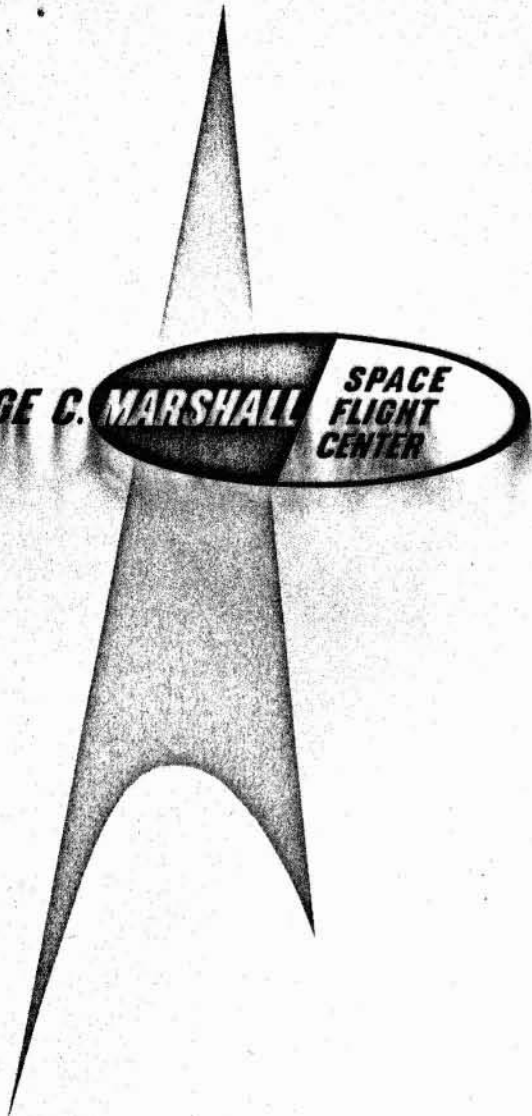


university of alabama in huntsville  
saturn history  
9/17/68



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SATURN HISTORY DOCUMENT  
University Of Alabama Research Institute  
History Of Science & Technology Group  
Date ----- Doc. No. -----

REPORT # I-MO-23-68  
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# APOLLO SATURN LIEF OPERATIONS PLAN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION



APOLLO LIEF OPERATIONS PLAN

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# LIEF OPERATIONS PLAN

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## LIEF OPERATIONS PLAN

### 1.0 INTRODUCTION

#### 1.1 Purpose

The purpose of this document is to identify the support functions to be performed by MSFC through LIEF during Apollo Saturn Mission Operations and the facilities required to carry out these functions. The LIEF Operations Plan also identifies subordinate mission specific documents required to carry out LIEF operations. This document is written in response to the Launch Vehicle Mission Directive.

#### 1.2 Revisions

This document describes and controls only principal support functions and facility requirements and will not be published on a mission specific basis. However, it will be revised to reflect any major changes in mission specific support plans. Comments and/or corrections should be addressed to the Operations Office, I-MO-O.

#### 1.3 LIEF Definition

The LIEF (Launch Information Exchange Facility) encompasses those communications, data processing, display, and related facilities utilized to make support available to Apollo - Saturn mission operations from the launch vehicle design team at MSFC. Principal among these facilities are the Huntsville Operations Support

Center (HOSC) and its supporting communications. LIEF Operations include use of the facilities for support of launch vehicle pre-launch checkout, launch operations, flight operations, and postflight data delivery and evaluation.

## 2.0 LIEF ORGANIZATION

### 2.1 Mission Period Organization

Figure 2.1 shows a Mission Period Organization with the LIEF interface to that organization identified by the dashed lines. MSFC provides a supporting function to both the Launch Director and Flight Director through the channels indicated. The MSFC Launch Vehicle Representative and the MSFC on-site support engineers at KSC have at their disposal the entire MSFC technical complex through LIEF. The Flight Director is supported directly by the MSFC Booster System Engineer who can also draw on LIEF for advisory support.

### 2.2 LIEF Mission Support Organization

The LIEF Mission Support Organization (Figure 2.2) is under the direction of the LIEF Operations Manager. The organization required to support a mission is planned by the Mission Operations Office, I-MO, which coordinates with other MSFC elements to establish adequate representation of all elements within the support organization.

I-MO insures that all assigned personnel are properly informed and trained to perform their function during the assigned mission phases. Instructions are provided to the support personnel to identify



