



## Senior Design Project in Electrical & Computer Engineering



# Testing VHF-DF Aspects Of Rescue 21

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Sponsor: USCG Headquarters (G-AND)

### Rescue 21 Background

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. In 2002, the Coast Guard awarded a \$611 million contract to General Dynamics to prevent another Morning Dew from ever occurring.



The objective of Rescue 21 is to modernize and upgrade the National Distress and Response System. 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 United States.
4. Link/Network systems on the coasts.

These goals have lead to a distress and response system that includes what should be a faster, more accurate direction finding system.

### VHF-DF Requirements

Rescue 21 has set the following performance specifications:

1. Accuracy within plus or minus two degrees
2. At a minimum, provide one line of bearing (LOB) to a voice transmission
3. Maximum search area encompasses within the search pattern not to exceed 25 square nautical miles

The VHF-DF is expected to meet those performance specifications if the signal meets the following conditions:

1. At least 1 micro volt per meter electric field
2. Frequency within 150.000 – 165.000 MHz
3. Signal to Noise Ratio (SNR) of no greater than 15 dB
4. An integration time of 200 milliseconds
5. The power ratings should be 1, 5, and 25 watts in order to simulate expected marine transmissions

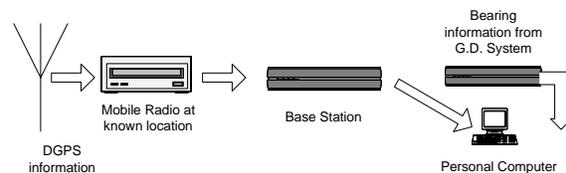
### Project Goals

To determine whether General Dynamics is equipping the Coast Guard with what it has bought, the new Direction Finding system must be tested. The main goal is to construct a testing device that uses DGPS to determine an actual bearing from the base station to the site and compares that to the DF bearing determined by the General Dynamics system. To accomplish this end, the following goals must be met:

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

### Project Plan

In 2004, we bought VHF data modem radios. These radios will be used to build the test system and conduct field tests. The proposed testing device is configured as shown:



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 are simultaneously relayed to the computer. The computer uses software to calculate the actual bearing from the site to the signal's location. The DF bearing is then compared to that actual bearing. After I have done this, I will test the system in different weather conditions and finally on moving transportation, such as a T-Boat or Patrol Boat.

The ultimate goal of the system is to verify that the system General Dynamics is building for the Coast Guard actually finds accurate bearing information within the specifications given by Rescue 21.