**Integrated Budget Office Toolbox**

The Integrated Budget Office Toolbox (IBOT) combines budgeting, resource allocation, organizational funding, and reporting features in an automated, integrated tool that provides data from a single source for Johnson Space Center (JSC) personnel. Using a common interface, concurrent users can utilize the data without compromising its integrity. IBOT tracks planning changes and updates throughout the year using both phased and POP-related (program-operating-plan-related) budget information for the current year, and up to six years out.

Separating lump-sum funds received from HQ (Headquarters) into separate labor, travel, procurement, Center G&A (general & administrative), and service-pool categories, IBOT creates a script that significantly reduces manual input time. IBOT also manages the movement of travel and procurement funds down to the organizational level and, using its integrated funds management feature, helps better track funding at lower levels. Third-party software is used to create integrated reports in IBOT that can be generated for plans, actuals, funds received, and other combinations of data that are currently maintained in the centralized format. Based on Microsoft SQL, IBOT incorporates generic budget processes, is transportable, and is economical to deploy and support.

*This program was written by Douglas A. Rushing, Chris Blakeley, Gerry Chapman, and Bill Robertson of Johnson Space Center and Allison Horton, Thomas Besser, and Debbie McCarthy of SAIC. Further information is contained in a TSP (see page 1), MSC-24167-1*

**PLOT3D Export Tool for Tecplot**

The PLOT3D export tool for Tecplot solves the problem of modified data being impossible to output for use by another computational science solver. The PLOT3D Exporter add-on enables the use of Tecplot as an interpolation tool for solution conversion between different grids of different types. This one add-on enhances the functionality of Tecplot so significantly, it offers the ability to incorporate Tecplot into a general suite of tools for computational science applications as a 3D graphics engine for visualization of all data.

*This work was done by Stephen Alter of Langley Research Center. Further information is contained in a TSP (see page 1), MSC-24139-1*

**Math Description Engine Software Development Kit**

The Math Description Engine Software Development Kit (MDE SDK) can be used by software developers to make computer-rendered graphs more accessible to blind and visually-impaired users. The MDE SDK generates alternative graph descriptions in two forms: textual descriptions and non-verbal sound renderings, or sonification. It also enables display of an animated trace of a graph sonification on a visual graph component, with color and line-thickness options for users having low vision or color-related impairments. A set of accessible graphical user interface widgets is provided for operation by end users and for control of accessible graph displays.

*This work was done by Robert O. Shelton of Johnson Space Center, Stephanie L. Smith and Dan E. Dexter of L-3 Communications Corp., and Terry R. Hodgson of Indyne, Inc. Further information is contained in a TSP (see page 1), MSC-24167-1*

**Astronaut Office Scheduling System Software**

AOSS is a highly efficient scheduling application that uses various tools to schedule astronauts’ weekly appointment information. This program represents an integration of many technologies into a single application to facilitate schedule sharing and management. It is a Windows-based application developed in Visual Basic. Because the NASA standard office automation load environment is Microsoft-based, Visual Basic provides AOSS developers with the ability to interact with Windows collaboration components by accessing objects models from applications like Outlook and Excel. This also gives developers the ability to create newly customizable components that perform specialized tasks pertaining to scheduling reporting inside the application. With this capability, AOSS can perform various asynchronous tasks, such as gathering/send/ing/managing astronauts’ schedule information directly to their Outlook calendars at any time. AOSS users use
ISS Solar Array Management

The International Space Station (ISS) Solar Array Management (SAM) software toolset provides the capabilities necessary to operate a spacecraft with complex solar array constraints. It monitors spacecraft telemetry and provides interpretations of solar array constraint data in an intuitive manner. The toolset provides extensive situational awareness to ensure mission success by analyzing power generation needs, array motion constraints, and structural loading situations.

The software suite consists of several components including samCS (constraint set selector), samShadyTimers (array shadowing timers), samWin (visualization GUI), samLock (array motion constraint computation), and samJet (attitude control system configuration selector). It provides high availability and uptime for extended and continuous mission support. It is able to support two-degrees-of-freedom (DOF) array positioning and supports up to ten simultaneous constraints with intuitive 1D and 2D decision support visualizations of constraint data. Display synchronization is enabled across a networked control center and multiple methods for constraint data interpolation are supported. Use of this software toolset increases flight safety, reduces mission support effort, optimizes array operation for achieving mission goals, and has run for weeks at a time without issues.

The SAM toolset is currently used in ISS real-time mission operations. This work was done by James P. Williams, Keith D. Martin, Justin R. Thomas, and Samuel Caro of United Space Alliance for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-24425-1

Probabilistic Structural Analysis Program

NASA/NESUS 6.2c is a general-purpose, probabilistic analysis program that computes probability of failure and probabilistic sensitivity measures of engineered systems. Because NASA/NESUS uses highly computationally efficient and accurate analysis techniques, probabilistic solutions can be obtained even for extremely large and complex models. Once the probabilistic response is quantified, the results can be used to support risk-informed decisions regarding reliability for safety-critical and one-of-a-kind systems, as well as for maintaining a level of quality while reducing manufacturing costs for larger-quantity products. NASA/NESUS has been successfully applied to a diverse range of problems in aerospace, gas turbine engines, biomechanics, pipelines, defense, weaponry, and infrastructure.

This program combines state-of-the-art probabilistic algorithms with general-purpose structural analysis and lifting methods to compute the probabilistic response and reliability of engineered structures. Uncertainties in load, material properties, geometry, boundary conditions, and initial conditions can be simulated. The structural analysis methods include non-linear finite-element methods, heat-transfer analysis, polymer-ceramic matrix composite analysis, monolithic (conventional metallic) materials life-prediction methodologies, boundary element methods, and user-written subroutines. Several probabilistic algorithms are available such as the advanced mean value method and the adaptive importance sampling method. NASA/NESUS 6.2c is structured in a modular format with 15 elements.

This work was done by Shantaram S. Pai, Christos C. G. Chamas, Pagau L. N. Murphy, and George R. Stofko of Glenn Research Center; David S. Raha and Ben H. Thacker of Southwest Research Institute; Vinod K. Nagpal of N & R Engineering and Subodh K. Mital of the University of Toledo. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office; Attn: Steve Feder, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18229-I

SPOT Program

A Spacecraft Position Optimal Tracking (SPOT) program was developed to process Global Positioning System (GPS) data, sent via telemetry from a spacecraft, to generate accurate navigation estimates of the vehicle position and velocity (state vector) using a Kalman filter. This program uses the GPS onboard receiver measurements to sequentially calculate the vehicle state vectors and provide this information to ground flight controllers. It is the first real-time ground-based shuttle navigation application using onboard sensors. The program is compact, portable, self-contained, and can run on a variety of UNIX or Linux computers.

The program has a modular object-oriented design that supports application-specific plugins such as data corruption remediation pre-processing and remote graphics display. The Kalman filter is extensible to additional sensor types or force models. The Kalman filter design is also strong against data dropouts because it uses physical models from state and covariance propagation in the absence of data.

The design of this program separates the functionalities of SPOT into six dif-