# Sustainable Solar Powered Radiosonde

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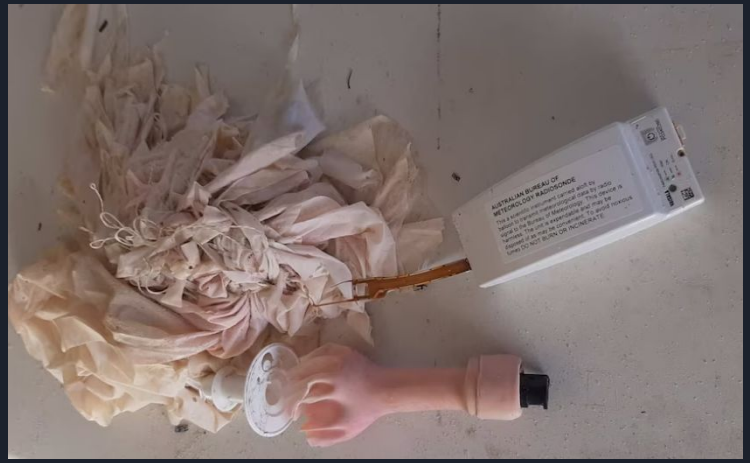
# Mission Overview

- Design a solar-powered weather balloon
- Create a more sustainable option than current industry practices
- The National Weather Service (NWS) launch ~70,000 balloons/year

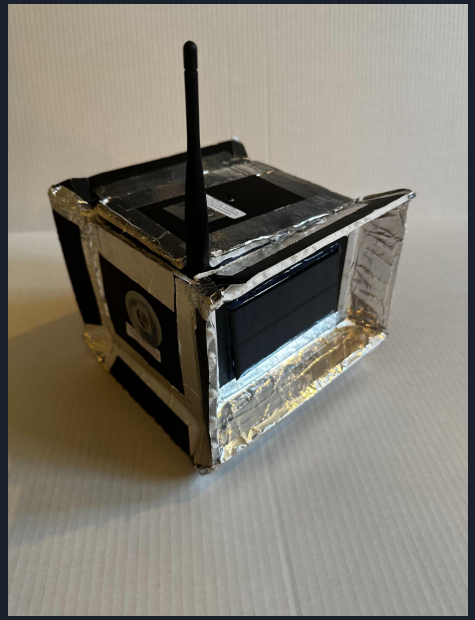


Photos: Tangaroa Blue Foundation

(National Weather Service, n.d.)
(Tangaroa Blue Foundation, 2019)

# Payload Design

- Capabilities roughly modeled after Lockheed Martin LMS-6 (right)
  - Equipped with weather sensors and a radio for live data transmission
- Wepwawet designed as a retrievable, reusable system
- About the same build cost



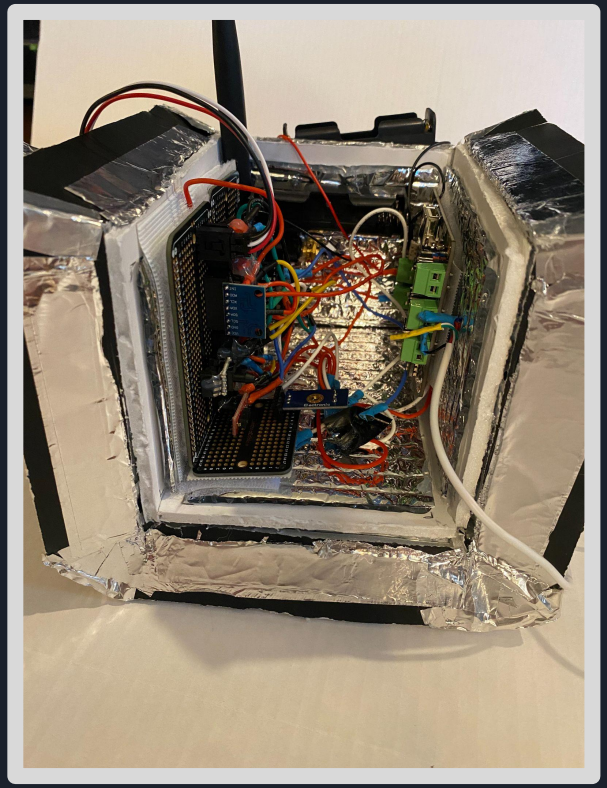
Wepwawet


Lockheed Martin LMS-6 Radiosonde

(National Weather Service, n.d.)
(Radiosonde Museum of North America, n.d.)

