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SOFTWARE CONVERSION HISTORY OF THE FLIGHT DYNAMICS SYSTEM (FDS)

Prepared for
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Goddard Space Flight Center
Greenbelt, Maryland

CONTRACT NAS 5-27888
Task Assignment 43000

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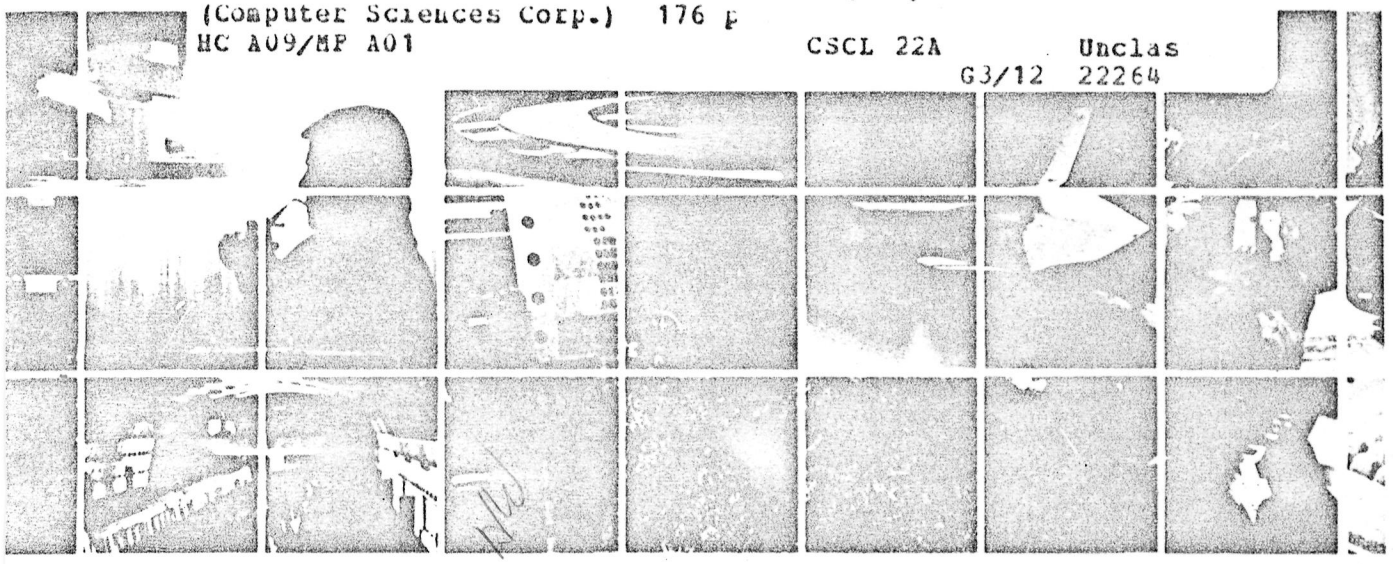

CSC
COMPUTER SCIENCES CORPORATION

N84-32404 #

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SOFTWARE CONVERSION HISTORY OF THE FLIGHT DYNAMICS SYSTEM (FDS)

Prepared for

GODDARD SPACE FLIGHT CENTER

By

COMPUTER SCIENCES CORPORATION

Under

Contract NAS 5-27888
Task Assignment 43000

Prepared by:

K. Liu 6/28/84
Date

G. Page
D. S. Green
E. C. Edwards (GSFC)
F. E. McGarry (GSFC)

Approved by:

C. B. Spence 6/28/84
C. B. Spence Date
Technical Supervisor

M. Plett 6/28/84
M. E. Plett Date
Project Manager

ABSTRACT

This report summarizes the overall history of the Flight Dynamics System (FDS) applications software conversion project. It describes the background and nature of the project; traces the actual course of conversion; assesses the process, product, and personnel involved; and offers suggestions for future projects. It also contains lists of pertinent reference material and examples of supporting data.

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TABLE OF CONTENTS

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TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

LIST OF ILLUSTRATIONS

LIST OF ILLUSTRATIONS (Cont'd)

Figure

LIST OF TABLES

Table

LIST OF TABLES (Cont'd)

SECTION 1 - INTRODUCTION

1.1 PURPOSE

This report summarizes the conversion history of the Flight Dynamics System (FDS) applications software from the IBM S/360 to the IBM 4341 computers. It evaluates the technical and managerial aspects of the FDS applications software conversion effort from a software engineering point of view. The report is intended to allow development managers to become familiar with both successful and unsuccessful practices and to provide them with a basis for improving the development process and product.

Sections 2 and 5 provide the highest level of detail, that is, the overall picture for higher level managers. Sections 3 and 5 and the appendixes provide the lowest level of detail; they include information that technical managers can use to improve or plan other software engineering projects. The conversion history was written by managers for managers.

Since most managers and some senior technical personnel contribute to a project's assessment, various interpretations of the same facet of the project can occur. Practical experience shows that most technical personnel and many technical managers have or take a parochial view of a project. For example, an incident that may have strongly impressed a person as a disaster and may have created lasting, vivid memories may represent only a fraction of a percent of the total effort and/or only a few days of the lifetime of the project. Furthermore, the senior-level managers do not always totally agree on the assessment of every aspect of a project. However, because the senior-level managers have the broadest background and experience, they weigh all input supplied and mutually determine a balanced presentation

of information from which various-level technical and administrative managers can learn the most about successful and unsuccessful practices. Therefore, users of this material must be aware that various levels of detail with different weights are presented.

The FDS applications software conversion project was one of the most successful projects in flight dynamics history, i.e., it was planned and managed well, it was highly visible and predictable, every phase was completed ahead of schedule and within budget, and it cost less than expected. However, valuable lessons can still be learned from the project by isolating deficiencies and areas for improvement.

1.2 REPORT ORGANIZATION

This report consists of six sections and three appendixes. Sections 2 and 5 contain the overview and summary, respectively; Sections 2.1 and 5.1 contain the executive portions. The information contained in each section is as follows:

- Section 2--Project Background and Description. Describes the origin of the requirements, the software problem and key requirements, the conversion organization, the purpose of the hardware/software system, key dates and products, and the characteristics of the software system.

- Section 3--Conversion History. Includes estimates of software size, required effort, schedule, and cost; organizational structure and key personnel; specified and unique conversion approaches; computing hardware and programming languages; special problems; and causes of major software changes.

- Section 4--Project Assessment. Assesses the strengths and weaknesses of the conversion process and product and the personnel who supported conversion. It also describes problem areas; the timeliness and usefulness of

conversion plans; adherence to standards; and the timeliness, completeness, and quality of the intermediate and final products.

- Section 5--Lessons Learned. In an executive summary, lists the key strengths and weaknesses of the requirements, conversion process, environment, product, and personnel involved; addresses topics that should be approached similarly and differently for future projects; and discusses major causes of errors and changes. A technical management summary brings together the objective and subjective assessments made throughout this report.

- Section 6--Reference Material. Contains lists of relevant background documents, project-produced documents, and other pertinent reference materials.

- Appendix A--Conversion Data. Consists of tables and graphs of conversion rate and resource usage data.

- Appendix B--Conversion Approach. Contains detailed explanation of the conversion process.

- Appendix C--List of Programs Converted. Contains list of the programs that were converted and some relevant information about each program.

SECTION 2 - PROJECT BACKGROUND AND DESCRIPTION

This section describes the origin of the requirements, the problem and key requirements, the conversion organization, the purpose of the work, the key dates and products, and software characteristics.

2.1 PROJECT BACKGROUND

2.1.1 OVERVIEW

The basic requirement for the FDS applications software conversion project was to rehost identified flight dynamics support software and its required data from the IBM S/360-95 (OS/MVT) computing environment to an IBM 4341 (OS/MVS) computing environment.

Flight dynamics software includes applications to support attitude determination, attitude control, maneuver planning, orbit adjustment, and general mission analysis. The applications developed in the flight dynamics area are mostly scientific and mathematical in nature, with moderate reliability requirements. Within the flight dynamics area, computers are shared among the analysis, software development, and operations areas.

The IBM S/360-95 had been in operation for nearly 15 years and had decayed severely. The IBM S/360-95 was unstable (frequent and extended downtime), was unreliable (6- to 8-hour mean time to failure with frequent disk storage failures), had limited access (insufficient number of alphanumeric terminals and high-resolution graphic devices), and had severely limited online direct-access storage. The new IBM 4341 computing environment was intended to significantly improve computer resource support for flight dynamics analytical, developmental, and operational activities.

The groundwork for the conversion effort was laid in the summer of 1980. GSFC Code 580 personnel identified programs and their required data and documentation in preparation for the FDS Contract Request for Proposals (RFP).[1] This exercise identified approximately 65 programs totaling approximately 900 thousand (K) source lines of code (SLOC),[2] 84 percent of which was written in FORTRAN and 16 percent in assembler language and macro. Code 580 personnel contracted Operations Research, Inc. (ORI) to prepare the identified software (system tapes containing job control language, source code, load modules, support data sets, benchmark tests) and associated information and documentation, intending delivery to the FDS contract winner. Approximately 1 staff-year of effort was expended over a 6-month period ending December 1981 in preparing the software for delivery. For various reasons, the FDS RFP was recast to provide for a separate FDS IBM-compatible hardware buy and support; the flight dynamics software would be converted for operation on the IBM-compatible machines under the Programming, Computation, and Analysis Support Services (PC&A) Contract.[3]

During July 1982, attention turned toward the actual FDS applications software conversion effort. Since approximately 1 year had passed and the need for some software on the 1981 list was no longer needed, Code 580 personnel's estimate of the amount of software for conversion decreased to 700K SLOC; this amount was expected to decrease further

[1]NASA RFP 5-67634/184, Flight Dynamics System.

[2]An SLOC is an 80-byte machine-readable image.

[3]NASA RFP 5-22434/158, Programming, Computation, and Analysis Support Services.

to approximately 500K SLOC.[1] The FDS hardware and support contract award was expected by September 1982. FDS software conversion was expected to start on October 1, 1982, with the PC&A contract award.

The actual conversion effort began on December 1, 1982, and lasted 18 months. Approximately 200 programs, ranging from less than 100 SLOC to more than 100K SLOC, were taken through the following steps:

1. Benchmarking on the IBM S/360-95
2. MVT conversion on the IBM 4341
3. MVS conversion on the IBM 4341

More than 1.3M SLOC (85 percent FORTRAN code and 15 percent assembler language and macro code) were converted for MVS operation on the IBM 4341. Approximately 12 staff years of effort were required to complete the project.

2.1.2 ORIGIN OF REQUIREMENTS

The requirements for the FDS software conversion effort were formulated by Code 580. Specifically, Code 581.2, 581.3, 582.1, and 582.2 Section Heads designated the actual software to be converted and assigned program conversion priorities (schedule). Table 2-1 lists the general responsibilities of the four Code 580 sections.

2.1.3 PROBLEM STATEMENT AND KEY REQUIREMENTS

The basic requirement was to rehost existing flight dynamics support software to the IBM 4341 for operation under MVS. However, to ensure configuration control, problem isolation, and continuity in operational support, while minimizing the lifetime and cost of the conversion process, a conservative

[1] Several operational programs were considered expendable because several missions would terminate soon.

Table 2-1. General Responsibilities of Code 580 Sections

CODE	RESPONSIBILITIES
581.2	ANALYSIS, DEVELOPMENT OF REQUIRMENTS, AND OPERATIONS FOR ATTITUDE DETERMINATION AND CONTROL SUPPORT
581.3	MISSION DESIGN, MISSION ANALYSIS, AND SPECIFICATION AND OPERATIONS FOR MANEUVER SUPPORT
582.1	DEVELOPMENT OF FLIGHT DYNAMICS OPERATIONS AND ANALYSIS SOFTWARE
582.2	ANALYSIS AND DEVELOPMENT OF ALGORITHMS AND APPROACHES FOR FUTURE FLIGHT DYNAMICS SUPPORT

but ambitious set of requirements was formulated. These requirements (program conversion priorities) and their objectives are presented in Table 2-2.

Because the amount of software for conversion had doubled since July 1982 and because hardware delivery and installation schedules had slipped, some compromise was required to make the early-phase requirements achievable. The revised requirements (program conversion priorities) are presented in Table 2-3.

2.2 PROJECT DESCRIPTION

2.2.1 KEY DATES

Table 2-4 contains actual key dates.

2.2.2 KEY PRODUCTS

The key products of the conversion effort were working load modules of each individual program at the three major phases, i.e., IBM S/360-95 benchmark, IBM 4341 MVT, and IBM 4341 MVS. For the latter two phases, the following documentation was to be delivered to the GSFC user points of contact for each program:

- FDS Software Conversion Delivery Form
- Data Set Request Form
- Change Report Form
- Listing of source code updates

The FDS Software Conversion Plan contains a complete description of the documentation.

2.2.3 SYSTEM CHARACTERISTICS

Flight dynamics software includes applications to support attitude determination, attitude control, maneuver planning, orbit adjustment, and general mission analysis. The attitude systems use tne Graphic Executive Support System (GESS) for interactive program execution control and graphic display

Table 2-2. Original Program Conversion Priorities

CONVERSION PRIORITY	NEED	OPERATING SYSTEM	TARGET DATE (1983)	PURPOSE
1	New software development and corresponding operational support	MVS	April 15	Allow Earth Radiation Budget Satellite (ERBS) attitude ground support system (AGSS) development effort to work with the target operating system and thereby minimize the impact of conversion on development
2	Critical to ongoing mission support	MVT	May 1	Allow a minimum of 30-day dual operation (IBM S/360-95 and IBM 4341) before the IBM S/360-95 was disconnected
		MVS	October 1	Allow a minimum of 90-day dual operation (MVT and MVS) before MVT was removed from IBM 4341
3	Essential to normal operational support	MVT	June 1	Allow IBM S/360-95 comparison runs before IBM S/360-95 was disconnected
		MVS	December 31	Allow MVT comparison runs before MVT was removed from IBM 4341
4	Useful for future support	MVS	December 31	Allow MVT fallback position during the checkout period before MVT was removed from IBM 4341

Table 2-3. Revised Program Conversion Priorities

CONVERSION PRIORITY	NEED	OPERATING SYSTEM	TARGET DATE (1983)	PURPOSE
1	New software development and corresponding operational support	MVS	April 15	Allow ERBS AGSS development to procede smoothly during conversion
		MVT	May 1	Allow ERBS AGSS development to move to IBM 4341 as soon as possible by eliminating or minimizing dependence on IBM S/360-95
		MVS, VSFORTRAN	May 15	Allow ERBS AGSS development to convert to VSFORTRAN as early as possible, i.e., at the end of build 1
2	Critical to ongoing mission support	MVT	May 1	Allow 30-day dual operations (IBM S/360-95 and IBM 4341) before IBM S/360-95 was disconnected
		MVS	October 1	Allow 90-day dual operations (MVT and MVS) before MVT was removed from IBM 4341
3	Essential for normal operational support	MVT	June 1	Allow IBM S/360-95 comparison runs before IBM S/360-95 was disconnected
		MVS	December 31	Allow MVT comparison runs before MVT was removed from IBM 4341
4	Future (intermediate term)	MVS	December 31	Allow MVT fallback position during the checkout period before MVT was removed from IBM 4341
5	Future (long term)	MVT	October 1	Allow time for checkout before MVT was removed from IBM 4341
6	Future (near term)	MVT	October 1	Allow time for checkout before MVT was removed from IBM 4341
		MVS	December 31	Allow MVT comparison runs before MVT was removed from IBM 4341

Table 2-4. Key Dates

CONVERSION CONTRACTS	KEY DATES: RFP	KEY DATES: CONTRACT AWARD
FDS	09/80	NONE
FDS HARDWARE BUY	–	09/82
PC&A (SOFTWARE CONVERSION)	01/82	10/82

CONVERSION GROUNDWORK	START	END
CODE 580 FDS RFP PREPARATION	05/80	08/80
ORI SOFTWARE PREPARATION	07/81	12/81

CONVERSION WORK	START	END
SOFTWARE AND DATA PREPARATION	12/01/82	05/06/83
DATA MIGRATION		
COPY FROM IBM S/360-95	01/14/83	05/06/83
UNLOAD ON IBM 4341	03/01/83	05/06/83

CONVERSION WORK	KEY DATES			
BENCHMARKING AND CONVERSION[1]	START	BENCHMARKS COMPLETED	SOFTWARE DELIVERED	USER ACCEPTED
BENCHMARKING ON IBM S/360-95	02/07/83	05/27/83	05/27/83	05/27/83
MVT CONVERSION ON IBM 4341	02/11/83	05/27/83	05/27/83	07/22/83
MVS CONVERSION ON IBM 4341	04/23/83	12/23/83	12/23/83	04/06/83

9604-180a1/84

[1]PRIORITY 1 SOFTWARE IS NOT INCLUDED BECAUSE IT WAS A SPECIAL CASE THAT CHANGED STATUS THROUGHOUT THE CONVERSION EFFORT.

of input and output. All the flight dynamics applications programs are primarily FORTRAN code with a small amount of assembler language code (1 to 3 percent). The attitude systems that use GESS typically contain approximately 15 percent assembler macro code (GESS tables). The following applications support programs are primarily assembler language code:

- Attitude Data Link (ADL)--Provides for receipt and data base management of spacecraft telemetry data
- Structured FORTRAN Preprocessor (SFORT)--Translates structured FORTRAN programming constructs into standard FORTRAN
- Graphic Executive Support System (GESS)--Provides interactive program execution control, error handling, and graphic display capabilities
- Online Processing System (OPS)--Provides interactive and system service capabilities

Table 2-5 lists the breakdown of FDS applications source code by GSFC Code. Table 2-6 lists the number of FDS applications programs by conversion priority. Table 2-7 lists the data transported to the FDS. Table 2-8 lists the type of source code by conversion priority by GSFC Code. Tables 2-9a and 2-9b list the effort required to convert the software by personnel type and by software, respectively.

Table 2-5. FDS Applications Source Code by GSFC Code

GSFC CODE	CONVERTED LINES OF CODE (LOC) IN THOUSANDS			TYPE OF CODE (PERCENTAGES)		
	SLOC[1]	LOC[2]	ExLOC[3]	FORTRAN	ASSEMBLER[4]	ALC TABLE MACROS[5]
581.2	856	475	390	81.8	11.1	7.1
581.3	167	150	120	99.9	0.0	0.1
582.1	213	120	95	84.4	15.6	0.0
582.2	89	45	35	94.5	5.1	0.4
TOTAL	1325K	790K	640K	85.3%	10.1%	4.6%

9604 (80):84

[1]SOURCE LOC (WITH COMMENTS).
[2]WITHOUT COMMENTS.
[3]EXECUTABLE LOC.
[4]ALC.
[5]FOR GESS.

Table 2-6. Number of FDS Applications Programs by Conversion Priority

GSFC CODE	CONVERSION PRIORITY					TOTAL
	1	2	3	4	6	
581.2	2	81	48	3	25	159
581.3	0	20	4	11	0	35
582.1	2	0	0	0	1	3
582.2	0	4	1	0	0	5
TOTAL	4	105	53	14	26	202

9604 (80):84

Table 2-7. Data Transported To the FDS

TYPE	GSFC CODE				TOTAL
	581.2	581.3	582.1	582.2	
DATA SETS					
SOURCE CODE	113	32	7	1	153
LOAD MODULES	114	29	9	5	157
JCL	26	22	2	35	85
CLISTs	10	16	2	1	29
PROCEDURES	12	4	0	2	18
DATA	415	172	36	25	648
TOTAL	690	275	56	69	1090
DIRECT-ACCESS STORAGE (THOUSANDS OF IBM 2314 TRACKS)[1]					
SOURCE CODE	9.8	1.7	0.4	0.6	12.5
LOAD MODULES	12.5	7.2	1.1	1.5	22.3
JCL	0.5	0.4	0.1	0.1	1.1
CLISTs	0.1	0.1	0.0	0.0	0.2
PROCEDURES	0.2	0.1	—	0.0	0.3
DATA	17.4	4.7	1.9	1.0	25.0
TOTAL	40.5	14.2	3.5	3.2	61.4

9004 1901/84

[1]AN IBM 2314 DISK PACK CONTAINS 4000 TRACKS. A TRACK CONTAINS 7294 BYTES OF STORAGE.

Table 2-8. Type of Source Code by Conversion Priority by GSFC Code

GSFC CODE	CONVERSION PRIORITY					TOTAL
	1	2	3	4	6	
FORTRAN						
581.2	4.7	499.2	137.6	14.2	44.5	700.2
581.3	0.0	126.9	10.5	29.4	0.0	166.8
582.1	5.2	0.0	0.0	0.0	174.3	179.5
582.2	0.0	81.5	2.4	0.0	0.0	83.9
TOTAL	**9.9**	**707.6**	**150.5**	**43.6**	**218.8**	**1130.4**
ASSEMBLER						
581.2	0.3	31.1	11.3	0.0	52.6	95.3
581.3	0.0	0.0	0.0	0.0	0.0	0.0
582.1	29.4	0.0	0.0	0.0	3.9	33.3
582.2	0.0	4.5	0.0	0.0	0.0	4.5
TOTAL	**29.7**	**35.6**	**11.3**	**0.0**	**56.5**	**133.1**
ALC MACROS						
581.2	0.0	46.2	14.2	0.0	0.0	60.4
581.3	0.0	0.2	0.0	0.0	0.0	0.2
582.1	0.0	0.0	0.0	0.0	0.0	0.0
582.2	0.0	0.4	0.0	0.0	0.0	0.4
TOTAL	**0.0**	**46.8**	**14.2**	**0.0**	**0.0**	**61.0**
TOTAL SLOC						
581.2	5.0	576.5	163.1	14.2	97.1	855.9
581.3	0.0	127.1	10.5	29.4	0.0	167.0
582.1	34.6	0.0	0.0	0.0	178.2	212.8
582.2	0.0	86.4	2.4	0.0	0.0	88.8
TOTAL	**39.6**	**790.0**	**176.0**	**43.6**	**275.3**	**1324.5**

3644 (80)/84

Table 2-9a. Effort[1] Required to Convert Software--by Personnel Type

TYPE	STAFF-YEARS	PERCENTAGE
MANAGERS[2]	2.3	19.5
DEVELOPERS	8.9	75.4
SUPPORT SERVICES[3]	0.6	5.1
TOTAL	**11.8**	**100.0**

9604 (80)-84

NOTES:

[1]EFFORT IS DEFINED AS BOTH GSFC AND CONTRACTOR SUPPORT REQUIRED FOR SOFTWARE CONVERSION, INCLUDING MANAGERS, DEVELOPERS, AND CLERICAL SUPPORT, SUCH AS LIBRARIANS. IT DOES NOT INCLUDE ANY EFFORT THAT USERS EXPENDED DEFINING, PREPARING, OR TESTING THEIR SOFTWARE NOR DOES IT INCLUDE ANY EFFORT THAT SYSTEMS PROGRAMMERS EXPENDED CONVERTING SYSTEM SUPPORT SOFTWARE.

[2]INCLUDES ASSISTANT TECHNICAL REPRESENTATIVE (ATR), PROJECT MANAGER AND LEADER, AND ADMINISTRATIVE PROJECT CONTROL PERSONNEL.

[3]INCLUDES SECRETARIAL, LIBRARIAN, AND TECHNICAL PUBLICATIONS PERSONNEL.

Table 2-9b. Effort Required To Convert Software--by Software

GSFC CODE	EFFORT (PERCENTAGES)	LINES OF CODE (PERCENTAGES)		
		SLOC	LOC	ExLOC
581.2	66.7	64.6	60.1	60.9
581.3	7.6	12.6	19.0	18.8
582.1	17.4	16.1	15.2	14.8
582.2	8.3	6.7	5.7	5.5

9604 (80)-84

SECTION 3 - CONVERSION HISTORY

This section presents the history of the FDS applications software conversion effort. It covers estimates of applications software size, required effort, schedule, and cost; organizational structure and key personnel; specified and unique conversion approaches; computer hardware and programming languages; special problems; and information about required software changes.

3.1 ESTIMATES OF APPLICATIONS SOFTWARE SIZE, REQUIRED EFFORT, SCHEDULE, AND COST

Effort and cost estimates in this section are for software conversion only; it does not include the users' preparation time, i.e., the work necessary to turn over a completely defined system and its benchmark tests, or the users' independent testing activities (specifically, dual operations).

Table 3-1 contains, for various key events, estimates of the size of the applications software to be converted and estimates of the effort required to do the work. Figure 3-1 illustrates the planned (January 1983) and the actual staffing levels for the conversion effort in full-time equivalents (40-hour workweeks).

Tables 3-2 through 3-5 provide the schedule estimates for the major phases by conversion priority. Table 3-6 presents the cost estimates.

Table 3-1. System Size and Effort Estimates

KEY EVENTS	DATE	ESTIMATES[1]	
		SIZE (IN K SLOC)[2]	EFFORT (IN STAFF YEARS)[3]
FDS RFP	09/80	900	10.0
FDS PROPOSAL EVALUATION	07/81	900	11.0
BEFORE CONVERSION CONTRACT AWARDS	07/82	700	10.0
START OF FDS CONVERSION EFFORT	12/82	1050	10.4
BEFORE IBM S/360 BENCHMARKING	01/83	1400	14.6
AFTER A NUMBER OF PROGRAM DELETIONS	03/83	1300	13.5
AFTER MVT CONVERSION	06/83	1400	14.6
ACTUAL DELIVERY	05/84	1325	11.8

9204 (80u1/84

[1]UPGRADE OF SUBSET OF SOFTWARE TO VSFORTRAN (FORTRAN 77) AND DOCUMENTATION UPDATES ARE NOT INCLUDED.

[2]IN THOUSANDS OF SOURCE LINES OF CODE (K SLOC).

[3]STAFF YEAR EQUALS 1872 HOURS.

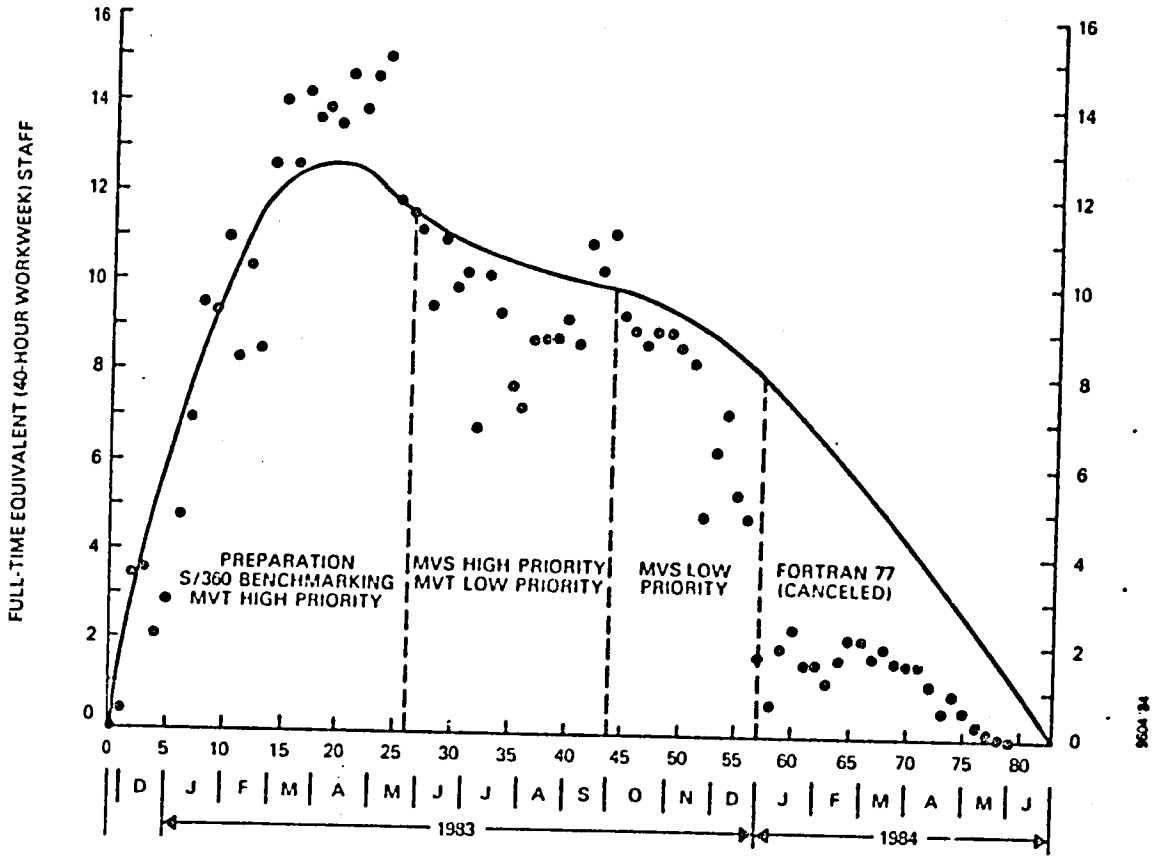

Figure 3-1. Planned (January 1983) Versus Actual Staff Effort Versus Conversion Week (Solid line indicates planned effort; dots, actual effort)

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Table 3-2. IBM S/360 Benchmaking Schedule Estimates

GSFC CODE	PRIORITY	PROGRAMS			SCHEDULE[1]		
		01/83 LIST	FINAL LIST		ESTIMATE		ACTUAL
			NO.	NBR[2]	12/82	01/83	
ALL 580	1	4	4	2	04/15	04/15	03/15
	2	111	105	13	05/01	05/01	04/20
	3	62	53	10	06/01	06/01	05/20
	4	17	14	2	06/01	06/01	05/03
	5	3	0	0	–	06/01	–
	6	37	26	14	–	06/01	05/05
	TOTAL	234	202	41			
581.2	1	2	2	2	–	–	–
	2	87	81	13	05 01	05/01	04.20
	3	57	48	10	06 01	06 01	05.20
	4	4	3	1	06 01	06.01	05/03
	5	3	0	0	–	06.01	–
	6	36	25	14	–	06 01	05.05
	TOTAL	199	159	40			
581.3	2	20	20	0	05 01	05/01	03.04
	3	4	4	0	06.01	06/01	03.25
	4	13	11	1	06 01	06.01	04/08
	TOTAL	37	35	1			
582.1	1	2	2	0	04/15	04/15	03/15
	6	1	1	0	06/01	06/01	03/03
	TOTAL	3	3	0			
582 2	2	4	4	0	05 01	05/01	04 01
	3	1	1	0	06/01	06/01	03/30
	TOTAL	5	5	0			

[1]ALL DATES ARE 1983.

[2]NBR INDICATES THAT NO BENCHMARK TEST WAS REQUIRED BY THE USER.

Table 3-3. MVT Conversion Schedule Estimates

GSFC CODE	PRIORITY	PROGRAMS				SCHEDULE[1]		
		01/83 LIST	FINAL LIST			ESTIMATE		ACTUAL
			NO.	LATE	REJ[2]	12/82	01/83	
ALL 580	1	4	4	0	0	–	04/15	04/08
	2	111	105	0	0	05/01	05/01	05/02
	3	62	53	0	1	06/01	06/01	06/01
	4	0	0	0	0	–	–	–
	5	3	0	0	0	–	10/01	–
	6	37	25	0	0	–	10/01	05/27
	TOTAL	217	188	0	1			
581.2	1	2	2	0	0	–	04/15	03/02
	2	87	81	0	0	05/01	05/01	05/02
	3	57	48	0	1	06/01	06/01	06/01
	5	3	0	0	0	–	10/01	–
	6	36	25	0	0	–	10/01	05/27
	TOTAL	185	156	0	1			
581.3	2	20	20	0	0	05/01	05/01	04/15
	3	4	4	0	0	06/01	06/01	04/08
	TOTAL	24	24	0	0			
582.1	1	2	2	0	0	–	04/15	04/08
	6	1	1	0	0	–	10/01	04/01
	TOTAL	3	3	0	0			
582.2	2	4	4	0	0	05/01	05/01	04/29
	3	1	1	0	0	06/01	06/01	04/29
	TOTAL	5	5	0	0			

9504 168-1 84

[1]ALL DATES ARE 1983.

[2]REJ INDICATES THAT THE FIRST DELIVERY OF A CONVERTED PROGRAM WAS REJECTED BY THE USER.

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Table 3-4. MVS Conversion Schedule Estimates

GSFC CODE	PRIORITY	PROGRAMS				SCHEDULE[1]		
		01/83 LIST	FINAL LIST			ESTIMATE		ACTUAL
			NO.	LATE	REJ[2]	12/82	01/83	
ALL 580	1	4	4	1	0	04/15	05/01	05/12
	2	111	104	2	2	10/01	10/01	11/04
	3	59	43	0	3	12/01	12/31	11.04
	4	17	13	0	2	12/01	12/31	11/04
	5	0	0	0	0	–	–	–
	6	37	21	0	1	–	12/31	12 23
	TOTAL	228	185	3	8			
581.2	1	2	2	0	0	04/15	05/01	04/15
	2	87	80	2	1	10/01	10 01	11/04
	3	54	38	0	2	12/01	12.31	11/04
	4	4	2	0	0	12.01	12/31	11/04
	6	36	20	0	1	–	12 31	12.23
	TOTAL	183	142	2	4			
581.3	2	20	20	0	1	10/01	10/01	09/02
	3	4	4	0	1	12/01	12/31	09/23
	4	13	11	0	2	12/01	12/31	10/28
	TOTAL	37	35	0	4			
582.1	1	2	2	1	0	04/15	05 01	05/12
	4	0	0	0	0	12/01	–	–
	6	1	1	0	0	–	12/31	08/26
	TOTAL	3	3	1	0			
582.2	2	4	4	0	0	10/01	10/01	09/30
	3	1	1	0	0	12/01	12/31	10/07
	TOTAL	5	5	0	0			

9004 (GSFC) 84

[1]ALL DATES ARE 1983.

[2]REJ INDICATES THAT THE FIRST DELIVERY OF A CONVERTED PROGRAM WAS REJECTED BY THE USER.

Table 3-5. VSFORTRAN Conversion Schedule Estimates

GSFC CODE	PRIORITY	PROGRAMS	SCHEDULE[1]				
			ESTIMATE				ACTUAL
			12/82	01/83	06/83	09/83	
ALL 580	1	4	–	04/15	10/01	12/0.	12/02
581.2	1	2	–	04/15	–	–	04/15
582.1	1	2	–	04/15	10/01	12/02	12/02

[1]ALL DATES ARE 1983.

Table 3-6. GSFC Cost Estimate History

GSFC FY[2]	POP 81-1	POP 81-2	POP 82-1	POP 82-2	POP 83-1	POP 83-2	POP 84-1	(ACTUALS) POP 84-2
THOUSANDS OF DOLLARS (K$)[1]								
82	231	0	0	0	0	0	0	0
83	155	218	346	578	420	427	400	400
84	0	300	539	630	451	479	200	100
85	0	132	0	0	0	0	0	0
86	0	363	0	0	0	0	0	0
TOTALS	386	1013	885	1208	871	906	600	500
84$	445	1026	925	1268	894	935	627	551
ONBOARD EQUIVALENTS (OBEs)								
82	5.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0
83	3.4	4.8	7.4	12.4	8.8	9.0	8.7	8.7
84	0.0	6.2	10.9	12.7	8.9	9.5	4.0	2.2
85	0.0	2.6	0.0	0.0	0.0	0.0	0.0	0.0
86	0.0	6.7	0.0	0.0	0.0	0.0	0.0	0.0
TOTALS	8.8	20.3	18.3	25.1	17.7	18.5	12.7	10.9

9604 (68*1)/84

[1]ESTIMATED FOR PROJECT OPERATIONS PROJECTIONS (POPs) 81-1 (JANUARY 1981), 81-2 (JULY 1981), etc. POP 84-2 REPRESENTS ACTUALS. ESTIMATES ARE EXPRESSED IN TERMS OF DOLLAR VALUE OF THE YEAR INDICATED.

[2]84$ INDICATES THAT THE TOTAL ONBOARD-EQUIVALENT (OBE) PROJECTIONS ARE GIVEN IN TERMS OF 1984 DOLLARS, $50.5K PER OBE, ROUNDED UP.

3.2 ORGANIZATIONAL STRUCTURE AND KEY PERSONNEL

GSFC Code 580 was the central point of control for the FDS applications software conversion project. A basic development team consists of

1. GSFC Assistant Technical Representative (ATR)--First- or second-line manager (normally one person) responsible for monitoring resources and progress. Serves as primary point of contact (POC) with customer, support, and contractor groups (15- to 100-percent involvement).

2. CSC project manager--First-line development manager responsible, with the project leader, for organizing and planning a task-assigned project. Provides technical consultation and manages project resources (20- to 100-percent involvement). Directes 8 to 25 persons, usually 12 $\pm$ 3.

