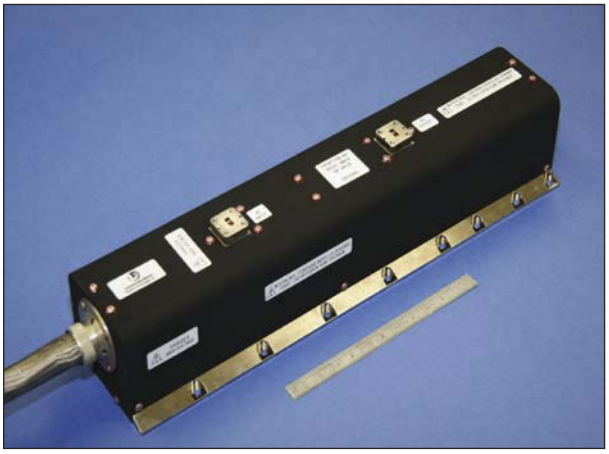
Space-Qualified Traveling-Wave Tube

TWT was developed for use as a high-power microwave amplifier for high-rate transmission of data.

John H. Glenn Research Center, Cleveland, Ohio

The L-3 Communications Electron Technologies, Inc. Model 999HA traveling-wave tube (TWT), was developed for use as a high-power microwave amplifier for high-rate transmission of data and video signals from deep space to Earth (see figure). The 999HA is a successor to the 999H — a non-space-qualified TWT described in "High-Power, High-Efficiency Ka-Band Traveling-Wave Tube" (LEW-17900-1), *NASA Tech Briefs*, Vol. 31, No. 2 (February 2007), page 32. Operating in the 31.8-to-32.3 GHz frequency band, the 999HA has been shown to generate 252 W of continuous-wave output power at 62 percent overall power efficiency — a 75-percent increase in output power over the 999H.



A **Photo of the TWT** shows its approximate dimensions. [The ruler below is 6 in. (≈15 cm) long.]

The mass of the 999HA is 35 percent less than that of the 999H. Moreover, taking account of the elimination of a Faraday cage that is necessary for operation of the 999H but is obviated by a redesign of high-voltage feedthroughs for the 999HA, the overall reduction in mass becomes 57 percent with an 82 percent reduction in volume. Through a series of rigorous tests, the 999HA has been qualified for operation aboard spacecraft with a lifetime exceeding seven years. Offspring of the 999HA will fly on the Kepler and Lunar Reconnaissance Orbiter missions.

This work was done by Jeffrey D. Wilson, Richard Krawczyk, Rainee N. Simons, and Wallace D. Williams of Glenn Research Center and Neal R. Robbins, Daniel R. Dibb, William L. Menninger, Xiaoling Zhai, and Robert T. Benton of L-3 Communications Electron Technologies, Inc. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18220-1.

Smart Power Supply for Battery-Powered Systems

This power supply can be used in remote vehicles, or for any application requiring battery power or battery charging.

John H. Glenn Research Center, Cleveland, Ohio

A power supply for battery-powered systems has been designed with an embedded controller that is capable of monitoring and maintaining batteries, charging hardware, while maintaining output power. The power supply is primarily designed for rovers and other remote science and engineering vehicles, but it can be used in any battery alone, or battery and charging source applications. The supply can function autonomously, or can be connected to a host processor through a serial communications link. It can be programmed *a priori* or on the fly to return current and voltage readings to a host.

It has two output power busses: a constant 24-V direct current nominal bus, and a programmable bus for output from approximately 24 up to approximately 50 V. The programmable bus voltage level, and its output power limit, can be changed on the fly as well. The power supply also offers options to reduce the programmable bus to 24 V when the set power limit is reached, limiting output power in the case of a system fault detected in the system.

The smart power supply is based on an embedded 8051-type single-chip microcontroller. This choice was made in that a credible progression to flight (radiation hard, high reliability) can be assumed as many 8051 processors or gate arrays capable of accepting 8051-type core presently exist and will continue to do so for some time.

To solve the problem of centralized control, this innovation moves an embedded microcontroller to the power supply and assigns it the task of overseeing the operation and charging of the power supply assets. This embedded processor is connected to the application central processor via a serial data link such that the central processor can request updates of various parameters within the supply, such as battery current, bus voltage, remaining power in battery estimations, etc. This supply has a direct connection to the battery bus for common (quiescent) power application. Because components from multiple vendors may have