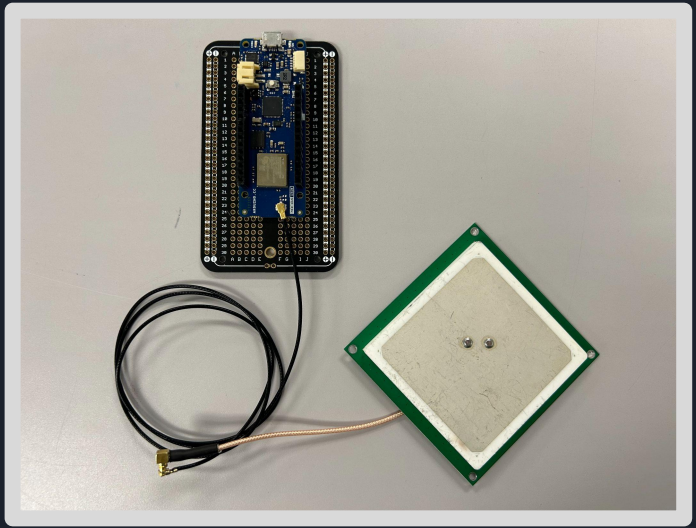
# Weather Balloon Subsystem

- Collects temperature, pressure, humidity, and acceleration data
- Live data transmitted via telemetry system

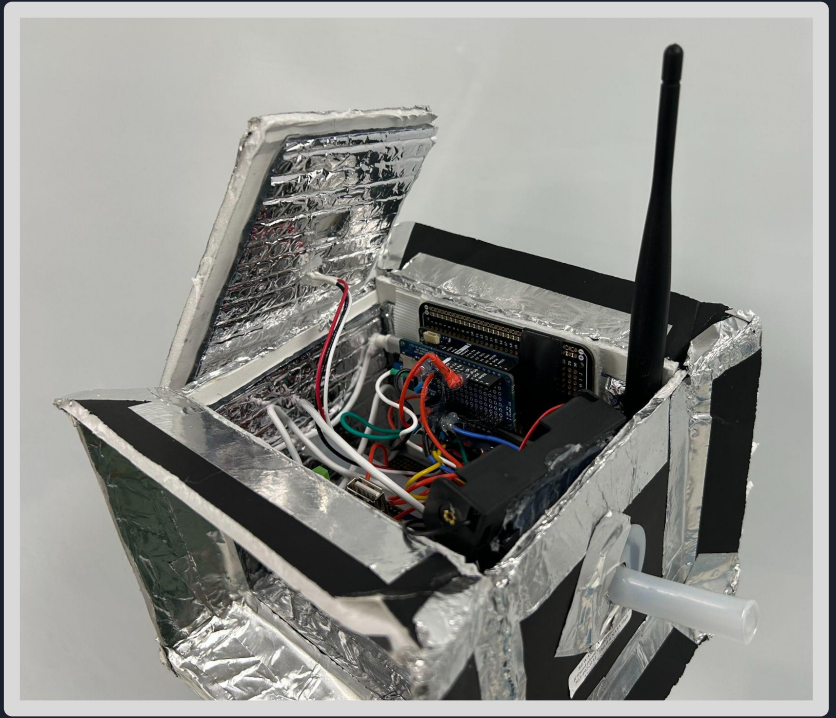


# Telemetry Subsystem

- Arduino MKR 1310 Radio
- 915 MHz General Purpose Ceramic Patch RF Antenna

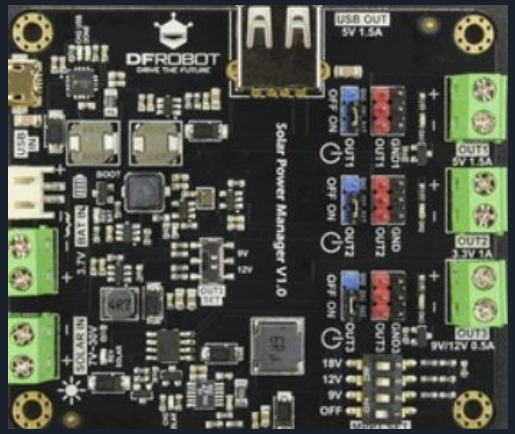


- Arduino MKR 1310 Radio with Arduino MKR MEM Shield
- 900-915 MHz 5dBi Gain Omnidirectional Antenna



# Solar Power Subsystem

- Challenge: Would solar be enough to power a weather balloon for an entire flight?
- 3 high-efficiency solar panels
- DFRobot Solar Power Manager

