



Senior Design Project in Electrical & Computer Engineering



Antenna Modeling for WPB-110 Class Cutters

Cadets: 1/c Darla Mora and 1/c Chris Weiser

Advisor: Dr. M. E. McKaughan

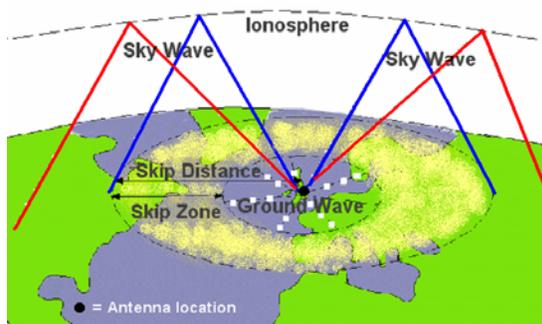
Sponsor: TISCOM

Project Background

In the Coast Guard fleet, 110' cutters are mainly used for search and rescue and law enforcement operations. Since these missions are essential to the Coast Guard, reliable communications between 110' cutters and the Group/District Command Centers are vital. Short-range communications, in particular, are important for 110' class cutters because of the close proximity to shore during typical SAR and LE cases.

The current HF antenna configuration on a 110' cutter has proven unreliable for this short-range communications. Currently 110' cutters use a whip antenna, which create a low take-off angle producing a large skip zone. As a result, the cutters communication within a range of 50 to 500 miles is very poor.

A skip zone is the distance between where the ground wave ends to where the sky wave returns to earth after bouncing off the ionosphere. In the below picture, a sky wave with a high take-off angle relative to the earth's surface is shown in blue. The skip zone is low compared to a sky wave with a small take-off angle, shown in red.



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

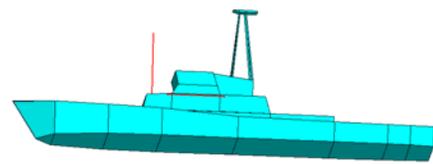
Project Plan

The project will design a new antenna for the 110' class cutter that will reduce the current skip zone. The new antenna will then be constructed and installed on a 110' cutter for further testing.

Project Work

Work prior project identified the towel bar antenna as the best candidate for further evaluation. This year we will test the efficiency, radiation characteristics, and the driving point impedance of the antenna for different location on the cutter.

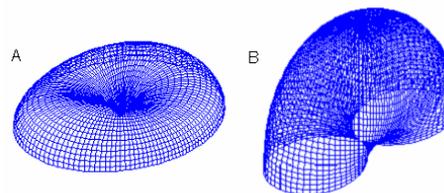
Preliminary analysis will be conducted through the use of computer modeling programs GNEC and WIPL-D to compare the mathematical and graphical results for different locations.



WPB-110' Cutter Model in WIPL-D

Project Deliverables

- An analysis of the different antenna placements on a 110' cutter using the GNEC and the WIPL-D programs.
- The candidate antenna will be built and installed on a 110' cutter.
- Compare the theoretical results obtained from GNEC and WIPL-D programs and actual data obtained from tested antenna on the 110' cutter.



Pattern A is the radiation pattern produced by a whip antenna where Pattern B is the radiation pattern made by a towel bar antenna. As can be seen the Vertical radiation of the towel bar antenna is much greater than that of the whip antenna, thus producing a higher take off angle. WIPL-D