brator's speaker is mounted at one end of a 14-cm-long and 4.1-cm diameter small plane-wave tube. This length was chosen so that the first evanescent cross mode of the plane-wave tube would be attenuated by about 90 dB, thus leaving just the plane wave at the termination plane of the tube. The tube terminates with a small, acrylic plate with five holes placed symmetrically about the axis of the speaker. Four ports are included for the four microphones on the probe. The fifth port is included for the pre-calibrated reference microphone.

The ports in the acrylic plate are in turn connected to the probe sensing elements via flexible PVC tubes. These five tubes are the same length, so the acoustic wave effects are the same in each tube. The flexible nature of the tubes allows them to be positioned so that each tube terminates at one of the microphones of the energy density probe, which is mounted in the acrylic structure, or the calibrated reference microphone. Tests performed verify that the pressure did not vary due to bends in the tubes. The results of these tests indicate that the average sound pressure level in the tubes varied by only 0.03 dB as the tubes were bent to various angles.

The current calibrator design is effective up to a frequency of approximately 4.5 kHz. This upper design frequency is largely due to the diameter of the plane-wave tubes.

*This work was done by Scott D. Sommerfeldt and Jonathan D. Blotter of Brigham Young University for Stennis Space Center.*

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*Refer to SSC-00248, volume and number of this* NASA Tech Briefs *issue, and the page number.*

# Four-Way Ka-Band Power Combiner

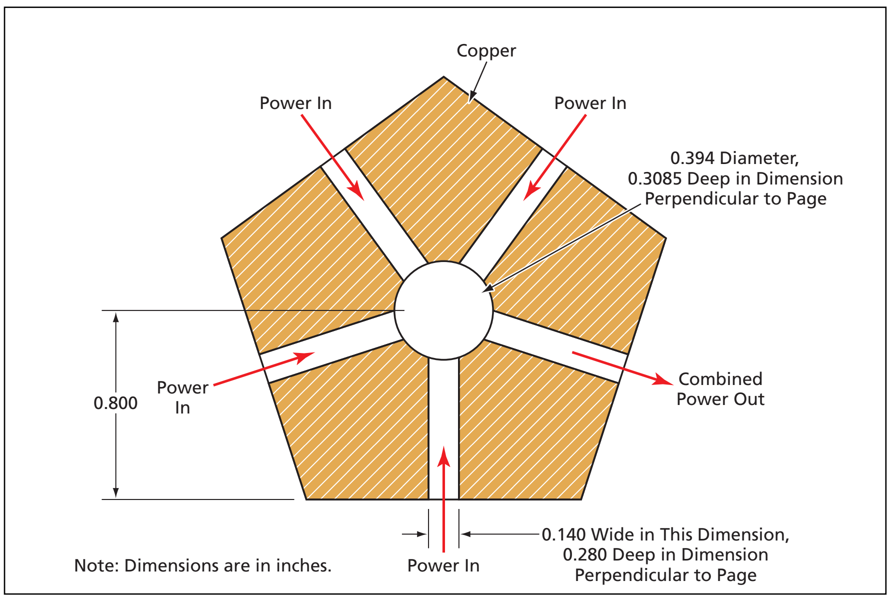
**A prior X-band design has been adapted to Ka band.**

*NASA's Jet Propulsion Laboratory, Pasadena, California*

A waveguide structure for combining the outputs of four amplifiers operating at 35 GHz (Ka band) is based on a similar prior structure used in the X band. The structure is designed to function with low combining loss and low total reflected power at a center frequency of 35 GHz with a 160 MHz bandwidth.

The structure (see figure) comprises mainly a junction of five rectangular waveguides in a radial waveguide. The outputs of the four amplifiers can be coupled in through any four of the five waveguide ports. Provided that these four signals are properly phased, they combine and come out through the fifth waveguide port.

*This work was done by Raul Perez and Samuel Li of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).*
*NPO-41291*




The **Power Combiner Structure** has five ports, of which four are used for input and one for output. This is a simplified cross-sectional view: holes for fastening and cooling are omitted for the sake of clarity.

# Loss-of-Control-Inhibitor Systems for Aircraft

**Excessive commands are resisted by feedback in the form of damping forces.**

*Langley Research Center, Hampton, Virginia*

Systems to provide improved tactile feedback to aircraft pilots are being developed to help the pilots maintain harmony between their control actions and the positions of aircraft control surfaces, thereby helping to prevent loss of control. A system of this type, denoted a loss-of-control-inhibitor system (LOCIS) can be implemented as a relatively simple addition to almost any pre-existing flight-control system. The LOCIS concept offers at least a partial solution to the problem of (1) keeping a pilot aware of the state of the control system and the aircraft and (2) maintaining sufficient control under conditions that, as described below, have been known to lead to loss of control.