

## **Third Generation MF-HF radar for Ionosphere Radio Science**

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A third generation of ionosphere sounding radars that operate in the Medium Frequency (MF) and High Frequency (HF) bands has recently been developed, installed and operated at several locations in both mono-static and bi-static configurations.

The first generation was the National Oceanic and Atmospheric Administration (NOAA) “Dynasonde” HF radar circa 1985, the second generation was the Air Force Research Laboratory (AFRL) sponsored Vertical Incidence Pulsed Ionosphere Radar circa 2007. The third generation of this radar system features improved digital transmitters and receivers using a Field Programmable Gate Array (FPGA) based signal processing design, increased sample rates and bit lengths, increased output word sizes, precise GPS timing for bi-static sounding, stable rubidium oscillators for bi-static phase measurements, and expanded frequency coverage of 0.5 to 30 MHz.

All of these instruments are designed to support the sophisticated Dynasonde modes of ionospheric sounding, as well as other measurement modes both simple and complicated, depending on the needs of the end user. High transmit signal power, low distortion, and multiple phase matched receive channels are key features to the design.

These new generation instruments have been installed in Texas, in Japan at 4 locations, in Antarctica, northern Sweden, and 2 receive only locations in South Korea. A description of the instrument design, operating principles and examples of the data the instruments are producing will be shown.