of-the-art for all-solid-state, all-planar heterodyne receivers at 1.2 THz operating at either room temperature or using passive cooling only. Since no cryogenic cooling is needed, the receiver is eminently suited to atmospheric heterodyne spectroscopy of the outer planets and their moons.

This work was done by Jose V. Siles, Imran Mehdi, Erich T. Schlecht, Samuel Gulkis, Goutam Chattopadhyay, Robert H. Lin, Choonsup Lee, and John J. Gill of Caltech; Bertrand Thomas of Radiometer Physic; and Alain E. Maestrini of Observatoire de Paris for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). ***NPO-48896***

Stacked Transformer for Driver Gain and Receive Signal Splitting

Lyndon B. Johnson Space Center, Houston, Texas

In a high-speed signal transmission system that uses transformer coupling, there is a need to provide increased transmitted signal strength without adding active components. This invention uses additional transformers to achieve the needed gain. The prior art uses stronger drivers (which require an IC redesign and a higher power supply voltage), or the addition of another active component (which can decrease reliability, increase power consumption, reduce the beneficial effect of serializer/deserializer preemphasis or deemphasis, and/or interfere with fault containment mechanisms), or uses a different transformer winding ratio (which requires redesign of the transformer and may not be feasible with high-speed signals that require a 1:1 winding ratio).

This invention achieves the required gain by connecting the secondaries of multiple transformers in series. The primaries of these transformers are currently either connected in parallel or are connected to multiple drivers. There is also a need to split a receive signal to multiple destinations with minimal signal loss. Additional transformers can achieve the split. The prior art uses impedance-matching series resistors that cause a loss of signal. Instead of causing a loss, most instantiations of this invention would actually provide gain. Multiple transformers are used instead of multiple windings on a single transformer because multiple windings on the same transformer would require a redesign of the transformer, and may not be feasible with high-speed transformers that usually require a bifilar winding with a 1:1 ratio. This invention creates the split by connecting the primaries of multiple transformers in series. The secondary of each transformer is connected to one of the intended destinations without the use of impedance-matching series resistors.

This work was done by Kevin R. Driscoll of Honeywell for Johnson Space Center. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809.

Title to this invention has been waived under the provisions of the National Aeronautics and Space Act {42 U.S.C. 2457(f)}, to Honeywell. Inquiries concerning licenses for its commercial development should be addressed to:

Honeywell
P.O. Box 52199
Phoenix, AZ 85072-2199

Refer to MSC-24854-1/6-1, volume and number of this NASA Tech Briefs *issue, and the page number.*

Wireless Integrated Microelectronic Vacuum Sensor System

This system is applicable to facility monitoring applications, as well as cryogenic fluid manufacture and transport.

Stennis Space Center, Mississippi

NASA Stennis Space Center's (SSC's) large rocket engine test facility requires the use of liquid propellants, including the use of cryogenic fluids like liquid hydrogen as fuel, and liquid oxygen as an oxidizer (gases which have been liquefied at very low temperatures). These fluids require special handling, storage, and transfer technology. The biggest problem associated with transferring cryogenic liquids is product loss due to heat transfer. Vacuum jacketed piping is specifically designed to maintain high thermal efficiency so that cryogenic liquids can be transferred with minimal heat transfer.

A vacuum jacketed pipe is essentially two pipes in one. There is an inner carrier pipe, in which the cryogenic liquid is actually transferred, and an outer jacket pipe that supports and seals the vacuum insulation, forming the "vacuum jacket." The integrity of the vacuum jacketed transmission lines that transfer the cryogenic fluid from delivery barges to the test stand must be maintained prior to and during engine testing. To monitor the vacuum in these vacuum jacketed transmission lines, vacuum gauge readings are used. At SSC, vacuum gauge measurements are done on a manual rotation basis with two technicians, each using a handheld instrument. Manual collection of vacuum data is labor intensive and uses valuable personnel time. Additionally, there are times when personnel cannot collect the data in a timely fashion (i.e., when a leak is detected, measurements must be taken more often). Additionally, distribution of this data to all interested parties can be cumbersome.

To simplify the vacuum-gauge data collection process, automate the data collection, and decrease the labor costs associated with acquiring these measurements, an automated system that monitors the existing gauges was developed by Invocon, Inc. For this project, Invocon developed a Wireless Integrated Microelectronic Vacuum Sensor System (WIMVSS) that provides the ability to gather vacuum-gauge measurements automatically and wirelessly, in near-real time — using a low-maintenance, low-power sensor mesh network. The WIMVSS operates by using a self-configuring mesh network of wireless sensor units. Mesh networking is a type of networking where each sensor or node can capture and disseminate its own data, but also serve as a relay to receive and transmit data from other sensors. Each sensor node can synchronize with adjacent sensors, and propagate data from one sensor to the next, until the destination is reached. In this case, the destination is a Network Interface Unit (NIU). The WIMVSS sensors are mounted on the existing vacuum gauges. Information gathered by the sensors is sent to the NIU. Because of the mesh networking, if a sensor cannot directly send the data to the NIU, it can be propagated through the network of sensors. The NIU requires antenna access to the sensor units, AC power, and an Ethernet connection. The NIU bridges the sensor network to a WIMVSS server via an Ethernet connection. The server is configured with a database, a Web server, and proprietary interface software that makes it possible for the vacuum measurements from vacuum jacketed fluid lines to be saved, retrieved, and then displayed from any Web-enabled PC that has access to the Internet. Authorized users can then simply access the data from any PC with Internet connection. Commands can also be sent directly from the Web interface for control and maintenance of the sensor network.

The technology enabled by the WIMVSS decreases labor required for gathering vacuum measurements, increases access to vacuum data by making it available on any computer with access to the Internet, increases the frequency with which data points can be acquired for evaluating the system, and decreases the recurring cost of the sensors by using off-the-shelf components and integrating these with heritage vacuum gauges.

This work was done by Eric Krug, Brian Philpot, Aaron Trott, and Shaun Lawrence of Invocon, Inc., for Stennis Space Center. For more information, please contact Invocon, Inc. at (281) 292-9903. Refer to SSC-00342.