racy of SBAS systems based upon the thin-shell model suffers due to the presence of complex ionospheric structure, high delay values, and large electron density gradients. Interpolation on the vertical delay grid serves as an additional source of delay error.

The conical-domain model permits direct computation of the user's slant delay estimate without the intervening use of a vertical delay grid. The key is to restrict each fit of GPS measurements to a spatial domain encompassing signals from only one satellite. The conical domain model is so named because each fit involves a group of GPS receivers that all receive signals from the same GPS satellite (see figure); the receiver and satellite positions define a cone, the satellite position being the vertex. A user within a given cone evaluates the delay to the satellite directly, using (1) the IPP coordinates of the line of sight to the satellite and (2) broadcast fit parameters associated with the cone.

The conical-domain model partly resembles the thin-shell model in that both models reduce an inherently four-dimensional problem to two dimensions. However, unlike the thin-shell model, the conical domain model does not involve any potentially erroneous simplifying assumptions about the structure of the ionosphere. In the conical domain model, the initially four-dimensional problem becomes truly two-dimensional in the sense that once a satellite location has been specified, any signal path emanating from a satellite can be identified by only two coordinates; for example, the IPP coordinates. As a consequence, a user's slant-delay estimate converges to the correct value in the limit that the receivers converge to the user's location (or, equivalently, in the limit that the measurement IPPs converge to the user's IPP).

This work was done by Lawrence Sparks, Attila Komjathy, and Anthony Mannucci of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

The software used in this innovation is available for commercial licensing. Please contact Karina Edmonds of the California Institute of Technology at (626) 395-2322. Refer to NPO-40930.

Evolvable Neural Software System

Goddard Space Flight Center, Greenbelt, Maryland

The Evolvable Neural Software System (ENSS) is composed of sets of Neural Basis Functions (NBFs), which can be totally autonomously created and removed according to the changing needs and requirements of the software system. The resulting structure is both hierarchical and self-similar in that a given set of NBFs may have a ruler NBF, which in turn communicates with other sets of NBFs. These sets of NBFs may function as nodes to a ruler node, which are also NBF constructs. In this manner, the synthetic neural system can exhibit the complexity, three-dimensional connectivity, and adaptability of biological neural systems.

An added advantage of ENSS over a natural neural system is its ability to modify its core genetic code in response to environmental changes as reflected in needs and requirements. The neural system is fully adaptive and evolvable and is trainable before release. It continues to rewire itself while on the job. The NBF is a unique, bi-level intelligence neural system composed of a higher-level heuristic neural system (HNS) and a lower-level, autonomic neural system (ANS). Taken together, the HNS and the ANS give each NBF the complete capabilities of a biological neural system to match sensory inputs to actions.

Another feature of the NFB is the Evolvable Neural Interface (ENI), which links the HNS and ANS. The ENI solves the interface problem between these two systems by actively adapting and evolving from a primitive initial state (a Neural Thread) to a complicated, operational ENI and successfully adapting to a training sequence of sensory input. This simulates the adaptation of a biological neural system in a developmental phase. Within the greater multi-NFB and multi-node ENSS, self-similar ENI's provide the basis for inter-NFB and inter-node connectivity.

This work was done by Steven A. Curtis of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-14657-1

Prediction of Launch Vehicle Ignition Overpressure and Liftoff Acoustics

Marshall Space Flight Center, Alabama

The LAIOP (Launch Vehicle Ignition Overpressure and Liftoff Acoustic Environments) program predicts the external pressure environment generated during liftoff for a large variety of rocket types. These environments include ignition overpressure, produced by the rapid acceleration of exhaust gases during rocket-engine start transient, and launch acoustics, produced by turbulence in the rocket plume. The ignition overpressure predictions are time-based, and the launch acoustic predictions are frequency-based. Additionally, the software can predict ignition overpressure mitigation, using water-spray injection into the rocket exhaust stream, for a limited number of configurations.

The framework developed for these predictions is extensive, though some options require additional relevant data and development time. Once these options are enabled, the already extensively capable code will be further enhanced.

The rockets, or launch vehicles, can either be elliptically or cylindrically shaped, and up to eight strap-on structures (boosters or tanks) are allowed. Up to four engines are allowed for the core launch vehicle, which can be of two different types. Also, two different sizes of strap-on structures can be used, and two different types of booster engines are allowed.

Both tabular and graphical presentations of the predicted environments at the selected locations can be reviewed by the user. The output includes summaries of rocket-engine operation, ignition overpressure time histories, and one-third octave sound pressure spectra of the predicted launch acoustics. Also, documentation is available to the user to help him or her understand the various aspects of the graphical user interface and the required input parameters.