FIGURE 2.1 MSFC INTERFACE TO MISSION DIRECTORS ORGANIZATION

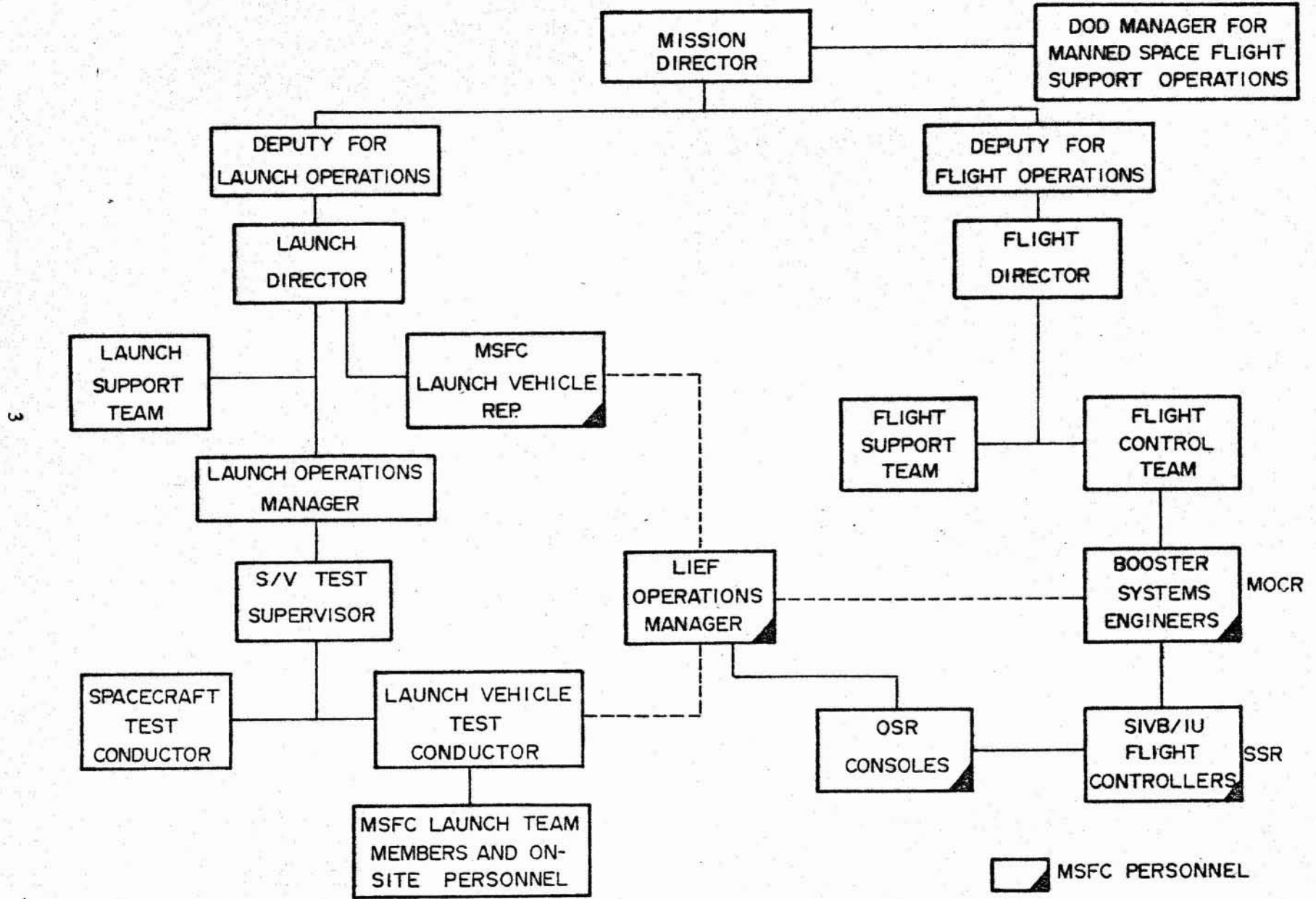
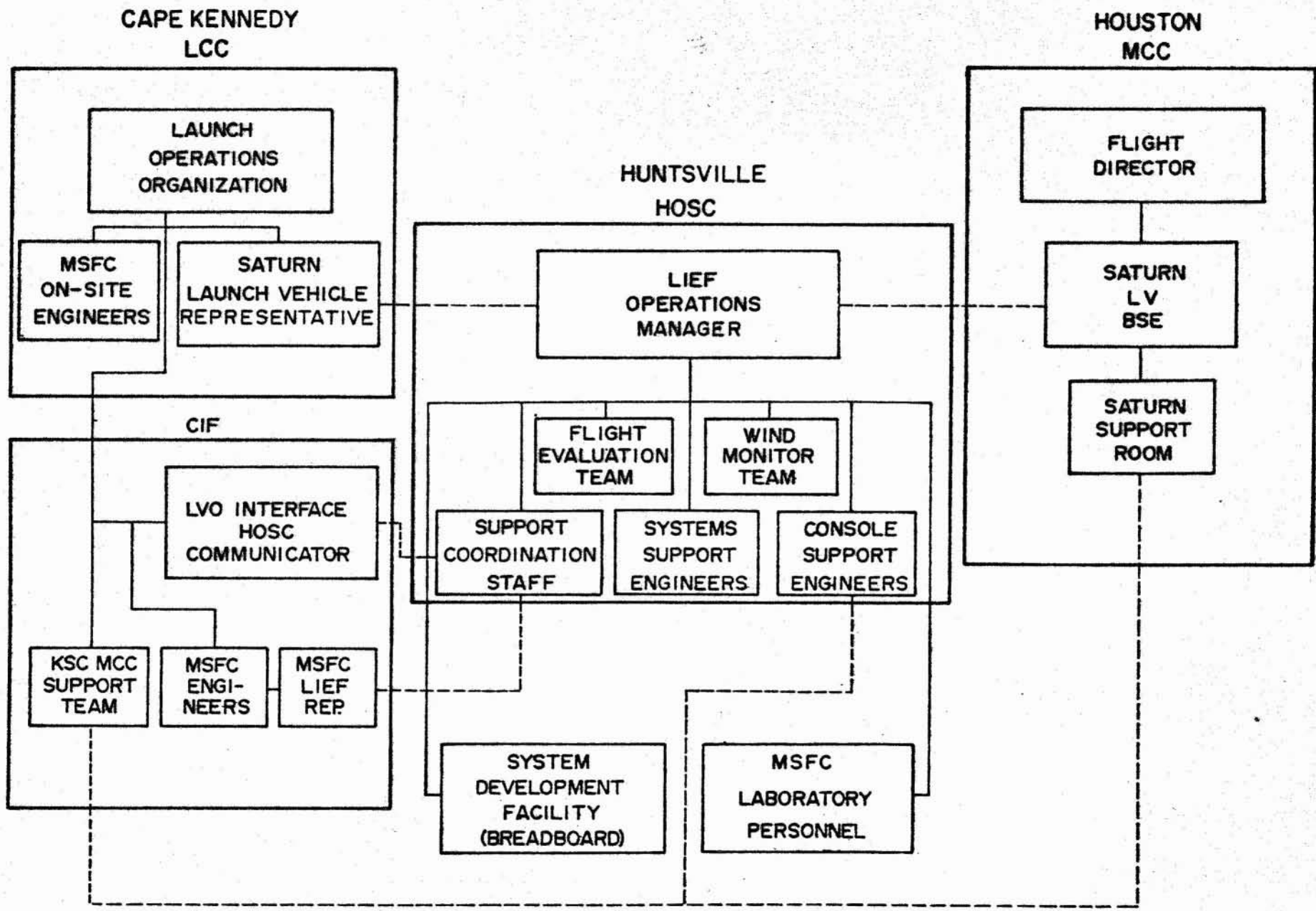


FIGURE 2.2 MSFC OPERATIONS SUPPORT ORGANIZATION



4

their responsibilities, operating procedures, etc., and a series of training sessions are conducted prior to the launch operations.

