Mariner Mars 1971 Mission Support

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While continuing to provide the tracking and data acquisition function for Mariner 9 on its journey to Mars, the DSN is planning and practicing for the orbital operations. The final steps of implementation and the test plans for orbital operations are outlined in this article.

I. Introduction

Previous articles have described the complex plans and configurations of the DSN for supporting the operations of the *Mariner* Mars 1971 mission. The time has finally arrived when we can describe the application of some of these plans and configurations; but the implementation, planning, testing, and training continues, because of the all-important Mars orbit operations beginning in November.

II. Cruise Support

After the loss of *Mariner 8* in the Atlantic Ocean off Puerto Rico, *Mariner 9* was successfully launched on Memorial Day, May 30, 1971. DSN coverage, starting with initial acquisition by DSS 51, has been continuous and nearly flawless. The continuous coverage was not initially a Project requirement, but with only one remaining spacecraft, the Project requested the DSN to apply to *Mariner 9* all resources that it had planned to apply to the dual mission. This has been done by the DSN, except in the area of 360/75 computer support, where, because of pressing development needs, the originally planned continuous support has been cut first to 14 h/day and then to 8 h/day. It is expected to be restored to 24 h/day before Mars orbit insertion.

The sacrifice of 10 to 16 h/day of 360/75 computer support has not been painless. Command activity has had to be limited, except for cases where manual commanding is acceptable, to the up-time of the 360/75 computers. Analysis of metric data has come to a standstill because the full 8 h is required to recall and process the data which has been piling up in the 490 communications processor. Monitor activity has been halted for 16 h of the day. DSN telemetry system analysis and Project data analysis is now heavily dependent on the mission and test computers (MTCs). And finally, pre-pass data flow tests cannot always be completely performed. Operations have been difficult under these conditions, but due to resourcefulness the result has been a smoother cruise operation than many expected.

There have been three notable spacecraft problems during cruise: excess usage of attitude-control gas, occasional loss of some telemetry measurements because of a commutator problem, and a decreased spacecraft transmitted signal level. Only the last problem has had any

effect on the DSN; several DSS 14 tracks have been scheduled where special spectrum analysis equipment is used in an attempt to isolate the problem.

III. Changes In Plan

In some cases, pre-mission generated plans have been modified for one of two reasons: a one rather than two-spacecraft mission, or late deliveries from implementation. The DSS 14 telemetry and command configuration was modified from a unique three-computer configuration to a standard two-computer configuration because of the need to process for only one spacecraft. In addition, the dual-engineering program was eliminated.

The 360/75 computer implementation schedule problems caused the deletion of many planned capabilities, including all master data record (MDR) and experiment data record (EDR) generation, all high-rate telemetry processing, and the interface with the high-speed data line to Boulder, Colorado. These processing loads were shifted to the MTCs; the MTC is also providing the DSN Telemetry Analysis Group a rudimentary network analysis capability.

IV. Implementation Progress

Implementation progress has not been as fast as originally planned, especially with the SFOF computers. 360/75 Model 3 was made available for operations in early August, and Model 4 will first be available after the start of Mission Operations System (MOS) orbital training. These problems and possibility of worse problems resulted in the deletion of many earlier planned capabilities. However, none of the deletions were critical or without an alternate. The Model 4 system is based upon the Manned-Spacecraft-Center-produced real-time operating system (RTOS) 15, rather than RTOS 13 as in earlier models and is expected to provide significant capability improvements.

The telemetry and command processor assembly (TCP) software also had its problems. It was discovered that the 16.2-kbps telemetry could not be processed properly, and several weeks of schedule time were lost before the problem was isolated and rectified.

V. Planning for Test and Training

The DSN plans the following activities prior to the beginning of support of orbital operations:

(1) Integration of facility elements

(2) Network system tests

(3) Combined system/combined station tests

(4) Facility training

(5) Network training

Because of late delivery of some equipment, these functions will not be able to be performed linearly with Project training; there will be some overlap. Therefore, both MOS and DSN personnel are working closely together to assure a test and training schedule with both maximum checkout of the ground systems and minimum impact on operations activities and training plans.