SAR RADIO REPEATER UAV

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Analog cross-band radio repeater integrated into a custom UAV platform with the purpose of improving communications reliability for Search and Rescue teams.

THE PROBLEM

SAR teams lose radio communication in remote terrain due to hills, trees, and distance. Existing repeaters are limited by road access, fixed tower locations, or unsafe manual placement.

OUR SOLUTION

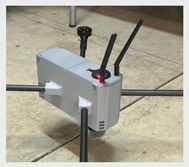
A UAV with an integrated radio repeater system that can be flown to high ground and landed to extend line-of-sight radio wave propagation.

HOW IT WORKS

Operator flies the UAV to a ridge or elevated location → The drone lands and powers on the repeater → The repeater receives SAR radio traffic on VHF → The system retransmits the messages on UHF → Communication reliability increases

FROM CONCEPT TO REALITY

First ever printed drone housing



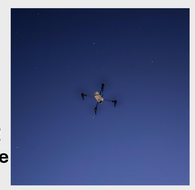
First flight and crash revealing failures

Sustained 5 consecutive flight tests without crashing

Planning & sketching possible UAV layouts

First iteration of UAV from original design

Final iteration taking into account all failure modes



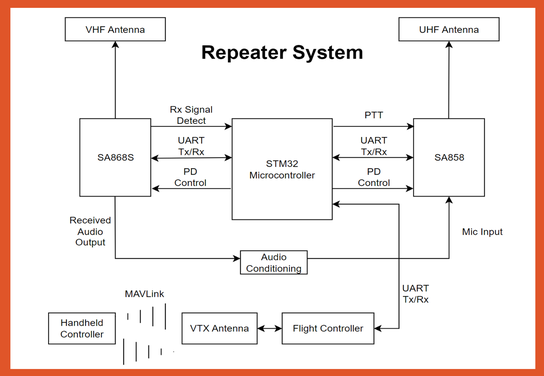
CHALLENGES

- Delayed parts resulting in delayed assembly and testing
- Limited manufacturing methods
- Developing a reliable folding mechanism for landing gear
- UAV battery life
- Reducing weight and size of the system
- Communication among teammates

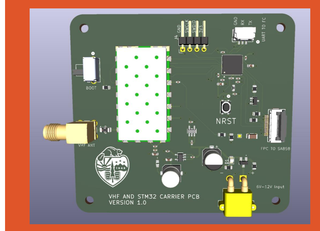
OUR FUTURE PLAN

- The UAV platform requires many component level optimizations. Including custom hardware and batteries.
- The frame needs to be optimized for CFD, and weight reduction
- The repeater and UAV system integration needs to be enhanced with improved functionality.
- The repeater system needs further testing, and development.

RADIO REPEATER SYSTEM DESIGN



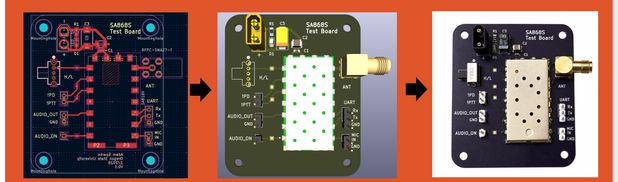
Receives VHF (134-174 MHz) → **Transmits UHF (400-480 MHz)**



CARRIER PCBS

- VHF module (NiceRF SA868S)
- Microcontroller (STM32F411)
- Audio conditioning
- Power regulation

Layout **3D Model** **Fabrication**

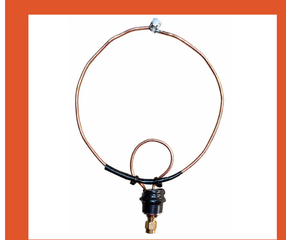


MICROCONTROLLER

- Detects received signal
- Keys UHF Transmitter
- Sends UART commands to VHF/UHF modules
- Enables remote control through flight controller

UHF Module

- NiceRF SA858
- 4W transmit power

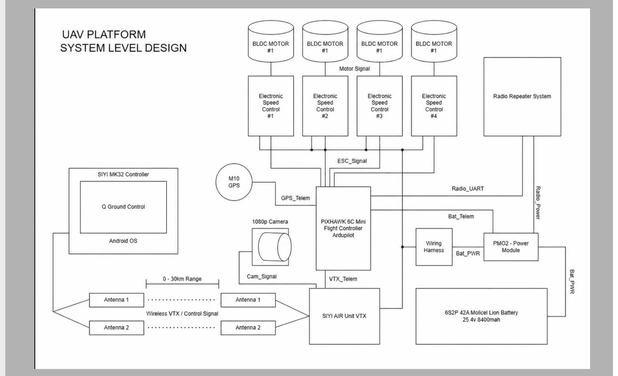


VHF ANTENNA

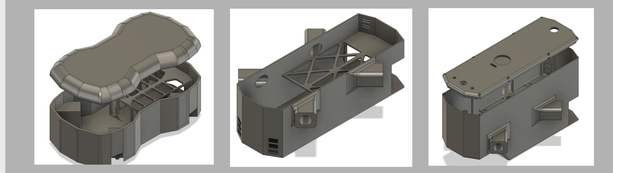
- Magnetic loop antenna
- Compact size
- Directional nulls
- Narrow bandwidth

Oregon State University

UAV PLATFORM SYSTEM DESIGN



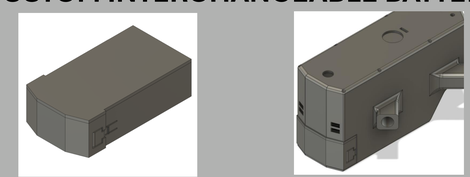
CUSTOM AIRFRAME DESIGN



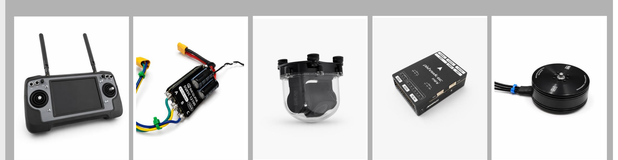
Version 1 Version 2 Version 3

CUSTOM LANDING GEAR

CUSTOM INTERCHANGEABLE BATTERY



FLIGHT CONTROLS & AVIONICS



FLIGHT TESTING RESULTS

- UAV flew at least 1 mile from controller
- UAV hovered for 17 minutes with 51% battery life remaining
- Discovered battery sag
- Total of 12 flight tests and 4 crashes