The DSN Hydromechanical Service Program—A Second Look

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The DSN Hydromechanical Service Program has progressed satisfactorily along the lines originally intended. The results of oil sampling and analysis have been particularly rewarding, detecting early signs of wear and forestalling catastrophic failures.

Since the status report in Technical Report 32-1526 (Vol. XIV, pp. 216–222), the program has progressed with gratifying results. Oil analysis is now being routinely performed for all 26-m stations and, on request, at the 64-m stations.

The past year of operation (Dec. 1972–Oct. 1973) has provided many examples of the value of a centralized oil analysis program and a hydromechanical repair facility in discovering anomalous conditions and providing restorative service:

(1) A servo pump from DSS 12 showed an increase in metal particle count and was also reported to be somewhat noisy. Disassembly and an inspection revealed a missing spring retainer pin, excessive wear in the piston and shoe assembly, excessive wear in the creep plate, bad shaft bearings, damaged hanger clevis, and splitting of the shaft seal. It can be assumed that failure was imminent and that a catastrophic failure was averted as a result of oil analysis. The pump was overhauled, tested, and returned to service.

(2) A new 64-m antenna drive motor was received for testing prior to shipment to DSS 14. The test failed due to a seized check valve in the crosscheck manifold. The motor was returned to the manufacturer under warranty. If this motor had not been tested prior to installation, it would have resulted in a failure at DSS 14. The motor was retested after the repair and the test was satisfactory. The motor is currently in operation at DSS 14.

(3) In December 1972, all 26-m antenna drive motors were drawn from network spares and shipped to the DSN Maintenance Center for testing prior to use in an exchange program. It was found that none of the motors was operational, and a major overhaul effort was required.

(4) In December 1972, an analysis of DSS 12 hydraulic oil revealed a high concentration of metal from pump number two. An inspection performed by station personnel revealed a failed hanger needle bearing.

(5) In May 1973, an analysis of DSS 62 hydraulic oil revealed a high concentration of metal from pump number two and severe depletion of oil viscosity improver. The station was subsequently requested to change the pump and to drain, clean and refill the system. The pump was returned to the DMC for maintenance.

(6) In June 1973, an analysis of DSS 61 gear reducer oil revealed a high concentration of water in the hour-angle east gear reducer. A recommendation was made to drain the gear reducers, spray the interior with isopropyl alcohol to absorb the water, add approximately 76 l of new oil and agitate with compressed air for 2 h, then drain the gear reducer and refill with new oil. After 30 days of operations, a sample was submitted for analysis and showed water content well below the oil specifications.

(7) In July 1973, an analysis of DSS 14 gear reducer oil revealed high metal concentration and depletion of viscosity improver. Oil was changed on all gear reducers.

(8) In August 1973, an analysis of DSS 43 and DSS 63 gear reducer oil revealed very heavy contamination. The two systems were drained, flushed, inspected, and refilled. An analysis of the oil presently in use will be done in the near future.

(9) Figures 1 and 2 show the rotating group of a 64-m antenna drive motor removed from DSS 42 because of blown seals and a faulty crossfeed valve. Internal inspection revealed that a complete separation of the rotating group had occurred, resulting in severe damage to the cylinder block, seizure of one piston in the block, and separation of the piston from the shoe. A new rotating group was installed, and the motor was tested for smooth operation and static tested prior to being returned to the station.

A complete change of pumps and motors is near completion at DSSs 11 and 12. Already there has been a significant improvement in the contamination levels from these two stations during routine oil analysis.

In the near future, routine oil analysis will be facilitated for the 64-m antenna systems. The program to exchange hydraulic components with rebuilt and serialized components will continue until all stations are completed. Then the equipment will be monitored through oil analysis and recording of operational time on the components. These two factors will determine frequency of replacement.

Fig. 1. 64-m antenna drive motor cylinder block

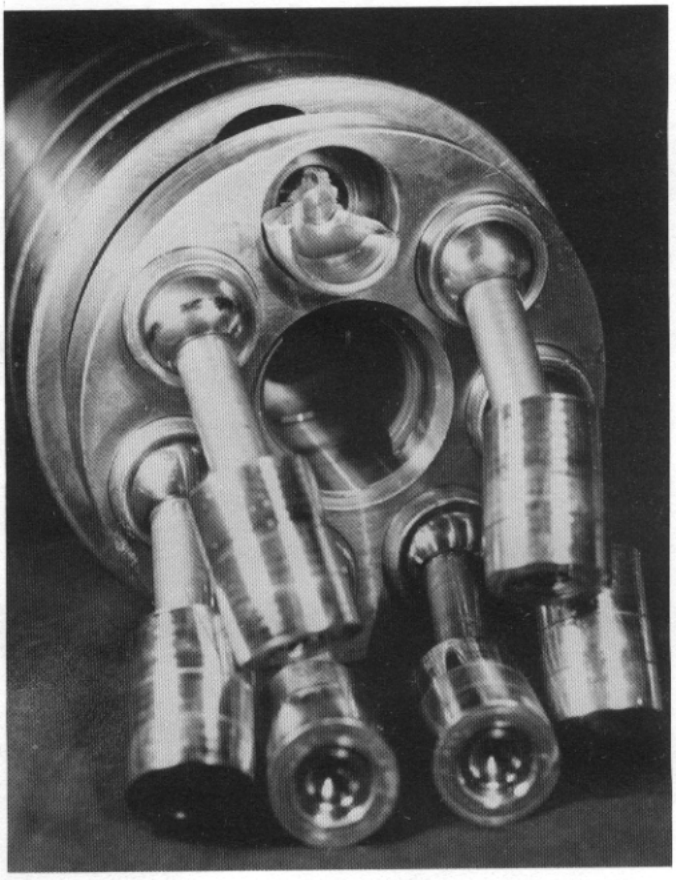

Fig. 2. 64-m antenna drive motor shaft and piston assembly (Note separation of piston from bronze shoe.)