# MISSION STATMENT

- Develop a UAV to serve as a **S**cientific **W**orkhorse for **I**n-**F**light **T**esting (**SWIFT – UAV**)
- Make aerial scientific research **accessible** by developing an **affordable**, **open-source**, **easy to manufacture** UAV capable of carrying a diverse set of scientific payloads

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# SWIFT-UAV

Scientific Workhorse for In-flight Field Tests – Unmanned Aerial Vehicle

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South Carolina

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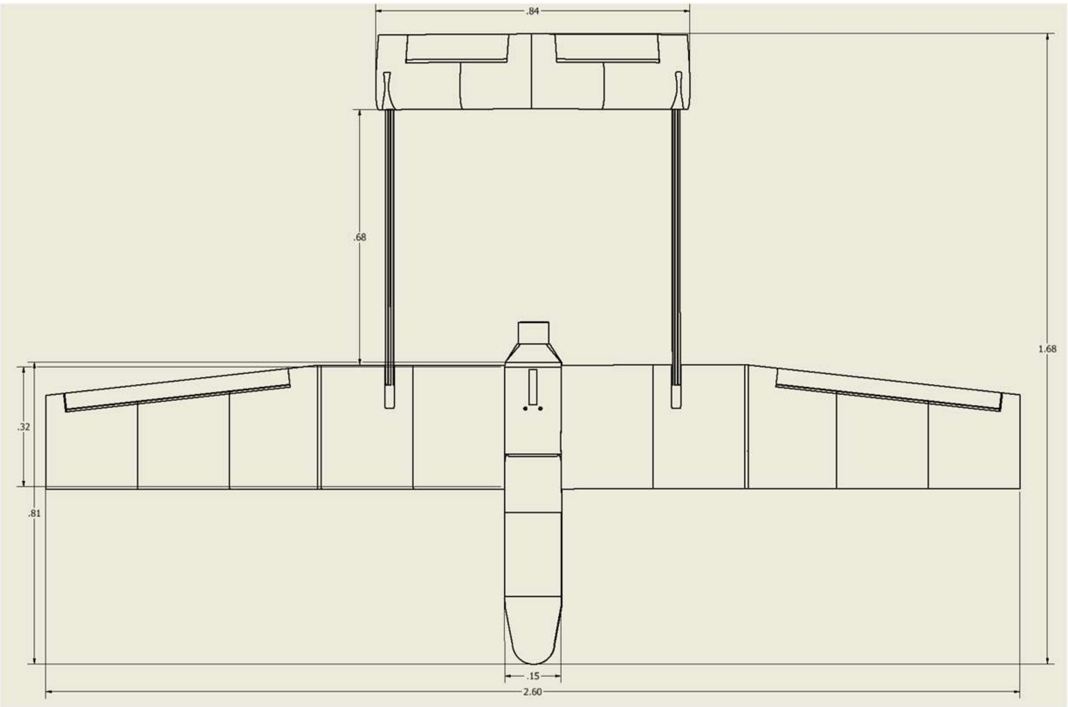
# OVERVIEW OF DESIGN

- High Wing, twin-boom mono-propeller pusher configuration was selected for its:
  - aerodynamic stability
    - High wing promotes “self-righting” in the roll axis
  - aerodynamic efficiency
    - No prop-wash over wings
  - structural integrity
    - “Box” shape enables multiple redundant struts
  - built-in safety envelop
    - Booms act to protect end users from the propellers path
  - ease of payload mounting
    - The entire front of the plane is clear to mount almost anything

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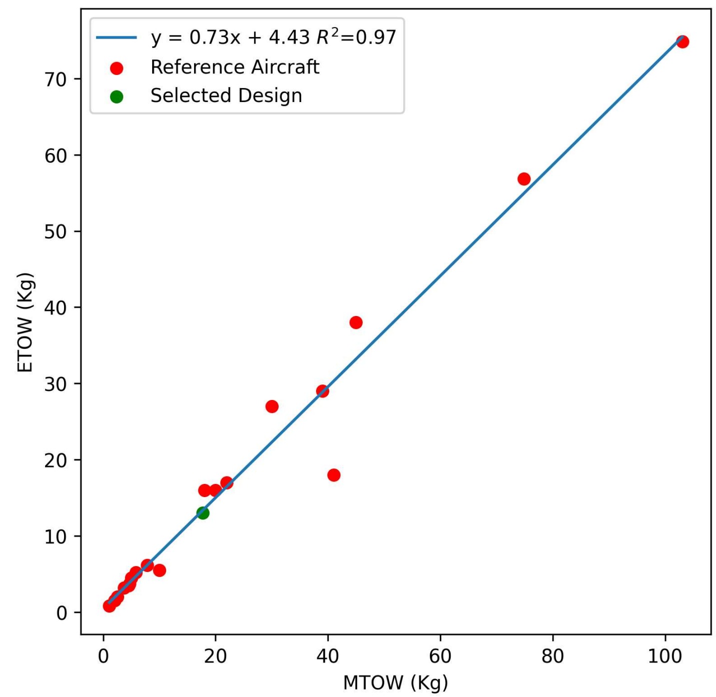
# TARGETED DESIGN SPECIFICATIONS

