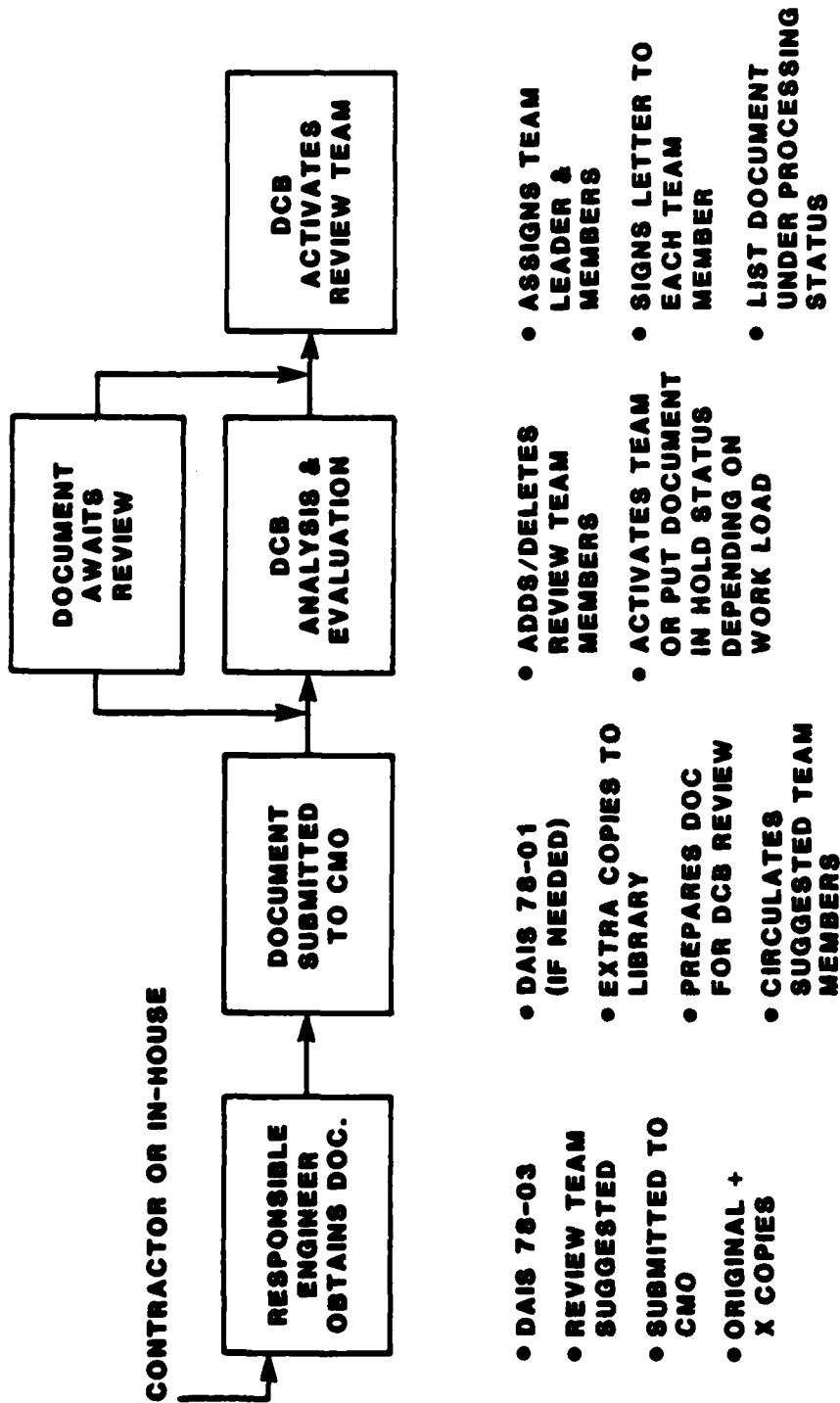
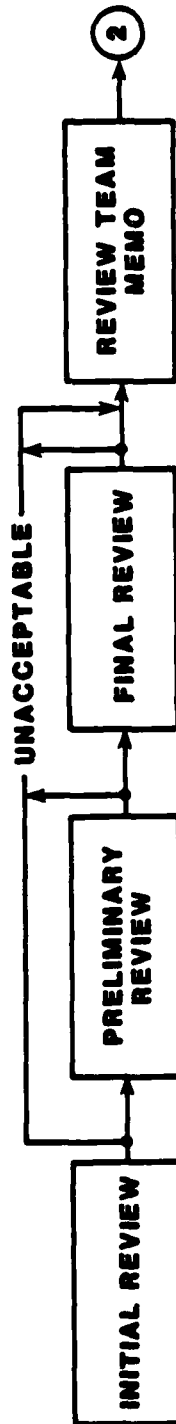


Figure 20. DOCUMENT REVIEW CYCLE

DOCUMENT REVIEW CYCLE (1 OF 2)



- | | | | |
|--|--|--|--|
| <ul style="list-style-type: none"> • WITHIN 10 WORKING DAYS OF DATE OF MEMO • SKIM DOCUMENT • ESTABLISH PRELIMINARY REVIEW COMPLETION DATE • IF UNACCEPTABLE SIGN REVIEW TEAM MEMO AT LAST MEETING | <ul style="list-style-type: none"> • CORRECT ERRORS • REVIEW THOROUGHLY FOR TECHNICAL CONTENT • CHECK FOR STANDARD PAGE FORMAT • ESTABLISH FINAL REVIEW COMPLETION DATE • IF UNACCEPTABLE SIGN REVIEW TEAM MEMO AT LAST MEETING | <ul style="list-style-type: none"> • REEXAMINE FOR CORRECTIONS • CATCH TYPOS • OBTAIN CORRECT TITLE PAGE FORMAT FROM CMO • SIGN REVIEW TEAM MEMO AT LAST MEETING | <ul style="list-style-type: none"> • LIST MAJOR CORRECTIONS OR MAJOR PROBLEMS • SIGNED BY ALL MEMBERS • FOLLOW EXAMPLE- IN CMP • SUBMIT TO CMO |
|--|--|--|--|

