cell weight and volume. The composite thermal switch (CTS™) coating can be incorporated in either the anode or cathode or both. The coating can be applied in a variety of different processes that permits incorporation in the cell and electrode manufacturing processes. The CTS responds quickly and halts current flow in the hottest parts of the cell first. The coating can be applied to metal foil and supplied as a cell component onto which the active electrode materials are coated.

This work was done by Robert McDonald, Shelly Brawn, Katherine Harrison, Shannon O'Toole, and Michael Moeller of Giner, Inc. for Glenn Research Center. 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: Steven Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18767-1.

XMOS XC-2 Development Board for Mechanical Control and Data Collection

NASA's Jet Propulsion Laboratory, Pasadena, California

The scanning microwave limb sounder (SMLS) will use technological improvements in low-noise mixers to provide precise data on the Earth's atmospheric composition with high spatial resolution. This project focuses on the design and implementation of a real-time control system needed for airborne engineering tests of the SMLS. The system must coordinate the actuation of optical components using four motors with encoder readback, while collecting synchronized telemetric data from a GPS receiver and 3-axis gyrometric system. A graphical user interface for testing the control system was also designed using Python.

Although the system could have been implemented with an FPGA(field-programmable gate array)-based setup, a processor development kit manufactured by XMOS was chosen. The XMOS architecture allows parallel execution of multiple tasks on separate threads, making it ideal for this application. It is easily programmed using XC (a subset of C). The necessary communication interfaces were implemented in software, including Ethernet, with significant cost and time reduction compared to an FPGA-based approach.

A simple approach to control the chopper, calibration mirror, and gimbal for the airborne SMLS was needed. The XMOS board allows for multiple threads and real-time data acquisition. The XC-2 development kit is an attractive choice for synchronized, real-time, event-driven applications. The XMOS is based on the transputer microprocessor architecture developed for parallel computing, which is being revamped in this new platform.

The XMOS device has multiple cores capable of running parallel applications on separate threads. The threads communicate with each other via user-defined channels capable of transmitting data within the device. XMOS provides a C-based development environment using XC, which eliminates the need for custom tool kits associated with FPGA programming. The XC-2 has four cores and necessary hardware for Ethernet I/O.

This work was done by Robert F. Jarnot of Caltech and William J. Bowden of the University of British Columbia for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

The software used in this innovation is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-48054.

Receiver Gain Modulation Circuit

Applications would be in testing and development of new algorithms to detect gain anomalies and correct drifts that affect climate-quality measurements over an accelerated time scale.

Goddard Space Flight Center, Greenbelt, Maryland

A receiver gain modulation circuit (RGMC) was developed that modulates the power gain of the output of a radiometer receiver with a test signal. As the radiometer receiver switches between calibration noise references, the test signal is mixed with the calibrated noise and thus produces an ensemble set of measurements from which ensemble statistical analysis can be used to extract statistical information about the test signal. The RGMC is an enabling technology of the ensemble detector. As a key component for achieving ensemble detection and analysis, the RGMC has broad aeronautical and space applications. The RGMC can be used to test and develop new calibration algorithms, for example, to detect gain anomalies, and/or correct for slow drifts that affect climate-quality measurements over an accelerated time scale.

A generalized approach to analyzing radiometer system designs yields a mathematical treatment of noise reference measurements in calibration algorithms. By treating the measurements from the different noise references as ensemble samples of the receiver state, i.e. receiver gain, a quantitative description of the non-stationary properties of the underlying receiver fluctuations can be derived. Excellent agreement has been obtained between model calculations and radiometric measurements. The mathematical formulation is equivalent to modulating the gain of a stable receiver with an externally generated signal and is the basis for ensemble detection and analysis (EDA).

The concept of generating ensemble data sets using an ensemble detector is similar to the ensemble data sets generated as part of ensemble empirical mode decomposition (EEMD) with exception