MASSACHUSETTS INSTITUTE OF TECHNOLOGY

APOLLO

GUIDANCE AND NAVIGATION

E-1808

ROPE MEMORY MODULE
ASSEMBLY PROCESSING PROCEDURES

by

A. LaPointe

June 1965

MIT INSTRUMENTATION LABORATORY

CAMBRIDGE 39, MASSACHUSETTS

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GUIDANCE AND NAVIGATION

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E-1808

ROPE MEMORY MODULE
ASSEMBLY PROCESSING PROCEDURE

ABSTRACT

This report establishes the procedures for the generation and process control of Apollo Guidance Computer Programs. The report includes; Program Control Boards established by Apollo Project Memo No. 619, description of forms utilized for process control and release of computer programs, and logistic requirements for fixed memory core ropes.

by Arthur LaPointe

June 1965

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SECTION I

INTRODUCTION

1.1 General

1.1.1 AGC Program Assembly

An AGC program is defined as information designed for performance of a specific function and stored in the computer fixed memory.

AGC programs are wired into fixed memory core ropes. The AGC fixed memory consists of three core ropes (S. T. R), each rope divided into two modules. The modules contain 1024 word memory banks (four in Block I and 100, and six in Block II) addressable through an arrangement of magnetic cores and threaded lines. Module position in the AGC tray (B) is designated by a B. (no.).

An AGC Program Assembly may consist of from one to three core ropes, or a combination of core rope modules and jumper modules. The number of modules required is dependent upon the program word content and organization.

For purposes of this instruction a "Program" is further defined as the total content of information stored in an AGC Program Assembly.

1.1.2 AGC Program Functions

Apollo G&C computer programs perform the functions of solving guidance and navigation problems, testing the operation of the G&C system, controlling and monitoring the entire operation of the spacecraft, and testing the computer subsystem.

The program functions to be performed are dictated by time, place, and the operational event for which the program is scheduled. The functions are established by the NASA and defined in the MIT "Guidance and Navigation System Operations Plan". (R-477 and subsequent documents)

1.1.3 AGC Program Design and Control

MIT has responsibility for the design, coding, and verification of the computer programs, release and revision of supporting documentation, and allocation of Computer Program Assemblies.

1.2 Purpose

This document, MIT/IL Report E-1808 was prepared with the intent of compiling and updating data relevant to the process control of Apollo G&C computer programs.

The procedures delineated herein establish the method by which MIT/IL will control the design, documentation and release of computer programs, and allocation of Computer Program Assemblies.

1.3 Scope

The procedure for processing AGC programs consists of:

1) Establishment of MIT AGC Program Control Boards.
2) Assignment of responsibilities for processing and controlling AGC programs.
3) Establishment of documentation requirements.
4) Identification of reports required.
5) Ground rules for allocation of Computer Program Assemblies.

SECTION II

AGC PROGRAM CONTROL BOARDS

2.1 AGC Operations Review Board (CORB)

2.1.1 Organization

The Computer Operations Review Board is a system-level board. The chairman of this board is the Apollo Technical Director. Other permanent members are:

Director, Guidance Analysis Group
Director, Digital Development Group
Director, Systems Operation Staff

2.1.2 Function

The CORB functions only as necessary to resolve technical, scheduling, and program control problems.

2.2 G&C System Operations Planning Board

2.2.1 Organization

The G&C System Operation Planning Board operates as a system-level board responsible for generating G&C Operations Plans. The chairman of this board is the Programming Director. Other board members are:

Director, Systems Operation Staff
Assigned Programmers, Guidance Analysis Group

2.2.2 Functions

The G&C System Operation Planning Board has the following functions:

1) Maintain control of the features which are intended to be incorporated into the AGC programs to achieve efficient system use of the computer.

2) Review the characteristics of each program with respect to other subsystem interfaces, other programs, and overall system operation.

3) Be the sole authenicator of information of the functional characteristics of the program and initial condition data.

4) Define AGC flight mission program requirements established by the NASA. This will require the preparation and maintenance of G&C System Operations Plans.

2.3 AGC Programming Board (CPB)

2.3.1 Function

The Computer Programming Board is a computer-oriented board charged with the responsibility for:

1) Generating test program requirements.

2) Assigning program features to programming activity and authenicating Computer Program Specification.

3) Integrating G&C system/AGC program interfaces.

4) Monitoring program data flow.

5) Program Verifying.

6) Releasing supporting documentation.

7) Allocating Computer Program Assemblies as required for G&C system function or AGC subsystem functions.

8) Reviewing schedules and progress of programs and determining relative priority for each program.

2.3.2 Organization

The membership of the Computer Programming Board (CPB) will consist of:

1) MIT:	- Director SGA (Chairman) - Director DDG - Other SGA/DDG personnel as authorized by the chairman - Recorder and Documentation Coordinator
2) NASA:	- NASA/RASPO or other observer personnel
3) Computer Directed Subcontractor:	- Support or observer personnel as authorized by the chairman.

2.4 Procedures

2.4.1 Apollo AGC Program Requirements

2.4.1.1 Apollo Guidance and Control System Test and AGC Subsystem Test Program Requirements

Program requirements for Apollo G&C system and AGC subsystem testing will be generated by MIT/IL CPB. Test requirements data will be obtained through meetings with MIT/IL, NASA, and Apollo contractor

personnel, and/or as determined by MIT/IL Design Group and system test laboratory personnel to support design specification tests.

2.4.1.2 Apollo Flight Mission Program Requirements

NASA has the responsibility for providing MIT/IL with flight mission requirement and the reference trajectory.

2.4.1.3 Factory Test Method (FTM) Program Requirements

Program requirements for AGC and associated equipment factory tests will be generated by the Apollo Guidance Computer Sub-Contractor.

MIT/IL CPB has the responsibility for monitoring the preparation of FTM programs and for final approval and release of supporting documentation.

2.4.2 Apollo AGC Program Specification (Fig. 2.1)

MIT/IL CPB is responsible for the generation of Apollo program specifications. The program specification will normally be prepared by supervising programmer assigned the task of writing the program.

