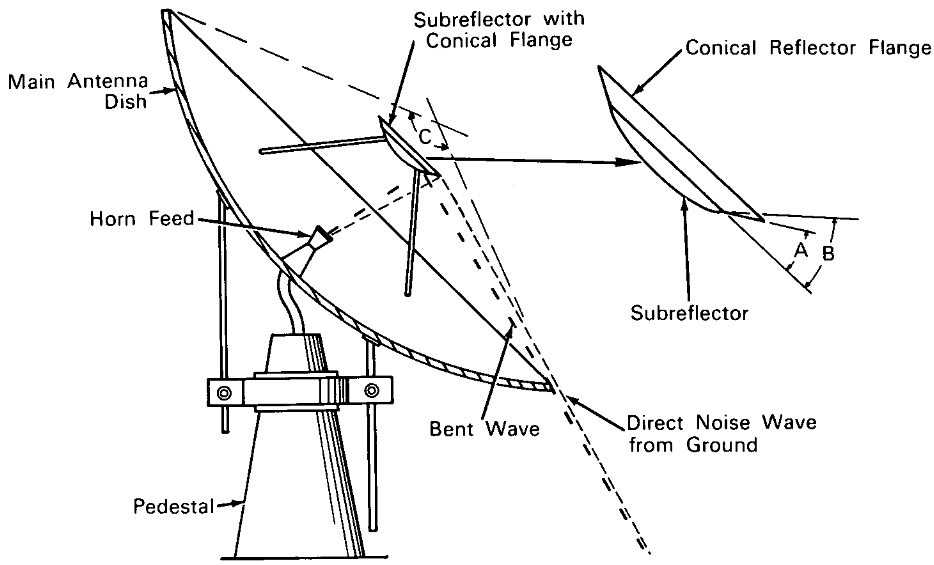
NASA TECH BRIEF

This NASA Tech Brief is issued by the Technology Utilization Division to acquaint industry with the technical content of an innovation derived from the NASA space program.

Flange on Microwave Antenna Subreflector Cuts Ground Noise



The problem: Undesirable noise picked up by a Cassegrainian microwave antenna when energy radiated from the ground around the antenna enters the horn feed. Microwaves, having wavelengths of significant size as compared to the size of the main parabolic reflector of the antenna, are emitted by the warm ground at the antenna site and cause noise in the receiver system. These waves are radiated by the surrounding warm ground, bend around the edges of the main reflector dish, are reflected by the subreflector, and enter the horn feed. The result is unwanted noise in the microwave signal received.

The solution: Redesign the subreflector so that its outer edge has a conical flange. Noise is greatly reduced by causing the undesired energy to cancel out before entering the antenna.

How it's done: By adding a conical flange around the circumference of the subreflector, the noise wave from the ground can be cancelled by another from the same source. This is due to the fact that the bent wave from the ground is approximately one half wavelength shorter than a direct wave from the ground. When the two waves arrive at the horn feed they are about 180 degrees out of phase and cancel, significantly reducing the noise.

The size of the conical flange and its angle with respect to the plane of the subreflector are adjusted until the noise level is reduced to a low level, while the efficiency of the antenna is still high. In the drawing, angle A lies between the flange and the plane of the subreflector, while angle B lies between a tangent to the subreflector and the plane of the subreflector. High antenna efficiency with reduced noise level has

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been achieved by using a flange having an inner-to-outer radius difference of two wavelengths, and an angle A, about three-fourths the size of angle B.

Using this method, the following is the design criteria for the development of a flange for a typical Cassegrainian antenna. Referring to the illustration, the main dish is 8.5 feet in diameter and subtends an angle C of 122 degrees. The subreflector is 0.8 of a foot in diameter with an angle B of 24.4 degrees. If the antenna is receiving and broadcasting on a frequency of 9.6 KMC, a flange having a rim of 0.2 of a foot with an angle A of 18.4 degrees will reduce the noise to a minimum while increasing the efficiency to near maximum.

Notes:

1. Transmitting efficiency is also increased by the inclusion of the conical flange. Energy from the horn feed that would normally be lost by bending around the edge of the main parabolic reflector is reflected back to it, increasing antenna efficiency. This should be of value in microwave and communications systems.
2. For further information about this innovation inquiries may be directed to:

   Technology Utilization Officer
   Jet Propulsion Laboratory
   4800 Oak Grove Drive
   Pasadena, California 91103
   Reference: B63-10229

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA Headquarters, Washington, D.C. 20546.

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