Figure 21. Details Of The Review Cycle

DOCUMENT REVIEW CYCLE (2 OF 2)

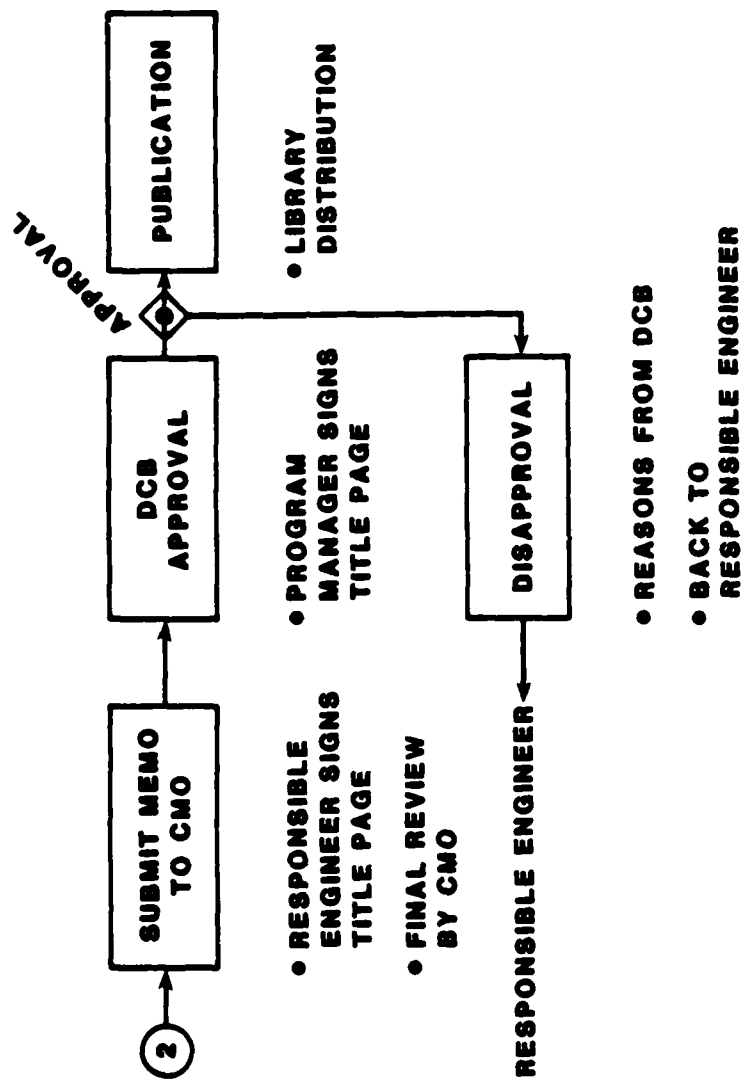


Figure 21. Details Of The Review Cycle (cont'd)

REVIEW TEAM LEADER

- OBTAINS COPY OF DOCUMENT FOR EACH TEAM MEMBER FROM LIBRARY
- CONDUCTS INITIAL REVIEW WITHIN 10 WORKING DAYS OF DATE OF ASSIGNMENT LETTER
- CONDUCTS SUBSEQUENT REVIEWS
- NOTIFIES SUPERVISOR OF DATE OF COMPLETION AND SCHEDULED DATE FOR NEXT PHASE OF REVIEW
- INSURES SCHEDULED DATES ARE MET
- IF DATES ARE NOT MET, NOTIFY SUPERVISOR OF REASONS FOR DELAY
- REQUESTS THROUGH SUPERVISOR FOR CMO ASSISTANCE IF REQUIRED (TYPING, FLOW CHARTS, FIGURES)
- PREPARES MEMO TO DCB OF APPROVAL/DISAPPROVAL FOR TEAM SIGNATURES
- DELIVERS SIGNED MEMO AND SIGNED TITLE PAGE WITH DOCUMENT TO CMO

Figure 22. DUTIES OF THE REVIEW TEAM LEADER

in the minutes), preparation, approval, printing and distribution of the minutes.

Additional responsibilities of the recording secretariat were:

- Maintenance of DCB Minutes file
- Maintenance of CCB Directive file
- Maintenance of PA00400 DAIS Document Status Plan
- Updating of MA 100100 DAIS Document Description Manual
- Maintenance of document awaiting-review file
- Maintenance of document in-review file
- Maintenance of file for all correspondence to the DCB
- Providing the central point of contact for outside government agencies and contractor personnel

4.6.3.5 Document Control Board Activities

During the life of the contract, the contractor provided the above mentioned support for 34 Document Control Board (DCB) meetings before the DCB was discontinued. The DCB was replaced by the MIL STD Conversion Team and the contractor provided support for 13 such meetings. Also, during this period 185 documents were processed through the document review cycle and released for distribution.

4.6.4 Problem Report Working Group

The Problem Report Working Group (PRWG), chaired by the Test Director, consisted of members designated as problem coordinators (PC) for the following areas:

- Real-Time Support Software
- System/Facility
- Controls and Displays
- Mission Software/Non-Real-Time Support Software
- Support Hardware
- Core Elements

A SITC representative, acting as recorder, was also a member of the PRWG.

