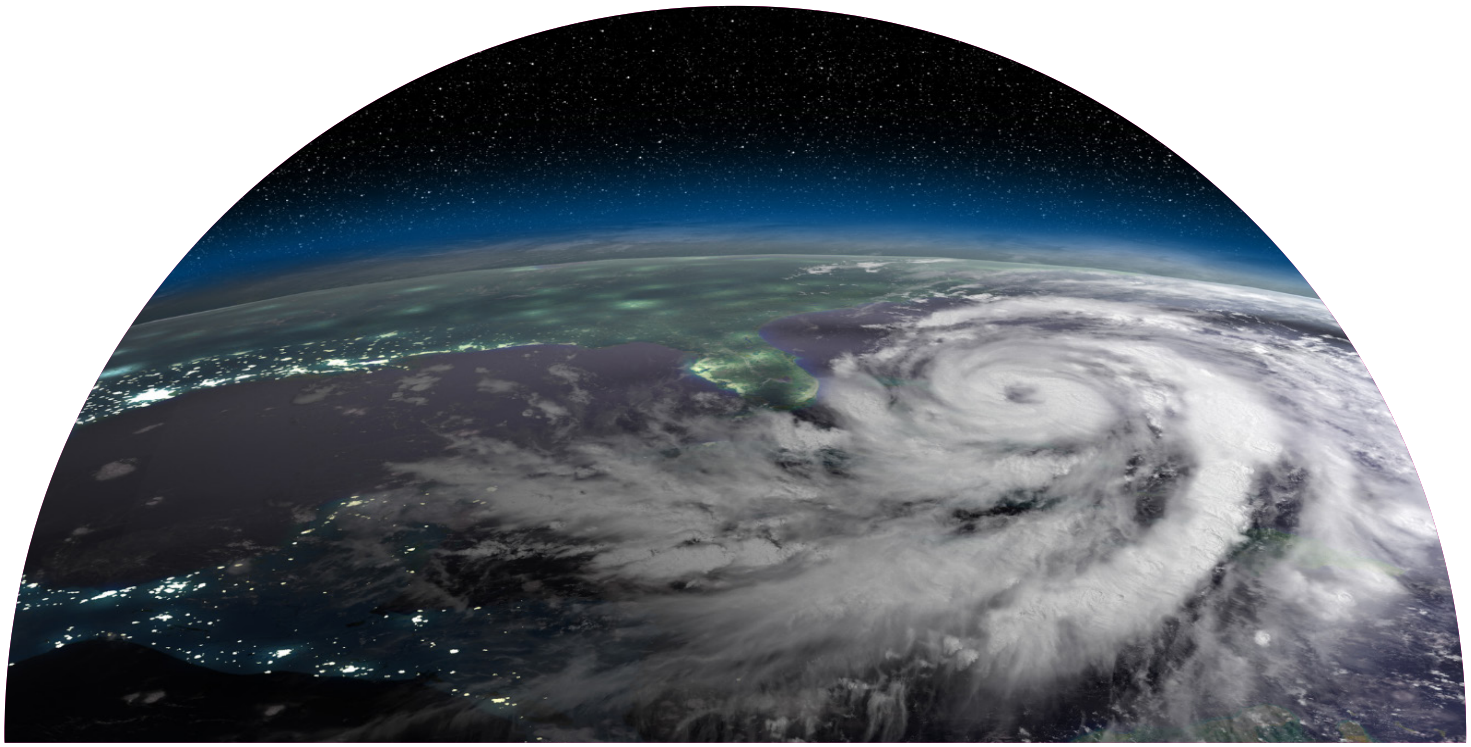
IONOSPHERE AS A SERVICE

ORION SPACE SOLUTIONS
an Arcfield company

Understanding the impact of the Ionosphere



IONOSPHERE AS A SERVICE

The ionosphere is a complex and rapidly changing region of space between 100 and 1000 km above Earth's surface that can bend, reflect, absorb and distort signals from high-frequency communications, over-the-horizon radar, GPS and satellite communications. Because the ionosphere is a contested environment and plays a major role in Department of Defense (DOD) missions, understanding its impact on these signals is vital for the modern multi-domain warfighter. Accurate nowcasting and forecasting of the ionosphere is a complicated challenge that requires decades of domain knowledge, millions of dollars in hardware and complex software models. The high cost of investment can be a significant barrier to entry, precluding some warfighters from access to critical ionospheric insights that could impact national security.

Orion Space Solutions is an established leader in accurately sensing and "making sense" of the ionosphere for the warfighter. The "ionosphere as a service" (IaaS) business model offers customers reliable nowcasts and forecasts as well as follow-on products that estimate ionospheric effects models on warfighter systems. With our expert team responsible for fielding and maintaining sensors and running the models, customers can expect ionospheric models that are more accurate, less expensive and easier to integrate for the warfighter than a military-owned and operated approach.

