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PREDICTIVE SOFTWARE COST MODEL STUDY. VOLUME II. SOFTWARE PACKA--ETC(U)

JUN 80   R B WAINA, A P BANGS, E E RODRIGUEZ   F33615-79-C-1734

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1 OF 6

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AFWAL-TR-80-1056
Volume II

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LEVEL III

AF WRIGHT AERONAUTICAL LABORATORIES

PREDICTIVE SOFTWARE COST MODEL STUDY

Hughes Aircraft Company
Support Systems
Canoga Park, California 91304

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JUNE 1980

VOLUME II: SOFTWARE PACKAGE DETAILED DATA

Final Report for Period 2 April 1979 - 2 June 1980

Approved for Public Release; Distribution Unlimited

Avionics Laboratory
Air Force Wright Aeronautical Laboratories
Air Force Systems Command
Wright-Patterson Air Force Base, Ohio 45433

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This report has been reviewed by the Office of Public Affairs (ASD/PA) and is releasable to the National Technical Information Service (NTIS). At NTIS, it will be available to the general public, including foreign nations.

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

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AFWAL/AAAS-2

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Avionics Support
Life Cycle Cost
Cost Effectiveness

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

Current cost estimating techniques do not adequately address the problem of predicting avionics embedded software support costs. This limitation results primarily from an inadequate understanding of how those costs are generated and from a scarcity of historical data on avionics software support and the resultant costs. The objectives of this Phase I study of the Predictive Software Cost Model (PSCM) program were to determine the feasibility of a model to predict those costs and to generate a roadmap for development of

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such a model. The feasibility of such a model was established. It will include the six key resource types required to support avionics software personnel, support hardware, support software, facilities (buildings), program documentation and flight test aircraft/ranges. Some preliminary estimating relationships were identified. A detailed roadmap for developing the model was generated. Phase II of the PSCM program will provide AFWAL/AA with an operating model for predicting avionics embedded software support costs.

PREFACE

The Predictive Software Cost Model Study Phase I Technical Report is prepared in two separately bound volumes.

Volume I - Final Technical Report

Volume II - Software Package Detailed Data

The Air Force Program Monitor was Mr. Daniel V. Ferens, Systems Evaluation Group, Avionics Systems Engineering Branch (AFWAL/AAAA-3).

TABLE OF CONTENTS

I. GENERAL

This volume contains the Predictive Software Cost Model Study Data Collection forms prepared from data collected during visits to Air Logistics Centers. Visits were made to all five ALCs (Oklahoma City, Sacramento, Warner-Robins, Ogden, and San Antonio) to(1) identify digital avionics software packages now or soon-to-be maintained by the Air Force, (2) determine current and proposed software support policies and procedures, (3) describe key characteristics of Air Force avionics software support agencies, (4) collect data on a sample of six avionics software packages, (5) collect data on electronic warface software support at WRALC, (6) collect data on automatic test equipment software support at SAALC, and (7) identify possible sources of historical data for a follow-on model development effort.

The Data Collection Forms contain the following information for each software package considered in the study:

General Software Package Description
Maintenance Agency Personnel
Maintenance Agency Work Distribution
Maintenance Agency Cost Accounting System
Maintenance Agency Policies and Procedures
Personnel Description
Facilities - Buildings
Facilities - Computers
Support Software
Training Requirements
Flight Test Requirements
Maintenance History
Maintenance Cost History
Historical Data Sources
Software Support Cost Predicting Recommendations

The Data Collection Forms and associated supportive data are presented in Appendixes A through H.

APPENDIX A

A7-D/OCALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION DATE: 27 July 1979

ALC: OC/NWC	WEAPON SYSTEM: A-7D

SOFTWARE PACKAGE: Operational Flight Program

PERSONNEL CONTACTED:

Dave Corder, MMEC (405) 734-2453
George Wann, MMEC
Mark Jacobson (China Lake), MMECZA (714) 939-5575/5474

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE: 15K

LANGUAGE: Assembly

APPLICATION: Navigation/Weapons Delivery

COMPLEXITY: Average

YEAR DEVELOPED: 1968

DEVELOPER: IBM/Vought

COMMENTS See p. A-2 for a rating of quality attribures.

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER: IBM

MODEL NUMBER/DESIGNATOR: TC-2

WORD SIZE: 16 bit

MEMORY SIZE: 16K

MEMORY FILL: 89% (1860 spare 16-bit words)

WEAPON SYSTEM USE:

NUMBER OF USERS: 370 aircraft, 1,000 pilots

LOCATIONS OF USERS: See page A-3.

FREQUENCY OF USE: Daily

INTERVIEWER(S): R. B. Waina, A. P. Bangs

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - Software Package Characteristics **DATE:** 27 July 1979

Rate the Package on the following Quality attributes: (1=Poor; 10=Excellent)

Accessibility: 3

Accountability: 6
(Timing & Testing Handloads)

Access Audit: 3
(Cross references only)

Access Control: 7

Accuracy: 8 (some algorithms are noisy)

Augmentability: 5 (I/O, Core and Time Bound)

Clarity: 3 (Program Structure is not good)

Communicativeness: 10

Communications, Commonality: 8
(Mostly machine dependent)

Completeness: 8
(Most of the program is stable)

Conciseness: 8

Consistency:
- Internal Consistency: 8
- External Consistency: 3

Correctness: 10

Data Commonality: 10 (Checked at assemble time)

Efficiency:
(An area of major concern)
- Execution Efficiency: 10
- Storage Efficiency: 10

Error Tolerance: 7 (Back-up modes are adequate; some hard failures)

Expandability: 3 (Timing constraints cause difficulty)

Generality: 10

Human Engineering 5 (Moding & operator functions bound by hardware)

Independence:
- Device: 3 (TC-2 only)
- Software System: (TC-2 only no operating system)

Instrumentation: 7 (Hardware Instrumentation) (output & S/W data reduction, SOVAC)

Interoperability: 6 (Difficult because of analog interfaces)

Integrity: Not applicable

Legibility: 3 (Assembly Language)

Maintainability: 3

Modifiability: 3

Modularity: 3

Operability: 7

Performance: 3 (system design is old)

Portability: 5 (can be run on upgraded TC-2A)

Reliability: 10 (User does not complain)

Robustness: 5 (There is some quality checking)

Reusability: 3 (Minimal due to poor structure)

Selfcontainedness: 10 (No complaints)

Selfdescriptiveness: 5

Simplicity: 3

Structuredness: 3

Testability: 5 (Test facilities & procedures are good, but program is hard to test)

Traceability: 5 (Built-in modification procedures)

Training: 5 (Difficult because S/W is complex)

Understandability: 5 (Some bad areas)

Usability (as-is utility): 7 (The OFP is the core of a very successful weapons system)

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - System Use **DATE:** 27 July 1979

A-7 AIRCRAFT DISTRIBUTION (as of April, 1979)

Assigned

COMMAND		AFSC		ATC		TAC		NGB
		7		13		114		259
BASE	Edwards	5	Sheppard	5	England	77	Kirtland	23
	Eglin	2	Chanute	6			Buckley	23
			Lowry	2	Davis-Monthan	37	Rickenbacker	18
							McEntire	19
							Pittsburgh	18
							San Juan	20
							Tucson	37
							Des Moines	19
							Sioux City	18
							Joe Foss	19
							Springfield	18
							Tulsa	18
							Selfridge	9
							Toledo Express	0
							Contractor (Vought)	1*

*73-1008 Prototype Conversion to A-7K

SUMMARY

459 Produced

65 Attrited

13 Grounded (ATC)

7 Non-Standard (AFSC)

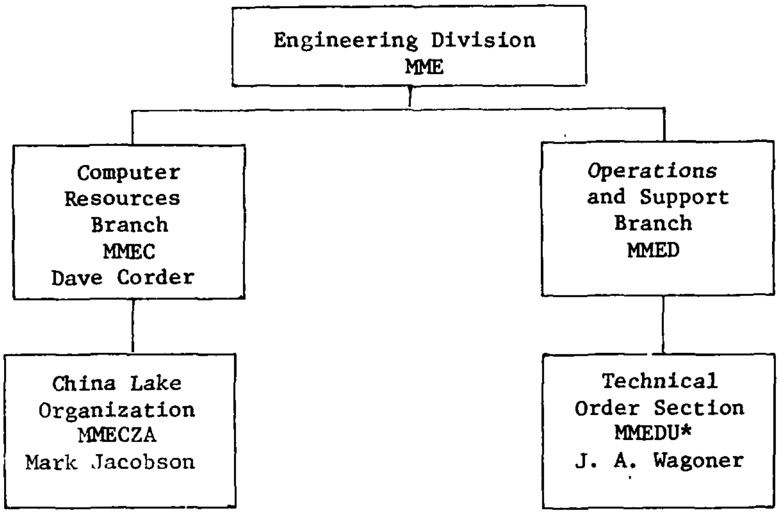
374 Standard Fleet Balance

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL DATE: 27 July 1979

ALC: OC/NWC	OFFICE SYMBOL: OCALC/MMECZA

KEY PERSONNEL/OGRANIZATION:



*In charge of AFCR/CPIN System

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE): To MMECZA

6 Civil Service
Additionally, about 8 manyear of effort is procured from NWC annually.

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

1 A7-D Operational Flight Program
1 A7-D Operational Test Program

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - WORK DISTRIBUTION **DATE:** 27 July 1979

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL

There is minimal maintenance on the Operational Test Program. Responsibilities on the Operational Flight Program are distributed as follows:

Position (Civil Service)	Functions
Supervisory Electronic Engineer	50% managerial, 50% technical (program design on flight computer)
Mathematician	50/50 simulation and data reduction
Computer Scientist	Simulation - 35% Data reduction - 35% Programming tests - 15% TC-2 support software - 15%
Equipment Specialist (Avionics)	Integration testing - set up instrumentation on flight test aircraft
Computer Operator	Run validation and verification tests

Additionally, eight manyears of assistance is procured from the Navy. This is detailed on page A-6.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET: Work Distribution **DATE:** 27 July 1979

Navy Personnel:

Quantity (manyears)	Function
1/2	Program Management
1/2	Administrative Assistance
3	Upgrading of equipment and facilities, support software development
2	Technical analysis of algorithms, etc. (e.g., weapons ballistics)
1	Data reduction
1	Flight test support - target preparation, weapons impact siting, data collection, etc.

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE: 27 July 1979

Costs are collected at a high level of aggregation.

Payments to Naval Weapons Center for services are categorized as follows:

I. MANAGEMENT ENGINEERING

a) Administration and Budget
b) Materials and Supplies
c) Travel
d) Contracted Documentation
e) Contracted Configuration Management
f) NWC Engineering Labor

II. SIMULATION AND LABORATORY FACILITIES

a) Labor
b) Contracted Maintenance
c) Equipment via NWC
d) Computer Use Charges

III. FLIGHT TESTING

a) Range Charges
b) Data Reduction
c) A/C Modification/Instrumentation

Manhours by the assigned Air Force civil service personnel are not documented by a task or function breakdown.

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 27 July 1979

SUPPORT PHILOSOPHY:

The A-7D software support philosophy is based on the need for a highly responsive and continuing engineering capability for analysis and correction of deficiencies reported and for design and production of major changes determined necessary and approved for implementation. The co-location of the Air Force Engineering Support Team at the Navy facility has provided for an interchange of experience and information and has resulted in a cost savings to the Air Force by sharing an existing DoD facility.

The Air Force-Navy Interservice Support Agreement (ISA) is being continued for the A-7D OFP/OTP support at China Lake to permit a dynamic organic engineering function for analysis and correction of deficiencies reported and for the design and production of all OFP changes determined necessary and approved for implementation by the A-7D Computer Program Configuration Sub-Board and OC-ALC and AFLC Configuration Control Boards. This includes OFP changes associated with both software deficiencies and hardware modifications. The Engineering Support Team also provides an integrated weapons system avionics testing capability for enhancement studies and direct support to the using commands and to the item Managers of A-7D subsystems and equipment. (Continued on p. A-9)

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Formal

CHANGE REVIEW PROCESS: The change review process is diagrammed on p. A-22.

CONFIGURATION IDENTIFICATION METHODS: OFP title is updated by assembler.

CONFIGURATION CHANGE CONTROL METHODS: Change control/status accounting methods are described on p. A-23.

CONFIGURATION STATUS ACCOUNTING METHODS:

See page A-23.

SOFTWARE LIBRARY CONTROL PROCEDURES: The DEC library is used.

CONTINUATION SHEET - Support Philosophy **DATE:** 27 July 1979

This support philosophy is expanded in the Memorandum of understanding reproduced on pp. A-10 through A-15, and the A-7D Operations/Flight Program Support Plan 74-1A reproduced on pp. A-16 through A-21.

MEMORANDUM OF UNDERSTANDING
FOR A-7D AIRCRAFT COMPUTER PROGRAMS
BETWEEN AIR FORCE AND NAVY

1. BACKGROUND

1.1 The A-7 Aircraft is a joint service weapon system using an airborne digital computer to integrate the Big "8" avionics navigation and weapons delivery system. Operational flight program (OFP) tapes are used within the computer memory and will require maintenance (reprogramming, updating, validation) throughout the life of the A-7 aircraft system. The Navy developed an organic capability at the Naval Weapons Center (NWC) China Lake to perform maintenance for the A-7C/E aircraft. An A-7D OFP Engineering support team was formed in 1974 and located at the Naval Weapons Center, China Lake, CA, to co-share the Naval facility and maintain the A-7D OFP. This team consists of nine OC-ALC/MME personnel and three TAC personnel. In addition, the Air Force funds NWC for the Navy efforts required on A-7D tapes as a pro rata share of those jointly used facilities. These actions result in a cost savings to the Air Force and Navy by utilizing an existing DOD facility/capability, provide for an interchange of experience, information, and maintain a basic nucleus of trained Air Force personnel in the airborne computer programming field.

2. PURPOSE

2.1 The purpose of this Memorandum of Understanding is to provide for the extension of the Air Force-Navy Interservice Agreement dated October 1973 in accordance with the terms and conditions stated herein. In those instances where this Memorandum of Understanding conflicts with the Air Force-Navy Interservice Agreement dated October 1973, the contents of this Memorandum of Understanding governs.

2.2 This plan encompasses a joint Air Force/Navy co-shared facility approach where the Air Force will maintain properly skilled personnel at NWC, China Lake to accomplish the Air Force OFP maintenance requirements.

2.3 It outlines the scope of the basic maintenance effort and the approach in accomplishing the task as agreed to by both Services.

2.4 Further, this plan outlines the organization, procedures, personnel, facilities, and hardware requirements to be furnished by each Service.

3. SCOPE

3.1 The A-7D Technical Support Team will perform sustaining engineering on the aircraft integrated Navigation and Weapon Delivery System (NWDS) software. This function will involve the following major tasks:

a. Solution of operational software NWDC problems.

b. Development of advanced software capabilities and improvements to the A-7D NWDS.

c. Maintain configuration control of the Tactical Computer Software Operational Flight Program (OFP), and Operational Test Program (OTP).

3.2 Problem solving will be performed to correct deficiencies which are discovered during engineering operations at NWC or are found during operational command usage.

3.3 Development of improvements and advanced capabilities will be performed as required to refine or expand the weapon system capability in the areas of functional performance, flexibility, operability, or maintainability. Such modifications may involve the integration of new avionics and associated computer software.

3.4 Configuration control of the OFP/OTP is required to insure that current documentation which meets the USAF standard is maintained on each computer program. This effort also insures that modifications and additions to each OFP/OTP are effectively coordinated with the master aircraft configuration plan.

3.5 It should be emphasized that this program provides for engineering support of the A-7D NWDS - the integrated assemblage of weapons, avionics, computer software, displays, and controls which combine to provide the basic navigation and weapon delivery capability of the aircraft. Axuiliary systems, such as the Automatic Flight Control System, communications equipment, standby attitude reference and the like are specifically excluded from this program.

4. APPROACH

4.1 The SM is responsible for insuring the A-7D NWDS engineering support program is properly coordinated. A special A-7D team staffed with USAF personnel must be maintained at NWC. The team is co-located with the A-7E engineering team to maximize Navy-Air Force interchange and facilitate guidance and assistance to the A-7D team.

4.2 The A-7D team will have the responsibility and authority for execution of all tasks assigned by OC-ALC Computer Resources Branch and will coordinate with the NWC A7 Program Manager in the execution of those tasks.

4.3 Existing A-7E engineering facilities (Flight Simulator, System Integration Lab, Navigation Integration Lab, and special avionic lab facilities) will be shared by the Navy and Air Force engineering teams. Modification to these facilities may be required to satisfy unique A-7D requirements. Such changes will be defined and implemented by the two teams with the approval of the NWC A7 Program Manager.

4.4 Due to the interrelationship of the Navy/Air Force teams in utilizing available NWC resources and to insure reasonable resource availability to achieve commitments, NWC approval and concurrence will be required on Air Force dates, milestones and schedules to accomplish assigned Air Force tasks as these dates, milestones and schedules affect available resources. This will allow proper and reasonable resource scheduling to accomplish both the NWC and Air Force missions.

5. DETAILED REQUIREMENTS

5.1 Personnel and Services

5.1.1 AFLC civilian positions have been established at the Naval Weapons Center to staff the A-7D OFP engineering support team.

5.1.2 In addition, the Air Force will provide necessary maintenance personnel to support the project A-7D aircraft. The number of personnel to support this effort will be determined by negotiation and on an as-required basis. The aircraft, project/liaison officer, and necessary personnel/equipment required for A-7D aircraft support will be provided by the Tactical Air Command.

5.1.3 The A-7D OFP engineering support team OC-ALC/MMECZA will have engineering responsibility for the instrumentation of flight test aircraft by Class II modification.

5.1.4 The Navy will provide general administrative support to the A-7D OFP engineering support team and will provide office materials and equipments required by the team in support of A-7D OFP engineering functions. Air Force funding will be based on labor expenditure, materials costs, and facilities costs.

5.1.5 The Navy will provide documentation update service in support of the A-7D OFP engineering effort upon request by OC-ALC.

5.1.6 The Navy will provide consultation and assistance to OC-ALC/MMECZA upon request, at a sustaining level in accordance with the NWC budget. Air Force funding will be based on estimated labor expenditures and rates.

5.1.7 The Navy will provide flight test data reduction services to OC-ALC/MMECZA with Air Force costs predicated on computer utilization time and Navy expenditures in support of those services.

5.1.8 The Naval Weapons Center will provide the normal transient military aircraft services and will assist in aircraft maintenance.

5.2 Facilities

5.2.1 The A-7D team will have full access, on a scheduled basis, to all the facilities of the A-7E team including the flight simulator, the Navigation Integration Laboratory, and the Weapons Integration Laboratory. In turn for their use of these facilities, the Air Force will share the cost of the maintenance and operation of these facilities. Scheduling these facilities is the responsibility of the NWC A7 Program Manager and will be accomplished based upon the requirements of the Navy and Air Force users. Equal consideration will be given to the Navy and Air Force when scheduling these facilities during normal duty hours.

5.2.2 Flight test range requirements at China Lake will be scheduled through the Navy A7 Flight Test Engineer. Test range expenses will be funded by the Navy from AFLC provided funds on a per-flight basis.

5.3 Aircraft and Equipment

5.3.1 The Air Force will provide an A-7D aircraft, properly instrumented for flight test purposes. Ordnance required for flight test will be provided by the Air Force for A-7D OFP support.

5.3.2 The Air Force will provide necessary spare parts and test equipment to support the aircraft during flight operations.

5.3.3 The Air Force will maintain one each of the NWDS components, which are peculiar to the A-7D, for use in the laboratory facilities at NWC. These will include, but will not be limited to:

a. ASN-91 NWDS Computer

b. Armament System Control Unit (ASCU)

c. AN/ASN-90 IMS

6. CONFIGURATION CONTROL. OFP/OTP configuration control is the responsibility of the Air Force.

7. REPORTS AND DOCUMENTATION

7.1 NWC shall provide quarterly management and financial reports to OC-ALC/MME. Content and format will be determined by NWC and OC-ALC/MME.

8. FUNDING

8.1 The funding of the A-7D OFP support program will be by means of a Military Interdepartmental Purchase Request (MIPR) Form DD 446 from the Air Force to the Naval Weapons Center. Funds will be provided either annually or at no shorter intervals than quarterly. The Naval Weapons Center will forward monthly Form 1080 reports to the Air Force showing expenditures of Air Force Funds.

9. GENERAL PROVISIONS. Terms and funding will be negotiated between the Services annually as required by DOD Directive 4000.19M. Termination or major modification may be instituted by either Service with a minimum of six months advance notice followed by joint Service determination of the impact on either Service and negotiation of the funding/hardware/personnel changes required.

ABBREVIATIONS

AFLC	Air Force Logistics Command, Wright-Patterson AFB OH
CCB	Configuration Control Board
CPCSB	Computer Program Configuration Sub-Board
MIPR	Military Interdepartmental Purchase Request
NGB	National Guard Bureau
NWC	Naval Weapons Center, China Lake, California
NWDS	Navigation/Weapons Delivery System
NWDC	Navigation/Weapons Delivery Computer (ASN-91)
OC-ALC	Oklahoma City Air Logistics Center, Tinker AFB, Oklahoma
OFP	Operational Flight Program
OTP	Operational Test Program
SM	System Manager
TAC	Air Force Tactical Air Command, Langley AFB, Virginia
TFWC	USAF Tactical Fighter Weapons Center, Nellis AFB, Nevada
TO	Technical Order

LIST OF DOCUMENTS

AFR 57-4	Retrofit Configuration Changes
AFR 800-14 Vol I	Management of Computer Resources in Systems
AFR 800-14 Vol II	Acquisition and Support Procedures for Computer Resources in Systems
AFLC Supplement 1 AFR 800-14	Acquisition Management - Management of Computer Resources in Systems
MIL-STD 480	Configuration Control-Engineering Changes, Deviations and Waivers
MIL-STD 483	Configuration Management Practices for Systems, Equipment, Munitions, and Computer Programs
MIL-STD-490	Specification Practices
MIL-STD 1521	Technical Reviews and Audits for Systems, Equipment and Computer Programs
TO 00-5-15	Air Force Technical Order System
AFLC Form 48	Configuration Control Board Item Record
DD Form 1692	Engineering Change Proposal
AFLC Form 252	Publication Change Request
AFLCR/AFSCR 57-4	Configuration Management in the Acquisition Phase
DoD Directive 4000.19	Basic Policies and Principles for Interservice, Interdepartmental and Interagency Support
DoD Directive 4000.19M	Defense Retail Interservice Support (DRIS) Manual

A-7D OPERATIONAL FLIGHT PROGRAM
SUPPORT PLAN 74-1A
OCTOBER 1976

SECTION I

INTRODUCTION

1. This document supersedes Plan 74-1 revised 30 August 1974.

2. The A-7D is a versatile weapon system providing highly accurate navigation and weapons delivery capability for TAC and ANG through its embedded computer system (ECS). The heart of the ECS is the Operational Flight Program (OFP) and the associated Operational Test Program (OTP). Throughout the life cycle of the weapon system, the ECS software (OFP/OTP) will require updating and maintenance to insure that the full potential of the weapon system will be realized and operational mission requirements will be met in a timely manner.

3. Three support alternatives were studied in the early phases of the A-7D program. These alternatives were: 1) Air Force in-house, 2) Navy Interservice, and 3) Contract. The alternative selected was an interservice arrangement between Navy and Air Force for Air Force utilization of the Naval Weapon Center A-7E OFP support facility at China Lake, CA. The initial interservice support agreement was consummated in October 1973 with approval by CSAF, Navy, TAC, AFLC, and OC-ALC.

SECTION II

REQUIREMENTS AND RESPONSIBILITIES

1. The organization of Air Force and Navy lines of communications and command hinge about the OC-ALC Directorate of Materiel Management (MM) and the China Lake Naval Weapon Center (NWC). Chart A-1 herein dipicts the OC-ALC/MM A-7D organizational arrangement.

2. The general flow of actions involving the ALC, TAC, ANG, and Navy is shown in Chart A-2. Included is contractor involvement when combined hardware and software changes require contractor support.

3. The OC-ALC A-7D System Management Branch, symbol MMSF, is responsible for the OFP/OTP configuration management and control and is the principal ALC point of contact for OFP/OTP deficiency reports and change requests. As the primary responsible office, MMSF will establish, convene, and chair a Computer Program Configuration Sub-Board (CPCSB) as necessity dictates and will ensure accomplishment of the board functions as required by AFR 800-14. The configuration management criteria encompassed by AFR 57-1, AFR 57-4, AFLCR 57-21, MIL-STD-480, MIL-STD-483, and MIL-STD-1521 will be adhered to through the MMSF actions.

4. Deficiency reporting will be in accordance with the criteria of TO 00-35D-54 and TO 00-5-1 with any peculiar exceptions documented in Operational/Support Configuration Management Procedures (AFR 800-14 and AFLC Sup 1) generated by the SM, TAC and ANG.

5. The detailed AF-Navy relationships are contained in Annex A hereto. (Not included here.)

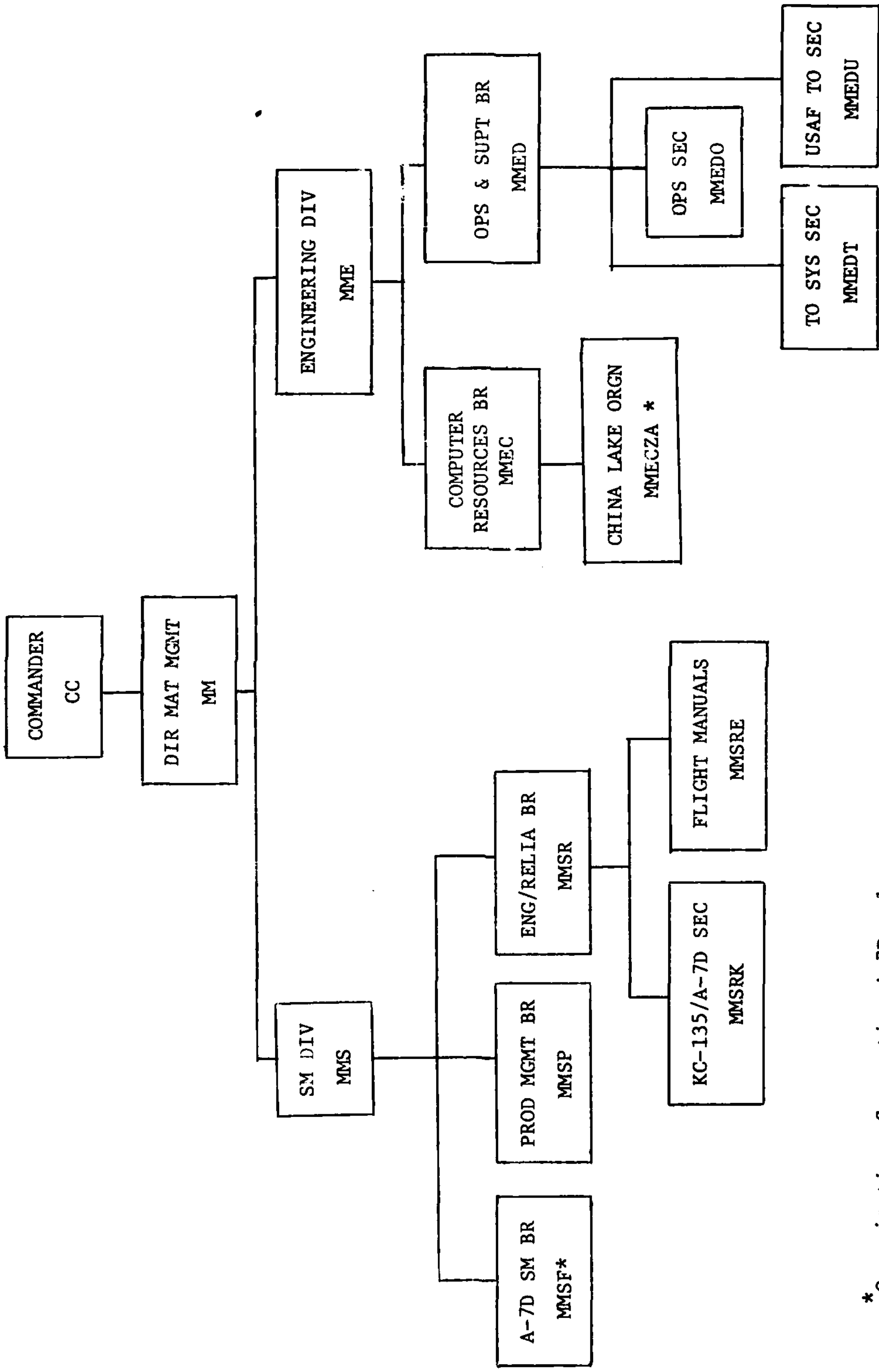
6. The TAC support/functional details are contained in Annex B hereto. (Not included here.)

7. The OC-ALC/MMECZA A-7D OFP engineering support team, China Lake, CA, will be responsive to engineering support requests and directions provided to them by OC-ALC/MMEC as received from OC-ALC/MMSF.

8. Joint software/hardware/system modifications will require joint efforts of OC-ALC/MME and OC-ALC/MMS engineering. MMSF will be the office of primary responsibility to manage the overall effort, call upon other organizations as required, establish agreements, and ensure that the totality of modification requirements is covered.

CONTINUATION SHEET

DATE: 27 July 1979



*Organizations Supporting A-7D only.

CHART A-1

OC-ALC/MM A-7D Organizational Structure - OFP/OTP Support

CONTINUATION SHEET **DATE:** 27 July 1979

A-7D OFP CHANGE

	FLOW	STEP
TAC, ANG IDENTIFICATION PHASE		1
MMS/MME SCREENING PHASE		2
MME/TAC/ANG/MMS NWC SUPPORT DEFINITION PHASE		3
		4
CPCSB/CCB MMM/MMS GO-AHEAD APPROVAL PHASE		
MME/NWC* IMPLEMENTATION DESIGN PHASE		5
MME/TAC/ANG/NWC* IMPLEMENTATION TEST PHASE		6
MME/MMS*		7
		8

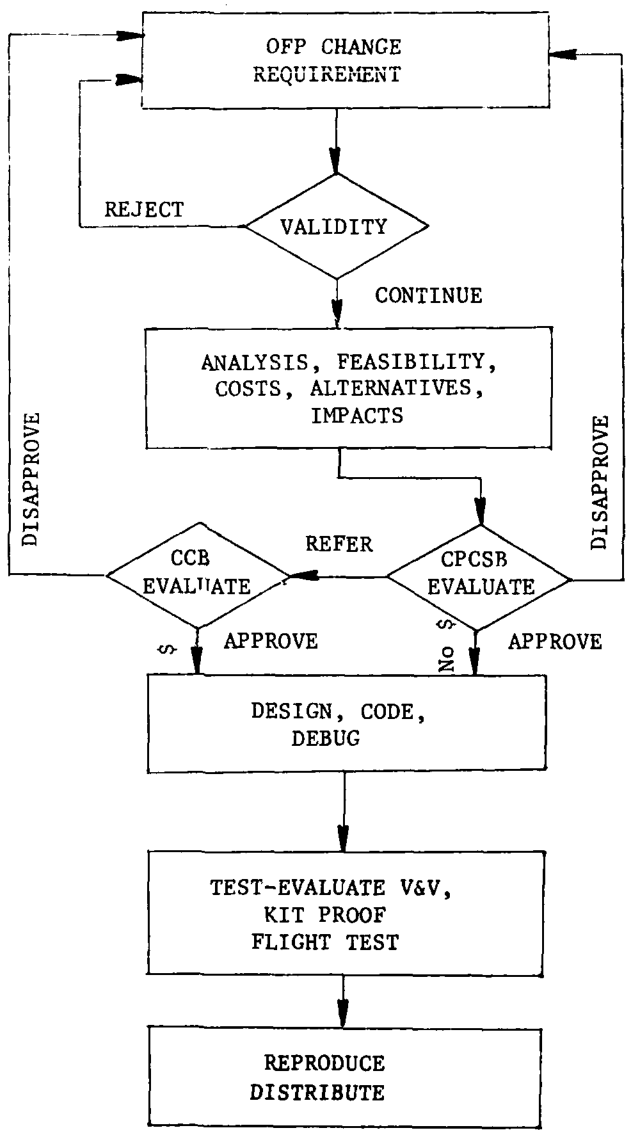


CHART A-2

*Responsible for review and approval of OFP changes accomplished by contractors as a result of a hardware/software modification.

CONTINUATION SHEET DATE: 27 July 1979

STEP

1. Identification of need for change due to deficiencies or operational requirements. Identification through TO 00-35D-54, TO 00-5-1 system, ROC, etc.

2. Assessment of requirement validity through initial analysis. Impacts if not implemented. Determination of type of modification, forms and data required, planned approach.

3. Detailed analysis and study; impacts on hardware, manuals, data, AGE, etc; alternatives with pros and cons; cost estimates; ECP information; Form 44 or 48 information.

4. Presentation before CPCSB. Software change only and no funds required - approve or disapprove. Funds required or hardware implications - disapprove or refer to CCB with information and recommendation.

5. If approved (and funded if funds required), design, code, and debug preparatory to full testing.

6. Run test series to prove acceptability of modified software and finalize.

7. Reproduce and distribute final program configuration, update manuals and data.

NOTE: Determination of associated hardware modification should occur at 2 or 3. In this instance <u>or</u> if an initial hardware modification requirement entails an associated software change, joint MMS/MME planning will be required. Planning and coordination under MMS as OPR will provide for organic or contract or mixed efforts for both software and hardware. For contract or mixed efforts, firm relationships between the Air Force organizations and the contractor will be established and contractually specified.

ABBREVIATIONS

ABBREVIATION	DEFINITION
AF	Air Force
AFLC	Air Force Logistics Command
AFLCR	Air Force Logistics Command Regulation
AFR	Air Force Regulation
ANG	Air National Guard
ALC	Air Logistic Center
CPCSB	Computer Program Configuration Sub-Board
CSAF	Chief of Staff Air Force
ECS	Embedded Computer System
MGMT	Management
NWC	Naval Weapons Center
OC-ALC	Oklahoma City Air Logistics Center
OFP	Operational Flight Program
OTP	Operational Test Program
ROC	Required Operational Capability
SM	System Manager
TAC	Tactical Air Command
TO	Technical Order

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - Change Review Process **DATE:** 27 July 1979

Change Requirement

Method of Transmittal

Feasibility Analysis
- Preliminary Design & Out-of-Line Code
- Preliminary documentation
- Preliminary Test Plans
- Preliminary User Guide

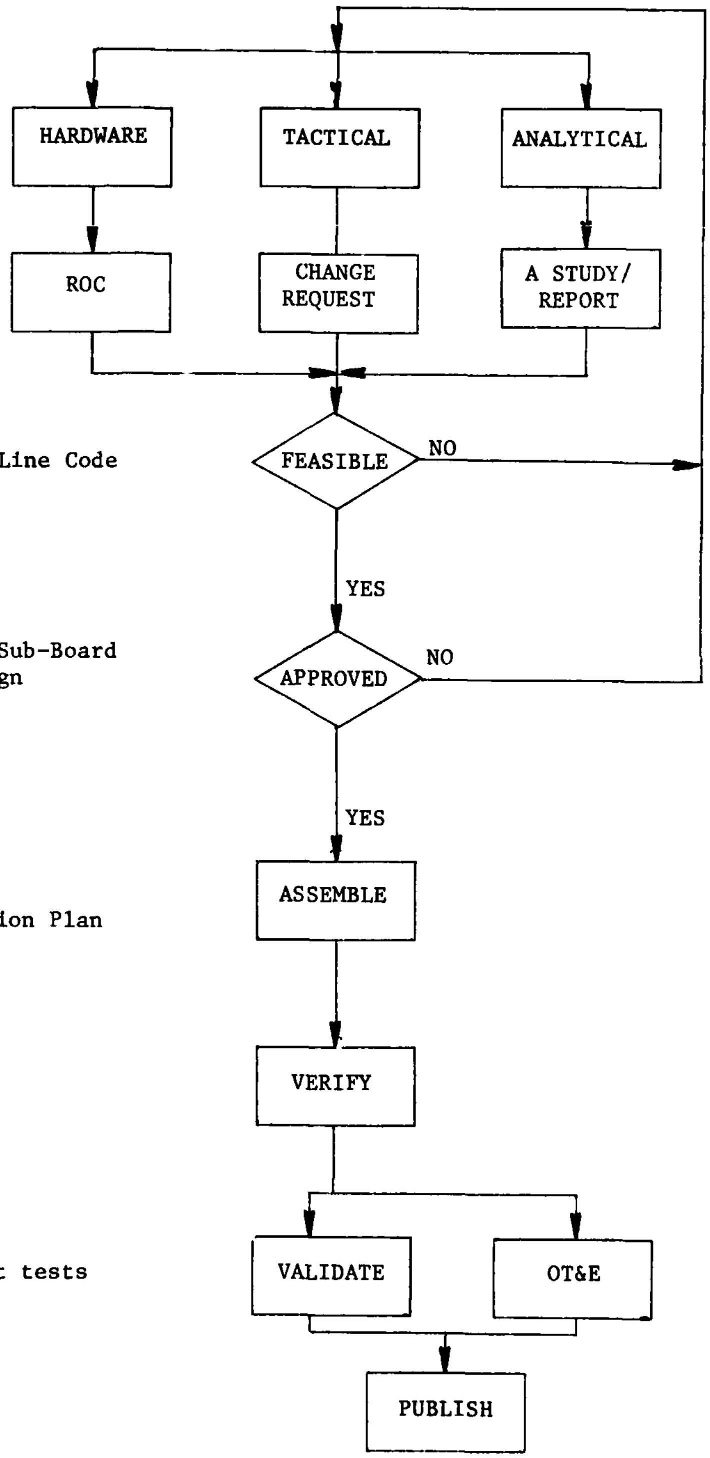
Computer Program Configuration Sub-Board
- Design Review, Finalize Design

Assemble In-Line Code
- Final Documentation
- Final Verification & Validation Plan
- Final User Guide

Verification
- Hardware Integration

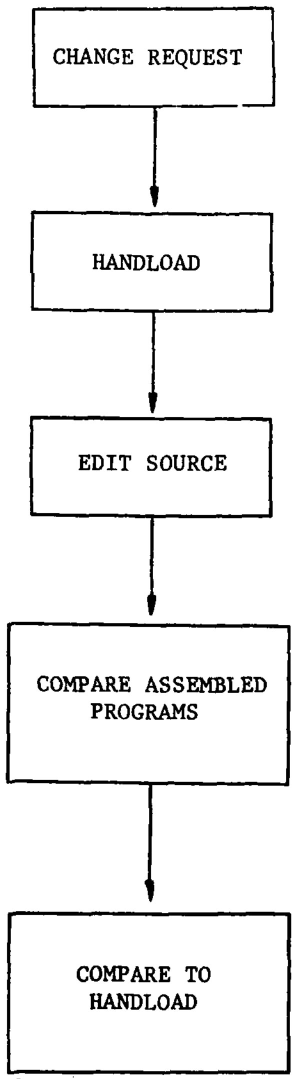
Validation and OT&E
- Simulation, Lab, and aircraft tests

Publish



CHANGE CONTROL METHODS

During the initial feasibility analysis of any individual change, a "Handload" (out-of-line patch) is completed. The "Handloads" serve as an index to the individual changes and they directly transform into an editor source that is used to edit the program source code to include the CPCSB approved changes in line. A "compare" program is then used to flag all additions and/or deletions between the old assembled program and the new assembled program. The output of the "compare" is checked against the original handload to ensure proper incorporation.



PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 27 July 1979

STRUCTURED DESIGN? – DESCRIBE

In-line changes are not structured. Stand-alone routines are top-down structured.

STRUCTURED PROGRAMMING? – DESCRIBE

See above.

CODING GUIDELINES:

Coding guidelines are described on pages A-25 through A-36, especially pp. 28ff.

CHANGE ENTRY METHODS:

CRT terminal is the primary method.

SCHEDULE:

Formal change schedules are issued.

REPORTING:

Weekly status reports are provided.

COMMENTS:

SOFTWARE GUIDELINE

May 21, 1979

Revision 4

INTRODUCTION

This guideline reviews several aspects of software documentation and coding techniques that have a bearing on the overall quality of software developed and on the eventual maintenance costs. Section I includes documentation needed for review during the definition and design phase, test planning during the integration and test phase, and user/maintainer understanding during production usage. It is based on numerous previous documentation guidelines and on practical experience. The primary references are a simplified version of DOD Standard 7935.1-S and the NAVAIR SOFTWARE MANAGEMENT MANUAL (Preliminary).

Section II covers Intraprogram Documentation (comments, program header), and is based on numerous different header styles in use at the NWC and elsewhere. It is also based on the article by Flores regarding commenting within programs.

Section III covers detailed coding guidelines including variable naming, recommended coding constructs, etc.

At this time, this guideline is intended for use by programming teams to provide them with a "menu" of recommended approaches, formats, and detailed coding rules that may be selected for that specific projects.

This document was adapted and reviewed by Richard Breisch, Steve Underwood, and Richard Fryer, with inputs from many others. The contributions of the A-7 team led by Harvey Nelson and the F-18 team led by Roy Law deserve special note. Many other documents were reviewed and good ideas "plagiarized," including the DAIS software development standard, the Federal Information Processing Standard for documentation of computer programs, and the DOD Automated Data System Documentation Standard (7935.1S). The similarity of these last two documents, and the potential need to conform to this format in future DOD programs suggest our use of it where applicable.

SECTION I

DEVELOPMENT AND DOCUMENTATION GUIDELINES

This section discusses the system documentation needed other than that provided in the actual code. For the actual documents to be provided, the Federal Information Processing Standards Publication Number 38 is recommended as a guideline. Specific examples are selected from this publication. This document does not cover the detailed format of documentation that may be used in Design Reviews. For this area, the NAVAIRSYSCOM SOFTWARE MANAGEMENT MANUAL is the primary reference. As a backup to this manual, MIL-STD-1521, "Technical Reviews and Audits For Systems, Equipment, and Computer Programs" is an excellent reference.

FRONT END DOCUMENTATION AND REVIEWS

During the pre-coding phase, requirements are solidified, preliminary design is conducted, and many design tradeoffs are carried out. This phase of the system development process plays a key role in the ultimate quality of the product, and in identifying commonality between various projects.

Functional Requirements provide a definition of the system to be produced in terms that are generally independent of the programming details, and provide a basis for mutual understanding to the various participants in a system development effort. These requirements describe the behavior of the system to be developed, with emphasis typically on the operating behavior of the system and the operating environment. Critical schedules may also be included. The documentation produced will be reviewed by users and other team members, typically in a design review and/or by review of a draft requirements document. The requirements document should address in general the topics in Section 3.1 of the reference document, FIPS PUB 38.

The review of requirements may take the form of a System Requirements Review. The purpose of this review, as defined in the Software Management Manual, is to determine the adequacy of the requirements definition, ensure that unrealistic requirements are not imposed, and provide a forum for discussion of test plans and other software development planning.

A System Design Review, which might be combined with the previous review, will also consider the quality of the requirements (completeness, efficiency, etc.), ensure that program risks are identified for program planning purposes, and will address needed support efforts such as Driver programs, Test data bases, Design Verification efforts, performance monitoring, testing, team development, testing approach, program support libraries, and evaluation of algorithms.

Specifications and/or Detailed Requirements are developed in systems where the software implications of the requirements document are not completely self-explanatory. It will include information such as operating environment, coding guidelines selected, etc. These documents are discussed in Sections 3.3 and 3.4 of the reference document.

The software design process may be reviewed at two other traditional and significant points in the development cycle. The first of these is called the Preliminary Design Review. This review is held to review the general program

description, the utilization of I/O, detailed requirements provided since the previous documents or reviews, Q/A provisions, details of Test requirements and plans, interface requirements, etc.

A review following the Preliminary review is held if required to review all documents required prior to start of coding, such as the subsystem specification, the data base document, etc. This Critical Design Review will also cover the software interface between modules, software/hardware detailed interface requirements, data base interactions (especially for software tools, etc.).

Other documents that may be initiated in the pre-coding phase are the Data Requirements/Data Base Specification (see Sections 3.2 and 3.5 of FIPS PUB 38) and the Test Plan (Section 3.9). While these documents may not be completed until the coding and testing is complete, a draft of the best available information in these areas can be a great aid during software development.

FOLLOW-ON DOCUMENTATION

A Program Maintenance Manual provides the information needed to provide detailed data on the implementation of the requirements and "how to make it work" type data. Section 3.8 of the reference discusses this.

A Users Manual is appropriate for complete systems for which the user interface is a major part of the operation, such as in data reduction and other software tools. If required, the format suggested appears in Section 3.6.

SECTION II

INTRAPROGRAM DOCUMENTATION

PROGRAM HEADER

The header comments should provide the necessary information to establish the data interfaces to this routine; proper usage of this routine, and what is to be accomplished by the routine. The header format is shown in Figure A-1 (on p. A-29), and a sample header appears in Figure's A-2a and A-2b (pp. A-30 and A-31).

COMMENT GUIDELINES

Comments within a program are used by the writer of the program before it is turned over to the user. During this period, comments can help him to recall details of the requirements or the algorithms that he has chosen, or to reflect areas that he expects to be modified at a later date.

Comments are also used to indicate how a module may be dependent on particular assumptions made; for example aspects that are dependent on the host computer.

The main issue to emphasize for comments is to assure that the intended message is clear in content and in appearance within the code. The comments may be grouped away from the code by positioning them to the right of the line, or by using separators or boxes, as shown in Figure A-3 (p. A-32).

Blank comment lines should be used to improve readibility (keep the comments separated from the code). Blank comment lines also serve to highlight major changes in flow in the program, such as subprogram calls and loops.

Columns 73-80 of a FORTRAN source statement can be ignored by the compiler, and hence are available for documentation. This field may be used for detailed documentation of program changes. With each statement altered or added (once a module had gone under configuration control), the programmer's initials and the date of the change should be entered in this field (alternately, the related Specification Change Notice or Notice of Change may be entered, at the project's discretion).

DESCRIPTION:

This section describes the function of the routine and what is done. The why will be explained in related documentation as described in Section I of this report. In unusual cases, the programmer may determine that additional information be included in the header.

MODIFICATIONS:

This field provides a continuous history of who modified the routine, when, and for what purpose. The CHANGE field may refer to the Specification Change Notice or another configuration management numbering scheme. See the example in Figure 2a.

REMARKS/QUESTIONS:

This field is left to permit the user to call attention to any part of the code that seems important if the configuration management/quality assurance scheme does not permit that data to be retained in a highly visible form.

SUBPROGRAMS CALLED:

This section provides the names in alphabetical order and the primary purpose (as used) for each subprogram/procedure called. The comment will refer not necessarily to the prime capability of the module called, but to the use that it is referred for in this routine.

INPUTS:

This field lists in alphabetical order all variables that must be defined before this routine is called (constants or parameters; whether in a calling list or in COMMON). The input definition will be extracted from the standard defined data base; that is, a special meaning will not be given to these variables in this comment section. If any special usage is accomplished, it should be described in the DESCRIPTION.

OUTPUTS:

This section is the same as for INPUTS, except that the named variables do not require initialization prior to calling this routine (normally). Any variable that is used for both input and output (that is, modified) will appear in both lists.

LOCAL VARIABLES:

This section covers temporary variables (used only during a single execution of this subprogram) and those that are only used in this subprogram, but that must be retained from one call of the subprogram to the next. These latter type will be placed in labeled COMMON to meet portability objectives.

Figure 1. Header Description.

CONTINUATION SHEET **DATE:** 27 July 1979

```
C ********************************************************************
      SUBROUTINE SAMPLE (X)
C ********************************************************************
C
C  DESCRIPTION
C
C  THIS ROUTINE IS A SAMPLE FOR DOCUMENTATION PURPOSES FOR THE STYLE
C  GUIDE
C  THIS ROUTINE USES NEWTON'S METHOD TO CALCULATE THE SQUARE ROOT OF ANY
C  NUMBER BETWEEN 1. AND 100.
C    IF THE NUMBER INPUT IS OUTSIDE THESE LIMITS, AN ERROR MESSAGE WILL
C    BE PRINTED OUT
C    IF THE NUMBER IS INSIDE THESE LIMITS, THE VARIABLE INPUT WILL BE
C    RETURNED AS THE SQUARE ROOT OF THE INPUT NUMBER.
C
C ********************************************************************
C
C  MODIFICATIONS
C
C    DATE       AUTHOR          CODE   PHONE     CHANGE   PURPOSE
C    ----------------------------------------------------------------
C
C    1 MAY 79   S. UNDERWOOD    SCI    446-3501  -        ORIGINAL AUTHOR
C    8 JUL 79   F. LLOYD        3194   X5425       13      IMPROVE SQUARE
C                                                         ROOT ALGORITHM
C    17 DEC 79  R. FRYER        3145   X5441       29      VARIABLE NAME
C                                                         CHANGES
C
C ********************************************************************
C
C  REMARKS/QUESTIONS
C
C  NOTE:  THE ACCURACY SHOULD BE ADDED TO THE REMARKS SECTION.  WHAT IS
C  IT?  R. FRYER 28 APR 79
C
C ********************************************************************
C
C  SUBPROGRAMS CALLED
C
C    ERRCK = CHECKS FOR ERROR IN THE INPUT VARIABLE LIMITS
C    NEWIT = PERFORMS ONE NEWTONIAN ITERATION
C
C ********************************************************************
C
```

Figure A-2a. Sample Header (top)

CONTINUATION SHEET DATE: 27 July 1979

```
C INPUTS
C
C    ERR      = ERROR TOLERANCE (R*8)
C    X        = I/O PARAMETER PASSED THROUGH THE CALL STATEMENT (R*4)
C
C ***********************************************************************
C
C  OUTPUTS:
C
C    X        = I/O PARAMETER PASSED THROUGH THE CALL STATEMENT (R*4)
C
C ***********************************************************************
C
C  LOCAL VARIABLES:
C
C    Y        = INTERNAL VERSION OF X DURING THE SQUARE ROOT COMPUTATION
C               (R*4)
C
C ***********************************************************************
C
```

Figure A-2b Header Sample (bottom)

CONTINUATION SHEET **DATE:** 27 July 1979

```
C *********************************************************************
C  THIS BLOCK OF CODE, WRITTEN IN FLEX,  IS COMPRISED OF THREE SECTIONS
C
C    SECTION A PLOTS THE AXIS WITH TIC MARKS
C    SECTION B ADJUSTS THE SCALE OF THE NUMBERS
C                (IF REQUIRED) SO THAT TIC MARKS HAVE READABLE LABELS
C    SECTION C GENERATES THE EXPONENT LABELS AND THE NUMBERS
C *********************************************************************
C
       IF (NC .LT. 0) SIGN = NEG
C                                         COMPUTE SOME CONSTANTS
C                                         REGARDLESS OF PARAMETERS INPUT
C                                         THESE COMMENTS STAND OUT FROM
C                                         THE CODE BY BLOCKING THEM TO
C                                         THE RIGHT SIDE OF THE PAGE
C
       ANGR = ANGLE*0.01745329
       CANG = COS(ANGR)
       SANG = SIN(ANGR)
C          SECTION B COMMENTS:            PSEUDO CODE FOLLOWS
C|  FROM THE ORIGINAL IN ADA (DOD-1), WE HAVE:                          |
C|                                                                     |
C|     IF DX >= 0.1 THEN                                               |
C|        IF DX < 100. THEN                                            |
C|           EXP := 0.                                                 |
C|        ELSE                                                         |
C|           WHILE DX > 10.                                            |
C|              EXP := EXP - 1.                                        |
C|              DX := DX/10.                                           |
C|           END LOOP                                                  |
C|        END IF                                                       |
C|     ELSE                                                            |
C|         WHILE DX < 1.0                                              |
C|           EXP := EXP + 1.                                           |
C|           DX := DX * 10.                                            |
C|          END LOOP                                                   |
C|     END IF                                                          |
C|_____________________________________________________________________|
C
      WHEN (DX .GE. 0.1)
         WHEN (DX .LT. 100.) EXP = 0.0
         ELSE WHILE (DX .GT. 10.0)
                 EXP = EXP - 1.0
                 DX = DX/10.0
                 FIN
           FIN
      ELSE WHILE (DX .LT. 1.0)
               EXP = EXP + 1.0
               DX = DX * 10.0
               FIN
        FIN
C                                                  END OF SECTION B
```

Figure A-3.Commenting Styles for Readability.

SECTION III

CODING GUIDELINES AND STYLE

The guidelines presented in this section are intended to achieve a uniformity of coding style that supports the major principles of structured and readable code. In general, the "rules" that follow are intended to improve program layout (and in some cases, program design) with the long-term goal of reducing maintenance labor. Programs will be easier to read if a standard format is generally used. Further, the golden rule of computer science can be applied: If the rules can be formalized, then the computer can apply them for us.

In general, the following apply:

Format so that the important parts stand out
Show the scope of control of an important command
Select names by a formula or mnemonic that enhances understanding

Specific rules follow.

Variable Names

Variable names should be descriptive. Do not use "cute" names unless they are foremost descriptive. A variable name should have a unique definition. If temporary variable names have no significance in themselves, don't attempt to give them significant names; "TEMPL," etc. may be sufficient. Don't use the same name for an intermediate value and the final value of a variable. Beware of changing variable names by only one letter at the end. For example, "AMAC" and "AMACH" sound the same and so may be confused, while "TEMP1" and "TEMP2" are probably O.K. Do not break variable names when using continuation lines.

Program Flow

Program flow should be from top to bottom (no backware referencing GO TO's). Do not branch to a section of code and then return to save a few statements. If appropriate, use a subprogram or procedure (memory is usually cheap).

Spacing

Spaces are recommended before and after each operator or delimiter (= + - * / < > (.OR. .AND.) etc. as needed to improve readability.

Examples:

```
I = 2*J + 3*K

IF ( A .OR. B )

IF ( A.EO.B .OR. C.EQ.D )
```

DO Loops

Statements that control multiple lines of code should show scope of the controlling statement by indentation. For the DO loop, the statements within the loop should be indented, (at least 3 spaces) so that the key word stands out, and closed with a CONTINUE that begins on the same column as the DO loop. Nested DO loops should be further indented, and should terminate on different CONTINUE statements.

Example:

```
C                    INSERT BLANK COMMENT BEFORE DO AND AFTER CONT.
   DO 30 I = 1,N
      SUM(I) = 0.0
C
      DO 20 J = 1,N
         SUM(I) = SUM(I) + X(I,J)
20    CONTINUE
C
30 CONTINUE
C
```

Array Indices

Zero and negative indicies are allowed (as in FORTRAN 77). For some data arrays, lower and upper limits can be chosen to improve readability; for example, when data items are numbered elsewhere in a certain order.

Example:

```
C
C                                     READ THE BUS INPUT ARRAY
C                                     USING FCN GETWRD WITH ID=BUS
C
      DIMENSION A(0:20)
C                                     NOTE THAT THERE ARE 21 VALUES
      DO 10 I = 0,20
         A(I) = GETWRD(BUS)
   10 CONTINUE
C
```

CONTINUE Statements

CONTINUE statements will be used only with DO loops.

Large DATA Statements

Singly dimensioned data arrays will have entries grouped into sets of 3, 4, or 5 to a line to facilitate reading. Thus it will be easy to find the nth item without counting each item. Do not break values by using continuation lines. For multiply dimensioned arrays, pick the number per line to facilitate location of a specific element. Implied DO loops are allowed to initialize full arrays.

Branching and Statement Numbers

Minimize branches by using control structures suited to the problem at hand. Statement numbers will be in increasing order (the use of a program such as TIDY to achieve this is an approved method). Unused statement numbers may be confusing and so should usually be avoided. Unless defined otherwise, statement numbers should start at 100 and increase by 10.

Conditionals

Avoid arithmetic IF statements. Avoid negative logic except where it clearly improves comprehension. Readability can be improved if two-state variables (i.e. switch on or off) are represented as LOGICAL variables and not numerical (e.g. 0, 1).

COMMON Blocks

COMMON blocks will be in alphabetical order within a module. As blocks are modified or created, the names within the blocks will also be in alphabetical order. If all variables within a block will not fit on one line, a second COMMON block should be defined. Begin all variable lists in column 23 and insert blanks after commas.

```
    Col. 07           Col. 23
       |                 |
       COMMON /BLK1/     ALPHA, BETA
       COMMON /BLOCK 2/  SAFE, WAY
       COMMON /SUPER/    AL, BERT, SONS
C                                     NOTICE THE CAREFUL AVOIDENCE
C                                     OF "CUTE" NAMES
```

Parentheses

Use parentheses freely to avoid ambiguous constructions.

A**B**C should be (A**B)**C

A/B*C should be (A/B)*C

Constants and Variable Initialization

All constants and variables that require initialization should be set in an initialization routine.

SUBPROGRAM Lengths

The length of any subprogram, function, or procedure should be designed to convey one major computation but, should not exceed nominally two or three pages of code, including comments, but excluding the header. However, the generous spacing of code (white space) is preferred to short dense listings. Keep ease of reading and understanding in mind. Avoid consistently short or long routines.

Deviations from the above guidelines should be discussed with the software development team, including the quality assurance activity (if any) to assure that quality, maintenance, and readability goals are not compromised.

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 27 July 1979

DOCUMENTATION:

REQUIREMENTS: Requirements documentation was never published for the A-7D.

See p. A-26 for guidelines.

DESIGN: Design documentation was last published in October 1978.

See p. A-26 for guidelines.

USER: User documentation was last published in October 1978.

PROGRAM PROBLEM REPORTING SYSTEM:

A program problem report form is shown on page A-38. This is generated by any user or analyst. After analysis, it is referred to the appropriate configuration manager (OFP, hardware, simulation software). The configuration manager generates the change notice shown on page A-39.

COMMENTS:

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 27 July 1979

PROPOSED CHANGE/PROBLEM REPORT

PROBLEM TITLE

PC/PR number
sheet of

Prepared by date org/code ext

Priority
__emergency
__urgent
__routine

date received by CM

DESCRIPTION OF PROBLEM:

ITEMS EFFECTED
Problem/Solution
Hardware/Software

P/S	H/S	assembly/ subroutine	module/algorithm/ common	cognizant person	date

PROPOSED SOLUTION

Prepared by date org/code ext

RELATED PC/PR

ESTIMATE OF RESOURCES REQUIRED (manpower, schedule, computer time, etc.)

FACILITY MANAGER date

__rejected __accepted

ACTUAL PRIORITY
__emergency
__urgent
__routine

REVIEW
__accepted as reviewed
__accepted minor revisions
__review needed __cancelled

Technical concurrer

CM date

Comments:

PRELIMINARY TESTING COMPLETED

Corrector

Technical Concurrer

CM date

UPDATE FORM FILED

date Corrector

UPDATE MADE

CM date

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 27 July 1979

NOTICE OF CHANGE

Corrector	date	org/code	ext	Notice of Change number

ITEMS EFFECTED BY CHANGE	RELATED PROPOSED CHANGE

This notice authorizes and provides a precise description of Hardware, Software and documentation changes. In addition to the basic description of the change, provide the following data.

A. Hardware: provide a precise "FROM-TO" drawing in the block.
B. Software: provide a source coding with marked changes.
C. Documentation: provide a list of change pages and effective data.

DESCRIPTION OF CHANGE

CM	date

PREDICTIVE SOFTWARE COST MODEL

PERSONNEL DESCRIPTION DATE: 27 July 1979

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

Position	Grade	Degree
SUPV Electronic Engr.	GS-13	BS, 1968 MS
Mathematician	GS-12	BS, 1965 MS
Computer Scientist	GS-11	BS, 1970
Equipment Specialist (Avionics)	GS-11	AA
Computer Operator	GS-09	BA, 1966
Clerk-Typist	GS-04	

Total experience with A-7 is 37 manyears.
Total experience with S/W is 18 manyears.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES DATE: 27 July 1979

BUILDINGS:

Weapons Integration Lab	-	935 ft^2
Mission Simulator	-	644 ft^2
Navigation Lab	-	1,240 ft^2
Office Space	-	1,680 ft^2

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 27 July 1979

COMPUTER FACILITIES (Type, Quantity, Application, Cost & Usage)

Type*	Quantity	Usage
DEC PDP 11/60	2	Simulation in Weapons Integration Lab
DEC PDP 11/45	2	Software Development and Data Reduction
DEC PDP 11/45	1	Graphics in Mission Simulator Laboratory
DEC PDP 11/34 (11/10, 11/05)	3	TC-2 Control & Display
Honeywell SIGMA V	1	Simulation in Mission Simulator, Software Development Data Reduction
Hewlett Packard 9830	1	Office calculator Management Tools Some Plotting Capability

*Only CPUs are listed. See p. A-43 for peripherals and interfaces.

pp. A-44 and A-45 give equipment prices for various equipment plus software for a facility that would have capabilities comparable to the existing weapons laboratory.

CONTINUATION SHEET - Computer Facilities **DATE:** 27 July 1979

EQUIPMENT

WPS LAB	PDP 11/60 (192K), 11/45 (32K), 11/10 (16K), 11/05 (4K)
	4 ADM.3 Terminals + (16 remote)
	DEC Writer
	Tape Drive
	4 Disk Drives (7M BYTE total)
	2 Dual Floppy
	2 Punch Tape Readers
	Versatec Printer
	1 TC-2
	Custom Interfaces
SIM LAB	Honeywell Σ5 64K
	2 Tape Drives
	2 Disk (48M BYTES total)
	Line Printer
	Card Reader
	TY 35
	Tape Punch/Reader
	Key Punch
	Custom Interfaces
	PDP 11/45 (32K)
	Disk
	Tape Drive
	Versatic Printer
	Vector General
	Tektronic 4014
	CADU
	TC-2
NAV LAB	PDP 11/45 (32K), 11/60 (192K), 11/10 (16K)
	Tape Drive
	Disk
	Punch Tape Reader
	Custom Interfaces & A/C equipment
	TC-2
OFFICE	2 ADM-3 Terminals
	1 Diablo Terminal
	HP 9830
	HP Plotter

CONTINUATION SHEET **DATE:** 27 July 1979

SHOPPING LIST

A-7D Computer Laboratory April 9, 1979

BASIC SYSTEM

This system is configured to provide the capability to assemble an OFP, run normal utilities (editor, file maintainer, etc.), provide short listings, and provide DUMCAD/MINI-SOVAC load/debug capabilities. Data reduction could be accommodated on an exclusive basis (system might not be able to assemble an OFP while doing data reduction; oriented for very limited hardcopy output).

CPU (11/6Ø) with 64K Bytes, Flt. Pt.	$ 31.3K
Additional 192K Bytes to fill up memory	$ 15.ØK
RL-11 Disc (For DEC backup)	$ 6.ØK
System Industries 3ØØM Byte Disc/Intf.	$ 24.ØK
DEC TJE16-EA (9 Track tape drive)	$ 17.1K
DH-11 16 line Multiplexer	$ 6.6K
Terminals:	
a) ADM 3A	$ ---
b) VT-1ØØ (2)	$ 4.4K
c) DECWRITER III	$ 3.8K
d) Diablo	$ ---
Software: (recommend a and c minimum)	
a) RSX-11M, for 4+	$ 9.ØK
b) BASIC Plus 2	$ 2.5K
c) DATATRIEVE	$ 2.8K
d) IMSL	$ 1.3K
e) TOTAL (or other DBMS) (Sharable?)	$ 33.ØK

This second section covers the portable components to build a 'front lab' style SOVAC system for debug and loading the TC-2.

PDP-11/23 system (est.)	$ 1Ø.ØK
Dual Floppy	$ 4.9K
DUMCAD/MiniSovac (est.)	$ 5.ØK
Tektronix 4Ø14	$ 14.5K

CONTINUATION SHEET DATE: 27 July 1979

ENHANCED SYSTEM

This section covers the enhancements needed to upgrade the 11/6Ø system to provide simulation capabilities in addition to those above. This system would probably be able to support full data reduction with timesharing for program development running concurrently and an assembly running in 'background'. The simulation could execute while running one or possibly more of these other tasks at low priority.

Second Disc Drive	$ 12.ØK
Line Printer (66ØLPM, 96char, impact)	$ 25.7K
Versatec printer plotter (hardcopy graphics)	$ 14.ØK
Second Tape Drive	$ 11.ØK
Miscellaneous Interfaces	$ 8.ØK
Unique TC-2 Interfaces	(?)

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE DATE: 27 July 1979

SOFTWARE	HOST COMPUTER	LANGUAGE	SIZE (16 Bit Words)
Assembler Family			
Handload Ass.	SIGMA 5 & PDP 11/45	Fort & Assy	22.3K wds
Assembler	SIGMA 5 & PDP 11/45	Fort & Assy	51.6K wds
Simulation Family			
Simulation	SIGMA 5	Fort & Assy	23.5K wds
Graphics	PDP 11/45	Fort & Assy	16K wds
Utility			
INDEX	SIGMA 5	Fort & Assy	19.0K wds
DATA BASE	SIGMA 5	Fort & Assy	10.0K wds
Data Reduction			
ACCURACY	SIGMA 5	Fort	3.5K wds
ARBSACC	SIGMA 5	Fort	4.1K wds
COREL	SIGMA 5	Fort & Assy	14.3K wds
SCAN	SIGMA 5	Fort	12.0K wds
LIST	SIGMA 5	Fort & Assy	26.0K wds
NAV	SIGMA 5	Fort & Assy	13.9K wds
RADLIST	UNIVAC 1110	Fort	12.4K wds
TCONV	UNIVAC 1110	Fort & Assy	10.9K wds
PLOT	SIGMA 5	Fort	14.0K wds
TIMEAF	SIGMA 5	Fort	1.9K wds
SOVAC (CADU)	PDP 11/34, 11/45	Pascal	20K wds

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS   DATE: 27 July 1979

PROGRAMMER TRAINING:

What percent of programmer time does training take? 10-20%
Formal or OJT? 1/2 formal, 1/2 OJT
How many curricula? Numerous
How long? Varies
Training agency: Several CSC, NWC, other formal and informal
Locations of training: Local and TDY
Training adequacy: Excellent
What kinds of morale problems do you experience? How do you handle them?
The remote location of China Lake limits the quantity of qualified personnel available to fill vacancies. System sponsors and users do not make requirements known, so future tasks are uncertain.

USER TRAINING:

Is training a major task? Yes
How many curricula? Two - a) New OFP Introduction, b) Fighter Weapons Course
How long are they? a) 4 hours, b) 2 days
Training agency: a) OC-ALC, b) Tucson, 162 TFG
Locations of training: a) At all bases, b) Tucson, AZ
Background required: a) General pilots and maintenance persónnel, b) Advanced pilot training
Dropout rate: None
Training adequacy: Engineering team also produces and distributes Video Tape presentations that explain changes in software operation that are new. Training appears adequate.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS – FLIGHT TEST REQUIREMENTS

DATE: 27 July 1979

1977

SEQUENCE FLT #	ORDNANCE	PURPOSE
1		NAV (groom)
2		NAV
3	MK 76	Weapons Groom
4	BDU-33	
5	"	
6	NONE	
7	BDU-33	25Hz vs. 20 Hz accuracy
8	"	weapons
9	"	25Hz vs. 20Hz accuracy
10	"	"
11	"	
12	"	"
13	"	"
14	"	"
15	"	"
16	"	"
17		Nav
18		Nav
19	BDU-33	Radar Evaluation Flight
20	BDU-33	"
21	BDU-33	also Nav
22		Nav
23 *NWC		Vert. vel. corr.
24		Nav
25 *NWC		Vert. vel. corr.
26	BDU-33	Radar Eval.
27		Nav AF02
28		Nav AF02
29	BDU-33	CCIP AF02
30	"	"
31	BDU-33	"
32	"	"
33		Nav
34	"	
35	"	CCIP + MER Springs
36	"	"
37	"	"
38 *NWC	BDU-33	BOC – V.A. eval.
39 *NWC	"	
40	"	CCIP + Springs
41	BDU-33	Weap. Eval.
42 *NWC	BDU-33	CCIP + Visual Atk.
43 *NWC	"	CCIP eval.
44 *NWC	"	"
45 *NWC	"	V.A. & CCIP eval.
46 *NWC	BDU-33	CCIP eval.

CONTINUATION SHEET

DATE: 27 July 1979

1977

SEQUENCE FLT #	ORDNANCE	PURPOSE
47 *NWC	BDU-33	CCIP & Visual Atk.
48		Nav.
49	"	Weap. Eval.
50	BDU-33	MER Springs Eval.
51	"	"
52	BDU-33	Radar Eval.
53	"	"
54	BDU-33	BOC + MER Adapter Eval.
55 *NWC	BDU-33	BOC & BOC Offset-loft also Nav
56	BDU-33	Fin Adapter Accuracy

1978

SEQUENCE FLT#	ORDNANCE	PURPOSE
1	BDU-33	CCIP & Mer Adapter Eval.
2 *NWC	BDU-33	HUD Fail & E.O. Bomb
3 *NWC	"	BOC loft Eval.
4 *NWC	"	HUD Fail & E.O. Bomb
5	BDU-33	V/A & Adapter Eval.
6 *NWC	BDU-33	Radar Alt. & CCIP
7 *NWC	"	Normal Atk. & Steering Error
8		Nav
9 *N, ORD	MK 82HD & Rockets	FLR Auto Reversion (Nellis)
10 *N, ORD	BDU-33 & Rockets	"
11		Nav
12	BDU-33	Weapons Eval.
13	"	Ground Spacing
14		Nav
15		Nav
16	BDU-33	MRI Class II
17	BDU-33	Visual Attack
18	"	V/A Offset "
19 *ORD	LAU-68/1000-20mm/ 1 CBU-30	Guns/Rkts/CBU
20 *ORD	MK-82 flex fuse	Flex Fuse
21 *ORD	MK-20, 6 MK-82	MRI Class IV & Class III
22 *ORD	MK-84	Simple lo
23 *ORD	BLU-27	7-2-5
24 *ORD	6 MK-82 SE	MRI Class I #7-1-4
25 *ORD	MK-82 SE	" #7-1-3
26 *ORD	MK-20	MRI Class IV #7-1-6
27 *ORD	MK-82	L.D. Option #7-2-1

CONTINUATION SHEET

DATE: 27 July 1979

1978

SEQUENCE FLT #	ORDNANCE	PURPOSE
28	BDU-33	Visual, Visual Offset, Hud Update
29		Nav
30		Nav
31	BDU-33	Weapons Eval.
32 *L		Pave Penny 6-1 OFF Boresight Acquisition
33 *L	"	" p.p. 6-2, Visual, Visual Offset
34 *L	"	"
35	BDU-33	Weap. Eval.
36	"	System Eval.
37	"	"
38	BDU-33	Pave Penny #6-2
39 *L	20mm & BDU-33	Guns w/Pave Penny
40 *L	"	Pave Penny: Offset & Guns
41		Nav
42 *L	20mm & BDU-33	P.P.:BOC, BOC Offset & Guns
43 *L	"	P.P.: 6-3 & Guns
44 *L	"	P.P.: & Guns
45 *L	"	P.P.: Manual Ripple & Guns #6-6
46 *L	"	P.P.: #6-2
47*L	"	P.P.: #6-3

Total Project Flights = 103

Flights Requiring Instrumented Range = 18

Flights Requiring Ordnance Crew = 11

Flights Requiring Laser Designated Target = 11

SOFTWARE PACKAGE MAINTENANCE HISTORY

DATE: 27 July 1979

DESCRIPTION OF NUMBERS AND TYPES OF MAINTENANCE ACTIONS PERFORMED EACH YEAR SINCE PMRT

Date	Reason	Gross Number Instructions Δ	Net Number Δ	Manhours	Cost
1/75	Add USAF Ballistics	Unknown	Unknown	Unknown	Unknown
*1/76	AF-1 (See attachment #10)	Unknown	Unknown	Unknown	Unknown
2/76	SCRUB Unused Features	Unknown	Unknown	Unknown	Unknown
8/77	AF-2	1592	1480	Note 1	Note 1
11/77	AF-2P-1 Pave Penny	1630	1409	Note 1	Note 1
1/78	AF-2P-2 Correct Pave Penny	158	28	Note 1	Note 1
*10/78	Final AF2.0	248	-297	Note 1	Note 1

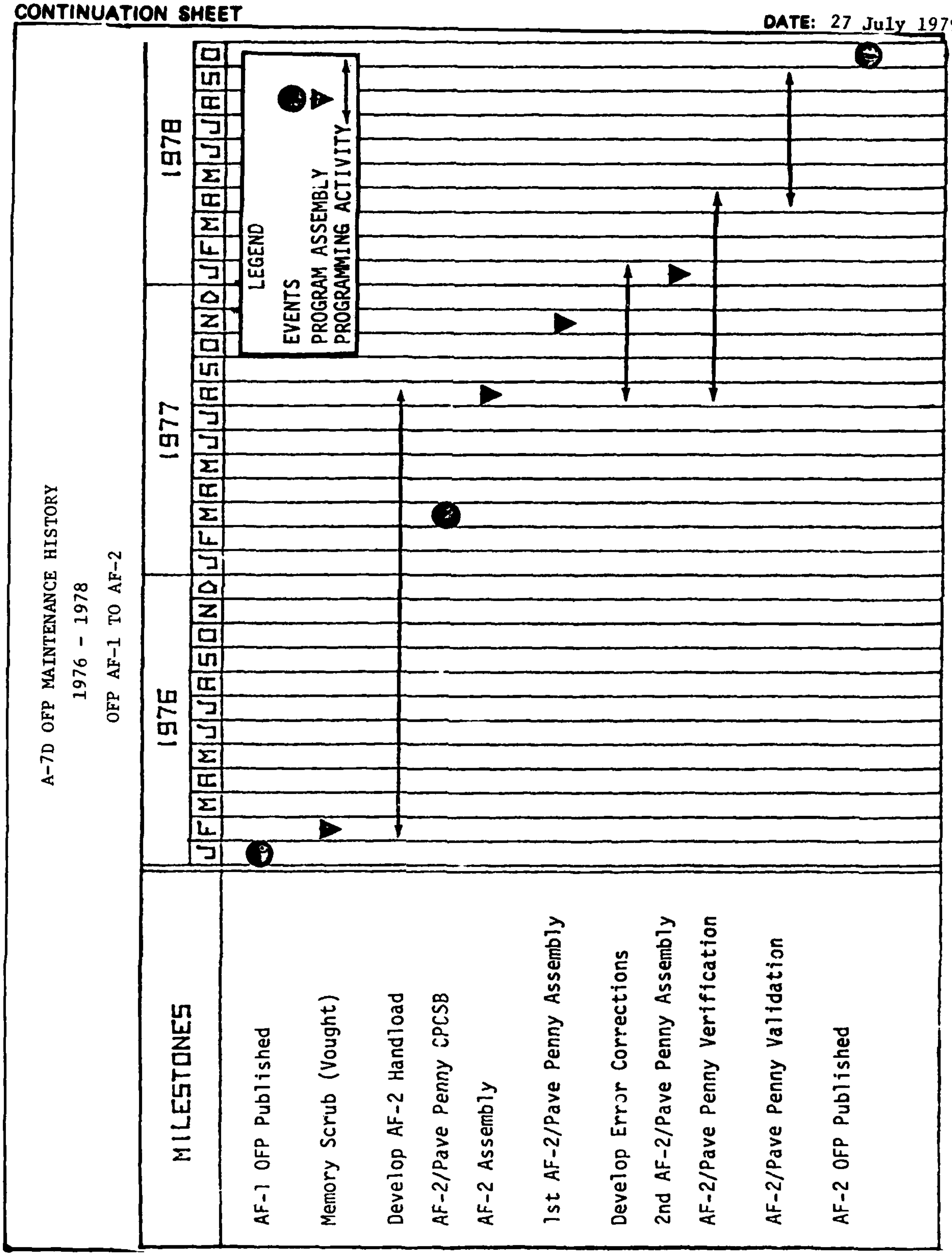
*Indicates Programs Published

Note 1: For the AF-2 and Pave Penny efforts, 14 manyears of effort and additional costs of $805,000 were expended during FY'77 and FY'78.

Page A-52 graphically portrays the maintenance history.
Pages A-53 through A-55 list the changes made to AF-2P-2.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 27 July 1979



PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 27 July 1979

OFP - A7 AF-2 MATH FLOW REVISIONS

1. The following is a list of changes to the Math Flow entitled AF-2P Rev. 2, 01-01-78.

Section	Sheet	Reference	Change Description
Cover Page			Delete "AF-2P Rev. 2" and insert "OFP - A7, AF-2 16 Oct 1978"
I	8	N414	Set LCAB = 0; delete comment
I	19 19A	N1164	Change flow director to 19A UTMFIX, Add new sheet 19A in accordance with example attached.
I	22	N1230	DI 1 Bit 13 vice DI 1 Bit 8
I	22	N1236	Add BARB correction in accordance with attached example
II	3	AV2	Add AOA calculations in accordance with attached example.
II	12	ARM25	Sheet 13 or 14 vice sheet 9
II	12	ARM20.6	DI 3 Bit 7 vice DI37
II	12	ARM21.1	Set Mode = K0008 vice 0001
II	13	ARM 28	Add "P.12 ARM 6"
II	18	Item 600	Change to read "RRAD-K00AA < Ø
II	18	Block after Item 600	Change to read "RRAD-K0AA-19E2 < Ø
II	18	Block after Item 600	Add note: "FLR MAX RNG = 52672', MIN RNG = 1344'
II	18	12A-A	Add "P.19"
II	19	SP9.25	Ƶ BARO (Vice Ƶ) = MAX ∣ ZBARO,14 ∣
II	19	SP9.261	Mode = Guns/Rockets or CCIP Vice Guns/Rockets only
II	19	SP31	Add "P.20"
II	20	SP23.6	Add five point smoothing change in accordance with attached example

CONTINUATION SHEET

DATE: 27 July 1979

Section	Sheet	Reference	Change Description
II	21	SP40.1	Add CCIP Timing Scrub in accordance with attached example.
II	22	RT 17 (2 places)	Add "P.23"
II	27	RT 24	Add "P.23"
II	26	25B	Add "P.22"
II	27	WP31.3	$M_t = -M_r$ vice $M_t' = M_r$
II	27	WP29	Add "P.28"
II	30	HD6	LAMAZ vice LAMEL LAMEL vice LAMAZ
II	30	HD7	Check signs in "LAMEFM"
II	30	HD10.1	Bit 6 vice Bit 9; 2 places
II	30	HD10.3B	Brance is to HD10.3C, P.32 vice HD40
II	31	HD25.71 HD25.6	Check signs of a* and b*
II	32	HD40	Entry point is HD10.3C vice HD40. HD40 is on sheet 33
II	33	SETUM	Branch after LAMERH 16° test should be to HIDESOL vice SETUM
II	35	AR19	Eliminate π in numerator of LAMARR calculation. This should be ATANII, not π.
II	46	42A	Add BDU-33 Blast Avoidance Moding in accordance with attached example
III	4	9A	Set Data 33 = 0, in Power-Up in accordance with attached example
IV	14	ENT 30	Change UTM processing in accordance with attached example
IV	14	ENT 33	Add new ENT 33 in accordance with attached example
IV	15	15 A,C,D	Add "P.16"

CONTINUATION SHEET DATE: 27 July 1979

Section	Sheet	Reference	Change Description
IV	15	ER	Add "21B P.22"
IV	17	19E	Add "P.20"
IV	28	24A "out"	Add "=99"
IV	28	25 A&B	Add "P.29"
IV	25	Data 32	Add comment by TTG < 0 test "compensate for next day target times"
IV	25	Data 33	Add Data 33 display in accordance with attached example

During 1976-1978 the USAF team developed the OFP changes of the AF-2 program while Vought developed a Pave Penny OFP. The two efforts were later combined into a single AF-2 OFP. Program assemblies were all performed by Vought since the USAF Assembler was not available until 1978. The Memory Scrub of February 1976 did not maintain stringent configuration control and was the cause of corrections as late as January 1978. To ensure better configuration control in later assemblies, the USAF team developed a "Compare" program to list differences between assemblies. Currently (Jun 1979) the USAF team assembles on either the PDP 11/45 or Honeywell Sigma V at China Lake. Handloads relate directly to source code editor listings and "Compare" is used to extract the handload from the final assembly to ensure configuration control.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE COST HISTORY DATE: 27 July 1979

Provide yearly cost of maintaining package, break down to cost per change if possible.

FIGURES IN ($K) NWC Contracts	FY 77	FY 78	PROJECTED FY 79
I. MANAGEMENT & ENGINEERING			
a) Admin. & Budget	30	31	32
b) Materials & Supplies	20	18	20
c) Travel	18	20	20
d) Contracted Documentation	10	0	9
e) Contracted Config. Mgt.	9	7	12
f) NWC Engineering Labor.	60	34	36
II. SIMULATION & LAB FACILITIES			
a) Labor	110	60	43
b) Contracted Maintenance	40	55	60
c) Equipment via NWC	30	24	25
d) Computer Use Charges	10	12	14
III. FLIGHT TESTING			
a) Range Charges	40	46	52
b) Data Reduction	40	61	62
c) A/C Modification/ Instrumentation	8	12	15
TOTAL	425	380	400
$K/MAN YEAR	60	62	64

Cost per instruction for AF-2 and Pave Penny

14 Man Years	$840,000
Additional Costs =	805,000
	$1,645,000

Cost/Instruction = 1,645,000/3628 = $453/Instruction

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES

DATE: 27 July 1979

Data Base Name	A-7D Operational Flight Program
Location	OC-ALC/MMECZA, Code 91, China Lake, CA
Contact Person	Mark E. Jacobson
Phone Number	Commercial (714) 939-5575
General Contents	Dollars expended by Fiscal Year buying services from NWC. Broken down into broad, general categories.
Period Covered	FY 77 through FY 79

General assessment of data quality - very little detail

PREDICTIVE SOFTWARE COST MODEL

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 27 July 1979

RESPONDENT: Mark Jacobson

One of the first tasks would be to discover who was (hopefully still is) the prime contractor and the contractor responsible for the software. Contractor reputation would give an indication of experience and with some investigation the methods used to develop the package would be visible. The contractor also would be important to provide the maintenance team with sufficient technical data to allow maintenance of the software. It would be especially important to review requirements and design documents to get the feeling for the design process, design decisions and structure of the program. The contractor's facilities may also provide information about the facilities needed (or additional facilities needed).

The second task would be to discover the Using Command's intended uses of the system and if any substantial system enhances are foreseen. This would give an indication of areas likely to change in the program and also provide an input for the size and experience level of the goverrment team necessary. It would be equally important to establish the maintenance office responsibilities during the life cycle of the system. Often, the maintenance office is tasked with R+D type taskings because they have access to the system and system testing facilities. If an R+D effort appears likely, then the proper personnel for this type of effort must be included in the maintenance team.

The third task would be to develop an understanding of the system and the data that is input to and ouput from the system. If this systems engineering analysis appears to correlate with the design of the system, programmer and engineering responsibilities will be better defined. Also at this time, growth possibilities for the system could be analyzed and used to again determine areas of the system that are likely to change.

The fourth task would be to assess the availability of existing testing facilities, including the system itself and test support facilities. If this is an aircraft system, then aircraft availability, range, maintenance personnel and equipment are all importand and I would make every attempt to extract the software maintenance program from aircraft operations/maintenance. This would require the services of a testing group and the contents of this group would be most important since a good testing group can help in the proof of the software and also answer questions on tactical applicability of the system.

If local computer facilities are not sufficient to perform the software services needed during the maintenance of the system, procurement of the necessary computing power will be necessary. I would approach this, using the background obtained earlier, and most likely would choose computing power different from the contractor. This would force the maintenance group to develop their own facilities and thereby promote in-depth understanding of the system. This also has the advantage of having two different approaches to the maintenance problem - the contractor may resolve certain issues, while the government team may discover other areas of concern.

Of overall importance would be the management support for the maintenance effort and the personnel involved in the maintenance effort. The management support is needed to allow the maintenance manager to develop long-term personnel plans for the members of the maintenance team. These plans could then be used as a departure point for training, work assignments, promotions, etc. If the program was large enough, an Organizational Development specialist should be included to ensure that the technical personnel involved in the maintenance effort understand their responsibilities and opportunities, and also so that management understands the personnel problems that may prove to be a very large factor in future efforts.

Of general importance would be to make use of all previously-developed tools and good software maintenance practices. Support software that can be procured is usually preferable to in-house developed software because of the unpredictable nature of in-house developed software and the long-term maintenance of such support software. Also, design documents and other documentation should be procured from the contractor along with any tools to keep these documents current.

APPENDIX B

FB-111A/SMALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION DATE: 28 Sept 1979

ALC: SM	WEAPON SYSTEM: FB-111A

SOFTWARE PACKAGE: General Navigation Computer/Weapons Delivery Computer

PERSONNEL CONTACTE 1 Patterson, MMECP
Lynn Bassett, MMECP

SOFTWARE PACKAGE CHARACTERISTICS: (two packages - see page B-2)

SIZE: 16K each for General Navigation Computer (GNC) and Weapons Delivery Computer (WDC).

LANGUAGE: Assembly

APPLICATION: Navigation, Weapons Delivery

COMPLEXITY: High

YEAR DEVELOPED: 1968

DEVELOPER: Autonetics

COMMENTS Minimal attention given to software reliability and maintainability. See rating of quality attributes on page B-3.

HOST (AIRBORNE) COMPUTER CHARACTERISTICS: (two computers)

MANUFACTURER: IBM

MODEL NUMBER/DESIGNATOR: CP2

WORD SIZE: 16-bit

MEMORY SIZE: 16K each

MEMORY FILL: 200 empty words each (98.8%)

WEAPON SYSTEM USE:

NUMBER OF USERS: 70

LOCATIONS OF USERS: Plattsburgh AFB, N.Y., Pease AFB, N.H.

FREQUENCY OF USE: Daily

INTERVIEWER(S): R. B. Waina, A. P. Bangs

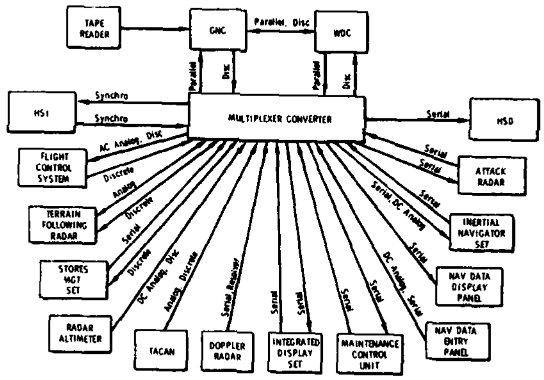


Figure B-1. F-111 Avionics System

GNC

NAVIGATION-RELATED FUNCTIONS AND FULL WEAPON DELIVERY BACK-UP

PRIMARY
- ACCURATE NAVIGATION
  - STATISTICAL PROCESSING OF DATA FROM INS, DOPPLER, ASTRO, AND POSITION FIXING
  - GROUND OR IN-FLIGHT ALIGNMENT
  - AUTOMATIC ECHELON OF NAVIGATION MODES BASED ON EQUIPMENT STATUS
- STORED MISSION PLANS WITH AUTOMATIC ROUTE POINT AND FIXPOINT SEQUENCING
- MULTI-MODE, VARIABLE GAIN STEERING WITH AUTO-PILOT OR MANUAL OPTION
- RADAR OR VISUAL FIXTAKING
- RECON POINT COORDINATE DETERMINATION
- SRAM DATA CALCULATIONS

BACK-UP
- FULL WEAPON DELIVERY BACK-UP IN EVENT OF WDC OR CS AREA 3 FAILURE

WDC

WEAPON DELIVERY RELATED FUNCTIONS, HSD DISPLAY FUNCTIONS, SELF-TEST, AND NAVIGATION BACK-UP

PRIMARY
- MULTI-MODE WEAPON DELIVERY
  - LEVEL DELIVERY WITH RADAR SIGHTING ON TARGET OR OFFSETS
  - LEVEL DELIVERY WITH VISUAL SIGHTING
  - DIVE WITH TFR RANGING
  - LADD WITH RADAR SIGHTING
- STORED BALLISTICS FOR ALL SAC WEAPONS
- FULL SOLUTION OF WEAPON TRAJECTORY BY INTEGRATION OF TRAJECTORY DIFFERENTIAL EQUATIONS
- ATTACK STEERING AND AUTOMATIC RELEASE COMPUTATIONS
- HORIZONTAL SITUATION DISPLAY FUNCTIONS
- SYSTEM OPERATING STATUS DETERMINATION THROUGH SELF-TEST MONITORING

BACK-UP
- CONVENTIONAL NAVIGATION, STEERING & FIXTAKING BACK-UP IN EVENT OF GNC OR CS AREA 1 FAILURE
- SRAM DATA CALCULATIONS BACK-UP IN EVENT OF GNC OR CS AREA 1 FAILURE

Figure B-2. F-111 OFP's

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - Quality Attributes **DATE:** 28 Sept 1979

Rate the Package on the following Quality attributes:

Accessibility: 0

Accountability: N/R

Access Audit: N/R

Access Control: N/R

Accuracy: 9

Augmentability: 6

Clarity: 4

Communicativeness: 8

Communications, Commonality: N/A

Completeness: 9

Conciseness: 9

Consistency:

- Internal Consistency: 7
- External Consistency: 8

Correctness: 10

Data Commonality: N/A

Efficiency: 10

- Execution Efficiency: 10
- Storage Efficiency: 10

Error Tolerance: 9

Expandability: 6

Generality: 0

Human Engineering: 9

Independence: 0

- Device: 0
- Software System: 0

Instrumentation: 4

Interoperability: 0

Integrity: 10

Legibility: 5

Maintainability: 8

Modifiability: 8

Modularity: 4

Operability: N/A

Performance: 10

Portability: 0

Reliability: 9

Robustness: 8

Reusability: 0

Selfcontainedness: 10

Selfdescriptiveness: 5

Simplicity: 3

Structuredness: 7

Testability: 8

Traceability: 8

Training: N/A

Understandability: 4

Usability (as-is utility): 9

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL — **DATE:** 28 Sept 1979

ALC: SM	**OFFICE SYMBOL:** MMECP

KEY PERSONNEL/OGRANIZATION:

MMEC
Mr. Robert Green

MMECP	MMECM	MMECS	MMECF
Mr. Al Patterson F/FB-111	Mr. Frank Davis Software Management	Major Hank Garretson Administration	Mr. Bob La Vergne Ground Communications, Electronics, and Meterological

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE): (MMECP)

4 Air Force (2-3 years experience)
19 Civil Service (3-5 years experience)
30 General Dynamics (2-3 years experience)
31 Autonetics (8-10 years experience)

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

7 - one OFP for each of the two computers (GNC and WDC) for each of the three aircraft, (F-111D, F-111F, FB-111A), plus one OFP for the NCU computer program for all three aircraft. Additionally, much simulation and support software is maintained, and numerous special projects are carried out.

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - WORK DISTRIBUTION DATE: 28 Sept 1979

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL (MMECP)

FUNCTION	NUMBER OF PERSONNEL AF	CS	CONTR
Management/Secretary		4	3
FB-111A S/W Engineering		1	5
F-111D S/W Engineering		1	5
F-111F/Pavetack S/W Engineering	1		5
Mission Programs	1	3	
F-111 A/E Acquisition Support		2	1
F-111 AISF Enhancements and S/W Support			15
F-111 OFP Mk II V & V		3	3
Flight Test Support			5
S/W Configuration Management			4
TSU			5
Special Projects	2	5	10
Major AISF Upgrades			[5-10 off-premise]
	4	19	61 [+ 5 - 10]

CONTINUATION SHEET - WORK DISTRIBUTION **DATE:** 28 Sept 1979

Manhours for FY'77 through FY'79 are distributed as follows:

Function	FY'77	FY'78	FY'79
FB-111A	18,041	15,069	9,809
F-111F	16,926	8,877	20,243
F-111D	13,880	19,376	14,373
Other F-111	6,391	3,288	6,467
Support Software	23,790	29,776	21,094
Special Projects	28,982	35,224	33,548
Leave/Holiday	19,904	23,580	24,597
Total	127,914	135,190	129,131

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE: 28 Sept 1979

SMALC uses a manhour accounting system which logs manhours by project. For each specific aircraft type block change, manhours are accounted for by five functions: management, definition, development, documentation and test. There is also a category for OFP Group Management. Beyond that, individual functions (e.g., configuration management) and projects are tracked.

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 28 Sept 1979

SUPPORT PHILOSOPHY:

AFLC needs to utilize its resources effectively and efficiently in maintaining and updating OFP's. A system entitled F-111 OFP Change and Control has been implemented in support of the F-111 aircraft. OFP's provide aircraft systems with tremendous flexibility, provided changes can be made to them in a timely manner. New aircraft capabilities, enhancements and improvements can be achieved through changes to OFP's. For example, capabilities and improvements added to the F-111 through OFP changes include SRAM alternate launch, moving target detect, expanded offset aimpoints, improved beacon bombing, enhanced fixtaking, expanded steerpoints, updated ballistics, and added avionics diagnostics. In addition, many modes have been improved, changed or deleted; navigation and bombing performance has been improved and numerous latent deficiencies corrected. This has been accomplished through some 177 OFP changes over a 3-year period.

The concept developed which permits OFP change activity of this order is the OFP Block Change. A block change is a collection of OFP changes (i.e., software changes only--no hardware impacts) which are concurrently processed and integrated (cont. on p. B- 9.)

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Very formal

CHANGE REVIEW PROCESS: See pages B-10 through B-17

CONFIGURATION IDENTIFICATION METHODS: See page B-15 ff

CONFIGURATION CHANGE CONTROL METHODS: See page B-15 ff

CONFIGURATION STATUS ACCOUNTING METHODS: Within the change process a baseline tape is generated. Individual changes are then keyed in by number. See description of the "dot-files," pages B-21/22.

SOFTWARE LIBRARY CONTROL PROCEDURES:

into the baseline program over some period of time. Since changes to OFP's are viewed as a continuing task over the life cycle of the aircraft system, the block change becomes a cyclic process. Efficiency is derived through a level of effort staffing and collective OFP change processing. Responsiveness is derived by keeping the cycle time to limits acceptable to the user. Obvious tradeoffs are level of effort staffing, number of changes in a block change and cycle time. For long-term efficiency the level of effort and cycle time are fixed and the parameter that varies from block change to block change is the number of OFP changes. This, of course, varies as a function of the priorities of change candidates and the magnitude and complexity of each. Flexibility is achieved in several ways. First, emergency changes can be expedited by processing on an individual basis. Depending on change magnitude, complexity and risk, it is possible to process these changes in a matter of weeks. Further, depending on priority and complexity, changes can be added or deleted from the block change until late in the change cycle, i.e., until configuration freeze. Finally, configuration control procedures have been set up in accordance with AFR 800-14 to process Computer Program Change Proposals (CPCP's) outside of the hardware configuration change process. A CPCP is the vehicle used for identification and approval of the OFP Block Change and attendant weapon system impacts. These procedures, in addition to adding flexibility, also greatly improve the responsiveness of the change system. Of course, with flexibility of this nature, strict control and complete documentation is essential for configuration management.

OFP BLOCK CHANGE CYCLE:

Figure 3 depicts the development cycle used for F-111 OFP Block Changes and is similiar to the standard software development cycle. It includes the major phases of analysis, feasibility, design, development, test, documentation and delivery. As shown in Figure 3, each phase starts and finishes with well defined milestones. The cycle is periodic with a 3-month overlap and produces updated OFP's for the user on an annual basis. Tradeoffs which dictated cycle time were F-111 change activity, required user response, and available support resources. However, other practical considerations which limit the minimum cycle time are mission simulator updates, availability of test aircraft, crew training, and documentation update.

Referring to Figure B-3 the change cycle starts with a requirements review. This is a user, system manager, engineering review where problems and change requirements which have accumulated over the past year are reviewed and prioritized. The Operational Software Requirements Document (OSRD) is updated and the feasibility study defined.

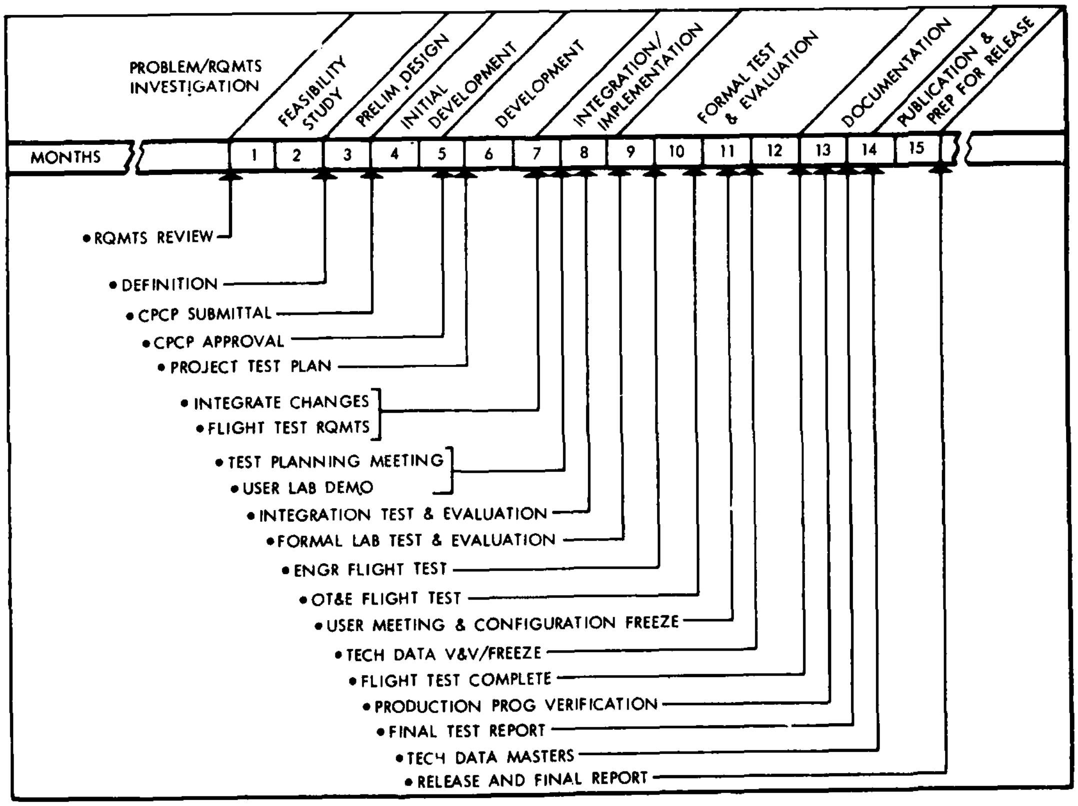


Figure B-3. Operational Flight Program Change Cycle

The Feasibility Study Phase is conducted by engineering in accordance with user priority. It primarily consists of: determining the update task for each change; scoping the resource requirements; investigating change impacts on other parts of the weapon system and support equipment; looking at computer memory and timing impacts; investigating integration problems; and determining if each change requirement is technically feasible and will actually provide the user with what is expected. The results of the feasibility study are then presented at an OFP Block Change Definition meeting attended by the user, the system manager and engineering. Based on the results of the feasibility study, an OFP Block Change Definition is established and agreed to. Constraints adhered to are: the block change contains only change candidates which do not impact hardware; the changes can be worked within existing resources; and the cycle time is maintained. Changes which do not meet these constraints are referred to the system manager for processing in accordance with hardware procedures. The main output of the feasibility study is the OFP Block Change Requirements Document.

The Preliminary Design Phase consists of: translating requirements into engineering terms; updating flow charts and logic layouts, defining mechanization, interface, scaling, and timing requirements; developing change narratives; determining the scope of impact to documentation, technical orders, mission simulator and other weapon system software; and preparing and submitting the Computer Program Change Proposal (CPCP).

The Initial Development Phase consists of: establishing the development baseline block change programs; firming up mechanization; programming and testing preliminary code; and establishing documentation files.

The Development Phase begins with the approval of the CPCP by both the user and system manager. The development phase consist of: finalizing and testing program code for each OFP change; developing engineering tapes, addendums, and documentation; developing change descriptions; developing the project test plan; developing flight test, data reduction and instrumentation test requirements; preparing test procedures; and providing preliminary data for mission simulator updates.

