their own plots with minimal effort, and can gain access to all of the features of the case management system. Users can also define their own models (including gravitational and non-gravitational force models), types of measurement, and optimizers, using software hooks that are made available in the scripting layer of the tool. This enables users to extend the functionality of MONTE without restriction.

MONTE provides maneuver optimization as well as re-optimization capability that includes support for particular constraints, such as cones and directions. The software has integrated support to help satisfy planetary quarantine requirements.

This work was done by Richard F. Sunseri, Hsi-Cheng Wu, Robert A. Hanna, Michael P. Mossey, Courtney B. Duncan, Scott E. Evans,

James R. Evans, Theodore R. Drain, Michelle M. Guevara, Tomas J. Martin Mur, and Ahlam A. Attiyah of Caltech for NASA's Jet Propulsion Laboratory.

Extensible Infrastructure for Browsing and Searching Abstracted Spacecraft Data

NASA's Jet Propulsion Laboratory, Pasadena, California

A computer program has been developed to provide a common interface for all space mission data, and allows different types of data to be displayed in the same context. This software provides an infrastructure for representing any type of mission data. Existing software requires that each type of mission data be treated separately. The new program's representations provide identifying information, and provide a means

of opening the data for further inspection. This is useful for searching and browsing large quantities of data across multiple databases.

The software is written in Java as part of the MSLICE program, and can be run on any Windows, Mac OS, or Linux computer. The software may be adapted to other mission operation software.

This work was done by Michael N. Wallick, Thomas M. Crockett, Joseph C. Joswig,

Recaredo J. Torres, Jeffrey S. Norris, Jason M. Fox, Mark W. Powell, David S. Mittman, Lucy Abramyan, Khawaja S. Shams, and Michael B. Vaughn of Caltech and Guy Pyrzak and Melissa Ludowise of Ames Research Center for NASA's Jet Propulsion Laboratory.

Lossless Compression of Data Into Fixed-Length Packets

NASA's Jet Propulsion Laboratory, Pasadena, California

A computer program effects lossless compression of data samples from a one-dimensional source into fixed-length data packets. The software makes use of adaptive prediction: it exploits the data structure in such a way as to increase the efficiency of compression beyond that otherwise achievable.

Adaptive linear filtering is used to predict each sample value based on past sample values. The difference between predicted and actual sample values is encoded using a Golomb code. The particular Golomb code used is selected using a

method described in "Simpler Adaptive Selection of Golomb Power-of-Two Codes" (NPO-41336), *NASA Tech Briefs*, Vol. 31, No. 11 (November 2007), page 71. As noted therein, the method is somewhat suboptimal (suboptimality $\leq 1/2$ bit per sample) but offers the advantage that it involves significantly less computation than does a prior method of adaptive selection of optimum codes through "brute force" application of all code options to every block of samples. Hence, the computer program is relatively simple and produces packets relatively rapidly.

The method and, hence, the program are robust to loss of packets: All parameters needed to decompress a packet are encoded in the packet. Therefore, the loss of one or more packets does not diminish the ability to reconstruct samples in remaining packets.

This work was done by Aaron B. Kiely and Matthew A. Klimesh of Caltech for NASA's Jet Propulsion Laboratory.

Video-Game-Like Engine for Depicting Spacecraft Trajectories

NASA's Jet Propulsion Laboratory, Pasadena, California

GoView is a video-game-like software engine, written in the C and C++ computing languages, that enables real-time, three-dimensional (3D)-appearing visual representation of spacecraft and trajectories (1)

from any perspective; (2) at any spatial scale from spacecraft to Solar-system dimensions; (3) in user-selectable time scales; (4) in the past, present, and/or future; (5) with varying speeds; and (6) for-

ward or backward in time. GoView constructs an interactive 3D world by use of spacecraft-mission data from pre-existing engineering software tools. GoView can also be used to produce distributable ap-

plication programs for depicting NASA orbital missions on personal computers running the Windows XP, Mac OsX, and Linux operating systems.

GoView enables seamless rendering of Cartesian coordinate spaces with programmable graphics hardware, whereas prior programs for depicting spacecraft trajectories variously require non-Cartesian coordinates and/or are not compatible with programmable hardware. GoView incorporates an algorithm for nonlinear interpolation between arbitrary reference frames, whereas the prior programs are restricted to special classes of inertial and non-inertial reference frames. Finally, whereas the prior programs present complex user interfaces requiring hours of training, the GoView interface provides guidance, enabling use without any training.

