Four methods for detecting object reflections have been implemented: detection in the rectified camera images using cross correlation, detection in stereo range images, detection in a world map generated from range data, and detection using combined stereo range images and rectified camera images. Detection in stereo range images (see figure) exploits the knowledge that 3D coordinates of stereo range data on object reflections occur below the ground surface at a range close to that of the reflecting object.

Any autonomous robotic platform used on cross-country terrain that has restrictions on driving through water could benefit from this software, including military platforms and perhaps some agricultural platforms. The automotive industry could potentially benefit from an application of this technology to detect wet pavement.

This work was done by Arturo L. Rankin and Larry H. Matthies of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

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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Refer to NPO-48494, volume and number of this NASA Tech Briefs *issue, and the page number.*

SATPLOT for Analysis of SECCHI Heliospheric Imager Data

NASA's Jet Propulsion Laboratory, Pasadena, California

Determining trajectories of solar transients such as coronal mass ejections is not always easy. White light images from SECCHI's (Sun Earth Connection Coronal and Heliospheric Investigation) heliospheric imagers are difficult to interpret because they represent a line-of-sight projection of optically thin solar wind structures. A structure's image by itself gives no information about its angle of propagation relative to the Sun-spacecraft line, and an image may show a superposition of several structures, all propagating at different angles. Analyzing SECCHI heliospheric imager data using plots of elongation (angle from the Sun) versus time at fixed position angle (aka "Jplots") has proved extremely useful in understanding the observed solar wind structures. This technique has been used to study CME (coronal mass ejection) propagation, CIRs (corotating interaction regions), and blobs.

SATPLOT software was developed to create and analyze such elongation versus time plots. The tool uses a library of cylindrical maps of the data for each spacecraft's panoramic field-of-view. Each map includes data from three SECCHI white-light telescopes (the COR2 coronagraph and both heliospheric imagers) at one time for one spacecraft. The maps are created using a Plate Carree projection, optimized for creating the elongation versus time plots. The tool can be used to analyze the observed tracks of features seen in the maps, and the tracks are then used to extract information, for example, on the angle of propagation of the feature.

This work was done by Jeffrey R. Hall and Paulett C. Liewer 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 Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-47826.

Plug-in Plan Tool v3.0.3.1

Lyndon B. Johnson Space Center, Houston, Texas

The role of PLUTO (Plug-in Port UTilization Officer) and the growth of the International Space Station (ISS) have exceeded the capabilities of the current tool PiP (Plug-in Plan). Its users (crew and flight controllers) have expressed an interest in a new, easy-to-use tool with a higher level of interactivity and functionality that is not bound by the limitations of Excel.

The PiP Tool assists crewmembers and ground controllers in making real-time decisions concerning the safety and compatibility of hardware plugged into the UOPs (Utility Outlet Panels) onboard the ISS. The PiP Tool also provides a reference to the current configuration of the hardware plugged in to the UOPs, and enables the PLUTO and crew to test Plug-in locations for constraint violations (such as cable connector mismatches or amp limit violations), to see the amps and volts for an end item, to see whether or not the end item uses 1553 data, and the cable length between the outlet and the end item. As new equipment is flown or returned, the database can be updated appropriately as needed. The current tool is a macro-heavy Excel spreadsheet with its own database and reporting functionality.

The new tool captures the capabilities of the original tool, ports them to new software, defines a new dataset, and compensates for ever-growing unique constraints associated with the Plug-in Plan. New constraints were designed into the tool, and updates to existing constraints were added to provide more flexibility and customizability. In addition, there is an option to associate a "Flag" with each device that will let the user know there is a unique constraint associated with it when they use it. This helps improve the safety and efficiency of real-time calls by limiting the amount of "corporate knowledge" overhead that has to be trained and learned through use.

The tool helps save time by automating previous manual processes, such as calculating connector types and deciding which cables are required and in what order.