Helios Mission Support

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TDA Mission Support

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This article reports on activities of the Network Operations organization in support of the Helios Project during December 1976 and January 1977.

I. Introduction

This article is the fourteenth in a continuing series of reports that discuss Deep Space Network support of Helios mission operations. Included in this report is information concerning the demonstration tracks conducted over DSS 12 and DSS 62 utilizing the Mark III-DSN Data Subsystem, the Helios-2 Receiver-1 failure, the future use of the STDN-DSN telemetry and command cross-support, and other mission-oriented information.

II. Mission Operations and Status

Helios-1 continues to function normally in its extended mission. The fourth aphelion occurred on January 8, 1977, without any problems. During the aphelion, the spacecraft configuration was medium power, high-gain antenna, bit rate of 512 bps, and all experiments on. No critical spacecraft temperature exceedings occurred.

The Helios-2 spacecraft encountered some difficulty during this past period, namely, the apparent failure of its Receiver 1 on January 7, 1977. As a result, the command subcarrier has been changed to 448 Hz from 512 Hz while using Receiver 2. No problems are expected with command support on Receiver 2 using a 10-kW uplink in the near future. Receiver 1 was acquired again on January 12, 1977, only to be lost again shortly thereafter. Before the receiver failure, Helios-2 passed a greyout zone on January 1, 1977. This phase was covered by DSS 42 in Australia and later by station 67/68 in Weilheim, Germany. The Sun-Earth-Probe angle at entry was 0.38 deg and 0.46 deg at exit. The second aphelion for Helios-2

occurred on January 20. This period was not covered by a ground station, but the next data received showed no problems were encountered.

III. Special Activities

A. Mark III-DSN Data Subsystems Support of Helios

Since the report of the first demonstration track utilizing the Mark III-DSN Data Subsystem at DSS 12 for Helios (Ref. 1), 11 such passes have been conducted. As a result, DSS 12 has been committed to support Helios flight operations. Following is a brief summary of the last 10 demonstration passes and the problems encountered.

Between January 5, 1977, and January 25, 1977, 10 demonstration tracks with Helios spacecraft were conducted over DSS 12. In nearly every instance, the same problems and detrimental conditions were evident. Listed below is a brief description of each and the resulting effect on operations.

(1) The Communications and Monitor Formatter was unable to consistently provide high-speed data output to the station's communications buffer and in turn to the Network Operations Control Center. Also, data such as command and predicts going to the station were hindered due to this same condition. Since the first tests, hardware and software changes have improved operation. Work is continuing to correct the remaining problems.

(2) The Telemetry Processor Assembly (TPA), when processing sequentially coded data, was unable to interface properly with the Temporary Original Data Record (TODR), and a failure in the TPA resulted. It was found that with the addition of three modifications to the MODCOMP computer within the TPA, this problem was corrected. In the interim, the TODR has been disabled while sequentially coded data were being processed.

(3) The Star Switch Controller, which interconnects all devices to the Communications and Monitor Formatter, was found to be arbitrarily reassigning output ports without operator intervention. This problem is being worked on and a solution is expected soon.

(4) The interface between the Digital Instrumentation Subsystem and the Star Switch Controller has not been adequate. The result has been dropouts of monitor data leaving the station. This problem is also being looked into in order to correct it as soon as possible.

(5) During the early test tracks, the Network Operations Control Center was lacking adequate monitor software, and the station's monitor data could not be validated and processed. Now that the software is available, this problem no longer exists.

(6) The Communications and Monitor Formatter seems limited as to what speed data can be replayed to or received from the Network Operations Control Center. Transmission rates in excess of 1 block per second create data gaps. This problem needs correction, because a rate of 5 blocks per second is what the system should be able to accommodate.

In addition to DSS 12 at Goldstone, California, DSS 62 in Spain began its Mark III-DSN Data Subsystems test and training phase on February 2. The first Helios demonstration track was conducted with DSS 62 on February 12. On this particular pass, no problems were encountered and this test was highly successful. Although the problems listed above were not evident during this particular exercise, they have been observed on previous testing with other projects at the Madrid station.

The configuration for Helios support is the same at DSS 62 as it is at DSS 12 (see Fig. 1).

B. STDN-DSN Cross-Support

Beginning March 1, 1977, the STDN-DSN cross-support configuration (Ref. 2) will again be required for Helios operations support. Prior to this time, the cross-support configuration will be tested to ensure success. The results of this and the actual real-time support will be reported in future articles. Also, the difference in the predicted signal-to-noise ratio of Helios-2 data and the actual level received, observed during the last cross-support period (Ref. 1), may be further explained.

References

1. Goodwin, P. S., Burke, E. S., and Adamski, T. P., "Helios Mission Support," in *The Deep Space Network Progress Report 42-37,* pp. 39-42, Jet Propulsion Laboratory, Pasadena, Calif., Dec. 28, 1976.

2. Goodwin, P. S., Burke, E. S., and Morris, R. E., "Helios Mission Support," in *The Deep Space Network Progress Report 42-36,* pp. 28-34, Jet Propulsion Laboratory, Pasadena, Calif., Oct. 15, 1976.

Table 1. Helios tracking coverage

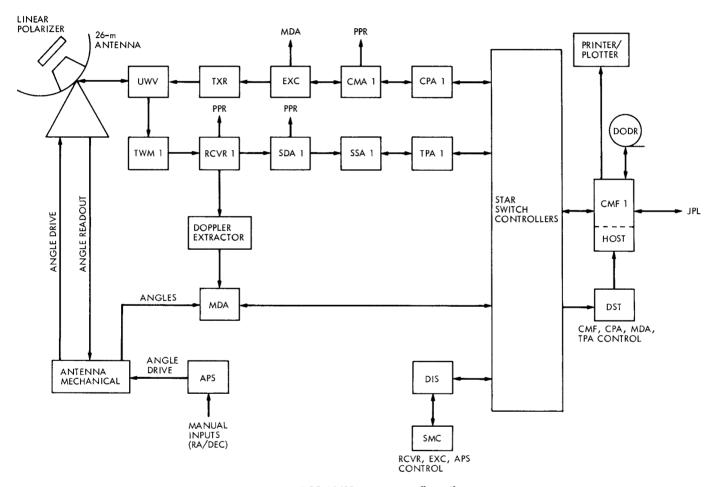| Period	Spacecraft	Station type	Number of tracks	Tracking/time, hr, min
December, 1976	Helios-1	26-meter	35	317:09
		64-meter	2	12:47
	Helios-2	26-meter	24	291:55
		64-meter	3	38:09
January, 1977	Helios-1	26-meter	27	180:59
		64-meter	4	22:13
	Helios-2	26-meter	35	208:36
		64-meter	3	11:33

Fig. 1. DSS 12/62 support configuration