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## REAL TIME COMPUTER COMPLEX

The Real Time Computer Complex (RTCC) provides the computation facilities for the MSCC, including trajectory analysis, acquisition predictions, and flight controller display calculations and information requests.

To accomplish this mission, the RTCC consists of four IBM 7094 computers, functional assignment switching devices, computer room display equipment, and associated support equipment such as magnetic tape drives, and IBM 1401 computers.

In addition to the real-time processing of incoming data, the RTCC has developed support programs to aid the flight control personnel. For example, in the area of trajectory analysis, the RTCC has developed programs that provide the nominal trajectory necessary for a successful mission. This nominal trajectory is used as a basis for the indication of trajectory status during a mission.

During a mission period, the display output from the RTCC is sent to the Display and Control System for evaluation by the flight control personnel. In support of simulated missions, the RTCC executes dynamic simulation programs and real-time control of data inputs to the Simulation, Checkout, And Training System. Like all other functional systems, the RTCC is equipped to support real and simulated missions simultaneously.

## DISPLAY AND CONTROL SYSTEM

The display and control system provides mission control personnel with information concerning booster and vehicle systems, flight dynamics, life systems, GOSS network, and recovery. This information is used to make the necessary decisions to assure mission success and to advise proper action by means of voice circuits and the digital command system.

Both computer derived data from the RTCC and unprocessed data from the communications system and telemetry inputs, as well as stored reference material, are displayed. To provide flexible and varied combinations of display data, the system includes selection and display generation equipment which operate in conjunction with the control and terminal display devices in the MOCR and the staff support rooms.

The MSCC employs one of the world's largest video matrix switching systems to provide each console operator with a vast selection of displays. A library of 64,000 prepared reference slides is available along with digital-to-TV converters which can superimpose computer generated data on the reference slide.

Thus, a vast variety of information is available to the Staff Support Rooms and the MOCR in many different formats and combinations including pictorials, meter type information, alphanumeric and XY plots. Large wall displays are used for group functions while matters of individual concern can be displayed on the control console.

A master timing system, synchronized with the National Bureau of Standards time station, WWV, supplies the time standard for the entire MSCC. Since accurate timing data is essential for mission success the timing system generates displays of Greenwich Mean Time (GMT), time to go before retro-fire, time elapsed since launch and other important time based data.

The Master Digital Command System (MDCS) in the MSCC provides the capability to perform updating and correcting operations in the spacecraft and vehicle systems without actually talking to the astronauts. To perform this function, the MDCS must receive, store, verify and route digital commands to real time sites such as BDA and TEX; also the MDCS must relay pre-pass information to the Digital Command System (DCS) units at remote sites. Teletype lines are used as the primary command link to the remote sites. When data is received at the remote sites, it is automatically checked for errors and valid data is placed in storage for future use. Unacceptable data is recorded and the originating source is requested to retransmit the information. Upon acceptance of the command sent by a DCS unit, the spacecraft acknowledges receipt and validation of the command by means of a telemetry signal known as a Message Acceptance Pulse (MAP).

## SIMULATION CHECKOUT AND TRAINING SYSTEM

The Simulation, Checkout, and Training System (SCATS) provides realistic simulation of manned space flight missions for training mission control personnel. The system has the capability to integrate the MSCC Simulation Systems with flight crew trainers located at the Manned Spacecraft Center and the Kennedy Space Center. In addition, the system has two Simulated Remote Sites (SRS) for indoctrination and training of remote site flight control personnel. These simulated stations can be exercised from the simulation control consoles using source data from the flight trainers, SCATS special equipment, the Ground Support Simulation Computer, or any combination of these.

Another example of the realistic concept of simulation at MSCC, is the situation in which a mission is being controlled by the personnel in one MOCR, while simulation exercises are taking place in the other MOCR and the SRS. This feature provides training for the flight controllers which would otherwise not be available, as future space flight missions will have lengthy flight times that will prohibit the use of one MOCR for simulation purposes. The use of two MOCR's will provide adequate facilities for simulation of the two manned space flight projects presently under development (Gemini and Apollo).