

# NASA MISSION CONTROL CENTER HOUSTON BUILDING 30 - 3RD FLOOR (APOLLO MISSIONS)

The third floor of the Mission Control Center - MCC (Houston) was part of a three story, windowless complex providing control and support for Gemini and Apollo missions with operations centered on the Mission Operations Control Room - MOCR 1 (pronounced Mo - Ker). The MCC third floor became fully operational on the 3<sup>rd</sup> of June, 1965 with the launch of Gemini IV and controlled all the remaining Gemini missions and then was reconfigured for Apollo missions by November 1967. It was then used exclusively for missions involving Saturn V launches until deactivated in May, 1973. The similarly equipped MCC second floor was the first to be utilized for Apollo mission with the launch of Saturn-Apollo 201 on February 22<sup>nd</sup>, 1966. However, whilst MOCR 2 and some Staff Support Rooms (SSR) on this floor are basically similar to those on the floor above, the majority are configured differently as required for earth orbit missions launched by the Saturn I/B and a larger simulation area.

In addition to the operational wing there is a three story office complex joined to the operations wing by a lobby wing that for a time, provided dormitory facilities for resting controllers during the longer duration Apollo missions. The nearby (but not structurally connected) building 45, provided office accommodation for senior mission controllers and housed on the third floor, the Mission Evaluation Room (MER), that provided in depth analysis and recommendations from NASA and contractor staff for the operational staff in Building 30.

The following is a summary of MOCR control positions and a description and purpose of the surrounding Staff Support Rooms (SSR) and other mission support rooms although actual manning depended on specific phases of the mission:

## MISSION OPERATIONS CONTROL ROOM - MOCR:

Row 1 - Left to Right (closest to the Group Display Projection screens and referred to by the controllers as "The Trench")

**BOOSTER - Boost Vehicles Systems Engineer** - three positions

The booster systems engineers monitored and evaluated performance of propulsion-related aspects of the launch vehicle during prelaunch and ascent. These consoles were nominally vacated after the Trans Lunar Injection (TLI) burn or until the SIV-B stage became dormant. BOOSTER responsibilities were delegated as follows:

- (a) BSE 1 had overall responsibility and abort command capability for the launch vehicle and for all S-IC and S-II stage functions.
- (b) BSE 2 had prime responsibility for S-IVB stage functions.
- (c) BSE 3 had prime responsibility for all Instrument Unit (IU) functions.

**RETRO - Retrofire Officer**

The RETRO participated in prelaunch checkout to insure system readiness and maintained an updated re-entry plan throughout the mission.

**FIDO - Flight Dynamics Officer**

The FIDO participated in prelaunch checkout to insure system readiness, monitored powered flight events and trajectories from the standpoint of mission feasibility; monitored re-entry events and trajectories and updated impact point estimates as required.

**GUIDO - Guidance Officer** - two positions

The GUIDOs participated in prelaunch checkout to insure system readiness and performed the guidance monitor functions during powered flight and spacecraft initialization. One GUIDO was also responsible for GSM and LGC command updates.

Row 2 - Left to Right

**SURGEON - Flight Surgeon**

The Flight Surgeon was responsible for the analysis and evaluation of all medical activities concerned with the flight - monitored crew health via telemetry, provided crew consultation via discrete ground/spacecraft communications.

**CAPCOM - Spacecraft Communicator**

The CAPCOM manned by an Astronaut from the backup flight crew, was responsible for all voice communications with the flight crew. The CAPCOM also served in conjunction with the FAO as a crew procedures advisor.

**EECOM - Environmental, Electrical and Communications Engineer**

The EECOM was responsible for monitoring and troubleshooting the Command and Service Module (CSM) environmental (ECS), electrical (EPS) and Sequential systems. Note. The Communications responsibility was transferred to a newly created position after the Apollo 10 mission - designated INCO.

**GNC - CSM Guidance, Navigation and Control Engineer**

The GNC was responsible for monitoring and troubleshooting the Command and Service Module (CSM) guidance, navigation, control and propulsion systems.

**TELMU - Telemetry, Electrical, and (EVA) Mobility Unit**

The TELMU was responsible for monitoring and troubleshooting the Lunar Module (LM) environmental (ECS), electrical (EPS) and the astronaut's Space Suit Portable Life Support System (PLSS) while on the lunar surface.