2.4.2.1 Instructions for Preparation of Apollo AGC Program Specification

An Apollo AGC Program Specification Form is required for each computer program and revision of same. Instructions for completion of the forms are detailed below.

Item 1. Computer Program Assembly Number

To be filled in by the Documentation Coordinator. This is the NASA drawing number assigned to the assembly of core rope modules wired for this program. The specification is identified by this number.

Item 2. Program Name.

Enter name assigned to program.

Item 3. References

Reference pertinent documentation which may provide additional information concerning the program requirements.

Item 4. Date

Fill in month, day, and year of form submittal to CPB.

Item 5. Revision

To be filled in by Documentation Coordinator. This is the revision letter assigned to identify revisions to released programs.

Item 6. AGC Program Assembly Effectivity

1. Check the appropriate box for type of program:
   FM (Flight Mission)
   ST (G&C System Test)
   SST (AGC Subsystem Test)
   FTM (Factory Test Method)

2. Enter the cut-in (C/I) and cut-out (C/O) serial numbers of AGEs with which the CP Assembly is scheduled to be employed. In the case of SST or FTM assemblies enter the AGC serial number or Computer Block (I, 100, or II) as appropriate.

Item 7. AGC Program Requirements

1. Describe in a general way the requirements the program must satisfy. Applicable sections of R-477, or subsequent documents, may be referenced.

2. Estimate of fixed memory size. Indicate what core rope modules will be required and word content of each bank. Documentation Coordinator will design module "Deck" numbers and module position (B-) numbers as appropriate.

Item 8. CPB Action

Fill in name of the Programmer supervising the writing of the program, and date program is required for release.

Item 9. Approval Signature

Chairman will sign specification, certifying items entered are correct. Enter date signed.

Item 10. Distribution

Copies to be distributed as indicated.

AGC COMPUTER PROGRAM SPECIFICATION

1. CP ASSEMBLY NO._____

2. PROGRAM NAME_____

4. DATE_____

5. REVISION_____

6. CP ASSEMBLY EFFECTIVITY

C/I - C/O

☐ FM AGE_____ -

☐ ST AGE_____ -

☐ SST AGC_____ BLOCK

☐ FTM BLOCK_____

7. AGC PROGRAM REQUIREMENTS

A. General Requirements

_____

_____

_____

B. Estimated Fixed Memory Size

_____

_____

_____

	S		T		R	
	B____ Deck #____	B____ Deck#____	B____ Deck#____	B____ Deck#____	B____ Deck#____	B____ Deck #____
Bank						
Bank						
Bank						
Bank						
Bank						
Bank						

8. CPB ACTION

Supervising Programmer Assigned _____

Date Program Required_____

10. DISTRIBUTION

Apollo A
CPB Files
Documentation
Programmer
NASA/RASPO
Coordinator

9. Approved_____

CPB Chairman

Fig. 2.1

SECTION III

AGC COMPUTER PROGRAM PROCESS CONTROL

3.1 AGC Program Control Data Flow

The process control, documentation, and release of AGC computer programs requires complete understanding of established procedures and cooperation of all personnel involved. Figure 3.1 delineates the flow of data required to support AGC program processing control.

3.2 Control Authority

The Computer Programming Board functions as the governing authority for data processing and release. Responsibilities of the CPB are outlined in Section II.

3.3 Process Control System

3.3.1 AGC Program Preparation and Verification

Program requirements will be assigned to a programming activity by the CPB utilizing the AGC Program Specification form. The programming activity will generate an Assembly Card Deck for processing by the MH 1800 (EDP) YUL Assembly System. The YUL system generates the following.

3.3.1.1 Symbolic Card Deck

The master card deck consists of 80-column punched cards and provides a binary record of the program. Copies of the deck, or modifications of same, are distributed to NASA authorized simulation activities. The Card Deck contains:

1) Log Card (Fig. 3.2)

The first card of the deck contains; the card type identification (L, for Log), module deck number (4 digits), vertical control number (4) indicating spacing, computer for which program is effective (AGC-4 Master Deck), paragraph number (004), date of processing (month, day, year).

2) Remarks Header Card (Fig. 3.3)

The second card of the deck contains; card type identification (R, for Remarks), module deck number, vertical control numbers, the words "New Program" and name or the revision number, the NASA Computer Program Assembly number and revision dash number (NASA 1003203-011), paragrah number, module position number, (B-28), and the wire set which denotes wire group or strand.

3) Detail Card (Fig. 3.4)

The detail card contains much of the same information found in the previous cards. In addition it contains; word information such as operating code, address and parity, and relative address.

3) Remarks Trailer Card (Fig. 3.5)

The remarks trailer card indicates the completion of the paragraph and the identification of the preceeding paragraph.

3.3.1.2 Magnetic Binary Record

The magnetic binary record is a magnetic tape to be utilized for program verification and maintained by the programming activity as a permanent record of the program. The binary records are used to generate manufacturing tapes, punched on mylar tape, consisting of the following:

3.3.1.2.1 Weaver Tapes

Weaver tapes are used in the manufacturing process as the information source for core rope module sense line wiring.

3.3.1.2.2 Checker Tapes

Checker tapes are used to test the completed modules in the Core Rope Tester.

3.3.1.3 Symbolic Listing

The Symbolic Listing (MH 1800 Print Out) contains program information in YUL language with octal equivalents and various tabulations; such as symbols defined, AGC storage used, etc. The listing also provides a cross reference between address and program word, and line-by-line instruction description.

3.3.2 AGC Program Information

In order to provide identification and control of released programs it is necessary that the following data appear on the Symbolic Deck, Symbolic Listing, AGC Computer Program Assembly drawing, and all tapes.

1) Program Name.

2) CP Assembly Number (NASA Drawing No.) and revision dash number.

3) Module Deck Numbers will be entered on the program specification by the Documentation Coordinator, and serve as control numbers to identify initial release or revisions of programs wired in each individual core rope module of a AGC Program Assembly.

4) Type of Tape (CRC Core Rope Checker or CRW Core Rope Weaver).

The above data will be printed on each section of tape preceding the sense wire identification. This is necessary because Weaver Tapes are cut into separate sections for wiring each block of sense wires.