The Key functions within the LIEF Mission Support Organization as depicted in Figure 2.2 are briefly described below:

2.2.1 Saturn Launch Vehicle Representative

The Saturn Launch Vehicle Representative is the official MSFC spokesman to the Launch Director in any matter affecting the launch vehicle. During his presence in the launch complex he is also the spokesman for the MSFC operations support organization established at Huntsville.

2.2.2 MSFC On-Site Support Engineers

In certain cases, KSC requests MSFC personnel for specific on-site support. HOSC capabilities are available to these personnel and in turn the HOSC is conferenced with these personnel for consultation when required.

2.3.2 HOSC Communicator

The HOSC Communicator is a KSC Launch Vehicle Operations member who mans the LIEF console in the CIF during FRT, CDDT and Launch. He provides launch vehicle status information during the countdown to the Launch Vehicle Operations (LVO) communicator and controls switching of operational TV and audio to the HOSC.

#### 2.2.4 MSFC LIEF Representative

The MSFC LIEF representative is a member of the MSFC LIEF organization assigned to the Cape who assists in coordinating the MSFC support to the Launch Operations. He is located in the CIF Launch Support Room.

#### 2.2.5 Support Coordination Staff

The LIEF Support Coordinator is responsible to track all support requests, assure satisfactory disposition of requests, and assure proper dissemination of information concerning such requests. He is assisted by the following personnel:

The Launch Vehicle Operations (LVO) Communicator maintains voice communications with the HOSC communicator and the MSFC LIEF Representative located in the CIF Launch Support Room. He insures LIEF support engineers are kept informed of countdown status and coordinates TV coverage with the HOSC Communicator.

The Personnel Locator maintains cognizance at all times of the location of all lead representatives, key MSFC Management personnel, and other designated technical personnel and assists in establishing conferences and direct calls between KSC, MSC, and MSFC.

The Main Conference Room Coordinators are stationed in the Main Conference Room to expedite the establishment of support conferences with MCR Support engineers and facilitate communications with these support engineers.

The Main Conference Room Information Manager insures that all pertinent information is relayed to Main Conference Room engineers and responds to requests for specific displays from MCR support engineers.

#### 2.2.6 Flight Evaluation Team (FET)

The FET represents the interface of the Flight Evaluation Working Group and its postflight evaluation efforts with the LIEF Operations organization. Members of the FEWG are absorbed throughout the organization to assist in real-time engineering analysis and to support the FEWG activities. The FEWG is formally represented to facilitate the LIEF Support of FEWG postflight activities.

#### 2.2.7 Console Support Engineers

Support is provided as required to launch and flight operations from HOSC ENGINEERING DATA CONSOLES. The console support activities are coordinated by Console Managers who are I-MO personnel. The consoles are manned by systems and design engineers identified by MSFC Laboratories, who perform detailed system data monitoring and analysis, and coordinate support to the Saturn Launch Vehicle Staff Support Room in Mission Control Center - Houston (MCC)

FIGURE 2.3

TECHNICAL SUPPORT REPRESENTATION

Saturn IB & V

R-AERO-F	Flight Dynamics
R-AERO-P	Projects Office
R-AERO-Y	Aerospace Environment
R-ASTR-B	Projects Office
R-ASTR-E	Electrical Systems
R-ASTR-F	Flight Dynamics
R-ASTR-G	Inertial Sensors & Stabilizers
R-ASTR-I	Instrumentation & Communication
R-ASTR-N	Guidance & Control
R-ASTR-S	Systems Engineering
R-P&VE-P	Propulsion
R-P&VE-S	Structures
R-P&VE-V	Vehicle Systems
R-P&VE-X	Projects Office
R-ME	M E Lab Representative
R-QUAL-P	Vehicle System Checkout
R-SE-F	Flight Systems
R-SE-G	Ground Systems
R-TEST-C	Components & Sub-Systems Test
R-TEST-S	Systems Test
I-E-J	J-2 Engine
I-MO-R	Mission Support Requirements
GE	Electrical Support Equipment
IBM	Instrument Unit
MDC	S-IVB Stage Contractor
MAR/RKT	J-2 Engine
RCA	Computer Systems

Saturn IB

I-E-H	H-1 Engine
I-IB-SI/IB	IB Stage Project
I-IB-SIVB	S-IVB Stage Project
I-I/IB-E	Systems Engineering
I-I/IB-G	Ground Support Equipment
I-I/IB-T	Test
I-I/IB-U	Instrument Unit
CCSD	S-IB Stage Contractor
NAR/RKT	H-1 Engine

Saturn V

I-E-F	F-1 Engine
I-V-E	Systems Engineering
I-V-F	Flight Operations
I-V-G	Ground Support Equipment
I-V-IU	Instrument Unit
I-V-SIVB	S-IVB Stage Project
I-V-SII	S-II Stage Project
I-V-SIC	S-IC Stage Project
TBC	S-IC Stage Contractor
NAR/SD	S-II Stage Contractor
NAR/RKT	F-1 Engine

#### 2.2.8 Systems Support Engineers

Systems Support Engineers include MSFC and stage contractor personnel. These engineers will provide support to the Saturn Launch Vehicle in areas which may be the subject of a KSC or MSC request for problem analysis during prelaunch tests, terminal count, and flight. Figure 2.3 shows the HOSC Technical Support Representation by major organization elements. There are approximately 200 System Support Engineers located in the HOSC during mission periods.