3. CSC project leader--Lead developer responsible, with project manager, for organizing and planning a task-assigned project. Provides technical direction and day-to-day supervision of project activities (usually 100-percent involvement).

4. CSC and/or GSFC developers--Programmer/analysts responsible for technical work (usually 100-percent involvement).

Figure 3-2 illustrates the organizational structure for the life of the project. Only minor changes occurred in the leadership positions; the title of the leader with the most significant contribution to the project is shown as it appears in Table 3-7, which lists the key personnel. The first group consists of the GSFC user POCs; the second group, GSFC ATRs and section heads; the third, CSC project managers; and the fourth, CSC project leaders and the technical personnel who provided significant technical contributions.

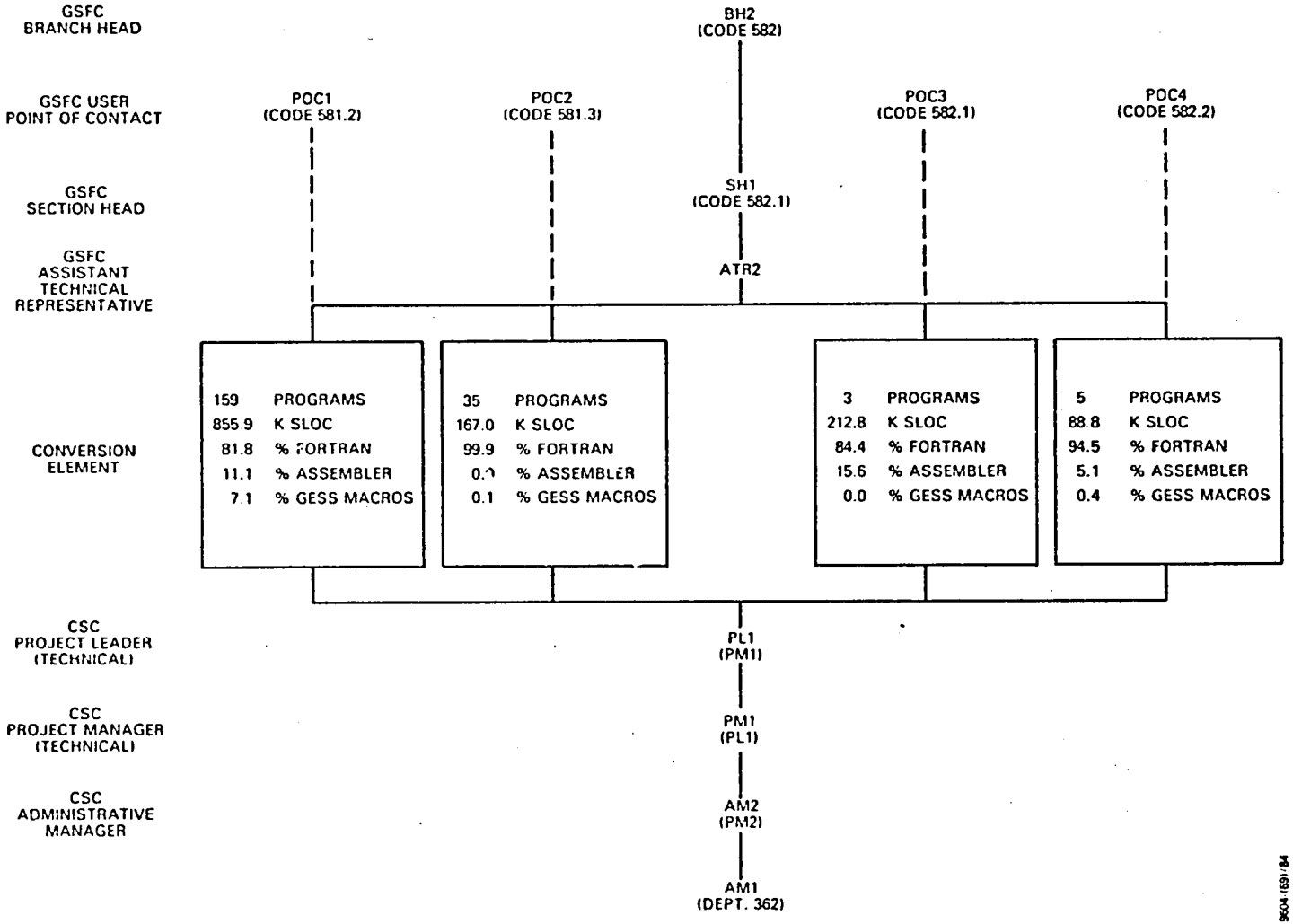

Figure 3-2. FDS Applications Software Conversion Organizational Structure From December 1982 Through May 1984

Table 3-7. Key Personnel

TYPE[1]	NAME	ORG	TITLE[2]	DATES	
				FROM	TO
MGR	ROGER WERKING	GSFC	POC1	12/01/82	09/11/83
MGR	JAMES COOLEY	GSFC	POC2	12/01/82	05/04/84
MGR	FRANK MCGARRY	GSFC	POC3	12/01/82	05/04/84
MGR	CHARLES NEWMAN	GSFC	POC4	12/01/82	05/04/84
MGR	GARY MEYERS	GSFC	POC5	09/12/83	05/04/84
MGR	FRANK MCGARRY	GSFC	SH1	12/01/82	05/04/84
MGR	FRANK MCGARRY	GSFC	ATR1	12/01/82	12/31/83
MGRTECH	ELIZABETH EDWARDS	GSFC	ATR2	01/07/83	05/04/84
MGR	KUEN-SAN LIU	CSC	PM1	12/01/82	05/04/84
MGR	C. BAILEY SPENCE	CSC	PM2	01/17/83	12/31/83
MGRTECH	KUEN-SAN LIU	CSC	PL1	12/01/82	12/31/83
MGRTECH	DAVID GREEN	CSC	PL2	01/01/84	05/04/84
TECH	DAVID GREEN	CSC	–	12/06/82	12/31/83
TECH	ROBERT HENDRICK	CSC	–	12/06/82	05/20/83
TECH	WAYNE TAYLOR	CSC	–	01/03/83	07/01/83
TECH	CHARLES BEARD	CSC	–	01/03/83	11/04/83
TECH	UMADEVI SAGGARE	CSC	–	01/03/83	09/30/83
TECH	JOHN KUHN	CSC	–	03/07/83	09/02/83

[1]TYPES:
- MGR = MANAGER
- MGRTECH = MANAGER WITH TECHNICAL ASSIGNMENT (ATR OR PROJECT LEADER)
- TECH = TECHNICAL WORKER

[2]TITLES:
- POCx = USER POINT OF CONTACT x
- SHy = SECTION HEAD y
- ATRz = ASSISTANT TECHNICAL REPRESENTATIVE z
- PMm = PROJECT MANAGER m
- PLn = PROJECT LEADER n

For each person, his/her organizational affiliation and title are given, along with the dates of his/her association with the project.

3.3 SPECIFIED APPROACHES

3.3.1 CONFIGURATION CONTROL AND REVIEW PROCESS

Configuration control and review procedures are embodied in the detailed step-by-step procedures outlined in the FDS Software Conversion Plan (Appendix B contains excerpts). The following tools were used as an aid to configuration control and the review process; some also aided the conversion process.

- Progress chart matrix--A chart containing one line per program with columns for most conversion steps (i.e., program definition (form number), data set transfers, benchmark definition and execution dates, MVT and MVS conversion initiation dates, benchmark test completion dates, delivery-to-POC dates, and the POC's program acceptance dates) was maintained manually and was updated and summarized weekly. Appendix C contains the information from the chart matrix, with additional information included to provide a more complete picture.

- Data migration aids--Small assembler language programs were written to generate the JCL needed to load/unload data migration tapes. The input to these programs was output from the MINIMAP program, which generates alphabetical listings of data set names and attributes for specified catalog index levels.

- Load module component analysis--A small FORTRAN utility was written to identify load modules containing specified subroutines. The utility worked by scanning output from the LISTIDR program, which generates listings of subroutine names for specified load modules.

- PANVALET--PANVALET was used as a source code management system for all software that was converted. Code modifications were (in most cases) made using PANVALET updates. The PANVALET facility for scanning an entire PANVALET library for a given character string was very useful.

- Partitioned data set (PDS) scanning/editing utilities--The attitude maintenance SCANPDS and MODPDS utilities were used for scanning and systematically editing source code and JCL stored in PDSs.

The following tools would have been useful for the software conversion effort:

- Preexisting data migration and load module component analysis tools.

- Online configuration management tool that would allow conversion personnel to rapidly locate information (e.g., source code, macros, JCL, and load modules) associated with a given program. Program description forms did not always provide complete information and were difficult to deal with in general. Conversion personnel new to the environment had a particularly difficult time finding needed information:

- Online compiling and assembling.
- Utility for calculating lines of code statistics.

3.3.2 LIBRARIAN FUNCTION AND DATA COLLECTION PROCEDURES

The librarians were used primarily to maintain conversion records and data (e.g., flow of program user's guides, system descriptions, tapes, and delivery documentation). The librarians also entered the source code for several programs that were available only from listings.

Each delivery of a program that was converted to MVT or MVS included a change report that indicated the nature and

extent of required changes. The developers also filled out component status forms weekly, recording the amount of time they spent on various activities by program (see sample forms in Appendix B). Resource usage data (conversion team hours and computer hours and runs) were collected weekly. Appendix A summarizes the resource usage data.

3.3.3 CONVERSION PROCEDURES

The applications software conversion process consisted of the following steps:

- Applications software preparation
- Benchmark preparation and execution on the IBM S/360-95
- Data migration from the IBM S/360-95 to the IBM 4341 computers
- Conversion to MVT on the IBM 4341
- Conversion to MVS on the IBM 4341
- Upgrading of key software to VSFORTRAN (FORTRAN 77), which was left open

Figure 3-3 illustrates the overall FDS applications software conversion process.

3.3.3.1 Applications Software Preparation

To prepare for the conversion effort, the following software information was collected:

- A comprehensive list of load modules to be converted
- The MVT and MVS conversion priorities for each load module
- The name of the person, project, or group responsible for operating each load module
- A list of all data sets associated with each load module (e.g., source code library, creation job

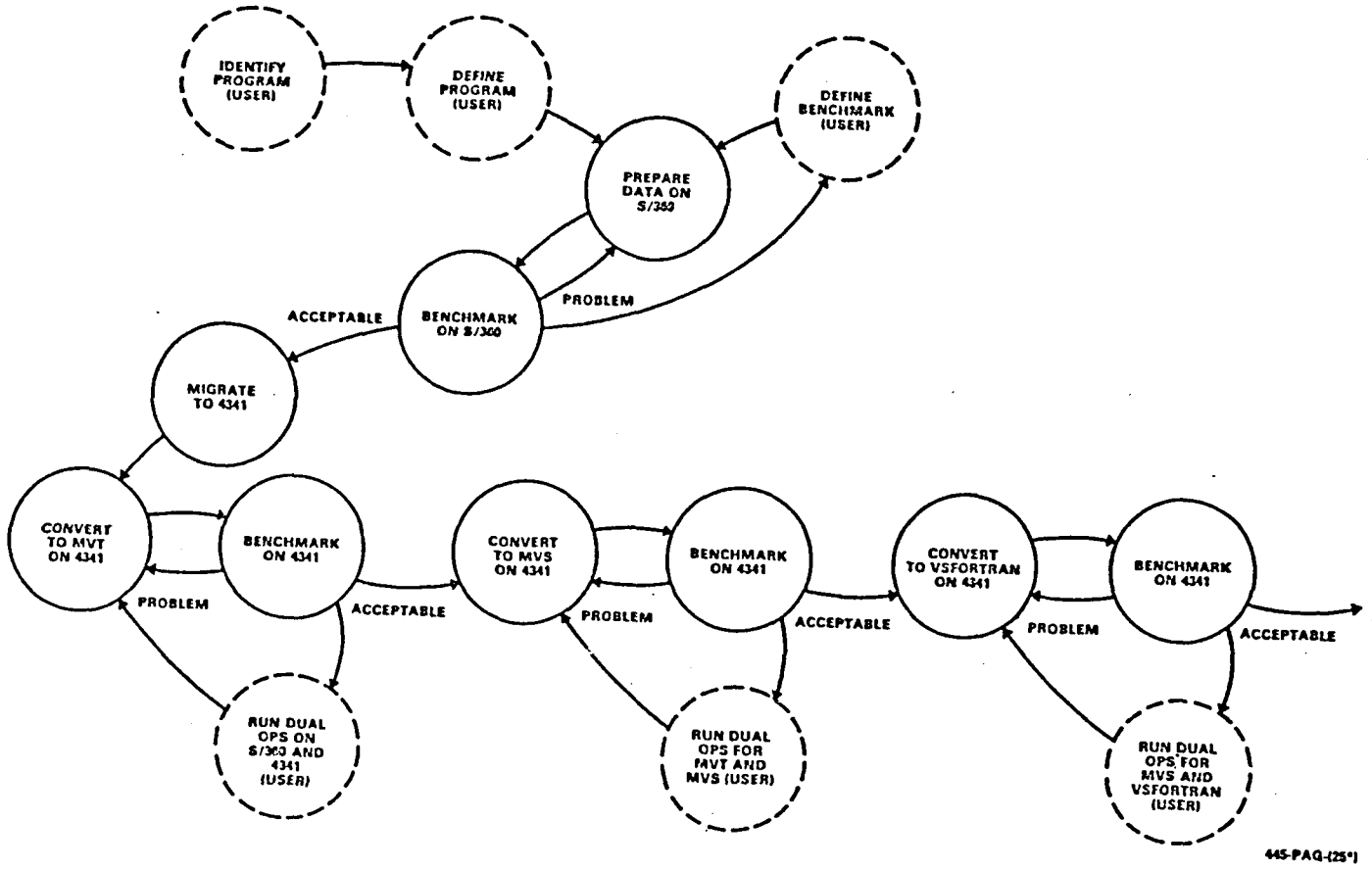

Figure 3-3. Overall FDS Applications Software Conversion Process

control language (JCL), execution JCL, overlay, timesharing option (TSO) control lists (CLISTs), GESS tables, link libraries, NAMELISTs, assembler macro libraries, input/output data sets)

- For each load module, a description of general software characteristics that may affect the conversion effort (e.g., source code language type, precompiler, overlay, graphic devices, graphic method, M&DO packages used, and use of 7-track tape drives)
- An indication, for each load module, as to whether an up-to-date system tape exists
- A list of all associated documentation for each load module to be converted

3.3.3.2 Benchmark Preparation and Execution on the IBM S/360-95

For each program to be benchmarked (through GSFC user points of contact), the user provided the conversion team with the JCL to execute the benchmark on the IBM S/360 under MVT. For data sets referenced in the JCL that required special initialization or set up, the user provided an explanation of the procedure involved. The conversion team was also given operating instructions if the benchmark test involved interactive processing. Finally, the team was given instructions for evaluating the benchmark tests. Upon receiving this information, the conversion team ran the benchmark test on the IBM S/360-95 according to the procedures delineated in Appendix B, correcting problems as they occurred until the benchmark test ran successfully.

3.3.3.3 Data Migration From the IBM S/360-95 to the IBM 4341

Concurrent with benchmarking on the IBM S/360-95, the data was transferred to the IBM 4341. The data transfer was conducted on a data set level as opposed to a program level.

To ensure that no important data was lost when the IBM S/360-95 was removed, all designated GSFC Code 580 data sets on the IBM S/360-95 were transferred to the IBM 4341 computers. The IBM S/360-95 data sets under the control of each GSFC Code 580 section were transferred wholesale to the FDS computers. Because the computers shared no direct-access storage, data was transferred on tapes.

3.3.3.4 Conversion to MVT on the IBM 4341

Load modules were converted according to their assigned MVT conversion priority. The only modifications made were those required for correct execution of the load module benchmark test on the IBM 4341 under MVT. Obsolete source code was not deleted nor were programs optimized. The procedure for converting a given load module to MVT on the IBM 4341 is shown in Figure 3-4 and is discussed in detail in Appendix B.2.

3.3.3.5 Conversion to MVS on the IBM 4341

After load modules successfully underwent MVT conversion on the IBM 4341, MVS conversion began. Again, load modules were converted according to their assigned MVS conversion priority. The only modifications made were those required for correct execution of the load module benchmark test under MVS. A limited amount of nonapplicable code was deleted and minimal program optimization (overlays) was performed for MVS. The procedure for converting a given load module to MVS on the IBM 4341 is shown in Figure 3-5 and is discussed in detail in Appendix B.3.

3.4 UNIQUE APPROACHES

No unique approaches were used in this software conversion effort.

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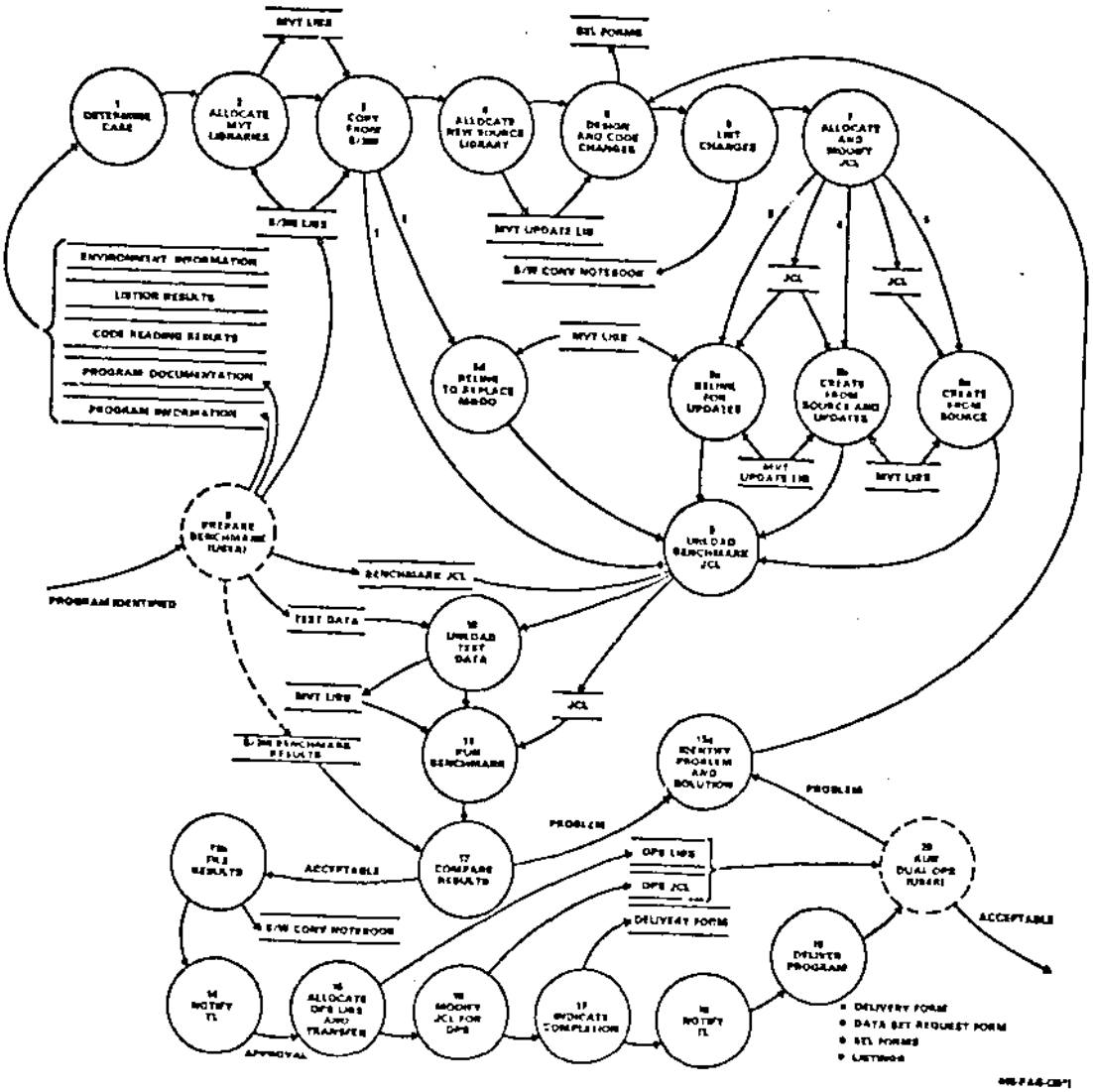

Figure 3-4. MVT Conversion on the IBM 4341

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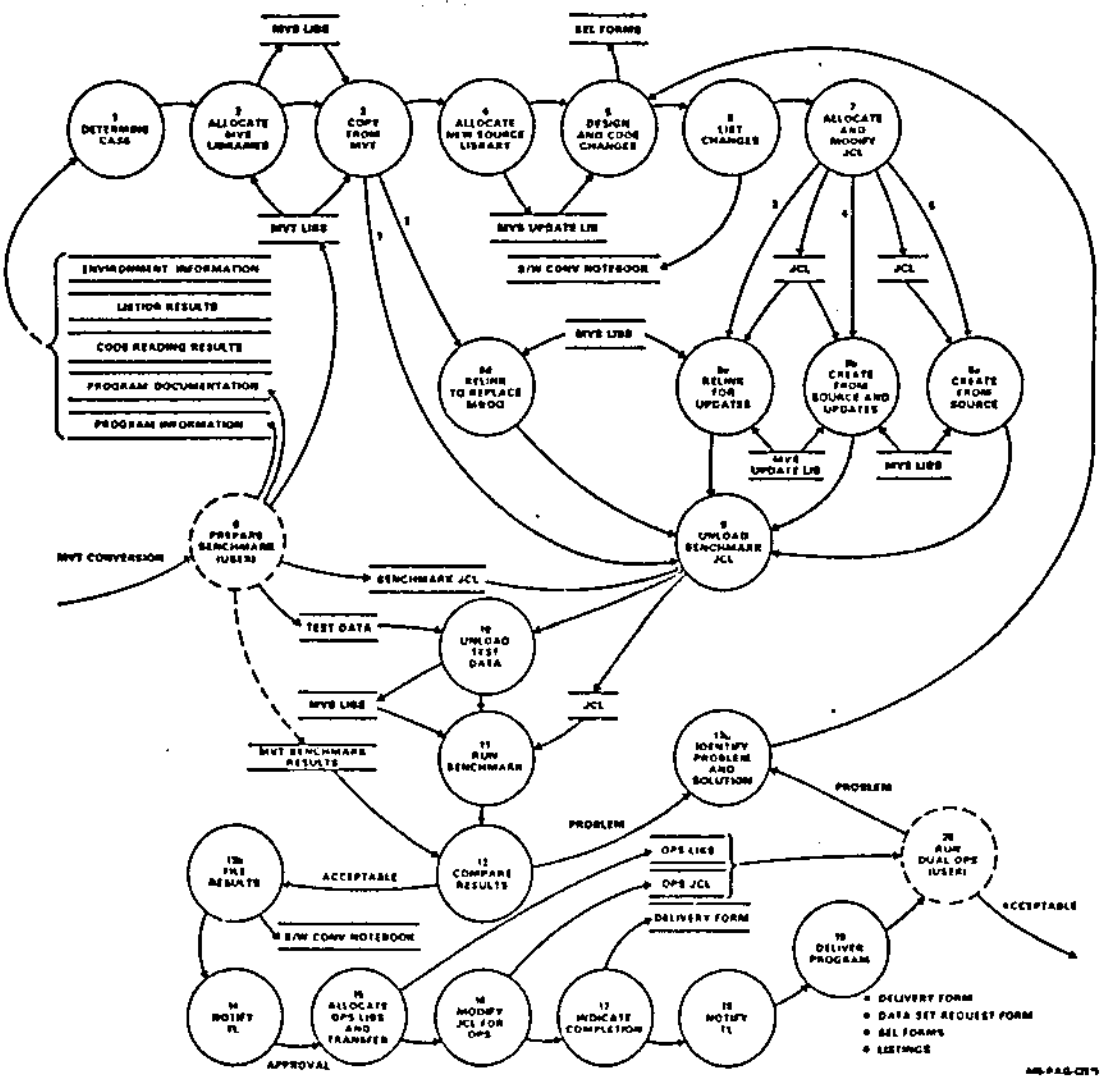

Figure 3-5. MVS Conversion on the IBM 4341

3.5 HARDWARE AND PROGRAMMING LANGUAGES

The computers used in the conversion effort were the IBM S/360-95, on which the applications software was originally designed to run, and the new IBM 4341s, to which the software was being converted. The IBM S/360-95 peripherals included IBM 2314 direct-access storage, 7- and 9-track tape drives, alphanumeric terminals, and IBM 2250 high-resolution graphic devices. The IBM 4341 peripherals included IBM 3350 (equivalent) direct-access storage, 9-track tape drives, IBM 3278 alphanumeric terminals, IBM 3251 high-resolution graphic device terminals, and IBM 3255 controllers.

The programming languages were

- FORTRAN IV (85 percent)
- VSFORTRAN (less than 1 percent)
- Assembler language code (10 percent)
- Assembler language macros (5 percent)

3.6 SPECIAL PROBLEMS

As with any large software conversion project, problems were bound to arise. This section identifies five main areas of concern:

1. Problem (requirements)
2. Process
3. Environment
4. Product
5. Personnel

In this particular conversion effort, requirements and personnel problems were expected; some also came up in the process area.

In the requirements area, because the amount of software to be converted was almost twice that expected and because the hardware delivery schedule slipped, it was known that the

June 1, 1983, IBM 4341 MVT conversion date would be difficult to meet.

In the area of personnel, the nature of the project (conversion to and from IBM machines) was a source of some problems. First, few, if any, developers actually elect to do conversion work. In addition, because of the time that had elapsed between the last IBM applications development project and this conversion effort, the environment was depleted of developers with recent IBM applications development experience.

These and other problems are discussed in more detail in the following subsections. Other information is also included to complete the historical picture.

3.6.1 PROBLEM (REQUIREMENTS)

Problems with the requirements centered around their evolving nature. The requirements for the software conversion effort changed continually from the first significant definition of the actual effort (July 1982) through most of the early phases of the effort (April 1983).

- Increased Scope of Effort--The amount of software for conversion doubled.
- Late Delivery of Hardware--Several hardware delivery and installation dates slipped more than once.
- Priority Changes--Changes to software priorities required that more programs were to be converted earlier. This problem was compounded by the delays in hardware deliveries. More and more work had to be done in shorter and shorter time periods during the early phases of conversion.
- Some Requirements Could Not Be Met Fully--Tapes, which were to be used for systems archived on tapes, were found to be basically useless and the conversion team had to prepare the data itself.

Also, users, who were to supply software systems and benchmark tests, were unfortunately, not generally available and had to be borrowed. These users were therefore not prepared to supply the necessary material.

- Hardware Misunderstandings--Problems resulting from the model of the high-resolution graphic device (IBM 3251) and the keyboards for alphanumeric terminals were magnified in light of the delayed hardware delivery and rigid schedule. Little time was available to reconcile problems that arose when the delivered hardware was not what it was supposed to be.

- Poor Hardware Performance and Reliability--The original hardware configuration provided poor performance and reliability. As a result, the team found that conversion took more time than expected.

3.6.2 PROCESS

Although late, in its final form, the conversion plan was excellent and was given to the conversion team in pieces, as needed. In part, delays in completing the plan were caused by requirements changes. For example, because of the limited value and condition of system tapes, procedures to define software systems and benchmark tests had to be worked out and discussed with the different user groups. Because users expected benchmark tests for graphic programs to be run interactively, the benchmark scripts were inadequate for other than the experienced user. Therefore, user help had to be arranged to accomplish that task.

Since most changes in requirements increased the amount of work to be done by the end of the MVT conversion milestone (June 1, 1983), considerable help from experts (i.e., developers, operators, or analysts) familiar with large or

difficult programs was needed and arranged for. The MVT conversion milestone could not have been met without good fortune and a very high degree of cooperation from the user community.

For example, the Earth Radiation Budget Satellite (ERBS) Attitude Ground Support System (AGSS) development team was late in using the IBM 4341. This allowed the conversion team to operate more efficiently (they were basically the only user) since system performance was poor at the time. As a result, they were able to get ahead of schedule. The enthusiasm of the conversion team core, the ability and willingness of the conversion team to adapt to the IBM 4341 system's performance at the time (e.g., adjusting their work schedules to obtain better access, running batch jobs), and the contributions of team members who developed the conversion plan also proved beneficial. Those team members, in addition to developing conversion tools to speed up the process (e.g., preparation, migration, systematic changes) and to make configuration control easier, also solved several system problems that would have caused substantial delays in the conversion process, for example, IBM 3251 graphic device controller, buffer, and keyboard problems.

The high degree of cooperation from the user community was demonstrated in a first-rate joint CSC and GSFC management effort. The managers were cognizant of the importance of getting conversion done in a timely manner so that

- Their future environment could be stabilized and fine tuned
- The effect on operations and mission preparation could be minimized
- The cost of keeping the IBM S/360-95 operational could be eliminated

Managers in both organizations continually ensured the availability of personnel critical to the efficient conversion of software with which they were most familiar. This frequently required coordinating staffing and support for a large group of other projects so that projects from which personnel were borrowed experienced minimal impact.

In all, through the MVT conversion phase approximately 60 developers, operators, analysts, librarians, and managers were involved in the effort to some degree.

3.6.3 ENVIRONMENT

3.6.3.1 Hardware

Compared with the IBM S/360-95 environment, the IBM 4341 environment has brought dramatic improvements, which aided the conversion process.

- The unstable, 6- to 8-hour mean time to failure (MTTF) IBM S/360-95 environment has been replaced with a stable, 24-hour MTTF environment that has considerably improved reliability; turnaround time, especially for time-consuming, many-step jobs (e.g., GESS table creation); and efficiency

- A sufficient number of alphanumeric terminals are now available on- and offsite, relieving some frustration of the more interactively oriented user community

- A sufficient number of high-resolution graphic devices (IBM 3251) are now available on- and offsite. The two offsite devices have improved productivity in that developers are not forced to use fixed-time-slot, programmer-present block time. Travel time and its attendant cost have also been reduced.

Because the environment is still being fine tuned and enhanced, further improvements are expected. For example,

- Reduced input/output (I/O) time. I/O time is long now because of restricted disk storage and data set configuration problems
- Improved timesharing option (TSO) response time
- Improved turnaround via high-speed printers on- and offsite
- Consistency among alphanumeric terminal keyboards. Seven different kinds of terminals are now used

3.6.3.2 Software

No improvement has been made in support software relative to the IBM S/360-95 environment. In fact, some capabilities have been lost. Because the system programmers have been busy checking and fine tuning the system, certain utilities have not yet been implemented and certain diagnostic features available on the IBM S/360-95 are not available on the IBM 4341 (e.g., SYSTERM compiler output).

3.6.4 PRODUCT

Since virtually all programs (approximately 99 percent) have been created from source code for MVS conversion, the user community now has the opportunity to employ better, stricter configuration control procedures so that the integrity of source code and load modules is maintained. Numerous benchmark tests exist and should be archived for use in configuration control.

3.6.5 PERSONNEL

Staffing the conversion effort was difficult because developers view conversion work as only a (small) step above maintenance work. (Conversion is a step above only because it ends; maintenance is forever.)

The managers' staffing goal was to form a team of approximately 12 full-time equivalents (FTEs) of developers, 25 percent of which would be experts or developers knowledgeable in different large or difficult programs. The remaining 75 percent (8 to 9 developers) would be the conversion team core, which would phase down to about 6 developers by the end of the MVS conversion phase.

The managers' goal for the team core makeup was

- A typical development project skill mix, i.e., equal numbers of senior, intermediate, and junior developers. The senior personnel would provide some direction and solve problems concerning the more difficult MVS conversion and still more difficult VSFORTRAN conversion
- Two full-time assembler language developers for the duration of the effort to work on the three large assembler language programs (ADL, GESS, OPS)
- One-third of the team core experienced with virtual memory operating systems (IBM S/370, 30xx, or 43xx) and applications
- Two-thirds or more of the team core experienced with IBM applications
- One-third of the team core experienced with some of the large or difficult programs

Because no IBM S/360 development project has been undertaken since the Dynamics Explorer (DE) Attitude Ground Support System (AGSS) was completed in June 1981, the environment was basically depleted of IBM applications developers. Therefore, the team core put together fell short in experience with full development (design, code, test) and with the programs being converted. Hence, the team had to depend on the conglomeration of experts to aid in benchmark testing, especially with the graphics programs. Since conversion to

VSFORTRAN was dropped as a requirement, overall, lack of full development experience was not a problem.

Because of developers' common dislike of conversion work, the team core that was put together fell short in experience with virtual memory systems; the team was also short one full-time assembler language developer for 9 months. However, since program optimization was not a requirement, a lack of virtual memory system experience was not a problem. The absence of the full-time assembler language developer did put a strain on the team's assembler language developers because the assembler language programs needed substantial (much more than expected) modifications.

Overall, the team core was average, i.e., the team had an average number of years of experience in the environment and with the application, relative to a typical AGSS development project. Here, "the application" means JCL, data set manipulation, TSO operation, minor code modification, load module creation, and simple batch benchmark testing. Collectively, the conversion team managers were very experienced.

3.7 REQUIRED SOFTWARE CHANGES

Table 3-8 lists the changes required to convert the FDS applications software to the IBM 4341. The table includes the reason for a change, the operating systems for which the change was necessary, the source code languages that had to be changed, and a brief description of the change.

Table 3-8. Change Required To Convert to IBM 4341 (1 of 6)

CHANGE	REASON	OPERATING SYSTEMS	SOURCE LANGUAGES	DESCRIPTION
1.	HARDWARE	MVS/MVT	FORTRAN AND ASSEMBLER	Direct-access data sets had to be reinitialized on the IBM 3350 equivalent disk packs; they could not be simply copied from the IBM 2314 disk packs (IBM S/360).
2.	HARDWARE	MVS/MVT	FORTRAN AND ASSEMBLER	Graphics programs, in general, could not access lower-case keyboard input from the IBM 3251 graphic device. The IBM 2250 graphic device (IBM S/360) only had upper-case keyboard input. For some programs, the changes were deferred until MVS conversion.
3.	HARDWARE	MVS/MVT	ASSEMBLER	Some graphics programs written using the Graphics Access Method (GAM) had to be modified to be compatible with the shared display buffer feature of the IBM 3251 graphic device.
4.	HARDWARE	MVS/MVT	ASSEMBLER	The 9-track tape version of the CalComp plotting package was implemented because 7-track tape drives are not used in the IBM 4341 environment.
5.	HARDWARE	MVS/MVT	ASSEMBLER	Code for using the FMOC and IBM 2260 graphic devices was deleted from programs because these graphic devices are not used in the IBM 4341 environment.
6.	USER SOFTWARE	MVS/MVT	FORTRAN AND ASSEMBLER	Some subroutines had the IBM 2314 disk pack track size hardcoded either explicitly or implicitly by assuming a certain number of blocks per track for data sets. The IBM 4341 uses IBM 3350 equivalent disk packs.

Table 3-8. Change Required To Convert to IBM 4341 (2 of 6)

CHANGE	REASON	OPERATING SYSTEMS	SOURCE LANGUAGES	DESCRIPTION
7.	USER SOFTWARE	MVS/MVT	FORTRAN AND ASSEMBLER	Some subroutines had been hardcoded with CPU identification, data set names, or disk volume serial numbers. For example, one program assumed that scratch pack volume serial numbers began with SCR. The IBM 4341 computers have different identification codes and data set naming conventions were changed for the different conversion process steps. Most of the required changes were deferred until MVS conversion.
8.	USER SOFTWARE	MVS/MVT	FORTRAN	Source code for some programs was missing (1), was not in agreement with the operational load modules or contained errors (19), or was available only from hardcopy listings (5).
9.	USER SOFTWARE	MVS	ASSEMBLER	Overlays were removed from MVS programs for execution efficiency. Some programs depended on the overlay supervisor to refresh (reinitialize) certain subroutine parameters.
10.	ENVIRONMENT SOFTWARE	MVS/MVT	FORTRAN AND ASSEMBLER	Programs using the Direct Access Input/Output (DAIO) and General FORTRAN Input/Output (FTIO) packages had to be relinked to incorporate versions designed for IBM 3350 equivalent disk packs.
11.	ENVIRONMENT SOFTWARE	MVS	FORTRAN	Originally, only the VSFORTRAN library was installed under MVS. However, M&DO's INCORE subroutine, which converts data to/from EBCDIC formats, was not compatible with the VSFORTRAN library. Therefore, the FORTRAN IV (H-extended) library had to be installed under MVS.

