Project Details

ROSES ID: NNH05ZDA001N
Selection Year: 2006
Program Element: Data, Tools, & Methods

Topic: Shock acceleration of solar energetic particles by interplanetary CMEs

Project Title:
Development of a Limb Scanning Occultation Receiver for Ionospheric/Atmospheric Remote Sensing using Galileo and Modernized GPS Signals

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Summary:
New radio receivers will be designed and tested for acquiring and tracking weak GPS and Galileo signals during limb scans that occur just before or after occultation of the line-of-sight from the low-Earth orbit (LEO) receiver platform to the transmitting satellite. These receivers will be useful for global-scale remote sensing of the ionosphere and the neutral atmosphere from LEO satellites. The receivers will be developed to use the existing GPS civilian L1 signal along with the new GPS civilian L2 and L5 signals. They will also use multi-frequency signals from the Galileo global navigation satellite system that the Europeans are building. These receivers will be specially designed to track very weak multi-frequency signals down to low minimum scan altitudes in the neutral atmosphere, and to return scientific data such as TEC, neutral atmosphere delay, and amplitude and phase fluctuations. One receiver will be designed using FPGA technology, and another will be designed using real-time software receiver technology. They will be capable of processing many occulting signals simultaneously from both GPS and Galileo satellites. One possible FPGA design will operate in a sequential batch mode on digital intermediate frequency data that is stored in a circular buffer. Batch operation allows a single-channel FPGA that implements a complex set of operations to function as a multi-channel device because it can perform its calculations many times faster than the rate at which data are logged. The goal of the design is to receive signals and produce science data for all GPS and Galileo occultations that occur in a typical LEO. The new receiver will be able to return 3 times as many limb scans per day as can current occultation receivers while using lower gain antennas and simpler radio-frequency processing. The use of newer high-quality GPS and Galileo signals will enable these goals to be achieved. The principal science advance of the project will be an increase by a factor of 3 or more of the global density of limb scan coverage for a given polar-orbiting LEO platform and an increased ability to field the new receivers on LEO platforms due to decreased cost and complexity. The net result will be a greatly improved ability to estimate dynamic global variations of ionospheric electron density, of neutral atmosphere temperature and pressure in the upper troposphere and the stratosphere, and of water vapor in the lower troposphere (if independent temperature measurements are available).

Publication References:

no references