

**EML4551-2**

**VDR 4  
Team 518:  
Light-Weight UAV**



January 21, 2021

# Team Introductions



Ethan Hale  
*Manufacturing and  
Systems Engineer*



Jackson Dixon  
*Supply Chain  
Engineer*



Maxwell Sirianni  
*Flight  
Dynamics Engineer*



John Storms  
*Test Engineer*



Joseph Ledo-Massey  
*Design Engineer and  
Project Manager*

# Sponsor and Advisor

**NORTHROP  
GRUMMAN**

**Jennifer Tecson**

Manager of Engineering

FSU Electrical Engineering Graduate



**Lance Cooley, Ph.D.**

Professor of Mechanical Engineering

Research interests in superconducting materials

Max Sirianni

# Objective

The objective of this project is to use multiple light-weighting techniques to reduce the overall weight of a UAV and increase the flight time.



Max Sirianni

# Fall Semester

Max Sirianni

Fall Semester

Spring Semester

Inventory Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work



# Markets and Key Goals

## Primary Market

Farmers and Agricultural industry

## Secondary Market

US Military, Hobbyists, Infrastructure Companies, Land Surveyors, and Teaching Facilities

## Key Goals

Retain lightweight qualities, easily transported and operated, and provide quality surveillance recordings.



Max Sirianni

Fall Semester

Spring Semester

Inventory Parts

What's Missing?

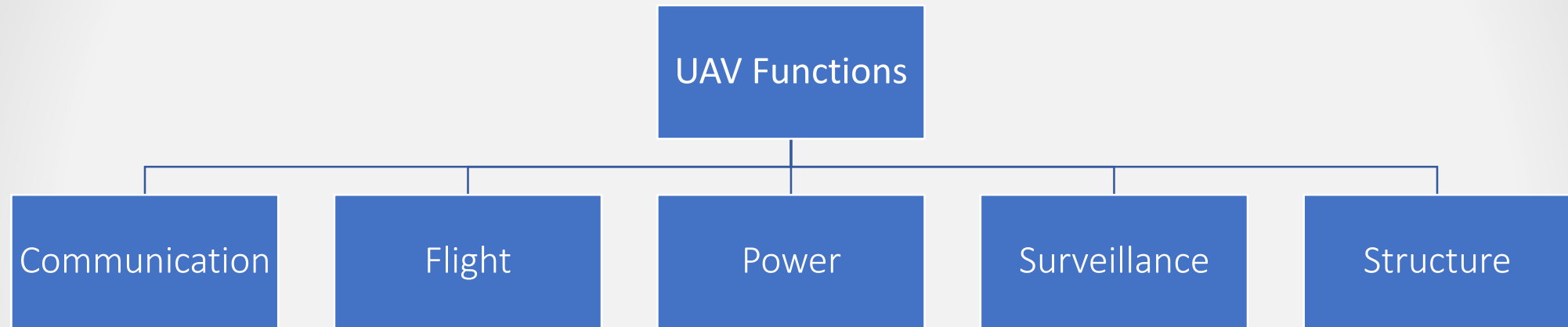
Initial Weight Comparison

Modeled Parts

Electrical System Testing

Future Work

# Functions



*Primary Systems of Light-Weight UAV*

Max Sirianni



# Concept Generation and Selection

## Concept Generation Methods:

- Biomimicry
- Anti problem
- Systematic Approach

## Concepts Generated:

- Generative Design
- Regenerative Power
- LW-PLA Constructed Parts
- Lighter Electrical Components
- Improve Propeller Design

## Selected Concept(s):

1. Lighter Electrical Components
2. LW-PLA Constructed Parts
3. Improve Propeller Design



Max Sirianni

Fall Semester

Spring Semester

Inventory Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work



# UAV Selection

Believer 1960mm

- Aerial Mapping UAV
- Light Weight Construction
- Payload Space



Max Sirianni

Fall Semester

Spring Semester

Inventory Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Spring Semester

Ethan Hale

Fall Semester

Spring Semester

Inventory Parts

What's Missing?