#### 2.2.9 Wind Monitoring Team

The actual flight wind environment during the terminal countdown is analyzed as to acceptability for launch by a joint MSFC/MSFC Wind Monitoring Team and results reported to the Launch Director. A go - no go decision is transmitted to KSC at T-2 hours. Real time monitoring of ground winds and the computation and analysis of launch vehicle bending moments is also performed in the HOSC.

#### 2.3 Supporting Documentation

The following documentation is prepared as a requirement of this LIEF Operations Plan to provide necessary definition and control of LIEF Operations. These documents and other technical documentation and historical information of the launch vehicle are available in the Systems Information Library during HOSC operations.



2.3.1 HOSC Display System Control Document

The Display System Control Document Controls the HOSC display system hardware systems configuration and software programming and is jointly approved by I-MO and R-COMP. This document is modified as required to reflect Display System Status.

2.3.2 HOSC Mission Display Plan

The Mission Display Plan specifies the nominal sequence of HOSC displays and their distribution during the mission. It is jointly approved by I-MO and R-COMP.

2.3.3 LIEF Communications Control Document

The LIEF Communications Control Document defines all communications services required by MSFC for support of LIEF operations and controls the configuration and operation of HOSC communications. Inserts are issued when required to update this document for mission peculiar items. It is jointly approved by I-MO and MS-C.

2.3.4 Mission Support Plan

This document describes the wind monitoring activities (ground & flight winds) and the Systems Development Facility (BREADBOARD) Support. The Primary interfaces between the Laboratories and HOSC are the Saturn IB and V SDF. This document

defines any special relationships and interfaces between the HOSC and SDF.

2.3.5 PSRD Inputs

LIEF/HOSC requirements for support provided by other NASA facilities are placed through the Program Support Requirements Document. This document is the designated NASA document for the identification of Manned Space Flight Support requirements and is a consolidation of the Office of Manned Space Flight prelaunch, mission and post mission requirements. MSFC inputs are given through I-MO to Operations Support Requirements Office (OSRO) for inclusion in the document.

2.3.6 LIEF Procedures Handbook

This document establishes Standard Operating Procedures (SOP) for use of LIEF communications and display systems and defines the mission specific duties, responsibilities, and operating procedures for LIEF Operations personnel and supporting elements. This document is issued by I-MO.

2.3.7 LIEF/HOSC Manning Plans

An HOSC Manning Plan is issued by I-MO for each FRT, CDDT and Launch. It includes the names and reporting times of the support engineers required to support the test.

**2.3.8 HOSC Training and Simulations**

These memoranda identify the training and simulation exercises necessary for the operations staff and console support engineers to insure that all personnel are properly briefed and ready to support the mission. They are issued by I-MO.

**2.3.9 HOSC Administrative Support Plan**

The HOSC Administrative Support Plan is a Management Plan for providing administrative support to HOSC Operations during Mission Periods. Included in the plan are provisions for clerical support, VIP protocol, access control, food services, janitorial services, and emergency services.

### 3.0 OPERATIONS ACTIVITIES

#### 3.1 Prelaunch Activities

Prior to the terminal countdown and flight, LIEF voice and data circuits are used directly between individual MSFC Laboratories and Offices to support KSC and MSC on a routine basis.

In addition, the LIEF/HOSC provides support services to KSC and MSC during certain prelaunch tests as described in the following:

##### 3.1.1 Mission Status Room

At approximately L-3 weeks, the HOSC Mission Status Room will be activated. During non-mission periods the Status Room will be operating from 7 a. m. to 5 p. m. daily. During mission periods the Status Room will be replaced by the total LIEF/HOSC Operation. The primary objectives of the HOSC Mission Status Room are to provide up-to-date information on the current Apollo/Saturn Mission to Key MSFC personnel and to establish technical support conferences when required by KSC and MSC.

##### 3.1.2 Prelaunch Test Locator Support to KSC & MSC

The HOSC Provides a Personnel Locator Service from T-1 day to KSC and MSC for contacting MSFC and Contractor Systems Support Engineers during the Flight Readiness Test (FRT), Countdown Demonstration Test (CDDT), and Launch. These MSFC and Contractor Personnel are selected by their respective organizations to

represent all major vehicle areas as Support Engineers for these tests. Lead or Key Support Engineers are on-call from T-1 day until the beginning of cryogenic loading. At this point in the count, these on-call support engineers will report to the HOSC and remain until the end of the test. During Launch operations additional support engineers will report to the HOSC at the same time as the Lead or Key Support Engineers. These Engineers will offer support to their Lead Representative in his respective technical area.

The Personnel Locator is located in the Support Coordination Room and maintains a log on the location and telephone numbers where each Countdown Support Engineer can be reached at all times throughout each test.

The primary communications utilized by the Personnel Locator for KSC Prelaunch Test Support will be two voice lines between the HOSC and the LIEF console in the CIF via the LIEF switchboard. When support is requested by KSC, the cognizant Support Engineer is contacted by the Personnel Locator by telephone through the LIEF switchboard. Once contact is established, the Support Engineer is conferenced into the LCC LIEF line and at KSC discretion into LCC working circuits as required.

### 3.1.3 Prelaunch Test and Facility Checkout Activities

During the CDDT and FRT the HOSC is manned with operations personnel, console engineers, and key support engineers in preparation for the launch operations terminal countdown activities. Voice conferencing with the appropriate LCC is established, launch vehicle checkout test data monitored, and the Systems Development Facility (SDF) is on standby.

The HOSC is manned during the following tests with Operations Staff Personnel to monitor countdown activities:

Overall Acceptance Test (OAT) #1, Plugs In.

Overall Acceptance Test (OAT) #2, Plugs Out.

