Senior Design Project in Electrical & Computer Engineering

VHF-DF Testing Methodology for Rescue 21

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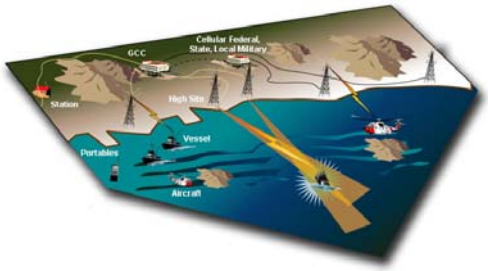
Sponsors: USCG Headquarters (G-AND)

Rescue 21 Background

The objective of Rescue 21 is to modernize and upgrade the three-decade old National Distress and Response System to create a faster, more accurate radio direction finding system which will save more lives. The ultimate goals of the system are:

1. Update hardware of the current system.
2. Provide automation in areas where there was previously none.
3. Fill coverage gaps across the waters of the United States.
4. Link/Network systems on the coasts.
5. Allow multiple channel radio operation.



Proposed Rescue 21 System

VHF-DF Requirements

Rescue 21 has set the following minimum performance specifications for the direction finder:

1. Accuracy within plus or minus two degrees
2. At a minimum, provide one line of bearing (LOB) to a voice transmission
3. Receive communications from a vessel with a 6 foot height of eye, transmitting with 1 Watt of power 20 nautical miles from the coast
4. Maximum search area encompasses within the search pattern not to exceed 25 square nautical miles

To fairly test the system, the Coast Guard Academy has decided the signal must meet the following specifications:

1. 1 micro-volt per meter electric field
2. Frequency within 150.000-165.000 MHz
3. Signal to Noise Ration of less than 15 dB
4. An integration time of 200 milliseconds

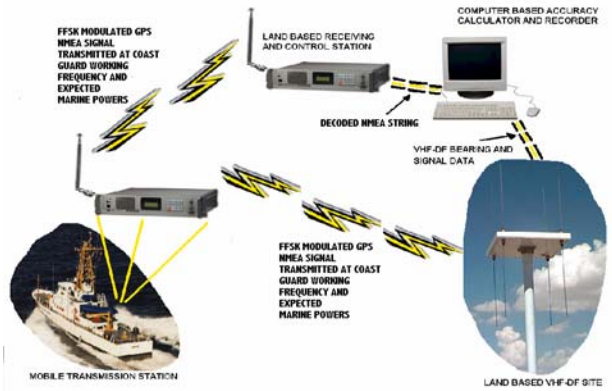
Project Goals

The ultimate goal of the project is to verify that the system that General Dynamics is building for the Coast Guard provides accurate position information within the specifications given by the Rescue 21 team. The results will speed up the adoption of Rescue 21 into the Coast Guard search and rescue program. To prove General Dynamics is providing the Coast Guard with a system that meets its needs, the new Direction Finding (DF) system must be tested. To accomplish this end, my goals for the project are:

1. Create the software and hardware interface between a computer and data radio modems for two different radio systems
2. Synthesize final testing system components
3. Test and adjust the testing system with available Direction Finding device
4. Develop specific site methodology test plan
5. Deploy, test, and adjust for actual fleet use

Project Plan

Last year we designed a system to test Rescue 21 using Teledyne modem radios. These radios, along with Key Systems radios, will be used to build the test system and conduct field tests. The proposed testing device is configured as shown:



Schematic of Proposed Rescue 21 testing Device

The land based control station decodes the data radio signal and sends it to the computer. The bearing from the DF site is simultaneously relayed to the computer which calculates the estimated bearing and compares it to the exact bearing calculated from the GPS data. After I have built the test system, I will perform field tests in different weather conditions and finally on a moving platform, such as a T-boat or Patrol Boat to test in conditions that Rescue 21 will actually be working in.