3.3.3 Program Description

The programmer will generate, in the form of a MIT/IL E Report, a complete and detailed description of the program, delineating:

1) The program requirements defined by the CPB.

2) Program construction and functional characteristics including:

a) Inputs
b) Outputs
c) Subroutines
d) Keyboard
e) Display
f) Downlink
g) Uplink
h) Interfaces

3.3.4 AGC Programs Supporting Documentation

3.3.4.1 Computer Program Assembly Drawing (Fig. 3.6)

The Documentation Coordinator is responsible for preparation of the Computer Program Assembly drawing and releasing TDRR. The drawing identifies an assembly of serialized core rope modules which are wired to function together as a computer program. Micro film copies of the drawing are available on aperture cards distributed to Apollo contractors. The following information appears on the assembly drawing:

1) Program Name
Assigned by the programming activity.

2) Program Assembly Number
NASA drawing number. Appropriate Block I (100), Block II or LEM, NASA drawing serial number will be assigned. ND 1000000, Apollo G&N System Index will be entered in the "next highest assembly" box.

3) Module Position

B-21, etc., locates module in tray B, position 21, as shown on AGC tray top assembly drawing.

4) Part Number

The part number is the NASA Rope Memory Module Assembly drawing number with a dash number (Fig. 3.7). The dash number is redundant with the module deck number in that it identifies the program sense line wiring for each module. The part number is displayed on a chart which cross references it with the module deck number and computer program assemblies for which it is effective.

NOTE: Flight mission programs will normally comprise a mixture of system test assembly modules and special flight modules. In this case a flight mission name and assembly number will be assigned.

5) Program Specification

a) Assembly (Revision) Dash Number

Control number for each program assembly. Identifies different configurations and revisions of the same program, and modules required.

b) Function

Identifies the specific task which program is designed to perform, subsystem test, system test, flight mission, etc.

c) Effectivity

(1) Launch Period

Applicable to Flight Mission Programs only. Period during which all Flight Mission requirements are satisfied by designated program assembly.

(2) Computer Serial Number

Apollo Guidance Computer or activity to which designated program assembly is allocated.

3.3.4.2 Technical Data Release/Revision (TDRR)

The TDRR form will be utilized for release and revison of Computer Program data and documentation per the requirements of MIT/IL Report E-1186. In addition to the information normally recorded on the TDRR form the following items should be included:

1) Description of Changes

Reference the Punched Paper Tapes and Symbolic Listing as part of the initial package release.

2) Other Documents Affected

Reference the Rope Module Assembly drawing. This drawing must be changed for each new or revised program release. Also reference ND 1000000 (Apollo G&N Systems Index).

3.3.4.3 AGC Program Assembly Allocation Report (Fig 3.8)

The AGC Program Assembly Allocation Report is prepared monthly by the Documentation Coordinator. It is distributed to permanent members of the Computer Programming Board and other MIT/IL personnel concerned with Computer Program manufacture and allocation, to NASA, and to Apollo G&C Contractors. The report is for information and planning purposes only. The following information is included in the report:

1) Report number.

2) AGC block included in report.

3) Date of report.

4) Authorized modules. List of Technical Directives and/or statements of work authorizing Core Rope Module manufacture, and the quantity and type authorized.

5) Program name.

6) AGC Program Assembly Number. Each assembly is listed separately by assembly dash number.

7) Quantity of Core Rope Modules included in assemblies for which sense line wiring is directed.

8) Reference Technical Directive or SOW authorizing manufacture of Core Ropes. Authorization restricts manufacture to stage of inhibit line wiring.

9) Amendment to T.D. directing sense line wiring.

10) Type of program to be sense wired and date delivery is required to meet system/subsystem requirements.

11) Listing of module positions included in the program assembly. Manufacturer's production control module serial number is entered under the applicable position to provide a record for module traceability.

12) Allocation. Includes: current location of CP Assembly, remarks as appropriate, assembly "Set" number assigned by the manufacturer during production, and AGC to which assembly is currently allocated.

13) Actual date of delivery by manufacturer.

A letter of transmittal is included with the report. The letter contains information concerning; program revision, manufacturing problems, Computer Program Board decisions, etc., which affect assembly allocation and delivery.

3.3.5 AGC Program Review and Approval

3.3.5.1 Review

The Programmer will submit the MH 1800 Symbolic Listing, and Punched Paper Tapes to the Documentation Coordinator. The Documentation Coordinator is responsible for preparation of the Computer Program (CP) Assembly Drawing and TDRR. He will submit all documents to the CPB for review.

3.3.5.2 Approval

The signature of the Supervising Programmer responsible for writing the program will be entered in the Engineering Approval Box of the TDRR form.

The CPB chairman, or his designated alternate, shall be entered in the Design Review Approval Box, indicating program authorization and design approval.

3.3.6 AGC Program Release

The Documentation Coordinator is responsible for submission of the TDRR, AGC Program Assembly drawing, MH 1800 Symbolic Listing (reproducible), and the manufacturing tapes to the MIT/IL CCB for release. He is also responsible for initiation of changes required to other drawings affected by the AGC Program Assembly Release and revision. (Core Rope Module Assembly drawing, etc.).

