



# Senior Design Project in Electrical & Computer Engineering

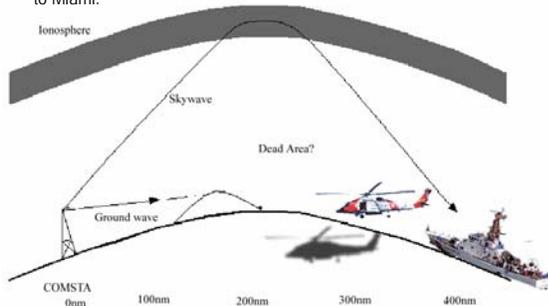


# HF Automatic Link Establishment

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 Sponsors: TISCOM & Coast Guard Headquarters (G-SCT)

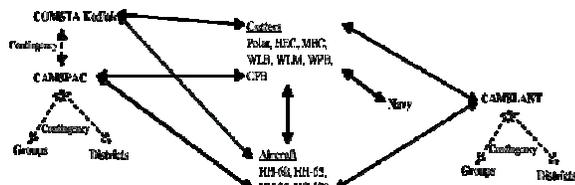
## Project Background

The Coast Guard often has had communications problems with patrol boats and aircraft flying between 30 and 300 nautical miles offshore. Historically, 30% of helicopter flights from the Bahama Islands are canceled due to the loss of High Frequency communications. This problem is largely due to the varying dead zone in HF signal propagation. Since the dead zone is different for each frequency and time of day, the communications problem can be solved by shifting to a frequency that has good propagation for the unit's current location. However, finding a good frequency requires coordination and good communication between the unit and the guarding station. Automatic Link Establishment radios solve this problem by polling each station on the net and determining which frequency will produce the best communications. In the Bahama Islands, the ALE radio was tested for two weeks flying 37 hours and every 15 minute guard call was completed. The test included many secure checks from Cuba and Haiti to Miami.

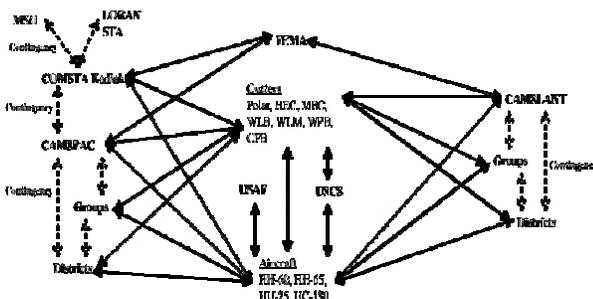


Dead Zone between Ground wave and Reflected Sky wave

### Conceptual HF ALE Data Connectivity Requirements



### Conceptual HF ALE Voice Connectivity Requirements

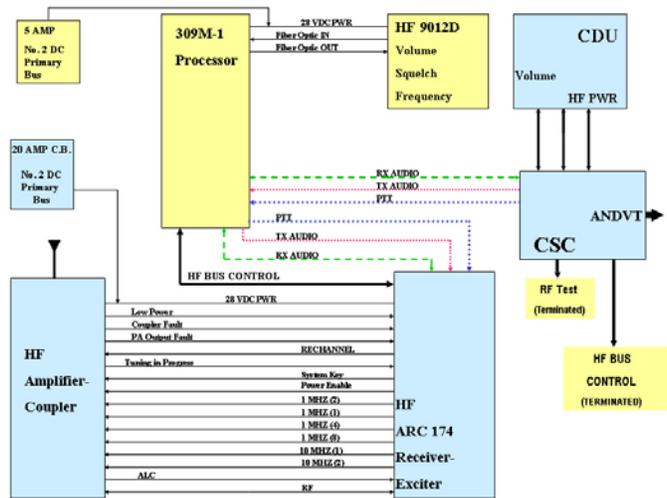


ALE Network Users

## Project Plan

ALE transmitter stations have been installed at CAMSPAC and COMMSTA Kodiak with the next scheduled installation for Hawaii. Tests are being conducted on these new transmitters using C-130 aircraft in the Gulf of Alaska. Our goal is to propose a network design including network control, transmitters, receivers and frequency sets. We will back up our proposal with testing and analysis conducted using McAllister Hall as a base.

## HF ALE Radio System



Upgrade components for ALE.

Existing components for HF radio..

ALE components added to existing system

## Project Work

We will design a system control including necessary hardware and methods for cross control to enable CAMSPAC or CAMSLANT to take control of the net. Our plan includes analyzing current transmitters and transmit antenna fields, utilizing propagation software to analyze current coverage and propose needed transmit locations for full coverage. Likewise, analysis of current receivers and receive antenna fields will be conducted and we will propose new antenna locations for adequate coverage. We will also analyze the current frequency lists and determine if there is adequate spatial separation to avoid East Coast vs. West Coast interference.

## Project Deliverables

- Specifications for a shore-side control system
- Analysis of transmitter coverage
- Proposals for new transmitter locations
- Analysis of receiver coverage
- Proposals for new receiver locations
- Frequency usage analysis
- Frequency lists

