Final Project

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17920: ENGRMAE 52 - Computer-Aided Design

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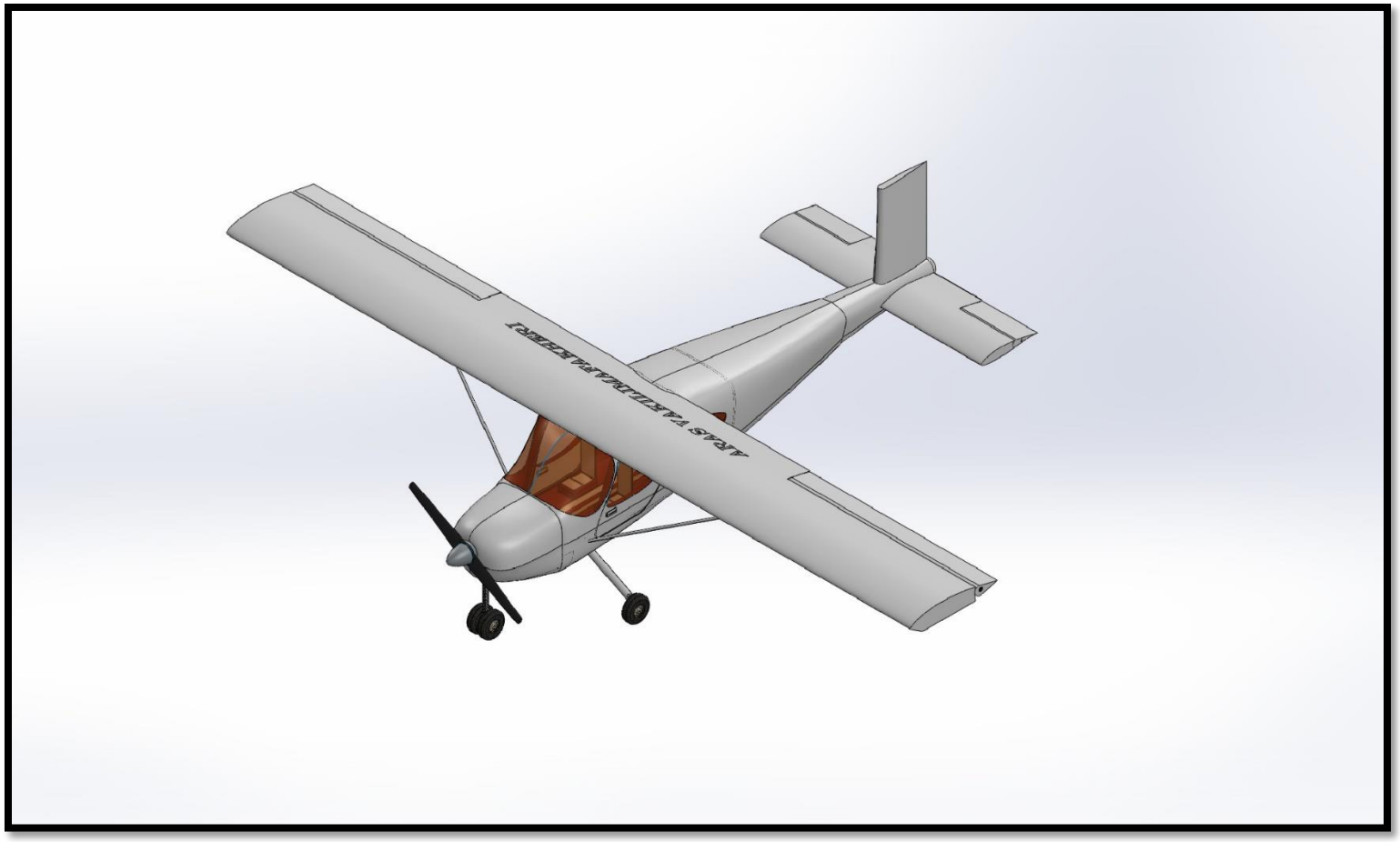
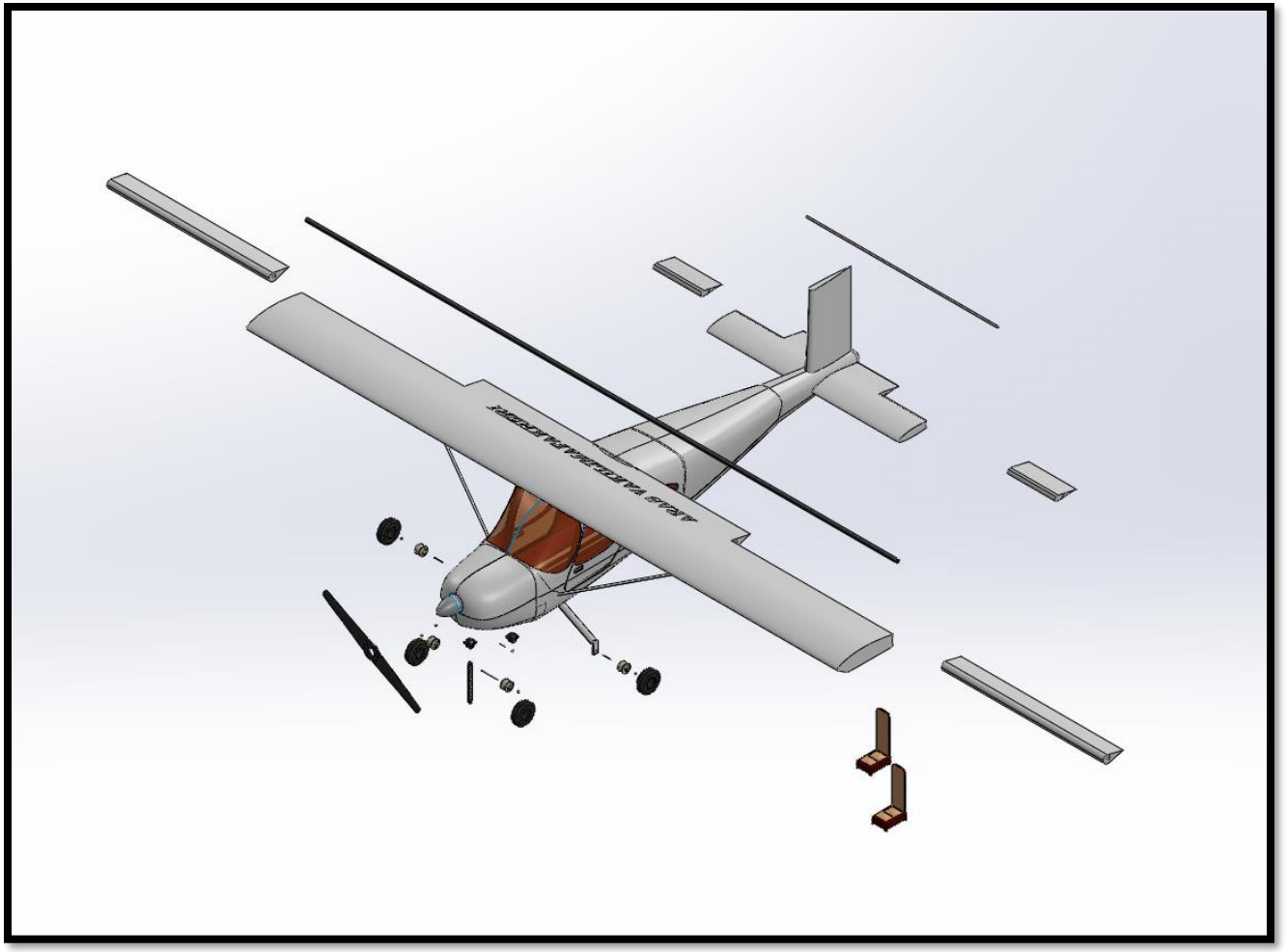
Project Overview



