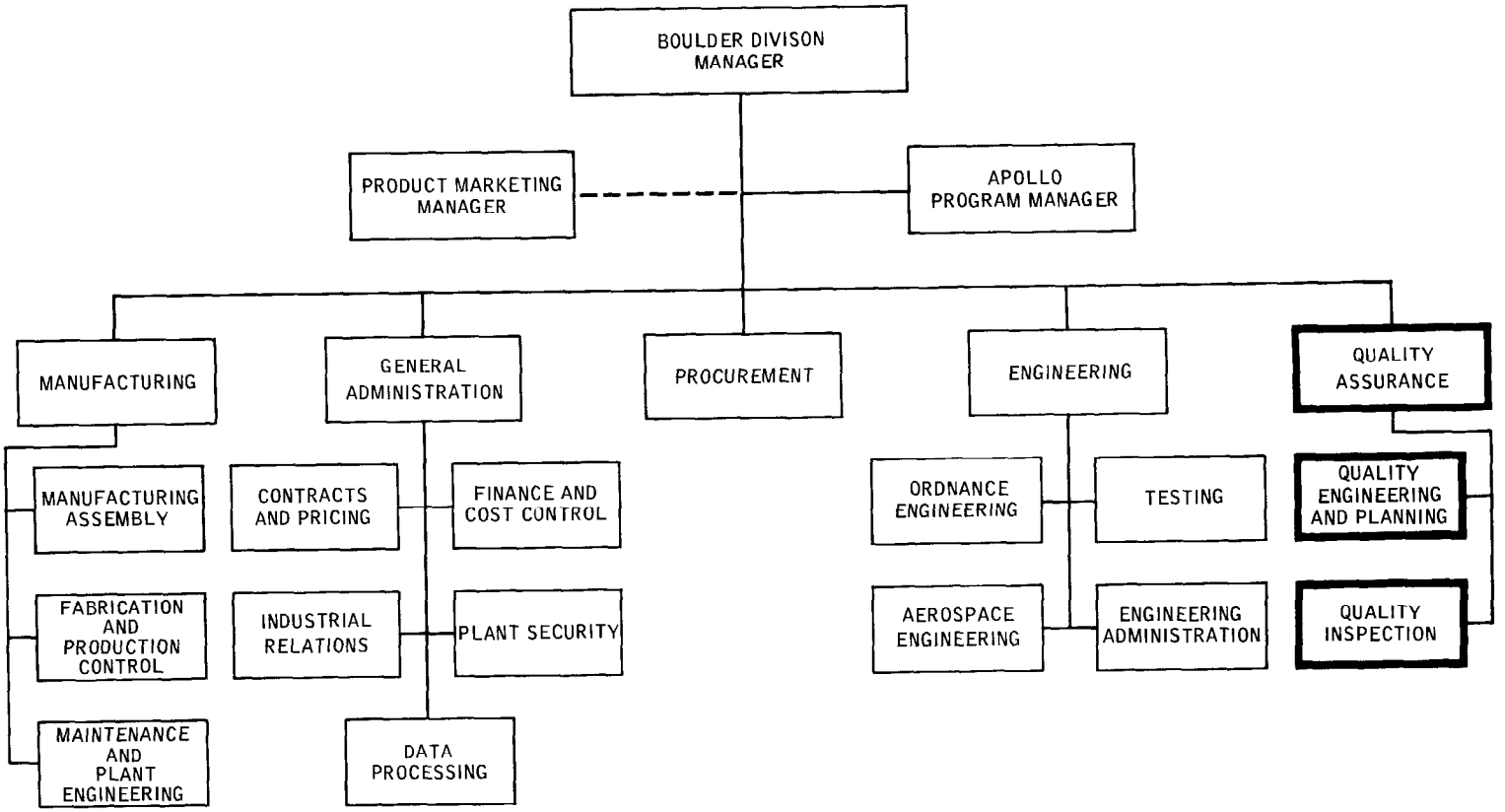

Figure E4-10.- Beech Aircraft Corporation organization.

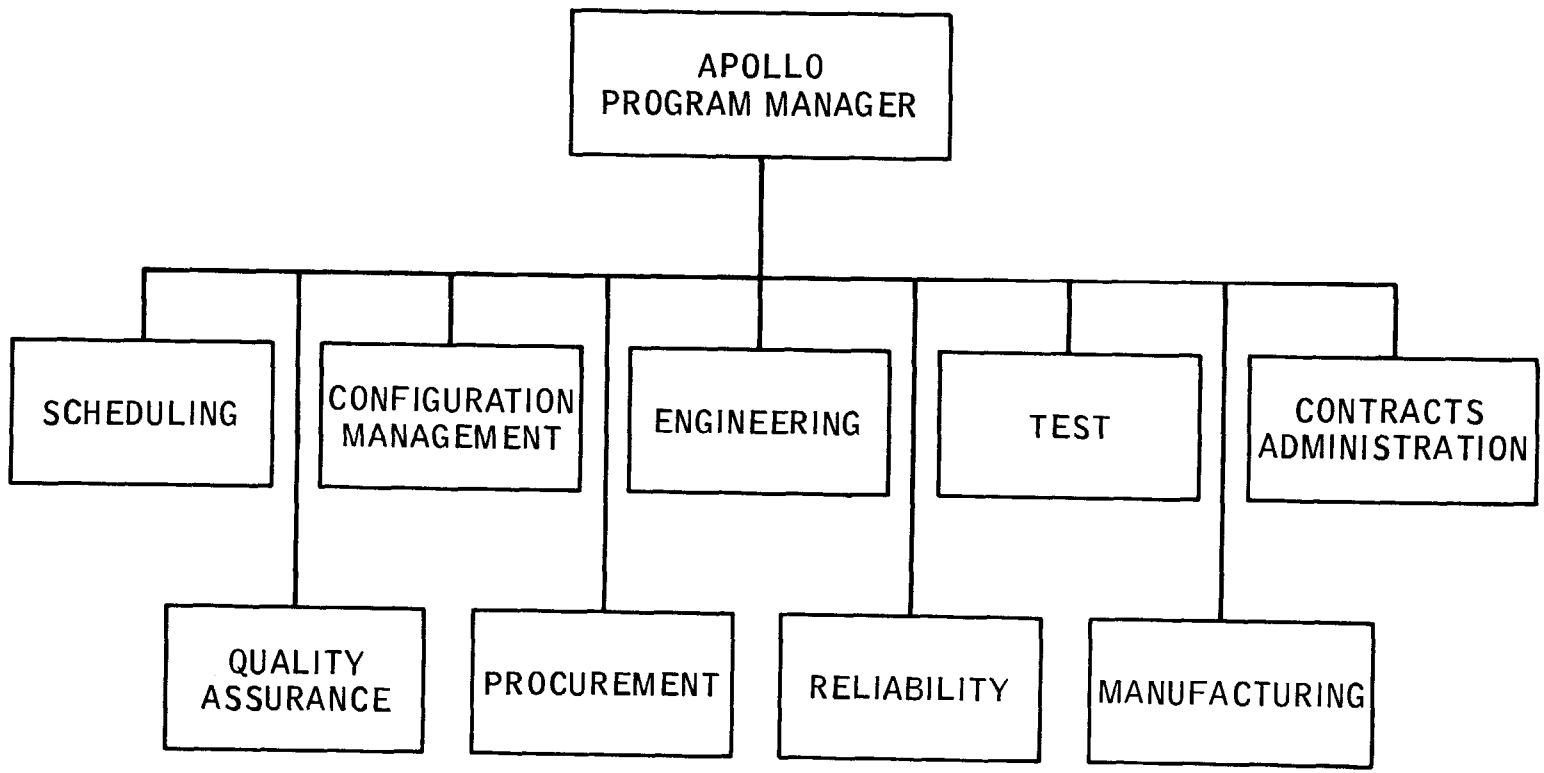

Figure E4-11.- Beech Aircraft Corporation, Boulder Division, Apollo Program Office organization.

