Books & Reports

On Release of Microbe-Laden Particles From Mars Landers

A paper presents a study in which rates of release of small particles from Mars lander spacecraft into the Martian atmosphere were estimated from first principles. Because such particles can consist of, or be laden with, terrestrial microbes, the study was undertaken to understand their potential for biological contamination of Mars. The study included taking account of forces and energies involved in adhesion of particles and of three mechanisms of dislodgement of particles from the surface of a Mars lander: wind shear, wind-driven impingement of suspended dust, and impingement of wind-driven local saltating sand particles. Wind shear was determined to be effective in dislodging only particles larger than about 10 microns and would probably be of limited interest because such large particles could be removed by pre-flight cleaning of the spacecraft, and their number on the launched spacecraft would thus be relatively small. Dislodge-ment by wind-driven dust was found to be characterized by an adhesion half-life of the order of 10,000 years — judged to be too long to be of concern. Dislodgement by saltating sand particles, including skirts of dust devils, was found to be of potential importance, depending on the sizes of the spacecraft-attached particles and characteristics of both Mars sand-particle and spacecraft surfaces.

This work was done by Josette Bellan and Kenneth Harstad of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-42687

A Concept for Run-Time Support of the Chapel Language

A document presents a concept for run-time implementation of other concepts embodied in the Chapel programming language. (Now undergoing development, Chapel is intended to become a standard language for parallel computing that would surpass older such languages in both computational performance in the efficiency with which pre-existing code can be reused and new code written.) The aforementioned other concepts are those of distributions, domains, allocations, and access, as defined in a separate document called "A Semantic Framework for Domains and Distributions in Chapel" and linked to a language specification defined in another separate document called "Chapel Specification 0.3." The concept presented in the instant report is recognition that a data domain that was invented for Chapel offers a novel approach to distributing and processing data in a massively parallel environment. The concept is offered as a starting point for development of working descriptions of functions and data structures that would be necessary to implement interfaces to a compiler for transforming the aforementioned other concepts from their representations in Chapel source code to their run-time implementations.

This work was done by Mark James 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 (626) 395-2322. Refer to NPO-42496.

Thermoelectric Inhomogeneities in $(Ag_{1-y}SbTe_2)_x(PbTe)_{1-x}$

A document presents a study of why materials of composition $(Ag_{1-y}SbTe_2)_{0.05}(PbTe)_{0.95}$ $[0 \leq y \leq 1]$ were previously reported to have values of the thermoelectric figure of merit [ZT (where $Z \equiv \alpha^2/\rho\kappa$, α is the Seebeck coefficient, ρ is electrical resistivity, κ is thermal conductivity, and T is absolute temperature)] ranging from <1 to >2. In the study, samples of $(AgSbTe_2)_{0.05}(PbTe)_{0.95}$, $(Ag_{0.67}SbTe_2)_{0.05}(PbTe)_{0.95}$, and $(Ag_{0.55}SbTe_2)_{0.05}(PbTe)_{0.95}$ were prepared by melting followed, variously, by slow or rapid cooling. Analyses of these samples by x-ray diffraction, electron microscopy, and scanning-microprobe measurements of the Seebeck coefficient led to the conclusion that these materials have a multiphase character on a scale of the order of millimeters, even though they appear homogeneous in x-ray diffraction and electron microscopy. The Seebeck measurements showed significant variations, including both n-type and p-type behavior in the same sample. These variations were found to be consistent with observed variations of ZT. The rapidly quenched samples were found to be less inhomogeneous than were the furnace-cooled ones; hence, rapid quenching was suggested as a basis of research on synthesizing more nearly uniform high-ZT samples.

This work was done by G. Jeffrey Snyder, Nancy Chen, Franck Gascoin, Eckhard Mueller, Gabriele Karpinski, and Christian Stiewe of Caltech for **NASA's Jet Propulsion Laboratory**. *Further information is contained in a TSP (see page 1).*
NPO-42657

Spacecraft Escape Capsule

A report discusses the Gumdrop capsule — a conceptual spacecraft that would enable the crew to escape safely in the event of a major equipment failure at any time from launch through atmospheric re-entry. The scaleable Gumdrop capsule would comprise a command module (CM), a service module (SM), and a crew escape system (CES). The CM would contain a pressurized crew environment that would include avionic, life-support, thermal control, propulsive attitude control, and recovery systems. The SM would provide the primary propulsion and would also supply electrical power, life-support resources, and active thermal control to the CM. The CES would include a solid rocket motor, embedded within the SM, for pushing the CM away from the SM in the event of a critical thermal-protection-system failure or loss of control. The CM and SM would normally remain integrated with each other from launch through recovery, but could be separated using the CES, if necessary, to enable the safe recovery of the crew in the CM. The crew escape motor could be used, alternatively, as a redundant means of de-orbit propulsion for the CM in the event of a major system failure in the SM.

This work was done by Edward A. Robertson, Dingell W. Charles, Ann L. Bufkin, Liana M. Rodriggs, Wayne Peterson, Peter Cuthbert, David E. Lee, and Carlos Westhelle of **Johnson Space Center**. *Further information is contained in a TSP (see page 1).*
MSC-23840