DSN Research and Technology Support

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The major current activities of the Development Support Group at both the Venus Deep Space Station and the Microwave Test Facility are presented, and accomplishments and progress are described. Activities include pulsar measurements, tri-cone implementation, precision antenna gain measurement (26-m antenna), weak source observations, Faraday rotation measurements on Applications Technology Satellite 1 (ATS-1), clock synchronization transmissions, and Block IV receiver/exciter testing and demonstration.

The Development Support Group, Section 335, is currently engaged in the following activities at DSS 13 and the Microwave Test Facility (MTF) at GDSCC.

I. DSS 13 Activities

A. In Support of Section 331

1. Pulsars. The twenty pulsars tabulated in Ref. 1 continue to be regularly observed during approximately 24 hours per week, and data on pulse-to-pulse spacing, power density spectra, and pulse arrival time continue to be obtained.

B. In Support of Section 332

1. Tri-cone support structure (TCSS). Waveguide and transmitter (20 and 400 kW) maser and receiver, water and helium/nitrogen plumbing and all control and power cabling have been installed. The S-Band polarization diversity (SPD) cone has been installed on top of the TCSS and testing of the 20-kW transmitter, both into the water load and out the feedhorn, has been completed. All low-level RF measurements have been completed on the waveguide and testing of the 400-kW transmitter has started.

C. In Support of Section 333

1. Precision antenna gain measurement (26 m). This program continues strongly with observations of Cygnus A and Apollo Lunar Surface Experiments Package (ALSEP). The gain standard horn has been relocated to a position just outside the periphery where there will be less interference from signals reflected off the subreflector.

2. Weak source observations. This program also continues strongly, with the noise adding radiometer (NAR) being used to observe radio sources 3C123, 3C218, 3C273, 3C348, 3C353, Virgo A, and the planet Jupiter. Additionally, technique and equipment improvement continue

with substantial testing being done with the antenna positioned to point at Polaris or an azimuth of 180 deg and elevation of 87 deg.

3. Faraday rotation. Geostationary satellite ATS-1 continues to be monitored to determine Faraday rotation of the signal at 137.5 MHz. This data can then be used to make ionospheric corrections to the doppler and range measurements made of *Mariner* 9. The Smythe receiver, a dual channel phase lock receiver, has been returned from maintenance and has been placed into operation to complement measurements made by the receiver from Stanford.

D. In Support of Section 335

1. 100-kW Clock synchronization transmitting system. The 100 KW klystron failed (shorted filament) and was replaced, and various minor software and hardware changes have been made. Routine transmissions are being successfully made to all equipped stations, specifically DSSs 14, 41, 42, 51, 62, and USNO. Antenna pointing problems have been resolved by calibration of the position readouts on the nine-meter antenna, and operation continues with minor problems with the SDS-910 computer causing occasional delay.

2. Block IV receiver/exciter. Successful interfacing between the station SDS-910 computer and the Block IV receiver/exciter was accomplished and fully automatic programmed oscillator control, AGC curve generation, and spacecraft acquisition and tracking (PN-6) was demonstrated as part of the TDA briefing on October 28, 1971. The system was subsequently removed and returned to JPL for further testing and development.

II. Microwave Test Facility

A. In Support of Section 332

1. Tri-cone support structure. Extensive machine shop support continues to be furnished, in particular redrilling of a precision drill jig (with which the TCSS floor is drilled to accept the 400-kW transmitter), and manufacture of numerous copper WR430 waveguide spacers, and various flanges, adapters, etc. Additionally, supervision of the low-level RF waveguide testing by the subcontractor was accomplished to ensure compliance with the statement of work.

B. In Support of Section 335

1. 100-kW Clock synchronization transmitter. Fabrication of waveguide, connectors, adapters, etc., continues as well as replacement of the buffer amplifier klystron and extensive RF survey work.

C. In Support of Section 337

1. Antenna and klystron checkout. A Standard Test Antenna (STA) to be reinstalled into DSS 11, was calibrated using the antenna range facilities. Also, a transmitter klystron was checked out using the test transmitter facilities.

Reference

1. Jackson, E. B., "DSN Research and Technology Support," in *The Deep Space Network,* Technical Report 32-1526, Vol. III, p. 158, Jet Propulsion Laboratory, Pasadena, Calif., June 15, 1971.