This page left blank intentionally.

PART E5

RESPONSIBILITIES AND OPERATING RELATIONSHIPS

The specific responsibilities assigned to most of the NASA organizational elements involved in management of the Apollo Program are described in some detail in the series of documents titled NASA-Apollo Program Management. Where those descriptions are still pertinent, they are incorporated here by reference or are paraphrased as necessary to maintain the continuity of this document. The following discussion is, for the most part, confined to those organizations and responsibilities that are germane to the present study.

NASA ADMINISTRATOR

The Administrator of NASA reserves to his own office the authority for establishing and enforcing Agency policy, for establishing overall program policy and objectives, for approving mission plans and schedules, for mission funding and major procurement actions, and for insuring adherence to functional management policies. Apollo Program policies, objectives, and management systems are reviewed and approved by the Administrator, as are significant schedule and budget decisions. Management directives relating to the Program are issued within the Agency-wide NASA Issuance System, with special provisions for specific instructions and directives to be issued by the Apollo Program Director to participating program elements in the Manned Space Flight Field Centers.

ASSOCIATE ADMINISTRATOR FOR MANNED SPACE FLIGHT

As described earlier, the Associate Administrator for Manned Space Flight, serving as the Administrator's executive agent for the general management of all manned space flight programs, shares full responsibility with the Administrator for all aspects of these programs. In this capacity, he is advised by three major policy bodies: the Manned Space Flight Management Council, the Science and Technology Advisory Committee, and the Manned Space Flight Experiments Board. The responsibilities of these groups are summarized as follows.

Manned Space Flight Management Council

The Council consists of the Associate Administrator for Manned Space Flight as Chairman and the Directors of the three Manned Space Flight Centers. The Associate Administrator for Manned Space Flight establishes program policy guidelines and program plans in consultation with the Council. For the Apollo Program, the Council reviews policy, progress, and performance to assure that goals are being met, that technical problems are being dealt with properly, and that adequate resources are available for conduct of the planned program. The Council also acts as the Design Certification Board in examining the entire Program for proof of development maturity prior to each manned flight of a new configuration. To insure flightworthiness and manned flight safety, the Council assesses the design of the space vehicle launch complex, the Mission Control Center, the Manned Space Flight Network, and the launch instrumentation for manned Apollo missions. A Mission Design Certification Document, executed by the entire membership of the Council, serves as the approval authority for proceeding with specific flight missions designated for manned flight.

Science and Technology Advisory Committee

The Committee is made up of leading scientists and engineers from universities, industry, and Government. The Committee functions in an advisory capacity to the Associate Administrator for Manned Space Flight on major technical and scientific questions. They perform independent evaluations and make recommendations to the Associate Administrator for Manned Space Flight.

Manned Space Flight Experiments Board

The Board consists of the Associate Administrator for Manned Space Flight as Chairman, the Associate Administrators for Space Science and Applications and for Advanced Research and Technology, and representatives from the Department of Defense and the Air Force. The Board's responsibility is to advise and recommend to the Associate Administrator for Manned Space Flight which experiments should be included in manned space flight missions.

APOLLO PROGRAM DIRECTOR

Full responsibility and authority for managing all aspects of the Program within the constraints of budget, schedule, and performance

approved by the Administrator are delegated to the Apollo Program Director by the Associate Administrator for Manned Space Flight. It is the Program Director's responsibility to define or approve mission requirements, technical requirements, program specifications, and reliability, quality assurance, and safety standards. His office is organized into the five functional Directorates shown in figure E5-1. The Apollo Program Offices in the three Manned Space Flight Centers have organizational structures similar to that of the Program Director's, thus providing parallel responsibilities for managers at the two levels. The responsibilities of four of the five Directorates in the Apollo Program Office are described in the following paragraphs.

Test Directorate

The Test Directorate is responsible for planning and coordinating development of test programs for all phases of design, manufacture, and checkout of launch vehicles, spacecraft, experiment hardware, and ground support equipment. The Directorate coordinates requirements for test facilities, and prepares and justifies budget requests for test programs and facilities.

Operations Directorate

The Operations Directorate is responsible for operations plans and schedules; operations documentation; mission test plans; flight plans; trajectory design and analysis; crew operations and training; premission operations checkout, mission safety, and hazard probabilities; and mission operations support.

Systems Engineering Directorate

The Systems Engineering Directorate is responsible for developing the Apollo Program Specifications; developing flight mission assignments (including mission objectives and overall flight profiles); reviewing program to define technical interfaces; establishing control weights for vehicle stages and spacecraft modules; and verifying that system performance requirements are achieved.

Program Control Directorate

The Program Control Directorate is responsible for integrated planning; preparation of Program Development Plans; maintaining interrelated schedules; logistics; specifications; performance analysis and control system management; configuration management; data management systems;

