A Screen Shot of the **WGM Temperature Tracker 2.3** graphic interface.

method of such stabilization to be implemented, which is immune to a variety of effects that mask the temperature variation.

WGM Temperature Tracker 2.3 (see figure) is a LabVIEW code developed for dual-mode temperature stabilization of WGM resonators. It has allowed for the temperature stabilization at the level of 200 nK with one-second integration time, and 6 nK with 10,000-second integration time, with the above room-temperature set point.

This software, in conjunction with the appropriate hardware, can be used as a noncryogenic temperature sensor/controller with sub-micro-Kelvin sensitivity, which at the time of this reporting considerably outperforms the state of the art.

This work was done by Dmitry V. Strekalov 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 Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-48306.

Large Terrain Continuous Level of Detail 3D Visualization Tool

NASA's Jet Propulsion Laboratory, Pasadena, California

This software solved the problem of displaying terrains that are usually too large to be displayed on standard workstations in real time. The software can visualize terrain data sets composed of billions of vertices, and can display these data sets at greater than 30 frames per second.

The Large Terrain Continuous Level of Detail 3D Visualization Tool allows large terrains, which can be composed of billions of vertices, to be visualized in real time. It utilizes a continuous level of detail technique called clipmapping to support this. It offloads much of the work involved in breaking up the terrain into levels of details onto the GPU (graphics processing unit) for faster processing.

This work was done by Steven Myint and Abhinandan Jain 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 Daniel Broderick of the California Institute of Technology at danielb@caltech.edu. Refer to NPO-47978.

SE-FIT

John H. Glenn Research Center, Cleveland, Ohio

The mathematical theory of capillary surfaces has developed steadily over the centuries, but it was not until the last few decades that new technologies have put a more urgent demand on a substantially more qualitative and quantitative understanding of phenomena relating to capillarity in general. So far, the new theory development successfully predicts the behavior of capillary surfaces for special cases. However, an efficient quantitative mathematical prediction of

capillary phenomena related to the shape and stability of geometrically complex equilibrium capillary surfaces remains a significant challenge. As one of many numerical tools, the open-source Surface Evolver (SE) algorithm has played an important role over the last two decades. The current effort was undertaken to provide a front-end to enhance the accessibility of SE for the purposes of design and analysis. Like SE, the new code is open-source and will remain

under development for the foreseeable future.

The ultimate goal of the current Surface Evolver – Fluid Interface Tool (SE-FIT) development is to build a fully integrated front-end with a set of graphical user interface (GUI) elements. Such a front-end enables the access to functionalities that are developed along with the GUIs to deal with pre-processing, convergence computation operation, and post-processing. In other words, SE-FIT

is not just a GUI front-end, but an integrated environment that can perform sophisticated computational tasks, e.g. importing industry standard file formats and employing parameter sweep functions, which are both lacking in SE, and require minimal interaction by the user. These functions are created using a mixture of Visual Basic and the SE script language. These form the foundation for a high-performance front-end that substantially simplifies use without sacrificing the proven capabilities of SE. The real power of SE-FIT lies in its automated pre-processing, pre-defined geometries, convergence computation operation, computational diagnostic tools, and crash-handling capabilities to sustain extensive computations.

SE-FIT performance is enabled by its so-called file-layer mechanism. During the early stages of SE-FIT development, it became necessary to modify the original SE code to enable capabilities required for an enhanced and synchronized communication. To this end, a file-layer was created that serves as a command buffer to ensure a continuous and sequential execution of commands sent from the front-end to SE. It also establishes a proper means for handling crashes. The file layer logs input commands and SE output; it also supports user interruption requests, back and forward operation (i.e. 'undo' and 'redo'), and others. It especially enables the batch mode computation of a series of equilibrium surfaces and the searching of critical parameter values in studying the stability of capillary surfaces. In this way, the modified SE significantly extends the capabilities of the original SE.

There is a growing need for SE in subjects such as flows related to microgravity tankage, inkjet printing, nanotechnologies, transport in porous media, capillary self-assembly and self-alignment, microscale wicking structures, foams, and more. It is hoped that SE-FIT will prove to be an essential tool for myriad capillary design and analysis applications as well as a tool for both education and inquiry.

Scalable Integrated Multi-Mission Support System Simulator Release 3.0

Goddard Space Flight Center, Greenbelt, Maryland

The Scalable Integrated Multi-mission Support System (SIMSS) is a tool that performs a variety of test activities related to spacecraft simulations and ground segment checks.

The GSFC Mission Services Evolution Center (GMSEC) has been advancing new technologies using its architecture to aid missions in the development of control centers, and to enable the interoperability of mission operations center (MOC) components. These new technologies are intended to provide missions with low-cost solutions in implementing their ground systems. SIMSS Version 2.0 was developed to run within the GMSEC architecture as a plug-in component. To accomplish this, SIMSS is integrated with GMSEC application programming interface (API) 3.0 libraries, which allows SIMSS to successfully operate in the GMSEC environment and communicate with other components using GMSEC messages that are transmitted over the GMSEC messaging middleware interface bus.

This innovation (SIMSS Release 3.0) provides a Generic Simulator module, which supports the use of an XTCE-based project database (PDB) from which telemetry data is generated, and then is published onto the GMSEC message bus.

SIMSS is a distributed, component-based, plug-and-play client-server system useful for performing real-time monitoring and communications testing. SIMSS runs on one or more workstations and is designed to be user-configurable or to use predefined configurations for routine operations. SIMSS consists of more than 100 modules that can be configured to create, receive, process, and/or transmit data. The SIMSS/GMSEC innovation is intended to provide missions with a low-cost solution for implementing their ground systems, as well as significantly reducing a mission's integration time and risk.

Mars Express Forward Link Capabilities for the Mars Relay Operations Service (MaROS)

NASA's Jet Propulsion Laboratory, Pasadena, California

This software provides a new capability for landed Mars assets to perform forward link relay through the Mars Express (MEX) European Union orbital spacecraft. It solves the problem of standardizing the relay interface between lander missions and MEX.

The Mars Operations Relay Service (MaROS) is intended as a central point for relay planning and post-pass analysis for all Mars landed and orbital assets. Through the first two phases of implementation, MaROS supports relay coordination through the Odyssey orbiter and the Mars Reconnaissance Orbiter (MRO).