Software

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 phasing 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 the most commonly available visualization tools to engineers for output of a standard format. The exportation of PLOT3D data from Tecplot has far reaching effects because it allows for grid and solution manipulation within a graphical user interface (GUI) that is easily customized with macro language-based and user-developed GUIs. The add-on also 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.

Within the PLOT3D Export Add-on are several functions that enhance the operations and effectiveness of the add-on. Unlike Tecplot output functions, the PLOT3D Export Add-on enables the use of the zone selection dialog in Tecplot to choose which zones are to be written by offering three distinct options — output of active, inactive, or all zones (grid blocks). As the user modifies the zones to output with the zone selection dialog, the zones to be written are similarly updated. This enables the use of Tecplot to create multiple configurations of a geometry being analyzed. For example, if an aircraft is loaded with multiple deflections of flaps, by activating and deactivating different zones for a specific flap setting, new specific configurations of that aircraft can be easily generated by only writing out specific zones. Thus, if ten flap settings are loaded into Tecplot, the PLOT3D Export software can output ten different configurations, one for each flap setting.

This work was done by Stephen Alter of Langley Research Center. Further information is contained in a TSP (see page 1). LAR-17678-1

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.

Version 1.0 of the MDE SDK generates text descriptions for 2D graphs commonly seen in math and science curriculum (and practice). The mathematically rich text descriptions can also serve as a virtual math and science assistant for blind and sighted users, making graphs more accessible for everyone.

The MDE SDK has a simple application programming interface (API) that makes it easy for programmers and Web-site developers to make graphs accessible with just a few lines of code. The source code is written in Java for cross-platform compatibility and to take advantage of Java's built-in support for building accessible software application interfaces. Compiled-library and NASA Open Source versions are available with API documentation and Programmer's Guide at http://prime.jsc.nasa.gov.

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-24139-1

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/sending/managing astronauts' schedule information directly to their Outlook calendars at any time. AOSS users use

this specific appointment information entered in the application to generate reports and to keep track of active NASA astronauts' whereabouts at all times.

AOSS can send or retrieve astronauts' schedule information via their individual Outlook calendars with a two-part process called PUSH and PULL. This process, along with weekly operational procedures agreed to by the users and current astronaut corps staff, delivers optimal scheduling processing performance. AOSS also provides the ability to create reports, statistics, and situation information for many NASA offices. Displays of the software are designed to be functional and familiar by using the same format design to ensure ease of use.

The software is composed of three main components — AOSS Application, AOSS Web, and AOSS Database. In the application, this is the main data entry point where most of the AOSS-typical transactions occur. AOSS users and the AOSS application perform data manipulation, reporting, and changes here. The application is the main lifeline between the user and the database. The AOSS Web function allows users to use a Web browser environment to view information, print results, and transact with the results of data entered in the AOSS database. This component contains a mixture of html and asp pages.

The main operation of the database is to hold data entered through the application component and to provide secure access to this information by qualified AOSS users, customers, and management. The database was developed in SQL and is held within an SQL server database environment. Using this system eliminates the need to prepare paper schedules and the time it takes to distribute them to the astronauts as well as ensuring a faster delivery of updates and schedule changes.

This work was done by Estevancio Brown of United Space Alliance for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-24384-1

Σ 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 gen-

eration 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 solar 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/NESSUS 6.2c is a general-purpose, probabilistic analysis program that computes probability of failure and probabilistic sensitivity measures of engineered systems. Because NASA/NESSUS 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/NESSUS 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/NESSUS 6.2c is structured in a modular format with 15 elements.

This work was done by Shantaram S. Pai, Christos C. Chamis, Pappu L. N. Murthy, and George L. Stefko of Glenn Research Center; David S. Riha and Ben H. Thacker of Southwest Research Institute; Vinod K. Nagpal of N&R Engineering and Subodh K. Mital of the University of Toledo. FFurther 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 Fedor, Mail Stop 4–8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18229-1

Σ 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-