The Integration and Implementation Phase begins with the laboratory integration of all OFP Block Change requirements. A user/engineering meeting is convened to discuss engineering and user flight test policy and to conduct a laboratory demonstration of each OFP change. Final reassembly of all approved OFP changes with the development baseline program is accomplished and the master engineering OFP tape produced. Formal verification testing and evaluation by the development engineering group is completed. Engineering source data for technical orders and engineering documentation is developed. Formal test and evaluation procedures are finalized. The mission and weapon control programs are produced. Laboratory test and flight test aircraft configurations are established to include aircraft computer data pumps and data reduction software. These steps are in preparation for formal test and evaluation.

The Formal Test and Evaluation Phase starts with the turnover of the master engineering OFP tape to a separate engineering group for test and evaluation. Formal testing consists of a three phase laboratory test, instrumented engineering flight test, and user Operational Test and Evaluation (OT&E). Phase I of laboratory testing is a dynamic functional test of all OFP modes. When completed, the master engineering OFP tape is cleared for engineering flight test. Initial engineering

flight test looks at overall air suitability and clears the master engineering OFP tape for user OT&E. Once cleared, OT&E and final engineering flight test are conducted concurrently. Phase II and III of the formal laboratory test are also run concurrently. Phase II is a quantitative test of performance, a look at performance envelopes and an inspection of code and baseline documents. Phase III is the retesting of modifications resulting from problems discovered during test. Part way through formal testing a meeting between the user and engineering is convened to review test results and to establish an OFP Block Change configuration freeze. Mandatory corrections to program discrepancies are defined, implemented and retested; trivial anomalies are accepted; and in the event a change cannot be accomplished, its coding is removed. Also, during this phase technical order source data is verified and validated by the user, engineering and the system manager. Source inputs for the mission simulator updates are finalized and delivered. At the completion of the formal test phase, the master OFP engineering addendum tape, incorporating all corrections found during test, is merged with the master engineering OFP tape to produce the engineering OFP release tape and the final OFP Block Change documentation.

During the Documentation Phase the engineering OFP release tape is converted into a production version and tested. All engineering documentation is finalized; the technical order masters are prepared and made ready for reproduction. The evaluation of test results is completed and the final test report is issued.

During the Publication and Preparation for Release Phase the production OFP tapes are duplicated; engineering documentation and technical orders are published; the final OFP Block Change Report is issued; and the new OFPs and associated technical orders are concurrently released to the user under a TCTO.

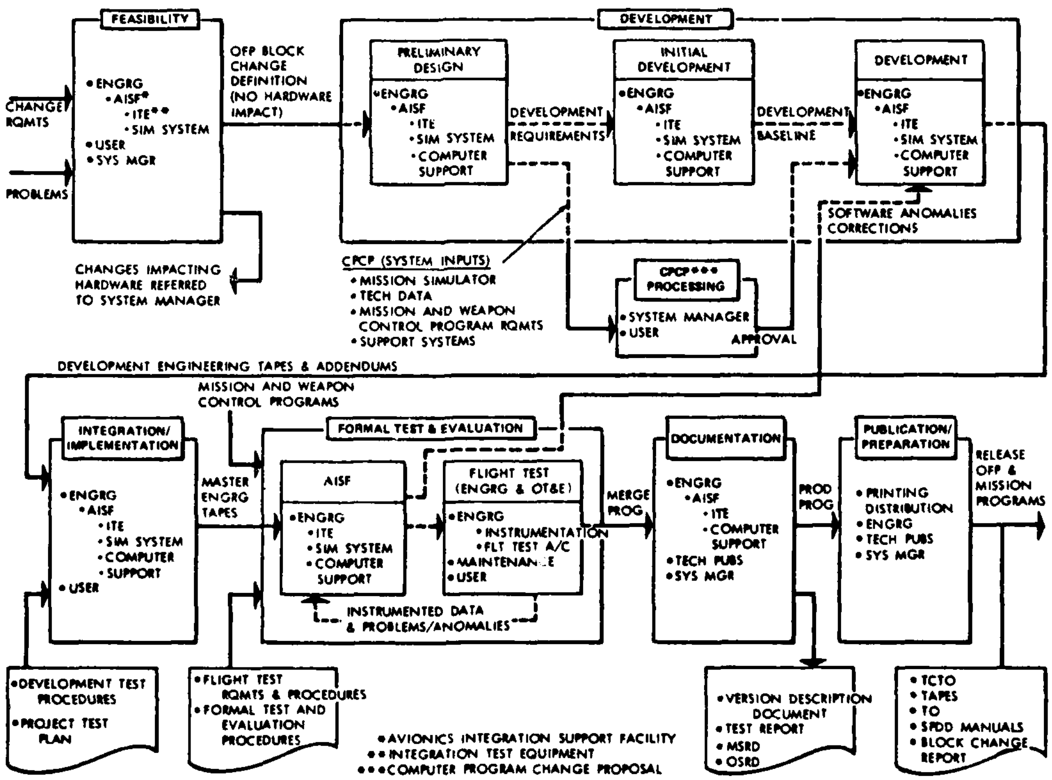
OFP BLOCK CHANGE PROCESS AND RESOURCE UTILIZATION:

FigureB-4 depicts the F-111 OFP Block change process. It illustrates several significant points: process flow; resource utilization; and major input/output products. The OFP Block Change process from start to finish is highly technical, and primarily involves engineering and engineering resources. However, system management, technical publications and user participation are essential. The system manager has complete responsibility for the control, coordination and integration of OFP changes into the overall integrated logistics management support system and participates to that extent. The user is intimately involved during feasibility and change definition to establish requirements and priorities, and to assure that requirements are properly interpreted. Further, the user actively participates during the integration and test phases so that performance can be verified and acceptance granted prior to configuration freeze and OFP release. The user's primary participation during these phases is in the laboratory verification. During the documentation, publication and preparation for release phases, the system manager and technical publications are extensively involved in the preparation and publication of technical orders, the duplication of OFP tapes and the preparation of the TCTO for release. Engineering is responsible for the technical management, planning and direction of the complete OFP change program and is also responsible for the development and implementation of all OFP changes. Therefore, engineering is actively involved in all phases both from the program management and technical detail aspects.

As noted in Figure B-4 the engineering resource utilized throughout the OFP change process is the Avionics Integration Support Facility (AISF). Figure B-5 depicts

the F-111 AISF which consists of an avionics integration area, subsystem test area, OFP dynamic simulation area, computer support area and instrumented flight test aircraft. The integration, simulation and computer support areas are used extensively throughout the change process while the flight test capability is extensively used during the test and evaluation phase.

The integration area, which contains avionics integraton test equipment (ITE), is used to integrate the OFPs with the avionics system. It further is used to recreate flight problems; check hardware/software interfaces; evaluate timing, stabilization and synchronization; and to conduct final OFP/avionics system compatibility tests. On-line OFP change capability is available in this area which enables efficient and expedient implementation of trial solutions.



FigureB-4. OFP Change Process

The F-111 OFP dynamic simulation area provides a unique capability to quantitatively analyze, develop, test and evaluate OFP's and OFP changes under realistic and repeatable conditions. The systems are hybrid simulators which retain the avionics computers with their resident OFP's and simulate the world as seen by these computers in actual flight. Complete visibility is gained into the innermost parts of the OFP's through data monitoring and acquisition systems which provide for full real-time traces of OFP execution. Each simulation system is made up of three Harris Corporation 6024/VM mini-computer systems, an aircraft cockpit mock-up, special interface devices and a simulation software package.

The computer support area satisfies all computer support requirements associated with maintaining and updating OFP's. These requirements include reassembly; data reduction and analysis; documentation generation, maintenance and storage; maintenance of support software; specialized programs and programming; and automated configuration control. The reassembly and automated documentation generation process is shown in Figure B-6. The computer support system includes two Interdata 8/32 mini-computer systems, a PDP 11/40 mini-computer system and a remote terminal to an IBM 360/65 complex.

The flight test capability includes EI coded F-111 aircraft equipped with special instrumentation packages designed specifically for monitoring and recording OFP flight performance. Flights are conducted to test overall OFP performance and air suitability; analyze change and problem areas; test specific modes and functions; and to obtain engineering data to define and verify system performance.

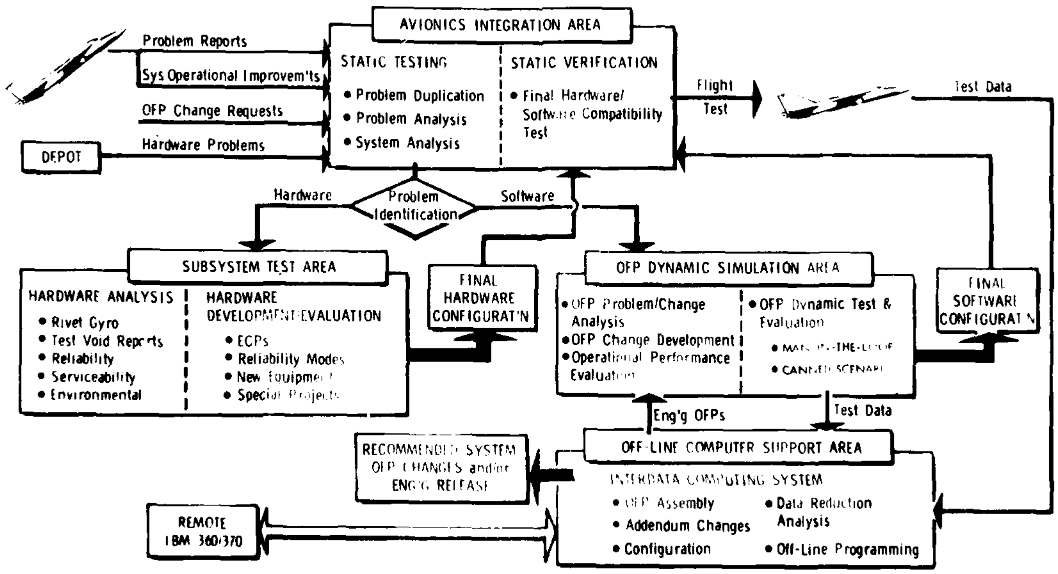


Figure B-5. F-111 Avionics Integration Support Facility

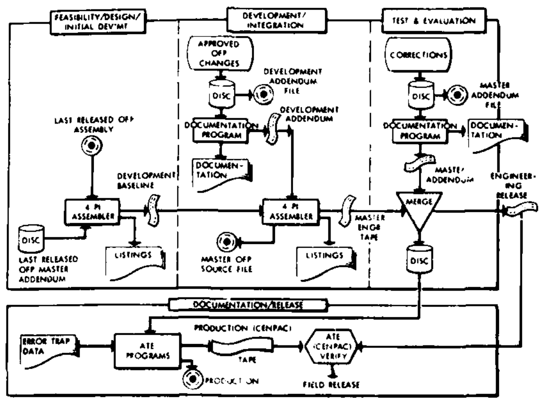


Figure B-6. OFP Tape and Automated Documentation Generation

The AISF technical staff consists of engineers, programmers and technicians. They encompass a spectrum of expertise on the aircraft system, avionics, computers, operational software, support software, bomb navigation, scientific programming, instrumentation, data reduction, systems analysis, configuration management, and equipment and software maintenance.

OFP TAPE AND AUTOMATED DOCUMENTATION GENERATION:

The key to efficiently making OFP changes and controlling configuration lies in an automated process for generating OFP's and all associated documentation. Figure B-6 illustrates the F-111 OFP Tape and Automated Documentation Generation System which ultimately will satisfy this goal. To date the process performs the reassembly, documentation/ addendum generation, merge, and production program conversions. The output products are engineering and production tapes, program listings, computer files, and documentation.

The process starts with the reassembly of the last released OFP to incorporate the Master Addendum changes along with subsequent changes to optimize program coding for memory and timing benefits. The output consists of the development baseline OFP. Inputs to the Documentation Program during development and integration include engineering development data, reassembly code and the specific machine code for the preparation of engineering addendum tapes. The documentation and files generated from the Documentation Program include: OFP change descriptions and requirements, change objectives, status, mechanization, assembly code, machine code (for key-ins and addendums); flight test, instrumentation and data reduction requirements; test procedures, technical order impacts and historical data. This information is continuously updated during the OFP Block Change cycle. Prior to formal test and evaluation the final development addendum is reassembled with the development baseline to produce the master reassembled engineering baseline. The final OFP Block Change configuration or engineering release is defined by the reassembled engineering baseline and the Master Addendum. Formal testing

is accomplished only with the computers loaded with the baseline OFP and an approved or Master Addendum thereby assuring a completely documented and controlled configuration. Current plans are to enhance the system such that all configuration control documentation listed in Figure B-7 can be produced using this system.

OFP CONFIGURATION CONTROL DOCUMENTS:

The OFP Change and Control System provides for extreme flexibility and therefore, strict control is essential if OFP configuration is to be maintained. The management control aspects associated with OFP changes, and the change process, have been described; however, essential to configuration control and management is good documentation. Since software is intangible (can't see or touch it), the documentation must be very thorough in describing its functional and performance characteristics. Equally as important is the requirement to have total visibility as to how these characteristics were derived. Without documentation that does these things, the on-going change process would eventually collapse. Figure 7 illustrates what is considered a complete set of OFP configuration control documents and where in the F-111 OFP change cycle these documents are completed and available. The list is confined to the end item OFP and is not intended to include documentation on supporting resources, support software or other portions of the weapon system impacted by the OFP changes. A similar set of documents is obviously required for these areas. An exception to this is in the formal test and evaluation process. As noted in Figure B-7, documents defining the test configuration of the laboratory, test aircraft, and mission and weapon control programs are required. If and when other test resources are used in formal testing, their configuration should also be documented and become a part of the OFP configuration control documents. As shown in Figure B-7, the physical documentation includes both automated and manually prepared documents as well as computer stored programs.

Current change requirements and problems are documented in the Operational Software Requirements Document (OSRD). A historical list of all requirements and problems, including those listed in the OSRD, is maintained in the Master Software Requirements Document (MSRD). All OFP source programs and programs generated after the final OFP Block Change assembly are stored on magnetic tape and hard copy listings are maintained on microfilm or microfiche. The OFP Block Change Requirements Document defines the initial block change definition while the final release configuration is documented using the previously described Documentation Program. These documents become a part of the OFP Block Change Version Description Document (VDD). The Computer Program Change Proposal becomes the system manager's official configuration control document and is updated as required to reflect the final released OFP configuration. All formal test requirements, plans, procedures, and reports become a part of the VDD and are a record of actual OFP performance. The OFP Block Change Report is a summary of total block change activity and results. The System Program Description Document (SPDD) is the actual OFP specification and is updated with each block change. It describes each of the OFP subroutines in detail and includes: narrative descriptions, inputs/outputs, interfaces, logic, timing, equations, and flow charts. The VDD is the historical record of the OFP Block Change and includes all other block change documents. In summary, the OFP source data, SPDD and program listings actually define the newly released OFP and the VDD defines the OFP Block Change to it. Technical orders generally aren't considered configuration control documents but are shown because of their importance to the user and because of the detail they offer in describing the OFP's and their relationship to the aircraft system operation. With the exception of the technical orders, all documentation is stored and maintained by engineering.

CONTINUATION SHEET - CHANGE REVIEW PROCESS AND CONTROL METHODS DATE: 28 Sept 1979

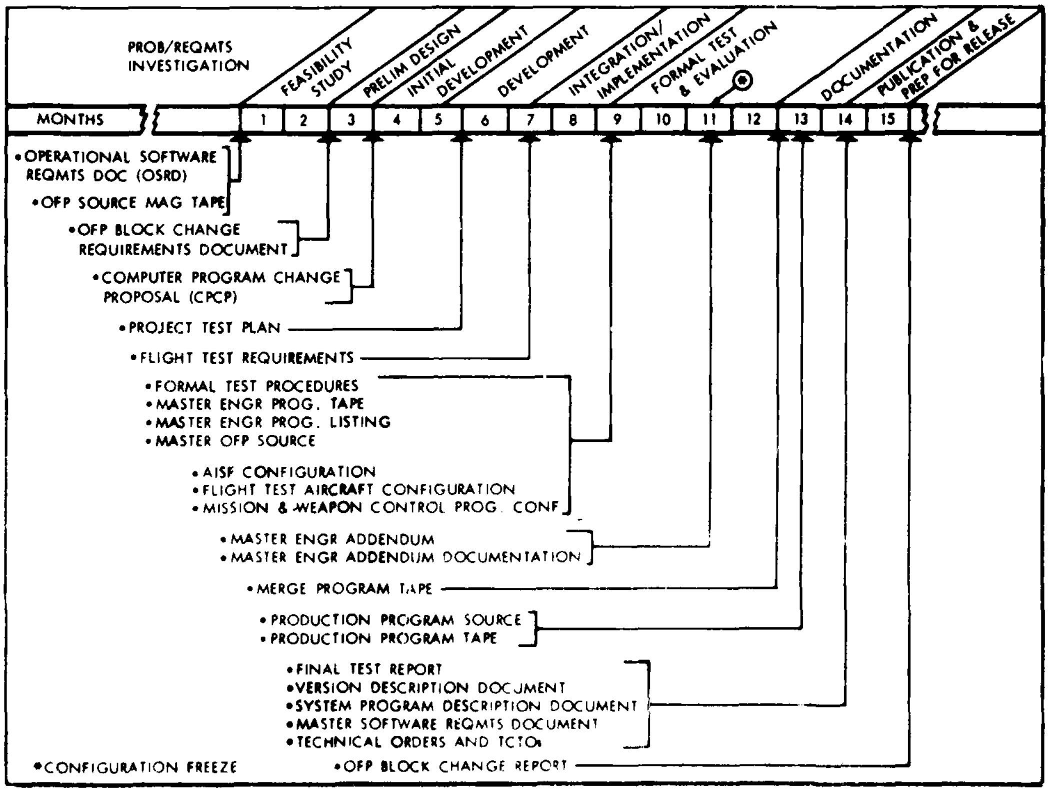


Figure B-7. OFP Configuration Control Documents

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 28 Sept 1979

STRUCTURED DESIGN? – DESCRIBE Minimal
STRUCTURED PROGRAMMING? – DESCRIBE Minimal
CODING GUIDELINES: Experience - A small group of mechanization engineers is used on each aircraft.
CHANGE ENTRY METHODS: CRT terminal. Interdata is used for an on-line record.
SCHEDULE: Formal published milestones, formal block change schedule.
REPORTING: Informal in-house reporting. Formal reports to users are via scheduled meetings (Ref. Figure 3, p. B-10).
COMMENTS:

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 28 Sept 1979

DOCUMENTATION:

REQUIREMENTS: Current requirements are defined in meeting minutes and in change summaries developed by engineers. See Computer Program Change Request on p. B-20.

DESIGN: The "dot" files are used for design documentation. They are described on pp. B-21 and B-22.

USER: User documentation is provided through formal changes to the system tech orders.

See Documentation Guide, pp. B-23 through B-42.

PROGRAM PROBLEM REPORTING SYSTEM:

Users generate Computer Program Change Requests. These are formally logged by MMECP, then analyzed/prioritized at the Requirements Review Meeting with users.

COMMENTS:

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

COMPUTER PROGRAM CHANGE REQUEST

Entered by SM/ALC

I.D. Number ________

1. TITLE: Enter descriptive title   2. DATE: Enter prepared date

3. COMPUTER PROGRAM IDENTIFICATION:

   Enter identification of program affected

4. DESCRIPTION/PRESENT OPERATION:

   Describe in detail the characteristics of computer operation or use as presently mechanized, including aircrew actions, observed reactions of various cockpit displays correlated with inputs to the system (including aircraft maneuvering or switch changes), any test data available, and any other information which might assist in identifying the cause or which might aid in implementing the correction or change.

5. DESIRED OPERATION:

   Describe the characteristics of computer operation or use desired as a result of this change, using the same guidelines as under "Present Operation."

6. REASON FOR CHANGE:

   Present the rationale behind the need for this change, emphasizing the relative importance of the current problem and the desired result.

7. CHANGE HISTORY/RELATED CHANGES:

   Information to be supplied by Sacramento ALC

8. REQUESTED BY: Person to be contacted for further information. ________ Name Orgn Phone	9. REQUESTING AGENCY: COORDINATION Wing coordination ________ Name Phone
10. REQUESTING COMMAND: APPROVAL SAC/TAC/USAFE ________ Name Phone	11. SUPPORTING AGENCY: APPROVAL SM/ALC ________ Name Phone

CONTINUATION SHEET — Documentation (Dot Files) **DATE:** 28 Sept 1979

File Designation	File Content and Structure
axxx	File series name: a indicates aircraft series; xxx is change number.
axxx.P	CHANGE STATEMENT — File is for insertion of a change statement. TITLE: CHANGE REQUIREMENT: CURRENT MECHANIZATION: OBJECTIVE: NOTES: STATUS:
axxx.M	MECHANIZATION — A narrative which is source data for update. Note if change as mechanized is different from requirement. DATE OF LAST UPDATE: DESCRIPTION:
axxx.K	KEYINS — For generating addendum tapes. Machine language code for patches entered prior to executing a compiled OFP. Assembly language statements are not required but provide design interpretation of ML code. Note required General Navigation Computer and Weapons Delivery Computer cues. $GNC — KEYINS LOC IS WAS CORRESPONDING AL CODE (address) (revised ML code) (old ML code) $END $WDC — KEYINS LOC IS WAS AL CODE $END
axxx.R	REASSEMBLY — Similar to KEYIN, but used to reassemble a program. $GNC — REASSEMBLY (Exact card image, punched cards format previously used for reassembly) $END

CONTINUATION SHEET — Documentation (Dot Files) **DATE:** 28 Sept 1979

File Designation	File Content and Structure
axxx.I	TEST PROCEDURES — Step-by-step test procedure to checkout a change.
axxx.F	FLIGHT TEST REQUIREMENTS — Contains information for flight test of OFP change. Contains summary of change and requirements for test execution (digital channels, test parameters, success criteria, et.al.).
axxx.G	GLOSSARY — List of any new labels or mnemonics.

DOCUMENTATION GUIDE FOR

MMECP SOFTWARE

14 DECEMBER 78

COMPILED BY

CONFIGURATION MANAGEMENT

I N D E X

PAGE	CONTENTS

DOCUMENTATION STANDARD 1

PROGRAMS

```
CM TITLE                  :  TITLE OF PROGRAM
CM
CM DATE OF LAST CHANGE:
CM
CM PROGRAMMER             :
CM
CF EXPLANATION            :  STATE WHAT THE PROGRAM DOES.
CF
CF OVERVIEW               :  OUTLINE THE LOGIC STRUCTURE.
CF
CF VARIABLES              :  SEPARATELY DEFINE EACH VARIABLE WHOSE NAME DOES
CF                           NOT ADEQUATELY DESCRIBE ITS FUNCTION, TYPE, OR
CF                           USAGE.
CF
CI EXTERNALS              :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                           DATA FILES ACCESSED BY THE PROGRAM AND THEIR
CI                           LOCATION.
CI
CI REMARKS                :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                           UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                           THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
C                            NECESSARY TO UNDERSTAND THE PROGRAM.
C
CD USER'S GUIDE           :  A USER'S GUIDE IN THE SOURCE LISTING IS
CD                           OPTIONAL.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

- SOURCE LISTING, EITHER 8080 OR ASSEMBLED
- USER'S GUIDE
- LOCATION OF JOBSTREAMS/CSS FILES OR MACROS ASSOCIATED WITH THE PROGRAM

DOCUMENTATION STANDARD 2

SUBROUTINES

```
CM TITLE               :  TITLE OF SUBROUTINE
CM
CM DATE OF LAST CHANGE:
CM
CM PROGRAMMER          :
CM
CF EXPLANATION         :  STATE WHAT THE SUBROUTINE DOES.
CF
CF PARAMETERS          :  DEFINE VARIABLES WHICH ARE PASSED TO AND FROM
CF                        THE SUBROUTINE.
CF
CI EXTERNALS           :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                        DATA FILES ACCESSED BY THE SUBROUTINE OR WHICH
CI                        CALL THIS SUBROUTINE.
CI
CI REMARKS             :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                        UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                        THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                        NECESSARY TO UNDERSTAND THE SUBROUTINE.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING

DOCUMENTATION STANDARD 3

LIBRARY ROUTINES

```
CM TITLE                 : TITLE OF LIBRARY ROUTINE
CM
CM ENTRY POINTS          :
CM
CM LIBRARY NAME          :
CM
CM DATE OF LAST CHANGE   :
CM
CM PROGRAMMER            :
CM
CF EXPLANATION           : STATE WHAT THE LIBRARY ROUTINE DOES.
CF
CF OVERVIEW              : OUTLINE THE LOGIC STRUCTURE.
CF
CF PARAMETERS            : DEFINE VARIABLES WHICH ARE PASSED TO AND FROM
CF                         THE ROUTINE.
CF
CI EXTERNALS             : LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                         DATA FILES ACCESSED BY THE LIBRARY ROUTINE.

CI REMARKS               : INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                         UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                         THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                         NECESSARY TO UNDERSTAND THE LIBRARY ROUTINE.
CI
CO USER'S GUIDE          : A USER'S GUIDE IN THE SOURCE LISTING IS OPTIONAL.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING
USER'S GUIDE

****

BOILER PLATES FOR THE STANDARDS ARE CONTAINED IN THE FOLLOWING LOCATIONS:

```
     INTERDATA: SYST:DOCSTD.FRM/S
       HARRIS: SYST*DOCSTD
RECORD NUMBER: PROGRAM 5-45; SUBROUTINE 50-80; LIBRARY ROUTINE 85-125
```

AD-A088 477 HUGHES AIRCRAFT CO CANOGA PARK CALIF F/G 14/1
PREDICTIVE SOFTWARE COST MODEL STUDY. VOLUME II. SOFTWARE PACKA--ETC(U)
JUN 80 R B WAINA, A P BANGS, E E RODRIGUEZ F33615-79-C-1734
UNCLASSIFIED AFWAL-TR-80-1056-VOL-2 NL

2 OF 6
AD A
088477

EXAMPLE: PROGRAM DOCUMENTATION

```
CM TITLE                : PACKPURGE
CM
CM DATE OF LAST CHANGE: 30 OCT 78
CM
CM PROGRAMMER           : B. BARTHELOW
CM
CF EXPLANATION          : THIS IS A PURGE PROGRAM FOR USE BY CONFIGURATION
CF                        MANAGEMENT.  THE PROGRAM WILL REQUEST A PACK NUMBER
CF                        FROM THE USER AND PROCEED TO PURGE ALL DATA FILES
CF                        NOT ACCESSED WITHIN THE PREVIOUS 7 DAYS.
CF
CF OVERVIEW             : PROGRAM PACKPURGE;
CF                            INTIALIZATION;
CF                                WHILE PACKPURGE NOT COMPLETE
CF                                    DO BEGIN
CF                                        GETAREAINFO;
CF                                        IF PROGTYPE .EQ. DATA-AREA
CF                                        THEN BEGIN
CF                                               IF QUALIFIER .NE. 0000SYST
CF                                               THEN BEGIN
CF                                                      IF LASTACCESS > SEVENDAYS
CF                                                      THEN ELIMINATEAREA;
CF                                                      END;
CF                                               END;
CF                                         END;
CF
CI VARIABLES            : PARLST IS THE PARAMETER LIST AND BUFFER AREA FOR
CI                            SDASAVE
CI                        ELIST IS THE PARAMETER LIST FOR THE SYSTEM
CI                            ELIMINATE ROUTINE
CI                        ALL VARIABLES ARE GLOBAL
CI
CI  EXTERNALS           : NONE
CI
CI  REMARKS             : THE PROGRAM IS COMPILED AS A FORTRAN PROGRAM FOR
CI                            EASE OF I/O.
CI                        DUE TO THE INTERNAL OPERATION OF VULCAN, THIS
CI                            PROGRAM MUST BE RUN AS *ACUTIL IN ORDER TO
CI                            UTILIZE THE SYSTEM ROUTINE SDASAVE.  IN ORDER
CI                            TO EFFECT THIS THE PROGRAM SHOULD BE EXECUTED
CI                            BY A JOB STREAM FILE WHICH RENAMES ACUTIL TO
CI                            TEMP, PACKPURGE TO ACUTIL, EXECUTES ACUTIL
CI                            AND UPON COMPLETION RENAMES ACUTIL TO
CI                            PACKPURGE, TEMP TO ACUTIL.
CI
CI
      WRITE(3,900)
900   FORMAT(" ENTER PACK # TO BE PURGED")
      READ(3,901) IPACK
 1    FORMAT(I3)
      WRITE(3,902) IPACK
902   FORMAT(2X,I3)
```

```
        STOP
  .SE
QLTEST  BLOK 1
PARLST BLOK 24
RLIST BLOK 1
ELIST BLOK 1
ARCNT BLOK 1
          TMA    IPACK
          TAM    PARLST+0
          TLO    PARLST
          BLJ    $DASAVE        FIRST CALL TO DASAVE
          DATA   1             FUNCTION CODE TO GET ALL AREAS
          BOZ    DONE           NO AREAS EXIT
          TEM    ARCNT         NUMBER OF AREA BLOCKS RETURNED * 20 WORDS/BLOCK
          BLU    STIME          GET TODAYS DATE
          SOE    7              SUBTRACT 7 DAYS
          TEM    PDATE          INITIALIZE PURGE DATE
MLOOP     BLJ    GTAREA        SET K REGISTER TO AREA BLOCK
          BOZ    DONE           NO MORE AREAS TO PROCESS
          TMA    6,K            CHECK IF DATA FILE OR PROGRAM FILE
          BON    MLOOP          PROGRAM FILE GET NEXT AREA BLOCK
          BLJ    QLTEST       CHECK IF 0000SYST QUALIFIER
          BNZ    MLOOP          YES, GET NEXT AREA BLOCK
          BLJ    ACCESS         CHECK LAST ACCESS
          BON    MLOOP          WITHIN 7 DAYS GET NEXT AREA BLOCK
          BLJ    ELIM           TO LONG ELIMINATE IT
          BUC    MLOOP          GET NEXT AREA BLOCK
*
*                       GETAREA ROUTINE
*                       ===============
*
*          ON ENTRY TO THIS ROUTINE LOC ARCNT CONTAINS CURRENT BUFFER
*          POINTER.
*          SUBTRACT 20 (AREABLOCK SIZE).
*          IF NOT POSITIVE DACALL ELSE MOVE POINTER TO K REGISTER & RETURN.
*          DACALL:
*                   CALLS $DASAVE.
*                   TRANSFERS BUFFER COUNT TO AREACOUNT.
*                   RETURNS TO MAINLINE IF NOTHING IN BUFFER I.E DONE.
*                   ELSE RE-ENTERS GETAREA.
*
*
*
GETAREA  AOM   -20              MOVE POINTER TO NEXT AREA DATA IN BUFFER
        DAC    ARCNT       ADDRESS OF LOCATION TO ADD TO
         BNP    DACALL          BUFFER COMPLETELY PROCESSED GET NEXT BUFFER
         TMK    ARCNT         MOVE POINTER TO K REGISTER
         BUC    0,J             RETURN TO MAINLINE
DACALL   TLO    PARLST          GET ADDRESS OF PARAMETER LIST
         BLJ    $DASAVE         CALL SYSTEM ROUTINE
         DATA   0               NOT THE FIRST CALL SO 0 HERE
         BNZ    $40             PROBLEMS  SEND ERROR MESSAGE
         TEM    ARCNT         MOVE BUFFER SIZE TO ARCNT
         BOZ    BUC0J           ALL DONE RETURN WITH ZERO FLAG SET
         BUC    GTAREA          GO SET POINTER
```

```
*                  ELIMINATE ROUTINE
*                  *****************
*
*        MOVES AREANAME AND QUALIFIER FROM BUFFER TO $ELIMINATE PRAM LIST
*        ELIMINATES FILE
*        RETURNS TO MAIN
*
*
ELIM     TMD   0,K               GET AREANAME FROM BUFFER
         TDM   ELIST             PUT IN PRAM LIST
         TMD   8,K               GET QUALIFIER FROM BUFFER
         TDM   ELIST+2           PUT IN PRAM LIST
         BNZ   $41               PROBLEM  SEND ERROR MESSAGE
         BUC   0,J               RETURN
*
*
*
*
*                  ACCESS ROUTINE
*                  **************
*
*       GETS LAST ACCESS DATE AND PURGE DATE.
*       SUBTRACTS PURGE DATE FROM ACCESS DATE.
*       RETURNS.

*
ACCESS    TME  17,K          GET LAST ACCESS DATE
          TMA  DTIME         GET PURGE DATE
          SAE                SUBTRACT
BUCOJ     BUC  0,J
$END
C
C
C         THE FOLLOWING DISPLAYS ERROR MESSAGE FOR $DASAVE ERROR
C
C
40    WRITE(3,400)
400   FORMAT(" ERROR IN $DASAVE ROUTINE CONTACT PROGRAMMER")
C     GO TO 50
C
C
C         THE FOLLOWING DISPLAYS ERROR MESSAGE FOR $ELIM ERROR
C
41    WRITE(3,410)
410   FORMAT(" ERROR IN $ELIMINATE ROUTINE CONTACT PROGRAMMER")
C
C
C         COMMON EXIT LOGIC
C  50    REWIND 10
C  51    READ(10,500)VARIABLE LIST
       IF(EOF)GO TO 60
C     WRITE(6,502)VARIABLE LIST
C     GO TO 51
C    60    CLOSE 3 6
      END
```

EXAMPLE: SUBROUTINE DOCUMENTATION

```
      SUBROUTINE GTDATE(TEMP)
CM
CM TITLE               :  GTDATE
CM
CM DATE OF LAST CHANGE:  8 NOV 78
CM
CM PROGRAMMER          :  M.TAYLOR & J.CLAAR
CM                        REVISION 1 - N. TEAGUE
CM
CF EXPLANATION         :  THIS SUBROUTINE CONVERTS AN ALPLHABETIC MONTH
CF                        NAME TO A NUMERIC VALUE.  THIRTEEN DAYS ARE
CF                        ADDED TO THE DATE TO ALLOW FOR CHECKING FOR
CF                        DELINQUENT TASK REQUESTS.  CROSS-OVER TO THE
CF                        NEXT MONTH AND/OR YEAR IS TAKEN INTO ACCOUNT.
CF
CI PARAMETERS          :  TEMP - ALPHANUMERIC INPUT/OUTPUT OF DATE;
CI                               FORMAT I
CI
CI EXTERNALS           :  CALLED BY MAIN
CI                        LOCATED IN TRISMAIN
CI
CI REMARKS             :  DATES WILL NOT BE CONVERTED BEYOND THE YEAR 1999.

CI
C    DATA DEFINITION
      INTEGER TEMP(3),YDATE(12,2)
      COMMON /IDATE/YDATE
C     END DATA DEFINTION
C     GET NUMERIC DATE FOR TEST IN CALLING ROUTINE
      DO 10 I=1,12
      IF(TEMP(2).EQ.YDATE(I,1)) GO TO 20
10    CONTINUE
      WRITE(3,1000) TEMP(2)
1000  FORMAT('0 MONTH GIVEN ('A4,') IS WRONG ',/,'  ENDING SESSION')
      CALL EXIT
C    SET ALPHA MONTH TO NUMERIC MONTH
20    TEMP(2)=I
C    ADD IN 13 FOR TWO WEEK CHECK
      TEMP(1)=TEMP(1)+13
C    CHECK TO SEE IF IT IS INTO ANOTHER MONTH
      IF(TEMP(1).LE.YDATE(I,2)) GO TO 9999
C    YES SUBTRACT OUT FOR DAYS INTO NEW MONTH
      TEMP(1)=TEMP(1)-YDATE(I,2)
C    INCREMENT MONTH COUNTER
      TEMP(2)=TEMP(2)+1
C    CHECK TO SEE IF INTO NEW YEAR
      IF(TEMP(2).LE.12) GO TO 9999
     ADD TO YEAR COUNTER (WILL NOT WORK FROM 1999 TO 2000)
      TEMP(3)=TEMP(3)+1
C    END OF DATE ROUTINE
9999  RETURN
      END
```

EXAMPLE: LIBRARY SUBROUTINE DOCUMENTATION

```
CM TITLE              : JULBIN
CM
CM ENTRY POINTS       : JULBIN
CM
CM LIBRARY NAME       : OFPLIB
CM
CM DATE OF LAST CHANGE: 8 MAY 77
CM
CM PROGRAMMER         : KARL W RASS
CM
CF EXPLANATION        : THE BUFFER STARTING AT IBUFF AND FOR NCHAR BYTES LONG
CF                      IS SCANNED LOOKING FOR A VALID DATE AND TIME IN ASCII.
CF                      THE DATE IS CONVERTED TO A BINARY WORD AND THE TIME IS
CF                      CONVERTED TO ANOTHER BINARY WORD.  THE APPROPRIATE
CF                      STATUS IS RETURNED.  THE DATE CAN BE EITHER IN INTERDAT
CF                      (E.G. 24/01/77) OR CONVENTIONAL (24 JAN 77) OR JULIAN
CF                      (77.024).  TIME IS IN HH:MM:SS AND IF NONE IS GIVEN
CF                      THEN 12:00:00 IS ASSUMED.
CF
CF OVERVIEW           : SCAN THE BUFFER
CF                         IF THE FORM IS JULIAN
CF                              CONVERT THE DATE TO BINARY
CF                              CONVERT THE TIME TO BINARY
CF                              RETURN
CF                         IF THE FORM IS DD/MM/YY OR DD/MMM/YY
CF                              IF THE YEAR IS LEAP YEAR
CF                                   IF THE MONTH IS LATER THAN FEB.
CF                                        ADD 1 DAY TO TOTAL DAYS IN DATE
CF                              CONVERT DATE TO BINARY
CF                              CONVERT TIME TO BINARY
CF                              RETURN
CF
CI PARAMETERS         : INPUT:
CI                         IBUFF = BUFFER START ADDRESS WHERE THE DATE/
CI                                 TIME IS LOCATED
CI                         NCHAR = LENGTH IN BYTES OF IBUFF; I4 FORMAT
CI
CI                      OUTPUT:
CI                         IBIN = IBIN(1) IS BINARY DATE
CI                                IBIN(2) IS BINARY TIME
CI                         ISTAT = STATUS; RANGE -6 - 0; I4 FORMAT
CI
CI EXTERNALS          : CALLS FSCAN; LOCATED IN SYS:USER LIBRARY
CI
CI REMARKS            : AFTER CALLING JULBIN, SUBROUTINE JULIAN MUST BE
CI                      CALLED TO CONVERT THE BINARY DATA TO JULIAN
CI                      FORMAT.  LEAP YEAR CALCULATIONS WILL BE INCORRECT
I                       BEGINNING WITH LEAP YEAR 1980.
*PROG JULBIN                                                            98
```

```
C++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

      SUBROUTINE JULBIN(IBUFF,IBIN,NCHAR,ISTAT)
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      DIMENSION IMONTH(12),ITEXT(2),ITABLE(12),IBIN(2),IDELIM(3)
C
      DATA IMONTH/'JAN ','FEB ','MAR ','APR ',
     *            'MAY ','JUN ','JUL ','AUG ',
     *            'SEP ','OCT ','NOV ','DEC '/
C
      DATA ITABLE/0,31,59,90,120,151,181,212,243,273,304,334/
C
      DATA IDEC/'.    '/,ICOLON/':    '/
      DATA IDELIM /'/           '/
C
C     FINDING OUT IN WHAT FORM THE BUFFER IS IN
C
      CALL FSCAN('SCINIT',NCHAR,IBUFF)
      CALL FSCAN('DLIM',1,IDELIM,IREGA)
      CALL FSCAN('GTDISP',IDISP)
      CALL FSCAN('TEXT',ITEXT,LENGTH)
C
C     IF THE FORM IS IN JULIAN( YR,DAY) GO TO 70
C
      IF(LENGTH .EQ. 6) GO TO 70

C     FORM MUST NOW BE IN DAY MONTH YR
C                         02  DEC   75
C                         02/12/75
      CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('NUMBER',IDAY,NNUM,LENGTH)
      IF(IDAY .GE. 32 .OR. IDAY .LE. 0) GO TO 990
C
C     IF THE FORM IS IN DD/MM/YY (02/12/75)
C
      CALL FSCAN('GTDISP',IDISP)
      CALL FSCAN('NUMBER',IMON,NNUM,LENGTH)
      IF(IMON .LT. 0) GO TO 2
      IF(IMON .EQ. 0 .OR. IMON .GT. 12) GO TO 991
      ITEXT(1) = IMONTH (IMON)
      GO TO 3
C
C     IF THE FORM IS DD MMM YY (02 DEC 75)
C
2     CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('TEXT',ITEXT,LENGTH)
      IF(LENGTH .NE. 3) GO TO 991
3     CALL FSCAN('NUMBER',IYR,NNUM,LENGTH)
      IF(IYR .GT. 99 .OR. IYR .LT. 0 ) GO TO 992
```

```
C
      DETERMINING IF YEAR IS LEAP YEAR
C
      DO 5 J=1,24
      ILEAP = 4*J
      IF( IYR .EQ. ILEAP) GO TO 30
5     CONTINUE
C
C     NON-LEAP YEAR CALCULATIONS
C
      DO 10 I = 1,12
      IF(ITEXT(1) .EQ. IMONTH(I)) GO TO 20
10    CONTINUE
      GO TO 991
20    NDAYS = ITABLE(I) + IDAY
      IYR   = IYR *(2**16)
      IBIN(1) = IYR + NDAYS
      GO TO 80
C
C     LEAP YEAR CALCULATIONS
C
30    DO 40 I = 1,12
      IF(ITEXT(1) .EQ. IMONTH(I)) GO TO 50
40    CONTINUE
      GO TO 991
50    IF(I .GT. 2) IDAY = IDAY + 1
      NDAYS = ITABLE(I) + IDAY
      IYR   = IYR *(2**16)
      IBIN(1)= IYR + NDAYS
      GO TO 80
C
C     IF THE DATE IS IN JULIAN FORMAT(YR,DAY)
C
70    CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('STCHAR',IDEC)
      CALL FSCAN('NUMBER',IYR,NNUM,LENGTH)
      IF(IYR .GT. 99  .OR. IYR .LT. 0) GO TO 992
      CALL FSCAN('NUMBER',IDAY,NNUM,LENGTH)
      IF(IDAY .GT. 366 .OR. IDAY .LT. 0) GO TO 990
      IBIN(1) = IYR * (2**16) + IDAY
C
C     PICKING UP THE TIME (HR:MIM:SEC)
C
80    CALL FSCAN('STCHAR',ICOLON)
      CALL FSCAN('NUMBER',IHR,NNUM,LENGTH)
      IF(IHR.LT. 0 .OR. IHR.GT. 24) GO TO 993
      CALL FSCAN('NUMBER',MIN,NNUM,LENGTH)
      IF(MIN .LT. 0 .OR. MIN .GT. 60) GO TO 994
      CALL FSCAN('NUMBER',ISEC,NNUM,LENGTH)
      IF(ISEC .LT. 0 .OR. ISEC .GT. 60) GO TO 995
```

```
      IBIN(2) = 36000 * IHR+ 600 * MIN + 10 *ISEC
      ISTAT = 0
      RETURN
C
C     DEFAULT OF NOON FOR THE TIME
C
90    IBIN(2) = 36000*12
      ISTAT = 0
      RETURN
C
C     ERRORS IN BUFFER PASSED
C
C     INVALID DAY    = -1
C     INVALID MONTH  = -2
C     INVALID YEAR   = -3
C     INVALID HR     = -4
C     INVALID MIN    = -5
C     INVALID SEC    = -6
C
990   ISTAT = -1
      RETURN
991   ISTAT = -2
      RETURN
992   ISTAT = -3
      RETURN
993   IF(IHR .EQ. -2) GO TO 90
      ISTAT = -4
      RETURN
994   ISTAT = -5
      RETURN
995   ISTAT = -6
      RETURN
      END
```

USER'S GUIDE PROCEDURES

1. PURPOSE

Give a general description of the program stating its purpose and function.

2. INPUT

Describe the input including format, content, input media, and sequencing.

3. OUTPUT

Describe the output including format, content, and output media.

4. OPERATING PROCEDURES

List the step by step procedures required to:

1. Initiate the program.
2. Maintain operation.
3. Terminate and restart the program.

Give an operational example.

5. RESTRICTIONS

Describe any limitations such as size of input, computer processor used, system space required, etc.

6. APPLICABLE ERROR MESSAGES

List any error message which may be displayed due to improper input, file generation error, etc.

4-PI ASSEMBLER USERS' GUIDE

1. PURPOSE

The major objective of the 4-PI Assembler rewrite project is to allow complete processing of 4-PI programs at SMALC. At this time, a syntaxing version of the assembler exists for use. This version accepts an ordinary 4-PI Assembler input file and creates from it a syntaxed and cross-referenced listing of the input. For complete documentation on the use of the assembler, refer to the IBM CP-2 and 4-PI manuals.

2. INPUT

This assembler accepts the same input as the Ogden assembler with the following exceptions:

1. The JCL cards are not needed and are ignored if found in the input file.

2. The Update Processor INCLUDE card must contain an Interdata filename. Defaults are set to the user volume and no extension. The included files must be present on the Interdata system and all member name cards must be deleted from the data sets.

OUTPUT

The output consists of the assembly listing including error messages, warning messages, error summary, input file description, cross reference dictionary, external symbol dictionary, special remarks cards, and table of contents.

4. OPERATING PROCEDURES

4.1 Initial Preparation Procedures

Before using the assembler for the first time, it is necessary to prepare the input files. It is assumed that the main input module is already located on an Interdata disc pack. However, since most of the EXBLKS reside as data sets in libraries at Ogden, the user must retrieve these data sets for use on the Interdata. A separate file is needed for each EXBLK, and the member name cards must be deleted. These files may be given any Interdata filename. If minimal text editing of files is desired, the above files should be named using the user volume, the name from the INCLUDE card, and no extension. If these defaults are not used, the user must modify any INCLUDE card in the source file to indicate the new filename.

4.2 OPERATION

The 4-PI Assembler is a non-interactive task. It is called by the following statement:

```
ASMPI filename1        , filename2
                         *
                         @
```

where
  filename1 is the user's input file
  filename2 is the user's output file

Options for the output file are:

1. filename = output goes to the specified file
2. *   = output is displayed on the CRT screen
3. @   = output goes to a null device
4. blank   = output goes to the user's default list file

End of task status is displayed on the CRT screen as follows:

```
END OF TASK 0   Assembled with no errors
END OF TASK 2   Assembled with warnings only
END OF TASK 3   Assembled with errors
```

Example: The following is a short example of a 4-PI program and an INCLUDE module with comments:

```
                SOURCE
//R1816GNSJOB   ('A354,',10,MMEC), 'DFP', CLASS:E
//SY11SCR.SYSIN DD *
//CPASMS.INCARD DD *
           ASSEM A.NSSG
```

The above cards, all JCL and the ASSEM card are treated as comments and are ignored.

```
         ENTRY DVY
         EXTRN VSHIFT
GAMBOL   EXBLK
         INCLUDE GAMBOL
```

Module GAMBOL must have been brought back from Ogden, separated into its own file, and placed on the user's default disc. The filename must have blanks in the extension.

```
              .
              .
FCDR          BSSH 1
              .
              .
              .
IOB16         EXBLK
*             INCLUDE FR01:IOB16.SRC/G
```

Module IOB16 has been fully described as residing on disc FB01 with extension .SRC/G.

```
                    .
                    .
                    .
                    USING NLOCAL2,1
                    .
                    .
                    .
                    END
```

Include Module: All member name cards must be deleted when creating the include file.

```
MEMBER NAME GAMBOL
GAMBOL      EXBLK DATE 69,192 B SYSTEM
LASTXR2     BSSH  1
```

Approximate compile time for large modules (ex: B16NSGNC) is 15 minutes.

5. RESTRICTIONS

1. The maximum number of labels allowed is 2000.

2. The maximum number of MACRO's allowed is 50.

3. The maximum number of included files is 9.

6. ERROR MESSAGES

Two types of errors are indicated by the assembler. The first displays bad file I/O to the CRT screen, giving the file involved and the I/O status. This type includes errors such as assignment errors for the input or output file. The second type of error is for syntax errors and warnings. These are merged into the output listing and appear, beginning in column 2, as follows:

```
*   WARNING --- 4    COLUMN 9 NOT BLANK
**  ERROR   --- 3    MULTIPLY DEFINED LABEL
```

Warnings and Errors:

Warnings:

1. SHORT INSTR DOESN'T FOLLOW A SKIP, COMPARE OR MODIFY STORAGE
2. LONG INSTRUCTION GENERATED IN EXBLK
3. SHORT INSTRUCTION GENERATED
4. COLUMN 9 NOT BLANK
5. SHIFT VALUE TO LARGE -- HAS BEEN SET TO MAXIMUM
6. ENTRY OR EXTRN DEFINED BUT NOT USED

Errors:

1. ILLEGAL OPCODE
2. ILLEGAL LABEL IN LOCATION FIELD
3. MULTIPLY DEFINED LABEL
4. LABEL TABLE LIMIT EXCEEDED
5. ILLEGAL CHARACTER IN COLUMN 15
6. ILLEGAL LABEL IN VARIABLE FIELD
7. UNDEFINED LABEL USED
8. MULTIPLY DEFINED LABEL USED
9. UNDEFINED SET OR EQU LABEL
10. ILLEGAL NUMERIC SPECIFICATION
11. INVALID SHIFT VALUE
12. INVALID INDEX REGISTER
13. INVALID HEX MASK
14. ILLEGAL VARIABLE FIELD FORMAT
15. ILLEGAL MACRO NAME SPECIFIED
16. MACRO NESTING EXCEEDS 10 LEVELS
17. MORE THAN 10 PARAMETERS USED
18. INVALID MACRO ARGUMENT
19. MACRO TABLE LIMIT EXCEEDED
20. MACRO, INBLK, EXBLK MUST APPEAR BEFORE EXECUTABLE CODE
21. INVALID IFF OR IFT INSTRUCTION
22. INVALID GO TO OPERAND
23. INBLK OR EXBLK DEFINITION EXCEEDED MAXIMUM SIZE
24. DEC OR BCI DATA TRUNCATED
25. ILLEGAL COMBINATION OF INBLK, EXBLK

FEASIBILITY STUDY PROCEDURES

1. PROBLEM

Describe the existing problem.

2. CURRENT IMPLEMENTATION

Describe what is currently available to handle the problem.

3. SOLUTIONS

List the available solutions. For each solution, include the following:

1) How the solution was reached.

2) What effects it will have on the general user.

3) What the new specifications will be.

4) The time cost in man hours and machine hours.

4. RECOMMENDATIONS

State which solution is most feasible.

TCOPY2 Feasibility Study

1. Problem

TCOPY2 under MTR03 will not process the header files on tapes created under MTR02.

2. Current Implementation

When accessing tapes created under MTR02, TCOPY2 must be implemented in no header mode. A user must user the ADV command to position the tape at the correct file.

3. Solutions

1) Modify TCOPY2 to ignore the account number field in the header files. The problem was discussed with the original programmer who suggested that the change could be easily implemented. The general user would be able to use the FIND command to locate a file on the tape and then proceed with a READ command. The time cost will be 30 man hours and 20 machine hours.

2) Use the current implementation. This requires the users to first use the INDEX command to display a list of all files on the tape; the count the number of files, including both header and data files, and use the ADV command to advance the proper number of files; then switch to NOHEADER mode and proceed with a READ command.

3) Recommendations

It is recommended that TCOPY2 be modified. This modification will make tape file acquisition less complicated for the general user.

PREDICTIVE SOFTWARE COST MODEL

PERSONNEL DESCRIPTION DATE: 28 Sept 1979

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

Below is the official position description for a GS-12 Electronic Engineer (Computer Systems). This description outlines the basic requirements of the work to be done, whether performed by Civil Service or contractor personnel.

I. INTRODUCTION

See functional statement filed in Official Position Description folder and the Sacramento ALC Organization Directory charts. Incumbent of this position serves as an Avionics System Engineer responsible for accomplishing software and systems engineering projects/tasks for avionics embedded computer systems, their resident Operational Flight Programs (OFPs) and their support systems for the F-111 and other Sacramento ALC prime aircraft systems.

II. DUTIES AND RESPONSIBILITIES

1. Develops, coordinates and carries through to completion blocks of work of large scope containing many phases of which two or more phases each contain several complex features. Plans and conducts research, development, or other work for which precedent data, criteria, methods or techniques are significantly inadequate, are controversial, or contain critical gaps. Develops or originates completely new features, in addition to improving, extending, or validating currently known precedents, data, methods or techniques. In accomplishing the above incumbent is responsible for the development of modifications and changes to complex aircraft digital avionics systems, their Operational Flight Programs (OFPs), and laboratory support systems (e.g., the Sacramento ALC F-111 Avionics Integration Support Facility (AISF)). In addition, incumbent is responsible for the investigation, analysis, evaluation and reporting on avionics system performance, problems and new requirements.

2. Develops and carries through to completion complex changes to the OFPs. Uses the F-111 AISF to analyze and evaluate OFP requirements in order to develop optimum implementation. Investigates potential solutions to system problems/change requirements considering tradeoff analyses involving implementation costs, algorithm developments, timing requirements, memory size, hardware/software integration requirements, support equipment, personnel capabilities and limitations, data package development and overall magnitude of the effort; and translates these change requirements into engineering specifications and tasks. Designs the change mechanization and integration; develops the programming code; and debugs, tests and documents the results. At all times assures aircraft system integrity and compatibility; and meets resource allocations, performance criteria, cost and schedule.

3. Establishes formal test requirements for OFPs; develops and implements test plans; conducts detailed tests using the full capabilities of the F-111 AISF and instrumented flight test aircraft; and analyzes, evaluates and reports test results.

4. Serves as project engineer for the design and development of changes and modifications to the AISF hardware/software resources and other avionics support systems. Provides system engineering support and assures compatibility with the aircraft avionics, digital computer complexes and OFPs. Establishes change requirements directly with the AISF and avionics support systems users. Prepares change specifications and plans and schedules the complete development and implementation.

5. Conducts studies and evaluations of systems in acquisition and determines support requirements. Performs 2612 studies, prepares Computer Resources Integrated Support Plans (CRISPs) and participates as a member of Computer Resources Working Groups (CRWGs).

6. Prepares contractual engineering proposals and associated specifications and work orders.

7. Monitors and maintains close liaison between contractor and Air Force activities associated with the engineering support of digital avionics, embedded computer systems and OFPs for Sacramento ALC prime aircraft systems.

8. Reviews, evaluates and advises on the effectiveness, technical adequacy and suitability of work and proposals of others related to digital avionics and OFP support. Evalutes more complex vendor proposed modifications for requirements, feasibility, completeness, accuracy, cost, and operational and logistics impact.

9. Consults, coordinates and attends conferences with other service activities and higher headquarters on matters pertaining to avionics OFP development and support. Makes recommendations to higher authority for changes to policies and practices, based on knowledge, experience, engineering studies, observations, and reports received from service activites, and defends Sacramento ALC's findings and recommendations. Travels to contractor or other government facilities to review engineering data and render opinions and decisions which are normally unreviewed; maintains liaison with other government activities and contractors in order to exchange engineering data and to maintain a current knowledge of the state-of-the-art.

10. Independently determines logical approach to solutions of major associated avionics OFP development and support problems. Carefully weighs the advantages of increased systems reliability, maintainability, etc., against time, cost, compatibility, and safety of flight. Makes and evaluates proposed changes to the system software on the basis of established hardware/software interfaces. Establishes supporting projects with other engineering personnel and directs the integration of auxiliary projects toward the ultimate objective. Scope of project effort is broad in that all projects consider, as applicable, the mission of the aircraft; functions of associated avionics systems (weapon delivery, navigation, reconnaissance, radar, instrumentation, etc.); communication/interface requirements; flight test; computer program documentation and configuration control; and validation/verification of the software. Applied research, special investigations, statistical analysis, etc., are a normal part of the incumbent's effort in accomplishing his duties and responsibilities.

III. CONTROLS OVER WORK

Incumbent is under the supervision of the Section Chief and receives technical direction from the functional group engineers and other senior engineers who give assignments in terms of broad, general objectives and relative priority of work. Extent and limits of assignments are mutually discussed. Incumbent works with considerable freedom from technical control in selecting and establishing the proper methods for attacking and resolving complex features and otherwise carrying assignments through to completion. Controversial policy questions are resolved by joint consideration with the supervisor and functional group engineer. Completed work is reviewed for adequacy in terms of broad objectives of the work and for compliance with Air Force policies and regulations. Decisions and recommendations based upon application of standard engineering practices are rarely changed by higher authority, except for reasons of policy, public relations, or budgetary consideration.

CONTINUATION SHEET **DATE:** 28 Sept 1979

IV. OTHER SIGNIFICANT FACTS

1. Fields of Engineering: Electronic - 55%, Computer Science - 30%
Aerospace - 15%

2. In addition to an extensive academic and professional knowledge of scientific and engineering principles, it will be necessary for the incumbent to possess a special faculty to do successful applied research and establish authoritative criteria based on sound engineering principles used within this section by joint consideration with other engineers. At most times, the incumbent will be responsible for several projects requiring difficult and advanced engineering work of a high degree of originality, therefore incumbent must have a thorough and detailed knowledge of avionics digital systems, (e.g., inertial navigation systems, fire control radars, stores management systems; digital controls and displays, etc.); aircraft embedded computer systems; real-time operational flight software; laboratory support systems to include real-time simulation systems, host computer systems and avionics system hot mock-ups; software configuration management; software documentation; OFP testing, evaluation, verification and validation; and aircraft performance and operation, specifically in the areas of navigation and weapon delivery. Must be experienced and knowledgeable in real-time programming, mathematical modeling, computer architecture and programming languages.

3. Incumbent must possess a high degree of professional judgment, skill, initiative, planning and leadership ability. Also must possess ability to maintain effective personal work relationships at all levels and to justify and sell his own professional viewpoints in conferences, engineering reviews and with fairly large groups wherein conflicting points of view are represented. Requires an intimate knowledge of functions, organizational structure, jurisdictional responsibilities, etc., of USAF and elements thereof.

4. The incumbent of this position must be capable and willing to perform TDY travel in accordance with the Joint Travel Regulation.

5. Supports and takes affirmative actions in furtherance of Equal Employment Opportunity in all aspects of personnel actions, with special emphasis on Upward Mobility and other special programs.

6. Position requires a security clearance of Secret.

7. Performs other related duties as required.

8. Subject to call during off-duty hours.

9. All personnel will share in the responsibility for a sound industrial safety program. Incumbent is required to comply with all applicable safety directives. Unsafe conditions are to be promptly reported to the immediate supervisor.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES DATE: 28 Sept 1979

BUILDINGS:

10,800 $ft.^2$ of standard computer-type facilities.

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 28 Sept 1979

COMPUTER FACILITIES (Type, Quantity, Application, Cost & Usage)

The basic equipment in the F/FB-111 Avionics Integration Support Facility is as follows:

Equipment	Cost ($ million)
Dynamic Simulation System (Harris) System and Software Engineering	12.0
Flight Test Data Reduction (PDP)	1.5
Off-line Computer Support (Interdata)	2.0
Integration Test Equipment @ 1.7x3 Original cost - $800K each	5.1 (replacement cost)
Subsystem Testers (11)	3.5 (replacement cost)
Avionics (loaned out of spare assets)	12.9
F-111F/Pavetack Dynamic Simulation	2.6
	39.6
To be added:	
F-111A/E Hardware	1.6
	41.2

Vendor support on the Harris, Interdata and PDP computers costs $308K/year plus $126K/year for expendables and prototype hardware (split 50/50).

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

INTERDATA 8/32 System
(Data Reduction and MIS)

2 Processors 1 megabyte each
8 40 mb disc drives (4 switchable, 4 fixed)
1 300 mb disc drives
12 4 kb Floppy Drives
1 Line Printer
4 Mag Tape Drives
1 Paper Tape Reader
1 Paper Tape Punch
12 CRTs
1 IBM Selectric Typewriter
1 HP Auxiliary Printer
1 Tektronix Plotter
3 ITE (Integration Test Equipment) Static Simulator

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

Harris/4 System
(Dynamic Simulator)

2 test stations

2 ADAGE (large display screen on test station)

6 processors - 80K each

2 SAS (Simulation and Switching) Interface between Harris & test station

6 CMACs (Computer Monitor and Control) Interface between 4pi computer and Harris

1 card reader

1 card punch

2 paper tape readers

8 mag tape drives

1 CDC line printer

2 Versatic printer/plotters

11 CRT

2 teletypes

6 10 mb disc drives

1 40 mb disc drives

2 300 mb disc drives

1 paper tape punch

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

PDP 11/40 System
(Flight Test Data Preprocessing)

16K words memory
1 Dec Writer
1 Card Reader
1 1.2 Mbyte Disc
1 9-track tape drive
1 Paper tape punch/reader
3 8-channel brush recorders
1 CRT display
1 Versatec printer/plotter

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

TYPICAL UTILIZATION OF HARRIS COMPUTER WEEK OF 23-27 July 1979

Time:	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0000							
0100							
0200							
0300							
0400							
0500							
0600							
0700							
0800	Harris (Maint)		Harris		Harris		
0900		IV & V		IV & V			
1000			GD		IV & V		
1100	IV & V						
1200							
1300		F	IV & V	F			
1400	GD (Modif & Upgrade)						
1500					F		
1600							
1700	MMECS (Backup, Archive, etc.)	GD	F	GD			
1800							
1900							
2000							
2100							
2200							
2300							
2400							

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE DATE: 28 Sept 1979

COMPUTER	SOFTWARE FUNCTION	ESTIMATE SOURCE LINES
INTERDATA 8/32	SYSTEM	166,957
	UTILITY	42,841
	SPECIAL UTILITY	
	AGERD	3,299
	4-PI	6,764
	MDS	2,525
	FLCL	696
	PLOTTER	4,754
	OFP UTILITY	13,286
	DATA REDUCTION	46,002
		287,124
HARRIS	SYSTEM	292,953
	UTILITY	34,494
	RJE	7,410
	PLOTTER	7,580
	OFP	4,000
	ADAGE	6,714
	SAS	2,888
	SIMULATOR	17,706
	CMAC	13,674
		387,419
PDP 11/40	UTILITY	5,177
	DATA	22,619
		27,796

Pages B-53 through B-71 provide a detailed listing of the support software.

CONTINUATION SHEET DATE: 28 Sept 1979

SOFTWARE IDENTIFICATION

CURRENT AS OF: 25JAN79

KEY:
- H = HARRIS
- I = INTERDATA
- GD = GENERAL DYNAMICS
- IH = IN HOUSE
- TI = TEXAS INSTRUMENTS
- DEC = DIGITAL EQUIPMENT CORPORATION
- N/C = NO SOURCE AVAILABLE
- TEK = TEKTRONIX
- VER = VERSATEC
- MAIT RES = MAINTENANCE RESPONSIBILITY
- GEN/RES = GENERAL RESEARCH

INTERDATA 8/32

UTILITY SOFTWARE

CI NAME	SUPPLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ACCOUNT	IH	IH	299.	INTERDATA USAGE REPORT GENERATION
AMAP	IH	IH	85.	ALPHABETICALLY LISTS FILES FROM DISC PACK
CAPS	IH	IH	634.	CONVERTS CAPITAL TO SMALL LETTERS AND VISA-VERSA
CARDIN	IH	IH	162.	HANDLER FOR THE CARD READER
COPYFILE	IH	IH	765.	COPIES FILES
COPYTAPE	IH	IH	206.	DUPLICATES PUNCHED TAPES
DOCPRO	IH	IH	507.	PULLS DOCUMENTATION FROM SOURCE FILES
ENTRY	IH	IH	193.	COPIES DATA FROM HEWLETT-PACKARD TERMINAL CASSETTE INTO A FILE
INDEX	IH	IH	152.	LISTS ALL OCCURRENCES OF A CHARACTER STRING IN A FILE
LIBINV	IH	IH	462.	DOCUMENT INVENTORY REPORT GENERATOR
LINK	IH	IH	513.	LINK BETWEEN THE INTERDATA AND HARRIS COMPUTER
LIST	IH	IH	220.	LISTS A FILE TO THE USER TERMINAL
MANHOURS	IH	IH	2414.	PERSONNMEL UTILIZATION REPORT GENERATOR
MICROFSH	IH	IH	2119.	REFORMATS FILES TO THE MICROFICHE PROCESSING FORMAT
MTCOPY	IH	IH	229.	DUPLICATES AND VERIFIES MAGNETIC TAPES
PAR7	IH	IH	626.	COPIES AR7 FORMAT DATA TO PUNCH TAPE
PRINT	IH	IH	185.	COPIES A FILE TO A HEWLETT-PACKARD AUXILIARY PRINTER
PUNCHR	IH	IH	1054.	DIRECT BIT COPY TO PUNCH TAPE
READFILE	IH	IH	546.	GENERATES A FORMATTED LIST FILE
RECOVER	IH	IH	376.	RECOVERS FILE FROM BACKUP TAPE
UMAP	IH	IH	152.	LIST FILES FROM DISC PACK BY USER NUMBER

CONTINUATION SHEET **DATE:** 28 Sept 1979

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TSUINV    . IH  . IH   .  1096. MAGNETIC TAPE INVENTORY REPORT GENERATION
REMOVE    . IH  . IH   .   212. SEPARATES COMMENTS FROM SOURCE CODE
RESTORE   . IH  . IH   .   255. REPLACES COMMENTS INTO SOURCE CODE
REQUESTS  . IH  . IH   .   735. TASK REQUEST AND SCHEDULED REPORT GENERATION
REWRITE   . IH  . IH   .   281. REWRITES AND REFORMATS DATA IN A FILE
SHIFT     . IH  . IH   .   173. SHIFTS DATA WITHIN A RECORD
SORT      . IH  . IH   .   230. SORTS A FILE IN ASCENDING ORDER
TAPEDIR   . IH  . IH   .   200. PRODUCES A DIRECTORY OF A BACKUP TAPE
TCOPY2    . IH  . IH   .  4403. COPIES FILES
TE        . IH  . IH   . 16257. PAGE-ORIENTED TEXT EDITOR
TERMINAL  . IH  . IH   .   261. SETS HEWLETT-PACKARD TERMINAL CHARACTERISTICS
TLIST     . IH  . IH   .   489. LIST A FILE TO THE USER TERMINAL
TYPE      . IH  . IH   .   299. COPIES A FILE TO AN IBM SELECTIC TYPEWRITER
WRITE     . IH  . IH   .   224. COPIES A FILE TO A HEWLETT-PACKARD TERMINAL
          .     .      .      .  CASSETTE

*************THE FOLLOWING CI'S ARE CONTAINED IN THE SYIUSER LIBRARY*************

ASSIG     . IH  . IH   .    87. INTERACTIVE TERMINAL DYNAMIC ASSIGNER
DATE      . IH  . IH   .    68. GIVES DAY AND TIME
FINDRA    . IH  . IH   .   330. SEARCHES A FILE FOR CHARACTER STRING
FSCAN     . IH  . IH   .  1456. SCANS A BUFFER FOR SPECIFIED DATA
LISTING   . IH  . IH   .   584. GENERATES A FORMATTED LISTING
RANDOM    . IH  . IH   .    15. RANDOM NUMBER GENERATOR
VIRMEM    . IH  . IH   .  1158. SIMULATES LARGE BUFFERS THROUGH PAGING

*****THE FOLLOWING CI'S ARE CONTAINED IN THE FORTRAN RUN-TIME LIBRARY************

AREANM    . IH  . IH   .   191. SCANS FOR DISC FILE NAME
.ENDFXD   . IH  . IH   .    91. EXIT ROUTINE FOR SUBPROGRAM USING .ENTFXD
.ENDVAR   . IH  . IH   .    72. EXIT ROUTINE FOR SUBPROGRAM USING .ENTVAR
.ENTFXD   . IH  . IH   .   233. ENTRY ROUTINE FOR A FIXED PARAMETER SUBPROGRAM
.ENTVAR   . IH  . IH   .   140. ENTRY ROUTINE FOR AVAILABLE PARAMETER SUBPROGRAM
.FSCAN    . IH  . IH   .    95. SCANS A BUFFER FOR SPECIFIED DATA (RE-ENTRANT)
FILEMG    . IH  . IH   .  1283. PROVIDES INTERFACE WITH SYSTEM SERVICE CALL
          .     .      .      .  7 (SVC 7)
FINDTX    . IH  . IH   .   110. SCANS A BUFFER FOR A SPECIFIED CHARACTER STRING
MVCHR     . IH  . IH   .    85. TRANSFERS CHARACTERS FROM ONE BUFFER TO ANOTHER
          .     .      .      .
 TOTAL    .     .      . 42841.

                              INTERDATA 8/32

                          SPECIAL UTILITY SOFTWARE

AGERD:
------
                           EST
          SUP-     MAIT   SOURCE
CI NAME   PLIER    RES    LINES                 DESCRIPTION
--------------------------------------------------------------------------------

ASSEMBLY  . IH    . IH   .  3299. AGERD ASSEMBLER
          .       .      .      .
 TOTAL    .       .      .  3299.
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CONTINUATION SHEET — DATE: 28 Sept 1979

4-PI

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ASMPI	IH	IH	6115.	4-PI ASSEMBLER
BFORM	IH	IH	165.	CONVERTS A FILE FOR TRANSMISSION TO 4-PI
CFORM	IH	IH	191.	CONVERTS A FILE AFTER TRANSMISSION FROM 4-PI
ILINK	IH	IH	293.	LINK FROM INTERDATA TO 4-PI
TOTAL			6764.	

MDS (MICROPROCESSOR DATA SYSTEMS):

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
PLM80	IH	IH	2088.	INTEL 8080 CROSS-ASSEMBLER
MLINK	IH	IH	436.	LINK FROM INTERDATA TO MDS
TOTAL			2525.	

FLCL (FLIGHT LINE COMPUTER LOADER):

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
FFORM	IH	IH	270.	CONVERTS FILES FOR TRANSMISSION TO FLCL
FLINK	IH	IH	426.	LINK BETWEEN INTERDATA AND FLCL
TOTAL			696.	

PLOTTER (TEKTRONIX)

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
PLOT 10 LIB	TEK	TEK, IH	3795.	ROUTINES USED TO CONTROL THE PLOTTER
PLOTTER	IH	IH	959.	GENERAL USER PLOT GENERATION
TOTAL			4754.	

CONTINUATION SHEET DATE: 28 Sept 1979

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                           INTERDATA 8/32

                           SYSTEM SOFTWARE


                         EST
          SUP-   MAINT   SOURCE
CI NAME   PLIER  RES     LINES
------------------------------------------------------------------------------

         .      .       .      .
BACKUP   . INT  .INT/IH.  4751. COPIES DISC PACK CONTENTS TO AND FROM MAG TAPE
OSEDIT   . INT  .INT/IH.  2938. SYSTEM TEXT EDITOR
BOOTPNCH . INT  .INT/IH.   482. GENERATES A PUNCH TAPE WITH BOOTSTRAP LOADER
CAL      . INT  .INT/IH.  9667. ASSEMBLY LANGUAGE ASSEMBLER
CALMACRO . INT  .INT/IH.  3870. ASSEMBLY LANGUAGE MACRO PROCESSOR
CUP16    . INT  .INT/IH.    26. OBJECT-LEVEL SYSTEM GENERATOR FOR THE 16-BIT
         .      .       .      .  PROCESSOR
CUPMT    . INT  .INT/IH.  4611. OBJECT-LEVEL SYSTEM GENERATOR FOR THE 32-BIT
         .      .       .      .  PROCESSOR
DISCDUMP . INT  .INT,IH.  2621. DUMPS THE CONTENTS OF A DISC PACK IN HEX
DISCHECK . INT  .INT,IH.  3076. CHECKS DISC PACK INTEGRITY
DISCINT  . INT  .INT,IH.  1967. INITIALIZES DISC PACKS
DISKMOD  . INT  .INT,IH.   176. MODIFIES DISC PACK CONTENTS
DUMPRINT . INT  .INT,IN.  2035. PANIC DUMP (FOR AFTER SYSTEM CRASHES)
EDIT32   . INT  .INT/IN.   525. SYSTEM TEXT EDITOR
FORTRAN  . INT  .INT    .  N/S . FORTRAN LANGUAGE COMPILER
HASP     . INT  .INT/IH.  6196. ALLOWS REMOTE JOB ENTRY
IFTRAN   . GEN/.GR/IH  .  1918. INTERPRETER OF STRUCTURED PROGRAMMING OF
         . RES .               .  FORTRAN
INITSPLG . INT  .INT/IH.   168. INITIATES THE SPOOL QUEUE
LIBLDR   . INT  .INT/IH.  2474. BUILDS AND EDITS LIBRARIES
MTM      . INT  .INT/IH.  8263. MULTI-TERMINAL MONITOR
OSCOPY   . INT  .INT/IN.  1907. SYSTEM COPY ROUTINE
PURGE    . IH   .IH     .   167. ELIMINATES OLD FILES FROM A DISC PACK
SPOOLER  . IH   .IH     .  1653. ALLOWS USER CONTROLLED INPUT TO THE SPOOL QUEUE
SRCUPDT  . INT  .INT/IH.  2281. CREATES AND MAINTAINS SOURCE FILES
TET32    . INT  .INT/IH.  5638. OS32 TASK ESTABLISHER
TUT      . INT  .INT/IN.   961. TASK FILE PATCH ROUTINE
WCS      . INT  .INT    .  3433. WRITABLE CONTROL STORE SUPPORT SOFTWARE
OSAIDS   . INT  .INT    .  6047. ASSEMBLY LEVEL DEBUGGING TOOL

*****THE FOLLOWING ARE SYSTEM LIBRARIES, AND CONTAIN TOO MANY SYSTEM ROUNTINES
  TO ANME AND DESCRIBE SEPARATELY******

DRIVER   . INT  .INT/IH. 27063. PROVIDES ALL SYSTEM DRIVER ROUTINES
SYS      . INT  .INT/IH. 34137. PROVIDES ALL SYSTEM MODULE ROUTINES


*****THE TWO PRECEDING LIBRARIES CREATE THE OPERATING SYSTEM

FORTRAN  . INT  .INT/IH. 23179. PROVIDES SUPPORT FOR THE FORTRAN VI LANGUAGE
RUN-TIME .      .       .      .  WITH MATHEMATICAL FUNCTIONS, I/O FACILITIES,
         .      .       .      .  AND REAL TIME INTERFACES.
         .      .       .      .
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PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET

DATE: 28 Sept 1979

TOTAL	.	.	.166957.	

INTERDATA

OFP (OPERATIONAL FLIGHT PROGRAM)

UTILITY SOFTWARE

CI NAME	SUP- PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ADDNDM	IH	IH	2375.	CREATES AND ADDENDUM TAPE
CHKWAS	IH	IH	790.	UPDATES "WAS" VALUE IN KEY-INS FILE
ELMOFP	IH	IH	224.	ELIMINATES UNUSED OFP DOCUMENTATION FILES
GENOFP	IH	IH	440.	GENERATES OFP DOCUMENTATION FILES
INTOFP	IH	IH	115.	INITIALIZES OFP DOCUMENTATION FILES
KFILE	IH	IH	95.	ENTER HEX ADDRESS IN ".K" OFP DOCUMENTATION FILE
LSTOFP	IH	IH	1211.	LISTS ALL OFP DOCUMENTATION FILES ASSOCIATES WITH A CHANGE CYCLE
OFPDATA	IH	IH	2732.	READS AND PUNCHES OFP PUNCH TAPES
REFILE	IH	IH	64.	LIST ERRORS AND WARNINGS FROM OFP ABSOLUTE LISTING FILE
***********THE FOLLOWING OFP CI'S ARE CONTAINED IN THE OFP LIBRARY**************				
AR7BIN	IH	IH	387.	CONVERTS AN AR7 FORMAT FILE FOR THE 4-PI TO BINARY IN CMAC FORMAT
AR7NCU	IH	IH	384.	CONVERTS AN AR7 FORMAT FILE FOR THE NCU TO TO BINARY IN CMAC FORMAT
BINHEX	IH	IH	207.	CONVERTS LOW 19 BITS FROM BINARY TO HEX
BINOCT	IH	IH	212.	CONVERTS LOW 12 BITS FROM BINARY TO OCTAL
BINNCU	IH	IH	308.	PRODUCES NCU PUNCH TAPE
BINPPT	IH	IH	295.	PRODUCES CMAC PUNCH TAPE FOR THE 4-PI
HEXBIN	IH	IH	230.	CONVERTTS TWO HEX WORDS TO ONE BINARY WORD
HEXPPT	IH	IH	318.	PUNCHES 4 FRAMES OF TAPE IN 4-PI FORMAT
JULBIN	IH	IH	231.	RETURNS DATE AND TIME IN BINARY
JULIAN	IH	IH	240.	RETURNS DATE AND TIME IN ASCII
OCTBIN	IH	IH	207.	CONVERTS TWO OCTAL WORDS TO BINARY
PPTTIT	IH	IH	347.	PUNCHES MAN-READABLE PUNCH TAPE LEADER AND TRAILER
PPTBIN	IH	IH	308.	READS A 4-PI PUNCH TAPE
PPTNCU	IH	IH	303.	READS A NCU PUNCH TAPE
SORT	IH	IH	1263.	UNIVERSAL SORT ROUTINE
TOTAL	.	.	13286.	

INTERDATA

DATA REDUCTION

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
AC1LBL	IH	IH	238.	CREATES IBM STANDARD TAPE LABELS
AC1LIST	IH	IH	421.	LISTS AC1 FORMAT DATA SETS
AC1READ	IH	IH	155.	READS AC1 FORMAT OR IBM V FORMAT MAGNETIC TAPE
CLFORM	IH	IH	1919.	REFORMATS TSPI OR ALAST PAVE FLIGHT TEST DATA TAPE
ENGLST	IH	IH	5808.	LISTS THE REFERENCE DATA FILE
GENFILE	IH	IH	1030.	CREATES CARD IMAGE INPUT FOR SMFILE
LABEL	IH	IH	251.	CREATES IBM STANDARD TAPE LABELS
MERGE	IH	IH	2585.	MERGES FLIGHT TEST DATA AND GROUND-BASED INSTRUMENTED RANGE DATA
PDFDUMP	IH	IH	220.	LISTS PERMANENT DATA FILES
SMDUMP	IH	IH	2609.	LISTS PERMANENT DATA FILES
SMEDIT	IH	IH	3777.	FORMATS AND TAGS DATA FROM A TEMPORARY DATA FILE TO A PERMANENT DATA FILE
SMFILE	IH	IH	12141.	BUILDS A REFERENCE DATA FILE
SMFORM	IH	IH	1354.	CREATES AN AC1 DATA BASE FROM A PERMANENT DATA FILE
SMLIST	IH	IH	9982.	PROVIDES PRINTED REPORTS OF FLIGHT TEST DATA
SMMERG	IH	IH	1527.	MERGES TWO PERMANENT DATA FILES
**********THE FOLLOWING D.R. CI'S ARE CONTAINED IN THE GDUSER LIBRARY***********				
ADPVCS	IH	IH	37.	COMBINES DOUBLE PRECISION PARITY, VALIDITY, CONTROL, AND SPARE BITS
ASCHEX	IH	IH	54.	CONVERTS ASCII HEX
ABEND	IH	IH	188.	ABNORMAL ENDS DUMP
ASCINT	IH	IH	54.	CONVERTS FROM ASCII TO BINARY INTEGER
ATIME	IH	IH	21.	PROVIDES TIME OF DAY
BCDBIN	IH	IH	53.	CONVERTS BCD TO BINARY
BIT	IH	IH	31.	EXTRACTS BITS FROM A HALFWORD
BIT4	IH	IH	32.	EXTRACTS BITS FROM A FULL WORD
BTIME	IH	IH	21.	PROVIDES TIME OF DAY
BIT8	IH	IH	39.	EXTRACTS BITS FROM A DOUBLE WORD
CDATE	IH	IH	21.	PROVIDES CALENDAR DATA
CF6R5A	IH	IH	55.	READS FLIGHT TEST TAPE ID RECORDS
CF686W	IH	IH	12.	MOVES DATA BETWEEN BUFFERS
CF686X	IH	IH	15.	CONVERTS TIME WORDS FROM INTEGER TO FLOATING POINT
CF686Y	IH	IH	15.	CONVERTS TIME WORDS FROM FLOATING POINT TO INTEGER
CF6R6Z	IH	IH	109.	READS FLIGHT TEST DATA
DUMP	IH	IH	123.	REGISTER AND CORE DUMP
FTDA	IH	IH	119.	READS ONE FRAME OF FLIGH TEST DATA
FTID	IH	IH	62.	DEFINES CHANNEL CODES AND READS ID INFORMATION
FTINIT	IH	IH	54.	READS INPUT VALUES AND INITIALIZES ARRAYS
INTEBA	IH	IH	37.	CONVERTS INTEGER TO ASCII
INTEBR	IH	IH	37.	CONVERTS INTEGER TO ASCII
INTHXA	IH	IH	31.	CONVERTS INTEGER TO HEX
INTHXB	IH	IH	32.	CONVERTS INTEGER TO HEX
KOMPAR	IH	IH	44.	LOGICAL COMPARE BETWEEN TWO CHARACTER STRINGS
LSTMSG	IH	IH	25.	LISTS MESSAGE TO THE OPERATOR CONSOLE
MVCHR	IH	IH	33.	MOVE CHARACTER REPEAT ROUTINE

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

RDUMP	IH	IH	95	DUMPS REGISTER CONTENTS
READ	IH	IH	35	NON-BUFFERED UNFORMATTED BINARY READ
SBYTE	IH	IH	37	SWAPS BYTES IN PDP WORDS
STATUS	IH	IH	95	OBTAINS JOB STATUS INFORMATION
TBLSRT	IH	IH	116	BUBBLE SORT
TRANSL	IH	IH	72	CONVERTS FROM EBCDIC TO ASCII AND VISA-VERSA
WRITE	IH	IH	35	NON-BUFFERED UNFORMATTED BINARY WRITE
TOTAL			46,002	

HARRIS F/FB

SYSTEM SOFTWARE

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ACLDMP	H	IH/H	100	UNKNOWN
ACUTIL	H	IH/H	2240	ACCOUNTING UTILITY
ATAB	H	IH/H	280	REAL TIME PROGRAM TO ACCUMULATE NUMBER OF
	H	IH/H		SECTORS USED BY EACH USER
BASLIB	H	IH/H	4060	BASIC LIBRARY
CH40FF	H	IH/H	120	INITIATES PROGRAM V:C40F:V TO PUT PRINTER
				OFF LINE
CH40N	IN	IN	100	INITIATES PROGRAM V:C40N:V TO PUT PRINTER
				ON LINE
COBOL	H	H/IH	1160	COBOL COMPILER
DATAPOOL	H	H/IH	1400	PROCESSES DATA AREAS USED BY FORTRAN COMPILER
DISKCHECK	H	H/IH	80	VERIFIES INTERNAL LOGIC INTEGRITY OF THE DISC
FORTRAN	H	H/IH	17280	FORTRAN COMPILER
GENCLIB	H	H/IH	300	GENERATES COBOL LIBRARY
IFTRAN	GEN/	GR/IH	1918	IFTRAN COMPILER
	RES			
ISUTIL	H	H/IH	440	INDEXED SEQUENTIAL UTILITY PRIMARILY USED FOR
				COBOL
JOBCNTRL	H	H/IH	20350	INTERACTIVE USER INTERFACE TO VULCAN
LFEDITOR	H.	H/IH	1860	LIBRARY FILE EDITOR
MSUTIL	H	H/IH	141	SORT/MERGE UTILITY
D COBOL	H.	H/IH	480	ANCILLARY PROGRAM USED BY *COBOL
PRINTF	H	H/IH	380	PROVIDES OCTAL OR ASCII DUMP OF SELECTED
				RECORDS OF A FILE
RPATCH	H	H/IH	N/A	HARRIS SUPPLIED SYSTEM PATCH
SAMIAM	IH	IH	100	CHECKS A DISC FOR UNUSED AMND SHARED SECTORS
SAUTEST	IH	IH	10	EXERCISES SCIENTIFIC ARITHMETIC UNIT (SAU) AND
				ABORTS ON ERROR
TAPESORT	H	H/IH	N/A	SORTS RECORDS ON TAPES
TEST	IH	IH	16	EXERCISES MULTIPLLICATION FUNCTION OF SAU
TLABEL	H	H/IH	1620	TAPE LABEL PROGRAM
V:ACPY:V	H	H/IH	120	ACCOUNTING RECORD COPY PROGRAM
V:ACSM:V	H	H/IH	260	ANCILLARY ACCOUNTING UTILITY

CONTINUATION SHEET **DATE:** 28 Sept 1979

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/:ASCT:V   .  H    .H/IH   .   200. ACCOUNTING SECTOR READ/WRITE SERVICE
/:ATL:V    .  H    .H/IH   .   120. ANCILLARY ACCOUNTING UTILITY
/:BFH2:V   .  H    .H/IH   .   160. BLOCKED DISC AREA HANDLER/EXTENSION
/:BLAH:V   .  H    .H/IH   .  1200. BLOCKED DISC AREA HANDLER
/:C40F:V   .  H    .IH     .   120. DISCONNECTS LINE PRINTER AND CARD READER
/:C40N:V   .  H    .IH     .   100. CONNECTS LINE PRINTER AND CARD READER
/:CBAS:V   .  H    .H/IH   .   140. BINARY CODED DECIMAL TO ASCII CONVERSION
/:CEAS:V   .  H    .H/IH   .   260. EBCDIC TO ASCII CONVERSION
/:CPOH:V   .  H    .H/IH   .   800. CARD PUNCH HANDLER
/:CPQS:V   .  H    .H/IH   .   600. CONTROL POINT QUEUE SWITCHER PROGRAM
/:CRDH:V   .  H    .H/IH   .   800. CARD READER HANDLER
/:CRPH:V   .  H    .H/IH   .  1520. CARD PUNCH HANDLER
/:CRTH:V   .  H    .H/IH   .  1860. HARRIS CRT HANDLER
/:DUMP:V   .  H    .H/IH   .   240. POST MORTEM DUMP GENERATOR
/:DUMPER:V    H    .H/IH   .   900. REAL TIME PORTION OF DUMP PROGRAM
/:EK73:V   .  IH   .IH     .    80.
/:GENS:V   .  H    .H/IH   .  1800. SYSTEM GENERATION MONITOR PROGRAM
/:HEAD:V   .  H    .H/IH   .   340. LINE PRINTER HEADER PAGE GENERATOR
/:IDAC:V   .  H    .H/IH   .  2200. DIRECT MEMORY ACCESS CONTROL PROCESSOR SUPPORT
           .       .       .      .  MODULE
/:INEX:V   .  H    .H/IH   .    80. INTERRUPT EXECUTIVE SERVICE
/:ITSP:V   .  H    .H/IH   .   320. INTERACTIVE TERMINAL SPOOLER PROGRAM
/:LP0H:V   .  H    .H/IH   .   780. UNIVERSAL LINE PRINTER HANDLER
/:LP1H:V   .  H    .H/IH   .  1060. UNIVERSAL LINE PRINTER HANDLER
/:LP2H:V   .  HK   .H/IH   .   980. VERSATEC LINE PRINTER HANDLER
/:LP3H:V   .  H    .H/IH   .   840. ASYNCHRONOUS LINE PRINTER HANDLER
/:LPGD:V   .  IH   .IH     .   420. MODIFIED LINE PRINTER HANDLER FOR GD HEADER
           .       .       .      .  PAGE
/:MEMD:V   .  IH   .IH     .  1200. CHECKS OUT C PROCESSOR
/:MESG:V   .  H    .H/IH   .   680. MESSAGE (SEND RECEIVE) SERVICE
/:OLAY:V   .  H    .H/IH   .   980. OVERLAY SERVICE
/:OPC0:V   .  H    .H/IH   .   660. OPERATOR COMMUNICATIONS COMMAND INTERPRETER
/:OPC1:V   .  H    .H/IH   .   600. OPERATOR COMMUNICATION SEGMENTS - EACH
           .       .       .      .  PROCESSES ONE OR MORE OPCOM COMMANDS
/:OPC2:V   .  H    .H/IH   .   600.          "              "              "
/:OPC3:V   .  H    .H/IH   .   900.          "              "              "
/:OPC4:V   .  H    .H/IH   .   620.          "              "              "
/:OPC5:V   .  H    .H/IH   .   900.          "              "              "
/:OPC6:V   .  H    .H/IH   .   620.          "              "              "
/:OPC7:V   .  H    .H/IH   .   340.          "              "              "
/:OPC8:V   .  H    .H/IH   .   460.          "              "              "
/:OPC9:V   .  H    .H/IH   .   720.          "              "              "
/:OPCA:V   .  H    .H/IH   .   480.          "              "              "
/:OPCB:V   .  H    .H/IH   .   720.          "              "              "
/:OPCC:V   .  H    .H/IH   .   780.          "              "              "
/:OPCD:V   .  H    .H/IH   .   320.          "              "              "
/:OPCX:V   .  H    .H/IH   .   300.          "              "              "
/:OPCZ:V   .  H    .H/IH   .   140.          "              "              "
/:P-PH:V   .  IH   .IH     .  1459.HANDLER FOR HARRIS END OF INTERDATA-HARRIS LINK
/:PIGD:V   .  IH   .IH     .   200. NON-RESIDENT HANDLER THAT PUTS OUT GD HEADER
/:PTPH:V   .  H    .H/IH   .   700. PAPER TAPE PUNCH HANDLER
/:PTRH:V   .  H    .H/IH   .   380. PAPER TAPE READER HANDLER
/:REHH:V   .  H    .H/IH   .   460. DISC DIRECTORY REHASH SERVICE
/:RSC2:V   .  H    .H/IH   .   460. RESOURCE ALLOCATION SERVICE - PART 2
/:RSEX:V   .  H    .H/IH   .   520. RESOURCE DEALLOCATION SERVICE
/:RSRC:V   .  H    .H/IH   .  1120. RESOURCE ALLOCATION SERVICE
/:RTEX:V   .  H    .H/IH   .    80. REAL TIME EXECUTIVE PROGRAM (USED FOR
           .       .       .      .  TIMER SCHEDULING)
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:RTPH:V	H	H/IH	600.	REAL TIME PERIPHERAL HANDLER
:SCAN:V	H	H/IH	1220.	FORMAT SCANNER SERVICE]
:SERV:V	H	H/IH	1480.	BACKGROUND SERVICES
:SRV2:V	H	H/IH	340.	BACKGROUND SERVICES
:SY25:V	H	H/IH	640.	SYSTEM INITIALIZATION PHASES
:SYI1:V	H	H/IH	740.	SYSTEM INITIALIZATION PHASES
:SYI2:V	H	H/IH	920.	SYSTEM INITIALIZATION PHASES
:SYI3:V	H	H/IH	1000.	SYSTEM INITIALIZATION PHASES
:SYI4:V	H	H/IH	1140.	SYSTEM INITIALIZATION PHASES
:TEN2:V	H	H/IH	340.	PHASE 2 OF V:TENS:V
:TENS:V	H	H/IH	800.	5 SECOND SYSTEM CHECK PROGRAM
:TLH1:V	H	H/IH	1960.	TAPE LABELING SERVICE
:TLH2:V	H	H/IH	2380.	TAPE LABELING SERVICE
:TLSS:V	H	H/IH	780.	TAPE LABELING SERVICE
:TOAD:V	H	H/IH	1000.	REAL TIME SERVICES
:TRAP:V	H	H/IH	620.	VULCAN EXECUTIVE TRAP SERVICE ROUTINE
:TTYH:V	H	H/IH	1760.	TELETYPE HANDLER
:UPRG:V	H	H/IH	200.	USER NUMBER DISC AREA PURGE PROGRAM
:UPUS:V	H	H/IH	180.	UPDATE USER ACCOUNTING SERVICE
:USER:V	H	H/IH	380.	USER NUMBER LOOK UP SERVICE
:USPC:V	H	H/IH	200.	DISC SPACE DEALLOCATION SERVICE
ASSEM	H	H/IH	9480.	ASSEMBLY LANGUAGE PROCESSOR
BASIC	H	H/IH	4420.	BASIC PROCESSOR
ILCAN00	IH	IH	18990.	DISC COPY OF RESIDENT VULCAN THAT IS PUT INTO MEMORY
ULCANIZ	IH	IH	200.	CREATES LOAD MODULES
REF	H	H/IH	2060.	CROSS REFERENCE PROCESSOR
IBERY	H	H/IH	124800.	HARRIS SYSTEM LIBRARY
:CASS:V	H	H/IH	1620.	CASSETTE HANDLER
ORP	IH	IH	10.	EXERCISES EXPONENTIATION FUNCTION IN SAU
:ETC:V	IH	IH	120.	NON-RESIDENT HANDLER FOR OBTAINING CONTENTS ON MEMORY SYSTEM ID, AND DAY OF THE WEEK
:UADR:V	IH	IH	100.	ABSOLUTE DISC READS FOR USER ROUTINES
:PMD	H	H/IH	1980.	POST MORTEM DUMP
TOTAL			292953.	

HARRIS F/FB

UTILITY SOFTWARE

I NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
N	IH	IH	103	CONVERTS NUMBER TO/FROM INTEGER, OCTAL, HEX, ASCII AND TASCII
OMPUTE	IH	IH	515.	FLOATING POINT CALCULATOR
OPYTAPE	IH	IH	200.	COPIES ONE MAG TAPE TO ANOTHER
C	IH	IH	60.	DISPLAYS SELECTED LOCATIONS OF CORE
F	IH	IH	N/S	DISPLAYS MAPPING INFORMATION FOR A FILE
LMNAMAP	IH	IH	260.	ELIMINATES FILES IN A MAP OUTPUT
LMNVER	IH	IH	260.	ELIMINATED FILES IN AVERIFY OUTPUT
[illegible]	IH	IH	140.	COPIES DATA FROM HP TAPE CASSETTE TO DISC FILE
MTSNAPS	IH	IH	65.	SPOOLS SNAPSHOT OF CRT SCREEN TO PRINTER

ENCMD	IH	IH	147.	GENERATES COMMAND FILE USED IN *TCOPY2
PCO	IH	IH	N/S	GENERAL PURPOSE COPY ROUTINE TO SUPPOR CAR- TRIDGE ON HP TERMINAL
EEPCK	IH	IH	354.	OUTPUTS FORMATTED LIST OF FILES ON A KEEPTAPE TO THE PRINTER AND VERIFIES THE TAPE
F	IH	IH	66.	COMPARES 2 FILES
PCOPY	IH	IH	200.	COPIES A MAG TAPE IN KEEP/FETCH FORMAT TO ANOTHER MAG TAPE
M	IH	IH	266.	PROVIDES A LIST OF WHICH LFN'S ARE CURRENTLY ASSIGNED FROM INTERACTIVE TERMINAL
EWUSER	H	H/IH	80.	CHANGES QUALIFIER AND/OR USER NUMBER OF FILES
AKCHK	IH	IH	99.	LISTS FILES WHICH HAVE NOT BEEN ACCESSED SINCE THE ENTERED CUTOFF DATE
EADFILE	IH	IH	1480.	READS FILE INTO AN OUTPUT FILE ADDING PAGE NUMBERS AND CARRIAGE CONTROL FOR SPOOLING TO THE PRINTER
FETCH	IH	IH	220.	CONSTRUCTS A JOB STREAM TO FETCH SELECTED FILES FROM A TAPE
NAPIT	IH	IH	40.	SNAPSHOTS THE CONTENTS OF A TEC-425 SCREEN
COPY2	IH	IH	1132.	READ/WRITE FROM DISC TO TAPE AND VISA-VERSA
E	IH	IH	16257.	TEXT EDITOR
HRUHS	IH	IH	600.	TRANSFERS FILES BETWEEN PROCESSORS THROUGH HIGH SPEED MEMORY
PECPY	IH	IH	80.	MAKES DIRECT BINARY COPY FROM TAPE TO TAPE
URN90	IH	IH	40.	ROTATES PRINTER OUTPUT 90 DEG.
XREF	IH	IH	240.	PRODUCES VARIABLE AND FILE NAME CROSS REFERENCE FROM AN ALPHABETIZED LIST OF VARIABLES AND FILES
RITE	IH	IH	200.	ALLOWS USER TO WRITE TO TAPE CARTRIDGE ON HP TERMINAL
EQ	IH	IH	180.	SEQUENCES SOURCE FILES

********SIMLIB - SIMULATION LIBRARY CONTAINS THE FOLLOWING SUBROUTINES:*********

RNM1	IH	IH	30.	UNPACK AREANAME FROM TRUNCATED ASCII (4CPW) TO STANDARD ASCII (1CPW)
RNM3	IH	IH	30.	UNPACK AREANAME FROM TRUNCATED ASCII (4CPW) TO STANDARD ASCII (3CPW)
ASLPDN	IH	IH		ASSIGN LFN (NON RESOURCABLE PDNS ONLY)
SLCAS	IH	IH	55.	ASSIGN LFN TO CASSETTE TAPE ON TI 733
SLDA	IH	IH	76.	ASSIGN LFN TO DISC AREA (FILENAME AND QUALI- FIER REQUIRED)
ASLDAS	IH	IH		ASSIGN LFN TO DISC AREA (QUALIFIER DEFAULTS TO SIGN-ON QUALIFIER)
SLINF	IN	IN	56.	ASSIGN LFN TO ANOTHER LFN (FIRST LFN ASSIGNMENT FOLLOWS SECOND)
ASLINP	IN	IN		ASSIGN LFN TO ANOTHER LFN (FIRST LFN ASSIGNMEN DOES NOT FOLLOW SECOND)
SORT1	IH	IH	102.	ALPHANUMERIC SORT ON AN ARRAY IN STANDARD ASCII (1CPW)
SORT3	IH	IH	200.	ALPHANUMERIC SORT ON AN ARRAY IN STANDARD ASCII (3CPW)
1TOA3	IH	IN	62.	CONVERT STANDARD ASCII (1CPW) TO STANDARD ASCII (3CPW)
1TOT4	IH	IH	70.	CONVERT STANDARD ASCII (1CPW) TO TRUNCATED ASCII (4CPW)
3TOA1	IH	IH	55.	CONVERT STANDARD ASCII (3CPW) TO STANDARD ASCII (1CPW)

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STUT4     .  IH  .IH  .   45. CONVERT STANDARD ASCII (3CPW) TO TRUNCATED
          .      .    .     .  ASCII (4CPW)
INHEX     .  IH  .IH  .   85. BINARY TO HEX
INPPT     .  IH  .IH  .  200. BINARY TO PUNCH PAPER TAPE
ITOH1     .  IH  .IH  .   60. CONVERT BINARY (1 WORD) TO HEX (ASCII 1CPW)
ITOH3     .  IH  .IH  .   65. CONVERT BINARY (1 WORD) TO HEX (ASCII 3CPW)
.FNAM     .  IH  .IH  .   60. CHECK LFN ASSIGNMENT STATUS AND OBTAIN ASSIGN-
          .      .    .     .  MENT INFORMATION
.UCBA     .  IH  .IH  .   45. CONVERTS BINARY TO ASCII
.UIO      .  IH  .IH  .  267. LONG FORM OF STANDARD CALL FOR I/O SERVICE
BLUIOA    .  IH  .IH  .     . CALL FOR I/O SERVICE TO RETURN CONTENTS OF
          .      .    .     .  A-REGISTER AFTER I/O
BLUIOC    .  IH  .IH  .     . CALL FOR I/O SERVICE FOR CHARACTER I/O
BLUIOE    .  IH  .IH  .     . CALL FOR I/O SERVICE TO RETURN CONTENTS OF
          .      .    .     .  E-REGISTER AFTER I/O
BLUIOS    .  IH  .IH  .     . SHORT FORM OF STANDARD CALL FOR I/O SERVICE
BLUIOW    .  IH  .IH  .     . LONG FORM OF STANDARD CALL FOR I/O SERVICE
          .      .    .     .  REQUESTING A WAIT AFTERWARDS
.ULFN     .  IH  .IH  .   42. CHECK LFN ASSIGNMENT STATUS
.UPDN     .  IH  .IH  .   35. CHECK PDN CHARACTERISTICS
/HXBI     .  IH  .IH  .   46. CONVERT HEX (ASCII) TO BINARY (1 WORD)
/SYSD     .  IH  .IH  .   90. CONVERT SYSTEM DATE/TIME IN $TIME FORMAT
          .      .    .     .  TO ASCII (MILITARY FORMAT)
ATE       .  IH  .IH  .   42. OBTAIN CURRENT DATE AND TIME FROM SYSTEM
INF01     .  IH  .IH  .  205. OBTAIN LIMITED INFORMATION ON A SPECIFIC
          .      .    .     .  DISC FILE
)INF02    .  IH  .IH  .     . OBTAIN MODERATE AMOUNT OF INFORMATION ON A
          .      .    .     .  SPECIFIC DISC FILE
)INF03    .  IH  .IH  .     . OBTAIN COMPLETE INFORMATION ON A SPECIFIC
          .      .    .     .  DISC FILE
ITOBI     .  IH  .IH  .  223. SCANS AND CONVERTS ASCII DATE/TIME (MIL OR
          .      .    .     .  JULIAN FORMAT) TO BINARY
RASE      .  IH  .IH  .   75. CLEAR TERMINAL SCREEN
.MNB      .  IH  .IH  .   76. ELIMINATE A SPECIFIC DISC FILE (QUALIFIER AND
          .      .    .     .  FILENAME REQUIRED)
ELMNBS    .  IH  .IH  .     . ELIMINATE A SPECIFIC DISC FILE (SIGN-ON)
          .      .    .     .  QUALIFIER ASSUMED)
INDCH     .  IH  .IH  .  174. FIND OCCURRENCE OF CHARACTER IN CHARACTER
          .      .    .     .  STRING FROM A GIVEN OFFSET
INDTX     .  IH  .IH  .  224. FIND OCCURRENCE OF A CHARACTER STRING IN A
          .      .    .     .  LARGER STRING
IP        .  IH  .IH  .  362. CONVERT ASCII REPRESENTATION OF A FLOATING
          .      .    .     .  POINT TO INTERNAL FLOATING POINT FORMAT
.GBIT     .  IH  .IH  .   64. SET A SPECIFIED BIT IN AN ARRAY
ITLAT     .  IH  .IH  .  163. FORMAT LATITUDE/LONGITUDE INTO ASCII
ITLON     .  IH  .IH  .     . FORMAT LATITUDE/LONGITURD INTO ASCII
RSTCH     .  IH  .IH  .   92. FIND FIRST NONBLANK CHARACTER IN A CHARACTER
          .      .    .     .  STRING
SCAN      .  IH  .IH  .  265. CALL TO SYSTEM FORMAT SCANNER SERVICE
ENDA      .  IH  .IH  .  165. GENERATE A DISC FILE WITH ACCOUNT ACCESS
          .      .    .     .  (SHORT FORM)
ENDL      .  IH  .IH  .     . GENERATE A DISC FILE (LONG FORM)
ENDO      .  IH  .IH  .     . GENERATE A DISC FILE WITH OWNER ACCESS ONLY
          .      .    .     .  (SHORT FORM)
ENDP      .  IH  .IH  .     . GENERATE A DISC FILE WITH PUBLIC ACCESS
          .      .    .     .  (SHORT FORM)
EXPIN     .  IH  .IH  .  180. CONVERT HEX TO BINARY
EXIN      .  IH  .IH  .   94. INPUT AND CONVERT HEX ASCII (UP TO 6 CHARACTERS
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         .        .      .          . TO BINARY  (1 WORD)
:XPPT    .  IH    .IH    .      164. DATA (IN HEX) TO PUNCH PAPER TAPE
3ORT3    .  IH    .IH    .       96. HEX SORT ON ASCII REPRESENTATION OF HEX
         .        .      .          .  NUMBERS IN AN ARRAY
ITOBI    .  IH    .IH    .       82. CONVERT HEX (ASCII 1CPW) TO BINARY (1 WORD)
)PIN     .  IH    .IH    .       95. OBTAIN PROGRAM OPTIONS FROM PROGRAM OPTION
         .        .      .          .  WORD FROM INITIALIZATION
3LNBK    .  IH    .IH    .          . ANOTHER ENTRY POINT FOR FRSTCH
JLIAN    .  IH    .IH    .      115. CONVERT RETURN FROM SYSTEM $TIME SERVICE TO
         .        .      .          .  JULIAN FORM DATE AND TIME
TP4PI    .  IH    .IH    .       60. CONVERT A HARRIS FLOATING PONT NUMBER TO 4PI
         .        .      .          .  FIXED POINT NUMBER
)MPAR    .  IH    .IH    .      122. COMPARE CHARACTER STRINGS
ISTCH    .  IH    .IH    .       93. FIND LAST NONBLANK CHARACTERS IN A CHARACTER
         .        .      .          .  STRING
(STING   .  IH    .IH    .      332. COPY FILE TO FILE WITH PRINTER SPACING
3TNBK    .  IH    .IH    .          . ANOTHER ENTRY POINT FOR LASTCH
JVCSP    .  IH    .IH    .       52. MOVE CURSOR ON THE TEKTRONIX 4014
/CHR     .  IH    .IH    .      100. MOVE DATA IN AN ARRAY
PARN     .  IH    .IH    .       75. SCAN OFP CHANGE/PROBLEM DESCRIPTION
:HRT4    .  IH    .IH    .       65. TRUNCATE AND INSERT ASCII CHARACTER IN A
         .        .      .          .  TRUNCATED ASCII ARRAY (4CPW)
3MOPT    .  IH    .IH    .       99. OBTAIN PROGRAM OPTIONS AND PARAMETERS AT
         .        .      .          .  PROGRAM INITIALIZATION
TLDR     .  IH    .IH    .       63. PUNCH PAPER TAPE LEADER
TTIT     .  IH    .IH    .       35. PUNCH PAPER TPAE TITLE
TCHAR    .  IH    .IH    .      197. CONVERT ASCII CHARACTER TO PAPER TAPE CODE
:NAME    .  IH    .IH    .       86. RENAME A DISC FILE TO A NEW NAME (QUALIFIER
         .        .      .          .  AND FILENAME REQUIRED)
?ENAMS   .  IH    .IH    .          . RENAME A DISC FILE TO A NEW NAME (SIGN-ON)
         .        .      .          .  QUALIFIER ASSUMED)
:TYPE    .  IH    .IH    .      100. RETYPE A DISC FILE TO A NEW TYPE SPECIFICATION
         .        .      .          .  (LONG FORM)
?ETYPS   .  IH    .IH    .          . RETYPE A DISC FILE TO A NEW TYPE SPECIFICATION
         .        .      .          .  (SHORT FORM)
TBIN     .  IH    .IH    .      149. READ PAPER TPAE AND CONVERT TO BINARY
THEX     .  IH    .IH    .      174. READ PAPER TPAE AND CONVERT TO HEX
3DSC     .  IH    .IH    .       65. RESOURSE DISC PACK
?SDSCT   .  IH    .IH    .          . TEST DISC RESOURCE REQUEST
?SDSCW   .  IH    .IH    .          . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR DISC
         .        .      .          .  PACK HAS BEEN FULFILLED
3HSM     .  IH    .IH    .       75. RESOURCE HIGH SPEED MEMORY
?SHSMT   .  IH    .IH    .          . TEST HIGH SPEED MEMORY REQUEST
?SHSMW   .  IH    .IH    .          . SPECIFY A WAIT UNTIL RESOUCE REQUEST FOR
         .        .      .          .  HIGH SPEED MEMORY FULFILLED
3MTL     .  IH    .IH    .      105. RESOURCE MAG TAPE (LONG FORM)
?SMTLT   .  IH    .IH    .          . TEST MAG TAPE RESOURCE REQUEST (LONG FORM)
?SMTLW   .  IH    .IH    .          . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR
         .        .      .          .  MAG TAPE HAS BEEN FULFILLED
3MTS     .  IH    .IH    .       86. RESOURCE MAG TAPE (SHORT FORM)
?SMTST   .  IH    .IH    .          . TEST MAG TAPE RESOURCE REQUEST (LONG FORM)
?SMTSW   .  IH    .IH    .          . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR MAG
         .        .      .          .  TAPE HAS BEEN FULFILLED
3PDN     .  IH    .IH    .       86. RESOURCE PDN (MUST BE RESOURCEABLE)
?SPDNT   .  IH    .IH    .          . TEST PDN RESOURCE REQUEST
?SPDNW   .  IH    .IH    .          . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR PDN
         .        .      .          .  HAS BEEN FULFILLED
:TBIT    .  IH    .IH    .       51. SET BIT IN A VECTOR ARRAY
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)RT	IH	IH	90.	BINARY SORT ON AN ARRAY BY ROW
)Z	IH	IH	62.	SQUEEZE BLOCKED DISC FILE TO MIN. REQUIREMENT
)07UR	IH	IH		SQUEEZE AN UNBLOCKED DISC FILE TO MINIMUM REQUIREMENTS
ITUA1	IH	IH	63.	CONVERT TRUNCATED ASCII (4PCW) TO STANDARD ASCII (ICPW)
ITUA3	IH	IH	47.	CONVERT TRUNCATED ASCII (4CPW) TO STANDARD ASCII (3CPW)
)TAL			34494.	

HARRIS F/FB

RJE (REMOTE JOB CONTROL) SOFTWARE

: NAME	SUP- PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
:/HASP	H	H/IH	3220.	SPOOLER FOR RJE
:NDER	IH	IH	10.	SCANS RJE FILE AND WRITES A LIST OF CRITICAL WARNING OR ERRORS
'C.RJE	H	H/IH	160.	OPCOM RJE DRIVER
IE	H	H/IH	1000.	REMOTE JOB ENTRY PROCESSOR
IE>T2	IH	IH	1300.	WRITES A LIST FORMAT RJE DATA FILE TO MAG TAPE FOR LISTING OR MICROFICHE
IEGEN	H	H/IH	560.	PARAMETER GENERATION PROGRAM USED IN CONFIGUR- ING THE IBM SITES INITIATED BY *RJE
:BERT;V	H	H/IH	180.	RJE UTILITY
:RJEH;V	H	H/IH	980.	REMOTE JOB ENTRY HANDLER
)TAL			7410.	

HARRIS F/FB

PLOTTER SOFTWARE

: FILE	SUP- PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ITRETPL	IH	IH	800.	DATA RETRIEVAL PLOTTING PROGRAM
'PLOT	IH	IH	160.	PLOTS WEAPON SCORING RELEASES PRODUCED BY *SCORE
'LOT	H	H/IH	1960.	VERSATEC PLOTTER ROUTINE
.OTLIB	H	H/IH	4460.	VERSATEC PLOTTER LIBRARY
IPLOT	IH	IH	200.	REPLOTS OR ELIMINATES AREAS CREATED BY USING *SCORE, KEEP OPTION
)TAL			7580.	

PREDICTIVE SOFTWARE COST MODEL

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HARRIS F/FB

OFP SOFTWARE

NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
'	IH	IH	360.	CONVERTS 4PI FORMAT TO/FROM ENGINEERING VALUES
MOFP	IH	IH	500.	ELIMINATES DOCUMENTATION FILES FOR OFP
NOFP	IH	IH	680.	GENERATES DOCUMENTATION FILES FOR OFP
ITOFP	IH	IH	1780.	LISTS DOCUMENTATION FILES FOR OFP
'D	IH	IH	680.	READS AN OFP FROM PAPER TAPE AND FORMATS IT ON DISC IN CMAC LOAD FORMAT
ITAL			4000.	

HARRIS F/FB

ADAGE SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
PP	IH	IH	2806.	ADAGE DIAGNOSTICS
APHIC	IH	IH	480.	ADAGE INTERFACE UTILITY
HSGS;V	IH	IH	80.	ADAGE DIAGNOSTIC
RMMS;V	IH	IH	380.	ADAGE MONITOR SERVICE
IT2	IH	IH	1049.	HOST COMPUTER INTERFACE TEST
XLD	IH	IH	1919.	LOADS TEST PATTERNS ON ADAGE
ITAL			6714.	

HARRIS F/FB

SAS SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION

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:AG	IH	IH	140.	SAS DIAGNOSTICS
)SAS	IH	IH	100.	PSEUDO REAL TIME PROGRAM USED BY *SASIO
\SIO	IH	IH	700.	ALLOWS THE USER TO SET AND MONITOR SIMULATION VARIABLES
:INST;V	IH	IH	20.	OUTPUT TEST INSTRUCTIONS AND DATA FROM C PROCESSOR SWITCHES TO SAS
:PRLS;V	IH	IH	80.	INITIALIZES AND LOADS DATA INTO ANY ONE OF IN SAS FROM C PROCESSOR
:SFRT;V	IH	IH	400.	SAS DIAGNOSTICS
:SASP;V	IH	IH	1400.	C PROCESSOR PROGRAM THAT DOES I/O FOR THE SIMULATOR
:T64S;V	IH	IH	48.	CHECKS OUT CLOCK
)TAL			2888.	

HARRIS F/FB

SIMULATOR SOFTWARE

: NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
)RS	IH	IH	216.	GENERATES ADDRESS AND CROSS REFERENCE INFORMA-TION FOR MONITOR COMMON VARIABLES
\LLIS	IH	IH	500.	COMPUTES BALLISTIC CURVES
(FR	IH	IH	200.	LOADS C PROCESSOR
\TRET	IH	IH	2880.	RETRIEVES SIMULATION DATA
\TRETQD	IH	IH	180.	QUICK AND DIRTY DATA RETRIEVAL PROGRAM
?SPEC	IH	IH	2240.	SETS UP DATA RECORDING FILE
\	IH	IH	60.	FUNCTION WORD ASSEMBLER
?SMLG	IH	IH	160.	KEEP AND FETCH *STMLOG ON TAPE
)NITOR	IH	IH	140.	MONITORS MEMORY LOCATIONS AND REPORTS ANY CHANGES IN VALUE
.AN	IH	IH	4320.	MISSION PLANNING PROGRAM
.ANUTIL	IH	IH	1840.	PLANNING FILE UTILITY PROGRAM
?T.LD35	IH	IH	20.	RESIDENT REAL TIME LOADER FOR *V;LD35;V
:ORE	IH	IH	500.	COMPUTES THE IMPACT POINT OF SIMULATION WEAPON RELEASES
:RIAL	IH	IH	100.	MONITORS SIMULATION SERIAL DATA WORD COUNTS
:TDAT	IH	IH	430.	PUTS A KNOWN VALUE IN MONITOR COMMON
/	IH	IH	240.	INITIATES THE START OF SIMULATION
?DATE	IH	IH	220.	UPDATES MONITOR COMMON DISC FILES USED BY THE SIMULATION DISPLAY PROGRAMS
:ADRS;V	IH	IH	80.	COMPUTES SEMI-CONDUCTOR MEMORY LOCATION OF MONITOR COMMON VARIABLES
:CLDR;V	IH	IH	200.	LOADS A PROGRAM IN C PROCESSOR FROM EITHER A OR B PROCESSOR
:IH70;V	IH	IH	200.	INTERRUP HANDLER FOR SIMULATOR SOFTWARE ON A PROCESSOR
:LD35;V	IH	IH	40.	SETS UPMONITOR SERVICE BLU35 FOR NON-RESIDENT HANDLER *V;ETC;V
:SPCA;V	IH	IH	500.	SETS UP MONITOR SERVICE BLU36 ON A PROCESSOR
:SPCB;V	IH	IH	700.	SETS UP MONITOR SERVICE BLU36 ON B PROCESSOR
(E-SNAP	IH	IH	140.	PRODECES FORMATTED LISTING OF ALL SIMULATION

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				COMMANDS
SORIVE	IH	IH	100.	RESCORES WEAPON DROPS BY THE SIMULATOR
REFO	IH	IH	240.	PROVIDES A LISTING OF SIMULATION MONITOR COMMON VARIABLES IN FILE
REFUP	IH		700.	UPDATES CROSS-REFVERENCE FILES USED BY *CMACRETV AND *FW
EPLAN	IH		560.	RESTRUCTURES PLANNING FILES TO THE NEW 5 OFFSET POINTS
[illegible]TAL			17706.	

HARRIS [illegible]

CMAC SOFTWARE

[illegible] NAME	SUPPLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
[illegible]TALOG	IH	IH	360.	CREATES CMAC LOAD FOR F/FB ASTRO
[illegible]OCKS	IH	IH	20.	CHECKS CLOCKS ON CMAC
[illegible]OCKT	IH	IH	100.	READS THE CLOCK FROM ALL 3 CMAC'S
MACDIAG	IH	IH	4000.	CMAC DIAGNOSITICS
MACRETV	IH	IH	2940.	RETRIEVES CMAC DATA
[illegible]ACTEST	IH	IH	4080.	ALLOWS USER TO COMMUNICATE WITH CMAC
MACTIME	IH	IH	160.	CONVERTS CMAC COARSE AND FUE
[illegible]MPTP	IH	IH	140.	DUMPS CMAC RECORDING
[illegible]	IH	IH	134.	CMAC DATA RETRIEVAL PROGRAM FOR RETRIEVING FULL SNAPSHOTS
[illegible]	IH	IH	1700.	SETS UP MONITOR SERVICE BLU34 FOR COMMUNICATION WITH CMAC
[illegible]TAL	IH	IH	13674.	

AGERO 6660
SYSTEM SOFTWARE

[illegible] NAME	SUPPLIEF	MAIT RES	EST SOURCE LINES	DESCRIPTION
[illegible] O/S	TI	IH	N/S	OPERATING SYSTEM

PDP 11/40
SYSTEM SOFTWARE

T NAME	SUPPLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
[illegible]NITOR	DEC	DEC	N/S	DISK OPERATING SYSTEM V08-08

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

IP	DEC	DEC	N/S	FILE UTILITY PACKAGE V08-02A
DIT	DEC	DEC	N/A	TEXT EDITOR V006A
ORTRAN	DEC	DEC	N/S	FORTRAN COMPILER V004A
ACRO	DEC	DEC	N/S	ASSEMBLER VE05-01A
IBR	DEC	DEC	N/S	LIBRARIAN V004A
INK	DEC	DEC	N/S	LINKER V11A01
DT	DEC	DEC	N/S	DEBUGGING PROGRAM
ILCOM	DEC	DEC	N/S	FILE COMPARE PROGRAM V02-04
ILDMP	DEC	DEC	N/A	FILE DUMP UTILITY V007A
ERIFY	DEC	DEC	N/S	VERIFICATION PROGRAM V002-4
ILUS	DEC	DEC	N/S	CORE IMAGE LIB UPDATE AND SAVE VA04
OLLIN	DEC	DEC	N/S	UTILITY TO SAVE DISK
YSLOD	DEC	DEC	N/S	SYSTEM LOADER V005A
FSLDR	DEC	DEC	N/S	ABSOLUTE LOADER V006A

PDP 11/40
UTILITY SOFTWARE

I NAME	SUP- PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
TNLST	IH	IH	N/S	LIST FORTRAN COMPILES W/50 LINES A PAGE
COPY	IH	IH	105.	TAPE TO TAPE COPY
TP	IH	IH	226.	GENERAL TAPE PRINT
ABELS	IH	IH	31.	PLOTS 24 VERTICAL LABELS FOR TAPES
DT	IH	IH	427.	CREATES MICROFICHE OR OTHER MACHINE COMPATABLE TAPE, LRECL 136 OR 80, ASCII OR EBCDIC
MALIB	IH	IH	4388.	SUBROUTINE LIBRARY
PLTB	VER	VER	N/S	VERSATEC PLOT LIBRARY
OTAL			5177.	

PDP 11/40
DATA REDUCTION SOFTWARE

I NAME	SUP- PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ALLIB	IH	IH	1129.	BUILD AND UPDATE CALIBRATION LIBRARY
ALLST	IH	IH	146.	LIST CALIBRATION LIBRARY
MLINE	IH	IH	238.	DISCRIMINATOR LINEARITY CHECK
XEC	IH	IH	2395.	A/D CONVERTER STORED ON MAG TAPE
MQAC	IH	IH	274.	CHECK "EXEC" TAPE
MEDIT	IH	IH	219.	REMOVE UNWANTED DATA FROM "EXEC" TAPE
MLIST	IH	IH	2286.	PERFORM ENGINEERING UNITS CONVERSION AND LIST FROM "EXEC" TAPE
MDUMP	IH	IH	218.	PERFORM ENGINEERING UNITS CONVERSION AND LIST FROM "EXEC" TAPE
PINIT	IH	IH	2066.	LOAD AND VERIFY DC

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

'PRUN	IH	IH	1864.	RECOVER MKII DATA THROUGH DC STORE ON TEMPORARY DATA FILE
M	IH	IH	1334.	RECOVER ANALOG FM DATA, STORE ON TEMPORARY DATA FILE
'CM	IH	IH	219.	LOAD AND VERIFY 700'S FOR PCM DATA/STRIP CHARTS
'CMAIN	IH	IH	1408.	RECOVER PCM DATA, STORE ON TEMPORARY DATA FILE
:DF2DK	IH	IH	75.	STORE REFERENCE DATA FILE ON DISK TO FREE TAPE DRIVE
:ALS	IH	IH	136.	GENERATES CALIBRATION LIBRARY FOR FM OR PCM RUN
:ALOK	IH	IH	60.	PRINT AND VERIFY CALIBRATION LIBRARY
'PSTAT	IH	IH	987.	PERFORM STATISTICAL AND TIME ANALYSIS OF TEMPORARY DATA FILE(S)
'PDUMP	IH	IH	256.	LIST SELECTED PARAMETERS FROM TEMPORARY DATA FILE(S)
UMP	IH	IH	238.	LIST SELECTED PARAMETERS FROM TEMPORARY DATA FILE(S)
'03	IH	IH	402.	CHECK FM SYSTEM
'05	IH	IH	165.	CHECK CALIBRATION ID/TAPE BREAK SYSTEM
'01	IH	IH	457.	CHECK DC LOAD
'02	IH	IH	549.	GROSS CHECK OF MKII SYSTEM
)CALG	IH	IH	30.	RECOVER MKII DATA AND STORE ON MAGNETIC TAPE
)CDUMP	IH	IH	128.	RECOVER MKII DATA AND STORE ON MAGNETIC TAPE
)CTEST	IH	IH	30.	CHECK DC
T06	IH	IH	421.	CHECK SIMULATOR TO COMPUTER COMMUNICATIONS
T07	IH	IH	1463.	CHECK SIMULATOR TO COMPUTER COMMUNICATIONS
T09	IH	IH	1993.	CHECK SIMULATOR TO COMPUTER COMMUNICATIONS
SPIKE	IH	IH	932.	FLAGS TIME OF VOLTAGE SPIKES
TIRE	IH	IH	361.	SEPARATE I/O COMMUTATED VALUES FROM UP TO 5 CHANNELS
3ATT	IH	IH	120.	SEPARATES I/O COMMUTATED VALUES
TOTAL			22619.	

MDS
MICRO-DATA SYSTEMS
INTEL 8080

?I NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
AL	IH	IH		CREATES A FILE
ENTRY	IH	IH		COPIES ASCII DATA FROM A HEWLETT-PACKARD TERMINAL CASSETTE TO A FILE
FAST	IH	IH		SETS TERMINAL BAUD RATE TO 9600
INVASM	IH	IH		CREATES AN INVERSE ASSEMBLY LISTING AND A PSUEDO
ISIS	INTEL	INTEL/IH		OPERATING SYSTEM
LIST	IH	IH		DISPLAYS A FILE TO THE CONSOLE
PTYPE	IH	IH		TYPE FROM CONSOLE TO LINE PRINTER
ROLLIN	IH	IH		COPY BINARY DATA FROM A HEWLETT-PACKARD TERMINAL CASSETTE TO A FILE
ROLOUT	IH	IH		COPY A BINARY FILE TO A HEWLETT-PACKARD

CONTINUATION SHEET DATE: 28 Sept 1979

