

## Senior Design Project in Electrical & Computer Engineering



# VHF-DF Testing System

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Sponsor: G-AND

### Motivation



#### Judge Awards \$19M in Morning Dew Case

##### He calls Coast Guard's conduct 'reckless and wanton'

On December 29<sup>th</sup>, 1997 the distressed sailing vessel Morning Dew, beaten by a strong winter gale outside of Charleston SC, called a mayday and cried out for help. The Coast Guard, not able to identify the transmission location could not respond. Three lives were lost. This day was not only tragic in its loss of human life but it gave the image of the Coast Guard a black eye that it is still recovering from. Now, the public and the Coast Guard are hard bent to prevent another Morning Dew from ever occurring.

### Project Background

The Coast Guard Headquarters' Acquisition Directorate G-AND office has initiated "The National Distress and Response System Modernization Project" or NDRSMP to resolve this problem. This project, now commonly referred to as "Rescue 21", will upgrade the current National Distress and Response System. Currently, the system is limited in its ability to discriminate between legitimate and false distress calls. One goal is to produce a Very High Frequency Direction Finding (VHF-DF) system. A VHF-DF system will save lives, reduce stress and wasted resources by allowing the Coast Guard to pinpoint the transmission location of distress callers. The single most important piece of information in any search and rescue case is the vessel's position because good position information often spells the difference between a single sortie with success and a resource intensive search and possible failure. If a distress call can be quickly located hoax calls can be delineated easily and search areas can be reduced so that lives and resources are saved. The accuracy of this system is paramount for its life-saving success.

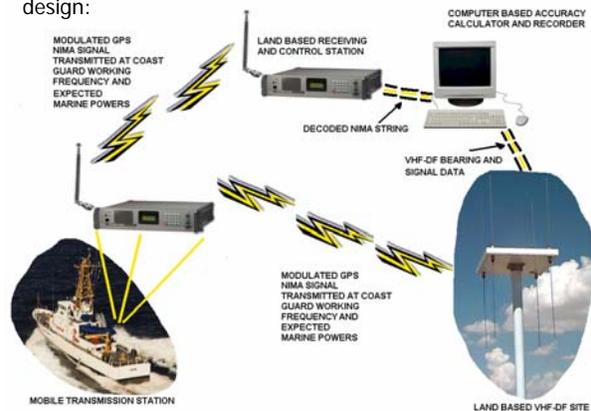
### Our Challenge

NDRSMP has requested the Coast Guard Academy produce a methodology and equipment to test the next generation VHF-based geolocation capabilities. This project will serve to clarify the performance and accuracy requirements of the DF system, create methods on how to measure and test these requirements and finally produce a prototype testing device for the VHF-DF system.

### Accomplishments

When it comes to the direction finding capability of the system, NDRSMP has set only basic specifications. These specifications have since been researched and further defined to meet the technical and operational needs of a Coast Guard DF system. Issues such as signal strength, Signal to Noise Ratio (SNR), frequency range and transmission duration are just a few of the clarifications to the specification that have been incorporated to produce a complete system specification for the DF testing device. Next, these recommendations must be presented to G-AND.

Testing methodology considerations such as the need for the system to be mobile, simulate actual marine transmissions and require as little manpower as possible produced the following design:



This system utilizes data radio modems to transmit a modulated GPS NIMA signal that includes transmission Latitude, Longitude and time references. This transmission is varied over the frequency range 150-165MHz and power ratings of 1, 5 and 25 watts to simulate real-life expected marine transmissions. The land based control station decodes the data radio signal and sends it to the computer. The DF bearing and signal data from the DF site is simultaneously relayed to the computer which compares the DF bearing predictions to the exact bearing calculated from the GPS data.

### Project Goals

The project goals are to:

- I. Order data packet radio modems and become familiar with programming protocol and operation.
- II. Create the software and hardware interface between the computer and the data radio modem.
- III. Synthesize final testing system components.
- IV. Test and adjust the testing system with available DF device.
- V. Develop specific site methodology test plan
- VI. Test and adjust for actual fleet use.