This work was done by Paul R. Upchurch of Caltech for NASA's Jet Propulsion Laboratory.

In accordance with Public Law 96-517, *the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:*

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Alert Notification System Router

Goddard Space Flight Center, Greenbelt, Maryland

The Alert Notification System Router (ANSR) software provides satellite operators with notifications of key events through pagers, cell phones, and e-mail. Written in Java, this application is specifically designed to meet the mission-critical standards for mission operations while operating on a variety of hardware environments.

ANSR is a software component that runs inside the Mission Operations Center (MOC). It connects to the mission's message bus using the GMSEC [Goddard Space Flight Center (GSFC) Mission Services Evolution Center (GMSEC)] standard. Other components, such as automation and monitoring components, can use ANSR to send directives to notify users or groups. The ANSR system, in addition to notifying users, can check for message acknowledgements from a user and escalate the notification to another user if there is no acknowledgement.

When a firewall prevents ANSR from accessing the Internet directly, proxies can be run on the other side of the wall. These proxies can be configured to access the Internet, notify users, and poll for their responses. Multiple ANSRs can be run in parallel, providing a seamless failover capability in the event that one ANSR system becomes incapacitated.

This work was done by Joseph Gurganus of Goddard Space Flight Center and Everett Cary, Robert Antonucci, and Peter Hitchener of Emergent Space Technologies, Inc. Further information is contained in a TSP (see page 1). GSC-15592-1
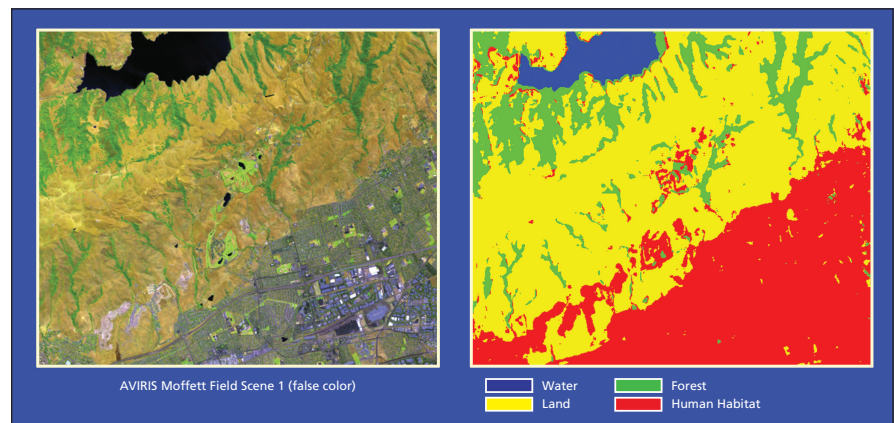
Lossless Compression of Classification-Map Data

This algorithm performs better than do general-purpose image-data compression algorithms.

NASA's Jet Propulsion Laboratory, Pasadena, California

A lossless image-data-compression algorithm intended specifically for application to classification-map data is based on prediction, context modeling, and entropy coding. The algorithm was formulated, in consideration of the differences between classification maps and ordinary images of natural scenes, so as to be capable of compressing classification-map data more effectively than do general-purpose image-data-compression algorithms.

Classification maps are typically generated from remote-sensing images acquired by instruments aboard aircraft (see figure) and spacecraft. A classification map is a synthetic image that summarizes information derived from one or more original remote-sensing image(s) of a scene. The value assigned to each pixel in such a map is the index of a class that represents some type of content deduced from the original image data — for example, a type of vegetation, a mineral, or a body of water — at the corresponding location in the scene. When classification maps are generated onboard the aircraft

AVIRIS Moffett Field Scene 1 (false color)

Water	Forest	
Land	Human Habitat	

This **False-Color Image and Classification Map** were derived from image data acquired by an airborne visible/infrared imaging spectrometer (AVIRIS) over Moffett Field, California. The classification map is typical of images meant to be processed by use of the present algorithm.

or spacecraft, it is desirable to compress the classification-map data in order to reduce the volume of data that must be transmitted to a ground station.