# The Canadian Enhanced Polar Outflow Probe (E-POP)

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The Enhanced Polar Outflow Probe (e-POP) is a new Canadian Ionosphere-Thermosphere mission. Scheduled for launch in late September 2013 into an elliptic polar low-Earth orbit onboard the Canadian CASSIOPE small satellite, e-POP will carry a suite of eight plasma, neutral, magnetic field, radio, auroral imager, and GPS receiver instruments, for high-resolution (~10 ms or 100 m) in-situ measurements up to 1500 km altitude, for studies of plasma outflow, neutral upwelling, auroral currents, and plasma irregularities in the topside ionosphere-thermosphere, as well as their effects on radio propagation. It will utilize the advanced communications capability onboard CASSIOPE to meet the large data downlink bandwidth (~10 GB/day) requirements.

We review the e-POP science objectives and our strategy to coordinate the planned observations with those from ground observatories and other ionosphere-thermosphere satellites, focusing on the radio science objectives. The GPS Attitude, Position and Profiling (GAP) instrument will receive signals from the Global Positioning System satellites for studies of ionospheric structure. When combined with data from earth-based GPS receivers, these measurements will be used to improve ionospheric tomography. The Coherent Electromagnetic Radiation Tomography (CERTO) beacon on e-POP will transmit at VHF and UHF in concert with dedicated receivers on the ground, for similar purposes of 2- or 3-D plotting of density structure and for investigation of scattering by ionospheric irregularities. The Radio Receiver Instrument (RRI) is a four-channel digital receiver for recording the electric fields of waves between 10 Hz and 18 MHz. Planned collaborative studies using transionospheric HF propagation for imaging mesoscale structures such as travelling ionospheric disturbances, patches, blobs and troughs will exploit ionosondes, coherent backscatter radars or other HF transmitters as wave sources. The structure thus observed will be compared with the results of ionospheric tomography from CERTO and GAP.

The observation and analysis of electromagnetic phenomena of spontaneous origin are planned in collaborations involving the RRI and ground-based receivers of space emissions. Transionospheric propagation at frequencies from ELF to HF will be studied to understand access to the magnetosphere of manmade signals and access to the ground of spontaneous noise from space.