November 1971

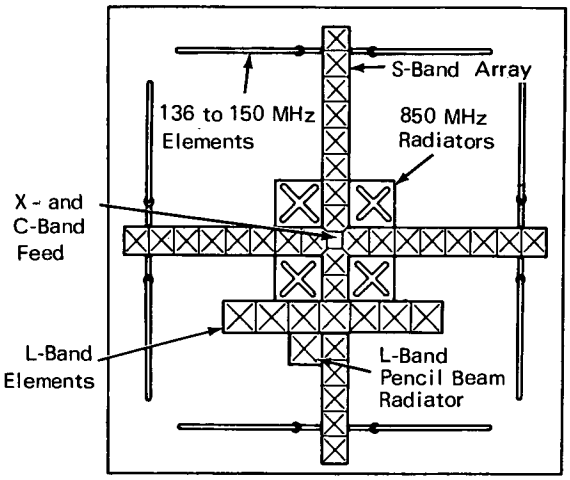
Brief 71-10410

NASA TECH BRIEF

Goddard Space Flight Center

Composite Antenna Feed System Operates from VHF to X-Band

A composite antenna feed system (see fig.), compatible with frequencies from VHF to X-band, has high radiation efficiency and minimal interaction between elements when inserted between a multimode, multifrequency transponder and a parabolic reflector in an airborne communications system.



The X-band feed consists of a center-mounted multimode horn with a radiating aperture reduced in cross-section to allow for closer spacing of S-band elements. The reduced section is dielectric-loaded to support the necessary modes and to shape the primary radiation pattern. The horn excitation is derived from a conventional four-port comparator through a four-port rectangular-to-square transition. All modes for monopulse operation are generated within the horn structure, and, in combination, produce sum and difference primary patterns.

At C-band, the feed is excited through the shunt ports located on opposite walls of the horn. Because the multimode horn is shared with the C-band feed, the C-band beam is coincident with the X-band sum channel beam.

The S-band feed is composed of 32 cavity-backed turnstile elements, each connected to a diplexer and mounted in a cross-array coincident with the feed axis. The four innermost elements form a monopulse feed with a diamond configuration which can be used for single aircraft tracking. An independent-feed phase center, composed of transmit and receive switching networks, generates 32 secondary beams for additional communication coverage.

The L-band feed is comprised of seven crossed-dipole elements mounted in a line-array to form the fan beam. The array consists of two groups of three elements each and a seventh element which is shared with the S-band array. The feed-array illuminates the reflector with an elliptical primary pattern, producing an amplitude and constant phase in the normal plane. An asymmetric reflector illumination generates a fan-shaped secondary beam having a given half-power beamwidth. In addition to the fan beam, a symmetrical pencil beam is generated using a separate single-cavity-backed, crossed-dipole element.

The UHF feed consists of four crossed dipole radiators reduced in size to allow for closer spacing between the element phase centers. The four elements are fed with equal amplitude and phase, generating a secondary beam coincident with the antenna system axis.

The VHF feed, which illuminates the reflector, consists of eight $\lambda/4$ loops (stubs) that form four dipoles mounted at the end of the S-band arrays. The dipoles are connected to a comparator network, where both the circularly polarized and two

(continued overleaf)

orthogonal linearly polarized error patterns are generated. A secondary beam in the 136-150 MHz frequency is generated, with sufficient gain to provide a special link for transmitting selected data to the ground station.

Note:

Requests for further information may be directed to:

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Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to:

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Source: V. Jakstys of
Philco-Ford Corp.
under contract to
Goddard Space Flight Center
(GSC-11046)