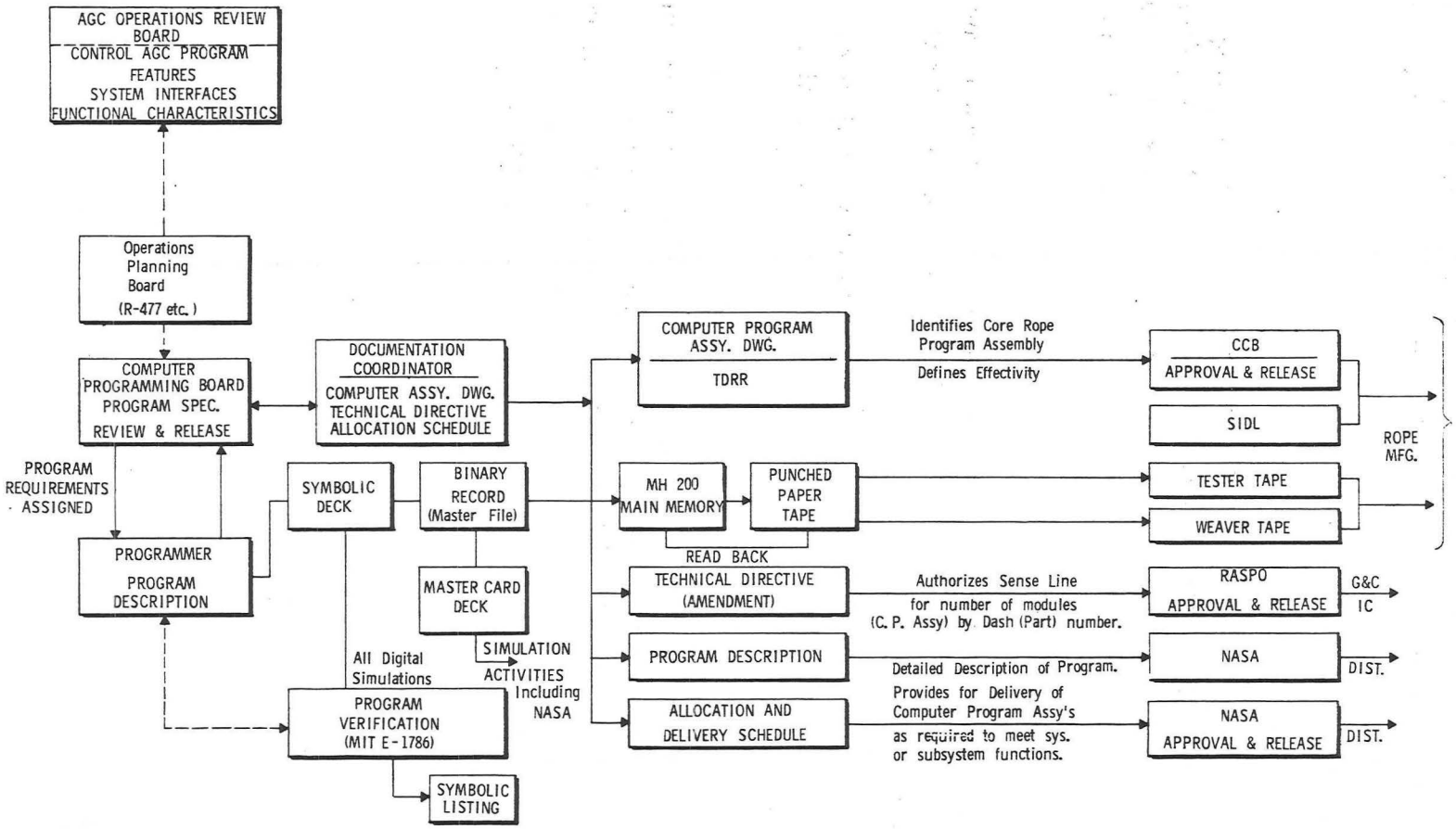
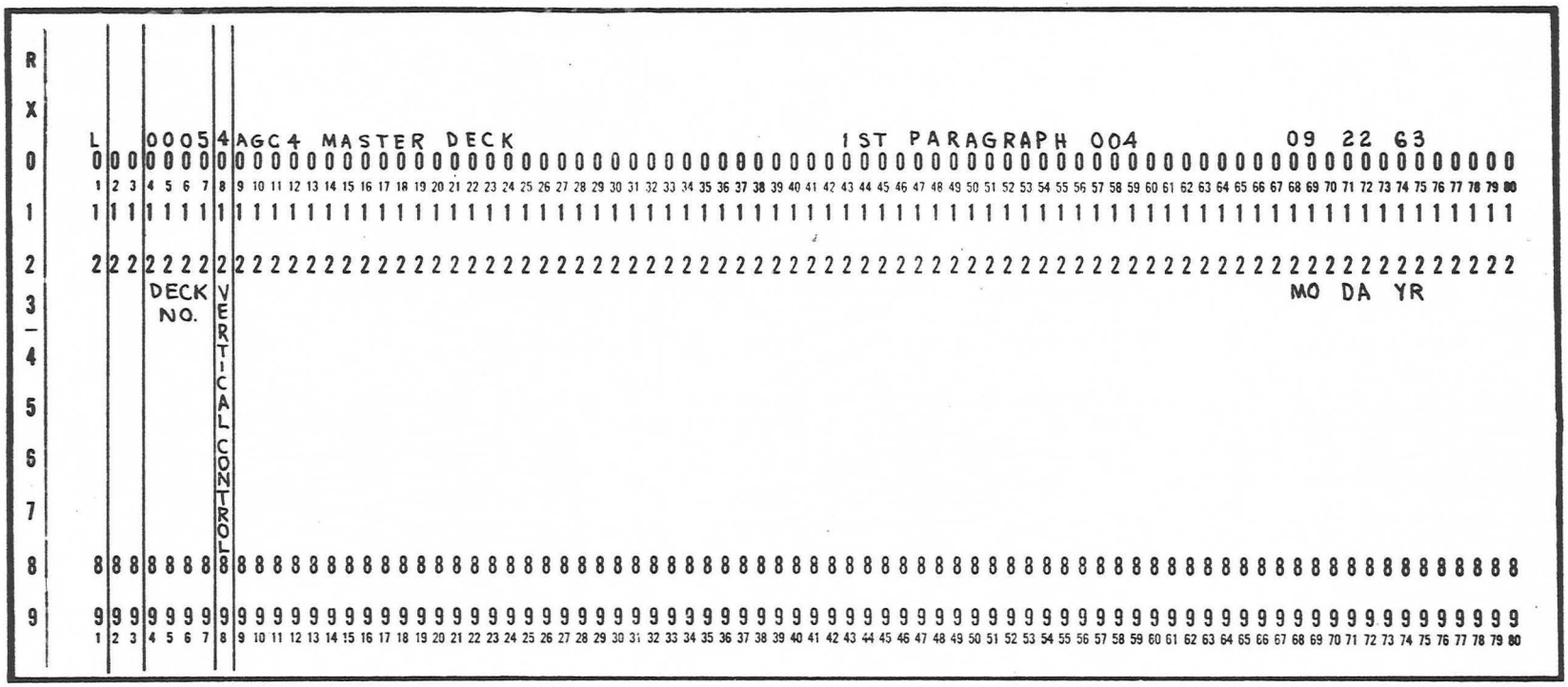


Fig. 3-1 Flow diagram AGC program process control system.

