II. Mission Support

A. Planetary Flight Projects

1. *Mariner* Mars 1971 Mission Support, *R. P. Laeser*

a. Introduction. In the last four issues of this volume, functional descriptions of the DSN tracking, telemetry, command and monitor systems, which are planned for support of the *Mariner* Mars 1971 Mission, have been described.

There have been two major changes which significantly affect the previously described systems. First, the data processing configuration in the SFOF has been changed by the adoption of configuration C (Fig. 1). Secondly, the flow of data in the GCF to and from the DSIF stations has been changed by the scheduled replacement of the 2400-bits/s capability with a 4800-bit/s capability.

b. SFOF data processing. Configuration C was adopted to replace the obsolescent IBM 7044 and 7094 computers and to upgrade DSN/SFOF capability to be consistent with the requirements of *Mariner* Mars 1971 and future projects. The configuration consists of two parallel IBM 360/75 computers, electrically connected to the dual processor Univac 1108 computer of the scientific computer facility (SCF). It is intended that the two 360/75's be used for real-time processing in a redundant mode—one backing up the other. Either one should be more than capable of handling all *Mariner* Mars 1971 real-time processing requirements. The 360/75 system will be designed to handle analysis programs as well as the real-time processing. However, because of schedule constraints, most analysis programs will have to be processed on the 1108.

A more detailed 360/75 configuration is shown in Fig. 2. The 360/75 communicates with the DSIF via teletype (through the communications processor), high-speed data lines, and the new digital wide-band data line. Keyboard/cathode ray tube input/output devices will be provided in the user areas along with computer-formatted digital TV displays, computer-reconstructed spacecraft video displays, and a computer-driven mission display board in the DSN operations area.

The DSN simulation computer, the ASI 6050, is electrically connected to the scientific computing facility (SCF) Univac 1108, which will perform spacecraft mathematical modeling. The SFOF PDP-7 computer performs the off-line media conversion tasks. The project-supplied mission and test computer (MTC) (Univac 1219/1230 complex) remains unchanged, as does the TV processing system. However, the TV processing system can receive its data from either the 360/75 or the MTC.