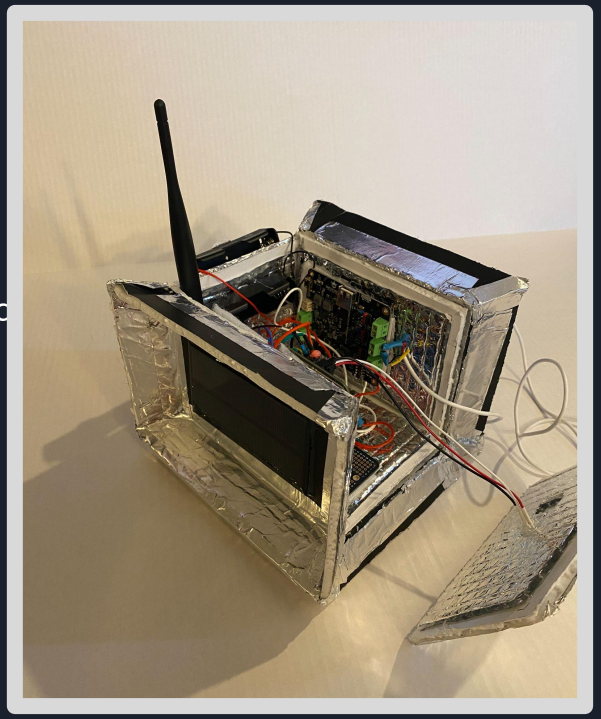



DFRobot Solar Power Manager

Payload Exterior

# Box Design

- Dimensions: 18.5cm x 18cm x 14c
- Materials: Foam core, aluminum tape, hot glue
- Solar panel protection



