

tion in the number of people on the sequence team. As a result, the uplink product generation process is significantly streamlined and mission risk is significantly reduced. Autogen is used for operations of MRO, Mars Global Surveyor (MGS), Mars Exploration Rover

(MER), Mars Odyssey, and will be used for operations of Phoenix. Autogen Version 3.0 is the operational version of Autogen including the MRO adaptation for the cruise mission phase, and was also used for development of the aerobraking and mapping mission phases for MRO.

*This program was written by Forest Fisher, Roy Gladded, and Teerapat Khanampompan for NASA's Jet Propulsion Laboratory.*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-43638.*

## Σ Generating Scenarios When Data Are Missing

NASA's Jet Propulsion Laboratory, Pasadena, California

A computer program implements the algorithm described in "Hypothetical Scenario Generator for Fault-Tolerant Diagnosis" (NPO-42516), *NASA Tech Briefs*,

Vol. 31, No. 6 (June 2007), page 71. To recapitulate: the Hypothetical Scenario Generator (HSG) is being developed in conjunction with other components of

artificial-intelligence systems for automated diagnosis and prognosis of faults in spacecraft, aircraft, and other complex engineering systems. The HSG accepts, as input, possibly incomplete data on the current state of a system (see figure).

The HSG models a potential fault scenario as an ordered disjunctive tree of conjunctive consequences, wherein the ordering is based upon the likelihood that a particular conjunctive path will be taken for the given set of inputs. The computation of likelihood is based partly on a numerical ranking of the degree of completeness of data with respect to satisfaction of the antecedent conditions of prognostic rules. The results from the HSG are then used by a model-based artificial-intelligence subsystem to predict realistic scenarios and states.

*This program was written by Mark James and Ryan Mackey 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 (626) 395-2322. Refer to NPO-43097.*



End-to-End Prognostic Architecture uses existing diagnostic models to generate predictions.

## Σ CASPER Version 2.0

NASA's Jet Propulsion Laboratory, Pasadena, California

The Continuous Activity Scheduling Planning Execution and Replanning (CASPER) computer program has been updated to version 2.0. A prototype version was reported in "Software for Continuous Replanning During Execution" (NPO-20972), *NASA Tech Briefs*, Vol. 26, No. 7 (April 2002), page 67. To recapitulate: CASPER is designed to perform automated planning of interdependent activities within a system subject to requirements, constraints, and limitations on resources.

In contradistinction to the traditional concept of batch planning followed by

execution, CASPER implements a concept of continuous planning and replanning in response to unanticipated changes (including failures), integrated with execution. Improvements over other, similar software that have been incorporated into CASPER version 2.0 include an enhanced executable interface to facilitate integration with a wide range of execution software systems and supporting software libraries; features to support execution while reasoning about urgency, importance, and impending deadlines; features that enable accommodation to a wide range of com-

puting environments that include various central processing units and random-access-memory capacities; and improved generic time-server and time-control features.

*This program was written by Steve Chien, Gregg Rabideau, Daniel Tran, Russell Knight, Caroline Chouinard, Tara Estlin, Daniel Gaines, Bradley Clement, and Anthony Barrett of Caltech for NASA's Jet Propulsion Laboratory.*

*This software is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-41987.*