Table 3-8. Change Required To Convert to IBM 4341 (3 of 6)

CHANGE	REASON	OPERATING SYSTEMS	SOURCE LANGUAGES	DESCRIPTION
12.	ENVIRON-MENT SOFTWARE	MVS	ASSEMBLER	The IBM utility IEBCOPY is an authorized program under MVS. Therefore, it cannot be invoked from an applications program without authorization.
13.	COMPILER SOFTWARE	MVS/MVT	FORTRAN	Programs written for the FORTRAN G compiler had to be modified for the FORTRAN IV (H-extended) compiler.
14.	COMPILER SOFTWARE	MVS/MVT	FORTRAN	Some programs written for the FORTRANQ compiler abnormally ended (ABENDed) execution with an S0C6 completion code unless the subroutine causing the ABEND was compiled at an optimization level of zero.
15.	COMPILER SOFTWARE	MVS	FORTRAN	Programs written for the FORTRAN IV (H-extended) compiler that were upgraded to the VSFORTRAN compiler required changes because • M&DO's INCORE subroutine and IBM's BCNV subroutine (which convert data to/from EBCDIC formats) were not compatible with the VSFORTRAN library. A VSFORTRAN-compatible version of INCORE was written • VSFORTRAN does not permit logical variables to be used with relational or arithmetic operators • VSFORTRAN will not allow logical variables to be assigned to arithmetic variables • VSFORTRAN does not support DEFINE FILE statements • VSFORTRAN will not allow ENTRY statement arguments to be referenced before the ENTRY statement

8504-(686-1)/84

Table 3-8. Change Required To Convert to IBM 4341 (4 of 6)

CHANGE	REASON	OPERATING SYSTEMS	SOURCE LANGUAGES	DESCRIPTION
16.	COMPILER SOFTWARE	MVS	ASSEMBLER	In VSFORTRAN, character arguments are passed in calling sequences with a pointer to the character string as well as to the character string's length. In addition, the character arguments are not padded with blanks. Several assembler subroutines were modified to make them VSFORTRAN callable.
17.	SYSTEM SOFTWARE	MVS	ASSEMBLER	When reading variable-length data, page-fix errors (S800 ABENDs) can occur if the specified number of bytes to be read exceeds the buffer size.
18.	SYSTEM SOFTWARE	MVS	ASSEMBLER	For unknown reasons, a binary synchronous telecommunications program becomes inactively suspended in execution unless it is in real memory, i.e., not paged.
19.	SYSTEM SOFTWARE	MVS	ASSEMBLER	Absolute offsets used with system control blocks are different under MVT and MVS.
20.	SYSTEM SOFTWARE	MVS	ASSEMBLER	System macros do not necessarily produce the same amount of code as they do under MVT. One program was changed to provide more space for a Data Control Block (DCB) macro and to increase the range of addressability.
21.	SYSTEM SOFTWARE	MVS	ASSEMBLER	MVS does not allow one job to examine the system control blocks belonging to another job. Programs using this feature could not be converted to MVS.
22.	SYSTEM SOFTWARE	MVS	ASSEMBLER	Dynamic printing and job submission from a job in execution were implemented using the MVS dynamic file allocation facility (SVC 99). These functions were available through ASP on the IBM S/360-95 or M&DO's ASPSIM utility on the IBM S/360-75.

Table 3-8. Change Required To Convert to IBM 4341 (5 of 6)

CHANGE	REASON	OPERATING SYSTEMS	SOURCE LANGUAGES	DESCRIPTION
23.	SYSTEM SOFTWARE	MVS	ASSEMBLER	Dynamic file allocation was implemented using SVC 99 rather than supervisor privileges to modify system control blocks.
24.	SYSTEM SOFTWARE	MVS	ASSEMBLER	An extra LOCATE macro must be issued to retrieve catalog information for a high-level index that resides in a catalog volume (CVOL).
25.	SYSTEM SOFTWARE	MVS	ASSEMBLER	SVC 33 (IOHALT) expects different parameters in registers 0 and 1 under MVS than under MVT.
26.	SYSTEM SOFTWARE	MVS	ASSEMBLER	IBM's POST macro does not assemble correctly. A copy of the macro was made and modified.
27.	SYSTEM SOFTWARE	MVS	ASSEMBLER	Several programs ABENDed with a completion code of S0C4 because of fetch storage protection exceptions. For example, one program tried to restore registers from a save area that had been released (FREEMAIN). These ABENDs are sporadic and depend on the layout of virtual memory storage. The ABENDs did not occur on the IBM S/360 computers because those machines did not have a fetch storage protection feature.
28.	SYSTEM SOFTWARE	MVS	ASSEMBLER	A flag used under MVT for TSO execution does not exist under MVS. A new procedure was written so that a program could determine whether it was executing under TSO or not.

Table 3-8. Change Required Tc Convert to IBM 4341 (6 of 6)

CHANGE	REASON	OPERATING SYSTEMS	SOURCE LANGUAGES	DESCRIPTION
29.	SYSTEM SOFTWARE	MVS	ASSEMBLER	MVS uses a different procedure from MVT to calculate elapsed CPU and I/O times for a program.
30.	SYSTEM SOFTWARE FOR TELE-COMMUNI-CATIONS	MVS	ASSEMBLER	A binary synchronous telecommunications program that used EXCP for line I/O did not handle line I/O errors properly. The problem was traced to dependence on a local error-handling routine for the communications lines. The error-handling routine was a part of the MVT system generation but not part of the MVS system generation. The problem was resolved by modifying the program to suppress system error handling for line I/O.
31.	SYSTEM SOFTWARE FOR TELE-COMMUNI-CATIONS	MVS	ASSEMBLER	A program that used BTAM encountered command-reject errors on the communications line. This problem was a result of a system generation error; the communications line had been specified as switched point-to-point rather than nonswitched point-to-point.

SECTION 4 - PROJECT ASSESSMENT

This section discusses the strengths and weaknesses of the conversion process and product and the personnel who supported conversion. It also describes problem areas; the timeliness and usefulness of conversion plans; adherence to standards; and the timeliness, completeness, and quality of the intermediate and final products.

4.1 STRENGTHS AND WEAKNESSES

The following subsections discuss the strengths and weaknesses in the five main areas of converting software.

4.1.1 PROBLEM (REQUIREMENTS)

Table 4-1 (page 4-2) summarizes the strengths and the weaknesses of the problem itself.

4.1.2 CONVERSION PROCESS

Table 4-2 (page 4-4) summarizes the strengths and weaknesses of the conversion process.

4.1.3 CONVERSION ENVIRONMENT

Table 4-3 (page 4-7) summarizes the strengths and weaknesses of the conversion environment.

4.1.4 CONVERSION PRODUCT

Table 4-4 (page 4-9) summarizes the strengths and weaknesses of the end product.

4.1.5 PERSONNEL INVOLVED

Table 4-5 (page 4-10) summarizes the strengths and weaknesses of the personnel who converted the software and various support personnel; Figure 4-1 (page 4-12) summarizes conversion team experience.

Table 4-1. Strengths and Weaknesses of the Problem (1 of 2)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
1. TARGET HARDWARE	**NEUTRAL**	**SATISFACTORY**
a. COMPATIBILITY	**NEUTRAL**	**AVERAGE** Hardware provided was much more compatible than pessimists expected, but not quite as compatible as optimists thought. Misunderstandings about models of peripherals caused most problems: Because GESS ran on a 2250 Model 3 on the IBM S/360-95, it was assumed that GESS would also run on the functionally equivalent 3251. In fact, GESS is not compatible with the 2250 Model 3, which typically uses a controller, and ran only because the particular device was assigned the first sector of the shared display buffer. Keyboards for IBM 3270 alphanumeric terminals were specified to be ASCII, but had to be converted to EBCDIC, causing period of unusability. Substantial changes to assembler language programs (ADL, OPS, GESS) were required.
b. AVAILABILITY	**NEUTRAL**	**LATE** Computer installation schedule slipped 1 month, compressing early phases of conversion and minimizing the opportunity for training. When computer was available, certain support software (utilities) was not and other support software (PROCs) was installed contrary to established user patterns. Staged deliveries of alphanumeric terminals slipped. Terminals had to be rented to alleviate limited access. AT&T divestiture caused delays in line installation, checkout, and repair service. Direct-access storage filled more quickly than expected.
c. PERFORMANCE	**WEAKNESS**	**BELOW AVERAGE** Originally specified configuration provided extremely slow response because of hardware and software reserves. Main features of configuration included access to all disk space from both computers with the MVT and MVS operating systems under VM.

9604(41).84

Table 4-1. Strengths and Weaknesses of the Problem (2 of 2)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
d. RELIABILITY	STRENGTH	**ABOVE AVERAGE** Downtime is minimal.
2. TARGET SOFTWARE	**NEUTRAL**	**SATISFACTORY**
a. AVAILABILITY	NEUTRAL	**AVERAGE** Most system tapes were useless: Software either had been updated, was no longer to be converted, or was not archived. Many system tapes were incomplete or damaged.
b. INTEGRITY	NEUTRAL	**AVERAGE** Source code for five programs was available only in listings. Source code for approximately 10 percent of the programs did not match the operational load module.
c. TESTABILITY	NEUTRAL	**AVERAGE** Benchmark tests did not exist for most programs.
d. AMOUNT	WEAKNESS	**UNSTABLE** Amount of software to be converted in July 1982 doubled by December 1982, although the amount had been expected to decrease.
3. TARGET SCHEDULES	**WEAKNESS**	**COMPRESSED** Time for preparation was minimal. The amount of software to be converted doubled. Higher priorities were assigned to software packages, requiring larger amounts to be converted earlier. Hardware installation and checkout slipped.

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Table 4-2. Strengths and Weaknesses of the Conversion Process (1 of 3)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
1. COST	STRENGTH	**EXCEPTIONAL** The projected and actual MVT and MVS conversion costs were within 2 percent. Cost savings resulted from the cancellation of VSFORTRAN conversion for a subset of the software. Related cost savings resulted because IBM S/360-95 contingency operation budget (June through September) was freed.
2. SCHEDULE	STRENGTH	**EXCEPTIONAL** Basically, all conversion activities were completed on time or ahead of schedule, considering priority changes and needs.
3. VISIBILITY	STRENGTH	**HIGHLY SATISFACTORY** No surprises. First-line managers (ATR, project leader, and project manager) provided excellent communications considering the number of individuals (approximately 60, including GSFC and CSC developers and managers) involved directly or indirectly in the effort. Team managers provided weekly chart matrix and summary update of conversion activities (progress). Team managers gave periodic presentations to higher-level managers on progress.
4. CONVERSION PLANS	STRENGTH	**HIGHLY SATISFACTORY** Conversion plans were excellent; however, the final typed and complete set of detailed plans was not available until April 1983. Nonetheless, parts of the plans were available to the conversion team, as needed.
a. TECHNICAL	STRENGTH	**EXCELLENT** Detailed step-by-step procedures were laid out for each conversion phase.

9604(64)1/84

Table 4-2. Strengths and Weaknesses of the Conversion Process (2 of 3)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
b. MANAGEMENT	STRENGTH	**HIGHLY SATISFACTORY** Managers used an extension of the *Recommended Approach to Software Development* (SEL-81-205) cost model for cost estimates. Managers collected data, conducted internal and external reviews, and used an earned-value method (with Performance Measurement System (PMS)) as a means of progress measurement and quality assurance. Points of contact, lines of authority, and mechanisms of communication were clearly delineated.
c. CONFIGURATION CONTROL	STRENGTH	**HIGHLY SATISFACTORY** Project leader controlled user-supplied and converted source code and load modules. Project used source code library management system (PANVALET) to control source code. Project used program definition, benchmark test definition, converted program delivery, and change report forms to control and monitor conversion team interactions.
5. CONVERSION PLAN PLAN EXECUTION	**STRENGTH**	**HIGHLY SATISFACTORY**
a. TECHNICAL	STRENGTH	**EXCEPTIONAL** In general, all procedures were strictly adhered to; however, certain aspects were changed for efficiency, e.g., individuals were allowed to allocate data sets and the project leader reviewed activities through data set allocation forms and disk maps.
b. MANAGEMENT	STRENGTH	**SATISFACTORY** Procedures worked well in general; however, noncentral control of the conversion effort caused some problems during the early phases of conversion: Higher-level managers at CSC did not like the apparently diffuse control of the conversion effort at GSFC, which included four

9604(64*1)/84

Table 4-2. Strengths and Weaknesses of the Conversion Process (3 of 3)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
b. MANAGEMENT (Cont'd)		user points of contact (POCs) and a senior and junior ATR combination, and asked the project leader and project manager to request GSFC organizational consolidation. In the absence of the senior ATR, the junior ATR and the Code 582 Branch Head misunderstood the lines of communication, as called out in the task assignment and set up with the senior ATR. They requested that all communication go through the junior ATR, thus slowing down the effort. Communication returned to normal shortly after the senior ATR returned.
c. CONFIGURATION CONTROL	STRENGTH	**HIGHLY SATISFACTORY** In general, all procedures were strictly adhered to; however, certain aspects were changed for efficiency, e.g., delivery material prepared by individuals was not always quality assured by the project leader. In only five cases, the wrong program or one that failed a benchmark test was delivered to a POC.
6. CONVERSION ORGANIZATION	**STRENGTH**	**ABOVE AVERAGE** Stable conversion organization. No changes occurred in technical management positions; one key technical member left after MVT conversion, as planned; the team was short one assembler language programmer for the first 9 months of the effort.
7. TESTING STRATEGY	**STRENGTH**	**HIGHLY SATISFACTORY** Simple benchmark testing was efficient and effective. Some programs were returned to the conversion team because additional user testing uncovered problems. Some programs for which the user required no benchmark test were returned to the conversion team when user testing uncovered problems.

9604164*1/84

Table 4-3. Strengths and Weaknesses of the Conversion Environment (1 of 2)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
1. OVERALL	**STRENGTH**	**SATISFACTORY** The environment (native MVS operating system) that evolved during the conversion effort is, relative to IBM S/360-95 environment, very reliable with adequate terminal access, less than ideal TSO response time, limited disk storage, and adequate turnaround.
2. HARDWARE	**STRENGTH**	**HIGHLY SATISFACTORY** During early phases of the conversion effort, many deficiencies existed (see Table 4-1, requirements). Computers have approximately 24-hour mean time to failure. A sufficient number of alphanumeric terminals are available on- and offsite. A sufficient number of high-resolution graphic devices (IBM 3251) are available on- and offsite. Further fine tuning and enhancement are planned and are being pursued.
3. SOFTWARE	**WEAKNESS**	**INADEQUATE**
a. SUPPORT SOFTWARE	**WEAKNESS**	**AVERAGE** Some necessary support software was not available and had to be worked around. One subroutine was written by the conversion team. Some support software still needs to be addressed.
b. CONVERSION TOOLS	**WEAKNESS**	**INADEQUATE** Conversion team members built tools to aid in the data migration step (IBM S/360-95 to IBM 4341) and to scan load modules for subroutines known to need changes.

9604164-1-84

Table 4-3. Strengths and Weaknesses of the Conversion Environment (2 of 2)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
b. CONVERSION TOOLS (Cont'd)		Users (developers or managers) did not have any other tools. For example, No tool to build system (program) that ensures configuration control. No management information system. No code auditor. No dynamic code diagnostic testing tool. No tool for dynamic system (program) configuration analysis. No system (program) performance monitoring tool.
4. TRAINING	**WEAKNESS**	**INADEQUATE** Conversion team training was either not available or was available after it was needed. Some essential manuals for conversion took long to obtain.

9604(64a*1)/84

Table 4-4. Strengths and Weaknesses of the End Product

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
1. OVERALL OBJECTIVES	STRENGTH	**HIGHLY SATISFACTORY** Basically, all software was delivered on or ahead of schedule, considering priority changes and needs. Only the schedule of one program conversion (VSFORTRAN version of GESS) could not have been met under any circumstances.
2. REQUIREMENTS MET	STRENGTH	**HIGHLY SATISFACTORY** All programs were prepared, benchmarked on the IBM S/360-95, transported to the IBM 4341, and converted to MVT on the IBM 4341, by June 1, 1983. MVT conversion for priority 4 and 6 programs were not scheduled to be completed until October 1, 1983 Priority 1 programs: For MVT operation, were completed approximately 1 month early. For MVS operation, were completed approximately 1 month late. For MVS VSFORTRAN operation, were completed approximately 6 months late; however, in part, this was because need for the programs changed. Conversion of a subset of the programs to VSFORTRAN was canceled. In only five cases, the wrong program or a program that failed the benchmark test was delivered. In cases when the user required no benchmark test, a few programs (e.g., OPS) were returned to the conversion team after user testing uncovered problems. In some cases where programs passed the simple benchmark test, the user uncovered problems with additional testing and returned the program to the conversion team.

9004164a-1/84

Table 4-5. Strengths and Weaknesses of the Personnel (1 of 2)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
1. USERS	**STRENGTH**	**ABOVE AVERAGE** Managers gave high priority to preparing user software for conversion, to preparing and executing benchmark tests, and to performing auxiliary tests in support of conversion milestones and objectives. Each user group was shorthanded since they had their regular work to do and also had to develop benchmark tests since few were on hand. However, in general, user support was very timely.
2. CONVERSION	**STRENGTH**	**AVERAGE**
a. DEVELOPERS	**STRENGTH**	**AVERAGE**
	WEAKNESS	The conversion team was inexperienced with full development, except for (very) small projects, with virtual operating systems and applications programs, with assembler language programming, and with the operation of most of the programs on an individual basis.
	STRENGTH	The conversion team averaged a little more than 4 years of applicable (IBM) experience and more than 2 years of flight dynamics environment experience.
	WEAKNESS	The team was in need of one full-time IBM assembler language programmer for 9 months.
	STRENGTH	The team was extremely enthusiastic; only one full-time member left prematurely.
	STRENGTH	The team had a maximum of five part-time members at any one time who were experts with large (or groups of) programs in one of the four software areas.
	WEAKNESS	The team had to depend on at least 8 other experts for spot assignments (primarily MVT conversion) and on approximately 12 attitude operations and maintenance personnel to help run benchmark tests, especially with the ADL group and graphics programs.
	STRENGTH	The two full-time IBM assembler language developers, who had worked in the attitude maintenance area, solved about six systems problems, e.g., with controllers, buffers, real memory, and MVT/MVS operating system discrepancies. They also wrote some system support routines that system personnel could not provide in a timely manner, and developed conversion tools for data migration (IBM S/360 to IBM 4341) and for scanning load modules for specific subroutines.

9604(64a)1/84

Table 4-5. Strengths and Weaknesses of the Personnel (2 of 2)

AREA	STRENGTH/ WEAKNESS	ASSESSMENT
b. MANAGERS	STRENGTH	**ABOVE AVERAGE** The CSC project leader/manager, the second project manager, and the administrative manager as well as the senior ATR, collectively, were very experienced development managers and were experts with most software. Together they had developed or directed/managed the development of more than half the software being converted. Combined with the five part-time and the three full-time software area experts, they ensured that virtually all the software was covered by a knowledgeable person. The managers, because of their vast experience, could answer questions, provide direction, and solve problems quickly.
3. MAINTENANCE	STRENGTH	**ABOVE AVERAGE** Maintenance personnel were primarily users; however, they provided very good support for disk pack and data set management problems.
4. OPERATIONS	STRENGTH	**ABOVE AVERAGE** Operations personnel were primarily users; however, they provided very good support by aiding the conversion team in testing certain programs, e.g., the ADL and SMM groups of programs.
5. LIBRARIANS	NEUTRAL	**AVERAGE** Librarians entered source code for the programs for which only listings existed and performed other clerical work.
6. PROGRAMMER ASSISTANCE CENTER	STRENGTH	**AVERAGE** PAC personnel provided excellent user-type support, (i.e., JCL, procedures, freeing jobs suspended in an inactive state).
7. SYSTEM	WEAKNESS	**AVERAGE** For system-type problems, system personnel were too busy checking and fine tuning the system to provide timely support. System personnel were not fully aware of local modifications to MVT.

9604(64-1)-84

FACTOR	FULL-TIME TEAM MEMBER										TOTAL OR AVERAGE	PART-TIME TEAM MEMBER						TOTAL OR AVERAGE	TOTAL OR AVERAGE
	1	2	3	4	5	6	7	8	9	10		1	2	3	4	5	6		
DURATION (MONTHS)	18	13	13	5	9	18	14	6	8	12	12	5	10	6	7	9	6	7	10
CONVERSION PHASE																			
MVT	●	●	●	●		●	●	●	●	●	9	●	●	●		●	●	5	14
MVS	●	●	●		●	●	●		●	●	8	●	●	●	●	●		5	13
ASSEMBLER EXPERIENCE																			
IBM						●		●			2				●			1	3
OTHER				●	●						2				●			1	3
VIRTUAL SYSTEM EXPERIENCE																			
IBM									●		1							0	1
VAX	●				●				●		3				●		●	2	5
SOFTWARE AREA EXPERTISE																			
CODE 581.2	●					●		●			3				●			1	6
CODE 581.3											0		●					1	1
CODE 582.1											0	●		●				2	2
CODE 582.2											0					●	●	2	2
DEVELOPMENT EXPERIENCE																			
LARGE	●								●		2							0	2
INTERMEDIATE	●				●	●		●	●		5			●	●		●	3	8
SMALL	●			●	●	●		●	●	●	7	●	●	●	●	●	●	6	13
MAINTENANCE	●	●	●	●	●	●	●	●	●		9	●	●	●	●	●	●	6	15
OTHER EXPERIENCE																			
ATTITUDE MAINTENANCE						●		●			2				●			1	3
ATTITUDE OPERATIONS	●		●		●	●		●			5				●			1	6
MISSION ANALYSIS OPERATIONS											0		●					1	1
ORBIT OPERATIONS		●					●				2	●		●				2	4
YEARS OF EXPERIENCE[1]																			
APPLICABLE	8	4	2	2	4	4	4	4	8	2	4	4	4	4	4	2	8	4	4
FLIGHT DYNAMICS	8	4	2	0	2	4	4	4	0	2	2	4	4	4	2	2	8	4	2

[1]GREATER THAN OR EQUAL TO 0, 1, 2, 4, 8 OR 16 YEARS OF EXPERIENCE (JUNE 1, 1983)

9604-PAG-153-91

Figure 4-1. Conversion Team Experience

4.2 PROBLEM AREAS

There were no significant problems. Only minor perturbations, for example, to schedule, cost, plans, leadership, configuration control procedures, occurred.

4.3 CONVERSION PLAN TIMELINESS, USEFULNESS, AND ADHERENCE

The conversion plan for the FDS applications software conversion project was prepared by the key personnel who had worked in the attitude maintenance area and the project leader, who had led several AGSS development projects. Therefore, the preparers were very experienced with the flight dynamics IBM computing environment, data collection, data set management, and configuration management and control, including review, request, and delivery mechanisms. Because of this, they were able to prepare very detailed step-by-step procedures for the various conversion steps. The upgrading of key software to VSFORTRAN was left open since that aspect of conversion would not be started for at least 9 months.

Outlines and a draft of the plan were available during the first month of the project (December 1982). A typed draft was available in January 1983. Each evolutionary version of the plan was reviewed by the ATRs and project managers and revised to incorporate a wider knowledge base, including changes in requirements, policy, and the planned environment. Certain aspects of the plan, for example, number of disk packs available to the conversion team and the policy for data set distribution on the disks, could not be completed until February or March. However, conversion team members were given relevant parts of the plan, with instructions, when they were needed. The final typed plan was issued in April 1983. Because the conversion steps in the plan were very detailed and in a step-by-step format, the plan was very useful.

Conversion team managers made reasonable changes to the plan to improve efficiency on the basis of practical experience with its application. For the most part, certain aspects (e.g., data set allocation) were delegated to team members to remove possible 1- to 2-day delays in project leader actions. The delays were possible and occurred occasionally because team members were stationed in several locations in three different buildings (two onsite and one offsite). Team members also worked early morning, late night, and weekend hours because they were borrowed part-time from an organization that worked those hours or because they wanted to get more efficient computer time. The conversion plan, with changes, was strictly adhered to.

4.4 TIMELINESS, COMPLETENESS, AND QUALITY OF INTERMEDIATE AND FINAL PRODUCTS

For the most part, software was delivered on time and was accepted by the user. Table 4-6 lists the converted programs that were not delivered on schedule and gives the reason for the delay. The quality of the products (source code, operational load modules, and delivery material for the MVT and MVS versions of programs) was consistently high. With few exceptions, the programs delivered to the users functioned properly on the basis of the simple benchmark testing strategy. To further atest to the quality of the conversion work, users' rigorous dual-operations testing and other forms of extensive testing before and after the programs were accepted uncovered only a few discrepancies. Table 4-7 lists the converted programs that were rejected by the user, addressing the reason for rejection.

Table 4-6. Converted Programs That Were Not Delivered on Schedule

NO.	PROGRAM	SLOC (K)	LANGUAGE	SCHEDULED DELIVERY	ACTUAL DELIVERY	REASON FOR DELAY
1	GESS (MVS, FORTRAN IV (H-EXTENDED))	27.8 2.0	ASSEMBLER FORTRAN	04/15/83	05/12/83	UNANTICIPATED CONVERSION PROBLEMS RELATED TO THE NEW HARDWARE OCCURRED, e.g., CONTROLLERS, BUFFERS, AND KEYBOARD INPUT.
2	GESS (MVS, VSFORTRAN)	27.8 2.0	ASSEMBLER FORTRAN	05/15/83 10/01/83 12/02/83	– – 12/02/83	THE VSFORTRAN-COMPATIBLE VERSION WAS INTENDED FOR ERBS AGSS DEVELOPMENT. SINCE THAT EFFORT WAS NOT PREPARED TO USE IT, THERE WAS NO PRESSING NEED TO COMPLETE THE CONVERSION AND THE SCHEDULE WAS RELAXED TO ACCOMMODATE HIGHER PRIORITY TASKS.
3	PASV1 (MVS)	3.0	FORTRAN	10/01/83	11/04/83	SOURCE CODE HAD TO BE KEYED MANUALLY FROM A POOR QUALITY LISTING. MANY KEYING ERRORS RESULTED.
4	XMITGFX (MVS)	0.4	ASSEMBLER	10/01/83	11/04/83	SYSTEM PROGRAMMERS HAD TO MAKE SYSTEM SUPPORT SOFTWARE MODIFICATIONS BEFORE CONVERSION COULD BE COMPLETED.

9604-PAG-153

Table 4-7. Converted Program That Were Rejected by the User

NO.	PROGRAM	SLOC (K)	LANGUAGE	REJECTION DATE	REDELIVERY DATE	REASON FOR REJECTION
1	PRWND	0.3	ASSEMBLER	05/01/83	–	PROGRAM OCCASIONALLY PRODUCED DATA CHECK WITH UNFORMATTED (UT) DATA SET UNDER MVT. IT WAS NOT REDELIVERED BECAUSE THE TSO EMPTY COMMAND TOOK CARE OF THE PROBLEM UNDER MVS.
2	OPPDSDEL	0.1 0.1	ASSEMBLER FORTRAN	09/02/83	09/16/83	PROGRAM HAD A SOURCE LINE OF CODE OUT OF ORDER.
3	GMAN	32.0	FORTRAN	09/15/83	01/20/84	PROGRAM HAS AN UNRESOLVED ERROR WHEN PROPAGATING BACKWARDS USING THE DRAG MODEL. USER IS INVESTIGATING PROBLEM.
4	CADLT	1.3	FORTRAN	09/27/83	10/25/83	PROGRAM COULD NOT ACCEPT LOWER-CASE INPUT FROM THE IBM 3251. THE IBM 2250 DID NOT HAVE LOWER-CASE INPUT.
5	EPHRD	0.1	FORTRAN	09/27/83	10/20/83	PROGRAM COULD NOT ACCEPT LOWER-CASE INPUT FROM THE IBM 3251. THE IBM 2250 DID NOT HAVE LOWER-CASE INPUT.
6	ATTDATA	3.3	FORTRAN	11/30/83	12/02/83	PROGRAM COULD NOT ACCEPT LOWER-CASE INPUT FROM THE IBM 3251. THE IBM 2250 DID NOT HAVE LOWER-CASE INPUT.
7	CONVERT	2.0	FORTRAN	11/30/83	12/02/83	PROGRAM COULD NOT ACCEPT LOWER-CASE INPUT FROM THE IBM 3251. THE IBM 2250 DID NOT HAVE LOWER-CASE INPUT.
8	LOGSCAN	0.1	FORTRAN	10/01/83	11/03/83	PROGRAM HAD DISCREPANCIES IN COMMON STATEMENTS.
9	DUMPDS	0.1	ASSEMBLER	10/11/83	–	PROGRAM WAS DELETED FROM CONVERSION LIST BEFORE PROBLEM WAS FOUND.
10	QUIKSTAT	0.8	FORTRAN	10/13/83	01/18/84	PROGRAM WOULD NOT EXECUTE WHEN LINKED WITH OLDER VERSION OF GMAS.
11	AMAP	10.9	FORTRAN	10/31/83	01/16/84	ORIGINAL SOURCE CODE HAD ERRORS. PROGRAM WAS RELINKED ONLY.
12	STAGTRKS	0.3	FORTRAN	11/15/83	01/26/84	PROGRAM CONTAINED CODE FOR SEVEN-TRACK TAPE VERSION OF CALCOMP PLOTTING PACKAGE. CODE WAS CHANGED FOR NINE-TRACK VERSION OF CALCOMP PACKAGE.
13	OSAG	1.1 0.1	FORTRAN ASSEMBLER	11/18/83	11/25/83	ORIGINAL SOURCE CODE HAD AN ERROR. ERROR WAS CORRECTED.
14	ADLDAT	1.1	ASSEMBLER	01/16/84	01/23/84	PROGRAM WOULD NOT RETURN TSO INFORMATION, PROGRAM WAS LINKED WITH MVT VERSION OF TSOTEL.

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NOTES: ALL THESE REJECTIONS WERE FOR PROGRAMS CONVERTED FOR OPERATION UNDER MVS EXCEPT FOR NUMBER 1 WHICH WAS AN MVT CONVERSION REJECTION.

FOR NUMBERS 4 THROUGH 7, THE USER ORIGINALLY DID NOT WANT THE LOWER-CASE INPUT CAPABILITY. THE CAPABILITY WAS ASKED FOR AFTER DELIVERY AND USE. NUMBER 9 WAS DELETED FROM THE MVS CONVERSION LIST AFTER DELIVERY. THEREFORE, THERE WERE EIGHT REAL REJECTIONS FOR MVS CONVERSION.

SECTION 5 - LESSONS LEARNED

This section summarizes the FDS applications software conversion effort. It contains an executive summary that recapitulates the overall process; discusses key strengths and weaknesses, focusing on how to reenforce the strengths and minimize the weaknesses for future projects; and delineates the lessons learned. It also contains a technical management summary that repeats the assessment of all aspects of the overall effort.

5.1 EXECUTIVE SUMMARY

5.1.1 OVERVIEW

The FDS applications software conversion project was an extremely successful effort, which was completed ahead of schedule and within budget. Approximately 1.3 million flight dynamics applications source lines of code (SLOC) (~200 programs) and associated data (~1000 data sets) were converted from the IBM S/360-95 (MVT) environment to the IBM 4341 (MVT) environment in 6 months while the IBM 4341 was being installed, checked out, and tuned. The MVT conversion phase was completed ahead of schedule (May 27, 1983), providing the users with ample time for rigorous dual-operations testing and allowing the IBM S/360-95 to be disconnected a few days early. In the following 7 months, the conversion to MVS was completed ahead of schedule (December 23, 1983). Low-level user support was provided for another 5 months. Only a handful of discrepancies could be attributed to the conversion process.

The following statements summarize the FDS applications software conversion effort:

1. Starting December 1, 1982, over an 18-month period, the FDS software conversion project rehosted more than 1.3 million SLOC and its associated data from an IBM S/360 environment to an IBM 4341 environment.

2. Overall, schedule and cost control of the effort were excellent.

   a. Hardware systems are more compatible than in the past.

   b. The users had prepared for the endeavor by identifying programs and preparing system tapes for the FDS RFP.

   c. The users had made the conversion effort and support for it their first priority.

   d. The requirements and plans for the conversion process delineated step-by-step processes and controls that ensured configuration control, problem isolation, visibility and measurement of the process, and continuity in operational support.

3. Overall, the managers and key personnel of the conversion effort were the most experienced in the flight dynamics environment.

4. Everyone involved in the effort, either directly or indirectly, provided the highest level of cooperation possible.

5. The resulting IBM 4341 operating computing environment is a vast improvement over the replaced IBM S/360 environment.

   a. The computers are reliable.

   b. There are sufficient numbers of alphanumeric terminals and high-resolution graphic devices on- and offsite.

   c. Improvements are scheduled.

6. The originally specified IBM 4341 computing system configuration was a disaster and caused severe

operations and performance problems throughout the first 4 months of use (March through June 1983)

5.1.2 KEY STRENGTHS AND WEAKNESSES

In the five main areas of FDS software conversion, the key strengths and weaknesses were

AREA	KEY STRENGTHS	KEY WEAKNESSES
PROBLEM (REQUIREMENTS)	HIGH-LEVEL STEPS TO ENSURE CONFIGURATION CONTROL, PROBLEM ISOLATION, AND CONTINUITY OF OPERATIONAL SUPPORT	DYNAMIC STATE (LATE DEFINITION OF DETAIL) READINESS AND INTEGRITY OF SOFTWARE FOR CONVERSION
PROCESS	ALL ASPECTS	NONE
ENVIRONMENT	RELIABILITY TERMINAL ACCESS COMMITMENT TO IMPROVEMENT	SUPPORT SOFTWARE. IN THE HARDWARE REPLACEMENT PROCESS, SOME SUPPORT SOFTWARE CAPABILITY WAS LOST. THE ENVIRONMENT LACKS SOFTWARE DEVELOPMENT AND MANAGEMENT TOOLS.
PRODUCT	RELIABLE END PRODUCTS DELIVERED ON OR AHEAD OF SCHEDULE	NONE
PERSONNEL	EXPERIENCED TECHNICAL MANAGERS AND KEY PERSONNEL OVERALL COOPERATION OF ALL INVOLVED	LACK OF ASSEMBLER LANGUAGE PROGRAMMING EXPERIENCE

9604 (SSC-1)/84

SEE TABLES 5-1 AND 5-2.

See Tables 5-1 and 5-2 for an elaboration of these strengths and weaknesses.

Table 5-1. Key Strengths of Project

KEY STRENGTH	EVIDENCE	METHOD TO REENFORCE
1. END PRODUCTS	Overall, delivered on or ahead of schedule; very few errors attributed to conversion process.	Build and maintain corporate memory so that project steps can be studied.
2. REQUIREMENTS-DEFINED PROCESS STEPS	Clearly defined life-cycle phases minimized configuration control problems and isolated problems.	Usually a process characteristic, but defined in the requirements for the conversion effort. Completely define life-cycle phases in advance, with intermediate and final products.
3. PROCESS	Use of archived information aided in predictable short- and long-term progress as well as cost and schedule control.	Apply environment-tuned cost model. Archive/use information during project to gauge progress and to update schedule/cost estimates. Completely define plans at beginning of project and enforce adherence.
4. EXPERIENCED TECHNICAL MANAGERS AND KEY PERSONNEL	Able to define plans and execute them smoothly. Always in control of aspects of the project. Solved problems outside the scope of the project.	Apply well-defined approach to training developers and technical managers to understand their capabilities and limitations better. Homegrown experienced personnel provide effective direction and continuity.
5. ENVIRONMENT (HARDWARE)	Computers reliable; sufficient number of terminals on and off site; improvements scheduled.	Continually fine tune, enhance, and upgrade environment to remove limitations, to improve performance, and to maintain reliability.

Table 5-2. Key Weaknesses of Project

KEY WEAKNESS	EVIDENCE	METHOD TO REENFORCE
1. REQUIREMENTS (SOFTWARE FOR CONVERSION)	Not very stable (programs and benchmark tests) until shortly before IBM 4341 MVT conversion milestone. Integrity of programs totaling approximately 25 percent of the source code was suspect.	Define and implement better, stricter procedures (through automated tools) that ensure software integrity, configuration control, and system retention (archive) and verifiability (benchmark tests).
2. SHORTAGE OF ASSEMBLER LANGUAGE DEVELOPERS	Most substantial source code modifications occurred in assembler language code; unable to handle in most timely manner.	Make commitment to development language of the future (Pascal, Ada) and phase out older (FORTRAN IV) and infrequently used (assembler) development languages. Reasonable development activity with a language is necessary to retain an expertise with it; minimal maintenance efforts are inadequate to retain a reasonable experience base.
3. ENVIRONMENT (DEVELOPMENT CAPABILITY)	No adequate development (conversion) tools.	Define and supply useful and usable development tools. Tune, enhance, and upgrade environment to remove limitations, to improve performance, and to maintain reliability. Hold regularly scheduled training sessions on performance concepts and changes, and on user do's and dont's.

5.1.3 FUTURE PROJECTS

This section contains recommendations on which aspects should be approached similarly or differently for future conversion projects on the basis of the lessons learned from tne FDS applications software conversion effort.

