UNMANNED AERIAL VEHICLE

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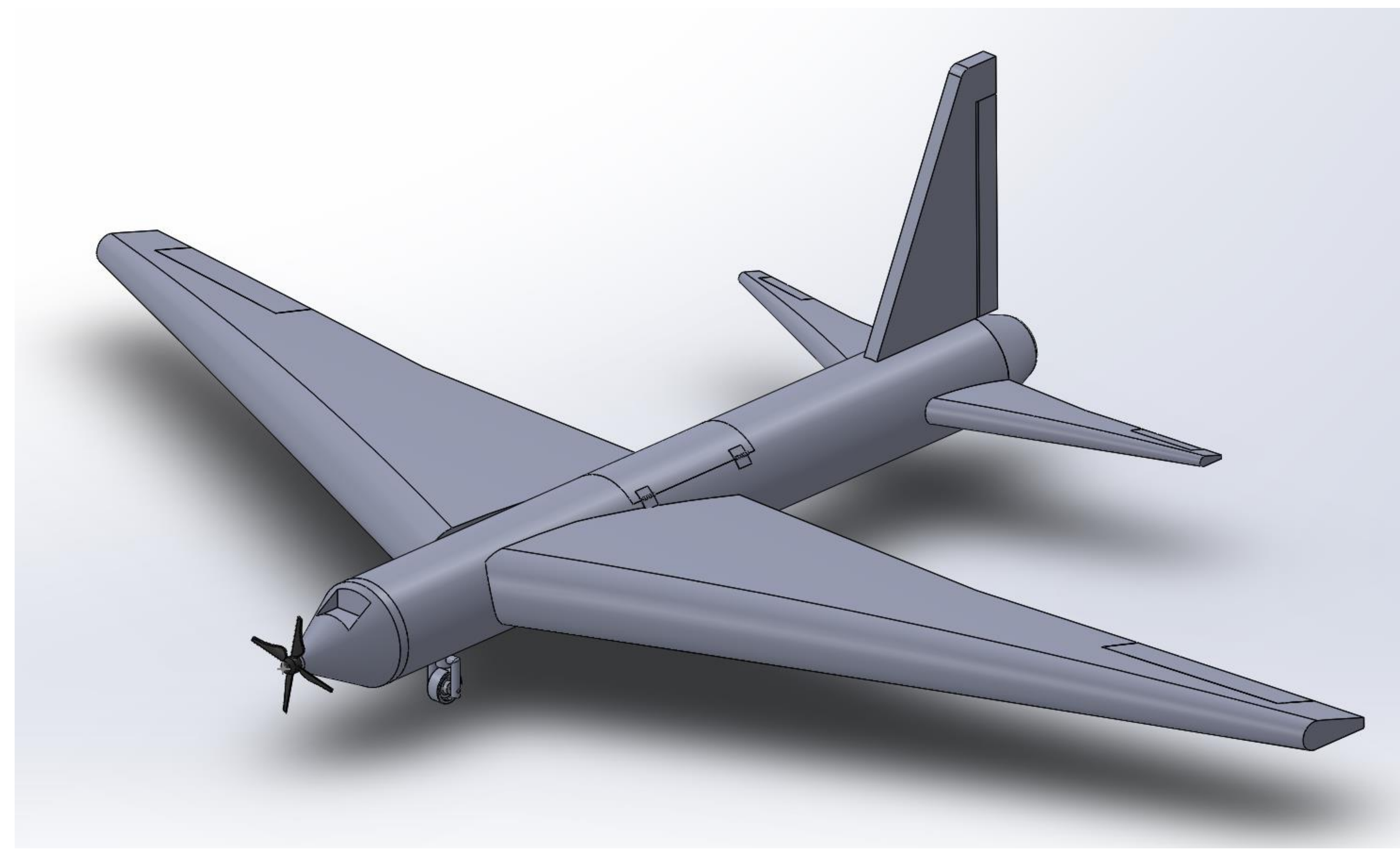
Boeing Pilot Outlook

According to the 2019 Boeing Pilot Outlook, the world is experiencing a shortage of pilots. There is an estimated need of more than 800,000 pilots that must undergo expensive and potentially dangerous flight training in the coming years. We proposed a way to train pilots in a much cheaper, safer way by having them fly a real plane from a ground cockpit.