- First class estimations of performance done using **specifications of similar aircraft** in conjunction with **classical aerodynamic analysis approaches**
  - Empirical methods exist to estimate most performance metrics of aircraft
  - **Conservative estimations**

| ETOW | Payload | Cruise | Stakeoff | Range | Endurance |
|---|---|---|---|---|---|
| 13 Kg | 3 Kg | 20 m/s | 20 m | 5 km | 3 hr |
| | | | | | |
| **Wing Span** | **Length** | **Fuesalge Width** | **Fuesalage Length** | **Airfoil** | **Root Coord** |
| 2.6 m | 1.7 m | 0.15 m | 0.8 m | NACA 2412 | 0.33 m |
| | | | | | |
| **Tip Coord** | **Battery Capcity** | **Max TWR** | **Fuesalage Length** | **Estimated Cost** | |
| 0.25 m | 10 Ah | 0.8 | 1 m | $2,000 | |

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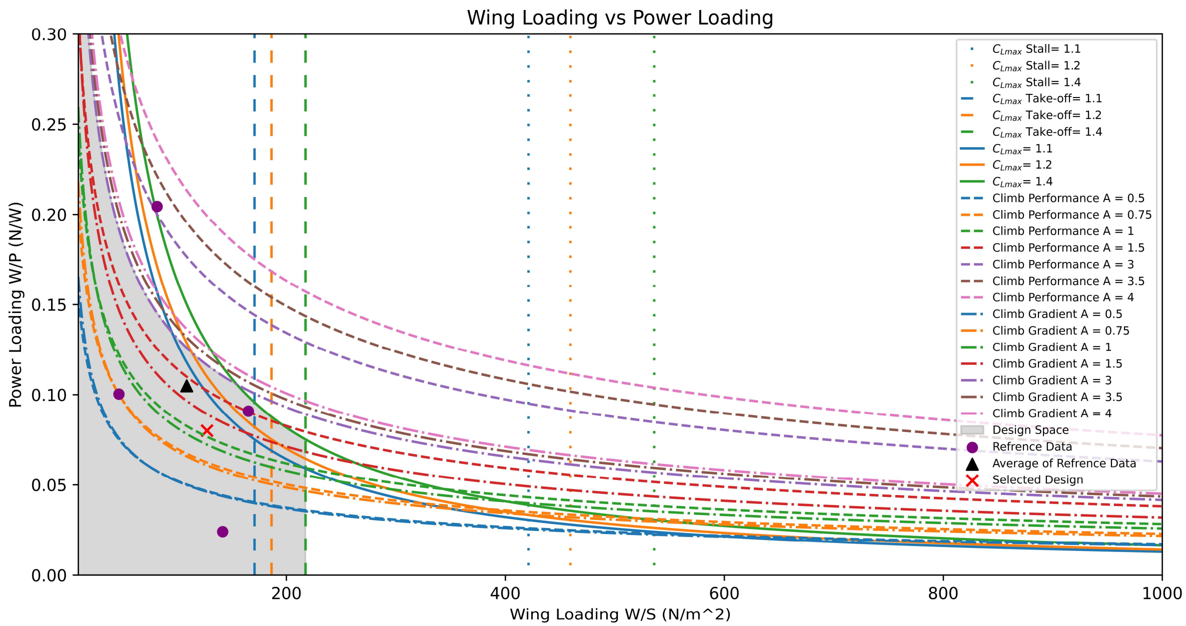
# AERODYNAMICS

- **Wing first design**
  - **Plane was designed around the wing**
- Classical aerodynamic wing analysis was performed to “bound” the aspect ratio, airfoil, wing length etc.
- Wing Specifications were then chosen to be in line with reference aircraft

