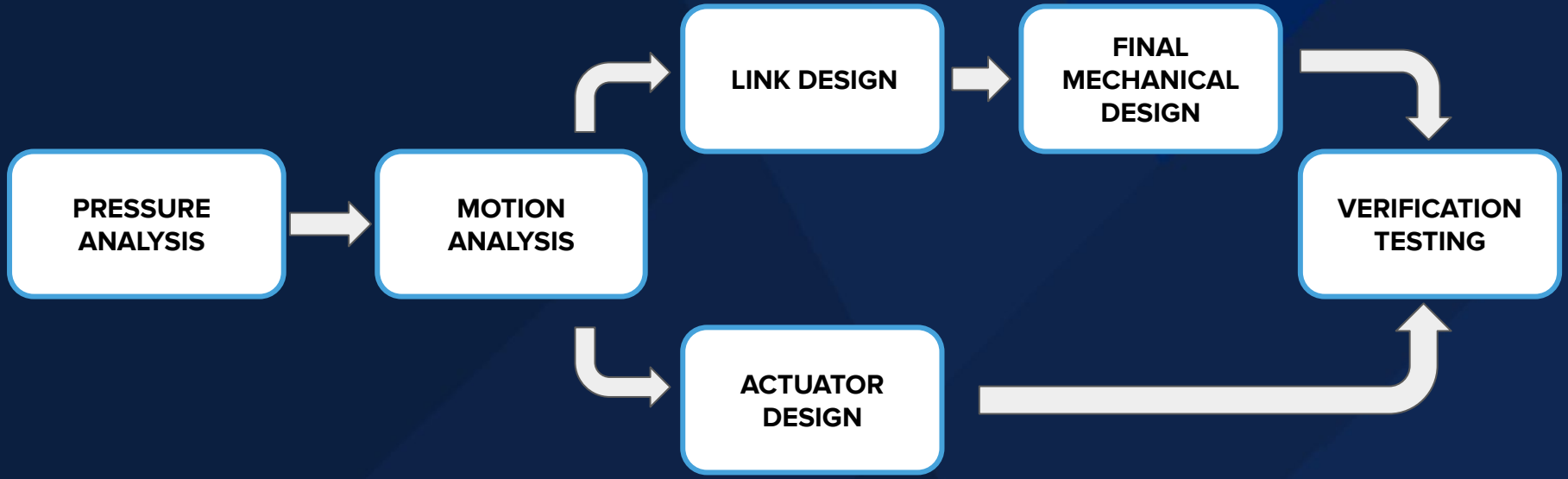
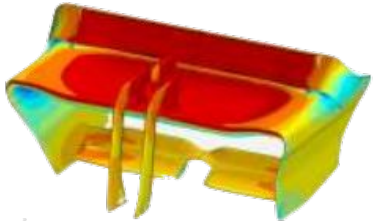
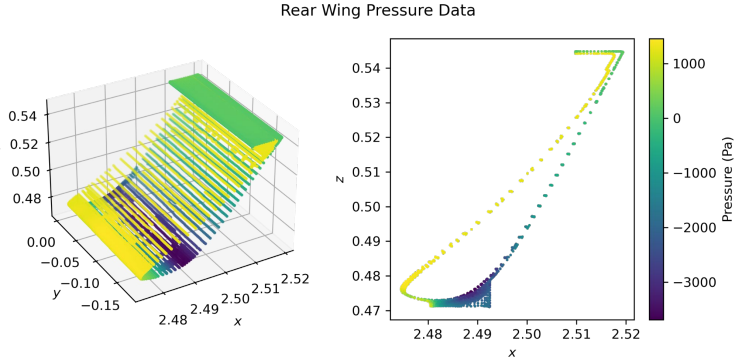
Formula 1 AutoAero

