

with a shared RF front end and digital receiver. The radiometer signal is coupled out after the first down-conversion stage. From there, the radar transmit frequencies are heavily filtered, and the bands outside the transmit filter are amplified and passed to a detector diode. This diode produces a DC output proportional to the input power. For a conventional radiometer, this level would be digitized. By taking this DC output and mixing it with a system oscillator at 10 MHz, the signal can instead be digitized by a second channel on the radar digital receiver (which typically do not accept DC inputs), and can be down-converted to a DC level again digitally. This unintuitive step allows the digital receiver to

sample both the radiometer and radar data at a rapid, synchronized data rate (greater than 1 MHz bandwidth).

Once both signals are sampled by the same digital receiver, high-speed quality control can be performed on the radiometer data to allow it to take data simultaneously with the radar. The radiometer data can be blanked during radar transmit, or when the radar return is of a power level high enough to corrupt the radiometer data. Additionally, the receiver protection switches in the RF front end can double as radiometer calibration sources, the short (four-microsecond level) switching periods integrated over many seconds to estimate the radiometer offset.

The major benefit of this innovation is that there is minimal impact on the radar performance due to the integration of the radiometer, and the radiometer performance is similarly minimally affected by the radar. As the radar and radiometer are able to operate simultaneously, there is no extended period of integration time loss for the radiometer (maximizing sensitivity), and the radar is able to maintain its full number of pulses (increasing sensitivity and decreasing measurement uncertainty).

*This work was done by Matthew McLinden and Jeffrey Piepmeier of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16490-1*

## Rapid Detection of Herpes Viruses for Clinical Applications

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There are eight herpes viruses that infect humans, causing a wide range of diseases resulting in considerable morbidity and associated costs. Varicella zoster virus (VZV) is a human herpes virus that causes chickenpox in children and shingles in adults. Approximately 1,000,000 new cases of shingles occur each year; post-herpetic neuralgia (PHN) follows shingles in 100,000 to 200,000 people annually. PHN is characterized by debilitating, nearly unbearable pain for weeks, months, and even years. The onset of shingles is characterized by pain, followed by the zoster rash, leading

to blisters and severe pain. The problem is that in the early stages, shingles can be difficult to diagnose; chickenpox in adults can be equally difficult to diagnose. As a result, both diseases can be misdiagnosed (false positive/negative).

A molecular assay has been adapted for use in diagnosing VZV diseases. The polymerase chain reaction (PCR) assay is a non-invasive, rapid, sensitive, and highly specific method for VZV DNA detection. It provides unequivocal results and can effectively end misdiagnoses. This is an approximately two-hour assay that allows unequivocal diagnosis and

rapid antiviral drug intervention. It has been demonstrated that rapid intervention can prevent full development of the disease, resulting in reduced likelihood of PHN. The technology was extended to shingles patients and demonstrated that VZV is shed in saliva and blood of all shingles patients. The amount of VZV in saliva parallels the medical outcome.

*This work was done by Duane Pierson of Johnson Space Center, and Satish Mehta of Enterprise Advisory Services, Inc. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-25009-1*

## High-Speed Data Recorder for Space, Geodesy, and Other High-Speed Recording Applications

*Goddard Space Flight Center, Greenbelt, Maryland*

A high-speed data recorder and replay equipment has been developed for reliable high-data-rate recording to disk media. It solves problems with slow or faulty disks, multiple disk insertions, high-altitude operation, reliable performance using COTS hardware, and long-term maintenance and upgrade path challenges.

The current generation data recorders used within the VLBI community are aging, special-purpose machines that are both slow (do not meet today's re-

quirements) and are very expensive to maintain and operate. Furthermore, they are not easily upgraded to take advantage of commercial technology development, and are not scalable to multiple 10s of Gbit/s data rates required by new applications.

The innovation provides a software-defined, high-speed data recorder that is scalable with technology advances in the commercial space. It maximally utilizes current technologies without being locked to a particular hardware plat-

form. The innovation also provides a cost-effective way of streaming large amounts of data from sensors to disk, enabling many applications to store raw sensor data and perform post and signal processing offline.

This recording system will be applicable to many applications needing real-world, high-speed data collection, including electronic warfare, software-defined radar, signal history storage of multispectral sensors, development of autonomous vehicles, and more.