BACKGROUND

- Radio
  - What is radio?
- Ham radio
  - What is ham radio
  - What are the different licenses?
- Demosat
APPLICATIONS OF HAM RADIO

• Telemetry
• Remote operation
• Networking
FREQUENCY SELECTION

UHF/VHF (30MHz +)
- Penetrates ionosphere
- Higher data transfer rate
- Smaller antenna
- Lower level Ham radio license required.

HF (3Mhz - 30Mhz)
- Bounces off ionosphere
- Longer range
- Larger antenna
- Requires a general license or higher
RADIO SELECTION CONSIDERATIONS

- Size
- Weight
- Power consumption
- Antenna length
- Availability
FEATHERWING LORA RADIO

• Pros
  • Built in arduino
  • Measures: 2in X 0.9in X 0.3in
  • Weight: 5.8 grams
  • M0 processor
  • Low power
    • 120mA during peak

• Cons
  • Low transmitting power (100mW)
  • Set frequency (433 Mhz)
ARDUPILOT
433MHZ TELEMETRY

• Pros
  • Works with any board
    • Via serial interface
  • Low power consumption
  • Lots of documentation.

• Cons
  • Higher level ground software
  • Low transmitting power
  • Separate module
ORANGE RX TRANSCEIVER

• Pros
  • Longest range
  • 1 Watt transmitting power
  • Programmable transmitting protocol (Arduino)
  • Serial connection

• Cons
  • Heaviest
  • More expensive ($34 each)
  • Not a lot of documentation
HAM SHIELD

• Pros
  • Easy wiring to Arduino
  • Large variety of frequencies
  • 500mW transmitting power
  • Variety of digital modes (AFSK)

• Cons
  • Expensive (98$)
  • Pre-order
  • Requires an Arduino ground station
IMPLEMENTATION
(OTHER ELECTRICAL COMPONENTS)

• On board sensors
  • IMU (Gyro, accelerometer, compass, and temp)
  • Pressure sensor (pressure, temperature, and altitude)

• Thermal resistor
• MOSFET
• 2 batteries
• LoRa radio
PROGRAMMING

- Low data rate
- Info to compare later
- Hello world #
- RSSI (-100 is no signal)
- Reading sensor values
- Heating element
  - Constant temperature
  - Algorithms
- Remote commands
- Call sign
MOBILE COMMUNICATIONS

• Modified yagi antenna
• TV antenna modified
• Mobile operation bracket
• Rotating motor
• Type F connector to SMA
STRUCTURAL ACCOMMODATIONS

- Insolation
- External antenna
- Accessible compartment.
- Room to mount batteries and electronics
- No metals for structure.
CONCLUSION

• Made it to a max height of 2600 Meters
• Needs higher power
• Battery kept compartment heated
• Payload landed safely.
• [https://www.adafruit.com/product/3179](https://www.adafruit.com/product/3179) - LoRa Radio Photo


• [https://stac.berkeley.edu/project/balloon](https://stac.berkeley.edu/project/balloon) - High Altitude Balloon

• [https://enhanced-radio-devices.myshopify.com/products/hamshield](https://enhanced-radio-devices.myshopify.com/products/hamshield) - Ham Shield Photo