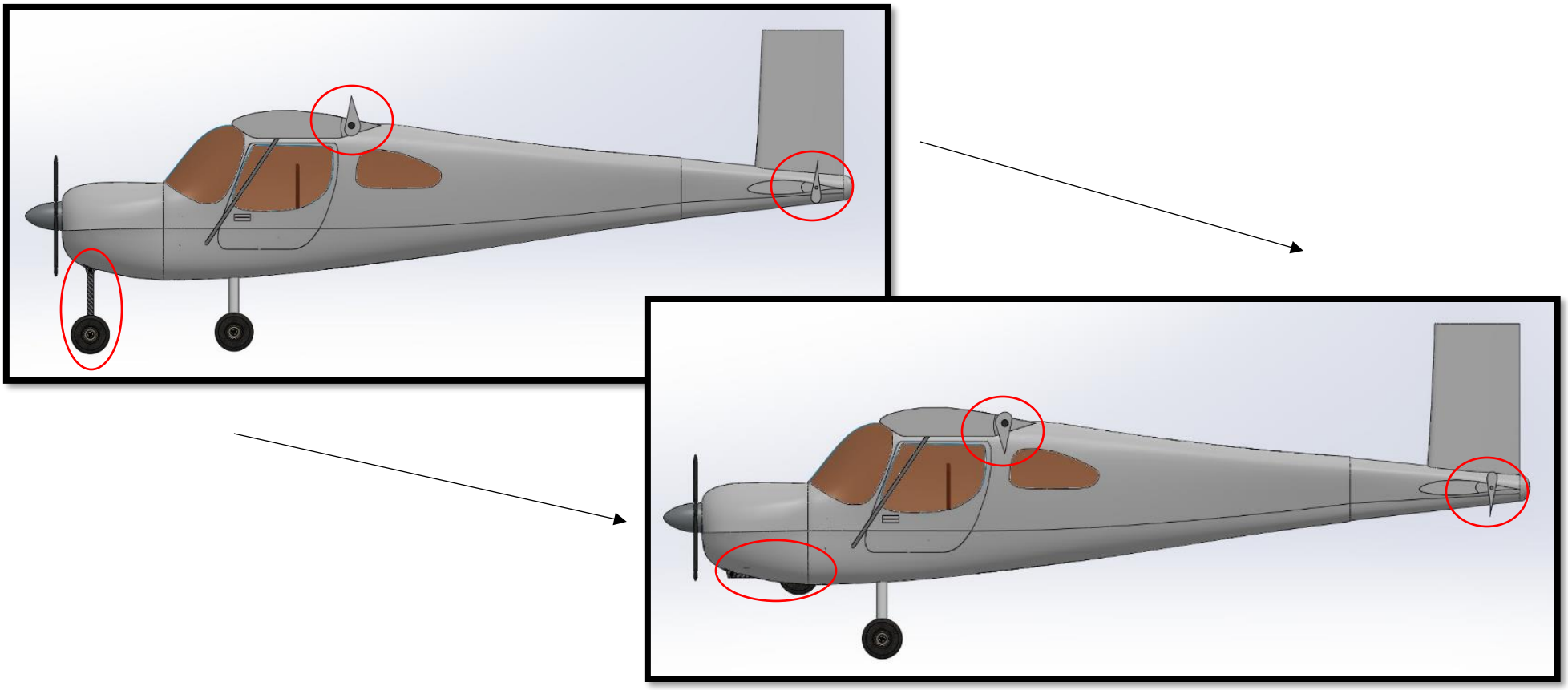
For my final project, I set out to create a CAD model of my dad's old single-engine light aircraft, which closely resembles the Cessna 162 Skycatcher. The image above shows the completed plane assembly, in the SolidWorks environment.