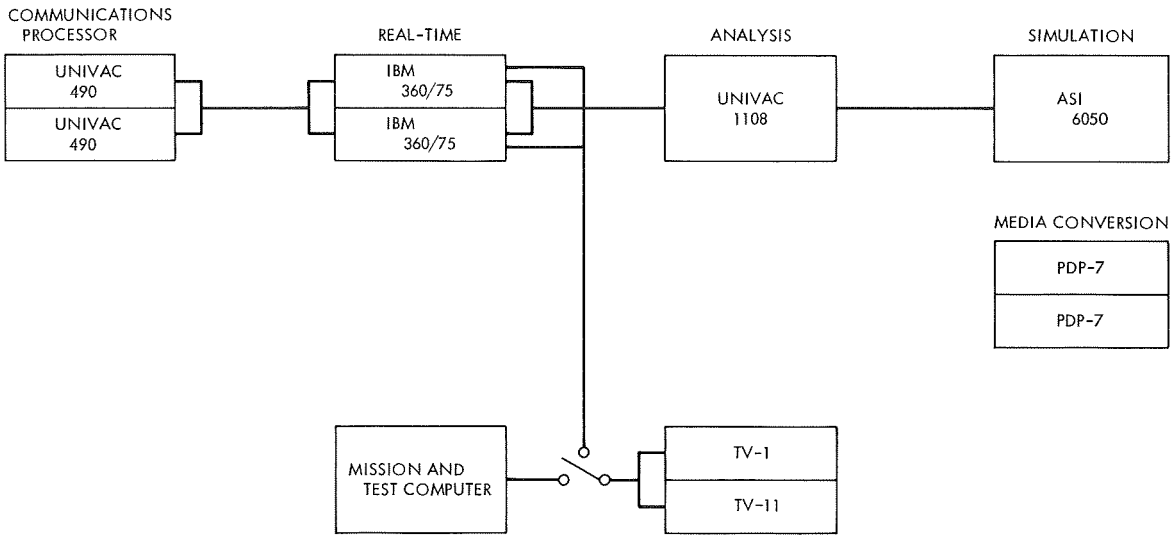

Fig. 1. SFOF configuration C data-processing system for *Mariner* Mars 1971

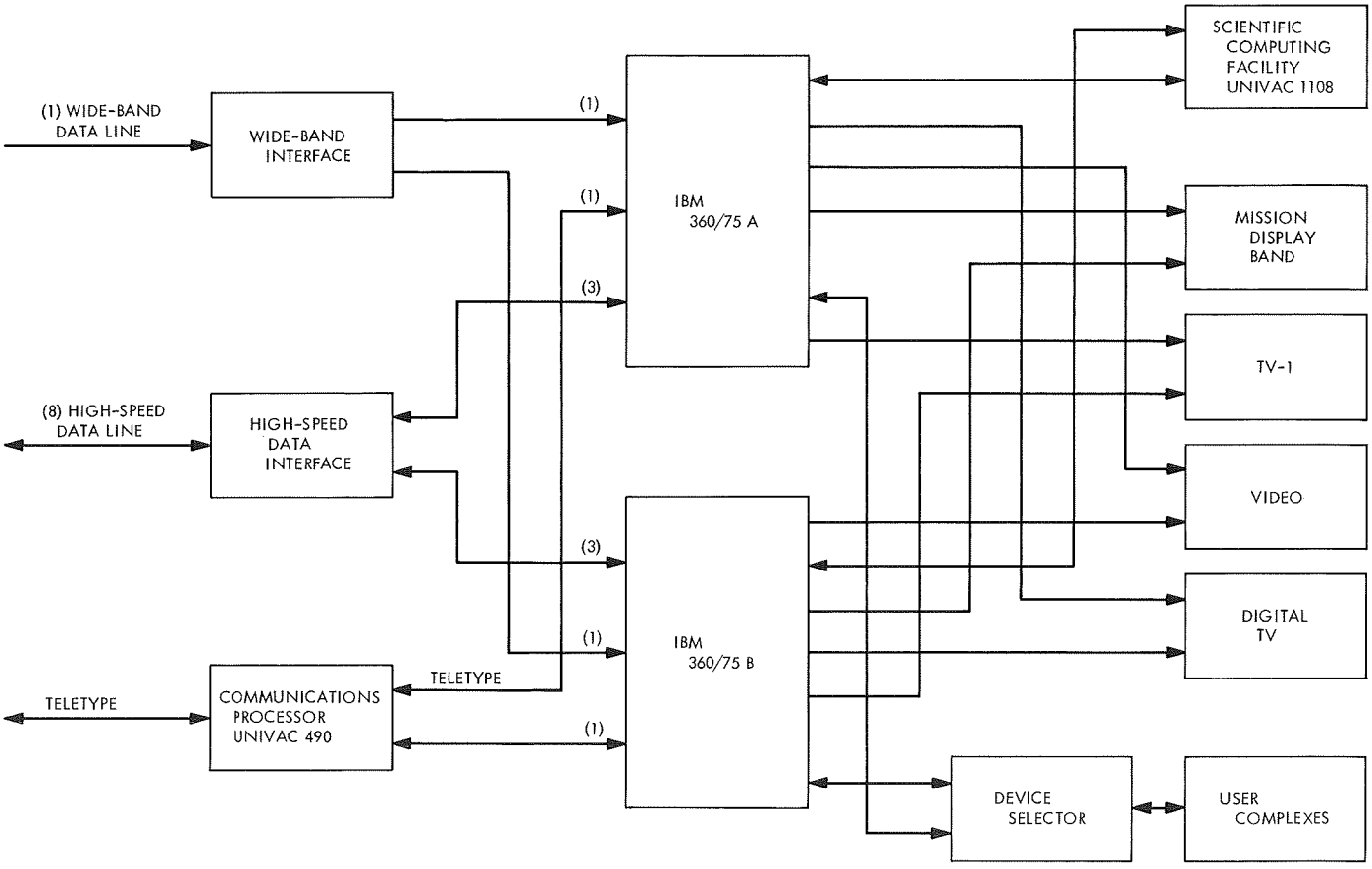

Fig. 2. SFOF *Mariner* Mars 1971 IBM 360/75 computer configuration

c. Effect of configuration C or DSN systems. A change of this magnitude obviously has a major effect on the DSN tracking, telemetry, command and monitor systems. In the tracking system, the tape interface between the DSN editing and original data record (ODR) generation functions in the 7094, and the project orbit determination function in the 1108 has been eliminated. Instead, there is now an electrical interface between the 360/75 and the 1108, with the 360/75 performing the editing, ODR generation, and pseudoresidual processing, and the 1108 performing all other functions, including DSIF prediction generation. An additional capability of the configuration is to process the high-speed tracking data which will be generated by the prototype DSIF tracking subsystem at DSS 14.

The telemetry system has the added capability of processing high-rate data from two spacecraft simultaneously as it is received over the new 50-kilobit/s digital wideband line from DSS 14. The capability of the 360/75 also allows generation in near real-time of master data records (MDR) for all telemetry data. The exact plans for MDRs have not yet been formulated. The new display capabilities of the 360/75 should be appreciated by all telemetry analysts, because silent, high-speed, large-volume devices will be provided.

The changes to the DSN command system are similar to those already described. The tape interface between the project command generation programs and the SFOF terminal of the automatic command transmission system will be eliminated and replaced with an electrical interface, and sophisticated input/output will be provided to expedite the command transmission process.

The DSN monitor system will undergo major physical change, but minor functional change as a result of the new configuration. The display buffer will be eliminated, and all DSN monitor functions will be performed by the 360/75.