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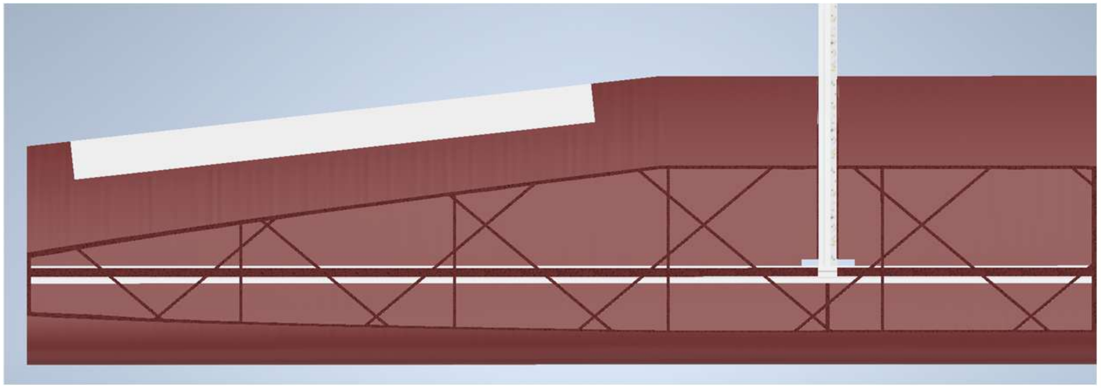
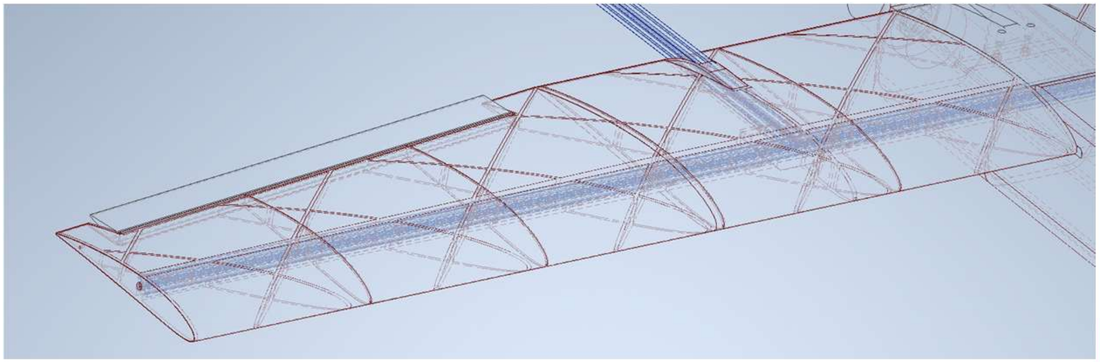
# STRUCTURAL

- Aluminum extrusion act as spars
  - Aluminum is very over-spec relative to the wing loading
- Diagonal Ribs are added to transfer load from wing skin to the central spar
- Skin is very thin walled, 0.8mm
- Since wing has to be printed in section the walls **don't act to carry much shear flow between sections**
  - Further Design optimization need to better handle torsional loading between sections
  - For now, the wing is glued to circumvent this





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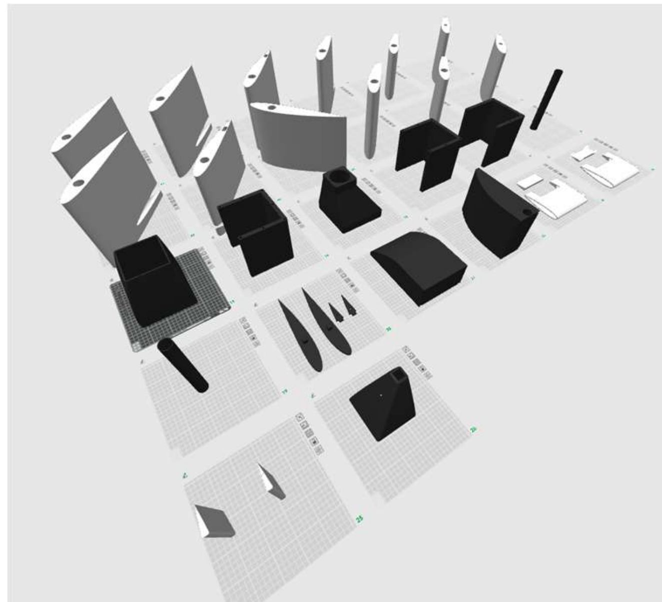
# MANUFACTURING