The PRWG met weekly to review the status of all outstanding Problem Reports, to ensure appropriate action was being taken. This group also was responsible for assigning new problems to a responsible engineer for resolution. Any problems that were determined to be beyond the charter of the PRWG (e.g., those impacting cost, schedule, etc.) were elevated by the PRWG to the Problem Report Board. It should be noted that, in addition to PRWG, any individual who felt that a problem should be elevated to the PRB could do so by either personally sending a memorandum to the PRB identifying the problem or by contacting the responsible problem coordinator and requesting that he elevate the problem.

4.6.4.1 Problem Report Working Group Chairman Tasks

- Scheduled meetings
- Assigned responsible Engineer
- Assigned priorities
- Monitored status of Problem Reports
- Coordinated the effort of different Groups
- Closed out Problem Reports
- Elevated PR to PRB
- Published Weekly Status Log
- Submitted Document Change Requirements to PRB

4.6.5 Problem Report Board (PRB)

This Board facilitated the handling of problems that were outside the charter of the standing Problem Report Working Group (PRWG). The PRB Membership consisted of the following members:

- Branch Chief - Chairman
- CMO Manager - Secretary
- DAIS Group Leaders
- ITB/STS Test Director
- SITC Contractor
- AAF Representative
- Documentation Contractor
- DAIS Contractors (as required)

In order to resolve Problem Reports that were elevated to the PRB, the PRB appointed Problem Report Groups (PRGs) to thoroughly review the problem report and submit recommendations for appropriate action. The status of these groups was tracked through the use of an attachment to the PRB minutes. When a group had completed its work, it was normally disbanded by the Board.

This Board met every two weeks after the DCB meeting or on an as-required basis.

4.6.5.1 Problem Report Procedures

A Problem Report was written for a milestone, task, or technical problem of sufficient significance to require control and follow-up to ensure completion of the action. Problem Reports were listed on the Problem Report Log, to provide proper tracking of action required and performed to resolve the problems. The Problem Report Flow is shown in Figure 23.

4.6.5.2 Problem Report Board Support

The contractor served as secretariat to the PRB, which included recording the minutes of thirty-five meetings, effecting the necessary coordination to ensure that the minutes accurately reflected the Board proceedings, published and distributed the minutes. Also, the secretariat assisted in developing the combined Problem Report form and in writing DCN #1 to the Configuration Management Plan, to incorporate the new Problem Report Procedure. Also, this support required the maintenance of a file for all opened and closed Problem Report forms. During the period of the contract over 461 Problem Reports were processed. Of this number, 64 were elevated to the PRB for resolution. Sixteen teams were formed to work these problems.