Honeywell

Electronic Data Processing

Layout Form — 80 Column Card



Title LOG CARD

Prepared By ..... For Program .....

By Programmer ..... Checked By .....

Date ..... Remarks .....

.....

Modification ..... Page 1 of 4

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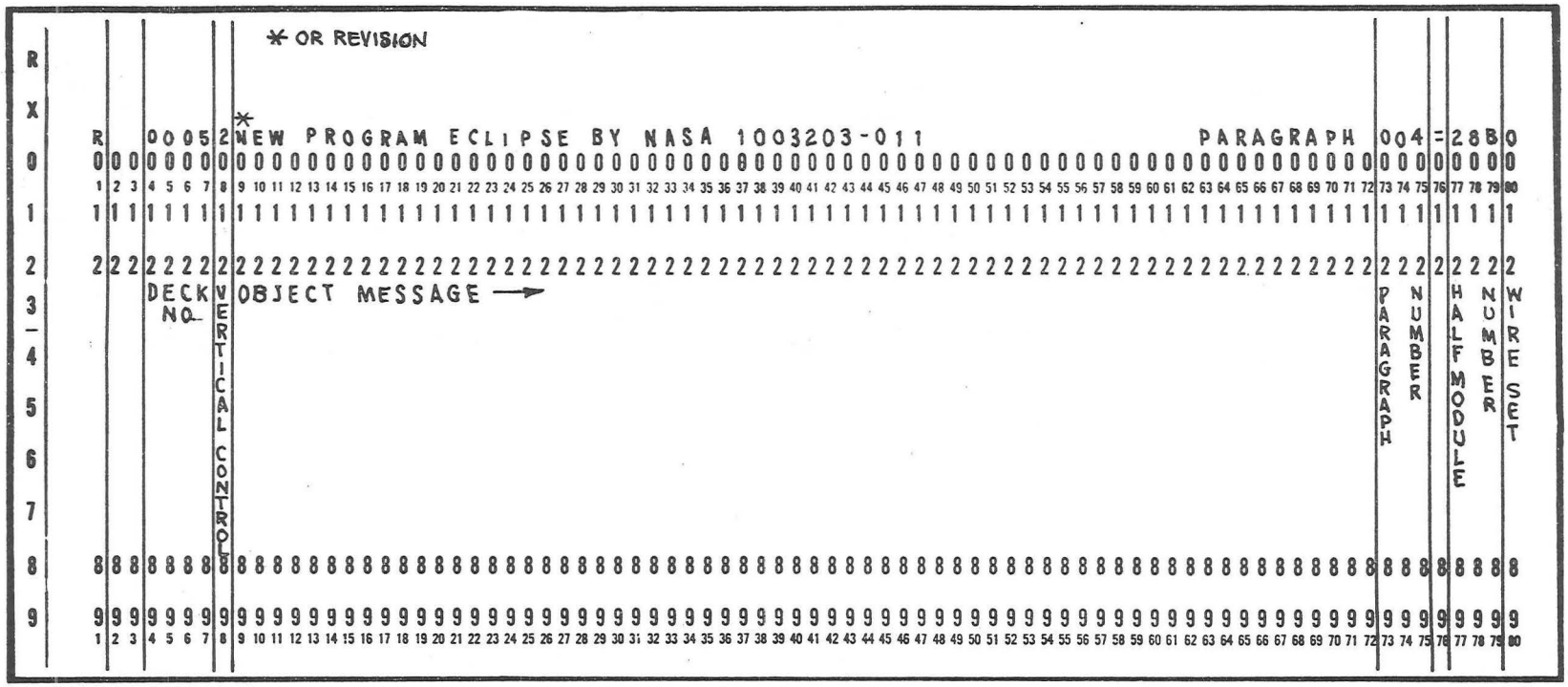
Fig. 3-2

Honeywell

Electronic Data Processing

Layout Form — 80 Column Card



Title REMARKS HEADER CARD

Prepared By ..... For Program .....

By Programmer ..... Checked By .....

Date ..... Remarks .....

.....

Modification ..... Page 2 of 4

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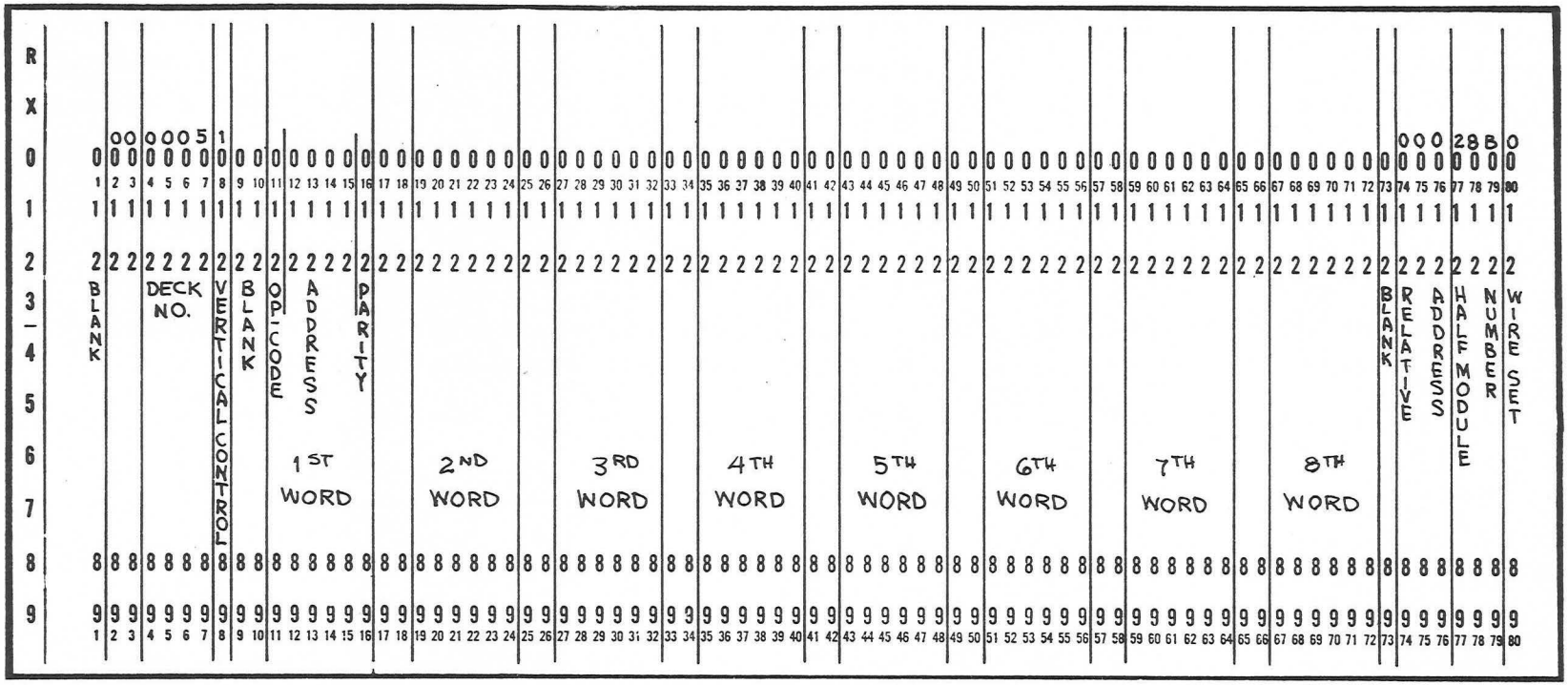
Fig 3-3

