Books & Reports

Instrument Package Manipulation Through the Generation and Use of an Attenuated-Fluent Gas Fold

This document discusses a technique that provides a means for suspending large, awkward loads, instrument packages, components, and machinery in a stable, controlled, and precise manner. In the baseplate of the test machine, a pattern of grooves and ports is installed that when pressurized generates an attenuated-fluent gas fold providing a low-cost, near-zero-coefficient-of-friction lubrication boundary layer that supports the object evenly, and in a predictable manner. Package movement control requires minimal force.

Aids to repeatable travel and positional accuracy can be added via the addition of simple guide bars and stops to the floor or object being moved. This allows easily regulated three-axis motions. Loads of extreme weight and size can be moved and guided by a single person, or by automated means, using minimal force. Upon removal of the attenuated-fluent gas fold, the object returns to a stable resting position without impact forces affecting the object.

This work was done by Daniel P. Breen of ASRC Aerospace 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-18739-1.

Multicolor Detectors for Ultrasensitive Long-Wave Imaging Cameras

A document describes a zeptobolometer for ultrasensitive, long-wavelength sensors. GSFC is developing pixels based on the zeptobolometer design that sense three THz wavelengths simultaneously.

Two innovations are described in the document: (1) a quasiparticle (QO) filter arrangement that enables a compact multicolor spectrum at the focal plane, and (2) a THz antenna readout by up to three bolometers. The innovations enable high efficiency by greatly reducing high, frequency-dependent microstrip losses, and pixel compactness by eliminating the need for bulky filters in the focal plane.

The zeptobolometer is a small TES bolometer, on the scale of a few microns, which can be readily coupled through an impedance-matching resistor to a metal or dielectric antenna. The bolometer is voltage-biased in its superconducting transition, allowing the use of superconducting RF multiplexers to read out large arrays. The antenna is geometrically tapped at three locations so as to efficiently couple radiation of three distinct wavelengths to the individual TESs. The transition edge hot electrons in metals offer a simple, compact arrangement for antenna readout, which can be crucial in the THz where line losses at high frequencies can be substantial. A metallic grill filter acts as a high-pass filter and directs the low-frequency components to a location where they will be absorbed. The absorption spectrum shows that three well-separated THz bands are feasible. The filters can be made from high-purity dielectrics such as float zone silicon or sapphire.

This work was done by Ari Brown, Dominic Benford, James Chervenak, and Edward Wollack of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15672-1

Lunar Reconnaissance Orbiter (LRO) Command and Data Handling Flight Electronics Subsystem

A document describes a high-performance, modular, and state-of-the-art Command and Data Handling (C&DH) system developed for use on the Lunar Reconnaissance Orbiter (LRO) mission. This system implements a complete hardware C&DH subsystem in a single chassis enclosure that includes a processor card, 48 Gbytes of solid-state recorder memory, data buses including MIL-STD-1553B, custom RS-422, SpaceWire, analog collection, switched power services, and interfaces to the Ka-Band and S-Band RF communications systems.

The C&DH team capitalized on extensive experience with hardware and software with PCI bus design, SpaceWire networking, Actel FPGA design, digital flight design techniques, and the use of VxWorks for the real-time operating system. The resulting hardware architecture was implemented to meet the LRO mission requirements.

The C&DH comprises an enclosure, a backplane, a low-voltage power converter, a single-board computer, a communications interface board, four data storage boards, a housekeeping and digital input/output board, and an analog data acquisition board. The interfaces between the C&DH and the instruments and avionics are connected through a SpaceWire network, a MIL-STD-1553 bus, and a combination of synchronous and asynchronous serial data transfers over RS-422 and LVDS (low-voltage differential-signaling) electrical interfaces. The C&DH acts as the spacecraft data system with an instrument data manager providing all software and internal bus scheduling, ingestion of science data, distribution of commands, and performing science operations in real time.

This work was done by Quang Nguyen, William Yuknis, Noosha Haghani, Scott Pursley, and Omar Haddad of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16100-1

Electro-Optic Segment-Segment Sensors for Radio and Optical Telescopes

A document discusses an electro-optic sensor that consists of a collimator, attached to one segment, and a quad diode, attached to an adjacent segment. Relative segment-segment motion causes the beam from the collimator to move across the quad diode, thus generating a measureable electric signal. This sensor type, which is relatively inexpensive, can be configured as an edge sensor, or as a remote segment-segment motion sensor.

This work was done by Alex Abramovici of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1). NPO-47528