



Senior Design Project in Electrical & Computer Engineering

HF Communications ALE/COTHEN



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Sponsors: TISCOM

Project Background

The Coast Guard depends on high frequency (HF) communications for aircraft position reports and long range communications. Unfortunately, current HF communications are not very reliable and are difficult to use. There are gaps in the coverage area (as shown in figure 1) and often times communications are lost and need to be transferred to another unit, resulting in discontinuity of command. The Communications Systems (COMMSYS)

Transformation has outlined these needs for Coast Guard HF communications:

- Standardize/Centralize Communications
- Reduce the load on Communications Area Master Stations
- Replace legacy systems
- Bring down maintenance costs
- Improve interoperability within the Department of Home Land Security
- Increase support and expertise

The solution that we will test is the use of Customs and Border Protection's Cellular Over The Horizon Enforcement Network (COHEN). This is a land based network that has 19 transmission sites connected by telephone and internet lines. The sites work together to create a coverage "umbrella" with no holes, as shown in figures 2, 3, and 6.



Figure 1: Coverage Area with Current HF Communications

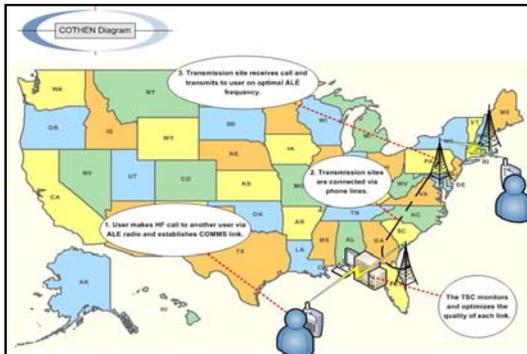


Figure 2: Diagram of COTHEN Operation

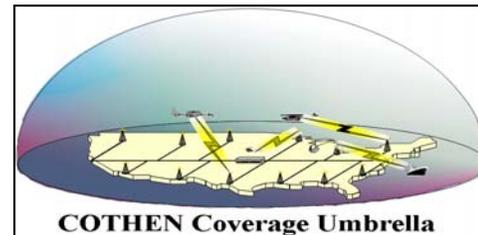


Figure 3: Coverage Umbrella with COTHEN

COHEN uses Automatic Link Establishment technology. This means that the radios optimize the frequency without any involvement from the user, this process is outline in the diagram found in Figure 4. Together, the COHEN network and ALE make HF communications much easier and more reliable.

COHEN can also provide drastically more support and expertise from the Technical Service Center (TSC) in Orlando Florida. The TSC monitors all calls within the Network to ensure the optimal link is established. Figure 5 is an inside image of the watchstanders monitoring the network at the TSC.

The user interface of the Remote Command Consoles for COHEN are shown below in Figure 6.



Figure 5: TSC in Orlando, FL

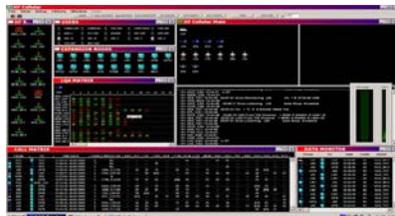


Figure 6: Command Console

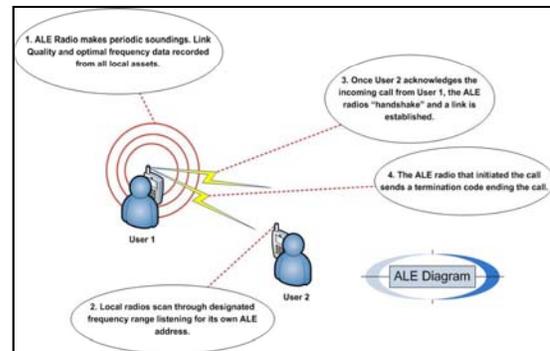


Figure 4: Diagram of Automatic Link Establishment Operation

Project Work

Thus far, the majority of the documentation for the project has been completed. This includes: the business case, the support plan, the project management plan, project research, and the design and test plan. Efforts will now be focused on the actual design and testing of COHEN. To do this, both pre-COHEN and post-COHEN data will be collected from Sector Key West, CAMSLANT and Sector San Diego. The data will be analyzed and compared against one another. The final recommendation to TISCOM and ultimately to the Coast Guard will be a synthesis of the findings.

Project Plan

- Learn about the Capabilities of COHEN
- Outline the current state of HF communications
- Test HF communications at Sector Key West and Sector San Diego without COHEN
- Test HF communications at Sector Key West and Sector San Diego with COHEN
- Compare and Contrast HF with and without COHEN
- Provide final recommendation about COHEN in the Coast Guard

Project Deliverables

The purpose of this project is to formulate an opinion and recommendation for the use of COHEN within the CG.



Figure 7: Propagation Map of COHEN