used to convey instrument-pointing information to the activity plan. The software allows users to develop a plan of what they would like the rover to accomplish for a given time period. When developing the plan, the user can input constraints between activities or groups of activities. MSLICE will enforce said constraints and ensure that all mission flight rules are satisfied.

This work was done by Mark W. Powell, Khawaja S. Shams, Michael N. Wallick, Jeffrey S. Norris, Joseph C. Joswig, Thomas M. Crockett, Jason M. Fox, Recaredo J. Torres of Caltech; James A. Kurien, Michael P. McCurdy, and Guy Pyrzak of NASA Ames Research Center; and Arash Aghevli and Andrew G. Bachmann of Stinger Ghaffarian Technologies, Inc. for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45908.

Telemetry-Enhancing Scripts

NASA's Jet Propulsion Laboratory, Pasadena, California

Scripts Providing a Cool Kit of Telemetry Enhancing Tools (SPACKLE) is a set of software tools that fill gaps in capabilities of other software used in processing downlinked data in the Mars Exploration Rovers' (MER) flight and test-bed operations. SPACKLE tools have helped to accelerate the automatic processing and interpretation of MER mission data, enabling non-experts to understand and/or use MER query and data product command simulation software tools more effectively. SPACKLE has greatly accelerated some operations and provides new capabilities.

The tools of SPACKLE are written, variously, in Perl or the C or C++ language. They perform a variety of search and shortcut functions that include the following:

- Generating text-only, Event Report-annotated, and Web-enhanced views of command sequences;
- Labeling integer enumerations with their symbolic meanings in text messages and engineering channels;
- Systematic detecting of corruption within data products;
- Generating text-only displays of data-product catalogs including downlink status;
- Validating and labeling of commands related to data products;
- Performing of convenient searches of detailed engineering data spanning multiple Martian solar days;
- Generating tables of initial conditions pertaining to engineering, health, and accountability data;
- Simplified construction and simulation of command sequences; and
- Fast time format conversions and sorting.

This program was written by Mark W. Maimone of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-45700.

Analog Input Data Acquisition Software

John F. Kennedy Space Center, Florida

DAQ Master Software allows users to easily set up a system to monitor up to five analog input channels and save the data after acquisition. This program was written in LabVIEW 8.0, and requires the LabVIEW runtime engine 8.0 (free download from National Instruments; ni.com) to run the executable. A DAQ card must be installed in the computer for this program to work correctly, and it must have up to five analog input channels. The user can set the channel configuration, and other channel details, from the setup tab after the program has begun.

A Setup tab holds all information for the channels that will be used for data acquisition, and allows the user to save or upload the settings for future use by writing or reading a configuration file. The Data Acquisition tab is where the commands to acquire, stop, and save data are located, and where the data will be displayed. The user can choose to display scaled or un-scaled data while acquisition is taking place.

This work was done by Ellen Arens of Kennedy Space Center. For more information, visit http://www.openchannelsoftware.com/projects/Analog_Input_Data_Acquisition for a free download. KSC-13203

Relay Sequence Generation Software

NASA's Jet Propulsion Laboratory, Pasadena, California

Due to thermal and electromagnetic interactivity between the UHF (ultra-high frequency) radio onboard the Mars Reconnaissance Orbiter (MRO), which performs relay sessions with the Martian landers, and the remainder of the MRO payloads, it is required to integrate and de-conflict relay sessions with the MRO science plan. The MRO relay SASF/PTF (spacecraft activity sequence file/ payload target file) generation software facilitates this process by generating a PTF that is needed to integrate the periods of time during which MRO supports relay activities with the rest of the MRO science plans. The software also generates the needed command products that initiate the relay sessions, some features of which are provided by the lander team, some are managed by MRO internally, and some being derived.

By utilizing an input file provided by the lander team, along with a managed configuration file, the MRO relay SASF/PTF generation software runs MRO's MTT (Mars Target Tool) software recursively to construct the Relay PTF. It also references these same input products to generate the SASFs needed to support the overflight. Each SASF has all of the parameters and commanding required to instruct MRO to initiate the relay session and to configure the onboard radio to transfer data to and from the landed asset. In addition, the software performs version checking on the current input file and determines any modifications to the file from any previous version. If instructed, it will output only that information which is relevant to the changed entries.

This work was done by Roy E. Gladden and Teerapat Khanampornpan of Caltech for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-46512.

GlastCam: A Telemetry-Driven Spacecraft Visualization Tool

Goddard Space Flight Center, Greenbelt, Maryland

Developed for the GLAST project, which is now the Fermi Gamma-ray Space Telescope, GlastCam software ingests telemetry from the Integrated Test and Operations System (ITOS) and generates four graphical displays of geometric properties in real time, allowing visual assessment of the attitude, configuration, position, and various cross-checks. Four windows are displayed: a "cam" window shows a 3D view of the satellite; a second window shows the standard position plot of the satellite on a Mercator map of the Earth; a third window displays star tracker fields of view, showing which stars are visible from the spacecraft in order to verify star tracking; and the fourth window depicts Sun sensor measurements, enabling verification of the solar array deployment state. Each of these windows has telltales showing useful information applicable to each window, such as spacecraft axes, magnetic field vectors, the Sun-pointing direction, and the like. These can be toggled on or off as desired. By breaking up the data into applicable windows, it is easier to monitor specific data of interest. Because the displays operate in real time and visually, any changes to the spacecraft's configuration or attitude are seen immediately. This allows for fast and intuitive spacecraft geometry assessment.

This work was done by Eric T. Stoneking and Dean Tsai of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-15572-1

Robot Vision Library

NASA's Jet Propulsion Laboratory, Pasadena, California

The JPL Robot Vision Library (JPLV) provides real-time robot vision algorithms for developers who are not vision specialists. The package includes algorithms for stereo ranging, visual odometry and unsurveyed camera calibration, and has unique support for very wide-angle lenses (as used on the Mars Exploration Rover HazCams). JPLV gathers these algorithms into one uniform, documented, and tested package with a consistent C API (application programming interface). The software is designed for real-time execution (10–20 Hz) on COTS (commercial, off-the-shelf) workstations and embedded processors.

This package incorporates algorithms developed over more than ten years of research in ground and planetary robotics for NASA, DARPA (Defense Advanced Research Projects Agency) and the Army Research Labs, and is currently being used in applications as diverse as legged vehicle navigation and large-scale urban modeling.

This work was done by Andrew B. Howard, Adnan I. Ansar, and Todd E. Litwin of Caltech and Steven B. Goldberg of Indelible Systems for NASA's Jet Propulsion Laboratory.

This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-46532.

Mission Operations and Navigation Toolkit Environment

NASA's Jet Propulsion Laboratory, Pasadena, California

MONTE (Mission Operations and Navigation Toolkit Environment) Release 7.3 is an extensible software system designed to support trajectory and navigation analysis/design for space missions. MONTE is intended to replace the current navigation and trajectory analysis software systems, which, at the time of this reporting, are used by JPL's Navigation and Mission Design section. The software provides an integrated, simplified, and flexible system that can be easily maintained to serve the needs of future missions in need of navigation services.

MONTE has an integrated case management system that allows users to create taxonomies to describe and categorize runs. It has the ability to plot and display multiple cases and scenarios simultaneously, using color to differentiate, allowing for side-by-side analysis. Users can define