Initial Weight  
Comparison





Modeled Parts














































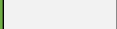

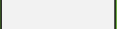

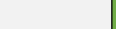

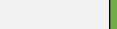

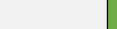













Electrical  
System Testing

Future Work



# Spring Semester Plan

Key	
Project Tasks	
Presentation	
Meeting	
Milestone	

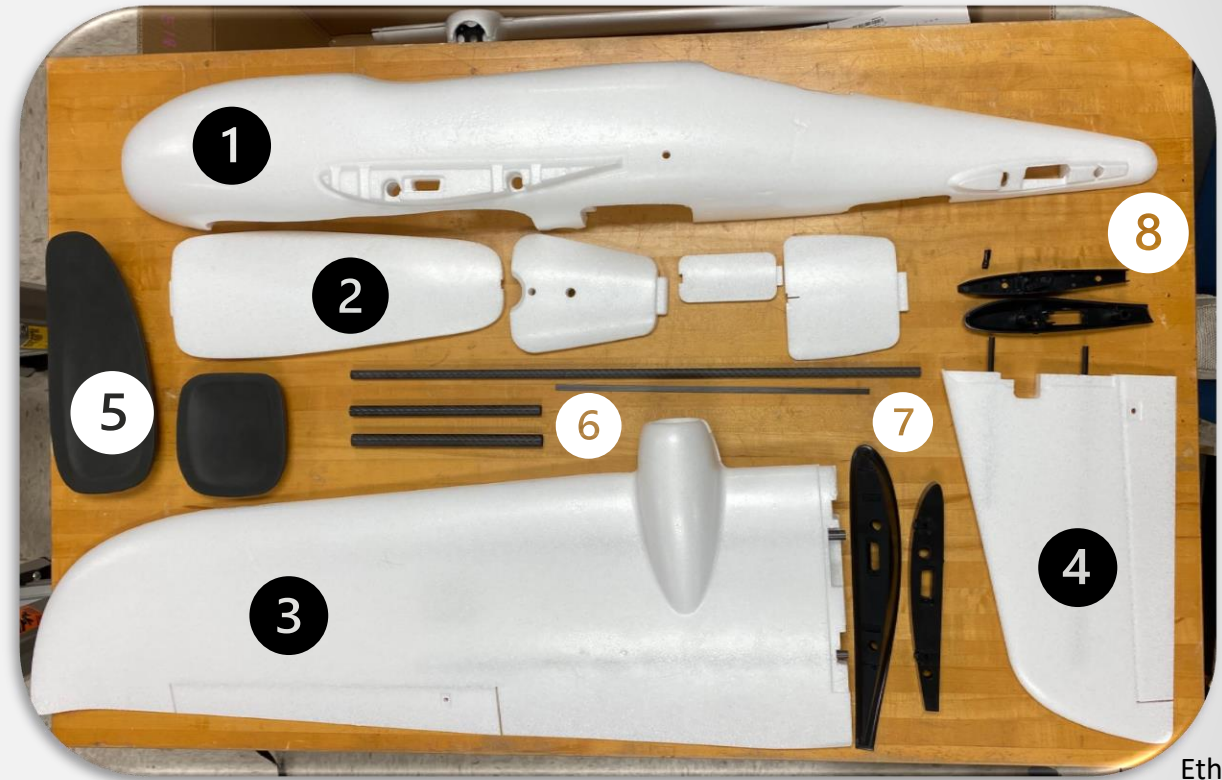
Task	January			February				March				April		
Catalog Parts														
Order Parts														
CAD Design of Selected UAV parts														
Virtual Design Reviews														
Test Electrical System														
Thrust Analysis														
Concept Analysis and Validation														
Production of New Parts														
Test Assembly of UAV														
Advisor Meeting														
Sponsor Meeting														
Website Development														
Final UAV Assembly														
Final Report														
Final Demonstration														

Ethan Hale



# Inventory of Parts: Airframe

1. Fuselage
2. Fuselage Covers
3. Wing
4. Empennage
5. Bottom Covers
6. Carbon Fiber Rods
7. Wing Mounting Brackets
8. Empennage Mounting Brackets



Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

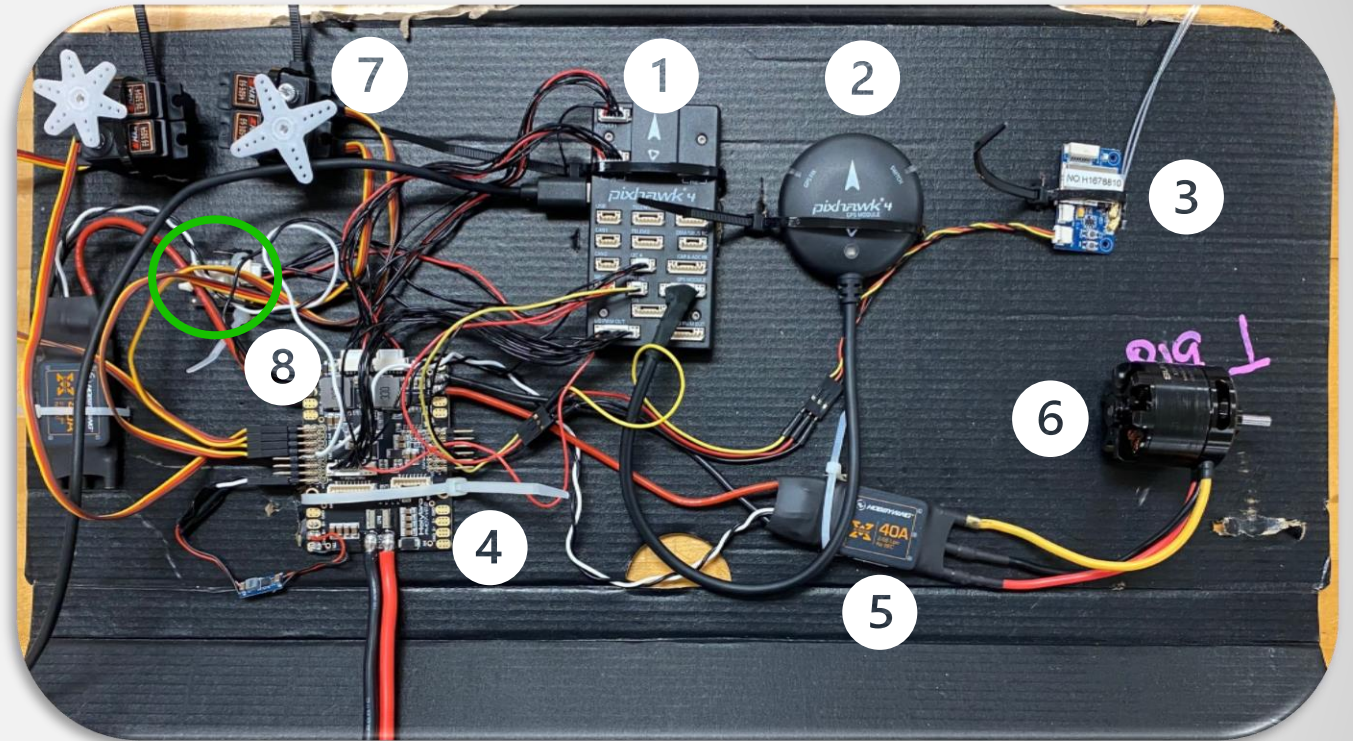
Modeled Parts

Electrical  
System Testing

Future Work

# Inventory of parts: Electrical System

1. Flight Controller
2. GPS Module
3. Radio Receiver
4. Power Control Board
5. Electronic Speed Controller
6. DC Motor
7. Servo Motor
8. Air Speed Sensor



Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Inventory of parts: Electrical System

1. Flight Controller
2. GPS Module
3. Radio Receiver
4. Power Control Board
5. Electronic Speed Controller
6. Motor
7. Servo Motor
8. Air Speed Sensor
9. Controller



Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Inventory of parts: Battery

## Turnigy battery:

- Recommended battery via Believer 1960 handbook
- 20000mAh
- 4 cell 14.8v
- 12-24C discharge



Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Inventory of parts: Battery

## Lumenier battery:

- Battery ordered during 2019-2020 school year
- 22000mAh
- 4 cell 14.8v
- 20-40C discharge



Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work



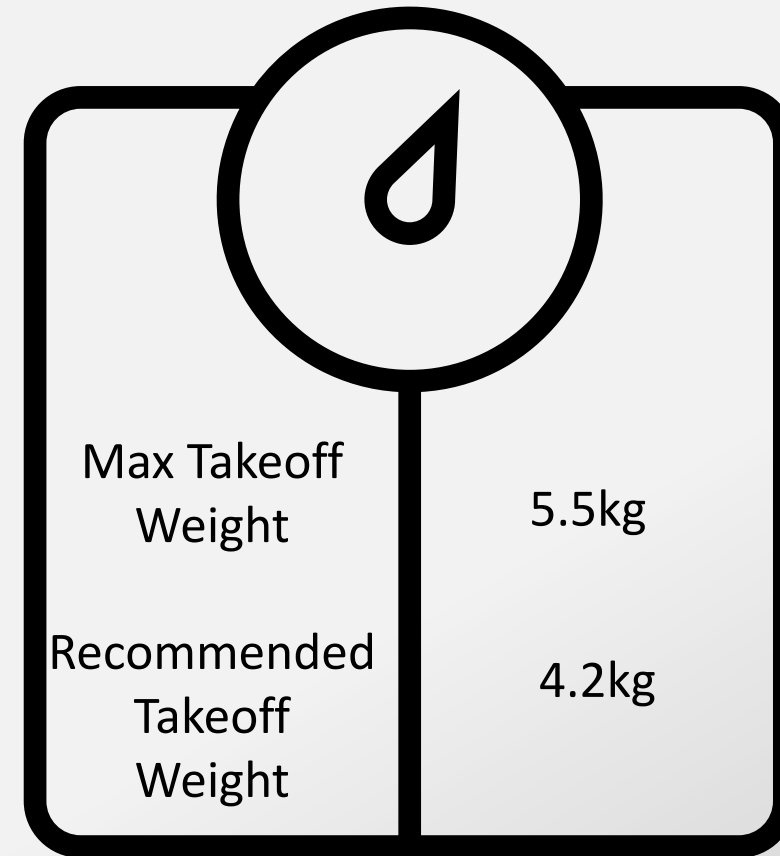
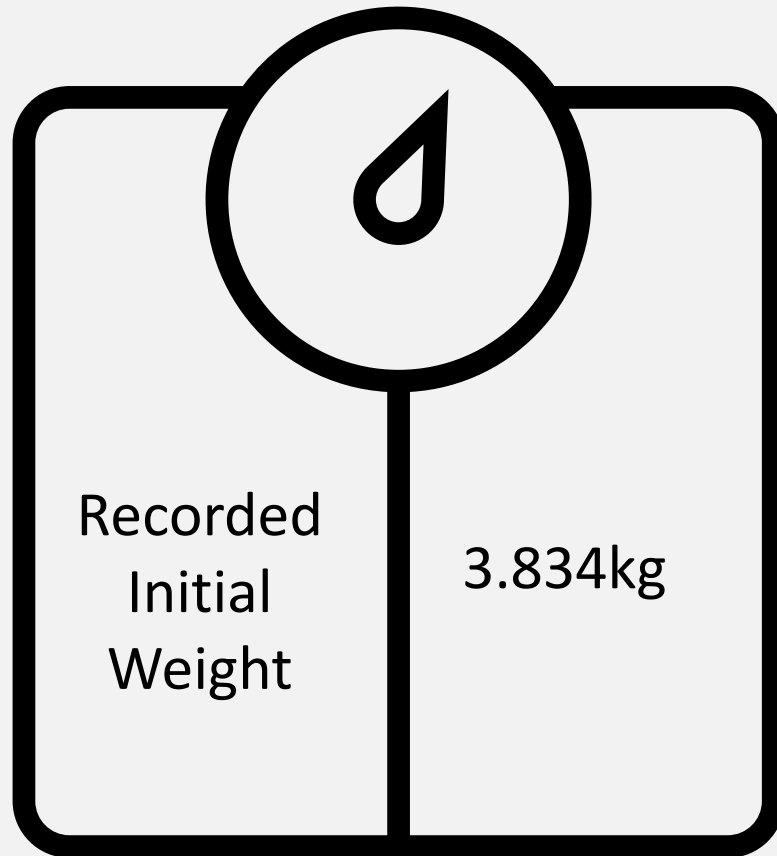
# What's Missing?