5.1.3.1 Similar Approaches

Future projects should adopt the following successful approaches to software conversion:

- Before a conversion effort, completely define programs and data, collect appropriate documents, and establish program priority scheme for conversion. Update information each time the conversion effort schedule slips more than 6 months
- Develop and adhere to software conversion and configuration control plans
- Define conversion life-cycle phases and products
- Use a limited number of user points of contact
- Use simple benchmark testing strategy
- Transport the entire user software environment and then cull unneeded software and data leisurely from the new environment to prevent loss
- Keep higher-level, more-experienced managers (Government and contractor) involved to monitor and assess progress, to solve problems, and to provide direction and guidance
- Use software application area experts to help in the conversion process (efficiency and timeliness)

5.1.3.2 Different Approaches

Future projects should differ from this conversion effort by taking the following approaches, the value of which was learned on this project:

- Completely define requirements before conversion effort starts
- Create and fully test systematic and automated transportation procedures for software and data (i.e, develop simple tools for this process); do not use individually prepared system tapes that are inconsistent, incomplete, and outdated
- Allow the conversion team time to prepare and review plans well before the conversion effort has to start
- Provide key conversion team members with essential system documentation and training before the conversion effort starts so that they can become familiar with system hardware and software differences
- Develop simple tools for well-known systematic changes from one operating system or language version to another
- Allow some time for the conversion team to get acclimated to the new environment
- Allow some time to test the proposed new computing system configuration or, at least, make the conversion schedule softer during that period

5.1.3.3 Causes of Errors and Changes

Errors and changes resulting from technical and management approaches to the conversion process were virtually nonexistent.

For IBM 4341 MVT conversion, the principal causes of errors in and changes to the FDS applications software (see Section 3.7 for details) were

1. User references to IBM S/360-specific hardware and identifications and user development practices
2. Environment software packages designed for general direct-access data storage that were affected by system hardware differences (IBM 2314 to IBM 3350 equivalent STC 8360)
3. System hardware differences, in particular the high-resolution graphic device (IBM 2250 to IBM 3251)

FORTRAN and assembler language applications code were affected equally with one exception. The system hardware changes primarily affected the assembler language code. By far, the most time and effort were required to overcome the system hardware differences, i.e., relinking to include modified environment software packages and modifying assembler language code to handle the IBM 3251 graphic device.

For IBM 4341 MVS conversion, the principal causes of errors in and changes to the FDS applications software (see Section 3.7 for details) included those for MVT conversion above as well as the following:

1. Users' software integrity and development practices
2. Environment utility software packages that were affected by system software differences
3. Compiler differences (older compilers to FORTRAN IV (H-extended) and to VSFORTRAN)
4. System software differences (MVT to MVS)
5. System hardware differences (IBM 2250 to IBM 3251 graphic device, and 7-track to 9-track-only tape devices)

FORTRAN code was affected primarily by user problems. Assembler language code was affected primarily by system software differences. By far, the most time and effort were required for assembler language code modifications to account for system software differences.

5.2 TECHNICAL MANAGEMENT SUMMARY

This section summarizes the objective and subjective assessments made throughout this report. The assessments are categorized according to the five main areas of software conversion and overall support.

The assessments can be found in the following tables:

Area of Software Conversion	Table
Overall Support	5-3
Problem (Requirements)	5-4
Process	5-5
Environment	5-6
Product	5-7
Personnel	5-8

Table 5-3. Assessment of Overall Support

AREA	GOOD/ BAD	ASSESSMENT
1. STAFFING	GOOD	The conversion team was very enthusiastic, had average overall experience in the environment and with the application, was fortified with software application area experts, and was led by very experienced technical managers.
		Everyone involved in the conversion effort, either directly or indirectly, provided the highest level of cooperation possible.
2. REQUIREMENTS	GOOD	Conceptually and at a gross level of detail, the requirements were timely, adequate to do the work, and clear.
	BAD	At the lowest level of detail, the requirements were dynamic, incomplete, and unstable.
3. CONVERSION	GOOD	Errors directly attributed to the conversion process were virtually nonexistent. Virtually all (99 percent) the source code now matches the operational load modules. Benchmark tests now exist for most programs. The user community now has the opportunity to employ better, stricter configuration control procedures to maintain software integrity, to ensure system retention (archive) and verifiability (benchmark test).

9004(640)1/84

Table 5-4. Assessment of Problem (Requirements)

AREA	GOOD/ BAD	ASSESSMENT
1. TIMELINESS	GOOD	Gross level detail was known before the conversion effort started.
2. COMPLETENESS	BAD	Definition of detail occurred during conversion process (programs and benchmark tests).
3. ADEQUACY TO DO THE WORK	GOOD	Conceptually, the problem had a very low level of complexity.
4. CLARITY	GOOD	Conceptually, the problem had a very low level of complexity.
5. STABILITY	BAD	Number of programs for IBM 4341 MVT conversion not completely defined until the month before the milestone.

9004164b'1 84

Table 5-5. Assessment of Process

AREA	GOOD/ BAD	ASSESSMENT
1. SCHEDULE CONTROL	GOOD	Overall, end products delivered on or ahead of schedule.
2. COST CONTROL	GOOD	Overall, significant cost savings. Conversion costs were as expected; IBM S/360-95 disconnected on time; FORTRAN 77 (VSFORTRAN) conversion canceled.
3. VISIBILITY	GOOD	Use of weekly archived data aided in predicting short- and long-term progress as well as cost and schedule control.
4. CONVERSION		
a. TECHNICAL	GOOD	Sound approach in mind and on paper.
b. MANAGEMENT	GOOD	Same as 4a.
c. CONFIGURATION CONTROL	GOOD	Same as 4a.
5. CONVERSION PLAN		
a. TECHNICAL	GOOD	Approach strictly adhered to; reasonable changes for efficiency were made.
b. MANAGEMENT	GOOD	In general, procedures worked well; however, noncentral control of project caused some short-term problems.
c. CONFIGURATION CONTROL	GOOD	Procedures strictly adhered to; reasonable changes for efficiency were made.
6. CONVERSION ORGANIZATION	GOOD	Stable team with experienced leaders.
7. TESTING STRATEGY	GOOD	Simple benchmark tests, in general, are efficient and effective for software conversion to a "compatible" hardware environment.

9004(64b*):84

Table 5-6. Assessment of Environment

AREA	GOOD/ BAD	ASSESSMENT
1. HARDWARE	GOOD	Reliable computers, stable environment, sufficient terminals on- and offsite, adequate job turnaround. Plans to further tune performance, strengthen interactive capability, enhance system (disk storage, high-speed printers).
2. SOFTWARE		
a. SUPPORT SOFTWARE	BAD	Most applications support software tuned to MVT operating system and developed in assembler language. Efficient and timely maintenance difficult.
b. DEVELOPMENT TOOLS	BAD	Very few suitable tools available.

9604(640*)/84

Table 5-7. Assessment of Product

AREA	GOOD/ BAD	ASSESSMENT
1. OVERALL OBJECTIVES	GOOD	Converted programs delivered and continue to support analysis, development, and operations.
2. REQUIREMENTS MET	GOOD	Very few problems could be attributed to the conversion process.
	BAD	In general, users were reluctant to accept converted software because additional user testing uncovered some problems after the software passed user-supplied benchmark tests and because user testing uncovered some problems in programs for which the user required no benchmark test.
3. CONVERTED SOFTWARE	GOOD	Nearly all software converted to MVS (99 percent) matches operational load modules. Source code (15K SLOC) for one program was available only from a listing and was not reentered.

9604164b*1/84

Table 5-8. Assessment of Personnel

AREA	GOOD/ BAD	ASSESSMENT
1. ALL	GOOD	First-rate cooperative effort from all personnel involved and affected.
2. USERS	BAD	Considering their own work and conversion support, the users were short-handed during IBM 4341 MVT conversion.
	GOOD	Managers established priority to support conversion.
3. DEVELOPERS	BAD	High level of dependence on area specialists for spot assignments.
		Shortage of assembler language developers to work on large assembler language support programs where most substantive source code modifications occurred.
	GOOD	The conversion team's experience was average in the environment and with the application.
		The conversion team was very enthusiastic about the project, adapted to the changing environment, and worked hard to meet all milestones.
4. MANAGERS		
a. PROJECT LEADERS, MANAGERS, AND ATRs	GOOD	Overall, very experienced group with keen sense of priorities and ability to make things happen.
b. HIGHER-LEVEL GSFC AND CSC MANAGERS	GOOD	Very supportive.

5604(64b*1)/84

SECTION 6 - REFERENCE MATERIAL

This section lists background and project-produced material pertinent to the FDS software conversion effort.

6.1 BACKGROUND MATERIAL

6.1.1 TASK ASSIGNMENTS

All task assignments (TAs) were issued by GSFC under Contracts NAS 5-27555 and NAS 5-27888 during GSFC fiscal years 1983 and 1984.

1. TA 86100, 582-311-80-63-78, FDS Software Conversion, F. McGarry, November 23, 1982
2. TA 40900, 582-311-80-63-78, FDS Software Conversion, F. McGarry, December 21, 1982; amended January 1, 1983, and December 2, 1983
3. TA 43000, 582-315-80-22-78, Software Conversion and Graphics Support, E. Edwards and K. Tasaki, November 15, 1983; amended March 13, 1984

6.2 PROJECT-PRODUCED MATERIAL

6.2.1 DOCUMENTATION

1. CSC, CSC/TM-83/6048, FDS Software Conversion Plan, R. Hendrick, D. Green, and K. Liu, April 1983
2. Software Delivery Forms

Software delivery forms were submitted for every program (see Appendix C) that was delivered. For most programs, two forms were delivered--one for the MVT delivery and one for the MVS delivery.

6.2.2 SOFTWARE ENGINEERING LABORATORY (SEL) FORMS

SEL forms were submitted by CSC and GSFC personnel from December 1, 1982, to June 1984. The forms and a data base representation are located with the Code 582 SEL.

Form Type	Number
1. Resource Summary Form	157 data base records
2. Component Status Report	3076 data base records
3. Change Report Form	85 forms
4. Component Information File	210 data base records
5. System Estimated Statistics	26 items per project
6. Project Phase Dates	8 dates for this project
7. Subjective Evaluations	600 items per project

6.3 OTHER REFERENCE MATERIAL

6.3.1 GENERAL PURPOSE

1. Software Engineering Laboratory, SEL-81-205, Recommended Approach to Software Development, F. McGarry, G. Page, et al., April 1983
2. --, SEL-83-001, An Approach to Software Cost Estimation, F. McGarry, G. Page, D. Card, et al., February 1984
3. --, SEL-83-002, Measures and Metrices for Software Development, D. Card, F. McGarry, G. Page, et al., March 1984
4. --, SEL-84-001, Manager's Handbook for Software Development, W. Agresti, F. McGarry, D. Card, et al., April 1984

6.3.2 COMPUTER MANUALS

IBM Manuals Used During Conversion

1. SC26-3985-3, VS FORTRAN Application Programming: Guide
2. GA22-7070-1, IBM 4300 Processors Principles of Operation for ECPS: VSE Mode
3. GA33-3035-2, An Introduction to the IBM 3250 Graphics Display System
4. GA33-3037-1, IBM 3250 Graphics Display System Component Description

5. GC26-3830-3, OS/VS2 System Programming Library: Data Management

6. GC26-3875-1, OS/VS2 MVS Data Management Services Guide

7. GC26-3983-3, VS FORTRAN Compiler and Library: General Information

8. GC26-3986-2, VS FORTRAN Application Programming: Language Reference

9. GC27-6974-1, OS/VS Problem Determination Aids and Messages and Codes for GPS and GSP

10. GC28-0627-2, OS/VS2 MVS System Programming Library: Job Management

11. GC28-0628-2, OS/VS2 System Programming Library: Supervisor

12. GC28-0648-3, OS/VS2 TSO Guide to Writing Terminal Monitor Program Command or a Processor

13. GC28-0689-6, OS/VS2 MVS Conversion Notebook

14. GC28-0706-1, OS/VS2 MVS System Programming Library: System Management Facilities (SMF)

15. GC28-0984-1, OS/VS2 MVS Overview

16. GC28-1047-0, Vol. 1, OS/VS2 System Programming Library: Debugging Handbook

17. GC28-1048-0, Vol. 2, OS/VS2 System Programming Library: Debugging Handbook

18. GC28-1049-0, Vol. 3, OS/VS2 System Programing Library: Debugging Handbook

19. GC28-1114-0, OS/VS2 MVS Supervisor Services and Macro Instruction

20. GC28-6628-9, IBM System/360 Operating System: System Control Blocks

21. GC28-6631-14, IBM System/360 Operating System: Messages and Codes

22. GC38-1002, OS/VS Message Library: VS2 System Messages

23. GC38-1008, OS/VS Message Library: VS2 System Codes

APPENDIX A - CONVERSION DATA

The FDS applications software conversion information in this appendix is grouped into three categories:

- Conversion rates--Number of programs and source lines of code (SLOC) benchmarked and converted by week
- Resource usage--Staff levels and computer usage by week
- Conversion effort algorithm

Table A-1 is an aid to locating the information on conversion rates and Table A-2 is an aid to locating the information on resource usage. Table A-3 contains the conversion effort algorithm used in planning the FDS conversion project. Table A-4 presents the planned level of effort for the three major phases. Table A-5 presents an example of FDS conversion project effort with actual data included.

Table A-1. Conversion Rate Locator

Figures	Content
A-1, A-2	Number of program benchmarked on IBM S/360
A-3, A-4	Number of program converted to MVT on IBM 4341
A-5, A-6	Number of program converted to MVS on IBM 4341
A-7	Number of SLOC benchmarked on IBM S/360
A-8	Number of SLOC converted to MVT on IBM 4341
A-9	Number of SLOC converted to MVS on IBM 4341

Table A-2. Resource Usage Locator

Figures	Content
A-10, A-11	Planned versus actual staff levels
A-12	Hours of computer use
A-13	Number of computer runs
A-14	Minutes of computer use per run
A-15	Hours of computer use per full-time equivalent (FTE) of staff
A-16	Number of computer runs per FTE of staff

Table A-3. Conversion Effort Algorithm

STRATEGY	PREPARATION	CONVERSION TO MVT	CONVERSION TO MVS	CONVERSION TO FORTRAN 77	UPDATE OF SYSTEM DOCUMENTATION
TESTING STRATEGY[2]					
SIMPLE BENCHMARKING	USER HAS COMPLETELY DEFINED PROGRAM AND BENCHMARK TESTS. CONVERSION TEAM COLLECTS AND MOVES A COPY OF ALL APPROPRIATE DATA INTO ITS CONTROL, RUNS THE BENCHMARK TESTS, AND MOVES ALL APPROPRIATE DATA (REFORMATTING WHERE NECESSARY) TO THE NEW MACHINE	CONVERSION TEAM CREATES NEW LOAD MODULE (MAKING JCL AND SOURCE CODE CHANGES WHERE NECESSARY), RUNS THE BENCHMARK TESTS, COMPARES THEM TO BENCHMARK TESTS FROM THE OLD MACHINE, AND RESOLVES DISCREPANCIES	CONVERSION TEAM CREATES NEW LOAD MODULE FROM SOURCE CODE (MAKING CHANGES WHERE NECESSARY), RUNS THE BENCHMARK TESTS, COMPARES THEM TO BENCHMARK TESTS FROM THE OLD MACHINE, AND RESOLVES DISCREPANCIES	CONVERSION TEAM MAKES SOURCE CODE CHANGES, CREATES NEW LOAD MODULE, RUNS THE BENCHMARK TESTS, COMPARES THEM TO BENCHMARK TESTS FROM THE OLD MACHINE, AND RESOLVES DISCREPANCIES	CONVERSION TEAM PROVIDES UPDATE PAGES TO REFLECT SOURCE CODE, JCL, AND DATA SET INFORMATION CHANGES, AND REISSUES DOCUMENTS. HOWEVER, THE DOCUMENTS ARE NOT UPGRADED TO REFLECT DEFICIENCIES AND CHANGES SINCE THE ORIGINAL ISSUE
EXTENSIVE TESTING	SAME DESCRIPTION AS FOR SIMPLE BENCHMARKING TESTING STRATEGY EXCEPT THAT CONVERSION TEAM DEFINES ADDITIONAL TESTS AND RUNS THEM.				
EXTENSIVE TESTING WITH ACCEPTANCE TESTING	SAME DESCRIPTION AS FOR SIMPLE BENCHMARKING TESTING STRATEGY EXCEPT THAT CONVERSION TEAM DEFINES ADDITIONAL TESTS AND RUNS THEM, AND THE USER DEFINES ACCEPTANCE TESTS THAT THE CONVERSION TEAM DEMONSTRATES TO THE USER.				
STAFF YEARS[3] OF EFFORT PER MILLION SLOC FOR CONVERSION STEPS					
SIMPLE BENCHMARKING	2.60	2.60	5.20	10.39	3.06
EXTENSIVE TESTING	3.16	3.16	6.31	12.62	3.06
EXTENSIVE TESTING WITH ACCEPTANCE TESTING	3.82	3.82	7.63	15.26	3.06

9604(63a*)/84

[1]BASED ON RECOMMENDED APPROACH TO SOFTWARE DEVELOPMENT (SEL 81-205) AND AN APPROACH TO SOFTWARE COST ESTIMATION (SEL-83-001)

[2]TO CONVERT 1.325 MILLION SLOC TO MVS USING A SIMPLE BENCHMARKING TESTING STRATEGY (HOWEVER, SYSTEM DOCUMENTATION WILL NOT BE UPDATED):

EFFORT = 1.325 (2.60 + 2.60 + 5.20)

= 13.78 STAFF YEARS

[3]STAFF YEAR EQUALS 1872 HOURS

Table A-4. Planned Effort for FDS Conversion Project by Testing Strategy

ITEM	CONVERSION STEP	EFFORT		
		SIMPLE BENCHMARK TESTING	EXTENSIVE TESTING	EXTENSIVE TESTING WITH ACCEPTANCE TESTING
1.	PREPARATION	3.44	4.19	5.06
	(PREPARATION)	(1.72)	(2.09)	(2.54)
	(BENCHMARKING)	(0.86)	(1.05)	(1.26)
	(MIGRATION)	(0.86)	(1.05)	(1.26)
2.	MVT CONVERSION	3.44	4.19	5.06
3.	MVS CONVERSION	6.89	8.36	10.11
4.	FORTRAN 77 CONVERSION	13.77	16.72	20.22
5.	DOCUMENTATION UPDATE	4.05	4.05	4.05
6.	**TOTAL**	**31.59**	**37.51**	**44.50**
7.	FDS TOTAL[2] (TOTAL MINUS ITEMS 4 AND 5)	13.77	16.74	20.23
8.	COLUMN x MINUS COLUMN 1 FOR ITEM 7	0.00	2.97	6.46

9604(63*)1-84

[1]STAFF YEAR EQUALS 1872 HOURS. THE ESTIMATED NUMBER OF SLOC DURING THE EARLY PART OF THE FDS PROJECT OSCILLATED BETWEEN 1.3 AND 1.4 MILLION. THE ACTUAL NUMBER OF SLOC (1.325 MILLION) IS USED IN THE EXAMPLE.

[2]FOR THE FDS PROJECT, A SIMPLE BENCHMARK TESTING STRATEGY WAS USED (COLUMN 1 NUMBERS). THE REQUIREMENT TO UPDATE DOCUMENTS WAS DELETED VERY EARLY IN THE PROJECT. THE REQUIREMENT TO CONVERT A SUBSET OF THE PROGRAMS TO FORTRAN 77 WAS NEVER DEFINED AND WAS DELETED ALTOGETHER VERY LATE IN THE PROJECT.

C-2

A-5

Table A-5. Conversion Project Example With Actual Data

CONVERSION STEP	PLANNED		ACTUAL		ACTUAL/ PLANNED RATIO
	EFFORT	PERCENTAGE	EFFORT	PERCENTAGE	
PREPARATION	3.44	25.0	2.78	23.6	0.81
(PREPARATION)	(1.72)	(12.50)	(1.78)	(15.1)	1.03
(BENCHMARKING)	(0.86)	(6.25)	(0.47)	(4.0)	0.55
(MIGRATION)	(0.86)	(6.25)	(0.53)	(4.5)	0.62
MVT CONVERSION	3.44	25.0	2.31	19.6	0.67
MVS CONVERSION	6.89	50.0	6.68	56.8	0.97
FDS TOTAL	**13.77**	**100.0**	**11.77**	**100.0**	**0.85**
USER TESTING[2]	6.46	46.9	4.99	42.4	0.77
FDS PLUS USER TESTING TOTAL	**20.23**		**16.76**		**0.83**

9604.03-84

[1]STAFF YEAR EQUALS 1872 HOURS. ALSO SEE TABLE A 4 FOOTNOTES.

[2]EFFORT IN THE PLANNED COLUMN IS THE DIFFERENCE BETWEEN COLUMNS 3 AND 1 FOR ITEM 7 IN TABLE A 4. THE ACTUAL AMOUNT OF EFFORT PLANNED TO BE USED FOR TESTING BY USERS IS NOT EASILY AVAILABLE. PERCENTAGE IS THE AMOUNT ABOVE THE FDS TOTAL, e.g., 100 (20.23/13.77) 100 46.9 FOR THE PLANNED COLUMN.

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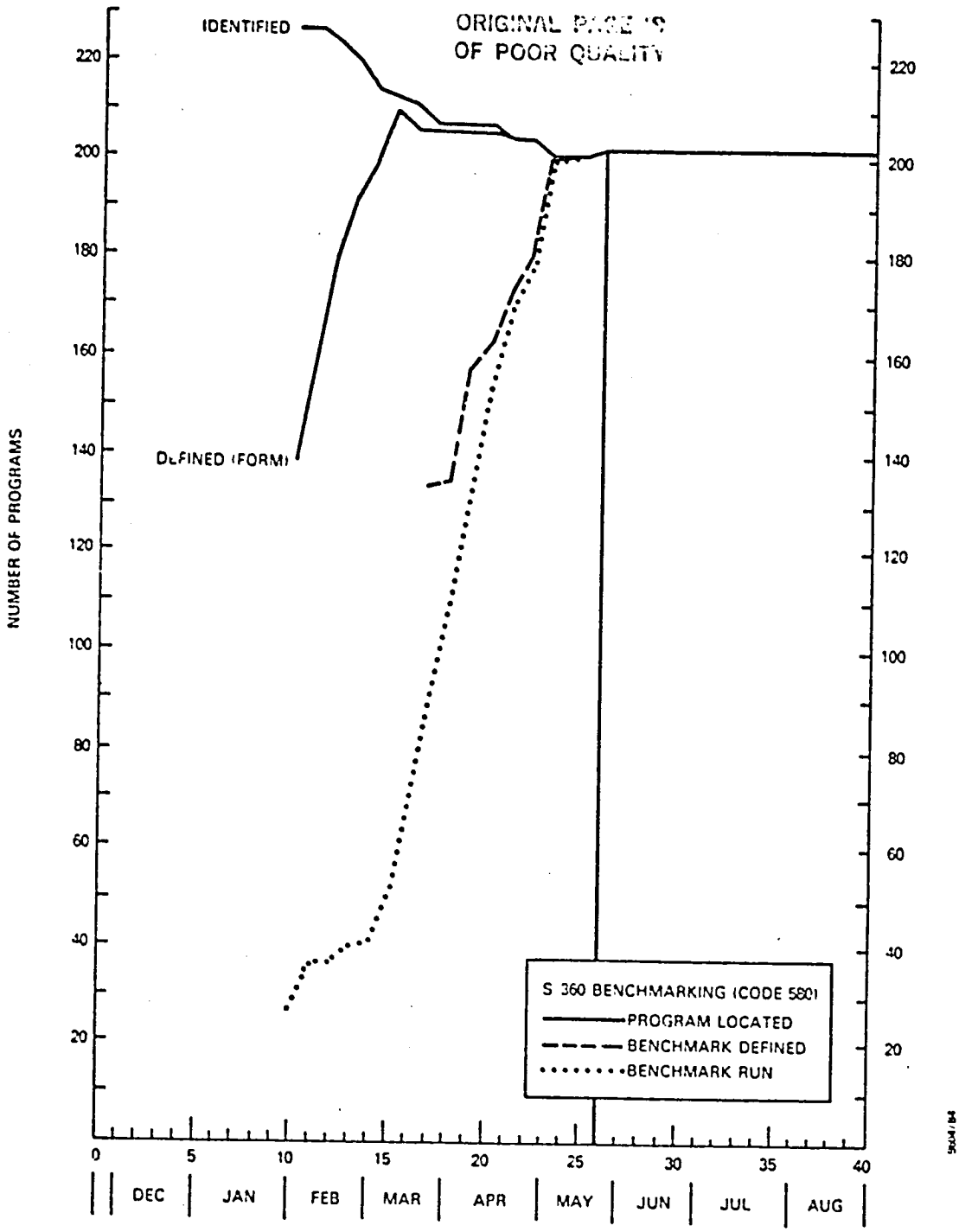

Figure A-1. Accumulated Number of Programs Benchmarked on the IBM S/360-95 by Week for All Code 580

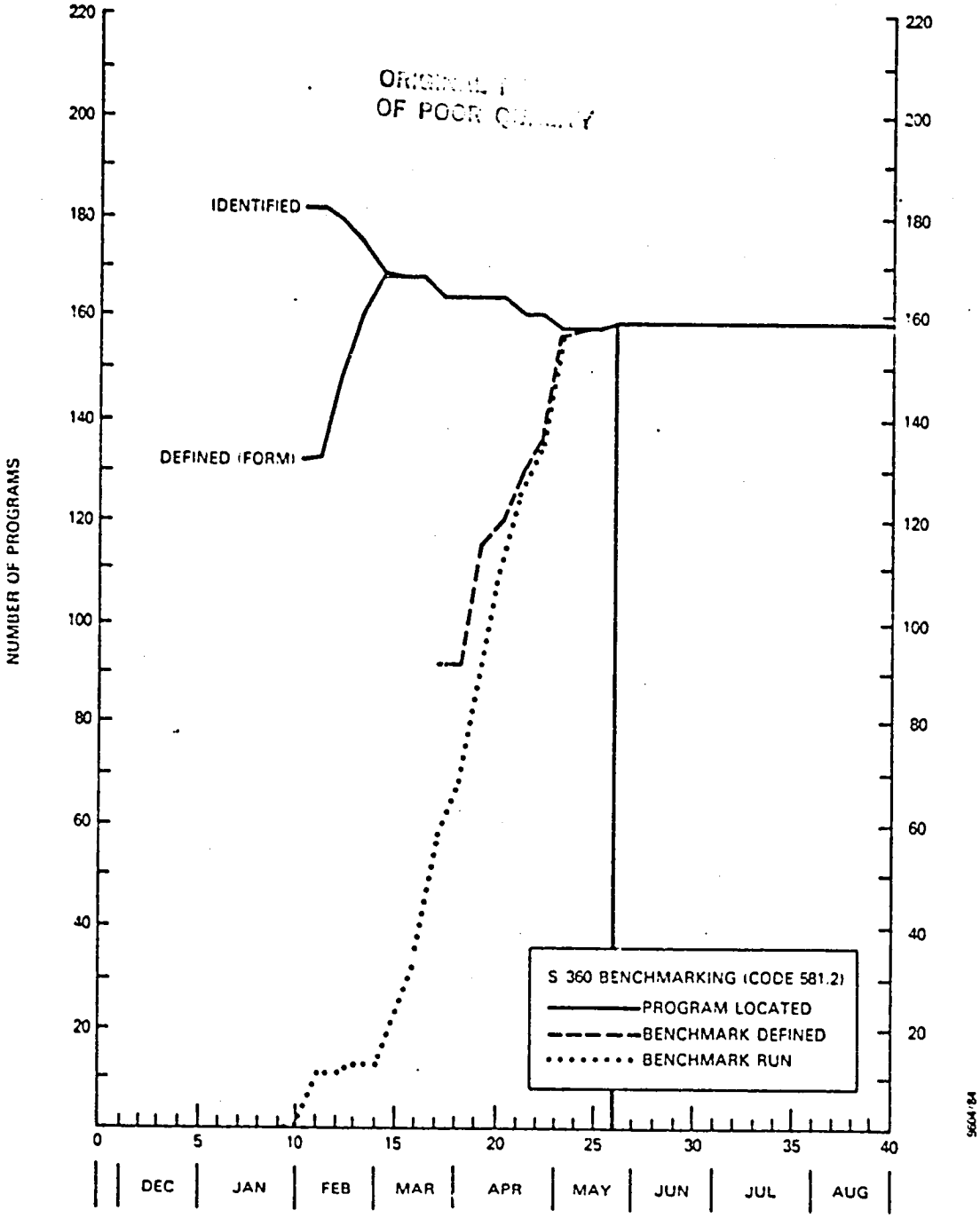

Figure A-2. Accumulated Number of Programs Benchmarked on the IBM S/360-95 by Week for Code 581.2

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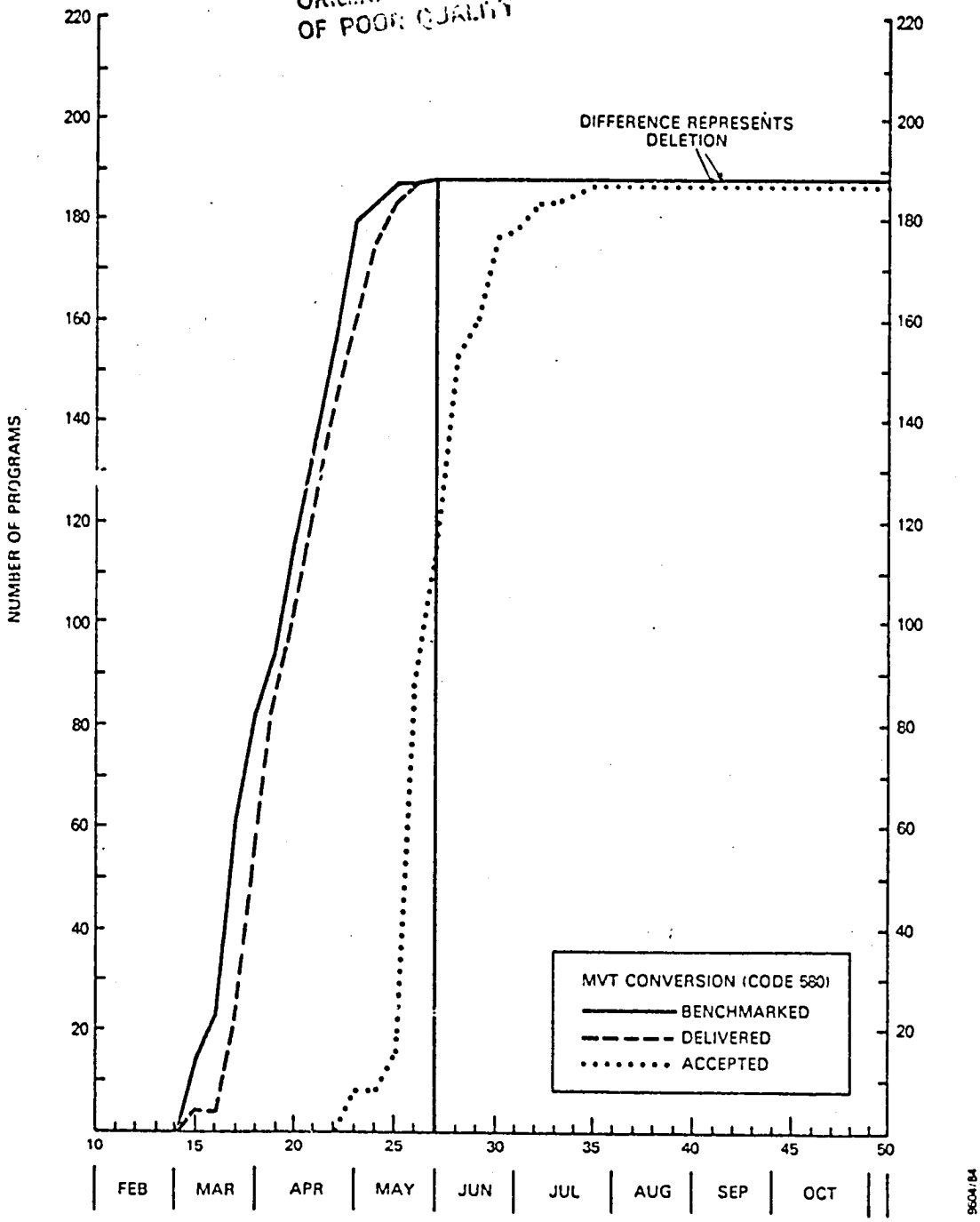

Figure A-3. Accumulated Number of Programs Converted to MVT on the IBM 4341 by Week for All Code 580

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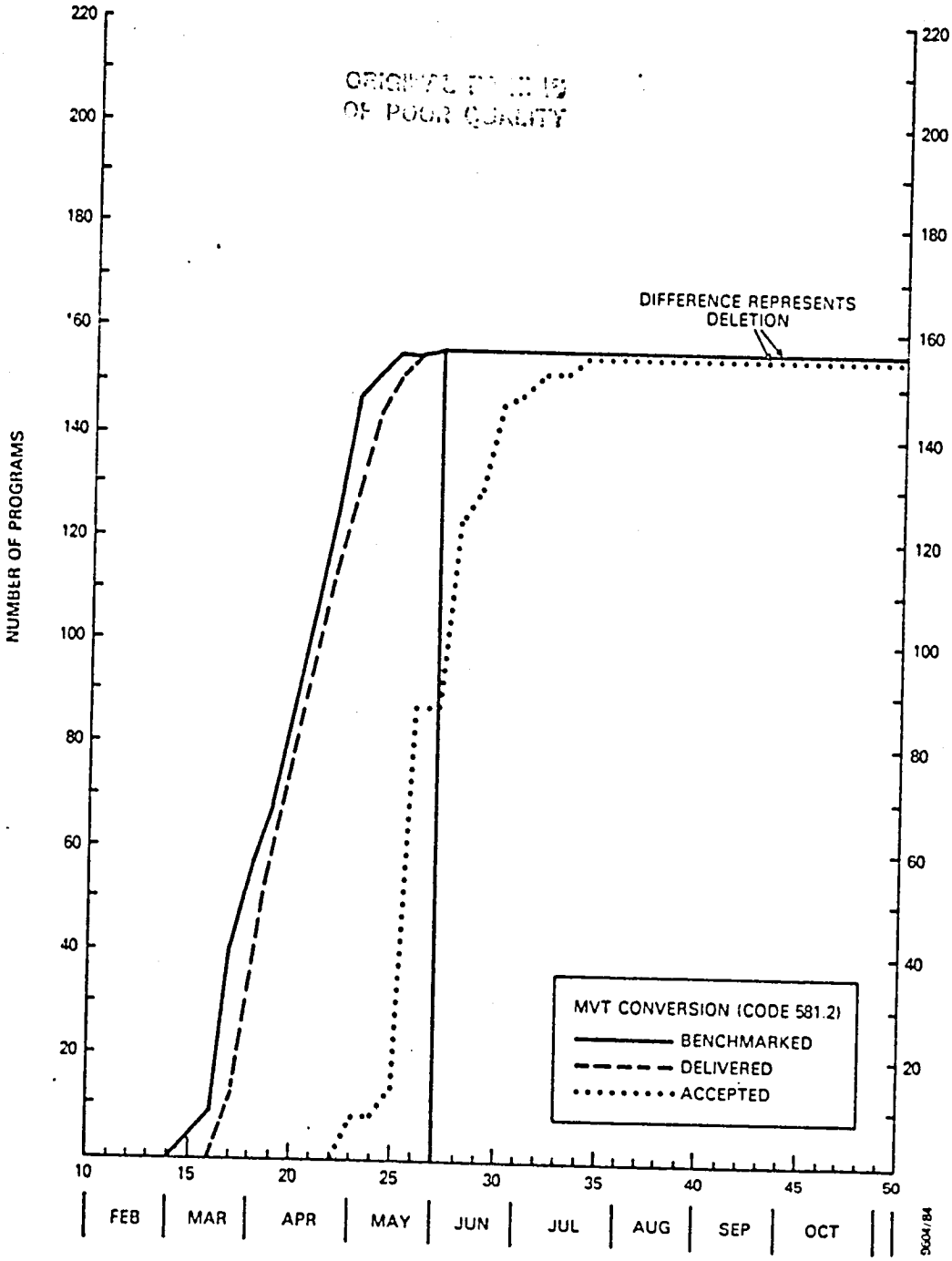

Figure A-4. Accumulated Number of Programs Converted to MVT on the IBM 4341 by Week for Code 581.2