```
         .       .     .       .  TERMINAL CASSETTE
SLOW     . IH    . IH  .       . SETS TERMINAL BAUD RATE TO 2400
SPACE    . IH    . IH  .       . GIVES REMAING NUMBER OF BLOCKS ON A DISK
SPOOL    . IH    . IH  .       . COPIES FILES TO THE LINE PRINTER WITH PAGING
         .       .     .       .  AND TITLING
TE       . IH    . IH  .       . TEXT EDITOR
WRITE    . IH    . IH  .       . COPIES AN ASCII FILE TO A HEWLETT-PACKARD
         . IH    . IH  .       . CASSETTE
```

SOFTWARE PACKAGE CHARACTERISTICS -
FLIGHT TEST REQUIREMENTS

DATE: 28 Sept 1979

Typically it will take about four to ten (average about six) sorties to get the system running smoothly before testing can begin in earnest. Flight test statistics are as follows:

Block Change	Nr. Sorties	Nr. Flight Hours
FB-15	23	67
FB-16	19	60.5

$10,000 per sortie is used by SMALC is a rough cost estimate for Flight testing, including system preparation and range costs. Calculations based on figures from AFR 173-10, USAF Cost and Planning Factors, Volume I, May 1977, yield a cost per flight hour of $2,957.

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 28 Sept 1979

PROGRAMMER TRAINING:

Engineering training is by OJT, with occasional formal classes on particular subjects. These are normally taught by one of the engineering staff members.

USER TRAINING:

User training occurs via the user meetings and user flight testing of preliminary OFP tapes. During this time there are typically 15-20 phone calls by the user to SMALC.

A major problem is that the flight simulator tape usually lags the operational tape by about one year. This is because of the time required to reprogram the simulator tape.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE HISTORY DATE: 28 Sept 1979

DESCRIPTION OF NUMBERS AND TYPES OF MAINTENANCE ACTIONS PERFORMED EACH YEAR SINCE PMRT

SOFTWARE CHANGE SUMMARY FOR THE FB-111A OFP

Release Date	FB-12 9-74	FB-13 1-76	FB-14 1-78	FB-15 1-78	FB-16 Sched.6-79	
Change Requirement Code						Total
A - Add Capability	3	1	1	2	8	15
C - Correct Deficiency	6	13	4	7	8	38
D - Delete Capability	2	6	0	5	3	16
E - Enhancement	4	10	8	5	5	32
O - Optimization	0	0	1	0	1	2
Total	15	30	14	19	25	103

CHANGES SOLVED IN FB-12

Change	Title	Code
B442	Designate switch	A
B443	Improved wind vector fix	C
B452	Heading fix mode	A
B480	Altitude calibration in bomb or Aila modes	C
B464	Delivery mode switch/bomb incompatibility indication	C
B508	Zero core at power-up	C
B509	PCO of computer error traps	E
B427	Converter bite failure reporting	C
B449	Entered PSIMV in Aila mode	E
B463	Retention of MTH corrections during Nav/Bomb transition	E
B467	Cursor initialization in ground align mode	C
B468	NDU displays in bomb mode	A
B469	Retention of MTH corrections during Bomb/Nav transition	E
B12WSAV	Capabilities deleted	
	A. Visual auto PP correction	D
	B. Visual auto fixpoint ID	D

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET DATE: 28 Sept 1979

CHANGES SOLVED IN FB-13

Change	Title	Code
B526	SRAM Alternate Launch (SAL)	A
B522	Present position update reasonableness test	E
B430	Use of doppler boresight and scale factor	C
B407	Doppler memory	E
B494	Transport precession correction in directional gyro mode	C
B485	.flight alignment (IFA)/initialization with INS true heading	C
B501	Inflight alignment restart	C
B527	Visual indication for heading fix mode entry and exit	C
B514	"INS mode" error light timing	C
B513	Delete 800 Ft. check for high altitude calibration	D
B547	Magnetic variation initialization/ground alignment	C
B473	Magnetic variation initialization/dead reckoning to inertial mode	C
B530	Same coordinates fix	
B524	Doppler radar system bore sight and scale factor storage control	E
B528	Whole value entry of Magvar and wind velocity in DR mode	E
B515	System altitude lag refinements	E
B478	Ballistics coefficients	E
B516	B-43 weight (SC-9 tail)	E
B474	System magnetic variation (MV) in inertial mode (I)	E
B529	SRAM integrated system checkout (ISC) fix	E
B531	Reduced time-to-go (TTG) window	C
B532	SRAM power up delay fix	C
B533	Astro self test tolerances	E
B534	Correct heading fix wind rotation	C
B535	Radar cursor jump GNC halt aila or radar bomb	C
B13WSAV	Capabilities deleted	
	A. Right hand race track	D
	B. Dive weapon release	D
	C. Ladd weapon release	D
	D. Guns and rockets	D
	E. Maneuvering modes and vertical range	D

CONTINUATION SHEET DATE: 28 Sept 1979

CHANGES SOLVED IN FB-14 (RELEASED WITH FB-15)

Change	Title	Code
B539	Selected sequence point cursor control	E
B565	System command code table	A
B568	Inability to sequence interrupt in offset	E
B455	Doppler over water	E
B555	Attack steering sensitivity	C
B558	Optional corrections to INS if present position reasonableness test failed	E
B550	Kalman model for doppler-inertial navigation	E
B563	No automatic SRAM channel changeover	C
B556	Hand entry of manual altitude	E
B447	Unfreeze TAS option	E
B540	Rescaling of TFR inertial flight vector	C
B559	Inhibit sequencing during visual overfly	C
B561	New weapons and new ballistics for weapons in permanent memory	E
B566	Move DG and boresight commands to syscom table	O

CONTINUATION SHEET **DATE:** 28 Sept 1979

CHANGES SOLVED IN FB-15

Change	Title	Code
B445	Mechanize Kalman filter for WDC	A
B584	Moving target designation	A
B572	Wind errors in wind vector/heading fix combination	C
B569	Converter set synchro output bite deficiency	C
B570	Rate group overload fault trap	E
B581	Erroneous heading fix enables	C
B582	Bomb mode computer recycling	C
B512	Astro capability in dead reckoning modes	E
B577	PCO error trap enhancement	E
B575	Improve SRAM fault reporting	E
B574	Minimum vertical range to target	E
B576	Altitude drift during high altitude calibration	C
B573	Steering in visual BOM mode	C
B586	Display range in manual ballistics	C
B15WSAV	Capabilities deleted	
	A. Horizontal situation display	D
	B. Manual update	D
	C. Conventional filter cycle	D
	D. Manual navigation	D
	E. RHAW homing mode	D

CONTINUATION SHEET DATE: 28 Sept 1979

CHANGES SOLVED IN FB-16 (SCHEDULED FOR RELEASE 6/79)

Change	Title	Code
B612	Short range attack missile (SRAM) airborne mission trainer (SAMIT)	A
B589	Selectable fixpoint quality	A
B600	Wind vector present position fix combination	E
B606	Special "Enter Visual Fix" (EVF)	A
B608	Fixpoint identification (FXPT ID)	O
B609	Fixpoint selected sequence point pushbutton	A
B613	Ground navigate mode	A
B585	Backup fault reporting	E
B549	Weapon release data trap	A
B596	Incorrect ballistics in manual altitude	C
B602	Doppler ground speed/drift correction angle filter	E
B610	ECP 3268 R01	C
B422	Fixpoint identification sequence numbers	C
B547	Computer halt with invalid switch positions	C
B587	Directional gyrocompass mode problem	C
B588	True air speed-inertial inflight alignment problem	C
B601	Manual true air speed	E
B611	Bomb mode wind vector/heading fix abort change	E
B594	Short range attack missile (SRAM) channel switchover logic	C
B598	Correct Akuron equations	C
B605	Astro elevation display	A
B614	Whole value update of present position in degraded modes	A
B16WSAV	Capabilities deleted	
	A. Homer set/Homer track fixtaking modes	D
	B. Blast radius/yield code	D
	C. Course line/course select steering	D

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE COST HISTORY DATE: 28 Sept 1979

YEARLY COST OF MAINTAINING PACKAGE:

Manhours expended in support of the FB-111A are as follows:

	FY77	FY78	FY79
Direct FB-111A Support	18041	15069	9809
Support Software[1]	23790	29776	21094

Manhours by block change are shown on p. B-80.

Vendor support of the Harris, Interdata and PDP computers costs $308K/year plus $126K/year for expendables and prototype hardware (split about 50/50).

1. For FB-111A, F-111D and F-111F, plus other projects.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - MAINTENANCE COST HISTORY **DATE:** 28 Sept 1979

Block	CHANGE A	C	D	E	O	Total	Manhour (FY'77 - FY'79)
FB-12 (released 9-74)	3	6	2	4	0	15	n/a
FB-13 (released 1-76)	1	13	6	10	0	30	n/a
FB-14 (released 1-78)	1	4	0	8	1	14	329
FB-15 (released 1-78)	2	7	5	5	0	19	18080
FB-16 (released 6-79)	8	8	3	5	1	25	21519
FB-17 (scheduled for release late 1980)							2867

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES DATE: 28 Sept 1979

Data Base Name	F/FB-111 Operational Flight Program
Location	SM-ALC/MMECP, McClellan AFB, California
Contact Person	Alton E. Patterson
Phone Number	(916)643-4762
General Contents	Manhours by Fiscal Year by function/ project
Period Covered	FY'77 through FY'79
Data Quality	Good detail on expenditure of manhours, down to level of OFP block change

PREDICTIVE SOFTWARE COST MODEL

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 28 Sept 1979

RESPONDENT: Bassett

If you were responsible for predicting, accumulating and accounting for software support costs, how would you do it?

1. AF Flight simulator concept (requirements different than A/C) - Need to be able to update flight simulator by just changing OFP software.

2. a. Demand spare memory

   b. Language - Function of application
      Need to study tradeoff between ease of development/maintenance vs. operational requirements (efficient code)

      Can HOL support those requirements?

      Support - peculiar language - need to buy original contractor

   c. Mission requirements
      TAC has more precise testing requirements than SAC.
      (Weapon delivery precision) [smart weapons]

   d. SPO is not motivated toward economical support
      AFLC needs veto power over design decisions

   Similarities among aircraft avionics are greater than differences.

   e. Analysis and design and testing overwhelms compilation/assembly.

   f. Support personnel cost more than development personnel
      (Need system knowledge. Implies experience.)

      Autonetics - $65K/man year
      GD - $35K/man year

APPENDIX C

F-111F/SMALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION DATE: 28 Sept 1979

ALC: SM

WEAPON SYSTEM: F-111F

SOFTWARE PACKAGE: General Navigation Computer/Weapons Delivery Computer

PERSONNEL CONTACTED:

Al Patterson, MMECP
Lynn Bassett, MMECP

SOFTWARE PACKAGE CHARACTERISTICS: (two packages - see page C-2).

SIZE: 16K each for General Navigation Computer (GNC) and Weapons Delivery Computer (WDC).

LANGUAGE: Assembly

APPLICATION: Navigation, Weapons Delivery

COMPLEXITY: High

YEAR DEVELOPED: 1968

DEVELOPER: Autonetics

COMMENTS Minimal attention given to software reliability and maintainability. See rating of quality attributes on page C-3.

HOST (AIRBORNE) COMPUTER CHARACTERISTICS: (two computers)

MANUFACTURER: IBM

MODEL NUMBER/DESIGNATOR: CP2

WORD SIZE: 16-bit

MEMORY SIZE: 16K each

MEMORY FILL: 200 empty words each (98.8 percent)

WEAPON SYSTEM USE:

NUMBER OF USERS: 94

LOCATIONS OF USERS: Lakenheath, England

FREQUENCY OF USE: Daily

INTERVIEWER(S): R. B. Waina, A. P. Bangs

CONTINUATION SHEET

DATE: 28 Sept 1979

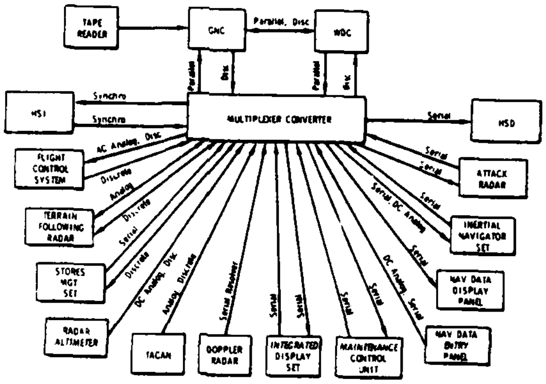


Figure C-1. F-111 Avionics System

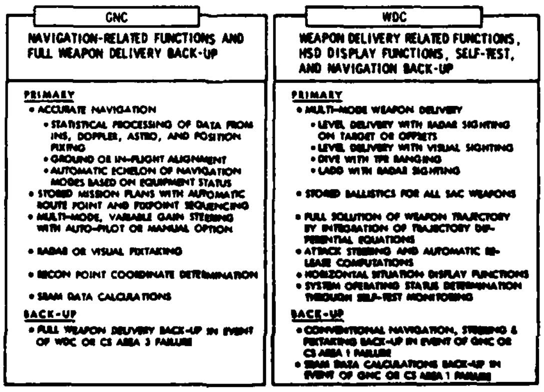


Figure C-2. F-111 OFP's

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - Quality Attributes **DATE:** 28 Sept 1979

Rate the Package on the following Quality attributes:

Accessibility: 0

Accountability: N/R

Access Audit: N/R

Access Control: N/R

Accuracy: 9

Augmentability: 6

Clarity: 4

Communicativeness: 8

Communications, Commonality: N/A

Completeness: 9

Conciseness: 9

Consistency:

- Internal Consistency: 7
- External Consistency: 8

Correctness: 10

Data Commonality: N/A

Efficiency: 10

- Execution Efficiency: 10
- Storage Efficiency: 10

Error Tolerance: 9

Expandability: 6

Generality: 0

Human Engineering: 9

Independence: 0

- Device: 0
- Software System: 0

Instrumentation: 4

Interoperability: 0

Integrity: 10

Legibility: 5

Maintainability: 8

Modifiability: 8

Modularity: 4

Operability: N/A

Performance: 10

Portability: 0

Reliability: 9

Robustness: 8

Reusability: 0

Selfcontainedness: 10

Selfdescriptiveness: 5

Simplicity: 3

Structuredness: 7

Testability: 8

Traceability: 8

Training: N/A

Understandability: 4

Usability (as-is utility): 9

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL DATE: 28 Sept 1979

ALC: SM	OFFICE SYMBOL: MMECP

KEY PERSONNEL/OGRANIZATION:

MMEC
Mr. Robert Green

MMECP
Mr. Al Patterson
F/FB-111

MMECM
Mr. Frank Davis
Software
Management

MMECS
Major Hank Garretson
Administration

MMECF
Mr. Bob La Vergne
Ground Communications, Electronics, and Meterological

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE): (MMECP)

4 Air Force (2-3 years experience)
19 Civil Service (3-5 years experience)
30 General Dynamics (2-3 years experience)
31 Autonetics (8-10 years experience)

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

7 - one OFP for each of the two computers (GNC and WDC) for each of the three aircraft, (F-111D, F-111F, FB-111A), plus one OFP for the NCU computer program for all three aircraft. Additionally, much simulation and support software is maintained, and numerous special projects are carried out.

MAINTENANCE AGENCY - WORK DISTRIBUTION DATE: 28 Sept 1979

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL (MMECP)

FUNCTION	NUMBER OF PERSONNEL AF	CS	CONTR
Management/Secretary		4	3
FB-111A S/W Engineering		1	5
F-111D S/W Engineering		1	5
F-111F/Pavetack S/W Engineering	1		5
Mission Programs	1	3	
F-111 A/E Acquisition Support		2	1
F-111 AISF Enhancements and S/W Support			15
F-111 OFP Mk II V & V		3	3
Flight Test Support			5
S/W Configuration Management			4
TSU			5
Special Projects	2	5	10
Major AISF Upgrades			[5-10 off-premise]
	4	19	61 [+ 5 - 10]

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - WORK DISTRIBUTION **DATE:** 28 Sept 1979

Manhours for FY'77 through FY'79 are distributed as follows:

Function	FY'77	FY'78	FY'79
FB-111A	18,041	15,069	9,809
F-111F	16,926	8,877	20,243
F-111D	13,880	19,376	14,373
Other F-111	6,391	3,288	6,467
Support Software	23,790	29,776	21,094
Special Projects	28,982	35,224	33,548
Leave/Holiday	19,904	23,580	24,597
Total	127,914	135,190	129,131

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE: 28 Sept 1979

SMALC uses a manhour accounting system which logs manhours by project. For each specific aircraft type block change, manhours are accounted for by five functions: management, definition, development, documentation and test. There is also a category for OFP Group Management. Beyond that, individual functions (e.g., configuration management) and projects are tracked.

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 28 Sept 1979

SUPPORT PHILOSOPHY:

AFLC needs to utilize its resources effectively and efficiently in maintaining and updating OFP's. A system entitled F-111 OFP Change and Control has been implemented in support of the F-111 aircraft. OFP's provide aircraft systems with tremendous flexibility, provided changes can be made to them in a timely manner. New aircraft capabilities, enhancements and improvements can be achieved through changes to OFP's. For example, capabilities and improvements added to the F-111 through OFP changes include SRAM alternate launch, moving target detect, expanded offset aimpoints, improved beacon bombing, enhanced fixtaking, expanded steerpoints, updated ballistics, and added avionics diagnostics. In addition, many modes have been improved, changed or deleted; navigation and bombing performance has been improved and numerous latent deficiencies corrected. This has been accomplished through some 177 OFP changes over a 3-year period.

The concept developed which permits OFP change activity of this order is the OFP Block Change. A block change is a collection of OFP changes (i.e., software changes only--no hardware impacts) which are concurrently processed and integrated (cont. on p. C-9.)

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Very formal

CHANGE REVIEW PROCESS: See pages C-10 through C-17

CONFIGURATION IDENTIFICATION METHODS: See page C-15 ff

CONFIGURATION CHANGE CONTROL METHODS: See page C-15 ff

CONFIGURATION STATUS ACCOUNTING METHODS: Within the change process a baseline tape is generated. Individual changes are then keyed in by number. See description of the "dot-files," pages C-21/22.

SOFTWARE LIBRARY CONTROL PROCEDURES:

into the baseline program over some period of time. Since changes to OFP's are viewed as a continuing task over the life cycle of the aircraft system, the block change becomes a cyclic process. Efficiency is derived through a level of effort staffing and collective OFP change processing. Responsiveness is derived by keeping the cycle time to limits acceptable to the user. Obvious tradeoffs are level of effort staffing, number of changes in a block change and cycle time. For long-term efficiency the level of effort and cycle time are fixed and the parameter that varies from block change to block change is the number of OFP changes. This, of course, varies as a function of the priorities of change candidates and the magnitude and complexity of each. Flexibility is achieved in several ways. First, emergency changes can be expedited by processing on an individual basis. Depending on change magnitude, complexity and risk, it is possible to process these changes in a matter of weeks. Further, depending on priority and complexity, changes can be added or deleted from the block change until late in the change cycle, i.e., until configuration freeze. Finally, configuration control procedures have been set up in accordance with AFR 800-14 to process Computer Program Change Proposals (CPCP's) outside of the hardware configuration change process. A CPCP is the vehicle used for identification and approval of the OFP Block Change and attendant weapon system impacts. These procedures, in addition to adding flexibility, also greatly improve the responsiveness of the change system. Of course, with flexibility of this nature, strict control and complete documentation is essential for configuration management.

OFP BLOCK CHANGE CYCLE:

Figure C-3 depicts the development cycle used for F-111 OFP Block Changes and is similiar to the standard software development cycle. It includes the major phases of analysis, feasibility, design, development, test, documentation and delivery. As shown in Figure C-3 each phase starts and finishes with well defined milestones. The cycle is periodic with a 3-month overlap and produces updated OFP's for the user on an annual basis. Tradeoffs which dictated cycle time were F-111 change activity, required user response, and available support resources. However, other practical considerations which limit the minimum cycle time are mission simulator updates, availability of test aircraft, crew training, and documentation update.

Referring to Figure C-3 the change cycle starts with a requirements review. This is a user, system manager, engineering review where problems and change requirements which have accumulated over the past year are reviewed and prioritized. The Operational Software Requirements Document (OSRD) is updated and the feasibility study defined.

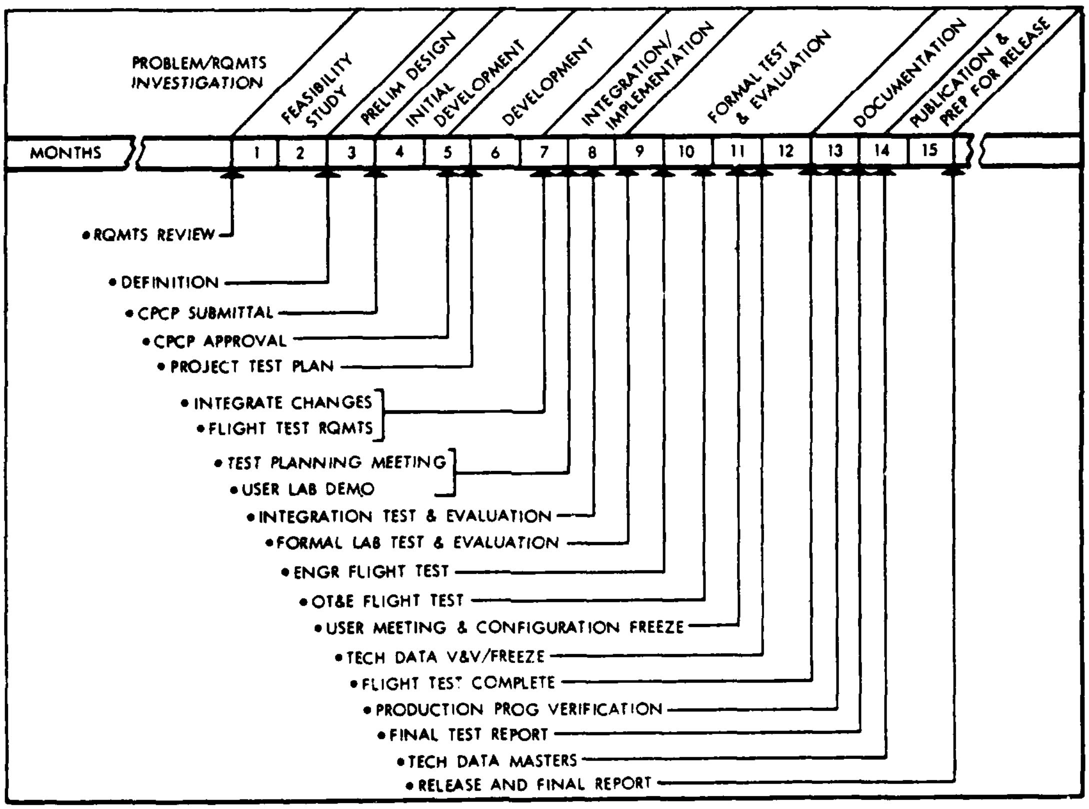


Figure C-3. Operational Flight Program Change Cycle

The Feasibility Study Phase is conducted by engineering in accordance with user priority. It primarily consists of: determining the update task for each change; scoping the resource requirements; investigating change impacts on other parts of the weapon system and support equipment; looking at computer memory and timing impacts; investigating integration problems; and determining if each change requirement is technically feasible and will actually provide the user with what is expected. The results of the feasibility study are then presented at an OFP Block Change Definition meeting attended by the user, the system manager and engineering. Based on the results of the feasibility study, an OFP Block Change Definition is established and agreed to. Constraints adhered to are: the block change contains only change candidates which do not impact hardware; the changes can be worked within existing resources; and the cycle time is maintained. Changes which do not meet these constraints are referred to the system manager for processing in accordance with hardware procedures. The main output of the feasibility study is the OFP Block Change Requirements Document.

The Preliminary Design Phase consists of: translating requirements into engineering terms; updating flow charts and logic layouts, defining mechanization, interface, scaling, and timing requirements; developing change narratives; determining the scope of impact to documentation, technical orders, mission simulator and other weapon system software; and preparing and submitting the Computer Program Change Proposal (CPCP).

The Initial Development Phase consists of: establishing the development baseline block change programs; firming up mechanization; programming and testing preliminary code; and establishing documentation files.

The Development Phase begins with the approval of the CPCP by both the user and system manager. The development phase consist of: finalizing and testing program code for each OFP change; developing engineering tapes, addendums, and documentation; developing change descriptions; developing the project test plan; developing flight test, data reduction and instrumentation test requirements; preparing test procedures; and providing preliminary data for mission simulator updates.

The Integration and Implementation Phase begins with the laboratory integration of all OFP Block Change requirements. A user/engineering meeting is convened to discuss engineering and user flight test policy and to conduct a laboratory demonstration of each OFP change. Final reassembly of all approved OFP changes with the development baseline program is accomplished and the master engineering OFP tape produced. Formal verification testing and evaluation by the development engineering group is completed. Engineering source data for technical orders and engineering documentation is developed. Formal test and evaluation procedures are finalized. The mission and weapon control programs are produced. Laboratory test and flight test aircraft configurations are established to include aircraft computer data pumps and data reduction software. These steps are in preparation for formal test and evaluation.

The Formal Test and Evaluation Phase starts with the turnover of the master engineering OFP tape to a separate engineering group for test and evaluation. Formal testing consists of a three phase laboratory test, instrumented engineering flight test, and user Operational Test and Evaluation (OT&E). Phase I of laboratory testing is a dynamic functional test of all OFP modes. When completed, the master engineering OFP tape is cleared for engineering flight test. Initial engineering

flight test looks at overall air suitability and clears the master engineering OFP tape for user OT&E. Once cleared, OT&E and final engineering flight test are conducted concurrently. Phase II and III of the formal laboratory test are also run concurrently. Phase II is a quantitative test of performance, a look at performance envelopes and an inspection of code and baseline documents. Phase III is the retesting of modifications resulting from problems discovered during test. Part way through formal testing a meeting between the user and engineering is convened to review test results and to establish an OFP Block Change configuration freeze. Mandatory corrections to program discrepancies are defined, implemented and retested; trivial anomalies are accepted; and in the event a change cannot be accomplished, its coding is removed. Also, during this phase technical order source data is verified and validated by the user, engineering and the system manager. Source inputs for the mission simulator updates are finalized and delivered. At the completion of the formal test phase, the master OFP engineering addendum tape, incorporating all corrections found during test, is merged with the master engineering OFP tape to produce the engineering OFP release tape and the final OFP Block Change documentation.

During the Documentation Phase the engineering OFP release tape is converted into a production version and tested. All engineering documentation is finalized; the technical order masters are prepared and made ready for reproduction. The evaluation of test results is completed and the final test report is issued.

During the Publication and Preparation for Release Phase the production OFP tapes are duplicated; engineering documentation and technical orders are published; the final OFP Block Change Report is issued; and the new OFPs and associated technical orders are concurrently released to the user under a TCTO.

OFP BLOCK CHANGE PROCESS AND RESOURCE UTILIZATION:

Figure C-4 depicts the F-111 OFP Block Change process. It illustrates several significant points: process flow; resource utilization; and major input/output products. The OFP Block Change process from start to finish is highly technical, and primarily involves engineering and engineering resources. However, system management, technical publications and user participation are essential. The system manager has complete responsibility for the control, coordination and integration of OFP changes into the overall integrated logistics management support system and participates to that extent. The user is intimately involved during feasibility and change definition to establish requirements and priorities, and to assure that requirements are properly interpreted. Further, the user actively participates during the integration and test phases so that performance can be verified and acceptance granted prior to configuration freeze and OFP release. The user's primary participation during these phases is in the laboratory verification. During the documentation, publication and preparation for release phases, the system manager and technical publications are extensively involved in the preparation and publication of technical orders, the duplication of OFP tapes and the preparation of the TCTO for release. Engineering is responsible for the technical management, planning and direction of the complete OFP change program and is also responsible for the development and implementation of all OFP changes. Therefore, engineering is actively involved in all phases both from the program management and technical detail aspects.

As noted in Figure C-4 the engineering resource utilized throughout the OFP change process is the Avionics Integration Support Facility (AISF). Figure C-5

the F-111 AISF which consists of an avionics integration area, subsystem test area, OFP dynamic simulation area, computer support area and instrumented flight test aircraft. The integration, simulation and computer support areas are used extensively throughout the change process while the flight test capability is extensively used during the test and evaluation phase.

The integration area, which contains avionics integraton test equipment (ITE), is used to integrate the OFPs with the avionics system. It further is used to recreate flight problems; check hardware/software interfaces; evaluate timing, stabilization and synchronization; and to conduct final OFP/avionics system compatibility tests. On-line OFP change capability is available in this area which enables efficient and expedient implementation of trial solutions.

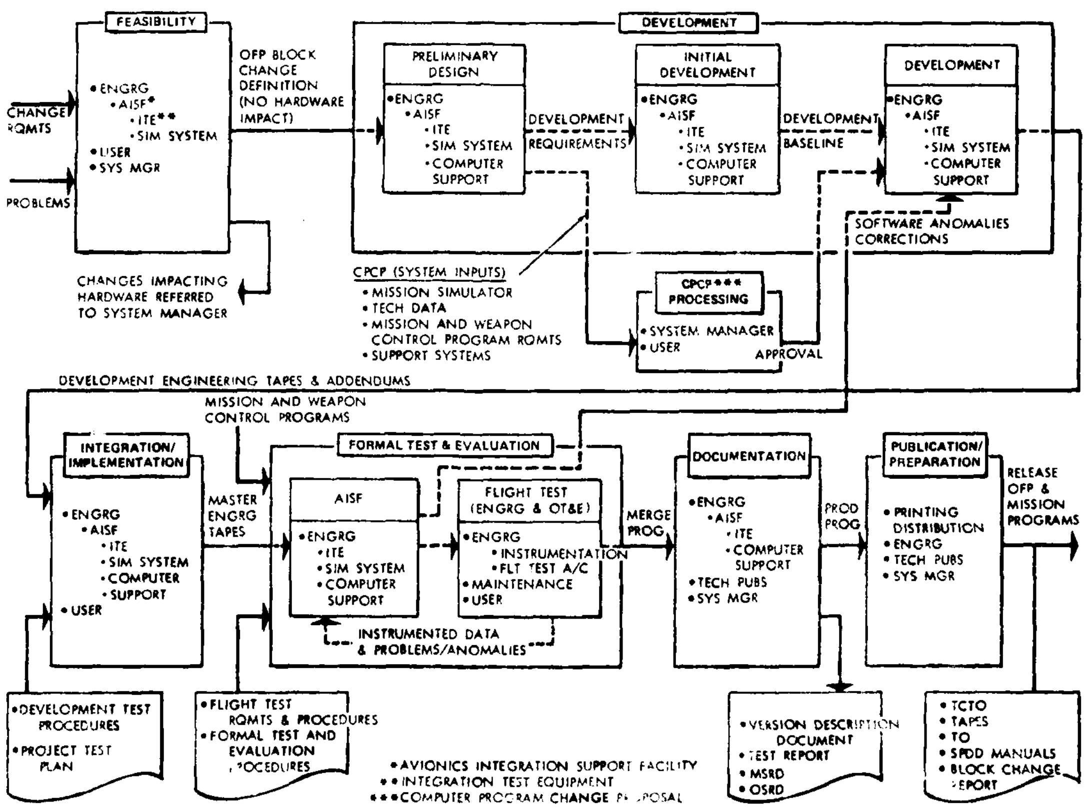


Figure C-4. OFP Change Process

The F-111 OFP dynamic simulation area provides a unique capability to quantitatively analyze, develop, test and evaluate OFP's and OFP changes under realistic and repeatable conditions. The systems are hybrid simulators which retain the avionics computers with their resident OFP's and simulate the world as seen by these computers in actual flight. Complete visibility is gained into the innermost parts of the OFP's through data monitoring and acquisition systems which provide for full real-time traces of OFP execution. Each simulation system is made up of three Harris Corporation 6024/VM mini-computer systems, an aircraft cockpit mock-up, special interface devices and a simulation software package.

The computer support area satisfies all computer support requirements associated with maintaining and updating OFP's. These requirements include reassembly; data reduction and analysis; documentation generation, maintenance and storage; maintenance of support software; specialized programs and programming; and automated configuration control. The reassembly and automated documentation generation process is shown in FigureC-6. The computer support system includes two Interdata 8/32 mini-computer systems, a PDP 11/40 mini-computer system and a remote terminal to an IBM 360/65 complex.

The flight test capability includes EI coded F-111 aircraft equipped with special instrumentation packages designed specifically for monitoring and recording OFP flight performance. Flights are conducted to test overall OFP performance and air suitability; analyze change and problem areas; test specific modes and functions; and to obtain engineering data to define and verify system performance.

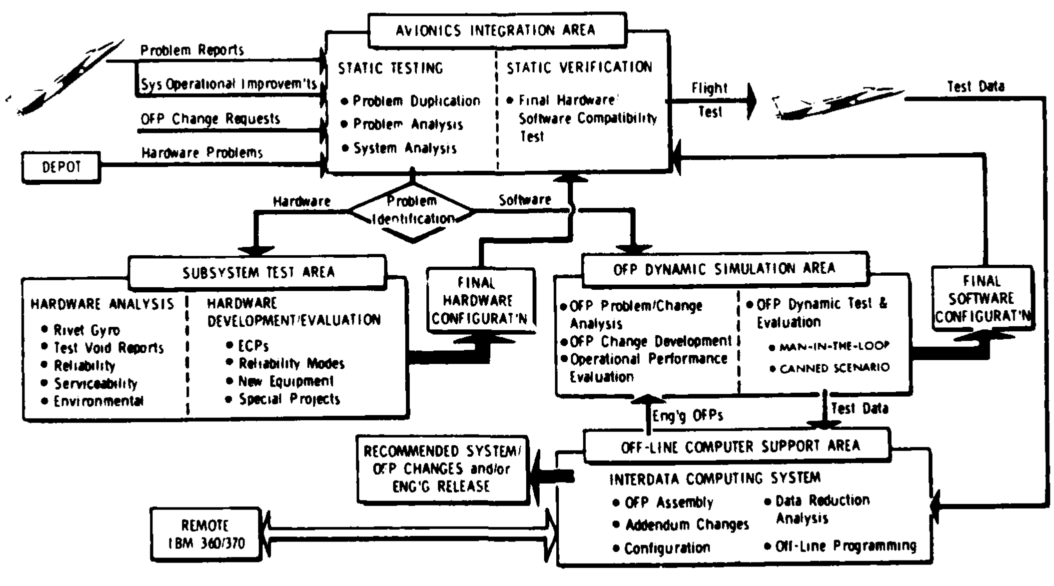
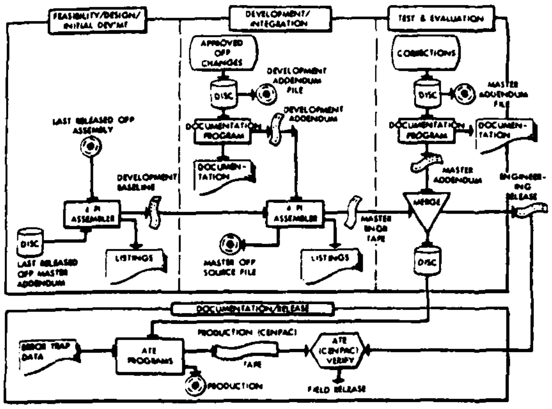


Figure C-5. F-111 Avionics Integration Support Facility



FigureC-6. OFP Tape and Automated Documentation Generation

The AISF technical staff consists of engineers, programmers and technicians. They encompass a spectrum of expertise on the aircraft system, avionics, computers, operational software, support software, bomb navigation, scientific programming, instrumentation, data reduction, systems analysis, configuration management, and equipment and software maintenance.

OFP TAPE AND AUTOMATED DOCUMENTATION GENERATION:

The key to efficiently making OFP changes and controlling configuration lies in an automated process for generating OFP's and all associated documentation. Figure C-6. illustrates the F-111 OFP Tape and Automated Documentation Generation System which ultimately will satisfy this goal. To date the process performs the reassembly, documentation/ addendum generation, merge, and production program conversions. The output products are engineering and production tapes, program listings, computer files, and documentation.

The process starts with the reassembly of the last released OFP to incorporate the Master Addendum changes along with subsequent changes to optimize program coding for memory and timing benefits. The output consists of the development baseline OFP. Inputs to the Documentation Program during development and integration include engineering development data, reassembly code and the specific machine code for the preparation of engineering addendum tapes. The documentation and files generated from the Documentation Program include: OFP change descriptions and requirements, change objectives, status, mechanization, assembly code, machine code (for key-ins and addendums); flight test, instrumentation and data reduction requirements; test procedures, technical order impacts and historical data. This information is continuously updated during the OFP Block Change cycle. Prior to formal test and evaluation the final development addendum is reassembled with the development baseline to produce the master reassembled engineering baseline. The final OFP Block Change configuration or engineering release is defined by the reassembled engineering baseline and the Master Addendum. Formal testing

is accomplished only with the computers loaded with the baseline OFP and an approved or Master Addendum thereby assuring a completely documented and controlled configuration. Current plans are to enhance the system such that all configuration control documentation listed in Figure C-7 can be produced using this system.

OFP CONFIGURATION CONTROL DOCUMENTS:

The OFP Change and Control System provides for extreme flexibility and therefore, strict control is essential if OFP configuration is to be maintained. The management control aspects associated with OFP changes, and the change process, have been described; however, essential to configuration control and management is good documentation. Since software is intangible (can't see or touch it), the documentation must be very thorough in describing its functional and performance characteristics. Equally as important is the requirement to have total visibility as to how these characteristics were derived. Without documentation that does these things, the on-going change process would eventually collapse. Figure C-7 illustrates what is considered a complete set of OFP configuration control documents and where in the F-111 OFP change cycle these documents are completed and available. The list is confined to the end item OFP and is not intended to include documentation on supporting resources, support software or other portions of the weapon system impacted by the OFP changes. A similar set of documents is obviously required for these areas. An exception to this is in the formal test and evaluation process. As noted in Figure 7, documents defining the test configuration of the laboratory, test aircraft, and mission and weapon control programs are required. If and when other test resources are used in formal testing, their configuration should also be documented and become a part of the OFP configuration control documents. As shown in Figure 7, the physical documentation includes both automated and manually prepared documents as well as computer stored programs.

Current change requirements and problems are documented in the Operational Software Requirements Document (OSRD). A historical list of all requirements and problems, including those listed in the OSRD, is maintained in the Master Software Requirements Document (MSRD). All OFP source programs and programs generated after the final OFP Block Change assembly are stored on magnetic tape and hard copy listings are maintained on microfilm or microfiche. The OFP Block Change Requirements Document defines the initial block change definition while the final release configuration is documented using the previously described Documentation Program. These documents become a part of the OFP Block Change Version Description Document (VDD). The Computer Program Change Proposal becomes the system manager's official configuration control document and is updated as required to reflect the final released OFP configuration. All formal test requirements, plans, procedures, and reports become a part of the VDD and are a record of actual OFP performance. The OFP Block Change Report is a summary of total block change activity and results. The System Program Description Document (SPDD) is the actual OFP specification and is updated with each block change. It describes each of the OFP subroutines in detail and includes: narrative descriptions, inputs/outputs, interfaces, logic, timing, equations, and flow charts. The VDD is the historical record of the OFP Block Change and includes all other block change documents. In summary, the OFP source data, SPDD and program listings actually define the newly released OFP and the VDD defines the OFP Block Change to it. Technical orders generally aren't considered configuration control documents but are shown because of their importance to the user and because of the detail they offer in describing the OFP's and their relationship to the aircraft system operation. With the exception of the technical orders, all documentation is stored and maintained by engineering.

CONTINUATION SHEET - CHANGE REVIEW PROCESS AND CONTROL METHODS DATE: 28 Sept 1979

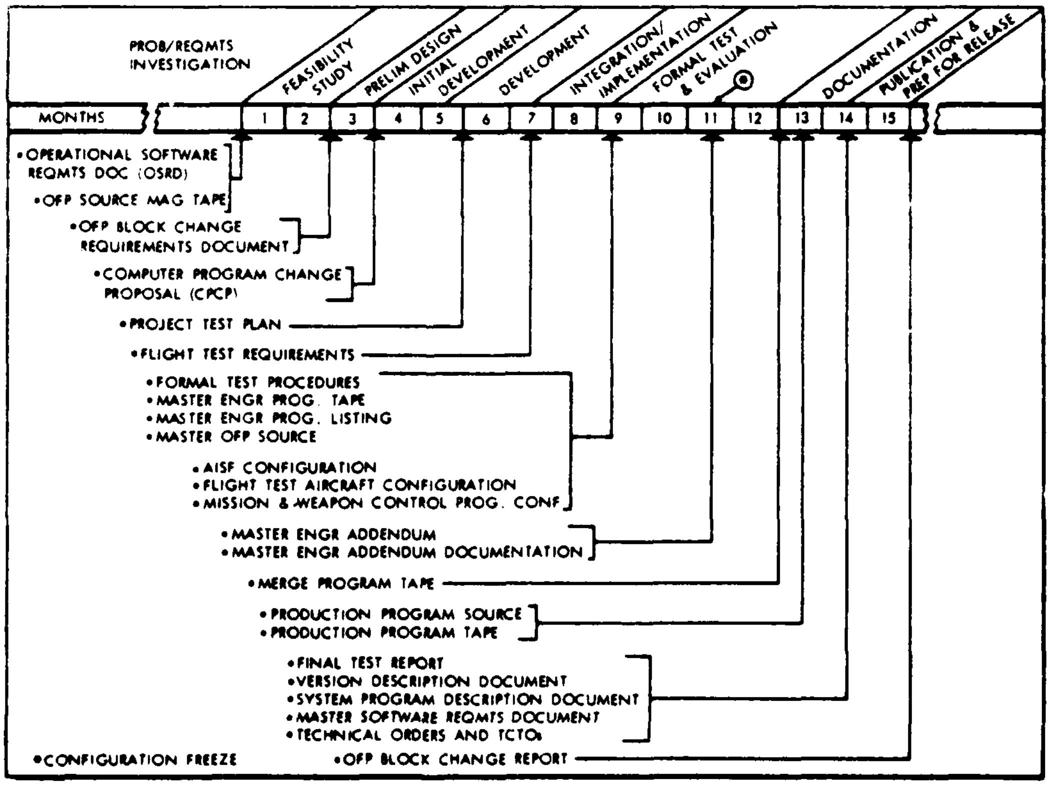


Figure C-7. OFP Configuration Control Documents

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 28 Sept 1979

STRUCTURED DESIGN? – DESCRIBE Minimal
STRUCTURED PROGRAMMING? – DESCRIBE Minimal
CODING GUIDELINES: Experience - A small group of mechanization engineers is used on each aircraft.
CHANGE ENTRY METHODS: CRT terminal. Interdata is used for an on-line record.
SCHEDULE: Formal published milestones, formal block change schedule.
REPORTING: Informal in-house reporting. Formal reports to users are via scheduled meetings (Ref. Figure 3, p. C-10).
COMMENTS:

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 28 Sept 1979

DOCUMENTATION:

REQUIREMENTS: Current requirements are defined in meeting minutes and in change summaries developed by engineers. See Computer Program Change Request on p. C-20.

DESIGN: The "dot" files are used for design documentation. They are described on pp. C-21 and C-22.

USER: User documentation is provided through formal changes to the system tech orders.

See Documentation Guide, pp. C-23 through C-42.

PROGRAM PROBLEM REPORTING SYSTEM:

Users generate Computer Program Change Requests. These are formally logged by MMECP, then analyzed/prioritized at the Requirements Review Meeting with users.

COMMENTS:

CONTINUATION SHEET DATE: 28 Sept 1979

COMPUTER PROGRAM CHANGE REQUEST

Entered by SM/ALC

I.D. Number __________

1. TITLE: Enter descriptive title 2. DATE: Enter prepared date

3. COMPUTER PROGRAM IDENTIFICATION:

Enter identification of program affected

4. DESCRIPTION/PRESENT OPERATION:

Describe in detail the characteristics of computer operation or use as presently mechanized, including aircrew actions, observed reactions of various cockpit displays correlated with inputs to the system (including aircraft maneuvering or switch changes), any test data available, and any other information which might assist in identifying the cause or which might aid in implementing the correction or change.

5. DESIRED OPERATION:

Describe the characteristics of computer operation or use desired as a result of this change, using the same guidelines as under "Present Operation."

6. REASON FOR CHANGE:

Present the rationale behind the need for this change, emphasizing the relative importance of the current problem and the desired result.

7. CHANGE HISTORY/RELATED CHANGES:

Information to be supplied by Sacramento ALC

8. REQUESTED BY: Person to be contacted for further information. Name Orgn Phone	9. REQUESTING AGENCY: COORDINATION Wing coordination Name Phone
10. REQUESTING COMMAND: APPROVAL SAC/TAC/USAFE Name Phone	11. SUPPORTING AGENCY: APPROVAL SM/ALC Name Phone

CONTINUATION SHEET — Documentation (Dot Files) DATE: 28 Sept 1979

File Designation	File Content and Structure
axxx	File series name: a indicates aircraft series; xxx is change number.
axxx.P	CHANGE STATEMENT — File is for insertion of a change statement. TITLE: CHANGE REQUIREMENT: CURRENT MECHANIZATION: OBJECTIVE: NOTES: STATUS:
axxx.M	MECHANIZATION — A narrative which is source data for update. Note if change as mechanized is different from requirement. DATE OF LAST UPDATE: DESCRIPTION:
axxx.K	KEYINS — For generating addendum tapes. Machine language code for patches entered prior to executing a compiled OFP. Assembly language statements are not required but provide design interpretation of ML code. Note required General Navigation Computer and Weapons Delivery Computer cues. $GNC — KEYINS LOC IS WAS CORRESPONDING AL CODE (address) (revised ML code) (old ML code) $END $WDC — KEYINS LOC IS WAS AL CODE $END
axxx.R	REASSEMBLY — Similar to KEYIN, but used to reassemble a program. $GNC — REASSEMBLY (Exact card image, punched cards format previously used for reassembly) $END

CONTINUATION SHEET — Documentation (Dot Files) **DATE:** 28 Sept 1979

File Designation	File Content and Structure
axxx.I	TEST PROCEDURES — Step-by-step test procedure to checkout a change.
axxx.F	FLIGHT TEST REQUIREMENTS — Contains information for flight test of OFP change. Contains summary of change and requirements for test execution (digital channels, test parameters, success criteria, et.al.).
axxx.G	GLOSSARY — List of any new labels or mnemonics.

DOCUMENTATION GUIDE FOR

MMECP SOFTWARE

14 DECEMBER 78

COMPILED BY

CONFIGURATION MANAGEMENT

I N D E X

P A G E	C O N T E N T S

DOCUMENTATION STANDARD 1

PROGRAMS

```
CM TITLE                 :  TITLE OF PROGRAM
CM
CM DATE OF LAST CHANGE:
CM
CM PROGRAMMER            :
CM
CF EXPLANATION           :  STATE WHAT THE PROGRAM DOES.
CF
CF OVERVIEW              :  OUTLINE THE LOGIC STRUCTURE.
CF
CF VARIABLES             :  SEPARATELY DEFINE EACH VARIABLE WHOSE NAME DOES
CF                          NOT ADEQUATELY DESCRIBE ITS FUNCTION, TYPE, OR
CF                          USAGE.
CF
CI EXTERNALS             :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                          DATA FILES ACCESSED BY THE PROGRAM AND THEIR
CI                          LOCATION.
CI
CI REMARKS               :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                          UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                          THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                          NECESSARY TO UNDERSTAND THE PROGRAM.
CI
CO USER'S GUIDE          :  A USER'S GUIDE IN THE SOURCE LISTING IS
CO                          OPTIONAL.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING, EITHER 8080 OR ASSEMBLED
USER'S GUIDE
LOCATION OF JOBSTREAMS/CSS FILES OR MACROS
ASSOCIATED WITH THE PROGRAM

DOCUMENTATION STANDARD 2

SUBROUTINES

```
CM TITLE                  :  TITLE OF SUBROUTINE
CM
CM DATE OF LAST CHANGE:
CM
CM PROGRAMMER             :
CM
CF EXPLANATION            :  STATE WHAT THE SUBROUTINE DOES.
CF
CF PARAMETERS             :  DEFINE VARIABLES WHICH ARE PASSED TO AND FROM
CF                           THE SUBROUTINE.
CF
CI EXTERNALS              :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                           DATA FILES ACCESSED BY THE SUBROUTINE OR WHICH
CI                           CALL THIS SUBROUTINE.
CI
CI REMARKS                :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                           UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                           THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                           NECESSARY TO UNDERSTAND THE SUBROUTINE.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING

DOCUMENTATION STANDARD 3

LIBRARY ROUTINES

```
CM TITLE                : TITLE OF LIBRARY ROUTINE
CM
CM ENTRY POINTS         :
CM
CM LIBRARY NAME         :
CM
CM DATE OF LAST CHANGE  :
CM
CM PROGRAMMER           :
CM
CF EXPLANATION          : STATE WHAT THE LIBRARY ROUTINE DOES.
CF
CF OVERVIEW             : OUTLINE THE LOGIC STRUCTURE.
CF
CF PARAMETERS           : DEFINE VARIABLES WHICH ARE PASSED TO AND FROM
CF                        THE ROUTINE.
CF
CI EXTERNALS            : LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                        DATA FILES ACCESSED BY THE LIBRARY ROUTINE.

   REMARKS              : INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                        UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                        THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                        NECESSARY TO UNDERSTAND THE LIBRARY ROUTINE.
CI
CO USER'S GUIDE         : A USER'S GUIDE IN THE SOURCE LISTING IS OPTIONAL.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING
USER'S GUIDE

****

BOILER PLATES FOR THE STANDARDS ARE CONTAINED IN THE FOLLOWING LOCATIONS:

```
     INTERDATA: SYST:DOCSTD.FRM/S
       HARRIS: SYST*DOCSTD
 RECORD NUMBER: PROGRAM 5-45; SUBROUTINE 50-80; LIBRARY ROUTINE 85-125
```

EXAMPLE: PROGRAM DOCUMENTATION

```
CM TITLE               : PACKPURGE
CM
CM DATE OF LAST CHANGE: 30 OCT 78
CM
CM PROGRAMMER          : B. BARTHELDW
CM
CF EXPLANATION         : THIS IS A PURGE PROGRAM FOR USE BY CONFIGURATION
CF                       MANAGEMENT. THE PROGRAM WILL REQUEST A PACK NUMBER
CF                       FROM THE USER AND PROCEED TO PURGE ALL DATA FILES
CF                       NOT ACCESSED WITHIN THE PREVIOUS 7 DAYS.
CF
CF OVERVIEW            : PROGRAM PACKPURGE;
CF                          INITIALIZATION;
CF                              WHILE PACKPURGE NOT COMPLETE
CF                                  DO BEGIN
CF                                      GETAREAINFO;
CF                                      IF PROGTYPE .EQ. DATA-AREA
CF                                      THEN BEGIN
CF                                            IF QUALIFIER .NE. 0000SYST
CF                                            THEN BEGIN
CF                                                  IF LASTACCESS > SEVENDAYS
CF                                                  THEN ELIMINATEAREA;
CF                                                  END;
                                              END;
CF                                      END;
CF
CI VARIABLES           : PARLST IS THE PARAMETER LIST AND BUFFER AREA FOR
CI                          SDASAVE
CI                       ELIST IS THE PARAMETER LIST FOR THE SYSTEM
CI                          ELIMINATE ROUTINE
CI                       ALL VARIABLES ARE GLOBAL
CI
CI  EXTERNALS          : NONE
CI
CI  REMARKS            : THE PROGRAM IS COMPILED AS A FORTRAN PROGRAM FOR
CI                          EASE OF I/O.
CI                       DUE TO THE INTERNAL OPERATION OF VULCAN, THIS
CI                          PROGRAM MUST BE RUN AS *ACUTIL IN ORDER TO
CI                          UTILIZE THE SYSTEM ROUTINE SDASAVE. IN ORDER
CI                          TO EFFECT THIS THE PROGRAM SHOULD BE EXECUTED
CI                          BY A JOB STREAM FILE WHICH RENAMES ACUTIL TO
CI                          TEMP, PACKPURGE TO ACUTIL, EXECUTES ACUTIL
CI                          AND UPON COMPLETION RENAMES ACUTIL TO
CI                          PACKPURGE, TEMP TO ACUTIL.
CI
CI
CI
      WRITE(3,900)
900   FORMAT(" ENTER PACK # TO BE PURGED")
      READ(3,901) IPACK
 1    FORMAT(I3)
      WRITE(3,902) IPACK
902   FORMAT(2X,I3)
```

```
          STOP
  JSE
QLTEST  BLOK 1
PARLST BLOK 24
RLIST BLOK 1
ELIST BLOK 1
ARCNT BLOK 1
          TMA    IPACK
          TAM    PARLST+0
          TLO    PARLST
          BLJ    SDASAVE        FIRST CALL TO DASAVE
          DATA   1             FUNCTION CODE TO GET ALL AREAS
          BOZ    DONE           NO AREAS EXIT
          TEM    ARCNT        NUMBER OF AREA BLOCKS RETURNED * 20 WORDS/BLOCK
          BLU    STIME          GET TODAYS DATE
          SDE    7              SUBTRACT 7 DAYS
          TEM    PDATE          INITIALIZE PURGE DATE
MLOOP     BLJ    GTAREA        SET K REGISTER TO AREA BLOCK
          BOZ    DONE           NO MORE AREAS TO PROCESS
          TMA    6,K            CHECK IF DATA FILE OR PROGRAM FILE
          BON    MLOOP          PROGRAM FILE GET NEXT AREA BLOCK
          BLJ    QLTEST       CHECK IF 0000SYST QUALIFIER
          BNZ    MLOOP          YES, GET NEXT AREA BLOCK
          BLJ    ACCESS         CHECK LAST ACCESS
          BON    MLOOP          WITHIN 7 DAYS GET NEXT AREA BLOCK
          BLJ    ELIM           TO LONG ELIMINATE IT
          BUC    MLOOP          GET NEXT AREA BLOCK
*
*                      GETAREA ROUTINE
*                      ===============
*
*          ON ENTRY TO THIS ROUTINE LOC ARCNT CONTAINS CURRENT BUFFER
*          POINTER.
*          SUBTRACT 20 (AREABLOCK SIZE).
*          IF NOT POSITIVE DACALL ELSE MOVE POINTER TO K REGISTER & RETURN.
*          DACALL:
*                  CALLS SDASAVE.
*                  TRANSFERS BUFFER COUNT TO AREACOUNT.
*                  RETURNS TO MAINLINE IF NOTHING IN BUFFER I.E DONE.
*                  ELSE RE-ENTERS GETAREA.
*
*
*
GETAREA   AOM    -20            MOVE POINTER TO NEXT AREA DATA IN BUFFER
         DAC    ARCNT      ADDRESS OF LOCATION TO ADD TO
         BNP    DACALL         BUFFER COMPLETELY PROCESSED GET NEXT BUFFER
         TMK    ARCNT        MOVE POINTER TO K REGISTER
         BUC    0,J            RETURN TO MAINLINE
DACALL   TLO    PARLST        GET ADDRESS OF PARAMETER LIST
         BLJ    SDASAVE        CALL SYSTEM ROUTINE
         DATA   0              NOT THE FIRST CALL SO 0 HERE
         BNZ    S40            PROBLEMS  SEND ERROR MESSAGE
         TEM    ARCNT        MOVE BUFFER SIZE TO ARCNT
         BOZ    BUC0J          ALL DONE RETURN WITH ZERO FLAG SET
         BUC    GTAREA        GO SET POINTER
```

```
*                   ELIMINATE ROUTINE
*                   =================
*
*         MOVES AREANAME AND QUALIFIER FROM BUFFER TO $ELIMINATE PRAM LIST
*         ELIMINATES FILE
*         RETURNS TO MAIN
*
*
ELIM      TMD    0,K            GET AREANAME FROM BUFFER
          TDM    ELIST          PUT IN PRAM LIST
          TMD    8,K            GET QUALIFIER FROM BUFFER
          TDM    ELIST+2        PUT IN PRAM LIST
          BNZ    $41            PROBLEM  SEND ERROR MESSAGE
          BUC    0,J            RETURN
*
*
*
*
*                   ACCESS ROUTINE
*                   ==============
*
*        GETS LAST ACCESS DATE AND PURGE DATE.
*        SUBTRACTS PURGE DATE FROM ACCESS DATE.
*        RETURNS.

*
ACCESS     TME   17,K        GET LAST ACCESS DATE
           TMA   DTIME       GET PURGE DATE
           SAE               SUBTRACT
BUCOJ      BUC   0,J
$END
C
C
C          THE FOLLOWING DISPLAYS ERROR MESSAGE FOR $DASAVE ERROR
C
C
40     WRITE(3,400)
400    FORMAT(" ERROR IN $DASAVE ROUTINE CONTACT PROGRAMMER")
C      GO TO 50
C
C
C          THE FOLLOWING DISPLAYS ERROR MESSAGE FOR $ELIM ERROR
C
41     WRITE(3,410)
410    FORMAT(" ERROR IN $ELIMINATE ROUTINE CONTACT PROGRAMMER")
C
C
C          COMMON EXIT LOGIC
C   50     REWIND 10
C   51     READ(10,500)VARIABLE LIST
         IF(EOF)GO TO 60
C      WRITE(6,502)VARIABLE LIST
C      GO TO 51
C     60     CLOSE 3 6
       END
```

EXAMPLE: SUBROUTINE DOCUMENTATION

```
      SUBROUTINE GTDATE(TEMP)
CM
CM TITLE                 :  GTDATE
CM
CM DATE OF LAST CHANGE:  8 NOV 78
CM
CM PROGRAMMER            :  M.TAYLOR & J.CLAAR
CM                          REVISION 1 - N. TEAGUE
CM
CF EXPLANATION           :  THIS SUBROUTINE CONVERTS AN ALPLHABETIC MONTH
CF                          NAME TO A NUMERIC VALUE.  THIRTEEN DAYS ARE
CF                          ADDED TO THE DATE TO ALLOW FOR CHECKING FOR
CF                          DELINQUENT TASK REQUESTS.  CROSS-OVER TO THE
CF                          NEXT MONTH AND/OR YEAR IS TAKEN INTO ACCOUNT.
CF
CI PARAMETERS            :  TEMP - ALPHANUMERIC INPUT/OUTPUT OF DATE;
CI                                FORMAT I
CI
CI EXTERNALS             :  CALLED BY MAIN
CI                          LOCATED IN TRISMAIN
CI
CI REMARKS               :  DATES WILL NOT BE CONVERTED BEYOND THE YEAR 1999.

CI
C     DATA DEFINITION
      INTEGER TEMP(3),YDATE(12,2)
      COMMON /IDATE/YDATE
C     END DATA DEFINTION
C     GET NUMERIC DATE FOR TEST IN CALLING ROUTINE
      DO 10 I=1,12
      IF(TEMP(2).EQ.YDATE(I,1)) GO TO 20
10    CONTINUE
      WRITE(3,1000) TEMP(2)
1000  FORMAT('0 MONTH GIVEN ('A4,') IS WRONG ',/,'  ENDING SESSION')
      CALL EXIT
C     SET ALPHA MONTH TO NUMERIC MONTH
20    TEMP(2)=I
C     ADD IN 13 FOR TWO WEEK CHECK
      TEMP(1)=TEMP(1)+13
C     CHECK TO SEE IF IT IS INTO ANOTHER MONTH
      IF(TEMP(1).LE.YDATE(I,2)) GO TO 9999
C     YES SUBTRACT OUT FOR DAYS INTO NEW MONTH
      TEMP(1)=TEMP(1)-YDATE(I,2)
C     INCREMENT MONTH COUNTER
      TEMP(2)=TEMP(2)+1
C     CHECK TO SEE IF INTO NEW YEAR
      IF(TEMP(2).LE.12) GO TO 9999
     ADD TO YEAR COUNTER (WILL NOT WORK FROM 1999 TO 2000)
      TEMP(3)=TEMP(3)+1
C     END OF DATE ROUTINE
9999  RETURN
      END
```

EXAMPLE: LIBRARY SUBROUTINE DOCUMENTATION

```
CM TITLE                 : JULBIN
CM
CM ENTRY POINTS          : JULBIN
CM
CM LIBRARY NAME          : OFPLIB
CM
CM DATE OF LAST CHANGE:  8 MAY 77
CM
CM PROGRAMMER            : KARL W RASS
CM
CF EXPLANATION           : THE BUFFER STARTING AT IBUFF AND FOR NCHAR BYTES LONG
CF                         IS SCANNED LOOKING FOR A VALID DATE AND TIME IN ASCII.
CF                         THE DATE IS CONVERTED TO A BINARY WORD AND THE TIME IS
CF                         CONVERTED TO ANOTHER BINARY WORD.  THE APPROPRIATE
CF                         STATUS IS RETURNED.  THE DATE CAN BE EITHER IN INTERDAT
CF                         (E.G. 24/01/77) OR CONVENTIONAL (24 JAN 77) OR JULIAN
CF                         (77.024).  TIME IS IN HH:MM:SS AND IF NONE IS GIVEN
CF                         THEN 12:00:00 IS ASSUMED.
CF
CF OVERVIEW              : SCAN THE BUFFER
CF                            IF THE FORM IS JULIAN
                                  CONVERT THE DATE TO BINARY
CF                                CONVERT THE TIME TO BINARY
CF                                RETURN
CF                            IF THE FORM IS DD/MM/YY OR DD/MMM/YY
CF                                IF THE YEAR IS LEAP YEAR
CF                                   IF THE MONTH IS LATER THAN FEB.
CF                                      ADD 1 DAY TO TOTAL DAYS IN DATE
CF                                CONVERT DATE TO BINARY
CF                                CONVERT TIME TO BINARY
CF                                RETURN
CF
CI PARAMETERS            : INPUT:
CI                            IBUFF = BUFFER START ADDRESS WHERE THE DATE/
CI                                    TIME IS LOCATED
CI                            NCHAR = LENGTH IN BYTES OF IBUFF; I4 FORMAT
CI
CI                         OUTPUT:
CI                            IBIN = IBIN(1) IS BINARY DATE
CI                                   IBIN(2) IS BINARY TIME
CI                            ISTAT = STATUS; RANGE -6 - 0; I4 FORMAT
CI
CI EXTERNALS             : CALLS FSCAN; LOCATED IN SYS:USER LIBRARY
CI
CI REMARKS               : AFTER CALLING JULBIN, SUBROUTINE JULIAN MUST BE
CI                         CALLED TO CONVERT THE BINARY DATA TO JULIAN
CI                         FORMAT.  LEAP YEAR CALCULATIONS WILL BE INCORRECT
                           BEGINNING WITH LEAP YEAR 1980.
.PROG JULBIN                                                                98
```

```
 '***************************************************************
      SUBROUTINE JULBIN(IBUFF,IBIN,NCHAR,ISTAT)
C
C***************************************************************
      DIMENSION IMONTH(12),ITEXT(2),ITABLE(12),IBIN(2),IDELIM(3)
C
      DATA IMONTH/'JAN ','FEB ','MAR ','APR ',
     *            'MAY ','JUN ','JUL ','AUG ',
     *            'SEP ','OCT ','NOV ','DEC '/
C
      DATA ITABLE/0,31,59,90,120,151,181,212,243,273,304,334/
C
      DATA IDEC/'.    '/,ICOLON/':    '/
      DATA IDELIM /'/            '/
C
C     FINDING OUT IN WHAT FORM THE BUFFER IS IN
C
      CALL FSCAN('SCINIT',NCHAR,IBUFF)
      CALL FSCAN('DLIM',1,IDELIM,IREGA)
      CALL FSCAN('GTDISP',IDISP)
      CALL FSCAN('TEXT',ITEXT,LENGTH)
C
C     IF THE FORM IS IN JULIAN( YR,DAY) GO TO 70
C
      IF(LENGTH .EQ. 6) GO TO 70

C     FORM MUST NOW BE IN DAY MONTH YR
C                             02  DEC   75
C                             02/12/75
      CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('NUMBER',IDAY,NNUM,LENGTH)
      IF(IDAY .GE. 32 .OR. IDAY .LE. 0) GO TO 990
C
C     IF THE FORM IS IN DD/MM/YY (02/12/75)
C
      CALL FSCAN('GTDISP',IDISP)
      CALL FSCAN('NUMBER',IMON,NNUM,LENGTH)
      IF(IMON .LT. 0) GO TO 2
      IF(IMON .EQ. 0 .OR. IMON .GT. 12) GO TO 991
      ITEXT(1) = IMONTH (IMON)
      GO TO 3
C
C     IF THE FORM IS DD MMM YY (02 DEC 75)
C
2     CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('TEXT',ITEXT,LENGTH)
      IF(LENGTH .NE. 3) GO TO 991
3     CALL FSCAN('NUMBER',IYR,NNUM,LENGTH)
      IF(IYR .GT. 99 .OR. IYR .LT. 0 ) GO TO 992
```

```
C
      DETERMINING IF YEAR IS LEAP YEAR
C
      DO 5 J=1,24
      ILEAP = 4*J
      IF( IYR .EQ. ILEAP) GO TO 30
5     CONTINUE
C
C     NON-LEAP YEAR CALCULATIONS
C
      DO 10 I = 1,12
      IF(ITEXT(1) .EQ. IMONTH(I)) GO TO 20
10    CONTINUE
      GO TO 991
20    NDAYS = ITABLE(I) + IDAY
      IYR   = IYR *(2**16)
      IBIN(1) = IYR + NDAYS
      GO TO 80
C
C     LEAP YEAR CALCULATIONS
C
30    DO 40 I = 1,12
      IF(ITEXT(1) .EQ. IMONTH(I)) GO TO 50
40    CONTINUE
      GO TO 991
50    IF(I .GT. 2) IDAY = IDAY + 1
      NDAYS = ITABLE(I) + IDAY
      IYR   = IYR *(2**16)
      IBIN(1)= IYR + NDAYS
      GO TO 80
C
C     IF THE DATE IS IN JULIAN FORMAT(YR,DAY)
C
70    CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('STCHAR',IDEC)
      CALL FSCAN('NUMBER',IYR,NNUM,LENGTH)
      IF(IYR .GT. 99  .OR. IYR .LT. 0) GO TO 992
      CALL FSCAN('NUMBER',IDAY,NNUM,LENGTH)
      IF(IDAY .GT. 366 .OR. IDAY .LT. 0) GO TO 990
      IBIN(1) = IYR * (2**16) + IDAY
C
C     PICKING UP THE TIME (HR:MIN:SEC)
C
80    CALL FSCAN('STCHAR',ICOLON)
      CALL FSCAN('NUMBER',IHR,NNUM,LENGTH)
      IF(IHR.LT. 0 .OR. IHR.GT. 24) GO TO 993
      CALL FSCAN('NUMBER',MIN,NNUM,LENGTH)
      IF(MIN .LT. 0 .OR. MIN .GT. 60) GO TO 994
      CALL FSCAN('NUMBER',ISEC,NNUM,LENGTH)
      IF(ISEC .LT. 0 .OR. ISEC .GT. 60) GO TO 995
```

```
      IBIN(2) = 36000 * IHR+ 600 * MIN + 10 *ISEC
      ISTAT = 0
      RETURN
C
C     DEFAULT OF NOON FOR THE TIME
C
90    IBIN(2) = 36000*12
      ISTAT = 0
      RETURN
C
C     ERRORS IN BUFFER PASSED
C
C     INVALID DAY   = -1
C     INVALID MONTH = -2
C     INVALID YEAR  = -3
C     INVALID HR    = -4
C     INVALID MIN   = -5
C     INVALID SEC   = -6
C
990   ISTAT = -1
      RETURN
991   ISTAT = -2
      RETURN
992   ISTAT = -3
      RETURN
993   IF(IHR .EQ. -2) GO TO 90
      ISTAT = -4
      RETURN
994   ISTAT = -5
      RETURN
995   ISTAT = -6
      RETURN
      END
```

USER'S GUIDE PROCEDURES

1. PURPOSE

Give a general description of the program stating its purpose and function.

2. INPUT

Describe the input including format, content, input media, and sequencing.

3. OUTPUT

Describe the output including format, content, and output media.

4. OPERATING PROCEDURES

List the step by step procedures required to:

1. Initiate the program.
2. Maintain operation.
3. Terminate and restart the program.

Give an operational example.

5. RESTRICTIONS

Describe any limitations such as size of input, computer processor used, system space required, etc.

6. APPLICABLE ERROR MESSAGES

List any error message which may be displayed due to improper input, file generation error, etc.

4-PI ASSEMBLER USERS' GUIDE

1. PURPOSE

The major objective of the 4-PI Assembler rewrite project is to allow complete processing of 4-PI programs at SMALC. At this time, a syntaxing version of the assembler exists for use. This version accepts an ordinary 4-PI Assembler input file and creates from it a syntaxed and cross-referenced listing of the input. For complete documentation on the use of the assembler, refer to the IBM CP-2 and 4-PI manuals.

2. INPUT

This assembler accepts the same input as the Ogden assembler with the following exceptions:

1. The JCL cards are not needed and are ignored if found in the input file.

2. The Update Processor INCLUDE card must contain an Interdata filename. Defaults are set to the user volume and no extension. The included files must be present on the Interdata system and all member name cards must be deleted from the data sets.

OUTPUT

The output consists of the assembly listing including error messages, warning messages, error summary, input file description, cross reference dictionary, external symbol dictionary, special remarks cards, and table of contents.

4. OPERATING PROCEDURES

4.1 Initial Preparation Procedures

Before using the assembler for the first time, it is necessary to prepare the input files. It is assumed that the main input module is already located on an Interdata disc pack. However, since most of the EXBLKS reside as data sets in libraries at Ogden, the user must retrieve these data sets for use on the Interdata. A separate file is needed for each EXBLK, and the member name cards must be deleted. These files may be given any Interdata filename. If minimal text editing of files is desired, the above files should be named using the user volume, the name from the INCLUDE card, and no extension. If these defaults are not used, the user must modify any INCLUDE card in the source file to indicate the new filename.

4.2 OPERATION

The 4-PI Assembler is a non-interactive task. It is called by the following statements:

ASMPI filename1 , filename2
*
@

where
filename1 is the user's input file
filename2 is the user's output file

Options for the output file are:

1. filename = output goes to the specified file
2. * = output is displayed on the CRT screen
3. @ = output goes to a null device
4. blank = output goes to the user's default list file

End of task status is displayed on the CRT screen as follows:

END OF TASK 0 Assembled with no errors
END OF TASK 2 Assembled with warnings only
END OF TASK 3 Assembled with errors

Example: The following is a short example of a 4-PI program and an INCLUDE module with comments:

```
                    SOURCE
//R1B16GNSJOB    ('A354,',10,MMEC), 'OFP', CLASS:E
//SY11SCR,SYSIN DD *
//CPASMS,INCARD DD *
            ASSEM A,NSSG
```

The above cards, all JCL and the ASSEM card are treated as comments and are ignored.

```
          ENTRY DVY
          EXTRN VSHIFT
GAMBOL    EXBLK
          INCLUDE GAMBOL
```

Module GAMBOL must have been brought back from Ogden, separated into its own file, and placed on the user's default disc. The filename must have blanks in the extension.

```
              .
              .
FCDR          BSSH 1
              .
              .
              .
IOB16         EXBLK
*             INCLUDE FR01:IOB16.SRC/G
```

Module IOB16 has been fully described as residing on disc FB01 with extension .SRC/G.

```
        .
        .
        .
        USING NLOCAL2,1
        .
        .
        .
        END
```

Include Module: All member name cards must be deleted when creating the include file.

```
MEMBER NAME GAMBOL
GAMBOL      EXBLK DATE 69,192 B SYSTEM
LASTXR2     BSSH  1
```

Approximate compile time for large modules (ex: B16NSGNC) is 15 minutes.

5. RESTRICTIONS

1. The maximum number of labels allowed is 2000.

2. The maximum number of MACRO's allowed is 50.

3. The maximum number of included files is 9.

6. ERROR MESSAGES

Two types of errors are indicated by the assembler. The first displays bad file I/O to the CRT screen, giving the file involved and the I/O status. This type includes errors such as assignment errors for the input or output file. The second type of error is for syntax errors and warnings. These are merged into the output listing and appear, beginning in column 2, as follows:

```
*   WARNING --- 4   COLUMN 9 NOT BLANK
**  ERROR   --- 3   MULTIPLY DEFINED LABEL
```

Warnings and Errors:

Warnings:

1. SHORT INSTR DOESN'T FOLLOW A SKIP, COMPARE OR MODIFY STORAGE
2. LONG INSTRUCTION GENERATED IN EXBLK
3. SHORT INSTRUCTION GENERATED
4. COLUMN 9 NOT BLANK
5. SHIFT VALUE TO LARGE -- HAS BEEN SET TO MAXIMUM
6. ENTRY OR EXTRN DEFINED BUT NOT USED

Errors:

1. ILLEGAL OPCODE
2. ILLEGAL LABEL IN LOCATION FIELD
3. MULTIPLY DEFINED LABEL
4. LABEL TABLE LIMIT EXCEEDED
5. ILLEGAL CHARACTER IN COLUMN 15
6. ILLEGAL LABEL IN VARIABLE FIELD
7. UNDEFINED LABEL USED
8. MULTIPLY DEFINED LABEL USED
9. UNDEFINED SET OR EQU LABEL
10. ILLEGAL NUMERIC SPECIFICATION
11. INVALID SHIFT VALUE
12. INVALID INDEX REGISTER
13. INVALID HEX MASK
14. ILLEGAL VARIABLE FIELD FORMAT
15. ILLEGAL MACRO NAME SPECIFIED
16. MACRO NESTING EXCEEDS 10 LEVELS
17. MORE THAN 10 PARAMETERS USED
18. INVALID MACRO ARGUMENT
19. MACRO TABLE LIMIT EXCEEDED
20. MACRO, INBLK, EXBLK MUST APPEAR BEFORE EXECUTABLE CODE
21. INVALID IFF OR IFT INSTRUCTION
22. INVALID GO TO OPERAND
23. INBLK OR EXBLK DEFINITION EXCEEDED MAXIMUM SIZE
24. DEC OR BCI DATA TRUNCATED
25. ILLEGAL COMBINATION OF INBLK, EXBLK

AD-A088 477 HUGHES AIRCRAFT CO CANOGA PARK CALIF F/G 14/1
PREDICTIVE SOFTWARE COST MODEL STUDY. VOLUME II. SOFTWARE PACKA--ETC(U)
JUN 80 R B WAINA, A P BANGS, E E RODRIGUEZ F33615-79-C-1734
UNCLASSIFIED AFWAL-TR-80-1056-VOL-2 NL

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FEASIBILITY STUDY PROCEDURES

1. PROBLEM

Describe the existing problem.

2. CURRENT IMPLEMENTATION

Describe what is currently available to handle the problem.

3. SOLUTIONS

List the available solutions. For each solution, include the following:

1) How the solution was reached.

2) What effects it will have on the general user.

3) What the new specifications will be.

4) The time cost in man hours and machine hours.

4. RECOMMENDATIONS

State which solution is most feasible.

TCOPY2 Feasibility Study

1. Problem

   TCOPY2 under MTR03 will not process the header files on tapes created under MTR02.

2. Current Implementation

   When accessing tapes created under MTR02, TCOPY2 must be implemented in no header mode. A user must user the ADV command to position the tape at the correct file.

3. Solutions

   1) Modify TCOPY2 to ignore the account number field in the header files. The problem was discussed with the original programmer who suggested that the change could be easily implemented. The general user would be able to use the FIND command to locate a file on the tape and then proceed with a READ command. The time cost will be 30 man hours and 20 machine hours.

   2) Use the current implementation. This requires the users to first use the INDEX command to display a list of all files on the tape; the count the number of files, including both header and data files, and use the ADV command to advance the proper number of files; then switch to NOHEADER mode and proceed with a READ command.

   3) Recommendations

   It is recommended that TCOPY2 be modified. This modification will make tape file acquisition less complicated for the general user.

