## Project Details

**ROSES ID:** NRA-01-OSS-01
**Selection Year:** 2002
**Program Element:** Independent Investigation: Geospace LWS

**Project Title:**
Dual Frequency GPS Software Receiver Development for Ionospheric Scintillation Measurement

**PI Name:** Mark Psiaki
**PI Email:** mlp4@cornell.edu
**Affiliation:** Cornell University
**Summary:**
Dual frequency software Global Positioning System (GPS) receivers will be developed to measure ionospheric scintillations. They are part of a GPS instrument that will be proposed for use on NASA's Ionospheric Mappers mission. Currently available GPS technology is inadequate for space-based scintillation monitoring, and the proposed receivers will fill this technology gap. The work will develop specialized signal processing algorithms for use in a dual frequency bit-grabber/software-receiver system. Such a system uses a minimal RF hardware front-end in conjunction with software that runs on a microprocessor. This set-up allows for after-the-fact processing of RF data. This mode of operation opens up the possibility of using non-causal signal processing algorithms. Such algorithms can enhance the gain of the tracking functions, which enables the receiver to detect and track weaker signals than can be tracked in a real-time receiver. The ability to track weak signals is critical when measuring ionospheric scintillations because they can cause deep fading of the received signal's power. This proposal will develop signal tracking algorithms that use non-linear smoothing techniques from the field of estimation along with FFT block-processing algorithms. They will be applied to track both of the GPS spread spectrum signals, the 1575.42 MHz L1 signal and the 1227.6 MHz L2 signal. The receiver will measure the effects of ionospheric scintillations on the following quantities: the amplitude and phase of each carrier and the two frequencies' differential group delay and differential carrier phase advance. These quantities characterize the diffraction effects of the scintillations and their impact on the Total Electron Count in a 1m-by-1m column from the receiver to the tracked GPS satellite. These developments will support Sun-Earth-Connection studies of Geospace disturbances. The developed software receiver will be ideal for use as the GPS instrument on NASA's proposed Ionospheric Mappers mission. The ionospheric scintillation data that it will measure will improve our understanding of these disturbances and will help us to develop operational radio receivers that are better able to cope with these effects. This knowledge will translate into reduced operational problems for other NASA missions that rely on GPS information for navigation and attitude determination, missions such as the Space Shuttle and the International Space Station.

## Publication References:

**Summary:** ''

**Reference:** Dual Frequency GPS Software Receiver Development - Psiaki, Mark Cornell University