Ethan Hale



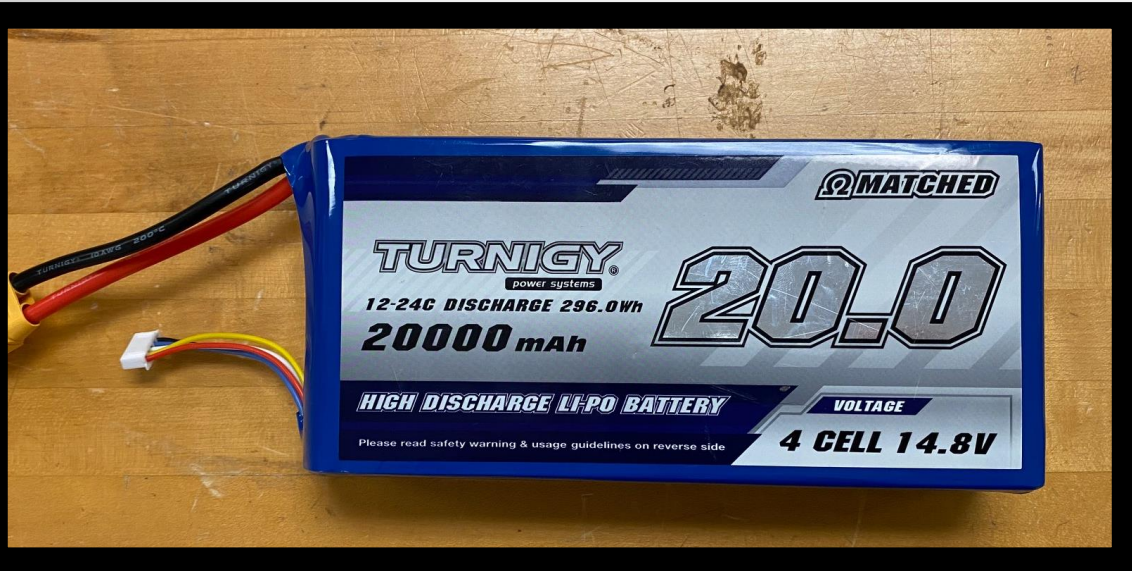
# Initial Weight Comparison



Max Sirianni



# Initial Weight Comparison



VS.



Max Sirianni

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Initial Weight Comparison

## Turnigy Battery

- Volume per data sheet: **883cm<sup>3</sup>**
- Recorded volume: **805cm<sup>3</sup>**
- Weight per data sheet: **1775g**
- Recorded weight : **1729g**

## Lumenier Battery

- Volume per data sheet: **766cm<sup>3</sup>**
- Recorded volume: **831cm<sup>3</sup>**
- Weight per data sheet: **1600g**
- Recorded weight: **1702g**

Max Sirianni

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Initial Weight Comparison

- Weight Savings: **27g** (previously 175g)
- Size Difference: **Lumenier slightly larger** (advertised as 1.15 times smaller)



Max Sirianni

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Initial Weight Comparison

SunnySky X2814 Brushless Motors

- Advertised Weight: **108g**
- Recorded Weight: **110g**
- Total Weight (Qty 2): **220g**



**What's better?**

Max Sirianni

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

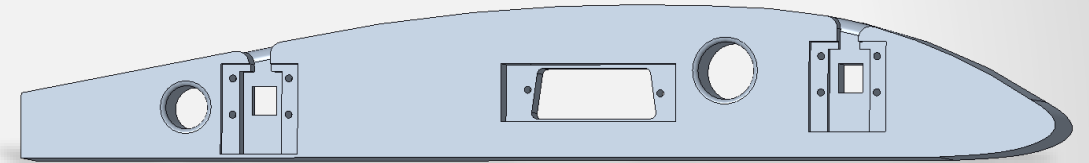
Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Modeled Parts



Wing Mounting Bracket

Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

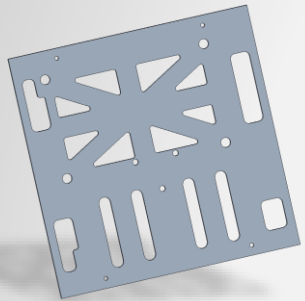
Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Modeled Parts



