Books & Reports

Deployable Shroud for the International X-Ray Observatory

A document describes the design of a lightweight (between 100 to 200 kg), light-tight shroud of about 3.9 meters in diameter that could be stowed into a very small volume, and be deployed to 12 meters. The shroud will consist of two concentric multi-layer blankets (MLIs) that are constructed in an accordion shape. The blankets have 2-mil (≈50 μm) Kapton outer layers, and several ¼-mil (≈6.4-μm) thick inner layers with Dacron netting scrim cloth. The two blankets are separated by 10 cm that creates a "Whipple Shield" effect that reduces the number of micrometeorite penetrations from thousands to less than 30 over the satellite's expected ten-year lifetime.

A 1/25th scale model of a shroud was constructed. It consists of nine flat sections with pleats and individual corner pieces that are taped between the flat sections. The 18 pleated folds are 19 mm wide. Hexagonal corner pieces are taped between the facets and work better if they are thinner than the bulk of the blanket.

A full-scale section of a shroud has been made to provide insights into the design, stowage, and handling issues. A complete shroud of 29 pleats will stow to 174 mm with no compression. The accordion-style construction allows the shroud to be stowed into a channel that is less than 20 cm tall and 30 cm wide.

This work was done by David W. Robinson of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15779-1

Improved Model of a Mercury Ring Damper

A short document discusses the general problem of mathematical modeling of the three-dimensional rotational dynamics of rigid bodies and of the use of Euler parameters to eliminate the singularities occasioned by the use of Euler angles in such modeling. The document goes on to characterize a Hamiltonian model, developed by the authors, that utilizes the Euler parameters and, hence, is suitable for use in computational simulations that involve arbitrary rotational motion. In this formulation unlike in prior Euler-parameter-based formulations, there are no algebraic constraints. This formulation includes a general potential-energy function, incorporates a minimum set of momentum variables, and takes an explicit state-space form convenient for numerical implementation.

Practical application of this formulation has been demonstrated by the development of a new and simplified model of the rotational motion of a rigid rotor to which is attached a partially filled mercury ring damper. Models like this one are used in guidance and control of spin-stabilized spacecraft and gyroscope-stabilized seekers in guided missiles.

This work was done by Eric P. Fahrenthold and Ravishankar Shivarma of the University of Texas for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-23830-1

Optoelectronic pH Meter: Further Details

A collection of documents provides further detailed information about an optoelectronic instrument that measures the pH of an aqueous cell-culture medium to within ±0.1 unit in the range from 6.5 to 7.5. The instrument at an earlier stage of development was reported in "Optoelectronic Instrument Monitors pH in a Culture Medium" (MSC-23107), *NASA Tech Briefs*, Vol. 28, No. 9 (September 2004), page 4a.

To recapitulate: The instrument includes a quartz cuvette through which the medium flows as it is circulated through a bioreactor. The medium contains some phenol red, which is an organic pH-indicator dye. The cuvette sits between a light source and a photodetector. [The light source in the earlier version comprised red (625 nm) and green (558 nm) light-emitting diodes (LEDs); the light source in the present version comprises a single green- (560 nm)-or-red (623 nm) LED.] The red and green are repeatedly flashed in alternation. The responses of the photodiode to the green and red are processed electronically to obtain the ratio between the amounts of green and red light transmitted through the medium. The optical absorbance of the phenol red in the green light varies as a known function of pH. Hence, the pH of the medium can be calculated from the aforesaid ratio.

This work was done by Antony S. Jeevarajan and Melody M. Anderson of Johnson Space Center and Ariel V. Macatangay of Wyle Laboratories. Further information is contained in a TSP (see page 1). MSC-23854-1

X-38 Advanced Sublimator

A document discusses a heat rejection device for transferring heat from a space vehicle by venting water into space through the use of a novel, two-stage water distribution system. The system consists of two different, porous media that stop water-borne contaminants from clogging the system and causing operational failures.

Feedwater passes through a small nozzle, then into a porous disk made of sintered stainless steel, and then finally into large-pore aluminum foam. The smaller pore layer of the steel disk controls the pressure drop of the feedwater. The ice forms in the foam layer, and then sublimates, leaving any contaminants behind. The pore-size of the foam is two orders of magnitude larger than the current porous plate sublimators, allowing for a greater tolerance for contaminants. Using metallic fibers in the foam also negates problems with compression seen in the use of poly(tetrafluoroethylene) felt.

This work was done by Chuck Dingell, Clemente Quintana, and Suy Le of Johnson Space Center and David S. Hafermalz, Mike Clark, and Robert Cloutier of Jacobs Sverdrup. Further information is contained in a TSP (see page 1).

This invention is owned by NASA, and a patent application has been filed. Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to the Patent Counsel, Johnson Space Center, (281) 483-1003. Refer to MSC-24207-1.

Solar Simulator Represents the Mars Surface Solar Environment

A report discusses the development of a Mars surface, laboratory-based solar simulator to create solar cells that can function better on Mars. The Mars Optimized Solar cell Technology (MOST) re-