# Testing

# Drop Test

Payload fell 30ft before hitting concrete

Damage to two corners as result of drop test

# Solar Panel Testing

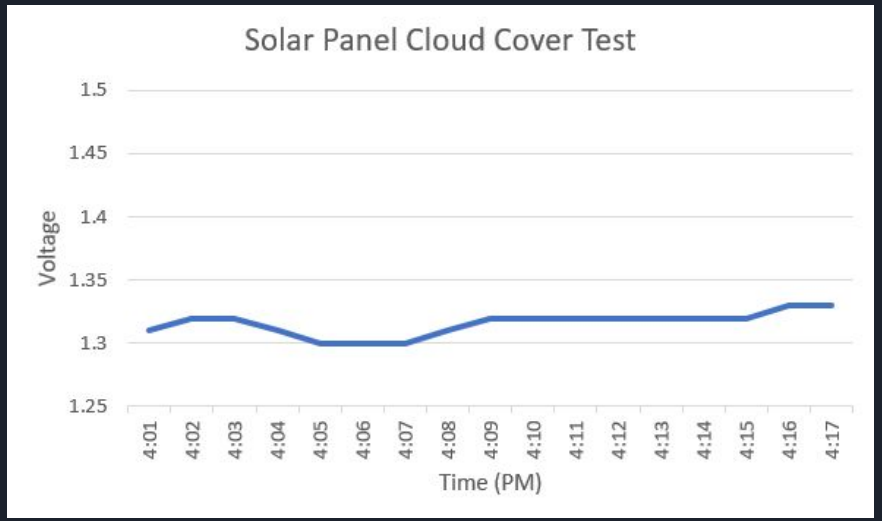



Figure 1

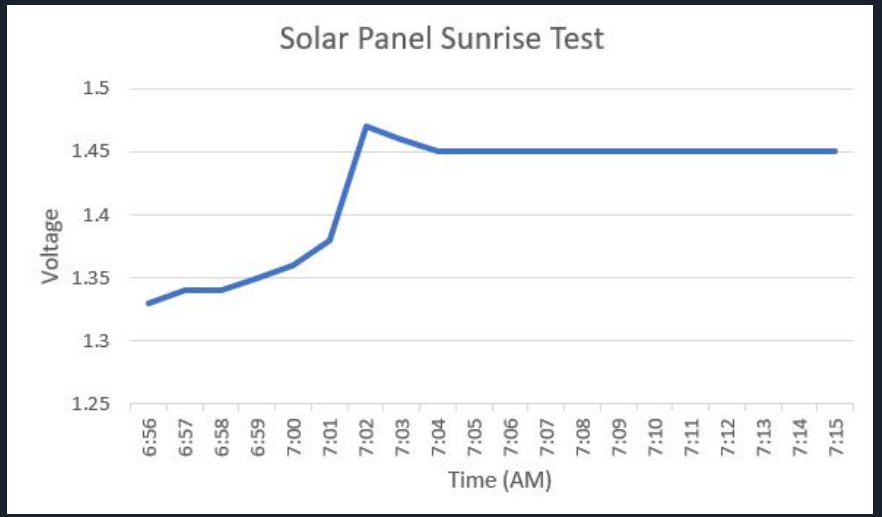
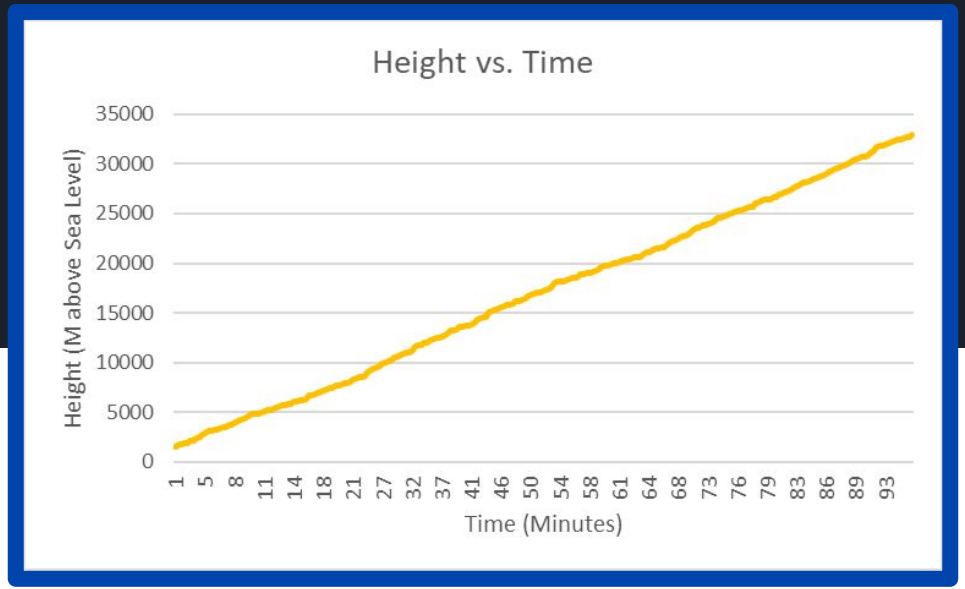



