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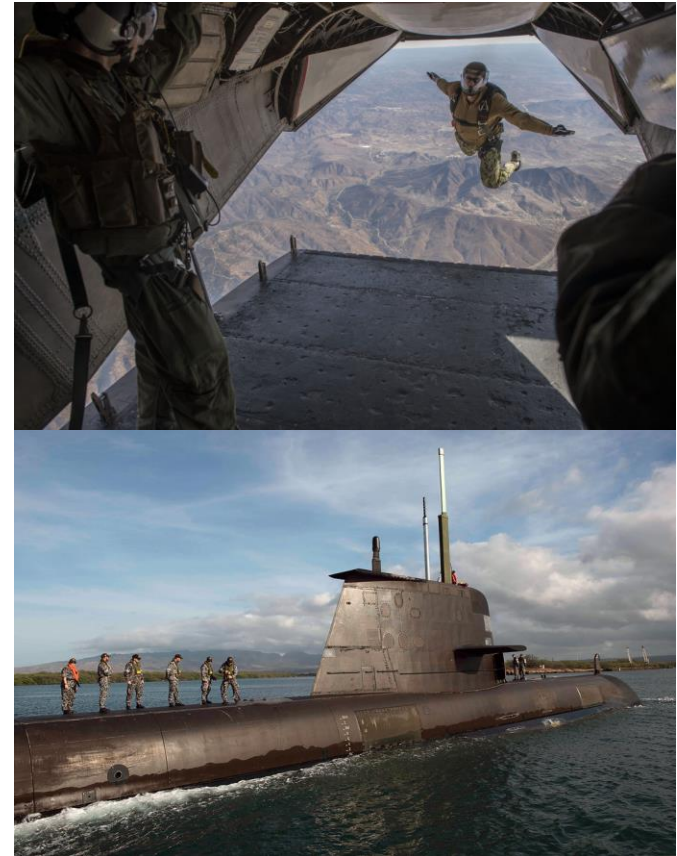
ENGINEERING
TEXAS A&M UNIVERSITY

Project name: Ultrasonic Radio
Team members: Nathan Cinocca
Jacob Ralls

Project description

Problem statement:

- Communicating information is very important in almost every military operation. However, sometimes sending information through traditional methods is not feasible.
- For example, electromagnetic waves can interfere with airplane or submarine equipment which can cause accidents.



