Software Assists in Responding to Anomalous Conditions

Fault Induced Document Retrieval Officer (FIDO) is a computer program that reduces the need for a large and costly team of engineers and/or technicians to monitor the state of a spacecraft and associated ground systems and respond to anomalies. FIDO includes artificial-intelligence components that imitate the reasoning of human experts with reference to a knowledge base of rules that represent failure modes and to a database of engineering documentation. These components act together to give an unskilled operator instantaneous expert assistance and access to information that can enable resolution of most anomalies, without the need for highly paid experts. FIDO provides a system state summary (a configurable engineering summary) and documentation for diagnosis of a potentially failing component that might have caused a given error message or anomaly. FIDO also enables high-level browsing of documentation by use of an interface indexed to the particular error message. The collection of available documents includes information on operations and associated procedures, engineering problem reports, documentation of components, and engineering drawings. FIDO also affords a capability for combining information on the state of ground systems with detailed, hierarchically-organized, hypertext-enabled documentation.

This program was written by Mark James, F. Kronbert, A. Weiner, T. Morgan, B. Stroozas, F. Girouard, A. Hopkins, L. Wong, J. Kneubuhl, and R. Malina 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 Don Hart of the California Institute of Technology at (818) 393-3425. Refer to NPO-40361.

Software for Autonomous Spacecraft Maneuvers

The AutoCon computer programs facilitate and accelerate the planning and execution of orbital control maneuvers of spacecraft while analyzing and resolving mission constraints. AutoCon-F is executed aboard spacecraft, enabling the spacecraft to plan and execute maneuvers autonomously; AutoCon-G is designed for use on the ground. The AutoCon programs utilize advanced techniques of artificial intelligence, including those of fuzzy logic and natural-language scripting, to resolve multiple conflicting constraints and automatically plan maneuvers. These programs can be used to satisfy requirements for missions that involve orbits around the Earth, the Moon, or any planet, and are especially useful for missions in which there are requirements for frequent maneuvers and for resolution of complex conflicting constraints. During operations, the software targets new trajectories, places and sizes maneuvers, and controls spacecraft burns. AutoCon-G provides a user-friendly graphical interface, and can be used effectively by an analyst with minimal training. AutoCon-F reduces latency and supports multiple-spacecraft and formation-flying missions. The AutoCon architecture supports distributive processing, which can be critical for formation-control missions. AutoCon is completely object-oriented and can easily be enhanced by adding new objects and events. AutoCon-F was flight demonstrated onboard GSFC's EO-1 spacecraft flying in formation with Landsat-7.

These programs were written by John Bristow, Dave Folta, Al Hawkins, and Greg Dell of **Goddard Space Flight Center**. *Further information is contained in a TSP (see page 1).*
GSC-14629-1

WinPlot

WinPlot is a powerful desktop graphical analysis tool that allows the user to generate displays of unrestrictive amounts of data. It is designed to operate on a Windows 98/NT/2000 based desktop platform. WinPlot was developed to fulfill the need for fast and easily managed graphical displays of NASA test articles and facilities with extreme amount of test data in a desktop-computer environment. WinPlot features include seamless displays of real-time and post-test-time data with time and event synchronization of data from multiple sources. WinPlot also processes full scripting capability for automation of processes. Entire analysis procedures may be recorded and replayed with a single command. Users may record their actions within WinPlot or may write scripts using text editor. Scripts may also call and execute other scripts, providing even greater automation of tasks. WinPlot is also unique in its ability to plot large volumes of data on a desktop workstation. Up to 1,000 test data files may be opened simultaneously with plots generated containing up to 1,000 curves per plot. WinPlot also has extensive abilities in generation of "on-the-fly" calculations, reducing or eliminating the need for external programs to generate the data. Calculations may include a series of recorded parameters, constants, and math functions. WinPlot's ability to export plots on a single mouse click can make easy work of preparing presentation material with office applications. One simply produces the plot with desired style and click of a button on the tool bar. Plots will be saved in a predefined folder with a sortable naming convention. One then just pastes the files into one's presentation. The ease of getting data on the screen is just the beginning with the user having many ways to manipulate data once on screen. The user can use the mouse to zoom in on any area of interest, use the arrow keys to pan around the view, or page up/down for general zooming. One may also use the mouse to select a slice of data and generate an instant report of min, max, average, range, sigma, or other values for plotted parameter within a slice. A single mouse click can export data into a spreadsheet and execute a spreadsheet application. A user may plot a parameter from a number to tests and instantly gather statistical data from the display. Importing of data from spreadsheets is as simple as copying the data to the clipboard and, within WinPlot, importing the clipboard and selecting the parameters to plot. The software package runs on a standard Windows desktop system. Memory and storage requirements are driven by the amount of data desired to be viewed and/or stored locally. Under most circumstances, the recommended system requirements for the operating system is sufficient for WinPlot. The source code modules and dynamic libraries are included in the software, which allows user versatility in importing, defining, viewing, and printing data.

This program was written by John R. Moody of Computer Sciences Corp. for **Marshall Space Flight Center**. *Further information is contained in a TSP (see page 1).*
MFS-31664