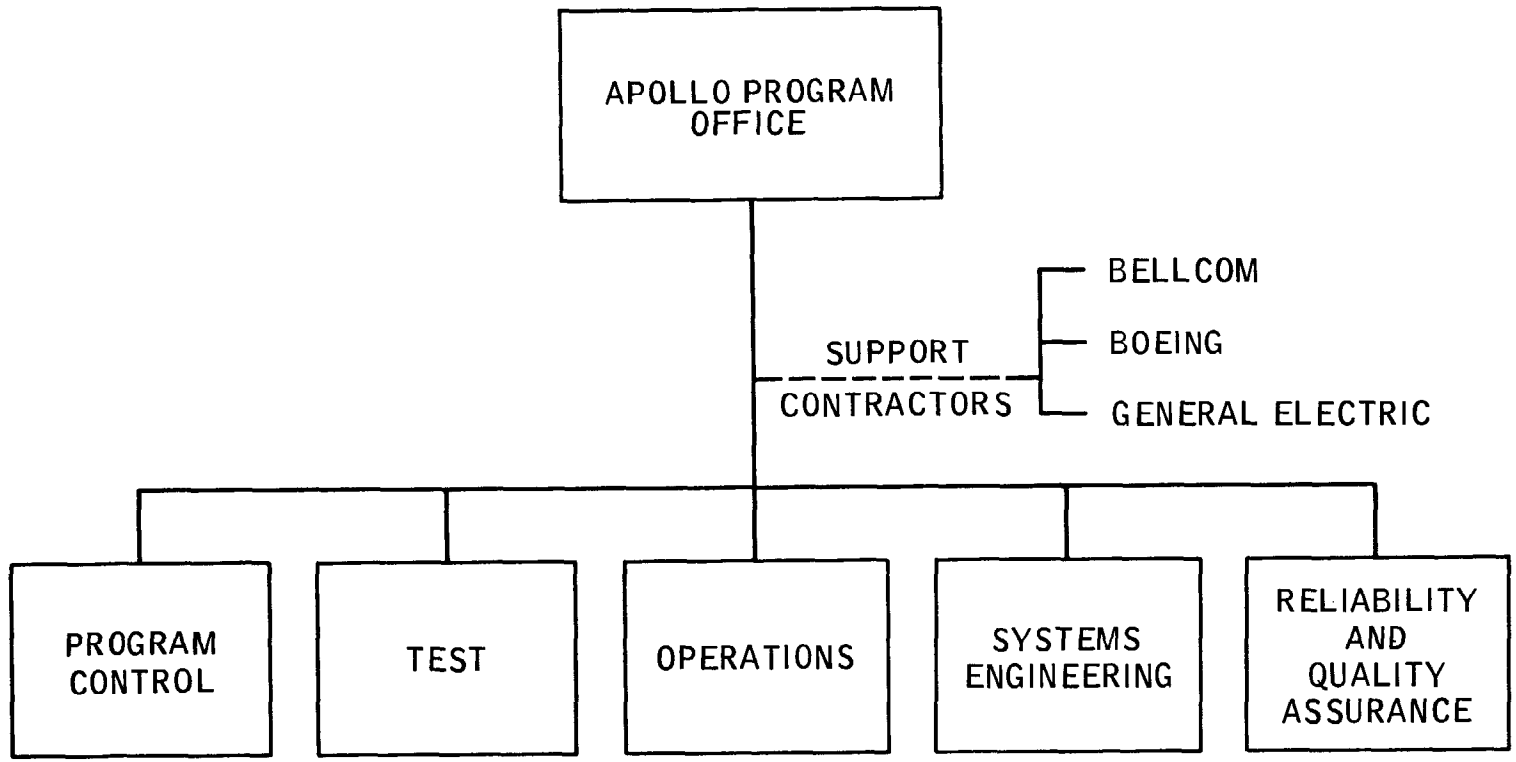

Figure E5-1.- Functional organization of the Apollo Program Office, NASA Headquarters.

preparation of budget and cost information; and operation of the Apollo Action Center.

Reliability and Quality Assurance (R&QA) Directorate

The R&QA Directorate is responsible for initiating program-wide R&QA policies and procedures; preparing program development plans for the Manned Space Flight Centers; developing R&QA training programs; establishing R&QA reporting requirements; and evaluating the effectiveness of R&QA programs in the Centers.

Support Contractors

The Apollo Program Director also has the services of three support contractors available to him:

1. Bellcomm, Inc. (AT&T), which provides systems engineering support consisting of studies, technical evaluations, analytical investigations, and technical consulting services.

2. The Boeing Company, Space Division, which performs the technical integration and evaluation function for the Program Director. This includes analyses and evaluation of program management, interface control, configuration management, logistics, engineering, manufacturing, testing, launch operations, and information systems.

3. General Electric Company, Apollo Systems Development, which provides general engineering support, including data management, management information systems, and R&QA investigations.

MSC APOLLO SPACECRAFT PROGRAM OFFICE (ASPO)

As in the Headquarters organization, the Apollo Spacecraft Program Manager at MSC acts for the MSC Center Director as general manager of all Apollo-related activities at the Center. In that capacity he is the official technical interface between NASA and the spacecraft contractors. He is responsible for managing the accomplishment of all Apollo tasks at the Center, even though many of those tasks are performed by Center personnel not organizationally responsible to him. His functional responsibilities essentially parallel those of the Apollo Program Director, but are applicable to the spacecraft only while those of the Program Director encompass all aspects of the Program. His Program Office organization is also essentially parallel to that of

the Program Director's, as shown in figure E5-2. He has delegated to three subordinate Managers (for the CSM, the LM, and Experiments and GFE) the following responsibilities:

1. Directing the design, development, and fabrication programs carried out by the contractors.

2. Directing and planning systems engineering and systems integration functions, including review of engineering design and systems engineering studies conducted by the contractors.

3. Developing the ground- and flight-test programs to be conducted at White Sands, MSC, and KSC.

4. Monitoring contractor operations to assure adherence to specifications and to identify and solve problems in the development and fabrication of systems and subsystems.

5. Chairing the Configuration Control Board (Level 3).

Assistant Program Manager for Flight Safety

There is also within the Apollo Spacecraft Program Office an Assistant Program Manager for Flight Safety, whose responsibility is to assure that the policies and procedures of MSC's Safety Office are adhered to in all Apollo Program activities relating to the spacecraft. He is the Apollo Spacecraft Program Manager's Safety representative to KSC and the spacecraft contractors. He oversees all program activities from a flight safety viewpoint and is an advisor to the Program Manager on the flightworthiness of all systems.

Systems Engineering Division

Referring again to figure E5-2, there are six functional divisions reporting to the Apollo Spacecraft Program Manager. Two of these perform functions that have a direct bearing on the development and manufacture of the cryogenic gas storage subsystem. The Systems Engineering Division is responsible for the coordination and control of the design and development of all spacecraft systems. The Division determines the technical requirements, and develops technical specifications (with the contractor) for systems and subsystems, and is responsible for assuring that all program elements (crew, hardware, and software) are successfully integrated into each system design. This Division plays its major role during the design and development stage of the spacecraft and its systems. It is responsible for organizing and conducting all Preliminary Design Reviews and Critical Design Reviews. It is also responsible

