Books & Reports

Cargo-Positioning System for Next-Generation Spacecraft

A report discusses a proposed system for mounting loaded pallets in the cargo bay of a next-generation space-shuttle-like spacecraft, such that the center of mass of the cargo would lie within a 1-in. (2.54-cm) cube that would also contain the center of mass of the spacecraft. The system would include (1) an algorithm for planning the locations of the pallets, given the geometric and weight properties of the pallets, and the geometric restrictions of the cargo bay; (2) quick-connect/quick-disconnect mounting mechanisms similar to those now used on air hoses; (3) other mounting mechanisms, comprising mostly spring-loaded pins, in a locking subsystem that would prevent shifting of the pallets under load; and (4) mechanisms for performing fine position adjustments to satisfy the center-of-mass requirement. The position-adjusting mechanisms would be motor-driven lead-screw mechanisms in groups of three — one for positioning each pin of the locking subsystem along each of three mutually perpendicular coordinate axes. The system also would include a triple-threaded screw that would provide compensation for thermal expansion or contraction of the spacecraft.

This work was done by Jon Holladay of **Marshall Space Flight Center** *and Jonathan Colton of Georgia Institute of Technology. Further information is contained in a TSP (see page 1).*
MFS-32069-1

Micro-Imagers for Spaceborne Cell-Growth Experiments

A document discusses selected aspects of a continuing effort to develop five micro-imagers for both still and video monitoring of cell cultures to be grown aboard the International Space Station. The approach taken in this effort is to modify and augment pre-existing electronic micro-cameras. Each such camera includes an image-detector integrated-circuit chip, signal-conditioning and image-compression circuitry, and connections for receiving power from, and exchanging data with, external electronic equipment. Four white and four multicolor light-emitting diodes are to be added to each camera for illuminating the specimens to be monitored. The lens used in the original version of each camera is to be replaced with a shorter-focal-length, more-compact singlet lens to make it possible to fit the camera into the limited space allocated to it. Initially, the lenses in the five cameras are to have different focal lengths: the focal lengths are to be 1, 1.5, 2, 2.5, and 3 cm. Once one of the focal lengths is determined to be the most nearly optimum, the remaining four cameras are to be fitted with lenses of that focal length.

This work was done by Alberto Behar, Jaret Matthews, Beverly St. Ange, and Helen Tanabe of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-42379

Holographic Solar Photon Thrusters

A document discusses a proposal to incorporate holographic optical elements into solar photon thrusters (SPTs). First suggested in 1990, SPTs would be systems of multiple reflective, emissive, and absorptive surfaces (solar sails) that would be attached to spacecraft orbiting the Earth to derive small propulsive forces from radiation pressures. An SPT according to the proposal would include, among other things, a main sail. One side of the sail would be highly emissive and would normally face away from the Earth. The other side would be reflective and would be covered by white-light holographic images that would alternately become reflective, transmissive, and absorptive with small changes in the viewing angle. When the spacecraft was at a favorable orbital position, the main sail would be oriented to reflect sunlight in a direction to maximize the solar thrust; when not in a favorable position, the main sail would be oriented to present a substantially absorptive/emissive aspect to minimize the solar drag. By turning the main sail slightly to alternate between the reflective and absorptive/emissive extremes, one could achieve nearly a doubling or halving of the radiational momentum transfer and, hence, of the solar thrust.

This work was done by Les Johnson of **Marshall Space Flight Center** *and Greg Matloff of New York City Technical College, The City University of New York (CUNY). Further information is contained in a TSP (see page 1).*
MFS-31889

Plasma-Based Detector of Outer-Space Dust Particles

A report presents a concept for an instrument to be flown in outer space, where it would detect dust particles — especially those associated with comets. The instrument would include a flat plate that would intercept the dust particles. The anticipated spacecraft/dust-particle relative speeds are so high that the impingement of a dust particle on the plate would generate a plasma cloud. Simple electric dipole sensors located equidistantly along the circumference of the plate would detect the dust particle indirectly by detecting the plasma cloud. The location of the dust hit could be estimated from the timing of the detection pulses of the different dipoles. The mass and composition of the dust particle could be estimated from the shapes and durations of the pulses from the dipoles. In comparison with other instruments for detecting hypervelocity dust particles, the proposed instrument offers advantages of robustness, large collection area, and simplicity.

This work was done by Bruce Tsurutani, David E. Brinza, and Michael D. Henry of Caltech; Liwei Dennis Zhang of Columbus Technologies and Services Inc.; and Douglas R. Clay of Skillstorm, Inc. for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30848

Generation of Data-Rate Profiles of Ka-Band Deep-Space Links

A short report discusses a methodology for designing Ka-band Deep-Space-to-Earth radio-communication links. This methodology is oriented toward minimizing the effects of weather on the Ka-band telecommunication link by maximizing the expected data return subject to minimum link availability and a limited number of data rates. This methodology differs from the current standard practices

in which a link is designed according to a margin policy for a given link availability at 10° elevation. In this methodology, one chooses a data-rate profile that will maximize the average data return over a pass while satisfying a minimum-availability requirement for the pass, subject to mission operational limititations expressed in terms of the number of data rates used during the pass. The methodology is implemented in an intelligent search algorithm that first finds the allowable data-rate profiles from the mission constraints, spacecraft-to-Earth distance, spacecraft EIRP (effective isotropic radiated power), and the applicable zenith atmospheric noise temperature distribution, and then selects the best data rate in terms of maximum average data return from the set of allowable data-rate profiles.

This work was done by Shervin Shambayati of Caltech 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 Karina Edmonds of the California Institute of Technology at (818) 393-2827. Refer to NPO-41073.