# CASPER Pilot Experiment Results: Estimation of Atmospheric Refractivity Using Propagation Loss

Caglar Yardim*[1], Jon Pozderac[1], Robert Burkholder[1], Qing Wang[2]
[1]ElectroScience Laboratory, The Ohio State University, Columbus, OH 43212
[2]Department of Meteorology, Naval Postgraduate School, Monterey CA 93943

Coupled Air-Sea Processes and Electromagnetic-ducting Research (CASPER) is a multi-university research initiative (MURI) project that explores the effects of environmental conditions in the marine-atmospheric boundary layer on low altitude EM propagation, ducting in particular, for naval applications. The CASPER Pilot Experiment was conducted off the coast of Moss Landing, CA, during April-May of 2015.

The Ohio State University deployed an X-band measurement system that consisted of a number of 11 GHz beacons emitting continuous wave (CW) signals placed on various mobile/shore platforms. These included a powerful 57 dBm shore transmitter with a high gain (24 dB) horn antenna, a 16 dBm beacon attached to an azimuthally omni-directional monopole the controlled towed vehicle (CTV) towed from a Twin-Otter airplane, and another 16 dBm monopole beacon on a rigid hulled inflatable boat (RHIB). Each beacon had a small offset from 11 GHz to differentiate between them.

The receiver system on the research vessel (R/V John Martin) was composed of a forward looking and a backward looking X-band horn controlled by a RF switch. Each antenna was connected to a small Signal Hound USB spectrum analyzer through a noise figure low-noise amplifier (LNA) and the data was recorded for all beacon frequencies simultaneously. This system allowed for the measurement of the one-way propagation loss between the emitters and receiver as a function of range as the mobile platforms move towards and away from the R/V John Martin or shore transmitter.

The measured signal was used to invert for the evaporation duct refractivity profile and compared to the profile inferred from concurrent meteorological and oceanographic measurements obtained by up-down and synoptic balloon radiosonde measurements and Naval Postgraduate School meteorological sensors at the bow mast of R/V John Martin. The results showed a very good match between the bulk measurement inferred duct parameters and EM-inverted ones.