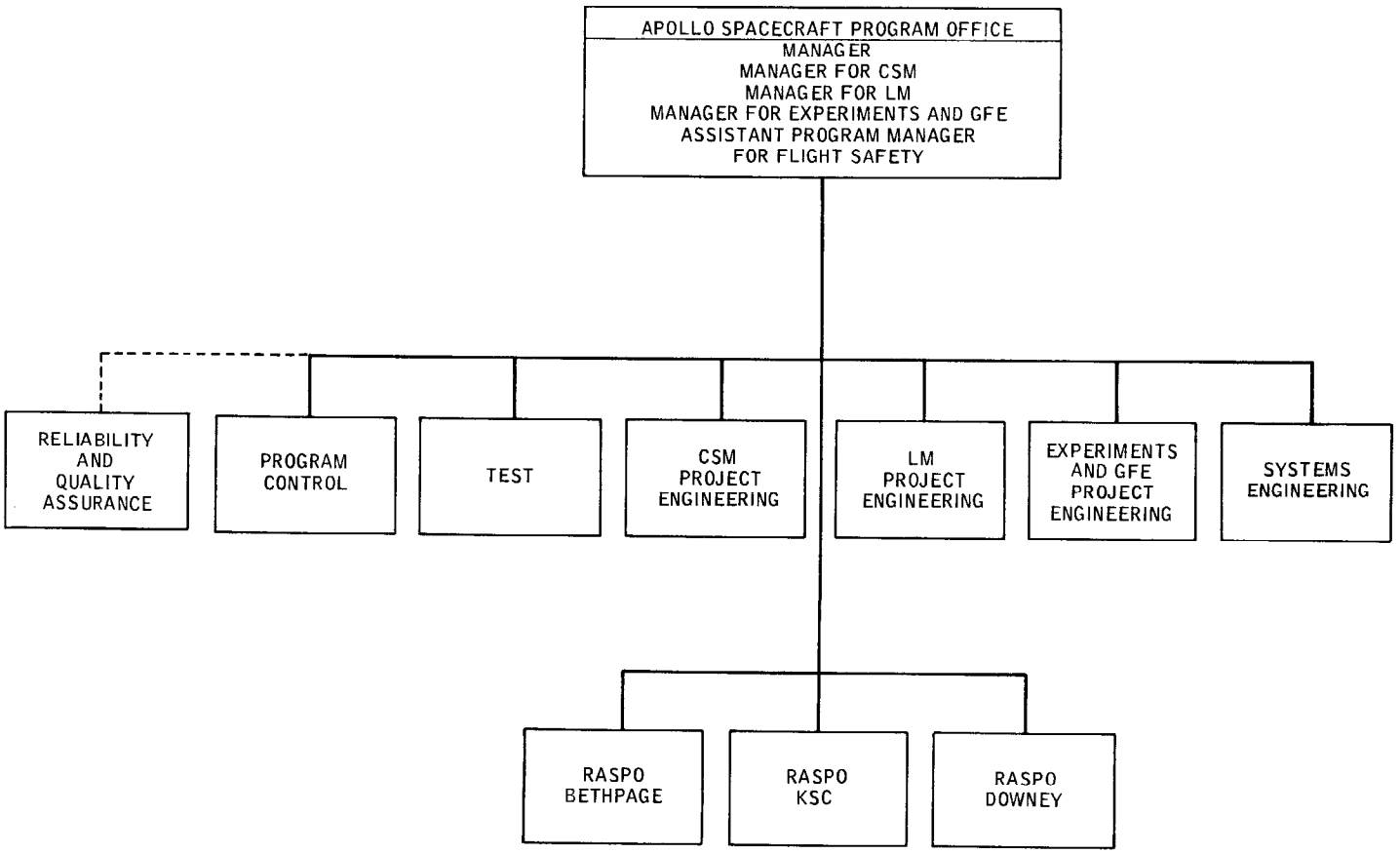

Figure E5-2.- Functional organization of the Apollo Spacecraft Program.

for definition and implementation of the nonmetallic materials program. Mission definition and planning are also major responsibilities.

CSM Project Engineering Division

This Division, which has counterpart Divisions for the LM and for Experiments and GFE, plays its major role during manufacture and test of the spacecraft. From this Division two engineers, designated as Project Engineers, are assigned to each spacecraft as it begins manufacture. The Project Engineers are the Program Manager's representatives for his particular spacecraft and are responsible for assuring that that particular spacecraft is ready for launch on schedule, that it has successfully passed all tests, inspections, and reviews, and that all associated ground support equipment is on schedule. Their responsibility extends up to launch and resumes after recovery for postflight testing.

Resident Apollo Spacecraft Program Offices (RASPO)

There are Resident Apollo Spacecraft Program Managers at the North American Rockwell plant, Downey, California (for the CSM prime contract), at Bethpage, New York (for the LM prime contract), and at the Kennedy Space Center (for launch activities). The Managers of the RASPO-Downey and the RASPO-Bethpage act for the Apollo Spacecraft Program Manager in all spacecraft activities taking place at their locations. Their responsibilities encompass program control, manufacture, test and checkout, and configuration management. The Manager at the RASPO-Kennedy represents the Apollo Spacecraft Program Manager in all operations at KSC which relate to the spacecraft. Specific responsibilities include:

1. Liaison with the KSC Spacecraft Operations Director on all matters relating to spacecraft preparation and checkout for launch.

2. Submission to KSC of MSC's prelaunch test and checkout requirements for the spacecraft.

3. Approval of KSC's Test and Checkout Plans.

4. Approval of waivers and deviations to MSC's test and checkout requirements.

5. Restricted change approval related to GSE and test operations.

MSC RELIABILITY AND QUALITY ASSURANCE (R&QA) OFFICE

The R&QA Office at MSC is an independent functional office reporting to the Director of the Center and responsive to the ASPO. It has overall responsibility for planning, coordinating, and directing all R&QA activities at the Center. Specific responsibilities include:

1. Establishing reliability, quality, and inspection requirements and criteria for spacecraft, systems, subsystems, and supporting equipment.

2. Insuring implementation of R&QA requirements and criteria at contractor plants and at MSC.

3. Developing MSC engineering design standards and criteria.

4. Establishing certification test criteria and approving certification test plans and reports.

5. Establishing and enforcing policies governing parts and materials identification, usage, and qualification information for critical spacecraft hardware.

MSC SAFETY OFFICE

The Safety Office at MSC is also an independent functional office, reporting to the Center Director. It is responsible for establishing safety policies, standards, and procedures in the fields of industrial operations and manned space flight. Specific responsibilities include:

1. Review and evaluation of the safety of operations in all Center organizations.

2. Advising the Center Director and Center Management on all matters relating to industrial and flight safety.

3. Reviewing and evaluating the effectiveness of contractor safety programs against MSC safety standards and criteria.

MSC ENGINEERING AND DEVELOPMENT DIRECTORATE

The Engineering and Development Directorate is the principal engineering component of the Center functional organization. This Directorate, organized into Divisions by technical discipline, conducts most of the Center's supporting research and technology, develops concepts for advanced systems, and provides technical support to all ongoing flight programs. This support roughly subdivides into three major categories:

1. Systems analyses and definition of new techniques applicable to space flight programs.

2. Subsystem and component tests.

3. Technical management of the design, manufacture, and testing of subsystems by the Program contractors.

This latter function represents a major element of the Apollo Program management system and is described as follows:

The three subordinate Managers in the ASPO (for CSM, LM, and Experiments and GFE) rely heavily on the matrix management concept for carrying out their responsibilities. They receive technical support from subsystem managers appointed from the technical Directorates of the Center's line organization. There are between 40 and 50 subsystem managers, most of them located in the Engineering and Development Directorate (fig. E4-4). The Subsystem Manager for the cryogenic gas storage subsystem is organizationally located in the Propulsion and Power Division of that Directorate. These managers remain assigned to their permanent organizations, but assume program responsibility for the design, development, and manufacture of particular subsystems. In this role they report to the Module Manager (e.g., Manager for the CSM) in the Program Office. For all other purposes they report through normal organizational lines. The subsystem manager's responsibility for his subsystem is continuous from preliminary design through operations. He is the Program Office's technical manager of all work done on the subsystem (although contractor direction is given through the Project Officer or Contracting Officer) and is responsible for assuring that the subsystem is built on schedule, within budget, and to specifications.

KSC APOLLO PROGRAM MANAGER

The Apollo Program Manager at KSC represents the Center Director in all matters relating to the launch of an Apollo space vehicle. He develops all necessary plans for work to be accomplished at KSC for the Apollo Program and issues "requirements" to the line organizations of the Center. The line organizations then assume full responsibility for conducting their parts of the Program, and the role of the Apollo Program Manager becomes one of monitoring, assessing, and modifying requirements as necessary. The organization of the KSC Apollo Program Office is shown in figure E5-3.

KSC DIRECTOR OF LAUNCH OPERATIONS

This organization has the principal functional responsibility for conducting the launch of the Apollo space vehicle. The Director of Launch Operations is responsible for the management and technical direction of preflight operation and integration, assembly, test, checkout, and launch of all space vehicles. He initiates, supervises, and coordinates the preparation of preflight and launch operations test plans and assures their effective execution. He assists the Apollo Program Manager in negotiating test and operational sequences, methods, and standards with the two development Centers (MSC and MSFC).

INTER-CENTER RELATIONSHIPS

Because the day-to-day management of the Apollo Program, from design through launch, requires close coordination of activities underway at three field Centers and in NASA Headquarters, formally documented Inter-Center Agreements have been drawn to specify how responsibilities are divided and how the activities at each location relate to those at the others. Additionally, a series of Inter-Center Coordination Panels has been established which recommend solutions to technical interface problems involving the responsibilities of two or more Centers. There are eight such panels, covering: Crew Safety, Electrical, Flight Evaluation, Mechanical, Instrumentation and Communications, Flight Mechanics, Launch Operations, and Flight Operations. All panels operate under the cognizance of a Panel Review Board made up of representatives from the three Manned Space Flight Centers and the Headquarters Office of Manned Space Flight.

