Dual-Frequency Feed System for 26-Meter Antenna Conversion

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New cassegrain feed cone assemblies are being designed as part of the upgrade of three 26-meter diameter antennas to 34-meter diameter with improved performance. The new dual-frequency feed cone (SXD) will provide both S- and X-band feed systems and traveling wave masers, with a reflex reflector system to permit simultaneous operation analogous to the 64-meter antennas.

I. Introduction

In order to extend the capabilities of a subnet of 26-meter antennas, it is planned to upgrade three stations to 34-meter diameter and generally improve their structural and microwave performance. The portion of this task that involves adding X-band receiving capability and improving the S-band feed performance in support of Voyager and later missions is described in this article.

II. SXD Cone Assembly

A new cassegrain feed cone assembly, designated the SXD cone (for dual S- and X-band), is being designed to replace the 15-year old S-band cassegrain monopulse (SCM) feed cone. The microwave design of the SXD cone is essentially complete and fabrication of components for the first cone (for DSS 12) is nearing completion. Assembly of the components into the cone shell is scheduled to commence not later than November 1977. Remaining design tasks involve support bracketry, cables, connector interfaces, and other details.

Figure 1 shows the basic layout of the major components within the SXD cone. The feeds are tilted toward each other to accommodate the reflex geometry. Above the large S-band horn will be mounted an ellipsoidal reflector that focusses the energy toward a dichroic plate above the X-band feed. The dichroic plate reflects S-band energy but is nearly transparent to X-band energy. Thus, the antenna will be capable of operating simultaneously at the two frequency bands in the same manner as the 64-meter antennas.

The S-band feed will contain two quarter-wave plate polarizers and three rotary joints so that complete polarization selectability will be available in the future as requirements arise. Present plans are to implement only a manually selected right- or left-hand circular polarization capability for the initial installation. Since no orthogonal-mode transducer is provided (space limitations prohibit its use without a new horn design), it will not be possible to receive two polarizations simultaneously as the 64-meter antennas are equipped to do. A diplexer and the necessary filtering and isolation is provided to permit simultaneous transmission of S-band uplink signals of 20 kW (up to 100 kW in the future).

The X-band feed is the same design as the XRO Mod II feed (Ref. 1), except that the mounting flange is adapted to the geometry of the SXD cone. This feed is capable of remote selection of either right- or left-hand circular polarization. There are no present plans for an X-band uplink on the 26- or 34-meter antennas.

Table 1 presents the design requirements for the SXD cone assembly. It is anticipated that all requirements will be met. Testing of the completed cone assembly is scheduled for the second quarter of 1978. Two more SXD cones for Australia (DSS 44) and Spain (DSS 62) will be fabricated and assembled to complete the subnet in 1979.

Reference

1. Hartop, R. W., "Selectable Polarization at X-Band," in *The Deep Space Network Progress Report 42-39*, pp. 177-180, Jet Propulsion Laboratory, Pasadena, Calif., June 15, 1977.

Table 1. SXD cone assembly design requirements

Parameter	S-band		X-band
	Transmit	Receive	Receive
Frequency, MHz	2110 ±10	2285 ±15	8420 ±20
Gain, dBi	55.3 ±0.7	$56.1^{+0.3}_{-0.9}$	$66.9^{+0.3}_{-0.9}$
System Noise Temperature, K	–	27.5 ±2.5[a]	25.0 ±3.0

[a]With diplexer; 21.5 ±2.5K in receive-only mode.

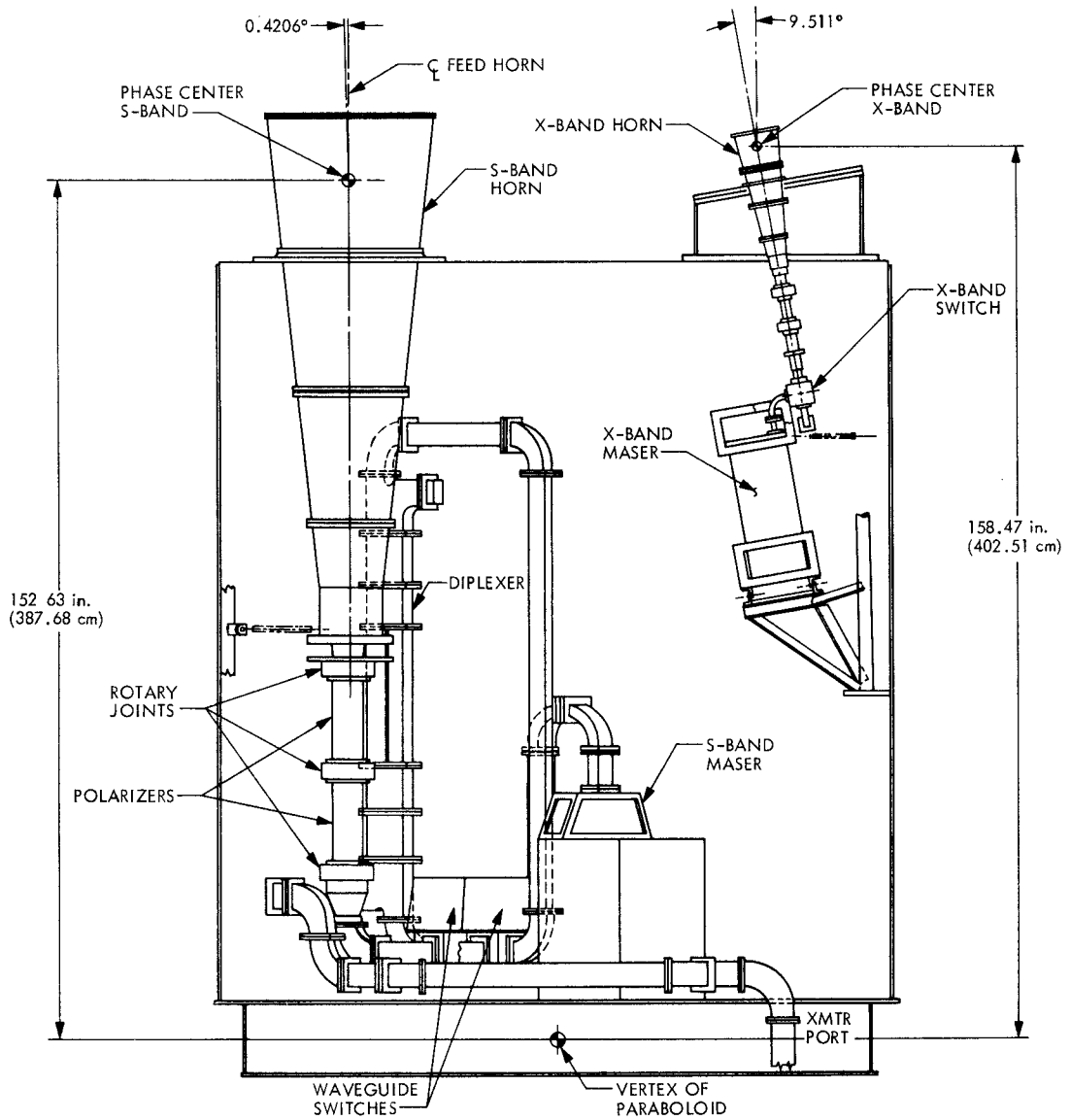

Fig. 1. SXD cone assembly layout