

from the line segments. The images are also processed by a feature-extraction algorithm that performs a wavelet analysis, then performs a pattern-recognition operation in the wavelet-coefficient space to determine matches to a texture feature measure derived from the horizontal, vertical, and diagonal coefficients. The centroids from the ellipse finder and the wavelet feature matcher are then fused to determine co-location. In the event that a match is found, the centroid (or centroids if multiple matches are present) is reported. If no match is found, the process reports the results of the analyses for further examination by human experts.

This program was written by Terrance Huntsberger, Yang Cheng, Robert Liebersbach, and Ashitey Trebi-Ollenu 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-43470.

Implementation of a Point Algorithm for Real-Time Convex Optimization

The primal-dual interior-point algorithm implemented in G-OPT is a relatively new and efficient way of solving convex optimization problems. Given a prescribed level of accuracy, the convergence to the optimal solution is guaranteed in a predetermined, finite number of iterations. G-OPT Version 1.0 is a flight software implementation written in C. On-board application of the software enables autonomous, real-time guidance and control that explicitly incorporates mission constraints such as control authority (e.g. maximum thrust limits), hazard avoidance, and fuel limitations.

This software can be used in planetary landing missions (Mars pinpoint landing and lunar landing), as well as in proximity operations around small celestial bodies (moons, asteroids, and comets). It also can be used in any spacecraft mission for thrust allocation in six-degrees-of-freedom control.

This program was written by Behçet Açıkmese, Shui Motaghedi, and John Carson 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-44352.

Handling Input and Output for COAMPS

Two suites of software have been developed to handle the input and output of the Coupled Ocean Atmosphere Prediction System (COAMPS), which is a regional atmospheric model developed by the Navy for simulating and predicting weather. Typically, the initial and boundary conditions for COAMPS are provided by a flat-file representation of the Navy's global model. Additional algorithms are needed for running the COAMPS software using global models. One of the present suites satisfies this need for running COAMPS using the Global Forecast System (GFS) model of the National Oceanic and Atmospheric Administration. The first step in running COAMPS — downloading of GFS data from an Internet file-transfer-protocol (FTP) server computer of the National Centers for Environmental Prediction (NCEP) — is performed by one of the programs (SSC-00273) in this suite. The GFS data, which are in gridded binary (GRIB) format, are then changed to a COAMPS-compatible format by another program in the suite (SSC-00278). Once a forecast is complete, still another program in the suite (SSC-00274) sends the output data to a different server computer.

The second suite of software (SSC-00275) addresses the need to ingest up-to-date land-use-and-land-cover (LULC) data into COAMPS for use in specifying typical climatological values of such surface parameters as albedo, aerodynamic roughness, and ground wetness. This suite includes (1) a program to process LULC data derived from observations by the Moderate Resolution Imaging Spectroradiometer (MODIS) instruments aboard NASA's Terra and Aqua satellites, (2) programs to derive new climatological parameters for the 17-land-use-category MODIS data; and (3) a modified version of a FORTRAN subroutine to be used by COAMPS. The MODIS data files are processed to reformat them into a compressed American Standard Code for Information Interchange (ASCII) format used by COAMPS for efficient processing.

These programs were written by Patrick Fitzpatrick, Nam Tran, Yongzuo Li, and Valentine Anantharaj of Mississippi State University for Stennis Space Center.

Inquiries concerning rights for its commercial use should be addressed to:

*GeoResources Institute
Mississippi State University
Building 1103, Room 233*

Stennis Space Center, MS 39529

(228) 688-4218

www.gri.msstate.edu

Refer to SSC-00273/4/5/8, volume and number of this NASA Tech Briefs issue, and the page number.

Modeling and Grid Generation of Iced Airfoils

SmagglIce Version 2.0 is a software toolkit for geometric modeling and grid generation for two-dimensional, single- and multi-element, clean and iced airfoils. A previous version of SmagglIce was described in "Preparing and Analyzing Iced Airfoils," NASA Tech Briefs, Vol. 28, No. 8 (August 2004), page 32. To recapitulate: Ice shapes make it difficult to generate quality grids around airfoils, yet these grids are essential for predicting ice-induced complex flow. This software efficiently creates high-quality structured grids with tools that are uniquely tailored for various ice shapes.

SmagglIce Version 2.0 significantly enhances the previous version primarily by adding the capability to generate grids for multi-element airfoils. This version of the software is an important step in streamlining the aeronautical analysis of ice airfoils using computational fluid dynamics (CFD) tools. The user may prepare the ice shape, define the flow domain, decompose it into blocks, generate grids, modify/divide/merge blocks, and control grid density and smoothness. All these steps may be performed efficiently even for the difficult glaze and rime ice shapes. Providing the means to generate highly controlled grids near rough ice, the software includes the creation of a wrap-around block (called the "viscous sublayer block"), which is a thin, C-type block around the wake line and iced airfoil. For multi-element airfoils, the software makes use of grids that wrap around and fill in the areas between the viscous sub-layer blocks for all elements that make up the airfoil. A scripting feature records the history of interactive steps, which can be edited and replayed later to produce other grids.

