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).

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.

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