IONOSPHERIC SENSING

Orion has a decades-long track record of designing, building and deploying ionospheric sensors to collect relevant data. One such instrument that increases the accuracy of operational forecasts is the Remote Ionospheric Observatory (RIO), Orion's sixth-generation, science-grade dual-frequency GPS receiver that tracks the traditional L1 civil signal and the L2 civil

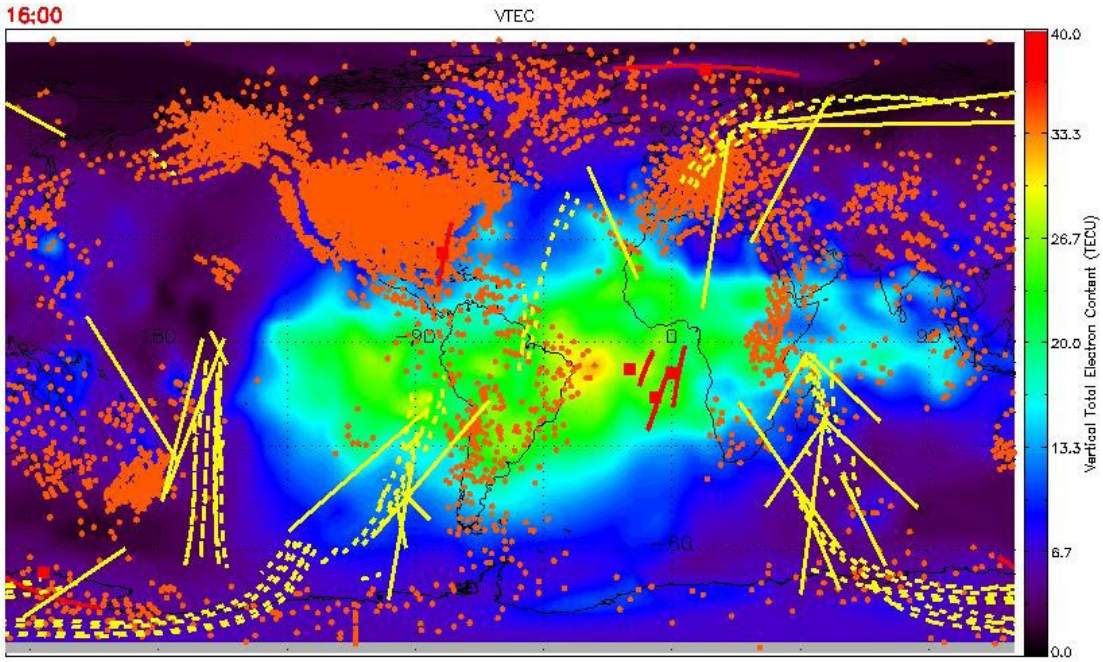
signal, L2C. RIO provides accurate measures of total electron content (TEC) as well as scintillation indices S4 and sigma phi. The RIO receiver design is also optimized for operations in remote locations, including ocean deployments, where power and other resources may be extremely limited.

IONOSPHERIC MODELING

The drivers of ionospheric variability, particularly in the bottom-side F region, are poorly sampled geographically. Additionally, the exchange processes that couple energy and momentum from the lower atmosphere are inadequately parameterized for the purpose of detailed ionospheric forecasting. One pioneering ionospheric data assimilation approach that addresses these two deficiencies is Orion's Ionospheric Data Assimilation Four-Dimension (IDA-4D) algorithm. Used extensively in DOD operational analysis studies, IDA-4D is an objective analysis maximum likelihood algorithm that estimates the global 3D time-varying distribution of electron density over large spatial regions and at all ionospheric altitudes. Orion has further developed and validated the IDA-4D algorithm by adding the Observing System Simulation Experiment Tool (OSSET) capability, which enables data assimilation design-of-experiments to aid in designing observational strategies to meet specific ionospheric specification goals

INNOVATIONS AHEAD

Orion is completely decomposing, rearchitecting and reimagining how ionospheric assimilation can leverage modern datasets, computational resources and tropospheric assimilation techniques. The result will be a new modular approach called Modular, Modern, Model for Space Data Assimilation, or M3SDA (pronounced "mesda"), which will be able to assimilate oblique ionograms such as those produced by SORcer. When it becomes available in the next few years, M3SDA will provide even more accurate ionospheric specification for Orion customers.



IDA-4D

Snapshot of Orion's IDA-4D data assimilation model showing intense plume of enhanced ionospheric TEC during an ionospheric storm