This project provides a better onboard tool for the crew to safely test ideas for reconfigurations before calling the ground, and send the changes directly. The layout provides clear detail for power channels, module locations, and data ports, and allows for intuitive "drag-and-drop" connections from the database. The software will allow only compatible connections to occur, and will flag violations if they exist. It also allows the user to flag unique constraints that might not be caught by the software's existing rules and calculations.

The PiP Tool includes reporting capabilities that allow the user to export database information and configuration information to Excel to share with others or run detailed comparisons and searches as needed.

This work was done by Kathleen E. Andrea-Liner, Brion J. Au, Blake R. Fisher, Watchara Rodbumrung, Jeffrey C. Hamic, Kary Smith, and David S.Beadle of the United Space Alliance for Johnson Space Center. Further information is contained in a TSP (see page 1). *MSC-24872-1*

Frequency Correction for MIRO Chirp Transformation Spectroscopy Spectrum

NASA's Jet Propulsion Laboratory, Pasadena, California

This software processes the flyby spectra of the Chirp Transform Spectrometer (CTS) of the Microwave Instrument for Rosetta Orbiter (MIRO). The tool corrects the effect of Doppler shift and local-oscillator (LO) frequency shift during the flyby mode of MIRO operations. The frequency correction for CTS flyby spectra is performed and is integrated with multiple spectra into a high signal-to-noise averaged spectrum at the rest-frame RF frequency. This innovation also generates the 8 molecular line spectra by dividing continuous 4,096-channel CTS spectra. The 8 line spectra can then be readily used for scientific investigations.

A spectral line that is at its rest frequency in the frame of the Earth or an asteroid will be observed with a time-varying Doppler shift as seen by MIRO. The frequency shift is toward the higher RF frequencies on approach, and toward lower RF frequencies on departure. The magnitude of the shift depends on the flyby velocity. The result of time-varying Doppler shift is that of an observed spectral line will be seen to move from channel to channel in the CTS spectrometer. The direction (higher or lower frequency) in the spectrometer depends on the spectral line frequency under consideration. In order to analyze the flyby spectra, two steps are required. First, individual spectra must be corrected for the Doppler shift so that individual spectra can be superimposed at the same rest frequency for integration purposes. Second, a correction needs to be applied to the CTS spectra to account for the LO frequency shifts that are applied to asteroid mode.

This work was done by Seungwon Lee 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-47304.

Nonlinear Estimation Approach to Real-Time Georegistration from Aerial Images

This technology can be used for real-time search and rescue operations and surveillance applications using cameras mounted on aircraft or UAVs.

NASA's Jet Propulsion Laboratory, Pasadena, California

When taking aerial images, it is important to know locations of specific points of interest in an Earth-centered coordinate system (latitude, longitude, height) (see figure). The correspondence between a pixel location in the image and its Earth coordinate is known as georegistration. There are two main technical challenges arising in the intended application. The first is that no known features are assumed to be available in any of the images. The second is that the intended applications are real time. Here, images are taken at regular intervals (i.e. once per second), and it is desired to make decisions in real time based on the geolocation of specific objects seen in the images as they arrive. This is in sharp contrast to most current methods for geolocation that operate "after-the-fact" by processing, on the ground, a database of stored images using computationally intensive methods.

The solution is a nonlinear estimation algorithm that combines processed real-time camera images with vehicle position and attitude information obtained from an onboard GPS receiver. This approach provides accurate georegistration estimates (latitude, longitude, height) of arbitrary features and/or points of interest seen in the camera images. This solves the georegistration problem at the modest cost of augmenting the camera information with a GPS receiver carried onboard the vehicle.

The nonlinear estimation algorithm is based on a linearized Kalman filter structure that carries 19 states in its current implementation. Six of the 19 states are calibration parameters associated with the initial camera pose. One of the states calibrates the scale factor associated with all camera-derived information. The remaining 12 states are used to model the current kinematic state of the vehicle (position, velocity, acceleration, and attitude).