Honeywell

Electronic Data Processing

Layout Form — 80 Column Card



Title DETAIL CARD

Prepared By ..... For Program .....

By Programmer ..... Checked By .....

Date ..... Remarks .....

.....

Modification ..... Page 3 of 4

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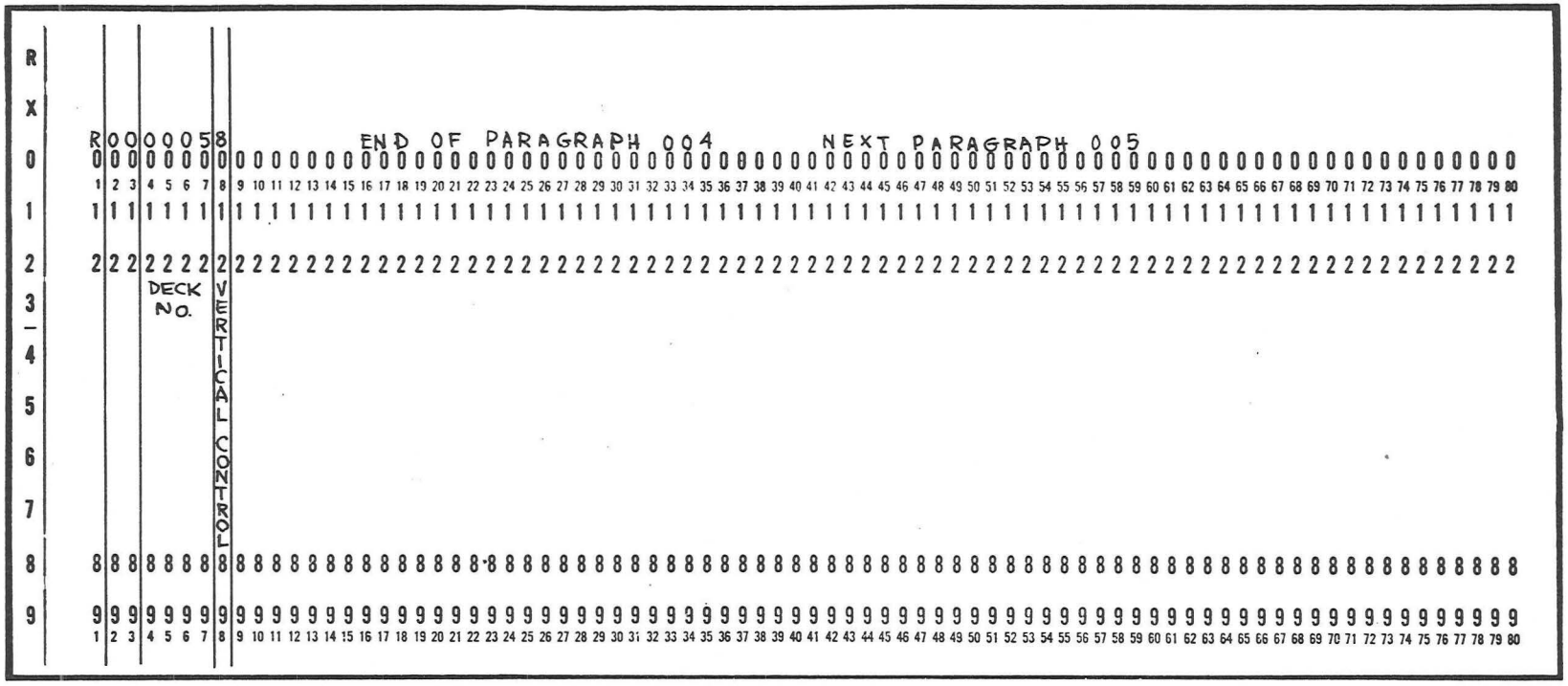
Fig 3-4

Honeywell

Electronic Data Processing

Layout Form — 80 Column Card



Title REMARKS TRAILER CARD

Prepared By ..... For Program .....

By Programmer ..... Checked By .....

Date ..... Remarks .....

.....