PROBLEM REPORT FLOW

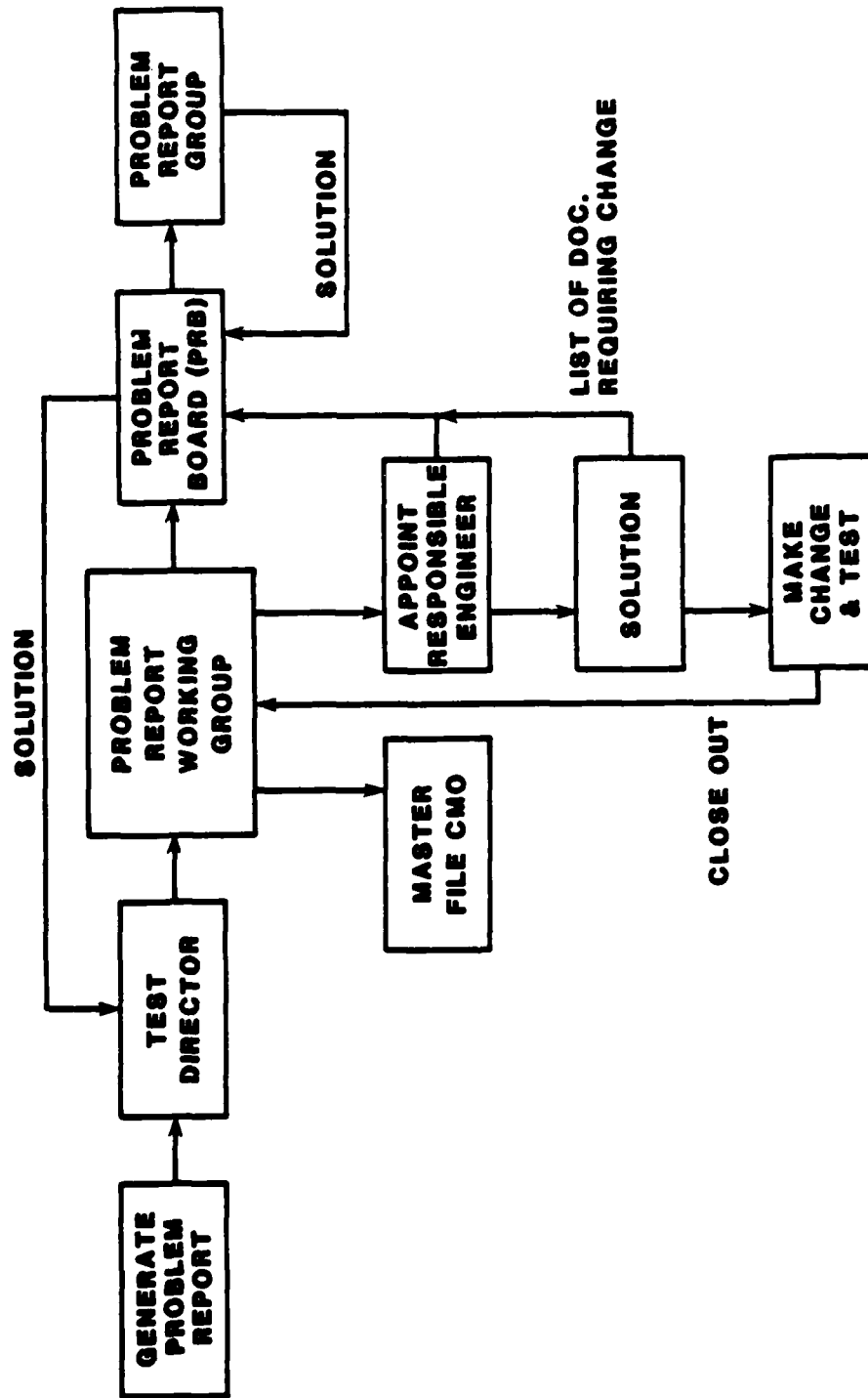


Figure 23. Problem Report Flow

4.6.6 Test Control Board (TCB)

This Board was responsible for organizing Test Working Groups (TWGs) to ensure that integration testing was accomplished efficiently and in a timely manner. The requirement for the TCB was generated by the fact that much of the testing performed on the STS/ITB, as the DAIS program matured cut across several areas (e.g., mission software, C&D, models, etc.) and was performed on a functional basis (e.g., weapon delivery, steering, etc.). This type of testing required participation by personnel from each area to support the tests and required judicious planning of the limited AFWAL/AAAS and contractor personnel resources to effectively perform the integration and test activities.

The members of the TCB were:

- Branch Chief - Chairman
- CMO Manager - Secretary
- DAIS Group Leaders
- ITB/STS Test Director
- SITC Contractor
- Documentation Contractor
- DAIS Contractors (as required)

The tentative schedule of Board meetings was every two weeks at the conclusion of the DCB meeting.

4.6.6.1 Test Control Board Tasks

The principal tasks of the TCB were as follows:

- Implemented DAIS demonstration objectives (interim and final) and tasks, as established by DAIS Program Branch Chief
- Reviewed and approved Integration and Test Concepts and Plans
- Formulated each TWG, assigned members and tasks
- Approved TWG schedules, Integration and Test Activities
- Reviewed status and progress of TWGs
- Established priorities
- Resolved Problem Reports that specifically affected Test Planning, TWG assignments of Test Schedules and Activities

4.6.6.2 Test Working Groups (TWGs) Tasks

- Performed Integration and Test Activities as assigned by TCB
- Prepared and submitted to Test Director (TD) an ITB/STS Schedule Request defining test time and configuration required
- Notified TD when assigned time could not be used
- Prepared checklists for TCB approval
- Prepared Problem Reports, as required, for submittal to TD
- Prepared Test Reports containing test checklist, test conclusions and exceptions at the end of the test for the TCB

In order to accomplish the above tasks, the typical flow of a test, from conception of a requirement to the submittal of a test report, is shown in Figure 24. The progress of the tests was tracked by the TCB by use of an attachment to the TCB minutes. Also, the team leader could be called upon to give a verbal progress report during a TCB meeting or at a special meeting if the situation dictated.