Figure 2

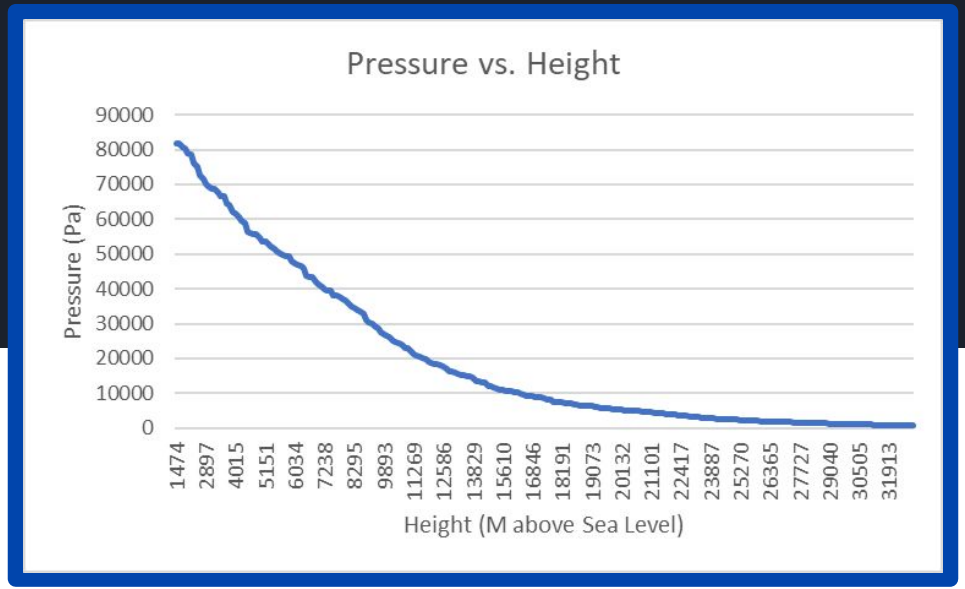
# Expected Results

# Altitude vs. Time



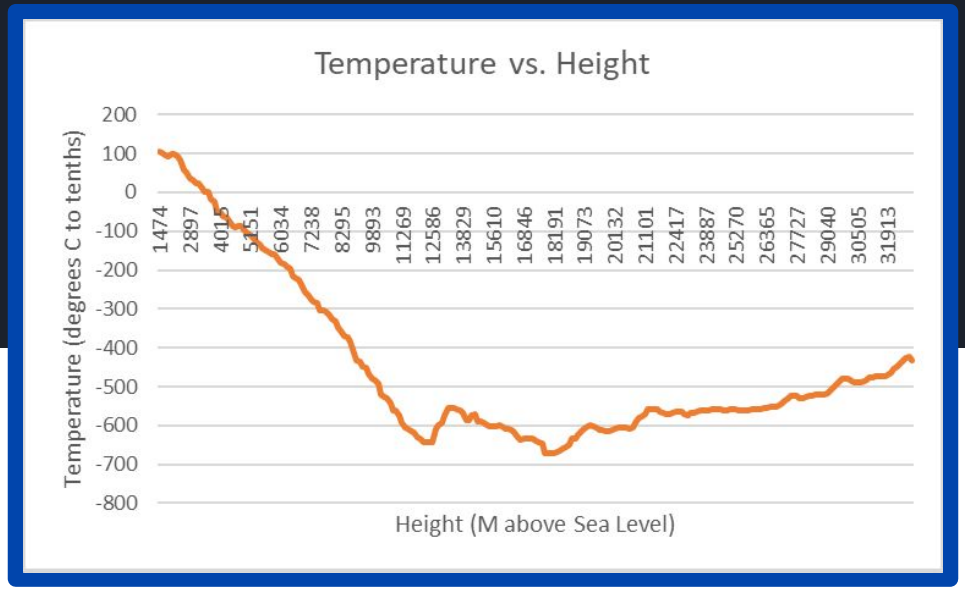

(National Centers for Environmental Information, Integrated Global...)

# Pressure vs. Height



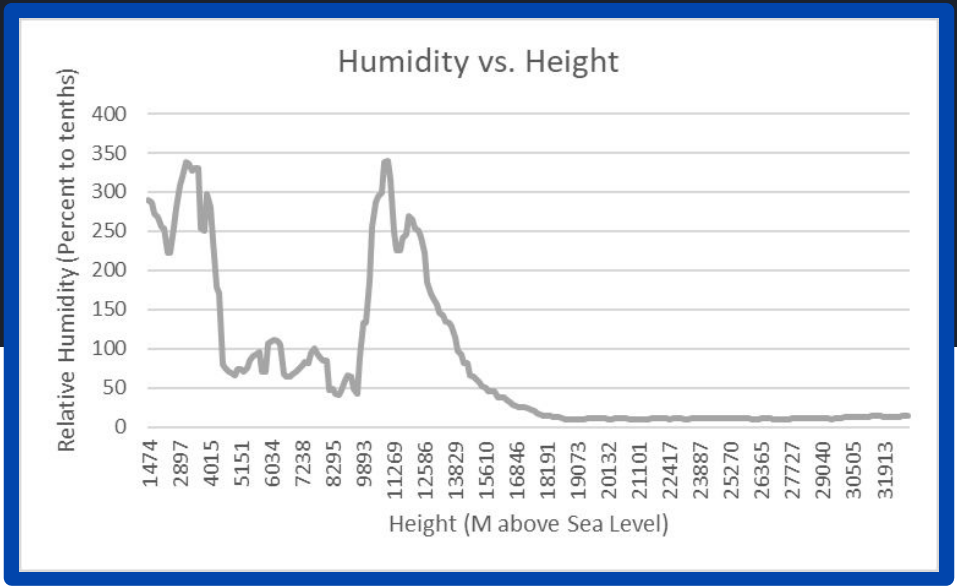

(National Centers for Environmental Information, Integrated Global...)

# Temperature vs. Height




(National Centers for Environmental Information, Integrated Global...)

# Humidity vs. Height




(National Centers for Environmental Information, Integrated Global...)

# Budget

- Average radiosonde costs around $200

(National Weather Service, n.d.)

| Part | Pack Cost | Actual Cost (used parts) |
|---|---|---|
| Arduino MKR WAN 1310 | $95.60 | $95.60 |
| Antenna for Ground | $35.09 | $35.09 |
| Antenna for Air | $14.00 | $7.00 |
| Solar Power Manger | $38.90 | $38.90 |
| IPEX Connector | $7.47 | $7.47 |
| Solar Panels | $30.46 | $15.21 |
| Battery Holders | $7.99 | $2.00 |
| Arudino MKR MEM Shield | $23.99 | $23.99 |
| 3.7 Li-Ion Batts | $23.99 | $12.00 |
| Voltmeters | $5.89 | $1.18 |
| Accelerometer | $6.49 | $6.49 |
| Pigtail Connectors | $12.99 | $3.25 |
| | $302.86 | $248.18 |

# Conclusion

- Expected launch Fall 2024

Next Steps:

- Further solar panel testing
- Battery testing
- Telemetry distance testing
- Compostable build material

Demosat Test Launch Spring 2024

# References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