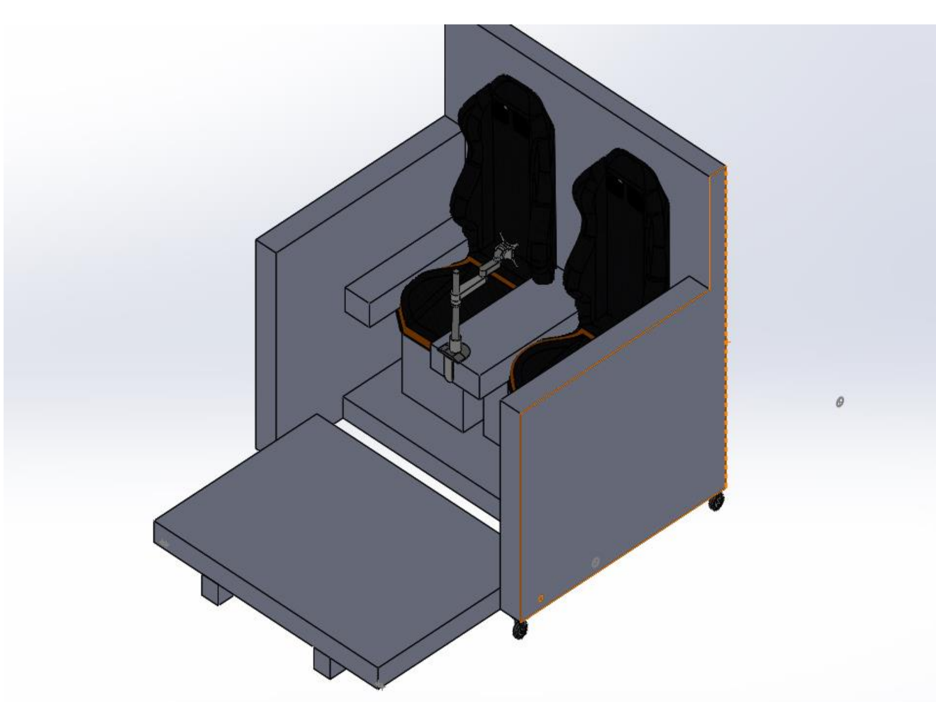


Model made with SolidWorks

THE COCKPIT

The cockpit is designed to fit an instructor pilot and the student who would be flying the plane. The cockpit would be made from wood frames for cost efficiency. Within the cockpit design there would be two racing car seats. There would also be electronic components such as the controllers sitting on the left and right side of both the pilot and students. We also integrated wheels on the whole cockpit so that it is easy to transfer to different locations as desired instead of having to disassemble entirely. The controls inside the cockpit would be the rudder pedals, the stick (or yoke) and the throttle. The student pilot would have a first-person view of the flight via a camera mounted onboard the aircraft and goggles worn to display the image.

