

NRL Beacons for Satellite and Sounding Rocket Applications

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The Coherent Electromagnetic Radio Tomography (CERTO) beacon has been flown on 12 satellite missions and 7 sounding rocket flights. This beacon provides unmodulated VHF/UHF and/or L-Band carriers for measurement of total electron content and radio scintillations data. In addition, the NRL COMMX instrument on TACSAT4 allows radio scintillation measurements in the frequency range 250 to 400 MHz. COMMX translates UHF communications signals from the ground to reradiated VHF signals near 250 MHz. The COMMX frequency translation preserves the phase coherency of the wave so that both amplitude and phase scintillations can be measured along with the coherence bandwidth of the channel. Currently, CERTO beacons are operating on DMSP/F15, C/NOFS and the recently launched ePOP satellites. CERTO on DMSP/F15 and ePOP in nearly polar orbits provide meridional scans of the ionosphere. CERTO on C/NOFS in a nearly equatorial orbit provides zonal scans of the low latitude ionosphere. NRL, AFRL, Kyoto University, SRI International, and other organizations are providing ground receivers for the VHF/UHF beacons. Tomographic images of high and low latitude irregularities have been acquired using chains of ground receivers aligned with the satellite orbits. The CERTO beacons were recently used to support rocket launches from Kwajalein, Marshall Islands during the MOSC mission and from Kyushu Island, Japan during the WIND III Campaign. These dual frequency (150/400 MHz) beacons yielded total electron content (TEC) from the rocket to the ground during the suborbital flights. This TEC has been differentiated by the distance along the rocket trajectory to yield the background electron density during the flight. The electron yields from the Samarium releases during MOSC were estimated from the artificial enhancements in TEC. Future CERTO beacon missions include the plasma experiments on the Naval Postgraduate School NPSAT1 satellite and the Tandem Instrument CubeSat Experiment (TICE).