- Almost entirely 3D-printed design enable trivial manufacturing
- In conjunction with the aluminum extrusion system used, almost no manual manufacturing is required
  - Cut 20/20
  - Screw/glue parts together



| Filament | Model | Flushed | Total |
|---|---|---|---|
| 1 | 1149.53 m<br>2737.28 g | 0.00 m<br>0.00 g | 1149.53 m<br>2737.28 g |
| 2 | 936.95 m<br>2366.31 g | 0.02 m<br>0.06 g | 936.97 m<br>2366.37 g |
| Total | 2086.48 m<br>5103.60 g | 0.02 m<br>0.06 g | 2086.50 m<br>5103.65 g |

Total cost: 212.54

**Time Estimation**

| | |
|---|---|
| Plate 1 | 12h14m |
| Plate 2 | 13h50m |
| Plate 3 | 12h21m |
| Plate 4 | 10h30m |
| Plate 5 | 7h3m |
| Plate 6 | 6h51m |
| Plate 7 | 13h50m |
| Plate 8 | 10h2m |
| Plate 9 | 12h20m |
| Plate 10 | 10h30m |
| Plate 11 | 7h3m |
| Plate 12 | 6h51m |
| Plate 13 | 4h58m |
| Plate 14 | 4h28m |
| Plate 15 | 4h22m |
| Plate 16 | 4h28m |
| Plate 17 | 4h27m |
| Plate 18 | 1h50m |
| Plate 19 | 1h50m |
| Plate 20 | 1h7m |
| Plate 21 | 7h52m |
| Plate 22 | 7h16m |
| Plate 23 | 3h21m |
| Plate 24 | 3h21m |
| Plate 25 | 1h28m |
| Plate 26 | 2h14m |
| Total | 7d8h29m |

Fig 1: V1.2 in slicer software with estimated print time

# “IRON BIRD” TESTING

- Preliminary iron bird testing will soon be conducted to validate electrical systems under load

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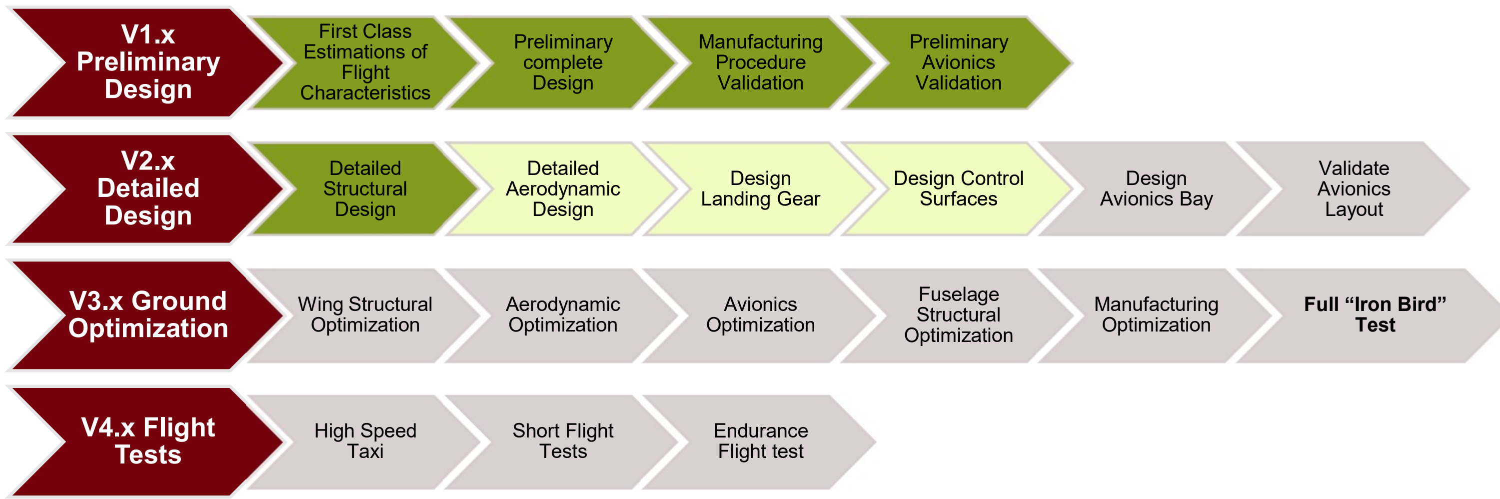
# TIMELINE

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# THANKS!

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