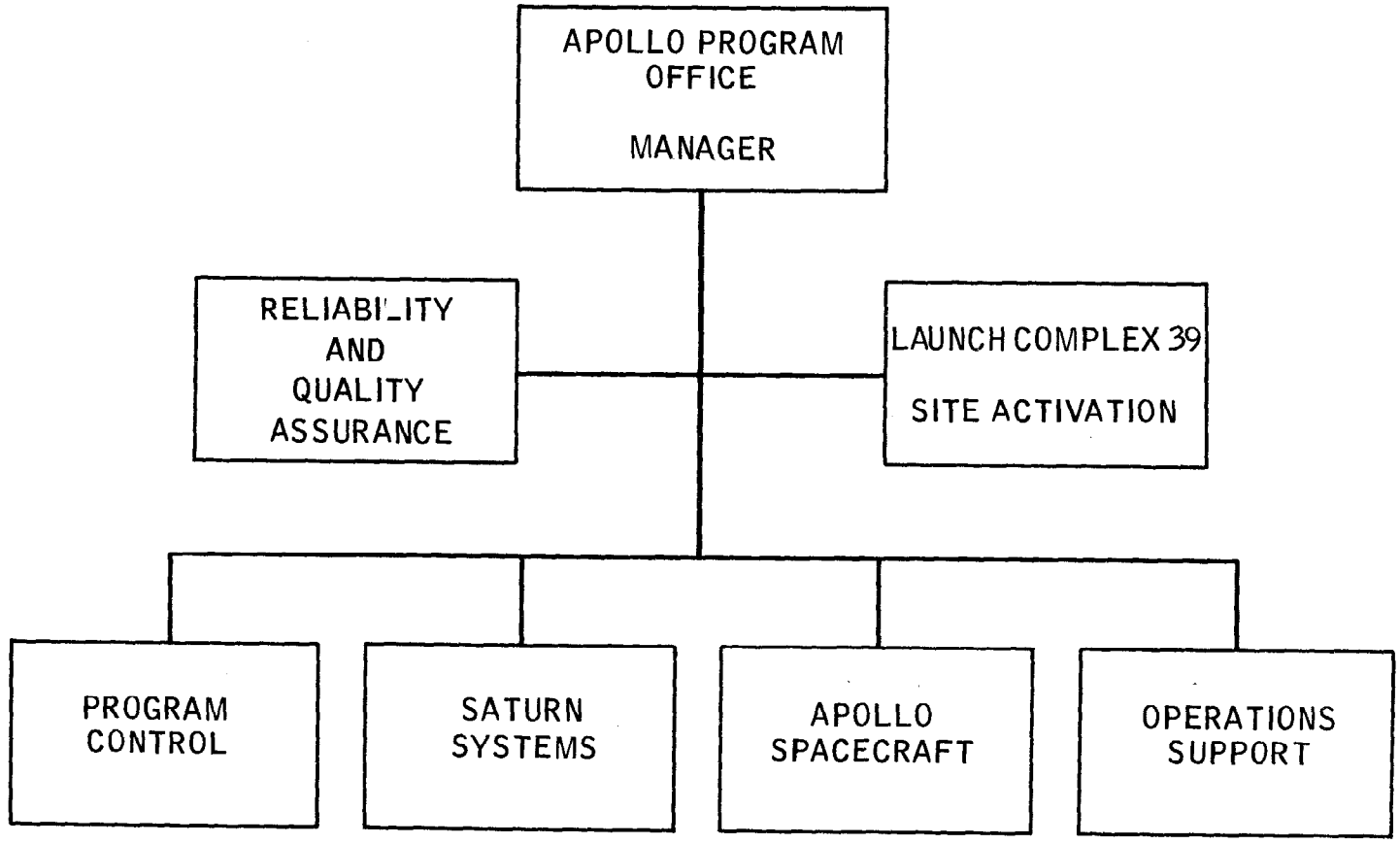

Figure E5-3.- Functional organization of the Apollo Program Office at KSC.

Apollo Program Directive No. 33A, issued in August 1968, defines in considerable detail the responsibilities of each of the three Centers in the Apollo Program. It is reproduced on the following pages in its entirety for reference.

OFFICE OF MANNED SPACE FLIGHT
PROGRAM DIRECTIVE

M-D MA 1400.095
(Project)

DATE
5 AUG 1968

APOLLO PROGRAM DIRECTIVE NO. 33A

TO: DISTRIBUTION

~~FROM:~~ APOLLO PROGRAM DIRECTOR

SUBJECT: Center Responsibilities in the Apollo Program

OFFICE OF PRIME RESPONSIBILITY: MAP

I. PURPOSE

The purpose of this Directive is to assign responsibility and functions and define inter-Center relationships for the conduct of the Apollo Program.

II. SCOPE

This Directive assigns responsibilities and functions to MSF Centers for accomplishment of the Apollo Program in amplification of and in consonance with NMI 1142.1 Functions and Authority - Manned Spacecraft Center, NMI 1142.3 Functions and Authority - George C. Marshall Space Flight Center, and NMI 1142.2 Functions and Authority - John F. Kennedy Space Center.

III. RESPONSIBILITY

A. The Director of the Manned Spacecraft Center is responsible for design, development, fabrication, qualification, acceptance test and delivery of Apollo spacecraft; associated ground support equipment and assigned experiments; for the planning of all Apollo Missions; for the control of the flight phase of Apollo Missions including the development of ground equipment necessary for mission control and not provided by other centers in the execution of their missions; for the selection, training and assignment of flight crews; for the development of software as needed for spacecraft guidance, checkout, and mission control; for establishing prelaunch requirements for test, checkout and inspection of Apollo spacecraft; and for the planning and implementation of a lunar science program to support the Apollo Program.

B. The Director of the George C. Marshall Space Flight Center is responsible for the design, development, fabrication, qualification, acceptance test and delivery of the Saturn launch vehicles including engines, associated ground support equipment and assigned experiments; providing mission planning data from the standpoint of overall vehicle performance; providing launch vehicle data and software for launch vehicle guidance and checkout; for establishing prelaunch requirements for test, checkout and inspection of Saturn launch vehicles; and supporting launch and flight operations as requested by KSC and MSC.

C. The Director of the John F. Kennedy Space Center is responsible for development and operation of launch and industrial facilities and associated ground support equipment required to support the Apollo Program and the assembly, test, inspection, checkout and launch of Apollo-Saturn space vehicles at KSC.

D. Center Directors will retain ultimate responsibility for Apollo Program functions delegated within the Center, and will supervise their performance. Significant changes in delegation of functions will be discussed with the Apollo Program Director prior to implementation.

IV. FUNCTIONS

A. Manned Spacecraft Center

The Manned Spacecraft Center is assigned the following functions for the Apollo Program:

1. Hardware

a. Providing for the detailed specifications, design, manufacture, checkout, test, reliability and quality, qualification, and acceptance of MSC developed hardware. This does not include the test and checkout functions accomplished at the launch site by KSC.

b. Developing and delivering to KSC spacecraft which has been qualified for flight along with associated software, data and support equipment.

c. Providing for the detailed specifications, design, development, fabrication, qualification, acceptance test and delivery of experiments flight hardware and associated specialized ground equipment for those experiments approved by the Manned Space Flight Experiments Board and assigned by the Apollo Program Director.

d. Providing logistic support planning and implementation at factory, test and launch sites for MSC developed hardware.

e. Controlling receipt and stowage of flight crew personal equipment at KSC which is scheduled for flight and providing to KSC a list of equipment which is considered flight crew personal equipment.