d. 4800-bits/s high-speed data. A new development, the Model 203 modem, is the device which provides this expanded capability. It replaces the Model 205 modem which operated at 2400 bits/s, and it uses the same physical circuits as the 205. With this new capability, the same quantity of data can be carried on one half the number of circuits. The rest of the GCF high-speed data system is not changed: block multiplexers, demultiplexers, and error detection encoders and decoders.

e. Effect of 4800-bits/s high-speed data. All DSN systems share the use of high-speed data lines. The total high-speed data transmission capacity for *Mariner* Mars 1971 will not change. Where each DSS previously interfaced with the SFOF over two 2400-bits/s circuits, it will now interface over one 4800-bits/s circuit. However, since there will no longer be an artificial barrier between the lines, the task of assigning data by type to one of two lines will disappear, thereby simplifying software at the DSS. The overall reduction in circuit quantity provides a simpler and easier-to-operate system.

f. Other changes. Two other changes are noteworthy. Open-loop receivers for support of the S-band occultation experiment will be provided at DSS 41 and DSS 62 as well as DSS 14. However, real-time digitization will be provided only at DSS 14. At the overseas stations, the open-loop data will be analog-recorded on FR-1400 recorders, and these recordings will be made available to the experimenter.

Three separate DSIF telemetry and command processor (TCP) programs are now planned. The first will be the standard operations program and will provide command processing, data recording, and transmission of one engineering and one science stream for one spacecraft for any allowable combination of spacecraft data rates, except for high-rate data of 4 kilobits/s and above; an optional use of this program will allow processing of high-rate data in excess of 4 kilobits/s when no other processing is performed. The second program will provide for playback of TCP recordings after the pass in order to fill in gaps in the master data record. The third program will be used at DSS 14 only and will provide processing of two engineering streams, one from each spacecraft, and command processing for one spacecraft.