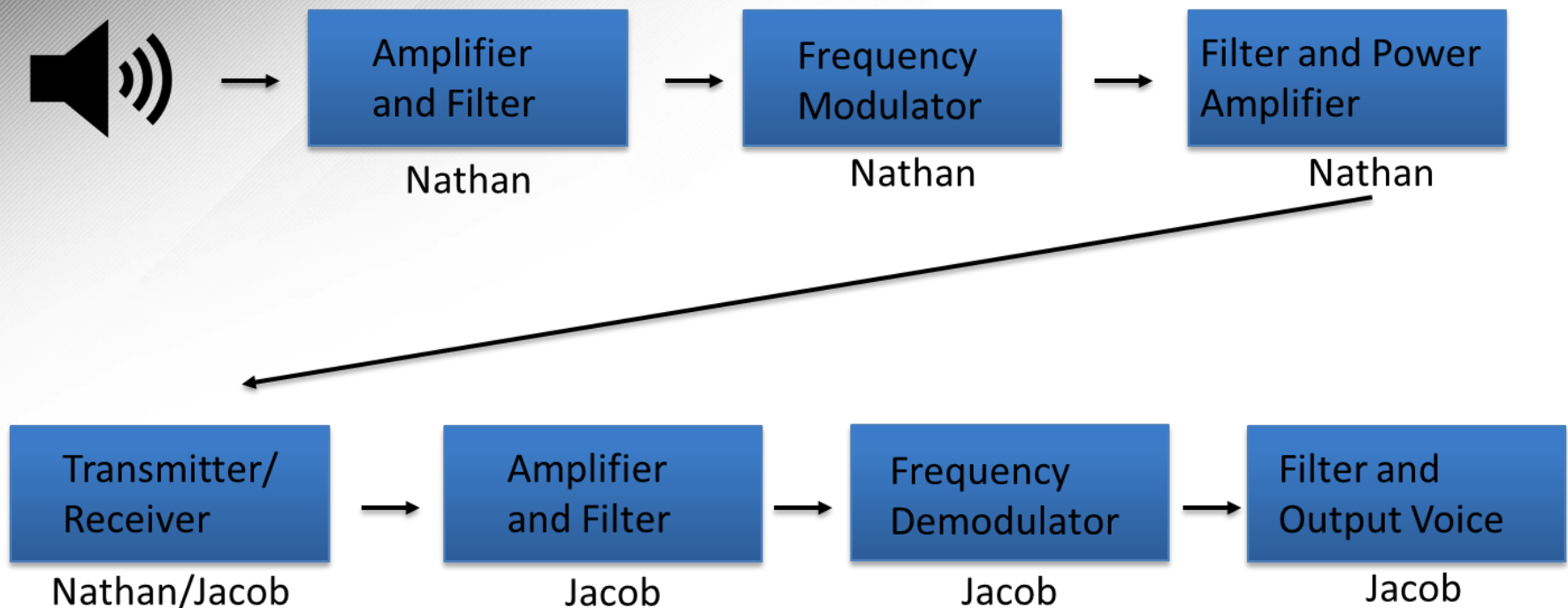
Project description

Solution proposal:

- A solution to this issue is to develop an acoustic ultrasonic radio.
 - Acoustic waves and lower frequencies will limit electromagnetic radiation
- This radio will allow for two-way communications over relatively short distances.
- Communication will be slower than devices using electromagnetic waves



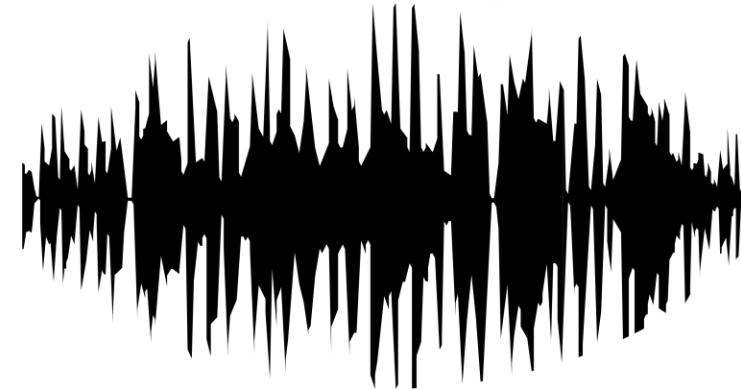
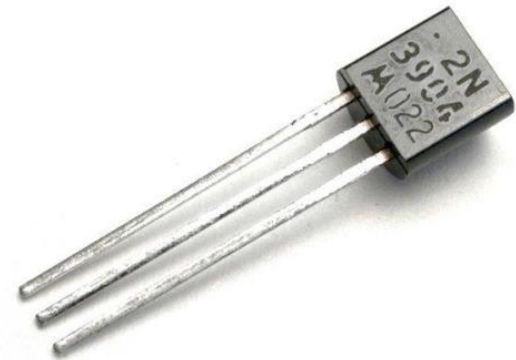
System Breakdown



The ultrasonic radio's input microphone covers human voice frequencies (100 Hz to 3 kHz), translating voice into an electrical signal. This signal is amplified and filtered to enhance its quality and eliminate unwanted noise. Next, it's modulated to ultrasonic frequencies for transmission, with optional additional filtering. The modulated signal goes through a power amplifier to achieve the required gain, then travels to the receiving microphone, where it's filtered and amplified for demodulation. After demodulation, it's filtered and output through a speaker within the human hearing range.