PERSONNEL DESCRIPTION DATE: 28 Sept 1979

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

Below is the official position description for a GS-12 Electronic Engineer (Computer Systems). This description outlines the basic requirements of the work to be done, whether performed by Civil Service or contractor personnel.

I. INTRODUCTION

See functional statement filed in Official Position Description folder and the Sacramento ALC Organization Directory charts. Incumbent of this position serves as an Avionics System Engineer responsible for accomplishing software and systems engineering projects/tasks for avionics embedded computer systems, their resident Operational Flight Programs (OFPs) and their support systems for the F-111 and other Sacramento ALC prime aircraft systems.

II. DUTIES AND RESPONSIBILITIES

1. Develops, coordinates and carries through to completion blocks of work of large scope containing many phases of which two or more phases each contain several complex features. Plans and conducts research, development, or other work for which precedent data, criteria, methods or techniques are significantly inadequate, are controversial, or contain critical gaps. Develops or originates completely new features, in addition to improving, extending, or validating currently known precedents, data, methods or techniques. In accomplishing the above incumbent is responsible for the development of modifications and changes to complex aircraft digital avionics systems, their Operational Flight Programs (OFPs), and laboratory support systems (e.g., the Sacramento ALC F-111 Avionics Integration Support Facility (AISF)). In addition, incumbent is responsible for the investigation, analysis, evaluation and reporting on avionics system performance, problems and new requirements

2. Develops and carries through to completion complex changes to the OFPs. Uses the F-111 AISF to analyze and evaluate OFP requirements in order to develop optimum implementation. Investigates potential solutions to system problems/change requirements considering tradeoff analyses involving implementation costs, algorithm developments, timing requirements, memory size, hardware/software integration requirements, support equipment, personnel capabilities and limitations, data package development and overall magnitude of the effort; and translates these change requirements into engineering specifications and tasks. Designs the change mechanization and integration; develops the programming code; and debugs, tests and documents the results. At all times assures aircraft system integrity and compatibility; and meets resource allocations, performance criteria, cost and schedule.

3. Establishes formal test requirements for OFPs; develops and implements test plans; conducts detailed tests using the full capabilities of the F-111 AISF and instrumented flight test aircraft; and analyzes, evaluates and reports test results.

4. Serves as project engineer for the design and development of changes and modifications to the AISF hardware/software resources and other avionics support systems. Provides system engineering support and assures compatibility with the aircraft avionics, digital computer complexes and OFPs. Establishes change requirements directly with the AISF and avionics support systems users. Prepares change specifications and plans and schedules the complete development and implementation.

5. Conducts studies and evaluations of systems in acquisition and determines support requirements. Performs 2612 studies, prepares Computer Resources Integrated Support Plans (CRISPs) and participates as a member of Computer Resources Working Groups (CRWGs).

6. Prepares contractual engineering proposals and associated specifications and work orders.

7. Monitors and maintains close liaison between contractor and Air Force activities associated with the engineering support of digital avionics, embedded computer systems and OFPs for Sacramento ALC prime aircraft systems.

8. Reviews, evaluates and advises on the effectiveness, technical adequacy and suitability of work and proposals of others related to digital avionics and OFP support. Evalutes more complex vendor proposed modifications for requirements, feasibility, completeness, accuracy, cost, and operational and logistics impact.

9. Consults, coordinates and attends conferences with other service activities and higher headquarters on matters pertaining to avionics OFP development and support. Makes recommendations to higher authority for changes to policies and practices, based on knowledge, experience, engineering studies, observations, and reports received from service activites, and defends Sacramento ALC's findings and recommendations. Travels to contractor or other government facilities to review engineering data and render opinions and decisions which are normally unreviewed; maintains liaison with other government activities and contractors in order to exchange engineering data and to maintain a current knowledge of the state-of-the-art.

10. Independently determines logical approach to solutions of major associated avionics OFP development and support problems. Carefully weighs the advantages of increased systems reliability, maintainability, etc., against time, cost, compatibility, and safety of flight. Makes and evaluates proposed changes to the system software on the basis of established hardware/software interfaces. Establishes supporting projects with other engineering personnel and directs the integration of auxiliary projects toward the ultimate objective. Scope of project effort is broad in that all projects consider, as applicable, the mission of the aircraft; functions of associated avionics systems (weapon delivery, navigation, reconnaissance, radar, instrumentation, etc.); communication/interface requirements; flight test; computer program documentation and configuration control; and validation/verification of the software. Applied research, special investigations, statistical analysis, etc., are a normal part of the incumbent's effort in accomplishing his duties and responsibilities.

III. CONTROLS OVER WORK

Incumbent is under the supervision of the Section Chief and receives technical direction from the functional group engineers and other senior engineers who give assignments in terms of broad, general objectives and relative priority of work. Extent and limits of assignments are mutually discussed. Incumbent works with considerable freedom from technical control in selecting and establishing the proper methods for attacking and resolving complex features and otherwise carrying assignments through to completion. Controversial policy questions are resolved by joint consideration with the supervisor and functional group engineer. Completed work is reviewed for adequacy in terms of broad objectives of the work and for compliance with Air Force policies and regulations. Decisions and recommendations based upon application of standard engineering practices are rarely changed by higher authority, except for reasons of policy, public relations, or budgetary consideration.

CONTINUATION SHEET DATE: 28 Sept 1979

IV. OTHER SIGNIFICANT FACTS

1. Fields of Engineering: Electronic - 55%, Computer Science - 30%
Aerospace - 15%

2. In addition to an extensive academic and professional knowledge of scientific and engineering principles, it will be necessary for the incumbent to possess a special faculty to do successful applied research and establish authoritative criteria based on sound engineering principles used within this section by joint consideration with other engineers. At most times, the incumbent will be responsible for several projects requiring difficult and advanced engineering work of a high degree of originality, therefore incumbent must have a thorough and detailed knowledge of avionics digital systems, (e.g., inertial navigation systems, fire control radars, stores management systems; digital controls and displays, etc.); aircraft embedded computer systems; real-time operational flight software; laboratory support systems to include real-time simulation systems, host computer systems and avionics system hot mock-ups; software configuration management; software documentation; OFP testing, evaluation, verification and validation; and aircraft performance and operation, specifically in the areas of navigation and weapon delivery. Must be experienced and knowledgeable in real-time programming, mathematical modeling, computer architecture and programming languages.

3. Incumbent must possess a high degree of professional judgment, skill, initiative, planning and leadership ability. Also must possess ability to maintain effective personal work relationships at all levels and to justify and sell his own professional viewpoints in conferences, engineering reviews and with fairly large groups wherein conflicting points of view are represented. Requires an intimate knowledge of functions, organizational structure, jurisdictional responsibilities, etc., of USAF and elements thereof.

4. The incumbent of this position must be capable and willing to perform TDY travel in accordance with the Joint Travel Regulation.

5. Supports and takes affirmative actions in furtherance of Equal Employment Opportunity in all aspects of personnel actions, with special emphasis on Upward Mobility and other special programs.

6. Position requires a security clearance of Secret.

7. Performs other related duties as required.

8. Subject to call during off-duty hours.

9. All personnel will share in the responsibility for a sound industrial safety program. Incumbent is required to comply with all applicable safety directives. Unsafe conditions are to be promptly reported to the immediate supervisor.

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES DATE: 28 Sept 1979

BUILDINGS:

10,800 $ft.^2$ of standard computer-type facilities.

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 28 Sept 1979

COMPUTER FACILITIES (Type, Quantity, Application, Cost & Usage)

The basic equipment in the F/FB-111 Avionics Integration Support Facility is as follows:

Equipment	Cost ($ million)
Dynamic Simulation System (Harris) System and Software Engineering	12.0
Flight Test Data Reduction (PDP)	1.5
Off-line Computer Support (Interdata)	2.0
Integration Test Equipment @ 1.7x3 Original cost - $800K each	5.1 (replacement cost)
Subsystem Testers (11)	3.5 (replacement cost)
Avionics (loaned out of spare assets)	12.9
F-111F/Pavetack Dynamic Simulation	2.6
	39.6
To be added:	
F-111A/E Hardware	1.6
	41.2

Vendor support on the Harris, Interdata and PDP computers costs $308K/year plus $126K/year for expendables and prototype hardware (split 50/50).

CONTINUATION SHEET - COMPUTER FACILITIES DATE: 28 Sept 1979

INTERDATA 8/32 System
(Data Reduction and MIS)

2 Processors 1 megabyte each
8 40 mb disc drives (4 switchable, 4 fixed)
1 300 mb disc drives
12 4 kb Floppy Drives
1 Line Printer
4 Mag Tape Drives
1 Paper Tape Reader
1 Paper Tape Punch
12 CRTs
1 IBM Selectric Typewriter
1 HP Auxiliary Printer
1 Tektronix Plotter
3 ITE (Integration Test Equipment) Static Simulator

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

Harris/4 System
(Dynamic Simulator)

2 test stations

2 ADAGE (large display screen on test station)

6 processors - 80K each

2 SAS (Simulation and Switching) Interface between Harris & test station

6 CMACs (Computer Monitor and Control) Interface between 4pi computer and Harris

1 card reader

1 card punch

2 paper tape readers

8 mag tape drives

1 CDC line printer

2 Versatic printer/plotters

11 CRT

2 teletypes

6 10 mb disc drives

1 40 mb disc drives

2 300 mb disc drives

1 paper tape punch

CONTINUATION SHEET - COMPUTER FACILITIES DATE: 28 Sept 1979

PDP 11/40 System
(Flight Test Data Preprocessing)

16K words memory

1 Dec Writer

1 Card Reader

1 1.2 Mbyte Disc

1 9-track tape drive

1 Paper tape punch/reader

3 8-channel brush recorders

1 CRT display

1 Versatec printer/plotter

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

TYPICAL UTILIZATION OF HARRIS COMPUTER WEEK OF 23-27 July 1979

Time:	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0000							
0100							
0200							
0300							
0400							
0500							
0600							
0700							
0800	Harris (Maint)		Harris		Harris		
0900		IV & V		IV & V			
1000			GD		IV & V		
1100	IV & V						
1200							
1300		F	IV & V	F			
1400	GD (Modif & Upgrade)						
1500					F		
1600							
1700	MMECS (Backup, Archive, etc.)	GD	F	GD			
1800							
1900							
2000							
2100							
2200							
2300							
2400							

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE DATE: 28 Sept 1979

COMPUTER	SOFTWARE FUNCTION	ESTIMATE SOURCE LINES
INTERDATA 8/32	SYSTEM	166,957
	UTILITY	42,841
	SPECIAL UTILITY	
	AGERD	3,299
	4-PI	6,764
	MDS	2,525
	FLCL	696
	PLOTTER	4,754
	OFP UTILITY	13,286
	DATA REDUCTION	46,002
		287,124
HARRIS	SYSTEM	292,953
	UTILITY	34,494
	RJE	7,410
	PLOTTER	7,580
	OFP	4,000
	ADAGE	6,714
	SAS	2,888
	SIMULATOR	17,706
	CMAC	13,674
		387,419
PDP 11/40	UTILITY	5,177
	DATA	22,619
		27,796

Pages C-53 through C-71 provide a detailed listing of the support software.

S O F T W A R E   I D E N T I F I C A T I O N
****

CURRENT AS OF: 25JAN79

KEY:
H = HARRIS
I = INTERDATA
GD = GENERAL DYNAMICS
IH = IN HOUSE
TI = TEXAS INSTRUMENTS
DEC = DIGITAL EQUIPMENT CORPORATION
N/C = NO SOURCE AVAILABLE
TEK = TEKTRONIX
VER = VERSATEC
MAIT RES = MAINTENANCE RESPONSIBILITY
GEN/RES = GENERAL RESEARCH

INTERDATA 8/32

UTILITY SOFTWARE

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ACCOUNT	IH	IH	299.	INTERDATA USAGE REPORT GENERATION
AMAP	IH	IH	85.	ALPHABETICALLY LISTS FILES FROM DISC PACK
CAPS	IH	IH	634.	CONVERTS CAPITAL TO SMALL LETTERS AND VISA-VERSA
CARDIN	IH	IH	162.	HANDLER FOR THE CARD READER
COPYFILE	IH	IH	765.	COPIES FILES
COPYTAPE	IH	IH	206.	DUPLICATES PUNCHED TAPES
DOCPRO	IH	IH	507.	PULLS DOCUMENTATION FROM SOURCE FILES
ENTRY	IH	IH	193.	COPIES DATA FROM HEWLETT-PACKARD TERMINAL CASSETTE INTO A FILE
INDEX	IH	IH	152.	LISTS ALL OCCURRENCES OF A CHARACTER STRING IN A FILE
LIBINV	IH	IH	462.	DOCUMENT INVENTORY REPORT GENERATOR
LINK	IH	IH	513.	LINK BETWEEN THE INTERDATA AND HARRIS COMPUTER
LIST	IH	IH	220.	LISTS A FILE TO THE USER TERMINAL
MANHOURS	IH	IH	2414.	PERSONNMEL UTILIZATION REPORT GENERATOR
MICROFSH	IH	IH	2119.	REFORMATS FILES TO THE MICROFICHE PROCESSING FORMAT
MTCOPY	IH	IH	229.	DUPLICATES AND VERIFIES MAGNETIC TAPES
PAR7	IH	IH	676.	COPIES AR7 FORMAT DATA TO PUNCH TAPE
PRINT	IH	IH	185.	COPIES A FILE TO A HEWLETT-PACKARD AUXILIARY PRINTER
PUNCHB	IH	IH	1054.	DIRECT BIT COPY TO PUNCH TAPE
READFILE	IH	IH	546.	GENERATES A FORMATTED LIST FILE
RECOVER	IH	IH	376.	RECOVERS FILE FROM BACKUP TAPE
UMAP	IH	IH	152.	LIST FILES FROM DISC PACK BY USER NUMBER

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

TSUINV	IH	IH	1096.	MAGNETIC TAPE INVENTORY REPORT GENERATIO
REMOVE	IH	IH	212.	SEPARATES COMMENTS FROM SOURCE CODE
RESTORE	IH	IH	255.	REPLACES COMMENTS INTO SOURCE CODE
REQUESTS	IH	IH	735.	TASK REQUEST AND SCHEDULED REPORT GENERATION
REWRITE	IH	IH	281.	REWRITES AND REFORMATS DATA IN A FILE
SHIFT	IH	IH	173.	SHIFTS DATA WITHIN A RECORD
SORT	IH	IH	230.	SORTS A FILE IN ASCENDING ORDER
TAPEDIR	IH	IH	200.	PRODUCES A DIRECTORY OF A BACKUP TAPE
TCOPY2	IH	IH	4403.	COPIES FILES
TE	IH	IH	16257.	PAGE-ORIENTED TEXT EDITOR
TERMINAL	IH	IH	261.	SETS HEWLETT-PACKARD TERMINAL CHARACTERISTICS
TLIST	IH	IH	489.	LIST A FILE TO THE USER TERMINAL
TYPE	IH	IH	299.	COPIES A FILE TO AN IBM SELECTIC TYPEWRITER
WRITE	IH	IH	224.	COPIES A FILE TO A HEWLETT-PACKARD TERMINAL CASSETTE

************THE FOLLOWING CI'S ARE CONTAINED IN THE SYIUSER LIBRARY*************

ASSIGN	IH	IH	87.	INTERACTIVE TERMINAL DYNAMIC ASSIGNER
DATE	IH	IH	68.	GIVES DAY AND TIME
FINDRA	IH	IH	330.	SEARCHES A FILE FOR CHARACTER STRING
FSCAN	IH	IH	1456.	SCANS A BUFFER FOR SPECIFIED DATA
LISTING	IH	IH	584.	GENERATES A FORMATTED LISTING
RANDOM	IH	IH	15.	RANDOM NUMBER GENERATOR
VIRMEM	IH	IH	1158.	SIMULATES LARGE BUFFERS THROUGH PAGING

*****THE FOLLOWING CI'S ARE CONTAINED IN THE FORTRAN RUN-TIME LIBRARY***********

AREANM	IH	IH	191.	SCANS FOR DISC FILE NAME
.ENDFXD	IH	IH	91.	EXIT ROUTINE FOR SUBPROGRAM USING .ENTFXD
.ENDVAR	IH	IH	92.	EXIT ROUTINE FOR SUBPROGRAM USING .ENTVAR
.ENTFXD	IH	IH	233.	ENTRY ROUTINE FOR A FIXED PARAMETER SUBPROGRAM
.ENTVAR	IH	IH	140.	ENTRY ROUTINE FOR AVAILABLE PARAMETER SUBPROGRAM
@FSCAN	IH	IH	95.	SCANS A BUFFER FOR SPECIFIED DATA (RE-ENTRANT)
FILEMG	IH	IH	1283.	PROVIDES INTERFACE WITH SYSTEM SERVICE CALL 7 (SVC 7)
FINDTX	IH	IH	110.	SCANS A BUFFER FOR A SPECIFIED CHARACTER STRING
MVCHR	IH	IH	85.	TRANSFERS CHARACTERS FROM ONE BUFFER TO ANOTHER
TOTAL			42841.	

INTERDATA 8/32

SPECIAL UTILITY SOFTWARE

AGERD:

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ASSEMBLY	IH	IH	3299.	AGERD ASSEMBLER
TOTAL			3299.	

CONTINUATION SHEET DATE: 28 Sept 1979

4-PI

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ASMPI	IH	IH	6115.	4-PI ASSEMBLER
BFORM	IH	IH	165.	CONVERTS A FILE FOR TRANSMISSION TO 4-PI
CFORM	IH	IH	191.	CONVERTS A FILE AFTER TRANSMISSION FROM 4-PI
ILINK	IH	IH	293.	LINK FROM INTERDATA TO 4-PI
TOTAL			6764.	

MDS (MICROPROCESSOR DATA SYSTEMS):

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
PLMRC	IH	IH	2088.	INTEL 8080 CROSS-ASSEMBLER
MLINK	IH	IH	436.	LINK FROM INTERDATA TO MDS
TOTAL			2525.	

FLCL (FLIGHT LINE COMPUTER LOADER):

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
FFORM	IH	IH	270.	CONVERTS FILES FOR TRANSMISSION TO FLCL
FLINK	IH	IH	426.	LINK BETWEEN INTERDATA AND FLCL
TOTAL			696.	

PLOTTER (TEKTRONIX)

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
PLOT 10 LIB	TEK	TEK, IH	3795.	ROUTINES USED TO CONTROL THE PLOTTER
PLOTTER	IH	IH	959.	GENERAL USER PLOT GENERATIOR
TOTAL			4754.	

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INTERDATA 8/32

SYSTEM SOFTWARE

CI NAME	SUP- PLIER	MAINT RES	EST SOURCE LINES	
BACKUP	INT	INT/IH	4751.	COPIES DISC PACK CONTENTS TO AND FROM MAG TAPE
OSEDIT	INT	INT/IH	2938.	SYSTEM TEXT EDITOR
BOOTPNCH	INT	INT/IH	482.	GENERATES A PUNCH TAPE WITH BOOTSTRAP LOADER
CAL	INT	INT/IH	9667.	ASSEMBLY LANGUAGE ASSEMBLER
CALMACRO	INT	INT/IH	3870.	ASSEMBLY LANGUAGE MACRO PROCESSOR
CUP16	INT	INT/IH	26.	OBJECT-LEVEL SYSTEM GENERATOR FOR THE 16-BIT PROCESSOR
CUPMT	INT	INT/IH	4611.	OBJECT-LEVEL SYSTEM GENERATOR FOR THE 32-BIT PROCESSOR
DISCDUMP	INT	INT,IH	2621.	DUMPS THE CONTENTS OF A DISC PACK IN HEX
DISCHECK	INT	INT,IH	3076.	CHECKS DISC PACK INTEGRITY
DISCINT	INT	INT,IH	1947.	INITIALIZES DISC PACKS
DISKMOD	INT	INT,IH	176.	MODIFIES DISC RACK CONTENTS
DUMPRINT	INT	INT,IH	2035.	PANIC DUMP (FOR AFTER SYSTEM CRASHES)
EDIT32	INT	INT/IH	525.	SYSTEM TEXT EDITOR
FORTRAN	INT	INT	N/S	FORTRAN LANGUAGE COMPILER
HASP	INT	INT/IH	6196.	ALLOWS REMOTE JOB ENTRY
IFTRAN	GEN/ RES	GR/IH	1918.	INTERPRETER OF STRUCTURED PROGRAMMING OF FORTRAN
INITSPLG	INT	INT/IH	168.	INITIATES THE SPOOL QUEUE
LIBLDR	INT	INT/IH	2474.	BUILDS AND EDITS LIBRARIES
MTM	INT	INT/IH	8263.	MULTI-TERMINAL MONITOR
OSCOPY	INT	INT/IN	1907.	SYSTEM COPY ROUTINE
PURGE	IH	IH	167.	ELIMINATES OLD FILES FROM A DISC PACK
SPOOLER	IH	IH	1653.	ALLOWS USER CONTROLLED INPUT TO THE SPOOL QUEUE
SRCUPDT	INT	INT/IH	2281.	CREATES AND MAINTAINS SOURCE FILES
TET32	INT	INT/IH	5638.	OS32 TASK ESTABLISHER
TUT	INT	INT/IN	961.	TASK FILE PATCH ROUTINE
WCS	INT	INT	3433.	WRITABLE CONTROL STORE SUPPORT SOFTWARE
OSAIDS	INT	INT	6047.	ASSEMBLY LEVEL DEBUGGING TOOL

*****THE FOLLOWING ARE SYSTEM LIBRARIES, AND CONTAIN TOO MANY SYSTEM ROUNTINES TO ANME AND DESCRIBE SEPARATELY******

DRIVER	INT	INT/IH	27063.	PROVIDES ALL SYSTEM DRIVER ROUTINES
SYS	INT	INT/IH	34137.	PROVIDES ALL SYSTEM MODULE ROUTINES

*****THE TWO PRECEDING LIBRARIES CREATE THE OPERATING SYSTEM

FORTRAN RUN-TIME	INT	INT/IH	23179.	PROVIDES SUPPORT FOR THE FORTRAN VI LANGUAGE WITH MATHEMATICAL FUNCTIONS, I/O FACILITIES, AND REAL TIME INTERFACES.

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CI NAME	SUPPLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
TOTAL			166957.	

INTERDATA

OFP (OPERATIONAL FLIGHT PROGRAM)

UTILITY SOFTWARE

CI NAME	SUP- PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ADDNDM	IH	IH	2375.	CREATES AND ADDENDUM TAPE
CHKWAS	IH	IH	790.	UPDATES "WAS" VALUE IN KEY-INS FILE
ELMOFP	IH	IH	224.	ELIMINATES UNUSED OFP DOCUMENTATION FILES
GENOFP	IH	IH	440.	GENERATES OFP DOCUMENTATION FILES
INTOFP	IH	IH	115.	INITIALIZES OFP DOCUMENTATION FILES
KFILE	IH	IH	95.	ENTER HEX ADDRESS IN ".K" OFP DOCUMENTATION FILE
LSTOFP	IH	IH	1211.	LISTS ALL OFP DOCUMENTATION FILES ASSOCIATES WITH A CHANGE CYCLE
OFPDATA	IH	IH	2732.	READS AND PUNCHES OFP PUNCH TAPES
REFILE	IH	IH	64.	LIST ERRORS AND WARNINGS FROM OFP ABSOLUTE LISTING FILE
***********THE FOLLOWING OFP CI'S ARE CONTAINED IN THE OFP LIBRARY**************				
AR7BIN	IH	IH	387.	CONVERTS AN AR7 FORMAT FILE FOR THE 4-PI TO BINARY IN CMAC FORMAT
AR7NCU	IH	IH	384.	CONVERTS AN AR7 FORMAT FILE FOR THE NCU TO TO BINARY IN CMAC FORMAT
BINHEX	IH	IH	207.	CONVERTS LOW 19 BITS FROM BINARY TO HEX
BINOCT	IH	IH	212.	CONVERTS LOW 12 BITS FROM BINARY TO OCTAL
BINNCU	IH	IH	308.	PRODUCES NCU PUNCH TAPE
BINPPT	IH	IH	295.	PRODUCES CMAC PUNCH TAPE FOR THE 4-PI
HEXBIN	IH	IH	230.	CONVERTTS TWO HEX WORDS TO ONE BINARY WORD
HEXPPT	IH	IH	318.	PUNCHES 4 FRAMES OF TAPE IN 4-PI FORMAT
JULBIN	IH	IH	231.	RETURNS DATE AND TIME IN BINARY
JULIAN	IH	IH	240.	RETURNS DATE AND TIME IN ASCII
OCTBIN	IH	IH	207.	CONVERTS TWO OCTAL WORDS TO BINARY
PPTTIT	IH	IH	347.	PUNCHES MAN-READABLE PUNCH TAPE LEADER AND TRAILER
RPTBIN	IH	IH	308.	READS A 4-PI PUNCH TAPE
PPTNCU	IH	IH	303.	READS A NCU PUNCH TAPE
SORT	IH	IH	1263.	UNIVERSAL SORT ROUTINE
TOTAL			13286.	

INTERDATA

DATA REDUCTION

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CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
AC1LBL	IH	IH	238.	CREATES IBM STANDARD TAPE LABELS
AC1LIST	IH	IH	421.	LISTS AC1 FORMAT DATA SETS
AC1READ	IH	IH	155.	READS AC1 FORMAT OR IBM V FORMAT MAGNETIC TAPE
CLFORM	IH	IH	1919.	REFORMATS TSPI OR ALAST PAVE FLIGHT TEST DATA TAPE
ENGLST	IH	IH	5808.	LISTS THE REFERENCE DATA FILE
GENFILE	IH	IH	1030.	CREATES CARD IMAGE INPUT FOR SMFILE
LABEL	IH	IH	251.	CREATES IBM STANDARD TAPE LABELS
MERGE	IH	IH	2585.	MERGES FLIGHT TEST DATA AND GROUND-BASED INSTRUMENTED RANGE DATA
PDFDUMP	IH	IH	220.	LISTS PERMANENT DATA FILES
SMDUMP	IH	IH	2609.	LISTS PERMANENT DATA FILES
SMEDIT	IH	IH	3777.	FORMATS AND TAGS DATA FROM A TEMPORARY DATA FILE TO A PERMANENT DATA FILE
SMFILE	IH	IH	12141.	BUILDS A REFERENCE DATA FILE
SMFORM	IH	IH	1354.	CREATES AN AC1 DATA BASE FROM A PERMANENT DATA FILE
SMLIST	IH	IH	9982.	PROVIDES PRINTED REPORTS OF FLIGHT TEST DATA
SMMERG	IH	IH	1527.	MERGES TWO PERMANENT DATA FILES
**********THE FOLLOWING D.R. CI'S ARE CONTAINED IN THE GDUSER LIBRARY***********				
ADPVCS	IH	IH	37.	COMBINES DOUBLE PRECISION PARITY, VALIDITY, CONTROL, AND SPARE BITS
ASCHEX	IH	IH	54.	CONVERTS ASCII HEX
ABEND	IH	IH	188.	ABNORMAL ENDS DUMP
ASCINT	IH	IH	54.	CONVERTS FROM ASCII TO BINARY INTEGER
ATIME	IH	IH	21.	PROVIDES TIME OF DAY
BCDBIN	IH	IH	53.	CONVERTS BCD TO BINARY
BIT	IH	IH	31.	EXTRACTS BITS FROM A HALFWORD
BIT4	IH	IH	32.	EXTRACTS BITS FROM A FULL WORD
BTIME	IH	IH	21.	PROVIDES TIME OF DAY
BIT8	IH	IH	39.	EXTRACTS BITS FROM A DOUBLE WORD
CDATE	IH	IH	21.	PROVIDES CALENDAR DATA
CF685A	IH	IH	55.	READS FLIGHT TEST TAPE ID RECORDS
CF686W	IH	IH	12.	MOVES DATA BETWEEN BUFFERS
CF686X	IH	IH	15.	CONVERTS TIME WORDS FROM INTEGER TO FLOATING POINT
CF686Y	IH	IH	15.	CONVERTS TIME WORDS FROM FLOATING POINT TO INTEGER
CF686Z	IH	IH	109.	READS FLIGHT TEST DATA
DUMP	IH	IH	123.	REGISTER AND CORE DUMP
FTDA	IH	IH	119.	READS ONE FRAME OF FLIGH TEST DATA
FTID	IH	IH	62.	DEFINES CHANNEL CODES AND READS ID INFORMATION
FTINIT	IH	IH	54.	READS INPUT VALUES AND INITIALIZES ARRAYS
INTEBA	IH	IH	37.	CONVERTS INTEGER TO ASCII
INTEBB	IH	IH	37.	CONVERTS INTEGER TO ASCII
INTHXA	IH	IH	31.	CONVERTS INTEGER TO HEX
INTHXB	IH	IH	32.	CONVERTS INTEGER TO HEX
KOMPAR	IH	IH	44.	LOGICAL COMPARE BETWEEN TWO CHARACTER STRINGS
LSTMSG	IH	IH	25.	LISTS MESSAGE TO THE OPERATOR CONSOLE
MVCHR	IH	IH	33.	MOVE CHARACTER REPEAT ROUTINE

PREDICTIVE SOFTWARE COST MODEL

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RDUMP	IH	IH	95.	DUMPS REGISTER CONTENTS
READ	IH	IH	35.	NON-BUFFERED UNFORMATTED BINARY READ
SBYTE	IH	IH	37.	SWAPS BYTES IN PDP WORDS
STATUS	IH	IH	95.	OBTAINS JOB STATUS INFORMATION
TBLSRT	IH	IH	116.	BUBBLE SORT
TRANSL	IH	IH	72.	CONVERTS FROM EBCDIC TO ASCII AND VISA-VERSA
WRITE	IH	IH	35.	NON-BUFFERED UNFORMATTED BINARY WRITE
TOTAL			46,002.	

HARRIS F/EB

SYSTEM SOFTWARE

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ACLDMP	H	IH/H	100.	UNKNOWN
ACUTIL	H	IH/H	2240.	ACCOUNTING UTILITY
ATAB	H	IH/H	280.	REAL TIME PROGRAM TO ACCUMULATE NUMBER OF
	H	IH/H		SECTORS USED BY EACH USER
BASLIB	H	IH/H	4060.	BASIC LIBRARY
CH4OFF	H	IH/H	120.	INITIATES PROGRAM V:C40F:V TO PUT PRINTER OFF LINE
CH4ON	IN	IN	100.	INITIATES PROGRAM V:C40N:V TO PUT PRINTER ON LINE
COBOL	H	H/IH	1180.	COBOL COMPILER
DATAPOOL	H	H/IH	1400.	PROCESSES DATA AREAS USED BY FORTRAN COMPILER
DISKCHECK	H	H/IH	80.	VERIFIES INTERNAL LOGIC INTEGRITY OF THE DISC
FORTRAN	H	H/IH	17280.	FORTRAN COMPILER
GENCLIB	H	H/IH	300.	GENERATES COBOL LIBRARY
IFTRAN	GEN/RES	GR/IH	1918.	IFTRAN COMPILER
ISUTIL	H	H/IH	440.	INDEXED SEQUENTIAL UTILITY PRIMARILY USED FOR COBOL
JOBCNTRL	H	H/IH	20350.	INTERACTIVE USER INTERFACE TO VULCAN
.FEDITOR	H.	H/IH	1860.	LIBRARY FILE EDITOR
MSUTIL	H	H/IH	141.	SORT/MERGE UTILITY
) COBOL	H.	H/IH	480.	ANCILLARY PROGRAM USED BY -COBOL
PRINTF	H	H/IH	380.	PROVIDES OCTAL OR ASCII DUMP OF SELECTED RECORDS OF A FILE
RPATCH	H	H/IH	N/A	HARRIS SUPPLIED SYSTEM PATCH
SAMIAM	IH	IH	100.	CHECKS A DISC FOR UNUSED AMND SHARED SECTORS
SAUTEST	IH	IH	10.	EXERCISES SCIENTIFIC ARITHMETIC UNIT (SAU) AND ABORTS ON ERROR
TAPESORT	H	H/IH	N/A	SORTS RECORDS ON TAPES
TEST	IH	IH	16.	EXERCISES MULTIPLLICATION FUNCTION OF SAU
TLABEL	H	H/IH	1620.	TAPE LABEL PROGRAM
V:ACPY:V	H	H/IH	120.	ACCOUNTING RECORD COPY PROGRAM
V:ACSM:V	H	H/IH	260.	ANCILLARY ACCOUNTING UTILITY

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/;ASCT;V   . H   .H/IH  .  200. ACCOUNTING SECTOR READ/WRITE SERVICE
/;ATL;V    . H   .H/IH  .  120. ANCILLARY ACCOUNTING UTILITY
/;BFH2;V   . H   .H/IH  .  160. BLOCKED DISC AREA HANDLER/EXTENSION
/;BLAH;V   . H   .H/IH  . 1200. BLOCKED DISC AREA HANDLER
/;C40F;V   . H   .IH    .  120. DISCONNECTS LINE PRINTER AND CARD READER
/;C40N;V   . H   .IH    .  100. CONNECTS LINE PRINTER AND CARD READER
/;CBAS;V   . H   .H/IH  .  140. BINARY CODED DECIMAL TO ASCII CONVERSION
/;CEAS;V   . H   .H/IH  .  260. EBCDIC TO ASCII CONVERSION
/;CPOH;V   . H   .H/IH  .  800. CARD PUNCH HANDLER
/;CPQS;V   . H   .H/IH  .  600. CONTROL POINT QUEUE SWITCHER PROGRAM
/;CRDH;V   . H   .H/IH  .  800. CARD READER HANDLER
/;CRPH;V   . H   .H/IH  . 1520. CARD PUNCH HANDLER
/;CRTH;V   . H   .H/IH  . 1860. HARRIS CRT HANDLER
/;DUMP;V   . H   .H/IH  .  240. POST MORTEM DUMP GENERATOR
/;DUMPER;V   H   .H/IH  .  900. REAL TIME PORTION OF DUMP PROGRAM
/;EK73;V   . IH  .IH    .   80.
/;GENS;V   . H   .H/IH  . 1800. SYSTEM GENERATION MONITOR PROGRAM
/;HEAD;V   . H   .H/IH  .  340. LINE PRINTER HEADER PAGE GENERATOR
/;IDAC;V   . H   .H/IH  . 2200. DIRECT MEMORY ACCESS CONTROL PROCESSOR SUPPORT
           .     .      .     .  MODULE
/;INEX;V   . H   .H/IH  .   80. INTERRUPT EXECUTIVE SERVICE
/;ITSP;V   . H   .H/IH  .  320. INTERACTIVE TERMINAL SPOOLER PROGRAM
/;LP0H;V   . H   .H/IH  .  780. UNIVERSAL LINE PRINTER HANDLER
/;LP1H;V   . H   .H/IH  . 1060. UNIVERSAL LINE PRINTER HANDLER
/;LP2H;V   . HK  .H/IH  .  980. VERSATEC LINE PRINTER HANDLER
/;LP3H;V   . H   .H/IH  .  840. ASYNCHRONOUS LINE PRINTER HANDLER
/;LPGD;V   . IH  .IH    .  420. MODIFIED LINE PRINTER HANDLER FOR GD HEADER
           .     .      .     .  PAGE
/;MEMD;V   . IH  .IH    . 1200. CHECKS OUT C PROCESSOR
/;MESG;V   . H   .H/IH  .  680. MESSAGE (SEND RECEIVE) SERVICE
/;OLAY;V   . H   .H/IH  .  980. OVERLAY SERVICE
/;OPC0;V   . H   .H/IH  .  660. OPERATOR COMMUNICATIONS COMMAND INTERPRETER
/;OPC1;V   . H   .H/IH  .  600. OPERATOR COMMUNICATION SEGMENTS - EACH
           .     .      .     .  PROCESSES ONE OR MORE OPCOM COMMANDS
/;OPC2;V   . H   .H/IH  .  600.        "            "            "
/;OPC3;V   . H   .H/IH  .  900.        "            "            "
/;OPC4;V   . H   .H/IH  .  620.        "            "            "
/;OPC5;V   . H   .H/IH  .  900.        "            "            "
/;OPC6;V   . H   .H/IH  .  620.        "            "            "
/;OPC7;V   . H   .H/IH  .  340.        "            "            "
/;OPC8;V   . H   .H/IH  .  460.        "            "            "
/;OPC9;V   . H   .H/IH  .  720.        "            "            "
/;OPCA;V   . H   .H/IH  .  480.        "            "            "
/;OPCB;V   . H   .H/IH  .  720.        "            "            "
/;OPCC;V   . H   .H/IH  .  780.        "            "            "
/;OPCD;V   . H   .H/IH  .  320.        "            "            "
/;OPCX;V   . H   .H/IH  .  300.        "            "            "
/;OPCZ;V   . H   .H/IH  .  140.        "            "            "
/;P-PH;V   . IH  .IH    . 1459.HANDLER FOR HARRIS END OF INTERDATA-HARRIS LINK
/;PIGD;V   . IH  .IH    .  200. NON-RESIDENT HANDLER THAT PUTS OUT GD HEADER
/;PTPH;V   . H   .H/IH  .  700. PAPER TAPE PUNCH HANDLER
/;PTRH;V   . H   .H/IH  .  380. PAPER TAPE READER HANDLER
/;REHH;V   . H   .H/IH  .  460. DISC DIRECTORY REHASH SERVICE
/;RSC2;V   . H   .H/IH  .  460. RESOURCE ALLOCATION SERVICE - PART 2
/;RSEX;V   . H   .H/IH  .  520. RESOURCE DEALLOCATION SERVICE
/;RSRC;V   . H   .H/IH  . 1120. RESOURCE ALLOCATION SERVICE
/;RTEX;V   . H   .H/IH  .   80. REAL TIME EXECUTIVE PROGRAM (USED FOR
           .     .      .     .  TIMER SCHEDULING)
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;RTPH;V	H	H/IH	600.	REAL TIME PERIPHERAL HANDLER
;SCAN;V	H	H/IH	1220.	FORMAT SCANNER SERVICEI
;SERV;V	H	H/IH	1480.	BACKGROUND SERVICES
;SRV2;V	H	H/IH	340.	BACKGROUND SERVICES
;SY25;V	H	H/IH	640.	SYSTEM INITIALIZATION PHASES
;SYI1;V	H	H/IH	740.	SYSTEM INITIALIZATION PHASES
;SYI2;V	H	H/IH	920.	SYSTEM INITIALIZATION PHASES
;SYI3;V	H	H/IH	1000.	SYSTEM INITIALIZATION PHASES
;SYI4;V	H	H/IH	1140.	SYSTEM INITIALIZATION PHASES
;TEN2;V	H	H/IH	340.	PHASE 2 OF V;TENS;V
;TENS;V	H	H/IH	800.	5 SECOND SYSTEM CHECK PROGRAM
;TLH1;V	H	H/IH	1960.	TAPE LABELING SERVICE
;TLH2;V	H	H/IH	2380.	TAPE LABELING SERVICE
;TLSS;V	H	H/IH	780.	TAPE LABELING SERVICE
;TOAD;V	H	H/IH	1000.	REAL TIME SERVICES
;TRAP;V	H	H/IH	620.	VULCAN EXECUTIVE TRAP SERVICE ROUTINE
;TTYH;V	H	H/IH	1760.	TELETYPE HANDLER
;UPRG;V	H	H/IH	200.	USER NUMBER DISC AREA PURGE PROGRAM
;UPUS;V	H	H/IH	180.	UPDATE USER ACCOUNTING SERVICE
;USER;V	H	H/IH	380.	USER NUMBER LOOK UP SERVICE
;USPC;V	H	H/IH	200.	DISC SPACE DEALLOCATION SERVICE
ASSEM	H	H/IH	9480.	ASSEMBLY LANGUAGE PROCESSOR
BASIC	H	H/IH	4420.	BASIC PROCESSOR
ILCAN00	IH	IH	18990.	DISC COPY OF RESIDENT VULCAN THAT IS PUT INTO MEMORY
ULCANIZ	IH	IH	200.	CREATES LOAD MODULES
REF	H	H/IH	2060.	CROSS REFERENCE PROCESSOR
IBERY	H	H/IH	124800.	HARRIS SYSTEM LIBRARY
;CASS;V	H	H/IH	1620.	CASSETTE HANDLER
ORP	IH	IH	10.	EXERCISES EXPONENTIATION FUNCTION IN SAU
;ETC;V	IH	IH	120.	NON-RESIDENT HANDLER FOR OBTAINING CONTENTS ON MEMORY SYSTEM ID. AND DAY OF THE WEEK
;UADR;V	IH	IH	100.	ABSOLUTE DISC READS FOR USER ROUTINES
;PMD	H	H/IH	1980.	POST MORTEM DUMP
TOTAL			292953.	

HARRIS F/FB

UTILITY SOFTWARE

I NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
N	IH	IH	103	CONVERTS NUMBER TO/FROM INTEGER, OCTAL, HEX, ASCII AND TASCII
OMPUTE	IH	IH	515.	FLOATING POINT CALCULATOR
OPYTAPE	IH	IH	200.	COPIES ONE MAG TAPE TO ANOTHER
C	IH	IH	60.	DISPLAYS SELECTED LOCATIONS OF CORE
F	IH	IH	N/S	DISPLAYS MAPPING INFORMATION FOR A FILE
ELMN@MAP	IH	IH	260.	ELIMINATES FILES IN A MAP OUTPUT
LMN@VER	IH	IH	260.	ELIMINATED FILES IN AVERIFY OUTPUT
NTRY	IH	IH	140.	COPIES DATA FROM HP TAPE CASSETTE TO DISC FILE
MTSNAPS	IH	IH	65.	SPOOLS SNAPSHOT OF CRT SCREEN TO PRINTER

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ENCMD    .  IM  .IM     .   147. GENERATES COMMAND FILE USED IN *TCOPY2
PCO      .  IM  .IM     .   N/S . GENERAL PURPOSE COPY ROUTINE TO SUPPOR CAR-
         .      .       .        . TRIDGE ON HP TERMINAL
KEEPCK   .  IM  .IM     .   354. OUTPUTS FORMATTED LIST OF FILES ON A KEEPTAPE
         .      .       .        .  TO THE PRINTER AND VERIFIES THE TAPE
F        .  IM  .IM     .    66. COMPARES 2 FILES
PCOPY    .  IM  .IM     .   240. COPIES A MAG TAPE IN KEEP/FETCH FORMAT TO
         .      .       .        . ANOTHER MAG TAPE
M        .  IM  .IM     .   266. PROVIDES A LIST OF WHICH LFN'S ARE CURRENTLY
         .      .       .        . ASSIGNED FROM INTERACTIVE TERMINAL
ENUSER   .  M   .M/IM   .    80. CHANGES QUALIFIER AND/OR USER NUMBER OF FILES
AKCHK    .  IM  .IM     .    99. LISTS FILES WHICH HAVE NOT BEEN ACCESSED
         .      .       .        . SINCE THE ENTERED CUTOFF DATE
READFILE .  IM  .IM     .  1080. READS FILE INTO AN OUTPUT FILE ADDING PAGE
         .      .       .        . NUMBERS AND CARRIAGE CONTROL FOR SPOOLING
         .      .       .        . TO THE PRINTER
SFETCH   .  IM  .IM     .   220. CONSTRUCTS A JOB STREAM TO FETCH SELECTED
         .      .       .        . FILES FROM A TAPE
NAPIT    .  IM  .IM     .    40. SNAPSHOTS THE CONTENTS OF A TEC-425 SCREEN
TCOPY2   .  IM  .IM     .  1132. READ/WRITE FROM DISC TO TAPE AND VISA-VERSA
E        .  IM  .IM     . 16257. TEXT EDITOR
HRUHS    .  IM  .IM     .   600. TRANSFERS FILES BETWEEN PROCESSORS THROUGH
         .      .       .        . HIGH SPEED MEMORY
PECPY    .  IM  .IM     .    80. MAKES DIRECT BINARY COPY FROM TAPE TO TAPE
URN90    .  IM  .IM     .    40. ROTATES PRINTER OUTPUT 90 DEG.
XREF     .  IM  .IM     .   240. PRODUCES VARIABLE AND FILE NAME CROSS REFERENCE
         .      .       .        . FROM AN ALPHABETIZED LIST OF VARIABLES AND
         .      .       .        . FILES
WRITE    .  IM  .IM     .   200. ALLOWS USER TO WRITE TO TAPE CARTRIDGE ON
         .      .       .        . HP TERMINAL
EQ       .  IM  .IM     .   180. SEQUENCES SOURCE FILES

********SIMLIB - SIMULATION LIBRARY CONTAINS THE FOLLOWING SUBROUTINES**********

RNM1     .  IM  .IM     .    30. UNPACK AREANAME FROM TRUNCATED ASCII (4CPW)
         .      .       .        . TO STANDARD ASCII (1CPW)
RNM3     .  IM  .IM     .    30. UNPACK AREANAME FROM TRUNCATED ASCII (4CPW)
         .      .       .        . TO STANDARD ASCII (3CPW)
ASLPON   .  IM  .IM     .        . ASSIGN LFN (NON RESOURCABLE PON'S ONLY)
SLCAS    .  IM  .IM     .    55. ASSIGN LFN TO CASSETTE TAPE ON TI 733
SLDA     .  IM  .IM     .    76. ASSIGN LFN TO DISC AREA (FILENAME AND QUALI-
         .      .       .        . FIER REQUIRED)
ASLDAS   .  IM  .IM     .        . ASSIGN LFN TO DISC AREA (QUALIFIER DEFAULTS
         .      .       .        . TO SIGN-ON QUALIFIER)
SLINF    .  IN  .IN     .    56. ASSIGN LFN TO ANOTHER LFN (FIRST LFN ASSIGNMENT
         .      .       .        . FOLLOWS SECOND)
ASLINP   .  IN  .IN     .        . ASSIGN LFN TO ANOTHER LFN (FIRST LFN ASSIGNMEN
         .      .       .        . DOES NOT FOLLOW SECOND)
SORT1    .  IM  .IM     .   102. ALPHANUMERIC SORT ON AN ARRAY IN STANDARD
         .      .       .        . ASCII (1CPW)
SORT3    .  IM  .IM     .   200. ALPHANUMERIC SORT ON AN ARRAY IN STANDARD
         .      .       .        . ASCII (3CPW)
1TOA3    .  IM  .IN     .    62. CONVERT STANDARD ASCII (1CPW) TO STANDARD
         .      .       .        . ASCII (3CPW)
1TOT4    .  IM  .IM     .    70. CONVERT STANDARD ASCII (1CPW) TO TRUNCATED
         .      .       .        . ASCII (4CPW)
3TOA1    .  IM  .IM     .    55. CONVERT STANDARD ASCII (3CPW) TO STANDARD
         .      .       .        . ASCII (1CPW)
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STOT4	IH	IH	45.	CONVERT STANDARD ASCII (3CPW) TO TRUNCATED ASCII (4CPW)
INHEX	IH	IH	85.	BINARY TO HEX
INPPT	IH	IH	200.	BINARY TO PUNCH PAPER TAPE
ITOH1	IH	IH	60.	CONVERT BINARY (1 WORD) TO HEX (ASCII 1CPW)
ITOH3	IH	IH	65.	CONVERT BINARY (1 WORD) TO HEX (ASCII 3CPW)
.FNAM	IH	IH	60.	CHECK LFN ASSIGNMENT STATUS AND OBTAIN ASSIGNMENT INFORMATION
.UCBA	IH	IH	45.	CONVERTS BINARY TO ASCII
.UIO	IH	IH	267.	LONG FORM OF STANDARD CALL FOR I/O SERVICE
3LUIOA	IH	IH		CALL FOR I/O SERVICE TO RETURN CONTENTS OF A-REGISTER AFTER I/O
3LUIOC	IH	IH		CALL FOR I/O SERVICE FOR CHARACTER I/O
3LUIOE	IH	IH		CALL FOR I/O SERVICE TO RETURN CONTENTS OF E-REGISTER AFTER I/O
3LUIOS	IH	IH		SHORT FORM OF STANDARD CALL FOR I/O SERVICE
3LUIOW	IH	IH		LONG FORM OF STANDARD CALL FOR I/O SERVICE REQUESTING A WAIT AFTERWARDS
.ULFN	IH	IH	42.	CHECK LFN ASSIGNMENT STATUS
.UPDN	IH	IH	35.	CHECK PDN CHARACTERISTICS
/HXBI	IH	IH	46.	CONVERT HEX (ASCII) TO BINARY (1 WORD)
/SYSD	IH	IH	90.	CONVERT SYSTEM DATE/TIME IN STIME FORMAT TO ASCII (MILITARY FORMAT)
ATE	IH	IH	42.	OBTAIN CURRENT DATE AND TIME FROM SYSTEM
INF01	IH	IH	205.	OBTAIN LIMITED INFORMATION ON A SPECIFIC DISC FILE
)INF02	IH	IH		OBTAIN MODERATE AMOUNT OF INFORMATION ON A SPECIFIC DISC FILE
)INF03	IH	IH		OBTAIN COMPLETE INFORMATION ON A SPECIFIC DISC FILE
ITOBI	IH	IH	223.	SCANS AND CONVERTS ASCII DATE/TIME (MIL OR JULIAN FORMAT) TO BINARY
IASE	IH	IH	75.	CLEAR TERMINAL SCREEN
.MNB	IH	IH	76.	ELIMINATE A SPECIFIC DISC FILE (QUALIFIER AND FILENAME REQUIRED)
ELMNBS	IH	IH		ELIMINATE A SPECIFIC DISC FILE (SIGN-ON) QUALIFIER ASSUMED)
INDCH	IH	IH	174.	FIND OCCURRENCE OF CHARACTER IN CHARACTER STRING FROM A GIVEN OFFSET
INDTX	IH	IH	224.	FIND OCCURRENCE OF A CHARACTER STRING IN A LARGER STRING
IP	IH	IH	362.	CONVERT ASCII REPRESENTATION OF A FLOATING POINT TO INTERNAL FLOATING POINT FORMAT
.GBIT	IH	IH	64.	SET A SPECIFIED BIT IN AN ARRAY
ITLAT	IH	IH	163.	FORMAT LATITUDE/LONGITUDE INTO ASCII
ITLON	IH	IH		FORMAT LATITUDE/LONGITURD INTO ASCII
ISTCH	IH	IH	92.	FIND FIRST NONBLANK CHARACTER IN A CHARACTER STRING
ICAN	IH	IH	265.	CALL TO SYSTEM FORMAT SCANNER SERVICE
INDA	IH	IH	165.	GENERATE A DISC FILE WITH ACCOUNT ACCESS (SHORT FORM)
INDL	IH	IH		GENERATE A DISC FILE (LONG FORM)
INDO	IH	IH		GENERATE A DISC FILE WITH OWNER ACCESS ONLY (SHORT FORM)
INDP	IH	IH		GENERATE A DISC FILE WITH PUBLIC ACCESS (SHORT FORM)
IXBIN	IH	IH	180.	CONVERT HEX TO BINARY
IXIN	IH	IH	94.	INPUT AND CONVERT HEX ASCII (UP TO 6 CHARACTERS

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          .      .     .        . TO BINARY  (1 WORD)
 ?XPPT    .  IH  .IH   .    164. DATA (IN HEX) TO PUNCH PAPER TAPE
 ?ORTS    .  IH  .IH   .     96. HEX SORT ON ASCII REPRESENTATION OF HEX
          .      .     .        . NUMBERS IN AN ARRAY
 ?TOBI    .  IH  .IH   .     82. CONVERT HEX (ASCII 1CPW) TO BINARY (1 WORD)
 ??PTN    .  IH  .IH   .     95. OBTAIN PROGRAM OPTIONS FROM PROGRAM OPTION
          .      .     .        . WORD FROM INITIALIZATION
 ?LNBK    .  IH  .IH   .        . ANOTHER ENTRY POINT FOR FRSTCH
 ?JLIAN   .  IH  .IH   .    115. CONVERT RETURN FROM SYSTEM STIME SERVICE TO
          .      .     .        . JULIAN FORM DATE AND TIME
 ?PAPI    .  IH  .IH   .     60. CONVERT A HARRIS FLOATING PONT NUMBER TO API
          .      .     .        . FIXED POINT NUMBER
 ?MPAR    .  IH  .IH   .    122. COMPARE CHARACTER STRINGS
 ?STCH    .  IH  .IH   .     93. FIND LAST NONBLANK CHARACTERS IN A CHARACTER
          .      .     .        . STRING
 ?STING   .  IH  .IH   .    332. COPY FILE TO FILE WITH PRINTER SPACING
 ?TNBK    .  IH  .IH   .        . ANOTHER ENTRY POINT FOR LASTCH
 ?VCSR    .  IH  .IH   .     52. MOVE CURSOR ON THE TEKTRONIX 4014
 ?CHR     .  IH  .IH   .    100. MOVE DATA IN AN ARRAY
 ??PARN   .  IH  .IH   .     75. SCAN OEP CHANGE/PROBLEM DESCRIPTION
 ?HRT4    .  IH  .IH   .     65. TRUNCATE AND INSERT ASCII CHARACTER IN A
          .      .     .        . TRUNCATED ASCII ARRAY (4CPW)
 ?MOPT    .  IH  .IH   .     99. OBTAIN PROGRAM OPTIONS AND PARAMETERS AT
          .      .     .        . PROGRAM INITIALIZATION
 ?TLDR    .  IH  .IH   .     63. PUNCH PAPER TAPE LEADER
 ?TTIT    .  IH  .IH   .     35. PUNCH PAPER TPAE TITLE
 ?CHAR    .  IH  .IH   .    197. CONVERT ASCII CHARACTER TO PAPER TAPE CODE
 ?NAME    .  IH  .IH   .     86. RENAME A DISC FILE TO A NEW NAME (QUALIFIER
          .      .     .        . AND FILENAME REQUIRED)
 ?ENAMS   .  IH  .IH   .        . RENAME A DISC FILE TO A NEW NAME (SIGN-ON)
          .      .     .        . QUALIFIER ASSUMED)
 ?TYPE    .  IH  .IH   .    100. RETYPE A DISC FILE TO A NEW TYPE SPECIFICATION
          .      .     .        . (LONG FORM)
 ?ETYPS   .  IH  .IH   .        . RETYPE A DISC FILE TO A NEW TYPE SPECIFICATION
          .      .     .        . (SHORT FORM)
 ?TBIN    .  IH  .IH   .    149. READ PAPER TPAE AND CONVERT TO BINARY
 ?THEX    .  IH  .IH   .    174. READ PAPER TPAE AND CONVERT TO HEX
 ?DSC     .  IH  .IH   .     65. RESOURSE DISC PACK
 ?SDSCT   .  IH  .IH   .        . TEST DISC RESOURCE REQUEST
 ?SDSCW   .  IH  .IH   .        . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR DISC
          .      .     .        . PACK HAS BEEN FULFILLED
 ?HSM     .  IH  .IH   .     75. RESOURCE HIGH SPEED MEMORY
 ?SHSMT   .  IH  .IH   .        . TEST HIGH SPEED MEMORY REQUEST
 ?SHSMW   .  IH  .IH   .        . SPECIFY A WAIT UNTIL RESOUCE REQUEST FOR
          .      .     .        . HIGH SPEED MEMORY FULFILLED
 ?MTL     .  IH  .IH   .    105. RESOURCE MAG TAPE (LONG FORM)
 ?SMTLT   .  IH  .IH   .        . TEST MAG TAPE RESOURCE REQUEST (LONG FORM)
 ?SMTLW   .  IH  .IH   .        . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR
          .      .     .        . MAG TAPE HAS BEEN FULFILLED
 ?MTS     .  IH  .IH   .     86. RESOURCE MAG TAPE (SHORT FORM)
 ?SMTST   .  IH  .IH   .        . TEST MAG TAPE RESOURCE REQUEST (LONG FORM)
 ?SMTSW   .  IH  .IH   .        . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR MAG
          .      .     .        . TAPE HAS BEEN FULFILLED
 ?PDN     .  IH  .IH   .     86. RESOURCE PDN (MUST BE RESOURCEABLE)
 ?SPDNT   .  IH  .IH   .        . TEST PDN RESOURCE REQUEST
 ?SPDNW   .  IH  .IH   .        . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR PDN
          .      .     .        . HAS BEEN FULFILLED
 ?TBIT    .  IH  .IH   .     51. SET BIT IN A VECTOR ARRAY
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)RT	IH	IH	90	BINARY SORT ON AN ARRAY BY ROW
IZ	IH	IH	62	SQUEEZE BLOCKED DISC FILE TO MIN. REQUIREMENT
)QZUB	IH	IH		SQUEEZE AN UNBLOCKED DISC FILE TO MINIMUM REQUIREMENTS
ITOA1	IH	IH	63	CONVERT TRUNCATED ASCII (4PCW) TO STANDARD ASCII (1CPW)
ITOA3	IH	IH	47	CONVERT TRUNCATED ASCII (4CPW) TO STANDARD ASCII (3CPW)
)TAL			34494	

HARRIS F/FB

RJE (REMOTE JOB CONTROL) SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
:/HASP	H	H/IH	3220	SPOOLER FOR RJE
:NDER	IH	IH	10	SCANS RJE FILE AND WRITES A LIST OF CRITICAL WARNING OR ERRORS
'C,RJE	H	H/IH	160	OPCOM RJE DRIVER
!E	H	H/IH	1000	REMOTE JOB ENTRY PROCESSOR
!E>T2	IH	IH	1300	WRITES A LIST FORMAT RJE DATA FILE TO MAG TAPE FOR LISTING OR MICROFICHE
!EGEN	H	H/IH	560	PARAMETER GENERATION PROGRAM USED IN CONFIGURING THE IBM SITES INITIATED BY *RJE
:BERT;V	H	H/IH	180	RJE UTILITY
:RJEH;V	H	H/IH	980	REMOTE JOB ENTRY HANDLER
)TAL			7410	

HARRIS F/FB

PLOTTER SOFTWARE

FILE	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
)TRETPL	IH	IH	800	DATA RETRIEVAL PLOTTING PROGRAM
*PLOT	IH	IH	160	PLOTS WEAPON SCORING RELEASES PRODUCED BY *SCORE
'LOT	H	H/IH	1960	VERSATEC PLOTTER ROUTINE
.OTLIB	H	H/IH	4460	VERSATEC PLOTTER LIBRARY
)PLOT	IH	IH	200	REPLOTS OR ELIMINATES AREAS CREATED BY USING *SCORE, KEEP OPTION
)TAL			7580	

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HARRIS F/FB

OFP SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
'	IH	IH	360.	CONVERTS API FORMAT TO/FROM ENGINEERING VALUES
MOFP	IH	IH	500.	ELIMINATES DOCUMENTATION FILES FOR OFP
NOFP	IH	IH	680.	GENERATES DOCUMENTATION FILES FOR OFP
ITOFP	IH	IH	1780.	LISTS DOCUMENTATION FILES FOR OFP
P	IH	IH	680.	READS AN OFP FROM PAPER TAPE AND FORMATS IT ON DISC IN CMAC LOAD FORMAT
ITAL			4000.	

HARRIS F/FB

ADAGE SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
PP	IH	IH	2806.	ADAGE DIAGNOSTICS
APHIC	IH	IH	480.	ADAGE INTERFACE UTILITY
HSGS;V	IH	IH	80.	ADAGE DIAGNOSTIC
RMMS;V	IH	IH	380.	ADAGE MONITOR SERVICE
IT2	IH	IH	1049.	HOST COMPUTER INTERFACE TEST
XLC	IH	IH	1919.	LOADS TEST PATTERNS ON ADAGE
ITAL			6714.	

HARRIS F/FB

SAS SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION

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;AG	IH	IH	140	SAS DIAGNOSTICS
JSAS	IH	IH	100	PSEUDO REAL TIME PROGRAM USED BY *SASIO
;SIO	IH	IH	700	ALLOWS THE USER TO SET AND MONITOR SIMULATION VARIABLES
;INST;V	IH	IH	20	OUTPUT TEST INSTRUCTIONS AND DATA FROM C PROCESSOR SWITCHES TO SAS
;PRLS;V	IH	IH	80	INITIALIZES AND LOADS DATA INTO ANY ONE OF IN SAS FROM C PROCESSOR
;SERT;V	IH	IH	400	SAS DIAGNOSTICS
;SASP;V	IH	IH	1400	C PROCESSOR PROGRAM THAT DOES I/O FOR THE SIMULATOR
;T64S;V	IH	IH	48	CHECKS OUT CLOCK
)TAL			2888	

HARRIS F/FB

SIMULATOR SOFTWARE

! NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
)RS	IH	IH	216	GENERATES ADDRESS AND CROSS REFERENCE INFORMA- TION FOR MONITOR COMMON VARIABLES
;LLIS	IH	IH	500	COMPUTES BALLISTIC CURVES
(FR	IH	IH	200	LOADS C PROCESSOR
;TRET	IH	IH	2880	RETRIEVES SIMULATION DATA
;TRETQD	IH	IH	180	QUICK AND DIRTY DATA RETRIEVAL PROGRAM
;SPEC	IH	IH	2240	SETS UP DATA RECORDING FILE
(	IH	IH	60	FUNCTION WORD ASSEMBLER
'SMLG	IH	IH	160	KEEP AND FETCH *STMLOG ON TAPE
)NITOR	IH	IH	140	MONITORS MEMORY LOCATIONS AND REPORTS ANY CHANGES IN VALUE
.AN	IH	IH	4320	MISSION PLANNING PROGRAM
.ANUTIL	IH	IH	1840	PLANNING FILE UTILITY PROGRAM
'T,LD35	IH	IH	20	RESIDENT REAL TIME LOADER FOR *V;LD35;V
;ORE	IH	IH	500	COMPUTES THE IMPACT POINT OF SIMULATION WEAPON RELEASES
!RIAL	IH	IH	100	MONITORS SIMULATION SERIAL DATA WORD COUNTS
;TDAT	IH	IH	430	PUTS A KNOWN VALUE IN MONITOR COMMON
/	IH	IH	240	INITIATES THE START OF SIMULATION
'DATE	IH	IH	220	UPDATES MONITOR COMMON DISC FILES USED BY THE SIMULATION DISPLAY PROGRAMS
;ADRS;V	IH	IH	80	COMPUTES SEMI-CONDUCTOR MEMORY LOCATION OF MONITOR COMMON VARIABLES
;CLDR;V	IH	IH	200	LOADS A PROGRAM IN C PROCESSOR FROM EITHER A OR B PROCESSOR
;IH70;V	IH	IH	200	INTERRUP HANDLER FOR SIMULATOR SOFTWARE ON A PROCESSOR
;LD35;V	IH	IH	40	SETS UPMONITOR SERVICE BLU35 FOR NON-RESIDENT HANDLER *V;ETC;V
;SPCA;V	IH	IH	500	SETS UP MONITOR SERVICE BLU36 ON A PROCESSOR
;SPCB;V	IH	IH	700	SETS UP MONITOR SERVICE BLU36 ON B PROCESSOR
(EWSNAP	IH	IH	140	PRODECES FORMATTED LISTING OF ALL SIMULATION

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				COMMANDS
3DRIVE	IH	IH	100.	RESCORES WEAPON DROPS BY THE SIMULATOR
REFQ	IH	IH	240.	PROVIDES A LISTING OF SIMULATION MONITOR COMMON VARIABLES IN FILE
REFUP	IH		700.	UPDATES CROSS-REFVERENCE FILES USED BY *CMACRETV AND *FW
PLAN	IH		560.	RESTRUCTURES PLANNING FILES TO THE NEW 5 OFFSET POINTS
OTAL			17706.	

HARRIS F/FB

CMAC SOFTWARE

I NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
ATALOG	IH	IH	360.	CREATES CMAC LOAD FOR F/FB ASTRO
.OCKS	IH	IH	20.	CHECKS CLOCKS ON CMAC
.OCKT	IH	IH	100.	READS THE CLOCK FROM ALL 3 CMAC'S
MACDIAG	IH	IH	4040.	CMAC DIAGNOSITICS
MACRETV	IH	IH	2940.	RETRIEVES CMAC DATA
MACTEST	IH	IH	4080.	ALLOWS USER TO COMMUNICATE WITH CMAC
MACTIME	IH	IH	160.	CONVERTS CMAC COARSE AND FUB
JMPTP	IH.	IH	140.	DUMPS CMAC RECORDING
SRET	IH	IH	134.	CMAC DATA RETRIEVAL PROGRAM FOR RETRIEVING FULL SNAPSHOTS
CMACIV	IH	IH	1700.	SETS UP MONITOR SERVICE BLU34 FOR COMMUNICATION WITH CMAC
OTAL	IH	IH	13674.	

AGERD 6660
SYSTEM SOFTWARE

I NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
X990 O/S.	TI	IH	N/S	OPERATING SYSTEM

PDP 11/40
SYSTEM SOFTWARE

I NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ONITOR	DEC	DEC	N/S	DISK OPERATING SYSTEM V08-08

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IP	DEC	DEC	N/S	FILE UTILITY PACKAGE V08-02A
DIT	DEC	DEC	N/A	TEXT EDITOR V006A
ORTRAN	DEC	DEC	N/S	FORTRAN COMPILER V004A
ACRO	DEC	DEC	N/S	ASSEMBLER VR05-01A
IBR	DEC	DEC	N/S	LIBRARIAN V004A
INK	DEC	DEC	N/S	LINKER V11A01
DT	DEC	DEC	N/S	DEBUGGING PROGRAM
ILCOM	DEC	DEC	N/S	FILE COMPARE PROGRAM V02-04
ILDMP	DEC	DEC	N/A	FILE DUMP UTILITY V007A
ERIFY	DEC	DEC	N/S	VERIFICATION PROGRAM V002-4
ILUS	DEC	DEC	N/S	CORE IMAGE LIB UPDATE AND SAVE VA04
OLLIN	DEC	DEC	N/S	UTILITY TO SAVE DISK
YSLOD	DEC	DEC	N/S	SYSTEM LOADER V005A
FSLDR	DEC	DEC	N/S	ABSOLUTE LOADER V006A

PDP 11/40
UTILITY SOFTWARE

I NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
TNLST	IH	IH	N/S	LIST FORTRAN COMPILES W/50 LINES A PAGE
COPY	IH	IH	105.	TAPE TO TAPE COPY
TP	IH	IH	226.	GENERAL TAPE PRINT
ABELS	IH	IH	31.	PLOTS 24 VERTICAL LABELS FOR TAPES
DT	IH	IH	427.	CREATES MICROFICHE OR OTHER MACHINE COMPATABLE TAPE, LRECL 136 OR 80, ASCII OR EBCDIC
MALIB	IH	IH	4388.	SUBROUTINE LIBRARY
PLIB	VER	VER	N/S	VERSATEC PLOT LIBRARY
OTAL			5177.	

PDP 11/40
DATA REDUCTION SOFTWARE

I NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
ALLIB	IH	IH	1129.	BUILD AND UPDATE CALIBRATION LIBRARY
ALLST	IH	IH	146.	LIST CALIBRATION LIBRARY
MLINE	IH	IH	238.	DISCRIMINATOR LINEARITY CHECK
XEC	IH	IH	2395.	A/D CONVERTER STORED ON MAG TAPE
MQAC	IH	IH	274.	CHECK "EXEC" TAPE
MEDIT	IH	IH	219.	REMOVE UNWANTED DATA FROM "EXEC" TAPE
MLIST	IH	IH	2286.	PERFORM ENGINEERING UNITS CONVERSION AND LIST FROM "EXEC" TAPE
MDUMP	IH	IH	218.	PERFORM ENGINEERING UNITS CONVERSION AND LIST FROM "EXEC" TAPE
PINIT	IH	IH	2066.	LOAD AND VERIFY DC

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

'PRUN	IH	IH	1864.	RECOVER MKII DATA THROUGH DC STORE ON TEMPORARY DATA FILE
M	IH	IH	1334.	RECOVER ANALOG FM DATA, STORE ON TEMPORARY DATA FILE
'CM	IH	IH	219.	LOAD AND VERIFY 700'S FOR PCM DATA/STRIP CHARTS
'CMAIN	IH	IH	1408.	RECOVER PCM DATA, STORE ON TEMPORARY DATA FILE
:DF2DK	IH	IH	75.	STORE REFERENCE DATA FILE ON DISK TO FREE TAPE DRIVE
:ALS	IH	IH	136.	GENERATES CALIBRATION LIBRARY FOR FM OR PCM RUN
:ALOK	IH	IH	60.	PRINT AND VERIFY CALIBRATION LIBRARY
'PSTAT	IH	IH	987.	PERFORM STATISTICAL AND TIME ANALYSIS OF TEMPORARY DATA FILE(S)
'PDUMP	IH	IH	256.	LIST SELECTED PARAMETERS FROM TEMPORARY DATA FILE(S)
)UMP	IH	IH	238.	LIST SELECTED PARAMETERS FROM TEMPORARY DATA FILE(S)
'03	IH	IH	402.	CHECK FM SYSTEM
'05	IH	IH	165.	CHECK CALIBRATION ID/TAPE BREAK SYSTEM
'01	IH	IH	457.	CHECK DC LOAD
'02	IH	IH	549.	GROSS CHECK OF MKII SYSTEM
)CALG	IH	IH	30.	RECOVER MKII DATA AND STORE ON MAGNETIC TAPE
)CDUMP	IH	IH	128.	RECOVER MKII DATA AND STORE ON MAGNETIC TAPE
)CTEST	IH	IH	30.	CHECK DC
T06	IH	IH	421.	CHECK SIMULATOR TO COMPUTER COMMUNICATIONS
T07	IH	IH	1463.	CHECK SIMULATOR TO COMPUTER COMMUNICATIONS
T09	IH	IH	1993.	CHECK SIMULATOR TO COMPUTER COMMUNICATIONS
3PIKE	IH	IH	932.	FLAGS TIME OF VOLTAGE SPIKES
TIRE	IH	IH	361.	SEPARATE I/O COMMUTATED VALUES FROM UP TO 5 CHANNELS
3ATT	IH	IH	120.	SEPARATES I/O COMMUTATED VALUES
TOTAL			22619.	

MDS
MICRO-DATA SYSTEMS
INTEL 8080

CI NAME	SUP-PLIER	MAIT RES	EST SOURCE LINES	DESCRIPTION
AL	IH	IH		CREATES A FILE
ENTRY	IH	IH		COPIES ASCII DATA FROM A HEWLETT-PACKARD TERMINAL CASSETTE TO A FILE
FAST	IH	IH		SETS TERMINAL BAUD RATE TO 9600
INVASM	IH	IH		CREATES AN INVERSE ASSEMBLY LISTING AND A PSUEDO
ISIS	INTEL	INTEL/IH		OPERATING SYSTEM
LIST	IH	IH		DISPLAYS A FILE TO THE CONSOLE
PTYPE	IH	IH		TYPE FROM CONSOLE TO LINE PRINTER
ROLLIN	IH	IH		COPY BINARY DATA FROM A HEWLETT-PACKARD TERMINAL CASSETTE TO A FILE
ROLOUT	IH	IH		COPY A BINARY FILE TO A HEWLETT-PACKARD

CONTINUATION SHEET DATE: 28 Sept 1979

```
         .       .       .        .  TERMINAL CASSETTE
SLOW     . IH    . IH    .        . SETS TERMINAL BAUD RATE TO 2400
SPACE    . IH    . IH    .        . GIVES REMAING NUMBER OF BLOCKS ON A DISK
SPOOL    . IH    . IH    .        . COPIES FILES TO THE LINE PRINTER WITH PAGING
         .       .       .        .  AND TITLING
TE       . IH    . IH    .        . TEXT EDITOR
WRITE    . IH    . IH    .        . COPIES AN ASCII FILE TO A HEWLETT-PACKARD
         . IH    . IH    .        . CASSETTE
```

SOFTWARE PACKAGE CHARACTERISTICS – FLIGHT TEST REQUIREMENTS

DATE: 28 Sept 1979

Typically it will take about four to ten (average about six) sorties to get the system running smoothly before testing can begin in earnest. Flight test statistics are as follows:

Block Change	Nr. Sorties	Nr. Flight Hours
F-12	13	34.2

$10,000 per sortie is used by SMALC as a rough cost estimate for Flight testing, including system preparation and range costs. Calculations based on Figures from AFR 173-10, USAF Cost and Planning Factors, Volume I, May 1977, yield a cost per flight hour of $2,992.

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 28 Sept 1979

PROGRAMMER TRAINING:

Engineering training is by OJT, with occasional formal classes on particular subjects. These are normally taught by one of the engineering staff members.

USER TRAINING:

User training occurs via the user meetings and user flight testing of preliminary OFP tapes. During this time there are typically 15-20 phone calls by the user to SMALC.

A major problem is that the flight simulator tape usually lags the operational tape by about one year. This is because of the time required to reprogram the simulator tape.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE HISTORY DATE: 28 Sept 1979

DESCRIPTION OF NUMBERS AND TYPES OF MAINTENANCE ACTIONS PERFORMED EACH YEAR SINCE PMRT

SOFTWARE CHANGE SUMMARY FOR THE F-111F OFP

Release Date	F-10 11-76	F-11 11-76	F-12 6-78	
Change Requirement Code				*Total*
A - Add Capability	7	6	10	23
C - Correct Deficiency	9	6	23	38
D - Delete Capability	0	6	5	11
E - Enhancement	17	7	5	29
0 - Optimization	1	1	3	5
Total	34	26	46	106

CHANGES SOLVED IN F-10 (RELEASED WITH F-11)

CHANGE	TITLE	CODE
F002	MULTIPLE WIND VECTOR FIXES	C
F004	DATA ENTRY ON POWER UP WITH ALT CAL PUSHBUTTON DEPRESSED	C
F011	HEADING CONPUTATION IN DEAD RECKONING	C
F025	SEQUENCE INTERRUPT IN THE BOMB MODE	E
F029	DESIGNATE SWITCH	E
F030	IMPROVED WIND VECTOR FIX	C
F034	AILA LATERAL STEERING DATA	E
F036	IMPROVED KALMAN RE-INITIALIZATION FOR VISUAL OVERFLY FIXTAKING	E
F038	WIND VECTOR FIX MODE IN THE WDC	A
F052	POTENTIAL WORD SAVERS	O
F054	POST BOMB RUN PP CORRECTION	E
F057	RENTENTION OF MTH CORRECTIONS IN THE NAV MODE	E
F077	ECP 3073	A
F078	ALTITUDE CALIBRATION ERROR	C
F079	FIXPOINT ID DISPLAY COORDINATES	E
F080	ABORTING PRESENT POSITION CORRECTIONS	E
F081	ATTACK RADAR SLANT RANGE ERROR	C
F083	BALLISTICS/SEPARATION EFFECTS IMPROVEMENTS	E
F084	ATTACK STEERING SENSITIVITY	C
F085	BOMBING ALTITUDE DISPLAY	E
F086	MAJOR CYCLE HANGUP - HIGH DRAG WEAPONS	C
F087	SYSTEM ALTITUDE LAG	C
F088	ZERO UNPROTECTED CORE AT POWER-UP	E
F089	PCO OF COMPUTER ERROR TRAPS	E
F090	WEAPONS INVENTORY	A
F092	RANGE & BEARING OFFSET MODE IMPROVEMENTS	A
F093	MANUAL MAG VAR ENTRY	E
F094	MANUAL BOMBING ALTITUDE ENTRY	A
F096	TAS ONLY MODE WIND VECTOR	E

CONTINUATION SHEET - SOFTWARE PACKAGE MAINTENANCE HISTORY **DATE:** 28 Sept 1979

CHANGES SOLVED IN F-10 (RELEASED WITH F-11) (Continued)

CHANGE	TITLE	CODE
F099	ODSS COMMAND FLIGHT VECTOR MODE	A
F101	CCIP DEPRESSION	E
F103	MANUAL MAG VAR ENTRY	A
F105	IMPROVED WIND VECTOR FIX ROUTINE	E
F106	SSP ELEVATION DISLAY	E

CHANGES SOLVED IN F-11

CHANGE	TITLE	CODE
F026	TERRAIN ELEVATION CALIBRATION	D
F037	HEADING FIX MODE	A
F056	ALTITUDE CAL MODE LIGHT	A
F058	MAG VAR. DR TO I MODE	E
F060	FOUR OAP CAPABILITY	A
F064	INFLIGHT ALIGN - INITIAL INS HEADING	C
F108	HOMER SET/HOMER TRACK AND FIXPOINT ID	A
F109	RADAR CURSORS	C
F110	FIX MODE SWITCH	E
E111	NDU DISPLAY	E
F113	BALLISTIC LEAD AND LAG	A
F114	HIGH ALTITUDE CALIBRATION	A
E116	COMPUTER HALT WITH INVALID SSP SELECTION	C
F118	TIMESAVER, 32 PER SECOND RATE GROUP	O
F122	GROUND AVOIDANCE INDICATION	E
F123	DRIFT AND LEAD-INTO-TURN LIMIT IMPROVEMENT	E
F124	APQ-144 BEACON OPERATION	E
F125	INERTIAL WIND VECTOR FIX	D
F126	RECON TABLES	D
F127	ROCKET DELIVERY	D
F128	RANGE/BEARING OFFSET TABLES	D
F129	BEACON BOMBING IMPROVEMENT	E
F130	DELETE HIGH TOSS MODE	D
F131	ILLEGAL CCU ADDRESS SELECTION	C
F132	RE-SCALING OF TFRIFV	C
F181	YIELD CODE 8 BLAST RADIUS	C

CONTINUATION SHEET - SOFTWARE PACKAGE MAINTENANCE HISTORY **DATE:** 28 Sept 1979

CHANGES SOLVED IN F-12

CHANGE	TITLE	CODE
F018	CONVERT SET BITE FAILURE REPORTING	C
F098	OBSOLETE RMAX DATA IN MANUAL BALLISTICS MODE	C
F112	BALLISTICS LOADING	A
F117	INACCURATE BALLISTICS COMPUTATION IN TRANSONIC REGION	C
F120	INS MODE LIGHT	A
F133	BALLISTICS DATA FOR CBU 52/58/71	A
F134	RIVET GYRO CS BITE	C
F139	LADD SAFE ESCAPE	C
F140	RECON POINT ELEVATION	C
F141	ALTITUDE DRIFT DURING HIGH ALTITUDE CAL	E
F142	PCO ERROR TRAP EXPANSION	A
F143	MISSION DESTRUCT	O
F144	PANEL LOCKOUT DURING DATA ENTRY	C
F145	RECON TABLE SYNCHRONIZATION	C
F148	RECON/BOMB MODE MECHANIZATION	C
F150	ANALOG BAR COMPUTATIONS	O
F156	REMECHANIZATION OF LADD MODE	E
F157	MK 106 BLAST RADII	A
F158	SUU 21 CERTIFICATION	A
F159	REVISE BALLISTICS LIST	A
F160	UPDATE EXISTING BALLISTICS	A
F161	BALLISTIC WIND CAPABILITY	A
F169	DELETE FIXPOINT AUTO SEQUENCING	D
F170	DELETE YIELD CODE "9"	D
F171	MOVE CVF TO ODS	E
F173	B43 BLAST RADIUS	E
F175	REMOVE LEAD/LAG LIMITS	E
F178	DELETE AUTOMATIC WEAPONS BAY DOOR OPENING DURING WEAPONS DELIVERIES FROM LEFT OR RIGHT BAY	D
F179	THE AIRCRAFT CAN CARRY DIFFERENT WEAPONS ON STATIONS 3/6 AND 3A/6A BUT THE WSO CAN ONLY ENTER THE WEAPONS LOC AND ID FOR ONE OF THESE WEAPONS	A
F180	DELETE WORDS ASSOCIATED WITH WEAPON STATIONS	D
F182	ARS NORTH ORIENTATION	D
F185	MEMORY ADDRESS COMPUTER HALTS	C
F187	MANUAL NAV MODE REMECHANIZATION	C
F188	ALT DEPENDENT WPN INCORRECT BALLISTICS	C
F189	GLIDE ANGLE/DIVE DISPLAY IN DIVE	C
F190	MANUAL NAV CURSOR CONTROL	C
F191	A/A SELECTION - PARTIAL BOMB MODE ENTRY (GNC)	
F192	ANALOG BAR NOT STOWED UPON A/A GUNS EXIT	C
F193	VISUAL BOMB STEERING	C
F194	INTERMITTENT SEQUENCING IN VISUAL BOMB	C
F195	NO INS CONTROL VECTOR - WDC ONLY	C

CONTINUATION SHEET - SOFTWARE PACKAGE MAINTENANCE HISTORY **DATE:** 28 Sept 1979

CHANGES SOLVED IN F-12 (Continued)

CHANGE	TITLE	CODE
F196	RANGE ITERATION - OPTIMIZATION ERROR	C
F197	GNC 011/101 ERROR TRAPS	C
F198	AUTOMATIC ROUTE POINT SEQUENCING IN VO UPDATE	C
F199	PITCH STEERING IN RIPPLE BOMB MODE	C
F201	FILTERCYCLE INITIALIZATION	C

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE COST HISTORY DATE: 28 Sept 1979

YEARLY COST OF MAINTAINING PACKAGE:

Manhours expended in support of the F-111F are as follows:

	FY77	FY78	FY79
Direct F-111F Support	16,926	8,877	20,243
Support Software[1]	23,790	29,776	21,094

Manhours by block change are shown on p. C-79.

Vendor support of the Harris, Interdata and PDP computers costs $308K/year plus $126K/year for expendables and prototype hardware (split about 50/50).

1. For FB-111A, F-111D and F-111F, plus other projects.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - MAINTENANCE COST HISTORY **DATE:** 28 Sept 1979

Block	A	C	D	E	O	Total	Manhour (FY77 - FY79)
F-10 (released 11-76)	7	9	0	17	1	34	n/a
F-11 (released 11-76)	6	6	6	7	1	26	393
F-12 (released 6-78)	10	23	5	5	3	46	34,629
F-13 (scheduled for release late 1979)							11,024

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES DATE: 28 Sept 1979

Data Base Name	F/FB-111 Operational Flight Program
Location	SM-ALC/MMECP, McClellan AFB, California
Contact Person	Alton E. Patterson
Phone Number	(916)643-4762
General Contents	Manhours by Fiscal Year by function/ project
Period Covered	FY'77 through FY'79
Data Quality	Good detail on expenditure of manhours, down to level of OFP block change

PREDICTIVE SOFTWARE COST MODEL

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 28 Sept 1979

RESPONDENT: Bassett

If you were responsible for predicting, accumulating and accounting for software support costs, how would you do it?

1. AF Flight simulator concept (requirements different than A/C) - Need to be able to update flight simulator by just changing OFP software.

2. a. Demand spare memory

   b. Language - Function of application
      Need to study tradeoff between ease of development/maintenance vs. operational requirements (efficient code)

      Can HOL support those requirements?

      Support - peculiar language - need to buy original contractor

   c. Mission requirements
      TAC has more precise testing requirements than SAC.
      (Weapon delivery precision) [smart weapons]

   d. SPO is not motivated toward economical support
      AFLC needs veto power over design decisions

   Similarities among aircraft avionics are greater than differences.

   e. Analysis and design and testing overwhelms compilation/assembly.

   f. Support personnel cost more than development personnel
      (Need system knowledge. Implies experience.)

      Autonetics - $65K/man year
      GD - $35K/man year

APPENDIX D

F/FB-111 SUPPORT SOFTWARE/SMALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION DATE: 28 Sept 1979

ALC: SM	WEAPON SYSTEM: F/FB-111 Support Software

SOFTWARE PACKAGE: Simulation Software

PERSONNEL CONTACTED:

Al Patterson, MMECP
Lynn Bassett
Jack Claar
Nan Teague

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE: 300K+ words in core (source lines and data files)

LANGUAGE: 75 percent Fortran, 25 percent Assembly

APPLICATION: Simulation of F/FB-111 Operational Environment

COMPLEXITY: High

YEAR DEVELOPED: 1974

DEVELOPER: General Dynamics

COMMENTS

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER: Harris

MODEL NUMBER/DESIGNATOR: Harris/4

WORD SIZE: 24-bit

MEMORY SIZE: 6 x 80K = 480K

MEMORY FILL: Virtual System

WEAPON SYSTEM USE:

NUMBER OF USERS: MMECP OFP, Test and Simulation Engineers

LOCATIONS OF USERS: SM-ALC

FREQUENCY OF USE: Daily

INTERVIEWER(S): R. B. Waina, A. P. Bangs

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - QUALITY ATTRIBUTES **DATE:** 28 Sept 1979

Rate the Package on the following Quality attributes:

Accessibility: 9

Accountability: 7

Access Audit: 1

Access Control: 10

Accuracy: 10

Augmentability: 9

Clarity: 5

Communicativeness: 9

Communications, Commonality: N/A

Completeness: 9

Conciseness: 10

Consistency:

Internal Consistency: 8
External Consistency: N/A

See Accuracy

Data Commonality: N/A

Efficiency:

Execution Efficiency: 10
Storage Efficiency: 10

Error Tolerance: 10

See Augmentability

Generality: 9

Human Engineering 8

Independence:

Device: 1
Software System: 1

See Testability

Interoperability: N/A

See Access Control

Legibility: 9

Maintainability: 9

Modifiability: See Maintainability

Modularity: See Conciseness

Operability: 10

Performance: See Efficiency

Portability: See Independence

Reliability: 10

Robustness: 9

Reusability: 5

Selfcontainedness: 10

Selfdescriptiveness: 1

Simplicity: 8

Structuredness: 7

Testability: N/A

Traceability: 5

Training: 6

Understandability: See Legibility

Usability (as-is utility): See All Above

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL — DATE: 28 Sept 1979

ALC: SM	OFFICE SYMBOL: MMECP

KEY PERSONNEL/OGRANIZATION:

MMEC
Mr. Robert Green

- MMECP
  Mr. Al Patterson
  F/FB-111
- MMECM
  Mr. Frank Davis
  Software Management
- MMECS
  Major Hank Garretson
  Administration
- MMECF
  Mr. Bob La Vergne
  Ground Communications, Electronics, and Meterological

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE): (MMECP)

4 Air Force (2-3 years experience)
19 Civil Service (3-5 years experience)
30 General Dynamics (2-3 years experience)
31 Autonetics (8-10 years experience)

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

7 - one OFP for each of the two computers (GNC and WDC) for each of the three aircraft, (F-111D, F-111F, FB-111A), plus one OFP for the NCU computer program for all three aircraft. Additionally, much simulation and support software is maintained, and numerous special projects are carried out.

MAINTENANCE AGENCY - WORK DISTRIBUTION DATE: 28 Sept 1979

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL (MMECP)

FUNCTION	NUMBER OF PERSONNEL AF	CS	CONTR
Management/Secretary		4	3
FB-111A S/W Engineering		1	5
F-111D S/W Engineering		1	5
F-111F/Pavetack S/W Engineering	1		5
Mission Programs	1	3	
F-111 A/E Acquisition Support		2	1
F-111 AISF Enhancements and S/W Support			15
F-111 OFP Mk II V & V		3	3
Flight Test Support			5
S/W Configuration Management			4
TSU			5
Special Projects	2	5	10
Major AISF Upgrades			[5-10 off-premise]
	4	19	61 [+ 5 - 10]

CONTINUATION SHEET - WORK DISTRIBUTION DATE: 28 Sept 1979

Manhours for FY'77 through FY'79 are distributed as follows:

Function	FY'77	FY'78	FY'79
FB-111A	18,041	15,069	9,809
F-111F	16,926	8,877	20,243
F-111D	13,880	19,376	14,373
Other F-111	6,391	3,288	6,467
Support Software	23,790	29,776	21,094
Special Projects	28,982	35,224	33,548
Leave/Holiday	19,904	23,580	24,597
Total	127,914	135,190	129,131

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE: 28 Sept 1979

SMALC uses a manhour accounting system which logs manhours by project. For each specific aircraft type block change, manhours are accounted for by five functions: management, definition, development, documentation and test. There is also a category for OFP Group Management. Beyond that, individual functions (e.g., configuration management) and projects are tracked.

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 28 Sept. 1979

SUPPORT PHILOSOPHY:

Simulation software is supported on an "as required" basis. Changes are made as necessary to react to changes in OFPs, respond to new simulation requirements, correct errors and achieve increased operating efficiency. Changes are made continuously rather than in blocks.

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Semi-Formal

CHANGE REVIEW PROCESS:

Steering Committee Review Board and simulation personnel review proposed changes in accordance with the Charter for the MMECP Steering Committee. See pp. D-8 through D-27.

CONFIGURATION IDENTIFICATION METHODS:

No formal methods exist. Identification is by reference to current program listing. More formal methods are being developed.

CONFIGURATION CHANGE CONTROL METHODS:

Configuration is controlled in accordance with the Charter for the MMECP Steering Committee.

CONFIGURATION STATUS ACCOUNTING METHODS: Informal.

SOFTWARE LIBRARY CONTROL PROCEDURES: Standard library procedures for utility routines.

CHARTER FOR THE MMECP STEERING COMMITTEE

1. SCOPE

This document establishes the purpose and scope of responsibility of the MMECP Steering Committee.

2. INTRODUCTION

The Avionics Software Section (MMECP) is responsible for engineering support of aircraft Operational Flight Programs (OFP's) assigned to the Sacramento Air Logistics Center (SM-ALC). This includes the engineering required: to investigate and analyze OFP problems, new requirements and deficiencies; to develop prototype, test and evaluate OFP updates and modifications; to integrate the OFP's with the avionics systems; to maintain the OFP avionics system performance; to maintin OFP configuration and documentation. It also includes the engineering required to develop and implement OFP support resources. The Section is divided into four functional groups. Those groups, and their responsibilities, are as follows:

A. The Operational Flight Program (OFP) group is responsible for overall management of the F-111 "block change" cycle which includes all changes, modifications, restructuring or recoding of the Embedded Computer System (ECS) software.

B. The Software System Working (SSW) group is delegated the responsibility for planning and performance of tasks supporting the OFP group, both in software and hardware.

C. The System Development and Integration group (SDI) is responsible for a variety of tasks, including the Test and Evaluation of the ECS software.

D. The Configuration Management (CM) group is responsible for Configuration Identification, Control and Status Accounting of all changes to the FCS software and all changes, both hardware and software, to the support equipment.

3. PURPOSE:

The purpose of the Steering Committee (SC) is to review all work (either new work or proposed changes) that falls within the scope of responsibility of the MMFCP Section. No work shall be considered except that work proposed on a Task Request, and delivered to Configuration Management. (For instructions on a Task Request, see Task Request Form, Instruction For Preparing Task Request Form, and Guidelines For Task Request). The work or changes proposed are not limited to software exclusively; changes to hardware, procedures, policies, manning, etc., and any other changes which will improve the operation or efficiency of the Section, or that will improve its effectiveness in the accomplishment of the mission, may be proposed.

4. ORGANIZATION:

The Steering Committee will be comprised of the MMFCP Section Chief (Chairman) or his designee, the Configuration Manager (Secretary), the SSW group leader, the SPT group leader, a representative from the OFP group, and other members as designated by the SC Chairman. These members will decide what action is to be taken on all MMFCP Task Requests. These members will also convey information back to their respective groups. (Group members will be requested to attend when their technical expertise is required).

5. APPLICAPILITY:

Task Requests may be submitted by anyone associated with the MMECP Section. These include the MMECP personnel themselves, the personnel assigned to MMECP from the Comptrollers Office (ACD), the Software Support Center (MAIT), the Rockwell International and General Dynamics contractor personnel. Inputs may also be received from other Sections in the MMEC Branch whose work or requirements impact or are impacted by the MMECP effort. The normal channel for communicating to other Sections on matters relating to computer resource allocation is the Resoruce Utilization Board, a Branch level board whose function it is to assure optimal use of all computer resources. The Configuration Manager is the MMECP Section's permanent member of the Resource Utilization Board and will include on the Steering Committee Agenda all requests from these other Sections. The normal channel for responding to other Sections on action taken on their requests is again through the Resource Utilization Board. When the magnitude of the request is too broad to be expeditiously handled throught the workings of the SC, the SC Chairman will accept the Task Request and deal directly with the other Section Chief(s) involved and/or with the Branch Chief until some resolution is reached. The Chairman will then report back to the SC on the disposition of the Task Request so that the SC may work toward accomplishing the goals decided on.

6. ACTIONS:

The SC will review all work submitted to Configuration Management and listed as an item on the Agenda.

A. Where the SC decides the task requested on a Task Request cannot or should not be accomplished, the task will be disapproved.

B. Where the SC decides the task requested is clearly necessary, the SC will approve it for implementation pending receipt of the Task Schedule. The Task Request will be sent directly to Operational Flight Program (OFP), System Development and Integration (SDI), or Support Software (SSW) Functional Group where Task Schedule assignments will be made. A Task Resources Allocation and Schedule (which will be referred to as Task Schedule in in this charter) will be prepared, showing the cost (both in manpower and resources) required for its completion and the estimated time frame during which the task can be accomplished (for instructions on a Task Schedule, see Task Resources Allocation and Schedule Form, Instructions For Preparing Task Resources Allocation and Schedule Form, and Guidelines For Task Resources Allocation and Schedule Form). All Task Schedules, regardless of to whom assigned, will be completed and provided to Configuration Management prior to the next SC meeting which will normally be five working days after the Task Request has been approved for implementation by SC. Any Task Schedule not delivered by that time will be logged as Delinquent and the appropriate group leader advised so that he may take remedial action. Where the SC concludes that the Task Request can be accomplished after examining the Task Schedule, the SC will approve the Task Request for Implementation; however, where the SC concludes that the Task Request cannot be accomplished, the SC will disapprove the Task Request.

C. When there are several viable alternative ways of accomplishing the task, and/or the task is of such magnitude and cost that the SC needs extensive information, a Feasibility Study will be requested. The assignment mechanism will be the same as that for the Task Schedule described in the paragraph above except that the schedule will be for completion of the Feasibility Study. The completed Feasibility Study will include a Task Schedule for implementation and will be delivered to Configuration Management for inclusion on the SC Agenda. The SC will review the Feasibility Study and either approve all or a portion of the Feasibility Study for implementation or disapprove the task. Where the SC approves all of the Feasibility Study for implementation, the status of the Task Request from which the Feasibility Study was developed will be changed from Study to Implementation. Where the SC approves a portion of the Feasibility Study for implementation then the Task Request from which the Feasibility Study was developed will be closed out and one or more Task Requests reflecting the approved portion of the Feasibility Study will be submitted to the SC for approval.

D. The completion date for any original schedule may be changed once by a verbal report to the SC as long as the date does not change by more than 30 days. Any other changes to the data on the schedule form will be accomplished by submitting a revised schedule form.

E. Where the Task Request has been implemented and/or completed, a Task Closure Form will be completed and provided to Configuration Management (for instructions on a Task Closure, see Task Closure Form, Instruction for Preparing Task Closure, and Guidelines for Task Closure).

GUIDELINES FOR TASK REQUEST FORM

1. SCOPE:

This document establishes the requirement for use of the Task Request form when making changes to the software or hardware within the F-111 Avionics Integration Software Facility (AISF). This form can be utilized by civilian, military, or contractor personnel.

2. APPLICATION:

The Task Request is to be prepared by any individual who perceives a need that requires a change to software, hardward, procedures or priorites that are within the scope of control of the Avionics Software Sction (MMECP). Configuration Management (CM) requires this form as a vehicle (a) to provide information for the Steering Committee, (SC), (b) to provide the information requried for CM to prepare the Agenda and to keep the status logs required by the Steering Committee, and (c) to control changes to the software (or hardware), thus assuring that the configuration is accurately reflected in the documentation.

3. RESPONSIBILITIES OF THE ORIGINATOR:

A. Prepares the Task Request form (TR)

B. Prepares a "requirements" document:

1. A new software program, or major changes to a program, requires the use of a requirements document. In brief, the requirements document establishes the performance, design, development, and test requirements for a program and will be used as the "design-to" document. It must be detailed enough to specify inputs, outputs, and pertinent interface-

ing with peripheral equipment, etc. It will also be the originator's responsibility to run the program against a test case using operating instructions delivered with the program, to check that the program meets the requirements of the Task Request, to notify CM when the job has been completed (testing completed), and to coordinate on the Task Closure form.

2. Minor changes to a program already in use requires only a detailed list of requirements indicating exactly all functions to be performed by the computer program expressed in mathematical, logical and operational terms, together with all relevant rules and tolerances. Also include details of input, output, all pertinent interfacing with peripheral equipment and identify the means by which the eventual performance of specified functions will be verified during formal testing.

C. Submits the Task Request form and the "requirements" document to CM in one "package".

4. CM RESPONSIBILITIES:

A. Log-in and assign a control number to the Task Request (TR).

B. Add the Task Request to the Steering Committee agenda, and forward the Task Request and "requirements" document to the Steering Committee for action.

C. If further action is approved by the Steering Committee, forward the Task Request and the "requirements" document to the responsible group leader.

D. Develop the Steering Committee minutes showing actions taken, and distribute to all group leaders so they may inform those individuals within their respective groups whose tasks have been

reviewed by the Steering Committee what action was taken.

5. PREPARATION OF TASK REQUEST: See TASK REQUEST FORM and INSTRUCTIONS FOR PREPARING TASK REQUEST.

TASK REQUEST FORM

TITLE: -- CCL NO.: --------------------

---------------------------------- ORIGINATOR: --------------------------

DATE OF SUBMITTAL: ------------------------ NEED DATE: ------------------------

TASK TYPE: NEW MOD S/W H/W MGMT TRNG CONFIG

SYSTEM: INTERDATA ITE 360/65 4-PI MDS AGERD ((F/FB D) HARRIS DTS)

OTHERS ---------------

STATEMENT OF PROBLEM:

PROPOSED SOLUTION:

JUSTIFICATION (PRIORITY)/(IMPACT):

**************************DO NOT WRITE BELOW THIS LINE**************************

*STEERING COMMITTEE ACTION: ------------------------ DATE: ------------------ *

ASSIGNED TO (GROUP REP): ---

COMMENTS: --

--

****

INSTRUCTIONS FOR PREPARING TASK REQUEST

The task request originator is required to complete each blank either in ink or typed, except as stated. Do not write below the line of *'s.

TITLE:
Brief, descriptive title for the task being considered.

CCL NO:
Configuration Management (CM) will assign this number at the time of log-in.

ORIGINATOR:
Enter the name of the individual offically responsible for originating the task (may be actual originator or any other person designated; e.g., group leader, section chief, etc.).

DATE OF SUBMITTAL:
Enter the date that this form is submitted to Configuration Management.

NEED DATE:
Enter the date that the person requesting the task needs the task to be completed to meet some requirement or milestone.

TASK TYPE:
Circle applicable answer(s).

SYSTEM:
Circle applicable answer(s); for the DTS and the Harris, specify if it is for the "F/FR" or "D" model.

STATEMENT OF PROBLEM:
A brief description of the symptoms of an existing problem or the possibility of a future problem for which the task is initiated.

PROPOSED SOLUTION:
A suggested solution (or requirement of a solution) deemed necessary by the orignator.

Note: This does not imply that any requirements stated here will absolute or even necessarily desirable, but only exists to provide a basis for discussion between the originator, approval authority, and development manager which will determine a mutually agreeable solution. a mutually agreeable solution)

JUSTIFICATION (PRIORITY)/(IMPACT):

Enter the priority that the development manager thinks should be placed on the task. The priority categories will be EMERGENCY: Problems critical to mission performance which, if not solved, will have direct impact on SM-ALC mission; PRIORITY: Problems which are higher in status than routine which, if not solved, will become elevated to EMERGENCY; ROUTINE: Problems which are encountered during the normal course of business which can be solved with an adequate lead time and which does not greatly impact mission performance and enhancement that are not absolutely necessary or does not greatly impact mission performance. Justify the task based on the ramifications resulting if the task was not performed.

STEERING COMMITTEE ACTION:

Indicate one of six categories: Disapprove/No Action/ or Cancel; Implement Emergency; Implement Priority; Implement Routine; and Implementation Study/or Feasibility Study; and Table.

GUIDELINES FOR TASK RESOURCES ALLOCATION AND SCHEDULE FORM

1. SCOPE:

This document establishes the requirement for use to the Task Resource Allocation and Schedule form (which will be referred to as Task Schedule form in these guidelines) when making changes to the software or hardware within the F-111 Avionics Integration Software Facility (AISF). This form will provide scheduling and resources information necessary for configuration control and management data and is used to supplement the Task Request. This form can be utilized by civilian, military or contractor personnel.