INTEGRATION TESTING

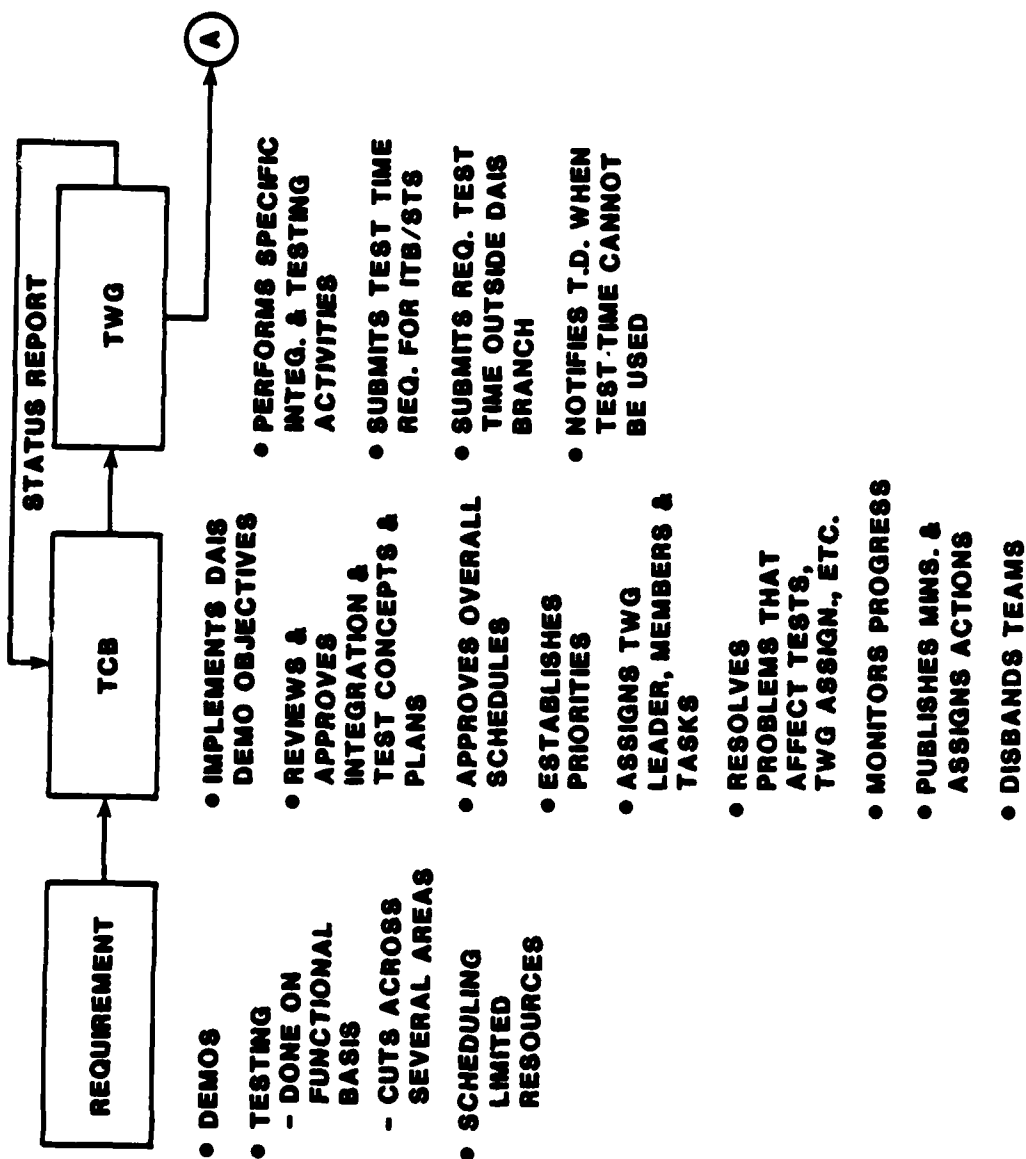


Figure 24. TYPICAL FLOW OF A TEST

FUNCTIONS OF TWG

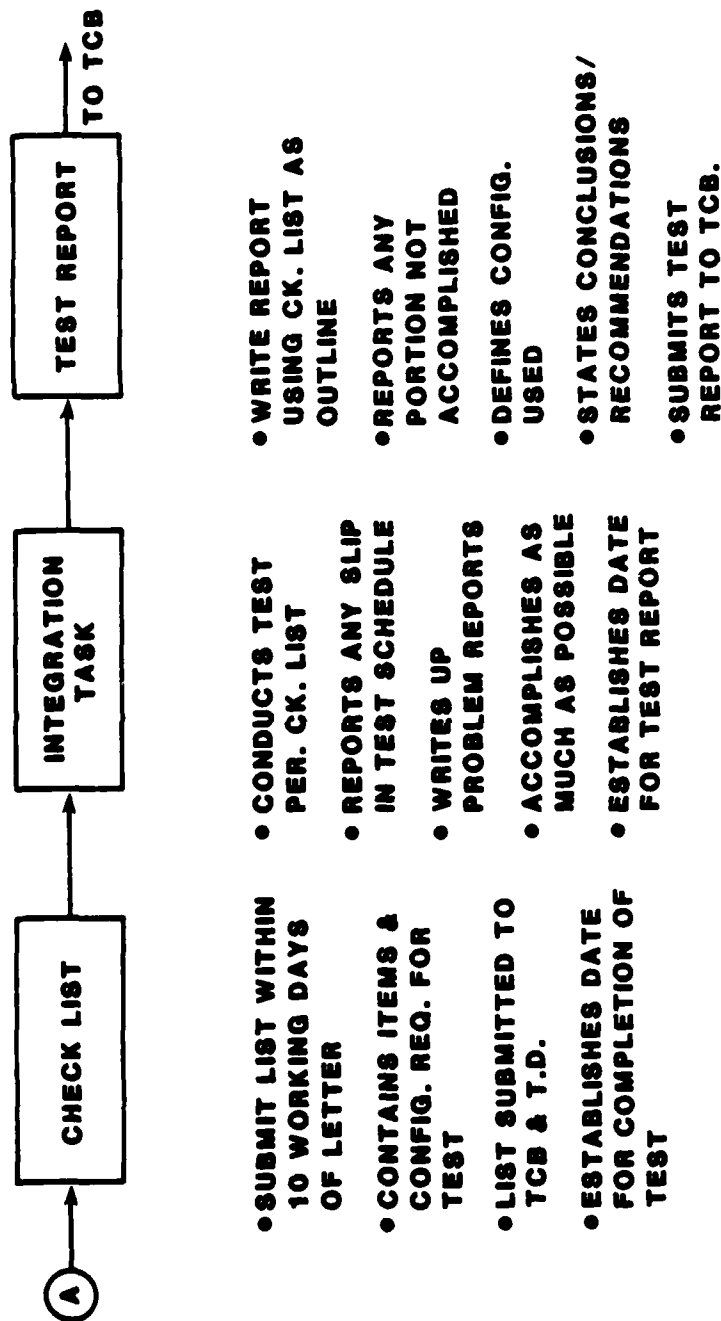


Figure 24. Typical Flow Of A Test (cont'd)

4.6.6.3 Test Control Board Support

The contractor served as the secretariat to the TCB. In this capacity, minutes were recorded and necessary coordination was performed to ensure that accurate information was contained in the minutes. Also, the minutes were published and distributed, and a file was maintained on all correspondence to and from the TCB. During the period of the contract six TCB meetings were conducted prior to its dissolution.

The Test Control Board provided adequate configuration control over the testing that was being accomplished. However these activities revealed problems that were occurring due to the lack of proper configuration control over DAIS software and hardware. Therefore, a new board, the Product Control Board (PCB) was formed. The PCB had the expanded charter to exercise control of the DAIS hardware, software and testing.