**CONTROL - LM Guidance, Navigation and Control Engineer**

CONTROL was responsible for the (LM) guidance, navigation, control and propulsion systems. Note: Manning of the TELMU and CONTROL consoles was usually minimal (up to Apollo 14) until LM activation prior to preparation for lunar descent and nominally vacated after the LM impacted the lunar surface post lunar activities.

Row 3 - Left to Right

**INCO - Integrated Communications Officer**

The INCO was responsible for monitoring all data, voice and video communications systems, including the configuration of in-flight communications and instrumentation systems and troubleshooting the CSM, LM, TV, PLSS and trackable antenna communications systems. Duties also included monitoring the telemetry link between the vehicle and the ground, and overseeing the uplink command and control processes. The position was created after Apollo 10 from the combining the LEM and CSM communication systems positions.

**PROCEDRES - Operations and Procedures (O&P) Officer**

The PROCEDRES officer shared a console and responsibilities with the INCO and his prime responsibility was for the detailed implementation of the Mission Control Center (MCC), Mission Space Flight Network (MSFN), Goddard Space Flight Center (GSFC) and the Kennedy Space Center (KSC) mission control interface procedures. The O&P was also responsible for scheduling and directing all telemetry and Data Storage Unit (DSU) voice playbacks. He also developed all communication inputs and changes to the ground support timeline.

**AFD - Assistant Flight Director**

The AFD was responsible for assisting the FD.

**FLIGHT - Flight Director (FD)**

The FD had ultimate authority to do anything necessary to ensure the crew's safety and the mission's success. The FD had overall control of all of the individual positions in the MOCR and was solely responsible during the mission for MOCR decisions and actions concerning vehicle systems, vehicle dynamics and Mission Control Center (MCC) / Manned Space Flight Network (MSFN) operations.

**FAO - Flight Activities Officer**

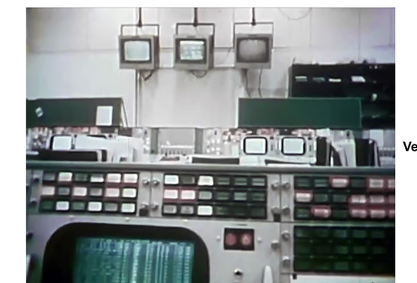
The FAO was responsible for developing and co-ordinating the Flight Plan.

**NETWORK - two positions**

The Network Controller was responsible for the detailed operational control and failure analysis of the Manned Space Flight Network (MSFN). The Assistant Network Controller, in addition to assisting the NC in his responsibilities, was also responsible for all Mission Control Center (MCC) equipment and its ability to support the mission.