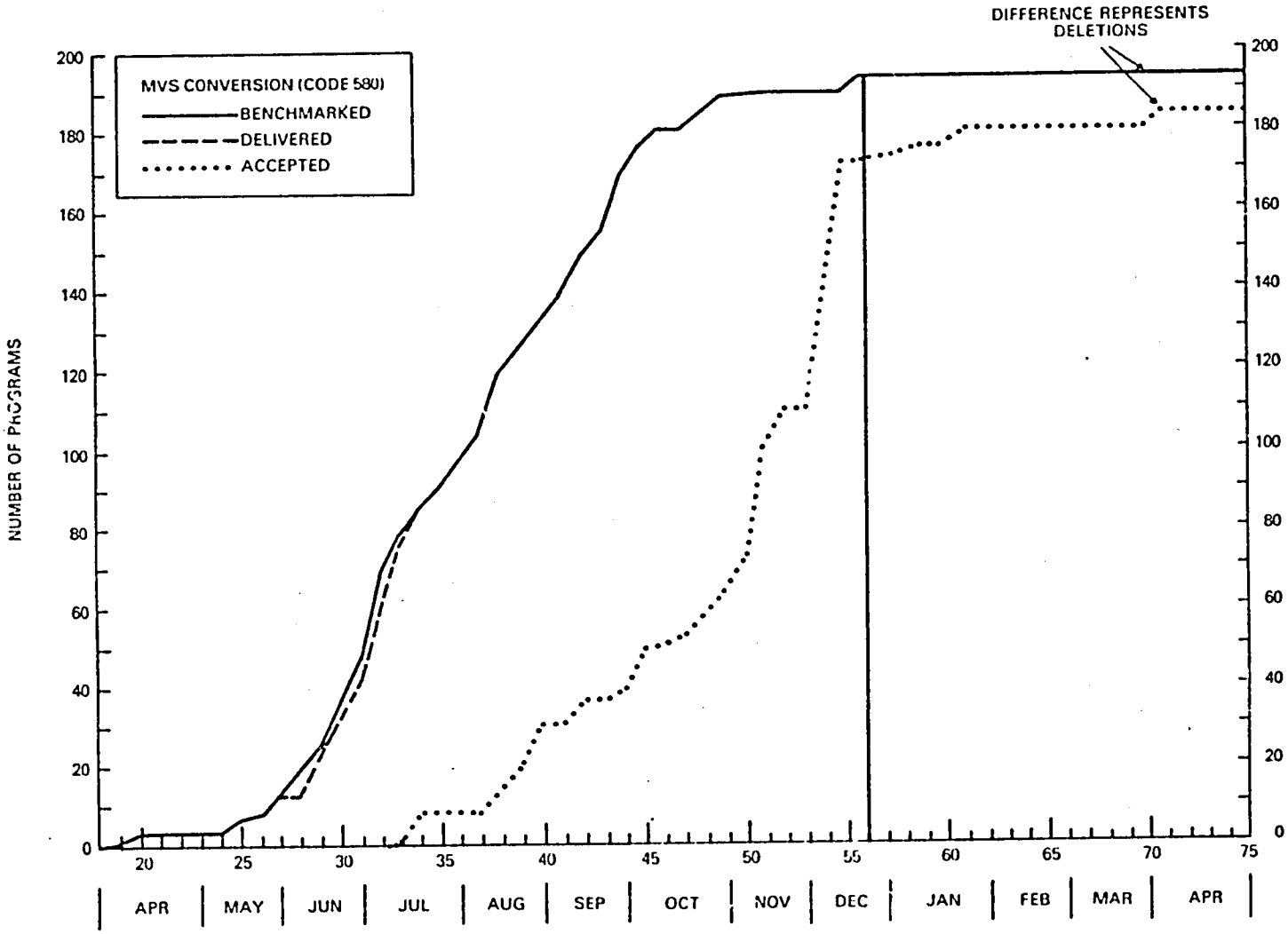

Figure A-5. Accumulated Number of Programs Converted to MVS on the IBM 4341 by Week for All Code 580

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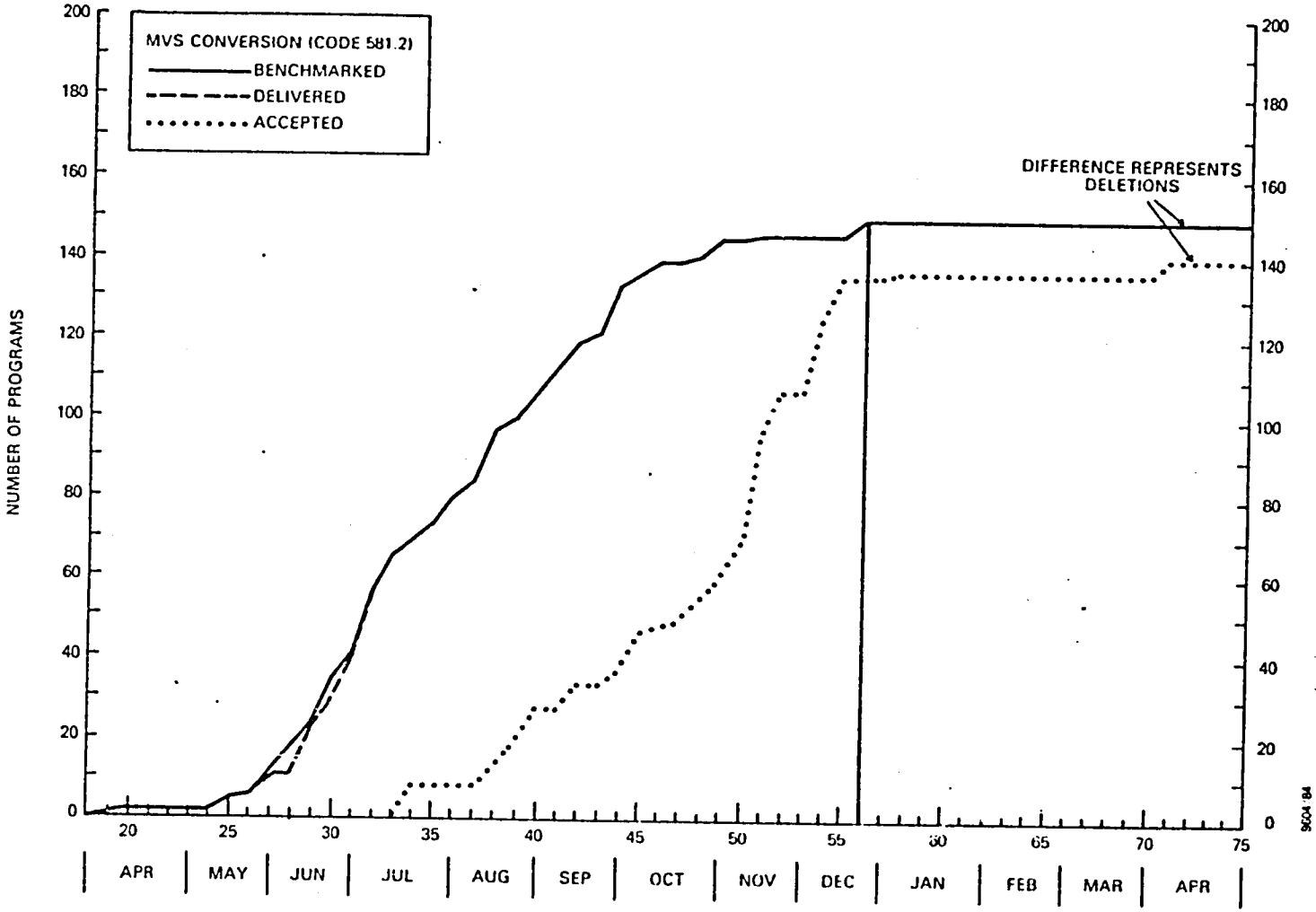

Figure A-6. Accumulated Number of Programs Converted to MVS on the IBM 4341 by Week for Code 581.2

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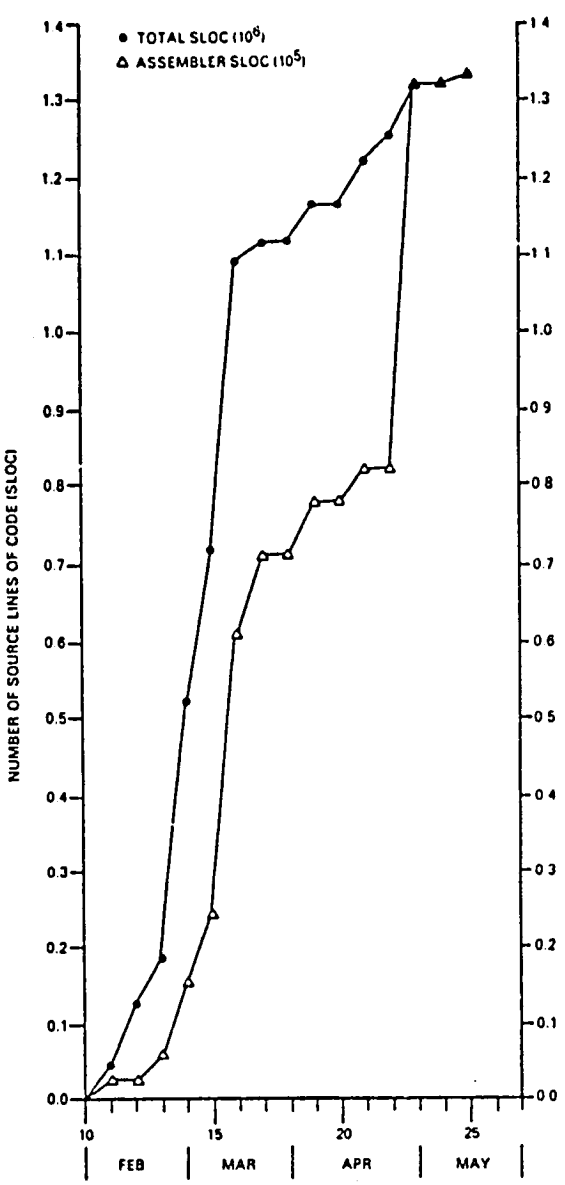

Figure A-7. Accumulated Number of SLOC Benchmarked on the IBM S/360-95 by Week

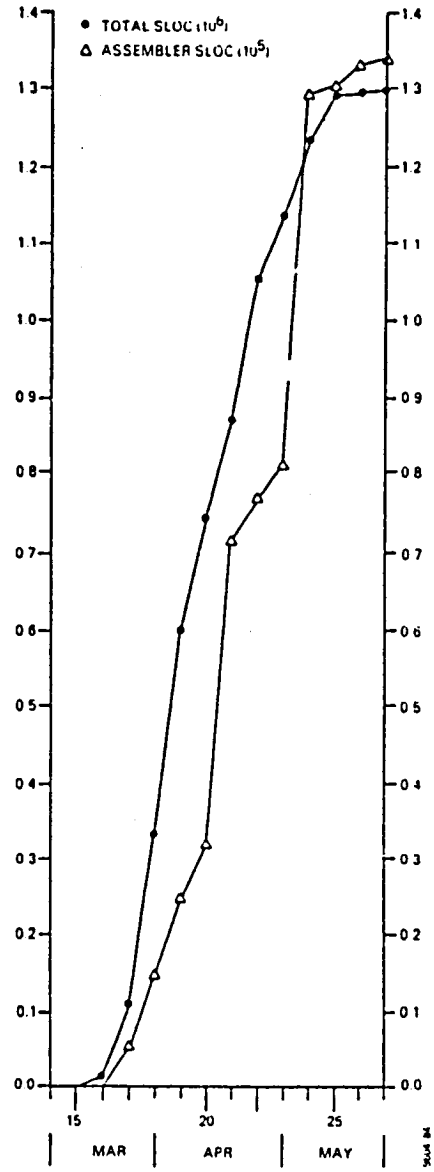

Figure A-8. Accumulated Number of SLOC Converted to MVT on the IBM 4341 by Week

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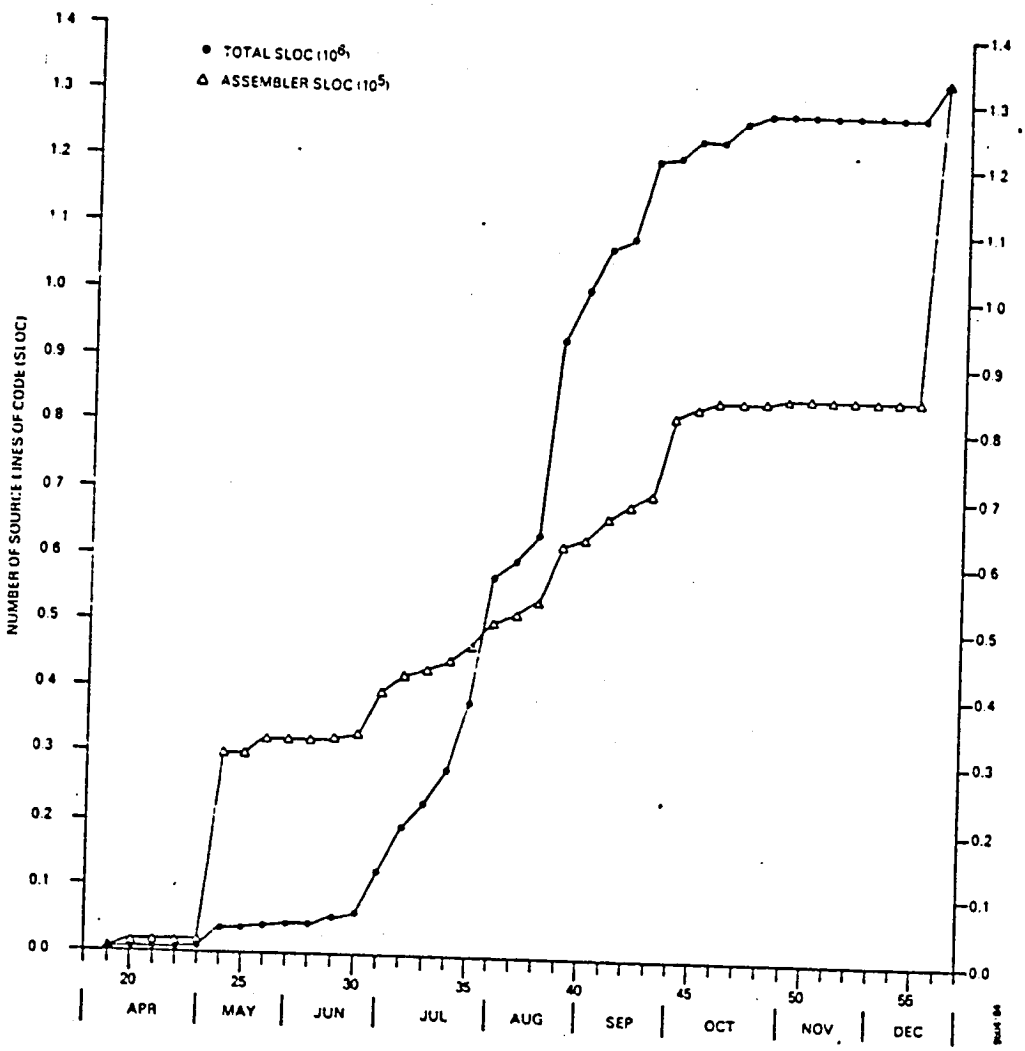

Figure A-9. Accumulated Number of SLOC Converted to MVS on the IBM 4341 by Week

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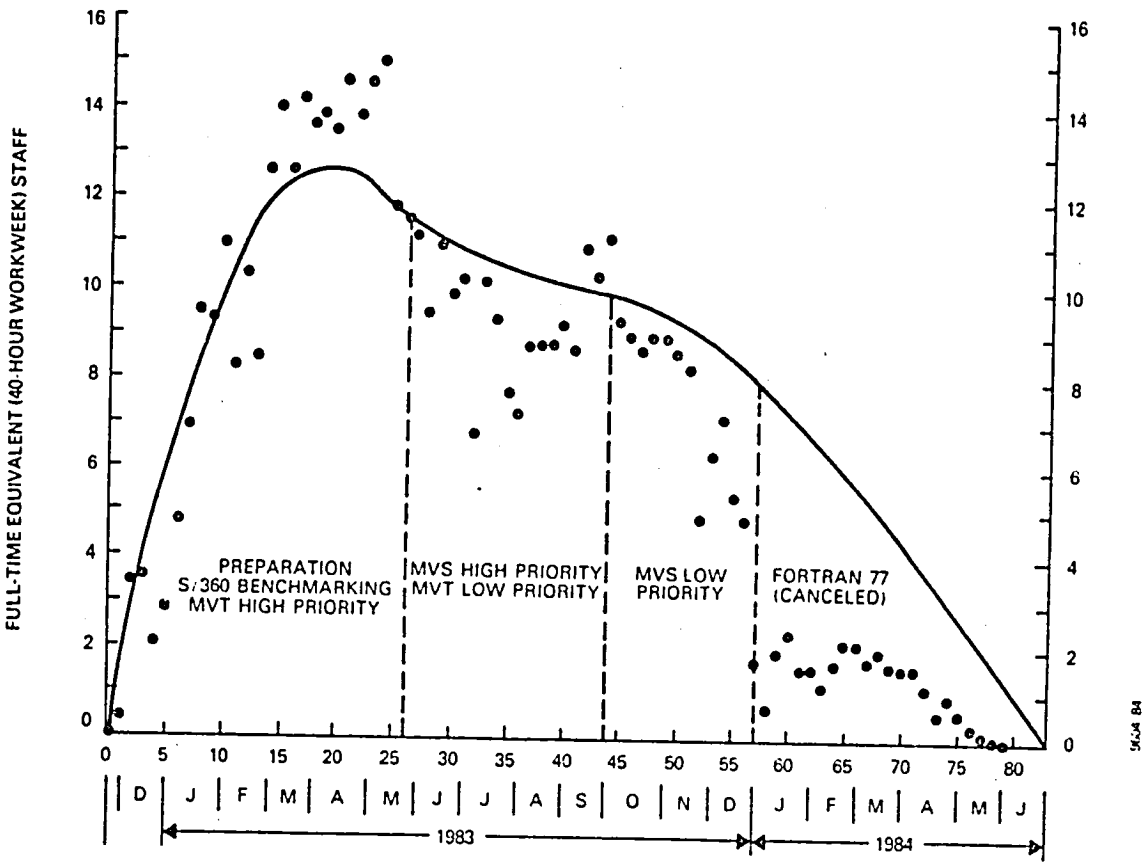

Figure A-10. Planned Versus Actual (Dots) Full-Time Equivalents of Staff by Week

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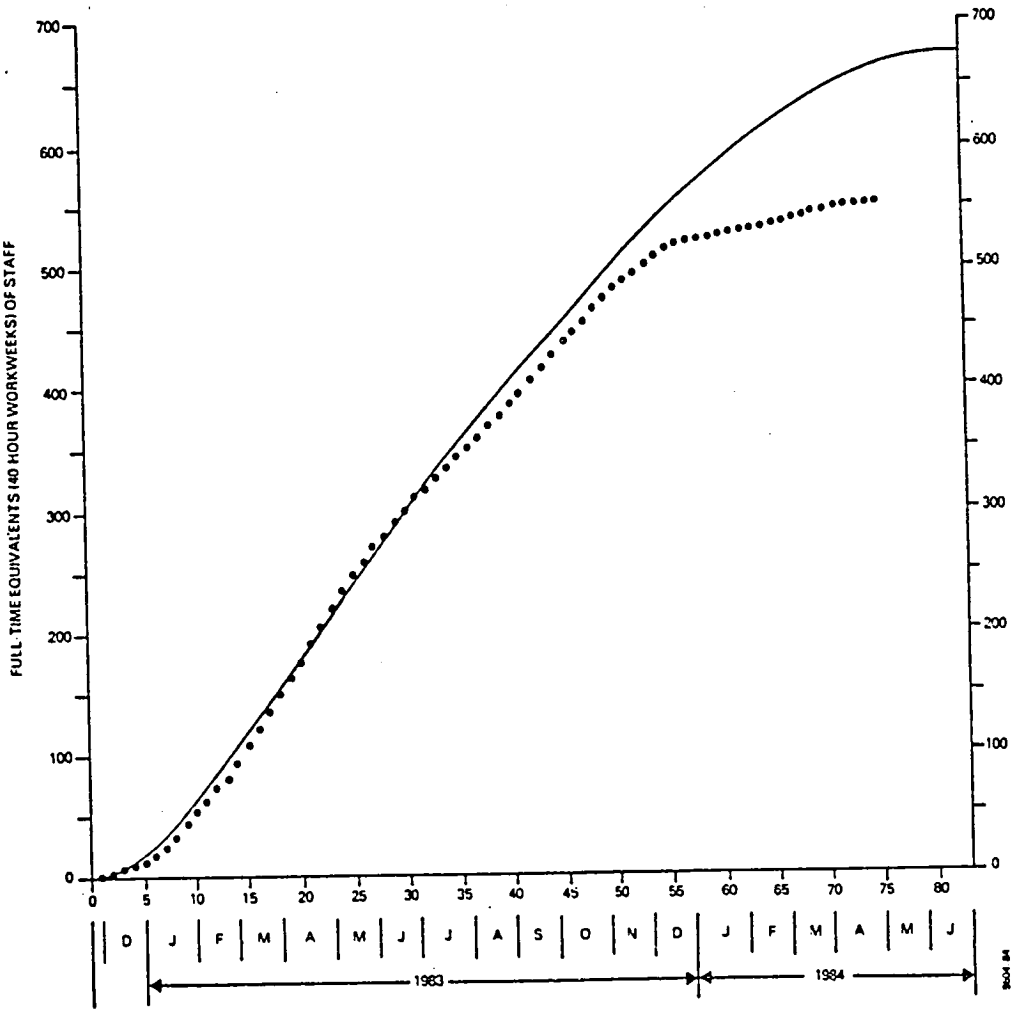

Figure A-11. Planned Versus Actual (Dots) Accumulated Full-Time Equivalents of Staff by Week

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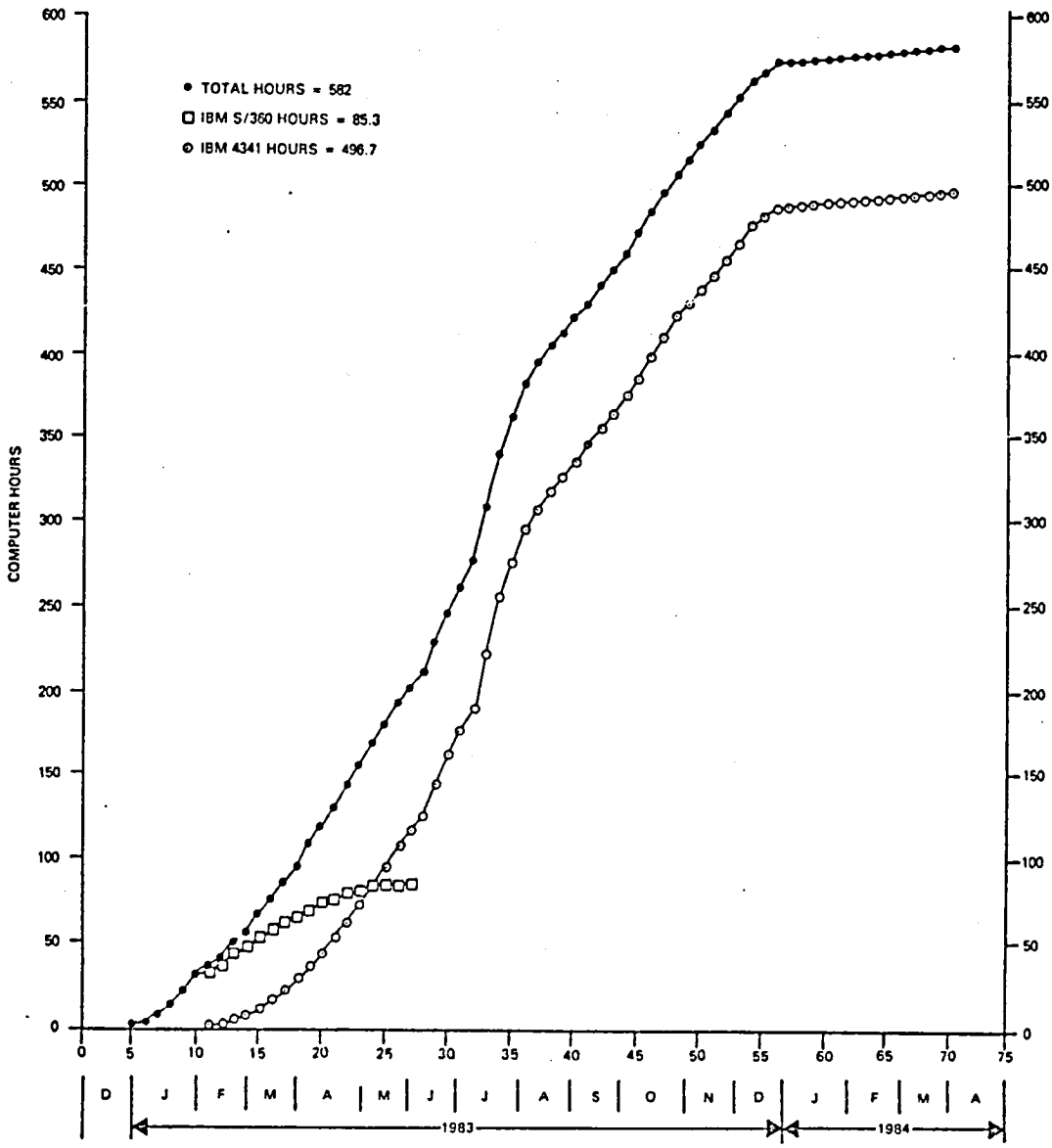

Figure A-12. Accumulated Hours of Computer Use by Week

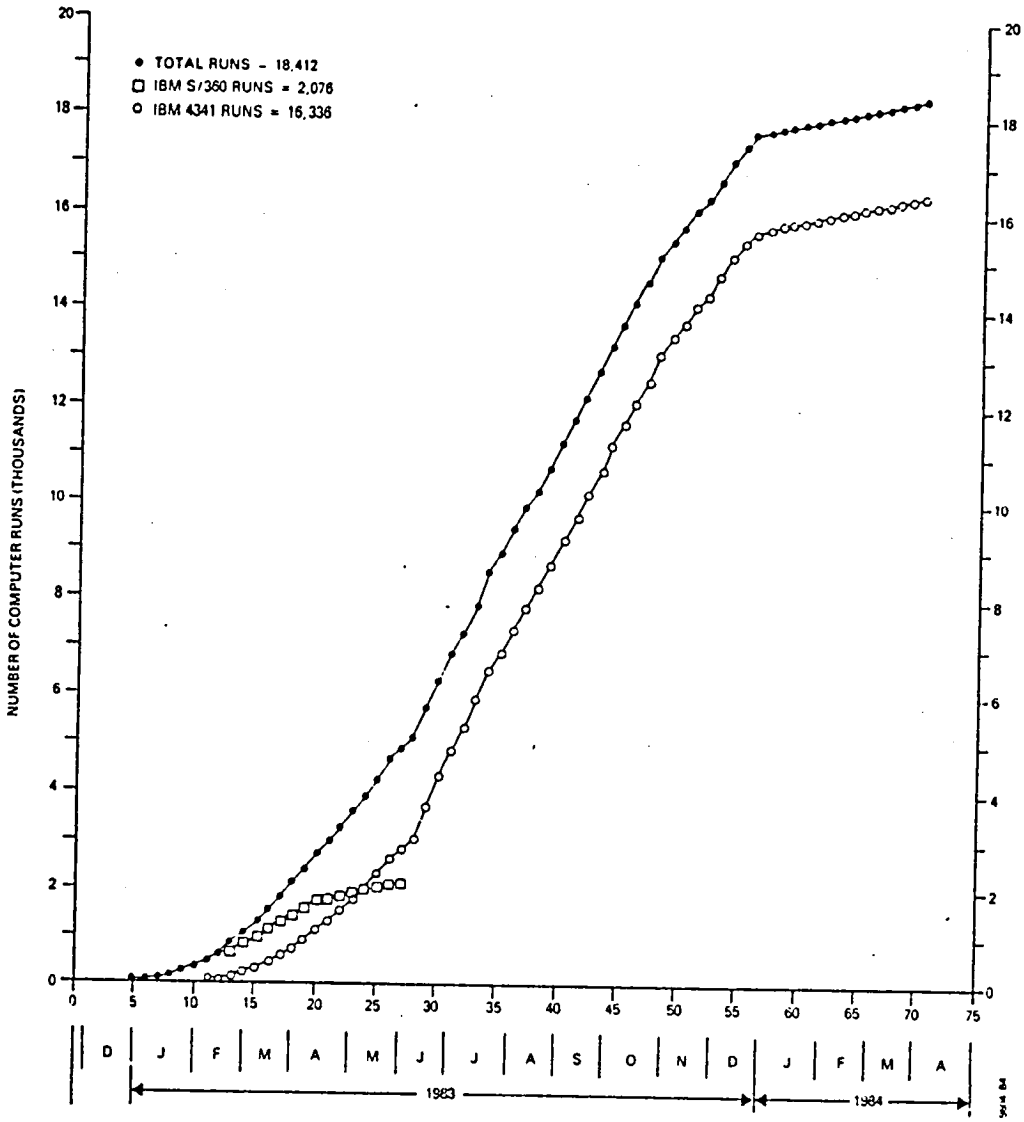

Figure A-13. Accumulated Number of Computer Runs by Week

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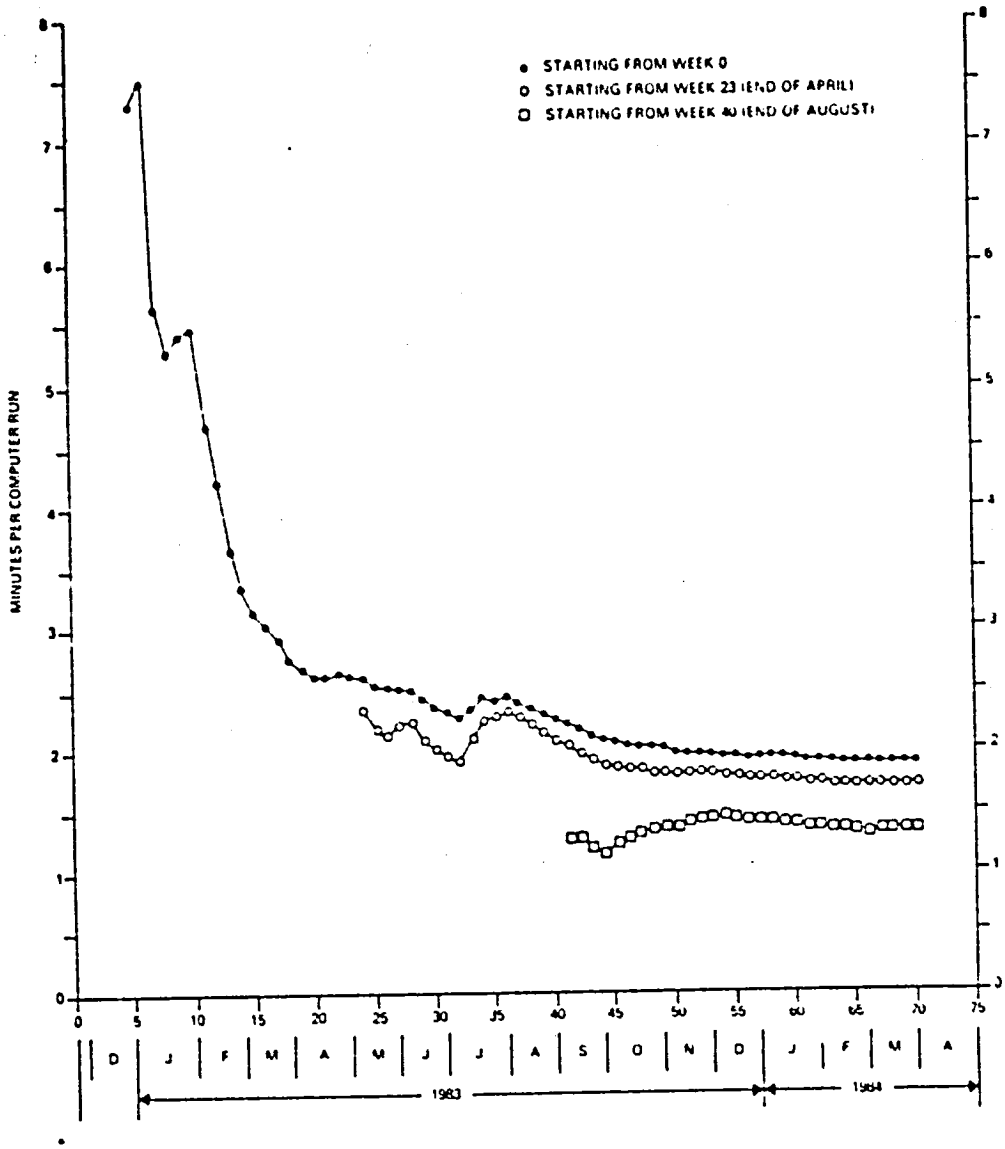

Figure A-14. Accumulated Minutes of Computer Use per Accumulated Computer Runs by Week

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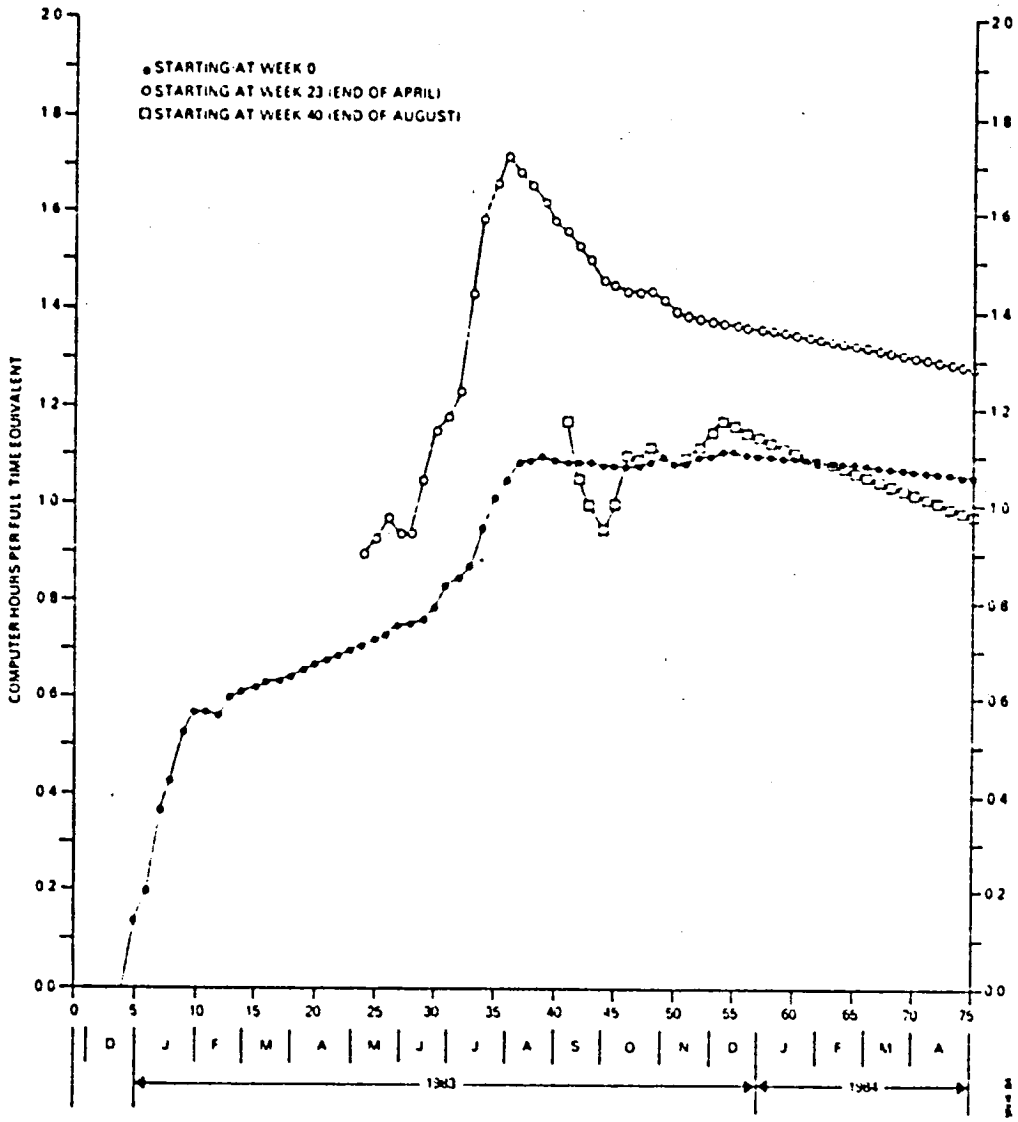

Figure A-15. Accumulated Hours of Computer Use per Accumulated Full-Time Equivalents of Staff by Week

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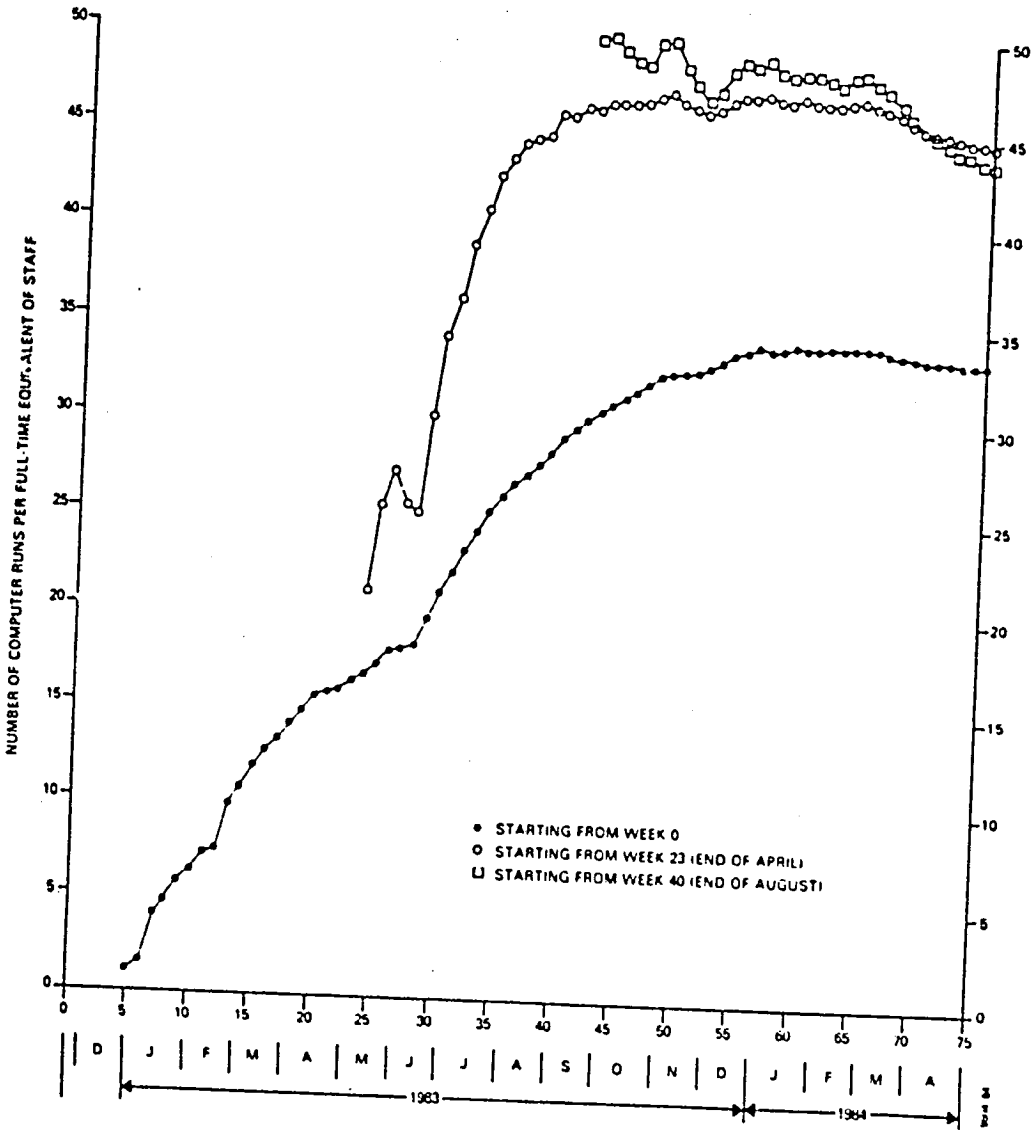

Figure A-16. Accumulated Number of Computer Runs per Accumulated Full-Time Equivalents of Staff by Week

APPENDIX B - CONVERSION APPROACH

This appendix contains the approaches for the three steps in the conversion process. Section B.1 presents the approach to benchmark preparation and execution on the IBM S/360-95. Sections B.2 and B.3 address the approaches to MVT and MVS conversion, respectively. Section B.4 contains facimiles of the various forms used throughout the conversion process.