Automated Wind Tunnel Model Drag Reduction System



PRESSURE ANALYSIS

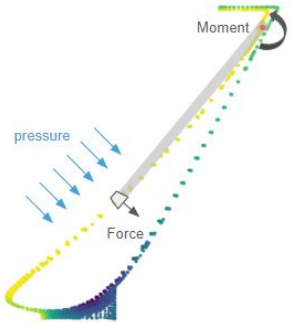


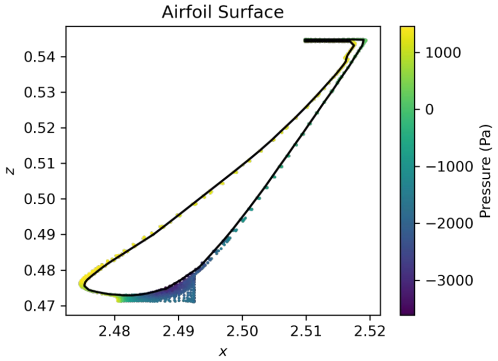


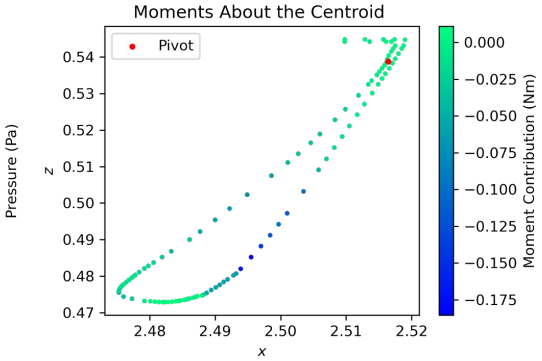
Principles of pressure and moments

Defining the surface using graph traversal techniques

Contributions all pressure tappings along the surface

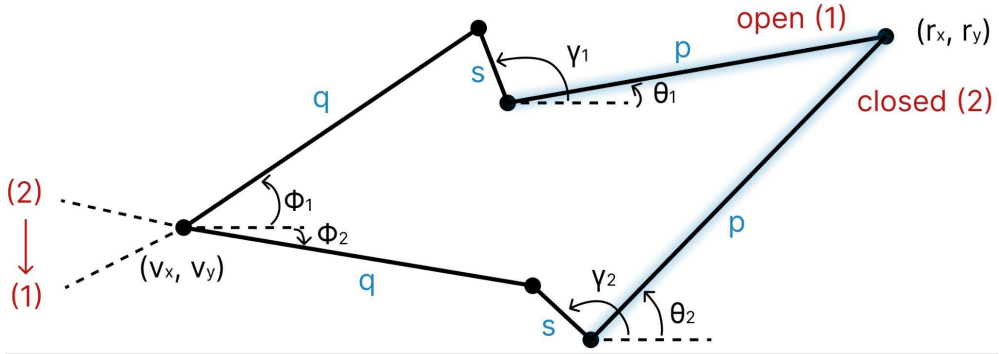




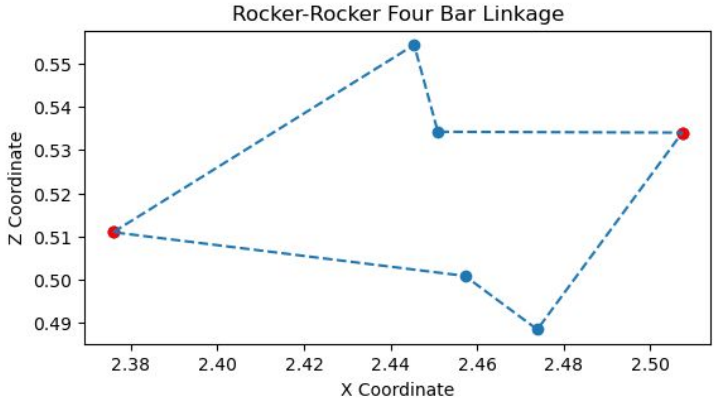


MOTION ANALYSIS

Geometric Modeling
With Constraints



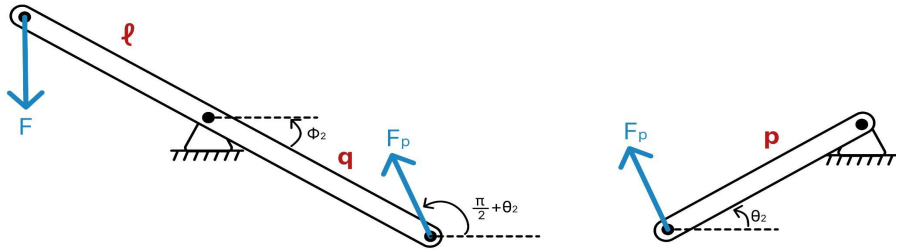
Visual Modeling of
Rocker-Rocker Linkage