Exploded View of Final Assembly



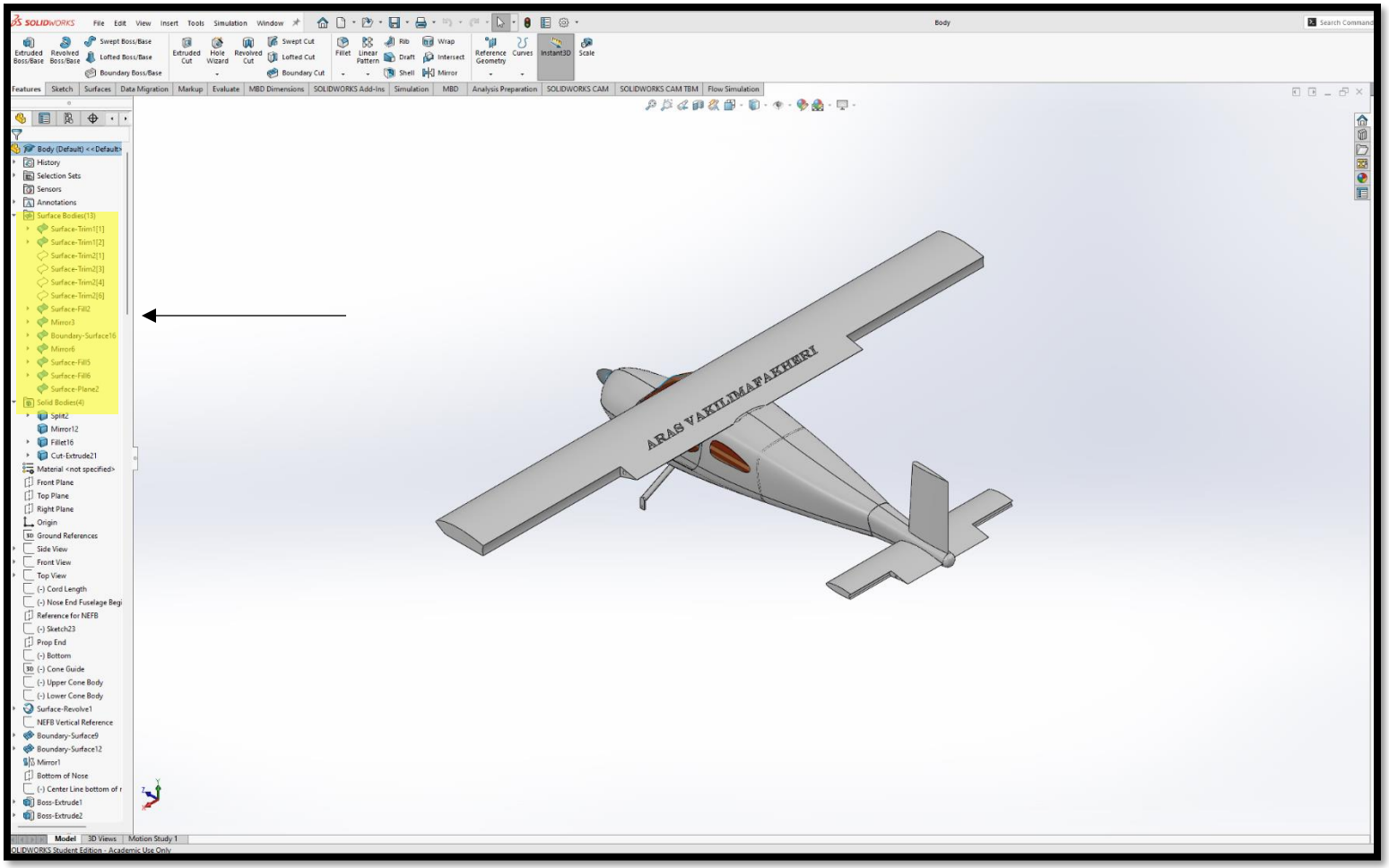
The final assembly is built around a single primary part: the aircraft's main body. Complementing this are multiple smaller parts, including the propeller, wheels, rims, seats, ailerons, front landing gear, and repeated standard components. This is underscored in the exploded view shown above. I utilized a variety of mates ranging from standard to mechanical to get the exact movement I wanted.