Modification ..... Page 4 of 4

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Fig. 3-5

SUNRISE PROGRAM ASSEMBLY 1021103																							
MODULE B-21	MODULE B-22	MODULE B-23	MODULE B-24	MODULE B-28	MODULE B-29	PROGRAM SPECIFICATION																	
PART NO.	PART NO.	PART NO.	PART NO.	PART NO.	PART NO.	ASSEMBLY DASH NO.	FUNCTION	EFFECTIVITY															
								LAUNCH PERIOD	COMPUTER SERIAL NO.														
1003733-011	1003763-021	1003763-021	1003763-021	1003733-021	1003733-031	-011 ONE EACH PER COMPUTER	SYSTEM TEST	N/A	120	108	117	112	107										
						B21			☒	☒	☒	☒	☒										
						B22			☒	☒	☒	☒	☒										
						B23			☒	☒	☒	☒	☒										
						B24			☒	☒	☒	☒	☒										
						B28			☒	☒	☒	☒	☒										
						B29			☒	☒	☒	☒	☒										
1003733-041	1003733-071	1003763-021	1003763-021	1003733-051	1003733-061	-021 ONE EACH PER COMPUTER	SYSTEM TEST	N/A	121	111	109	122	SPI	123	124	SP2	NAA SPARE	MILA SPARE					
						B21			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒					
						B22			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒					
						B23			☒	☒	☒	☒	☒	☒	☒	☒	☒						
						B24			☒	☒	☒	☒	☒	☒	☒	☒	☒						
						B28			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒				
						B29			☒	☒	☒	☒	☒	☒	☒	☒	☒	☒	☒				
1003733-011	1003733-071	1003763-021	1003763-021	1003733-021	1003733-031	-031 ONE EACH PER COMPUTER	SYSTEM TEST	N/A	120	108	117	112	107										
						B22			☒	☒	☒	☒											

☒ SYMBOL INDICATES MODULE REQUIRED

Fig. 3-6 Computer Program Assembly Sunrise
NASA Dwg. D-1021103

091	081	071	061	051	041	031	021	QTY 011	PART OR IDENTIFYING NO.	NOMENCLATURE OR DESCRIPTION	FIND NO.
AR	–	–	–	–	–	–	–	–	SEE NOTE 23	MODULE DECK NO. 0022	REF
–	AR	–	–	–	–	–	–	–	SEE NOTE 23	MODULE DECK NO. 0021	REF
–	–	AR	–	–	–	–	–	–	SEE NOTE 23	MODULE DECK NO. 0023	REF
X	X	1	1	1	1	X	X	X	1003821-021	ROPE MEMORY MODULE SUBASSY	35
AR	AR	AR	AR	AR	AR	AR	AR	AR	1012507-003	TAPE LACING	34
			512	512	512	X	X	X	1006320	CORE, MAGNETIC	33
–	–	–	AR	–	–	AR	–	–	SEE NOTE 23	MODULE DECK NO. 0018	REF
–	–	–	–	AR	–	–	AR	–	SEE NOTE 23	MODULE DECK NO. 0020	REF
–	–	–	–	–	AR	–	–	AR	SEE NOTE 23	MODULE DECK NO. 0019	REF
16	16	16	16	16	16	16	16	16	1004727	GASKET ROPE MODULE	32
2	2	2	2	2	2	2	2	2	1004726	GASKET ROPE MODULE	31
								X	SEE NOTE 22	WIRE, ELECTRICAL	30
								X	NAS-1391-24-9	WIRE, ELECTRICAL	29
AR	AR	AR	AR	AR	AR	AR	AR	AR	1006275-2	WIRE, ELECTRICAL	28
			2	2	2	2	2	2	1000093-2	SCREW, BUTTON HD	27
AR	AR	AR	AR	AR	AR	AR	AR	AR	1004623-2	SHIM	26
			AR	AR	AR	AR	AR	AR	1006776-22	SLEEVING	25
REF	REF	REF	REF	REF	REF	REF	REF	REF	1006144	SCHEMATIC	X
1	1	1	1	1	1	1	1	1	1004603	INSULATOR	24
2	2	2	2	2	2	2	2	2	1004546-3	WASHER, FLAT	23
2	2	2	2	2	2	2	2	2	MS16633-4015	RING, RETAINING, EXTERNAL "E"	22
								2	MS39086-100	PIN, SPRING	21
								2	1004207	SCREW, EJECTION DRIVE CYLINDER	20
2	2	2	2	2	2	2	2	2	1004579-1	SCREW, JACKING	19
2	2	2	2	2	2	2	2	2	1004546-1	WASHER, FLAT	18
8	8	8	8	8	8	8	8	8	1004237	WASHER, FLAT	17
								2	1000104-1	SCREW, FLAT HEAD	16
8	8	8	8	8	8	8	8	8	1006783-11	SCREW, BUTTON HEAD	15
			AR	AR	AR	AR	AR	AR	1006275-1	WIRE, ELECTRICAL	14
			AR	AR	AR	AR	AR	AR	1006757-1	WIRE, .010 X .020	13
			256	256	256	256	256	256	1006751	DIODE	12
			128	128	128	128	128	128	1006750-39	RESISTOR, FIXED 2K	11
			1	1	1	1	1	1	1003134	TERMINAL BOARD ASSEMBLY	10
			X	X	X	512	512	512	1006298-1	CORE, MAGNETIC	9
								AR	1004117	PLUG, KEYING	8
								1	1004235-1	INSULATOR	7
			X	X	X	1	1	1	1004235-3	INSULATOR	6
1	1	X	X	X	X	1	1	1	1003821-011	ROPE MEMORY MODULE SUB ASSY	5
			4	4	4	4	4	4	1004233	HOLDER, CORE	4
			1	1	1	1	1	1	1004232	HOLDER, COMPONENT	3
								1	1004236	COVER	2
			1	1	1	1	1	1	1003135	HEADER ASSEMBLY	1
B29	B28	B22	B29	B28	B21	B29	B28	B21	LIST OF MATERIALS		

UNLESS OTHERWISE SPECIFIED
DIMENSIONS ARE IN INCHES
TOLERANCES ON
FRACTIONS ± DECIMALS ± ANGLES ±
DO NOT SCALE THIS DRAWING
MATERIAL //
HEAT TREATMENT //
FINAL FINISH //

MIT INSTRUMENTATION LAB
CAMBRIDGE, MASS.
DWG. NO. CONTRACT
DRAWN DATE
CHECKED
APPROVAL E.J. Duggan 9/24/64
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MANNED SPACECRAFT CENTER
HOUSTON, TEXAS