LINK DESIGN

$$F_{linear} = \frac{M * q * p * sin(\frac{\pi}{2} - \theta_2 - \phi_2)}{l * cos(\phi_2)}$$

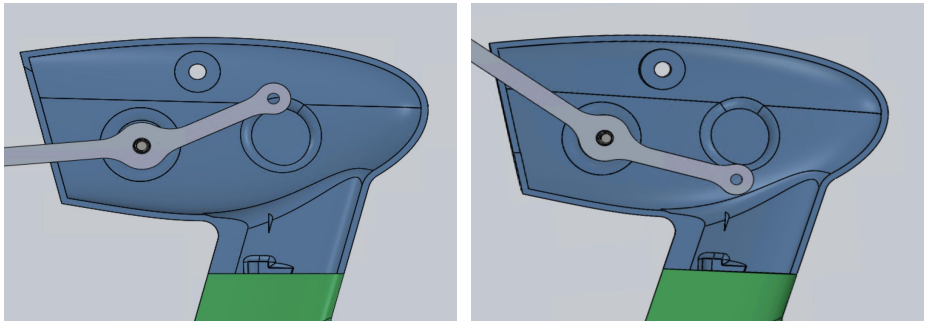
$$F_{linear} \approx 2.317\text{N}$$



Material selection guided by required strength

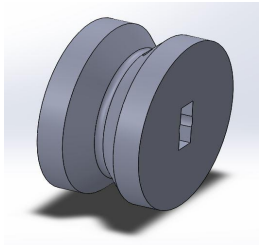
$$\tau_{allowable} = \frac{2 * thickness * distance * S_y}{\sqrt{3}}$$

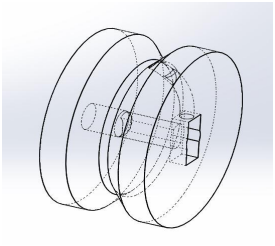
Accounting for clearance, required force translation, and desired motion



ACTUATOR DESIGN

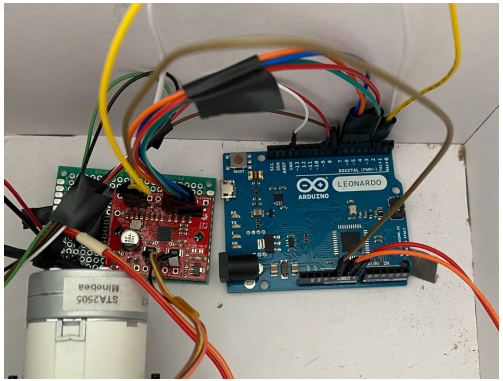
A spool was designed to tether the cable to the motor and allow it to rotate.



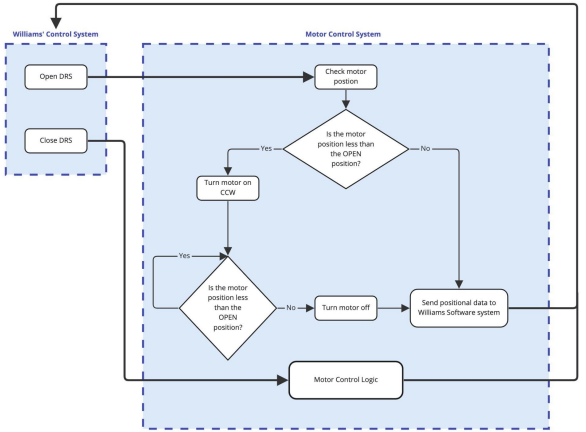


Motor was chosen to:

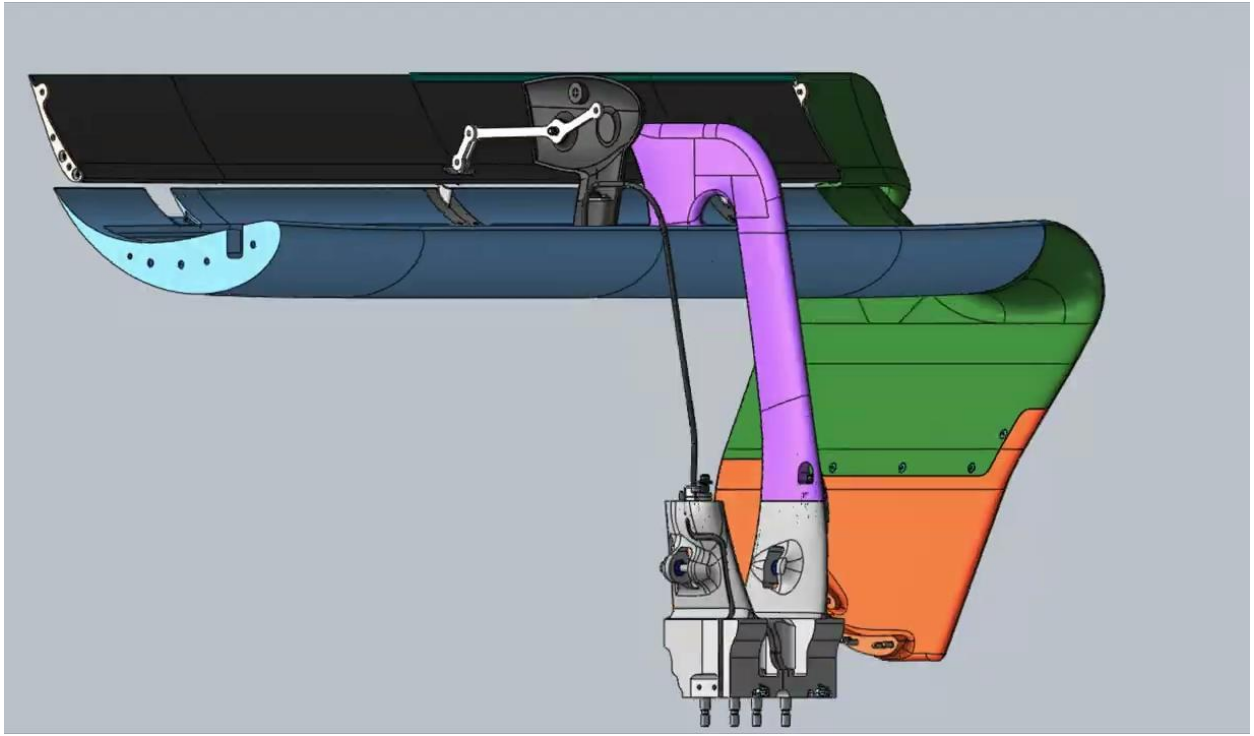
1. Apply at least **0.2 Nm** of torque to position the wing
2. Allow linear movement of **2.74 cm**
3. No speed requirement



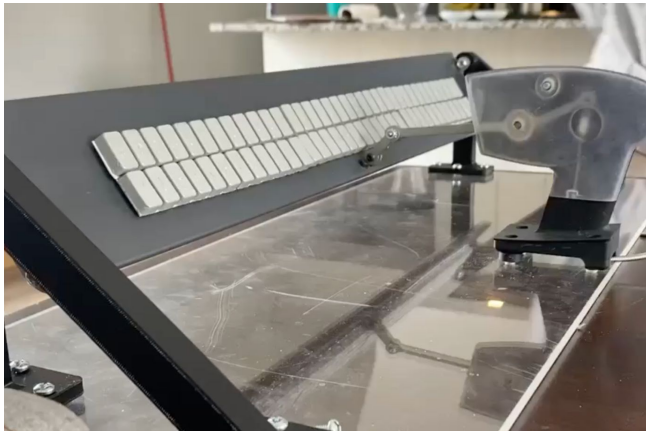
Controlled using a microcontroller and user input



FINAL MECHANICAL DESIGN



TESTING



$$m_{load} = \frac{M_{wing} * r_{centroid}}{g} + \Delta m_{wing}$$