

## Project Details

**ROSES ID:** NRA-01-OSS-01

**Selection Year:** 2002

**Program Element:** Independent Investigation: Geospace LWS

**Project Title:**

Investigation and Development of Data-Driven D-Region Model for HF Systems Impacts

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**Summary:**

Space Environment Corporation (SEC) proposes a 3-year program to develop and validate a weather-capable D-Region model that assimilates solar & earth-space observations to provide a High Frequency (HF) absorption model for HF communication links and radar facilities. Motivation for the study is based on the low accuracy rates of climatological models in assessing the real-time impacts of solar and magnetic storms on HF communication systems. The proposed effort will include (1) optimization of D region model for fast, accurate absorption calculations, (2) develop assimilation algorithms for NASA satellite data streams for D-region/HF absorption model, (3) establish a low-cost HF-link monitoring and analysis effort for algorithm validation, (4) incorporate HF-link observations in assimilative model for regional improvements. The weather-capable D-Region/HF absorption model will account for solar induced impacts on HF absorption, including X-rays, Solar Proton Events (SPE's), and auroral precipitation variability. Ionosphere variability is induced by short time variations of solar electromagnetic radiation, energetic solar protons, solar wind and interplanetary magnetic field. The ionospheric variability greatly influences HF propagation characteristics and, thus, HF technologies. There are 20+ HF propagation and absorption programs developed in the last 30 years. These are based on climatological models of the ionosphere and are best used to aid in design of HF facilities. Currently, climatological models are being used in near real-time support of communications and radar communities. A growing base of evidence indicates that ionosphere climatology cannot provide suitable real-time support for the HF users. Data assimilating ionosphere weather models are being developed, but these models contain only E and F region altitudes. The D-region specifications are needed to correctly determine HF signal degradation. SEC proposes to undertake a program of algorithm development to assimilate space-based data from several satellites into an optimized D-region model. The data from WIND, IMAGE, POLAR, DMSP that relates to the ionization characteristics of the D region will be used to produce a weather-capable D-region model for use in HF propagation program.. Validation of the assimilation algorithms and model will be done using a large existing database of HF-links (PENEX) and a low-cost monitoring of an International HF Beacon network.

## Publication References:

**Summary:** "

**Reference:** Assimilative D-Region Model for HF Systems - Eccles, J. Vincent Space Environmental Corporation