



HFGeo

HIGH-FREQUENCY GEOLOCATION

INTELLIGENCE VALUE

HFGeo developed a capability that dramatically improved the USG ability to geolocate and characterize highfrequency (HF) emitters.

HF communications are very attractive as their signals can propagate over continental distances by “bouncing” off the Earth’s ionosphere. Yet, the geolocation of transmitted HF signals is challenging because they are bent, reflected, and attenuated by the ever-changing ionosphere. Ionospheric structure and behavior can dramatically vary in space and time as a function of many factors, including weather. This variation causes the reflected HF signals to be modulated in angle of arrival, which compounds the challenges associated with detecting and geolocating their emitters

HFGeo improved HF signal geolocation by advancing the state of the art in three areas: (1) ionospheric modeling, prediction, and characterization methods; (2) novel antenna design capable of resolving multiple angles-of-arrival and signal polarization states; and (3) multi-dimensional, adaptive signal processing methods to reduce detectable signal-to-noise ratio, enhance detection, and improve source geolocation of HF signals.

HFGeo began in 2011 and concluded in 2020. Some key accomplishments include:

- an integrated system that significantly improved HF signal geolocation accuracy,
- a successful field demonstration, and
- the technology was transitioned to government partners.

PRIME PERFORMERS

- Systems & Technology Research
- Northrop Grumman
- Leidos
- NorthWest Research Associates
- Southwest Research Institute

KEYWORDS

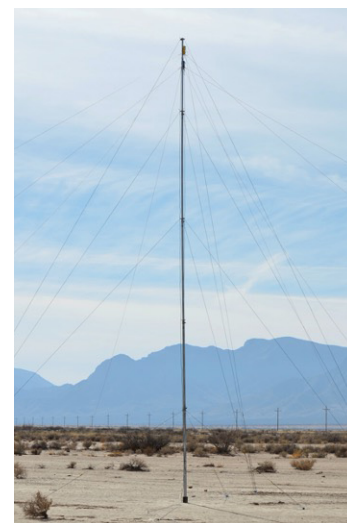
- Ionosphere
- Angle of Arrival
- Geolocation
- HF
- Software Defined Radio
- Machine Learning

TESTING AND EVALUATION PARTNERS

- Air Force Research Laboratory
- Johns Hopkins University Applied Physics Laboratory
- MITRE
- National Security Agency System Performance Evaluation Laboratory
- Massachusetts Institute of Technology Lincoln Laboratory
- Applied Research Laboratories, University of Texas
- Penn State University Applied Research Laboratory



Example geolocation results; Kent Island, MD antenna array configuration.



OCONUS/CONUS deployment of HFGeo standard polarization sensitive antenna (one of 19 in an array).



PROGRAM MANAGER

dni-iarpa-info@iarpa.gov
(301)-243-1995



www.iarpa.gov



@IARPAnews