4.6.7 Product Control Board (PCB)

The Product Control Board's principal responsibility centered around identifying, controlling, recording and authorizing changes to the Software Test Stand (STS) and Integrated Test Bed (ITB) hardware and software. The integration testing was controlled in the same manner as it was accomplished under the dissolved Test Control Board.

The members of the TCB were:

- Branch Chief - Chairman
- CMO Manager - Secretary
- DAIS Group Leaders
- ITB/STS Test Director
- SITC Contractor
- Documentation Contractor
- DAIS Contractors (as required)

The tentative schedule of Board meetings was every two weeks at the conclusion of the PRB meeting.

4.6.7.1 Hardware/Software Configuration Control Procedures

The AFWAL/AAAS Test Director, with support from the SITC contractor, was responsible for maintaining control of the STS and ITB hardware and software configurations. The Test Director Tasks are outlined in Table III. A set of configuration status logs was utilized to track the configuration changes as follows: two master logs, one each for STS equipment configuration and ITB equipment configuration; a set of status logs for each equipment and support software end item.

Changes to the ITB and STS items had to be coordinated with and approved by the Test Director and recorded in the specific log as summarized below:

1. STS and ITB Equipment Configurations
 - a. Minor Changes. Any minor changes in the configurations (e.g., bus patch panel and CIU patch panel) were verbally coordinated with the Test Director.
 - b. Major Changes - Hardware Relocations. All equipment relocations within STS or ITB, or removal from or incorporation into STS or ITB, had to be approved by the Test Director and recorded in the Master STS or ITB log. The Test Director scheduled the movement of the equipment in order to minimize impact on either STS or ITB activities. Equipment Allocation Control Flow is depicted in Figure 25.
2. Equipment End Item Modifications
 - a. Permanent Hardware Configuration Changes. All permanent changes were documented and approved by the CCB in a CCB directive. The modifications were usually incorporated and tested offline in the stand-alone test area. Relocation into the STS or ITB was coordinated with the Test Director as described in 1(a) above. The changes were also recorded in the equipment end item status log.

TABLE III

TEST DIRECTOR TASKS

- MONITORS TEST STATUS OF STS AND ITB
- SCHEDULES ALL BLOCKS OF TIME ON STS AND ITB
- REVIEWS, APPROVES, CONTROLS AND RECORDS STATUS OF STS AND ITB SYSTEM AND EQUIPMENT CONFIGURATION CHANGES
- MAINTAINS CONTROLLED HARDWARE AND SOFTWARE BASELINE FOR EACH DEMONSTRATION PACKAGE
- CHAIRMAN OF PROBLEM REPORT WORKING GROUP
- REVIEWS AND SUBMITS ALL PROBLEM REPORTS TO PROBLEM REPORT WORKING GROUP AND CMO
- EXPEDITES ISOLATION AND RESOLUTION OF ANY CRITICAL SYSTEM PROBLEMS WHICH MAY IMPEDE OR DELAY OVERALL SYSTEM TESTING
- OUTPUTS
 - STS/ITB SCHEDULE
 - PROBLEM REPORTS
 - HARDWARE AND SOFTWARE CHANGES RECORDED IN MASTER ITB/STS LOG BOOKS