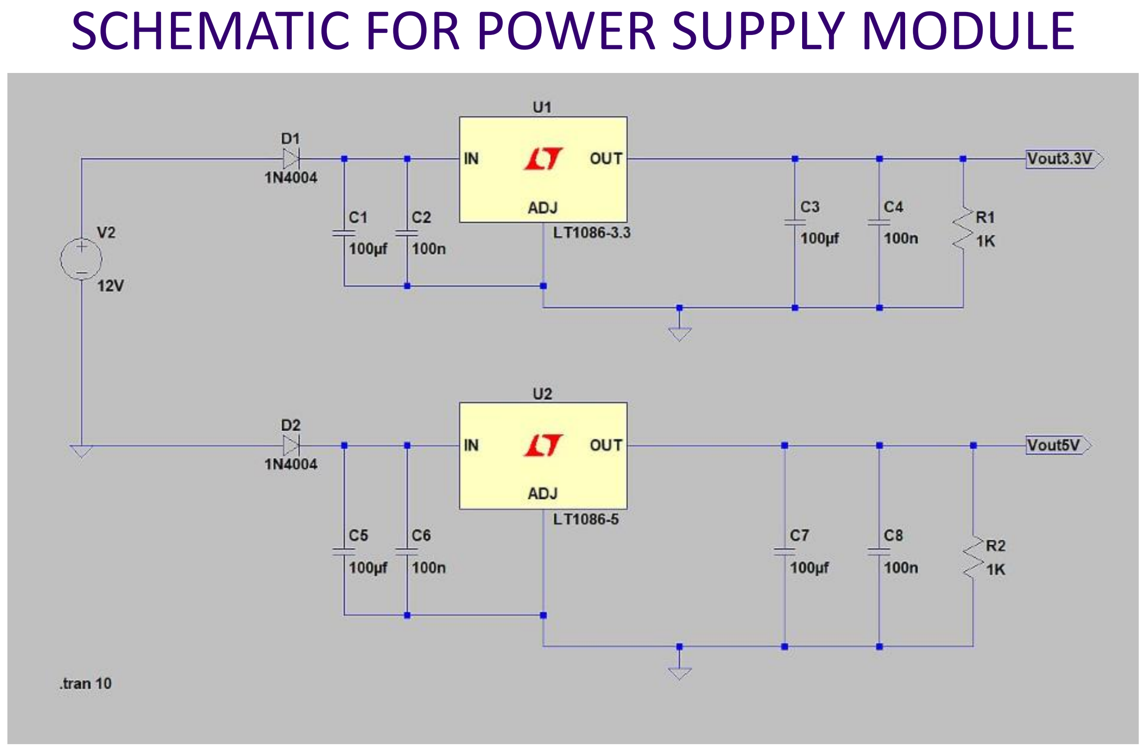
CAD MODEL



GOGGLES

The screen came is connected to a receiver and a screw-on antenna. It is rechargeable with a mini USB cable. The camera also has an antenna but the one we chose is built-in along with a transmitter. A 750mAh battery is required to run the camera, which is much smaller than the batteries required to run the motor or the control surfaces. After both the camera and screen are turned on the receiver on the screen must be changed until the camera is showing. The goggles themselves are 3D printed FPV goggles with an added strap to be used when in the cockpit.

SCHEMATIC FOR POWER SUPPLY MODULE



To ensure the the best flight time we will be using two batteries. One will power the powertrain of the UAV and the other will power the remaining components. The first battery will be plugged into the electronic speed controller which will also send power into the main PCB board with all the circuits and the transmitter. From that battery 1 (the bigger battery) will power the motor and the servos only. The second smaller battery will power the rest of the equipment such as the GPS module and the camera.

PHYSICAL MODEL

THE PLANE

The plane was modeled at first after a Lockheed C-130, but the design evolved to suit the team's needs. We had a 12-foot wingspan with struts in the wings and the fuselage for structure and held together by wooden dowels. The vertical stabilizer was inserted into the horizontal stabilizer and were made of solid foam core board. The three control surfaces were the rudder on the vertical stabilizer, the ailerons on the trailing edge of the wings, and the elevators on the trailing edge of the horizontal stabilizer. This would allow the plane to control yaw, roll, and pitch. The camera, batteries, transmitter, and additional instruments would be mounted in the fuselage of the aircraft. Servo motors would receive a signal from the pilot and actuate the control surfaces.

BASIC COMPONENTS

> 3 batteries (one each for the motor, control surfaces, camera).