Mission Operations Control Room - MOCR



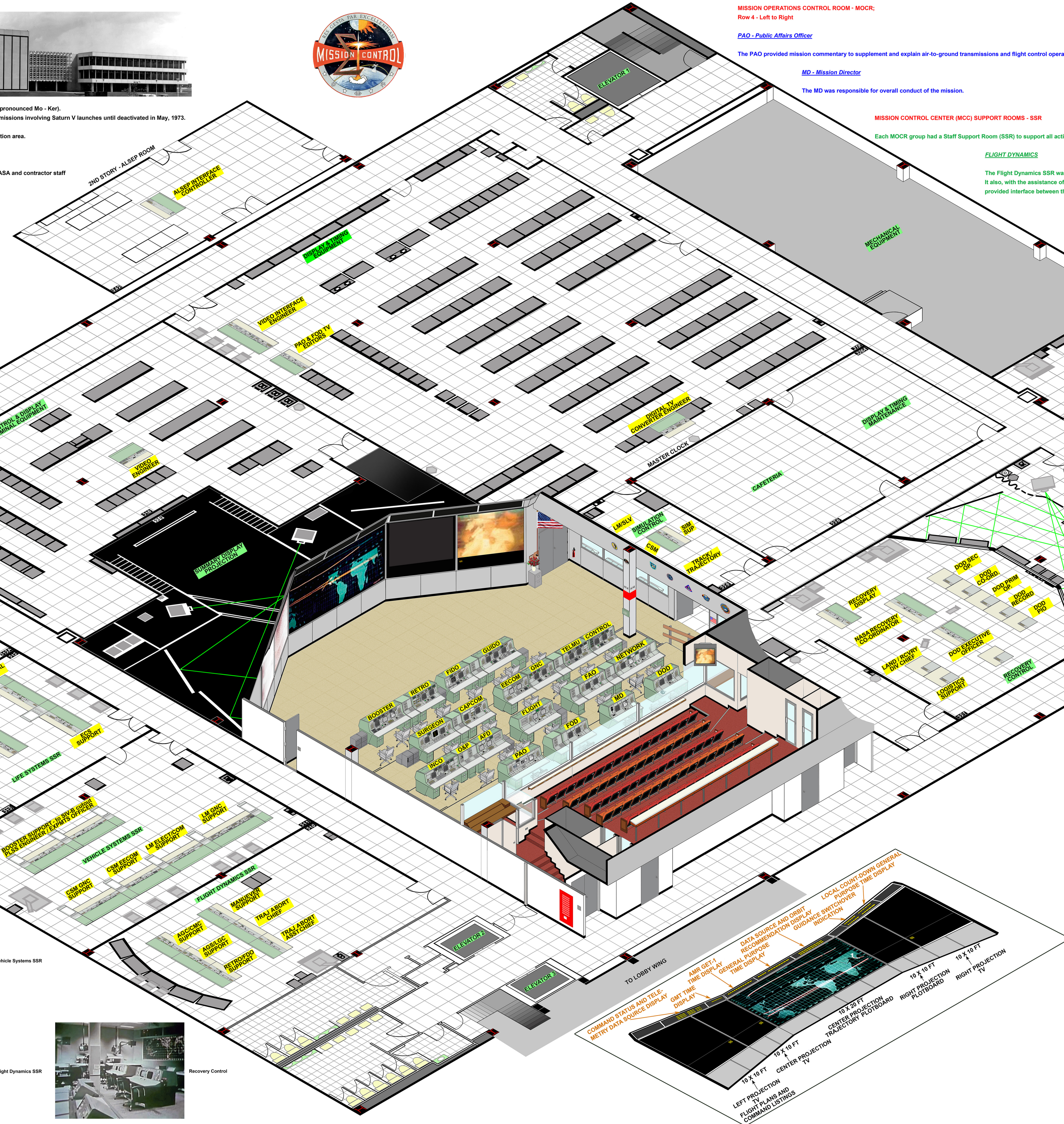
Vehicle Systems SSR



Flight Dynamics SSR



Recovery Control



**MISSION OPERATIONS CONTROL ROOM - MOCR:**  
Row 4 - Left to Right

**PAO - Public Affairs Officer**  
The PAO provided mission commentary to supplement and explain air-to-ground transmissions and flight control operations to the news media and the public.

**MD - Mission Director**  
The MD was responsible for overall conduct of the mission.

**FOD - Flight Operations Director**  
The FOD was responsible for the interface between the Flight Director and management.

**DDO - Department of Defense Representative** - two positions  
The DOD Representative, assisted by the Assistant DOD Representative, was responsible for co-ordination and direction of all DOD mission support forces and sites.

**MISSION CONTROL CENTER (MCC) SUPPORT ROOMS - SSR**  
Each MOCR group had a Staff Support Room (SSR) to support all activities required by each MOCR position. These SSR's were strategically located in areas surrounding the MOCR and were manned by the various personnel of a given activity sourced from NASA or the respective contractor.

**FLIGHT DYNAMICS**  
The Flight Dynamics SSR was responsible for the Flight Dynamics Group (RETRO, FIDO, GUIDO) in the MOCR for providing detailed analysis of launch and re-entry parameters, maneuver requirements and orbital trajectories. It also, with the assistance of the Mission Planning and Analysis Division (MPAD), provided real-time support in the areas of trajectory and guidance to the MOCR Flight Dynamics team on trajectory and guidance matters. An additional service required provided interface between the MOCR Flight Dynamics team and parties normally outside the Flight Control team such as Program Office representatives, spacecraft contractor representatives, etc.

**VEHICLES SYSTEMS**  
The vehicle Systems SSR was responsible to the Systems Operations Group (BOOSTER, EECOM, GNC, TELMU, CONTROL) in the MOCR for monitoring the detailed status and trends of the flight systems; avoiding, correcting and circumventing vehicle equipment failures; and detecting and isolating vehicle malfunctions.

