

quired to operate below a stringent 4MB high-water memory ceiling; hence, numerous tricks and strategies were introduced to reduce the memory footprint. Local filtering operations were re-coded to operate on horizontal data stripes across the image. Data types were reduced to smaller sizes where possible. Binary-valued intermediate results were squeezed into a more compact, one-bit-per-pixel representation through bit packing and bit manipulation macros.

An estimated 16-fold reduction in memory footprint relative to the original Rockster algorithm was achieved. The resulting memory footprint is less than four times the base image size. Also, memory allocation calls were modified to draw from a static pool and consolidated to reduce memory management overhead and fragmentation.

Rockster-MER has now been run on-board Opportunity numerous times as part of AEGIS with exceptional

performance. Sample results are available on the AEGIS website at <http://aegis.jpl.nasa.gov>.

This work was done by Michael C. Burl, David R. Thompson, Benjamin J. Bornstein, and Charles K. deGranville of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

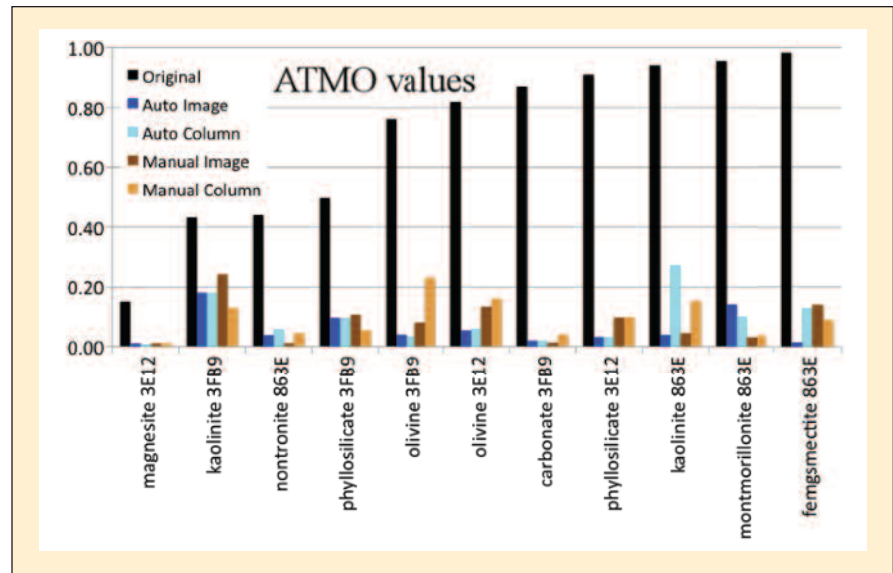
This software is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-47954.

Advanced Multimission Operations System (ATMO)

NASA's Jet Propulsion Laboratory, Pasadena, California

The HiiHat toolbox developed for CAT/ENVI provides principal investigators direct, immediate, flexible, and seamless interaction with their instruments and data from any location. Offering segmentation and neutral region division, it facilitates the discovery of key endmembers and regions of interest larger than a single pixel.

Crucial to the analysis of hyperspectral data from Mars or Earth is the removal of unwanted atmospheric signatures. For Mars and the Compact Reconnaissance Imaging Spectrometer for Mars (CRISM), residual atmospheric CO₂ absorption is both directly problematic and indicative of processing errors with implications to the scientific utility of any particular image region. Estimating this residual error becomes key both in selecting regions of low distortion, and also to select mitigating methods, such as neutral region division. This innovation, the ATMO estimator, provides a simple, 0-1 normalized scalar that estimates this distortion (see figure). The metric is defined as the coefficient of determination of a quadratic fit in the region of distorting atmospheric absorption ($\approx 2 \mu\text{m}$). This mimics the behavior of existing CRISM



Automatic Method matches manual for atmospheric correction.

team mineralogical indices to estimate the presence of known, interesting mineral signatures. This facilitates the ATMO metric's assimilation into existing planetary geology workflows.

This work was done by Lukas Mandrake and David R. Thompson of Caltech

for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

This software is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-47670.

Robot Sequencing and Visualization Program (RSVP)

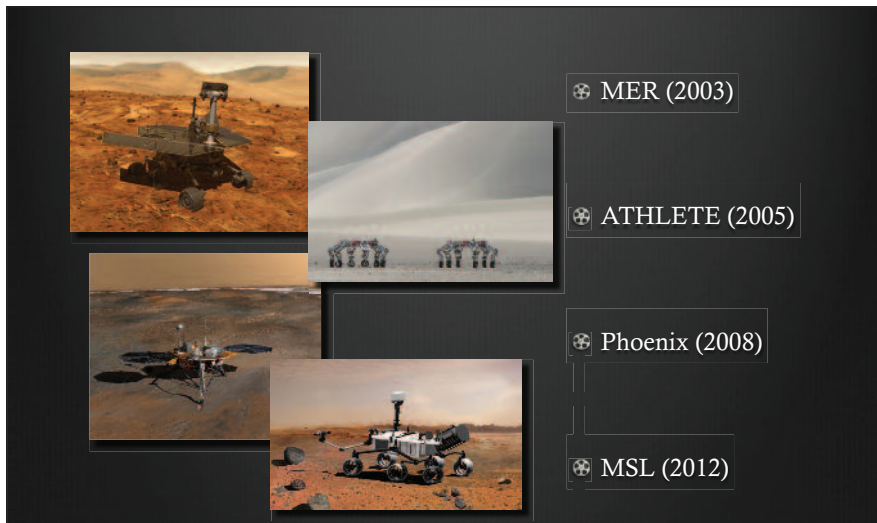
NASA's Jet Propulsion Laboratory, Pasadena, California