Data from these tests are recorded and replayed for training and facility checkout.

Data is transmitted from the Central Instrumentation Facility (CIF) Data-Core to the HOSC and recorded for each test.

During certain tests including the Network Simulations the data is observed in conjunction with the Saturn Launch Vehicle (SLV) Flight Controllers at MCC for the purpose of voice communications training and familiarization, evaluation of the operational readiness of the HOSC data display systems, and checkout data observation.

### 3.2 Terminal Countdown, Launch and Flight

#### 3.2.1 MSFC Prelaunch Wind Monitoring

Prelaunch flight wind monitoring analyses and trajectory simulations are jointly performed by MSFC Laboratory personnel in conjunction with MSC personnel located at MSFC during the terminal countdown. Beginning at T-14 hours, actual wind data are electronically transmitted periodically from KSC to the HOSC. These data are used by the MSFC/MSFC wind monitoring team in vehicle flight digital simulations to verify the capability of the vehicle with these winds. Angle of attack, engine deflections, and structural loads are calculated and compared against vehicle limits. Simulations are made on either the IBM 7094 or B5500 computer and results are reported to the Launch Control Center (LCC) within 60 minutes after wind data transmission. At T-2 hours a go no-go recommendation is transmitted to KSC by the MSC/MSFC Wind Monitoring Team. A go no-go condition is also relayed to the LCC just prior to LOX loading.

In the event of marginal wind conditions, contingency wind data balloon releases are made by KSC on an hourly basis after T-2 hours and a go no-go recommendation transmitted to KSC for each contingency release. These contingency data are provided MSFC in real-time via CIF/DATA-CORE and trajectory simulations are performed on-line to expedite reporting to KSC.

Ground Wind monitoring activities are also performed by AERO and P& VE Laboratory personnel to advise KSC when marginal ground wind conditions are experienced. Wind anemometer and strain gauge data are received in real-time and bending moments computed and compared with similar bending moment displays in CIF.

These activities are centralized in the Wind Simulation, Trajectory and Orbit Analysis Room located in the HOSC (See Figure 4.1).

### 3.2.2 Launch and Flight Operations Support

During the prelaunch period, primary support is directed to KSC. Voice communications are also maintained between the HOSC consoles, the Saturn Launch Vehicle Staff Support Room (SLV/SSR) at MCC, and the KSC MCC support engineers in CIF to coordinate preparations for the flight phase and answer any support request. Manning requirements and reporting times during launch are covered under section 3.1.2.

At lift-off primary support transfers from KSC to the MCC. The HOSC engineering consoles provide support as required to the SLV/SSR for S-IVB/IU orbital operations by monitoring detailed instrumentation for the evaluation of system in-flight and dynamic trends, assisting in the detection and isolation of vehicle malfunctions, and providing advisory contact with vehicle design



specialists. This support is normally provided from lift-off through the active launch vehicle/spacecraft separation phase; or until LIEF Mission Support Termination.

In addition, key Support Engineers are located in the LIEF Control Room during orbital operations and a number of charts are plotted in real-time to keep the Support Engineer properly informed on the status of the mission and the condition of the S-IVB/IU.

Following completion of the active launch vehicle support activities, data are recalled as required for more detailed analysis and initial preparation made to provide support to postflight evaluation.

The LIEF Operations Manager submits a report of LIEF activities and support to the Mission Director within two hours after LIEF/HOSC mission support termination.

### 3.3 Post Flight Evaluation Support

The LIEF staff and facilities continue to support the Flight Evaluation Working Group in postflight evaluation. The primary LIEF support functions to post flight evaluation are the electronic transmission of postflight data, and utilization of the HOSC/MCR for Flight Evaluation Working Group Meetings.

### 3.4 Preliminary Mission Failure Investigation

In the event a failure occurs that apparently results from a technical area or action within the cognizance of MSFC, and no