2. APPLICATION:

Configuration Management (CM) requires this form as a vehicle (a) to provide information for the Steering Committee (SC), (b) to provide the information required for CM to prepare the Agenda and to keep the status logs required by the Steering Committee, and (c) to control changes to the software (or hardware), thus assuring that the configuration is accurately reflected in the documentation.

3. RESPONSIBILITIES OF THE ORIGINATOR:

A. The Task Schedule will be prepared by the design engineer delegated this responsibility by his group leader.

B. The Task Schedule must be filled out and submitted to CM prior to the next SC meeting which will normally be five working days after the Task Request has been approved by SC for implementation.

4. CM RESPONSIBILITIES:

A. Log-in and assign a control number for the Task Schedule. (Note: this number will be the same as the number on the Task Request initiating the task.)

B. Add the Task Schedule to the Steering Committee agenda, and forward the Task Schedule, Task Request, and "requirements" document to the Steering Committee for action.

C. If approved by the Steering Committee, forward the Task Schedule, Task Request and "requirements" document to the responsible group leader.

D. Develop the Steering Committee minutes showing actions taken, and distribute to all group leadres so they may inform those individuals within their respective groups whose tasks have been reviewed by the Steering Committee what action was taken.

E. Furnish periodic reports to the Steering Committee updating delinquent Task Schedule lists.

5. PREPARATION OF TASK SCHEDULE: See TASK RESOURCES ALLOCATION AND SCHEDULE FORM and INSTRUCTIONS FOR PREPARING TASK RESOURCES ALLOCATION AND SCHEDULE.

TASK RESOURCES ALLOCATION AND SCHEDULE FORM

TITLE: CCL NO.:

-------------------------------------- -------------------

PERSON ASSIGNED TASK:

DATE OF SUBMITTAL:

RESOURCES REQUIRED FOR TASK:

HARDWARE REQUIRED:

CURRENT / CHANGE

ESTIMATED NUMBER OF HARDWARE HOURS: --------------- / -----------

ESTIMATED NUMBER OF MANHOURS: --------------- / -----------

ESTIMATED WORK START DATE: --------------- / -----------

ESTIMATED COMPLETION DATE: --------------- / -----------

REMARKS/REASON FOR CHANGE:

***************************DO NOT WRITE BELOW THIS LINE************************
*   *
*STEERING COMMITTEE ACTION: DATE: *
* ------------------------ --------------------*
*   *
*COMMENTS: *
* ---*
*   *
--
*   *
--
****

TASK RESOURCES ALLOCATION AND SCHEDULE FORM

INSTRUCTIONS FOR PREPARING TASK RESOURCES ALLOCATION AND SCHEDULE

The person assigned the task is required to complete each blank, either in ink or type except as stated. Do not write below the line of *'s.

TITLE:
The same title that was used for the Task Request.

CCL NO:
The same number that was assigned to the Task Request; this is a TASK ID and will be used to coordinate the Task Request with the Task Schedule.

PERSON ASSIGNED TASK:
Name of the person assigned the task by the Group Leader.

DATE OF SUBMITTAL:
The actual date that the form is submitted to Configuration Management (CM).

HARDWARE REQUIRED:
This lists the type and description of hardware needed, e.g., Interdata, Harris, D-DTS, F/FR-DTS, ITE, 360/65, 4-PI, MDS or AGERD; CABLING and/or SPECIAL EQUIPMENT.

ESTIMATED NUMBER OF HARDWARE HOURS:
This entry has two parts; the first part is for the current estimated number of hardware hours needed for the task and the second part is a revised estimate of the current estimated number of hardware hours needed.

ESTIMATED NUMBER OF MANHOURS:
This entry has two parts; the first part is for the current estimated number of manhours needed for the task and the second part is a revised estimate of the current estimated number of manhours needed.

ESTIMATED WORK START DATE:
This entry has two parts; the first part is for the current estimated first day of work for the task and the second part is a revised estimate of the first day of work for the task.

ESTIMATED COMPLETION DATE:
This entry has two parts; the first part is for the current estimated date that the work will be completed and the second part is a revised estimate of the data that the work will be completed.

REMARKS/REASON FOR CHANGE:
This entry has two parts; the first part is any statement(s) that the person assigned the task wishes to make concerning the task, the second part is the reason(s) for submitting a change to the Task Schedule.

STEERING COMMITTEE ACTION:

Enter "APPROVED" or "DISAPPROVED" depending on the action taken by the Steering Committee.

DATE:

Enter the date that the Steering Committee took action on the Task Schedule.

COMMENTS:

Any statement(s) made by the Steering Committee Secretary that are pertinent to the Task Schedule.

NOTE:

Return the completed copy of the Task Schedule to CM.

GUIDELINES FOR TASK CLOSURE FORM

1. SCOPE

This document establishes the requirement for use of the Task Closure form when making changes to the software or hardware within the F-111 Avionics Integration Software Facility (AISF). This form will provide closing information necessary for configuration control and management data and is used to supplement the Task Request and Task Resources Allocation and Schedule. This form can be utilized by civilian, military or contractor personnel.

2. APPLICATION:

Configuration Management (CM) requires this form as a vehicle (a) to provide information for the Steering Committee (SC), (b) to provide the information required for CM to keep the status logs required by the Steering Committee, and (c) to control changes to the software (or hardware), thus assuring that the configuration is accurately reflected in the documentation.

3. RESPONSIBILITIES OF THE ORIGINATOR:

A. The Task Closure will be prepared by the design engineer delegated this responsibility by his group leader.

B. The Task Closure will be submitted to CM after all documentation has been completed and the task originator has verified the task meets the requirements of the Task Request and has coordinated the Task Closure form. If the task affects computer operations, the Operations manager must also coordinate the Task Closure form.

4. CM RESPONSIBILITIES:

A. Log-in and assign a control number for the Task Closure.

(Note: This number will be the same as the number on the Task Request initiating the task).

B. Verify the documentation meets minimum standards and create a configured baseline of the software source or verify the hardware change. If the standards are not met, the Task Closure will not be accepted.

C. Distribute the applicable documentation (i.e., - users' guide) to the appropriate locations.

D. Initiate action necessary for loading any new or modified software into the computer.

5. PREPARATION OF TASK CLOSURE:

See TASK CLOSURE FORM and INSTRUCTIONS FOR PREPARING TASK CLOSURE.

TASK CLOSURE FORM

TITLE: CCL NO.:

-- --------------------

DATE OF SUBMITTAL:

ACTUAL HARDWARE HOURS: ACTUAL MANHOURS:

--------------------- -------------------

DOCUMENTATION: IF YES (WHERE?)

IF NO (WHY?)

APPLICABLE FILE(S): NAME(S) / LOCATION(S)

----------------------------- / --------------------

----------------------------- / --------------------

----------------------------- / --------------------

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----------------------------- / --------------------

CHANGE DESCRIPTION AND USER IMPACT:

ORIGINATOR ACCEPTANCE COORDINATION AND DATE:

OPERATION COORDINATION AND DATE:

```
************************DO NOT WRITE BELOW THIS LINE*****************************
*                                                                               *
*CM MANAGER:                              CM CLOSE DATE:                         *
*           ----------------------                       -------------------------*
*                                                                               *
*COMMENTS:                                                                      *
*        ----------------------------------------------------------------------*
*********************************************************************************
```

TASK CLOSURE FORM

PREPARATION INSTRUCTIONS FOR TASK CLOSURE FORM

The person assigned the task is required to complete each blank in ink or typed, except as stated. Do not write below the line of *'s.

TITLE:
The same title that was used for the Task Request is required.

CCL NO.:

The same number that was assigned to the Task Request; this TASK ID will be used to coordinate the Task Request with the Task Closure.

DATE OF SUBMITTAL:
The actual date that the form is submitted to Configuration Management (CM).

DOCUMENTATION:
The "yes" blank is to be completed if documentation exists with an explanation as to where the documentation can be located. The "no" blank is to be completed if no documentation exists with a brief explanation as to why there is no documentation.

APPLICABLE FILE(S):
Any files affected due to the Task Request change will be listed along with their locations.

CHANGE DESCRIPTION AND USER IMPACT:
A description of the changes implemented and their impact on the user/operator is to be listed here.

ORIGINATOR ACCEPTANCE COORDINATION AND DATE:
The originator of the Task Request shall sign and date the Task Closure Form indicating that the task meets with his specifications.

OPERATION COORDINATION AND DATE:

Operations coordinates and dates the Task Closure Form if the closed Task Request affects Operations.

CM MANAGER:

CM coordinates when the Task Request is closed and all documentation is turned in.

CM CLOSE DATE:

Enter the date CM closes the Task Request.

COMMENTS:

Any statements made by the Steering Committee or CM that are applicable are entered here.

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 28 Sept 1979

STRUCTURED DESIGN? – DESCRIBE No
STRUCTURED PROGRAMMING? – DESCRIBE No
CODING GUIDELINES: Experience of simulation programmers.
CHANGE ENTRY METHODS: CRT on-line
SCHEDULE: Informal
REPORTING: Task Listing - see p. D-29
COMMENTS:

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET

DATE: 28 Sept. 1979

ALL TASKS AS OF 13JUL79 PAGE 8

LOG NO	TITLE	TASK REQUEST INFORMATION			TASK SCHEDULE INFORMATION				CLS DT	
		SC DATE	GRP	ACTION	SC DATE	ACTION	IND ASSIGNED TASK	COMP DT		
S78-031	DEVELOPMENT QUALIFIER	02MAR78	CM	ROUTINE	N/A	N/A	J. CLAAH/GD	N/A	07MAR78	
S78-032	PRINTER PLOT	02MAR78	MECS	ROUTINE	11JAN79	APPROVED	BILL OLDRIDGE/HI	07MAR79		
S78-033	QUALIFIER REVISION	09MAR78	CM	ROUTINE	N/A	N/A	J. CLAAH/GD	N/A	21MAR78	
S78-034	DATA REDUCTION	09MAR78	SSHG	ROUTINE	11JUL79	APPROVED	K. SHEWES/GD	01SEP79		
S78-035	SHMERGE	09MAR78	SSHG	ROUTINE	N/A	N/A	K. SHEWES/GD	20MAR78	20MAR78	
S78-036	CREATION OF CLASSIFIED SYS	09MAR78	CM	STUDY	N/A	N/A	J. CLAAH/GD	VOID	21FEB78	
S78-037	DEV QUALIFIER	23MAR78	CM	ROUTINE	N/A	N/A	J. CLAAH/GD	N/A	19APR78	
S78-038	DEV QUALIFIER	23MAR78	CM	ROUTINE	N/A	N/A	J. CLAAH/GD	N/A	19APR78	
S78-039	API TO INTERDATA INTERFACE	23MAR78		DISAPPROV	N/A	N/A	N/A	VOID	23MAR78	
S78-040	MICROFICHE MOD (RJE)	23MAR78	SSHG	PRIORITY	04MAY78	APPROVED	D. MARGIN/GD	31MAY78	05JUN78	
S78-041	TAPE DIRECTORY	N/A	N/A	N/A	N/A	N/A	N/A	VOID	14MAR78	
S78-042	REMOTE 1 SWITCH BOX	23MAR78	MECS	ROUTINE	N/A	N/A	N/A	VOID	05JUN77	
S78-043	ESCAPE FEATURE TO *TYPE	30MAR78	SSHG	ROUTINE	N/A	N/A	K. SATTANHITE/GD	24MAR78	03APR78	
S78-044	*TYPE RELIABILITY	30MAR78	SSHG	ROUTINE	N/A	N/A	K. SATTANHITE/GD	24MAR78	03APR78	
T S78-045	*TE REPLACE OP WITH ML	13APR78	SSHG	ROUTINE	N/A	N/A	L. MORRIS/ACURU	24MAR78	17MAY78	
S78-046	RESTART AFTER FALSE STOP	13APR78	N/A	DISAPPROV	N/A	N/A	N/A	VOID	14APR78	
S78-047	DATEBASE MANAGEMENT SYSTEM	06APR78	N/A	DISAPPROV	N/A	N/A	N/A	VOID	13APR78	
S78-048	API TO INTERDATA INTERFACE	30MAR78	SSHG	ROUTINE	N/A	N/A	K. SATTANHITE/GD	12MAY78	26MAY78	
S78-049	IMPLEMENT. OF SYSTEM TASKS	06APR78	OFRR	ROUTINE	19MAY78	APPROVED	D. KOEDEL/MAIT	04AUG78	17OCT78	
S78-050	DEV. QUALIFIER	13APR78	CM	ROUTINE	N/A	N/A	J. CLAAH/GD	N/A	19APR78	
S78-051	ITE/CP2 - INTERDATA LINK	19MAY78	SSHG	ROUTINE	01JUN78	APPROVED	R. MORGAN/HI	01APR79	27APR79	
S78-052	ITE/CP2A - INTERDATA LINK	06APR78	SSHG	STUDY	28SEP78	CANCEL	N/A	VOID	28SEP78	
S78-053	DATA RED. PREPROCESSOR	13APR78	MECS	VOID	N/A	N/A	N/A	VOID	14APR78	
S S78-054	IMMEDIATE INS ALIGN UPON S/W R	13APR78	SSHG	VOID	25MAY78	APPROVED	J. COLGATE/MMECH	VOID	26OCT78	unknown
S78-055	DEV QUALIFIER	13APR78	CM	ROUTINE	N/A	N/A	J. CLAAH/GD	N/A	19APR78	

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 28 Sept 1979

DOCUMENTATION:

REQUIREMENTS: Current requirements are defined in meeting minutes and in change summaries developed by engineers. See Computer Program Change Request on p. D-31.

DESIGN: The "dot" files are used for design documentation. They are described on pp. D-32 and D-33.

USER: User documentation is provided through formal changes to the system tech orders.

See Documentation Guide, pp. D-34 through D-53.

PROGRAM PROBLEM REPORTING SYSTEM:

Users generate Computer Program Change Requests. These are formally logged by MMECP, then analyzed/prioritized at the Requirements Review Meeting with users.

COMMENTS:

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

COMPUTER PROGRAM CHANGE REQUEST

Entered by SM/ALC

I.D. Number _________

1. TITLE: Enter descriptive title	2. DATE: Enter prepared date

3. COMPUTER PROGRAM IDENTIFICATION:

Enter identification of program affected

4. DESCRIPTION/PRESENT OPERATION:

Describe in detail the characteristics of computer operation or use as presently mechanized, including aircrew actions, observed reactions of various cockpit displays correlated with inputs to the system (including aircraft maneuvering or switch changes), any test data available, and any other information which might assist in identifying the cause or which might aid in implementing the correction or change.

5. DESIRED OPERATION:

Describe the characteristics of computer operation or use desired as a result of this change, using the same guidelines as under "Present Operation."

6. REASON FOR CHANGE:

Present the rationale behind the need for this change, emphasizing the relative importance of the current problem and the desired result.

7. CHANGE HISTORY/RELATED CHANGES:

Information to be supplied by Sacramento ALC

8. REQUESTED BY: Person to be contacted for further information. Name Orgn Phone	9. REQUESTING AGENCY: COORDINATION Wing coordination Name Phone
10. REQUESTING COMMAND: APPROVAL SAC/TAC/USAFE Name Phone	11. SUPPORTING AGENCY: APPROVAL SM/ALC Name Phone

CONTINUATION SHEET — Documentation (Dot Files) **DATE:** 28 Sept 1979

File Designation	File Content and Structure
axxx	File series name: a indicates aircraft series; xxx is change number.
axxx.P	CHANGE STATEMENT — File is for insertion of a change statement. TITLE: CHANGE REQUIREMENT: CURRENT MECHANIZATION: OBJECTIVE: NOTES: STATUS:
axxx.M	MECHANIZATION — A narrative which is source data for update. Note if change as mechanized is different from requirement. DATE OF LAST UPDATE: DESCRIPTION:
axxx.K	KEYINS — For generating addendum tapes. Machine language code for patches entered prior to executing a compiled OFP. Assembly language statements are not required but provide design interpretation of ML code. Note required General Navigation Computer and Weapons Delivery Computer cues. $GNC — KEYINS LOC IS WAS CORRESPONDING AL CODE (address) (revised ML code) (old ML code) $END $WDC — KEYINS LOC IS WAS AL CODE $END
axxx.R	REASSEMBLY — Similar to KEYIN, but used to reassemble a program. $GNC — REASSEMBLY (Exact card image, punched cards format previously used for reassembly) $END

CONTINUATION SHEET – Documentation (Dot Files) **DATE:** 28 Sept 1979

File Designation	File Content and Structure
axxx.I	TEST PROCEDURES – Step-by-step test procedure to checkout a change.
axxx.F	FLIGHT TEST REQUIREMENTS – Contains information for flight test of OFP change. Contains summary of change and requirements for test execution (digital channels, test parameters, success criteria, et.al.).
axxx.G	GLOSSARY – List of any new labels or mnemonics.

DOCUMENTATION GUIDE FOR

MMECP SOFTWARE

14 DECEMBER 78

COMPILED BY

CONFIGURATION MANAGEMENT

I N D E X

P A G E   C O N T E N T S

DOCUMENTATION STANDARD 1

PROGRAMS

```
CM TITLE                 :  TITLE OF PROGRAM
CM
CM DATE OF LAST CHANGE:
CM
CM PROGRAMMER            :
CM
CF EXPLANATION           :  STATE WHAT THE PROGRAM DOES.
CF
CF OVERVIEW              :  OUTLINE THE LOGIC STRUCTURE.
CF
CF VARIABLES             :  SEPARATELY DEFINE EACH VARIABLE WHOSE NAME DOES
CF                          NOT ADEQUATELY DESCRIBE ITS FUNCTION, TYPE, OR
CF                          USAGE.
CF
CI EXTERNALS             :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                          DATA FILES ACCESSED BY THE PROGRAM AND THEIR
CI                          LOCATION.
CI
CI REMARKS               :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                          UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                          THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
C                           NECESSARY TO UNDERSTAND THE PROGRAM.
C
CO USER'S GUIDE          :  A USER'S GUIDE IN THE SOURCE LISTING IS
CO                          OPTIONAL.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING, EITHER 8080 OR ASSEMBLED
USER'S GUIDE
LOCATION OF JOBSTREAMS/CSS FILES OR MACROS
ASSOCIATED WITH THE PROGRAM

DOCUMENTATION STANDARD 2

SUBROUTINES

```
CM TITLE                 :  TITLE OF SUBROUTINE
CM
CM DATE OF LAST CHANGE:
CM
CM PROGRAMMER            :
CM
CF EXPLANATION           :  STATE WHAT THE SUBROUTINE DOES.
CF
CF PARAMETERS            :  DEFINE VARIABLES WHICH ARE PASSED TO AND FROM
CF                          THE SUBROUTINE.
CF
CI EXTERNALS             :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                          DATA FILES ACCESSED BY THE SUBROUTINE OR WHICH
CI                          CALL THIS SUBROUTINE.
CI
CI REMARKS               :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                          UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                          THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                          NECESSARY TO UNDERSTAND THE SUBROUTINE.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING

DOCUMENTATION STANDARD 3

LIBRARY ROUTINES

```
CM TITLE                 :  TITLE OF LIBRARY ROUTINE
CM
CM ENTRY POINTS          :
CM
CM LIBRARY NAME          :
CM
CM DATE OF LAST CHANGE   :
CM
CM PROGRAMMER            :
CM
CF EXPLANATION           :  STATE WHAT THE LIBRARY ROUTINE DOES.
CF
CF OVERVIEW              :  OUTLINE THE LOGIC STRUCTURE.
CF
CF PARAMETERS            :  DEFINE VARIABLES WHICH ARE PASSED TO AND FROM
CF                          THE ROUTINE.
CF
CI EXTERNALS             :  LIST ALL EXTERNAL SUBROUTINES, FUNCTIONS AND
CI                          DATA FILES ACCESSED BY THE LIBRARY ROUTINE.

   REMARKS               :  INSERT COMMENTS TO DESCRIBE DATA STRUCTURES AND
CI                          UNUSUAL PROGRAMMING TECHNIQUES AND REQUIREMENTS.
CI                          THESE COMMENTS SHOULD CONTAIN ANY INFORMATION
CI                          NECESSARY TO UNDERSTAND THE LIBRARY ROUTINE.
CI
CO USER'S GUIDE          :  A USER'S GUIDE IN THE SOURCE LISTING IS OPTIONAL.
```

NOTE: DESCRIPTIVE COMMENTS SHOULD BE GENEROUSLY USED THROUGHOUT THE SOURCE CODE TO DESCRIBE WHAT IS HAPPENING.

OTHER DOCUMENTATION NEEDED:

SOURCE LISTING
USER'S GUIDE

****

BOILER PLATES FOR THE STANDARDS ARE CONTAINED IN THE FOLLOWING LOCATIONS:

```
     INTERDATA:  SYST:DOCSTD.FRM/S
        HARRIS:  SYST*DOCSTD
 RECORD NUMBER:  PROGRAM 5-45; SUBROUTINE 50-80; LIBRARY ROUTINE 85-125
```

EXAMPLE: PROGRAM DOCUMENTATION

```
CM TITLE                 : PACKPURGE
CM
CM DATE OF LAST CHANGE:  30 OCT 78
CM
CM PROGRAMMER            : B. BARTHELOW
CM
CF EXPLANATION           : THIS IS A PURGE PROGRAM FOR USE BY CONFIGURATION
CF                         MANAGEMENT.  THE PROGRAM WILL REQUEST A PACK NUMBER
CF                         FROM THE USER AND PROCEED TO PURGE ALL DATA FILES
CF                         NOT ACCESSED WITHIN THE PREVIOUS 7 DAYS.
CF
CF OVERVIEW              : PROGRAM PACKPURGE;
CF                            INITIALIZATION;
CF                                WHILE PACKPURGE NOT COMPLETE
CF                                    DO BEGIN
CF                                        GETAREAINFO;
CF                                        IF PROGTYPE .EQ. DATA-AREA
CF                                        THEN BEGIN
CF                                               IF QUALIFIER .NE. 0000SYST
CF                                               THEN BEGIN
CF                                                      IF LASTACCESS > SEVENDAYS
CF                                                      THEN ELIMINATEAREA;
CF                                                      END;
                                                 END;
CF                                       END;
CF
CI VARIABLES             : PARLST IS THE PARAMETER LIST AND BUFFER AREA FOR
CI                             SDASAVE
CI                         ELIST IS THE PARAMETER LIST FOR THE SYSTEM
CI                             ELIMINATE ROUTINE
CI                         ALL VARIABLES ARE GLOBAL
CI
CI  EXTERNALS            : NONE
CI
CI  REMARKS              : THE PROGRAM IS COMPILED AS A FORTRAN PROGRAM FOR
CI                             EASE OF I/O.
CI                         DUE TO THE INTERNAL OPERATION OF VULCAN, THIS
CI                             PROGRAM MUST BE RUN AS *ACUTIL IN ORDER TO
CI                             UTILIZE THE SYSTEM ROUTINE SDASAVE.  IN ORDER
CI                             TO EFFECT THIS THE PROGRAM SHOULD BE EXECUTED
CI                             BY A JOB STREAM FILE WHICH RENAMES ACUTIL TO
CI                             TEMP, PACKPURGE TO ACUTIL, EXECUTES ACUTIL
CI                             AND UPON COMPLETION RENAMES ACUTIL TO
CI                             PACKPURGE, TEMP TO ACUTIL.
CI
CI
      WRITE(3,900)
900   FORMAT(" ENTER PACK # TO BE PURGED")
      READ(3,901) IPACK
  1   FORMAT(I3)
      WRITE(3,902) IPACK
902   FORMAT(2X,I3)
```

```
        STOP
    USE
QLTEST  BLOK 1
PARLST BLOK 24
RLIST BLOK 1
ELIST BLOK 1
ARCNT BLOK 1
        TMA   IPACK
        TAM   PARLST+0
        TLO   @ARLST
        BLJ   $DASAVE        FIRST CALL TO DASAVE
        DATA  1             FUNCTION CODE TO GET ALL AREAS
        BOZ   DONE           NO AREAS EXIT
        TEM   ARCNT         NUMBER OF AREA BLOCKS RETURNED * 20 WORDS/BLOCK
        BLU   STIME          GET TODAYS DATE
        SDE   7              SUBTRACT 7 DAYS
        TEM   PDATE          INITIALIZE PURGE DATE
MLOOP   BLJ   GTAREA        SET K REGISTER TO AREA BLOCK
        BOZ   DONE           NO MORE AREAS TO PROCESS
        TMA   6,K            CHECK IF DATA FILE OR PROGRAM FILE
        BON   MLOOP          PROGRAM FILE GET NEXT AREA BLOCK
        BLJ   QLTEST        CHECK IF 0000SYST QUALIFIER
        BNZ   MLOOP          YES, GET NEXT AREA BLOCK
        BLJ   ACCESS         CHECK LAST ACCESS
        BON   MLOOP          WITHIN 7 DAYS GET NEXT AREA BLOCK
        BLJ   ELIM           TO LONG ELIMINATE IT
        BUC   MLOOP          GET NEXT AREA BLOCK
*
*                   GETAREA ROUTINE
*                   ===============
*
*       ON ENTRY TO THIS ROUTINE LOC ARCNT CONTAINS CURRENT BUFFER
*       POINTER.
*       SUBTRACT 20 (AREABLOCK SIZE).
*       IF NOT POSITIVE DACALL ELSE MOVE POINTER TO K REGISTER & RETURN.
*       DACALL:
*               CALLS $DASAVE.
*               TRANSFERS BUFFER COUNT TO AREACOUNT.
*               RETURNS TO MAINLINE IF NOTHING IN BUFFER I.E DONE.
*               ELSE RE-ENTERS GETAREA.
*
*
*
GETAREA  AOM  -20              MOVE POINTER TO NEXT AREA DATA IN BUFFER
       DAC   ARCNT       ADDRESS OF LOCATION TO ADD TO
         BNP  DACALL            BUFFER COMPLETELY PROCESSED GET NEXT BUFFER
         TMK  ARCNT           MOVE POINTER TO K REGISTER
         BUC  0,J               RETURN TO MAINLINE
DACALL   TLO  PARLST           GET ADDRESS OF PARAMETER LIST
         BLJ  $DASAVE           CALL SYSTEM ROUTINE
         DATA 0                 NOT THE FIRST CALL SO 0 HERE
         BNZ  $40               PROBLEMS  SEND ERROR MESSAGE
         TEM  ARCNT           MOVE BUFFER SIZE TO ARCNT
         BOZ  BUC0J             ALL DONE RETURN WITH ZERO FLAG SET
         BUC  GTAREA           GO SET POINTER
```

```
*                    ELIMINATE ROUTINE
*                    =================
*
*          MOVES AREANAME AND QUALIFIER FROM BUFFER TO $ELIMINATE PRAM LIST
*          ELIMINATES FILE
*          RETURNS TO MAIN
*
*
ELIM       TMD    0,K             GET AREANAME FROM BUFFER
           TDM    ELIST           PUT IN PRAM LIST
           TMD    8,K             GET QUALIFIER FROM BUFFER
           TDM    ELIST+2         PUT IN PRAM LIST
           BNZ    $41             PROBLEM  SEND ERROR MESSAGE
           BUC    0,J             RETURN
*
*
*
*
*                    ACCESS ROUTINE
*                    ==============
*
*         GETS LAST ACCESS DATE AND PURGE DATE.
*         SUBTRACTS PURGE DATE FROM ACCESS DATE.
*         RETURNS.

*
ACCESS     TME    17,K        GET LAST ACCESS DATE
           TMA    DTIME       GET PURGE DATE
           SAE                SUBTRACT
BUCOJ      BUC    0,J
$END
C
C
C          THE FOLLOWING DISPLAYS ERROR MESSAGE FOR $DASAVE ERROR
C
C
40      WRITE(3,400)
400     FORMAT(" ERROR IN $DASAVE ROUTINE CONTACT PROGRAMMER")
C       GO TO 50
C
C
C          THE FOLLOWING DISPLAYS ERROR MESSAGE FOR $ELIM ERROR
C
41      WRITE(3,410)
410     FORMAT(" ERROR IN $ELIMINATE ROUTINE CONTACT PROGRAMMER")
C
C
C          COMMON EXIT LOGIC
C   50     REWIND 10
C   51     READ(10,500)VARIABLE LIST
         IF(EOF)GO TO 60
C       WRITE(6,502)VARIABLE LIST
C       GO TO 51
C     60     CLOSE 3
        END
```

EXAMPLE: SUBROUTINE DOCUMENTATION

```
      SUBROUTINE GTDATE(TEMP)
CM
CM TITLE                 :  GTDATE
CM
CM DATE OF LAST CHANGE:  8 NOV 78
CM
CM PROGRAMMER            :  M.TAYLOR & J.CLAAR
CM                          REVISION 1 - N. TEAGUE
CM
CF EXPLANATION           :  THIS SUBROUTINE CONVERTS AN ALPHABETIC MONTH
CF                          NAME TO A NUMERIC VALUE.  THIRTEEN DAYS ARE
CF                          ADDED TO THE DATE TO ALLOW FOR CHECKING FOR
CF                          DELINQUENT TASK REQUESTS.  CROSS-OVER TO THE
CF                          NEXT MONTH AND/OR YEAR IS TAKEN INTO ACCOUNT.
CF
CI PARAMETERS            :  TEMP - ALPHANUMERIC INPUT/OUTPUT OF DATE:
CI                                 FORMAT I
CI
CI EXTERNALS             :  CALLED BY MAIN
CI                          LOCATED IN TRTSMAIN
CI
CI REMARKS               :  DATES WILL NOT BE CONVERTED BEYOND THE YEAR 1999.

CI
C     DATA DEFINITION
      INTEGER TEMP(3),YDATE(12,2)
      COMMON /IDATE/YDATE
C     END DATA DEFINTION
C     GET NUMERIC DATE FOR TEST IN CALLING ROUTINE
      DO 10 I=1,12
      IF(TEMP(2).EQ.YDATE(I,1)) GO TO 20
10    CONTINUE
      WRITE(3,1000) TEMP(2)
1000  FORMAT('0 MONTH GIVEN ('A4,') IS WRONG ',/,'  ENDING SESSION')
      CALL EXIT
C     SET ALPHA MONTH TO NUMERIC MONTH
20    TEMP(2)=I
C     ADD IN 13 FOR TWO WEEK CHECK
      TEMP(1)=TEMP(1)+13
C     CHECK TO SEE IF IT IS INTO ANOTHER MONTH
      IF(TEMP(1).LE.YDATE(I,2)) GO TO 9999
C     YES SUBTRACT OUT FOR DAYS INTO NEW MONTH
      TEMP(1)=TEMP(1)-YDATE(I,2)
C     INCREMENT MONTH COUNTER
      TEMP(2)=TEMP(2)+1
C     CHECK TO SEE IF INTO NEW YEAR
      IF(TEMP(2).LE.12) GO TO 9999
      ADD TO YEAR COUNTER (WILL NOT WORK FROM 1999 TO 2000)
      TEMP(3)=TEMP(3)+1
C     END OF DATE ROUTINE
9999  RETURN
      END
```

EXAMPLE: LIBRARY SUBROUTINE DOCUMENTATION

```
CM TITLE               :  JULBIN
CM
CM ENTRY POINTS        :  JULBIN
CM
CM LIBRARY NAME        :  OFPLIB
CM
CM DATE OF LAST CHANGE:  8 MAY 77
CM
CM PROGRAMMER          :  KARL W RASS
CM
CF EXPLANATION         :  THE BUFFER STARTING AT IBUFF AND FOR NCHAR BYTES LONG
CF                        IS SCANNED LOOKING FOR A VALID DATE AND TIME IN ASCII.
CF                        THE DATE IS CONVERTED TO A BINARY WORD AND THE TIME IS
CF                        CONVERTED TO ANOTHER BINARY WORD.  THE APPROPRIATE
CF                        STATUS IS RETURNED.  THE DATE CAN BE EITHER IN INTERDAT
CF                        (E.G. 24/01/77) OR CONVENTIONAL (24 JAN 77) OR JULIAN
CF                        (77.024).  TIME IS IN HH:MM:SS AND IF NONE IS GIVEN
CF                        THEN 12:00:00 IS ASSUMED.
CF
CF OVERVIEW            :  SCAN THE BUFFER
CF                           IF THE FORM IS JULIAN
CF                              CONVERT THE DATE TO BINARY
CF                              CONVERT THE TIME TO BINARY
CF                              RETURN
CF                           IF THE FORM IS DD/MM/YY OR DD/MMM/YY
CF                              IF THE YEAR IS LEAP YEAR
CF                                 IF THE MONTH IS LATER THAN FEB.
CF                                    ADD 1 DAY TO TOTAL DAYS IN DATE
CF                              CONVERT DATE TO BINARY
CF                              CONVERT TIME TO BINARY
CF                              RETURN
CF
CI PARAMETERS          :  INPUT:
CI                           IBUFF = BUFFER START ADDRESS WHERE THE DATE/
CI                                   TIME IS LOCATED
CI                           NCHAR = LENGTH IN BYTES OF IBUFF; I4 FORMAT
CI
CI                        OUTPUT:
CI                           IBIN = IBIN(1) IS BINARY DATE
CI                                  IBIN(2) IS BINARY TIME
CI                           ISTAT = STATUS; RANGE -6 - 0; I4 FORMAT
CI
CI EXTERNALS           :  CALLS FSCAN; LOCATED IN SYS:USER LIBRARY
CI
CI REMARKS             :  AFTER CALLING JULBIN, SUBROUTINE JULIAN MUST BE
CI                        CALLED TO CONVERT THE BINARY DATA TO JULIAN
CI                        FORMAT.  LEAP YEAR CALCULATIONS WILL BE INCORRECT
 T                        BEGINNING WITH LEAP YEAR 1980.
*PROG JULBIN                                                               98
```

```
 ++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++

      SUBROUTINE JULBIN(IBUFF,IBIN,NCHAR,ISTAT)
C
C+++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++++
      DIMENSION IMONTH(12),ITEXT(2),ITABLE(12),IBIN(2),IDELIM(3)
C
      DATA IMONTH/'JAN ','FEB ','MAR ','APR ',
     *            'MAY ','JUN ','JUL ','AUG ',
     *            'SEP ','OCT ','NOV ','DEC '/
C
      DATA ITABLE/0,31,59,90,120,151,181,212,243,273,304,334/
C
      DATA IDEC/'.   '/,ICOLON/':   '/
      DATA IDELIM /'/         '/
C
C     FINDING OUT IN WHAT FORM THE BUFFER IS IN
C
      CALL FSCAN('SCINIT',NCHAR,IBUFF)
      CALL FSCAN('DLIM',1,IDELIM,IREGA)
      CALL FSCAN('GTDISP',IDISP)
      CALL FSCAN('TEXT',ITEXT,LENGTH)
C
C     IF THE FORM IS IN JULIAN( YR.DAY) GO TO 70
C
      IF(LENGTH .EQ. 6) GO TO 70

C     FORM MUST NOW BE IN DAY MONTH YR
C                         02  DEC   75
C                         02/12/75
      CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('NUMBER',IDAY,NNUM,LENGTH)
      IF(IDAY .GE. 32 .OR. IDAY .LE. 0) GO TO 990
C
C     IF THE FORM IS IN DD/MM/YY (02/12/75)
C
      CALL FSCAN('GTDISP',IDISP)
      CALL FSCAN('NUMBER',IMON,NNUM,LENGTH)
      IF(IMON .LT. 0) GO TO 2
      IF(IMON .EQ. 0 .OR. IMON .GT. 12) GO TO 991
      ITEXT(1) = IMONTH (IMON)
      GO TO 3
C
C     IF THE FORM IS DD MMM YY (02 DEC 75)
C
2     CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('TEXT',ITEXT,LENGTH)
      IF(LENGTH .NE. 3) GO TO 991
3     CALL FSCAN('NUMBER',IYR,NNUM,LENGTH)
      IF(IYR .GT. 99 .OR. IYR .LT. 0 ) GO TO 992
```

```
C
      DETERMINING IF YEAR IS LEAP YEAR
C
      DO 5 J=1,24
      ILEAP = 4*J
      IF( IYR .EQ. ILEAP) GO TO 30
5     CONTINUE
C
C     NON-LEAP YEAR CALCULATIONS
C
      DO 10 I = 1,12
      IF(ITEXT(1) .EQ. IMONTH(I)) GO TO 20
10    CONTINUE
      GO TO 991
20    NDAYS = ITABLE(I) + IDAY
      IYR   = IYR *(2**16)
      IBIN(1) = IYR + NDAYS
      GO TO 80
C
C     LEAP YEAR CALCULATIONS
C
30    DO 40 I = 1,12
      IF(ITEXT(1) .EQ. IMONTH(I)) GO TO 50
40    CONTINUE
      GO TO 991
50    IF(I .GT. 2) IDAY = IDAY + 1
      NDAYS = ITABLE(I) + IDAY
      IYR   = IYR *(2**16)
      IBIN(1)= IYR + NDAYS
      GO TO 80
C
C     IF THE DATE IS IN JULIAN FORMAT(YR,DAY)
C
70    CALL FSCAN('STDISP',IDISP)
      CALL FSCAN('STCHAR',IDEC)
      CALL FSCAN('NUMBER',IYR,NNUM,LENGTH)
      IF(IYR .GT. 99 .OR. IYR .LT. 0) GO TO 992
      CALL FSCAN('NUMBER',IDAY,NNUM,LENGTH)
      IF(IDAY .GT. 366 .OR. IDAY .LT. 0) GO TO 990
      IBIN(1) = IYR * (2**16) + IDAY
C
C     PICKING UP THE TIME (HR:MIN:SEC)
C
80    CALL FSCAN('STCHAR',ICOLON)
      CALL FSCAN('NUMBER',IHR,NNUM,LENGTH)
      IF(IHR.LT. 0 .OR. IHR.GT. 24) GO TO 993
      CALL FSCAN('NUMBER',MIN,NNUM,LENGTH)
      IF(MIN .LT. 0 .OR. MIN .GT. 60) GO TO 994
      CALL FSCAN('NUMBER',ISEC,NNUM,LENGTH)
      IF(ISEC .LT. 0 .OR. ISEC .GT. 60) GO TO 995
```

```
      IBIN(2) = 36000 * IHR+ 600 * MIN + 10 *ISEC
      ISTAT = 0
      RETURN
C
C     DEFAULT OF NOON FOR THE TIME
C
90    IBIN(2) = 36000*12
      ISTAT = 0
      RETURN
C
C     ERRORS IN BUFFER PASSED
C
C     INVALID DAY    = -1
C     INVALID MONTH  = -2
C     INVALID YEAR   = -3
C     INVALID HR     = -4
C     INVALID MIN    = -5
C     INVALID SEC    = -6
C
990   ISTAT = -1
      RETURN
991   ISTAT = -2
      RETURN
992   ISTAT = -3
      RETURN
993   IF(IHR .EQ. -2) GO TO 90
      ISTAT = -4
      RETURN
994   ISTAT = -5
      RETURN
995   ISTAT = -6
      RETURN
      END
```

USER'S GUIDE PROCEDURES

1. PURPOSE

Give a general description of the program stating its purpose and function.

2. INPUT

Describe the input including format, content, input media, and sequencing.

3. OUTPUT

Describe the output including format, content, and output media.

4. OPERATING PROCEDURES

List the step by step procedures required to:

1. Initiate the program.
2. Maintain operation.
3. Terminate and restart the program.

Give an operational example.

5. RESTRICTIONS

Describe any limitations such as size of input, computer processor used, system space required, etc.

6. APPLICABLE ERROR MESSAGES

List any error message which may be displayed due to improper input, file generation error, etc.

4-PI ASSEMBLER USERS' GUIDE

1. PURPOSE

The major objective of the 4-PI Assembler rewrite project is to allow complete processing of 4-PI programs at SMALC. At this time, a syntaxing version of the assembler exists for use. This version accepts an ordinary 4-PI Assembler input file and creates from it a syntaxed and cross-referenced listing of the input. For complete documentation on the use of the assembler, refer to the IBM CP-2 and 4-PI manuals.

2. INPUT

This assembler accepts the same input as the Ogden assembler with the following exceptions:

1. The JCL cards are not needed and are ignored if found in the input file.

2. The Update Processor INCLUDE card must contain an Interdata filename. Defaults are set to the user volume and no extension. The included files must be present on the Interdata system and all member name cards must be deleted from the data sets.

OUTPUT

The output consists of the assembly listing including error messages, warning messages, error summary, input file description, cross reference dictionary, external symbol dictionary, special remarks cards, and table of contents.

4. OPERATING PROCEDURES

4.1 Initial Preparation Procedures

Before using the assembler for the first time, it is necessary to prepare the input files. It is assumed that the main input module is already located on an Interdata disc pack. However, since most of the EXBLKS reside as data sets in libraries at Ogden, the user must retrieve these data sets for use on the Interdata. A separate file is needed for each EXBLK, and the member name cards must be deleted. These files may be given any Interdata filename. If minimal text editing of files is desired, the above files should be named using the user volume, the name from the INCLUDE card, and no extension. If these defaults are not used, the user must modify any INCLUDE card in the source file to indicate the new filename.

4.2 OPERATION

The 4-PI Assembler is a non-interactive task. It is called by the following statement:

```
ASMPI filename1          , filename2
                           *
                           •
```

where
  filename1 is the user's input file
  filename2 is the user's output file

Options for the output file are:

```
1.  filename = output goes to the specified file
2.  *        = output is displayed on the CRT screen
3.  •        = output goes to a null device
4.  blank    = output goes to the user's default list file
```

End of task status is displayed on the CRT screen as follows:

```
END OF TASK 0   Assembled with no errors
END OF TASK 2   Assembled with warnings only
END OF TASK 3   Assembled with errors
```

Example: The following is a short example of a 4-PI program and an INCLUDE module with comments:

```
                  SOURCE
//R1B16GNSJOB    ('A354,',10,MMEC), 'OFP', CLASS:E
//SY11SCR.SYSIN DD *
//CPASMS.INCARD DD *
            ASSEM A.NSSG
```

The above cards, all JCL and the ASSEM card are treated as comments and are ignored.

```
          ENTRY DVY
          EXTRN VSHIFT
GAMBOL    EXBLK
          INCLUDE GAMBOL
```

Module GAMBOL must have been brought back from Ogden, separated into its own file, and placed on the user's default disc. The filename must have blanks in the extension.

```
               .
               .
FCDR           BSSH 1
               .
               .
               .
IOB16          EXBLK
*              INCLUDE FR01:IOB16.SRC/G
```

Module IOB16 has been fully described as residing on disc FB01 with extension .SRC/G.

```
                   .
                   .
                   .
                   USING NLOCAL2,1
                   .
                   .
                   .
                   END
```

Include Module: All member name cards must be deleted when creating the include file.

```
MEMBER NAME GAMBOL
GAMBOL      EXBLK DATE 69,192 B SYSTEM
LASTXR2     BSSH  1
```

Approximate compile time for large modules (ex: B16NSGNC) is 15 minutes.

5. RESTRICTIONS

1. The maximum number of labels allowed is 2000.

2. The maximum number of MACRO's allowed is 50.

3. The maximum number of included files is 9.

6. ERROR MESSAGES

Two types of errors are indicated by the assembler. The first displays bad file I/O to the CRT screen, giving the file involved and the I/O status. This type includes errors such as assignment errors for the input or output file. The second type of error is for syntax errors and warnings. These are merged into the output listing and appear, beginning in column 2, as follows:

```
*   WARNING --- 4   COLUMN 9 NOT BLANK
**  ERROR   --- 3   MULTIPLY DEFINED LABEL
```

Warnings and Errors:

Warnings:

1. SHORT INSTR DOESN'T FOLLOW A SKIP, COMPARE OR MODIFY STORAGE
2. LONG INSTRUCTION GENERATED IN EXBLK
3. SHORT INSTRUCTION GENERATED
4. COLUMN 9 NOT BLANK
5. SHIFT VALUE TO LARGE -- HAS BEEN SET TO MAXIMUM
6. ENTRY OR EXTRN DEFINED BUT NOT USED

Errors:

1. ILLEGAL OPCODE
2. ILLEGAL LABEL IN LOCATION FIELD
3. MULTIPLY DEFINED LABEL
4. LABEL TABLE LIMIT EXCEEDED
5. ILLEGAL CHARACTER IN COLUMN 15
6. ILLEGAL LABEL IN VARIABLE FIELD
7. UNDEFINED LABEL USED
8. MULTIPLY DEFINED LABEL USED
9. UNDEFINED SET OR EQU LABEL
10. ILLEGAL NUMERIC SPECIFICATION
11. INVALID SHIFT VALUE
12. INVALID INDEX REGISTER
13. INVALID HEX MASK
14. ILLEGAL VARIABLE FIELD FORMAT
15. ILLEGAL MACRO NAME SPECIFIED
16. MACRO NESTING EXCEEDS 10 LEVELS
17. MORE THAN 10 PARAMETERS USED
18. INVALID MACRO ARGUMENT
19. MACRO TABLE LIMIT EXCEEDED
20. MACRO, INBLK, EXBLK MUST APPEAR BEFORE EXECUTABLE CODE
21. INVALID IFF OR IFT INSTRUCTION
22. INVALID GO TO OPERAND
23. INBLK OR EXBLK DEFINITION EXCEEDED MAXIMUM SIZE
24. DEC OR BCI DATA TRUNCATED
25. ILLEGAL COMBINATION OF INBLK, EXBLK

FEASIBILITY STUDY PROCEDURES

1. PROBLEM

   Describe the existing problem.

2. CURRENT IMPLEMENTATION

   Describe what is currently available to handle the problem.

3. SOLUTIONS

   List the available solutions. For each solution, include the following:

   1) How the solution was reached.

   2) What effects it will have on the general user.

   3) What the new specifications will be.

   4) The time cost in man hours and machine hours.

4. RECOMMENDATIONS

   State which solution is most feasible.

TCOPY2 Feasibility Study

1. Problem

TCOPY2 under MTR03 will not process the header files on tapes created under MTR02.

2. Current Implementation

When accessing tapes created under MTR02, TCOPY2 must be implemented in no header mode. A user must user the ADV command to position the tape at the correct file.

3. Solutions

1) Modify TCOPY2 to ignore the account number field in the header files. The problem was discussed with the original programmer who suggested that the change could be easily implemented. The general user would be able to use the FIND command to locate a file on the tape and then proceed with a READ command. The time cost will be 30 man hours and 20 machine hours.

2) Use the current implementation. This requires the users to first use the INDEX command to display a list of all files on the tape; the count the number of files, including both header and data files, and use the ADV command to advance the proper number of files; then switch to NOHEADER mode and proceed with a READ command.

3) Recommendations

It is recommended that TCOPY2 be modified. This modification will make tape file acquisition less complicated for the general user.

PERSONNEL DESCRIPTION DATE: 28 Sept 1979

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

Below is the official position description for a GS-12 Electronic Engineer (Computer Systems). This description outlines the basic requirements of the work to be done, whether performed by Civil Service or contractor personnel.

I. INTRODUCTION

See functional statement filed in Official Position Description folder and the Sacramento ALC Organization Directory charts. Incumbent of this position serves as an Avionics System Engineer responsible for accomplishing software and systems engineering projects/tasks for avionics embedded computer systems, their resident Operational Flight Programs (OFPs) and their support systems for the F-111 and other Sacramento ALC prime aircraft systems.

II. DUTIES AND RESPONSIBILITIES

1. Develops, coordinates and carries through to completion blocks of work of large scope containing many phases of which two or more phases each contain several complex features. Plans and conducts research, development, or other work for which precedent data, criteria, methods or techniques are significantly inadequate, are controversial, or contain critical gaps. Develops or originates completely new features, in addition to improving, extending, or validating currently known precedents, data, methods or techniques. In accomplishing the above incumbent is responsible for the development of modifications and changes to complex aircraft digital avionics systems, their Operational Flight Programs (OFPs), and laboratory support systems (e.g., the Sacramento ALC F-111 Avionics Integration Support Facility (AISF)) In addition, incumbent is responsible for the investigation, analysis, evaluation and reporting on avionics system performance, problems and new requirements

2. Develops and carries through to completion complex changes to the OFPs. Uses the F-111 AISF to analyze and evaluate OFP requirements in order to develop optimum implementation. Investigates potential solutions to system problems/change requirements considering tradeoff analyses involving implementation costs, algorithm developments, timing requirements, memory size, hardware/software integration requirements, support equipment, personnel capabilities and limitations, data package development and overall magnitude of the effort; and translates these change requirements into engineering specifications and tasks. Designs the change mechanization and integration; develops the programming code; and debugs, tests and documents the results. At all times assures aircraft system integrity and compatibility; and meets resource allocations, performance criteria, cost and schedule.

3. Establishes formal test requirements for OFPs; develops and implements test plans; conducts detailed tests using the full capabilities of the F-111 AISF and instrumented flight test aircraft; and analyzes, evaluates and reports test results.

4. Serves as project engineer for the design and development of changes and modifications to the AISF hardware/software resources and other avionics support systems. Provides system engineering support and assures compatibility with the aircraft avionics, digital computer complexes and OFPs. Establishes change requirements directly with the AISF and avionics support systems users. Prepares change specifications and plans and schedules the complete development and implementation.

5. Conducts studies and evaluations of systems in acquisition and determines support requirements. Performs 2612 studies, prepares Computer Resources Integrated Support Plans (CRISPs) and participates as a member of Computer Resources Working Groups (CRWGs).

AD-A088 477 HUGHES AIRCRAFT CO CANOGA PARK CALIF F/G 14/1
PREDICTIVE SOFTWARE COST MODEL STUDY. VOLUME II. SOFTWARE PACKA--ETC(U)
JUN 80 R B WAINA, A P BANGS, E E RODRIGUEZ F33615-79-C-1734
UNCLASSIFIED AFWAL-TR-80-1056-VOL-2 NL

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6. Prepares contractual engineering proposals and associated specifications and work orders.

7. Monitors and maintains close liaison between contractor and Air Force activities associated with the engineering support of digital avionics, embedded computer systems and OFPs for Sacramento ALC prime aircraft systems.

8. Reviews, evaluates and advises on the effectiveness, technical adequacy and suitability of work and proposals of others related to digital avionics and OFP support. Evalutes more complex vendor proposed modifications for requirements, feasibility, completeness, accuracy, cost, and operational and logistics impact.

9. Consults, coordinates and attends conferences with other service activities and higher headquarters on matters pertaining to avionics OFP development and support. Makes recommendations to higher authority for changes to policies and practices, based on knowledge, experience, engineering studies, observations, and reports received from service activites, and defends Sacramento ALC's findings and recommendations. Travels to contractor or other government facilities to review engineering data and render opinions and decisions which are normally unreviewed; maintains liaison with other government activities and contractors in order to exchange engineering data and to maintain a current knowledge of the state-of-the-art.

10. Independently determines logical approach to solutions of major associated avionics OFP development and support problems. Carefully weighs the advantages of increased systems reliability, maintainability, etc., against time, cost, compatibility, and safety of flight. Makes and evaluates proposed changes to the system software on the basis of established hardware/software interfaces. Establishes supporting projects with other engineering personnel and directs the integration of auxiliary projects toward the ultimate objective. Scope of project effort is broad in that all projects consider, as applicable, the mission of the aircraft; functions of associated avionics systems (weapon delivery, navigation, reconnaissance, radar, instrumentation, etc.); communication/interface requirements; flight test; computer program documentation and configuration control; and validation/verification of the software. Applied research, special investigations, statistical analysis, etc., are a normal part of the incumbent's effort in accomplishing his duties and responsibilities.

III. CONTROLS OVER WORK

Incumbent is under the supervision of the Section Chief and receives technical direction from the functional group engineers and other senior engineers who give assignments in terms of broad, general objectives and relative priority of work. Extent and limits of assignments are mutually discussed. Incumbent works with considerable freedom from technical control in selecting and establishing the proper methods for attacking and resolving complex features and otherwise carrying assignments through to completion. Controversial policy questions are resolved by joint consideration with the supervisor and functional group engineer. Completed work is reviewed for adequacy in terms of broad objectives of the work and for compliance with Air Force policies and regulations. Decisions and recommendations based upon application of standard engineering practices are rarely changed by higher authority, except for reasons of policy, public relations, or budgetary consideration.

CONTINUATION SHEET DATE: 28 Sept 1979

IV. OTHER SIGNIFICANT FACTS

1. Fields of Engineering: Electronic - 55%, Computer Science - 30%
Aerospace - 15%

2. In addition to an extensive academic and professional knowledge of scientific and engineering principles, it will be necessary for the incumbent to possess a special faculty to do successful applied research and establish authoritative criteria based on sound engineering principles used within this section by joint consideration with other engineers. At most times, the incumbent will be responsible for several projects requiring difficult and advanced engineering work of a high degree of originality, therefore incumbent must have a thorough and detailed knowledge of avionics digital systems, (e.g., inertial navigation systems, fire control radars, stores management systems; digital controls and displays, etc.); aircraft embedded computer systems; real-time operational flight software; laboratory support systems to include real-time simulation systems, host computer systems and avionics system hot mock-ups; software configuration management; software documentation; OFP testing, evaluation, verification and validation; and aircraft performance and operation, specifically in the areas of navigation and weapon delivery. Must be experienced and knowledgeable in real-time programming, mathematical modeling, computer architecture and programming languages.

3. Incumbent must possess a high degree of professional judgment, skill, initiative, planning and leadership ability. Also must possess ability to maintain effective personal work relationships at all levels and to justify and sell his own professional viewpoints in conferences, engineering reviews and with fairly large groups wherein conflicting points of view are represented. Requires an intimate knowledge of functions, organizational structure, jurisdictional responsibilities, etc., of USAF and elements thereof.

4. The incumbent of this position must be capable and willing to perform TDY travel in accordance with the Joint Travel Regulation.

5. Supports and takes affirmative actions in furtherance of Equal Employment Opportunity in all aspects of personnel actions, with special emphasis on Upward Mobility and other special programs.

6. Position requires a security clearance of Secret.

7. Performs other related duties as required.

8. Subject to call during off-duty hours.

9. All personnel will share in the responsibility for a sound industrial safety program. Incumbent is required to comply with all applicable safety directives. Unsafe conditions are to be promptly reported to the immediate supervisor.

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES DATE: 28 Sept 1979

BUILDINGS:

10,800 $ft.^2$ of standard computer-type facilities.

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 28 Sept 1979

COMPUTER FACILITIES (Type, Quantity, Application, Cost & Usage)

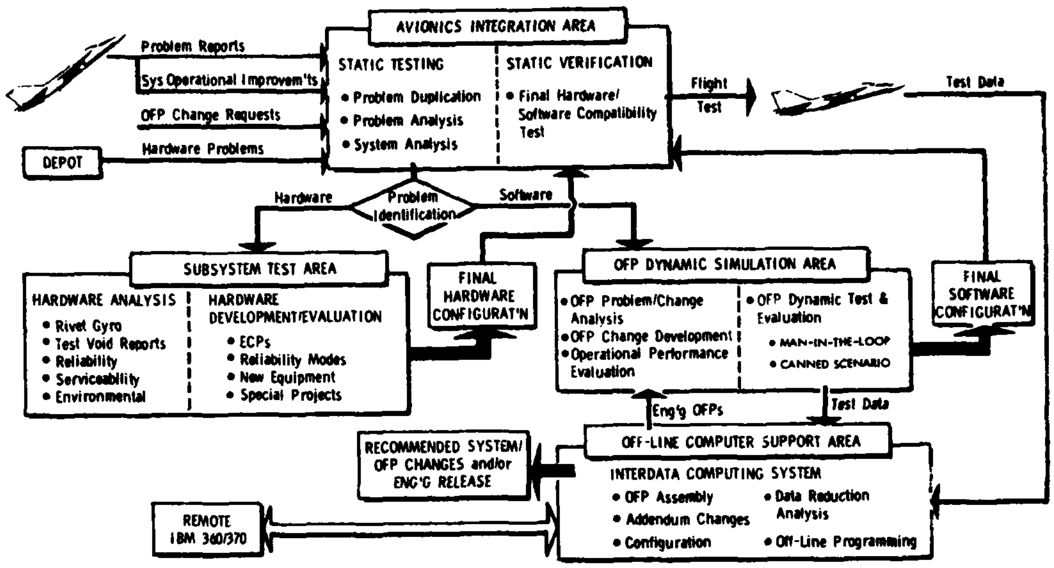
The basic equipment in the F/FB-111 Avionics Integration Support Facility is as follows:

Equipment	Cost ($ million)
Dynamic Simulation System (Harris) System and Software Engineering	12.0
Flight Test Data Reduction (PDP)	1.5
Off-line Computer Support (Interdata)	2.0
Integration Test Equipment @ 1.7x3 Original cost - $800K each	5.1 (replacement cost)
Subsystem Testers (11)	3.5 (replacement cost)
Avionics (loaned out of spare assets)	12.9
F-111F/Pavetack Dynamic Simulation	2.6
	39.6
To be added:	
F-111A/E Hardware	1.6
	41.2

Vendor support on the Harris, Interdata and PDP computers costs $308K/year plus $126K/year for expendables and prototype hardware (split 50/50).

The Avionics Integration Support Facility is diagrammed on page D-59. Specific equipment within the Harris/4, which contains the simulation software, is shown on page D-60.

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979



F-111 Avionics Integration Support Facility

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

Harris/4 System
(Dynamic Simulator)

2 test stations

2 ADAGE (large display screen on test station)

6 processors - 80K each

2 SAS (Simulation and Switching) Interface between Harris & test station

6 CMACs (Computer Monitor and Control) Interface between 4pi computer and Harris

1 card reader

1 card punch

2 paper tape readers

8 mag tape drives

1 CDC line printer

2 Versatic printer/plotters

11 CRT

2 teletypes

6 10 mb disc drives

1 40 mb disc drives

2 300 mb disc drives

1 paper tape punch

CONTINUATION SHEET - COMPUTER FACILITIES **DATE:** 28 Sept 1979

TYPICAL UTILIZATION OF HARRIS COMPUTER WEEK OF 23-27 July 1979

Time:	Mon	Tue	Wed	Thu	Fri	Sat	Sun
0000							
0100							
0200							
0300							
0400							
0500							
0600							
0700							
0800	Harris (Maint)		Harris		Harris		
0900		IV & V		IV & V			
1000			GD		IV & V		
1100	IV & V						
1200							
1300		F	IV & V	F			
1400	GD (Modif & Upgrade)						
1500					F		
1600							
1700	MMECS (Backup, Archive, etc.)	GD	F	GD			
1800							
1900							
2000							
2100							
2200							
2300							
2400							

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE DATE: 28 Sept 1979

COMPUTER	SOFTWARE FUNCTION	ESTIMATED SOURCE LINES
HARRIS	SYSTEM	292,953
	UTILITY	34,494
	RJE	7,410
	PLOTTER	7,580
	OFP	4,000
	ADAGE	6,714
	SAS	2,888
	SIMULATOR	17,706
	CMAC	13,674
		387,419

Pages D-63 through D-71 provide a detailed listing of the relevant Harris software.

CONTINUATION SHEET

DATE: 28 Sept. 197?

HARRIS F/FB

SYSTEM SOFTWARE

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ACLOMP	H	IH/H	100.	UNKNOWN
ACUTIL	H	IH/H	2240.	ACCOUNTING UTILITY
ATAR	H	IH/H	280.	REAL TIME PROGRAM TO ACCUMULATE NUMBER OF SECTORS USED BY EACH USER
	H	IH/H		
BASLIB	H	IH/H	4060.	BASIC LIBRARY
CH40FF	H	IH/H	120.	INITIATES PROGRAM V:C40F:V TO PUT PRINTER OFF LINE
CH40N	IN	IN	100.	INITIATES PROGRAM V:C40N:V TO PUT PRINTER ON LINE
COBOL	H	H/IH	1180.	COBOL COMPILER
DATAPOOL	H	H/IH	1400.	PROCESSES DATA AREAS USED BY FORTRAN COMPILER
DISKCHECK	H	H/IH	80.	VERIFIES INTERNAL LOGIC INTEGRITY OF THE DISC
FORTRAN	H	H/IH	17280.	FORTRAN COMPILER
GENCLIB	H	H/IH	300.	GENERATES COBOL LIBRARY
IFTRAN	GEN/RES	GR/IH	1918.	IFTRAN COMPILER
ISUTIL	H	H/IH	440.	INDEXED SEQUENTIAL UTILITY PRIMARILY USED FOR COBOL
JOBCNTRL	H	H/IH	20350.	INTERACTIVE USER INTERFACE TO VULCAN
LFEDITOR	H.	H/IH	1860.	LIBRARY FILE EDITOR
MSUTIL	H	H/IH	141.	SORT/MERGE UTILITY
O COBOL	H.	H/IH	480.	ANCILLARY PROGRAM USED BY *COBOL
PRINTF	H	H/IH	380.	PROVIDES OCTAL OR ASCII DUMP OF SELECTED RECORDS OF A FILE
RPATCH	H	H/IH	N/A	HARRIS SUPPLIED SYSTEM PATCH
SAMIAM	IH	IH	100.	CHECKS A DISC FOR UNUSED AMND SHARED SECTORS
SAUTEST	IH	IH	10.	EXERCISES SCIENTIFIC ARITHMETIC UNIT (SAU) AND ABORTS ON ERROR
TAPESORT	H	H/IH	N/A	SORTS RECORDS ON TAPES
TEST	IH	IH	16.	EXERCISES MULTIPLLICATION FUNCTION OF SAU
TLABEL	H	H/IH	1620.	TAPE LABEL PROGRAM
V:ACPY:V	H	H/IH	120.	ACCOUNTING RECORD COPY PROGRAM
V:ACSM:V	H	H/IH	260.	ANCILLARY ACCOUNTING UTILITY

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET — DATE: 28 Sept 1979

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/:ASCT:V   .  H   .H/IH   .  200. ACCOUNTING SECTOR READ/WRITE SERVICE
/:ATL1V    .  H   .H/IH   .  120. ANCILLARY ACCOUNTING UTILITY
/:BFH2:V   .  H   .H/IH   .  160. BLOCKED DISC AREA HANDLER/EXTENSION
/:BLAH:V   .  H   .H/IH   . 1200. BLOCKED DISC AREA HANDLER
/:C40F:V   .  H   .IH     .  120. DISCONNECTS LINE PRINTER AND CARD READER
/:C40N:V   .  H   .IH     .  100. CONNECTS LINE PRINTER AND CARD READER
/:CBAS:V   .  H   .H/IH   .  140. BINARY CODED DECIMAL TO ASCII CONVERSION
/:CEAS:V   .  H   .H/IH   .  260. EBCDIC TO ASCII CONVERSION
/:CPOH:V   .  H   .H/IH   .  800. CARD PUNCH HANDLER
/:CPQS:V   .  H   .H/IH   .  600. CONTROL POINT QUEUE SWITCHER PROGRAM
/:CRDH:V   .  H   .H/IH   .  800. CARD READER HANDLER
/:CRPH:V   .  H   .H/IH   . 1520. CARD PUNCH HANDLER
/:CRTH:V   .  H   .H/IH   . 1860. HARRIS CRT HANDLER
/:DUMP:V   .  H   .H/IH   .  240. POST MORTEM DUMP GENERATOR
/:DUMPER:V    H   .H/IH   .  900. REAL TIME PORTION OF DUMP PROGRAM
/:EK73:V   .  IH  .IH     .   80.
/:GENS:V   .  H   .H/IH   . 1800. SYSTEM GENERATION MONITOR PROGRAM
/:HEAD:V   .  H   .H/IH   .  340. LINE PRINTER HEADER PAGE GENERATOR
/:IDAC:V   .  H   .H/IH   . 2200. DIRECT MEMORY ACCESS CONTROL PROCESSOR SUPPORT
           .      .       .     .  MODULE
/:INEX:V   .  H   .H/IH   .   80. INTERRUPT EXECUTIVE SERVICE
/:ITSP:V   .  H   .H/IH   .  320. INTERACTIVE TERMINAL SPOOLER PROGRAM
/:LP0H:V   .  H   .H/IH   .  780. UNIVERSAL LINE PRINTER HANDLER
/:LP1H:V   .  H   .H/IH   . 1060. UNIVERSAL LINE PRINTER HANDLER
/:LP2H:V   .  HK  .H/IH   .  980. VERSATEC LINE PRINTER HANDLER
/:LP3H:V   .  H   .H/IH   .  840. ASYNCHRONOUS LINE PRINTER HANDLER
/:LPGD:V   .  IH  .IH     .  420. MODIFIED LINE PRINTER HANDLER FOR GD HEADER
           .      .       .     .  PAGE
/:MEMD:V   .  IH  .IH     . 1200. CHECKS OUT C PROCESSOR
/:MESG:V   .  H   .H/IH   .  680. MESSAGE (SEND RECEIVE) SERVICE
/:OLAY:V   .  H   .H/IH   .  980. OVERLAY SERVICE
/:OPC0:V   .  H   .H/IH   .  660. OPERATOR COMMUNICATIONS COMMAND INTERPRETER
/:OPC1:V   .  H   .H/IH   .  600. OPERATOR COMMUNICATION SEGMENTS - EACH
           .      .       .     .  PROCESSES ONE OR MORE OPCOM COMMANDS
/:OPC2:V   .  H   .H/IH   .  600.        "               "               "
/:OPC3:V   .  H   .H/IH   .  900.        "               "               "
/:OPC4:V   .  H   .H/IH   .  620.        "               "               "
/:OPC5:V   .  H   .H/IH   .  900.        "               "               "
/:OPC6:V   .  H   .H/IH   .  620.        "               "               "
/:OPC7:V   .  H   .H/IH   .  340.        "               "               "
/:OPC8:V   .  H   .H/IH   .  460.        "               "               "
/:OPC9:V   .  H   .H/IH   .  720.        "               "               "
/:OPCA:V   .  H   .H/IH   .  480.        "               "               "
/:OPCB:V   .  H   .H/IH   .  720.        "               "               "
/:OPCC:V   .  H   .H/IH   .  780.        "               "               "
/:OPCD:V   .  H   .H/IH   .  320.        "               "               "
/:OPCX:V   .  H   .H/IH   .  300.        "               "               "
/:OPCZ:V   .  H   .H/IH   .  140.        "               "               "
/:P-PH:V   .  IH  .IH     . 1459.HANDLER FOR HARRIS END OF INTERDATA-HARRIS LINK
/:PIGD:V   .  IH  .IH     .  200. NON-RESIDENT HANDLER THAT PUTS OUT GD HEADER
/:PTPH:V   .  H   .H/IH   .  700. PAPER TAPE PUNCH HANDLER
/:PTRH:V   .  H   .H/IH   .  380. PAPER TAPE READER HANDLER
/:REHH:V   .  H   .H/IH   .  460. DISC DIRECTORY REHASH SERVICE
/:RSC2:V   .  H   .H/IH   .  460. RESOURCE ALLOCATION SERVICE - PART 2
/:RSEX:V   .  H   .H/IH   .  520. RESOURCE DEALLOCATION SERVICE
/:RSRC:V   .  H   .H/IH   . 1120. RESOURCE ALLOCATION SERVICE
/:RTEX:V   .  H   .H/IH   .   80. REAL TIME EXECUTIVE PROGRAM (USED FOR
           .      .       .     .  TIMER SCHEDULING)
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PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

$RTPH$V	H	H/IH	600.	REAL TIME PERIPHERAL HANDLER
$SCAN$V	H	H/IH	1220.	FORMAT SCANNER SERVICE]
$SERV$V	H	H/IH	1480.	BACKGROUND SERVICES
$SRV2$V	H	H/IH	340.	BACKGROUND SERVICES
$SY25$V	H	H/IH	640.	SYSTEM INITIALIZATION PHASES
$SYI1$V	H	H/IH	740.	SYSTEM INITIALIZATION PHASES
$SYI2$V	H	H/IH	920.	SYSTEM INITIALIZATION PHASES
$SYI3$V	H	H/IH	1000.	SYSTEM INITIALIZATION PHASES
$SYI4$V	H	H/IH	1140.	SYSTEM INITIALIZATION PHASES
$TEN2$V	H	H/IH	340.	PHASE 2 OF V$TENS$V
$TENS$V	H	H/IH	800.	5 SECOND SYSTEM CHECK PROGRAM
$TLH1$V	H	H/IH	1960.	TAPE LABELING SERVICE
$TLH2$V	H	H/IH	2380.	TAPE LABELING SERVICE
$TLSS$V	H	H/IH	780.	TAPE LABELING SERVICE
$TOAD$V	H	H/IH	1000.	REAL TIME SERVICES
$TRAP$V	H	H/IH	620.	VULCAN EXECUTIVE TRAP SERVICE ROUTINE
$TTYH$V	H	H/IH	1760.	TELETYPE HANDLER
$UPRG$V	H	H/IH	200.	USER NUMBER DISC AREA PURGE PROGRAM
$UPUS$V	H	H/IH	180.	UPDATE USER ACCOUNTING SERVICE
$USER$V	H	H/IH	380.	USER NUMBER LOOK UP SERVICE
$USPC$V	H	H/IH	200.	DISC SPACE DEALLOCATION SERVICE
ASSEM	H	H/IH	9480.	ASSEMBLY LANGUAGE PROCESSOR
BASIC	H	H/IH	4420.	BASIC PROCESSOR
ILCAN00	IH	IH	18990.	DISC COPY OF RESIDENT VULCAN THAT IS PUT INTO MEMORY
ULCANIZ	IH	IH	200.	CREATES LOAD MODULES
REF	H	H/IH	2060.	CROSS REFERENCE PROCESSOR
IBERY	H	H/IH	124800.	HARRIS SYSTEM LIBRARY
$CASS$V	H	H/IH	1620.	CASSETTE HANDLER
ORP	IH	IH	10.	EXERCISES EXPONENTIATION FUNCTION IN SAU
ETCV	IH	IH	120.	NON-RESIDENT HANDLER FOR OBTAINING CONTENTS ON MEMORY SYSTEM ID, AND DAY OF THE WEEK
$UADR$V	IH	IH	100.	ABSOLUTE DISC READS FOR USER ROUTINES
$PMD	H	H/IH	1980.	POST MORTEM DUMP
TOTAL			292953.	

HARRIS F/FB

UTILITY SOFTWARE

CI NAME	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
N	IH	IH	103	CONVERTS NUMBER TO/FROM INTEGER, OCTAL, HEX, ASCII AND TASCII
OMPUTE	IH	IH	515.	FLOATING POINT CALCULATOR
OPYTAPE	IH	IH	200.	COPIES ONE MAG TAPE TO ANOTHER
C	IH	IH	60.	DISPLAYS SELECTED LOCATIONS OF CORE
F	IH	IH	N/S	DISPLAYS MAPPING INFORMATION FOR A FILE
ELMN$MAP	IH	IH	260.	ELIMINATES FILES IN A MAP OUTPUT
LMN$VER	IH	IH	260.	ELIMINATED FILES IN AVERIFY OUTPUT
NTRY	IH	IH	140.	COPIES DATA FROM HP TAPE CASSETTE TO DISC FILE
HTSNAPS	IH	IH	65.	SPOOLS SNAPSHOT OF CRT SCREEN TO PRINTER

CONTINUATION SHEET DATE: 28 Sept 19

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ENCMD     .  IH  .IH    .    147. GENERATES COMMAND FILE USED IN *TCOPY2
PCO       .  IH  .IH    .    N/8 . GENERAL PURPOSE COPY ROUTINE TO SUPPOR CAR-
          .      .      .         . TRIDGE ON HP TERMINAL
KEEPCK    .  IH  .IH    .    354. OUTPUTS FORMATTED LIST OF FILES ON A KEEPTAPE
          .      .      .         .  TO THE PRINTER AND VERIFIES THE TAPE
F         .  IH  .IH    .     66. COMPARES 2 FILES
PCOPY     .  IH  .IH    .    240. COPIES A MAG TAPE IN KEEP/FETCH FORMAT TO
          .      .      .         . ANOTHER MAG TAPE
M         .  IH  .IH    .    266. PROVIDES A LIST OF WHICH LFN'S ARE CURRENTLY
          .      .      .         . ASSIGNED FROM INTERACTIVE TERMINAL
EWUSER    .  H   .H/IH  .     80. CHANGES QUALIFIER AND/OR USER NUMBER OF FILES
AKCHK     .  IH  .IH    .     99. LISTS FILES WHICH HAVE NOT BEEN ACCESSED
          .      .      .         . SINCE THE ENTERED CUTOFF DATE
READFILE  .  IH  .IH    .   1080. READS FILE INTO AN OUTPUT FILE ADDING PAGE
          .      .      .         . NUMBERS AND CARRIAGE CONTROL FOR SPOOLING
          .      .      .         . TO THE PRINTER
SFETCH    .  IH  .IH    .    220. CONSTRUCTS A JOB STREAM TO FETCH SELECTED
          .      .      .         . FILES FROM A TAPE
NAPIT     .  IH  .IH    .     40. SNAPSHOTS THE CONTENTS OF A TEC-425 SCREEN
TCOPY2    .  IH  .IH    .   1132. READ/WRITE FROM DISC TO TAPE AND VISA-VERSA
E         .  IH  .IH    .  16257. TEXT EDITOR
HRUHS     .  IH  .IH    .    600. TRANSFERS FILES BETWEEN PROCESSORS THROUGH
          .      .      .         . HIGH SPEED MEMORY
PECPY     .  IH  .IH    .     80. MAKES DIRECT BINARY COPY FROM TAPE TO TAPE
URN90     .  IH  .IH    .     40. ROTATES PRINTER OUTPUT 90 DEG.
XREF      .  IH  .IH    .    240. PRODUCES VARIABLE AND FILE NAME CROSS REFERENCE
          .      .      .         . FROM AN ALPHABETIZED LIST OF VARIABLES AND
          .      .      .         . FILES
WRITE     .  IH  .IH    .    200. ALLOWS USER TO WRITE TO TAPE CARTRIDGE ON
          .      .      .         . HP TERMINAL
EQ        .  IH  .IH    .    180. SEQUENCES SOURCE FILES

********SIMLIB - SIMULATION LIBRARY CONTAINS THE FOLLOWING SUBROUTINES!*********

RNM1      .  IH  .IH    .     30. UNPACK AREANAME FROM TRUNCATED ASCII (4CPW)
          .      .      .         . TO STANDARD ASCII (1CPW)
RNM3      .  IH  .IH    .     30. UNPACK AREANAME FROM TRUNCATED ASCII (4CPW)
          .      .      .         . TO STANDARD ASCII (3CPW)
ASLPDN    .  IH  .IH    .         . ASSIGN LFN (NON RESOURCABLE PDN'S ONLY)
SLCAS     .  IH  .IH    .     55. ASSIGN LFN TO CASSETTE TAPE ON TI 733
SLDA      .  IH  .IH    .     76. ASSIGN LFN TO DISC AREA (FILENAME AND QUALI-
          .      .      .         . FIER REQUIRED)
ASLDAS    .  IH  .IH    .         . ASSIGN LFN TO DISC AREA (QUALIFIER DEFAULTS
          .      .      .         . TO SIGN-ON QUALIFIER)
SLINF     .  IN  .IN    .     56. ASSIGN LFN TO ANOTHER LFN (FIRST LFN ASSIGNMENT
          .      .      .         . FOLLOWS SECOND)
ASLINP    .  IN  .IN    .         . ASSIGN LFN TO ANOTHER LFN (FIRST LFN ASSIGNMEN
          .      .      .         . DOES NOT FOLLOW SECOND)
SORT1     .  IH  .IH    .    102. ALPHANUMERIC SORT ON AN ARRAY IN STANDARD
          .      .      .         . ASCII (1CPW)
SORT3     .  IH  .IH    .    200. ALPHANUMERIC SORT ON AN ARRAY IN STANDARD
          .      .      .         . ASCII (3CPW)
1TOA3     .  IH  .IN    .     62. CONVERT STANDARD ASCII (1CPW) TO STANDARD
          .      .      .         . ASCII (3CPW)
1TOT4     .  IH  .IH    .     70. CONVERT STANDARD ASCII (1CPW) TO TRUNCATED
          .      .      .         . ASCII (4CPW)
3TOA1     .  IH  .IH    .     55. CONVERT STANDARD ASCII (3CPW) TO STANDARD
          .      .      .         . ASCII (1CPW)
```

STOT4	IH	IH	45.	CONVERT STANDARD ASCII (3CPW) TO TRUNCATED ASCII (4CPW)
INHEX	IH	IH	85.	BINARY TO HEX
INPPT	IH	IH	200.	BINARY TO PUNCH PAPER TAPE
ITOH1	IH	IH	60.	CONVERT BINARY (1 WORD) TO HEX (ASCII 1CPW)
ITOH3	IH	IH	65.	CONVERT BINARY (1 WORD) TO HEX (ASCII 3CPW)
.FNAM	IH	IH	60.	CHECK LFN ASSIGNMENT STATUS AND OBTAIN ASSIGN-MENT INFORMATION
.UCBA	IH	IH	45.	CONVERTS BINARY TO ASCII
.UIO	IH	IH	267.	LONG FORM OF STANDARD CALL FOR I/O SERVICE
3LUIOA	IH	IH		CALL FOR I/O SERVICE TO RETURN CONTENTS OF A-REGISTER AFTER I/O
3LUIOC	IH	IH		CALL FOR I/O SERVICE FOR CHARACTER I/O
3LUIOE	IH	IH		CALL FOR I/O SERVICE TO RETURN CONTENTS OF E-REGISTER AFTER I/O
3LUIOS	IH	IH		SHORT FORM OF STANDARD CALL FOR I/O SERVICE
3LUIOW	IH	IH		LONG FORM OF STANDARD CALL FOR I/O SERVICE REQUESTING A WAIT AFTERWARDS
.ULFN	IH	IH	42.	CHECK LFN ASSIGNMENT STATUS
.UPDN	IH	IH	35.	CHECK PDN CHARACTERISTICS
HXBI	IH	IH	46.	CONVERT HEX (ASCII) TO BINARY (1 WORD)
/SYSD	IH	IH	90.	CONVERT SYSTEM DATE/TIME IN STIME FORMAT TO ASCII (MILITARY FORMAT)
ATE	IH	IH	42.	OBTAIN CURRENT DATE AND TIME FROM SYSTEM
INF01	IH	IH	205.	OBTAIN LIMITED INFORMATION ON A SPECIFIC DISC FILE
)INF02	IH	IH		OBTAIN MODERATE AMOUNT OF INFORMATION ON A SPECIFIC DISC FILE
)INF03	IH	IH		OBTAIN COMPLETE INFORMATION ON A SPECIFIC DISC FILE
TOBI	IH	IH	223.	SCANS AND CONVERTS ASCII DATE/TIME (MIL OR JULIAN FORMAT) TO BINARY
ASE	IH	IH	75.	CLEAR TERMINAL SCREEN
.MNB	IH	IH	76.	ELIMINATE A SPECIFIC DISC FILE (QUALIFIER AND FILENAME REQUIRED)
LMNBS	IH	IH		ELIMINATE A SPECIFIC DISC FILE (SIGN-ON) QUALIFIER ASSUMED)
INDCH	IH	IH	174.	FIND OCCURRENCE OF CHARACTER IN CHARACTER STRING FROM A GIVEN OFFSET
INDTX	IH	IH	224.	FIND OCCURRENCE OF A CHARACTER STRING IN A LARGER STRING
P	IH	IH	362.	CONVERT ASCII REPRESENTATION OF A FLOATING POINT TO INTERNAL FLOATING POINT FORMAT
.GBIT	IH	IH	64.	SET A SPECIFIED BIT IN AN ARRAY
TLAT	IH	IH	163.	FORMAT LATITUDE/LONGITUDE INTO ASCII
TLON	IH	IH		FORMAT LATITUDE/LONGITURD INTO ASCII
STCH	IH	IH	92.	FIND FIRST NONBLANK CHARACTER IN A CHARACTER STRING
CAN	IH	IH	265.	CALL TO SYSTEM FORMAT SCANNER SERVICE
NDA	IH	IH	165.	GENERATE A DISC FILE WITH ACCOUNT ACCESS (SHORT FORM)
NDL	IH	IH		GENERATE A DISC FILE (LONG FORM)
NDO	IH	IH		GENERATE A DISC FILE WITH OWNER ACCESS ONLY (SHORT FORM)
NDP	IH	IH		GENERATE A DISC FILE WITH PUBLIC ACCESS (SHORT FORM)
XBIN	IH	IH	180.	CONVERT HEX TO BINARY
XIN	IH	IH	94.	INPUT AND CONVERT HEX ASCII (UP TO 6 CHARACTERS

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```
                                              . TO BINARY  (1 WORD)
  IXPPI   .  IH  .IH   .   164. DATA (IN HEX) TO PUNCH PAPER TAPE
  3ORTS   .  IH  .IH   .    96. HEX SORT ON ASCII REPRESENTATION OF HEX
          .      .     .      .  NUMBERS IN AN ARRAY
  ITOBI   .  IH  .IH   .    82. CONVERT HEX (ASCII 1CPW) TO BINARY (1 WORD)
  I)PTN   .  IH  .IH   .    95. OBTAIN PROGRAM OPTIONS FROM PROGRAM OPTION
          .      .     .      .  WORD FROM INITIALIZATION
  3LNBK   .  IH  .IH   .      . ANOTHER ENTRY POINT FOR FRSTCH
  JJLIAN  .  IH  .IH   .   115. CONVERT RETURN FROM SYSTEM STIME SERVICE TO
          .      .     .      .  JULIAN FORM DATE AND TIME
  PP4PI   .  IH  .IH   .    60. CONVERT A HARRIS FLOATING PONT NUMBER TO 4PI
          .      .     .      .  FIXED POINT NUMBER
  )MPAR   .  IH  .IH   .   122. COMPARE CHARACTER STRINGS
  ISTCH   .  IH  .IH   .    93. FIND LAST NONBLANK CHARACTERS IN A CHARACTER
          .      .     .      .  STRING
  ISTING  .  IH  .IH   .   332. COPY FILE TO FILE WITH PRINTER SPACING
  ITNBK   .  IH  .IH   .      . ANOTHER ENTRY POINT FOR LASTCH
  JVCSR   .  IH  .IH   .    52. MOVE CURSOR ON THE TEKTRONIX 4014
  /CHR    .  IH  .IH   .   100. MOVE DATA IN AN ARRAY
  C?PARN  .  IH  .IH   .    75. SCAN OFP CHANGE/PROBLEM DESCRIPTION
  ?HRT4   .  IH  .IH   .    65. TRUNCATE AND INSERT ASCII CHARACTER IN A
          .      .     .      .  TRUNCATED ASCII ARRAY (4CPW)
  3MOPT   .  IH  .IH   .    99. OBTAIN PROGRAM OPTIONS AND PARAMETERS AT
          .      .     .      .  PROGRAM INITIALIZATION
  ?TLDR   .  IH  .IH   .    63. PUNCH PAPER TAPE LEADER
  ?TTIT   .  IH  .IH   .    35. PUNCH PAPER TPAE TITLE
  ?CHAR   .  IH  .IH   .   197. CONVERT ASCII CHARACTER TO PAPER TAPE CODE
  ?NAME   .  IH  .IH   .    86. RENAME A DISC FILE TO A NEW NAME (QUALIFIER
          .      .     .      .  AND FILENAME REQUIRED)
  ?ENAMS  .  IH  .IH   .      . RENAME A DISC FILE TO A NEW NAME (SIGN-ON)
          .      .     .      .  QUALIFIER ASSUMED)
  ?TYPE   .  IH  .IH   .   100. RETYPE A DISC FILE TO A NEW TYPE SPECIFICATION
          .      .     .      .  (LONG FORM)
  ?ETYPS  .  IH  .IH   .      . RETYPE A DISC FILE TO A NEW TYPE SPECIFICATION
          .      .     .      .  (SHORT FORM)
  ?TBIN   .  IH  .IH   .   149. READ PAPER TPAE AND CONVERT TO BINARY
  ?THEX   .  IH  .IH   .   174. READ PAPER TPAE AND CONVERT TO HEX
  ?DSC    .  IH  .IH   .    65. RESOURSE DISC PACK
  ?SDSCT  .  IH  .IH   .      . TEST DISC RESOURCE REQUEST
  ?SDSCW  .  IH  .IH   .      . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR DISC
          .      .     .      .  PACK HAS BEEN FULFILLED
  ?HSM    .  IH  .IH   .    75. RESOURCE HIGH SPEED MEMORY
  ?SHSMT  .  IH  .IH   .      . TEST HIGH SPEED MEMORY REQUEST
  ?SHSMW  .  IH  .IH   .      . SPECIFY A WAIT UNTIL RESOUCE REQUEST FOR
          .      .     .      .  HIGH SPEED MEMORY FULFILLED
  ?MTL    .  IH  .IH   .   105. RESOURCE MAG TAPE (LONG FORM)
  ?SMTLT  .  IH  .IH   .      . TEST MAG TAPE RESOURCE REQUEST (LONG FORM)
  ?SMTLW  .  IH  .IH   .      . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR
          .      .     .      .  MAG TAPE HAS BEEN FULFILLED
  ?MTS    .  IH  .IH   .    86. RESOURCE MAG TAPE (SHORT FORM)
  ?SMTST  .  IH  .IH   .      . TEST MAG TAPE RESOURCE REQUEST (LONG FORM)
  ?SMTSW  .  IH  .IH   .      . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR MAG
          .      .     .      .  TAPE HAS BEEN FULFILLED
  ?PDN    .  IH  .IH   .    86. RESOURCE PDN (MUST BE RESOURCEABLE)
  ?SPDNT  .  IH  .IH   .      . TEST PDN RESOURCE REQUEST
  ?SPDNW  .  IH  .IH   .      . SPECIFY A WAIT UNTIL RESOURCE REQUEST FOR PDN
          .      .     .      .  HAS BEEN FULFILLED
  ?TBIT   .  IH  .IH   .    51. SET BIT IN A VECTOR ARRAY
```

PREDICTIVE SOFTWARE COST MODEL

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)RT	IH	IH	90.	BINARY SORT ON AN ARRAY BY ROW
IZ	IH	IH	62.	SQUEEZE BLOCKED DISC FILE TO MIN. REQUIREMENT
IQZUB	IH	IH		SQUEEZE AN UNBLOCKED DISC FILE TO MINIMUM REQUIREMENTS
ITOA1	IH	IH	63.	CONVERT TRUNCATED ASCII (4PCW) TO STANDARD ASCII (1CPW)
ITOA3	IH	IH	47.	CONVERT TRUNCATED ASCII (4CPW) TO STANDARD ASCII (3CPW)
)TAL			34494.	

HARRIS F/FB

RJE (REMOTE JOB CONTROL) SOFTWARE

[NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
:/HASP	H	H/IH	3220.	SPOOLER FOR RJE
:NDER	IH	IH	10.	SCANS RJE FILE AND WRITES A LIST OF CRITICAL WARNING OR ERRORS
'C.RJE	H	H/IH	160.	OPCOM RJE DRIVER
IE	H	H/IH	1000.	REMOTE JOB ENTRY PROCESSOR
IE>T2	IH	IH	1300.	WRITES A LIST FORMAT RJE DATA FILE TO MAG TAPE FOR LISTING OR MICROFICHE
IEGEN	H	H/IH	560.	PARAMETER GENERATION PROGRAM USED IN CONFIGUR-ING THE IBM SITES INITIATED BY *RJE
:BERT;V	H	H/IH	180.	RJE UTILITY
:RJEH;V	H	H/IH	980.	REMOTE JOB ENTRY HANDLER
)TAL			7410.	

HARRIS F/FB

PLOTTER SOFTWARE

: FILE	SUP-PLIER	MAINT RES	EST SOURCE LINES	DESCRIPTION
ITRETPL	IH	IH	800.	DATA RETRIEVAL PLOTTING PROGRAM
'PLOT	IH	IH	160.	PLOTS WEAPON SCORING RELEASES PRODUCED BY *SCORE
'LOT	H	H/IH	1960.	VERSATEC PLOTTER ROUTINE
.OTLIB	H	H/IH	4460.	VERSATEC PLOTTER LIBRARY
IPLOT	IH	IH	200.	REPLOTS OR ELIMINATES AREAS CREATED BY USING *SCORE, KEEP OPTION
)TAL			7580.	

HARRIS F/FB

SIMULATOR SOFTWARE

NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
)RS	IH	IH	216.	GENERATES ADDRESS AND CROSS REFERENCE INFORMA- TION FOR MONITOR COMMON VARIABLES
LLIS	IH	IH	500.	COMPUTES BALLISTIC CURVES
(FR	IH	IH	200.	LOADS C PROCESSOR
TRET	IH	IH	2880.	RETRIEVES SIMULATION DATA
TRETQD	IH	IH	180.	QUICK AND DIRTY DATA RETRIEVAL PROGRAM
SPEC	IH	IH	2240.	SETS UP DATA RECORDING FILE
	IH	IH	60.	FUNCTION WORD ASSEMBLER
SMLG	IH	IH	160.	KEEP AND FETCH *STMLOG ON TAPE
)NITOR	IH	IH	140.	MONITORS MEMORY LOCATIONS AND REPORTS ANY CHANGES IN VALUE
AN	IH	IH	4320.	MISSION PLANNING PROGRAM
ANUTIL	IH	IH	1840.	PLANNING FILE UTILITY PROGRAM
T,LD35	IH	IH	20.	RESIDENT REAL TIME LOADER FOR *V:LD35:V
ORE	IH	IH	500.	COMPUTES THE IMPACT POINT OF SIMULATION WEAPON RELEASES
RIAL	IH	IH	100.	MONITORS SIMULATION SERIAL DATA WORD COUNTS
TDAT	IH	IH	430.	PUTS A KNOWN VALUE IN MONITOR COMMON
/	IH	IH	240.	INITIATES THE START OF SIMULATION
DATE	IH	IH	220.	UPDATES MONITOR COMMON DISC FILES USED BY THE SIMULATION DISPLAY PROGRAMS
ADRS:V	IH	IH	80.	COMPUTES SEMI-CONDUCTOR MEMORY LOCATION OF MONITOR COMMON VARIABLES
CLDR:V	IH	IH	200.	LOADS A PROGRAM IN C PROCESSOR FROM EITHER A OR B PROCESSOR
IH70:V	IH	IH	200.	INTERRUP HANDLER FOR SIMULATOR SOFTWARE ON A PROCESSOR
LD35:V	IH	IH	40.	SETS UPMONITOR SERVICE BLU35 FOR NON-RESIDENT HANDLER *V:ETC:V
SPCA:V	IH	IH	500.	SETS UP MONITOR SERVICE BLU36 ON A PROCESSOR
SPCB:V	IH	IH	700.	SETS UP MONITOR SERVICE BLU36 ON B PROCESSOR
EWSNAP	IH	IH	140.	PRODECES FORMATTED LISTING OF ALL SIMULATION

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				COMMANDS
3DRIVE	IH	IH	100	RESCORES WEAPON DROPS BY THE SIMULATOR
REFQ	IH	IH	240	PROVIDES A LISTING OF SIMULATION MONITOR COMMON VARIABLES IN FILE
REFUP	IH		700	UPDATES CROSS-REFVERENCE FILES USED BY *CMACRETV AND *FW
PLAN	IH		560	RESTRUCTURES PLANNING FILES TO THE NEW 5 OFFSET POINTS
OTAL			17706	

HARRIS F/FB

CMAC SOFTWARE

I NAME	SUP-PLIED	MAINT RES	EST SOURCE LINES	DESCRIPTION
ATALOG	IH	IH	360	CREATES CMAC LOAD FOR F/FB ASTRO
.OCKS	IH	IH	20	CHECKS CLOCKS ON CMAC
.OCKT	IH	IH	100	READS THE CLOCK FROM ALL 3 CMAC'S
MACDIAG	IH	IH	4040	CMAC DIAGNOSITICS
MACRETV	IH	IH	2940	RETRIEVES CMAC DATA
MACTEST	IH	IH	4080	ALLOWS USER TO COMMUNICATE WITH CMAC
MACTIME	IH	IH	160	CONVERTS CMAC COARSE AND FUB
JMPTP	IH	IH	140	DUMPS CMAC RECORDING
SRET	IH	IH	134	CMAC DATA RETRIEVAL PROGRAM FOR RETRIEVING FULL SNAPSHOTS
ICMAC;V	IH	IH	1700	SETS UP MONITOR SERVICE BLU34 FOR COMMUNICATION WITH CMAC
OTAL	IH	IH	13674	

SOFTWARE PACKAGE CHARACTERISTICS –
FLIGHT TEST REQUIREMENTS

DATE: 28 Sept 1979

None. Each change is checked out in accordance with normal debug procedures for a simulation package.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 28 Sept 1979

PROGRAMMER TRAINING:

OJT - Forth Worth (General Dynamics)

USER TRAINING:

OJT

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE HISTORY **DATE:** 28 Sept 1979

DESCRIPTION OF NUMBERS AND TYPES OF MAINTENANCE ACTIONS PERFORMED EACH YEAR SINCE PMRT

Log No.	Title	Req Dt	Comp Dt	Man Hours Hardware	Man Hours Software
SS76-001	Ref. Engage Switch	25May78	18Jul78	16	80
SS76-002	Autopilot Engage Discrep	25May78	08Jun78	--	24
SS77-005	Radar Alt Break Lock Limit	01Sep77	23Sep77	--	1
SS77-009	Atmosphere Model Error	01Sep77	23Sep77	--	8
SS77-010	Takeoff Trim Button	01Sep77	17Jul78	16	24
SS77-011	OFP-F Pitch System Alt	01Sep77	22Sep77	--	8
SS77-012	Wpn Scoring: CBU-30	01Sep77	26Oct77	--	2
SS77-013	Wpn Scoring: M61 Bay Gun	01Sep77	26Oct77	--	4
SS77-014	Wpn Scoring: MK-36	01Sep77	09Dec77	--	4
SS77-015	Wpn Scoring: Wpn #4	01Sep77	26Oct77	--	2
SS77-016	Wpn Scoring: Wpn #20	01Sep77	26Oct77	--	2
SS77-017	Wpn Scoring: Wpn #9	01Sep77	26Oct77	--	2
SS77-018	Wpn Scoring: Wpn #10	01Sep77	26Oct77	--	2
SS77-019	Wpn Scoring: Wpn #20	01Sep77	26Oct77	--	2
SS77-020	Wpn Scoring: Wpn #27	01Sep77	26Oct77	--	2
SS77-021	F-111F SMS Stn 3/6	01Sep77	23Sep77	--	4
SS77-022	F-111F SMS Stn 1/8	01Sep77	23Sep77	--	4
SS77-042	Wpn ID Cross Index Disp	13Sep77	1Aug77	--	16
SS77-046	Grid Identifiers	08Sep77	28Nov77	--	16
SS77-051	Winds and Errors in Sim	01Jun77	19Dec77	--	180?
SS77-052	Recage Irm X-Axis	01Jun77	18Nov77	--	60
SS77-053	Wind Table Interpolation	N/A	28Nov77	--	2
SS77-054	Std Atmosphere Model	N/A	17Oct77	--	8
SS77-055	Simulator ODSS Problem	N/A	28Nov77	--	2
SS77-062	ODSS-Air Discrete Loss	N/2	28Nov77	--	12
SS77-063	Wpn Scoring Errors	05Jul77	31Aug78	--	80
SS77-085	Altitude Cal Problem	15Sep77	28Nov77	--	1
SS77-090	Inconsistent Wpn Names	22Sep77	28Nov77	--	8
SS77/094	Wpn Scoring Printouts	06Oct77	05Oct78	--	80
SS77-133	D-Bugs	15Dec77	28Aug78	--	200
SS77-138	Non-Functioning SWO HDI/HS	25May78	08Jun78	--	8
SS77-139	"SIM Time" Backs-up Interm	25May78	08Jun78	--	4
SS77-140	SIM Lack of Four OAPs	25May78	14Aug78	--	400

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 28 Sept 1979

Log No	Title	Req Dt	Comp Dt	Man Hours Hardware	Man Hours Software
SS77-141	"SDD NDUZ" Values Not Disp	25May78	08Jun78	--	16
SS78-023	FB Test Stn SRAM Integ	23Feb78		Open	
SS78-027	Wind Table Interpolation	02Mar78	06Apr78	--	1
SS78-054	Immediate INS Align Upon R	13Apr78	26Oct78	Unknown	
SS78-056	F/FB DTS Update for FB16	13Apr78	17Jul79	Unknown	
SS78-058	Non-Std Atmosphere MO	13Apr78	28Aug78	--	60
SS78-078	Loss of *Plan Updates	04May78	17Jul78	--	14
SS78-092	D19 Sim Problems	01Jun78	06Apr79	Unknown	
SS78-106	Take-off Pitch Angle	29Jun78	06Oct78	--	80
SS78-109	Pod Slant Range Wrong	29Jun78	31Oct78	--	1
S78-110	Pod Mode Display Errors	29Jun78	28Sep78	Unknown	
SS78-112	Pod Tracking Handle & TH	29Jun78	02Apr79	--	40
SS78-114	Burst Event Based on Time	29Jun78	17Aug78	--	20
SS78-115	"Hdg Nav" Autopilot Errors	29Jun78	29Nov78	--	8
SS78-121	Roll Autopilot Problems	13Jul78	17Aug78	--	20
SS78-124	Modification of Winds	20Jul78	28Aug78	--	0.3
SS78-157	CBU Timer Toss Ripple	06Oct78	29Nov78	--	4
S78-166	*PLOTIT Grid	20Nov78	22Jan79	--	3
SS79-020	D-Sim Heading Error	18Apr79	08Jun79	Unknown	

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE COST HISTORY **DATE:** 28 Sept 1979

YEARLY COST OF MAINTAINING PACKAGE:

Total AISF support requires approximately ten on-site contractor personnel, plus five to ten personnel at General Dynamics involved in major upgrades.

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES DATE: 28 Sept 1979

Data Base Name:	AISF Task Listing
Location:	SM-ALC/MMECP, McClellan AFB, California
Contact Person:	Alton E. Patterson
Phone Number:	(916) 643-4762
General Contents:	Listing of all hardware and software modifications to the AISF. Manhour data can be recovered from the individual task data in the files.
Period Covered:	FY'77 through FY'79
Data Quality:	Good detail on individual tasks

PREDICTIVE SOFTWARE COST MODEL

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 28 Sept 1979

RESPONDENT: Bassett

If you were responsible for predicting, accumulating and accounting for software support costs, how would you do it?

1. AF Flight simulator concept (requirements different than A/C) - Need to be able to update flight simulator by just changing OFP software.

2. a. Demand spare memory

   b. Language - Function of application
      Need to study tradeoff between ease of development/maintenance vs. operational requirements (efficient code)

      Can HOL support those requirements?

      Support - peculiar language - need to buy original contractor

   c. Mission requirements
      TAC has more precise testing requirements than SAC.
      (Weapon delivery precision) [smart weapons]

   d. SPO is not motivated toward economical support
      AFLC needs veto power over design decisions

   Similarities among aircraft avionics are greater than differences.

   e. Analysis and design and testing overwhelms compilation/assembly.

   f. Support personnel cost more than development personnel
      (Need system knowledge. Implies experience.)

      Autonetics - $65K/man year
      GD - $35K/man year

APPENDIX E

F-16/OOALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION DATE: 31 Oct. 1979

ALC: Ogden (Hill AFB)

WEAPON SYSTEM: F-16

SOFTWARE PACKAGE: F-16 OFPs - see page E-2.

PERSONNEL CONTACTED:

Mr. Dave Thornell/Mr. Lee Calvert - MMECA
Captain Michael Fick/Mr. Robert Anderak - MMETA
Mr. Roy Taketa/Mr. Vernon Duncan - ACDCS
Mr. Wayne Bates - MMARF

SOFTWARE PACKAGE CHARACTERISTICS: Summary - See pp. E-2 through E-6 for overall description, pp. E-7 through E-16 for details.