The Robot Sequencing and Visualization Program (RSVP) is being used in the Mars Science Laboratory (MSL) mission for downlink data visualization and command sequence generation. RSVP reads and writes downlink data products from the operations data server (ODS)

and writes uplink data products to the ODS. The primary users of RSVP are members of the Rover Planner team (part of the Integrated Planning and Execution Team (IPE)), who use it to perform traversability/articulation analyses, take activity plan input from the Science

and Mission Planning teams, and create a set of rover sequences to be sent to the rover every sol (see figure).

The primary inputs to RSVP are downlink data products and activity plans in the ODS database. The primary outputs are command sequences to be placed in



Missions using RSVP.

the ODS for further processing prior to uplink to each rover. RSVP is composed of two main subsystems. The first, called the Robot Sequence Editor (RoSE), understands the MSL activity and command dictionaries and takes care of converting incoming activity level inputs

into command sequences. The Rover Planners use the RoSE component of RSVP to put together command sequences and to view and manage command level resources like time, power, temperature, etc. (via a transparent real-time connection to SEQGEN).

The second component of RSVP is called HyperDrive, a set of high-fidelity computer graphics displays of the Martian surface in 3D and in stereo. The Rover Planners can explore the environment around the rover, create commands related to motion of all kinds, and see the simulated result of those commands via its underlying tight coupling with flight navigation, motor, and arm software. This software is the evolutionary replacement for the Rover Sequencing and Visualization software used to create command sequences (and visualize the Martian surface) for the Mars Exploration Rover mission.

This work was done by Brian K. Cooper, Scott A. Maxwell, Frank R. Hartman, John R. Wright, Jeng Yen, Nicholas T. Toole, and Zareh Gorjian of Caltech; and Jack C. Morrison of Northrop Grumman for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

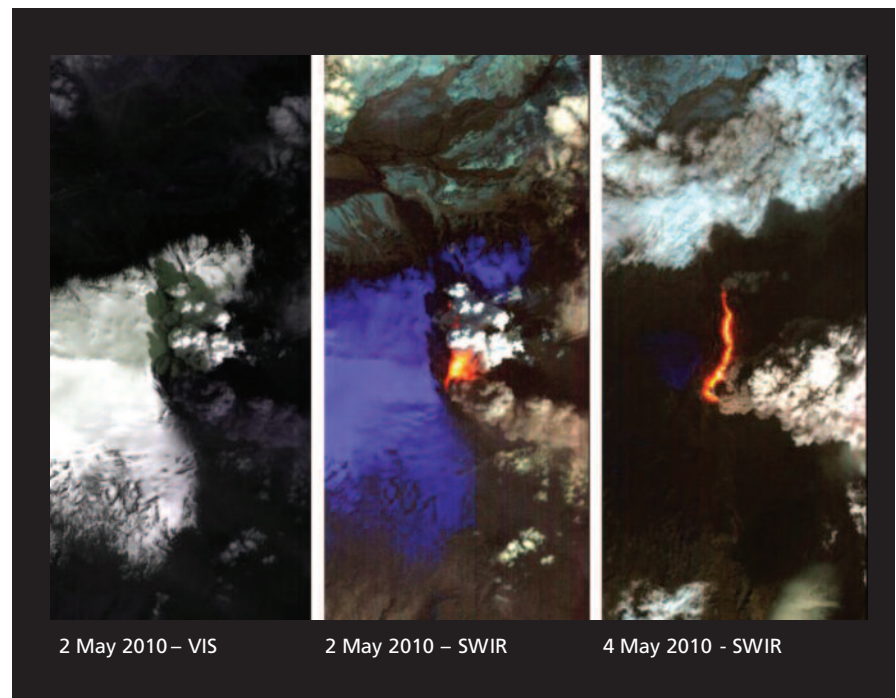
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Automating Hyperspectral Data for Rapid Response in Volcanic Emergencies

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In a volcanic emergency, time is of the essence. It is vital to quantify eruption parameters (thermal emission, effusion rate, location of activity) and distribute this information as quickly as possible to decision-makers in order to enable effective evaluation of eruption-related risk and hazard. The goal of this work was to automate and streamline processing of spacecraft hyperspectral data, automate product generation, and automate distribution of products.

The software rapidly processes hyperspectral data, correcting for incident sunlight where necessary, and atmospheric transmission; detects thermally anomalous pixels; fits data with model black-body thermal emission spectra to determine radiant flux; calculates atmospheric convection thermal removal; and then calculates total heat loss. From these results, an estimation of effusion rate is made. Maps are generated of thermal emission and location (see figure). Products are posted online, and relevant parties notified. Effusion rate data are added to historical record and



Visible and Short-Wave Infrared Images of volcanic eruption in Iceland in May 2010.