B.1 BENCHMARK PREPARATION AND EXECUTION ON IBM S/360-95

Through GSFC user points of contact (POCs), the software program's user provided the following information to software conversion personnel for each program to be benchmarked:

1. Job control language (JCL) to execute the benchmark test on the IBM S/360-95 or -75(C1) computer. If any data sets referenced in the JCL required special initialization or set up, the POC provided an explanation of the procedure involved.

2. Operating instructions, if the benchmark involved interactive processing.

3. Indication as to how the IBM 4341 benchmark tests were to be evaluated; that is, what program output was to be compared after the IBM S/360 and IBM 4341 benchmark tests.

After receipt of the necessary information, software conversion personnel performed the following activities:

1. Obtained the volume serial numbers of two blank library tapes. These tapes were of 6250-bytes-per-inch (bpi) quality, whenever available, and were to be written at a density of 1600 bpi with BYPASS label processing. One tape was used in generating a primary benchmark tape; the second was a copy (created in step 13 below) of the primary benchmark tape.

2. Copied to one tape all data sets referenced by the benchmark execution JCL provided by the POC. Load module and GESS-nonresident tables data sets, as well as empty data sets, were copied. Data sets were copied to tape, one data set per file. The IEBGENER and VSCOPY utilities were used for copying sequential and partitioned data sets, respectively.

3. Described the contents of the tape by completing a Tape Description Form. The volume serial numbers of both tapes obtained in step 1 were indicated on the form, with a note as to which tape is primary. In the Disk Data Set Name field, two data set names were given: the actual name of the data set copied to tape and a name in the form

GJFDS.idBENCH.pgm.qual

where id denotes the initials of the appropriate GSFC Section Head (RW = R. Werking, JC = J. Cooley, CN = C. Newman, and FM = F. McGarry), pgm is the name of the program, and qual is a unique qualifier indicating the function of the data set (e.g., NL1, TPOUT2, DATA1, OUT1, OUT2). The latter data set name was given to the disk data set into which the tape file was unloaded (see step 6 below).

4. Allocated a permanent partitioned data set named GJFDS.idBENCH.pgm.CNTL, where id and pgm are as defined in step 3 above. This data set had to be large enough to contain, in separate members, the benchmark execution JCL provided by the POC, the benchmark execution JCL as modified by software conversion personnel, and JCL to unload the benchmark tape. The data control block (DCB) attributes of the data set were RECFM=FB, LRECL=80, and BLKSIZE=800.

5. Placed the benchmark execution JCL provided by the POC in members EXEC and OLDEXEC of GJFDS.idBENCH.pgm.CNTL.

6. Set up, in GJFDS.idBENCH.pgm.CNTL(UNLOAD), JCL to unload the files placed on the benchmark tape in step 2. This JCL unloaded each tape file into a scratch disk data set using the same utility that created the file. These scratch data sets were created and cataloged within the unload JCL. The data sets were given names in the form GJFDS.idBENCH.pgm.qual as specified on the Tape Description Form. The data set attributes and size were identical with those of the original data set that was copied to the tape.

7. Modified the benchmark execution JCL in GJFDS.idBENCH.pgm.CNTL(EXEC) to change all data set names (except for load module and GESS-nonresident table data sets) to corresponding names of the form GJFDS.idBENCH.pgm.qual as referenced in the unload JCL. Any data sets that were not copied to the tape in step 2 because they were empty were allocated by the benchmark execution JCL and the JCL was modified to reflect this change. Data set names in the form GJFDS.idBENCH.pgm.qual were used for this purpose. Program output that was to be evaluated to determine the success of the benchmark was directed to a data set (and not, for example, to SYSOUT=A) to allow the output to be copied to the benchmark tape in step 10 below. Again the JCL was modified, as necessary, to reflect this change. Data set names in the form GJFDS.idBENCH.pgm.qual were used for this purpose. The above-mentioned output was also obtained in hard-copy form. To do this, additional job steps had to be coded to copy the output from the data set to SYSOUT=A. This copying was done using the IEBGENER and LISTPDS utilities for sequential and partitioned data sets, respectively. If the output was not in EBCDIC form, a hexadecimal listing of the data set had to be generated using the PATRICK utility with the DMP option for sequential data sets and the LISTPDS utility with the HEXOUT option for partitioned data sets.

The parameter MSGLEVEL=(1,1) had to be coded in the JOB statement.

8. Decided which computer, the IBM S/360-95 or -75(C1), would be used to execute the benchmark, given that either computer was acceptable. Submitted the JCL to unload the benchmark tape on that computer. If this JCL was submitted on the IBM S/360-75(C1), it was necessary to ask dispatch personnel to take the library tape to that computer.

9. After the benchmark tape was unloaded successfully, submitted the JCL to execute the benchmark. If the benchmark involved interactive processing, performed the processing by following the operating instructions provided by the POC.

10. After the benchmark was executed, appended to the benchmark tape the GJFDS.idBENCH.pgm.CNTL data set and the output data sets needed to evaluate the success of the benchmark. The above-mentioned data sets were copied to the tape in the above order with one data set per file. The IEBGENER and VSCOPY utilities was used to copy sequential and partitioned data sets, respectively.

11. Completed additional entries on the Tape Description Form to describe the tape files created in step 10 above. The Disk Data Set Name field contained only the name of the data set that was copied to the tape.

12. Clearly labeled the printed output from the benchmark execution run to indicate the program name, the associated data definition name (DDNAME), and the date.

13. Using the PATRICK utility, copied the benchmark tape to the second of the two tapes obtained in step 1 and ran the TAPESCAN utility on both tapes.

14. Delivered the following items to the project leader: the Tape Description Form, all printed output from

the benchmark run (including the SYSMSG output), the TAPESCAN printed output, the description provided by the POC of how benchmark runs were to be evaluated, and any benchmark operating instructions or data set initialization/setup procedures provided by the POC. The project leader quality assured these items and then notified the POC that the program has been benchmarked.

15. Deleted GJFDS.idBENCH.pgm.CNTL.

B.2 MVT CONVERSION

Load modules were converted according to their assigned MVT conversion priority. The only modifications made were those required for correct execution of the load modules under MVT on the IBM 4341. Obsolete source code was not deleted nor were programs optimized.

The procedure for converting a given load module to MVT on the IBM 4341 is shown in Figure B-1. These same activities are discussed below in greater detail.

1. Determined as accurately as possible for each load module one of the following four cases (priority order: case 1, case 2, ...):

CASE 1	Load module can be used as is
CASE 2	Load module must be relinked to include new versions of M&DO routines (e.g., FTIO, DAIO, CALCOMP) or general application subroutines
CASE 3	Source code must be modified and load module created via relink
CASE 4	Source code must be modified and load module created from source code

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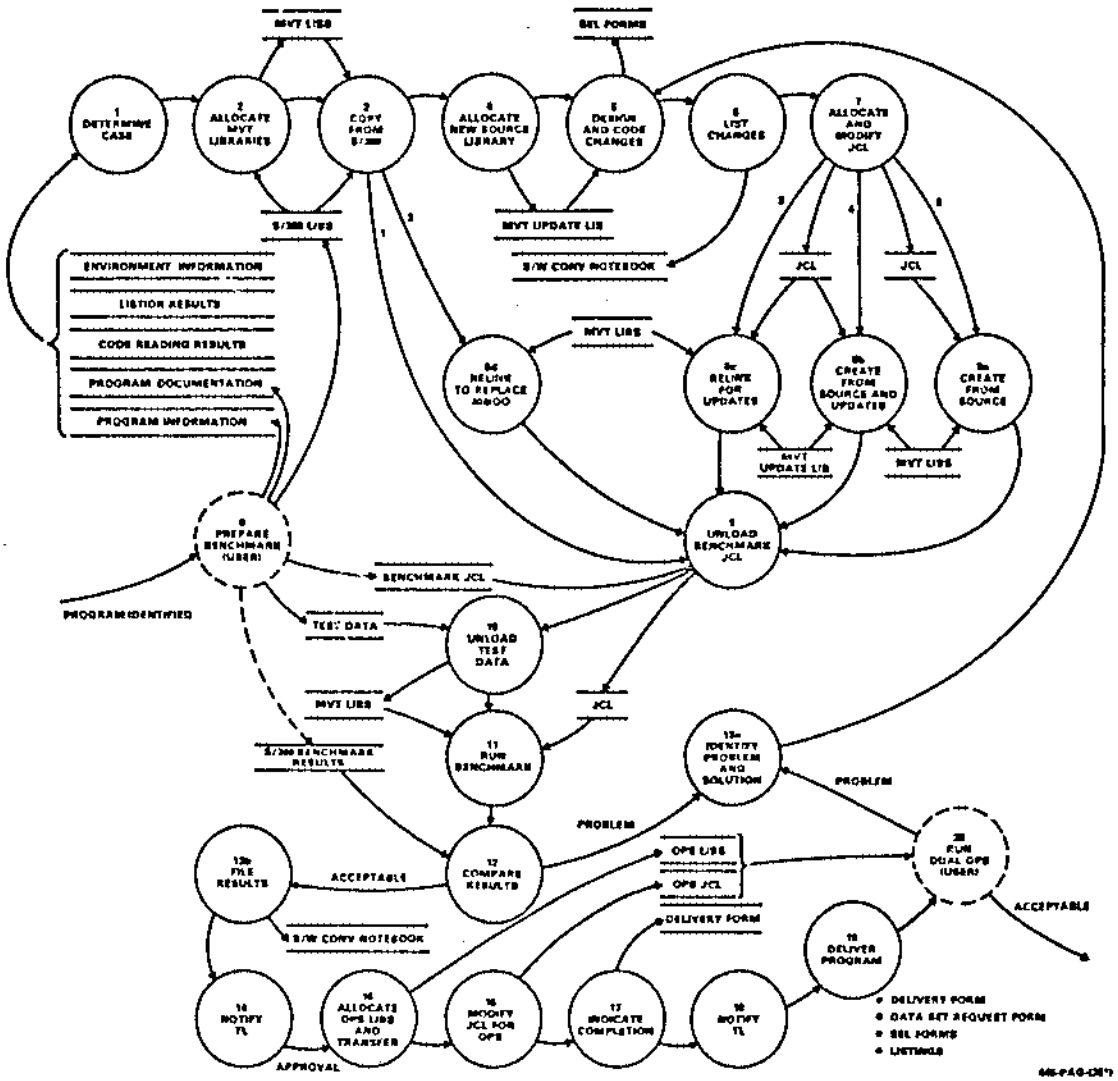

Figure B-1. MVT Conversion

To help make this determination, personnel

a. Studied the new computer system by reading manuals, attending class, and holding discussions with cognizant personnel

b. Obtained listing of CSECTs in the load module using the M&DO LISTIDR utility to check for the presence of subroutines that had been previously identified as requiring modification

c. Read the code (e.g., to look for device dependencies)

d. Read application program documentation

e. Consulted with personnel familiar with the software

2. An MVT load library, an MVT PANVALET library, and, if required, an MVT GESS nonresident tables data set were allocated.

EXAMPLE:

Load library--ATTIT.DEA.ADS.LOAD
Source code data set--ATTIT.DEA.ADS.PAN
Nonresident tables--ATTIT.DEA.ADS.NRES
MVT load library--SWCON.ATTIT.MVT.DEA.ADS.LOAD
MVT PANVALET library--SWCON.ATTIT.MVT.DEA.ADS.PAN
MVT nonresident tables--SWCON.ATTIT.MVT.DEA.ADS.NRES

The IBM S/360 load module was copied to the MVT load library and the program source code was transferred from the IBM S/360 source code data set to the MVT PANVALET library.

3. If a load module was determined to be CASE 1 (i.e., load module used as is) steps 4 through 10 were skipped and preparation was made for benchmark testing (step 11).

4. If a load module was determined to be CASE 2 (i.e., relink to replace subroutines), a new load module had to be

created. Steps 5 through 8 were skipped and load module creation (step 9) was begun.

5. Source code was modified. An MVT PANVALET update control statement data set was allocated.

EXAMPLE:

MVT PANVALET update data set--SWCON.ATTIT.MVT.DEAADS.UPD

6. Temporary PANVALET update control statements were designed and coded. These were placed in the update data set.

7. Two listings of the updates were made and placed in the software conversion notebook.

8. A Software Engineering Laboratory (SEL) Change Report Form was filled out for each set of related source code changes being made.

9. An MVT JCL data set was allocated and the load module creation JCL set up. Any device-dependent JCL was modified to remove such dependencies (e.g., UNIT = 2314). Additionally, as necessary the creation JCL was rewritten to perform a relink instead of a creation from source code and/or to incorporate PANVALET updates.

10. Load module, (and GESS tables, if necessary) was created and new load module (and tables) placed in the data sets allocated in step 2. For CASE 2, the load module was created by linking with the load module transferred to the IBM 4341 and including replacement subroutines. For CASE 3, the load module was created by applying updates to the MVT PANVALET library, linking with the load module transferred to the IBM 4341, and including modified subroutines. For CASE 4, the load module was created from the source code in the MVT PANVALET library after the updates were applied.

11. The benchmark execution JCL was unloaded from the benchmark tape and modified, as needed, to account for device dependencies and to reference the MVT data sets.

12. Test input and output data was unloaded from the benchmark tape to disk data set(s).

13. The benchmark was executed and the results compared with those obtained on the IBM S/360. Printed output was filed.

14. If the benchmark was not successful, the problem and a solution were identified, a new load module was created, if necessary (using applicable procedures described above), and the benchmark reexecuted.

15. If the benchmark was successful, the project leader was notified that the load module had passed the benchmark test.

16. With the project leader's authorization, the necessary data sets were allocated on the operational disk packs and the load module and any nonresident tables were copied from the software conversion MVT data sets to corresponding operational data sets. If source code was modified, the MVT PANVALET library was permanently updated and the source code transferred to the corresponding operational source code data set. All data sets allocated on operational disk packs were recorded on Data Set Request Forms.

17. Execution JCL for running the load module operationally under MVT on the IBM 4341 was modified. (Only nominal modifications were made and this JCL was not tested.) This JCL was placed in the operational JCL data set.

18. An FDS Software Conversion Program Delivery Form was filled out.

19. The project leader was notified when the MVT version of the program was ready for delivery to the GSFC point of contact.

20. The project leader delivered the following items to the GSFC point of contact: the FDS Software Conversion Program Delivery Form, the Data Set Request Form, any SEL Change Report Forms completed, and listings of any source code updates that were made.

21. If problems were experienced with a load module after it was delivered, the cognizant personnel were consulted to examine the problem. If a new load module had to be created, the benchmark was reexecuted, and the new load module delivered.

B.3 MVS CONVERSION

Load modules were converted according to their assigned MVS conversion priority. The only modifications that made were those required for (1) correct program execution under MVS, (2) conversion to VSFORTRAN, (3) deletion of nonapplicable code, and (4) program optimization for MVS.

The procedure for converting a given load module to MVS on the FDS is shown in Figure B-2. These same activities are discussed below in greater detail.

1. Determined as accurately as possible for each load module one of the following five cases (priority order: case 5, case 4, case 3, ...):

CASE 1	Load module can be used as is
CASE 2	Load module must be relinked to include new versions of subroutines
CASE 3	Source code must be modified and load module created via relink

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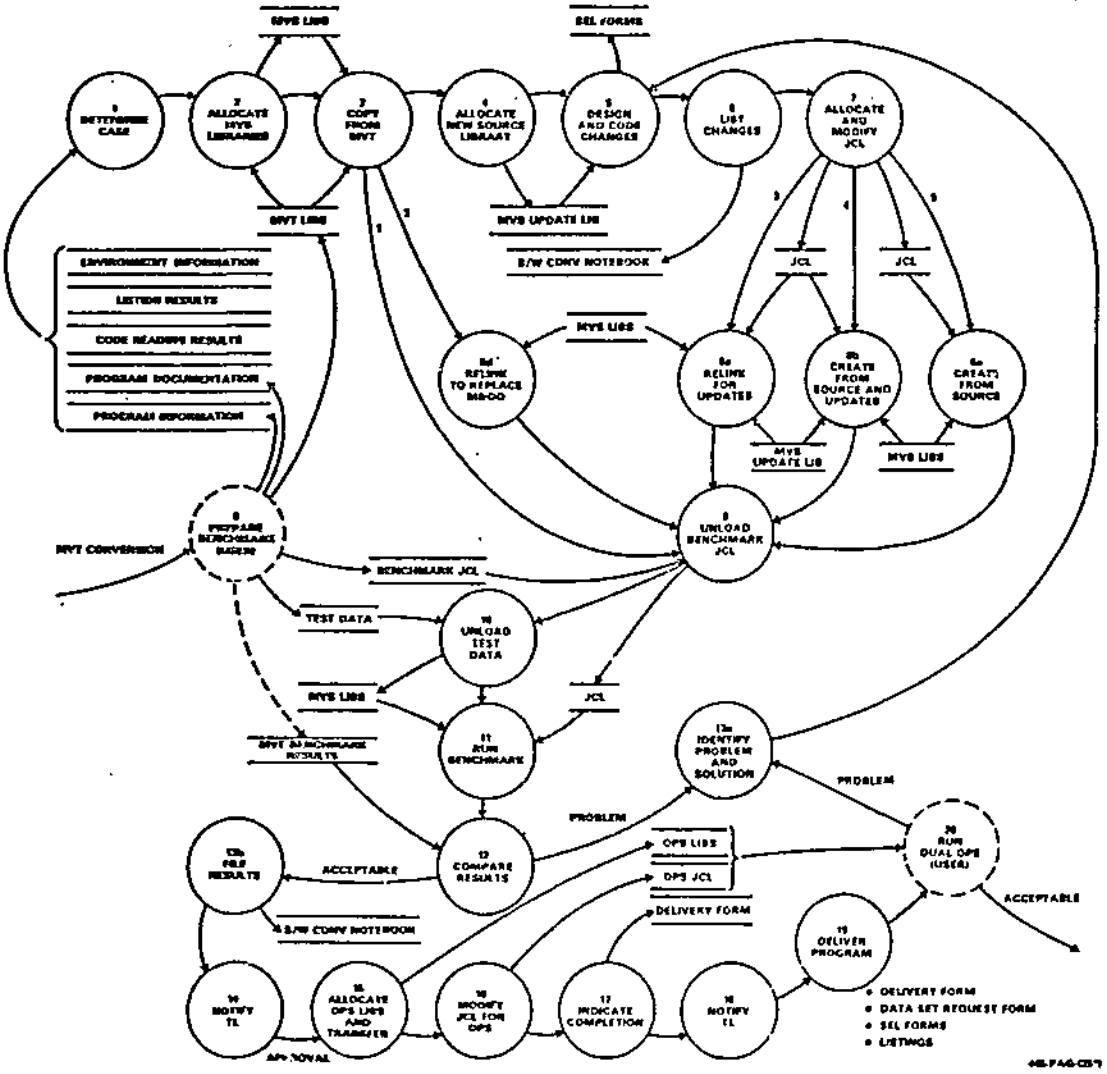

Figure B-2. MVS Conversion

CASE 4 Source code must be modified and load module created from source code

CASE 5 Load module must be created from source code

To help make this determination, personnel

a. Studied the new computer system by reading manuals, attending classes, holding discussions with cognizant personnel

b. Obtained listing of CSECTs in the load module using the M&DO LISTIDR utility to check for the presence of subroutines that had been previously identified as requiring modification

c. Read the code (e.g., to look for device dependencies)

d. Read application program documentation

e. Consulted with personnel familiar with the software

2. An MVS load library, an MVS PANVALET library, and, if required, an MVS GESS nonresident tables data set were allocate.

EXAMPLE:

Load library--ATTIT.DEA.ADS.LOAD
Source code data set--ATTIT.DEA.ADS.PAN
Nonresident tables--ATTIT.DEA.ADS.NRES
MVS load library--SWCON.ATTIT.MVS.DEA.ADS.LOAD
MVS PANVALET library--SWCON.ATTIT.MVS.DEA.ADS.PAN
MVS nonresident tables--SWCON.ATTIT.MVS.DEA.ADS.NRES

The MVT load module was copied to the MVS load library and the program source code was transferred from the MVT source code data set to the MVS PANVALET library.

3. If a load module was determined to be CASE 1 (i.e., load module used as is) steps 4 through 10 were skipped and preparation was made for benchmark testing (step 11).

4. If a load module was determined to be CASE 2 (i.e., relink to replace subroutines) or CASE 5 (i.e., generate load module from source code), a new load module had to be created. Steps 5 through 8 were skipped and load module creation (step 9) was begun.

5. Source code was modified. An MVS PANVALET update control statement data set was allocated.

EXAMPLE:

MVS PANVALET update data set--SWCON.ATTIT.MVS.DEAADS.UPD

6. Temporary PANVALET update control statements were designed and coded. These were placed in the update data set.

7. Two listings of the updates were made and placed in the software conversion notebook.

8. A SEL Change Report Form was filled out for each set of related source code changes being made.

9. An MVS JCL data set was allocated and the load module creation JCL set up.

10. Load module (and GESS tables, if necessary) was created and new load module (and tables) placed in the data sets allocated in step 2. For CASE 2, the load module was created by linking into the MVT load module and including replacement subroutines. For CASE 3, the load module was created by applying updates to the MVS PANVALET library and linking with the MVT load module and including modified subroutines. For CASE 4, the load module was created from the source code in the MVS PANVALET library after the updates were applied. For CASE 5, the load module was created from the source code in the MVS source code library.

11. The benchmark execution JCL was unloaded from the benchmark tape and modified as needed to account for device dependencies and to reference the MVS data sets.

12. Test input and output data was unloaded from the benchmark tape to disk data set(s).

13. The benchmark was executed and the results compared with those obtained on the IBM S/360. Printed output was filed.

14. If the benchmark was not successful, the problem and a solution were identified, a new load module was created, if necessary (using applicable procedures described above), and the benchmark reexecuted.

15. If the benchmark was successful, the project leader was notified that the load module had passed the benchmark test.

16. With the project leader's authorization, the necessary data sets were allocated on the operational disk packs and the MVS software was copied from software conversion MVS data sets to corresponding operational data sets. If source code was modified, the MVS PANVALET library was permanently updated and the source code transferred to the corresponding operational source code data set. All data sets allocated on operational disk packs were recorded on Data Set Request Forms.

17. Execution JCL for running the load module operationally under MVS on the IBM 4341 was modified. (Only nominal modifications were made and this JCL was not tested.) This JCL was placed in the operational JCL data set.

18. An FDS Software Conversion Program Delivery Form was filled out.

19. The project leader was notified when the MVS version of the program was ready for delivery to the GSFC point of contact.

20. The project leader delivered the following items to the GSFC point of contact: the FDS Software Conversion Program Delivery Form, the Data Set Request Form, any SEL Change Report Forms completed (including informal notes on the changes), and listings of any source code updates that were made.

21. If problems were experienced with a load module after it was delivered, the cognizant personnel were consulted to examine the problem. If a new load module had to be created, the benchmark was reexecuted, and the new load module delivered.

B.4 SAMPLE CONVERSION FORMS

Facimiles of the following forms, used in the conversion effort, are included in this subsection as Figures B-3 through B-8:

- Program Description Form
- Attitude Tape Description
- Component Status Report for FDS Conversion
- Data Set Request Form
- Change Report Form
- FDS Software Conversion Program Delivery Form

SYSTEM: CONVERSION PRIORITY (MVT/MVS)

PROGRAM: GSFC SECTION HEAD:

DESCRIPTION: _____

ADDITIONAL INFORMATION CONTACTS

SOFTWARE OPERATION/USE: Name: _____ Phone: _____

SOFTWARE DESIGN/CODE: Name _____ Phone: _____

GENERAL SOFTWARE CHARACTERISTICS (Check any applicable boxes)

SOURCE LANGUAGES: ☐ FORTRAN (%) ☐ ALC (%) ☐ _____ (%)

PRECOMPILER: ☐ SFORT ☐ _____

OVERLAY: ☐ YES ☐ NO

GRAPHIC DEVICES: ☐ 2250 ☐ 6600 (FMOC) ☐ TSO ☐ _____

GRAPHIC METHOD: ☐ GESS ☐ GSP ☐ GPS/GAM ☐ ROSS (2200) ☐ _____

M&DO PKGS USED: ☐ DAIO ☐ FTIO ☐ CALCOMP ☐ WOLFPLOT

SYSTEM TAPE INFORMATION

ORI TAPE NUMBER _____ CREATE DATE _____

PROGRAM MODIFIED AFTER ABOVE DATE? ☐ YES ☐ NO

DOES A SYSTEM TAPE EXIST? ☐ YES ☐ NO

TAPE REFERENCE NUMBER _____ CREATE DATE _____

PROGRAM MODIFIED AFTER ABOVE DATE? ☐ YES ☐ NO

LOCATION OF TAPE _____

GSFC PROGRAM LIBRARY PROGRAM NO. (If any) _____

DOCUMENTATION (List Title, Reference No., and Location of Program Documentation):

Form Initiated _____ Est. Completion _____ Actual Completion _____

Form Completed by _____

Figure B-3. Program Description Form (1 of 2)

SYSTEM _____ PROGRAM _____

	DATA SET NAME	TYPE (PS, PO, PAN, CARDS, etc.)	DESCRIPTION (Source code, load module, NAMELISTs, execution JCL, etc.)	

List all data sets necessary for program creation and execution. This should include source code, load module, creation JCL, overlay, execution JCL, TSO CLISTs, GESS tables, link libraries, NAMELISTs, ALC maclibs, input/output data sets, etc. For 'DATA SET NAME' column, specify PDS member names/PANVALET prefixes where appropriate; if not on disk, specify desired name.

Figure B-3. Program Description Form (2 of 2)

ORIGINAL PAGE IS
OF POOR QUALITY

PROGRAM NUMBER _____

DENSITY 800 1600 6250

TAPE NUMBER _____ PROGRAM ID _____ SATELLITE ID _____

GENERAL DESCRIPTION OF PURPOSE AND USE OF TAPE: (Write a description understandable to others)

TAPE FILE	DATE ADDED	DISK DATA SET NAME	DESCRIPTION (SOURCE, LOAD MODULE, TELEMETRY, etc.)	UTILITY USED TO PUT ON TAPE	DCB ON DSN RECFM LRECL BLKSIZE DSORG	DCB ON TAPE RECFM LRECL BLKSIZE	SPACE TRK/DIR

Figure B-4. Attitude Tape Description

ORIGINAL PAGE IS
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PROJECT FDS DATE

PROGRAMMER

COMPONENT	DESIGN			CODE DEVELOPMENT			TEST			OTHER	
	CREATE	READ	FORMAL REVIEW	CODE	READ	FORMAL REVIEW	UNIT	INTEG	REVIEW	ACTIVITY	HRS
										TRAVEL	
										FORMS	
	MATERIAL COLLECTION			MVT TO MVT			MVT TO MVS			MEETINGS	
	CREATE TAPE OR DISK FILES	DATA PREP-ARATION	95 BENCH-MARK TEST	CODE CHANGES	MVT BENCH-MARK TEST	DELIVERY WORK	CODE CHANGES	MVS BENCH-MARK TEST	DELIVERY WORK	ACC TEST	
										TRAINING	
JCL											
OVERLAY											
USER GUIDE											
SYSTEM DESC											
										$$ANALYT	
										$$BLKTIM	
										$$CONSUL	
										$$DATGEN	
										$$DATSET	
										$$DEMO	
										$$IMPLAN	
										$$INTERF	
										$$KEYPCH	
										$$MANUAL	
										$$MEMO	
										$$MNTHLY	
										$$NOTEBK	
										$$PAPERW	
										$$PLANS	
										$$PRESNT	
										$$QUESTS	
										$$ROSW	
										$$RREQS	
										$$RSTDS	
										$$SCHEDL	
										$$SEMINR	
										$$SIM	
										$$STATUS	
										$$SYSTAP	
										$$SYSTST	
										$$TESTPL	
										$$TOOL	
										$$WEEKLY	
										$$XEROX	

Figure B-5. Component Status Report for FDS Conversion

GSFC Sponsor Approval: _____

mountable/shareable

Net space change +/– _____ tracks

Name: _____

Phone: _____

Date: _____

Page: _____ of _____

Action	RT	Data Set Name	Disk	DSORG	trks/dir	DCB	Init.?	Comments

Action = allocate, delete, rename, etc.; DSORG = PO, PS, DA, etc.; DCB = RECFM/LRECL/BLKSIZE; Init.? = DA or Panlib;
RT = indicates that this data set is required for real-time support.

NOTE: Edit requests must be accompanied by a complete listing indicating the desired changes to the data set.

Figure B-6. Data Set Request Form

ORIGINAL PAGE IS
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PROJECT NAME _____ CURRENT DATE _____

PROGRAMMER NAME _____ APPROVED BY _____

SECTION A – IDENTIFICATION

DESCRIBE THE CHANGE: (What, why, how) _____

EFFECT: What components (or documents) are changed? (Include version) _____

EFFORT: What additional components (or documents) were examined in determining what change was needed? _____

	(Month	Day	Year)*
Need for change determined on			
Change completed (incorporated into system)			

	1hr/less	1hr/1dy	1dy/3dys	>3dys
Effort in person time to isolate the change (or error)				
Effort in person time to implement the change (or correction)				

SECTION B – ALL CHANGES

TYPE OF CHANGE (Check one)

- ☐ Error correction
- ☐ Planned enhancement
- ☐ Implementation of requirements change
- ☐ Improvement of clarity, maintainability, or documentation
- ☐ Improvement of user services
- ☐ Insertion/deletion of debug code
- ☐ Optimization of time/space/accuracy
- ☐ Adaptation to environment change
- ☐ Other (Explain on back)

EFFECTS OF CHANGE

Y	N	
☐	☐	Was the change or correction to one and only one component?
☐	☐	Did you look at any other component?
☐	☐	Did you have to be aware of parameters passed explicitly or implicitly (e.g., common blocks) to or from the changed component?

SECTION C – FOR ERROR CORRECTIONS ONLY

SOURCE OF ERROR (Check one)

- ☐ Requirements
- ☐ Functional specifications
- ☐ Design
- ☐ Code
- ☐ Previous change

CLASS OF ERROR (Check most applicable)*

- ☐ Initialization
- ☐ Logic/control structure (e.g., flow of control incorrect)
- ☐ Interface (internal) (module to module communication)
- ☐ Interface (external) (module to external communication)
- ☐ Data (value or structure) (e.g., wrong variable used)
- ☐ Computational (e.g., error in math expression)

*If two are equally applicable, check the one higher on the list

CHARACTERISTICS (Check Y or N for all)

Y	N	
☐	☐	Omission error (e.g., something was left out)
☐	☐	Commission error (e.g., something incorrect was included)
☐	☐	Error was created by transcription (clerical)

FOR LIBRARIANS USE ONLY

NUMBER _____

DATE _____

BY _____

CHECKED BY _____

	(Month	Day	Year)
ORIGIN DATE			

(Additional Comments on Reverse Side)

Figure B-7. Change Report Form

☐ MVT/☐ MVS

DATE: _____

PRIORITY: _____

PROGRAM: _____ GSFC CODE: _____

PROGRAM CHANGES: ☐ YES ☐ NO

RELINK: ☐ DAIO

☐ FTIO

☐ GESS (MVT) ☐ GESS (MVS)

☐ OTHERS: _____

_____

_____

CREATED FROM SOURCE CODE: ☐

MODULES MODIFIED: _____

_____

_____

_____

BENCHMARK RUN: ☐ YES ☐ NO 95 CPU (MIN) _____ I/O (MIN) _____

FDS CPU (MIN) _____ SRB (MIN) _____

ATTACHED SHEETS: ☑ DATA SET REQUEST FORM

☐ CHANGE REPORT FORM

☐ SOURCE CODE UPDATE LISTING

PROGRAM ACCEPTED BY: _____ DATE: _____

9004(85a*1)/84

Figure B-8. FDS Software Conversion Program Delivery Form

APPENDIX C - CONVERTED PROGRAMS

This appendix contains, by GSFC code, the programs converted to the IBM 4341 computers (FDS). For each program, the following information is given:

- First line--Program name, conversion priority (Px), and an indication as to whether the program was deleted at some stage.
- Second line--Brief description of the program.
- Third line--Program size information by language in thousands of source lines of code (80-byte images).
- Fourth line--Preparation information, i.e., whether the program was defined on a form (and its number); whether the program was copied to tape from the IBM S/360-95 (T or Ta), and whether the program was copied to the FDS (C or Ca).
- Fifth line--IBM S/360-95 benchmark information.
- Sixth and seventh lines--MVT and MVS conversion dates.