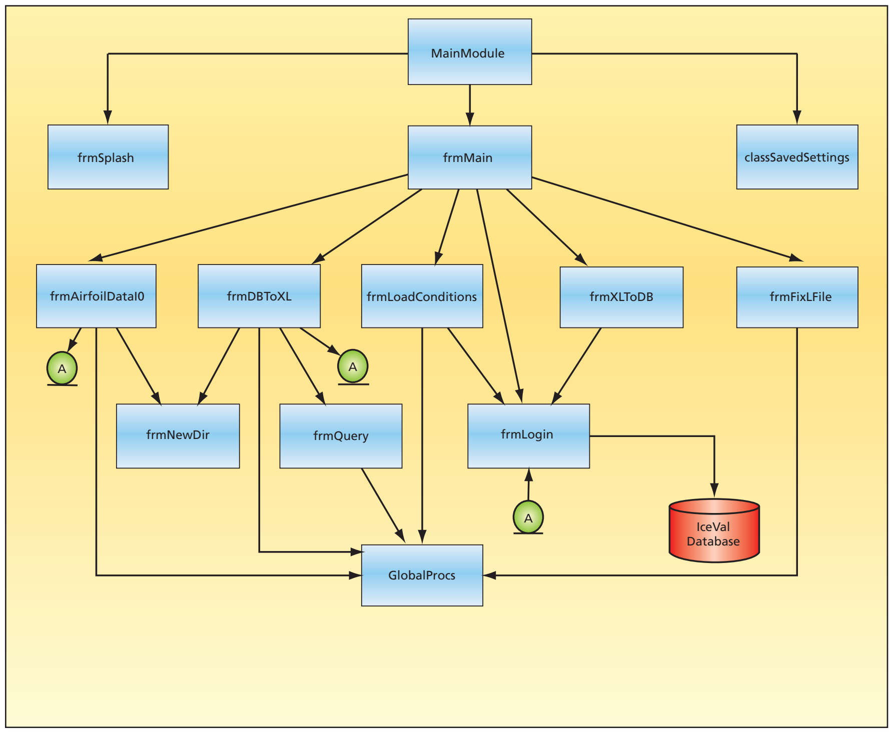
This work was done by Matthew Casiano of Marshall Space Flight Center. For more information, contact Sammy Nabors, MSFC Commercialization Assistance Lead at sammy.a.nabors@nasa.gov. Refer to MFS-32579-1.

Interactive, Automated Management of Icing Data

John H. Glenn Research Center, Cleveland, Ohio

IceVal DatAssistant is software (see figure) that provides an automated, interactive solution for the management of data from research on aircraft icing. This software consists primarily of (1) a relational database component used to store ice shape and airfoil coordinates and associated data on operational and environmental test conditions and (2) a graphically oriented database access utility, used to upload, download, process, and/or display data selected by the user.

The relational database component consists of a Microsoft Access 2003 database file with nine tables containing data of different types. Included in the database are the data for all publicly releasable ice tracings with complete and verifiable test conditions from experiments conducted to date in the Glenn Research Center Icing Research Tunnel. Ice shapes from computational simulations with the corresponding conditions performed utilizing the latest version of the LEWICE ice shape prediction code are likewise included, and are linked to the equivalent experimental runs.



IceVal DatAssistant Software system structure.

The database access component includes ten Microsoft Visual Basic 6.0 (VB) form modules and three VB support modules. Together, these modules enable uploading, downloading, processing, and display of all data contained in the database. This component also affords the capability to perform various database maintenance functions — for example, compacting the database or creating a new, fully initialized but empty database file.

This program was written by Laurie H. Levinson 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-18343-1.

LDPC-PPM Coding Scheme for Optical Communication

This scheme offers competitive performance and is suitable for parallel processing.

NASA's Jet Propulsion Laboratory, Pasadena, California

In a proposed coding-and-modulation/demodulation-and-decoding scheme for a free-space optical communication system, an error-correcting code of the low-density parity-check (LDPC) type would be concatenated with a modulation code that consists of a mapping of bits to pulse-position-modulation (PPM) symbols. Hence, the scheme is denoted LDPC-PPM. This scheme could be considered a competitor of a related prior scheme in which an outer convolutional error-correcting code is concatenated with an interleaving operation, a bit-accumulation operation, and a PPM inner code. Both the prior and present schemes can be characterized as serially concatenated pulse-position modulation (SCPPM) coding schemes.

Figure 1 represents a free-space optical communication system based on ei-