SENIOR DESIGN PROJECT IN
ELECTRICAL ENGINEERING

DIRECTION FINDING OF SPREAD SPECTRUM SIGNALS

TRANSMITTING AND RECEIVING SPREAD SIGNALS
EVALUATION & ANALYSIS

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PROJECT REQUIREMENTS

Realistic emulation

Transmitted signal's format should be similar to the upgraded EPIRB system

Compatibility

Must be compatible with future search and rescue system

Accuracy

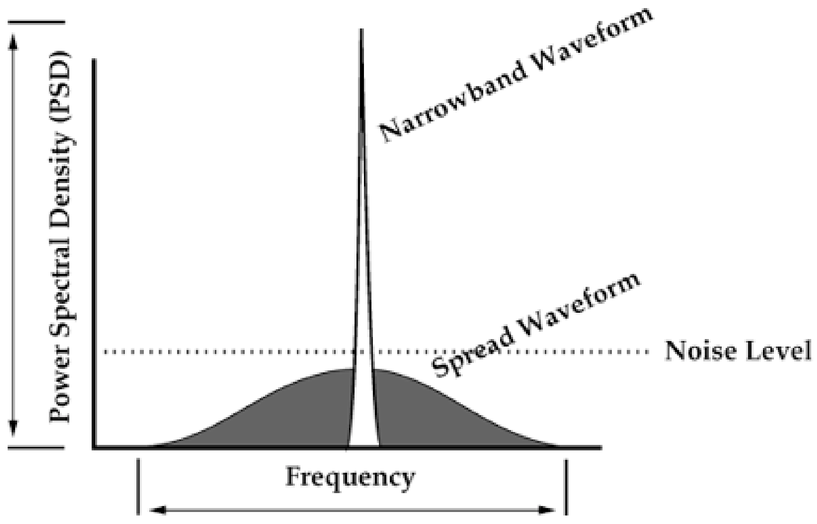
Must accurately determine the direction of a broadcasted spread spectrum signal

User Interface

Must display direction of signal in a manner that easy for the user to interpret

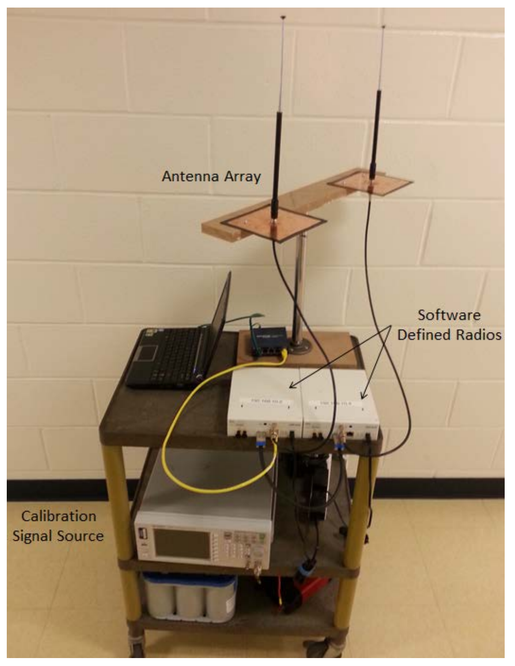
PROJECT BACKGROUND

EPIRBs (Emergency Position Indicating Radio Beacons) have long been an extremely useful tool in Search and Rescue (SAR) operations to quickly locate distress mariners. Once activated, EPIRBs transmit to a satellite system which relays information to ground units. The entire system is currently in the process of being upgraded with one of the biggest changes occurring in the transmitted signal format. The new signal will implement code division multiple access (CDMA) which changes the signal from narrow-banded to spread spectrum. This will improve accuracy, prevent jamming, and reduce the cost of the distress beacons. It also renders current SAR homing equipment obsolete which can only direction find a narrow-banded signal. In our senior design capstone project, we have been tasked with developing a direction finding system that can place on operation units and accurately determine the direction of these wideband signals.



DIRECT SEQUENCE SPREAD SPECTRUM IS COMMONLY USED IN THE COMMUNICATION INDUSTRY AND WORKS BY SPREADING THE ENERGY OF A NARROWBAND SIGNAL OVER A MUCH WIDER BANDWIDTH

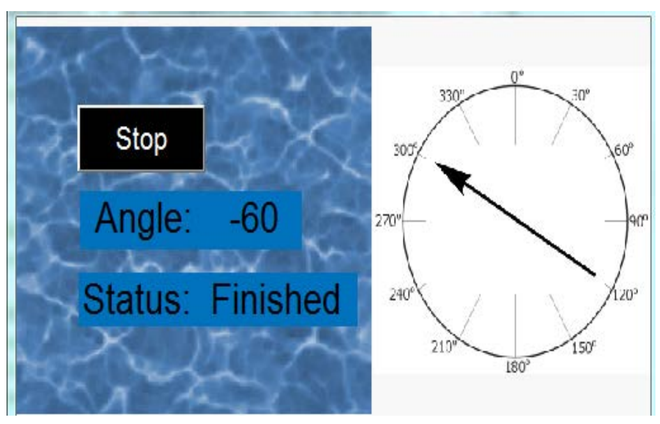
ANTENNA ARRAY AND RECEIVER



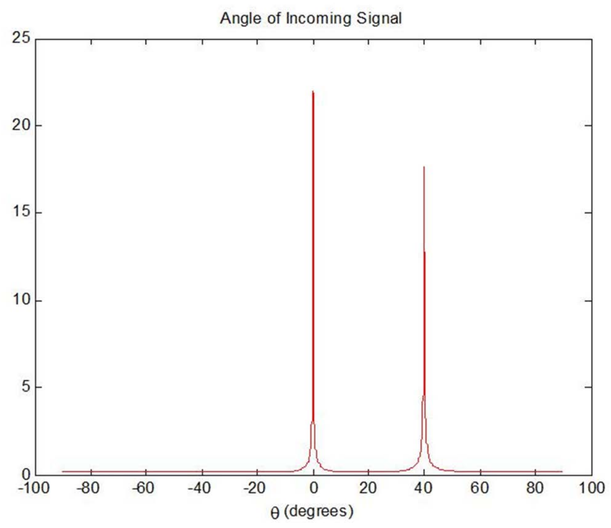
A NEW TECHNIQUE THROUGH MUSIC

We used an innovative technique to determine the direction of arrival. Instead of looking at the amplitude of received signals, we analyzed the phase characteristics with the Multiple Signal Classification algorithm (MUSIC). This allows source localization of any signal without Despreading or Demodulation.

GRAPHICAL USER INTERFACE



RESULTS

This year we have built a two antenna phased array system and have been successful in direction finding on low power, narrow-banded signals. Future project implementations will increase the size of the array improving the robustness of the system

MUSIC ALGORITHM RESULTS