



Senior Design Project in Electrical & Computer Engineering



Patrol Boat Near Vertical Incident Skywave (NVIS) Antenna

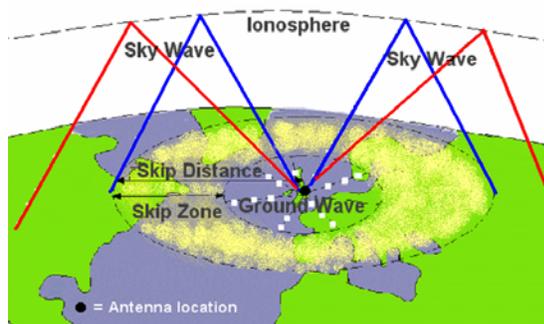
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Sponsor: TISCOM

Project Background

Coast Guard patrol boats perform certain missions such as search and rescue, drug interdiction, and migrant operations. To successfully conduct these missions, patrol boats need to have clear communications with a command center at a sector, station, or other patrol boats in the area in which they are operating. A problem that is occurring with the patrol boats is that their high frequency (HF) radio communications are often unreliable. Though some HF communication is possible, a problem called a skip zone is created that causes the unreliability of HF communications. The skip zone is the area where there is no signal coverage from either the ground wave or the reflected sky wave. The purpose of this project is to implement a near vertical incident sky wave (NVIS) antenna on patrol boats that will eliminate the skip zone by causing an overlap between the ground wave and the reflected sky wave.



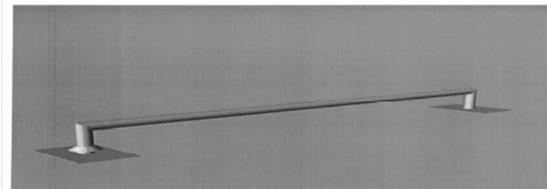
Example of sky waves of different take off angles reflecting off the ionosphere.

Project Objectives

The objective of the project is to implement a NVIS antenna on patrol boats that will eliminate the HF skip zone. This will allow HF communications to be sent and received reliably in the area where the vessels operate. This goal will be accomplished by collecting quantitative results from tests on board operational Coast Guard Units. The quantitative data needs to be obtained using the automatic link establishment (ALE) feature that is a part of the RT-9000 HF transceivers used by these Coast Guard patrol boats. This radio provides a numerical value that is proportional to the signal to noise ratio (SNR). The final step in achieving this objective is to conduct side by side tests with the whip antennas that are currently on board the patrol boats. These tests will demonstrate which antenna performs better.

Project Design

The design of the NVIS antenna is that of a towel bar. The length of the towel bar antenna is 145", and the height of the towel bar antenna is 15" from the top of the coupler box cover. The two bases of the antenna have fabricated coupler box covers that are 24" x 13". The purpose of the coupler box covers is to replace the existing covers and make the antenna installation simple. The new covers allow the NVIS antenna to be bolted on to the couplers. The previous year's antenna was welded onto a cutter and by bolting down the antenna, it makes it easier to put on and take off.



Design of NVIS antenna with fabricated coupler box covers

Project Work

The remaining work that needs to be completed on this project is quantitative testing of the NVIS and whip antenna side by side and radiation hazard (RADHAZ) assessment. The purpose of the quantitative test is to determine which antenna is better for voice communications. The purpose for the RADHAZ test is to determine the levels of electromagnetic energy present in the vicinity of the towel bar antenna. These levels will then be compared to safe levels of exposure for the ship's crew.



NVIS antenna installed on the USCGC KISKA