SIZE:	121K (typical size is 12K for NAV/Display, 32K for Radar/Fire Ctl.)
LANGUAGE:	Jovial (J3B-2) HOL and computer-unique assembly language
APPLICATION:	Fire Control (FCC), Navigation (INS), Displays (HUD), Radar, and (armament) Stores Management (SMS)
COMPLEXITY:	Varies from low to high — see quality ratings on pp. E-8, 10, 12, 14, 16
YEAR DEVELOPED:	1976-1979
DEVELOPER:	See individual OFP summaries
COMMENTS	The Fire Control Computer OFP is representative of the F-16 system. All OFPs and OO-ALC operations are summarized in this package.

HOST (AIRBORNE) COMPUTER CHARACTERISTICS: See pp. E-7 through E-16 for summary and comments on individual OFPs.

MANUFACTURER:	
MODEL NUMBER/DESIGNATOR:	
WORD SIZE:	
MEMORY SIZE:	
MEMORY FILL:	

WEAPON SYSTEM USE:

NUMBER OF USERS:	USAF - Tactical Air Command and European Participating Governments (EPG)
LOCATIONS OF USERS:	US/Worldwide and EPG: Belgium, Denmark, the Netherlands, and Norway
FREQUENCY OF USE:	Daily

INTERVIEWER(S): R. B. Waina, E. E. Rodriguez, A. P. Bangs

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F-16 Avionics/OFPs

Package Summary

The F-16 avionics is supported by seven computer/operational flight program (software) subsystems. This package summarizes the individual OFP characteristics and includes organizational, test, support software, and facility data for the entire F-16 OO-ALC support. The Fire Control Computer (FCC) OFP is considered a representative OFP. OFP change history is presented for the five OFPs expected to be maintained by OO-ALC organically after PMRT (e.g., FCC, INS, HUD, RFC, and SMS). Change history currently reflects contractor-initiated changes with verification and simulation testing by MMECA, avionics and simulator testing/flight testing by MMETA.

A summary of the multiplex F-16 avionics, taken from the Computer Resources Integrated Support Plan (CRISP) is included below with detailed FCC function block diagrams.

Multiplex System

Digital communication among F-16 avionic subsystems is accomplished over a dually redundant, MIL-STD-1553 multiplex system. In this type of system, data is transmitted at a one megahertz bit rate over half-duplex channels using a command/response control scheme. Waveforms, timing and word/message formats are as prescribed in MIL-STD-1553. Data may be transmitted either between a bus controller and a remote terminal or between two remote terminals. A diagram of the F-16 avionic multiplex system is presented in Figure E-1. The primary control of the multiplex system operations is performed by the bus control function in the Fire Control Computer through a hardware bus controller that operates on software commands stored in the computer memory. This bus controller initiates all information exchanges over the data buses by issuing command words to remote terminals to transmit or receive data and determines whether Bus A or Bus B is to be used for the transmission. A backup bus control function is provided by the Inertial Navigation System (INS). If the Fire Control Computer is turned off or fails to pass its self-test/built-in-test, a discrete signal to the INS is turned off to indicate that the navigation set is to assume control. Under these conditions, the INS indicates all information exchanges over the bus and selects the bus to be used.

FCC Operational Flight Program

The Fire Control Computer Operational Flight Program (FCC OFP) provides logic and computations to implement and integrate fire control system modes and functions. The OFP consists of computer processing instructions which have been developed to satisfy allocated avionics requirements. Because of its central role in integrating F-16 sensors and equipment into the desired fire control system, the OFP is designated a configuration item and has accordingly had requirements for configuration management in accordance with MIL-STD-483 and the configuration management plan 16PP153. The Fire Control Subsystem is diagrammed in Figure E-2.

The FCC OFP is a real-time program which coordinates sensor and equipment data transfers over the serial digital multiplex data bus and schedules various processing activities to implement the fire control and navigation modes selected by the pilot. The functional data flow relating the OFP functions to each other and to external elements is shown in Figure E-3.

Most of the processing instructions which comprise the OFP are written in the J3B-2 high-order language (HOL) to support advanced concepts of software documentation, understanding, and maintainability. Use of J3B-2 HOL also facilitates modular design and testing. In the design process, each functional requirement is mapped into one or more OFP components for implementation. The definition of components is accomplished through the top-down, structured programming methodology, which results in a linear, modular program with readily identifiable hierarchical levels and single entry and exit points for each module. As a result, the OFP can be easily read and tested, and revisions to the OFP can be readily undertaken and accomplished.

Contractual specifications provide for 30 percent memory and 40 percent speed reserves in the FCC OFP system, with currently specified requirements for the system. Additional detailed data on the requirements this program and their implementation may be found in the development and product specification documents, 16ZE011-1 and 16AE011-2.

CONTINUATION SHEET DATE: 31 October 1979

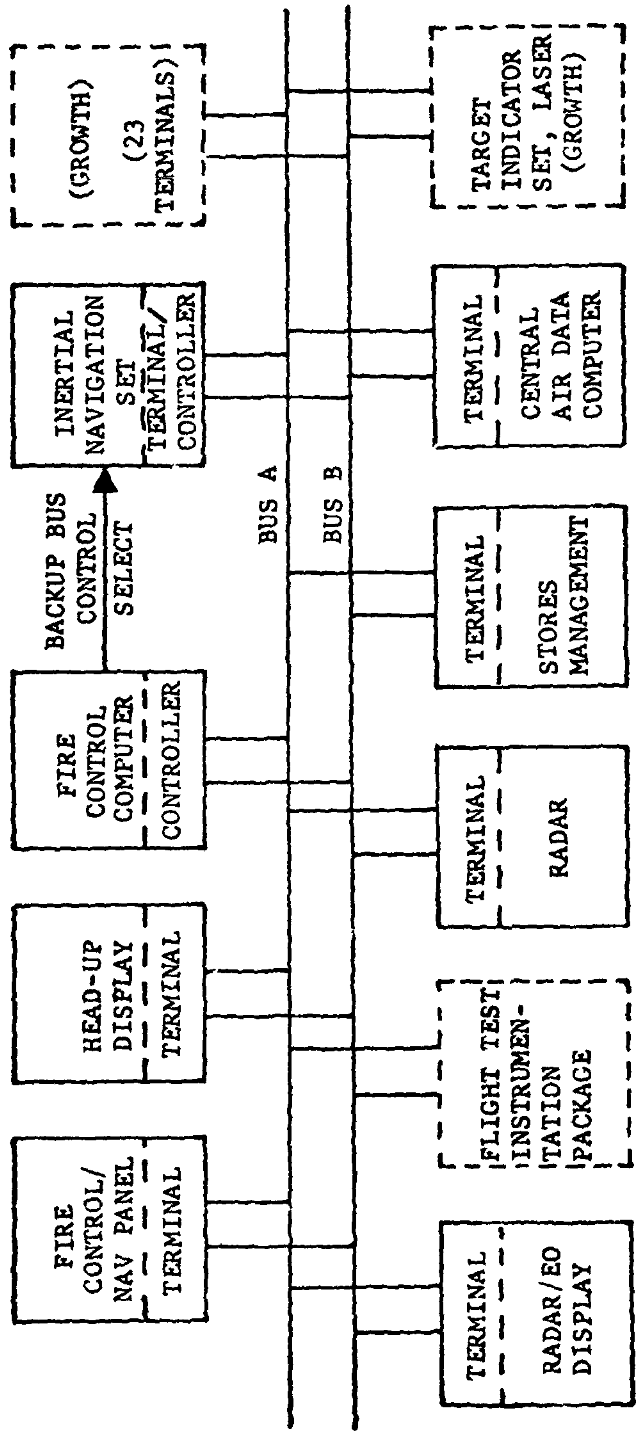

Figure E-1. F-16 Avionic Multiplex System

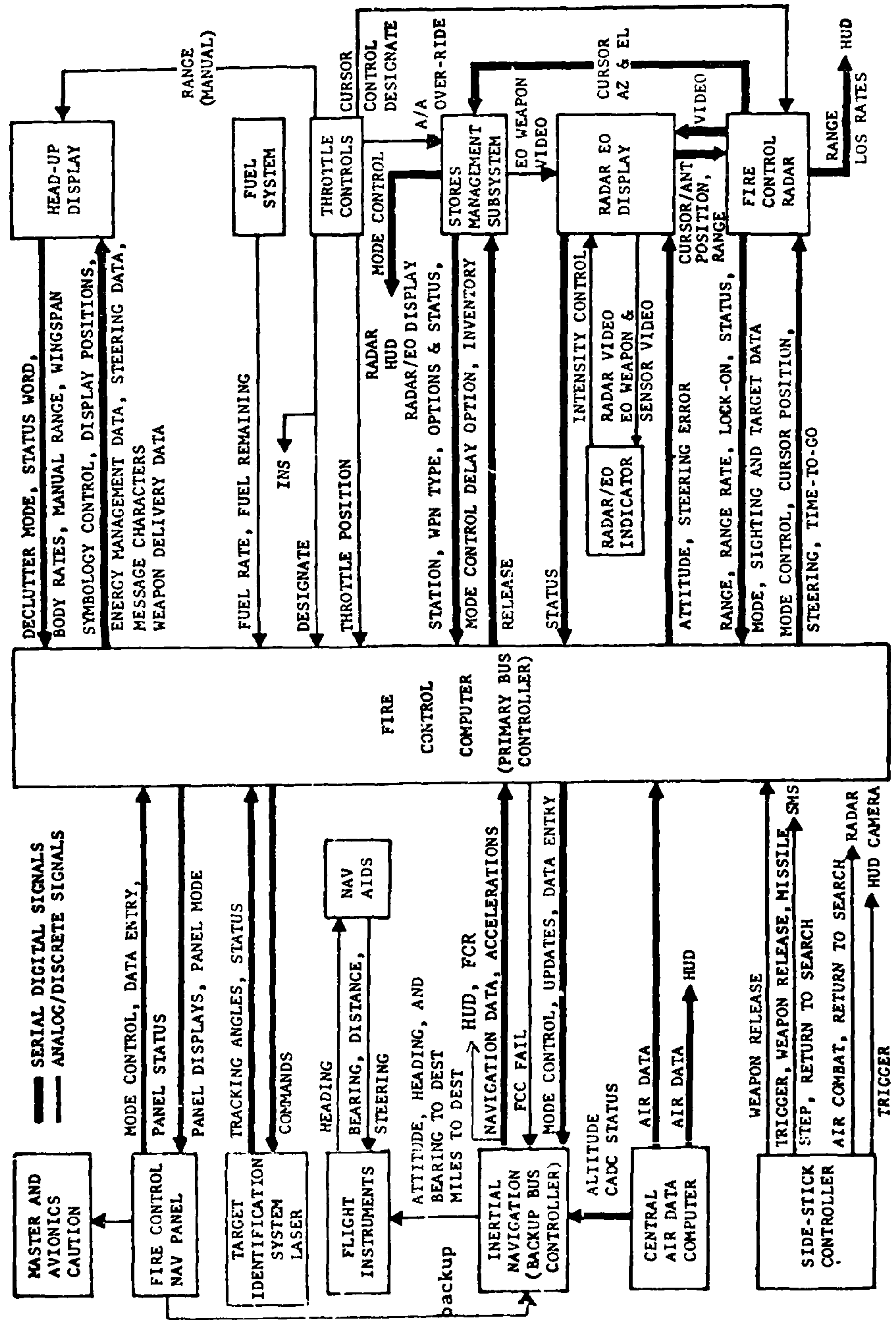

Figure E-2. F-16 Fire Control Subsystem

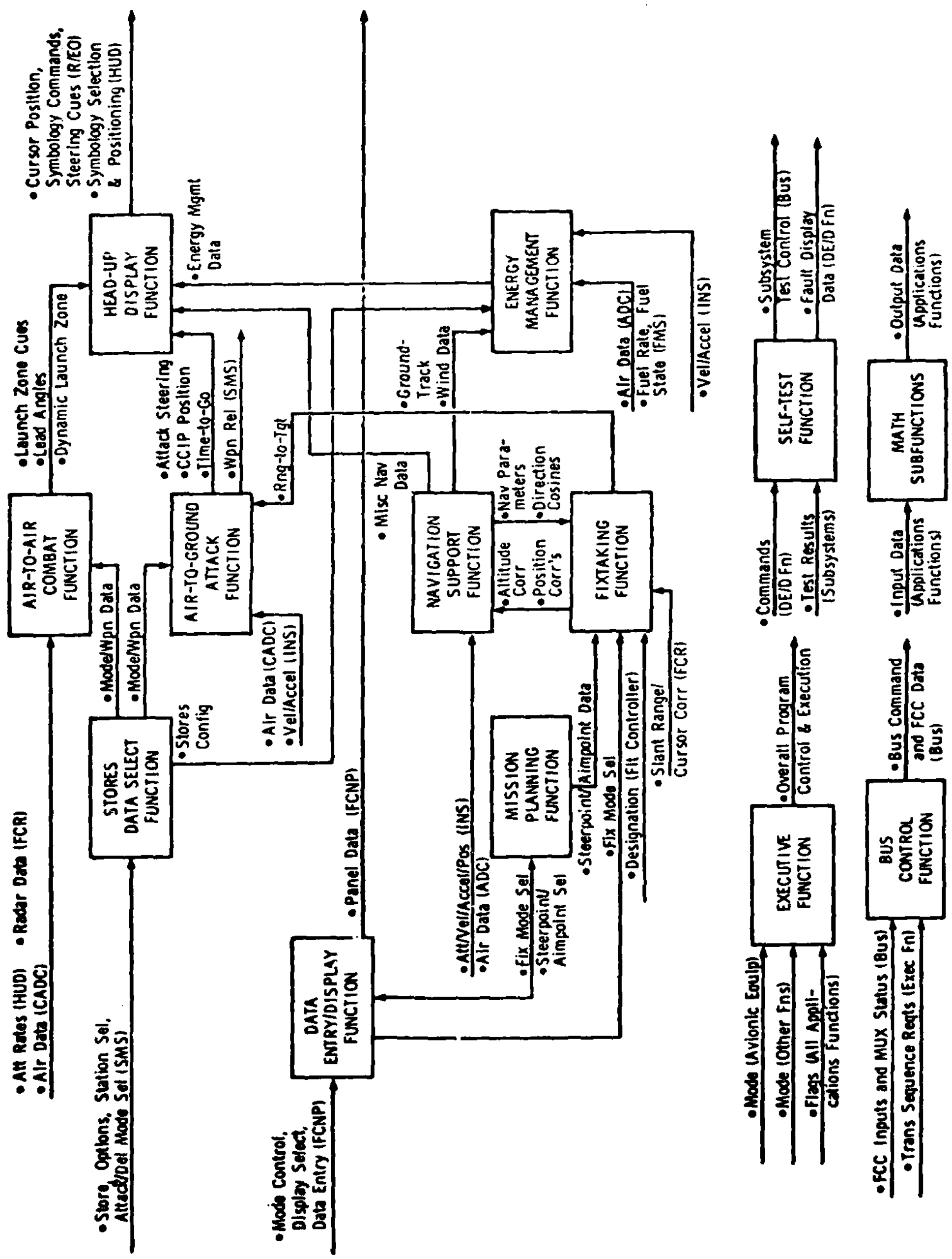

Figure E-3. FCC OFP Data Flow

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - **DATE:** 31 October 1979

SOFTWARE PACKAGE: F-16 Fire Control Computer (FCC)

PERSONNEL CONTACTED:

Jim Oldham — MMECA Lead Engineer

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE:	32,768 words
LANGUAGE:	JOVIAL J3B-2 HOL and MAGIC F-2 Assembly
APPLICATION:	Air-Air/Air-Gnd. Fire Control, Data/Displays, Store Select, HUD, NAV Support, Mission Planning, Fixtaking
COMPLEXITY:	Average — See also quality ratings
YEAR DEVELOPED:	1975-1976
DEVELOPER:	General Dynamics
COMMENTS	JOVIAL/MAGIC/ML Cross Compiler by Softech

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER:	Delco Electronics
MODEL NUMBER/DESIGNATOR:	MAGIC 362 F-2
WORD SIZE:	16 and 32-Bit instructions; 16 and 32-Bit Fix. Pt. Data; 24 and 48-Bit Float Pt. Data
MEMORY SIZE:	MAIN — 32K (K = 1024) — 16 Bit Word Storage CPU — 1K-40-Bit microprogram ROM
MEMORY FILL:	26,542 (80 percent) — 85 percent is JOVIAL developed; 15 percent is direct AL

COMMENTS: FCC Specifications:

Requirements (B5) — No. 16ZE011-1D
Design (C5) — No. 16ZE011-2C
User Manual — No. 16PR249B

All Block II Changes are JOVIAL implemented
Analysis is 80 percent; Implementation is 20 percent

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET Quality Ratings, FCC OFP **DATE:** 31 October 1979

Accessibility: 8

Accountability: 7

Access Audit: 1

Access Control: 8

Accuracy: 7

Augmentability: 8

Clarity: 9

Communicativeness: 7

Communications, Commonality: 6

Completeness: 9

Conciseness: 9

Consistency:

- Internal Consistency: 8
- External Consistency: 7

Correctness: 8

Data Commonality: 8

Efficiency: 8

- Execution Efficiency: 6
- Storage Efficiency: 7

Error Tolerance: 9

Expandability: 8

Generality: 7

Human Engineering: 7

Independence:

- Device: 1
- Software System: 1

Instrumentation: 7

Interoperability: 1

Integrity: 8

Legibility: 7

Maintainability: 8

Modifiability: 8

Modularity: 8

Operability: 7

Performance: 8

Portability: 1

Reliability: 8

Robustness: 1

Reusability: 3

Selfcontainedness: 8

Selfdescriptiveness: 7

Simplicity: 6

Structuredness: 8

Testability: 7

Traceability: 8

Training: 7

Understandability: 8

Usability (as-is utility): 7

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - DATE: 31 October 1979

SOFTWARE PACKAGE: F-16 Inertial Navigation Set (INS)

PERSONNEL CONTACTED:

Paul Reimann — MMECA Lead Engineer

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE: PROM/ROM/RAM: 9194 (Max. is 11,776 words for existing memory cards)

LANGUAGE: SKC-3000 Assembly Language

APPLICATION: Inertial Navigation Unit — Navigation Panel Display, Back-up bus control for all OFPs if FCC inoperative.

COMPLEXITY: Low to moderate — see also quality ratings

YEAR DEVELOPED: Version 2.03 release date — August 1976
Version 2.06 release date — December 1977

DEVELOPER: Singer Kearfott Division (SKD), Wayne, N.J.

COMMENTS Instruction set, constants are in firmware — PROM/ROM

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER: Singer Kearfott

MODEL NUMBER/DESIGNATOR: SKC-3000

	Instruction	Data	MUX Variable	Senal Core I/O Variable	I/O Channel
WORD SIZE:	15 bit ROM	19 bit RAM & ROM	16 bit RAM	19 bit core	19 bit
MEMORY SIZE: *	7168	2048	2048	64	448
MEMORY FILL: **	6685 (93%)	1487 (73%)	832 (40.6%)	64 (100%)	24 5%

*Listed is program size. Total physical memory except core and I/O is 32K. Thus fill is 28% H/W; 81.6% of maximum OFP S/W.

**Besides 6685 instruction words, another 102 15-bit instruction words used as data constants (95% total); 512 (50%) of 1048 19-bit RAM (volatile) data memory and 975 (95%) of bit ROM data constants are used up.

COMMENTS: The INS OFP is contractor supported until (at least) 1983 by a Reliability Improvement Warranty (RIW). Changes are by subcontractor, Singer-Kearfott (SKD) manufacturing change of the ROM chips. Due to expected infrequent OFP changes, complete program verification is tested with a SKD test stand. OO-ALC tests consist of Interpretive Computer Simulation (small portions of the OFP), post-processing scaling and inspection, inter-OFP communications test in the Avionics Equipment Bay (AEB) by MMETA, and flight tests.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET Quality Ratings, INS OFP **DATE:** 31 October 1979

Accessibility: 2

Accountability: 2

Access Audit: 1

Access Control: 5

Accuracy: 8

Augmentability: 4

Clarity: 4

Communicativeness: 7

Communications, Commonality: 3

Completeness: 9

Conciseness: 9

Consistency:

- Internal Consistency: 6
- External Consistency: 7

Correctness: 8

Data Commonality: 6

Efficiency:

- Execution Efficiency: 8
- Storage Efficiency: 9

Error Tolerance: 5

Expandability: 4

Generality: 3

Human Engineering: 6

Independence:

- Device: 1
- Software System: 1

Instrumentation: 2

Interoperability: 7

Integrity: 8

Legibility: 4

Maintainability: 4

Modifiability: 4

Modularity: 6

Operability: 5

Performance: 3

Portability: 1

Reliability: 8

Robustness: 5

Reusability: 2

Selfcontainedness: 9

Selfdescriptiveness: 4

Simplicity: 3

Structuredness: 6

Testability: 4

Traceability: 7

Training: 3

Understandability: 4

Usability (as-is utility): 5

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - DATE: 31 October 1979

SOFTWARE PACKAGE: F-16 Head-Up Display (HUD)

PERSONNEL CONTACTED:

Lowell Weed - MMECA Lead Engineer

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE: Block (Issue) I - 7168; Block II - 11264 words

LANGUAGE: Assembly (Marconi Specialized)

APPLICATION: Displays with snapshoot gunnery, backup missile launch, LCOS & ILS flight director functions

COMPLEXITY: Not rated (by ALC) - see also quality ratings.

YEAR DEVELOPED: 1976

DEVELOPER: Marconi-Elliot Avionic Systems, Ltd., England

COMMENTS The HUD operational flight program was developed first as a two level (BLOCK I) and then as a three level (BLOCK II) program.

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER: Marconi General Dynamics

MODEL NUMBER/DESIGNATOR: GD P/N 16VE017003

WORD SIZE: 16-bit

MEMORY SIZE: Block I - 8K; Block II - 16K

MEMORY FILL: Block I - 88 percent; Block II - 70 percent

COMMENTS:

The HUD, Central Air Data Computer (CADC) and RADAR-EO Display were originally one configuration item. The CADC and REO OFPs are low frequency change CPCIs not to be maintained by ALC. Originally HUD was a ROM, since changed to EPROM. Although not a PSCM OFP package item, OFP and support software data for CADC and REO are attached for reference.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET Quality Ratings, HUD OFP **DATE:** 31 October 1979

Accessibility: 1

Accountability: 3

Access Audit: 1

Access Control: 3

Accuracy: 9

Augmentability: 5

Clarity: 6

Communicativeness: 7

Communications, Commonality: 2

Completeness: 8

Conciseness: 9

Consistency:

- Internal Consistency: 7
- External Consistency: 8

Correctness: 9

Data Commonality: 7

Efficiency:

- Execution Efficiency: 9
- Storage Efficiency: 8

Error Tolerance: 2

Expandability: 7

Generality: 2

Human Engineering: 9

Independence:

- Device: 1
- Software System: 1

Instrumentation: 7

Interoperability: 9

Integrity: 10

Legibility: 7

Maintainability: 7

Modifiability: 8

Modularity: 3

Operability: 8

Performance: 8

Portability: 1

Reliability: 8

Robustness: 1

Reusability: 4

Selfcontainedness: 8

Selfdescriptiveness: 8

Simplicity: 7

Structuredness: 6

Testability: 6

Training: 5

Training: 5

Understandability: 5

Usability (as-is utility): 7

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - DATE: 31 October 1979

SOFTWARE PACKAGE: F-16 Fire Control Radar (FCR)

PERSONNEL CONTACTED:

Dave Erickson - MMECA Lead Engineer

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE: Current: EPROM - 32768 ECP116: EPROM - 49152 words
RAM - 4096 RAM - 16384

LANGUAGE: Assembly

APPLICATION: Air-air search, acquisition, and target tracking; ground mapping, air-ground ranging, and processing.

COMPLEXITY: Very - see also quality ratings.

YEAR DEVELOPED: 1976-1979; ECP update 1979-1980

DEVELOPER: Westinghouse Electric Corporation

COMMENTS

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER: Westinghouse

MODEL NUMBER/DESIGNATOR: -

WORD SIZE: 16-Bits

MEMORY SIZE: 32K EPROM,4K RAM will be 48K EPROM, 16K RAM

MEMORY FILL: 100 percent; will have a 12K EPROM reserve

COMMENTS:

Although design is structured (29 functional task) module, programming is not except for top level flow chart branching. Local and global labels have common alphanumerics for related functions.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET Quality Ratings, FCR OFP **DATE:** 31 October 1979

Rate the Package on the following Quality attributes:

Accessibility; 8

Accountability: 5

Access Audit: 2

Access Control: 2

Accuracy: 8

Augmentability: 4

Clarity: 4

Communicativeness: 8

Communications, Commonality: 8

Completeness: 5

Conciseness: 8

Consistency:

- Internal Consistency: 7
- External Consistency: 7

Correctness: 5

Data Commonality: 8

Efficiency:

- Execution Efficiency: 6
- Storage Efficiency: 6

Error Tolerance: 6

Expandability: 3

Generality: 7

Human Engineering: 5

Independence:

- Device: 1
- Software System: 1

Instrumentation: 8

Interoperability: 6

Integrity: 1

Legibility: 3

Maintainability: 7

Modifiability: 5

Modularity: 5

Operability: 7

Performance: 5

Portability: 1

Reliability: 8

Robustness: 5

Reusability: 1

Selfcontainedness: 5

Selfdescriptiveness: 6

Simplicity: 5

Structuredness: 7

Testability: 7

Traceability: 7

Training: 7

Understandability: 3

Usability (as-is utility): 6

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - DATE: 31 October 1979

SOFTWARE PACKAGE: F-16 Stores Management System (SMS)

PERSONNEL CONTACTED:

Darwin Jensen - MMECA Lead Engineer

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE:	34816 words
LANGUAGE:	Assembly
APPLICATION:	Monitor status, control, and release of armament (stores)
COMPLEXITY:	High - see also quality ratings
YEAR DEVELOPED:	1978
DEVELOPER:	General Dynamics
COMMENTS	

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER:	General Dynamics
MODEL NUMBER/DESIGNATOR:	8080
WORD SIZE:	8-Bits
MEMORY SIZE:	36864
MEMORY FILL:	94%

COMMENTS: Programs permits ground or airborne mission allocation, multiple options on delivery/selection, arming, and release. Each store has pre-determined options and has target type (eg-TANK) association for operation selection. SMS computer has a primary and second (backup) microprocessor. ALC engineers have two years experience with 2-3 weeks microprocessor AL/ML and system specialized training.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET Quality Ratings, SMS OFP **DATE:** 31 October 1979

Accessibility: 9

Accountability: 5

Access Audit: 1

Access Control: 1

Accuracy: 9

Augmentability: 2

Clarity: 3

Communicativeness: 7

Communications, Commonality: 8

Completeness: 6

Conciseness: 3

Consistency:

- Internal Consistency: 9
- External Consistency: 6

Correctness: 9

Data Commonality: 10

Efficiency:

- Execution Efficiency: 9
- Storage Efficiency: 5

Error Tolerance: 3

Expandability: 2

Genrality: 5

Human Engineering: 9

Independence:

- Device: 6
- Software System: 6

Instrumentation: 4

Interoperability: 8

Integrity: 9

Legibility: 2

Maintainability: 1

Modifiability: 2

Modularity: 8

Operability: 8

Performance: 8

Portability: 9

Reliability: 10

Robustness: 10

Reusability: 1

Selfcontainedness: 10

Selfdescriptiveness: 2

Simplicity: 1

Structuredness: 4

Testability: 1

Traceability: 4

Training: 2

Understandability: 2

Usability (as-is utility): 3

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL DATE: 31 October 1979

ALC Ogden	OFFICE SYMBOL: OOALC/MMECA

KEY PERSONNEL/OGRANIZATION:

Dave Thornell - MMECA (801) 777-7231 - Section Chief
Mike Welch - MMECA/F-16 - Lead OFP Engineer
Capt. Fick - MMETA (801) 777-1211 - AISF & Flight Test Interface
Bob Anderak - MMETA/F-16
Verlon Duncan - ACDCS (801) 777-7522 - AISF
Roy Taketa - ACDCS (801) 777-6161 - GPCC
Wayne Bates - MMARE (801) 777-5871 - Configuration Control
Lee Calvert - MMECA - Change Control

Figure E-4 on page E-18 provides an organization chart.

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE): (all civil service/military)

MMECA - 33
MMETA - 15 (projected)
ACDCS - 39 (planned)

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

F-16 - 7 OFPs
F-4 - 2 OFPs
plus support software

CONTINUATION SHEET

DATE: 31 October 1979

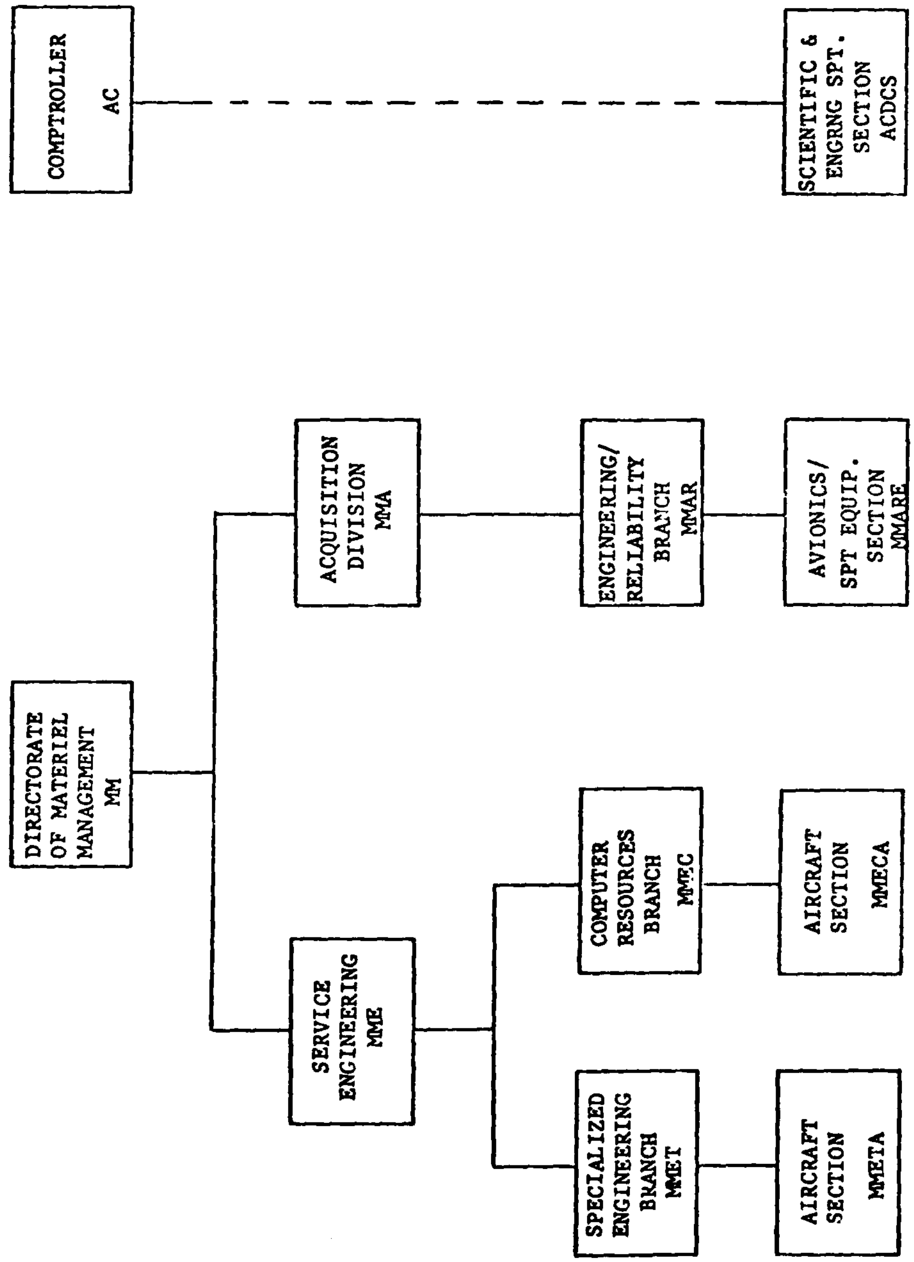

Figure E-4. Ogden ALC Organization Offices Associated with F-16 OFP Support

MAINTENANCE AGENCY - WORK DISTRIBUTION

DATE: 31 October 1979

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL

MMECA has (i.e., will have after PMRT) responsibility for software engineering on the F-4 and F-16. MMETA provides independent validation and verification (both ground simulation and flight testing) of software changes, and also provides AISF services to MMECA. ACDCS (comptroller) provides programming support for the support software (both AISF and General Purpose Computer Complex). ACDCS personnel essentially work for MMECA. MMARE provides acquisition support, controls the F-16 budget, and currently provides three engineers which MMETA would normally have. This arrangement is due to local manpower restrictions.

Organization	Total	F-16		F-4	Flight Test
MMECA[1]	33[2]	15	⟷	17	
MMETA	15[3]	7		3	4
ACDCS:	39[4]				
AISF		9		14	
GPCC		8		8	
	87[2]	39		42	4

1. Personnel shift back and forth in response to workload requirements.
2. Includes section chief.
3. Includes section chief.
4. Five persons shared between F-4/F-16.

CONTINUATION SHEET - WORK DISTRIBUTION DATE:

MMECA assigned personnel:

1	GS-13	Electronics Engineer (supervisory)
25	GS-12	Electronics Engineer (ECS)
2	GS-11	Electronics Engineer
1	GS-9	Electronics Engineer
2	1-Lt	Electronics Engineer
2	GS-4	Clerk

ACDCS assigned personnel (planned):

1	GS-13	Supervisor
15	GS-12	Lead Engineer
19	GS-11	Analysts and Programmers
1	GS-07	Configuration Management
3	GS-05	Steno/Computer Aide/Technician

CONTINUATION SHEET - WORK DISTRIBUTION **DATE:**

MMETA organization:

Section Chief (Capt./Major)

F-4 AISF
- 1-Lt/Capt/GS-12
- GS-12 (ACM)
- GS-12 (ARN-101)

F-16 AISF*
- Capt
- GS-13 Electronics Engineer
- GS-12 to be
- GS-12 added

Following supplied by MMA:
- AIS Engineer (GD)
- AEB Engineer (GD)
- RES Engineer (Westinghouse)

Flight Test Engineering
- Capt
- Capt
- GS-9 (munitions testing)

Photo Recon Engineering
- 1-Lt

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE:

Cost accounting tracks all activities directly associated with OFP maintenance and support. Documentation is via the Project Accounting and Control System. Sample reports are shown on pp. E-23 and E-24.

SUMMARY PROJECT ANALYSIS

F16 BLOCK IIMMA-D76-C03 3307 PERIOD AUG 25,79

PROJECT LEADER W WELCH

LEVEL / PRIORITY	REVISED ESTIMATE	PREVIOUS ESTIMATE	ORIGINAL ESTIMATE	PROJECTED ESTIMATE	REVISED EST VS PROJ EST	ACTUAL / TO DATE	PROJECTED TO COMPLT	PERCENT COMPLETE
PROJECT /*C4CC*								
BUDGET / COST	2,069		2,069	7,837	5,768-	5,395.68	2,442	68 PCT
START DATE	DEC 4,78		DEC 4,78			DEC 10,78		
FINISH DATE	MAR 2,80	AUG 7,79	AUG 7,79	FEB 11,81	345-			
RESOURCE TIME	175.0		175.0	6,645.2	6,470.2-	4,203.2	2,442.0	63 PCT
EQUIPMENT TIME	10.4		10.4					N/A
PHASE								
BUDGET / COST	2,069		2,069	121	1,948	69.00	52	57 PCT
START DATE	DEC 4,78		DEC 4,78			JAN 14,79		
FINISH DATE	AUG 7,79		AUG 7,79	APR 7,80	245-			
RESOURCE TIME	175.0		175.0	121.0	54.0	69.0	52.0	57 PCT
EQUIPMENT TIME								
POR SUPPORT, RELEASE 1A								
BUDGET / COST	522		522	771	249-	771.20		100 PCT
START DATE	JAN 22,79		JAN 22,79			FEB 4,79		
FINISH DATE	MAR 1,79		MAR 1,79	JUN 23,79		JUN 23,79		
RESOURCE TIME	522.0		522.0	771.2	249.2-	771.2		100 PCT
EQUIPMENT TIME								
CPF TEST, RELEASE 1 - C								
BUDGET / COST	2,876		2,876	3,173	297-	1,847.00	1,326	58 PCT
START DATE	MAR 2,79	APR 15,79	APR 15,79			APR 6,79		
FINISH DATE	JUL 1,79		JUL 1,79	AUG 8,80	405-			
RESOURCE TIME	2,876.0		2,876.0	3,173.0	297.0-	1,847.0	1,326.0	58 PCT
EQUIPMENT TIME								

CONTINUATION SHEET

PREDICTIVE SOFTWARE COST MODEL

DATE: 31 October 1979

PROJECT DETAIL ANALYSIS

F16 BLOCK IIMMA-076-003 3307 PERIOD AUG 25,79

PROJECT LEADER M WELCH

DESCRIPTION TAG DEF IDENT. PRI	REVISED EST	TIME REMAINING	ACTUAL TIME LST PRD/ TO DATE	REVISED START	REVISED FINISH	PROJECTED FINISH	VAR &/-	PERCENT CPL/CCM	ASSIGNED RESOURCE BUDGET VS ACTUAL
SMS FLT LC MCCE 3LAC	150.0	134.0	16.0	MAR 2,79	MAR 2,80	JUN 9,80	95-	10/ 10	L OLDHAM 150/ 16
STORES CANDIDATE CHANG 3MAC	354.0	178.0	176.0	MAR 2,79	MAR 2,80	MAR 5,80	3-	49/ 20	M WELCH 354/ 176
NAV MECH & SLEW RATE 3MAD	200.0	62.0	138.0	APR 21,79	MAR 2,80	OCT 30,79	125	69/ 20	G STRONG 200/ 138
CCFF/VRF 3MBC	177.0	117.0	60.0	MAR 2,79	MAR 2,80	MAY 2,80	61-	33/ 10	M WELCH 177/ 60
TABLE DRIVEN FX 3MCC	177.0	53.0	124.0	MAR 2,79	MAR 2,80	DEC 20,79	74	70/ 10	M WELCH 177/ 124
PREV INDV FCS UPDATE 3CAC	80.0	1.0	80.0	MAR 2,79	MAR 2,80	SEP 6,79	179	98/ 5	J OLDHAM 80/ 80
CCFF/VRF 3CBC	160.0	86.0	74.0	MAR 2,79	MAR 2,80	MAR 6,80	4-	46/ 10	J OLDHAM 160/ 74
MARK INITIALIZATION 3CCC	40.0	1.0	40.0	MAR 2,79	MAR 2,80	SEP 7,79	178	97/ 3	J OLDHAM 40/ 40
VIF ON SMS 3CDC	160.0	160.0		MAR 2,79	MAR 2,80	AUG 8,80	155-	/ 10	J OLDHAM 160/ 0
STANDARD ELEV ENTRY 3SAC	40.0		10.0	MAR 2,79	MAR 2,80	JUN 16,79*	261	100/ 3	R SUZUKI 40/
PREV INADV FCS UPDATE 3SBC	80.0	80.0		MAR 2,79	MAR 2,80	AUG 8,80	155-	/ 5	R SUZUKI 80/

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 31 October 1979

SUPPORT PHILOSOPHY:

PMRT for the F-16 aircraft is scheduled for 1985. However, OO-ALC will assume responsibility for software engineering in 1981 as originally planned. MMECA currently provides validation and verification (V&V) services to the SPO for contractor-supplied OFPs and updates. Also included are AISF* integration and test, and flight test. Post-PMRT will be guided by the Material Improvement Project (MIP) which provides problem/management control for all change tracking and documentation of OFP O&M activity. Pages E-26 through E-29, extracted from the F-16 avionics Computer Resources Integrated Support Plan, describe the overall support plan.

*See Glossary on pp. E-72ff for acronyms.

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Currently informal; a formal tracking system is being established. Approval authorities are described on pages E-30 through E-33.

CHANGE REVIEW PROCESS:

The process is documented in "F-16 Operational/Support Configuration Management Procedures" dated 2 July 1979. A formal baseline will be established at PMRT based on the turn-over Version Description Documents. The change process is described on pp. E-34 through E-38.

CONFIGURATION IDENTIFICATION METHODS:

Computer Program Identification Numbers - see pp. E-39 through E-41.

CONFIGURATION CHANGE CONTROL METHODS:

See pages E-39 through E-41.

CONFIGURATION STATUS ACCOUNTING METHODS:

See page E-42.

SOFTWARE LIBRARY CONTROL PROCEDURES:

Support software is under ACDCS control; master tape and working tapes under MMETA (AISF) control with central and remote tape vaults.

CONTINUATION SHEET - SUPPORT PHILOSOPHY **DATE:** 31 October 1979

PRE-PMRT Program Management

The implementing command, AFSC, has total management responsibility from the Conceptual through Full Scale Development Phases until the system turnover milestone. At system turnover, the configuration baseline will have been established.

System/equipment turnover will be accomplished in accordance with the F-16 System/Equipment Turnover Plan. From system turnover until PMRT, AFSC retains overall program management responsibility and is the final approval authority for all system changes.

OFP Changes

The change process used by the SPO during Full Scale Development will be continued through to PMRT. Changes to F-16 computer programs will be considered Class I and will be processed as Class I ECPs IAW the F-16 SPO procedures.

AFLC/User Participation

Eventual transition of an F-16 OFP support posture as outlined by the CRISP requires participation by AFLC and F-16 user organizations in Full Scale Development and Production activities. Where participation is such a nature that is not normally covered within existing plans and MOAs, separate agreements will be established between the involved organizations; the degree of participation, location of the activity and resources will be negotiated thereunder. However, these agreements will not jeopardize the responsibilities of the contractor in obtaining formal Air Force acceptance of the approved production OFP baseline.

An agreement will be developed to delineate the working arrangements to be utilized in phasing in AFLC organic OFP support. The concept to be employed will be single point responsibility for technical and engineering aspects of software modifications.

Prior to PMRT, emphasis will be placed on useability at the operational site and supportability planned by AFLC. In all cases, the SPO will make the final decision regarding the extent of Ogden ALC software support to the FSD and Production contracts.

Post-PMRT Program Management

At PMRT, the F-16 Multinational Configuration Control Board (MCCB) will transfer to Ogden ALC. EPG and user representation to the F-16 MCCB will be retained. The F-16 MCCB, under the authority of the Ogden ALC CCB Chairman, will consider, evaluate and make decisions on behalf of the involved parties with respect to Engineering Change Proposals (ECPs) that impact the F-16 weapon system.

The CRISP assumes that a Multinational CPCSB will be established under the MCCB to centralize the control of F-16 OFP software changes which do not affect system equipment.

OFP Changes

For planning purposes, organic OFP update block changes will be scheduled approximately once per year. However, user priorities and projected AFLC workload may affect the detailed scheduling, as well as the anticipated time span to retrofit released OFP updates.

F-16 MCCB approval will be required for organic updates affecting both software and hardware. Additionally, MCCB approval will be required for contractor ECPs addressing software and/or hardware impacts related to the F-16 production program. When the proposed modifications are approved, the changes will be implemented in accordance with the applicable AFLC procedures.

Production Interface

Until production of the F-16 aircraft ceases, Ogden ALC must assure the F-16 AISF equipment and software reflect current configurations of the F-16 system. Additionally, Ogden ALC must assure that production impacts are adequately addressed for any proposed OFP updates.

Retrofit

It is planned that the FCC OFP update will be released as a field level TCTO. Each user will requisition the required number of kits once the block change is released and will schedule their retrofit based on their retrofit implementation planning.

Conceptually, the AIS data file will be updated with the new release of the FCC OFP. Then the FCC will be cycled through maintenance to reload the FCC with the updated OFP.

Reprogrammable firmware retrofit concepts are under review to assess configuration management and logistics impacts. In October, 1978, the F-16 program initiated action to obtain an intermediate level retrofit capability for the memory contents of the Central Interface Unit (CIU) and the Radar Computer. The concept is to obtain a self-contained piece of support equipment designed to reprogram and verify the firmware (EPROMs) in an intermediate level environment. Firmware (PROM) retrofit is not contemplated at the intermediate level due to very low change rates.

Non-reprogrammable firmware (ROM) and reprogrammable firmware (PROM) retrofit of the SRUs at the depot is via a depot level TCTO. The retrofit concept will be summarized in later CRISP updates on analyses and planning by the F-16 Maintenance Engineering Working Group.

OFP Block Change Cycle

Reported computer program deficiencies and new capabilities will be forwarded to Ogden ALC for review and evaluation. As shown in Figure E-5, Preliminary Engineering Change Proposal(s), addressing accumulated OFP Change requests, will be reviewed at a joint technical conference attended by representatives of the USAF/EPAF users and chaired by F-16 System Manager (SM) representative.

The purpose of the technical conference is to establish priorities, acquire user approval of the proposed OFP changes and revise the Preliminary Engineering Change Proposal(s). This conference will be supported by data from feasibility studies and engineering tests conducted to better define the requirements and/or software solution. Following approval by the CPCSB/MCCB, the update process will proceed through the engineering development and test cycles as shown in Figure E-5. At each major design review (PDR, CDR), the option exists to transfer selected change candidates to the next OFP block change as negotiated by the F-16 SM and the USAF/EPAF user and approved by the CPCSB/MCCB. For planning purposes, the joint technical conference will effectively constitute a System Design Review (SDR) unless the CPCSB/MCCB directive stipulates a need for a follow-on SDR.

Review of the OFP update will be conducted in accordance with MIL-STD-1521. The documentation will be produced and maintained in accordance with MIL-STD-483 and 490. Additionally, the approved Preliminary ECP(s) establishes the new functional baseline.

The PDR will be held to review the preliminary design approach and the computer program development specifications. The review must (1) result in concurrence on the acceptability of the engineering approach and follow-on effort, (2) provide formal approval of the computer program development specifications, and (3) give approval to proceed with detailed design. Additionally, the computer program development specifications are placed under configuration control so that any further changes must be formally approved.

CONTINUATION SHEET - SUPPORT PHILOSOPHY DATE: 31 October 1979

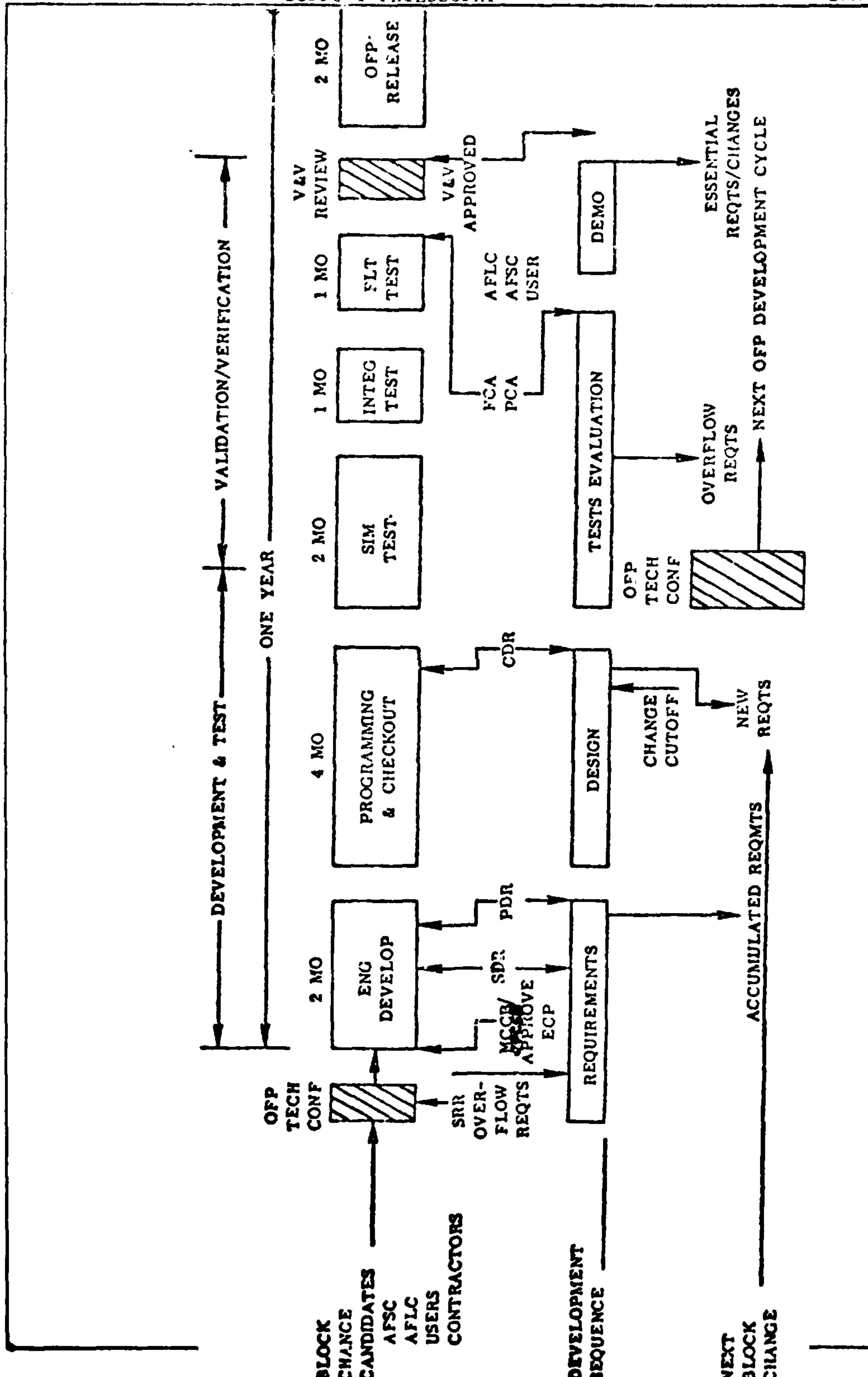

Figure E-5. OFP Update Cycle

CONTINUATION SHEET - CHANGE CONTROL AUTHORITY **DATE:** 31 October 1979

Approval Authority, Boards and Committees for Computer Program Configurations:

F-16 Air Combat Fighter Configuration Steering Group (F-16 ACF/CSG). The following responsibilities are direct extractions from the CSG Charter:

The CSG acts as the USAF focal point for review and control of the F-16 weapons system design and production configuration(s).

The group members are AF/RD (Chairman), AF/XD, AF/OF, AF/RDP, AF/RDQ, TAC/DR, AFALD and AFSC/SD. The CSG will meet when called by the chairman. Progress reports will be forwarded to AF/CC as required. A termination date of the CSG has not been determined.

Following are functions of the CSG:

a. Review, analyze and establish the basic F-16 configuration.

b. Review, analyze, and approve/disapprove appropriate change proposals for the F-16, based on their effect on life cycle cost, schedule and performance.

c. Periodically review activities of the F-16 Configuration Control Board in managing the configuration of the F-16 as prescribed in AFR 65-3.

d. Request studies or reports as necessary from the F-16 System Program officer and other organizations to insure that all requirements and configuration changes are considered in the light of the objective of minimizing life cycle costs while retaining required operational performance capabilities.

Types of Change Proposals (CPs) to be resolved by CSG action include:

a. Those CPs originating external (using/supporting command or allied country) to the F-16 Program Office/Contractor, and with which the Program Manager (PM) disagrees (unless the CP is withdrawn by the originator).

b. Those CPs having a Configuration Control Board (CCB) minority position, which is supported by major command deputate level.

c. Those CPs which change system performance capability from validated operational requirements.

d. Those CPs which, if implemented, will be likely to breach performance, cost, or schedule thresholds documented in the PMD.

e. Those CPs requiring resources outside of the allocated program resources, i.e., VECPs and CPs requiring now dollars to affect life cycle cost savings.

f. Those CPs which the PM judges to be of interest to the CSG.

NOTE: All other CP activity to be managed in accordance with with existing regulations, with a quarterly summary report to the CSG, attendant to, but separate from, the PAR/SPR.

For avionics software, the CSG shall allocate memory and timing reserves.

Multinational Configuration Control Board (MCCB):

The MCCB is established by the Multinational Memorandum of Understanding (MOU) and shall be a governing body for the lifetime of the weapon system. Prior to PMRT, the System Program Director (ASD/YP), is the chairman of the MCCB which acts on all Engineering Change Proposals. Representatives of the Five Nations and TAC sit on the MCCB.

After PMRT, one representative from each participating government and TAC will become a member of the Ogden ALC Multinational Configuration Control Board (MCCB), on F-16 matters. The MCCB, under authority of the Ogden ALC MCCB Chairman, will consider, evaluate, and make implementing decisions on behalf of the involved parties with respect to Engineering Change Proposals (ECPs) presented to the board. In general, the MCCB shall consider implementation of all changes to the F-16 weapon system. The authority/decision to approve any modifications to the F-16 weapon system will remain with the appropriate government offices.

Computer Program Configuration Sub-Board: At PMRT, the OO-ALC MCCB will establish an F-16 CPCSB to review and approve/disapprove F-16 weapon system software change requests.

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The CPCSB will include representation from applicable AFLC, AFSE, TAC, EPAF, and technical coordinators as required. Each nation shall have one voting member. The F-16 System Manager (MMA) will be the chairman of the CPCSB. This CPCSB shall be governed by OO-ALC Reg XXXX. The significant roles of the multinational CPCSB are:

a. Approval/disapproval authority for all CPCI Class II on-aircraft software changes.

b. Approval/disapproval authority for all CPCI Class I on-aircraft software changes which do not affect system equipment and can be accomplished within existing AFLC/TAC/EPAF resources.

c. Approval/disapproval authority of companion Class I and Class II software changes to off-aircraft computer resources.

d. Approve/disapprove emergency software change requests/ECPS.

e. Recertify and reprioritize outstanding software change requests.

f. Approve/disapprove UUT test program CPCIs changes.

g. Approve/disapprove ECPs for AIS control and support software CPCI: It is anticipated that minor changes to electronic warfare and training devices may be accomplished without affecting system integrity. However, if recoupment is planned, such changes will be forwarded to F-16 MCCB for review/approval/disapproval.

TAC Software Requirements Review (SRR): TAC will establish an SRR OPR to receive, screen, prioritize, and recertify to the program manager (SPO)/AFLC SM all TAC software change requests. HQ TAC/DR will serve as chairman fo the SRRB and will be the single point of contact for all TAC F-16 weapon system software changes. The chairman of the SRRB will be appointed as command representative to all joint AFLC/TAC/EPAF software review boards/committees which are established to perform formal design reviews and to monitor approved software change requests.

EPAF Software Requirements Review (SRR): Each will establish an SRR OPR to receive, screen, prioritize, certify and submit to the AFLC SM all software change requests. The following EPAF single points of contact will serve as the chairman of their respective SRRB and focal point for software change requests:

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a. Belgium - The software support cell (VDT/B-5) avionics section at BAF airstaff in Brussels, Belgium.

b. Norway - Royal Norwegian Air Force (RNoAF) Materiel Command at Kjeller, Norway.

c. Netherlands - The F-16 Avionics Section at the Directorate of Air Materiel in THE HAGUE (DMKLU/AVL/VL2).

d. Denmark - The HQ Tactical Air Command Denmark (TACDEN), Karup Air Base.

Computer Program Configuration Items

Operational Flight Programs (OFPs) will be managed as Computer Program Configuration Items (CPCIs). Changes to baseline CPCIs which are proposed by the contractor will be submitted as Class I Engineering Change Proposals (ECPs) per MIL-STD-480, MIL-STD-481, as supplemented by MIL-STD-483, Appendix XIV. All using activity proposed engineering changes to baseline CPCIs will be submitted per AFR 57-4, Retrofit Configuration Changes procedures. Prior to PMRT, 16PP153, the F-16 Configuration Management Plan will apply to configuration management of CPCIs.

OFP Configuration Management Approach

The purpose of this section is to present the planned approach for configuration amangement of all F-16 OFPs. Configuration management for the various phases of the F-16 life cycle will differ. Consequently, this section is divided into three phases: developmental, transitional, and operational.

Developmental Phase

The developmental phase is that period of time beginning with the conception of the system and ending at F-16 Air Vehicle Physical Configuration Audit (PCA). Software configuration management, documentation, reviews and audits for both operational and support software shall be developed and conducted in accordance with the guidance provided by MIL-STDs-483, 490, and 1521. The product baseline will be established after completion of the Air Force flight test program and after all changes required for acceptable F-16 performance have been implemented, verified, and documented. Changes to CPCIs will be proposed, formatted and processed in accordance with MIL-STD-483 (Appendix XIV). Engineering change control authority is the responsibility of the F-16 System Program Director throughout this phase of the program. Assisting the Program Director in the Engineering Change Control area will be the F-16 Multinational Configuration Control Board (MCCB).

Transitional Phase

The transitional phase is that period of time commencing with PCA and ending with overall acceptance of the engineering and management of the system by AFLC at the Program Management Responsibility Transfer (PMRT) date set in accordance with AFR 800-4, Transfer of Program Management Responsibility.

During the transitional phase only System Program Office (SPO) approved changes will be implemented. The MCCB will ensure that proper configuration management of modified software is maintained. The SPO is responsible for maintaining configuration control of all production configurations. Only the SPO can authorize expenditure of funds to make software changes, including T.O. compatibility changes. Modifications required will be processed using existing ECP procedures. All changes will be prioritized by the F-16 SPO with inputs from USAF/EPAF users. The SPO will consider the feasibility of incorporating changes into the contract baseline depending upon the merit of the change, the costs involved, and the mission impact.

Details of the configuration management organization and procedures will be described in the Operational/Support Configuration Management Procedures (O/S CMP) document produced during the Full Scale Development Phase. The System Program Director supported by the MCCB, remains as the final authority for the approval of any change to a CPCI baseline. A Computer Program Configuration Sub-Board (CPCSB, AFB 800-14, paragraph 6-11) will be established at Ogden ALC (MMARE, MMECA) and from resident representatives of the USAF/EPAF as they deem necessary. Its functions will be to supply the SPO with the AFLC evaluation of all change proposals having an impact on OFPs. As such, it will form the basis for the CPCSB which will exist at Ogden ALC in the Post-PMRT period and which will directly support the F-16 System Manager and MCCB.

Operational Phase

The Operational phase is that period of time commencing with the complete PMRT acceptance per AFR 800-4, and continues through the life of the system.

a. The F-16 AISF is used extensively in the modification and test of the F-16 OFPs and associated documentation, and in support software directly related to the OFPs (e.e., assembler and link editor programs), to data reduction and analysis programs, and to those dynamic and mission simulation programs which are developed to verify change to the OFPs. Analysis, design/coding, validation and verification (V&V) of software changes are accomplished within the F-16 AISF. Each change is then flight tested if applicable. Further, MMECA, using the F-16 AISF, has the responsibility to technically interface the OFPs with other F-16 software systems and to ensure that hardware/software interface integrity is maintained. During investigation and development, complete records of events, steps taken, difficulties encountered, and their impacts are maintained with the result that the MMECA end product OFP is fully documented. When computer program changes are contracted, MMECA will monitor the contractor's progress and accomplish V&V of the end product software change developed as part of the ECP.

b. Each F-16 computer program planned to be designated as a CPCI will be identified in 16PP153, Table II. These specifications and associated documentation define the CPCI baselines which USAF/EPAF and AFLC will maintain during the operational phase. Changes to the computer programs will require a corresponding change to the Part II specifications and possibly also to the Part I. The CPCSB will be the central point for processing computer program changes. All change requests to common CPCI baseline OFPs used by all USAF/EPAF members will be agreed upon and prioritized by joint USAF/EPAF action prior to being submitted for incorporation into an ECP. Technical support from Ogden ALC is available to assist USAF/EPAF in this action. Change requests to country peculiar OFPs (i.e., OFPs not utilized by all members of the USAF/EPAF) will be handled in an identical manner as far as configuration management is concerned, subject to agreements yet to be developed.

c. The sequence to begin an Engineering Change Proposal (ECP) is shown in Figure E-6. Request for OFP changes to correct errors or to improve capabilities will be "breadboarded" where possible, and their impact evaluated as they are received by the SM. Changes not considered feasible will be returned to the submitting organization with an appropriate explanation. All others will then be evaluated to determine whether they involve a hardware change to the aircraft configuration or not. If the new requirement has a hardware impact, the SM is responsible for coordination with the hardware IM to obtain the IMs approval of the hardware change. When sufficient OFP change items have been accumulated to warrant a block update of the OFP configuration, the total change items will be reviewed jointly by Ogden ALC and the USAF/EPAF users. In this review, the exact change items to be included in the block update will be agreed upon.

d. An ECP will then be prepared containing the engineering data accompanied by a description of the requirement change. This ECP will be submitted by MMAR to the computer Program Configuration Sub-Board for approval. If approved, the SM will prepare and submit the appropriate documentation to the MCCB for approval or forwarding to the appropriate level for funds authorization to implement the program change. If disapproved, information on status of the ECP will be forwarded to the originating unit and other affected agencies. If during software V&V tests, a make-work change is required, Program Change Requests (PCRs), as applicable, will be submitted by the program development group for approval by the CPCSB before the necessary coding changes are incorporated. The CPCSB will document each PCR and determine the impact of such changes on all affected activities (T.O.s, trainers, test plans, hardware, etc.). When it has been determined that no additional make-work changes (PCRs) are required, and upon CPCSB approval, the ECP will be revised. If additional funding is required, the SM will amend and resubmit to the Ogden MCCB the previously approved modification requirements.

e. When suspected system OFP problems are discovered, in the field, they will be documented and submitted in accordance with T.O. 00-35D-54, USAF Material Deficiency Reporting System. They will be reviewed by joint USAF/EPAF action, and a recommendation will be submitted to the SM by the USAF/EPAF as to the action required by the SM. All such problems requiring OFP changes will be separated into "emergency change," "urgent," or "collect for next scheduled update" categories by joint decision of the SM and USAF/EPAF. Problems which have a significant impact on F-16 avionics system capability or safety will be placed in the emergency or urgent change category, in accordance with MIL-STD-480 priority definitions. Emergency and urgent changes will proceed quickly through the problem analysis, coding and check-out phase. The design goal will be to implement the necessary requirements as quickly as practicable with a minimum change to the source OFP. Design interface problems will be resolved whenever possible by person-to-person contact and followed by formal documentation.

f. At completion of check-out, the change to the updated OFP will undergo an independent verification, the goal of which is to determine that the change solves the problem and does not interfere with other normal operating modes.

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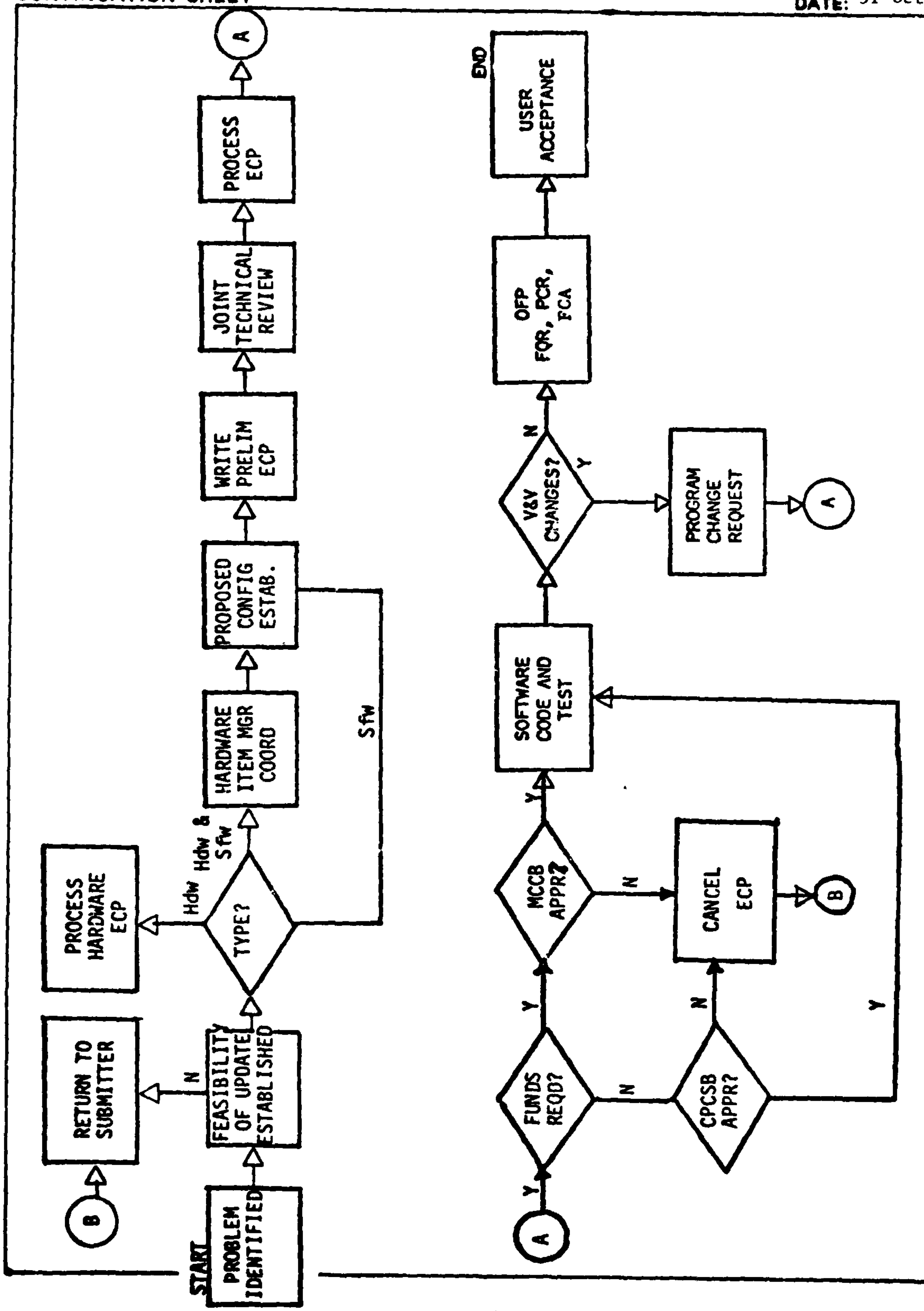

Figure E-6. Post-PMRT Program Change Sequence

Verification will be performed in the AISF and flight test/range facility. Concurrent with the verification activity, change pages to T.O.s will be written and verified in the AISF and/or during flight test. At completion of verification, the updated OFP and T.O.s are fielded and trainers and ATE are updated as soon as practical. Documentation, such as criteria, requirements, program description, and interface documents, is made compatible with the new program.

g. Support software such as compilers, assemblers, simulators, loaders, link editors, and V&V programs will be updated by ACDCS and MMECA direction to reflect changes made to the operational software. During the operational software change cycle, required changes to support software and hardware will be accomplished to accommodate the operational software change(s). Both support hardware and software baseline documentation will be maintained to show details of all changes required for a particular operational software change. Then, upon approval of new/revised operational software, these data will be updated to indicate permanent change approval. Changes to support software/hardware to enhance their capabilities will be thoroughly documented and controlled by OOALC/MME. A configuration management program will be developed and maintained within MME to show baseline software configuration and changes thereto accomplished during the OFP software update. This program will assure adequate control over the engineering development processes prior to release to the field by the F-16 SM.

CONFIGURATION MANAGEMENT CONCEPTS:

Classes of Configuration Changes:

Class I Changes:

For the purpose of the O/SCMP, MIL-STD-483 (USAF), Appendix XIV, Paragraph 140.6.1, shall be the recognized definition of Class I changes.

Class II Changes:

For the purpose of the O/SCMP, MIL-STD-483 (USAF), Appendix XIV, Paragraph 140.6.2, shall be the recognized definition Class II changes.

After PCA of computer programs, and prior to PMRT, there will be no Class II changes allowed.

Priorities of Configuration Changes: For the purpose of the O/SCMP, MIL-STD-480, Paragraph 4.5, provides the definition of Class I Emergency, Urgent and Routine engineering change priorities.

Computer Program Configuration Items (CPCI):

Definition of a Computer Program Configuration Item: A computer program end product whose development and subsequent modification is subject to configuration management.

Baseline Documentation of CPCIs: The "Contract Data Requirements List" (CDRL), DD Form 1423, is the sole contractual document listing all data to be delivered under the contract. For computer programs, this usually includes Parts I and II specifications, users' and programmers' manuals, configuration management baseline documentation, test plans and results, end item delivery format and ECP submittals. Annexes to this O/SCMP shall include specific CDRL requirements.

Assignment of Computer Program Identification Numbers:

Computer Program Identification Number (CPIN): Computer programs, support programs and related documentation will be separately identified through a centrally controlled standard Air Force system maintained and operated by OC-ALC/MMEDU and supported by OC-ALC/ACDT. To maintain the CPIN system, a separate subsystem under G022, Logistics Management of Technical Order System, is under development. The Data System Designator for this subsystem is Q016. The centrally controlled numbering system also permits OC-ALC to issue a compendium for all items identified as CPINs. A CPIN number shall be assigned to each CPCI in the F-16 Weapon System.

CPCI NUMBER:

CPCI Number: In accordance with AFR 65-3, MIL-STD-483 and AFR 800-14, each computer program or aggregated programs subject to configuration management shall be designated as a Computer Program Configuration Item (CPCI).

Supplier P/N: All computer programs (CPCIs) provided in the F-16 program have supplier part numbers assigned to them. These part numbers shall be used as the item identifier in configuration management status accounting and control processes. It is also known as the "alternate number" in the CPIN system.

Configuration Management Phases:

Implementation Phase: The implementation phase is that period of time beginning with the conception of the system and ending at the end item physical configuration audit (PCA). Software configuration management, documentation, reviews and audits for both operational and support software shall be developed and conducted in accordance with the guidance provided by MIL-STDs-480, 483, 490, and 1521. The product baseline will be established after all changes required for acceptable performance have been implemented, verified, and documented. Changes to CPCIs will be proposed, formatted and processed in accordance with MIL-STD-480 and 483. Engineering change control authority is the responsibility of the F-16 System Program Director (ASD/YP) throughout this phase of the program. Assisting the program director in the engineering change control area will be the F-16 Multinational Configuration Control Board (MCCB).

Transitional Phase (Pre-PMRT): The transitional phase is that period of time commencing with PCA and ending with overall acceptance of the engineering and management of the system by AFLC at the Program Management Responsibility Transfer (PMRT) data set in accordance with AFR 800-4, Transfer of Program Management Responsibility.

The System Program Director, supported by the MCCB, remains as the final authority for the approval of any change to a CPCI baseline. Prior to PMRT, the Computer Program Configuration Sub-Board (CPCSB, AFR 800-14, Paragraph 6-11) will be established at Ogden ALC (MMA) from resident representatives of the USAF and EPAF. As such, it will form the basis for the CPCSB which will exist at Ogden ALC in the Post-PMRT period. The TAC representative will be from HQ TAC. The CPCSB established prior to PMRT shall act only on those responsibilities delegated to it by the MCCB.

During the transitional phase, only System Program Office (SPO) approved changes will be implemented. The MCCB will ensure that proper configuration management of modified software is maintained. The SPO is responsible for maintaining configuration control of all production configurations. Only the SPO can authorize expenditure of funds to make software changes, including TO compatibility changes. Modifications required will be processed using existing ECP procedures. All changes will be prioritized by the F-16 SPO with inputs from USAF/EPAF supporting and using commands. The SPO will consider the feasibility of incorporating changes into the contract baseline depending upon the merit of the change, the costs involved, and the mission impact.

Operational Phase (Post-PMRT): The operational phase is that period of time commencing with the complete PMRT acceptance per AFR 800-4, and continued through the life of the weapons system.

A Computer Program Configuration Sub-Board (CPCSB, AFR 800-14, Paragraph 6-11), consisting of resident representatives of the

USAF and EPAF, will be established at Ogden ALC to function in the Post-PMRT period. The CPCSB will operate within the guidelines established in the Post-PMRT Multinational Configuration Management Plan (Steering Committee Decision No. 22) and perform support responsibilities assigned to it by the MCCB.

After a system is in operational use, changes to computer programs may be necessary to remove latent errors, improve coding or operation, adapt to changes in system requirements, or incorporate knowledge gained from operational use. Based upon complexity and other factors such as system interfaces, constraints, and priorities, control may vary from on-site management to complex checks and balances with mandatory security keys and access codes. The authority to change the computer programs must be carefully and specifically delineated, particularly when security, safety, or special nuclear restrictions are involved. Engineering change control authority is the responsibility of the system manager. The CPCSB performs support responsibilities assigned to it by the MCCB.

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STATUS ACCOUNTING:

The equipment maintenance status accounting used by AFLC after F-16 items have been delivered to the using organizations is based on AFLCR 66-16.

All computer programs designated as CPCIs shall be accounted for on the Advance Configuration Management System (ACMS), DO-57G.

The Advanced Configuration Management System record contains the following elements:

FSC/Part Number Identification - This may be either the CPCI number, or manufacturer's (supplier) part number, or an abbreviated CPIN to 15 digits.

TCTO Data

Correction Data

Location Data

Serial number identification - The computer program will share the same serial number assigned to the end computer hardware item.

Removal and Installation

Component Relationship

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STRUCTURED DESIGN? – DESCRIBE Generally, No.
OFP not structured. The OO-ALC INS OFP Flowchart is structured (IFTRAN)
Future programs will embody structured design.
The Radar OFP comprises 29 components, each performing particular tasks.

STRUCTURED PROGRAMMING? – DESCRIBE

Not currently. Where applicable, new mods will be structured if OFP module can accommodate.

CODING GUIDELINES:

Identical to "Programming and Software Documentation Standards for the F-4 Weapon System Test Complex at Ogden ALC," 30 June 1976. It requires structured design, flowcharting and coding using IFTRAN language and pre-processors.

CHANGE ENTRY METHODS:

Use TSO text-editor package to modify source statements.
Backup storage of two previous versions.

SCHEDULE:

Formal block change schedule: Block II Schedule (18 months)
Block III Schedule (9 months)
Thereafter (12 months)

REPORTING:

See pages E-54 and E-55

COMMENTS: Contracts do not specify requirements for structured programming in OFP. Contractor supplied programming standards are used. FCC is 80 percent JOVIAL HOL; Other OFP's are assembly language. Support/Simulation software is Fortran and IBM 360 Basic Assembly Language (BAL)

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 31 October 1979

DOCUMENTATION: See pages E-45 through E-48.

REQUIREMENTS: MMECA writes a Development Specification for any new software package.
Changes are requested using a standard form.

B-5

DESIGN: Contractor format patterned after MIL-STD-483/490
ACDCS writes a Product Specification describing the design of the software needed to implement the requirements specifications.

USER: C-5
A User's Manual is written for each new software package.
A Version Description Document is written for each modification to an existing software (configured) item.
Manuals: Pilot's Manual
Standard Support Software Manual
Computer Programming Manual Guide

PROGRAM PROBLEM REPORTING SYSTEM: See pages E-49 and E-50.

COMMENTS:

DOCUMENTATION

General

It is imperative that adequate documentation be provided in order to properly operate, maintain, modify, and otherwise support the OFP after acceptance. Such documentation should include not only that applicable to the OFPs themselves, but also that applicable to the design, operation and maintenance of the OFP support equipment in the F-16 AISF, that applicable to the OFP utility support software (Assemblers etc.), and that necessary for the USAF/EPAF users to accomplish their OFP support functions. Within the limits of F-16 disclosure guidance authorized at the time of EPAF requests, documentation will be made available to EPAF representatives in their home country. Such documentation may include data related to programming languages, specifications, program descriptions, etc. in the appropriate media. Such documentation is being developed during the Full Scale Development Phase by the SPO (see Tables E-1 and E-2), and will be updated by the SPO as necessary until PMRT occurs, at which time the SM will continue that update responsibility. In order to allow OOALC/USAF/EPAF personnel to become cognizant of the OFPs and AISF early in the program, and to facilitate a quick and orderly transfer of engineering responsibility, users with data requirements will order such data through the F-16 SPO. All documentation will use applicable military standard formats or will conform to the contractor's best commercial practices as appropriate. Other contractor-generated data not specified in the Contract Data Requirements List may be acquired on one-time basis via the Data Accession List during FSD.

AISF Support

As each set of equipment for each OFP is acquired, the F-16 SPO and Ogden ALC will establish the necessary data requirements. Currently, the Avionics Equipment Bay (AEB) is being procured as an item of support equipment and the Dynamic System Simulator (DSS) is being procured under an AFALD contract. These separate, distinct actions preclude developing a data matrix similar to Table E-2.

However, typical data deliveries will baseline the equipment design, operation, maintenance and provide provisions to maintain configuration reporting.

TABLE E-1. DATA ITEM DESCRIPTION TITLES

DI-E-3119A	Computer Program Development Specification
DI-E-3120A	Computer Program Product Specification
DI-E-3121	Version Description Document (Computer Program)
DI-E-3122	Configuration Index (Computer Program)
DI-E-3123	Change Status Report (Computer Program)
DI-M-3410/M	Users Manual (Computer Program)/ *Modified*
DI-M-3411/M	Computer Programming Manual/ Modified
DI-T-3703	Category I Test Plan/ Procedures (Computer Programs)
DI-T-3717	Category Test Report (Computer Programs)
DI-H-5072/M	Contract End Item Format Requirements (Software)/Modified

Table E-2
DIDs Applied to Computer Programs

	DI E 3119A	DI E 3120A	DI E 3121	DI E 3122	DI E 3123	DI M 3410/M	DI M 3411/M	DI T 3703	DI T 3717	DI H 5072/M
FCC OFP	X	X	X	X	X	X	S	X	X	X
NAV	X	X	X	X	X	X	E	X	X	X
RADAR	X	X	X	X	X	X	E	X	X	X
HUD	+1	+2	+X	+X	+X	+CF				X
CADC	+1	+2	+X	+X	+X	+CF	N			X
SMS OFP	+1	+2	X	+X	+X	+CF	O			X
RADAR/EO DISPLAY OFP	+1	+2	+X	+X	+X	+CF	T			X
J3B-2 COMPILER	X	X	+X	+X	+X	X	E			X
AED COMPILER		+2				+CF				X
FCC SIMULATOR	X	X	+X	+X	+X	X	T			X
FCC ASSEMBLER	X	X	+X	+X	+X	X	H			X
FCC LINK EDITOR	X	X	+X	+X	+X	X	R			X
FCC LOADER	X	X	+X	+X	+X	X	E			X
FCC MAINTENANCE DIAGNOSTIC		+2				+CF	E			X
NAV SIMULATOR	X	X	+X	+X	+X	X				X
NAV ASSEMBLER	X	X	+X	+X	+X	X				X
NAV LINK EDITOR	X	X	+X	+X	+X	X				X
NAV LOADER	X	X	+X	+X	+X	X				X
NAV MAINTENANCE DIAGNOSTIC		+2				+CF				X
RADAR SIMULATOR	X	X	+X	+X	+X	X				X
RADAR ASSEM	X	X	+X	+X	+X	X				X
RADAR LINK EDITOR	X	X	+X	+X	+X	X				X
RADAR LOADER	X	X	+X	+X	+X	X				X
RADAR MAINT DIAGNOSTIC		+2				+CF				X
HUD ASSEMBLER		+2	+X	+X	+X	+CF				X
CADC ASSEMBLER		+2	+X	+X	+X	+CF				X
RADAR/EO OFP ASSEMBLER		+2	+X	X	+X	+CF				X
SPECIAL PURPOSE QUALIF PGMS	1	2				CF				X
EXECUTIVES - JCL JOB STREAMS		+2								X

CF: Contractor Format
1: Computer Program Requirements (CF)
2: Computer Program Description and Listing (CF)
3: Computer Programming Manuals are required for each unique computer/programming language combination.
+: Contractual implementation in process.

TABLE E-3. AISF MAINTENANCE AND SUPPORT DOCUMENTATION

DATA ITEM DESCRIPTION	IDENTIFICATION
DI-E-7013A	Drawings, Engineering and Associated Lists, Level 1 (Conceptual and Development Design)
DI-E-7014A	Drawings, Engineering and Associated Lists, Level 2 (Production Prototype and Limited Production)
DI-E7015A	Drawings, Engineering and Associated Lists, Level 3 (Production)
DI-E-5049	Maintenance Data, Commercial
DI-M-5097	Computer Maintenance Diagnostic Manual
DI-P-3472A	Procurement Data Package and Lists
DI-P-3461	Procurement Method Coding Document
DI-H-3265	Training Planning Information

DEFICIENCY REPORT/CHANGE PROCEDURES: The USAF Material Deficiency Reporting and Investigating System, TO 00-35D-54, establishes the system that will feed back deficiency data on computer programs, so that corrective action may be taken. Following is a brief synopsis of deficiency report categories:

a. Category I Material Deficiency Report (MDR): A report of an emergency condition on computer programs which presents, or has the clear potential to present an unacceptable safety, operational, or maintenance hazard.

b. Category II MDR: Deficiencies in computer programs which are related to errors generated in design and production or changes that could upgrade its operation. This does not include major modification program efforts to produce a new capability.

Pre-PMRT Change Process: Prior to PMRT, only System Program Office (SPO) approval changes will be implemented. During this period, the F-16 SPO is responsible for the F-16 Deficiency Reporting Program and YPCB is the designated single point of contact for all deficiency reports. YPOI 800-9, processing of F-16 Deficiency Reports (DRs), establishes the responsibilities and procedures for the processing, evaluation and disposition of F-16 DRs for all personnel assigned or attached to the Deputy for F-16. The System Program Director, supported by the MCCB, remains as the final authority for approval for any change. His approval is required as DRs/changes are submitted in requests for Engineering Change Proposals. YP OI 800-3, Advance Change Study Notices (ACSNs), Contract Change Proposals (ECPs) Processing, describes the F-16 SPO procedures allow supporting/implementing command/country participation in the solicitation/evaluation of DRs and other changes. Additionally, they are represented at MDRB meetings.

Post-PMRT Change Process: Figure E-6 (page E-41) graphically illustrates the software change process following PMRT. All F-16 airborne software (OFPs) are assigned to the System Manager (SM) at Ogden ALC. Also all F-16 peculiar AICS LRU and SRU items are MMAC coded to the Ogden ALC System Manager. Therefore, this process shall apply to avionics, AIS, Depot and microprocessor subsystem/support equipment categories.

Change Request Submittals: Most frequently, changes will originate through deficiency reports submitted in accordance with TO 00-35D-54. All MDRs will be prepared on the DD Form 173, Joint Messages, and submitted electrical transmission. The format used shall be Standard Form 368, Quality Deficiency Report, blocks 3 through 22 (AFR 74-6). Changes may also be initiated through unsolicited ECPs, letters, etc. All change activity shall be controlled through the Material Improvement Program (MIP) and tracked with G026 reporting system.

Screening Function: The System Manager shall perform a preliminary review of all DRs and other change recommendations. All members of the CPCSB shall receive copies of these documents at least two weeks prior to the CPCSB meeting. They will be distributed on a regular basis for maximum awareness. The SM may assemble a technical review team of CPCSB members and applicable IM/MME/MACT engineers and technicians required to isolate the problem and separate hardware versus software discrepancies. This function may include AISF testing as well as contractor tasking. The technical review team shall assist the SM in the preparation of required forms for CPCSB and MCCB action

as described in the following paragraph. Related LRU/SRU test program impacts will also be assessed. Finally, the CPCSB shall provide approval or disapproval of continuing the project. The Trainer Device Manager (MMT) representative of the CPCSB shall initiate impacted changes for the Operational Flight Trainer (OFT) and Simulated Aircraft Maintenance Trainer (SAMT) design. Impacted System and Item Managers external to OO-ALC shall be notified early of impending changes affecting their interfaced equipment. Their participation on the CPCSB for the related project may be considered desirable.

Project Formalization:

a. Software change requirements shall be documented on AFLC Form 75 by the System Manager.

b. Software change requirements resulting from or causing hardware modifications will require AFLC Form 75 to be appended to AFLC Form 48 (Class IV modification). For Class V modifications, AFLC Form 2600 series (i.e., 2612, 2613, etc.) are applicable. Total software cost will be identified in block 12F of the AFLC Form 48. The budget project column on this form will be annotated EEIC 583 for software requirements.

c. Once a change requirement has been identified, verified and defined it may next be held in a "loop" awaiting an appropriate implementation time. This delay may be caused by various factors (i.e., grouping of block update changes, memory and timing approval of the Configuration Steering Group (CSG), low impact priority, etc.).

PERSONNEL DESCRIPTION DATE: 31 October 1979

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

I. OFP Engineers are EE/math trained, generally skilled as systems engineers.

II. DUTIES AND RESPONSIBILITIES

1. The incumbents perform a variety of computer resource engineering and related assignments in support of resea~ch, advanced, and/or production Air Force Weapon systems. The work may be in one of the major functional areas of computer resource functional requirements, operational or system test computer resources. The work is generally broken down into tasks, and the incumbents are responsible for the planning and execution of such tasks under the technical direction of an avionics systems functional expert for the particular functions involved.

2. The incumbents execute tasks of high complexity, and must have a detailed knowledge of the impact of the computer resources on the performance of the weapons system. This requires a detailed knowledge of the applicable computer program and computer hardware performance characteristics.

3. The incumbents assist in the solution of difficult avionics engineering problems and implement the solution to such problems via the appropriate avionics computer program. The incumbents accomplish such action in conformance with the principles and practices identified in AFR 800-14 Vols I and II. These problems are normally ones that have not been previously solved, and thus have no precedent. In order to solve such problems, the incumbents bridge the gap between the problem requirements and the methods and techniques available in the existing technology.

4. The duties of the incumbents involve major responsibility for one or more of the following depending on the system requirements:

a. Analysis of digital avionic system functional and performance requirements including the system's operational environment, crew capabilities and training, avionic equipment capabilities and performance characteristics, man/machine interface, special compatibility requirements in areas such as programming language, documentation standards, etc.

b. Formulation of avionic system development approaches and procurement strategies.

c. Definition and development of the operating procedures, tools and facilitities necessary to support the development approach.

d. Preparation of materials and the definition and execution of procedures and tasks necessary to effect procurement strategies.

e. Definition, design, development and documentation of the operational and support computer resources necessary to meet the system's functional and performance requirements together with providing assistance as required in the integration, test and evaluation of such computer resources.

f. Maintain a knowledge of computer architectures, interface requirements and programming languages for application in solving data processing requirements of both existing and proposed systems.

CONTINUATION SHEET - PERSONNEL DESCRIPTION **DATE:** 31 October 1979

g. Assist in conducting laboratory and/or system demonstrations as required.

h. Monitor contractor oriented tasks by chairing design reviews and reviewing and approving delivered documentation, etc.

i. Monitors all Engineering Change Proposals (ECPs) and TCTOs to assure that configuration changes do not affect computer program interfaces.

j. Provides engineering advisory and consultation services for Air Force activities as required.

k. Performs other duties as directed.

III. OTHER SIGNIFICANT FACTS

The incumbents must have a thorough knowledge of the fundamentals of engineering, and mathematics such as would be required of a Bachelor of Science degree in Engineering, Physics or Mathematics. In addition, the position requires a minimum of one year's experience in any one or all of the areas of systems analysis, digital computer systems, programming languages and system development techniques. The incumbents must possess the capability to quickly correlate the technical, administrative and economic aspects of the work to assure a cost-effective system development.

IV. TYPICAL EXPERIENCE

GS-12 Electronics Engineer with experience in Embedded Computer Systems. Typically would have 8-15 years experience in aircraft systems and software support.

Normally have had 40-80 hours specialized class training on microprocessor/assembly language, Fortran IV. Education level includes BS, MS, Ph.D candidate.

V. ORGANIC VERSUS CONTRACTOR

It is expected that not all OFP support will be organic following PMRT. PMRT is 1985 with OFPs now under Reliability Improvement Warranty (RIW) until 1983. An AF study using the F-16 will be the basis for determination of subsystem support by the ALC.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES DATE: 31 October 1979

BUILDINGS:

MMECA/ACDCS - 5000 Square Feet
(50% use-shared with F-4)

MMETA -

AISF including AEB (tower) 13,000 Square Feet

DSS Room 3,000 Square Feet Raised Floor

AIS Room 3,600 Square Feet

AEB Room 1,250 Square Feet

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 31 October 1979

COMPUTER FACILITIES (Type, Quantity, Application, Cost & Usage)

OFP activities are split between MMECA evaluation and simulation via OS 360-TSO, MMETA test using the avionics Integrated Support Facility (AISF), and actual flight test. OFP testing is indicated in Figure E-7. The ACDCS OS 360 system is shown in Figure E-8. The Dynamic System Simulator (DSS) is shown in Figure E-9.

The purpose of the support test beds for maintenance of F-16 OFPs is to provide the necessary tools to identify OFP errors, optimize OFP operation and handle new OFP operational concepts during the life cycle of the F-16 aircraft. The proposed test beds are functionally organized into four parts. These include a General Purpose Computer Complex (GPCC) for creation of OFP tapes, Dynamic Test Stations (DTS) to check out the individual OFPs in real time with a simulated real world environment, and Avionics Equipment Bay (AEB) to test the interfaces between the various avionics systems, and a Flight Test Aircraft Range Facility to test the system in an operational environment. The proposed capabilities to be provided by these equipments and facilities and the OFP Support System Flow are discussed below and shown in Figure E-10. The total OFP support process will involve use of all of the described equipments and facilities.

The proposed support system will, in all likelihood, be of the same order of magnitude of complexity as the systems whose problems it is intended to solve. One of the basic system design requirements is, therefore, that the facilities be designed such that the test engineer has a high degree of confidence in the support facilities functions. Valuable resources will be wasted if the test engineers have to decide whether the causes of anomalous behavior lie in the support facility or in the avionics under test. The support facilities must therefore provide diagnostic capabilities to determine the integrity of the support facilities and isolate any problems associated with the support facilities. In addition, a self-test capability should be included that provides a go/no-go overall closed-loop test to be performed before use of the DTS or AEB. This insures that the test facilities are functioning normally and promotes test engineer confidence in use of the system. In addition, each facility will undergo certification testing as a final portion of each development segment. The testing will consist of comparison of results from all facilities against flight test results with all discrepancies corrected or explained.

General Purpose Computer Complex (GPCC)

As shown in Figure E-7, the GPCC is the first step in the OFP support system flow. The purpose of this facility is to provide the necessary support for OFP development required before testing on the Dynamic Test Stations. These support tasks would include algorithm evaluation of proposed OFP changes, logging all OFP changes, assembly and creation of OFPs for testing and operational use, preliminary check-out of new OFP code, reduction of flight test simulation data and support of configuration management tasks (e.g., file management, automatic flow charting). The GPCC will support these activities with a general purpose IBM 360-65 computer available at Ogden ALC (see Figure E-8). This general purpose computer can provide the necessary resources to perform the functions described above. These include a Higher Order Language (e.g., FORTRAN, JOVIAL J3B) for algorithm evaluation and data reduction programs, assemblers/compilers for various flight computers, functional simulations of the various flight computers for initial code check-out, document generation and maintenance using editing and test processing features, etc. The GPCC will not be dedicated to the F-16 support facility. Use of the general purpose computer will, therefore, be in either a batch, remote-job-entry, or interactive timesharing mode.

CONTINUATION SHEET DATE: 31 October 1979

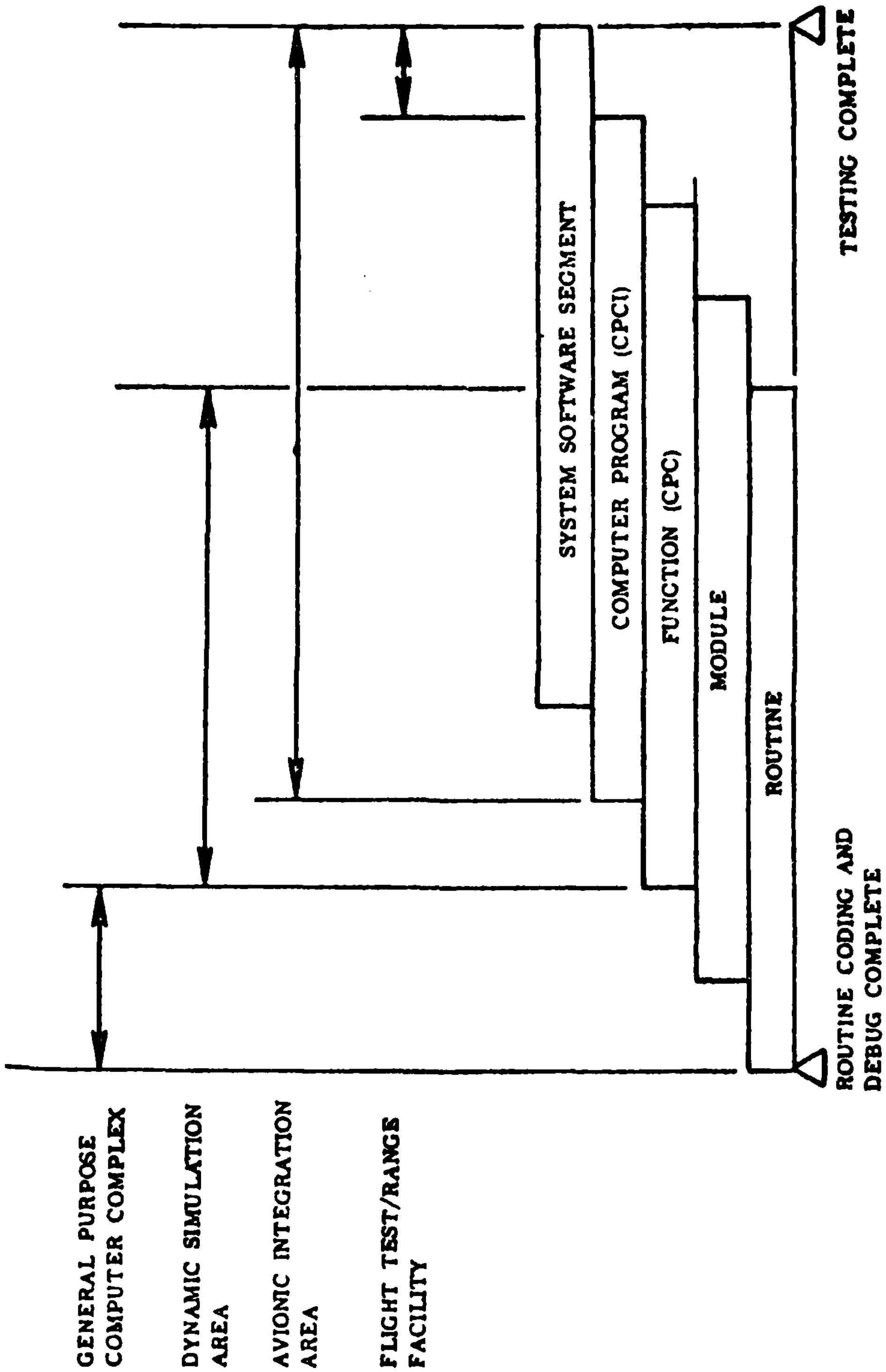

Figure E-7. OFP Testing

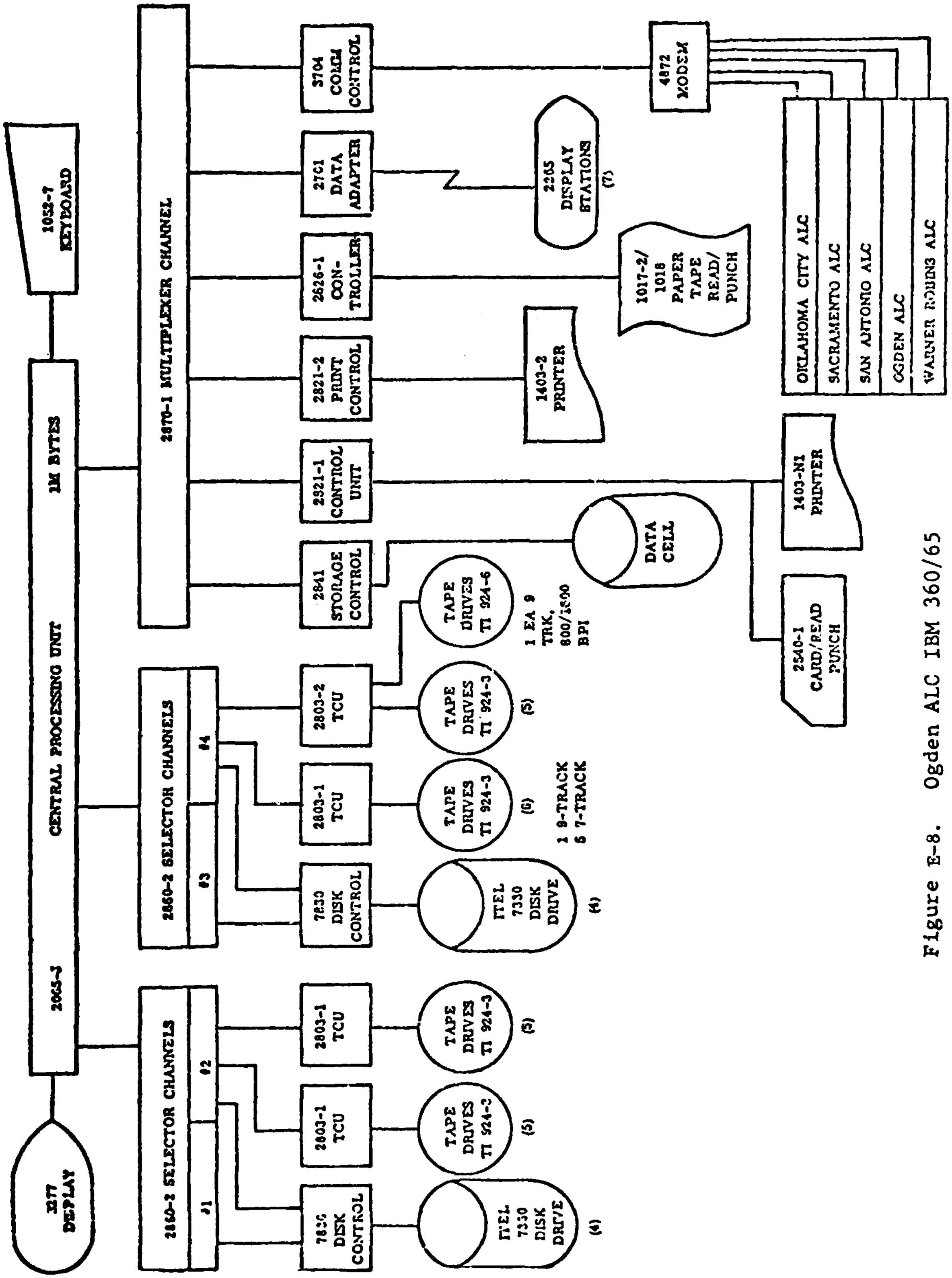

Figure E-8. Ogden ALC IBM 360/65

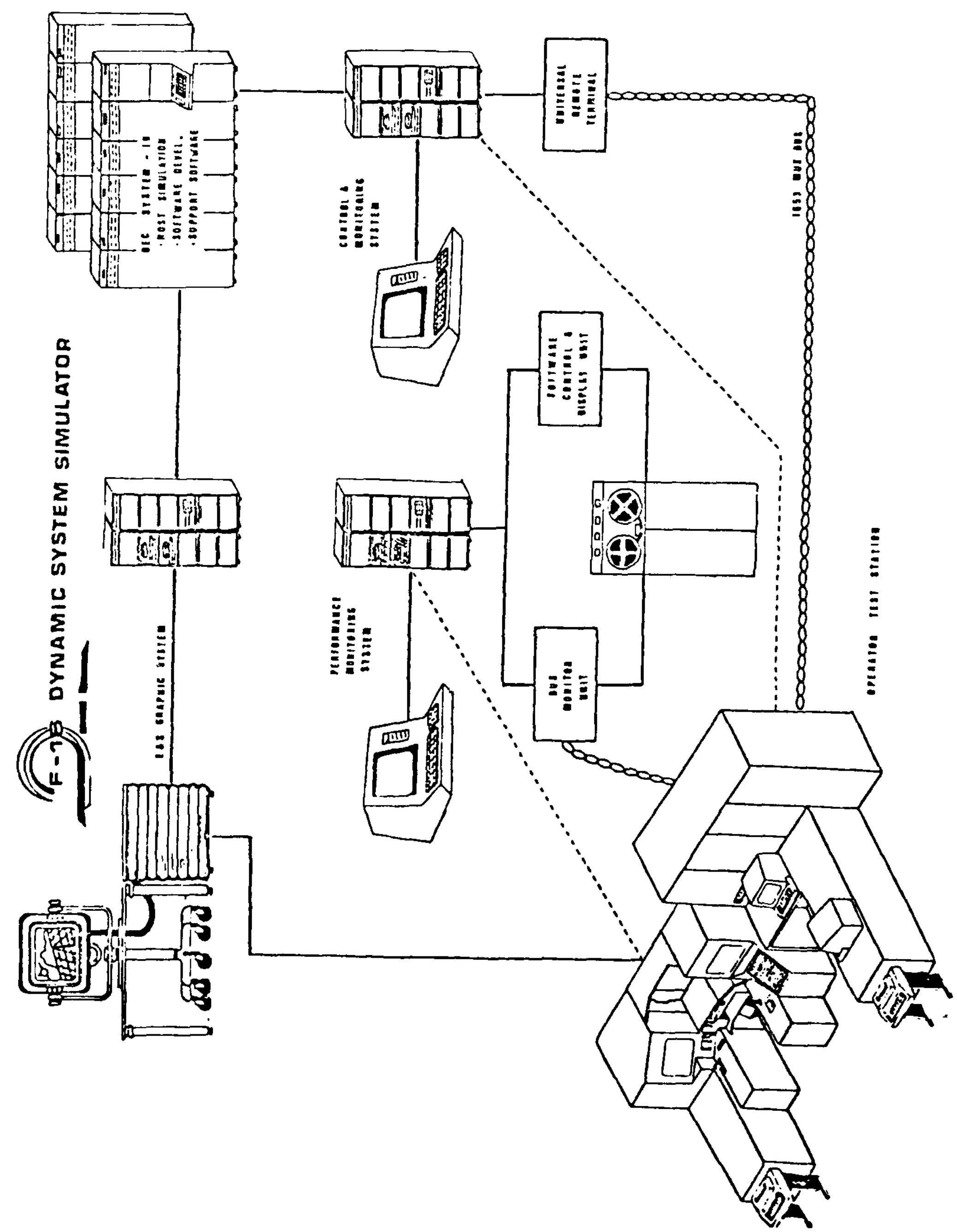

Figure E-9. OO-ALC Dynamic System Simulator (DSS)

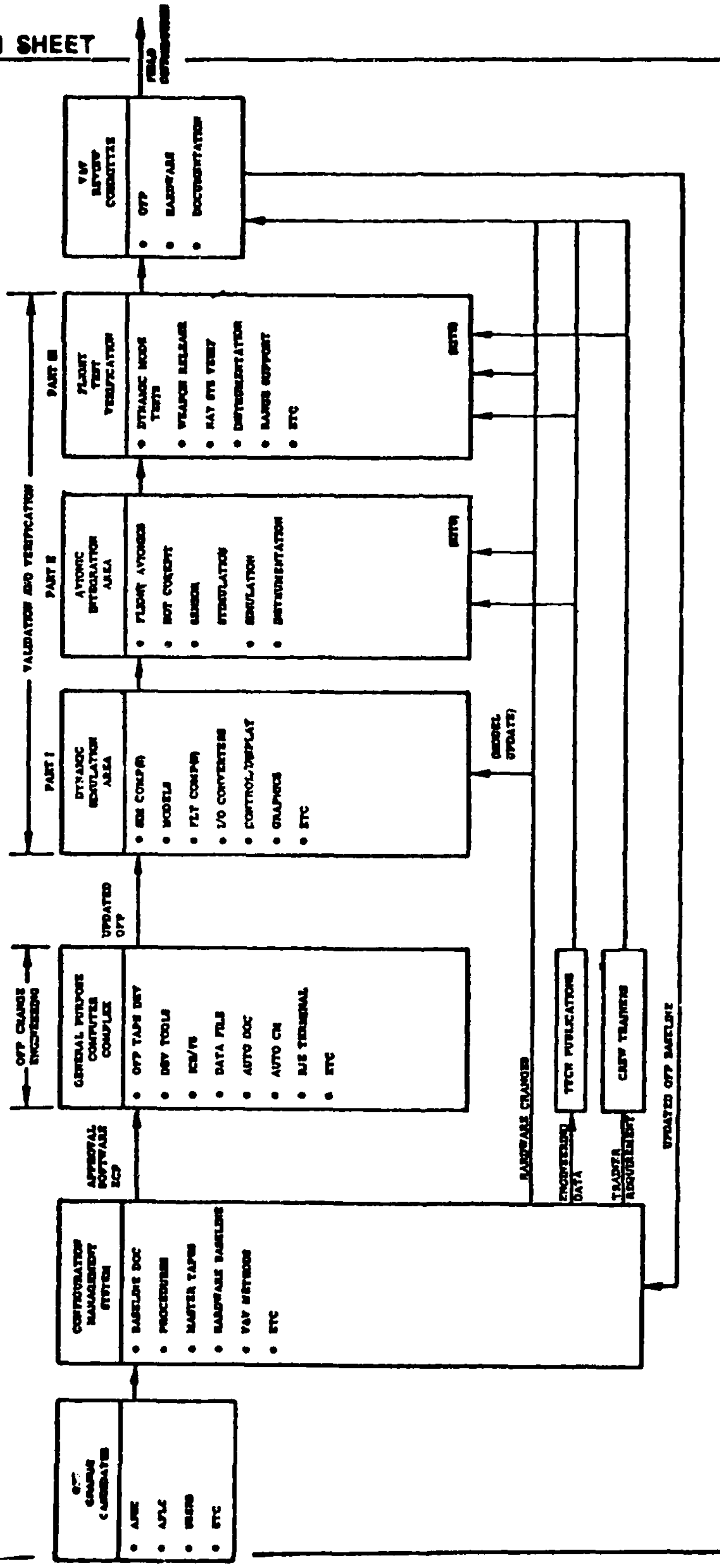

Figure E-10. OFP Support System Flow

F-16 Avionics Integration Support Facility (AISF) Equipment

The F-16 AISF will contain the support equipment necessary to maintain selected F-16 OFPs at Ogden ALC throughout the life of the F-16. The support equipment will be of two types, Dynamic Test Stations, and Avionics Equipment Bay.

a. The Dynamic System Simulator (DSS) is a FCC OFP test stand which can be operated in various modes for FCC OFP components interface testing. A decision to develop an in-house capability was made based upon a comparison of the cost required to establish such a capability in the AISF versus the cost for contractor support via his in-plant support equipment for the workload estimated for that OFP.