#### 4.0 FACILITIES DESCRIPTION

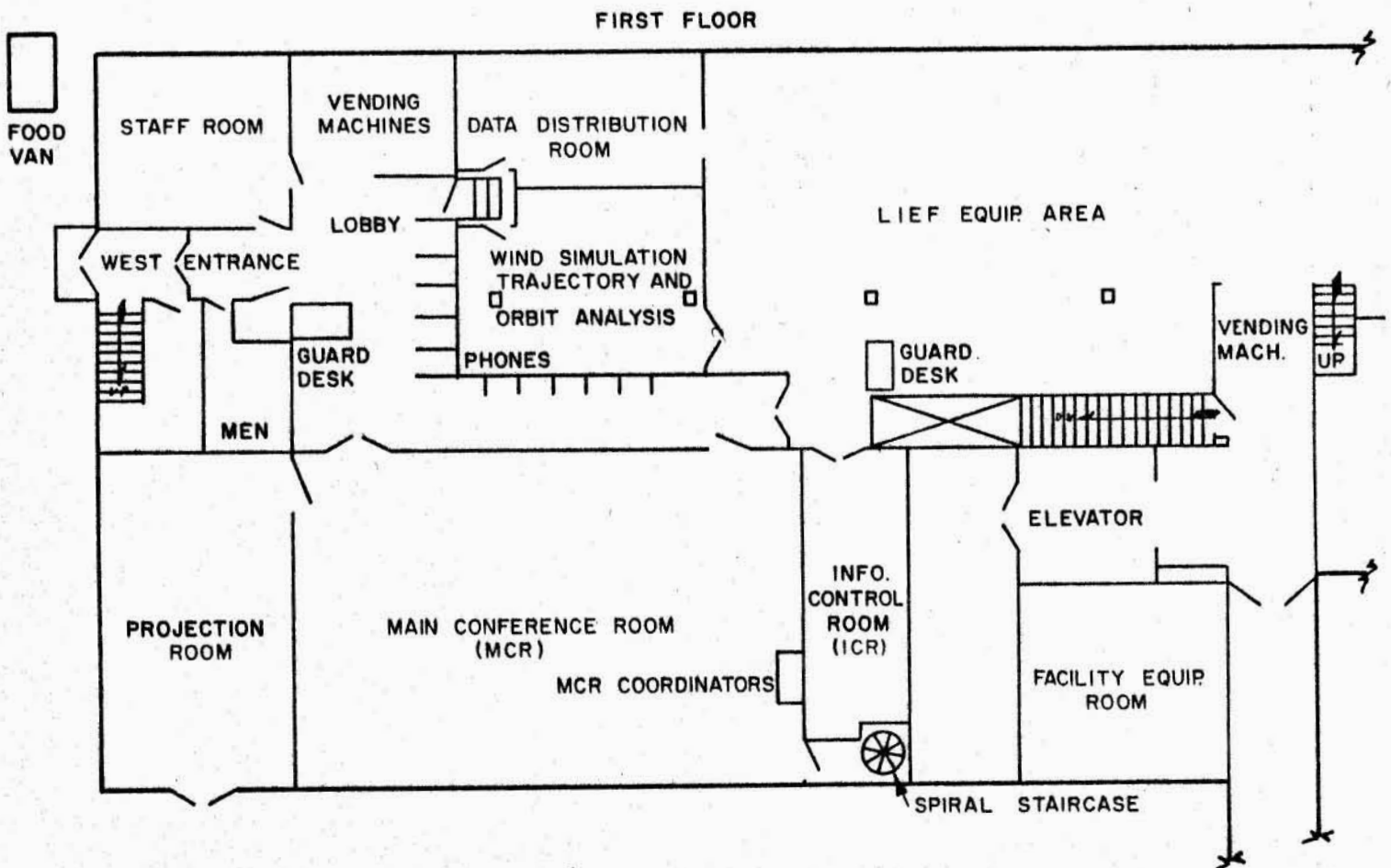
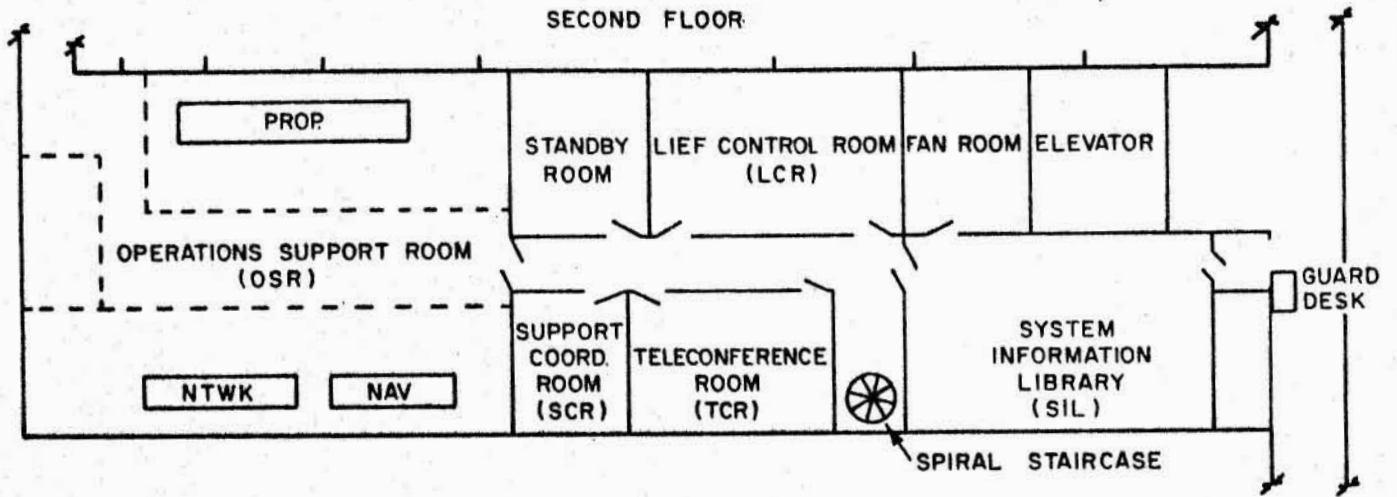
##### 4.1 Huntsville Operations Support Center (HOSC)

The HOSC is physically located in the west end of A-wing, Building 4663, on Martin Road. The main entrance is at the west end of A-wing. The Operations Area is located on the first and second floors with additional area in the basement for communications equipment and storage. A brief description of the areas shown in Figure 4.1 is given in the following paragraphs:

##### 4.1.1 Main Conference Room (MCR)

The MCR has space for approximately 150 people during operational periods in an auditorium type arrangement. The MCR is equipped with a public address system, sound reinforcement, audio pickup and recording, variable lighting, rostrum, three 6' x 8' Rear Projection Screens, three TV monitors, and sliding corkboard for mounting data records, schematics, and other static displays. Associated with the MCR is the Projection Room with three Eidophors, a 16 mm movie projector, slide projectors (2" x 2" and 3 1/4" x 4") and three viewgraph projectors. A spiral staircase is provided in the rear of the MCR to expedite the movement of Support Engineers to the LIEF Control Room and Operations Area. MCR coordinators are located at the rear of the MCR to assist the support engineers.

FIGURE 4.1  
HOSC FLOOR PLAN  
A-WING BUILDING 4663



#### 4.1.2 Information Control Room (ICR)

The ICR is located at the rear of the Main Conference Room. ICR features include: a 4' raised floor, with window between ICR and MCR, a 12 section console, and one equipment rack.

The ICR is utilized for overall HOSC display and audio control which is performed by the Main Conference Room Information Manager and Assistant, Display Controller and Assistant, and Display Technician.

