Semiconductors & ICs

Interface Supports Multiple Broadcast Transceivers for Flight Applications

NASA's Jet Propulsion Laboratory, Pasadena, California

A wireless avionics interface provides a mechanism for managing multiple broadcast transceivers. This interface isolates the control logic required to support multiple transceivers so that the flight application does not have to manage wireless transceivers. All of the logic to select transceivers, detect transmitter and receiver faults, and take autonomous recovery action is contained in the interface, which is not restricted to using wireless transceivers. Wired, wireless, and mixed transceiver technologies are supported.

This design's use of broadcast data technology provides inherent cross-strapping of data links. This greatly simplifies the design of redundant flight subsystems. The interface fully exploits the broadcast data link to determine the health of other transceivers used to detect and isolate faults for fault recovery. The interface uses simplified control logic, which can be implemented as an intellectual-property (IP) core in a field-programmable gate array (FPGA).

The interface arbitrates the reception of inbound data traffic appearing on multiple receivers. It arbitrates the transmission of outbound traffic. This system also monitors broadcast data traffic to determine the health of transmitters in the network, and then uses this health information to make autonomous decisions for routing traffic through transceivers. Multiple selection strategies are supported, like having an active transceiver with the secondary transceiver powered off except to send periodic health status reports. Transceivers can operate in round-robin for load-sharing and graceful degradation.

This work was done by Gary L. Block, William D. Whitaker, James W. Dillon, James P. Lux, and Mohammad Ahmad of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-46317

FPGA Sequencer for Radar Altimeter Applications

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A sequencer for a radar altimeter provides accurate attitude information for a reliable soft landing of the Mars Science Laboratory (MSL). This is a field-programmable-gate-array (FPGA)-only implementation. A table loaded externally into the FPGA controls timing, processing, and decision structures. Radar is memory-less and does not use previous acquisitions to assist in the current acquisition. All cycles complete in exactly 50 milliseconds, regardless of range or whether a target was found.

A RAM (random access memory) within the FPGA holds instructions for up to 15 sets. For each set, timing is run, echoes are processed, and a comparison is made. If a target is seen, more detailed processing is run on that set. If no target is seen, the next set is tried.

When all sets have been run, the FPGA terminates and waits for the next 50-millisecond event. This setup simplifies testing and improves reliability. A single vertex chip does the work of an entire assembly. Output products require minor processing to become range and velocity.

This technology is the heart of the Terminal Descent Sensor, which is an integral part of the Entry Decent and Landing system for MSL. In addition, it is a strong candidate for manned landings on Mars or the Moon.

This work was done by Andrew C. Berkun, Brian D. Pollard, and Curtis W. Chen of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-46988

Miniature Sapphire Acoustic Resonator — MSAR

Q values as high as 10^8 may be achieved at room temperature.

NASA's Jet Propulsion Laboratory, Pasadena, California

A room temperature sapphire acoustics resonator incorporated into an oscillator represents a possible opportunity to improve on quartz ultrastable oscillator (USO) performance, which has been a staple for NASA missions since the inception of spaceflight.

Where quartz technology is very mature and shows a performance improvement of perhaps 1 dB/decade, these sapphire acoustic resonators when integrated with matured quartz electronics could achieve a frequency stability improvement of 10 dB or more. As quartz oscillators are an essential element of nearly all types of frequency standards and reference systems, the success of MSAR would advance the development of frequency standards and systems for both ground-based and flight-based projects.