ROPE MEMORY MODULE ASSEMBLY

CODE IDENT NO.	SIZE	NASA DRAWING NO.
80230	J	1003733

SCALE 2/1 WT SHEET 1 OF 2

Fig. 3-7 Rope Memory Module Assembly
NASA Dwg. J-1003733

TYPE ROPES REQUIRED

ST - System Test SST = Subsystem Test
FT - Factory Test J = Jumper
FM - Flight Mission

Block I - Block I (100 Series)
Block II
Date: 1 June 1965

T.D. # 132 = 60 (Block I)
T.D. # 135 = 18 (Simulation AGC)

AUTHORIZED MODULES
T. D. #220 = 48 (BL II Prototype)

* = Estimated Flight Program Tapes Released to Ray.
T.D. # 140 = 12 (AGC-4B)
T.D. # 199 = 90 (Block I - 100 Series)

NAME	ASSY NO.	QUANTITY (MODULES)	T.D.	AMENDMENT	ASSY REQ'D DATE (PRIORITY)	B21	B22	B23	B24	B28	B29	REV.	ALLOCATION Location AGE	ALLOCATION Test #	AGC/AGE	DELIVERED DATE
Sunrise	1021102-(031)	3	132	1148-64	ST 2/1/65	78	J-1			79	80	B	(Not Assigned)	Set #7	S/C #3	
	1021103 - (-011)	3	132	#1	ST 3/15/65	10	J-10	J-14	J-15	8	12	B	NAA BP #14	Set #12	AGC-108	3/19/65
	(-031)	1	199	#4	ST 4/30/65		31					C	NAA BP #14	Set #12/#14	AGC-108	6/1/65
	(-011	3	132	#1	ST 3/1/65	1	J-7	J-8	J-9	2	3	B	NAA AFRM 008	Set #10	AGC-120	2/27/65
	(-031)	1	199	#4	ST 5/15/65		32					C	NAA AFRM 008	Set #10/#5	AGC-120	
	(-011)	3	132	#1	ST 3/23/65	4	J-4	J-5	J-6	5	6	B	NAA AFRM 011	Set #11	AGC-117	3/13/65
	(-031)	1	199	#2	ST 5/15/65		33					C	NAA AFRM 011	Set #11/#6	AGC-117	
					*FLT 7/1/65								SA 202 - AFRM 011	Set #	AGC-117	
					FLT 7/1/65								SA 202 - NAA	Set #	AGC-	
	(-011	3	132	#1	ST 4/16/65	7	J-11	J-12	J-13	11	9	B	NAA AFRM 012	Set #13	AGC-112	
	(-031	1	199	#2	ST 4/9/65		25					C	NAA AFRM 012	Set #13/#2	AGC-112	5/2/65
					*FLT 9/15/65								SA 203	Set #	AGC-112	
														Set #	AGC-	
	(-011)	3	135	#1	ST 4/16/65	21	J-16	J	J	22	23	B	NAA AF 006	Set #9	AGC-107	
	(-041)	1	199	#2	ST 4/16/65		30					C	NAA AF 006	Set #3	AGC-107	
	(-021)	4	199	#4	ST 6/1/65	26	29			27	28	C	NAA Spares	Set #1	NAA	
	(-021)	4	199	#2	ST 6/22/65	36	39	J-22	J-23	37	38	C	NAA AFRM 014	Set #2	AGC-121	
					*FLT 12/15/65								SA 204	Set #	AGC-121	
	(-021)	4	199	#2	ST 7/15/65	40	43	J-26	J-27	45	46	C	ACSP SYS QUAL	Set #3	AGC-111	
	(-021)	4	199	#2	ST 8/15/65	48	51	J-28	J-29	49	50	C	NAA AFRM 015	Set #4	AGC-122	
					*FLT 2/15/66											
	(-021)	4	199	#1	ST 7/31/65	44	47	J-24	J-25	41	42	C	ACSP (Sled test)	Set #5	AGC-109	
	(-021)	4	199	#2	ST 8/1/65	52	55	J-30	J-31	53	54	C	Spare #1	Set #6	AGC-	

TP13319

SECTION IV

AGC PROGRAM ASSEMBLY LOGISTICS

4.1 Ground Rules for Allocation of AGC Program Assemblies

The AGC Program Assembly is not part of the AGC hardware. It is identified and handled as a separate end item on the G&C System Assembly drawing. This arrangement permits flexibility in making module or Computer Program Assembly changes as necessary to satisfy system program requirements. ND 1000000 G&N Systems Index will be updated to indicate all assembly allocation and changes.

4.1.1 AGC System Test Program Assemblies

1) An AGC Program Assembly, designed to perform system tests, will normally be allocated to each AGC and LGC.

2) A spare system test AGC Program Assembly will be provided to each Apollo contractor G&C system test facility as designated by NASA.

4.1.2 AGC Factory Test Method (FTM) Program Assemblies

1) An AGC FTM Program Assembly will be allocated for each AGC subsystem test station required by the computer manufacturer.

2) In addition to the above, one spare assembly will be provided.

4.1.3 Apollo Flight Mission Program Assemblies

1) Apollo Flight Mission Program Assemblies will be allocated as follows:

a) One assembly to the flight G&C system. This assembly should be available no later than the time of delivery of the G&C system to KSFC.

b) One duplicate assembly (first assy. mfg'd) to MIT/IL. This assembly will be utilized to verify program functions and assembly manufacture, and will be available as a flight mission spare.

c) One duplicate assembly to activities designated by the NASA, (i.e., MSC, NAA, GAEC, etc.). This requirement may be satisfied with a program tape for use in the Core Rope Simulator.

2) Flight Mission program assemblies will be designed to incorporate compatible core rope modules from system test assemblies. The combined assembly will be identified by the Flight Mission Program assembly number.

3) Flight Mission Program Assembly modifications may be required as a result of flight test and engineering changes. In addition, certain functions of the program are launch time dependent and may require change. It is estimated that the installation of the ropes incorporating the change and checkout of the flight system will require a minimum of a week.

E-1808

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