#### 4.1.3 LIEF Control Room (LCR)

The LIEF Control Room is the focal point for the provision of HOSC support to the Saturn Launch Vehicle Representative at KSC and the Booster Systems Engineer at MSC. The LIEF Operations Manager is located in this room and it is utilized as the primary room for support conferences and problem discussions. The room is equipped with audio facilities for voice conferencing between MSFC, KSC, and MSC and TV monitors for information and data display. In addition, rapid access slide display of technical and historical information available in the Systems Information Library is available for problem analysis and discussions.

#### 4.1.4 Teleconference Room (TCR)

The Teleconference Room is configured almost identical with the LCR and is equipped with audio facilities for voice conferences between MSFC, KSC, and MSC, and with TV monitors for

information and data display. The TCR will house key MSFC and Contractor support representatives and is used as a backup for support conferences or conducting simultaneous problem conferences.

#### 4.1.5 Support Coordination Room

The support coordination room contains the Support Coordinator, Personnel Locator, LVO Coordinator and Operations Supervisor and is equipped with communication consoles for the support coordination staff. It is located such that the staff has visual access to all rooms of the Operations Area.

#### 4.1.6 Operations Support Room (OSR)

The Operations Support Room provides an operations area for the vehicle systems engineers who supply the remote technical support to KSC for launch support and to MCC for Apollo Flight Control Support.

Engineering consoles in the Operations Support Room display vehicle systems performance data in real-time. Overhead TV monitors in the Operations Support Room provide general status information remoted from the Main Conference Room Displays. MSFC Laboratory personnel man the engineering consoles and each stage contractor has an observer located in the OSR.

#### 4.1.7 Standby Room

The Standby Room provides a location for key MSFC management personnel and is equipped with three TV monitors that are slaved to the MCR. Audio is provided thru two speakers, each with a six button selector capability.

#### 4.1.8 LIEF Equipment Area

The LIEF Equipment Area contains the equipment for data receipt, data recording, data processing, and display generation.

#### 4.1.9 HOSC Communication Center

A HOSC Communication Center is located in the basement directly below the main floor of the HOSC. The HOSC Communication Center contains teletype and facsimile equipment and serves as a central control area for HOSC communication problems.

#### 4.1.10 Telephone Patch Panel Room

A patch panel for programming the internal HOSC communication system is located in the HOSC basement adjacent to the HOSC Communications Center

#### 4.1.11 Wind Simulation, Trajectory and Orbit Analysis Room

This room contains recording and display equipment and is utilized for inflight and ground wind monitoring activities and real-time event and trajectory analysis by the joint MSFC/MSW Wind Monitoring Team.



There are also three KSC Exchange Dial Circuits on the LIEFBOARD. The three circuits are a rotary group beginning with telephone number 867-2072.

#### 4.2.1.2 MSC

There are six voice circuits to MSC. One is a monitor of the Flight Directors loop. One is a direct line from the HOSC to the Booster Systems Engineer #1 (BSE #1). One is a direct line between the Mission Director's Console in the MCC and the LIEF Operations Manager in the HOSC. The other three are from the HOSC Engineers to the SSR Engineers, and are conferenced at MSFC with circuits from the KSC Mission Support Room (MSR).

#### 4.2.1.3 GSFC

There are two voice circuits to GSFC, one each to the Ground Operational Support System (GOSS) Network Monitor and the Network Coordination (GOSS 4).

#### 4.2.1.4 Summary of Voice Channel Assignment

##### KSC

- 3 MILA DIAL (867 Exchange)
- 4 LCC
  - L/V Test Conductor OIS
  - S/V Test Supervisor OIS
  - Launch Vehicle Representative
  - Operations Management Room



KSC (continued)

6      CIF  
         Room 307 (2)  
         Data-Core  
         LIEF Console  
         OIS (Switchable -2)

GSFC

GOSS Conference  
GOSS 4 (Network Coordination)

MCC

Booster Systems Engineer  
Mission Director's Staff  
Staff Support Room (3)  
Flight Director (Monitor)

4.2.1.5 Headset Monitors

In addition to the headsets used by the console engineers and operations staff personnel, headsets (monitor only) are provided in the Standby Room, OSR, LCR & TCR to permit observers and support engineers to monitor a particular voice channel.

4.2.2 Facsimile

Facsimile will be provided on the Western Union 600 System. A network will be available through the New Orleans switch that conferences the HOSC, LCC, the KSC MCC Support Team in the CIF and the SLV/SSR in MCC.

#### 4.2.3 Teletype

Classified teletype is provided between KSC and MSFC. Teletype is also used from GSFC to MSFC to provide tracking data for flight evaluation, and from MCC to HOSC for Launch Vehicle Summary Messages and Trajectory Vector Messages.

#### 4.2.4 Data

40.8 Kbs data circuits are used between the DATA-CORE (KSC) and the real-time computer (HOSC) and between U-1004 tape transceivers at the CIF and HOSC.

#### 4.2.5 TV

Closed Circuit TV is provided from the TV System at KSC to the HOSC. TV coverage starts just prior to cryogenic loading and terminates at T-0 for CDDT and at orbital insertion for launch. No TV coverage is provided for FRT.

