

been computationally simulated; for comparison, the performances of linear and nonlinear coherent DTTLs have also been computationally simulated. The results of these simulations show that, among other things, the expected mean-square timing errors of coherent

and noncoherent DTTLs are relatively insensitive to window width. The results also show that at high signal-to-noise ratios (SNRs), the performances of the noncoherent DTTLs approach those of their coherent counterparts at, while at low SNRs, the noncoherent DTTLs

incur penalties of the order of 1.5 to 2 dB.

This work was done by Marvin Simon and Andre Tkachenko of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-42540

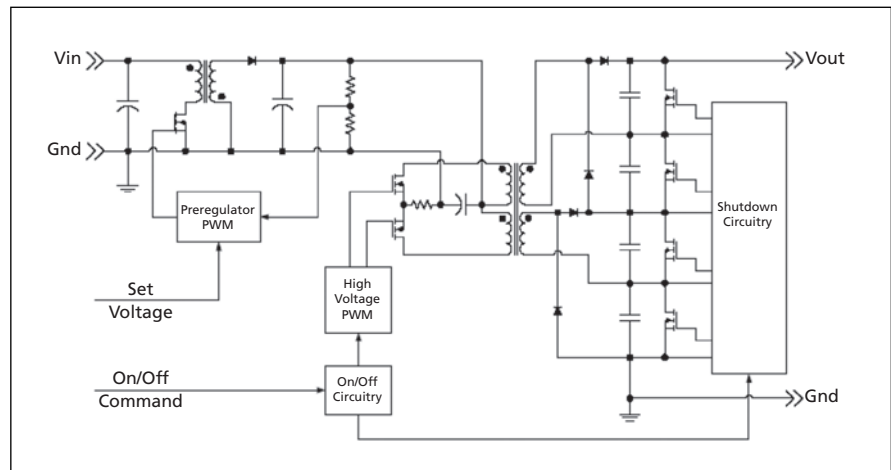
High-Voltage Power Supply With Fast Rise and Fall Times

Output is electronically programmable and electronically switchable.

Marshall Space Flight Center, Alabama

A special-purpose high-voltage power supply can be electronically switched on and off with fast rise and fall times, respectively. The output potential is programmable from 20 to 1,250 V. An output current of 50 μ A can be sustained at 1,250 V. The power supply was designed specifically for electronically shuttering a microchannel plate in an x-ray detector that must operate with exposure times as short as 1 ms. The basic design of the power supply is also adaptable to other applications in which there are requirements for rapid slewing of high voltages.

The power-supply circuitry (see figure) includes a preregulator, which is used to program the output at 1/30 of the desired output potential. After the desired voltage has been set, the outputs of a pulse width modulator (PWM) are enabled and used to amplify the preregulator output potential by 30. The amplification is achieved by use of two voltage doublers with a transformer that has two primary and two secondary windings. A resistor is used to limit the current by controlling the drive voltage of two field-effect transistors (FETs) during turn-on of the PWM. A pulse transformer is



This Power-Supply Circuit features a rise time of 80 μ s and a fall time of 60 μ s.

used to turn on four FETs to short-circuit four output capacitors when the outputs of the PWM have been disabled. The most notable aspects of the performance of the power supply are a rise time of only 80 μ s and a fall time of only 60 μ s at a load current of 50 μ A or less. Another notable aspect is that the application of a 0-to-5-V square wave to a shutdown pin of the PWM

causes the production of a 0-to-1,250-V square wave at the output terminals.

This work was done by Douglas B. Bear-den, Richard M. Acker, and Robert E. Kapustka of Marshall Space Flight Center. For further information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-31912-1.

Waveguide Calibrator for Multi-Element Probe Calibration

Acoustic waveguide technology produces the same acoustic field at each of the sensing elements.

Stennis Space Center, Mississippi

A calibrator, referred to as the "spider" design, can be used to calibrate probes incorporating multiple acoustic sensing elements. The application is an acoustic energy density probe, although the calibrator can be used for other types of acoustic probes. The calibrator relies on the use of acoustic waveguide technology to produce the same acoustic field at each of the sensing elements. As a result, the sensing elements

can be separated from each other, but still calibrated through use of the acoustic waveguides.

Standard calibration techniques involve placement of an individual microphone into a small cavity with a known, uniform pressure to perform the calibration. If a cavity is manufactured with sufficient size to insert the energy density probe, it has been found that a uniform pressure field can only be created at very

low frequencies, due to the size of the probe. The size of the energy density probe prevents one from having the same pressure at each microphone in a cavity, due to the wave effects.

The "spider" design probe is effective in calibrating multiple microphones separated from each other. The spider design ensures that the same wave effects exist for each microphone, each with an individual sound path. The cali-

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.

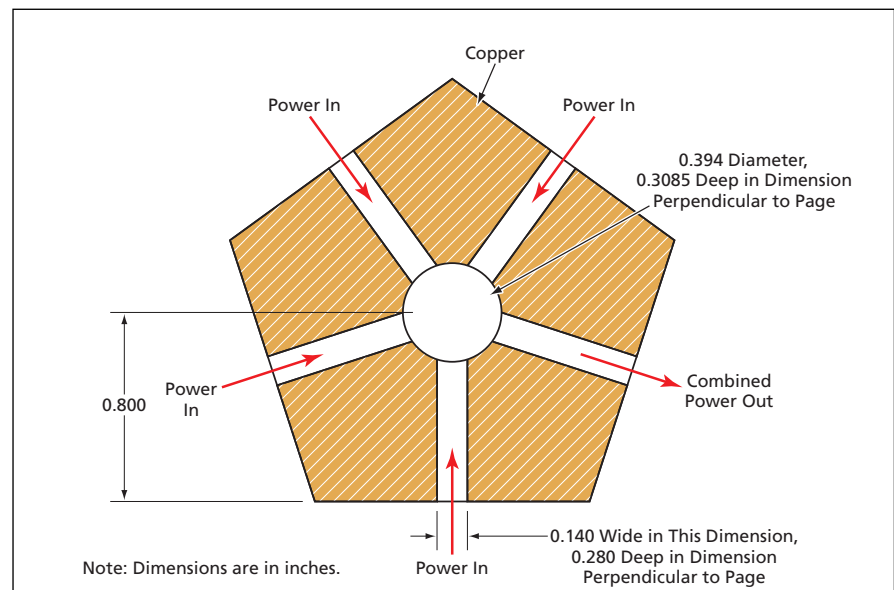
NASA's Jet Propulsion Laboratory, Pasadena, California

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 con-

trol. 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.