Database of Properties of Meteors

Marshall Space Flight Center, Alabama

A database of properties of meteors, and software that provides access to the database, are being developed as a contribution to continuing efforts to model the characteristics of meteors with increasing accuracy. Such modeling is necessary for evaluation of the risk of penetration of spacecraft by meteors. For each meteor in the database, the record will include an identification, date and time, radiant properties, ballistic coefficient, radar cross section, size, density, and orbital elements. The property of primary interest in the present case is density, and one of the primary goals in this case is to derive densities of meteors from their atmospheric decelerations. The database and software are expected to be valid anywhere in the solar system. The database will incorporate new data plus results of meteoroid analyses that, heretofore, have not been readily available to the aerospace community. Taken together, the database and software constitute a model that is expected to provide improved estimates of densities and to result in improved risk analyses for interplanetary spacecraft. It is planned to distribute the database and software on a compact disk.

This program was written by Rob Suggs of **Marshall Space Flight Center** *and Coster Anthea of Massachusetts Institute of Technology Lincoln Laboratories. For further information, contact Rob Suggs at rob.suggs@nasa.gov. MFS-32243-1*

Computing Spacecraft Solar-Cell Damage by Charged Particles

Goddard Space Flight Center, Greenbelt, Maryland

General EQFlux is a computer program that converts the measure of the damage done to solar cells in outer space by impingement of electrons and protons having many different kinetic energies into the measure of the damage done by an equivalent fluence of electrons, each having kinetic energy of 1 MeV. Prior to the development of General EQFlux, there was no single computer program offering this capability: For a given type of solar cell, it was necessary to either perform the calculations manually or to use one of three Fortran programs, each of which was applicable to only one type of solar cell. The problem in developing General EQFlux was to rewrite and combine the three programs into a single program that could perform the calculations for three types of solar cells and run in a Windows environment with a Windows graphical user interface. In comparison with the three prior programs, General EQFlux is easier to use.

This program was written by Edward M. Gaddy of **Goddard Space Flight Center**. *For further information, contact the Goddard Innovative Partnerships Office at (301) 286-5810.*
GSC-14791-1

Thermal Model of a Current-Carrying Wire in a Vacuum

NASA's Jet Propulsion Laboratory, Pasadena, California

A computer program implements a thermal model of an insulated wire carrying electric current and surrounded by a vacuum. The model includes the effects of Joule heating, conduction of heat along the wire, and radiation of heat from the outer surface of the insulation on the wire. The model takes account of the temperature dependences of the thermal and electrical properties of the wire, the emissivity of the insulation, and the possibility that not only can temperature vary along the wire but, in addition, the ends of the wire can be thermally grounded at different temperatures. The resulting second-order differential equation for the steady-state temperature as a function of position along the wire is highly nonlinear. The wire is discretized along its length, and the equation is solved numerically by use of an iterative algorithm that utilizes a multidimensional version of the Newton-Raphson method.

This program was written by James Borders 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-41067.

Program for Analyzing Flows in a Complex Network

Marshall Space Flight Center, Alabama

Generalized Fluid System Simulation Program (GFSSP) version 4 is a general-purpose computer program for analyzing steady-state and transient flows in a complex fluid network. [GFSSP version 2.01 was reported in a prior issue of *NASA Tech Briefs*.] The program is capable of modeling compressibility, fluid transients (e.g., water hammers), phase changes, mixtures of chemical species, and such externally applied body forces as gravitational and centrifugal ones. A graphical user interface enables the user to interactively develop a simulation of a fluid network consisting of nodes and branches. The user can also run the simulation and view the results in the interface. The system of equations for conservation of mass, energy, chemical species, and momentum is solved nu-

merically by a combination of the Newton-Raphson and successive-substitution methods. The program includes subroutines that compute thermodynamic and thermophysical properties for 12 fluids and is integrated with a commercial program that gives thermodynamic properties of 36 fluids. Eighteen different options are provided for modeling momentum sources or sinks in the branches. Additional capabilities, including new resistance options, new fluids, and nonlinear boundary conditions, can be added by means of subroutines. An audio-visual training CD (compact disk) containing lectures, demonstration of graphical user interface, and tutorial problems is available for learning to use the program.

*This program was written by Alok Kumar Majumdar of **Marshall Space Flight Center**. Further information is contained in a TSP (see page 1).*

This invention is owned by NASA, and a patent application has been filed. For further information, contact Sammy Nabors, MSFC Commercialization Assistance Lead, at sammy.a.nabors@nasa.gov. Refer to MFS-32125-1.

Program Predicts Performance of Optical Parametric Oscillators

Langley Research Center, Hampton, Virginia

A computer program predicts the performances of solid-state lasers that operate at wavelengths from ultraviolet through mid-infrared and that comprise various combinations of stable and unstable resonators, optical parametric oscillators (OPOs), and sum-frequency generators (SFGs), including second-harmonic generators (SHGs). The input to the program describes the signal, idler, and pump beams; the SFG and OPO crystals; and the laser geometry. The program calculates the electric fields of the idler, pump, and output beams at three locations (inside the laser resonator, just outside the input mirror, and just outside the output mirror) as functions of time for the duration of the pump beam. For each beam, the electric field is used to calculate the fluence at the output mirror, plus summary parameters that include the centroid location, the radius of curvature of the wavefront leaving through the output mirror, the location and size of the beam waist, and a quantity known, variously, as a propagation constant or beam-quality factor. The program provides a typical Windows interface for entering data and selecting files. The program can include as many as six plot windows, each containing four graphs.

*This program was written by Patricia L. Cross of **Langley Research Center** and Mark Bowers of Aculight Corporation. Further information is contained in a TSP (see page 1). LAR-16529-1*

Processing TES Level-1B Data

NASA's Jet Propulsion Laboratory, Pasadena, California

TES L1B Subsystem is a computer program that performs several functions for the Tropospheric Emission Spectrometer (TES). The term "L1B" (an abbreviation of "level 1B"), refers to data, specific to the TES, on radiometric calibrated spectral radiances and their corresponding noise equivalent spectral radiances (NESRs), plus ancillary geolocation, quality, and engineering data. The functions performed by TES L1B Subsystem include shear analysis, monitoring of signal levels, detection of ice build-up, and phase correction and radiometric and spectral calibration of TES target data. Also, the program computes NESRs for target spectra, writes scientific TES level-1B data to hierarchical-data-format (HDF) files for public distribution, computes brightness temperatures, and quantifies interpixel signal variability for the purpose of first-order cloud and heterogeneous land screening by the level-2 software summarized in the immediately following article. This program uses an in-house-developed algorithm, called "NUSRT," to correct instrument line-shape factors.

*This program was written by Richard C. De Baca, Edwin Sarkissian, Mariyetta Madatyan, Douglas Shepard, Scott Gluck, Mark Apolinski, James McDuffie, and Dennis Tremblay 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-35218.

Automated Camera Calibration

NASA's Jet Propulsion Laboratory, Pasadena, California

Automated Camera Calibration (ACAL) is a computer program that automates the generation of calibration data for camera models used in machine vision systems. Machine vision camera models describe the mapping between points in three-dimensional (3D) space in front of the camera and the corresponding points in two-dimensional (2D) space in the camera's image. Calibrating a camera model requires a set of calibration data containing known 3D-to-2D point correspondences for the given camera system. Generating calibration data typically involves taking images of a calibration target where the 3D locations of the target's fiducial marks are known, and then measuring the 2D locations of the fiducial marks in the images. ACAL automates the analysis of calibration target