Using this version of SmagglIce, ice shape handling and grid generation can become a practical engineering process, rather than a laborious research effort.

This program was written by Mary B. Vickerman, Marivell Baez, Donald C. Braun, Anthony W. Hackenberg, James A. Pennline, and Herbert W. Schilling of Glenn

Research Center. Further information is contained in a TSP (see page 1).

Inquiries concerning rights for the commercial use of this invention should be addressed to NASA Glenn Research Center, Innovative Partnerships Office, Attn: Steve Fedor, Mail Stop 4-8, 21000 Brookpark Road, Cleveland, Ohio 44135. Refer to LEW-18187-1.

Automated Identification of Nucleotide Sequences

STITCH is a computer program that processes raw nucleotide-sequence data to automatically remove unwanted vector information, perform reverse-complement comparison, stitch shorter sequences together to make longer ones to which the shorter ones presumably belong, and search against the user's choice of private and Internet-accessible public 16S rRNA databases. ["16S rRNA" denotes a ribosomal ribonucleic acid (rRNA) sequence that is common to all organisms.] In STITCH, a template 16S rRNA sequence is used to position forward and reverse reads. STITCH then automatically searches known 16S rRNA sequences in the user's chosen database(s) to find the sequence most similar to (the sequence that lies at the smallest edit distance from) each spliced sequence.

The result of processing by STITCH is the identification of the most similar well-described bacterium. Whereas previously commercially available software for analyzing genetic sequences operates on one sequence at a time, STITCH can manipulate multiple sequences simultaneously to perform the aforementioned operations. A typical analysis of several dozen sequences (length of the order of 10^3 base pairs) by use of STITCH is completed in a few minutes, whereas such an analysis performed by use of prior software takes hours or days.

This program was written by Shariff Osman and Kasthuri Venkateswaran of Caltech; George Fox of Dept. of Biology and Biochem-

istry, University of Texas, Houston; and Dianhui Zhu of Dept. of Computer Sciences, University of Texas, Houston for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this invention. Inquiries concerning rights for its commercial use should be addressed to:

*Innovative Technology Assets Management
JPL*

Mail Stop 202-233

4800 Oak Grove Drive

Pasadena, CA 91109-8099

E-mail: iaoffice@jpl.nasa.gov

Refer to NPO-44785, volume and number of this NASA Tech Briefs issue, and the page number.

Balloon Design Software

PlanetaryBalloon Version 5.0 is a software package for the design of meridionally lobed planetary balloons. It operates in a Windows environment, and programming was done in Visual Basic 6. By including the effects of circular lobes with load tapes, skin mass, hoop and meridional stress, and elasticity in the structural elements, a more accurate balloon shape of practical construction can be determined as well as the room-temperature cut pattern for the gore shapes. The computer algorithm is formulated for sizing meridionally lobed balloons for any generalized atmosphere or planet. This also covers zero-pressure, over-pressure, and super-pressure balloons. Low circumferential loads with meridionally reinforced load tapes will produce shapes close to what are known as the "natural shape."

The software allows for the design of constant angle, constant radius, or constant hoop stress balloons. It uses the desired payload capacity for given atmospheric conditions and determines the required volume, allowing users to design exactly to their requirements. The

formulations are generalized to use any lift gas (or mixture of gases), any atmosphere, or any planet as described by the local acceleration of gravity.

PlanetaryBalloon software has a comprehensive user manual that covers features ranging from, but not limited to, buoyancy and super-pressure, convenient design equations, shape formulation, and orthotropic stress/strain.

This program was written by Rodger Farley of Goddard Space Flight Center. Further information is contained in a TSP (see page 1).GSC-15112-1

Rocket Science 101 Interactive Educational Program

To better educate the public on the basic design of NASA's current mission rockets, Rocket Science 101 software has been developed as an interactive program designed to retain a user's attention and to teach about basic rocket parts. This program also has helped to expand NASA's presence on the Web regarding educating the public about the Agency's goals and accomplishments.

The software was designed using Macromedia's Flash 8. It allows the user to select which type of rocket they want to learn about, interact with the basic parts, assemble the parts to create the whole rocket, and then review the basic flight profile of the rocket they have built.

This program was written by Dennis Armstrong of Space Gateway Support and Deborah Funkhouser and Donald DiMarzio of Kennedy Space Center. For further information, contact:

Teresa L. Kinney

ELV Structural Dynamics

VA-F3

Kennedy Space Center, FL 32899

Phone: (321) 867-5060

Refer to KSC-12942, volume and number of this NASA Tech Briefs issue, and the page number.