   The Simulator Host Computer (SHC) will provide modes simulating the aircraft response and flight sensors as well as a real world model for dynamic simulation of the F-16 performance in an operational environment. The OFP output from the DSS will be processed by the SHC with its models, the response conditioned, and inputted back to the OFP. This complex will be used to make and check OFP updates. The internal procedures for the change process of a new OFP will reflect those established by Ogden ALC/MME.

b. The Avionic Equipment Bay is a hot mock-up of the forward fuselage containing those F-16 avionics having digital interface with the F-16 OFPs. It is used for system integration of various combinations of hardware and software.

c. The AISF will contain those resources necessary to modify, test, reproduce and distribute AIS software. The software preparation stations will be used to update, modify and maintain control, support and test software for the four types of F-16 AIS test stations. Additionally, it will be used for preparation of new test programs required to test additional LRUs on the AIS. The AIS test stations will be used for engineering analysis of hardware/software problems, evaluation of proposed design changes, integration of AIS elements, and V&V of all changed programs. They will be utilized to assure design and performance compatibility between the Avionics Self Test/Built-in Test and AIS test programs. The AIS will also be used in support of hardware/software modifications to the test stations.

   The AISF will contain an Interface Test Adapter modifying area for prototyping/modifying ITAs. Additionally, an AIS documentation library within the AISF will have the necessary equipment to reproduce and distribute changed programs.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET - Computer Equipment List **DATE:** 31 October 1979

ACDCS:

IBM 360/65 Quantity = 1

The IBM 360 is used for the following:

1. Generate OFP machine code.
2. Testing with interpretive simulation programs.
3. Checkout of HOL written algorithms (FORTRAN).
4. Analyze flight test data.
5. MIS Programs.

Languages: FORTRAN (90 percent) COBOL (10 percent)

7 computer terminals | computer support
1 printer |

Required 360 hours for PDR OFP Test of F-4, F-16.

MMETA:

F-16 AISF - (See attached list of equipment)

AIS - Automated Test Equipment to support field automatic test equipment
*50 percent software support, 50 percent hardware support

- o 4 test stands
- o Adapters
- o Peculiar Test Equipment $ 7.5M*

AEB (Tower) - hot avionics mock-up to bench test OFP compatibility and hardware mods.

40 percent software support, 60 percent hardware support $ 4.3M

- o Test Bench
- o Hot Mock-up
- o Peculiar T.E.

DSS/SMOP DTC - simulator - *100 percent software support
and RES (bid not in yet) $ 10.5M*

CONTINUATION SHEET DATE: 31 October 1979

F-16 AISF

DEC System 10	1	Host Simulation Computer
DMA-10	1	DEC Sys. 10 DMA Window
TU45	2	Tape Drives
RP06	2	Disk
Line Printer	1	
DEC VT-100	4	Terminals
DEC 11-55	1	Connector Between DEC Sys 10 and DSS
RK05	2	Disk
DEC 11-34	1	DSS
RK05	2	Disk
VT-100	1	Terminal
Picture System 2	1	Evans and Southerland Graphic Display Sys.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE   DATE: 31 October 1979

Software	Host	Language	Size*	
Vendor Supplied - application unknown	IBM 360/65	Fortran	33867 lines	code and comment
FCC Data Reduction	IBM 360/65	Fortran	8346 lines	code and comment
FCR Data Reduction	IBM 360/65	Fortran	6230 lines	code and comment
SM Data Reduction	IBM 360/65	Fortran	6570 lines	code and comment
General Support	IBM 360/65	Fortran	576 lines	code and comment
FCC Postflight	IBM 360/65	Fortran	4378 lines	code and comment
SM Postflight	IBM 360/65	Fortran	3664 lines	code and comment
FCR Postflight	IBM 360/65	Fortran	3154 lines	code and comment
SMS Cross Assembler	IBM 360/65	Fortran	277K words	
INS Cross Assembler	IBM 360/65	Fortran & BAL	220K words	
INS Cross Link Edit	IBM 360/65	Fortran & BAL	120K words	
INS Simulator	IBM 360/65	Fortran & BAL	150K words	
INS RPG	IBM 360/65	Fortran & BAL	62K words	
INS Post Processing	IBM 360/65	Fortran & BAL	94K words	
DSS Control/Monitor	PDP-11/34	AL	24K words	
AEB	Delco Alpha	AL	32K words	
L&S Picture System	PDP-11/55	Fortran (5% AL)	96K words	
AISF System SIM	DEC-10	Fortran	768K words	
Bus Monitor	PDP-11/55	AL	28K words	

*NOTE: No Line/Object Size was available where lines only given, ratio varies with design. INS provided detail analysis (available in original FIELD SITE DATA on file) which indicates estimates for comparison of program sizes will vary. Generally BAL produces less object code - is more difficult to write and modify - than FORTRAN.

SOFTWARE PACKAGE CHARACTERISTICS –
FLIGHT TEST REQUIREMENTS

DATE: 31 October 1979

Support of OFP flight test requirements will be managed by the SPO (ASD/YPT) until PMRT at which point Ogden ALC will assume this responsibility. The SPO plans to primarily use the FSD avionics test aircraft (F-16A No.3, serial number 75-0747) for this task. This aircraft is equipped with an avionics data bus that allows all traffic on the MUX bus to be recorded. These software testing tasks will be accomplished at Edwards AFB.

The DT&E disposition plan (not yet formally approved) assigned F-16A No.5 (serial number 75-0749) to Hill AFB for OFP support. This aircraft is to be transferred from Edwards in October 1979. F-16A No.5 will require additional instrumentation in order to record MUX bus data. Intermediate and depot level support of the instrumentation and the reduction of avionics data will be accomplished at the AFFTC subject to an MOU between Ogden ALC and AFFTC.

It is anticipated that the F-16 flight test aircraft used for OFP flight testing will carry instrumentation which will include capability for data recording. The addition of sophisticated instrumentation, on the range and the aircraft, will provide a facility to test and evaluate air combat maneuvering, air-to-station/air-to-air weapons release, gunnery, and navigational systems.

Approximately 90 flight hours per block change are forecast for OFP testing.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 31 October 1979

PROGRAMMER TRAINING:

F-16 systems familiarization for software support systems engineering/programming personnel will be required. These courses will establish a basic knowledge in avionics navigation/weapon release functions as mechanized in the digital avionics system. Specialized courses for software support systems simulation personnel are also required. This training will familiarize and establish basic skills in the development and operation of minicomputer systems, peripheral equipment, real-time avionics models, simulation software executive routines, and data reduction/analysis information processing. Management courses in OFP support systems will establish management visibility in the many disciplines whose composite structure is an operating OFP support system. These courses will include such topics as V&V methodology, configuration management, tactical systems simulation techniques, etc. Training in certain areas of these categories will take place as part of the OFP Independent Assessment activities in FSD; however, the training will still be required for those additional personnel that are acquired during the transitional phase. The F-16 Maintenance Training and Transition Plan produced during FSD will outline specific training requirements. The phasing of courses will be optimized to reduce the impact on F-16 production activities during the training periods.

USER TRAINING:

Plans for user training are being developed.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE HISTORY — DATE: 31 October 1979

DESCRIPTION OF NUMBERS AND TYPES OF MAINTENANCE ACTIONS PERFORMED EACH YEAR SINCE PMRT

The following Pre-PMRT F-16 OFP changes were cited by MMECA personnel:

Change ID	Date	OFP	Description
ECP 042R	1977	INS	Incorporate automatic magnetic variation (MAGVAR) Modification of two cards Addition of two ROM chips 1228 data base words affected
ACSN 484	1/1977	HUD	Symbology change including seven major refinements
Block I		HUD	Use of fall line to indicate $10^{\circ} \times 4^{\circ}$ Radar Scan
ECP 206 (Block II)		HUD	5 additions 9 modifications
ECP 153	9/1978	Radar	Definition of configuration update, Retrofit Plan, and schedule
W ECP 22	4/1979	Radar	Correct Problems
W ECP 23	8/1979	Radar	Correct Problems
W ECP 30	9/1979	Radar	Correct Problems
W ECP 17R1		Radar	Upgrade Radar OFP
Block II		SMS	Code design updates Code modification for POD testing

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE COST HISTORY **DATE: 31 October 1979**

YEARLY COST OF MAINTAINING PACKAGE:

The table below summarizes the MMECA effort spent directly in requirements evaluation of change candidates and OFP testing of change items for F-16 Block II. Reference: Project Analysis Report dated 25 August 1979.

Description	Number of Changes/Tasks	Original Estimate	Actual Resource Time	Percent Completed	Projected Estimate to Complete
PDR Support, Release 1A	19	522	771 Hours	100%	771 Hours
OFP Test, Release 1C	25	2,876	1,847	58%	3,173
Requirements Evaluation Release 2E	76 (task re-assigned to contractor)	1,056	337	98%	343
OFP Test, Release 2G	22	1,465	279	22%	1,257
Requirements Evaluation, Release 3I	4	80	-	0%	80
Requirements Evaluation, Release 11	65	610	900	100%	900
TOTAL	211	6,609	4,134 Hours		6,524 Hours

The projected cost budget is shown on pages E-67 through E-69.

F-16 SOFTWARE COST SHARING BUDGET

TOTAL COST SUMMARY

	TOTAL COSTS ($ MIL)		
	FY '80	FY '81	FY '82
Manpower	4.03	5.40	5.89
AISF & SSC	.43	2.31	3.10
ECP	*	*	*
TOTAL	4.46	7.71	8.99

*ASD/YP (AFSC) Administered Prior to PMRT.

PRO-RATA COST SUMMARY

			APPORTIONED COST ($ MIL)		
	Number of Aircraft	PCT	FY '80	FY '81	FY '82
USAF	650	65.2	2.91	5.03	5.86
Belgium	116	11.6	.52	.89	1.04
Netherlands	102	10.2	.45	.79	.92
Norway	72	7.2	.32	.56	.65
Denmark	58	5.8	.26	.45	.52
TOTAL	998	100.0	4.46	7.71	8.99

CONTINUATION SHEET DATE: 31 October 1979

F-16 SOFTWARE COST SHARING BUDGET

	Manpower			Total Cost ($ MIL)		
	FY '80	FY '81	FY '82	FY '80	FY '81	FY '82
MMAR(SM)	6	6	6	.30	.30	.30 *
MMET(AISF)	6	6	6	.30	.30	.30 *
(Flight Test)	3	3	3	.15	.15	.15 *
MMEC	27	27	27	1.35	1.35	1.35 *
MACT	8	18	18	.46	1.04	1.04 **
MACP/L	5	15	15	.29	.87	.87 **
ACDC	17	20	22	.85	1.00	1.10 *
CONTRACTOR Engr	5	6	12 (1)	.33	.39	.78 ***
	77	101	109	4.03	5.40	5.89

* Estimated at $50K/man year
** Estimated at 58K/man year
*** Estimated at 65K/man year

Note (1) MMAR -4
(a) Integ Engr (GD)
(b) AEB Engr (GD)
(c) RES Engr (WEC)
(d) AIS Engr (GD)
(2) MMET -3
(3) MMEC -5 (GD)

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 31 October

F-16 SOFTWARE COST SHARING BUDGET

EQUIPMENT MAINTENANCE

Item	Cost ($ MIL) Orig Cost	Maintenance Cost ($ MIL) Maint Factor	FY '80	FY '81	FY '82
AEB	4.03	3.56	.21	.43	.43
DEC10	1.32	1.32	.08	.16	.16
DSS (Phase I)	3.24	1.08	.03	.13	.13
(Phase II)	2.33	.78		.09	.09
SMOP TS	2.50	.83		.10	.10
MDS 800	.05	.05		.01	.01
RES	1.00	1.00		.12	.12
AIS	9.00	9.00		.81	1.08
HUD TS	2.50	.83		.10	.10
Flight Test (FY '81)	3.73	1.24		.15	.15
Flight Reduction	.58	.58		.07	.07
ESS	.08	.08		.01	.01
EPROM Programmer	.25	.10	.01	.01	.01
ATPG	5.64	1.90			.23
Mini DEMS	.72	.37			.04
S/W Prep Station	.58	.28	.02	.03	.03
S/W Repo Station	.18	.18			.02
AISF A/C, Halon, 400 Hz	.17		.17	.02	.02
SUB TOTAL	37.90	23.35	.37	2.24	3.02
UTILITIES			.01	.01	.01
SUPPLIES			.01	.01	.02
IBM 360 UTILIZATION			.04	.05	.05
TOTAL			.43	2.31	3.10

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES DATE: 31 October 1979

Data Base Name	F-16 Operational Flight Program
Location	OO-ALC/MMECA, Hill AFB, Utah
Contact Person	Dave Thornell
Phone Number	(801) 777-7231
General Contents	Manhours by task
Period Covered	The data base currently contains only manhours associated with V&V of contractor-generated changes. OO-ALC/MMECA will not begin generating changes until 1981.
Data Quality	Good detail on expenditure of manhours to task level.

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 31 October 1979

RESPONDENT: Dave Thornell

- What existing airplane will it be most like?
- How much ROM? (Use for infrequently changed programs.)
- HOL versus AL - Does not make much difference price-wise. FCC uses JOVIAL HOL which is easier to modify (the OFP) and provides good visibility of change/ structure. Software interfaces have significant cost impact.
- Number of aircraft supported - not a major cost factor.
- What functions will the system have? What mission-support automated features (e.g., BIT)? Will there be off-line systems (e.g., mission profile generators, BIT analysis)?
- How much software will be assigned to the system manager via the item manager?
- Is it being built by somebody who supports another system I'm using?
- Is the ALC required to support OT&E requirements from AFTEC?
- When is PMRT in relation to production?
- Will the whole system transfer, or just certain configurations?

AD-A088 477 HUGHES AIRCRAFT CO CANOGA PARK CALIF F/G 14/1
PREDICTIVE SOFTWARE COST MODEL STUDY. VOLUME II. SOFTWARE PACKA--ETC(U)
JUN 80 R B WAINA, A P BANGS, E E RODRIGUEZ F33615-79-C-1734
UNCLASSIFIED AFWAL-TR-80-1056-VOL-2 NL

5 OF 6
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088477

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING **DATE:** 31 October 1979

RESPONDENT: Dave Thornell

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- o Is the ALC required to support OT&E requirements from AFTEC?
- o When is PMRT in relation to production?
- o Will the whole system transfer, or just certain configurations?

CONTINUATION SHEET - Acronyms

DATE: 31 October 1979

AD	Data Automation
ADTS	Avionic Depot Test Station
AEB	Avionic Equipment Bay
AIS	Avionic Intermediate Shop
AISF	Avionic Integration Support Facility
ATD	Aircrew Training Device
ATS	Automatic Test System
CADC	Central Air Data Computer
CDR	Critical Design Review
CEP	Contractural Engineering Proposal
C/I	Computer/Inertial
CM	Configuration Management
CPCI	Computer Program Configuration Item
CPCSB	Computer Program Configuration Sub-Board
CPIN	Computer Program Identification Number
CRISP	Computer Resources Integrated Support Plan
D/I	Display/Indicator
DRs	Deficiency Reports
DSS	Dynamic System Simulator
DTS	Dynamic Test Station
ECP	Engineering Change Proposal
ECS	Embedded Computer System
EPROM	Erasable-Programmable Read Only Memory
EW	Electronic Warfare
FCC	Fire Control Computer
FCR	Fire Control Radar
FMS	Foreign Military Sales
GPCC	General Purpose Computer Complex
HUD	Head-up Display
IAW	In Accordance With
IM	Item Manager
INS	Inertial Navigation Set
LRU	Line Replaceable Unit
MCCB	Multinational Configuration Control Board
MDMP	Multinational Configuration Management Plan
MDRB	Material Deficiency Review Board
MIP	Material Improvement Program
MOU	Memorandum of Understanding
MUX	Multiplex

CONTINUATION SHEET - Acronyms | DATE: 31 October 1979

OCP	Organic Change Proposal
OFP	Operational Flight Program
OFT	Operational Flight Trainer
OI	Operating Instruction
OPR	Office of Prime Responsibility
O/SCMP	Operational/Support Configuration Management Plan
PCA	Physical Configuration Audit
PDR	Preliminary Design Review
PMRT	Program Management Responsibility Transfer
P/P	Processors/Pneumatics
PROM	Programmable Read-Only Memory
RAM	Random Access Memory
REO	Radar/Electro-Optical Display
RF	Radio Frequency
ROM	Read-Only Memory
SAMT	Simulated Aircraft Maintenance Trainer
SM	System Manager
SMS	Stores Management Set
SOW	Statement of Work
SPO	System Program Office
SRR	Software Requirement Review
SRU	Shop Replaceable Unit
TCTO	Time Compliance Technical Order
UUT	Unit Under Test
V&V	Validation and Verification

APPENDIX F

F-15/WRALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION — DATE: 15 Feb.'80

ALC: WR — WEAPON SYSTEM: F-15

SOFTWARE PACKAGE: See description on pages F-2 through F-4.

PERSONNEL CONTACTED:
Charles Singleton, MMEC
Herschel Vandiver, MMEC
Henry McGirt, MMECD
Bob Anderson, MMECD
Pete Cerny, MMECV

SOFTWARE PACKAGE CHARACTERISTICS:

	CC	RDP
SIZE:	16K	24K (96k is planned for June 1980. This includes the PSP).
LANGUAGE:	Assembly	Assembly
APPLICATION:	General navigation and flight control	Target acquisition and fire control
COMPLEXITY:	Not very complex, structured design	Very complex
YEAR DEVELOPED:	1970	1972
DEVELOPER:	McAir	Hughes
COMMENTS		Inadequate visibility into program

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

	CC	RDP
MANUFACTURER:	IBM	Hughes
MODEL NUMBER/DESIGNATOR:	AP-1	HCM-231
WORD SIZE:	32 bit	24 bit
MEMORY SIZE:	16K	24K (the planned 96k memory will have ~30k spare words)
MEMORY FILL:	70%	Full

WEAPON SYSTEM USE:

NUMBER OF USERS: ~ 400 ; 729 planned

LOCATIONS OF USERS: Worldwide

FREQUENCY OF USE: daily

INTERVIEWER(S): R.B. Waina, G. L. Foreman, A. P. Bangs

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F-15 Avionics System Overview - The F-15 uses an integrated system in which twelve avionics subsystems interface with the Central Computer (CC) via redundant multiplex (MUX) busses. The Central Computer performs primarily mission oriented calculations, while computations and processing generic to peripheral avionic subsystems are accomplished (insofar as possible) within the subsystems themselves. Thus, the Central Computer accepts inputs calculated by peripheral avionics devices, performs mission oriented calculations and outputs results to the appropriate subsystems. The F-15 Radar System, Air Data System, Lead Computing Gyro, Inertial Navigation Set and Radar Warning Receiver of the Tactical Electronics Warfare System have self-contained computers. The Radar Warning Receiver (RWR) and Internal Countermeasures Set (ICS), part of the Tactical Electronic Warfare System, the Central Computer, and Radar Processor are the only programmable devices on the F-15. The RWR has a data processor and the ICS has a read only memory which will be used as a back up if the RWR has a malfunction. Also, the Heads-Up Display and Vertical Situation Display have self-contained symbol generators. In addition, each avionics device which interfaces with the Central Computer has a self-contained analog-to-digital and digital-to-analog conversion unit so that all interfaces between the Central Computer and peripheral avionics are digital. Should communication between the Central Computer and Radar be interrupted, the Radar Data Processor via an independent multiplex bus can provide control of the radar to sustain a capability to continue combat. Although this discussion portrays relatively simple interfaces, the fact remains that integration is extensive and performance of the F-15 Weapon System is directly dependent on the proper functioning of the Central Computer and Radar Data Processor Operational Flight Programs. Figures F-1 and F-2 are block diagrams of the CC and RDP interfaces, respectively.

Central Computer - The F-15 CC is an IBM developed general purpose, stored program, simplex, high speed, digital machine designated the AP-1. The CC memory is random access, non-volatile core with a capacity of 16,384 34-bit words (2 parity) which is expandable to 24,576 words.

Central Computer OFP (CCOFP) - The CCOFP directs the computer to solve the various F-15 related problems. The CCOFP is divided into eight program modules as listed below. The modular sturcture of the CCOFP allows for considerable flexibility in accomplishing program changes or adding additional functions.

CCOFP Modules

Executive (EXEC)
Air-to-Air (A/A)
Air-to-Ground (A/G)
Navigation (NAV)
Flight Director (FD)
Control and Display (C&D)
Computer Self Test (CST)
Math Subroutine (SR)

CONTINUATION SHEET DATE: 15 Feb. '80

Radar Data Processor (RDP) - The RDP is a Hughes developed general purpose computer which provides the local point for radar set operation as well as for interface with other avionics equipment. The RDP consisits of a processor, a special input/output unit and integrated power supply. Three RDP configurations are planned:

a. Core Memory - A 16,384 word device using core memory. This unit was incorporated in all production aircraft prior to ECP 900 (approx. mid 1978), and is scheduled to be eliminated via retrofit during 1980.

b. Solid State Memory, 24K - A 24, 576 word device using solid state Electrically Alterable Read Only Memory (EAROM) for non-volatile storage and solid state random Access Memory for scratch pad use. This unit is scheduled for use in all F-15 A and B aircraft beginning with production aircraft in mid 1978. It will also be used in early C and D model aircraft, but will be replaced by the 96 K unit.

c. Solid State Memory, 96 K - A 98, 304 word device also using solid state memory. The added memory will be used as non-volatile program storage for the Programmable Signal Processor LRU as well as for RDP program expansion. This unit will be incorporated in all C & D model aircraft beginning with production with models in 1980.

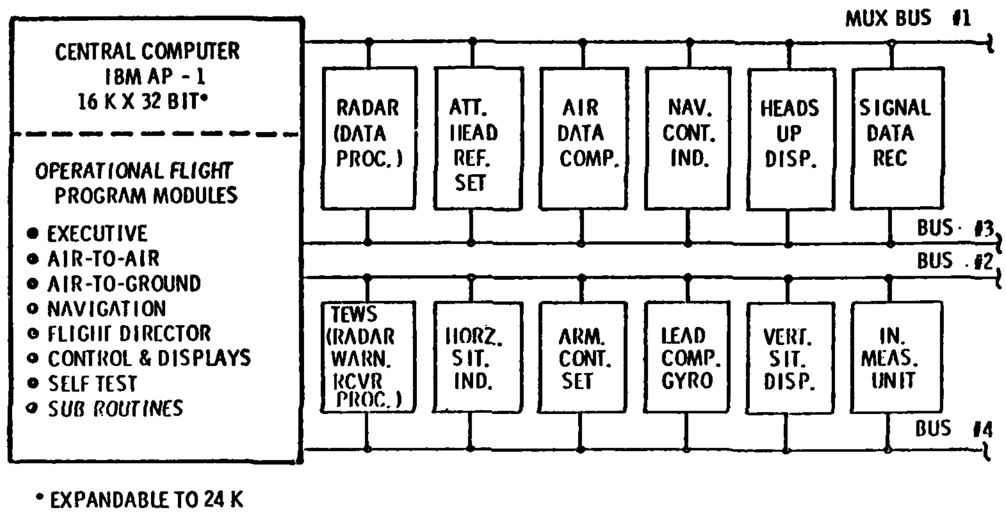
RDP Operational Flight Program (RDPOFP) -(1) The Acquisition, (2) Track and (3) Built-in-Test (BIT). For purposes of describing the overall structure of the program, the RDPOFP can be divided into eight program modules, shown below, and a data base.

RDPOFP Modules

Power Up
Antenna Control
Search and Acquisition
Track
Displays
BIT
Executive Module
Subroutine

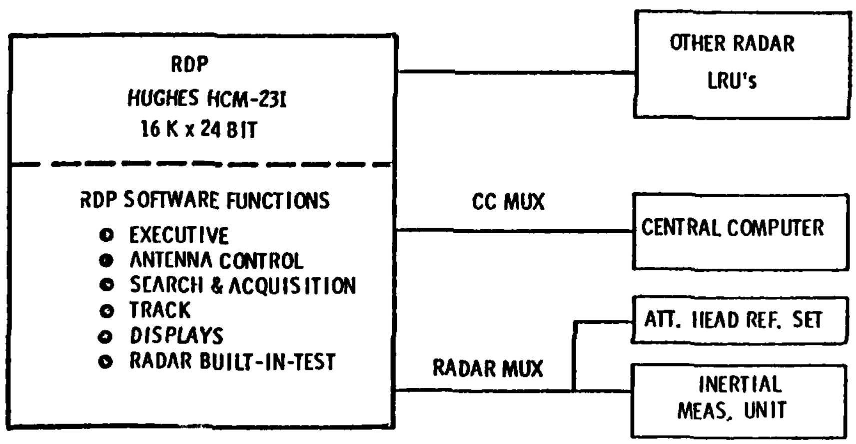
Programmable Signal Processor (PSP) - The PSP is a Hughes developed special purpose computer which provides digital processing of the radar returns. The program for the PSP is loaded and stored with the RDP program and thus is part of the RDPOFP. The PSP has no OFP of its own.

CONTINUATION SHEET DATE: 15 Feb. '80



F-15 AVIONICS SYSTEM (CENTRAL COMPUTER)

Figure F-1



RADAR DATA PROCESSOR (RDP)

Figure F-2

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL DATE: 15 Feb. '80

ALC: WR | OFFICE SYMBOL: MMEC

KEY PERSONNEL/OGRANIZATION:

MMEC - Charles Singleton

MMECD - Herschel Vandiver

MMECE - Jay Hedge

MMECV - Chester Sherrill

MMECA Don Purvis

MMECT - Charlie Walker

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE):

Orgin	Function	F-15 Personnel
MMECD	OFP Design	20
MMECV	Validation & Verification,	13
MMECE	Avionics Integration & Support	13
MMECA	Avionics Test Acq.	5
		51

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

Two F-15 OFP's: CC and RDP

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 15 Feb. '80

Total MMEC manning requirements as of 30 September 1980 are as follows:

System	OFP	ATE	System	OFP	ATE
F-15	63	9	Misc.	.7	
PAVETACK	16		FSG-70		5.5
JTIDS	13	1	AIM 4/9		1
VATS	1		A-7D		1
HARM	1		A-10		2
EAR	1		B-52	.5	7
HAST	.2		C-5		.5
GPS	5	1	C-130	.25	.5
AMRAAM	0		C-141		.5
HMS	1		E-3A AWACS	.2	3
HH-53H	.2		AFCAT-COM		2
CSD	1		F-4	1	1
DAIS/IDA	-0		F-105		1
SAS	.25		F-106		2
LOCUST	.2		F-111	1	6
			TOTAL	106	44

MAINTENANCE AGENCY - WORK DISTRIBUTION DATE: 15 Feb. '80

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL

MMEC has been reorganized as below. To data manning is totally civil service/AF.

MMECT - ATE Support

MMECA - ATE Acquisition

MMECV - Validation & Verification

MMECE - AISF Equipment & Support

MMECD - Weapon System Integration

- MMECDF- F-15 OFP Design
  - Radar
  - Central Computer
- MMECDA -Acquisition Support
  - Pavetack
  - JTIDS
  - GPS
- MMECDM -Management

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE: 15 Feb. '80

WR-ALC is planning to build an Engineering Data Management System (EDMS) to satisfy project control, change control, and configuration management requirements for avionics systems. The Project Control function in EDMS shall provide MMEC management with an automatic means of tracking manpower estimates versus actual usage over the lifetime of the set of engineering projects within a Branch, as well as all other personnel charges (leave, training, etc.)

Typical reports include:

- An "ECS Change Cost Summary"(Figure F-3) shall be generated based on the user's request and specification of an ECS Change Block.
- An 'AISF Change Cost Summary'(Figure F-4) shall be generated based on the user's request and specification of an AISF Change Block.
- A Final Project Status Report shall be generated upon completion of the project, A project shall be marked closed after all employees assigned to that project have been closed out and this fact is recorded in the data base. An example of the type of data to be provided is presented in Figure F-5.

CONTINUATION SHEET DATE: 15 Feb. '80

ECS CHANGE COST SUMMARY

DOCUMENT NUMBER: PAGE
SYSTEM:
CHANGE BLOCK ID:
CONTRACT ENGINEERING PROJECT/DATE: /DD-MMM-YY
CHANGE REQUESTS BEING INCORPORATED:

WEEK ENDING	CONTRACTOR COSTS	ORGANIC COSTS							WEEKLY TOTAL
		PERSONNEL	TDY	TEST RANGE	EQUIPMENT	MAINTENANCE		ORGANIC TOTAL	
						AIRCRAFT	AISF		
CUMULATIVE COSTS									

Figure F-3. ECS Change Cost Summary Report

CONTINUATION SHEET

DATE: 15 Feb.'80

AISF CHANGE COST SUMMARY (Non ECS Change Related)

Document Number: Page

Fiscal Year:

AISF Change Block ID:

Change Requests Being Incorporated:

Week Ending	Contractor	Organic				Weekly Total
		Personnel	TDY	Equipment	Total	
Cumulative Costs						

Figure F-4. AISF Change Cost Summary Report

CONTINUATION SHEET DATE: 15 Feb. '80

FINAL PROJECT STATUS REPORT

PROJECT NAME: DATE OPENED __/__/__

PROJECT NO: DATE DUE __/__/__

PRODUCTION CODE: DATE CLOSED __/__/__

STANDARD:

PURPOSE:

MIP NO:

MME OPENDATE __/__/__ ALC OPENDATE __/__/__

MME DUE DATE __/__/__ ALC DUE DATE __/__/__

ENGINEERS ASSIGNED	WORK UNIT	EST HOURS	ACT HOURS
TOTALS			

Figure F-5. Example of Final Project Status Report

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 15 Feb. '80

SUPPORT PHILOSOPHY:

The following information is extracted from MMEC operating instruction 800-14.

1. GENERAL: A summary sequence of events relative to tasks and documentation requirements is presented in Figure F-6. (No absolute time division is intended.)

2. CHANGE BLOCKING: OFP design, and validation and verification personnel, will review the list of user prioritized change requests and select requests, based on change priorities and changing organization staff power, for inclusion in organic or contractor block change(s). Coordinate change candidates with the using organization.

a. Contractor Change. For changes not considered organically feasible contractor assistance is obtained.

b. Organic Change. For organic changes, OFP design personnel will review mission/system requirements as relates to identified block changes.

(1) Emergency Change. Emergency changes will take precedence over routine changes and should be handled in accordance with established procedures.

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Formal

CHANGE REVIEW PROCESS: See pages F-18 through F-24

CONFIGURATION IDENTIFICATION METHODS: See pages F-18 through F-24

CONFIGURATION CHANGE CONTROL METHODS: See pages F-18 through F-24

CONFIGURATION STATUS ACCOUNTING METHODS: See page F-19

SOFTWARE LIBRARY CONTROL PROCEDURES: See page F-17

CONTINUATION SHEET DATE: 15 Feb. '80

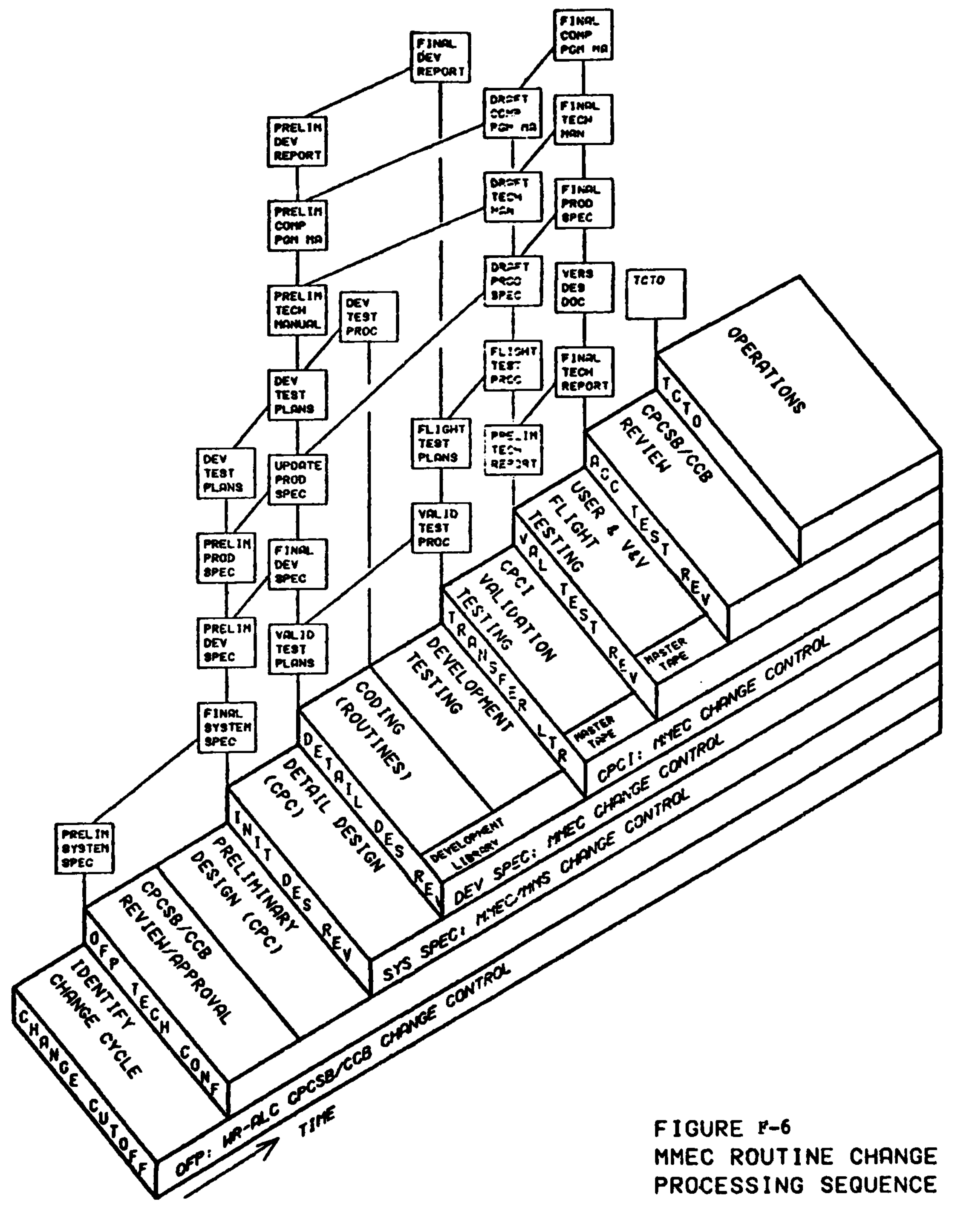


FIGURE F-6
MMEC ROUTINE CHANGE
PROCESSING SEQUENCE

(2) Preliminary System Specification. OFP design personnel will prepare a preliminary system specification change or certify no change required.

(3) OFP Technical Conference. CM personnel will schedule an OFP Technical Conference. A list of topics to be discussed is presented on pages

(4) Change Approval. Configuration management personnel will submit the proposed change block, with AFLC Form 75 prepared by the CPSP, to the CPCSB/CCB for approval. Technical assistance will be provided by OFP design personnel.

3. PRELIMINARY DESIGN: OFP design personnel will proceed with preliminary design of the OFP after appropriate change approval.

a. Final System Specification. Prepare a final system specification change if required. Sign-off by the systems engineer (SM-IM), OFP design engineer and the validation and verification engineer after the Initial Design Review, constitutes approval of a system specification change.

b. Preliminary Development Specification. OFP design personnel will review the development specification and prepare a preliminary development specification change or certify no change required.

c. Preliminary Product Specification. OFP design personnel will prepare a preliminary product specification change.

d. Preliminary Development Test Plans. OFP design personnel will prepare preliminary computer program configuration item and computer program component development test plans presented on page F-31.

e. Initial Design Review. CM personnel will schedule an Initial Design Review. A list of topics to be discussed is presented on page F-25.

f. System Specification Change Control. The Modification Request (MR) form will be used to request changes to the system specification after formal approval.

4. <u>DETAILED DESIGN</u>: OFP design personnel will proceed with detailed design after approval of the system specification.

a. Final Development Specification. Prepare a final development specification change if required. Sign-off by the CPCI lead engineer and validation and verification engineer after the Detail Design Review constitutes approval of a development specification change.

b. Update Product Specification. Perform detailed design to routine level, with flow charts, and update the product specification.

c. Update Development Test Plans. Update the development test plans to comply with the development specification.

d. Validation Test Plans. Validation and verification personnel will prepare validation test plans. The general contents of the plans are presented on page

e. Preliminary User's Technical Manuals. OFP design personnel will prepare preliminary change sheets to the user's technical manuals if affected.

CONTINUATION SHEET - SUPPORT PHILOSOPHY DATE:

f. Preliminary Computer Programming Manuals. OFP design personnel will prepare preliminary change sheets to the computer programming manual if affected.

g. Preliminary Development Report. OFP design personnel will prepare a preliminary development report. The general contents of the report are presented on page F-31.

h. Detail Design Review. CM personnel will schedule a Detail Design Review. A list of topics to be discussed is presented on page F-26.

i. Development Specification Change Control. The MR form will be used to request changes to the development specification after formal approval.

5. CODE AND DEVELOPMENT TEST: OFP design personnel will proceed with detailed coding and development testing after approval of the development specification change.

a. Development Library. OFP design personnel will copy the save tape (source code) from the last OFP release into the development library and modify the source code to incorporate the addendum, if any, from the last release. Assemble the new source and test sufficiently to be confident of a correctly executing OFP. This new source becomes Baseline A for the current change cycle. Perform all coding and development testing using the development library.

b. Development Test Procedures. OFP design personnel will prepare development test procedures. The general contents of the procedures are presented on page F-32.

c. Validation Test Procedures. Validation and verification personnel will prepare validation test procedures. The general contents of the procedures are presented on page F-32.

d. Flight Test Plans. Validation and verification personnel will prepare flight test plans. The general contents of the plans are presented on page F-32.

e. Final Development Report. Prepare a final development report.

f. Master Tape. OFP design personnel will generate a new baseline master copy of the OFP relocatable binary code or magnetic tape.

g. Save Tape. OFP design personnel will generate a save copy of the OFP source code on magnetic tape.

h. Transfer Letter. OFP design personnel will prepare a transfer letter to the V&W section at completion of development testing. The contents of the letter are presented on page

i. Software Change Control. The MR form will be used for reporting software problems after the date of the transfer letter.

(1) Problem Solution. OFP design personnel will analyze the problem, modify source instructions or make machine code patches as required, perform testing as required, indicate action taken on the MR and sign off on the MR.

(2) New Baseline/Addendum. OFP design personnel will produce or magnetic tape, a new baseline OFP or an updated addendum.

(3) Documentation Changes. Review the need for changes to the development specification, product specification, validation test procedures, etc.

6. CPCI VALIDATION TEST: After receipt of the transfer letter, V&V personnel will proceed with CPCI ground validation testing using the baseline and addendum if applicable, as identified in the transfer letter.

a. Preliminary Technical Report. Validation and verification personnel will prepare a preliminary technical report. The general contents of the report are presented on page F-32.

b. Flight Test Procedures. Validation and verification personnel will prepare flight test procedures. The general contents of the procedures are presented on page

c. Final Product Specification. Prepare a draft of the final product specification changes.

d. Final User's Technical Manual. Prepare a draft of the final user's technical manual change.

e. Final Computer Programming Manual. Prepare a draft of the final computer programming manual change.

f. Validation Test Review. CM personnel will schedule a validation test review. A list of topics to be discussed is presented on page

7. USER AND V&V FLIGHT TEST: After successful completion of the Validation Test Review, V&V personnel will proceed with flight testing as required.

a. User Copy. Validation and verification personnel will send a copy of the OFP master tape and latest addendum, if appropriate, reproduced on the appropriate medium, to the using organization when a hardware change was not involved.

b. Flight Testing. Load flight computers from a copy of the master tape and latest addendum, if appropriate, and perform flight testing.

c. Change Control. Report software problems, encountered during flight testing, to OFP design personnel via telephone and follow up with a completed MR Form. The change procedure will follow that established for CPCI validation testing.

d. Final Technical Report. Prepare a final technical report.

e. Final Product Specification. Prepare the final product specification change sheets. Sign-off by the CPCI lead engineer and validation and verification engineer after the Acceptance Test Review constitutes approval of a product specification change.

f. Final User's Technical Manual. Prepare the final user's technical manual change sheets.

g. Final Computer Programming Manual. Prepare the final computer programming manual change sheets.

h. Version Description Document. OFP design personnel will prepare a Version Description Document. The contents of the document are presented on page F-33.

i. Acceptance Test Review. CM personnel will schedule an Acceptance Test Review. A list of topics to be discussed is presented on page F-27.

8. BLOCK CHANGE REVIEW: Submit the version description document; index to CPIN; technical report; and prepared briefing, when requested, to the CPCSB/CCB for review.

a. Disapproved Change. If the block change implementation is disapproved, take the change back in the change process as far necessary to correct the dificiency.

b. Approved Change. After change implementation approval, integrate the documentation changes into a new OFP release.

(1) OFP Release. OFP design personnel will produce duplicate copies of the master tape and latest addendum, if appropriate, recorded on the appropriate medium, for release to the using command.

(2) Archival Library. Retain archival copies of the master tape, latest addendum, save tape, and documentation at WR-ALC/MMEC. Documentation will include the system specification, development specification, product specification, version description document, development report and technical report.

CONTINUATION SHEET - CONFIGURATION MANAGEMENT DATE: 15 Feb.'80

1. SCOPE. These pages specify the minimum configuration management requirements for OFP software changes.

2. REVIEWS. Configuration management personnel will schedule and co-chair the technical reviews specified within this document, except contractor held reviews, and prepare minutes of each review.

3. DOCUMENTATION LIBRARY. Configuration management personnel will maintain an archival library of specified OFP related documentation.

4. MODIFICATION REQUESTS. Modification request forms and control numbers will be provided by configuration management. This form will be prepared in an acceptable format, and in accordance with the following instructions:

a. Date - Enter the date MR is being prepared.

b. Change class - Enter one of the classes defined as follows:

(1) A: Testing has halted due to the problems defined. Fix needed to continue testing.

(2) B: Testing is continuing with problem being bypassed or test temporarily skipped. Fix date to be negotiated. Fix must go into current release.

(3) C: Desirable change or typographical error. Does not interfere with testing. Fix may go into current release at the convience of the designer.

c. MR Number - Modification request control number to be entered by CM personnel.

d. System/OFP Nomenclature - Enter the system name and/or OFP nomenclature as needed to identify the OFP.

e. Problem software element or specification - Enter the nomenclature of the software module with the problem, if known, or the problem specification.

f. Date problem detected - Enter the date the problem was detected.

g. Date fix required - For a Class B change, enter the latest date that a fix is acceptable in order to complete testing on schedule.

h. Temporary action taken - Briefly describe any action taken to resolve or bypass the problem and may be of help to the development section.

i. Problem description - Briefly describe the problem.

j. Proposed solution - Optionally, enter a brief proposed solution to the problem.

k. Signature - Signature of person completing the MR form.

CONTINUATION SHEET DATE: 15 Feb.'80

l. Office/Phone - Office symbol and phone extension of person completing the form.
Items m-q of the form are to be completed by person resolving the problem.

m. Software element(s) and/or specification changed - Enter the number and nomenclature of the element(s) or specification changed.

n. Remarks - Enter remarks as necessary (e.g. MR cancelled. Error was in test procedures.)

o. Date completed - Enter the data the software development tests were completed or specification changed.

p. Release/Version - For changed software, enter the release and version numbers of the new OFP or addendum.

q. CM signature - CM personnel will sign the completed form and forward a copy to the originating office.

5. STATUS ACCOUNTING. Configuration management personnel will maintain internal status accounting of OFP software changes. Monthly status reports will include the following, as a minimum:

a. OFP Change Cost Summary - This report will be prepared, for each change block, in an acceptable format in accordance with the following instructions:

(1) Document Number - Enter the local document number of this summary.

(2) Page - Enter page number and total number of pages in this summary.

(3) System (Item) - Enter the nomenclature of the host system or item of the embedded computer system.

(4) OFP/Release - Enter the nomenclature and new release number of the OFP included in this block change.

(5) Change Requests Being Incorporated - Enter the numbers of all change reports, deficiency reports and engineering change proposals being incorporated in the software change.

(6) Week Ending - Enter the date of the end of week when cost occurred. (Saturday is end of the week.)

(7) Conractor - Enter contractor costs as occurring on the date of a contract.

(8) Organic - Enter costs for each category listed and total of the organic categories.

(9) Cumulative Total - Enter the cumulative total for contractor and organic costs for each reporting period.

(10) Cumulative costs - Enter the cumulative cost for each category at the end of each listing. This is the last entry in the list.

CONTINUATION SHEET DATE:

b. Configuration Index. This report will be prepared and maintained for the duration of the change block, for each computer program configuration item, in a a format that is illustrated on Pg.F-21 and in accordance with the following instructions: The initial issue will contain only (1) Section A, identifying schedule and completed milestone data pertaining to the CPCI and (2) Section I, listing the basic issue of the development specification.

(1) Document Number - Enter the local document number of the configuration index.

(2) Office Symbol - Enter the office symbol of the office responsible for the OFP design.

(3) CPCI Nomenclature - Enter the approved nomenclature of the CPCI.

(4) CPCI Number - Enter the number of the CPCI.

(5) System - Enter the title and number of the system of which the CPCI is a part.

(6) Issue Number - Enter the issue number of the index. The number "1" is assigned to the first issue of each change block; subsequent issues are numbered consecutively.

(7) Date - Enter the publication date of the given index issue.

(8) Processor Signature - Signature of person processing the index to be entered after last issue before the index is submitted to the review board for implementation approval.

(9) Supervisor Signature - Signature of processor's supervisor to be entered after last issue before the index is submitted to the review board for implementation approval.

(10) Table of Contents - Prepare a table of contents at the front of the index following the data contained in the blocks previously described. Entries will be added to the contents at the time a new section is added to the Configuration Index. The page number will identify the first page of each section and each of the two parts of a section.

c. Configuration Item Development Record - Section A - This section, a part of the index, will be prepared in an acceptable format and in accordance with the following instructions:

(1) CPCI Number and Nomenclature - Enter the number and approved name of the CPCI as it appears on the front cover of the CPCI development specification.

(2) System Specification Number and Date - Enter the number of the system specification and date of last change.

CONFIGURATION INDEX

Document Number:

Office Symbol:

CPCI Nomenclature:

CPCI Number:

System:

Issue Number:

Date:

Processor Signature:

Supervisor Signature:

TABLE OF CONTENTS

(3) Development Specification Number and Dates - Enter the number of the development specification, the date of last change, and the date it was accepted as an approval change.

(4) Product Specification Number and Dates - Enter the number of the product specification, the date of last change, and date it was accepted as an approved change.

(5) Milestones - For each indicated milestone event, enter the date scheduled for for the event at the time of initial issue of the index. If rescheduling occurs, enter each new date under the original in sequence, retaining all previous dates. Enter the date, followed by a "c', on which the event is actually accomplished.

(6) Test Documents - Enter the document number, title and date of issue of all CPCI test plans, test procedures and test reports.

(7) Technical Manuals - Enter the number, title and date of change of all manuals.

(8) Version Description Document - Enter the document number, title and date of issue.

d. Configuration Item Development Record - Section I - This section, a part of the index, will be prepared in an acceptable format and in accordance with the following instructions:

(1) Number - Enter the number of the development specification.

(2) Date - Enter the date of the approved issue of the development specification.

(3) Modification Request Number - Enter the numbers of all MRs written against the development specification which have been resolved. MRs will be removed after one issue of the report.

(4) Remarks - Enter a few words describing the MRs.

(5) MR Number - Enter the numbers of all MRs written against the development specification not yet resolved at the date of this index issue.

(6) Class Change - Enter class of change specified on the MR.

(7) Date Issued - Enter the date that the MR was issued.

(8) Due Date - Enter the date solution is due for Class B MRs.

(9) Remarks - Enter a few words description for the MR.

e. Configuration Item Development Record - Section II - This section, a part of the index, will be added after issuance of the transfer letter. It will be prepared in an acceptable format 7 and in accordance with the following instructions:

CONTINUATION SHEET DATE: 15 Feb.'80

(1) CPCI Nomenclature - Enter the approved nomenclature of the CPCI.

(2) Release Number- Enter the new release number of the OFP to be released.

(3) Transfer Letter Date - Enter the date of the transfer letter for this OFP.

(4) Modification Request Number - Enter the numbers os all MRs which have been resolved since the last issuance of this section. MRs will remain on this report for one issue before being removed.

(5) Impacted Program or Document - Enter the number of the software element or document against which the MR is written.

(6) Remarks - Enter a few words description of the MR.

(7) MR Number - Enter the numbers of all MRs written against this CPCI but not yet resolved at the date of this index issue.

(8) Class Change - Enter the class of change specified on the MR.

(9) Date Issued - Enter the date that the MR was issued.

(10) Date Due - Enter the date solution is due for Class B MRs.

(11) Remarks - Enter a few words description of the MR.

f. Change Status Listing (Computer Program) - Section I - This report will be prepared in an acceptable format and in accordance with the following instructions:

(1) System - Enter the title and number of the system of which the CPCI is a part.

(2) Date - Enter the preparation date of this section.

(3) CPCI Number and Nomenclature - Enter the number and name of the CPCI as it appears on the front of the CPCI development specification.

(4) Change Number - Enter the numbers of all change reports, deficiency reports and engineering change proposals written against the reference CPCI. The entry will appear in each subsequent issue for at least one issue following either (a) disapproval of the change or (b) completion of implementation of the change.

(5) Title - Enter the short title of the change.

(6) Status - Enter one of the status indications listed as follows:

(a) S - Change not yet considered by the review board.

(b) C - Initial approval by the review board.

(c) D - Disapproval by the review board.

(d) X - Deferred by the review board.

(e) A - Approved by the appropriate review board for inclusion in a change block.

(f) I - Implemented.

CONTINUATION SHEET DATE: 15 Feb.'80

g. Change Status Listing - Section II - This section of the listing will consist of one form for each change listed in Section I with a status of C, D, X, A or I. They will be prepared in an acceptable format and in accordance with the following instructions:

(1) Change Number - Enter change number as enter in Section I.

(2) Enter the date that the change report was prepared.

(3) Change Title - Enter the short title of the change report.

(4) Summary of Problem - Enter a brief summary of the problem which the change proposes to resolve.

(5) Description of Proposed Solution - Enter a brief description of the proposed solution.

(6) Reference Documents - Enter a listing of letters, reports of design studies or tests, problem reports, etc. relative to this change.

(7) Action Status - Enter a statement as to whether the change report has been approved or disapproved by the review board, has been returned or withdrawn for revision/correction, has been implemented, etc.,

(8) Implementation Status - Enter the scheduled date of distribution of the new CPCI version.

CONTINUATION SHEET - Configuration Reviews DATE: 15 Feb.'80

1. SCOPE. These pages list the configuration reviews and topics to be covered in support of operational flight program changes.

a. The conference and reviews, except those at a contractor facility, are to be scheduled by configuration management personnel.

b. Minutes prepared by configuration management personnel and signed by representatives of configuration management; OFP design; and validation and verification, constitutes satisfactory completion of a review.

2. OFP TECHNICAL CONFERENCE. An informal presentation and discussion of proposed changes and system engineering studies addressing the following topics as a minimum:

a. Mission and program requirements analysis.

b. Preliminary requirements allocation.

c. Trade Studies.

d. System interface studies.

e. Test planning.

f. Effect on facility CIs.

g. Effect on integrated logistics support.

h. Functional flow analysis.

i. Human Factors Analysis.

j. System safety analysis.

3. INITIAL DESIGN REVIEW. The following topics, as a minimum, should be addressed:

a. Ensure that the final system specification adequately satisfies mission requirements.

b. Ensure that technical risks are identified and reduced through trade-off.

c. Ensure compatibility of CPCI design approach with system requirements and with other system equipment and facilities or other software programs.

d. Review the system specification and preliminary development specification changes for format, content, technical adequacy and completion.

e. Identify all computer program CIs required throughout the change cycle. (e.g., Operational programs, maintenance/diagnostic programs, test/debug programs, exercise and analysis programs, simulation programs and other required support programs.)

f. Identify modifications required to the support/test hardware/software.

g. Review adequacy of the development test plans.

h. Review the system functional flow that identifies allocation of computer program components and depicts the sequence of operation.

i. Review detail storage allocation.

j. Review structure and organization of data bases.

k. Review critical timing requirements.

l. Review CPCI interaction with personnel subsystem requirements.

m. Identify the interfaces between CPCI and hardware CIs sufficiently to enable computer program design to proceed independently.

n. Identify OFP aspects sensitive to system safety.

4. DETAIL DESIGN REVIEW. The following topics, as a minimum, should be addressed:

a. Ensure compatibility of detail design with the development specification.

b. Review updated sizing and timing data.

c. Review all interface requirements for compatibility with system design, by analysis of detailed flow charts and other descriptive documentation, and ensure that the requirements are complete. Review the formats of all inputs and outputs. Review the parameters which may occur in each of the formats and identify the valid values, or range of values, and address techniques for recovering from invalid parameter values. The review will address the interface between CPCIs, between CPCs within each CPCI, and between CPCIs and equipment CIs.

d. Ensure design integrity by review of logic diagrams, storage allocation charts, detailed flow charts, etc., which are a part of the product specification.

e. Review interaction with data bases.

f. Review updating changes to the system and development specifications subsequent to the Initial Design Review and ensure that changes are reflected in preliminary product specifications.

g. Review plans for supporting the CPCIs including the modifications required of the support/test hardware/software and support documentation.

CONTINUATION SHEET - Configuration Reviews DATE: 15 Feb.'80

h. Review development and validation test plans for currency and technical adequacy in compliance with the development specification.

i. Review preliminary changes to user's technical and computer programming manuals for technical adequacy.

5. VALIDATION TEST REVIEW. The following topics, as a minimum, should be addressed:

a. Review validation test data to ensure the CPCIs performance is in compliance with the development specification. A discussion will include requirements of the development specification not met in validation testing and a proposed solution to each discrepancy.

b. Review the Initial Design Review and Detail Design Review minutes to ensure that all findings have been incorporated and completed.

c. Review the product specification change for format and completeness.

d. Review changes to the user's and computer programming manuals for format and completeness.

e. Review flight test procedures for technical adequacy.

6. ACCEPTANCE TEST REVIEW. The following topics, as a minimum, should be addressed:

a. Review flight test results and user comments. Determine disposition of user comments.

b. Review Validation Test Review Minutes for recorded discrepancies that require action. Ensure that necessary action has been taken.

c. Review the product specification, including its flow charts, listings, design narratives, data base characteristics, storage allocation charts, and timing and sequencing characteristics, to ensure that it adequately defines the CPCI.

d. Review final changes to the user's and computer programming manuals for format, completeness and technical adequacy.

e. Review the Technical Report for completeness and technical adequacy.

f. Review the Version Description Document to ensure that it accurately depicts the system to be released.

7. <u>QUALIFICATION TEST REVIEW</u>. The following topics, as a minimum, should be addressed:

a. Review test data to ensure that CPCIs performance is in compliance with the development specification. A discussion will include requirements of the development specification not met in testing and a proposed solution to each discrepancy.

b. Review the Initial Design Review and Detail Design Review minutes to ensure that all findings have been incorporated.

c. Review the product specification change for format and completeness, including its flow charts, listings, design narratives, data base characteristics, storage allocation charts, and timing and sequencing characteristics, to ensure that it adequately defines the CPCI.

d. Review changes to the user's and computer programming manuals for format, completeness and technical adequacy.

e. Review the Technical Report for completeness and technical adequacy.

f. Review the Version Description Document to ensure that it accurately depicts the system to be released.

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 15 Feb.'80

STRUCTURED DESIGN? – DESCRIBE NO
STRUCTURED PROGRAMMING? – DESCRIBE NO
CODING GUIDELINES: Programming standards are being developed
CHANGE ENTRY METHODS: On-Line Terminal
SCHEDULE: 15 month block change cycle
REPORTING: See pages F-18 through F-24
COMMENTS:

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 15. Feb.'80

DOCUMENTATION: See pages F-31 through F-34

REQUIREMENTS:

DESIGN:

USER:

PROGRAM PROBLEM REPORTING SYSTEM:

MDR/UER or informal requests

Problems are reported via the standard MIPS G026 system. Informal request and MDRs/UERs are sometimes used.

COMMENTS:

CONTINUATION SHEET - Documentation Requirements **DATE:** 15 Feb.'80

1. SCOPE. These pages describe the format and/or contents of documentation required during modification of operational flight programs. (Documentation is not necessarily limited to this list.)

2. SYSTEM SPECIFICATION. Changes to this specification affecting OFPs will be made by OFP design personnel. It states the technical and mission requirements for a system as an entity, allocates requirements to functional areas and defines the interfaces between or among the functional areas. Use MIL-STD-483, Appendix III, as a guide in preparation of this specification.

3. DEVELOPMENT SPECIFICATION. This specification, one for each computer program configuration item, to be maintained by OFP design personnel, describes in operational; function; and mathematical language, all of the requirements necessary to design and verify the required computer program in terms of performance criteria. The specification provides the logical, detailed description of performance requirements of a computer program. It provides the tests required to assure development of a computer program satisfactory for the intended use. Use MIL-STD-490, Appendix VI, as a guide in preparation of this specification.

4. PRODUCT SPECIFICATION. This specification, one for each computer program configuration item, to be maintained by OFP design personnel, specifies the detailed design configuration in terms of technical descriptions and flow charts, and includes complete listings of source code instructions. Use MIL-STD-490, Appendix XIII, as a guide in preparation of this specification.

5. DEVELOPMENT TEST PLANS. These plans, to be prepared by OFP design personnel, specify the test objective, elements or modules to be tested, method of testing and acceptance criteria.

6. VALIDATION TEST PLANS. These plans, to be prepared by validation and verification personnel, specify the method and content for each test required to validate the CPCI and lower level performance requirements contained in the applicable development specification. It will define the test requirements, test conditions, test equipment, support software, and criteria for acceptance. Test plans will be derived from test requirements of the applicable development specification.

7. DEVELOPMENT REPORT. This report, to be prepared by OFP design personnel, will include the change number, with brief title, of all changes included in the block change. Include reference to any emergency changes which were merged with the block change. Indicate any changes which were added or deleted since CPCS3/CC3 approval of the change block. Present a brief summary of any feasibility study of included changes. Briefly describe any problems which were encountered in the design. Present a statement to the fact that the Software System Safety Checklist has been completed during analysis and design.

CONTINUATION SHEET - Documentation Requirements **DATE:** 15 Feb.'80

8. DEVELOPMENT TEST PROCEDURES. This document, to be prepared by OFP design personnel, will specify step-by-step procedures for implementing the test definitions of the applicable test plans. It will include procedures for exercising the code, proving logic accuracy, testing limits, verifying timing, and so on. It will include detailed acceptance criteria.

9. VALIDATION TEST PROCEDURES. This document, to be prepared by validation and verification personnel, will specify the step-by-step procedures for implementing the test definitions of the applicable validation test plans. It will specify details concerning test setup, operation, evaluation, etc.. Procedures will be derived from the applicable test plans and development specification.

10. FLIGHT TEST PLANS. These plans, to be prepared by validation and verification personnel, will specify the method and contents for each test required to validate the total integrated system under flight conditions. It will define the test requirements, test conditions and general criteria for acceptance. Test plans will be derived from the applicable development specifications.

11. FLIGHT TEST PROCEDURES. This document, to be prepared by validation and verification personnel, will specify the step-by-step procedures for implementing the test definitions of the flight test plans. It will specify details concerning test setup, operation, evaluation, etc..

12. TRANSFER LETTER. This letter, from the OFP Design Section to the Validation and Verification Section, will identify the OFP baseline and addendum, when applicable, which is to be validated. It will give the date of release for validation testing. The letter will include a listing of all known problems where the software deviated from the requirements of the development specification, with a discussion of the problem and proposed solution. It is also to include a listing of all outstanding modification requests.

13. TECHNICAL REPORTS. This report to be prepared by validation and verification personnel, will be a final test report for each OFP being changed and will include the following items as a minimum:

a. Identification of test objectives, including applicable requirements, specification title, number and date, as appropriate.

b. Name and CPIN of OFP being tested.

c. Summary of test results stating what tests were performed and the results of each test.

d. Description of test facility, including any control conditions imposed during the test.

e. Discussion of test result analyses and conclusions.

f. Statement to the fact that the Software System Safety Checklist has been completed during validation and verification.

14. VERSION DESCRIPTION DOCUMENT. This document, to be prepared by OFP design personnel, will specify the exact program configuration released to the user.

a. Title Page - The title page will be prepared in an approved format and in accordance with the following instructions.

(1) CPCI Nomenclature - Enter the name of the CPCI as it appears on the Front cover of the CPCI product specification.

(2) CPIN - Enter the CPIN of the OFP.

(3) Version Number - Enter the version number of the OFP being released.

(4) Version Issue Date - Enter the date that the Version Description Document (VDD) was first issued.

(5) System - Enter the title of the system of which the CPCI is a part.

(6) CPCI Product Specification Number - Enter the number of the CPCI product specification.

(7) VDD Revision Letter - For a change to an existing version (interim VDD) only, enter the revision letter to the version. (e.g., "A" represents the first interim change to a computer program.)

(8) VDD Revision Date - For a change to an existing version (interim VDD) only, enter the date that the revised VDD is being issued.

(9) ECP/Change Package Designator - Enter the ECP number or the internally generated block change designator.

(10) Signature - Signature and typed name of the OFP design section supervisor.

(11) Signature - Signature and typed name of the validation and verification supervisor.

(12) Signature - Signature and typed name of the configuration management representative.

b. Content Page - The contents of the document will be in accordance with the following instructions:

(1) Inventory of Materials Released - List the description, format and contents of all items (tape, cards, discs) which are covered by a CPCI number. Identify all utility and/or support computer program release documents which are not a part of the released items but which are required to operate, load or regenerate the released CPCI.

(2) Inventory of CPCI Contents - Identify all computer programs and data content, either by reference to appropriate specifications and manuals and/or by listing, which are being released.

(3) Class II Changes Installed - List the change number and date of all Class II changes to the computer programs and data base incorporated since the previous version/revision.

CONTINUATION SHEET DATE: Feb. 15'80

(4) Class I Changes Installed - List the change number and date of all Class I changes to the computer programs and data base incorporated since the previous version/revision.

(5) Adaptation Data - Identify, by reference to appropriate specification and/or listings, all unique-to-site data which are contained in the items being released. This section shall also identify changes which have been made to the adaptation data as a result of the change.

(6) Interface Compatibility - Indicate other systems and/or CIs affected by the changes incorporated in this new release.

(7) Bibliography of Reference Documents - List the title and date of all pertinent documents related to the release of a new version.

(8) Operational Description - For each Class II and Class I change listed in this version/revision, prepare a subsection containing the operational effect of the change.

(9) Installation Instructions - Describe, directly or by reference, the method to be used to install and checkout the delivered CPCI version/revision.

(10) Possible Problems and Known Errors - Identify aspects of the change which should be further tested. Identify and possible problems or known errors and describe any steps being taken to resolve the problems or correct the errors.

PERSONNEL DESCRIPTION DATE: 15 Feb.'80

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

POSITION DESCRIPTION

FOR

ELECTRONICS ENGINEER, GS-855-12

INTRODUCTION: The purpose of the position is to serve as a Computer Software project engineer in support of Operational Flight Programs (OFP) and associated support software as assigned.

DUTIES AND RESPONSIBILITIES:

1. Accomplishes complex engineering projects for which existing guidelines are not, in most cases, available. Such projects include those affecting maintainability and reliability of Warner Robins ALC prime avionic systems. Develops software designs such as prototypes for AF wide adaptation. Assigned engineering projects are of such a nature that the incumbent is required to work in areas where precedent data, criteria, methods, or techniques are inadequate, are controversial, or contain critical gaps.

2. Has responsibility for maintaining the design and performance integrity of assigned systems. Deficiencies present in system software are inherently complex and incongruous in nature. Resolution of service, field, and system revealed software deficiencies require that the incumbent plan, research and design modifications having far reaching consequences in the aircraft mission. Due to the complexity of the computer controlled avionic systems, the problems may be large in scope, affecting both complex and conventional portions. Conventional portions may be assigned to lower grade engineers, but incumbent must maintain the reponsibility for evaluation and incorporation into the overall solution.

3. Incumbent must be proficient in the programming of computers at the machine and/or assembly language level, as well as use of higher level languages, and be responsible for the design and redesign of subprograms, codes, flowcharts, and debugging of program changes. Due to the complex interface between the software and hardware of computer controlled avionic systems, this programming is accomplished utilizing knowledge of hardware operations and limitations created by hardware design. Works closely with hardware oriented systems/project engineer to ensure a unified solution to problems is accomplished in the most effective manner.

4. Incumbent particpates in the operational testing of avionic software by setting up computer runs to check programs against environmental and operational simulations. Detects and identifies program troubles to such a degree that he is able to direct the finding of subtle programming errors which will cause minor or major program malfunctions, or improper indications of faults.

5. Accomplishes engineering and analytical tasks for isolating system deficiencies and develops modifications to correct these. The incumbent performs engineering/analytical studies and procedures to determine causes. Conducts analyses to define or assess system requirements. Develops system specifications and concepts. Develops system interface designs and develops associated technical computer software programs. Prepares laboratory, ground and flight test plans. Maintains liaison with operational units and provides consultation to those units on problems or questions which arise.

CONTINUATION SHEET DATE: 15 Feb.'80

6. Scope of personal contacts is broad as the incumbent consults with IM, SM, Procurement, Shop Contractor, and operating command personnel. Decisions on technical aspects of assigned systems must be rendered independently without benefit of review during periods of TDY.

7. Designs modifications and improvements to highly complex technical mission oriented avionics systems programs.

8. Prepares inputs (tasks), provides guidance, monitors, evaluates and approves results of contractor efforts on Service Engineering contracts.

9 Performs other related duties as required.

CONTROLS OVER WORK: Works under general supervision of the Section Chief who gives assignments in terms of broad general objectives and relative priority. Little or no technical guidance is received, but controversial policy is jointly resolved. Work is reviewed for adequacy in terms of broad policy objectives and policy compliance. Efficiency is determined by end results.

OTHER SIGNIFICANT FACTS:

1. Position requires that incumbent participates in flight test as assigned.

2. Incumbent is subject to TDY in CONUS or overseas for periods up to several weeks.

3. Specialized training may necessitate PCS for up to one year at contractor's plant at the discretion of management.

4. Military aircraft will be used, when available, to perform TDY. Commercial aircraft or other modes of transportation will be used when military aircraft is not available.

5. Fields of engineering: Electronic - 55%; Electrical - 5%; Computer Science - 40%.

6. Specializations in the electronic and digital systems engineering fields are: logic circuitry, program development and testing, logic design, signal integration networks, micro-electronics, large and medium scale integrated logical and memory circuits, computer technology, programming languages, simulation modelling, integration of computer controlled airborne equipment, and software documentation and configuration control.

7. Subject to call during off duty hours and an occasional requirement for weekend and holiday work.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES

DATE: 15 Feb.'80

BUILDINGS:

F-15 space requirements are projected as follows:

	Current	1983	1986
AISF Equip't.	4800*	9000	11000
Office	5000	7000	7000
Support	500	2700	3000
	10,300	18,700	21,000

*Numbers are $Ft.^2$

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 15 Feb.'80

Computer Facilities (Type, Quantity, Application, Cost & Usage)

General - The AISF will be composed of a Dynamic Simulation System (DSS), a data Reduction and Analysis System (DRAS), A Flight Test Preprocessing System (FTPS) and support areas. Its purpose is to provide AFLC with a facility to: (a) design and develop software changes to the CC and RDP - primarily by utilizing the basic debug and static test capability of the DSS; (b) verify and validate software changes to the CC and RDP software prior to flight test - primarily by utilizing the dynamic test capability of the DSS; (c) flight test software changes to the CC and RDP - by means of an instrumented F-15 aircraft and FTPS; simulation analysis, OFP analysis and data reduction analysis.

Dynamic Simulation Systems (DDS) - The purpose of the DSS is to perform hardware, software, and hardware/software system and subsystem tests and integration and will consist of computer programs, airborne computers, selected avionics and a control processing system. The system will provide basic debug and static test capability for the airborne computers and programs by means of single step command driving functions or by mission scenario profiles. In addition, a dynamic test capability will allow the airborne computers, programs and avionics hardware to be subjected to any selected mode of aircraft operation together with a number of simulated environmental stimuli. The DSS will consist of a complete radar subsystem control processing system and selected avionics, sensors, controls, and displays operating under the control of the control processing system and associated peripherals.

a. Control Processing System (CPS) - The CPS for the DSS will provide the computation, control and interface signals necessary to exercise and monitor the F-15 avionics in real time, simulating aircraft operation.

The minimum peripheral equipment requirements are:

Line Printer
Card Reader
Computer Graphics System
Tape Controller and drives (4)
Mini-computer Interfaces (for CC and RDP)
Paper Tape Reader/Punch
Disk Controller and Drive (5)
Keyboard CRT Displays (7) (3 Control & 4 Terminals)
Simulation and Switching Unit
Printer/Plotter

b. F-15 Avionics Hardware - The DSS will maximize the use of existing F-15 avionics hardware. Some avionics hardware not installed in the facility but whose functions are necessary will have those functions provided by a simulation program through a special interface.

CONTINUATION SHEET DATE: 15 Feb.'80

The avionics hardware required for the DSS are:

Central Computer (CC)	CP-1075/AYK
Head-Up Display (HUD)	AN/AVO-20
Fire Control Radar (FCR)	AN/APG-63
Indicator Group (IG)	OD-60/A
Armament Control Set (ACS)	AN/AWG-20
Primary Flight Instruments	
Navigation Control Panel	C-8849/ASN-109
Indicator Set	AN/AJN-18
Attitude Direction Indicator (ADI)	ARU-39/A
BIT Control Panel (BCP)	

c. Cockpit Mock-Up (CMU) - The CMU will tie the various F-15 avionics together for operation in the AISF environment as part of the DSS, and will have the cockpit instruments configured much like the F-15 aircraft.

d. Special Input/Output and Excitation Equipment - Special equipment will be required to replace, interface, and/or simulate the F-15 Avionics equipment.

(1) Special input/output equipment will replace the following avionics equipment:

Attitude Heading Reference Set	AN/ASN-108
Lead Computing Gyro (LCG)	CN/1377/AWG
Tactical Electronic Warface System (TEWS)	
Automatic Direction Finder (ADF)	OA-8639/ARD
Tactical Air Navigation (TACAN)	AN/ARN-111
Inertial Navigation System (INS)	AN/ASN-109
Instrument Landing Set (ILS)	AN/ARN-112

(2) A special interface unit shall provide the ILS, ADF, and TACAN navigation data through the Flight Director Adapter (FDA), MX-9119/AHB-18, for the Horizontal Situation Indicator (HSI), ID-1805/AJN-18.

(3) Other special interface units will be required for the flight control stick, throttle, BIT control panel, and cockpit switches to provide the appropriate data to the CPS for simulation control and equipment status.

(4) A power control panel will provide a central location for circuit breakers, power monitors, and avionics power control. This unit will be built into standard panel racks and will proide all electrical power required for the avionics mock-up and the special simulator/stimulator equipment. It will replace the F-15 generators and power system.

(5) A radar target generator will simulate radar targets for the F-15 radar system.

(6) An air data computer (ADC) simulator and interface will provide simulation of the ADC functions, and interface with the primary flight instruments.

(7) A CC console will monitor, load, and control the internal registers of the CC and will interface the CC aerospace ground equipment connector with the CPS.

(8) A HUD target/horizon flight profile simulator will provide the simulated (correlated with the earth model) target image for the pilot. The unit will be mounted so that the pilot can see the simulated target/horizon and flight profile with respect to the HUD symbology.

(9) A stores station simulator rack will simulate the functions of the various stores stations on the F-15 aircraft.

e. Auxiliary Equipment - An intercom system will be installed in the DDS.

Data Reduction and Analysis System (DRAS) - The purpose of the DRAS is to provide the capability of flight test data reduction and analysis, data management, and assembling OFP's. For flight test data reduction and analysis, the system requires CC, RDP and TEWS computer compatible digital tapes which have been pre-processed by scaling, analysis techniques and output moding for the computer tapes. In the data management configuration the DRAS operates as an information retrieval system for the DDS, the OFP's flight test, reports and studies. As an assembler the DRAS will convert the CC and RDP assembly language programs to machine code and produce a master mylar tape for each OFP. The DRAS will consist of a control processor and peripherals.

a. Control Processor - The DRAS control processor will provide the computations, controls, and interface to perform flight test data reduction and analysis, data management, and OFP assembling.

b. Control Processor Peripherals - The minimum peripheral equipment requirements are:

Disk Storage Units (2)
Magnetic Tape Drives (2)
Keyboard CRT Display (7) (1 Control, 6 Terminals)
Card Reader (400 CPM)
Line Printer (600 LPM)
Paper Tape Punch/Rader
Printer Plotter
Tape Punches (10)

Flight Test Preprocessing System (FTPS) - The FTPS will have the capability to perform preliminary screening or quick-look evaluation of the F-15 flight test data, to pre-process the data for processing by the DRAS, and to present the DRAS processed data in hardcopy graph and tabular form. Facilities will also be included to view the video recordings of the HUD, VSD, and TEWS cockpit visual presentation. Input media will be compatible with the flight test data recording media and DSS media. Output media is to be compatible with DSS media. Flight data will be gathered by a production configured F-15 assigned to WR-ALC/MM. The FTPS will consist of a PCM front end, a control processor and associated peripherals.

CONTINUATION SHEET DATE: 15 Jan.'80

a. Control Processor - The FTPS control processor will provide the computations, control, and interface to preprocess the F-15 flight test data. Features of the control processor include direct memory address (DMA), high speed hardware floating point arithmetic, priority interrupts, and operator interrupts.

b. Control Processor Peripherals - The minimum peripheral equipment requirements are:

Disk Storage Units
Magnetic Tape Drive (2)
Card Reader (600 CPM)
Teletype
Keyboard CRT Display
Pulse Code Modulation (PCM) Interface
Airborne Recording Device Compatible Input Equipment
Quick Look Presentations

c. Auxiliary Equipment - The FTPS will also include facilities to view the video recordings of the HUD, BSD, and TEWS visual representation. To enable this function, the auxiliary equipment should include a video tape playback machine, a video de-multiplexer facility and two (2) cathode ray tube display stations.

SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE DATE: 15 Feb.'80

General - Computer software will be provided for both simulation and support of the DSS, DRAS and FTPS.

DSS Software - The DSS software will simulate the F-15 aircraft dynamics, environment, and missing avionics equipment so the software in the CC and RDP can be exercised throughout their full range of operation. The primary function of the DSS software is to permit F-15 OFP validation and verification (V&V) in a dynamically simulated environment. It will contain modular structured source code consisting of the executive module, sensor models, environment models, F-15 airframe models and subystem models. Standard FORTRAN IV language will be utilized as the main programming language, and assembly language used only when time considerations, CRT control, or communications with the real time operating systems (RTOS) require its use. The design of the DSS software will be such that the entire range of the CC and RDP can be exercised with or without a man-in-the-loop. When the man is taken out of the loop, the cockpit portion of the interaction will be simulated so that the operator can have complete control of the input/output signals. This will be accomplished through either a scenario mission tape or a simulated pilot model. The organization of the software will be designed to keep the simulation within a real time environment, and to allow for non-real time, step-by-step operation through operator control of key CRT formatted messages. An RTOS will interact with the executive module so that control of the simulation can be transferred to the operator after his CRT entry.

DRAS Software - Standard support and utility software for the DRAS will be provided. These support packages will be those usually supplied by the processor vendors. Special support software for the DRAS shall be provided such as file management, interactive operation, etc. General support software is needed to permit offline data analysis and will include batch processing monitor, time sharing monitor, FORTRAN processor, symbol, meta-symbol, data management system, sort/merge, report writer, editor, simulation package, circuit analysis package, and plotter package.

FTPS Software - The FTPS Software will provide the capability for quick look evaluation of flight test data, for preprocessing flight test data so that it is compatible with the DRAS, and for printing and plotting DRAS reduced data.

General Support Software - Software will be supplied to: provide tools which aid in the design, development, and debugging of software; generate listings of data, histograms and time history plots; provide tools which aid in configuration management of the AISF hardware and software; provide for the transfer of data from one recording media to another.

Subsystem Test Area - As part of the LRU Analysis Center and the F-15 AISF, applicable subsystem test equipment will be made available to WR-ALC/MME as they are phased out of the F-15 developmental effort. This equipment is the hot-bench type subsystem test station in use to test out applicable LRU's. This equipment will be made available to WR-ALC as the development cycle comes to an end.

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 15 Feb.'80

PROGRAMMER TRAINING:

The F-15 weapon system's reliance on a highly integrated state-of-the-art avionics system requires responsible personnel to be knowledgeable of the system in order to maintain the software. The training required to acquire this knowledge will be sectioned into formal course work and informal hands-on training.

The formal courses submitted to ATC training are outlined below. These courses will supply the basic knowledge required to support the OFPs.

		Length (weeks)
MMEKF-3	FORTRAN IV	2
-6	Avionics System	4
-7	Simulation Techniques	1
-8	Central Computer OFP Design	3
-9	Central Computer AP-1 Assembly Language	3
-10	RDP OFP Design	3 (10 is desirable)
-11	RDP Assembly Language	3
-12	Special Equipment (Software)	2
MMECD-14	APG-63 Radar Familiarization	2
-15	Specialized CC Avionics Training	(incorporated into MMEKF-6)
-16	Specialized Radar Avionics Training	(incorporated into MMECD-14
-18	Harris Slash 7 Assembler/VMS JCL Programming	3
-19	Adage GP-440 Graphics Peripheral and Microcode Programming	2
-20	Kalman Filter - Theory and Application	2
-21	APG-63 RTBS Operation and Maintenance	2 (8 is desirable)
-22	Analog-Digital Techniques and Application	2
-23	Data Reduction/Analysis Techniques I	1

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS –
FLIGHT TEST REQUIREMENTS

DATE: 15 Feb.'80

These will be one fully instrumented F-15 dedicated to the flight test program. It is expected to fly about 100 hrs/year in support of all changes (S/W, H/W, Tactical Electronics Warfare System, etc.) Approximately 15 flights (1 hr/flight) are expected for each software block change.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE HISTORY DATE: 15 Feb. '80

DESCRIPTION OF NUMBERS AND TYPES OF MAINTENANCE ACTIONS PERFORMED EACH YEAR SINCE PMRT

No change history is available. WR-ALC plans to track the history of changes from source to implementation.

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE MAINTENANCE COST HISTORY DATE: 15 Feb.'80

YEARLY COST OF MAINTAINING PACKAGE:

No cost data were available.

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES DATE: 15 Feb.'80

Data Base Name:	F-15 OFP
Location:	WR-ALC/MMEC, Robbins AFB, GA.
Contact Person:	Charles Singleton
Phone Number:	(912) 926-2753
General Contents:	N/A
Period Covered:	They hope to complete the first central computer OFP change by the end of 1980.
Data Quality:	N/A

PREDICTIVE SOFTWARE COST MODEL

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 15 Feb.'80

RESPONDENT: ANDERSON / VANDIVER

If you were responsible for predicting software support costs, how would you do it?

1. Wpn System utilization/application

   Multiple scenarios
   Implications for S/W structure

2. Know the support environment/hardware
   People
   Facilities

3. How much provision for additional capability?

   Firmware - a limiter
   Core capacity - a limiter

4. Quality of documentation

5. Firmware - need to do an "ORLA" with sensitivity analysis

APPENDIX G

EW/WRALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION DATE: 31 JAN 80

ALC: WR	WEAPON SYSTEM: EW SOFTWARE
SOFTWARE PACKAGE: N/A	
PERSONNEL CONTACTED: Boby McDonald (912) 926-2204/5780 Major Al Becker (912) 926-2607	
SOFTWARE PACKAGE CHARACTERISTICS: SIZE: N/A LANGUAGE: APPLICATION: COMPLEXITY: YEAR DEVELOPED: DEVELOPER: COMMENTS	
HOST (AIRBORNE) COMPUTER CHARACTERISTICS: MANUFACTURER: N/A MODEL NUMBER/DESIGNATOR: WORD SIZE: MEMORY SIZE: MEMORY FILL:	
WEAPON SYSTEM USE: N/A NUMBER OF USERS: LOCATIONS OF USERS: FREQUENCY OF USE:	
INTERVIEWER(S): R. B. Waina, G. L. Foreman	

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL DATE: 31 JAN 80

ALC: WR	OFFICE SYMBOL: MMR

KEY PERSONNEL/OGRANIZATION:

MMR (EW Management) - LTC L. Huffman

MMRD (Regts. and Distr.)- J. Dunnaway

MMRM (logs Mgt.) - E. Bass

MMRD (Prod. Mgt.) - W. Smith

MMRR (Engr. and Rel.) - J. Brittain

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE):

MMRR has 223 filled positions versus 283 authorized. Requirements for FY80 are 318.

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

See page G-4.

MAINTENANCE AGENCY - WORK DISTRIBUTION DATE: 31 JAN 80

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL

MMRR is organized as shown below. FY80 manpower requirements by system are shown on page G-4.

MMRRC - Jammers

MMRRV - Receivers

MMRRI - Integrated Systems

MMRRA - Threat simulation to test systems

MMRRS - Technical Data, spares definition, user interface, deficiency reports

MMRRW - Administration, budget, configuration control

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET DATE: 31 JAN 80

System	Total Personnel Requirement (INCL.O/H)
ALQ-131*	30.7
ALQ-165(ASPJ)	4.1
ALQ-155*	16.2
ESAS*W	6.3
ALQ-117	5.3
ALQ-119	27.6
APR-38*	34.6
ALQ-125*	7.2
ALR-56*	18.8
ALQ-135*	11.5
ALE-45	4.0
IRS	7.3
USM-464(FLTS)	16.4
ALQ-99	16.4
ARC	8.6
ALR-46*	39.6
ALR-62*	20.8
ALQ-153	5.7
ALR-69*	36.7
	317.8

*Software-controlled systems

MMRR has had an engineering project log on-line since July 1978. All data is stored on a drum except for closed-out projects. Data categories include:

System

Project # (i.e., specific task)

Work Unit Code

Engineer

Estimated Hours

Actual Hours

Open Date

Due Date

Close Date

Task Description

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 31 JAN 80

SUPPORT PHILOSOPHY:

EW software changes are supported under a block change concept (see page G-7) except for urgent or emergency changes. Those are processed upon receipt on a "crash" basis.

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Formal

CHANGE REVIEW PROCESS: See pages G-8 through G-18.

CONFIGURATION IDENTIFICATION METHODS: See page G-15.

CONFIGURATION CHANGE CONTROL METHODS: See pages G-8 through G-18.

CONFIGURATION STATUS ACCOUNTING METHODS: See page G-13.

SOFTWARE LIBRARY CONTROL PROCEDURES: System-dependent

CONTINUATION SHEET

DATE: 31 JAN 80

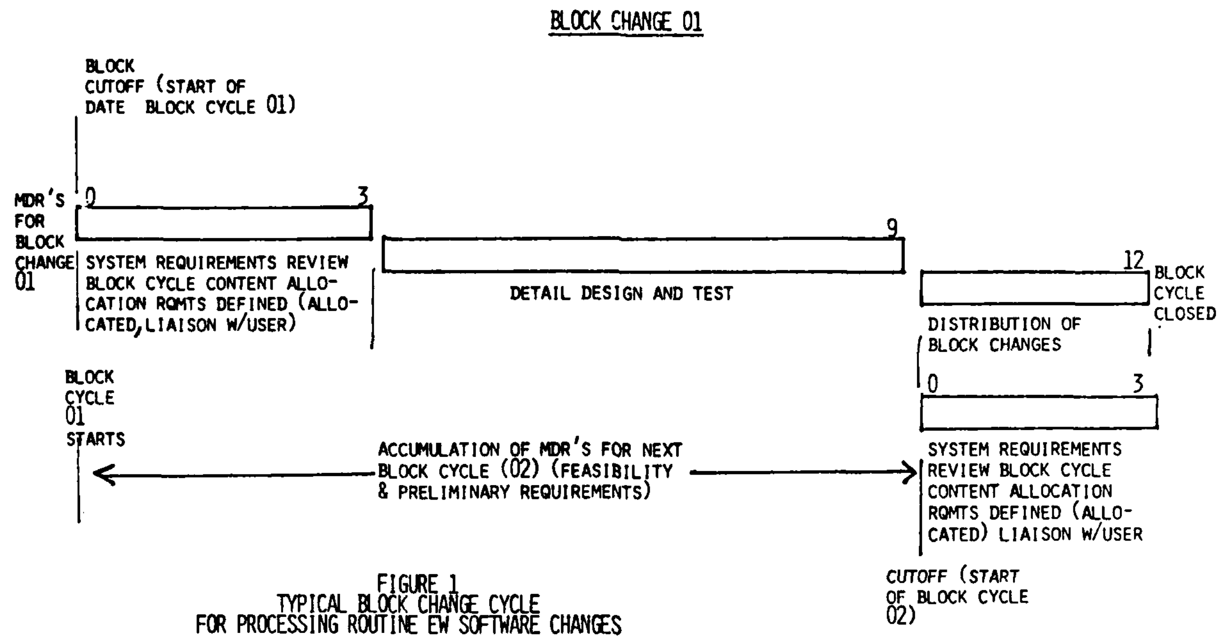


FIGURE 1
TYPICAL BLOCK CHANGE CYCLE
FOR PROCESSING ROUTINE EW SOFTWARE CHANGES

NOTE 1: TIME INTERVALS ARE USED FOR ILLUSTRATION ONLY. ACTUAL TIME FRAME WILL BE UNIQUE FOR EACH SYSTEM.
2: MDR = MATERIAL DEFICIENCY REPORT
3: OVERLAPING OF DISTRIBUTION PHASE WITH REQUIREMENT REVIEW PHASE OF SUCCESSIVE BLOCK CYCLES IS NOT REQUIRED. WHETHER BLOCK CYCLES SHOULD OVERLAP IS LEFT TO EACH SYSTEM.

MMR OPERATING INSTRUCTION 800-01

4. CONFIGURATION CONTROL PROCEDURES

CONFIGURATION MANAGEMENT CONTROL OVER SOFTWARE CHANGES IS IMPOSED VIA THE SCREENING PANEL, AND/OR THE CPCSB IN ACCORDANCE WITH THIS REGULATION. NO SOFTWARE CHANGE REQUEST, REDESIGN OF EXISTING COMPUTER PROGRAMS OR CHANGE TO THE SPECIFICATIONS THAT DESCRIBE THE PROGRAM CONFIGURATION CAN BE ACCOMPLISHED WITHOUT THE CONCURRENCE OF THESE BODIES. MANAGEMENT CONTROL IS EXERCISED AT FORMAL CONFIGURATION REVIEWS AND AUDITS.

4.1. REVIEWS

A CONFIGURATION MANAGEMENT REVIEW IS A MEETING OF A DESIGNATED CONFIGURATION MANAGEMENT BODY (CPCSB, SP, CCB, ETC.) CONVENED FOR THE PURPOSE OF APPROVING, DISAPPROVING OR CERTIFYING BASELINE DOCUMENTATION AND CHANGES TO APPROVED BASELINE DOCUMENTATION. REVIEWS DEFINED FOR THE EW SYSTEM SOFTWARE CHANGE PROCESS ARE:

- SYSTEM REQUIREMENT REVIEW (SRR)
- COMBINED SYSTEM DESIGN REVIEW AND PRELIMINARY DESIGN REVIEW (SDR/PDR)
- CRITICAL DESIGN REVIEW (CDR)
- PRODUCT VERIFICATION REVIEW (PVR)
- FORMAL (SYSTEM) QUALIFICATION REVIEW (FQR)

4.1.1. SRR

IN THE SRR, THE CPCSB PROVIDES THE AUTHORIZATION TO PROCEED WITH BLOCK CYCLE SOFTWARE CHANGES AND COMMITTMENT OF MMRR RESOURCES. THE CPCSB APPROVES THE FOLLOWING:

- THE ANALYSIS OF THE FEASIBILITY OF THE PROPOSED CHANGES
- PROPOSED CHANGES (PRELIMINARY SCNS) TO THE SYSTEM SPECIFICATION (FUNCTIONAL BASELINE)
- IMPLEMENTION PLAN
- ATE SOFTWARE CHANGES

ALSO THE CPCSB WILL ASCERTAIN THAT MIPS HAVE BEEN OPENED, AND REVIEW AND INITIAL THE PROCESS CONTROL DOCUMENTS (MDR/SPR CHECKLIST, CHANGE PROCESS CHECK LIST, CHANGE REQUEST INDEX, MDRS AND MIPS). THE SRR IS NOT HELD FOR EMERGENCY OR URGENT CHANGES AS THE APPROVAL TO PROCEED WITH A PRIORITY CHANGE IS AUTOMATICALLY

GRANTED (ASSUMING THE CHANGE IS FEASIBLE) UNDER EMERGENCY OR URGENT CONDITIONS.

4.1.2. SDR/PDR

IN THE COMBINED SYSTEM DESIGN REVIEW AND PRELIMINARY DESIGN REVIEW, THE SYSTEM SPECIFICATION, THE SOFTWARE PART I SPECIFICATION CHANGES, TEST PLANS AND THE SOFTWARE DESIGN APPROACH (INCLUDING ALLOCATIONS OF SOFTWARE SUBSYSTEM FUNCTIONS) WILL BE REVIEWED BY THE SCREENING PANEL (SP). THE APPROVED PART I SPECIFICATION CONSTITUTES THE SOFTWARE ALLOCATED BASELINE.

4.1.3. CDR

IN THE CRITICAL DESIGN REVIEW, THE PRELIMINARY PART II SPECIFICATION DESIGN CHANGES AND DETAILED CODING DIAGRAMS WILL BE REVIEWED BY THE LEAD ENGINEER. THE PURPOSE WILL BE TO ASSURE THAT THE PROGRAMMER'S APPROACH TO CODING IS SOUND.

4.1.4. PVR

BY THE PRODUCT VERIFICATION REVIEW (HELD AT THE COMPLETION OF THE DESIGN PHASE), CODED AND TESTED CHANGES WILL BE DOCUMENTED AS CHANGES TO THE SOFTWARE PART II SPECIFICATION. THE SOFTWARE SYSTEM TEST RESULTS AND PART II SPECIFICATION WILL BE REVIEWED BY THE SCREENING PANEL (SP). THE APPROVED PART II SPECIFICATION CONSTITUTES THE PRELIMINARY PRODUCT BASELINE.

4.1.5. FQR

IN THE FORMAL QUALIFICATION REVIEW, THE CPCSB WILL REVIEW THE REPORTS OF THE FUNCTIONAL CONFIGURATION AUDIT (FCA) AND PHYSICAL CONFIGURATION AUDIT (PCA), AND WILL APPROVE OR DISAPPROVE THE CHANGE PACKAGE FOR DISTRIBUTION. THE DOCUMENTS THAT ARE APPROVED AT THE FQR CONSTITUTE THE SYSTEM PRODUCT BASELINE.

4.2. AUDITS

TWO FORMAL AUDITS, THE FUNCTIONAL CONFIGURATION AUDIT (FCA) AND THE PHYSICAL CONFIGURATION AUDIT (PCA) ARE THE PRIMARY MEANS FOR

QUALITY CONTROL OF THE PRODUCT OF THE CHANGE PROCESS.

4.2.1. FUNCTIONAL CONFIGURATION AUDIT (FCA)

THE FCA VERIFYS THAT THE CPCI HAS ACHIEVED THE PERFORMANCE SPECIFIED IN THE PART I AND SYSTEMS SPECIFICATIONS. THE REPORTS/RESULTS OF THE VARIOUS TESTS (SW SIMULATION, ISS SYSTEM, EWOLS/ECSAS, ETC.) ABOVE THE CODE SEGMENT/MODULE LEVEL ARE AUDITED FOR RESULTS VERSUS REQUIREMENTS. REVIEWED ARE:

- ARE THE REQUIREMENTS APPROPRIATELY TESTED?
- ARE THE RESULTS ACCEPTABLE (I.E. DID THE CPCI MEET THE REQUIREMENTS)?

THE APPROPRIATE SECTIONS OF THE CHANGE PROCESS CHECK LIST, SIGNED OFF, TEST RESULTS SYNOPSIS AND THE FCA REPORT DOCUMENT THE KCA.

4.2.2. PHYSICAL CONFIGURATION AUDIT (PCA)

THE PURPOSE OF THE PCA IS TO ESTABLISH THE ACCURACY AND COMPLETENESS OF THE DOCUMENTATION THAT DESCRIBES THE CONFIGURATION ITEM AFTER ALL CHANGES HAVE BEEN INCORPORATED. THE PCA INCLUDES A COMPARISION OF THE PART II SPECIFICATION CHANGES WITH THOSE OF THE FLOW CHARTS, COMPUTER PROGRAM LISTINGS, MANUALS/HANDBOOKS, TEST PLANS/REPORTS AND CHANGE PROCESS DOCUMENTATION. A FINAL CHECK IS TO COMPARE A LISTING GENERATED BY THE CPCI AT THE PCA WITH THE LISTING (REDLINED OR GENERATED DURING THE CHANGE PROCESS) IN THE PART II SPECIFICATION.

THE APPROPRIATE SIGNED OFF SECTIONS OF THE CHANGE PROCESS CHECKLIST AND THE PCA REPORT SATISFY THE REQUIREMENTS FOR PCA DOCUMENTATION.