Kinematics in the Final Assembly



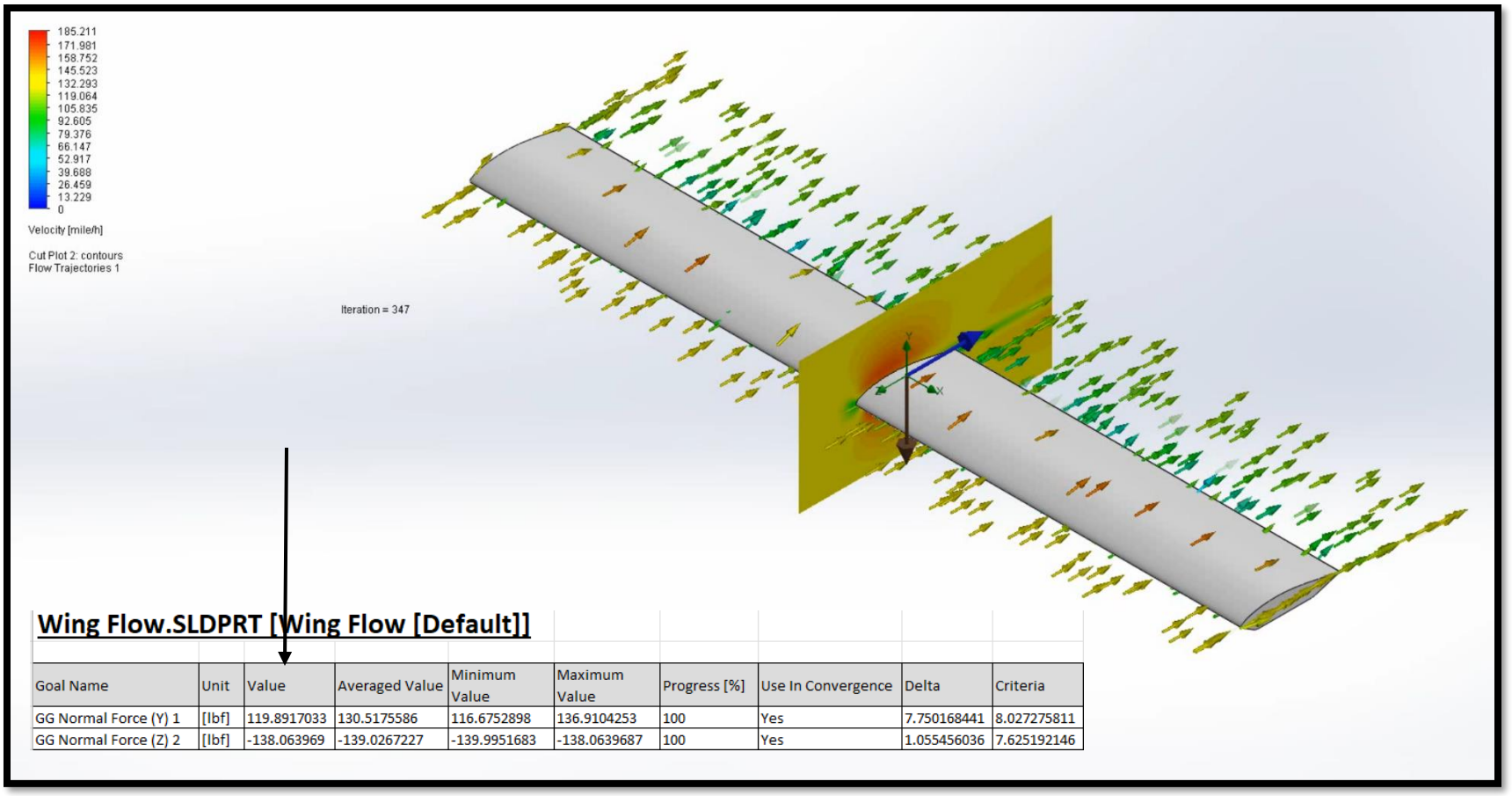
My final project included several moving components, such as the propeller, front landing gear, wheels, and ailerons. Among these, the front landing gear and ailerons stood out due to the advanced mating required to achieve the desired realistic motion. For the ailerons, I used the Limit Angle Mate, which restricted their rotation to 180 degrees about their shafts. Similarly, I applied the Hinge Mate with an angle limit to the front landing gear, restricting rotation to 90 degrees while maintaining synchronized movement of all connected parts.

Design Process



Following the class resources, I made extensive use of boundary surfaces, surface fills, and surface trims. The interplay between these surfaces and solid bodies in SolidWorks required some getting used to but introduced me to new tools such as the knit surface and thickening tools. I ran into several zero thickness surface geometry errors, which deepened my understanding of how SolidWorks handles surface interactions.

Airflow Simulation



Wing Flow.SLDPRT [Wing Flow [Default]]

Goal Name	Unit	Value	Averaged Value	Minimum Value	Maximum Value	Progress [%]	Use In Convergence	Delta	Criteria
GG Normal Force (Y) 1	[lbf]	119.8917033	130.5175586	116.6752898	136.9104253	100	Yes	7.750168441	8.027275811
GG Normal Force (Z) 2	[lbf]	-138.063969	-139.0267227	-139.9951683	-138.0639687	100	Yes	1.055456036	7.625192146

I attempted an aerodynamic study on the main wing of the aircraft using the SolidWorks Flow Simulation. I gave the environment initial conditions including gravity, air, and a velocity of 136 mph to mimic the top speed of the aircraft. The graphic shows the velocity of the wing and its projections as they hit the wing. Further, the simulated values for lift and drag are shown.