Integrated System for Autonomous Science

The New Millennium Program Space Technology 6 Project Autonomous Sciencecraft software implements an integrated system for autonomous planning and execution of scientific, engineering, and spacecraft-coordination actions. A prior version of this software was reported in “The TechSat 21 Autonomous Sciencecraft Experiment” (NPO-30784), NASA Tech Briefs, Vol. 28, No. 5 (March 2004), page 33. This software is now in continuous use aboard the Earth Orbiter 1 (EO-1) spacecraft mission and is being adapted for use in the Mars Odyssey and Mars Exploration Rovers missions. This software enables EO-1 to detect and respond to such events of scientific interest as volcanic activity, flooding, and freezing and thawing of water. It uses classification algorithms to analyze imagery on-board to detect changes, including events of scientific interest. Detection of such events triggers acquisition of follow-up imagery. The mission-planning component of the software develops a response plan that accounts for visibility of targets and operational constraints. The plan is then executed under control by a task-execution component of the software that is capable of responding to anomalies.

This program was written by Steve Chien, Robert Sherwood, Daniel Tran, Benjamin Cicily, Ashley Davies, Rebecca Castaño, Gregg Rubideau, Stuart Frye, Bruce Trotz, Seth Shulman, Thomas Doggett, Felipe Ip, Ron Gruen, Victor Baker, James Dohn, and Darrell Boyer 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 Karina Edmonds of the California Institute of Technology at (818) 393-2827. Refer to NPO-41962.

Satellite Image Mosaic Engine

A computer program automatically builds large, full-resolution mosaics of multispectral images of Earth landmasses from images acquired by Landsat 7, complete with matching of colors and blending between adjacent scenes. While the code has been used extensively for Landsat, it could also be used for other data sources. A single mosaic of as many as 8,000 scenes, represented by more than 5 terabytes of data and the largest set produced in this work, demonstrated what the code could do to provide global coverage. The program first statistically analyzes input images to determine areas of coverage and data-value distributions. It then transforms the input images from their original universal transverse Mercator coordinates to other geographical coordinates, with scaling. It applies a first-order polynomial brightness correction to account for variations in the illumination of the Earth's surface.