

of control activities, such as monitoring and control of the electric grid, chemical, or nuclear plant processes, air traffic control, and the like.

*This program was written by Hasan Rahman of Lockheed Martin for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-24337-1*

## Update on PISCES

An updated version of the Platform Independent Software Components for the Exploration of Space (PISCES) software library is available. A previous version was reported in “Library for Developing Spacecraft-Mission-Planning Software” (MSC-22983), *NASA Tech Briefs*, Vol. 25, No. 7 (July 2001), page 52. To recapitulate: This software provides for Web-based, collaborative development of computer programs for planning trajectories and trajectory-related aspects of spacecraft-mission design. The library was built using state-of-the-art object-oriented concepts and software-development methodologies. The components of PISCES include Java-language application programs arranged in a hierarchy of classes that facilitates the reuse of the components.

As its full name suggests, the PISCES library affords platform-independence: The Java language makes it possible to use the classes and application programs with a Java virtual machine, which is available in most Web-browser programs. Another advantage is expandability: Object orientation facilitates expansion of the library through creation of a new class. Improvements in the library since the previous version include development of orbital-maneuver-planning and rendezvous-launch-window application programs, enhancement of capabilities for propagation of orbits, and development of a “desktop” user interface.

*This program was written by Don Pearson, Dustin Hamm, Brian Kubena, and Jonathan K. Weaver of Johnson Space Center. For further information, contact the Johnson Commercial Technology Office at (281) 483-3809. MSC-23633-1*

## Ground and Space Radar Volume Matching and Comparison Software

This software enables easy comparison of ground- and space-based radar observations. The software was initially designed to compare ground radar reflectivity from operational, ground based S-

and C-band meteorological radars with comparable measurements from the Tropical Rainfall Measuring Mission (TRMM) satellite’s Precipitation Radar (PR) instrument. The software is also applicable to other ground-based and space-based radars. The ground and space radar volume matching and comparison software was developed in response to requirements defined by the Ground Validation System (GVS) of Goddard’s Global Precipitation Mission (GPM) project.

This software innovation is specifically concerned with simplifying the comparison of ground- and space-based radar measurements for the purpose of GPM algorithm and data product validation. This software is unique in that it provides an operational environment to routinely create comparison products, and uses a direct geometric approach to derive common volumes of space- and ground-based radar data. In this approach, spatially coincident volumes are defined by the intersection of individual space-based Precipitation Radar rays with the each of the conical elevation sweeps of the ground radar. Thus, the resampled volume elements of the space and ground radar reflectivity can be directly compared to one another.

*This work was done by Kenneth Morris and Mathew Schwaller of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). Additional information can also be found on the GPM GVS web site: <http://gpm.gsfc.nasa.gov/groundvalidation.html>. GSC-15738-1*

## Web-Based Interface for Command and Control of Network Sensors

This software allows for the visualization and control of a network of sensors through a Web browser interface. It is currently being deployed for a network of sensors monitoring Mt. Saint Helen’s volcano; however, this innovation is generic enough that it can be deployed for any type of sensor Web. From this interface, the user is able to fully control and monitor the sensor Web. This includes, but is not limited to, sending “test” commands to individual sensors in the network, monitoring for real-world events, and reacting to those events.

*This work was done by Michael N. Wallick, Joshua R. Doubleday, and Khawaja S. Shams of Caltech for NASA’s Jet Propulsion*

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*This software is available for commercial licensing. Please contact Daniel Broderick of the California Institute of Technology at [danielb@caltech.edu](mailto:danielb@caltech.edu). Refer to NPO-47110.*

## Orbit Determination Toolbox

The Orbit Determination Toolbox is an orbit determination (OD) analysis tool based on MATLAB and Java that provides a flexible way to do early mission analysis. The toolbox is primarily intended for advanced mission analysis such as might be performed in concept exploration, proposal, early design phase, or rapid design center environments. The emphasis is on flexibility, but it has enough fidelity to produce credible results. Insight into all flight dynamics source code is provided.

MATLAB is the primary user interface and is used for piecing together measurement and dynamic models. The Java Astrodynamics Toolbox is used as an engine for things that might be slow or inefficient in MATLAB, such as high-fidelity trajectory propagation, lunar and planetary ephemeris look-ups, precession, nutation, polar motion calculations, ephemeris file parsing, and the like. The primary analysis functions are sequential filter/smoothing and batch least-squares commands that incorporate Monte-Carlo data simulation, linear covariance analysis, measurement processing, and plotting capabilities at the generic level.

These functions have a user interface that is based on that of the MATLAB ODE suite. To perform a specific analysis, users write MATLAB functions that implement truth and design system models. The user provides his or her models as inputs to the filter commands. The software provides a capability to publish and subscribe to a software bus that is compliant with the NASA Goddard Mission Services Evolution Center (GMSEC) standards, to exchange data with other flight dynamics tools to simplify the flight dynamics design cycle. Using the publish and subscribe approach allows for analysts in a rapid design center environment to seamlessly incorporate changes in spacecraft and mission design into navigation analysis and vice versa.

*This work was done by James R. Carpenter and Kevin Berry of Goddard Space Flight Center and Kate Gregory, Keith Speckman, Sun Hur-Diaz, Derek Surka, and Dave Gaylor of Emergent Space Technologies, Inc. For*