drives the design to be mirrored, where the two channels are fabricated back-to-back, achieving direct mechanical interface to improve the isothermal performance, which drives RF phase balance. This back-to-back design forces components to have a "left" and "right" handed version, which is not typically possible for packaged components, but with full design control of hybrid design, this is achievable. The radar was designed to have a series of separate subcarriers, which could be hermetically sealed individually, which is much easier than sealing the entire unit. Also, in the event of late component failure, rather than losing or reworking the entire unit, the subcarrier can easily be replaced by another qualified subcarrier.

This new instrument is a smaller, higher-bandwidth dual-channel interferometer with 500-MHz bandwidth at Ka-band (35.5 to 36 GHz), as compared to the prior instrument WSOA (Wide Swath Ocean Altimeter), which was Ku-band (13.275 GHz) with 80-MHz bandwidth. The new instrument has six-fold improvement in resolution capability, and better control of factors that contribute to RF phase stability.

Continuous-Integration Laser Energy Lidar Monitor

The integrator can be used in developing pulsed lasers for space-based lidar and ground-based laser applications.

Goddard Space Flight Center, Greenbelt, Maryland

This circuit design implements an integrator intended to allow digitization of the energy output of a pulsed laser, or the energy of a received pulse of laser light. It integrates the output of a detector upon which the laser light is incident. The integration is performed constantly, either by means of an active integrator, or by passive components. If an active integrator is used, closed-loop dc biasing is added with a time constant much longer than the laser pulse width. The output of the integrator goes to a track-and-hold amplifier (THA), using a zero-potential switch topology. The track/hold control is derived from timing information obtained either by a threshold comparator on the detector, or a peak detector. Laser pulses of varying widths can be accommodated by adjusting the characteristics of the timing control circuitry. The output of the THA is available for digitization at a later time. Bandwidth limiting can be used in the signal path as necessary, depending on the noise characteristics of the signal.

Prior integration techniques utilize threshold comparators to "start" and "stop" the integration. Some implementations require reset circuitry, which can create offset at the output. Starting and stopping the integration usually involves clipping off the beginning and/or end of the signal; this introduces greater errors as the signal amplitude decreases. Also, as the signal speed increases, the comparator speed must increase, and thus its power consumption rises. As the signal (pulse) gets narrower, the comparator delay time may cut off significant portions of the signal unless electronic delay is introduced. This adds complexity, mass, and timing uncertainty.

The advantage of this integration technique is that it does not depend on exact threshold adjustment to start or stop the integrator, nor does it require the use of switches to discharge the integration capacitor. Further, there is no pedestal introduced in the integrator.

This circuit is intended to implement an integrator that does not require time gating, delay, or reset circuitry, in order to avoid the limitations that these elements impose. The integrator is part of a pulsed laser energy monitor. This implementation of a continuous integrator is designed to be used in a laser transmit energy monitor.

The final design had the ability to integrate pulses down to 50 mV at 4.5 ns, and 250 mV at 3 ns, with 0.8-percent electrical accuracy.

Miniaturized Airborne Imaging Central Server System

This imaging server can be used for natural disaster response and for locating new sources of spring water.

Goddard Space Flight Center, Greenbelt, Maryland

In recent years, some remote-sensing applications require advanced airborne multi-sensor systems to provide high performance reflective and emissive spectral imaging measurement rapidly over large areas. The key or unique problem of characteristics is associated with a black box back-end system that operates a suite of cutting-edge imaging sensors to collect simultaneously the high throughput reflective and emissive spectral imaging data with precision georeference. This back-end system needs to be portable, easy-to-use, and reliable with advanced onboard processing.

The innovation of the black box back-end is a miniaturized airborne imaging central server system (MAICSS). MAICSS integrates a complex embedded system of systems with dedicated power and signal electronic circuits inside to serve a suite of configurable cutting-edge electro-optical (EO), long-wave infrared (LWIR), and medium-wave infrared (MWIR) cameras, a hyperspectral imaging scanner, and a GPS and inertial measurement unit (IMU) for atmospheric and surface remote sensing. Its compatible sensor packages include NASA's 1,024×1,024 pixel LWIR quantum well in-