

into elements susceptible to independent verification and validation, in such a manner that scaling issues are minimized, so that relatively large software systems can be aggressively verified in a cost-effective manner.

*This work was done by William Reinholtz and Daniel Dvorak 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-40842.*

## Tool for Ranking Research Options

Tool for Research Enhancement Decision Support (TREDS) is a computer program developed to assist managers in ranking options for research aboard the International Space Station (ISS). It could likely also be adapted to perform similar decision-support functions in industrial and academic settings. TREDS provides a ranking of the options, based on a quantifiable assessment of all the relevant programmatic decision factors of benefit, cost, and risk. The computation of the benefit for each option is based on a figure of merit (FOM) for ISS research capacity that incorporates both quantitative and qualitative inputs. Qualitative inputs are gathered and partly quantified by use of the time-tested analytical hierarchical process and used to set weighting factors in the FOM corresponding to priorities determined by the cognizant decision maker(s). Then by use of algorithms developed specifically for this application, TREDS adjusts the projected benefit for each option on the basis of levels of technical implementation, cost, and schedule risk. Based partly on Excel spreadsheets, TREDS provides screens for entering cost, benefit, and risk information. Drop-down boxes are provided for entry of qualitative information. TREDS produces graphical output in multiple formats that can be tailored by users.

*This program was written by James N. Ortiz of Johnson Space Center, Kelly Scott of Booz Allen Hamilton Inc., and Harold Smith of Raytheon Co. For further information, contact the Johnson Technology Transfer Office at (281) 483-3809. MSC-23744*

## Enhanced, Partially Redundant Emergency Notification System

The Johnson Space Center Emergency Notification System (JENS) software utilizes pre-existing computation and communication infrastructure to augment a prior variable-tone, siren-based, outdoor alarm system, in order to enhance the ability to give notice of emergencies to employees working in multiple buildings. The JENS software includes a component that implements an administrative Web site. Administrators can grant and deny access to the administrative site and to an originator Web site that enables authorized individuals to quickly compose and issue alarms. The originator site also facilitates maintenance and review of alarms already issued. A custom client/server application program enables an originator to notify every user who is logged in on a Microsoft Windows-based desktop computer by means of a pop-up message that interrupts, but does not disrupt, the user's work. Alternatively or in addition, the originator can send an alarm message to recipients on an e-mail distribution list and/or can post the notice on an internal Web site. An alarm message can consist of (1) text describing the emergency and suggesting a course of action and (2) a replica of the corresponding audible outdoor alarm.

*This program was written by Clark D. Pounds of Science Applications International Corp. for Johnson Space Center. For further information, contact the Johnson Technology Transfer Office at (281) 483-3809. MSC-23773*

## Close-Call Action Log Form

"Close Call Action Log Form" ("CCALF") is the name of both a computer program and a Web-based service provided by the program for creating an enhanced database of close calls (in the colloquial sense of mishaps that were avoided by small margins) assigned to the Center Operations Directorate (COD) at Johnson Space Center. CCALF provides a single facility for on-line collaborative review of close calls. Through CCALF, managers can delegate responses to employees. CCALF utilizes a pre-existing e-mail system to notify managers that there are close calls to review, but eliminates the need for the prior practices of passing multiple e-mail messages around

the COD, then collecting and consolidating them into final responses: CCALF now collects comments from all responders for incorporation into reports that it generates. Also, whereas it was previously necessary to manually calculate metrics (e.g., numbers of maintenance-work orders necessitated by close calls) for inclusion in the reports, CCALF now computes the metrics, summarizes them, and displays them in graphical form. The reports and all pertinent information used to generate the reports are logged, tracked, and retained by CCALF for historical purposes.

*This work was done by Linda M. Spuler and Patricia K. Ford of Johnson Space Center and Darren C. Skeete, Scot Hershman, Pushpa Raviprakash, John W. Arnold, Victor Tran, and Mary Alice Haenze of Science Applications International Corp. For further information, contact the Johnson Technology Transfer Office at (281) 483-3809. MSC-23808*

## Task Description Language

Task Description Language (TDL) is an extension of the C++ programming language that enables programmers to quickly and easily write complex, concurrent computer programs for controlling real-time autonomous systems, including robots and spacecraft. TDL is based on earlier work (circa 1984 through 1989) on the Task Control Architecture (TCA). TDL provides syntactic support for hierarchical task-level control functions, including task decomposition, synchronization, execution monitoring, and exception handling. A Java-language-based compiler transforms TDL programs into pure C++ code that includes calls to a platform-independent task-control-management (TCM) library. TDL has been used to control and coordinate multiple heterogeneous robots in projects sponsored by NASA and the Defense Advanced Research Projects Agency (DARPA). It has also been used in Brazil to control an autonomous airship and in Canada to control a robotic manipulator.

*This program was written by Reid Simmons and David Apfelbaum of Carnegie Mellon University for Johnson Space Center. For further information, contact the Johnson Technology Transfer Office at (281) 483-3809. MSC-23460*