2. Configuration Control

a. Establishing and controlling configuration of spacecraft hardware, associated software and support equipment (designed or provided by MSC) at each stage of preparation or test in the factory, test or launch site, including approval of changes at KSC.

b. Providing and maintaining a list of acceptable items and materials that may enter the spacecraft for checkout and for flight.

3. Test and Checkout

a. Establishing and maintaining test and checkout requirements and test and checkout specifications and criteria for factory or test site acceptance and launch site preparation of MSC developed hardware (including Ground Support Equipment and software).

b. Providing test and checkout requirements and test and checkout specifications and criteria for launch site preparation of MSC developed hardware, software and Ground Support Equipment.

c. Reviewing factory, test site and launch site test requirements and test and checkout plans and procedures as necessary to assure that adequate testing is being accomplished without unnecessary overlap and duplication between testing conducted at different locations.

d. Providing written approval of KSC test and checkout plans in consonance with paragraphs IV.A.3b and IV.A.3c.

e. Providing Center approved factory or test site test and checkout procedures to KSC for use as a baseline in the development of similar procedures required at the launch site.

f. Reviewing at the option of MSC, the adequacy of KSC test procedures at the launch site.

g. Providing requirements and criteria to KSC for assuring flight readiness of experiments flight hardware, unless KSC and MSC on the basis of written agreement for a specific experiment make other arrangements for flight readiness determination.

h. Determining functional performance and flight readiness of flight hardware closed out at the factory or test site and not accessible for inspection or not included in test and checkout requirements for evaluation of functional performance at KSC.

i. Providing such technical assistance or data as may be required by KSC in preparation of hardware for flight.

j. Assuring that MSC personnel participating in KSC tests are responsive to KSC direction during conduct of the tests and attend pre-test briefings and participate in training exercises as required by KSC in accordance with responsibilities outlined herein.

k. Providing an assessment of flight readiness of the spacecraft and associated software at the Flight Readiness Review in accordance with Apollo Program Directives.

4. Reliability and Quality Assurance

   a. Providing quality control requirements and inspection criteria for MSC developed hardware for use at the factory, test site and launch site.

   b. Conducting audits to evaluate contractor factory and test site performance in accordance with MSC quality control requirements and inspection criteria for MSC developed hardware, and participating at the option of MSC in audits conducted by KSC at the launch site.

   c. Determining corrective action and disposition of MSC developed hardware which fails, malfunctions or performs outside the performance limits contained in test and checkout specifications and criteria during checkout at KSC. This responsibility does not include routine trouble-shooting or maintenance of MSC developed ground support equipment operated by KSC.

5. Systems Engineering

   Providing MSC technical representation on design and operations inter-Center panels or working groups as established by Apollo Program Directives.

6. Operations

   a. Developing flight techniques for mission control and hardware and software for the Mission Control Center.

   b. Developing mission objectives, plans and rules to support Apollo mission assignments.

   c. Conducting flight operations.

   d. Obtaining from KSC the operational requirements pertaining to checkout and launch which need to be incorporated into MSC designed hardware.

   e. Planning jointly with the Department of Defense the provision of recovery support.

   f. Providing input to and comment on KSC launch rules.

   g. Identifying MSC operational support requirements according to approved procedures and evaluating support implementation of said requirements.

7. Flight Crew

   a. Providing trained flight crews and personal equipment for manned missions.

   b. Directing all astronaut activities except during the time they are participating in KSC flight hardware tests.

   c. Developing and operating flight crew simulators and training equipment at MSC and KSC.

8. Science

   a. Planning and implementation of a lunar science program to support Apollo, including site selection, lunar science operations, the Lunar Receiving Laboratory operation and lunar sample analysis.

9. Management

   This section contains general management responsibilities for the conduct of the Apollo program at MSC as well as some specific management requirements which need to be highlighted.

   General

   a. Assuring that Apollo program requirements for manpower or for institutional support from other elements of MSC are properly conveyed to those elements and that Apollo program institutional support requirements are reflected in Center resource requirements plans, schedules, and budgets.

   b. Assuring that Apollo program requirements for institutional support are met on an effective and timely basis.

   c. Developing and operating Center facilities required for the Apollo Program.

   d. Developing and implementing adequate security procedures.

   e. Establishing detailed schedules (Levels 2, 3 and 4) for MSC hardware, software and associated equipment and operations activities consistent with the basic schedules (Level 1) approved by the Director, Apollo Program, and the Director, Mission Operations.

   f. Providing contract authority for KSC control of spacecraft contractor's test and checkout activities at KSC through a supplemental contract under KSC administration.

   Medical

   Medical support for the Apollo program will be provided in accordance with NMI 8900.1. In addition, the following specific requirements will be met on the Apollo program.

a. Providing for the medical surveillance and support of the astronauts during all phases of the Apollo Program at any location including test and checkout operations.

b. Providing for the evaluation of medical data obtained during manned tests, to insure that the interpretation of such data regarding the acceptability of equipment performance is properly reflected in post flight mission reports.

c. Providing for the development and implementation of medical disaster plans associated with the test of Apollo hardware at MSC.

Safety

Safety activities in the Apollo program will be conducted in accordance with instructions provided by the Apollo Program Director and directives issued by the Manned Space Flight and NASA Safety Directors. In addition the following specific requirements will be met on the Apollo program.

a. Providing written approval of KSC criteria for determining hazardous operations at the launch site.

b. Reviewing and approving any KSC test and checkout procedure in which the flight crew participates.

B. George C. Marshall Space Flight Center

The George C. Marshall Space Flight Center is assigned the following functions for the Apollo Program.

1. Hardware

   a. Providing for the detailed specifications, design, manufacture, checkout, test, reliability and quality, qualification and acceptance of MSFC developed hardware. This does not include the test and checkout functions accomplished at the launch site by KSC.

   b. Developing and delivering to KSC launch vehicles which have been qualified for flight along with associated software, data and support equipment.

   c. Providing for the detailed specifications, design, development, fabrication, qualification, acceptance test and delivery of experiments flight hardware and associated specialized ground equipment for those experiments approved by the Manned Space Flight Experiments Board and assigned by the Apollo Program Director.

   d. Providing logistic support planning and implementation at factory, test and launch sites for MSFC controlled hardware.

2. Configuration Control

   a. Establishing and controlling configuration of launch vehicle hardware, associated software and support equipment (designed or provided by MSFC) at each stage of preparation or test in the factory, test or launch site, including approval of changes at KSC.

   b. Providing criteria to KSC for controlling tools, equipment and materials that enter and leave the launch vehicle stages and instrument unit during operations at KSC.