> A motor and propeller.

> Camera and transmitter remotely connected to FPV goggles.

> 12-foot wingspan wings.

> Fuselage approximately 6 feet long with built-in vertical stabilizer.

> Landing gear and propeller.

> Horizontal stabilizer.

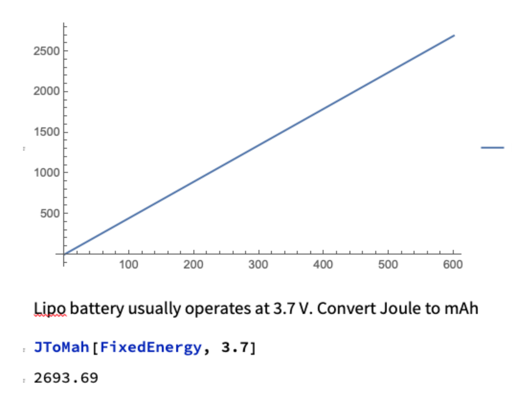
> Cockpit seats and table.

> Throttle for controlling thrust.

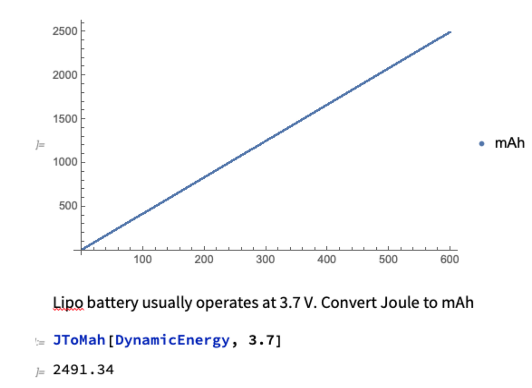
> Stick for controlling roll.

> Rudder pedals for controlling yaw.