**LIFE SYSTEMS**  
The Life Systems SSR (Aeromed SSR) was responsible to the Medical Research and Operations and the Systems Operations Group for providing detailed monitoring of the physiological and environmental data from the spacecraft concerning the flight crew and their environment.

**FLIGHT DIRECTOR'S**  
The Flight Director's SSR was responsible for staff support to the Flight Director (FD), the AFD, Data Management Officer, the FAO and the ALSEP Experiments Officer. This SSR was also responsible to INCO in the MOCR for monitoring the detailed status of the communications systems. This SSR was also responsible for the two TV channel displays; Ground Timeline and Flight Plan.

**ALSEP (Apollo Lunar Surface Experiments Package)**  
The ALSEP SSR was responsible to the Experiments Officer, Lunar Surface Program Office and Principle Investigators for providing detailed monitoring of ALSEP central station and experiments data from the lunar surface. The SSR was also responsible for all scheduling of activities, commanding and data distribution to appropriate users.  
Note: Facilities for ALSEP operations were expanded to additional rooms as mission science operations increased in type and complexity with each subsequent mission.

**MISSION SUPPORT**  
Three other rooms on the third floor provided specialist support for mission preparation and operation.

**SPACECRAFT METEOROLOGICAL ROOM**  
The Spacecraft Meteorological room was responsible to the Mission Command and Control Group for meteorological and space radiation information.

**RECOVERY ROOM - ROCR**  
The Recovery Operations room was responsible for the recovery phase of the mission. Additionally, the Recovery Operations Control Room provided an interface between the DOD Representative and the military recovery forces.

**SIMULATION CONTROL ROOM**  
Pre-mission mission control simulations were conducted and observed from a room adjacent to the MOCR.  
Note: There were additional simulation rooms on the second floor associated with simulation of ground based facilities required for earth orbital operations.

The following equipment rooms contained equipment and systems to generate information in various formats necessary for the operation of the Mission Control Center.

**DISPLAY PROJECTION ROOM**  
Behind the Group Display screen was the Display Projection room, commonly called the "Bat Cave", with associated optical projector equipment such as the Eidophor optical system. A similarly equipped but smaller Display Projection room was located behind the Recovery Control room.

**DISPLAY & TIMING EQUIPMENT**  
The master instrumentation timing equipment, countdown processor, timing interface unit, serial decimal time converter, a wall mounted master control unit clock and components of the television and telemetry systems were located in this room. Additional components of the timing, television and telemetry subsystems were also located in rooms on the other two floors.

**FIRST FLOOR MISSION SUPPORT**  
Fundamental to the operation of the second and third floor mission control, recovery control and support rooms, was the primary support areas provided by the Communications, Command and Telemetry System (CCATS) and the Real Time Computer Complex (RTCC) located on the first floor of the Mission Control building which in association with other specific equipment and facilities, provided timing, communications, computed telemetry data in "real time" on console indicator lights and monitor/group displays, chart recorders and hard data copies plus other relevant support information.

**SOURCES AND GENERAL INFORMATION**

Sources:  
The following sources have been used in part to derive the graphic.  
- National Park Service - United States Department of The Interior - Historic American Engineering Record TX-109-C - John Watchel.  
- NASA Document Images:  
- MCC Operational Configuration - PHO-TR155 - Mission J1 - Apollo 15.  
- Report Of Apollo 13 Review Board - Appendix A.  
- Mission Control Center Houston - Familiarization Manual - PHO-FAM001.  
- Misc. other NASA documents and images.

**General Information:**  
The graphic represents the entire 3<sup>rd</sup> floor of the Mission Control Center - Building 30 in approximate scale. The MOCR and Viewing rooms are presented in 3d Isometric view with the remaining floor area presented as a plan view. The graphic is a generic representation of the 3<sup>rd</sup> floor based predominantly on the launch configuration for Apollo 15 with a partial representation of features in the MOCR associated with Apollo 13. The graphic plan features of the support/equipment rooms are depicted in a number of representative shapes:  
- Consoles are represented as plan views of individual consoles  
- Various floor equipment such as printers, chart and drum recorders, teletypes, etc. are represented as a black outline shaded in dark gray.  
- Various wall and ceiling mounted equipment such as plotboards, opaque televiewers, projectors, cameras, etc are represented as dark gray outline shaded in light gray.  
- Wall clocks are represented by gray hexagonal shapes.