3. Test and Checkout

   a. Establishing and maintaining test and checkout requirements and test and checkout specifications and criteria for factory or test site acceptance and launch site preparation of MSFC developed hardware (including Ground Support Equipment and software).

   b. Providing test and checkout requirements and test and checkout specifications and criteria for launch site preparation of MSFC developed hardware, software and Ground Support Equipment.

   c. Reviewing factory, test site and launch site test requirements and test and checkout plans and procedures as necessary to assure that adequate testing is being accomplished.

   d. Providing written approval of KSC test and checkout plans in consonance with paragraphs IV.B.3b and IV.B.3c.

   e. Providing Center approved factory or test site test and checkout procedures to KSC for use as a baseline in the development of similar procedures required at the launch site.

f. Reviewing at the option of MSFC, the adequacy of KSC test procedures at the launch site.

g. Providing requirements and criteria to KSC for assuring flight readiness of experiments flight hardware, unless KSC and MSFC on the basis of written agreement for a specific experiment make other arrangements for flight readiness determination.

h. Determining functional performance and flight readiness of flight hardware closed out at the factory or test site and not accessible for inspection or not included in test and checkout requirements for evaluation of functional performance at KSC.

i. Providing such technical assistance or data as may be required by KSC in preparation of hardware for flight.

j. Assuring that MSFC personnel participating in KSC tests are responsive to KSC direction during conduct of the tests and attend pre-test briefings and participate in training exercises as required by KSC in accordance with responsibilities outlined herein.

k. Providing an assessment of flight readiness of the launch vehicle and associated software at the Flight Readiness Review in accordance with Apollo Program Directives.

4. Reliability and Quality Assurance

a. Providing quality control requirements and inspection criteria for MSFC developed hardware for use at the factory, test site and launch site.

b. Conducting audits to evaluate contractor factory and test site performance in accordance with MSFC quality control requirements and inspection criteria for MSFC developed hardware, and participating at the option of MSFC in audits conducted by KSC at the launch site.

c. Determining corrective action and disposition of MSFC developed hardware which fails, malfunctions, or performs outside the performance limits contained in test and checkout specifications and criteria during checkout at KSC. This responsibility does not include routine trouble-shooting or maintenance of MSFC-developed ground support equipment operated by KSC.

5. Systems Engineering

a. Providing MSFC technical representation on design and operations inter-Center panels or working groups as established by Apollo Program Directives.

b. Providing the overall integrated space vehicle systems analysis and criteria for operational requirements and limitations for handling, checkout, launch and flight as required by MSFC, MSC and KSC.

c. Operating the Manned Space Flight Interface Documentation Repository.

6. Operations

   a. Developing mission objectives and plans to support Apollo mission assignments.

   b. Providing real time mission support as requested by MSC and KSC both on site and at Huntsville.

   c. Providing input to and comment on KSC launch and MSC flight mission rules.

   d. Obtaining from KSC the operational requirements pertaining to checkout and launch which need to be incorporated into MSFC designed hardware.

   e. Identifying MSFC operational support requirements according to approved procedures and evaluating support implementation of said requirements.

7. Flight Crew

   Providing instructions and material for training and familiarization of flight crews with the Saturn vehicle.

8. Science

   None

9. Management

   This section contains general management responsibilities for the conduct of the Apollo program at MSFC as well as some specific management requirements which need to be highlighted.

   General

   a. Assuring that Apollo program requirements for manpower or for institutional support from other elements of MSFC are properly conveyed to those elements and that Apollo program institutional support requirements are reflected in Center resource requirements plans, schedules, and budgets.

   b. Assuring that Apollo program requirements for institutional support are met on an effective and timely basis.

   c. Developing and operating Center facilities required for the Apollo Program.

   d. Developing and implementing adequate security procedures.

   e. Establishing detailed schedules (Levels 2, 3 and 4) for MSFC hardware, software, and associated equipment consistent with the basic schedules (Level 1) approved by the Apollo Program Director.

   f. Providing liquid hydrogen management for MSFC and KSC.

g. Providing contract authority for KSC control of launch vehicle contractor's test and checkout activities at KSC through a supplemental contract under KSC administration.

Medical

Medical support for the Apollo program will be provided in accordance with NMI 8900.1. In addition, the following specific requirement will be met on the Apollo program.

a. Providing for the development and implementation of medical disaster plans associated with the test of Saturn hardware at MSFC.

Safety

Safety activities in the Apollo program will be conducted in accordance with instruction provided by the Apollo Program Director and directives issued by the Manned Space Flight and NASA Safety Directors. In addition the following specific requirement will be met on the Apollo program.

a. Providing written approval on KSC criteria for determining hazardous operations at the launch site.

C. John F. Kennedy Space Center

The John F. Kennedy Space Center is assigned the following functions for the Apollo Program.

1. Hardware

a. Providing for detailed specifications, design, manufacture, checkout, test, reliability and quality, qualification and acceptance of KSC developed hardware.

b. Developing and delivering qualified ground support equipment associated with launch facilities and not provided by MSC or MSFC.

c. Developing and operating ground communications, computation, and instrumentation systems and equipment for the conduct of launch operations.

d. Taking measures to protect flight hardware and associated Ground Support Equipment from contamination, corrosion or damage which may result from environment, housekeeping, procedure or human error and reporting incidents to MSC and MSFC as appropriate.

e. Providing logistics support planning and implementation at the factory test or at KSC for KSC developed hardware.

2. Configuration Control

a. Establishing and controlling configuration of KSC developed launch facilities and ground support equipment at each stage of preparation or test at the factory, test site or at KSC.

b. Maintaining configuration control of MSC and MSFC developed hardware and software after delivery to KSC in accordance with the configuration requirements established by MSC and MSFC. Assuring that prior approval is secured from MSC and MSFC before any changes in configuration are made in spacecraft, launch vehicle, or associated GSE furnished by MSC or MSFC.

c. Securing, after the flight readiness test, the prior approval of MSC or MSFC for the replacement of failed parts.

d. Controlling everything that enters and leaves the spacecraft during checkout at KSC in accordance with the MSC list of acceptable items and materials that may be taken into the spacecraft for checkout and for flight.

e. Controlling tools, equipment and materials that enter and leave the launch vehicle stages and instrument unit during operations at KSC in accordance with criteria provided by MSFC.

3. Logistics Management

a. Provide total logistics support planning and management for all KSC equipment. Plan for the utilization at KSC of equipment provided by other design cognizant centers, using the inter-center coordinated support planning provided by those centers.

b. Provide logistics products and services to meet the valid intent of NHB 7500.1 for KSC designed equipment. Utilize logistics products and services provided by other centers to support equipment under their design cognizance, unless stipulated otherwise in inter-center logistics agreements.

c. Receive, store, issue and dispose of spare parts for all Apollo Program equipment operated at KSC in accordance with inter-center coordinated plans and directions from the design cognizant centers.

d. Provide reports of logistics requirements, status and spares consumption as required.

e. Establish, implement and control a logistics discrepancy reporting system.