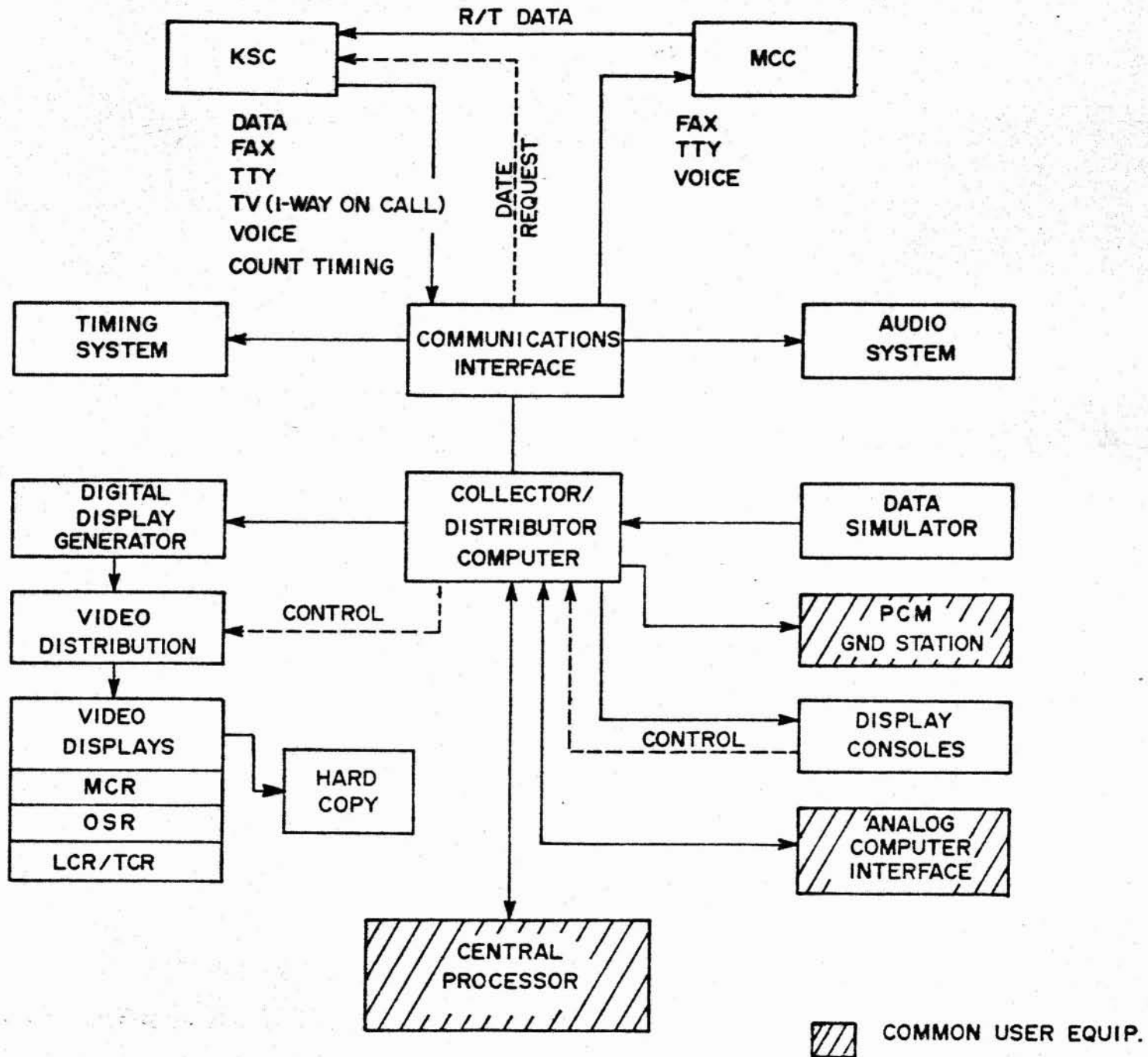
### 4.3 HOSC Information Systems

The HOSC Information Systems are shown in Figure 4.2 and are generally described below for information purposes. A more definitive description is given in the Mission Display Plan and HOSC Systems Control Document, which takes precedence over this document for the control of the display system configuration.

#### 4.3.1 Data Processing System

The primary data processing elements in the HOSC are the Collector/Distributor (DDP-224) and the Central

FIGURE 4.2 HOSC INFORMATION SYSTEMS



Processor. The Collector/Distributor computer exercises control over the data and display distribution by collecting the real-time data received from DATA-CORE and distributing it to the Central Processor and the end items of the display system. The Central Processor receives and records for permanent record all data sent by the Collector/Distributor, performs all primary calculations and outputs to display devices via the Collector/Distributor Computer.

#### 4.3.2 Display System

The TV Matrix is a key element at the HOSC display system controlling the variety of available television displays. The inputs to the system are internal HOSC camera pickups, digital-to-TV display generators and external television signals. The outputs will include a variety of regular monitors mounted throughout the HOSC area and three large Eidophor screen displays located in the Main Conference Room.

The Operations Support Room contains three engineering consoles for the monitoring of propulsion, navigation, and electrical networks data. Each Console has analog meters, discrete lights, digital readouts, eight channel strip charts recorders, and TV displays.

In addition, all areas of the HOSC are served by a Voice Communications Systems (VCS) and a Timing System.

#### 4.3.3 Hard Copy

Hard Copy capability of images on TV monitors is available throughout the HOSC Operation Area.

#### 4.3.4 Laboratory Facility Interfaces

##### 4.3.4.1 General

LIEF Voice and data circuits are regularly utilized by the individual MSFC laboratories and offices in the day-to-day coordination between MSFC, KSC and MSC. The location of primary LIEF voice and data circuit terminals at MSFC are summarized below:

##### VOICE:

Saturn IB Systems Development Facility (Breadboard)

Saturn V Systems Development Facility (Breadboard)

Data ( U-1004 Tape - to- Tape)

R-COMP-R (Building 4663)

Saturn IB System Development Facility

##### 4.3.4.2 LIEF-HOSC/Saturn Systems Development Facility (SDF) Interface

A special interface between the LIEF-HOSC facilities and the Saturn V SDF located in Building 4708 and Saturn IB SDF located in Building 4436 permits two-way voice communications with the SDF Intercom System through the LIEFBOARD. In addition

a video signal (Cape TV or data display) is provided from the HOSC.  
Communications between the Launch Complex at KSC and the SDF  
can be conducted through this interface.

## DISTRIBUTION

### MSFC

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DEP-T, Mr. Neubert

MS-CH, Mr. Sorensen  
MS-C, Mr. Hildreth (3)  
MS-D, Mr. Denton

R-DIR, Mr. Weidner  
R-OM-DIR, Mr. Fellows  
R-SSL-DIR, Dr. Stuhlinger

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