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C.1 CODE 581.2 PROGRAMS

NAME: ATTIT.ADCS.COEF.LOAD (TOM); priority 3
DESCRIPTION: Determines the aerodynamic coefficients for any spacecraft in the free-molecular flow regime.
SIZE (k): Total = 1.0 FORT = 1.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 117 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-05-83	05-12-83	05-13-83	05-31-83
MVS	06-13-83	06-17-83	06-17-83	11-16-83

NAME: ATTIT.ADCS.FSD.LOAD (SIM); priority 6
DESCRIPTION: Simulates flexible body spacecraft dynamics.
SIZE (k): Total = 23.2 FORT = 23.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 116 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-06-83	05-17-83	05-20-83	07-01-83
MVS	09-19-83	10-12-83	10-14-83	12-01-83

NAME: ATTIT.ADL.LOAD (ACTRD); priority 2
DESCRIPTION: Reads PDS member created by the subroutine ACTWRT
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 64 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-30-83	NR	04-01-83	05-18-83
MVS	06-27-83	NR	07-08-83	11-16-83

NAME: ATTIT.ADL.LOAD (ACTWRT); priority 2
DESCRIPTION: Stores attitude command data in a PDS.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 65 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-30-83	NR	04-01-83	05-18-83
MVS	06-27-83	NR	07-08-83	11-16-83

NAME: ATTIT.ADL.LOAD (ADLMOVE); priority 2
DESCRIPTION: Initializes an ADL backup data base and copies the ADL data base to the backup.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 68 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-28-83	04-01-83	05-25-83
MVS	05-09-83	07-13-83	07-15-83	08-18-83

NAME: ATTIT.ADL.LOAD (ADLSPY52); priority 2
DESCRIPTION: Detects chaining and I/O errors on the ADL data base.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 69 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-28-83	04-01-83	05-18-83
MVS	05-09-83	06-30-83	07-01-83	08-18-83

NAME: ATTIT.ADL.LOAD (ADL0BLK); priority 2
DESCRIPTION: Fills specified blocks on the ADL data base with zeros to determine if an I/O error exists.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 71 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-30-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	04-01-83	04-01-83	05-31-83
MVS	06-20-83	06-23-83	06-24-83	08-18-83

NAME: ATTIT.ADL.LOAD (STDXMT); priority 2
DESCRIPTION: Opens a telecommunication line and performs the transmission function of TAPETRAN.
SIZE (k): Total = 0.4 FORT = 0.0 ALC = 0.4 GESS = 0.0
PREPARATION: Form = yes No. = 72 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	07-22-83	NR	08-05-83	11-16-83

NAME: ATTIT.ADL.LOAD (UTILN5); priority 1
DESCRIPTION: Allows access to the ADL data base by applications systems ADLOPN, ADLCLS, ADLRD, and ADLERANL.
SIZE (k): Total = 0.3 FORT = 0.0 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 74 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-07-83	NR	03-25-83	05-18-83
MVS	03-31-83	NR	04-08-83	11-16-83

NAME: ATTIT.ADL.LOAD (XMITTR); priority 2
DESCRIPTION: Transmits an attitude telemetry record over a telecommunications line.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 75 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	dSTARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	06-28-83	NR	07-08-83	11-16-83

NAME: ATTIT.ADL.LOAD (XMTCLS); priority 2
DESCRIPTION: Closes a telecommunications line.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 76 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	06-28-83	NR	07-08-83	11-16-83

NAME: ATTIT.ADL.LOAD (XMTCOM); priority 2
DESCRIPTION: COMMON area used by XMITTR.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 77 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	06-28-83	NR	07-08-83	11-16-83

NAME: ATTIT.ATTMAIN.CP.LOAD (All Members); priority 6 (deleted)
DESCRIPTION: None.
SIZE (k): Total = 0.4 FORT = 0.0 ALC = 0.4 GESS = 0.0
PREPARATION: Form = yes No. = 205 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-17-83	NR	05-27-83	06-06-83
MVS	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (ADLDUMP); priority 2 (deleted)
DESCRIPTION: Dumps data link control blocks.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 154 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (ADLFIX); priority 2
DESCRIPTION: Corrects chaining errors on the ADL data base.
SIZE (k): Total = 0.7 FORT = 0.0 ALC = 0.7 GESS = 0.0
PREPARATION: Form = yes No. = 163 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-30-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	04-01-83	04-01-83	05-31-83
MVS	05-09-83	06-30-83	07-01-83	08-29-83

NAME: ATTIT.ATTMAIN.LOAD (ADLTELL); priority 2
DESCRIPTION: Debugs ADL program.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 155 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-19-83	NR	04-22-83	05-18-83
MVS	05-09-83	NR	05-20-83	11-16-83

NAME: ATTIT.ATTMAIN.LOAD (BSCTEST); priority 2 (deleted)
DESCRIPTION: Tests telecommunications lines.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION:-f10f- Form = yes No. = 141 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (DSORGDA); priority 3 (deleted)
DESCRIPTION: Creates a direct access data set from TSO.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 177 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-27-83	04-29-83	05-09-83
MVS	06-27-83	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (DSREPORT); priority 3 (deleted)
DESCRIPTION: Gives a report of changes in data set allocations.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 180 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-28-83	04-29-83	05-31-83
MVS	08-22-83	10-05-83	10-07-83	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (DSUPDATE); priority 3 (deleted)
DESCRIPTION: Updates a file containing a listing of data sets allocations.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 182 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-28-83	04-29-83	05-31-83
MVS	08-22-83	10-05-83	10-07-83	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (DUMPDS); priority 6 (deleted)
DESCRIPTION: Dumps partitioned data sets in HEX and EBCDIC formats to a TSO terminal.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 192 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed 05-02-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-03-83	05-18-83	05-20-83	05-31-83
MVS	08-08-83	08-15-83	08-19-83	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (ERASE); priority 6 (deleted)
DESCRIPTION: Rewinds partitioned data sets.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 195 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (INITDA); priority 3
DESCRIPTION: Initializes a direct access data set with zeroes.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 183 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-06-83	04-07-83	04-22-83	05-09-83
MVS	06-27-83	06-30-83	07-01-83	08-29-83

NAME: ATTIT.ATTMAIN.LOAD (LOGSCAN); priority 6
DESCRIPTION: Lists the OPS log.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 195 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-25-83
MVS	09-06-83	NR	11-01-83	11-29-83

NAME: ATTIT.ATTMAIN.LOAD (LOOKJCL); priority 6 (deleted)
DESCRIPTION: Displays the OPS parameter field for graphics jobs.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 208 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (MAPD); priority 3 (deleted)
DESCRIPTION: Edits and displays sections of output from the MAPDISK program.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 181 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	05-19-83	05-20-83	05-31-83
MVS	09-27-83	10-05-83	10-07-83	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (MINI); priority 6 (deleted)
DESCRIPTION: Creates a mini restart to test the ADL. Remains separate from the ADL.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 196 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (MODPDS); priority 3
DESCRIPTION: Searches numbers of a PDS for a specified character string and replaces it with the second specified character string.
SIZE (k): Total = 0.3 FORT = 0.0 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 197 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-30-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	04-01-83	04-01-83	05-05-83
MVS	08-08-83	08-15-83	08-19-83	08-29-83

NAME: ATTIT.ATTMAIN.LOAD (PDSSPACE); priority 3
DESCRIPTION: Lists the size of each member in a partitioned data set.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 176 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-30-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	04-01-83	04-01-83	05-25-83
MVS	06-20-83	06-23-83	06-24-83	08-29-83

NAME: ATTIT.ATTMAIN.LOAD (PRWND); priority 3 (deleted)
DESCRIPTION: Clears the directory block of a PDS.
SIZE (k): Total = 0.3 FORT = 0.0 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 174 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 04-12-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-14-83	04-22-83	04-22-83	05-09-83
MVS	06-27-83	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (PUNCHPDS); priority 6 (deleted)
DESCRIPTION: Outputs a partitioned data set to cards.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 179 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (PURGEMON); priority 6
DESCRIPTION: Shows whether purging is currently being performed on the ADL data base.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 188 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-17-83	NR	05-20-83	06-21-83
MVS	07-29-83	NR	08-12-83	08-29-83

NAME: ATTIT.ATTMAIN.LOAD (REVERT); priority 6 (deleted)
DESCRIPTION: Retrieves oversized PDS members from tape files that were created by using VSCOPY.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 142 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (SCANPDS); priority 3
DESCRIPTION: Scans all members of a PDS for occurrences of a specified character string.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 189 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-30-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	04-01-83	04-01-83	05-04-83
MVS	09-01-83	09-08-83	09-09-83	09-27-83

NAME: ATTIT.ATTMAIN.LOAD (SRCHDSN); priority 6 (deleted)
DESCRIPTION: Searches for a data set on an online pack.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (SRCHVOL); priority 6
DESCRIPTION: Searches all online scratch packs for a given data set. Returns VOLSER if found.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 191 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-02-83	05-05-83	05-06-83	05-31-83
MVS	08-01-83	08-11-83	08-19-83	08-29-83

NAME: ATTIT.ATTMAIN.LOAD (TAPENONG); priority 6
DESCRIPTION: Transmits definitive attitude data from tape over a bisynchronous line directly to the IPD from a nongraphics mode job.
SIZE (k): Total = 0.8 FORT = 0.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 202 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	05-25-83	05-27-83	07-20-83
MVS	08-23-83	12-21-83	12-23-83	01-04-84

NAME: ATTIT.ATTMAIN.LOAD (TAPESEND); priority 3 (deleted)
DESCRIPTION: Transmits a sequential file from tape using BTAM over telecommunications line using OPS.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 201 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-27-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-11-83	NR	05-20-83	06-23-83
MVS	07-29-83	NR	08-12-83	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (TAPETRAN); priority 3 (deleted)
DESCRIPTION: Transmits definitive attitude data from tape over a bisynchronous line directly to the IPD from a graphics mode job.
SIZE (k): Total = 1.1 FORT = 0.7 ALC = 0.4 GESS = 0.0
PREPARATION: Form = yes No. = 146 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-11-83	NR	05-20-83	07-01-83
MVS	08-08-83	NR	08-19-83	04-04-84

NAME: ATTIT.ATTMAIN.LOAD (TIOTJOB); priority 6 (deleted)
DESCRIPTION: Displays the TIOT DD entries for job that is executing.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 209 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-31-83
MVS	09-06-83	NR	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ATTMAIN.LOAD (TIOTLINE); priority 6
DESCRIPTION: Displays TIOT entry.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 210 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-31-83
MVS	09-06-83	NR	12-23-83	04-04-84

NAME: ATTIT.ATTMAIN.LOAD (TIOTLIST); priority 6
DESCRIPTION: Prints TIOT on a terminal or to a given DD name.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 211 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-31-83
MVS	09-06-83	NR	10-28-83	11-14-83

NAME: ATTIT.ATTMAIN.UTIL.OBJ (All Members); priority 1
DESCRIPTION: Contains general purpose utility routines, i.e., matrix multiplication, interpolation, time conversion and ephemeris read routines.
SIZE (k): Total = 5.0 FORT = 5.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = C No. = 228 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	02-14-83	NR	03-25-83	05-18-83
MVS	02-14-83	NR	04-15-83	11-16-83

NAME: ATTIT.ATS6.ATSBS.LOAD (SUNATS); priority 3 (deleted)
DESCRIPTION: Computes ATS attitude using Sun data.
SIZE (k): Total = 2.0 FORT = 2.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 231 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-25-83 Executed 04-25-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-27-83	05-02-83	05-06-83	05-25-83
MVS	07-18-83	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DE.DEFUTIL.LOAD (LFSS); priority 3 (deleted)
DESCRIPTION: Generates the whole list of DE-B fine sensor data for a report in Xerox form.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 114 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DE.DEFUTIL.LOAD (LLIST); priority 3
DESCRIPTION: Generates the whole list of DE definitive data for the monthly report in a Xerox form.
SIZE (k): Total = 0.2 FORT = 0.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 113 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-15-83	04-15-83	05-02-83
MVS	08-12-83	08-17-83	08-19-83	11-22-83

NAME: ATTIT.DE.DEFUTIL.LOAD (LLISTW); priority 3
DESCRIPTION: Prepares a weekly report for DE-1 and DE-2 in a Xerox form.
SIZE (k): Total = 0.2 FORT = 0.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 112 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-15-83	04-15-83	05-02-83
MVS	08-12-83	08-17-83	08-19-83	11-22-83

NAME: ATTIT.DE.DEFUTIL.LOAD (LMONTH); priority 3
DESCRIPTION: Creates a monthly DE definitive data processing status report.
SIZE (k): Total = 0.3 FORT = 0.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 111 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-15-83	04-15-83	05-02-83
MVS	08-12-83	08-17-83	08-19-83	11-22-83

NAME: ATTIT.DE.DEFUTIL.LOAD (LWKLY); priority 3
DESCRIPTION: Creates a weekly definitive data processing status report for DE.
SIZE (k): Total = 0.3 FORT = 0.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 110 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-15-83	04-15-83	05-02-83
MVS	08-12-83	08-17-83	08-19-83	11-22-83

NAME: ATTIT.DE.DEFUTIL.LOAD (TPRPFSS); priority 3 (deleted)
DESCRIPTION: DE-B FSS correction preprocessor.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 109 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DE.MAGCP.LOAD (CP1019); priority 3 (deleted)
DESCRIPTION: Controls and predicts Magsat attitude.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 108 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DE.RTUTIL.LOAD (ATT1008A); priority 2
DESCRIPTION: Generates DE attitude maneuver commands.
SIZE (k): Total = 6.9 FORT = 6.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 28 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-25-83 Executed 02-25-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-18-83	04-08-83	05-25-83
MVS	08-01-83	09-26-83	09-30-83	11-21-83

NAME: ATTIT.DE.RTUTIL.LOAD (DEMAP); priority 2
DESCRIPTION: Predicts results of the attitude and momentum commands.
SIZE (k): Total = 6.9 FORT = 6.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No.31 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-25-83 Executed 02-25-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-18-83	04-08-83	05-31-83
MVS	08-01-83	09-20-83	09-30-83	11-21-83

NAME: ATTIT.DE.RTUTIL.LOAD (DEMOM); priority 2
DESCRIPTION: Generates DE momentum commands.
SIZE (k): Total = 6.9 FORT = 6.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 32 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-25-83 Executed 02-25-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-18-83	04-08-83	05-31-83
MVS	08-01-83	09-26-83	09-10-83	11-21-83

NAME: ATTIT.DE.RTUTIL.LOAD (DESERV); priority 2
DESCRIPTION: Predicts the visibility of Sun and/or Earth data for the DE spacecraft attitude sensors and generates DE-2 data generator coefficients.
SIZE (k): Total = 9.2 FORT = 8.1 ALC = 0.0 GESS = 1.1
PREPARATION: Form = yes No. = 33 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-11-83	03-11-83	04-22-83	05-02-83
MVS	07-05-83	07-08-83	07-15-83	11-09-83

NAME: ATTIT.DE.RTUTIL.LOAD (DETRAN); priority 2
DESCRIPTION: Checks the quality of final output for three DE attitude determination systems.
SIZE (k): Total = 5.2 FORT = 4.0 ALC = 0.5 GESS = 0.7
PREPARATION: Form = yes No. = 34 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-21-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-24-83	04-14-83	04-15-83	06-02-83
MVS	05-23-83	07-05-83	07-08-83	11-21-83

NAME: ATTIT.DE.RTUTIL.TLOAD (CMSPRINT); priority 5 (deleted)
DESCRIPTION: Prints a command management system file.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = none No. = none Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DE.RTUTIL.TLOAD (SUNDAT); priority 5 (deleted)
DESCRIPTION: Predicts the time when the Sun will be in the Sun sensor field of view.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DE.UTIL.LOAD (CMSPRINT); priority 2
DESCRIPTION: Prints a command management system file.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 35 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-10-83 Executed 03-10-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-24-83	04-01-83	05-25-83
MVS	06-20-83	09-09-83	09-09-83	11-23-83

NAME: ATTIT.DE.UTIL.LOAD (DEFRANK); priority 2
DESCRIPTION: Reads a real time attitude history data set.
SIZE (k): Total = 2.0 FORT = 1.9 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 36 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-10-83 Executed 03-10-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-25-83	04-01-83	05-18-83
MVS	09-12-83	09-15-83	09-16-83	11-02-83

NAME: ATTIT.DE.UTIL.LOAD (LAMBDA); priority 2
DESCRIPTION: Formats spacecraft ephemeris information.
SIZE (k): Total = 2.0 FORT = 1.9 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 41 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-11-83	03-11-83	04-08-83	05-02-83
MVS	06-20-83	06-23-83	06-24-83	11-09-83

NAME: ATTIT.DE.UTIL.LOAD (LBNFLD); priority 2
DESCRIPTION: Computes magnetic field and LBN coordinates.
SIZE (k): Total = 2.2 FORT = 2.1 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 42 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-10-83 Executed 03-10-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-24-83	04-08-83	05-25-83
MVS	06-13-83	06-17-83	06-17-83	11-21-83

NAME: ATTIT.DE.UTIL.LOAD (RDEXPFIL); priority 2
DESCRIPTION: Reads experimenter's file.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 45 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 03-25-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	04-22-83	05-25-83
MVS	06-27-83	06-30-83	07-08-83	11-02-83

NAME: ATTIT.DEA.ADS.LOAD (DEA1119A); priority 2
DESCRIPTION: Calculates attitude for DE-1.
SIZE (k): Total = 69.1 FORT = 59.7 ALC = 1.2 GESS = 8.2
PREPARATION: Form = yes No. = 46 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-21-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-24-83	04-14-83	04-22-83	05-25-83
MVS	06-27-83	07-29-83	08-05-83	11-28-83

NAME: ATTIT.DEB.ADS.LOAD (DEB0504A); priority 3
DESCRIPTION: Calculates attitude for DE-2.
SIZE (k): Total = 68.1 FORT = 58.5 ALC = 1.8 GESS = 7.8
PREPARATION: Form = yes No. = 48 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 03-21-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-24-83	05-06-83	05-06-83	06-02-83
MVS	08-15-83	08-24-83	08-26-83	12-13-83

NAME: ATTIT.DEV.AMAP.LOAD (AMAP); priority 4 (deleted)
DESCRIPTION: Generates constraints on attitude and reference vectors, predicts launch windows for a satellite.
SIZE (k): Total = 7.6 FORT = 7.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 26 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-03-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-20-83	XX-XX-XX
MVS	08-22-83	NR	11-18-83	XX-XX-XX

NAME: ATTIT.DEV.AMAP.OSAG.LOAD (OSAG); priority 6 (deleted)
DESCRIPTION: Generates orbit, Sun, and attitude geometry information for a spacecraft.
SIZE (k): Total = 1.2 FORT = 1.1 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 107 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-03-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-04-83	NR	05-06-83	07-20-83
MVS	08-22-83	NR	10-14-83	XX-XX-XX

NAME: ATTIT.DEV.DE.ABOS.LOAD (ABOSYSIM); priority 4 (deleted)
DESCRIPTION: Predicts attitude bias and observability.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 25 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DYNSIM.LOAD (DS0203); priority 3
DESCRIPTION: Simulates spacecraft dynamics.
SIZE (k): Total = 15.4 FORT = 12.9 ALC = 0.4 GESS = 2.1
PREPARATION: Form = yes No. = 88 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 05-12-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-16-83	05-19-83	05-20-83	06-03-83
MVS	07-18-83	07-22-83	07-29-83	08-18-83

NAME: ATTIT.DYNSIM.LOAD (RES); priority 3 (deleted)
DESCRIPTION: Existing GESS resident tables for load module creation of dynamics simulator program.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 89 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.DYNSIM.LOAD (TRALER); priority 3
DESCRIPTION: Creates subroutine titles at the bottom of source listings by using output from "PRINT command.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 90 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-03-83	NR	05-06-83	06-02-83
MVS	07-11-83	NR	07-15-83	10-03-83

NAME: ATTIT.DYNSIM.LOAD (TRES); priority 3 (deleted)
DESCRIPTION: Test resident table for DYNSIM load module creation.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 89 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.GOES.ABOS.LOAD (ABOSYSIM); priority 4 (deleted)
DESCRIPTION: Computes attitude biases and observability values.
SIZE (k): Total = 5.0 FORT = 5.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 25 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-03-83 Executed 05-03-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	05-12-83	05-20-83	XX-XX-XX
MVS	08-15-83	11-02-83	11-04-83	12-13-83

NAME: ATTIT.GOES.MSAD.LOAD (MSAD1231); priority 3
DESCRIPTION: Calculates GOES spacecraft attitudes.
SIZE (k): Total = 49.7 FORT = 42.5 ALC = 3.0 GESS = 4.2
PREPARATION: Form = yes No. = 12 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-22-83 Executed 04-22-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-27-83	05-12-83	05-13-83	06-16-83
MVS	06-13-83	06-30-83	07-01-83	12-03-83

NAME: ATTIT.GOES.SIM.LOAD (SM515); priority 4
DESCRIPTION: Simulates GOES satellite telemetry data.
SIZE (k): Total = 1.7 FORT = 1.7 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 91 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-03-83 Executed 05-03-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	05-12-83	05-20-83	XX-XX-XX
MVS	07-22-83	08-05-83	08-05-83	12-03-83

NAME: ATTIT.ISEE.DEFOG.LOAD (DEFOG6); priority 2
DESCRIPTION: Generates definitive output for ISEE-1 and ISEE-2.
SIZE (k): Total = 7.8 FORT = 6.5 ALC = 0.6 GESS = 0.7
PREPARATION: Form = yes No. = 8 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-19-83	04-21-83	04-22-83	06-01-83
MVS	07-18-83	09-16-83	09-23-83	11-04-83

NAME: ATTIT.ISEE.UTIL.LOAD (AQC303); priority 3 (deleted)
DESCRIPTION: None.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 11 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ISEE.UTIL.LOAD (AQC306); priority 2
DESCRIPTION: Compares attitude solutions obtained from the PAS and those from FSS for ISEE-3.
SIZE (k): Total = 1.8 FORT = 1.7 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 55 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 04-13-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-14-83	04-15-83	04-15-83	06-01-83
MVS	06-20-83	06-24-83	06-24-83	10-05-83

NAME: ATTIT.ISEE.UTIL.LOAD (ARCHIVE); priority 2
DESCRIPTION: Archives ISEE-2 Sun Angle data set.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 57 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-14-83	04-15-83	06-01-83
MVS	05-30-83	06-02-83	06-03-83	07-19-83

NAME: ATTIT.ISEE.UTIL.LOAD (ASUD1); priority 2 (deleted)
DESCRIPTION: Provides analytical support for attitude determination for the ISEE-2.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 2 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ISEE.UTIL.LOAD (CMAN); priority 2
DESCRIPTION: Converts ISEE-3 coordinate system from relative solar ecliptic to GCI.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 58 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-11-83	04-12-83	04-15-83	05-25-83
MVS	05-30-83	06-02-83	06-03-83	07-19-83

NAME: ATTIT.ISEE.UTIL.LOAD (DEFOGQA); priority 2
DESCRIPTION: Quality assures ISEE-1 and ISEE-2 definitive output.
SIZE (k): Total = 0.4 FORT = 0.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 59 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 04-13-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-19-83	04-21-83	04-22-83	06-01-83
MVS	06-20-83	06-23-83	06-24-83	07-29-83

NAME: ATTIT.ISEE.UTIL.LOAD (ICDRVR); priority 2
DESCRIPTION: Drives ISEE maneuver routines.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 60 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-11-83	04-12-83	04-15-83	05-25-83
MVS	05-31-83	06-02-83	06-03-83	07-19-83

NAME: ATTIT.ISEE.UTIL.LOAD (PASV1); priority 2
DESCRIPTION: Predicts availability of attitude data from the panoramic attitude sensor.
SIZE (k): Total = 3.0 FORT = 3.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 7 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-14-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-12-83	04-15-83	04-15-83	05-25-83
MVS	09-29-83	11-04-83	11-04-83	11-29-83

NAME: ATTIT.ISEE.UTIL.LOAD (PLTICA); priority 3
DESCRIPTION: Calculates and plots polar coordinates of an attitude by using a reference vector as a center of coordinates.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 61 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-12-83	04-15-83	04-15-83	05-25-83
MVS	05-31-83	06-02-83	06-03-83	07-19-83

NAME: ATTIT.ISEE.UTIL.LOAD (RDEFOG); priority 2
DESCRIPTION: Reads ISEE-1 and ISEE-2 transmission data sets from tape or disk and prints the dates of data and date processed.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 56 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 04-13-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-19-83	04-21-83	04-22-83	06-01-83
MVS	06-02-83	06-07-83	06-17-83	09-12-83

NAME: ATTIT.ISEE.UTIL.LOAD (SPADE); priority 2
DESCRIPTION: Used as a maneuver planning utility for ISEE-1 and ISEE-3.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 53 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-11-83	04-12-83	04-15-83	05-25-83
MVS	06-06-83	06-07-83	06-17-83	07-19-83

NAME: ATTIT.ISEE.UTIL.LOAD (SPIN); priority 2
DESCRIPTION: Computes ISEE-1 and ISEE-3 spin maneuvers.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 54 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-11-83	04-12-83	04-15-83	05-25-83
MVS	06-13-83	06-16-83	06-17-83	07-19-83

NAME: ATTIT.ISEE.UTIL.LOAD (VOLUME); priority 2
DESCRIPTION: Computes ISEE-1 and ISEE-2 telemetry volume. Adds data to the appropriate data base for subsequent (optional) use by a graphics routine.
SIZE (k): Total = 0.2 FORT = 0.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 63 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-01-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-06-83	04-08-83	04-08-83	05-25-83
MVS	06-02-83	09-08-83	09-09-83	11-04-83

NAME: ATTIT.ISEEA.ACS.LOAD (ISEEAAC1); priority 2
DESCRIPTION: Generates ISEE-1 spin axis attitude reorientation sequences as well as the commands necessary for execution of a maneuver sequence.
SIZE (k): Total = 4.4 FORT = 3.6 ALC = 0.0 GESS = 0.8
PREPARATION: Form = yes No. = 6 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-31-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-06-83	04-08-83	04-08-83	05-25-83
MVS	07-11-83	07-29-83	07-29-83	11-04-83

NAME: ATTIT.ISEEA.MSAD.LOAD (ISEEA4); priority 2
DESCRIPTION: Calculates ISEE-1 spacecraft spin axis attitudes from telemetered PAS data.
SIZE (k): Total = 69.9 FORT = 62.4 ALC = 1.1 GESS = 6.4
PREPARATION: Form = yes No. = 4 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-14-83 Executed 04-01-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-14-83	04-15-83	05-25-83
MVS	07-28-83	08-31-83	09-09-83	11-04-83

NAME: ATTIT.ISEEB.MSAD.LOAD (ISEEB4); priority 2
DESCRIPTION: Calculates ISEE-2 spin axis attitudes from telemetered ASU readings.
SIZE (k): Total = 54.6 FORT = 48.6 ALC = 1.1 GESS = 5.5
PREPARATION: Form = yes No. = 1 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-12-83	04-15-83	04-15-83	05-25-83
MVS	06-20-83	09-15-83	09-16-83	11-04-83

NAME: ATTIT.ISEEB.ASU.LOAD (ASUD1); priority 2
DESCRIPTION: Predicts quality of data for the sensor unit.
SIZE (k): Total = 3.0 FORT = 3.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 2 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-15-83	04-18-83	04-22-83	06-01-83
MVS	06-01-83	06-23-83	06-24-83	09-12-83

NAME: ATTIT.ISEEB.ESA.RIPPLE.LOAD (RIPPLE); priority 3
DESCRIPTION: Computes spin period oscillation frequency and generates commands to dampen oscillation.
SIZE (k): Total = 2.5 FORT = 2.2 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 62 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	04-21-83	04-22-83	06-01-83
MVS	06-13-83	06-24-83	06-24-83	09-28-83

NAME: ATTIT.ISEEB.SUNATT.LOAD (ADS1220A); priority 2
DESCRIPTION: Computes spin axis attitudes for ISEE-2 using a set of Sun-angle measurements.
SIZE (k): Total = 3.5 FORT = 3.4 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 14 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-14-83 Executed 04-01-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-06-83	04-08-83	04-08-83	05-25-83
MVS	07-11-83	07-14-83	07-15-83	10-05-83

NAME: ATTIT.ISEEC.ODAP.LOAD (ODAP); priority 6 (deleted)
DESCRIPTION: Predicts when spacecraft optical aspect system will provide useful data and the accuracy with which attitude can be computed.
SIZE (k): Total = 0.8 FORT = 0.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 92 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ISEEC.ODAP.LOAD (OSAG); priority 6 (deleted)
DESCRIPTION: Generates orbit, Sun and attitude geometry information for a satellite.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 93 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.ISEEC.ACS.LOAD (ACSMAN2); priority 2
DESCRIPTION: Computes spin-axis reorientation maneuver parameter for the ISEE-3.
SIZE (k): Total = 28.0 FORT = 28.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 52 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-31-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-05-83	04-06-83	04-08-83	05-25-83
MVS	08-01-83	08-16-83	08-19-83	12-01-83

NAME: ATTIT.ISEEC.FSSDAT.LOAD (FSSDAT); priority 2
DESCRIPTION: Manages FSS operational and definitive files.
SIZE (k): Total = 2.6 FORT = 2.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 9 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-25-83 Executed 04-08-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-11-83	04-14-83	04-29-83	06-01-83
MVS	05-27-83	06-02-83	06-03-83	07-19-83

NAME: ATTIT.ISEEC.MSAD.LOAD (ICCADS); priority 2
DESCRIPTION: Calculates ISEE-3 spacecraft spin axis attitudes.
SIZE (k): Total = 75.7 FORT = 67.2 ALC = 1.1 GESS = 7.4
PREPARATION: Form = yes No. = 10 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-14-83 Executed 04-06-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-18-83	04-29-83	04-29-83	06-01-83
MVS	07-12-83	07-27-83	07-29-83	11-04-83

NAME: ATTIT.ISEEC.MSAD.LOAD (RAWIN); priority 2 (deleted)
DESCRIPTION: Initializes FSS raw data set.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 51 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.LANDSAT.GEO.LOAD (GEOSHD); priority 2
DESCRIPTION: Calculates the geometric parameters associated with sunshade performance.
SIZE (k): Total = 0.6 FORT = 0.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 80 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-04-83	03-08-83	03-18-83	05-18-83
MVS	06-01-83	06-06-83	06-17-83	09-12-83

NAME: ATTIT.LANDSAT.LOAD (GSC0805); priority 2
DESCRIPTION: Predicts FHST occultations and output data for sunshade analysis.
SIZE (k): Total = 4.1 FORT = 1.7 ALC = 2.1 GESS = 0.3
PREPARATION: Form = yes No. = 81 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	02-14-83	03-23-83	04-01-83	05-18-83
MVS	07-11-83	07-14-83	07-15-83	09-12-83

NAME: ATTIT.MSAP.LOAD (BRRS); priority 3
DESCRIPTION: Is an orbit generator subroutine.
SIZE (k): Total = 0.4 FORT = 0.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 94 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	07-05-83	NR	07-08-83	11-16-83

NAME: ATTIT.MSAP.LOAD (ELCON0); priority 3
DESCRIPTION: Converts geocentric inertial elements to osculating elements and vice versa.
SIZE (k): Total = 0.6 FORT = 0.3 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 95 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-04-83	05-18-83
MVS	07-05-83	NR	07-08-83	11-16-83

NAME: ATTIT.MSAP.LOAD (KEPLR1); priority 3
DESCRIPTION: Solves Kepler's equation for eccentric anomaly given the mean anomaly and eccentricity by the Miles Standard algorithm.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 96 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	07-05-83	NR	07-08-83	11-16-83

NAME: ATTIT.MSAP.LOAD (VECTR2); priority 3
DESCRIPTION: Obtains most of the orbit dependent quantities usually required in attitude determination, simulation, and prediction programs.
SIZE (k): Total = 1.2 FORT = 1.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 97 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	07-05-83	NR	07-08-83	11-16-83

NAME: ATTIT.MSAP.LOAD (VTROP0); priority 3
DESCRIPTION: Is a vector operation package.
SIZE (k): Total = 0.3 FORT = 0.0 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 98 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	NR	04-01-83	05-18-83
MVS	07-05-83	NR	07-08-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (ADL); priority 2
DESCRIPTION: Provides telecommunications support to attitude determination activities by controlling the receipt of data, transmitting processed data, and maintaining a data base.
SIZE (k): Total = 4.6 FORT = 0.0 ALC = 4.6 GESS = 0.0
PREPARATION: Form = yes No. = 150 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-20-83	04-22-83	05-25-83
MVS	05-02-83	09-20-83	09-28-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (ADLARC); priority 2
DESCRIPTION: Archives data from the data base to a sequential disk or tape data set.
SIZE (k): Total = 0.3 FORT = 0.1 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 160 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-07-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-17-83	03-21-83	03-25-83	05-25-83
MVS	07-05-83	07-14-83	07-15-83	08-18-83

NAME: ATTIT.OPRLIB.LOAD (ADLMSG); priority 2
DESCRIPTION: Logs ADL diagnostic and status messages.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 152 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-20-83	04-22-83	05-25-83
MVS	05-02-83	09-20-83	09-28-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (ADLCNTL); priority 2 (deleted)
DESCRIPTION: Passes information from the ADL main program to the communications block and vice versa.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 225 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (ADLDAT); priority 2
DESCRIPTION: Monitors the data on the data base (inter-active program).
SIZE (k): Total = 1.1 FORT = 0.0 ALC = 1.1 GESS = 0.0
PREPARATION: Form = yes No. = 166 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-10-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-18-83	03-22-83	03-25-83	05-18-83
MVS	07-05-83	08-11-83	08-19-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (ADLMON); priority 2
DESCRIPTION: Queries the status of the ADL, delivers commands to the ADL, and examines output on the data base.
SIZE (k): Total = 2.2 FORT = 0.0 ALC = 2.2 GESS = 0.0
PREPARATION: Form = yes No. = 153 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-10-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-18-83	03-22-83	03-25-83	05-25-83
MVS	05-09-83	05-25-83	05-27-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (ADLPCT); priority 2
DESCRIPTION: Displays the percentage of utilization of the ADL data base by satellite ID.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 157 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	NR	04-29-83	05-25-83
MVS	08-08-83	NR	10-14-83	10-27-83

NAME: ATTIT.OPRLIB.LOAD (ADLPRINT); priority 2
DESCRIPTION: Formats and prints hard copies of the line history archived on the ADLLOG data set.
SIZE (k): Total = 0.3 FORT = 0.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 161 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-08-83 Executed 03-24-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	04-01-83	04-08-83	05-18-83
MVS	06-27-83	07-13-83	07-15-83	10-05-83

NAME: ATTIT.OPRLIB.LOAD (ADLPUNCH); priority 2 (deleted)
DESCRIPTION: None.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (ADLSCAN); priority 2
DESCRIPTION: Checks for chaining errors and record count discrepancies for a given satellite chain; Executes only from TSO.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 164 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-15-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-21-83	03-25-83	05-11-83
MVS	06-03-83	06-08-83	06-17-83	08-18-83

NAME: ATTIT.OPRLIB.LOAD (AEMDEL); priority 3 (deleted)
DESCRIPTION: Delete[illegible]rs from a partitioned data set.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: For = yes No. = 185 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (ANGSEP); priority 6
DESCRIPTION: Determines the angle between two alpha and delta points.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 220 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-12-83 Executed 04-12-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	04-21-83	04-22-83	06-23-83
MVS	08-22-83	08-31-83	10-03-83	10-18-83

NAME: ATTIT.OPRLIB.LOAD (ATTDATA); priority 3
DESCRIPTION: Computes attitude dependent geometries for the Sun, Earth, Moon, and magnetic fields.
SIZE (k): Total = 3.3 FORT = 3.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 222 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-06-83	04-07-83	05-13-83	06-23-83
MVS	07-18-83	08-12-83	08-12-83	12-08-83

NAME: ATTIT.OPRLIB.LOAD (ATTIMER); priority 3 (deleted)
DESCRIPTION: Keeps the task active even though the tube may be idle.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 137 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-02-83	NR	05-06-83	05-18-83
MVS	08-19-83	NR	09-02-83	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (CADLT); priority 3
DESCRIPTION: Monitors data records in the ADL data base.
SIZE (k): Total = 1.3 FORT = 1.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = C No. = 175 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-15-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-17-83	03-21-83	03-25-83	05-18-83
MVS	07-18-83	09-08-83	10-25-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (CONES); priority 6
DESCRIPTION: Calculates cone intersections.
SIZE (k): Total = 0.2 FORT = 0.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 218 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-12-83 Executed 04-12-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	04-21-83	04-22-83	06-23-83
MVS	08-22-83	08-31-83	09-02-83	09-16-83