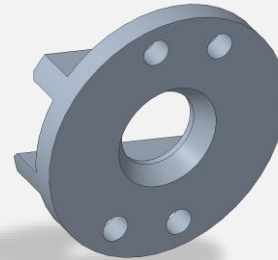
Autopilot Locating Board



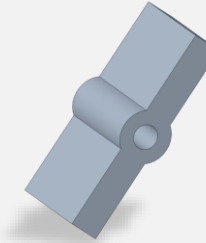
Parachute Hatch Cover



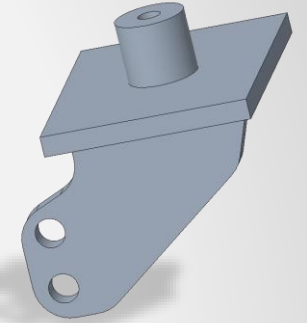
Cabin Cover



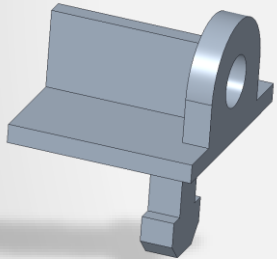
Chuck



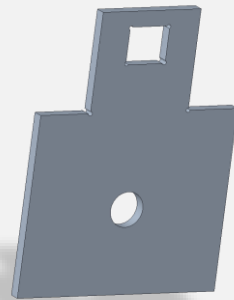
Stud



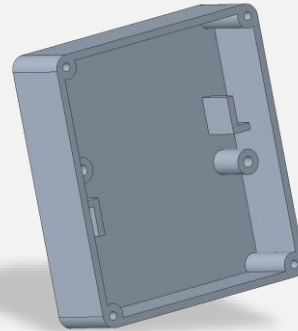
Helm angle



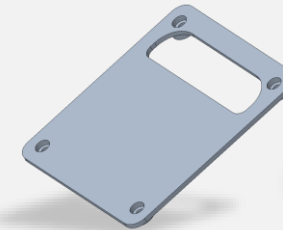
Cabin Cover Locking Nail



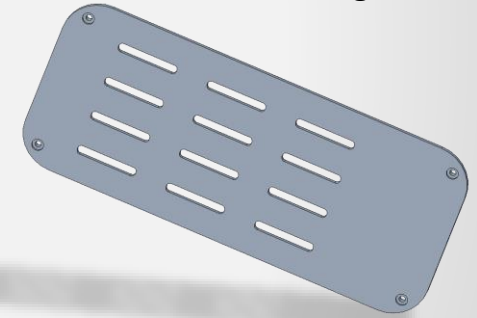
Antenna Fixing Board



Servo Installing Base



Servo Covering Plate



Electric Regulating Cover

Ethan Hale

Fall Semester

Spring Semester

Inventory of Parts

What's Missing?

Initial Weight Comparison

Modeled Parts

Electrical System Testing

Future Work



# Electrical System Testing



## Validated:

- Flight Controller
- GPS Module
- Servos
- Motors
- Airspeed sensor
- Receiver



## Struggles:

- Applying the throttle to turn on DC motor
- Consistent GPS lock

Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

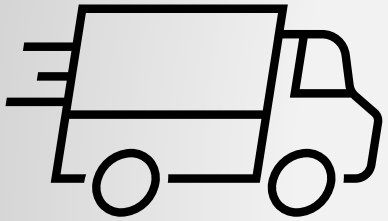
Initial Weight  
Comparison

Modeled Parts

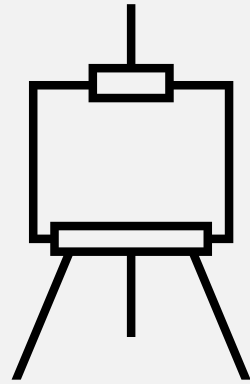
Electrical  
System Testing

Future Work

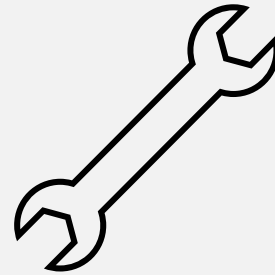
# Future Work



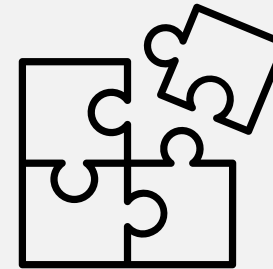
Order New Parts



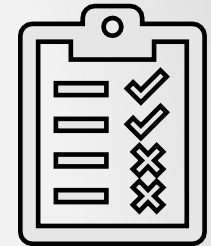
Develop LW-PLA Parts



Concept Analysis



Reassemble UAV



Testing UAV

Ethan Hale

Fall Semester

Spring Semester

Inventory of  
Parts

What's Missing?

Initial Weight  
Comparison

Modeled Parts

Electrical  
System Testing

Future Work

# Recap