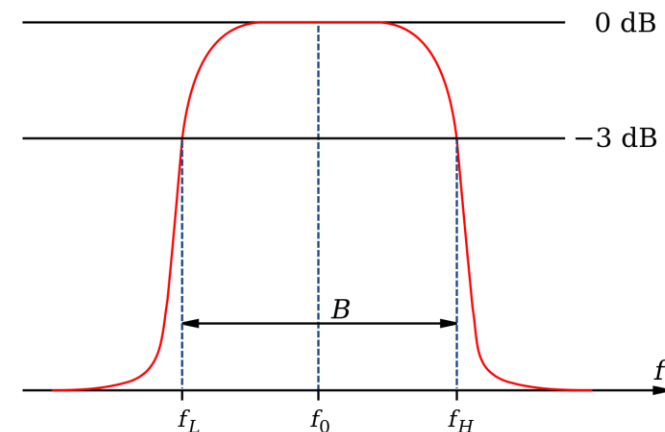
Signal Amplifier

- Signal Amplifier will increase the strength of signals to improve transmission and reception
- Signal Amplifier will be transistor based using 2N3904 and 2N3906 NPN and PNP transistors
- The Amplifier will use 5 volts and ≤ 50 mA
- I have begun designing the amplifier using multisim



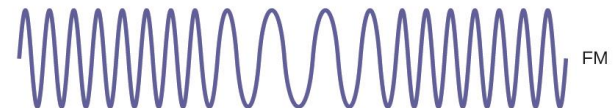
Filters

- Multiple filters will be used for this radio, but all will be band pass filters
- Pass bands will vary depending on placement in circuit
 - Voice filters 100-300 Hz
 - Transmitting filter 50 kHz
 - Receiving filter 60 kHz
- Filters should help to reduce noise
- Use op amp LM741CN



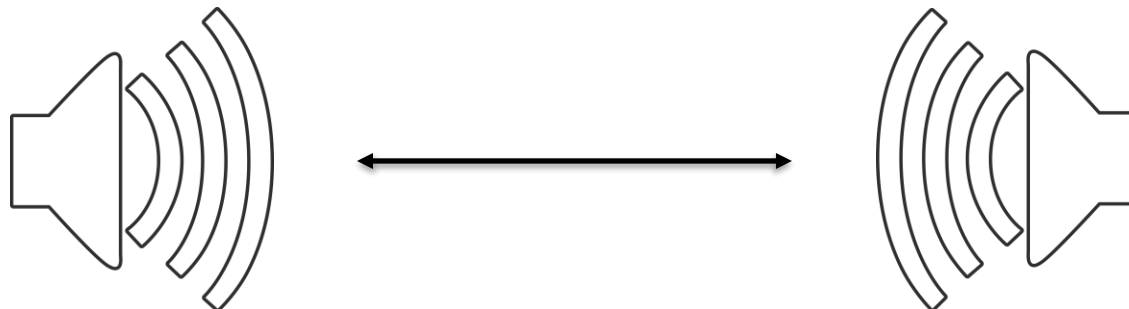
Frequency Modulation/Demodulation

- Information will be transmitted after applying frequency modulation
 - Signal will be modulated to the ultrasonic frequencies of the transducers
- Creating the modulator using op amp LM741CN



Power Amplifier

- Power Amplifier will allow for increased transmission distance
 - Roughly 50 feet
- Very large gain of around 100 dB
- The power amplifier will be used right before transmission
- The Amplifier will be transistor based using FM415 Transistors
 - 500 mA current limit





Validation/Execution plan

Currently: have outlined basic functions of systems, selected some parts, and begun signal amplifier design

	October 6th	October 20th	November 3rd	November 17th	December 1st
Signal Amplifier	Design, simulate, and do basic testing	None	None	None	Final testing
Filters	Begin design and simulations	Test filters	None	None	Final testing
Frequency Modulation/ Demodulation	Do additional research	Begin designing and Simulating Modulator	Test modulator and design demodulator	Simulate and test demodulator	Final testing
Power Amplifier	Do additional research	Research and designing	Begin simulations	Test power amplifier	Final testing



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