ted data than the coarser data acquisition of the prior software.

The data-conditioning module provides a clean data set for the analysis module. For multiple measurements at a given degree, the first measurement is used. For omitted measurements, the missing field is estimated by linear interpolation between the two nearest measurements.

The analysis module was rewritten for the dual rotation, triaxial probe measurement process and now has better moment estimation accuracy, based on the finer one degree of data acquisition resolution. The magnetic moments thus computed are used as an input to summarize the total spacecraft field.

This program was written by Kimberly Shultz, Albert Whittlesey, and Pablo Narvaez 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-44192.

Analyzing Responses of Chemical Sensor Arrays

NASA's Jet Propulsion Laboratory, Pasadena, California

NASA is developing a third-generation electronic nose (ENose) capable of continuous monitoring of the International Space Station's cabin atmosphere for specific, harmful airborne contaminants. Previous generations of the ENose have been described in prior *NASA Tech Briefs* issues.

Sensor selection is critical in both (pre-fabrication) sensor material selection and (post-fabrication) data analysis of the ENose, which detects several analytes that are difficult to detect, or that are at very low concentration ranges. Existing sensor selection approaches usually include limited statistical measures, where selectivity is more important but reliability and sensitivity are not of concern. When reliability and sensitivity can be major limiting factors in detecting target compounds reliably, the existing approach is not able to provide meaningful selection that will actually improve data analysis results.

The approach and software reported here consider more statistical measures (factors) than existing approaches for a similar purpose. The result is a more balanced and robust sensor selection from a less than ideal sensor array. The software offers quick, flexible, optimal sensor selection and weighting for a variety of purposes without a time-consuming, iterative search by performing sensor calibrations to a known linear or nonlinear model, evaluating the individual sensor's statistics, scoring the individual sensor's overall performance, finding the best sensor array size to maximize class separation, finding optimal weights for the remaining sensor array, estimating limits of detection for the target compounds, evaluating fingerprint distance between group pairs, and finding the best event-detecting sensors.

This program was written by Hanying Zhou 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-43988.

PREDICTS

NASA's Jet Propulsion Laboratory, Pasadena, California

PREDICTS is a computer program that predicts the frequencies, as functions of time, of signals to be received by a radio science receiver — in this case, a special-purpose digital receiver dedicated to analysis of signals received by an antenna in NASA's Deep Space Network (DSN). Unlike other software used in the DSN, PREDICTS does not use interpolation early in the calculations; as a consequence, PREDICTS is more precise and more stable. The precision afforded by the other DSN software is sufficient for telemetry; the greater precision afforded by PREDICTS is needed for radio-science experiments. In addition to frequencies as a function of time, PREDICTS yields the rates of change and interpolation coefficients for the frequencies and the beginning and ending times of reception, transmission, and occultation.

PREDICTS is applicable to S-, X-, and Ka-band signals and can accommodate the following link configurations: (1) one-way (spacecraft to ground), (2) two-way (from a ground station to a spacecraft to the same ground station), and (3) three-way (from a ground transmitting station to a spacecraft to a different ground receiving station).

This work was done by Nicole Rappaport 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-40987.

Software Compensates Electronic-Nose Readings for Humidity

NASA's Jet Propulsion Laboratory, Pasadena, California

A computer program corrects for the effects of humidity on the readouts of an array of chemical sensors (an "electronic nose"). To enable the use of this program, the array must incorporate an independent humidity sensor in addition to sensors designed to detect analytes other than water vapor. The basic principle of the program was described in "Compensating for Effects of Humidity on Electronic Noses" (NPO-30615), *NASA Tech Briefs*, Vol. 28, No. 6 (June 2004), page 63. To recapitulate: The output of the humidity sensor is used to generate values that are subtracted from the outputs of the other sensors to correct for contributions of humidity to those readings. Hence, in principle, what remains after corrections are the contributions of the analytes only.

The outputs of the non-humidity sensors are then deconvolved to obtain the concentrations of the analytes. In addition, the humidity reading is retained as an analyte reading in its own right. This subtraction of the humidity background increases the ability of the software to identify such events as spills in which contaminants may be present in small concentrations and accompanied by large changes in humidity.

This program was written by Hanying Zhou 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-30859.

Space Propulsion Design and Analysis

Marshall Space Flight Center, Alabama

This software provides an improved methodology for predicting launcher base pressure and heat loads for RSRM (Reusable Solid Rocket Motor) launchers by accounting for complex anisotropic stress/strains and variable turbulent Prandtl and Schmidt numbers. A "building block" approach to turbulence model development, and validation has been applied for improved missile/launcher base region analysis.

Modifications to existing $k - \varepsilon$ turbulence models and application of scalar variance models are incorporated into a RANS-based method for aeropropulsive flow modeling, directly related to base flow methodology. (RANS stands for Reynolds-averaged Navier-Stokes.) The models are applied in a RANS solver framework and can improve analysis of other complex flow fields.

The enhanced models provide a more accurate predictive capability for improving the design and analysis of RSRM launcher configuration. The $k - \varepsilon$ model enhancements have been shown to improve the capability for predicting turbulence effects in base blow environments. The scalar variance models have been assessed over a wide range of flow configurations to improve prediction of turbulent scalar mixing.

This program was written by Neeraj Sinha, Kevin Brinckman, Haritha Ayyalasomayajula, and Sanford Dash of CRAFT Tech for Marshall Space Flight Center. Further information is contained in a TSP (see page 1). Refer to MFS-32442-1.

Parallelization of the Coupled Earthquake Model

NASA's Jet Propulsion Laboratory, Pasadena, California

This Web-based tsunami simulation system allows users to remotely run a model on JPL's supercomputers for a given undersea earthquake. At the time of this reporting, predicting tsunamis on the Internet has never happened before. This new code directly couples the earthquake model and the ocean model on parallel computers and improves simulation speed.

Seismometers can only detect information from earthquakes; they cannot detect whether or not a tsunami may occur as a result of the earthquake. When earthquake-tsunami models are coupled with the improved computational speed of modern, high-performance computers and constrained by remotely sensed data, they are able to provide early warnings for those coastal regions at risk.

The software is capable of testing NASA's satellite observations of tsunamis. It has been successfully tested for several historical tsunamis, has passed all alpha and beta testing, and is well documented for users.

This program was written by Gary Block, P. Peggy Li, and Yuhe T. Song 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-44443.