BATTERY CAPACITY



Constant Power throughout Flight

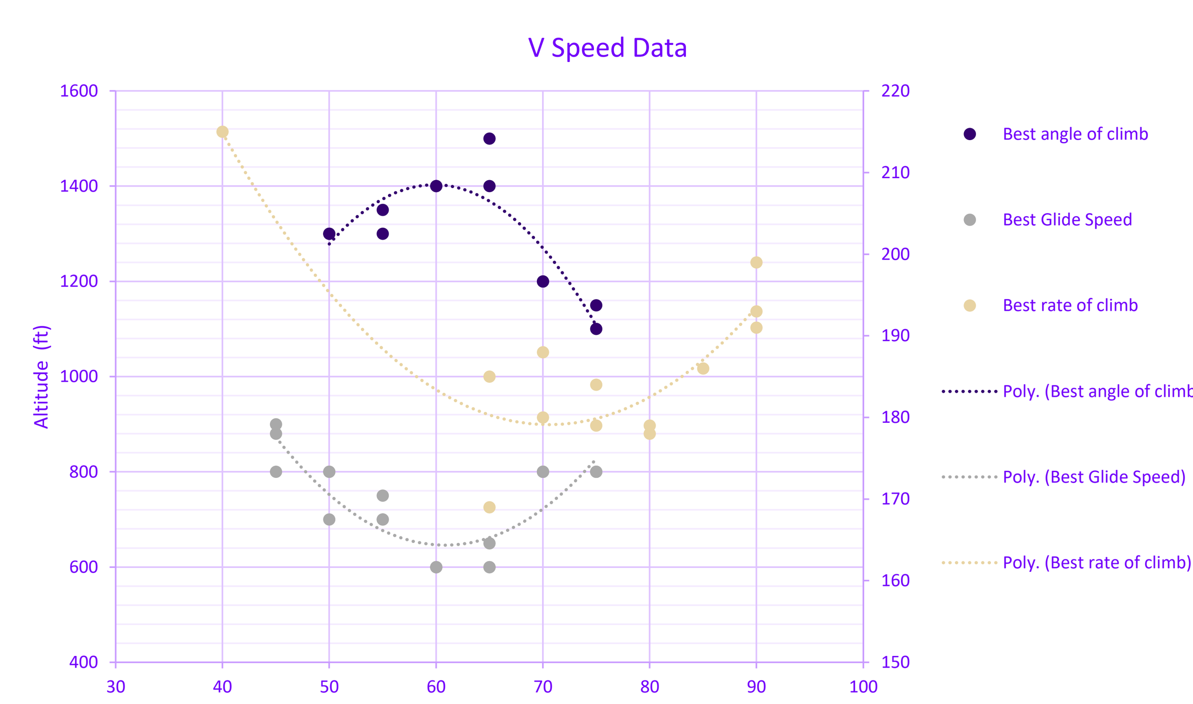


Power Changing Randomly throughout Flight

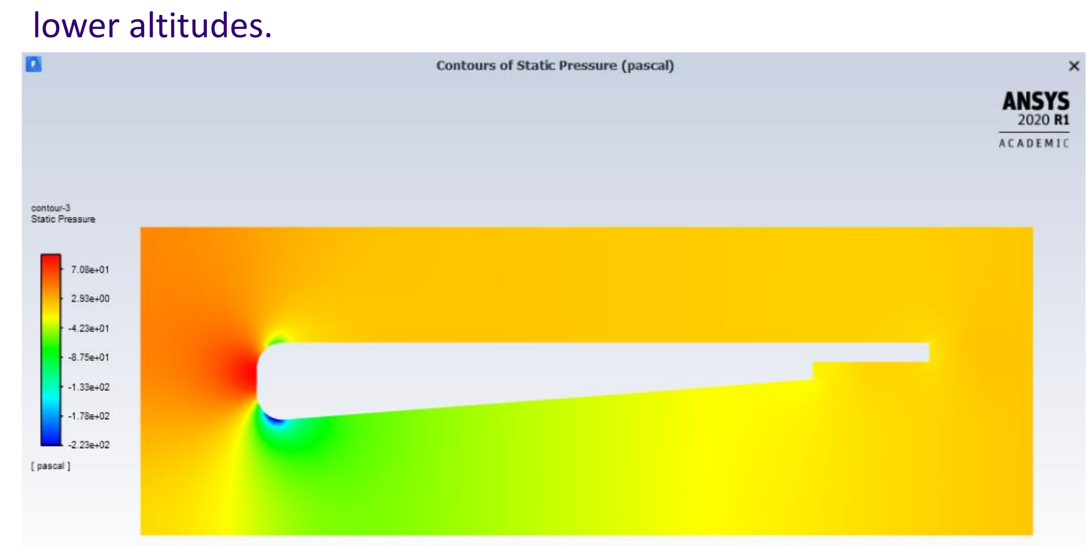
One main concern we had throughout the design process was how long the plane could stay in the air using battery power versus using gas power. After building most of the 12-foot model we were able to finalize the design using battery power rather than gas because it would be so light.

AERODYNAMIC SIMULATION

The team conducted simulated flight tests to determine the V speeds of an existing aircraft. Upon completing construction of the aircraft, the team would have conducted these exact tests to publish a pilot operating handbook.



Taking the shape of the original wing, we created a simulation of the surrounding environment of the airfoil. Using the Ansys program Fluent, a visual generation of the surrounding air pressure due to the wing shows the low-pressure zone being generated beneath the wing.
The current shown graph shows the static pressures in a zone of 20 mph coming through the inlet on the left and is under standard conditions at lower altitudes.



Looking Forward

The Aviation Capstone project will continue through the next four years, with plans to increase the size and scope of the endeavor. Subsequent teams of engineering students will research and employ advanced avionics systems, upgraded controls and video monitoring, and finally seek to design and build a full-scale electric 2-seat aircraft with the intention of offering a completely carbon neutral aviation system.

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