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## **First Measurements of Equatorial Ionospheric TEC and GPS Scintillation from an Unmanned Marine Vehicle**

Abstract:

Our ability to monitor the geospace environment from the vast stretches of the open ocean remains a technological challenge. This is a problem because oceans cover about 70% of the Earth's surface. Traditional ground-based ionospheric and upper atmospheric monitoring systems (e.g. ionosondes, imagers, interferometers) have been bulky, power intensive and have not been demonstrated to successfully operate from a platform in the open ocean. ASTRA has developed capabilities for hosting small size, weight, and power (SWaP) geospace instruments on unmanned marine vehicles. As part of this effort, we have successfully demonstrated a real-time monitoring capability for ionospheric TEC and scintillation measurements.

In this paper we describe a low SWaP dual-frequency GPS receiver called "GPS Autonomous Micro-Monitor at ASTRA" (GAMMA) which can be optimized for operations from an extremely dynamic environment such as the ocean surface. Funded by the Air Force Research Laboratory, ASTRA recently performed a multi-day demonstration of the receiver off the coast of Lima, Peru.

In this paper, we will discuss the GAMMA receiver; describe the operating platform for the receiver; and present measurements of ionospheric TEC and GPS scintillations made while deployed in the ocean. TEC and scintillation measurements from the marine vehicle will be compared against ground observations to provide validation and to assess the impact of the ocean environment on the data quality.

We anticipate this capability will open up many new applications for passively monitoring the ionospheric and its perturbations from previously inaccessible regions, such as the ocean.