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High Power Amplifier and Power Supply

A document discusses the creation of a high-voltage power supply (HVPS) that is able to contain voltages up to –20 kV, keep electrical field strengths to below 200 V/mil (≈7.87 kV/mm), and can provide a 200-nanosecond rise/fall time focus modulator swinging between cathode potential of 16.3 kV and –19.3 kV. This HVPS can protect the 95-GHz, pulsed extended interaction klystron (EIK) from arcs/discharges from all sources, including those from within the EIK's vacuum envelope.

This innovation has a multi-winding pulse transformer design, which uses new winding techniques to provide the same delays and rise/fall times (less than 10 nanoseconds) at different potential levels ranging from –20 kV to –16 kV. Another feature involves a high-voltage printed-wiring board that was corona-free at –20 kV DC with a 3-kV AC swing. The corona-free multilayer high-voltage board is used to simulate fields of less than 200 V/mil (≈7.87 kV/mm) at 20 kV DC. Drive techniques for the modulator FETs (field-effect transistors) (four to 10 in a series) were created to change states (3,000-V swing) without abrupt steps, while still maintaining required delays and transition times. The packing scheme includes a potting mold to house a ten-stage modulator in the space that, in the past, only housed a four-stage modulator.

Problems keeping heat down were solved using aluminum oxide substrate in the high-voltage section to limit temperature rise to less than 10° while withstanding –20 kV DC voltage and remaining corona-free.

This work was done by Johnny Duong, Scot Stride, Wayne Harvey, Inam Haque, Newton Packard, Quintin Ng, and Julie Y. Ispirian of Caltech; Christopher Waian of Robert M. Hadley Co.; and Drew Janes of Vallet Syncom Circuits for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

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Refer to NPO-44241, volume and number of this NASA Tech Briefs *issue, and the page number.*

Estimating Mixing Heights Using Microwave Temperature Profiler

A paper describes the Microwave Temperature Profiler (MTP) for making measurements of the planetary boundary layer thermal structure — data necessary for air quality forecasting as the Mixing Layer (ML) height determines the volume in which daytime pollution is primarily concentrated. This is the first time that an airborne temperature profiler has been used to measure the mixing layer height. Normally, this is done using a radar wind profiler, which is both noisy and large.

The MTP was deployed during the Texas 2000 Air Quality Study (TexAQS-2000). An objective technique was developed and tested for estimating the ML height from the MTP vertical temperature profiles. In order to calibrate the technique and evaluate the usefulness of this approach, estimates from a variety of measurements during the TexAQS-2000 were compared. Estimates of ML height were used from radiosondes, radar wind profilers, an aerosol backscatter lidar, and *in-situ* aircraft measurements in addition to those from the MTP.

Relative to the benchmark radiosonde estimates, radar wind profiler ML height estimates were nearly bias-free. Airborne lidar and profiler estimates generally were in good agreement inland, but spatial gradients of ML heights made comparisons difficult near the coast. The presence of a residual layer above the sea breeze was probably responsible for a gross overestimate of ML height by lidar in a few instances. The accuracy of the MTP-based ML height estimates is similar to that of other techniques for estimating ML height. The airborne MTP thus shows promise for measuring the spatial distribution of ML structure, especially in coastal environments where aerosol lidars may have difficulty identifying the ML.

This work was done by John Nielson-Gammon and Christina Powell of Texas A&M University; Michael Mahoney of Caltech; and Wayne Angevine of CIRES for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-43887

Multiple-Cone Sunshade for a Spaceborne Telescope

A document describes a sunshade assembly for the spaceborne telescope of the Terrestrial Planet Finder Coronagraph mission. During operation, the telescope is aimed at target stars in the semi-hemisphere away from the Earth's Sun. The observatory rotates about its pointing axis during a single star observation, resulting in relative movement of the Sun. The sunshade assembly protects the telescope against excessive solar-induced thermal distortions for times long enough to complete observations.

The assembly includes a cylindrical baffle immediately surrounding the telescope, and a series of coaxial conical shields at half-cone angle increments of between 3° and 6°. The black inner surface of the cylindrical baffle suppresses stray light. The outer surface of the cylindrical baffle and all the surfaces of the conical shields except the outermost one are specular and highly reflective in the infrared. The outer surface of the outer shield is a material with low solar absorptance and high infrared emittance, such as silverized Teflon or white paint. This arrangement strongly radiatively couples each shield layer more effectively to cold space than to adjacent shield layers. The result is that the solar-driven temperature gradients in the cylindrical baffle are nearly negated, and only weakly communicated to the highly-infrared-reflective face of the primary telescope mirror.

This work was done by Terry Cafferty of TC Technology and Virginia Ford of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-41419