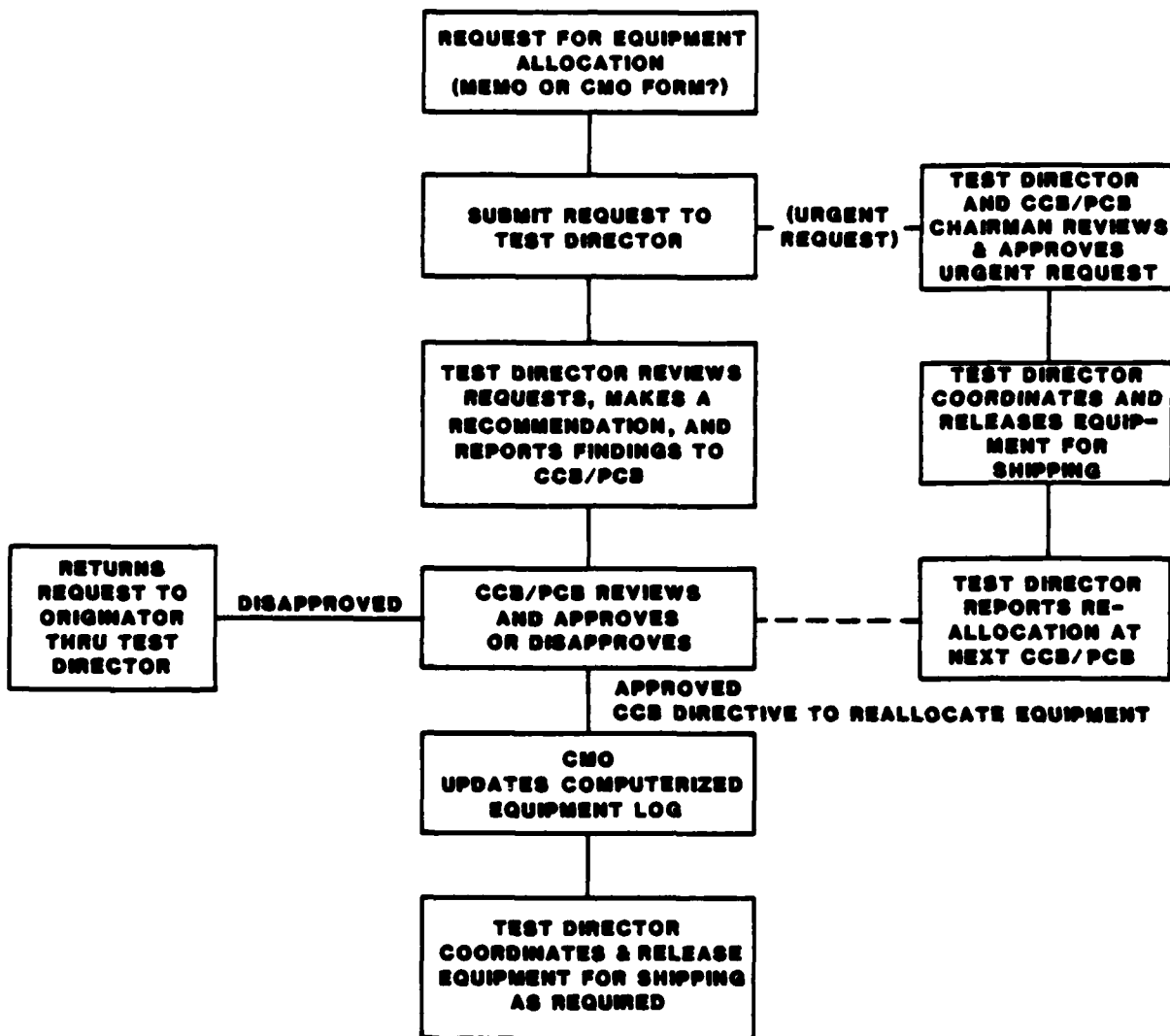


Figure 25. EQUIPMENT ALLOCATION CONTROL FLOW

- b. Temporary Hardware Configuration Changes. Temporary hardware changes were incorporated into a specific end item to support problem isolation or as temporary fixes for critical problems. This could be initiated as a result of a problem report. A description of the temporary modification and instructions on how to return the end item to the prior configuration was attached to the problem report. The Test Director scheduled and approved the temporary change, recorded the change in the Master STS or ITB log book and respective equipment log.

3. Real-Time Support Software Configuration Control

- a. Enhancements and Modifications. Developers enhanced and modified their software from a "Private Area" file or disk area. All changes were documented, tested, and submitted to the Test Director for approval. After Test Director approval, the PCB was notified and the new version was moved into a "New Version Area" disk or file.
- b. Maintaining "Official Copy". At turnover of the "New Version", a series of tests were performed to show the software met all of its system requirements. All errors uncovered were reported in Problem Reports. A "New Version" was then turned over to the Test Director for retest.

The Test Director notified the PCB after successfully completing these tests and the PCB approved movement of the new version to the "Official Version Area" as shown in Figure 26. Backup of the "Official Version Area" on separate disks or tapes was maintained by the S/W CMO. The S/W CMO recorded the new version change in the respective log.

All users used the "New Version" or "Official Version", and reported all problems in Problem Reports to the Test Director. The "Official Version" was used for demonstrations.

4.6.7.2 Product Control Board Support

During the period of the contract there were 25 meetings of the PCB; 70 backup tapes of the Official Version Area were made. The PCB was dissolved once configuration control was gained and the system running smoothly. However, to insure it was properly maintained the Hardware and Software Logs were placed under the PRB and all changes were briefed at the PRB meetings.

4.7 Copying Support

The contractor shall provide 150,000 copies of pages of documents as requested by the Configuration Management Office. These copies are used for reviews and fast turn-around requirements. Whenever possible the Air Force printing office or other AFAL reproduction facilities are used. Use of AF printing facilities must be coordinated with the Project Monitor. PCO approval is also required.

4.7.1 Copying Request Flow

The originator of a request for copying support made the request through the CMO office and it specified the document number, title and date. The need date was stated to assist the CMO in determining if the copying could be accomplished by the Air Force printing office or at the contractor facility. The criteria used by the CMO was: If the copies weren't needed for two weeks or more than ten copies were needed and the document was larger than ten pages then it could be accomplished by the Air Force printing office. If a fast turn-around was required, such as for review team activities, or if less than ten copies or ten pages, then the copying job was accomplished at the contractor facility..

4.7.2 Copying Tracking

Copying requests that were accomplished by the contractor were entered into a log book, reflecting the date of the request and an expected return date. This log was reviewed daily to insure timely submission of the required copies. Turn around time for a normal size document was one calendar day. During the period of the contract 139,321 copies of pages were provided.

4.8 Program Management

The contractor shall provide the services and materials indicated below to organize, direct, coordinate and control the tasks set forth in the Statement of Work.

4.8.1 Contract Work Breakdown Structure (CWBS)

The contractor shall maintain the CWBS and dictionary in compliance with the concepts set forth in MIL-STD-881. The negotiated CWBS shall provide the basis for further evolutionary extension by the contractor to lower levels during the performance of the contract. The contractor shall use the CWBS as the primary framework for contract planning, budgeting and reporting status of costs and schedule to the Air Force. The CWBS shall be maintained and updated by the contractor during the execution of the contract according to the CDRL. During the performance of the contract, the contractor shall update the CWBS as additional system definition is accomplished and may propose alternatives for improvement. Authority for approval and use of such alternatives rests with the DAIS Program Manager through the PCO.

4.8.1.1 Contract Work Breakdown Structure (CWBS) Delivery

The Contract Work Breakdown Structure, Table IV, was designed to give maximum visibility for cost control to provide easy correlation to the tasks outlined in the work statement and division of tasks within the project organization. By using the WBS the total program was divided into many small "work packages" which were individually budgeted. This detailed cost break out concept was used to control costs throughout the term of the contract. The costs of the individual work tasks in the WBS were continually monitored and the manager was alerted to any deviations from budget which permitted appropriate and timely corrective action.

