

AURORA: A Cost-Effective Solution for Monitoring, Imaging, and Forecasting Low Latitude Ionospheric Irregularities

Joseph Comberiate¹, Larry J. Paxton¹, and Michael Paul¹

¹ Johns Hopkins Applied Physics Laboratory, Laurel, MD (Joseph.Comberiate@jhuapl.edu)

Ionospheric irregularities affect a number of critical functions including: command, control, communication intelligence, surveillance and reconnaissance (C3ISR). Two DMSP satellites, F16 and F17, have been launched and each of them carries a Special Sensor Ultraviolet Spectrographic Imager (SSUSI). DMSP flies in two orbit planes: twilight (6AM/6PM) and early evening (8AM/8PM). The DMSP SSUSI instrument on F16 is in the ideal orbit for imaging equatorial plasma bubbles (EPB): 8AM/8PM. F18 is currently slated for that orbit as well. Delays in the NPOESS program may lead to putting the unflown DMSP satellites in a twilight orbit.

Disk imaging from cross-track scans perpendicular to the orbit plane have allowed for tomographic reconstruction of altitude vs. longitude profiles of electron density from GUVI and SSUSI observations. GUVI images have been part of the first coordinated ground- and space-based optical observations of equatorial plasma bubbles. We are developing a technique to use SSUSI F16 data to combine multiple reconstructed electron density cross-sections into three-dimensional images of plasma bubbles.

We anticipate using nightside UV observations from DMSP F18 as a central component of a new effort to link three-dimensional bubble structure to RF propagation issues including scintillation. New instruments are essential to ensure a continuity of observations through the upcoming solar maximum and beyond. The proposed AURORA instrument would build on the accomplishments of the SSUSI program and ensure that the necessary data is available to address a major need of the warfighter by improving the understanding of equatorial ionospheric irregularities and enhancing the AFWA ability to forecast scintillation.

AURORA could be flown on the NPOESS satellites (it was, in fact, selected for flight but then, as a result of the Nunn-McCrudy mandated restructuring, descope) or it could be flown on a dedicated small-sat freeflyer. We have developed a number of cost-effective approaches that enable the continuity of this key data set.