NAME: ATTIT.OPRLIB.LOAD (CONTROL); priority 2
DESCRIPTION: Passes information from the ADL main program to the communications block and vice versa.
SIZE (k): Count included in ATTIT.OPRLIB.LOAD (ADL)
PREPARATION: Form = yes No. = 151 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-20-83	04-22-83	05-25-83
MVS	05-02-83	09-20-83	09-28-83	11-16-83

NAME: ATTIT.OPRLIB.LOAD (CONVERT); priority 3
DESCRIPTION: Converts right ascension and declination to PHI MAX and LAMBDA or vice versa.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 170 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-15-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-17-83	03-22-83	03-25-83	06-23-83
MVS	06-02-83	10-31-83	11-04-83	12-08-83

NAME: ATTIT.OPRLIB.LOAD (COPYDD); priority 6
DESCRIPTION: Copies one sequential data set to another by ddname.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 178 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-27-83	04-28-83	05-06-83	05-18-83
MVS	08-08-83	08-11-83	08-19-83	10-07-83

NAME: ATTIT.OPRLIB.LOAD (ENABLE); priority 2
DESCRIPTION: Tests a telecommunications line.
SIZE (k): Count included in ATTIT.OPRLIB.LOAD (ADL)
PREPARATION: Form = yes No. = 125 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-27-83	04-29-83	05-25-83
MVS	09-19-83	09-28-83	09-30-83	10-24-83

NAME: ATTIT.OPRLIB.LOAD (EPHTAP); priority 6
DESCRIPTION: Reads the header of an ephemeris tape.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 198 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-27-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-04-83	NR	05-06-83	05-25-83
MVS	08-15-83	NR	09-02-83	09-27-83

NAME: ATTIT.OPRLIB.LOAD (EPHRD); priority 3
DESCRIPTION: Reads the header from an ephemeris tape.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 203 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-17-83	03-22-83	03-25-83	05-18-83
MVS	07-18-83	09-22-83	09-23-83	11-17-83

NAME: ATTIT.OPRLIB.LOAD (EPHCOPY); priority 3
DESCRIPTION: Writes out portions of an ephemeris data set.
SIZE (k): Total = 0.4 FORT = 0.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 168 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 03-24-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	04-01-83	04-08-83	05-09-83
MVS	06-27-83	06-29-83	07-01-83	07-29-83

NAME: ATTIT.OPRLIB.LOAD (FTIMER); priority 3
DESCRIPTION: Reads system clock and computes W time and W date/day intervals; used for automatic execution/job submission.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 184 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-31-83
MVS	07-22-83	NR	07-29-83	10-05-83

NAME: ATTIT.OPRLIB.LOAD (GAMWIN); priority 3
DESCRIPTION: Produces launch window constraints.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 167 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-20-83 Executed 04-20-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-27-83	04-29-83	06-23-83
MVS	08-15-83	09-01-83	09-02-83	10-21-83

NAME: ATTIT.OPRLIB.LOAD (GESSDOC); priority 3
DESCRIPTION: Produces formatted tables of displays, CPOINTS and alphabetical listings of GESS allocated arrays for any system that uses GESS.
SIZE (k): Total = 2.0 FORT = 2.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 186 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed 04-20-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	05-02-83	05-06-83	06-23-83
MVS	08-08-83	08-26-83	09-02-83	09-27-83

NAME: ATTIT.OPRLIB.LOAD (HALTLINE); priority 3
DESCRIPTION: Disables a telecommunications line.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 221 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-27-83	04-29-83	05-31-83
MVS	09-19-83	09-28-83	09-30-83	10-24-83

NAME: ATTIT.OPRLIB.LOAD (LASTPASS); priority 2
DESCRIPTION: Retrieves and displays information regarding the most recently received telemetry data pass for any spacecraft on the ADL.
SIZE (k): Total = 0.6 FORT = 0.0 ALC = 0.6 GESS = 0.0
PREPARATION: Form = yes No. = 149 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-22-83	03-25-83	05-18-83
MVS	08-22-83	09-19-83	09-23-83	10-06-83

NAME: ATTIT.OPRLIB.LOAD (LISTVOLS); priority 2
DESCRIPTION: Lists space on online volumes.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 135 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-15-83	04-18-83	04-22-83	05-25-83
MVS	07-11-83	07-14-83	07-15-83	08-29-83

NAME: ATTIT.OPRLIB.LOAD (LOADJCL); priority 6 (deleted)
DESCRIPTION: Loads a set of DD entries from the OPS JCLLIB.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 206 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-07-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (MINIMAP); priority 2 (deleted)
DESCRIPTION: Maps individual data sets on volumes where data sets reside, provides a listing of members names of partitioned and PANVALET data sets.
SIZE (k): Total = 2.0 FORT = 0.4 ALC = 1.6 GESS = 0.0
PREPARATION: Form = yes No. = 147 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-11-83	03-15-83	03-25-83	05-25-83
MVS	06-20-83	09-30-83	09-30-83	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (NODEHIST); priority 2
DESCRIPTION: Predicts progression of nodes.
SIZE (k): Total = 2.4 FORT = 2.3 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 156 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Def ed 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	02-14-83	03-03-83	04-08-83	05-25-83
MVS	06-01-83	07-29-83	08-05-83	10-07-83

NAME: ATTIT.OPRLIB.LOAD (ODAP); priority 3
DESCRIPTION: Predicts when a spacecraft optical aspect system will provide useful data and the accuracy with which attitudes can be computed from that data.
SIZE (k): Total = 0.8 FORT = 0.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 216 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-05-83 Executed 05-05-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	05-12-83	05-13-83	07-01-83
MVS	06-27-83	10-12-83	10-14-83	11-04-83

NAME: ATTIT.OPRLIB.LOAD (OPPDSDEL); priority 3
DESCRIPTION: Deletes members from a partitioned data set.
SIZE (k): Total = 0.2 FORT = 0.1 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 130 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 03-24-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	04-01-83	05-06-83	05-25-83
MVS	07-07-83	07-14-83	07-15-83	09-29-83

NAME: ATTIT.OPRLIB.LOAD (OPFLASH); priority 2
DESCRIPTION: Displays the bottom half of the ATFLASH display on a beehive terminal.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 169 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	04-18-83	04-29-83	05-18-83
MVS	06-01-83	07-13-83	07-15-83	10-06-83

NAME: ATTIT.OPRLIB.LOAD (OPSLIN); priority 6
DESCRIPTION: Initializes OPS log routines.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 207 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-07-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-25-83
MVS	09-09-83	NR	09-16-83	10-21-83

NAME: ATTIT.OPRLIB.LOAD (OPSLP); priority 6 (deleted)
DESCRIPTION: Retrieves and displays information regarding the most recently received telemetry data pass for any spacecraft on the ADL in an online fashion.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 162 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-09-83	NR	05-13-83	05-25-83
MVS	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (OSAG); priority 3
DESCRIPTION: Computes spacecraft orbit, Sun, and attitude geometries.
SIZE (k): Total = 0.6 FORT = 0.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 215 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-02-83	05-06-83	05-13-83	05-25-83
MVS	06-20-83	09-12-83	09-16-83	12-08-83

NAME: ATTIT.OPRLIB.LOAD (OUTARC); priority 3
DESCRIPTION: Copies a transmission data set from disk to tape or from tape to disk.
SIZE (k): Total = 1.5 FORT = 1.5 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 200 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 03-24-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	04-01-83	04-08-83	05-25-83
MVS	07-18-83	08-24-83	08-26-83	09-16-83

NAME: ATTIT.OPRLIB.LOAD (PERHIST); priority 2
DESCRIPTION: Predicts spacecraft perigee based on perigee history and current orbital elements.
SIZE (k): Total = 2.6 FORT = 2.3 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 143 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	02-14-83	03-03-83	04-08-83	05-05-83
MVS	05-27-83	07-29-83	08-05-83	10-28-83

NAME: ATTIT.OPRLIB.LOAD (REBLOK); priority 6
DESCRIPTION: Reblocks telemetry data using FORTRAN access routines.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 199 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-27-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-02-83	NR	05-06-83	07-01-83
MVS	06-13-83	NR	06-17-83	07-29-83

NAME: ATTIT.OPRLIB.LOAD (RESETLNE); priority 3
DESCRIPTION: Frees a telecommunications line from TSO that has been designated by the SETLINE routine.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 173 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-27-83	04-29-83	05-25-83
MVS	09-19-83	09-28-83	09-30-83	10-24-83

NAME: ATTIT.OPRLIB.LOAD (SETLINE); priority 3
DESCRIPTION: Designates a telecommunications line to the LINEOUT DD card when the unit address is given as a parameter.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 212 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	04-27-83	04-29-83	05-25-83
MVS	09-08-83	09-28-83	09-30-83	10-24-83

NAME: ATTIT.OPRLIB.LOAD (SUN); priority 6
DESCRIPTION: Computes Sun angle of given attitude vector.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 219 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-12-83 Executed 04-12-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	04-21-83	04-22-83	06-23-83
MVS	08-22-83	08-24-83	08-26-83	09-27-83

NAME: ATTIT.OPRLIB.LOAD (SUNDAP); priority 6
DESCRIPTION: Predicts time when Sun is in the Sun sensor field of view.
SIZE (k): Total = 0.8 FORT = 0.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 27 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-04-83	NR	05-06-83	06-23-83
MVS	07-29-83	NR	08-12-83	08-29-83

NAME: ATTIT.OPRLIB.LOAD (TELMFIND); priority 3
DESCRIPTION: Displays selected portions of telemetry data records. Program unpacks 312 byte records and displays up to six values at a time per frame in hex, binary, or integel form.
SIZE (k): Total = 0.9 FORT = 0.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 213 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	03-22-83	04-01-83	07-19-83
MVS	08-22-83	09-07-83	09-09-83	10-27-83

NAME: ATTIT.OPRLIB.LOAD (TESTGAP); priority 2
DESCRIPTION: Locates gaps of data in the real-time and definitive attitude data transmissions.
SIZE (k): Total = 0.6 FORT = 0.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 214 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-17-83	03-22-83	04-01-83	05-18-83
MVS	07-05-83	07-07-83	07-08-83	08-18-83

NAME: ATTIT.OPRLIB.LOAD (TIMEGAP); priority 3 (deleted)
DESCRIPTION: Examines a user-specified set of telemetry records for a given spacecraft and outputs the start and end times of the record members.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 172 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (TLMGAP); priority 3 (deleted)
DESCRIPTION: Locates periods of mission data in real-time and definitive data transmissions.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 171 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.OPRLIB.LOAD (TUBTYP); priority 2
DESCRIPTION: Determines the tube type assigned to a DD card.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 144 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-16-83	NR	04-01-83	05-18-83
MVS	05-06-83	NR	05-20-83	11-28-83

NAME: ATTIT.OPRLIB.LOAD (V6COPY); priority 2
DESCRIPTION: Performs interactively a variety of input/output operations.
SIZE (k): Total = 7.5 FORT = 3.1 ALC = 3.7 GESS = .7
PREPARATION: Form = yes No. = 148 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-10-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-14-83	04-15-83	05-31-83
MVS	05-26-83	06-30-83	07-01-83	10-28-83

NAME: ATTIT.OPRLIB.LOAD (XMITBACK); priority 2
DESCRIPTION: Allows the user to re-create previously transmitted PDS members from an ACTS-created tape.
SIZE (k): Total = 0.2 FORT = 0.0 ALC = 0.2 GESS = 0.0
PREPARATION: Form = yes No. = 120 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-20-83	04-22-83	05-25-83
MVS	07-05-83	07-07-83	07-08-83	11-30-83

NAME: ATTIT.OPRLIB.LOAD (XMITGFX); priority 2
DESCRIPTION: Permits initialization of XMITTAPE and XMITLINE utilities from a graphics device.
SIZE (k): Total = 0.4 FORT = 0.0 ALC = 0.4 GESS = 0.0
PREPARATION: Form = yes No. = 121 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-28-83	NR	05-02-83	05-25-83
MVS	07-18-83	NR	11-04-83	12-01-83

NAME: ATTIT.OPRLIB.LOAD (XMITLINE); priority 2
DESCRIPTION: Performs the transmission function of the ACTS system over a telecommunications line.
SIZE (k): Total = 0.3 FORT = 0.0 ALC = 0.3 GESS = 0.0
PREPARATION: Form = yes No. = 118 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-18-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-28-83	NR	05-02-83	05-25-83
MVS	07-18-83	NR	07-22-83	11-30-83

NAME: ATTIT.OPRLIB.LOAD (XMITTAPE); priority 2
DESCRIPTION: Performs the transmission function of the ACTS system from magnetic tape.
SIZE (k): Total = 0.4 FORT = 0.0 ALC = 0.4 GESS = 0.0
PREPARATION: Form = yes No. = 119 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-20-83	04-22-83	05-25-83
MVS	07-05-83	07-07-83	07-08-83	11-30-83

NAME: ATTIT.OPRLIB.OPS.LOAD (All Members); priority 6
DESCRIPTION: Online processing system.
SIZE (k): Total = 48.1 FORT = 0.0 ALC = 48.1 GESS = 0.0
PREPARATION: Form = yes No. = 204 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	NR	05-13-83	05-25-83
MVS	10-17-83	NR	12-23-83	04-04-84

NAME: ATTIT.SENSOR.LOWTRN.LOAD (LOW0304A); priority 2
DESCRIPTION: Generates atmospheric radiance profiles and writes output to a direct access data set.
SIZE (k): Total = 3.4 FORT = 3.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 85 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 04-06-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-07-83	04-08-83	04-08-83	05-25-83
MVS	06-10-83	06-16-83	06-17-83	07-29-83

NAME: ATTIT.SENSOR.LOWTRN.LOAD (RAOBS); priority 2
DESCRIPTION: Averages climatological data for latitude bias for later use in the LOWTRN5 program.
SIZE (k): Total = 3.0 FORT = 3.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 86 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-20-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	04-21-83	04-22-83	05-31-83
MVS	06-27-83	06-30-83	07-01-83	11-11-83

NAME: ATTIT.SENSOR.LOWTRN.LOAD (RDBASE); priority 2
DESCRIPTION: Reads a portion of the direct access data base called ATTIT.SENSOR.
RADPRO.MASTER.
SIZE (k): Total = 0.2 FORT = 0.1 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 87 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-18-83 Executed 04-18-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-20-83	04-26-83	04-29-83	05-25-83
MVS	06-20-83	06-23-83	06-24-83	07-29-83

NAME: ATTIT.SENSOR.STATS.LOAD (ST0826B); priority 6
DESCRIPTION: Generates star availability statistics for ASTROS.
SIZE (k): Total = 1.0 FORT = 0.9 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 99 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 05-05-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-06-83	05-10-83	05-13-83	05-31-83
MVS	06-10-83	06-15-83	06-17-83	07-19-83

NAME: ATTIT.OPRLIB.OPS.UTIL.LOAD (All Members); priority 6
DESCRIPTION: OPS utilities.
SIZE (k): Total = 48.2 FORT = 0.0 ALC = 48.2 GESS = 0.0
PREPARATION: Form = yes No. = 232 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 05-02-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-02-83	NR	05-11-83	05-25-83
MVS	10-17-83	NR	12-23-83	04-04-84

NAME: ATTIT.ATTMAIN.LOAD (TSOTEL); priority 2
DESCRIPTION: Determines if a job is executing under TSO.
SIZE (k): Total = 0.1 FORT = 0.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 233 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-04-83	NR	04-08-83	05-18-83
MVS	05-02-83	NR	05-20-83	11-28-83

NAME: ATTIT.SENSOR.HRDB.LOAD (RM0517); priority 3
DESCRIPTION: Models horizon radiance for HRDB studies.
SIZE (k): Total = 2.1 FORT = 2.0 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 05-20-83 Executed 05-20-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-23-83	06-01-83	06-01-83	06-16-83
MVS	NA	NA	NA	NA

NAME: ATTIT.SENSOR.HRDB.LOAD (NM0519); priority 3
DESCRIPTION: Reads and compares data from NIMBUS tapes with HRDB data.
SIZE (k): Total = 3.4 FORT = 2.2 ALC = 1.2 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 05-20-83 Executed 05-20-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-23-83	05-25-83	05-27-83	06-16-83
MVS	NA	NA	NA	NA

NAME: ATTIT.SENSOR.HRDB.LOAD (BP0519); priority 3
DESCRIPTION: Integrates the horizon radiance data for a specified band pass.
SIZE (k): Total = 1.0 FORT = 0.9 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 05-20-83 Executed 05-20-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	05-23-83	05-26-83	05-27-83	06-16-83
MVS	NA	NA	NA	NA

NAME: ATTIT.SMM.DMS.LOAD (DMS0306); priority 2
DESCRIPTION: Monitors SMM attitude hardware data.
SIZE (k): Total = 44.1 FORT = 35.4 ALC = 1.3 GESS = 7.4
PREPARATION: Form = yes No. = 17 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed 03-11-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-18-83	04-01-83	04-08-83	06-02-83
MVS	05-23-83	08-25-83	08-26-83	12-05-83

NAME: ATTIT.SMM.DUT.LOAD (DUT1126); priority 2
DESCRIPTION: Generates tables containing information to update the SMM onboard computer data base.
SIZE (k): Total = 21.6 FORT = 19.3 ALC = 0.0 GESS = 2.3
PREPARATION: Form = yes No. = 20 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed 03-11-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-22-83	03-31-83	04-08-83	05-25-83
MVS	07-20-83	08-04-83	08-05-83	11-16-83

NAME: ATTIT.SMM.FOCS.LOAD (FOCS0908); priority 2
DESCRIPTION: Calibrates SMM's fine-pointing Sun sensors.
SIZE (k): Total = 14.8 FORT = 12.7 ALC = 0.1 GESS = 2.0
PREPARATION: Form = yes No. = 18 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-06-83 Executed 03-06-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-08-83	03-21-83	04-008-83	06-02-83
MVS	05-30-83	07-21-83	07-22-83	12-05-83

NAME: ATTIT.SMM.FG.LOAD (FG0130); priority 6
DESCRIPTION: Calculates Kalman filter gains for SMMOBC.
SIZE (k): Total = 2.6 FORT = 2.5 ALC = 0.0 GESS = 0.1
PREPARATION: Form = yes No. = 19 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed 03-11-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-23-83	03-30-83	04-15-83	06-02-83
MVS	05-16-83	07-18-83	07-22-83	12-05-83

NAME: ATTIT.SMM.ADS.LOAD (SMM0916); priority 2
DESCRIPTION: Computes attitude for SMM.
SIZE (k): Total = 101.8 FORT = 88.3 ALC = 1.3 GESS = 12.2
PREPARATION: Form = yes No. = 15 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-06-83 Executed 03-06-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-08-83	03-25-83	04-08-83	06-02-83
MVS	07-20-83	08-04-83	08-05-83	11-30-83

NAME: ATTIT.SMM.GSOC.LOAD (GSC0731); priority 2
DESCRIPTION: Predicts FHST and FPSS occultations and selects guide stars for SMM OBC attitude control.
SIZE (k): Total = 12.1 FORT = 9.9 ALC = 0.1 GESS = 2.1
PREPARATION: Form = yes No. = 16 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 02-09-83 Executed 02-09-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-04-83	03-21-83	04-08-83	05-25-83
MVS	07-06-83	07-20-83	07-22-83	11-16-83

NAME: ATTIT.SMM.SIM.LOAD (LM062179); priority 6
DESCRIPTION: Simulates SMM spacecraft telemetry data.
SIZE (k): Total = 14.6 FORT = 14.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 21 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-27-83 Executed 04-27-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-29-83	05-03-83	05-06-83	06-13-83
MVS	08-15-83	10-25-83	10-28-83	12-13-83

NAME: 1 ATTIT.SMM.T2FOCS.LOAD (FOX0306); priority 5 (deleted)
DESCRIPTION: Calibrates fine-pointing Sun sensors.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 22 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.SMM.UTIL.LOAD (MAGBS); priority 2
DESCRIPTION: Estimates magnetometer alignments, bias, and torque coupling.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 101 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-04-83 Executed 04-04-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-25-83	04-29-83	06-13-83
MVS	06-20-83	06-23-83	07-01-83	12-05-83

NAME: ATTIT.SMM.UTIL.LOAD (OBCDUMP); priority 6 (deleted)
DESCRIPTION: Reads SMM telemetry and dumps selected words.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 102 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.SMM.UTIL.LOAD (OCTRQ); priority 6 (deleted)
DESCRIPTION: Creates a roll reference update table.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 103 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: ATTIT.SMM.UTIL.LOAD (QUATT); priority 2
DESCRIPTION: Determines single-frame attitudes using FHST and FPSS data for comparison with gyro-propagated attitudes.
SIZE (k): Total = 1.2 FORT = 1.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 104 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-11-83 Executed 04-11-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-27-83	04-29-83	06-13-83
MVS	06-20-83	06-23-83	07-01-83	12-05-83

NAME: ATTIT.SMM.STAR.PAN; priority 2
DESCRIPTION: Determines availability of stars in the SMM star tracker's field of view.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 230 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-11-83 Executed 03-11-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-07-83	03-29-83	04-08-83	06-13-83
MVS	05-26-83	06-03-83	06-17-83	11-30-83

NAME: ATTIT.TDRSS.SMM.LOAD (TDRSSM); priority 2
DESCRIPTION: Provides operational support for scheduling TDRSS services.
SIZE (k): Total = 12.7 FORT = 12.6 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 13 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 03-24-83 Executed 03-28-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-31-83	04-04-83	04-08-83	XX-XX-XX
MVS	06-02-83	07-06-83	07-08-83	12-08-83

NAME: ATTIT.SMM.UTIL.LOAD (FOXSTR); priority 2
DESCRIPTION: Merges a FOCS raw interface data set with an SMM/ADS star output data set to form a FOXSTR data set.
SIZE (k): Total = 0.1 FORT = 0.1 ALC = 0.1 GESS = 0.0
PREPARATION: Form = yes No. = 100 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-11-83 Executed 04-11-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-13-83	04-27-83	04-29-83	06-13-83
MVS	06-20-83	06-23-83	07-01-83	12-05-83

NAME: ATTIT.SMM.UTIL.LOAD (MAS/PUP); priority 2
DESCRIPTION: None.
SIZE (k): Total = 19.5 FORT = 19.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = 228 Tape = Ta FDS = Ca
IBM S/360 BENCHMARK: Defined 04-25-83 Executed NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-25-83	NR	04-29-83	05-18-83
MVS	07-18-83	NR	09-30-83	11-16-83

C.2 CODE 581.3 PROGRAMS

NAME: ACQSCAN; priority 2
DESCRIPTION: Computes the rise and set times of a satellite over multiple ground stations or tracking satellites.
SIZE (k): Total = 9.8 FORT = 9.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-21-83	03-25-83	05-31-83
MVS	05-02-83	06-30-83	07-08-83	12-07-83

NAME: CHECKOBT; priority 2
DESCRIPTION: Reads and verifies data in orbit and ephemeris files.
SIZE (k): Total = 4.2 FORT = 4.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-02-83	03-02-83	03-18-83	05-31-83
MVS	07-05-83	07-08-83	07-15-83	12-12-83

NAME: CONVERT; priority 2
DESCRIPTION: Calculates Keplerian elements, averaged Brower mean elements and other orbit parameters at the descending node for the Landsat spacecraft.
SIZE (k): Total = 2.0 FORT = 2.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-22-83	03-22-83	04-08-83	05-31-83
MVS	05-02-83	08-15-83	08-19-83	12-07-83

NAME: EPHGEN; priority 2
DESCRIPTION: Integrates equations of motion and generates an ephemeris file.
SIZE (k): Total = 7.8 FORT = 7.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-07-83	03-07-83	03-18-83	05-31-83
MVS	05-02-83	06-03-83	07-08-83	12-07-83

NAME: FACTBL; priority 2
DESCRIPTION: Generates data required by ground stations to acquire and track the ATS-6 satellite.
SIZE (k): Total = 6.9 FORT = 6.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-21-83	04-01-83	05-31-83
MVS	07-20-83	08-05-83	08-12-83	12-23-83

NAME: FLASH; priority 2
DESCRIPTION: Processes raw telemetry data to produce a time history plot of converted accelerations.
SIZE (k): Total = 2.6 FORT = 2.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	04-12-83	04-15-83	05-31-83
MVS	08-15-83	08-22-83	08-26-83	11-30-83

NAME: GMAN; priority 2
DESCRIPTION: Computes detailed maneuver scenarios necessary to achieve desired orbit and maneuvers.
SIZE (k): Total = 32.0 FORT = 32.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-08-83	03-09-83	03-25-83	05-31-83
MVS	06-20-83	06-30-83	07-08-83	01-17-84

NAME: HAP; priority 2
DESCRIPTION: Calculates the perturbations due to terrestrial harmonics on the Keplerian elements on a spacecraft orbit.
SIZE (k): Total = 1.2 FORT = 1.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-30-83	03-31-83	04-01-83	05-31-83
MVS	07-20-83	08-11-83	08-12-83	11-30-83

NAME: MAESTROL; priority 2
DESCRIPTION: Computes the optimum time and attitude for firing of the apogee boost motor so that various mission objectives are satisfied.
SIZE (k): Total = 12.2 FORT = 12.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-21-83	03-25-83	05-31-83
MVS	07-20-83	08-11-83	08-12-83	11-30-83

NAME: MONITOR; priority 2
DESCRIPTION: Performs monte carlo analyses of orbital parameters.
SIZE (k): Total = 8.4 FORT = 8.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-18-83	03-31-83	04-01-83	05-31-83
MVS	07-20-83	07-27-83	07-29-83	12-12-83

NAME: PILOT/COPILOT; priority 2
DESCRIPTION: Performs a mission simulation in order to generate optimum launch windows.
SIZE (k): Total = 8.3 FORT = 8.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-17-83	03-31-83	04-01-83	05-31-83
MVS	08-08-83	08-15-83	08-19-83	12-12-83

NAME: PPP; priority 2
DESCRIPTION: Predicts station coverage and visibility times of the spacecraft for specified ground stations.
SIZE (k): Total = 2.6 FORT = 2.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-11-83	03-11-83	03-25-83	05-31-83
MVS	07-05-83	07-08-83	07-15-83	12-12-83

NAME: PRELUDE; priority 2
DESCRIPTION: Calculates fuel optimization and station acquisition conditions for synchronous spacecraft over a prescribed station longitude.
SIZE (k): Total = 5.2 FORT = 5.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-14-83	03-17-83	03-25-83	05-31-83
MVS	07-11-83	07-20-83	07-22-83	11-30-83

NAME: QUICKSTAT; priority 3
DESCRIPTION: Generates a quick-look Monte Carlo analysis of apogee kick motor firings.
SIZE (k): Total = 0.8 FORT = 0.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	04-07-83	04-08-83	05-31-83
MVS	08-29-83	09-21-83	09-23-83	01-19-84

NA-ME: RESTOR; priority 2
DESCRIPTION: Calculates delta-V magnitudes and maneuver locations for near-circular orbit semi-major.
SIZE (k): Total = 2.0 FORT = 2.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-11-83	03-11-83	03-25-83	05-31-83
MVS	07-05-83	07-08-83	07-22-83	12-07-83

NAME: SCENARIO; priority 2
DESCRIPTION: Generates in-plane maneuver plans to place a spacecraft into a circular synchronous over a prescribed on-station location.
SIZE (k): Total = 4.7 FORT = 4.7 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-14-83	03-17-83	03-25-83	05-31-83
MVS	08-22-83	08-26-83	09-02-83	11-30-83

NAME: SCRIPT; priority 2
DESCRIPTION: Calculates and prints spacecraft look angles and parameters for tracking by ground stations.
SIZE (k): Total = 8.3 FORT = 8.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-22-83	03-22-83	03-25-83	05-31-83
MVS	07-05-83	07-08-83	07-15-83	12-12-83

NAME: SENSORS; priority 2
DESCRIPTION: Propagates a given set of orbit conditions over a selected time span and produces Earth sensor and Sun sensor information for a given attitude.
SIZE (k): Total = 2.8 FORT = 2.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-08-83	03-08-83	04-01-83	05-31-83
MVS	07-12-83	07-20-83	07-22-83	12-12-83

NAME: STATDBM; priority 2
DESCRIPTION: Performs station data base operations.
SIZE (k): Total = 1.8 FORT = 1.8 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-10-83	03-10-83	03-18-83	05-31-83
MVS	05-02-83	07-08-83	07-15-83	11-30-83

NAME: TIMELINE; priority 2
DESCRIPTION: Generates detail launch scripts for a particular mission.
SIZE (k): Total = 0.4 FORT = 0.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-10-83	03-10-83	04-01-83	05-31-83
MVS	06-20-83	06-30-83	07-08-83	12-12-83

NAME: TWOBURN; priority 2
DESCRIPTION: Checks for worst case errors on timing, thrust, and pointing errors on motor firings, reports a minimum fuel usage table.
SIZE (k): Total = 2.0 FORT = 2.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	04-01-83	05-31-83
MVS	08-15-83	08-22-83	08-26-83	11-30-83

NAME: FBA; priority 3
DESCRIPTION: Models orbit evolution using a fourth order Runge-Kutta integration technique.
SIZE (k): Total = 3.5 FORT = 3.5 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-07-83	03-07-83	03-25-83	05-31-83
MVS	07-05-83	07-08-83	07-22-83	122-14-83

NAME: ROPP; priority 3
DESCRIPTION: Integrates spacecraft orbits quickly.
SIZE (k): Total = 6.0 FORT = 6.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-11-83	03-11-83	04-01-83	05-31-83
MVS	07-11-83	07-20-83	07-22-83	12-13-83

NAME: AEDYNE; priority 4 (deleted)
DESCRIPTION: X
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = XX
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: AEROSPACE; priority 4
DESCRIPTION: Calculates the delta-V required to achieve a final orbit using initial and final orbits as input.
SIZE (k): Total = 0.7 FORT = 0.7 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-01-83	04-04-83	XX-XX-XX	XX-XX-XX
MVS	09-21-83	09-28-83	09-30-83	12-13-83

NAME: AMAP; priority 4
DESCRIPTION: Provides preliminary trajectory and guidance information required for feasibility studies in mission analysis.
SIZE (k): Total = 10.9 FORT = 10.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-01-83	04-04-83	XX-XX-XX	XX-XX-XX
MVS	10-10-83	10-25-83	10-28-83	01-16-84

NAME: COMBINED; priority 4
DESCRIPTION: Computes attitude and delta-V information needed to perform a specified maneuver.
SIZE (k): Total = 2.1 FORT = 2.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	XX-XX-XX	XX-XX-XX
MVS	09-12-83	09-16-83	09-23-83	12-12-83

NAME: CURVEFIT; priority 4
DESCRIPTION: Reduces thruster data to polynomial form.
SIZE (k): Total = 0.6 FORT = 0.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-21-83	03-21-83	XX-XX-XX	XX-XX-XX
MVS	09-02-83	09-09-83	09-16-83	12-12-83

NAME: IGOS; priority 4 (deleted)
DESCRIPTION: X
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = XX
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX
MVS	XX-XX-XX	XX-XX-XX	XX-XX-XX	XX-XX-XX

NAME: MAPLIB; priority 4
DESCRIPTION: Collection of subroutines that are stand alone functions used in several operational programs.
SIZE (k): Total = 4.0 FORT = 4.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined = NR Executed = NR

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	XX-XX-XX	NR	XX-XX-XX	XX-XX-XX
MVS	10-10-83	NR	10-14-83	12-13-83

NAME: MOVIE; priority 4
DESCRIPTION: Generates 16mm movies or single frame plots of satellite orbits.
SIZE (k): Total = 1.9 FORT = 1.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-14-83	03-17-83	XX-XX-XX	XX-XX-XX
MVS	09-20-83	09-27-83	09-30-83	12-12-83

NAME: REPEAT CYCLES; priority 4
DESCRIPTION: Determines orbit repeat cycles as a function of the orbital semimajor axis and/or orbit inclinations.
SIZE (k): Total = 0.2 FORT = 0.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	XX-XX-XX	XX-XX-XX
MVS	09-27-83	10-04-83	10-07-83	12-07-83

NAME: SANDTRACKS; priority 4
DESCRIPTION: Propagates an epoch state vector by Brower analytic method to output the time histories of the worldmap and the look angles from ground station.
SIZE (k): Total = 2.2 FORT = 2.2 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	XX-XX-XX	XX-XX-XX
MVS	10-10-83	10-04-83	10-07-83	12-07-83

NAME: SHACQ/SAUP; priority 4
DESCRIPTION: Generates and plots an acquisition table and/or a summary file containing time, Shuttle-TDRS look angles, shuttle subsatellite points, antenna masking info.
SIZE (k): Total = 5.3 FORT = 5.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	XX-XX-XX	XX-XX-XX
MVS	09-06-83	09-13-83	09-16-83	12-13-83

NAME: SHADET; priority 4
DESCRIPTION: Determines the shadow duration for a given satellite orbit and time span.
SIZE (k): Total = 1.1 FORT = 1.1 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-28-83	03-31-83	XX-XX-XX	XX-XX-XX
MVS	09-26-83	10-03-83	10-07-83	12-13-83

NAME: STAGTRKS; priority 4
DESCRIPTION: Plots the ground track output tape generated by the SANDTRACKS 2 program.
SIZE (k): Total = 0.3 FORT = 0.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	04-04-83	04-07-83	XX-XX-XX	XX-XX-XX
MVS	09-26-83	10-28-83	10-28-83	01-26-84

NAME: SUNSHADE; priority 3
DESCRIPTION: Computes daily Sun angles and shadow conditions for a given orbit.
SIZE (k): Total = 0.9 FORT = 0.9 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined XX-XX-XX Executed XX-XX-XX

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-22-83	03-22-83	03-25-83	05-31-83
MVS	09-13-83	09-20-83	09-23-83	12-13-83

C.3 CODE 582.1 PROGRAMS

NAME: GESS; priority 1
DESCRIPTION: Provides an interactive graphic control structure for applications programming systems.
SIZE (k): Total = 29.8 FORT = 2.0 ALC = 27.8 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-15-83 Executed 03-15-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	02-07-83	03-25-83	04-01-83	05-17-83
MVS	02-07-83	05-09-83	05-12-83	08-29-83
VSFORTRAN	02-07-83	12-02-83	12-02-83	12-15-83

NAME: SFORT; priority 1
DESCRIPTION: Preprocesses structured Fortran code.
SIZE (k): Total = 4.7 FORT = 3.1 ALC = 1.6 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 02-22-83 Executed 02-22-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	02-07-83	03-17-83	04-08-83	05-17-83
MVS	02-07-83	04-15-83	04-15-83	07-13-83

NAME: R&DGTDS; priority 6
DESCRIPTION: Research and Development GTDS.
SIZE (k): Total = 178.2 FORT = 174.3 ALC = 3.9 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-03-83 Executed 03-03-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-14-83	03-25-83	04-01-83	05-17-83
MVS	03-28-83	08-22-83	08-26-83	08-29-83

C.4 CODE 582.2 PROGRAMS

NAME: GMAS; priority 2
DESCRIPTION: Goddard mission analysis system.
SIZE (k): Total = 72.4 FORT = 67.5 ALC = 4.5 GESS = 0.4
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 04-01-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-07-83	04-15-83	04-29-83	05-25-83
MVS	05-02-83	09-16-83	09-30-83	12-12-83

NAME: GMAS utilities; priority 2
DESCRIPTION: GMAS utilities.
SIZE (k): Total = 0.0 FORT = 0.0 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 04-01-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-07-83	04-15-83	04-29-83	05-25-83
MVS	05-02-83	09-16-83	09-30-83	12-12-83

NAME: GMAS ISEE EM; priority 2
DESCRIPTION: Provides engine modeling for the ISEE-3 extended mission.
SIZE (k): Total = 11.6 FORT = 11.6 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-24-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	04-25-83	04-29-83	07-27-83
MVS	08-12-83	09-22-83	09-30-83	01-10-84

NAME: GMAS ISEE module; priority 2
DESCRIPTION: Special utilities to support ISEE-3 extended mission maneuvers.
SIZE (k): Total = 2.3 FORT = 2.3 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-04-83 Executed 03-24-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	04-15-83	04-29-83	05-25-83
MVS	08-12-83	09-16-83	09-30-83	12-12-83

NAME: GMAS OPEN module; priority 3
DESCRIPTION: Special utilities to support OPEN mission.
SIZE (k): Total = 2.4 FORT = 2.4 ALC = 0.0 GESS = 0.0
PREPARATION: Form = yes No. = none Tape = T FDS = C
IBM S/360 BENCHMARK: Defined 03-30-83 Executed 03-30-83

CONVERSION	STARTED	BENCHMARK	DELIVERED	ACCEPTED
MVT	03-25-83	NR	04-29-83	07-06-83
MVS	08-12-83	NR	10-07-83	01-10-84

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