4.3. TOOLS OF CONFIGURATION MANAGEMENT

THE TOOLS AVAILABLE TO THE SCREENING PANEL AND CPCSB TO PERFORM CONFIGURATION MANAGEMENT ARE:

- COMPUTER PROGRAM IDENTIFICATION NUMBER (CPIN)
- BASELINE DOCUMENTATION

•CHANGE CONTROL CHECK LISTS, FORMS AND REPORTS

•STATUS ACCOUNTING

4.3.1. CPIN

THE CPIN SYSTEM, DESCRIBED IN AFR 800-14 AND MMROI 800-02 (ON CPINS), PROVIDES THE VEHICLE FOR IDENTIFICATION OF COMPUTER PROGRAMS (AND VARIOUS VERSIONS/REVISIONS) IN THE FIELD.

4.3.2. BASELINE DOCUMENTATION

THROUGHOUT THE SOFTWARE CHANGE CYCLE, THE BASELINE MANAGEMENT CONCEPT PERMITS A BASIS FOR CONTROLLING THE CHANGE PROCESS. THE FOLLOWING ARE THE REQUIRED DOCUMENTS FOR SYSTEM AND SOFTWARE CONFIGURATION IDENTIFICATION. CHANGE CONTROL AND STATUS ACCOUNTING ARE BASED ON THESE DOCUMENTS.

- SYSTEM SPECIFICATION (FUNCTIONAL BASELINE)
- DEVELOPMENT (PART I) SPECIFICATION (ALLOCATED BASELINE)
- PRODUCT (PART II) SPECIFICATION (PRODUCT BASELINE)
- TEST PLANS/PROCEDURES
- TEST REPORTS

4.3.3. CHANGE CONTROL CHECK LISTS, FORMS AND REPORTS

CONFIGURATION CONTROL IS EXERTED THROUGH THE IMPLEMENTATION OF THE BELOW LISTED FORMS, REPORTS, AND CHECK LISTS:

1. CHANGE PROCESS CHECKLIST: A PROCEDURAL CHECKLIST FOR BLOCK CPCI CHANGES, TO MONITOR THAT THE CORRECT PROCEDURES HAVE BEEN ACCOMPLISHED BEFORE PROCEEDING TO THE NEXT STEP IN THE SOFTWARE CHANGE PROCESS (MMRR FORM).

2. SOFTWARE PROBLEM REPORT (SPR): AN AF FORM 1775 USED TO DOCUMENT A SOFTWARE DEFICIENCY ENCOUNTERED DURING TESTING OF EW

OFP, ATE, OR ASSOCIATED SUPPORT SOFTWARE. THE ACTION IN THE SPR MUST BE APPROVED BEFORE IT IS IMPLEMENTED.

3. CHANGE REQUEST INDEX: A LISTING OF CHANGE REQUESTS DENOTING CONTROL NUMBERS, PROBLEM DESCRIPTIONS, AND WORK EFFORT.

4. MDR/SPR CHECKLIST: A PROCESSING LIST GENERATED FOR EACH MDR/SPR. THIS FORM PROVIDES THE RESULTS OF THE FEASIBILITY STUDY BY THE SCREENING PANEL.

5. MATERIAL IMPROVEMENT PROJECT (MIP) AFLC FORM 48: USED TO RECORD A PROJECT REQUIREMENT FOR THE REMOVAL OF A DEFICIENCY.

6. ISS TEST PLANS/PROCEDURES:

- MODULE/INTEGRATION: TEST CASES (INPUT/OUTPUT) FOR EACH MODULE AND A MODULE INTEGRATION PROCEDURE.
- SOFTWARE SIMULATION: TEST CASES (INPUT/OUTPUT) FOR THE INTEGRATED SOFTWARE PROGRAM.
- ISS SYSTEM TESTS: TEST CASES (INPUT/OUTPUT) USING STIMULATION OF THE SYSTEM HOT MOCKUP BY RF GENERATORS.

7. ISS TEST REPORTS: DOCUMENTATION OF THE RESULTS OF TESTS PERFORMED ACCORDING TO THE ISS TEST PLANS/PROCEDURES DOCUMENT.

8. SYSTEM VERIFICATION TEST PLANS/PROCEDURES: DOCUMENTATION OF THE TEST OBJECTIVES, CRITERIA, CASES, METHOD OF TESTING, AND OTHER PERTINENT DATA NEEDED TO CONDUCT TESTING FOR THE FOLLOWING TEST SYSTEMS:

- EWOLS/ECSAS
- DEES
- AFEWS
- FLIGHT TEST

9. SYSTEM VERIFICATION TEST REPORTS: DOCUMENTATION OF THE RESULTS OF THE TESTS CONDUCTED IN ACCORDANCE WITH THE SYSTEM VERIFICATION TEST PLANS/PROCEDURES.

10. AFLC FORM 75: THE 'CPCSB ITEM RECORD' WHICH CONTAINS A DESCRIPTION OF THE SYSTEM CHANGE AND THE CPCSB APPROVAL OR DISAPPROVAL.

11. AFLC FORM 873: 'TIME COMPLIANCE TECH ORDER REQUIREMENTS' REQUIRED TO SET TCTO NUMBER, DATA CODE, ISSUE DATE, AND RESCISSION DATE.

12. AFLC FORM 505: CPIN/AF CRI DATA AND CONTROL RECORD - PART I (CPIN REQUEST FORM) FOR NEW OR REVISED NUMBERS, PART I.

13. AFLC FORM 506: CPIN/AF CRI DATA AND CONTROL RECORD PART II (CPIN REQUEST FORM) FOR NEW OR REVISED NUMBERS, PART II.

14. AFLC FORM 252: 'PUBLICATION CHANGE REQUEST FORM'. THIS FORM IS USED TO ACCOMPLISH AN ACTUAL CHANGE TO AN EXISTING TECHNICAL ORDER.

15. AFLC FORM 875: 'TCTO CHECKLIST'. THIS FORM INSURES THAT ALL ITEMS PERTINENT TO THE MODIFICATION PROCESS ARE ACCOMPLISHED.

16. SCN: SPECIFICATION CHANGE NOTICE FORM DD 1696 TRACKS MDR NUMBER AND INDICATES THE BASELINE SPECIFICATION PAGES CHANGED AS A RESULT OF CHANGES IMPLEMENTED TO CORRECT THE DEFICIENCY. ONE IS ISSUED FOR EACH SPECIFICATION CHANGED.

17. DCN: DOCUMENT CHANGE NOTICE IS USED SIMILAR TO THE SCN BUT FOR DOCUMENTS (TEST PLANS/PROCEDURES, MANUALS, ETC.) OTHER THAN SPECIFICATIONS.

18. COMPUTER PROGRAM CLASS II CHANGE REPORT: DESCRIBES THE CLASS II CHANGE. AS A RULE, CLASS II CHANGES ARE INCLUDED IN SCNS, ISSUED TO INCORPORATE CLASS I CHANGES.

19. WR-ALC FORM 304: CONFIGURATION MANAGEMENT SYSTEM-INPUT DATA.

20. EMERGENCY/URGENT CHANGE PROCESS CHECKLIST: AN ABBREVIATED CHANGE LIST FORM USED ONLY FOR EMERGENCY OR URGENT CHANGES.

4.3.4. STATUS ACCOUNTING

CONFIGURATION STATUS ACCOUNTING IS DEFINED IN MIL-STD-480 AS: 'THE RECORDING AND REPORTING OF THE INFORMATION THAT IS NEEDED TO MANAGE CONFIGURATION EFFECTIVELY, INCLUDING A LISTING OF THE APPROVED CONFIGURATION IDENTIFICATION, THE STATUS OF PROPOSED CHANGES TO CONFIGURATIONS, AND THE IMPLEMENTATION STATUS OF APPROVED CHANGES.' THE PURPOSE IS TO PROVIDE MANAGEMENT:

- AN OVERVIEW OF PROGRESS OF CHANGE IMPLEMENTATION (PROGRAM, TESTS, AND DOCUMENTATION).

- TIMELY INFORMATION ABOUT PROBLEMS ENCOUNTERED OR ANTICIPATED.

- A BASIS FOR STANDARDIZING AND IMPROVING REPORTING PROCEDURES. A DECISION TO MAKE A CHANGE MUST BE IMPLEMENTED AND RECORDS ARE NEEDED ON HOW THE SYSTEM CHANGE IS EVOLVING. THESE CHANGE RECORDS CONSTITUTE CONFIGURATION STATUS ACCOUNTING. THEY

CONTINUATION SHEET DATE: 31 JAN 80

PROVIDE THE MEANS BY WHICH THE HISTORY OF THE SOFTWARE SYSTEM LIFE CYCLE CAN BE TRACED.

SOFTWARE CONFIGURATION STATUS ACCOUNTING USES THE SAME FORMS, REPORTS, AND CHECKLISTS AS CONFIGURATION CONTROL (SEE ABOVE) FOR RECORDING AND REPORTING THE FOLLOWING:

- THE DATE AT WHICH EACH APPROVED BASELINE CAME INTO BEING.
- DESCRIPTIVE INFORMATION ABOUT EACH SOFTWARE CONFIGURATION ITEM, SUCH AS ISSUING AGENCY, NOMENCLATURE, CPIN, EW SYSTEM, ETC.
- SPR/SCN STATUS (DATE WRITTEN, APPROVED, DISAPPROVED, IMPLEMENTED).
- DESCRIPTIVE INFORMATION ABOUT EACH CHANGE REQUEST (MDR/SPR).
- STATUS OF TECHNICAL AND ADMINISTRATIVE DOCUMENTATION ASSOCIATED WITH A BASELINE OR CPCI CHANGE (SUCH AS A PLAN PRESCRIBING TESTS TO BE PERFORMED ON CPCI CHANGES).
- DEFICIENCIES IN A TO-BE-ESTABLISHED BASELINE (CPCI) UNCOVERED DURING THE CHANGE PROCESS (SPRS).

4.4. BLOCK CHANGE CYCLE

THE BLOCK CHANGE CYCLE WILL BE THE PRIMARY MANAGEMENT METHOD FOR SCHEDULING, DEVELOPING, TESTING, AND IMPLEMENTING ROUTINE CHANGES (INCLUDING CLASS II CHANGES) TO EW OFPS, ATE AND RELATED OPERATIONAL SUPPORT SOFTWARE. A COLLECTION OF PROGRAM CHANGES WILL BE PROCESSED CONCURRENTLY IN EACH CHANGE CYCLE AND INTEGRATED INTO THE LATEST CONFIGURATION FOR THE CPCIS AFFECTED FOR EACH SYSTEM. CHANGE REQUESTS WILL BE PROCESSED AND PLACED IN A QUEUE UP TO THE BLOCK CYCLE CUTOFF DATE. PROGRAM CHANGES RECEIVED AFTER THE CUTOFF DATE WILL BE REVIEWED AND HELD FOR THE NEXT BLOCK CHANGE CYCLE. CHANGES TO ATE SOFTWARE SHALL BE COORDINATED DURING THE SAME BLOCK CYCLE THAT THE EW OFP CHANGES ARE IMPLEMENTED. THE LENGTH OF THE BLOCK CHANGE CYCLE CUTOFF SUBMISSION DATE AND OTHER SIGNIFICANT MILESTONES ARE DECIDED ON A SYSTEM BY SYSTEM BASIS AND ESTABLISHED IN THE SYSTEM O/S CMP. SEE FIGURE 1 FOR AN ILLUSTRATION OF A HYPOTHETICAL BLOCK CYCLE.

EACH APPROVED EMERGENCY AND URGENT CHANGE MAY INTERRUPT THE BLOCK CYCLE CHANGE PROCESS. THE E/U MDR WILL BE FORWARDED IMMEDIATELY TO THE SYSTEM ENGINEERING GROUP FOR IMPLEMENTATION AND RELEASE. UPON RELEASE IT WILL BECOME THE NEW BASELINE FOR THE INTERRUPTED CHANGE CYCLE. THE BASELINE DOCUMENTS WILL THEN REPRESENT A NEW VERSION CPCI THAT IS DIFFERENT FROM THE ORIGINAL CPCI

CONFIGURATION OF THE INTERRUPTED BLOCK CYCLE. THEREFORE, THE INTERRUPTED BLOCK CYCLE MAY BE REQUIRED TO RETURN TO ITS INITIAL STARTING POINT AND ALL CHANGES MADE UP TO THE TIME OF INTERRUPTION MAY HAVE TO BE REEXAMINED.

4.4.1. CHANGE CYCLE IDENTIFICATION

EACH BLOCK CHANGE CYCLE SHALL BE IDENTIFIED FOR EACH SYSTEM BY THE SYSTEM NOMECLATURE AND A CONSECUTIVE BLOCK NUMBER 01,02,03,.--- N (I.E. ALR-46 BLOCK -01). EMERGENCY OR URGENT CHANGES WILL UTILIZE THE MDR NUMBER AS THE IDENTIFIER. PERFORMANCE OF BLOCK CYCLE CHANGES MAY BE INTERRUPTED ONLY FOR E OR U PRIORITIZED CHANGES. ROUTINE CHANGES THAT ARE NOT COMPLETED DUE TO THE DIVERSION TO E OR U CHANGE PRIORITIES OR FOR OTHER REASONS WILL LIKEWISE BE HELD OVER TO THE NEXT BLOCK CYCLE.

4.4.2. REQUIREMENTS ANALYSIS

A PRELIMINARY ANALYSIS OF EACH NEW ROUTINE PROGRAM CHANGE REQUEST IS HELD AS EACH IS RECEIVED. THIS WILL INCLUDE UNCOMPLETED CHANGES LEFT OVER FROM THE PREVIOUS BLOCK CYCLE. DURING THIS ANALYSIS, THE SCREENING PANEL WILL IDENTIFY SYSTEM REQUIREMENTS, ASSESS FEASIBILITY, AND WILL ESTIMATE IMPACT, COSTS, RESOURCES, AND LEVELS OF EFFORT. CHANGES DETERMINED TO REQUIRE CONTRACTOR SUPPORT WILL BE IDENTIFIED FOR LATER PRESENTATION TO THE CCB. LIKEWISE, HARDWARE CHANGES WILL BE DEFINED AS EARLY AS POSSIBLE TO THE CCB. THE HARDWARE CHANGE RESULTING FROM A SOFTWARE CHANGE MAY NOT BE RELEASED AT THE SAME TIME AS THE SOFTWARE CHANGE BUT A COORDINATED SCHEDULE FOR THE INSTALLATION OF BOTH SHALL BE ESTABLISHED. REQUESTS ONLY FOR A FEASIBILITY STUDY WILL BE CONDUCTED AND A REPORT PROVIDED TO THE APPROPRIATE COMMAND BUT NO CHANGE WILL BE PROCESSED.

WHEN THE SUBMISSION CUTOFF DATE IS REACHED, THE LIST OF CHANGES IN THE QUEUE IS REVIEWED AND PRIORITIZED BY NEGOTIATION WITH THE USER COMMAND. INCLUDED IN THIS LIST ARE THE MDRS AND SPRS CARRIED OVER FROM THE PREVIOUS BLOCK CYCLE. THE PRIORITIZED CHANGE LIST IS COMPARED AGAINST PROJECTED AVAILABLE RESOURCES AND THE FINAL LIST OF CHANGES TO BE INCORPORATED IN THE BLOCK CHANGE IS LIMITED TO THOSE RESOURCES. ANY CHANGES THAT COULD NOT BE INCLUDED WILL BE HELD OVER TO THE NEXT BLOCK CYCLE AND THE USER COMMAND NOTIFIED ACCORDINGLY. A SYSTEM REQUIREMENT REVIEW IS CONVENED AND CPCSB CONCURRENCE IS REQUESTED FOR BLOCK CHANGE CONTENT AND RESOURCE COMMITMENT.

4.4.3. IMPLEMENTATION

THE BLOCK CYCLE IMPLEMENTATION IS STARTED AFTER THE SYSTEMS REQUIREMENT REVIEW WITH A REQUIREMENTS DEFINITION/ALLOCATION PHASE WHEN THE SCREENING PANEL MEETS TO ANALYZE THE CHANGES SELECTED FOR THE BLOCK CYCLE. DURING THIS PHASE THE PRELIMINARY ANALYSIS OF EACH CHANGE REQUEST IS REFINED. SYSTEM ENGINEERING STUDIES ARE CONDUCTED TO DEFINE PERFORMANCE, DESIGN, INTERFACE, FUNCTIONAL REQUIREMENTS, AND TEST PLANS.

CHANGES TO ATE SOFTWARE, IF ANY, ARE DEFINED AT THIS TIME AND ARE CONTROLLED UNDER THIS MMROI IN THE SAME MANNER AS EW OFP CHANGES, WHETHER THE ATE SYSTEM WAS ORIGINALLY DEVELOPED BY MMRR OR ASD. THE DECISION TO DELEGATE ATE SOFTWARE MAINTENANCE FOR UNIT UNDER TEST (UUT) SOFTWARE CHANGES TO OTHER WR-ALC DIVISIONS DOES NOT RELEASE THE RESPONSIBLE MMRR SYSTEM ENGINEERING UNIT FROM PERFORMING THEIR VERIFICATION AND VALIDATION FUNCTION FOR ATE SOFTWARE CHANGES. IN THIS INSTANCE, THE SYSTEM ENGINEERING UNIT SHALL COMPLY WITH ALL REQUIREMENTS OF THIS MMROI. THE SAME APPLIES TO CONTRACTOR SUPPORTED SOFTWARE CHANGES, WHETHER FOR EW OR ATE PROGRAMS.

4.4.4. DESIGN AND TEST

THE SOFTWARE CHANGE ACTIVITY INCLUDES DESIGN, CODING CHECK OUT, TESTING AND INTEGRATION.

THE DESIGN OF THE CHANGE CONSISTS OF DEFINING, IN A LOGICAL AND ORGANIZED MANNER, THE NECESSARY FUNCTIONS AND OPERATIONS TO SATISFY THE SOFTWARE REQUIREMENT. IT IS DURING THIS PHASE THAT TEST PLANS ARE GENERATED TO ENSURE A SATISFACTORY DEMONSTRATION OF QUALITY ASSURANCE REQUIREMENTS.

IN THE CODING AND CHECKOUT PHASE, THE DETAILED SOFTWARE DESIGN IS TRANSLATED INTO A HIGHER ORDER OR ASSEMBLY LANGUAGE. THE FORMAL TEST PROCEDURES SHOULD BE PREPARED DURING THIS PERIOD.

THE TESTING PHASE DETERMINES THAT THE SOFTWARE PERFORMS AS INTENDED AND THAT SYSTEM REQUIREMENTS ARE SATISFIED. INTEGRATION TESTS (INCLUDING ISS LEVEL TESTS) SYSTEM VERIFICATION TESTS, AND FLIGHT TESTS ARE PERFORMED USING INTEGRATED SYSTEM COMPONENTS, HARDWARE AS WELL AS SOFTWARE.

4.4.4.1. ATE SOFTWARE

SYSTEM ENGINEERING (MMRR) IS THE DESIGNATED UUT ATE SOFTWARE AND INTERFACE ADAPTER MANAGER IN ACCORDANCE WITH AFR 800-14 VOL II, AFLC SUPPLEMENT NO 1, AND THE 'WR-ALC O/SCMP FOR UUT ATE SOFTWARE.' THE DESIGN AND TEST OF ATE SOFTWARE CHANGES WILL NORMALLY BE PERFORMED BY MMECT AS TASKED BY MMRR IN ACCORDANCE WITH PROCEDURES OUTLINED IN PARAGRAPHS 4.2.2 AND 4.2.3 OF THE ABOVE MENTIONED O/SCMP. THE SP ATE ENGINEER WILL PROVIDE GUIDANCE FOR THIS PROCEDURE. IN SOME INSTANCES, AGREEMENTS WILL BE MADE BETWEEN MMRR AND MMEC FOR MMRR TO ORGANICALLY SUPPORT ATE SOFTWARE CHANGES. IN ANY EVENT, CONFIGURATION MANAGEMENT OF ALL ATE CHANGES REMAINS THE RESPONSIBILITY OF MMRR IRRESPECTIVE OF THE DESIGN AGENCY. THE ATE CHANGE WILL BE PROCESSED IN ACCORDANCE WITH THIS MMROI UP UNTIL THE DESIGN PHASE (AFTER SDR/PDR). AT THIS POINT THE CHANGE WILL BE DESIGNED AND TESTED BY THE DESIGN AGENCY. THE LEAD ENGINEER AND/OR ATE ENGINEER WILL MONITOR ATE VERIFICATION TESTING AND ASSURE COMPATABILITY WITH THE UUT. THEREAFTER, THE COMPLETED ATE SOFTWARE CHANGES WITH THE DOCUMENTS LISTED IN STEP 10 OF PARAGRAPH 5.1, WILL BE PRESENTED TO THE SCREENING PANEL FOR THE FCA/PCA AUDIT. THEREFORE, THE SP AND CPCSB REVIEWS, AUDITS AND APPROVAL PROCEDURES STATED HEREIN WILL BE FOLLOWED FOR ALL UUT ATE SOFTWARE CHANGES.

4.4.5. BASELINE MANAGEMENT

4.4.5.1. CHANGE DOCUMENTATION

THE SOFTWARE SYSTEM WHICH ENTERS A BLOCK CYCLE SHOULD BE FULLY BASELINED (SEE PARAGRAPH 4.3.2). THE CHANGE PROCESS WILL CONVERT THESE BASELINE DOCUMENTS TO NEW VERSIONS. CHANGES TO THE SOFTWARE WILL BE DOCUMENTED BY CHANGES TO THESE BASELINES AND IDENTIFIED BY A SPECIFICATION CHANGE NOTICE (SCN) DD FORM 1696. AN SCN WILL BE GENERATED FOR EACH CHANGED SPECIFICATION AT THE TIME A CHANGE TO THAT SPECIFICATION IS IDENTIFIED. THE SCN SHALL LIST ALL CHANGES (CLASS I & II) TO THAT SPECIFICATION FOR THE BLOCK CYCLE. CLASS II CHANGES THAT DO NOT IMPACT SOFTWARE CONFIGURATION WILL BE DOCUMENT ON A COMPUTER PROGRAM CLASS II CHANGE REPORT. DOCUMENT CHANGE NOTICES (DCNS) WILL BE ISSUED FOR CHANGES TO TEST PLANS/PROCEDURES. THE SCNS AND DCNS ARE KEPT AS PART OF THE CHANGE PROCESS RECORD SET (BLOCK CYCLE NOTEBOOK) AND FUNCTION AS WORKING INDEXES FOR FUTURE CHANGES. IN ORDER TO MAINTAIN TRACEABILITY OF CHANGES, THE DOCUMENTATION MANAGEMENT PROCEDURES IN THE NEXT SECTION WILL BE FOLLOWED.

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4.4.5.2. DOCUMENTATION MAINTENANCE

TWO COPIES OF THE SYSTEM SOFTWARE BASELINE DOCUMENTS SET WILL BE RESIDENT AT WR-ALC. COPY NO. 1 WILL BE MAINTAINED BY THE MMRR LEAD ENGINEER WHO IS RESPONSIBLE FOR THE SYSTEM BEING CHANGED. COPY NO. 2 WILL BE FILED AND MAINTAINED BY MMRRW. A THIRD COPY WILL BE STORED FOR SAFETY AT A DESIGNATED SITE.

COPY NO. 1 WILL BE A WORKING DOCUMENT. DURING A BLOCK CYCLE, APPROVED SOFTWARE CHANGES WILL BE MADE TO COPY NO. 1 BY REDLINE, HANDWRITTEN ENTRIES. A MARGINAL NOTATION WILL DATE EACH ENTRY AND IDENTIFY THE CORRESPONDING SPR/MDR. PRIOR TO THE END OF THE CHANGE CYCLE, THE REDLINED CHANGED PAGES, THE SCNS/DCNS, CLASS II CHANGE REPORTS, AND THE CHANGE REQUEST INDEX THAT CORRESPOND TO APPROVED, IMPLEMENTED CHANGES WILL BE TURNED OVER TO MMRRW.

MMRRW WILL HAVE THE RED LINED PAGES AND SCNS RETYPED. ONE SET OF TYPED CHANGED PAGES AND SCNS WILL BE FORWARDED TO THE LEAD ENGINEER WHO WILL INSERT THEM INTO COPY NO. 1, REPLACING THE CHANGED PAGES. COPY NO. 1 WILL THEN CONSTITUTE THE NEW VERSION BASELINE.

COPY NO. 2 OF THE BASELINE DOCUMENTS WILL BE KEPT UNCHANGED IN THE MMRRW FILES. THE SET OF TYPED CHANGED PAGES AND SCNS, AND THE REDLINED PAGES WILL BE FILED WITH THE MMRRW COPY NO. 2. COPY NO. 2 WILL THEN CONSTITUTE THE PRECHANGE BASELINE DOCUMENTS AND CHANGES TO THE PRECHANGE DOCUMENTS. MMRRW WILL ALSO TYPE THE CHANGE REQUEST INDEX.

THE BASELINE FILES AT MMRRW WILL MAINTAIN TRACEABILITY OF CHANGES THROUGH ALL SEQUENTIAL BLOCK CYCLES. IN ADDITION TO THE ORIGINAL SET OF BASELINE DOCUMENTS, EACH BLOCK CYCLE FILE WILL CONTAIN THE CHANGE RECORDS GENERATED IN THE CYCLE, INCLUDING:

- MDR/SPRS
- SCN/DCNS
- REDLINED, CHANGED PAGES
- COMPUTER PROGRAM CLASS II CHANGE REPORTS
- CHANGE PROCESS CHECKLIST
- MDR/SPR CHECK LISTS
- CHANGE REQUEST INDEX
- PCA REPORT
- FCA REPORT
- IMPLEMENTATION PLAN

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 31 JAN 80

STRUCTURED DESIGN? – DESCRIBE System-dependent
STRUCTURED PROGRAMMING? – DESCRIBE System-dependent
CODING GUIDELINES: Informal: a code walk-through is scheduled prior to testing of the change.
CHANGE ENTRY METHODS: System-dependent: most often on-line on small computer.
SCHEDULE: Depends on urgency of change
REPORTING: Via project log system
COMMENTS:

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 31 JAN 80

DOCUMENTATION: See pages G-21 through G-52.

REQUIREMENTS:

DESIGN:

USER:

PROGRAM PROBLEM REPORTING SYSTEM:

Tasks are generated via MDRs, messages, etc., from operating commands. They are then tracked via the MIP System.

COMMENTS:

DOCUMENTION AND FORMS 16 OCT 79

1. REFERENCE DOCUMENTS

ESD-TR-77-254 ESD GUIDEBOOK
AN AF GUIDE TO COMPUTER
PROGRAM CONFIGURATION MANAGEMENT

2. DOCUMENTATION

THE CONTENT AND FORMAT REQUIRED FOR THE SYSTEM, PART I AND PART COMPUTER PROGRAM SPECIFICATIONS ARE OUTLINED IN MIL-STD-490 AS SUPPLEMENTED BY MIL-STD-483 (AIR FORCE). THE NOMENCLATURE USED MIL-STD-490 FOR THE VARIOUS SPECIFICATIONS IS:

MMROI 800-01/MIL-STD-483	MIL-STD-490
SYSTEM	SYSTEM - TYPE A
PART I	DEVELOPMENT - TYPE B
PART II	PRODUCT - TYPE C

MIL-STD-490 FURTHER DIFFERENTIATES COMPUTER PROGRAM SPECIFICATI AS SUBTYPES B5 AND C5. ESD GUIDEBOOK ESD-TR-77-254 'AN AF GUID TO COMPUTER PROGRAM CONFIGURATION MANAGEMENT', SECTION 3, PROVI A TUTORIAL ON THE REQUIREMENTS TO BE DESCRIBED IN THESE SPECIFICATIONS.

THE SYSTEM CONTRACTOR WILL USUALLY PROVIDE THE SYSTEM SPECIFICATION, PART I DEVELOPMENT SPECIFICATION, PART II PRODUC SPECIFICATION, TEST PLANS, TEST PROCEDURES, CONFIGURATION INDEX CHANGE STATUS LIST, AND VERSION DESCRIPTION DESCRIPTION DOCUMEN AS BASELINE DOCUMENTATION AT PMRT. THE CONTRACTOR MUST BE DIRECTED TO MAINTAIN THIS DOCUMENTATION IF THE CONTRACTOR WILL CONTINUE TO SUPPORT THE SYSTEM UNDER WR-ALC CONTRACT AFTER PMRT

THE SYSTEM ENGINEERING GROUP (MMRR) WILL BE RESPONSIBLE TO MAN AND MONITOR THE CONTRACTOR IMPLEMENTED CHANGES TO THE BASELINE DOCUMENTS AND THE CPCI.

SYSTEMS ORGANICALLY DEVELOPED AT WR-ALC MUST DEVELOP THE SAME DOCUMENTATION. ALL ORGANICALLY SUPPORTED SYSTEMS MUST MAINTAI THE DOCUMENTATION WITHIN MMRR IN ACCORDANCE WITH THIS OI.

CONTINUATION SHEET DATE: 31 JAN 80

3. STATUS ACCOUNTING FORMS

THE STATUS ACCOUNTING FORMS REQUIRED AND A REFERENCE TO THE INSTRUCTIONS FOR COMPLETING THE FORMS, ARE LISTED BELOW:

FORM	TITLE	INSTRUCTIONS
AFLC FORM 75	CPCSB ITEM RECORD	AFLC SUP 1 TO AFR 800-14, VOL II
AF FORM 1775	SOFTWARE PROBLEM REPORT	ATTACHED (MODIFIED)
DD FORM 1696	SPEC. CHANGE NOTICE (SCN)	ATTACHED (MODIFIED)
MMR FORM	MDR/SPR CHECK LIST	ATTACHED
MMR FORM	CHANGE PROCESS CHECK LIST (CPCL)	ATTACHED
MMR FORM	EMER./URGENT CHANGE PROCESS CHECK LIST	ATTACHED
MMR FORM	CHANGE REQUEST INDEX	ATTACHED
MMR FORM	PCA REPORT	ATTACHED
MMR FORM	FCA REPORT	ATTACHED
MMR FORM	DOC. CHANGE NOTICE (DCN)	ATTACHED
MMR FORM	COMPUTER PROGRAM CLASS II REPORT	ATTACHED

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Instructions for Completing AF Form 1775, Software Problem Report (SPR)
Taken from AFR 300-15, Attachment 8, 16 Jan 78

* CONTROL NUMBER: Enter a unique control number in accordance with local configuration management procedures.

DATE SUBMITTED: Self-explanatory.

TO: Enter the organization responsible for development or maintenance of the software.

* FROM: Enter the initiating organization.

INFO COPIES TO: Self-explanatory.

* ADS: Enter the title of the ADS of which the program is a part.

PROGRAM NAME: Enter the name of the program in which the problem or discrepancy was detected.

* IDENT: Enter the identification of the program involved.

RUN DATE: Enter the date the program was run in which the discrepancy or error was detected.

POINT OF CONTACT: Enter the name of the individual in the organization which initiated the SPR who is most familiar with the problem.

PROBLEM DESCRIPTION: Describe what the discrepancy or error is, and the circumstances helped cause it. Tell what should have happened if there had been no discrepancy and the impact of the discrepancy.

COMMENTS: Indicate the urgency of the correction and any other pertinent facts.

PROBLEM ANALYSIS: Describe the cause of the discrepancy or error, the impact, and any other programs or data bases affected.

NAME OF ANALYST: Self-explanatory.

RECOMMENDED ACTION: Describe the proposed corrective action (if necessary), and provide an estimate of the time and resources required to complete the recommended action.

APPROVED OR DISAPPROVED: Self-explanatory.

SIGNATURE OF APPROVING OFFICIAL: Self-explanatory.

DATE: Enter date of signature.

ACTION TAKEN: Tell what corrective action (if any) was taken.

DATE ACTION COMPLETED: Self-explanatory.

*Modified for MMRR use as follows:

1. CONTROL NUMBER: Enter the current block cycle number or Emergency/Urgent MDR number (as applicable) followed by a sequential number assigned to the SPR. Numbers are assigned consecutively 1---N for each block cycle or Emergency/Urgent change.
EXAMPLE: 04 - 05 identifies the 5th SPR generated during block cycle 4.

2. FROM: Enter "Same" if initiating organization is the same as the maintaining organization.

3. ADS: Enter system (i.e., ALR-46, F-15 TEWS, Etc.)

4. IDENT: Enter Part II Spec Number and name (or equivalent).

PREDICTIVE SOFTWARE COST MODEL

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PROGRAM ANALYSIS			
NAME OF ANALYST *(Type or print)*			
RECOMMENDED ACTION			
☐ APPROVED ☐ DISAPPROVED	DATE	APPROVING OFFICIAL *(Type or print name)*	SIGNATURE
ACTION TAKEN			
DATE ACTION COMPLETED			

AF FORM 1775 (REVERSE)

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET **DATE:** 31 JAN 80

SOFTWARE PROBLEM REPORT (SPR)		DATE SUBMITTED	CONTROL NO.
TO:	FROM:	INFO COPIES TO:	
ADS	PROGRAM NAME	IDENTIFICATION	
RUN DATE	POINT OF CONTACT *(Type or print name)*		

PROBLEM DESCRIPTION

COMMENTS

AF FORM 1775

CONTINUATION SHEET DATE: 31 JAN 80

SUPPLEMENTAL INSTRUCTIONS FOR DD FORM 1696

MIL-STD-490 INSTRUCTIONS FOR COMPLETING DD FORM 1696 ARE MODIFIED AS FOLLOWS:

BLOCK 6. SCN NUMBERS ARE TO BE ASSIGNED CONSECUTIVELY BY LEAD ENGINEER.

BLOCK 8. IS CHANGED TO INDICATE BLOCK CYCLE CHANGE ID NUMBER.

BLOCK 11. IS TO INDICATE WHETHER DOCUMENT IS SYSTEMS, PART I OR PART II SPECIFICATION.

BLOCK 13. CHANGE SCN TO MDR/SPR.

BLOCK 14. INDICATE PAGE AND PARAGRAPH NUMBER (IF APPLICABLE).

ANY BLOCKS NOT APPLICABLE, INSERT 'N/A'.

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MIL-STD-490

1 February 1969

SPECIFICATION CHANGE NOTICE

(SUBMITTAL DATE)
DATE PREPARED 6/5/67

1. ORIGINATOR NAME AND ADDRESS (SCN PREPARING ACTIVITY)	2. ☐ PROPOSED ☐ APPROVED	3. CODE IDENT. (DESIGN ACTIVITY)	4. SPEC. NO.
		5. CODE IDENT. (SCN PREPARING ACTIVITY)	6. SCN NO. 2
7. SYSTEM DESIGNATION (TYPE, MODEL, SERIES, ETC.)	8. RELATED ECP NO.	9. CONTRACT NO.	10. CONTRACTUAL ACTIVITY (NOTE 2)
11. CONFIGURATION ITEM NOMENCLATURE		12. EFFECTIVITY (CI SERIAL NUMBERS OF ALL ITEMS AFFECTED BY THIS SCN)	

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
	PAGES CHANGED AND TRANSMITTED HEREWITH			
2	6	X		
	6a, 6b		X	
	12 DELETED			
	SUMMARY OF CHANGED PAGES			
1	1, 2	X		3/12/67
2	6	X		6/5/67
2	6a, 6b		X	6/5/67
2	12 DELETED			6/5/67
3	11	X		5/8/67

NOTES:

1. BLOCKS 2, 4, 6, 8, 9, 11, 13, & 15 ARE SELF-EXPLANATORY
2. TYPE OF CONTRACTUAL ACTION REQUIRED FOR IMPLEMENTATION OF THIS SCN, e.g., CCN, SUPPLEMENTAL AGREEMENT, ETC.

16. TECHNICAL CONCURRENCE (PROCURING ACTIVITY SIGNATURE)	DATE 7/6/67 (APPROVAL DATE)

DD FORM 1696   * "S" indicates supersedes earlier page   "A" indicates added page

Specification Change Notice

CONTINUATION SHEET DATE: 31 JAN 80

MDR/SPR CHECKLIST INSTRUCTIONS

BLOCK 1. BRIEFLY STATE A FUNCTIONAL DESCRIPTION OF MDR/SPR FOR EASY REFERENCE.

BLOCK 2. ENTER DATE OF MDR OR SPR.

BLOCK 3. ENTER THE IDENTIFICATION NUMBER OF THE MDR OR SPR. IF HOLD OVER FROM PREVIOUS CYCLE, THEN CHECK BOX AND ATTACH THE ORIGINAL MDR OR SPR.

BLOCK 4. CHECK (1 BLOCK ONLY) THE APPROPRIATE PRIORITY. IF ROUTINE, THEN ENTER THE BLOCK CYCLE NUMBER WHEN THE MDR/SPR WILL BE PROCESSED.

BLOCK 5. ENTER THE MIP NUMBER THIS MDR OR SPR WAS ASSIGNED.

BLOCK 6. ENTER THE ENGINEER ASSIGNED TO THIS MIP.

BLOCK 7. ENTER THE SCHEDULED DATE FOR SCREENING PANEL REVIEW. WHEN REVIEW IS COMPLETED, ENTER THIS DATE WITH THE LETTER "C" NEXT TO THE DATE; I.E., 16 SEP 79
17 SEP 79 C

BLOCK 8. CHECK BOX TO INDICATE WHETHER CHANGE IS A NEW REQUIREMENT OR IS A DEFICIENCY.

BLOCK 9. INDICATE WHETHER USER REQUIREMENTS NEED MORE CLARIFICATION. IF YES, THEN ATTACH CORRESPONDENCE WITH THE USER (I.E., MESSAGES, MEMOS OF TELEPHONE CONVERSATIONS, ETC.). CHECK BOX (TO RIGHT OF YES) WHEN THE REVISED MDR IS RECEIVED (AND ATTACH IT TO CHECKLIST).

BLOCK 10. INDICATE WHICH AREAS ARE AFFECTED BY THE MDR/SPR REQUEST.

BLOCK 11A.
INDICATE THE MDR/SPR'S STATUS AS DETERMINED DURING REVIEWS BY THE SCREENING PANEL, CPCSB, AND USER COMMAND.

PREDICTIVE SOFTWARE COST MODEL

MDR/SPR CHECKLIST

CONTINUATION SHEET **DATE:** 31 JAN 80

1. TITLE:

2. DATE:

3. IDENTIFICATION:

☐ MDR NO.____________________

☐ SPR NO.____________________

☐ HOLD OVER (ATTACH ORIGINAL)

4. PRIORITY:

☐ EMERGENCY

☐ URGENT

☐ ROUTINE (BLOCK CYCLE NO.________)

5. MIP NUMBER:

6. ENGINEER ASSIGNED:

7. SCREENING PANEL REVIEW DATE:

8. CHANGE IS: ☐ NEW REQUIREMENT ☐ DEFICIENCY

9. FUNCTIONAL REQUIREMENT NEEDS CLARIFICATION:

☐ NO

☐ YES (ATTACH MESSAGE) ☐ REVISED MDR ATTACHED

10. AFFECTED WORK AREAS:

AREA	NO	YES	OFFICE SYMBOL	INITIAL	MANHOUR EST. (ENGR) ANALYSIS	DESIGN	TEST
SOFTWARE			MMRR ___				
HARDWARE			MMRR ___				
LOGISTICS			MM ___				
ATE			MMECT				
OTHER							

11A. MDR/SPR STATUS:

SCREENING PANEL ☐ ACCEPTED ☐ DELETED ☐ HELD OVER

USER REPRESENTATIVE ☐ ACCEPTED ☐ DELETED ☐ HELD OVER

CPCSB (SRR) ☐ ACCEPTED ☐ DELETED ☐ HELD OVER

11B. SIGNATURES AND DATES:

SCREENING PANEL CHAIRMAN____________________ DATE________

USER COMMAND REP.____________________ DATE________

12. IF MDR/SPR WAS HELD OVER OR DELETED THEN BRIEFLY STATE WHY.

CHANGE PROCESS CHECKLIST INSTRUCTIONS

SECTION 1: IDENTIFICATION

BLOCK 1: ENTER THE BLOCK CYCLE NUMBER.

BLOCK 2: A. ENTER SYSTEM NAME (I.E., ALR-62) AND VERSION.
B. CHECK APPROPRIATE COMMAND.
C. INDICATE NOMENCLATURE.

BLOCK 3: ENTER THE INCLUSIVE DATES OF PRESENT BLOCK CYCLE. SAME AS BLOCK 3 OF THE CHANGE REQUEST FORM.

BLOCK 4: A. ENTER THE QUANTITY OF MDR/SPR'S WHICH WERE HELD OVER FROM PREVIOUS CYCLES. ENTER Ø IF NONE.
B. ENTER THE QUANTITY OF NEW MDR/SPR'S REQUESTED FOR PRESENT CYCLE.
C. TOTAL OF A AND B.

BLOCK 5: A. ENTER OLD (CURRENT) CPIN AND DATE.
B. ENTER NEW CPIN (WHEN ASSIGNED) AND DATE.

BLOCK 6: USER COMMAND REPRESENTATIVE SIGNATURE (AND DATE) INDICATING APPROVAL OF THE PRIORITIZATION OF THE CHANGE REQUESTS LISTED ON THE CHANGE REQUEST FORM: "A" IF SAC AND "B" IF TAC.

BLOCK 7: PRINT OR TYPE IN THE NAMES AND SYMBOLS OF THE SCREENING PANEL MEMBERS PRESENT FOR THE SRR AND THE FQR. ENTER "SAME" UNDER THE FQR IF THE MEMBER IS UNCHANGED FROM THE SRR.

BLOCK 8: SAME AS BLOCK 7 EXCEPT FOR UNIT/SECTION CHIEFS.

BLOCK 9: SAME AS BLOCK 7 EXCEPT FOR CPCSB MEMBERS.

CONTINUATION SHEET DATE: 31 JAN 80

SECTION 2: REVIEWS AND AUDITS

BLOCK 1: A. CHECK BLOCK AS ITEM IS ACCOMPLISHED.
B. ENTER DATE OF SRR.
C. CPCSB CHAIRMAN ACCEPTANCE SIGNATURE.

BLOCK 2: A. CHECK BOX AS ITEM IS ACCOMPLISHED.
B. ENTER DATE OF SDR/PDR.
C. APPROVAL SIGNATURES AS INDICATED.

BLOCK 3: A. CHECK BOX AS ITEM IS ACCOMPLISHED.
B. ENTER DATE OF PVR.
C. APPROVAL SIGNATURES AS INDICATED.

BLOCK 4: A. CHECK BOX AS ITEM IS ACCOMPLISHED.
B. ENTER DATE OF FCA/PCA.
C. APPROVAL SIGNATURES AS INDICATED.

BLOCK 5: A. CHECK BOX AS ITEM IS ACCOMPLISHED.
B. ENTER DATE OF FQR.
C. CPCSB CHAIRMAN APPROVAL SIGNATURE.

SECTION 3: TEST COMPLIANCE MATRIX

BLOCK 1: ENTER SYSTEM NAME.

BLOCK 2: TEST REQUIRED BOX; FOR EACH CHECK "Y" IF YES
CHECK "N" IF NO.

BLOCK 3: TEST PLANS: ENTER DATE TEST PLANS DUE;
ENTER APPROVAL OF TEST PLANS BY SIGNATURE;
ENTER DATE OF APPROVAL.

BLOCK 4: TEST PROCEDURES: SAME AS NUMBER 3.

BLOCK 5: TEST REPORTS: SAME AS NUMBER 3. ALSO INDICATE THE NUMBER OF SPR'S GENERATED DURING EACH LEVEL OF TESTING.

PREDICTIVE SOFTWARE COST MODEL

CHANGE PROCESS CHECKLIST

SECTION 1: IDENTIFICATION

DATE: 31 JAN 80

1. BLOCK CYCLE NO: ______	NOTE: THIS FORM FOR ROUTINE PRIORITY CHANGES ONLY
2A. SYSTEM ______ VER ______ B. COMMAND: ☐ SAC ☐ TAC C. CPCI NOMENCLATURE:	3. BLOCK CYCLE DATES: A. ESTABLISHED: ______ B. SUBMISSION CUTOFF: ______
4. NUMBER OF MDR/SPR's: A. NO. HELD OVER ______ B. NEW CANDIDATES ______ C. TOTAL ______	5. CONFIGURATION MANAGEMENT USE ONLY A. OLD CPIN: DATE ______ B. NEW CPIN: DATE ______
6. USER COMMAND PRIORITIZATION: A. ☐ SAC ______	DATE ______ B. ☐ TAC ______

7. SCREENING PANEL MEMBERS	ACCEPTANCE (SRR) NAME/SYMBOL	APPROVAL (FQR) NAME/SYMBOL
EQUIPMENT SPECIALIST (CHARIMAN)	______	______
LOG OFFICER	______	______
LEAD ENGINEER	______	______
ATE ENGINEER	______	______
(OTHERS)	______	______
	______	______
8A. UNIT CHIEF	______	______
B. SECTION CHIEF	______	______
9. COMPUTER PROGRAM CONFIGURATION SUB-BOARD MEMBERS (CPCSB)		
DIVISION CHIEF (CHAIRMAN)	______	______
SYSTEM ENGINEERING MANAGER	______	______
TECHNICAL SERVICES MANAGER	______	______
PRODUCTION MANAGER	______	______
LOGISTICS MANAGER	______	______
ATE SOFTWARE MANAGER	______	______
USER COMMAND REPRESENTATIVE	______	______

PREDICTIVE SOFTWARE COST MODEL

CHANGE PROCESS CHECKLIST

DATE: 31 JAN 80

SECTION 2: REVIEWS AND AUDITS SYSTEM

1A. SYSTEM REQUIREMENT REVIEW (SRR)	1B. DATE:
☐ Change Request Index (Prioritized) ☐ MDR/SPR Checklists ☐ MIP Forms 48 ☐ User Command Minutes (If Applicable) ☐ System Specification Redlines Approved ☐ Implementation Plan Approved ☐ AFLC Form 75 Total Manhour Estimate _____	1C. CPCSB Acceptance: Chairman __________
2A. SYSTEM/PRELIMINARY DESIGN REVIEW (SDR/PDR)	2B. DATE:
☐ Part I Specification Redlines Approved ☐ Test Compliance Matrix Approved	2C. Screening Panel Approval: Chairman __________ Lead Engineer __________ Unit Chief __________
3A. PRODUCT VERIFICATION REVIEW (PVR)	3B. DATE:
☐ Part II Specification Redlines Approved ☐ SPR's Correctly Dispositioned ☐ Test Compliance Matrix Approved	3C. Screening Panel Approval: Chairman __________ Lead Engineer __________ Unit Chief __________
4A. FUNCTIONAL/PHYSICAL CONFIGURATION AUDIT (FCA/PCA)	4B. DATE:
☐ Part I Specification Approved ☐ Part II Specification Approved ☐ FCA Report Approved (Test Synopsis) ☐ Test Compliance Matrix Approved ☐ SPR's Correctly Dispositioned ☐ PCA Report Approved	4C. Screening Panel Approval: Chairman __________ Lead Engineer __________ Unit Chief __________
5A. FORMAL QUALIFICATION REVIEW (FQR)	5B. DATE:
☐ FCA/PCA Reports Approved ☐ Change Request Index ☐ Open MDR's Correctly Dispositioned ☐ Open SPR's Correctly Dispositioned ☐ AFLC Form 75 Completed ☐ Test Compliance Matrix Approved	5C. CPCSB Approval: Chairman __________

CONTINUATION SHEET

DATE: 31 JAN 80

SECTION 3:

CHANGE PROCESS CHECKLIST
TEST COMPLIANCE MATRIX

SYSTEM

TEST				TEST PLANS			TEST PROCEDURES			TEST REPORTS			
REQ'D Y	REQ'D N	LEVEL	TYPE	DUE DATE	APPR. SIG.	DATE	DUE DATE	APPR. SIG.	DATE	DUE DATE	APPR. SIG.	DATE	NO. SPR's
☐	☐	1. MODULE	ISS										
☐	☐	2. INTEGRATION	ISS										
☐	☐	3. SIMULATION	ISS										
☐	☐	4. SYSTEM	ISS										
☐	☐	5. SYSTEM	EWOLS/ ECSAS										
☐	☐	6. SYSTEM	DEES										
☐	☐	7. FLIGHT	EGLIN										
☐	☐												

CONTINUATION SHEET DATE: 31 JAN 80

EMERGENCY/URGENT CHANGE PROCESS CHECKLIST INSTRUCTIONS

BLOCK 1: CHECK CORRECT PRIORITY.

BLOCK 2: ENTER DATE CHANGE REQUEST WAS RECEIVED.

BLOCK 3: A. ENTER SYSTEM NAME AND VERSION (IF APPLICABLE).
B. CHECK APPROPRIATE COMMAND.
C. ENTER CPCI NOMENCLATURE.

BLOCK 4: A. ENTER OLD CPIN NUMBER WITH DATE OF RELEASE.
B. ENTER NEW CPIN NUMBER WITH DATE OF RELEASE.

BLOCK 5: PRINT OR TYPE IN THE NAMES AND OFFICE SYMBOLS OF THE SCREENING PANEL MEMBERS (OR ALTERNATES).

BLOCK 6: PRINT OR TYPE IN THE NAME AND OFFICE SYMBOL OF THE UNIT AND SECTION CHIEF.

BLOCK 7: PRINT OR TYPE IN THE NAMES AND OFFICE SYMBOLS OF THE CPCSB MEMBERS (OR ALTERNATES).

BLOCK 8: CHECK EACH BLOCK AS ITEMS ARE COMPLETED. APPROVAL OF ALL CHECKED ITEMS IS INDICATED BY THE SIGNATURES OF THE EQUIPMENT SPECIALIST, LEAD ENGINEER, AND UNIT CHIEF.

BLOCK 9: CHECK APPROPRIATE BLOCK INDICATING THE CPCSB'S DECISION. THE CPCSB CHAIRMAN SIGNS AND DATES THE DECISION.

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BLOCK 11B.

AFTER CHECKING THE APPROPRIATE BOX IN 11A, THE SCREENING PANEL CHAIRMAN THEN SIGNS AND DATES. THE SAME APPLIES TO THE USER COMMAND REPRESENTATIVE.

BLOCK 12A.

BRIEFLY STATE WHY THE MDR OF SPR WAS HELD OVER OR DELETED.

PREDICTIVE SOFTWARE COST MODEL

EMERGENCY/URGENT CHANGE PROCESS CHECKLIST

CONTINUATION SHEET **DATE:** 31 JAN 80

1. PRIORITY: ☐ EMERGENCY ☐ URGENT	2. DATE RECEIVED:
3. A. SYSTEM ____________ VER ______ B. COMMAND: ☐ SAC ☐ TAC C. CPCI NOMENCLATURE:	4. CONFIGURATION MANAGEMENT USE ONLY A. OLD CPIN: DATE ______ B. NEW CPIN: DATE ______

5. SCREENING PANEL MEMBERS	NAME	OFFICE SYMBOL
EQUIPMENT SPECIALIST (CHAIRMAN)	________	______
LOG OFFICER	________	______
LEAD ENGINEER	________	______
ATE ENGINEER	________	______
(OTHERS)	________	______
6. A. UNIT CHIEF	________	______
B. SECTION CHIEF	________	______
7. COMPUTER PROGRAM CONFIGURATION SUB-BOARD MEMBERS (CPCSB)		
DIVISION CHIEF (CHAIRMAN)	________	______
SYSTEM ENGINEERING MANAGER	________	______
TECHNICAL SERVICES MANAGER	________	______
PRODUCTION MANAGER	________	______
LOGISTICS MANAGER	________	______
ATE SOFTWARE MANAGER	________	______
USER COMMAND REPRESENTATIVE	________	______

8. SCREENING PANEL APPROVAL ITEMS	APPROVAL SIGNATURES
☐ SCN'S FOR SPECIFICATIONS	
☐ SYSTEM SPECIFICATION REDLINES	EQUIPMENT SPECIALIST ________
☐ PART I SPECIFICATION REDLINES	LEAD ENGINEER ________
☐ PART II SPECIFICATION REDLINES	UNIT CHIEF ________
☐ TEST COMPLIANCE MATRIX	
☐ PCA/FCA REPORTS	
☐ ALFC FORM 75	

9. CPCSB DECISION: ☐ APPROVED ☐ DISAPPROVED

CPCSB CHAIRMAN: ____________ DATE: ______

CONTINUATION SHEET DATE: 31 JAN 80

CHANGE REQUEST INDEX INSTRUCTIONS

BLOCK 1

ENTER THE SYSTEM NAME; I.E., ALR-62 V 1, 2, 3

BLOCK 2

ENTER THE CPIN OF THE OFP TO BE ALTERED BY THESE CHANGES.

BLOCK 3

BLOCK ESTABLISHED DATE: ENTER THE SUBMISSION CUTOFF DATE OF THE PREVIOUS BLOCK CYCLE.
SUBMISSION CUTOFF DATE: ENTER THE DATE AFTER WHICH NO FURTHER CHANGE REQUESTS WILL BE ACCEPTED FOR THIS BLOCK CYCLE.

BLOCK 4

CHECK THE BOX (ONE ONLY) INDICATING THE PRIORITY OF THE CHANGES LISTED IN BLOCK 5. IF ROUTINE, THEN GIVE THE BLOCK CYCLE NUMBER.

BLOCK 5

LIST EACH CHANGE REQUEST. INDICATE WHETHER IT IS AN MDR OR SPR FOLLOWED BY THE ID NUMBER. (I.E., MDR Ø62 417 OR SPR 1ØØ6).

BLOCK 6

SAME AS BLOCK 1 (TITLE) ON THE MDR/SPR CHECKLIST. (BRIEF FUNCTIONAL DESCRIPTION).

BLOCK 7

INDICATE THE STATUS OF EACH CHANGE REQUEST (I.E., ACTION TAKEN BY CPCSB) AND THE DATE OF ACTION (I.E., CA/17 OCT 79).

NOTE: THE ABOVE INSTRUCTIONS FOR BLOCKS 5, 6, AND 7 APPLY TO THE CHANGE REQUEST CONTINUATION SHEET ALSO.

CONTINUATION SHEET

DATE: 31 JAN 80

CHANGE REQUEST INDEX

1. SYSTEM:	2. CPIN AFFECTED:	3. BLOCK ESTABLISHED DATE: SUBMISSION CUTOFF DATE:
4. PRIORITY: ☐ EMERGENCY ☐ URGENT ☐ ROUTINE BLOCK CYCLE NUMBER ________	CX = CPCSB DEFERRED CA = CPCSB ACCEPTANCE CD = CPCSB DISAPPROVAL XX = DEFERRED DURING CHANGE PROCESS	SA = SPR GENERATED/ACCEPTED IN BLOCK CYCLE SX = SPR GENERATED/DEFERRED IN BLOCK CYCLE

5. CHANGE REQUEST NUMBER	6. CHANGE REQUEST TITLE	7. STATUS/DATE (USE ABOVE CODES)
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		
11.		
12.		

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET DATE: 31 JAN 80

CHANGE REQUEST INDEX (CONTINUATION SHEET) SYSTEM ____

CHANGE REQUEST NUMBER	CHANGE REQUEST TITLE	STATUS/DATE

PCA REPORT INSTRUCTIONS

1: ENTER SYSTEM NAME, DATE OF PCA, SYSTEM (CURRENT) CPIN AND TITLE (CPIN NOMENCLATURE).

2: BLOCK 1. CHECK BLOCKS A, B, C, AND D AS EACH IS ACCOMPLISHED BY THE SCREENING PANEL.
BLOCK 2. CHECK BLOCK AS ITEM IS ACCOMPLISHED AND APPROVED BY THE SCREENING PANEL.
BLOCK 3. CHECK BLOCK AS ITEM IS ACCOMPLISHED.

3: APPROVAL SIGNATURES AS INDICATED.

PREDICTIVE SOFTWARE COST MODEL

PHYSICAL CONFIGURATION AUDIT (PCA) REPORT

CONTINUATION SHEET DATE: 31 JAN 80

SYSTEM ______________________ DATE ______________________

CPIN NO. ______________________ TITLE ______________________

1. PART II SPECIFICATION REVIEWED FOR FORMAT AND COMPLETENESS

   A. ☐ TOP LEVEL CPCI FLOW CHARTS AND COMPUTER PROGRAM COMPONENT (CPC) FLOW CHARTS REVIEWED FOR PROPER ENTRIES, SYMBOLS, AND LABELS.

   B. ☐ CPC FLOW CHARTS CONSISTENT WITH SOURCE CODED PROGRAM.

   C. ☐ COMPUTER LISTING IN PART II SPECIFICATION CHECKED WITH CURRENT LISTING MADE AT PCA.

   D. ☐ MDR'S, SPR'S, SCN'S, DCN'S TRACED TO CHANGES IN SPECIFICATIONS.

2. ☐ CHECKED MANUALS (USERS, PROGRAMMERS, ETC.) FOR PROPER ENTRY IF AFFECTED BY CHANGE.

3. ☐ VERIFIED THAT FCA REPORTED DISCREPANCIES ARE RESOLVED.

PCA CONDUCTED BY

EQUIPMENT SPECIALIST ______________________

LEAD ENGINEER ______________________

UNIT CHIEF ______________________

OTHER ______________________

REMARKS:

NOTE: ANY ITEMS NOT APPLICABLE, STATE N/A.

CONTINUATION SHEET DATE: 31 JAN 80

FCA REPORT INSTRUCTIONS

1: ENTER SYSTEM NAME.

2: ENTER PART I SPECIFICATION NUMBER.

3: ENTER THE PARAGRAPH NUMBER (I.E., 3.2.1) IN THE PART I SPECIFICATION OF INTEREST.

4: BRIEFLY STATE THE REQUIREMENT CALLED FOR IN THE PARAGRAPH.

5: BRIEFLY STATE HOW THE GIVEN REQUIREMENT WAS TESTED (I.E., ISS SIMULATION, EWOLS, ETC.).

6: BRIEFLY STATE ANY RESULTS (I.E., PASSED OR FAILED).

7: ENTER THE REPORT NUMBER IN WHICH THE TESTING IS DOCUMENTED.

8: SIGNATURE OF PERSON WHO COMPLETED THE FCA REPORT.

9: ENTER THE PART II SPECIFICATION NUMBER.

AD-A088 477 HUGHES AIRCRAFT CO CANOGA PARK CALIF F/G 14/1
PREDICTIVE SOFTWARE COST MODEL STUDY. VOLUME II. SOFTWARE PACKA--ETC(U)
JUN 80 R B WAINA, A P BANGS, E E RODRIGUEZ F33615-79-C-1734
UNCLASSIFIED AFWAL-TR-80-1056-VOL-2 NL

6 OF 6
AD A088477

END
DATE
FILMED
10-80
DTIC

FCA REPORT

SPECIFICATION COMPLIANCE MATRIX

SYSTEM________________

PART I SPEC NO.____________				
PARA. NO.	REQUIREMENT	METHOD OF VERIFICATION (TEST TYPE)	RESULTS/COMMENTS	DOCUMENT/REPORT NO.

COMPLETED BY________________ PART II SPEC NO.________________

CONTINUATION SHEET DATE: 31 JAN 80

INSTRUCTIONS FOR COMPLETING DOCUMENT CHANGE NOTICE (DCN)

ISSUE DATE: ENTER THE DATE THIS DCN WAS ISSUED.

DOCUMENT NO.: ENTER THE NUMBER OF THE DOCUMENT WHICH IS BEING CHANGED BY THIS DCN.

DOCUMENT: ENTER THE NAME OF THE DOCUMENT. (INCLUDE SYSTEM NAME.)

CPCI(S): ENTER THE CPCI'S OF THE SYSTEM AFFECTED BY THIS DCN.

ISSUED BY: ENTER THE NAME AND ORGANIZATION OF THE PERSON(S) ISSUING THE DCN.

APPROVED: ENTER THE LEAD ENGINEER APPROVAL SIGNATURE.

PAGE NO.: NUMBER OF THE PAGE ALTERED.

S: PAGE WAS SUPERCEDED (ENTER AN "X").

A: PAGE WAS ADDED (ENTER AN "X").

D: PAGE WAS DELETED (ENTER AN "X").

I.E.,

PAGE NO.	S	A	D	
11			X	(DELETED)
12	X			(SUPERCEDED)
13		X		(ADDED)

CONTINUATION SHEET

DATE: 31 JAN 80

ISSUE DATE:	DOCUMENT NO.

DOCUMENT CHANGE NOTICE

DOCUMENT:

CPCI(S):

ISSUED BY:	APPROVED:

PAGES SUPERSEDED, ADDED, AND DELETED WITH THIS MODIFICATION

PAGE NO.	S	A	D		PAGE NO.	S	A	D		PAGE NO.	S	A	D

CONTINUATION SHEET DATE: 31 JAN 80

INSTRUCTIONS FOR COMPLETING THE COMPUTER PROGRAM CLASS II CHANGE REPORT

ORIGINATOR: ENTER THE NAME OF THE ORGANIZATION WHICH ORIGINATED THIS REPORT.

DATE: ENTER THE DATE THIS REPORT WAS ORIGINATED.

SPEC NO./PART: ENTER THE SPECIFICATION NUMBER AND PART NUMBER (WHEN APPLICABLE) OF THE SPECIFICATION WHICH THIS CHANGE REPORT REFERS TO.

CR NO.: ENTER THE CHANGE REPORT NUMBER OF THIS REPORT. START WITH 1 AND NUMBER FOLLOWING CHANGE REPORTS SEQUENTIALLY.

REVISION: ENTER THE REVISION CODE (LETTER OR NUMBER) OF THE DOCUMENT THIS REPORT REFERS TO.

CPCI NOMENCLATURE: ENTER THE NOMENCLATURE OF THE CPCI REFERRED TO BY THIS REPORT.

TITLE OF CHANGE: ENTER A SHORT FUNCTIONAL DESCRIPTION OF THE CHANGE.

DESCRIPTION OF CHANGE: DESCRIBE IN DETAIL THE CLASS II CHANGE REQUESTED BY THIS REPORT.

JUSTIFICATION: DESCRIBE BRIEFLY YOUR JUSTIFICATION FOR REQUESTING THIS PARTICULAR CHANGE IN THE DOCUMENTATION.

RELEASED BY: ENTER THE NAME AND ORGANIZATIONAL SYMBOL OF THE PERSON RELEASING THIS REPORT. (USUALLY THE LEAD ENGINEER.)

AUTHOR: ENTER THE NAME AND ORGANIZATIONAL SYMBOL OF THE PERSON WHO INITIATED THIS REPORT.

CLASSIFICATION APPROVAL: ENTER THE SIGNATURE OF THE INDIVIDUAL WHO APPROVED THIS AS A CLASS II CHANGE. (USUALLY THE LEAD ENGINEER.)

DATE: ENTER THE DATE OF RELEASE OF THIS REPORT.

CONTINUATION SHEET DATE: 31 JAN 80

COMPUTER PROGRAM CLASS II CHANGE REPORT			
ORIGINATOR	DATE		
SPEC NO./PART	CR NO.	REV	CORR
CPCI NOMENCLATURE			
TITLE OF CHANGE			
DESCRIPTION OF CHANGE			
JUSTIFICATION			
RELEASED BY	AUTHOR		
CLASSIFICATION APPROVAL	DATE		

4. MOD DATA FORMS - SPECIAL INSTRUCTIONS

THIS SECTION DELINEATES ONLY THE DEVIATIONS FROM THE NORMAL INSTRUCTIONS FOR COMPLETING THE MODIFICATION DATA FORMS (PREPARED BY THE EQUIPMENT SPECIALIST) DUE TO A SOFTWARE CHANGE. THESE INSTRUCTIONS SHALL BE FOLLOWED WHEN A CHANGE PACKAGE CONSISTS OF:

1. A TCTO ONLY (TO CONVERSION TO CPIN)
2. TCTO AND MEDIA (TAPE) (SOFTWARE CHANGE)
3. TCTO AND KIT (PROM CHANGE)

4.1. AFLC FORM 873

PART I: HEADING INFORMATION. TECHNICAL ORDER (TO) AND DATA CODE NUMBERS WILL BE ASSIGNED, AND PROCESSED NORMALLY. RESCISSION DATA WILL NOT BE LESS THAN NINE MONTHS AFTER 'TO' ISSUE. (THE NINE MONTHS WILL BE THE NORM, EXCEPTIONS WILL OCCUR.)

PART II: COMPLIANCE INFORMATION. WHEN WORK WILL BE ACCOMPLISHED. 'AS DIRECTED BY USING ACTIVITY BUT NOT LATER THAN 00 DAYS AFTER RECEIPT OF TIME COMPLIANCE TECHNICAL ORDER (TCTO).' (MME WILL CHANGE EDITORIALLY FORMS NOT COMPLETED ACCORDINGLY.)

PART III: SUPPLY INFORMATION. AFLC FORM 874 IS NOT REQUIRED. (SOFTWARE CHANGE ONLY. NO HARDWARE INVOLVED.)

PART IV: KIT INSTALLATION TOOLS. NOT REQUIRED.

PART V: MAN-HOURS REQUIRED. TOTAL.

PART VI: WEIGHT AND BALANCE. N/A

PART VII: FORM ENTRY REQUIREMENT. AFTO FORM 349 REPORTING WILL BE REQUIRED. 'AN AFTO FORM 349 WILL BE SUBMITTED FOR EACH AFFECTED TEST TAPE (LISTED IN PARAGRAPH 1A OF TCTO) AFTER TCTO COMPLIANCE.' DUPLICATE COPIES OF TAPES LISTED IN PARAGRAPH 1A WILL BE REPORTED INDIVIDUALLY.

PART VIII: FUNCTIONAL CHECK. NOT REQUIRED.

PART IX: TECHNICAL ORDERS AFFECTED. COMPLETE AS REQUIRED.

PART X: KIT PROOF TESTING. NOT REQUIRED.

PART XI: MODIFICATION MARKING. NOT REQUIRED.

CONTINUATION SHEET DATE: 31 JAN 80

REMARKS: COMPLETE AS REQUIRED.

4.2. WR-ALC FORM 304

THIS FORM IS REQUIRED FOR SUBMISSION TO MMSK. A COPY OF THE AFLC FORM 873 MUST BE SUBMITTED WITH THE WR-ALC FORM 304 TO MMMSK. CAREFUL ATTENTION MUST BE GIVEN TO THE QUANTITY. YOU ARE REMINDED THE QUANTITY REFLECTED HERE WILL BE INPUT INTO THE D066 TO REFLECT STATUS OF COMPLIANCE. MMRP WILL BE RELYING ON THIS PRODUCT IN DETERMINING COMPLIANCE COMPLETION. MMEDT WILL UPON REQUEST PROVIDE INFORMATION THEY HAVE AVAILABLE TO ASSIST MMRR IN OBTAINING QUANTITIES TO BE INPUT.

4.3. AFTO FORM 82

NOT REQUIRED IN CONVERSION FROM COMPUTER TAPE (CT) TO CPIN OR FOR SOFTWARE CHANGES.

4.4. AFLC FORM 874

NOT REQUIRED IN CONVERSION FROM COMPUTER TAPE (CT) TO CPIN OR FOR SOFTWARE CHANGES.

4.5. AFLC FORM 252

COMPLETE AS CUSTOMARY WITH THE FOLLOWING EXCEPTIONS AND REMARKS:

- REMARKS BLOCK: INCLUDE PRIORITY AND THE STATEMENT 'RESULT OF TCTO----------.'
- SAFETY ENGINEERING GROUP (SEG) COORDINATION IS NOT REQUIRED (THIS ACTION WAS COORDINATED WITH SEG ON 20 JUNE 1979).
- CAREFUL ATTENTION MUST BE GIVEN TO THE STRUCTURE AND TYPING OF THE CPINS. THE ALIGNMENT IS IMPORTANT.
- IF THE 'TO' IS CLASSIFIED, INCLUDE THE STATEMENT: 'THIS IS AN UNCLASSIFIED CHANGE TO A CLASSIFIED TO' IF APPLICABLE.
- AN AFLC FORM 252 WILL BE REQUIRED FOR EVERY 'TO'

REFERENCED ON THE AFLC FORM 873.

- THE COMPUTER PROGRAM IDENTIFICATION NUMBER (CPIN) DATE WILL BE THE CPIN REQUEST DATE.

4.6. AFLC FORM 875

TIME COMPLIANCE TECHNICAL ORDER PROGRAMMING DOCUMENT:

THE HEADING IS COMPLETED NORMALLY BUT USE SAME COMMENTS AS USED ON AFLC FORM 873 IN WHEN TO BE ACCOMPLISHED BLOCK. MMRR WILL COMPLETE AS ROUTINE THROUGH COLUMN G. WHEN REQUIRED, MMRP WILL COMPLETE FROM COLUMN I. COLUMNS H AND K WILL BE USED FOR DATES FURNISHED BY MMEC/MMED.

SECTION 1A. MMRR WILL CHECK COLUMN D, MMRP WILL CHECK COLUMN I AND MMEDT WILL FURNISH DATE SCHEDULED FOR TCTO AVAILABILITY. THIS DATE WILL BE FURNISHED AT THE PRERELEASE REVIEW GROUP (PRRG) MEETING OR VIA TELEPHONE IF A PRRG MEETING IS NOT HELD.

SECTION 1F. SEG COORDINATION IS NOT REQUIRED ON A CONVERSION TCTO.

SECTION 2. COMPLETE AS REQUIRED. LINE E WILL REQUIRE A DATE FROM MMEC IF TAPE REPRODUCTION IS TO BE DONE BY MMEC.

SECTIONS 3, 4, 5, 6, 7, 8, AND 9 WILL BE ANNOTATED AS NOT APPLICABLE.

SECTION 10. THIS SECTION WILL BE COMPLETED AS APPLICABLE.

SECTIONS 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21, AND 22 WILL BE ANNOTATED AS NOT APPLICABLE.

SECTION 23:

LINE B. CROSS OUT AFLC FORM 874 AS IT IS NOT APPLICABLE. ACTIONS REQUIRED AND COMPLETED WILL PERTAIN ONLY TO THE AFLC FORM 873.

LINE C. TAPE OVER PRINTED SEGMENT IN COLUMN 'ITEM B'. TYPE IN 'MASTER TAPE OR MASTER MEDIA AVAILABLE'. IF MEDIA HAS BEEN FURNISHED PRIOR TO THE COMPLETION OF THE FORM, GIVE DATE AND ANNOTATE OFFICE TO WHICH TAPE WAS DELIVERED IN COLUMN H. IF A PART OF THE PACKAGE BEING PREPARED, SO ANNOTATE.

LINE D. TAPE OVER PRINTED SEGMENT IN COLUMNS 'ITEM B' AND 'REFERENCE C'. TYPE IN 'REPRODUCED CPIN MEDIA AVAILABLE'. IT IS NOT EXPECTED THAT IN MOST CASES THE REPRODUCED TAPE WILL BE

CONTINUATION SHEET DATE: 31 JAN 80

AVAILABLE AT THE TIME OF THE COMPLETION OF THE AFLC FORM 875. HOWEVER, MMEC WILL FURNISH A DATE FOR COLUMN H AT THE PRRG MEET OR VIA TELEPHONE. ON A CONVERSION CHECK N/A. MMRP WILL RETAIN RESPONSIBILITY FOR CONCURRENCY RELEASE. ACCORDINGLY, MMED AND MMEC WILL OBTAIN MMRP COORDINATION PRIOR TO THE RELEASE OF TCTO/MANUAL CHANGES AND CPIN MEDIA.

FLIGHT MANUAL COORDINATION

MMSRD (FLIGHT MANUAL) COORDINATION IS NOT REQUIRED. (THIS WAS COORDINATED WITH MMSRD ON 20 JUNE 1979.

4.7. DRAFTING OF THE TCTO:

RESCISSION DATE: NINE MONTHS WILL BE USED AS A STANDARD (EXCEPTIONS WILL OCCUR).

WHEN TO BE ACCOMPLISHED: 'AS DIRECTED BY USING ACTIVITY BUT NOT LATER THAN 90 DAYS AFTER RECEIPT OF THIS TECHNICAL ORDER.'

HOW WORK IS ACCOMPLISHED: THE FORMAT TO BE PLACED ON LABELS IS CRITICAL DUE TO THE LIMITED SPACE ON A LABEL (FIVE LINES ARE REQUIRED, NO MORE CAN BE USED). DISPLAY INFORMATION AS FOLLOWS:

CPIN: DTD (ONLY 33 SPACES AVAILABLE)
P/N: (ONLY 23 SPACES AVAILABLE)
NOUN: (35 SPACES AVAILABLE)
RELATED MANUAL: (20 SPACES)
REPLACES: (COMPUTER TAPE (CT) AND DATE - 37 SPACES AVAILABLE)

(LINE TITLE COUNT IS NOT INCLUDED IN AVAILABLE SPACE ACCOUNT. CAREFUL PROOFREADING IS NECESSARY.)

RECORDS:

'ACTION REQUIRED ON MAINTENANCE RECORDS. AN AFTO FORM 349 WILL BE SUBMITTED FOR EACH AFFECTED COMPUTER TEST TAPE LISTED IN PARAGRAPH 1A AFTER ACCOMPLISHMENT OF THIS TECHNICAL ORDER. DUPLICATE COPIES OF TAPES LISTED IN PARAGRAPH 1A WILL BE REPORTED INDIVIDUALLY.'

PERSONNEL DESCRIPTION DATE: 31 JAN 80

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

The usual GS-855 electronic engineer is used in supporting EW software. In addition, MMRR uses GS-1550 computer scientists. Below is the position discription for a GS-1550-12.

POSITION DESCRIPTION FOR
COMPUTER SCIENTIST,
GS-1550-12

Introduction

The purpose of this position is to serve as a Computer Scientist to perform professional research and development projects in support of reprogrammable, computer controlled Electronic Warfare Avionics systems and related support equipment and software for which Warner Robins ALC is prime.

Duties and Responsibilities

1. Incumbent develops, coordinates and carries through to completion computer science projects and tasks of large scope containing several complex features. Conducts professional research and development work to evolve new methods and techniques to store, manipulate, transform, or present information by means of digital computers. Develops or originates completely new features, in addition to improving, extending, or validating currently known precedents, data, methods or techniques. In accomplishing the above, the incumbent is responsible for development of new or improved computer methods, techniques, principles, or concepts.

2. Serves as a professional computer scientist performing research and development. Assures integrity and compatibility of the development with program managers, system project managers, and other user elements as required. Plans and schedules all assigned professional computer science development projects and tasks, including investigation, analysis, design, coding, debugging, testing, evaluation, integration, documentation, and implementation. Prepares requirements documents, design specifications, test procedures, implementation specifications and software documentation. Maintains configuration control during development and coordinates or performs the update of all documentation.

3. Incumbent must be proficient in the programming of computers at the machine and/or assembly language level, as well as use of higher level languages. Due to the complex interface between the software and hardware of computer controlled systems, this programming is accomplished utilizing knowledge of hardware operations and limitations created by hardware design. Works closely with hardware oriented systems/project engineer to insure a unified solution to problems is accomplished in the most effective manner.

4. Conducts research in computational complexity, analyzes algorithms for data structures that lead to highly efficient combinational power of different computer models. Develops advanced concepts of automation information processing developing, control and transfer.

CONTINUATION SHEET DATE: 31 JAN 80

5. Incumbent is responsible for advanced or exploratory development work wherein digital computers are employed in support of data acquisition/reduction, record keeping, real-time control/monitoring, modeling and simulation, and resource allocation. Scope of assigned task or project effort is broad in that all tasks or projects consider, as applicable, the support resources, host computers, systems interfaces, support software interfaces, specialized operating system configurations, documentation, and validation/verification.

6. Prepares contractual proposals and associated specifications and work orders. Monitors and maintains close liaison between contractor and Air Force activities associated with support of contracts involving development of new and improved concepts, principles, and techniques that advance the body of knowledge associated with digital computers. Reviews, evaluates and advises on the effectiveness, technical adequacy and suitability of work and proposals of lower grade personnel related to such development. Evaluates vendor proposals for requirements, feasibility, completeness, accuracy, cost and operational and logistics impact.

7. Scope of personal contacts is broad as the incumbent consults with IM, SM, Procurement, Shop, Contractor, and operating command personnel.

8. Performs other related duties as assigned.

Controls Over Work

1. Works under general supervision. Assignments are given by Section/Unit Chief or higher grade engineer or Computer Scientist with instructions as to the purpose of the work and possible complex features. The feasible approach and solution are the responsibility of the incumbent.

2. Little guidance is given except on cases of controversial complex features and policy.

3. Completed work is reviewed for overall technical adequacy and conformance with the objectives of the assignment. When there is serious consequence of error, a complete independent check may be made of programs, drawings, computations, etc.

Other Significant Facts

1. Position requires that incumbent participate in flight test as assigned.

2. Incumbent is subject to TDY in CONUS or overseas for periods up to several weeks. Specialized training may necessitate TDY or PCS for up to one year at other government or contractor's plants.

3. Military aircraft will be used, when available, to perform TDY. Commercial aircraft or other modes of transportation will be used when military aircraft is not available.

4. Fields of engineering: Electronic - 25 percent, Electrical - 5 percent, Computer Science/Programming - 70 percent.

CONTINUATION SHEET DATE: 31 JAN 80

5. Specializations required include: Bachelor's degree in computer science, engineering, physics, mathematics, or other technical area and experience in program development and testing, computer technology, programming languages, simulation modeling, operating systems, data structures, input/output compilers/assemblers, integration of computer controlled hardware and software, software documentation, and configuration management.

6. Subject to call during off-duty hours and an occasional requirement for weekend and holiday work.

SOFTWARE PACKAGE CHARACTERISTICS - FACILITIES (Cont) DATE: 31 JAN 80

COMPUTER FACILITIES (Type, Quantity, Application, Cost & Usage)

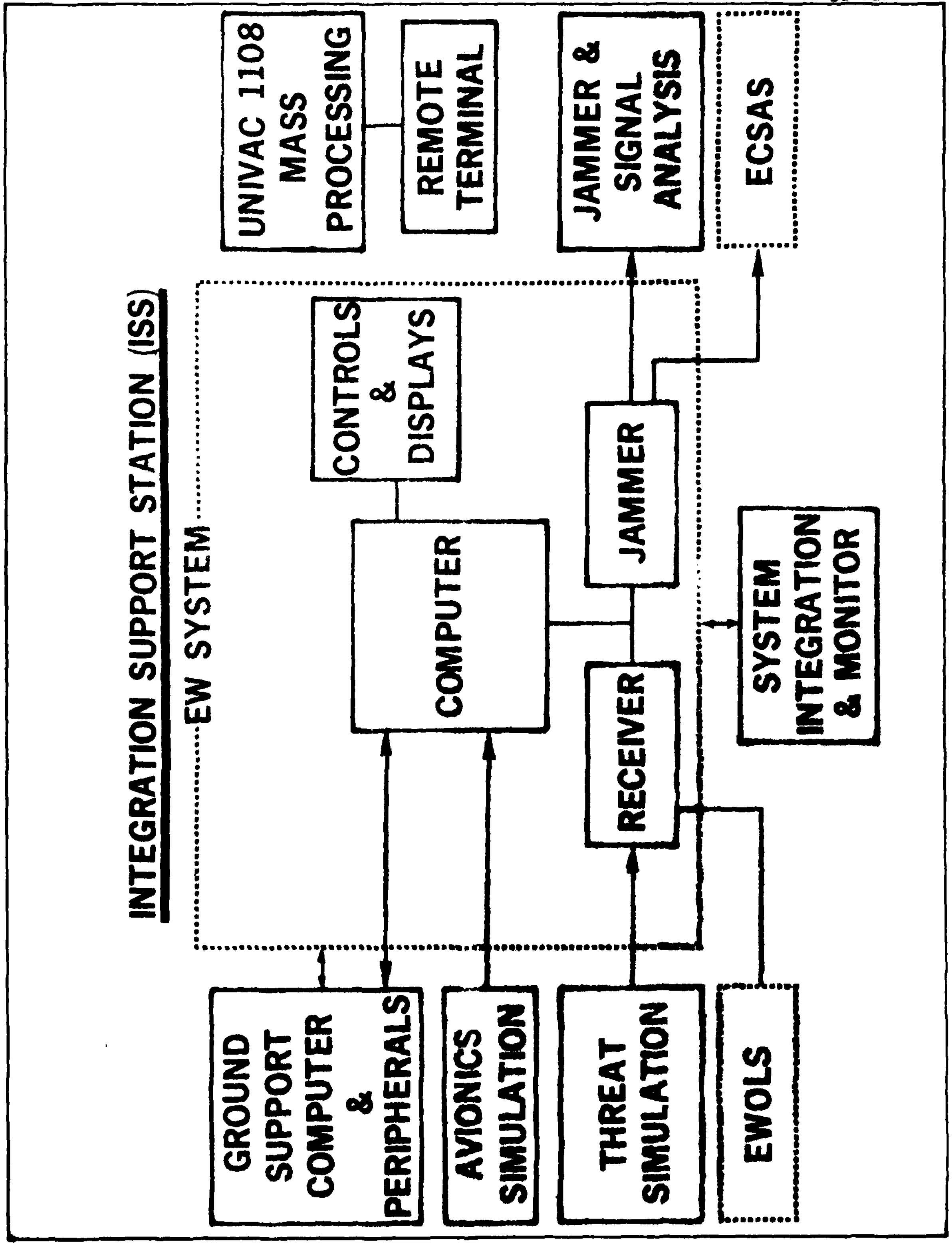
A typical Electronic Warfare Integration Support System (ISS) is diagrammed on page G-58.

For each software-controlled EW system there will be a Resources Acquisition Management Plan (RAMP). Its contents are detailed below.

RESOURCES ACQUISITION MANAGEMENT PLAN
TABLE OF CONTENTS

TABLE OF CONTENTS (Continued)

CONTINUATION SHEET DATE: 31 Jan 80



SOFTWARE PACKAGE CHARACTERISTICS - SUPPORT SOFTWARE DATE: 31 JAN 80

Below is a list of support software programs used on the F-15 TEWS.

SEQUENTIAL ORDER OF PLACEMENT AND FUNCTION

MAIN VERSION: V-EX-001-A	This program initializes the TEWS TT2520 assembler on the datacraft slash four computer.
TLIBRARY	This program provides all of the functions required to utilize and maintain the F15 TEWS library.
MAIN VERSION: V-EX-001	This program initiates then completes Link/Load function.
TLIST	This program updates the org and instruction addresses of a preassembled and linked TI-2510 program.
TPUNCH	This program punches tape with the contents of pseudomemory.
TVERIFY	This program compares the contents of pseudo-memory with a punched tape.
TRUN	This program clears the test central interface and clock and starts the TI computer.

SOFTWARE PACKAGE CHARACTERISTICS –
FLIGHT TEST REQUIREMENTS

DATE: 31 JAN 80

The amount of flight test is a function of the kind of change. Most of the V and V testing is done on a simulator in the lab.

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 31 JAN 80

PROGRAMMER TRAINING:

GENERIC TRAINING REQUIREMENTS FOR REPROGRAMMABLE EW SYSTEMS

1. Introduction

   a. EW System Theory of Operation

   b. Integrated Support Station (ISS) System Theory of Operation

2. Airborne EW System

   a. EW System Programming Language(s)

   b. EW System Software Theory: In-depth study of the System Operation Flight Program.

   c. EW System Operator's Course: Required for large power management systems when the ISS contains a system hot-mockup

   d. EW System Maintenance (Hardware): To include trouble-shooting/repair of the reprogrammable EW system and all interfaces

3. Integrated Support Station (ISS)

   a. ISS Programming Language(s)

   b. ISS Software Theory: Familiarization with system unique support software used on the ISS, to include de-bug programs and simulators. In-depth study of compilers, assemblers, operating systems, and utilities not normally required, but may be needed for particular systems.

   c. ISS Operator's Course

   d. ISS Maintenance (hardware): To include total ISS system trouble-shooting/repair.

4. Automatic Test Equipment (ATE) (Organization, Intermediate, Depot)

   a. ATE Programming

   b. ATE Operator's Course

   c. ATE Theory of Operation

   d. Test Software Theory of Operation

5. General Training Requirements for Reprogrammable EW System Engineers and Technicians. Designed to bring engineers and technicians with no (or little) previous EW/ECM/ECCM experience to an acceptably productive level.

CONTINUATION SHEET DATE: 31 JAN 80

a. Principles of Radar: Analysis of radar principles designed to familiarize personnel with radar principles, modulation techniques and radar pulse signatures, which will improve efficiency in the capabilities of engineers to recognize the techniques required to counter these threats.

b. Principles of EW/ECM/ECCM: Designed to provide personnel with a general overview of the concepts and principles of electronic warfare and its functional parameters.

c. Jammer Techniques: A detailed study of the jammer and its role in the EW scenario, specifically its interface into a power management system.

d. Radar Warning Receivers: A detailed study of radar warning receivers, their functional role and interface with power management systems.

e. Threat Radar Updatas (Periodic): Designed to provide EW engineers with a periodic review of existing and projected threat radars and their signatures.

f. Software Configuration Control/Management: Designed to educate personnel in the support, control and documentation of software within the EW Management Division.

g. Software Validation and Verification (V&V): To acquaint personnel with the computer program (software) V&V process and its relationship to the computer program life cycle.

HISTORICAL DATA SOURCES DATE: 31 JAN 80

Data Base		Electronic Warfare Systems
Location		WR-ALC/MMRR, Robins AFB, Georgia
Contact Person		Bobby McDonald
Phone Number		(912) 926-2204/5780
General Contents	-	The ALR-46 and its derivatives have been in the field 5 to 6 years. Data is available in the project log files. The ALR-62 and ALQ-131 are newly fielded.
Data Quality	-	Manhours to task level. Requires manual search and summarization.

PREDICTIVE SOFTWARE COST MODEL

RECOMMENDATIONS RE SOFTWARE SUPPORT COST PREDICTING DATE: 31 JAN 80

RESPONDENT: Bobby McDonald

- Need to know system type, complexity, accuracy requirements. From this you can make a manpower estimate.
- The AISF estimate depends on the S/W tools, diagnostic tools and degree of automation involved.
- Need to know the S/W structure. In particular are operational parameters spread throughout the program or tabled?
- How maintainable is the EW software?

APPENDIX H

ATE/SAALC DETAILED DATA

PREDICTIVE SOFTWARE COST MODEL
FIELD EVALUATION REPORT

GENERAL SOFTWARE PACKAGE DESCRIPTION — DATE: 15 Feb. '80

ALC: SA	WEAPON SYSTEM: ATE
SOFTWARE PACKAGE: Not Applicable (N/A)	

PERSONNEL CONTACTED:

Roy Wimpee, MMMMD
Jim Lincoln, MMIR
Bob Smallwood, MMIR
Cecil Smith, MMIMP
John Ferrell, MMIMP
Bob Clay, MMIRAB
Harry Cogburn, MMEC
Rod Staggs, MMIC
Jim Sides, MATT

SOFTWARE PACKAGE CHARACTERISTICS:

SIZE: N/A

LANGUAGE:

APPLICATION:

COMPLEXITY:

YEAR DEVELOPED:

DEVELOPER:

COMMENTS

HOST (AIRBORNE) COMPUTER CHARACTERISTICS:

MANUFACTURER: N/A

MODEL NUMBER/DESIGNATOR:

WORD SIZE:

MEMORY SIZE:

MEMORY FILL:

WEAPON SYSTEM USE:

NUMBER OF USERS: N/A

LOCATIONS OF USERS:

FREQUENCY OF USE:

INTERVIEWER(S): R. B. Waina, G. L. Foreman

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY PERSONNEL

DATE: 15 Feb. 1980

ALC: WR	OFFICE SYMBOL: N/A

KEY PERSONNEL/OGRANIZATION:

TOTAL ASSIGNED PERSONNEL (NUMBER & TYPE):

MMECA has 24 personnel overseeing avionics and ATE. MMIR and MMIM have a requirement (FY'80) of 28 (breakout by system on page H-3)

TOTAL PACKAGES MAINTAINED (NUMBER & TYPE):

Of about 400-500 ATE systems, 20-30 are most active with respect to software.

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET DATE: 15 Feb. 1980

FY'80 manpower requirement by system is as follows:

System	Manpower Req.t. (MMIM and MMIR)
A-7D	0.46
A 10A	1.34
B-52	2.02
FB-111	0.60
C-5	0.57
C 130	0.55
C-135	0.45
C-141	0.46
E-3A	2.08
E-4	0.70
F-4	1.26
F-5	3.45
F-15	0.93
F-16	2.78
F-101	0.45
F-105	0.45
F-106	0.53
F-111	0.91
T-38	0.45
T-43	0.45
T-45	0.45
AGM-28	0.45
AGM-65	C.00
AGM-69A	0.80
LGM-30	0.45
Avionics*	2.06
Communications*	0.41
Missile Systems*	1.42
Simulators	0.08
Miscellaneous	0.90
TOTAL	27.91

*Multiple Weapon System Applications

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - WORK DISTRIBUTION DATE: 15 Feb. 1980

DESCRIPTION OF WORK PACKAGE DISTRIBUTION, INCLUDING RESPONSIBILITIES AND DEGREE OF SPECIALIZATION OF AF/CS/CONTR PERSONNEL

30% of the MMEC work is done by contractors, 55% is done by MATT, and 15% by MMEC.

CONTINUATION SHEET DATE: 15 Feb.1980

NOTE: Much UUT (unit-under-test) software is controlled by WR ALC. WR-ALC/MMECT has 29 personnel overseeing approximately 2000 CPINs. MMECT determines the need for software changes, develops the functional specifications and does V&V. MZxx does the actual coding.

MAINTENANCE AGENCY - COST ACCOUNTING SYSTEM DATE: 15 Feb. 1980

Very diverse.

WR-ALC/MMECT has several ways of recording manhours. Log books, Work Authorizations to Item Managers, and Project Folders (Form 138). No data are available in machine-processable format.

MAINTENANCE AGENCY - POLICIES & PROCEDURES DATE: 15 Feb. 1980

SUPPORT PHILOSOPHY:

Changes to ATE software programs and/or documentation can be grouped into two classifications, each requiring different processing and review procedures depending on the impact of the changes. Changes may be required for different reasons, such as problems identified in the field, testing conducted at a support facility, new mission requirements, and engineering modifications. CPCI changes are classified IAW Appendix XIV of MIL-STD-483 (USAF) as Class I (design) and Class II (discrepancy).

a. Class I Software Changes. Those changes not affecting system equipment may originate as a problem or as an engineering or mission requirement. Each change must be examined to determine any impact upon equipment or other computer programs. When the change affects equipment or exceeds the existing organic capability, AFR 57-4 procedures apply.

b. Class II software changes. Those changes not affecting system equipment result from a discrepancy and are not design or equipment problems, but may be changes to the CPCI or associated documentation.

CHANGE CONTROL METHODS:

FORMAL OR INFORMAL: Semi-Formal

CHANGE REVIEW PROCESS: See pages H-8 and H-9.

CONFIGURATION IDENTIFICATION METHODS: - CPIN

Off-line S/W controlled by Version Descr. Document n/s.

CONFIGURATION CHANGE CONTROL METHODS:

See pages H-8 and H-9.

CONFIGURATION STATUS ACCOUNTING METHODS:
AFCR system at OC-ALC - Controlled by T)'s

SOFTWARE LIBRARY CONTROL PROCEDURES:

Just being established

CONTINUATION SHEET DATE: 15 Feb. 1980

Configuration Control Board (CCB). After PMRT the SA-ALC/MM CCB is the configuration change control authority. It has the responsibility for all changes to the ATE system and its configuration items. Its members should be representatives of all involved agencies and system functional areas such as configuration management, engineering, programming, system analysis, test procurement, financial control, training, and logistics support. The board will assure that all system impacts of CPCI changes including those that affect equipment or other computer programs have been evaluated, changes to system documentation have been identified and the resources have been identified to implement the change.

Computer Program Configuration Sub-Board (CPCSB). The CPCSB functions as a subordinate element of the CCB and will be designated for CPCI change processing. CPCI here refers to all computer programs, whether the program is identified with a TO number or with a Computer Program Identification Number (CPIN). For computer program changes AFLC Form 75, CPCSB Item Record, will be used. If hardware is affected as well, the Form 75 will be used as an attachment to AFLC Form 48, CCB Item Record.

a. The ATE CPCSB will review and approve all CPCI I changes that do not affect system equipment, as follows:

(1) Verify class of program change involved.
(2) Perform system/equipment impact evaluation.
(3) Recommend action on change.
(4) Forward action copy to the CCB when the change involves hardware.
(5) CPIN will be used as the modification number.

b. The CPCSB will review and approve all Class II changes. When appropriate, considering the complexity of the system, the board may act upon Class II changes or handle these changes by means of a screening function.

c. ATE Computer Program (CP) change requirements (Class I or Class II) resulting from or causing system.equipment modifications will be documented on AFLC Form 75, processed through the CPCSB and appended to the AFLC Form 48 (Class IV modification) or AFSC/AFLC Form 44 (Class V modification). Total CP costs will be identified in block 12.f of the AFLC Form 48 for Class IV modifications and block 20 of the AFLC/AFSC Form 44 for Class V modifications. The budget project column on these forms will, in all cases, be annotated with the appropriate fund cite, as an example, EEIC 583. These forms will be processed through the CCB according to standard procedures.

d. ATE CP only changes will be processed as organic change proposals (OCP) when accomplished organically. CP only changes will be processed as ECPs when accomplished contractually. All CP only changes will be documented on AFLC Form 75, CPCSB Item Record, and processed through the ATE CPCSB for final approval if costs are within allocated funds. Class IV/V modification numbers will not be assigned to CP only changes, and these changes will be excluded from the G079 system. The ATE CPCSB is designated as the final approval authority for CP only changes which can be implemented within allocated resources, and in the opinion of the CpCSB, do not require CCB approval.

Specific Division/Branch Responsibilities. The major functional responsibilities of the various divisions/branches concerning software configuration are described below IAW AFLCR 23-43.

a. MMI will exercise ALC surveillance of ATE software support activities and assure coordination with all agencies involved in hardware, software, and data modifications/changes of associated ATE systems.

b. MMIM will analyze planning and programming documents and data to assure adequate logistics coverage. Also provide managers to administer, coordinate, and control the management of ATE software.

c. MMIR has responsibility for full range engineering and technical integration of ATE equipment and software to assure design performance and compatibility, and that all ATE CP deficiency reports are processed and controlled.

d. MME will provide engineering management and develop engineering design changes for ATE ECS programs. Plan and program for the capability to organically support system software.

e. MMEC will maintain a computer program distribution program to assure that material is issued and that all computer programs are properly numbered.

f. MMEC will identify minimum essential weapon system computer resources documentation requirements for operational support. Conduct or participate in verification and validation of assigned ECS programs. Evaluate and define the cause of software deficiencies related to ATE. Determine and recommend changes required to correct those deficiencies. Maintain files and issue computer programs and documentation. Evaluate contractor-prepared ECPs for computer programs and documentation and apply cost effectiveness criteria. It is also the final engineering approval authority for ECS integral to the ATE system, processes AFLC Form 925, CPIN request, to obtain CPINs from OC-ALC/MMEDUD, and reproduces computer programs for distribution.

g. MMED will assemble and initiate reproduction of manuals by the Government Printing Office (GPO).

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 15 Feb. 1980

STRUCTURED DESIGN? – DESCRIBE NO
STRUCTURED PROGRAMMING? – DESCRIBE NO
CODING GUIDELINES: NONE - Function of available documentation
CHANGE ENTRY METHODS: Function of System - 1) CRT Key-in 2) Punchcard → punchtape 3) resident compiler on ATE
SCHEDULE: Formal, established by MIPS
REPORTING: MIPS
COMMENTS:

PREDICTIVE SOFTWARE COST MODEL

MAINTENANCE AGENCY - POLICIES & PROCEDURES (Cont) DATE: 15 Feb. 1980

DOCUMENTATION:

Applicable documents are listed on pages H-12 and H-13.

REQUIREMENTS:

DESIGN:

USER:

PROGRAM PROBLEM REPORTING SYSTEM:

MIPs

COMMENTS:

CONTINUATION SHEET DATE: 15 Feb. 1980

APPLICABLE DOCUMENTS

AFR 800-14	
Volume I	Management of Computer Resources in Systems
Volume II	Acquisition and Support Procedures for Computer Resources in Systems
AFR 800-2	Program Management
AFR 800-4	Transfer of Program Management Responsibilities
AFR 800-19	Acquisition Management - System/Equipment Turnover
AFR 50-9	Special Training
AFR 65-3	Configuration Management
AFR 66-30	Product Improvement Program
AFR 74-6	Quality Assurance Program for Space, Weapon, Support, and Command and Control System/Equipment
AFR 80-14	Test and Evaluation
AFM 50-5	Administration of Formal School Training
AFR 205-4	AF Participation in DOD Industrial Security Program
AFR 205-1	Information Security Program
DOD 5200.1-R	Information Security Program Regulation
AFLCR 23-43	Organization and Mission Field
AFLCR 57-21	Modification Program Approval
AFLCR 66-15	Designating/Redesignating Electronics Equipment
AFLCR 66-27	Automated Support of Numerical Control and Automatic Test Equipment Software
AFLCR 66-37	Management of Automated Test Systems
AFLCM 172-1	Budget, Budget Operations
T.O. 00-5-1	Technical Order System
T.O. 00-5-15	AF Time Compliance Technical Order System
T.O. 00-25-115	AFLC Maintenance Engineering Management
T.O. 00-20-4	Configuration Management System
T.O. 00-35D-54	USAF Material Deficiency Reporting System

CONTINUATION SHEET DATE: 15 Feb. 1980

MIL-STD-480	Configuration Control, Engineering Changes, Deviations and Waiver
MIL-STD-482	Configuration Status Accounting, Data Elements and Related Test Features.
MIL-STD-483	Configuration Management Practices for Systems, Equipment and Computer Programs
MIL-STD-1521	Technical Reviews and Audits for Systems, Equipment and Computer Programs
MMOI 66-29	Configuration Control Board Class IV/V Mods
MMOI 66-39	Material Improvement Projects

PERSONNEL DESCRIPTION

DATE: 15 Feb. 1980

DESCRIPTION OF SKILL LEVEL AND TYPE (AF/CS/CONT) OF PERSONNEL MAINTAINING THIS PACKAGE

The basic skill is the GS-855/11 or /12 electronic engineer (embedded computer systems).

PREDICTIVE SOFTWARE COST MODEL

SOFTWARE PACKAGE CHARACTERISTICS - TRAINING REQUIREMENTS DATE: 15 Feb. 1980

PROGRAMMER TRAINING:

MATT spends about $20,000/yr. on electronic ATE training for a staff of 40-50 people.

Specific courses are listed on page H-16.

USER TRAINING:

PREDICTIVE SOFTWARE COST MODEL

CONTINUATION SHEET TRAINING REQUIREMENTS - MATT DATE: 15 Feb. 1980

	COURSE	LENGTH
1.	MCS-48 System Workshop	40
2.	Interfacing Microprocessors	24
3.	NOVA Assembly Language Programming	80
4.	PDP-11 Assembly Language	40
5.	Introduction to Minicomputers	40
6.	RTM Operating System Course #133 and #135	80
7.	Bendix Model 320 Programming	80
8.	AAI 5565 Applications and Programming	120
9.	Gen Rad Corp. ATE Programming	40
10.	Gen Rad Corp Simulation Command Language	40
11.	Gen Rad Atlas Translator	40
12.	Hewlett-Packard HP9845 Programming Course	40
13.	Assertive Management	24
14.	Introduction to Microcomputers (Includes SDK-85 Kit)	32

PREDICTIVE SOFTWARE COST MODEL

HISTORICAL DATA SOURCES DATE: 15 Feb. 1980

Possible sources on ATF software support data at SA-ALC include AFLC Form 75's and minutes of the CPCSB meetings. Initial contact would be Roy Wimpee, MMMP.

Possible data sources at WR-ALC/MMECT are discussed on page F-6. Primary contact would be Don Purvis.

*U.S.Government Printing Office: 1980 — 657-084/12

DATE

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