Table IV. Contract Work Breakdown Structure

WORK PACKAGE #			DESCRIPTION
LEVEL 1	LEVEL 2	LEVEL 3	
1	1.1		DAIS Documentation
			Library Maintenance
		1.1.1	Printing of DAIS Documents
		1.1.2	Distribution of DAIS Documents
		1.1.3	Inventory Maintenance
	1.2	1.1.4	Master File Maintenance
			Preparation of Bus Monitor Specification
			Drafting Support
			Editing
		1.4.1	Technical Editing/Rewrite
	1.3	1.4.2	Format Editing/Proofreading
			Audits
		1.5.1	Physical Audit of Universal Remote Terminal (URT)
		1.5.2	Physical Audit of Modular Programmable Display Generator (MPDG)
		1.5.3	Physical Audit of Bus Monitor Unit (BMU)
	1.4	1.5.4	Software Audit of Simulated Subsystem Data Formatter (SSDF) Program
			DAIS Control Board Support
			Copying Support
			Program Management
		1.8.1	Contract Work Breakdown Structure (CWBS)
	1.5	1.8.2	Technical Reporting
		1.8.3	Schedule and Cost Reporting
			DAIS Information Booklet

4.8.2 Technical Reporting

The contractor shall prepare and provide to the government a monthly accounting of work accomplished, identification of problem areas with recommended solutions and work to be accomplished during the next period. This information shall be submitted in conformance with the appropriate data items specified in the CDRL.

4.8.2.1 Technical Reports Submitted

During the life of the contract, 22 Monthly R&D Status Reports were submitted which covered the activities of the contractor during the previous month.

4.8.3 Schedule and Cost Reporting

The contractor shall prepare and provide to the government a monthly Program Schedule and financial reports in accordance with the appropriate data items specified in the CDRL.

4.8.3.1 Schedule and Cost Reports Submitted

During the life of the contract, 22 Monthly Performance and Cost Reports were submitted which gave a break out by tasks, the number of dollars and hours expended during the previous month, and the cumulative totals to date.

4.9 DAIS Information Booklet

Preparation and Reproduction of a DAIS Information Booklet(Task 9). The contractor shall develop an Information Booklet for DAIS by utilizing existing information and/or writing new material. The pictures, illustration, etc., can be created new or from existing items. The manual is to be 15 to 20 pages and 4,000 copies are to be reproduced.

4.9.1 DAIS Information Booklet Contents

A twenty page multi-colored Information Booklet was developed. This booklet covered in the introduction the efforts that have gone into Avionic Systems Integration and then discussed in detail the Controls and Displays, Multiplex Data Bus, Processors, Avionics Software, Test Support Facility, and Avionics Costs. The last section of the booklet outlines what lies ahead in the avionic systems information fusion concepts and technologies being advanced by the Avionics Laboratory.

4.9.2 Information Booklet Delivery

Four thousand copies of the booklet were delivered. Initial distribution of approximately two thousand booklets were made to Major Air Force Commands, Numbered Air Forces and active flying units.

5. CONCLUSIONS AND RECOMMENDATIONS

The DAIS program, which did not include the full implementation of configuration management from its inception in 1973, presented a unique set of situations which had to be considered in the organization and implementation of a configuration management effort in 1975.

Considerations included:

- DAIS Concepts and ultimate goals
- Status of the DAIS Program with respect to hardware, software and program data availability at the time of configuration management implementation
- Organic capabilities available to implement a program of configuration management
- Impact on contractor working on contract for the design and development of items required as an integral part of the DAIS Program

By necessity this effort was formulated in a pattern which imposed the basic policies and procedures of configuration management in a form most compatible with criteria imposed by an "in process" program.

To obtain control of the DAIS configuration items of hardware and software, two major phases were necessary. The first involved documentation and the second related to the hardware and software and their relationship to the documentation.

5.1 Phase I - Documentation Control

Documentation control was highly successful in the effort of gathering, reviewing, cataloging and filing of all DAIS specifications, interface control documents, user's manuals, engineering drawings and test plans and procedures. A total of 185 documents were reviewed, approved, printed and distributed to in-house Air Force units, other government agencies, and civilian industry.

5.2 Phase II - Product Control

Product control was also successful but not to the same degree as Phase I. Configuration control was attained over the software that had been developed by insuring that it had been developed as required by the specifications and was compatible to its associated listing. Selected items of hardware used in the development of the DAIS program underwent a physical audit which revealed many discrepancies between the physical units and the documents describing them. These were corrected and a higher degree of control over changes to the hardware was initiated, but this came about too late in the program to make a significant contribution to control of the hardware. This was evidenced by the fact that only three hardware-related ECPs were processed. It would be difficult to assess how the overall hardware met the criteria established by its associated documentation due to the limited scope of the hardware physical audits.

Therefore it is recommended that in future programs that the principles of Configuration Management be implemented as early as possible in the program life cycle. This should be accomplished by the establishment of a Configuration Management Office (CMO) in the Program Office (PO). In the early phases the CMO should provide control of performance/system specifications and provide visibility into the development process. At the same time the PO should establish contractual requirements for CM on the contractors who are involved in the development of software, hardware or facility support. Also the CMO should act as the focal point within the PO for centralized specification control and for hardware configuration status, including identification and control. CM should be applied to all elements of the program—hardware, computer programs, support equipment, facilities and documentation (specifications, plans, drawings, manuals, etc). The basic

approach is to use the standard CM techniques but retain flexibility to tailor requirements for each particular program.

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