Books & Reports

Progress in Fabrication of Rocket Combustion Chambers by VPS

Several documents in a collection describe aspects of the development of advanced materials and fabrication processes intended to enable the manufacture of advanced rocket combustion chambers and nozzles at relatively low cost. One concept discussed in most of the documents is the fabrication of combustion-chamber liners by vacuum plasma spraying (VPS) of an alloy of 88Cu/8Cr/4Nb (numbers indicate atomic percentages) — a concept that was reported in "Improved Alloy for Fabrication of Combustion Chambers by VPS" (MFS-26546), *NASA Tech Briefs*, Vol. 23, No. 1 (January 1999), page 50. Another concept is the deposition of graded-composition wall and liner structures by VPS in order to make liners integral parts of wall structures and to make oxidation- and thermal-protection layers integral parts of liners: The VPS process is started at 100 percent of a first alloy, then the proportion of a second alloy is increased gradually from zero as deposition continues, ending at 100 percent of the second alloy. Yet another concept discussed in one of the documents is the VPS of oxidation-protection coats in the forms of nickel-and-chromium-containing refractory alloys on VPS-deposited 88Cu/8Cr/4Nb liners.

This work was done by Richard R. Holmes of **Marshall Space Flight Center** *and Timothy N. McKechnie of Plasma Processes.*

This invention is owned by NASA, and a patent application has been filed. For further information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-31267.

CHEM-Based Self-Deploying Spacecraft Radar Antennas

A document proposes self-deploying spacecraft radar antennas based on cold hibernated elastic memory (CHEM) structures. Described in a number of prior *NASA Tech Briefs* articles, the CHEM concept is one of utilizing open-cell shape-memory-polymer (SMP) foams to make lightweight structures that can be compressed for storage and can later be expanded, then rigidified for use. A CHEM-based antenna according to the proposal would comprise three layers of microstrip patches and transmission lines interspersed with two flat layers of SMP foam, which would serve as both dielectric spacers and as means of deployment. The SMP foam layers would be fabricated at full size at a temperature below the SMP glass-transition temperature (T_g). The layers would be assembled into a unitary structure, which, at temperature above T_g, would be compacted to much smaller thickness, then rolled up for storage. Next, the structure would be cooled to below T_g and kept there during launch. Upon reaching the assigned position in outer space, the structure would be heated above T_g to make it rebound to its original size and shape. The structure as thus deployed would then be rigidified by natural cooling to below T_g.

This work was done by Witold Sokolowski, John Huang, and Reza Ghaffarian of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-30742

Scalable Multiprocessor for High-Speed Computing in Space

A report discusses the continuing development of a scalable multiprocessor computing system for hard real-time applications aboard a spacecraft. "Hard real-time applications" signifies applications, like real-time radar signal processing, in which the data to be processed are generated at "hundreds" of pulses per second, each pulse "requiring" millions of arithmetic operations. In these applications, the digital processors must be tightly integrated with analog instrumentation (e.g., radar equipment), and data input/output must be synchronized with analog instrumentation, controlled to within fractions of a microsecond. The scalable multiprocessor is a cluster of identical commercial-off-the-shelf generic DSP (digital-signal-processing) computers plus generic interface circuits, including analog-to-digital converters, all controlled by software. The processors are computers interconnected by high-speed serial links. Performance can be increased by adding hardware modules and correspondingly modifying the software. Work is distributed among the processors in a parallel or pipeline fashion by means of a flexible master/slave control and timing scheme. Each processor operates under its own local clock; synchronization is achieved by broadcasting master time signals to all the processors, which compute offsets between the master clock and their local clocks.

This work was done by James Lux, Minh Lang, Kouji Nishimoto, Douglas Clark, Dorothy Stosic, Alex Bachmann, William Wilkinson, and Richard Steffke 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 Don Hart of the California Institute of Technology at (818) 393-3425. Refer to NPO-40270.

Simple Systems for Detecting Spacecraft Meteoroid Punctures

A report describes proposed systems to be installed in spacecraft to detect punctures by impinging meteoroids or debris. Relative to other systems that have been used for this purpose, the proposed systems would be simpler and more adaptable, and would demand less of astronauts' attention and of spacecraft power and computing resources. The proposed systems would include a thin, hollow, hermetically sealed panel containing an inert fluid at a pressure above the spacecraft cabin pressure. A transducer would monitor the pressure in the panel. It is assumed that an impinging object that punctures the cabin at the location of the panel would also puncture the panel. Because the volume of the panel would be much smaller than that of the cabin, the panel would lose its elevated pressure much faster than the cabin would lose its lower pressure. The transducer would convert the rapid pressure drop to an electrical signal that could trigger an alarm. Hence, the system would provide an immediate indication of the approximate location of a small impact leak, possibly in time to take corrective action before a large loss of cabin pressure could occur.

This work was done by Stephen B. Hall of **Marshall Space Flight Center**. *Further information is contained in a TSP (see page 1).*

This invention is owned by NASA, and a patent application has been filed. For further information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at (256) 544-5226 or sammy.a.nabors@nasa.gov. Refer to MFS-31636.