4. Test and Checkout

a. Conducting the assembly, checkout, and launch of flight hardware for Apollo missions and assembly, checkout and operation of required ground support equipment.

b. Providing control of all personnel participating in test and checkout activities, including representatives from MSC and MSFC, and assuring that personnel attend pre-test briefings and participate in training exercises as necessary to assure personnel safety and proper conduct of the tests.

c. Providing requirements, specifications and criteria, and procedures for test and checkout of KSC developed support equipment whose performance must be verified for each launch.

d. Providing test and checkout plans in accordance with MSC and MSFC test and checkout requirements plus any additional KSC test requirements necessary to verify launch facility, Manned Space Flight Network and launch crew readiness or to satisfy range and safety requirements.

e. Securing MSC and MSFC written approval on test and checkout plans and changes thereto before the plans are approved or implemented.

f. Developing and providing to MSC or MSFC test and checkout procedures adapted to the KSC environment using as a baseline the development center approved factory test and checkout procedures.

g. Making final determination that test and checkout procedures are adequate, safe and in accordance with MSC and MSFC test and checkout requirements and test and checkout specifications and criteria.

h. Obtaining approval on deviations and waivers from MSC and MSFC concerning test and checkout requirements, test and checkout specifications and criteria and inspection criteria when unable to meet requirements.

i. Determining functional performance and flight readiness of flight hardware and software in accordance with test and checkout requirements and test and checkout specifications and criteria provided by MSC and MSFC except for that which is closed out at the factory and not accessible for inspection or not included in test and checkout requirements for evaluation of functional performance at KSC.

j. Determining flight readiness of equipment associated with inflight experiments in accordance with MSC or MSFC (as appropriate) specifications and criteria unless specifically excluded by written agreement with MSC or MSFC.

k. Controlling receipt and storage, and assuring flight readiness of all Government Furnished Equipment, other than flight crew personal equipment, which is scheduled for flight and which is not processed to KSC through a contractor responsible to KSC.

l. Providing routine trouble shooting and maintenance for MSC and MSFC developed equipment in accordance with MSC and MSFC requirements, specifications and criteria.

m. Providing an assessment of the flight readiness of the launch complex, flight hardware and software at the Flight Readiness Review in accordance with Apollo Program Directives.

5. Reliability and Quality Assurance

a. Providing quality control requirements and inspection criteria for KSC developed hardware for use at the factory, test site and KSC.

b. Conducting audits to evaluate contractor factory and test site performance in accordance with KSC quality control requirements and inspection criteria for KSC developed hardware.

c. Determining corrective action and disposition of KSC developed hardware which fails, malfunctions, or performs outside the performance limits contained in test and checkout specifications and criteria during checkout at KSC.

d. Generating approval from the appropriate development center (MSC or MSFC) to disassemble or open any flight hardware closed out at a factory or test site.

e. Securing MSC and MSFC written approval of quality control plans insofar as development center responsibilities are concerned before the plans are approved or implemented.

f. Conducting quality control inspections and audits of contractor activities at KSC and inviting MSC and MSFC participation as applicable.

g. Obtaining approval from the appropriate development center (MSC or MSFC) to disassemble or open any flight hardware closed out at a factory or test site.

h. Advising MSC or MSFC of any problem arising during prelaunch preparation concerning flight worthiness of flight hardware.

i. Conducting failure analysis as required by MSC and MSFC.

j. Participating in MSC and MSFC flight hardware acceptance reviews and providing recommendations to MSC or MSFC and the Apollo Program Director, concerning the acceptance of the hardware for shipment to KSC.

6. Systems Engineering

Providing KSC representation on design and operations inter-Center panels or working groups as established by Apollo Program Directives.

7. Operations

a. Identifying KSC operational support requirements according to approved procedures and evaluating implementation of support planning.

b. Providing data to MSC and MSFC in accordance with approved Program Support Requirements Documents.

c. Conducting launch operations.

d. Developing launch plans and rules.

8. Flight Crew

Coordinating and directing astronaut activities during the time they are actively participating in KSC tests of flight hardware except that the flight crew may take any action necessary for their safety.

Science

None

10. Management

This section contains general management responsibilities for the conduct of the Apollo program at KSC as well as some specific management requirements which need to be highlighted.

General

a. Assuring that Apollo program requirements for manpower or for institutional support from other elements of KSC are properly conveyed to those elements and that Apollo program institutional support requirements are reflected in Center resource requirements plans, schedules, and budgets.

b. Assuring that Apollo program requirements for institutional support are met on an effective and timely basis.

c. Providing control of all activities of Apollo contractors at KSC other than those directly associated with astronaut training.

d. Developing and operating Center facilities required for the Apollo Program.

e. Developing and implementing adequate security procedures.

f. Establishing detailed schedules (Levels 2, 3 and 4) for KSC hardware, software and associated equipment consistent with the basic schedules (Level 1) approved by the Director, Apollo Program and the Director, Mission Operations.

Medical

Medical support for the Apollo program will be provided in accordance with NMI 8900.1. In addition, the following specific requirement will be met on the Apollo program.

a. Providing for the development and implementation of medical disaster plans associated with the assembly, checkout and prelaunch operations of Apollo flight hardware at KSC.

Safety

Safety activities in the Apollo program will be conducted in accordance with instructions provided by the Apollo Program Director and directives issued by the Manned Space Flight and NASA Safety Directors. In addition the following specific requirements will be met on the Apollo program.

a. Performing as the NASA single point of responsibility for safety in the Merritt Island and Cape Kennedy area and for NASA range safety inputs to the Eastern Test Range.

b. Developing criteria for determining hazardous operations at the launch site and securing written approval of MSC and MSFC.

V. PRECEDENCE

This Directive takes precedence over any inter-Center agreements on Apollo program responsibilities.

VI. CONCURRENCE

This Program Directive has been reviewed and concurred in by the Associate Administrator for Manned Space Flight and the Associate Administrator for Organization and Management. Any proposed substantive changes in the responsibilities defined in this document will be submitted for review and concurrence in the same manner.

PROGRAM MANAGEMENT CONTINUITY

The Panel considered the question of continuity of experience in certain key positions at MSC, KSC, NR-Downey, and Beech, and found that it has been good.

At MSC, three different men have held the Subsystem Manager position for the cryogenic gas storage subsystem since November 1963. The first held the position for nearly 3 years during the later design phases and through most of the oxygen tank development period. The second Subsystem Manager was in the position from 1966 through 1968 and was then succeeded by the present incumbent, who had been his assistant.

In the MSC ASPO, there have been five Program Managers, two during the design and development of the oxygen tank. Additional continuity in this position was provided from 1961 through 1966, by the fact that the first Program Manager became the Deputy Program Manager in 1962 and served in that position, under two successive Program Managers, through 1965. In 1967, when the Program Manager next changed, the position was taken by the then Deputy Director of the Center, who had been associated with the Program from that position. The present Program Manager, who took over last year, had been an astronaut with detailed familiarity with the manned space flight program since 1962.

At KSC, the persons with principal responsibility for the test, checkout, and launch of all Apollo spacecraft are the Director of Launch Operations and, reporting to him, the Director of Spacecraft Operations. Continuity in these positions has been good. The present Director of Launch Operations was the Deputy Director for the prior 2 years, approximately. Before that he had been the head of the MSC Resident Apollo Spacecraft Office at KSC. The present incumbent of the Spacecraft Operations position has occupied that position for 5 years. Prior to that time he served as the Assistant Manager for Gemini, MSC Florida Operations.

At North American Rockwell the position with direct responsibility for overseeing design and manufacture of the cryogenic gas storage system (CGSS) by the subcontractor, Beech, is the Manager, Fuel Cells and Cryogenic Systems (fig. E4-10). The present incumbent of that position has held it since 1962 and has been NR-Subsystem Manager for the Apollo CGSS over that entire period. The present Apollo Program Manager at NR succeeded to that position last year when the former Program Manager was appointed NASA Associate Administrator for Manned Space Flight. Prior to his promotion, the present Program Manager had been the Assistant CSM Program Manager for about 4 years.

At Beech-Boulder Division, the same men have occupied one or another of the key positions in the CGSS contract to NR over the life of the contract. There has been turnover in manufacturing personnel at the technician and trades levels but the principal managers and supervisors have not changed. It is noteworthy that when members of the Apollo 13 Review Board visited Beech for a demonstration of the assembly of an Apollo oxygen tank, the technician who performed the assembly demonstration was the same man who had assembled Apollo 13 tank no. 2 in 1966.

This page left blank intentionally.