
180-GHz Interferometric Imager

NASA's Jet Propulsion Laboratory, Pasadena, California

A 180-GHz interferometric imager uses compact receiver modules, combined high- and low-gain antennas, and ASIC (application specific integrated circuit) correlator technology, enabling continuous, all-weather observations of water vapor with 25-km resolution and 0.3-K noise in 15 minutes of observation for numerical weather forecasting and tropical storm prediction.

The GeoSTAR-II prototype instrument is broken down into four major subsystems: the compact, low-noise receivers; sub-array modules; IF signal distribution; and the digitizer/correlator. Instead of the single row of antennas adopted in GeoSTAR, this version has

four rows of antennas on a coarser grid. This dramatically improves the sensitivity in the desired field of view.

The GeoSTAR-II instrument is a 48-element, synthetic, thinned aperture radiometer operating at 165–183 GHz. The instrument has compact receivers integrated into “tiles” of 16 elements in a 4×4 arrangement. These tiles become the building block of larger arrays. The tiles contain signal distribution for bias controls, IF signal, and local oscillator signals. The IF signals are digitized and correlated using an ASIC correlator to minimize power consumption.

Previous synthetic aperture imagers have used comparatively large multichip

modules, whereas this approach uses chip-scale modules mounted on circuit boards, which are in turn mounted on the distribution manifolds. This minimizes the number of connectors and reduces system mass. The use of ASIC technology in the digitizers and correlators leads to a power reduction close to an order of magnitude.

This work was done by Pekka P. Kangaslahti, Boon H. Lim, Ian J. O'Dwyer, Mary M. Soria, Heather R. Owen, Todd C. Gaier, Bjorn H. Lambigtsen, and Alan B. Tanner of Caltech, and Christopher Ruf of the University of Michigan for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov. NPO-47995

Maturation of Structural Health Management Systems for Solid Rocket Motors

Marshall Space Flight Center, Alabama

Concepts of an autonomous and automated space-compliant diagnostic system were developed for conditioned-based maintenance (CBM) of rocket motors for space exploration vehicles. The diagnostic system will provide real-time information on the integrity of critical structures on launch vehicles, improve their performance, and greatly increase crew safety while decreasing inspection costs. Using the SMART Layer technology as a basis, detailed procedures and calibration techniques for implementation of the diagnostic system were developed.

The diagnostic system is a distributed system, which consists of a sensor net-

work, local data loggers, and a host central processor. The system detects external impact to the structure. The major functions of the system include an estimate of impact location, estimate of impact force at impacted location, and estimate of the structure damage at impacted location.

This system consists of a large-area sensor network, dedicated multiple local data loggers with signal processing and data analysis software to allow for real-time, *in situ* monitoring, and long-term tracking of structural integrity of solid rocket motors. Specifically, the system could provide easy installation of

large sensor networks, onboard operation under harsh environments and loading, inspection of inaccessible areas without disassembly, detection of impact events and impact damage in real-time, and monitoring of a large area with local data processing to reduce wiring.

This work was done by Xinlin Qing, Shawn Beard, and Chang Zhang of Accellent Technologies, Inc for Marshall Space Flight Center. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-32819-1.

Validating Phasing and Geometry of Large Focal Plane Arrays CCD defects are used here to advantage.

NASA's Jet Propulsion Laboratory, Pasadena, California

The Kepler Mission is designed to survey our region of the Milky Way galaxy to discover hundreds of Earth-sized and smaller planets in or near the habitable zone. The Kepler photometer is an array of 42 CCDs (charge-coupled devices) in the focal plane of a 95-cm Schmidt camera onboard the Kepler spacecraft. Each 50×25-mm CCD has 2,200×1,024 pixels.

The CCDs accumulate photons and are read out every six seconds to prevent saturation. The data is integrated for 30 minutes, and then the pixel data is transferred to onboard storage. The data is subsequently encoded and transmitted to the ground.

During End-to-End Information System (EEIS) testing of the Kepler Mission

System (KMS), there was a need to verify that the pixels requested by the science team operationally were correctly collected, encoded, compressed, stored, and transmitted by the FS, and subsequently received, decoded, uncompressed, and displayed by the Ground Segment (GS) without the outputs of any CCD modules being flipped, mir-