

Commercially, because it is so generic, Enigma can be used for almost any project that requires engineering visualization, model building, or animation. Models in Enigma can be exported to many other formats for use in other applications as well. Educationally, Enigma

is being used to allow university students to visualize robotic algorithms in a simulation mode before using them with actual hardware.

*This work was done by David Shores and Sharon P. Goza of Johnson Space Center; Cheyenne McKeegan, Rick Easley, Janet Way,*

*and Shonn Everett of MEI Technologies; Mark Manning of PTI; and Mark Guerra, Ray Kraesig, and William Leu of Tietronix Software, Inc. For further information, contact the JSC Innovation Partnerships Office at (281) 483-3809. MSC-24211-1*

## Micrometeoroid and Orbital Debris (MMOD) Shield Ballistic Limit Analysis Program

*Lyndon B. Johnson Space Center, Houston, Texas*

This software implements penetration limit equations for common micrometeoroid and orbital debris (MMOD) shield configurations, windows, and thermal protection systems. Allowable MMOD risk is formulated in terms of the probability of penetration (PNP) of the spacecraft pressure hull.

For calculating the risk, spacecraft geometry models, mission profiles, debris environment models, and penetration limit equations for installed shielding configurations are required. Risk assess-

ment software such as NASA's BUMPER-II is used to calculate mission PNP; however, they are unsuitable for use in shield design and preliminary analysis studies.

The software defines a single equation for the design and performance evaluation of common MMOD shielding configurations, windows, and thermal protection systems, along with a description of their validity range and guidelines for their application. Recommendations are based on preliminary reviews of fundamental assumptions, and accuracy in pre-

dicting experimental impact test results.

The software is programmed in Visual Basic for Applications for installation as a simple add-in for Microsoft Excel. The user is directed to a graphical user interface (GUI) that requires user inputs and provides solutions directly in Microsoft Excel workbooks.

*This work was done by Shannon Ryan of the USRA Lunar and Planetary Institute for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-24582-1*

## Spitzer Telemetry Processing System

*NASA's Jet Propulsion Laboratory, Pasadena, California*

The Spitzer Telemetry Processing System (SirtfTlmProc) was designed to address objectives of JPL's Multi-mission Image Processing Lab (MIPL) in processing spacecraft telemetry and distributing the resulting data to the science community. To minimize costs and maximize operability, the software design focused on automated error recovery, performance, and information management.

The system processes telemetry from the Spitzer spacecraft and delivers Level 0 products to the Spitzer Science Center. SirtfTlmProc is a unique system with automated error notification and recovery, with a real-time continuous service that can go quiescent after periods of inactivity.

The software can process 2 GB of telemetry and deliver Level 0 science products to the end user in four hours. It provides analysis tools so the operator can

manage the system and troubleshoot problems. It automates telemetry processing in order to reduce staffing costs.

*This work was done by Alice Stanboli, Elmain M. Martinez, and James M. McAuley of Caltech for NASA's Jet Propulsion Laboratory. For more information, contact iaoffice@jpl.nasa.gov.*

*This software is available for commercial licensing. Please contact Dan Broderick at Daniel.F.Broderick@jpl.nasa.gov. Refer to NPO-47803.*

## Planetary Protection Bioburden Analysis Program

*NASA's Jet Propulsion Laboratory, Pasadena, California*

This program is a Microsoft Access program that performed statistical analysis of the colony counts from assays performed on the Mars Science Laboratory (MSL) spacecraft to determine the bioburden density, 3-sigma biodensity, and the total bioburdens required for the MSL prelaunch reports. It also contains numer-

ous tools that report the data in various ways to simplify the reports required. The program performs all the calculations directly in the MS Access program. Prior to this development, the data was exported to large Excel files that had to be cut and pasted to provide the desired results. The program contains a main menu and a

number of submenus. Analyses can be performed by using either all the assays, or only the accountable assays that will be used in the final analysis.

There are three options on the first menu: either calculate using (1) the old MER (Mars Exploration Rover) statistics, (2) the MSL statistics for all the assays, or