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## **Transionospheric Radio Propagation Research with CASSIOPE/ePOP**

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The Radio Receiver Instrument (RRI) launched in 2013 as part of the Enhanced Polar Outflow Probe (ePOP) payload on the Canadian CASSIOPE small satellite has been successfully operated in a number collaborative transionospheric propagation experiments. The RRI is a digital receiver that operates in the frequency range from 10 Hz to 18 MHz and connects to 4 tubular monopoles usually configured as two orthogonal 6-m dipoles. CASSIOPE's elliptical (325 km - 1500 km) high-inclination (81°) orbit has presented a variety of experimental opportunities in plasma-wave research. Experiments have featured the reception of EM signals from coordinated ground transmitters of various radiated powers in the very-low-frequency to high-frequency range, including VLF communication transmitters, HF ionospheric heaters, HF over-the-horizon radars, HF coherent-backscatter radars, ionosondes and amateur radio sources. In many cases, the distortion of signals in transionospheric propagation observed by the RRI inside the ionosphere may be used to test long-held interpretive assumptions about propagation that normally is only observed when reflected or scattered back to the ground. Special interest arises with radio propagation detected at low altitudes near perigee at 325 km altitude, a height range rarely visited by orbital observatories. The RRI is also used to detect the results of plasma instabilities that occur in different locations in the ionosphere-magnetosphere system and give rise to EM radiation seen on the ground. In many cases, the RRI measurements are part of collaborative studies exploiting other field and particle instruments on the ePOP payload .

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