



Aviation Science & Engineering

Spring 2023

Essential Questions:

- How do aircraft achieve lift and flight?
- How does the engineering of these machines affect their operation, and how do we incrementally make things better based on success and failure?
- What factors and variables such as temperature, humidity, and altitude influence pre-flight planning and aircraft performance?

Description:

Aviation Science and Engineering is about all things aviation. In this ECS, students will dive into the technical aspects of aviation by understanding aerodynamics, propulsion systems, the forces of flight, physics, and aviation laws in the United States.

Students will experience the topic firsthand through hands-on explorations and construction projects, including the construction of a wind tunnel, the creation and testing of aviation models in both virtual reality and modeling, live discussions with local aerospace legends, and participation in live testing such as indoor skydiving and other projects. Students will also come to understand some basic meteorology and why the weather impacts aviation so greatly. Over the course of this three-week ECS, students will grow to understand the complexity of aviation standards and the true miracle that is modern powered flight.



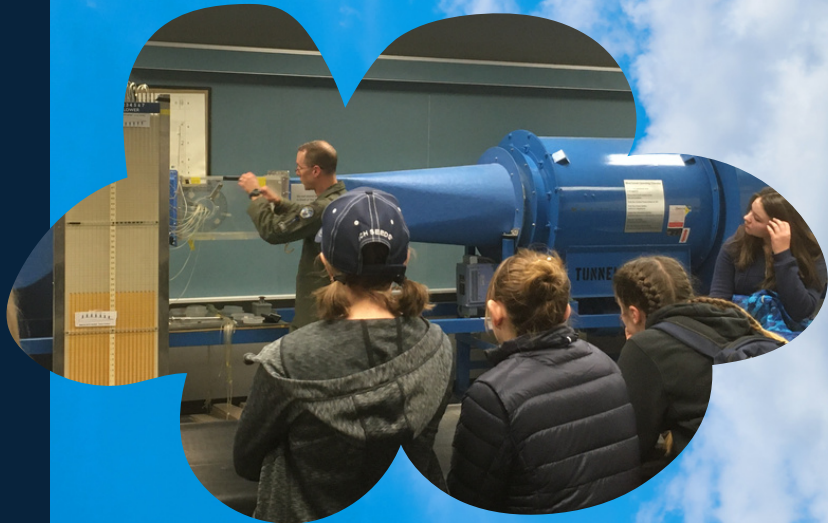
A Variety of Wind Tunnels

By Norah O. '25 & Isabel V. '25

March 1, 2023

During our first two days of ECS studies, we spent a lot of time practicing some helpful math and physics concepts to further our understanding of flight and aviation. After spending time building motors on Monday and completing math problems related to pendulum motion, ballistic trajectories, and freefall on Tuesday, we were ready to visit the Air Force Academy to learn about their aeronautic engineering programs and, specifically, to gain inspiration from their wind tunnels for our own designs.

On Wednesday, after a lesson about weather and a review of airfoils, we set off for a nutritious off-campus lunch at Chipotle before we continued on to the Academy. When we got to the Academy, we were greeted by Colonel Doug Wickert, the Department Head of Aeronautics for the Air Force Academy, and many friendly cadets. He showed us three different wind tunnel designs, the function of a jet engine, and many more aspects of the Air Force aeronautics program. We also learned about Bernoulli's Principle, pressure, and the four forces of aviation: lift, weight, thrust, and drag, furthering both our knowledge and our mental fortitude. Finally, we took a lot of inspiration from the machinery we saw, so we could begin to design our own small-scale and then larger-scale wind tunnel prototypes. In all, the Air Force Academy was an incredible experience and an even more incredible start to our aviation journey.



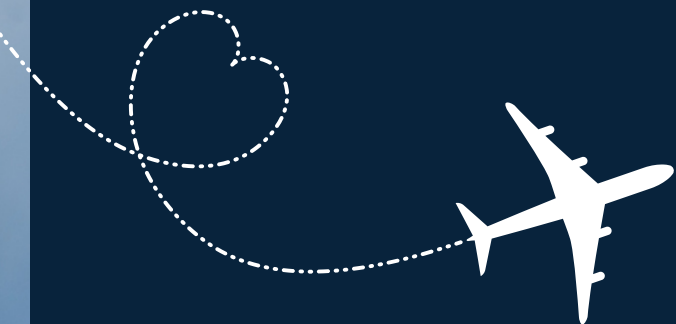
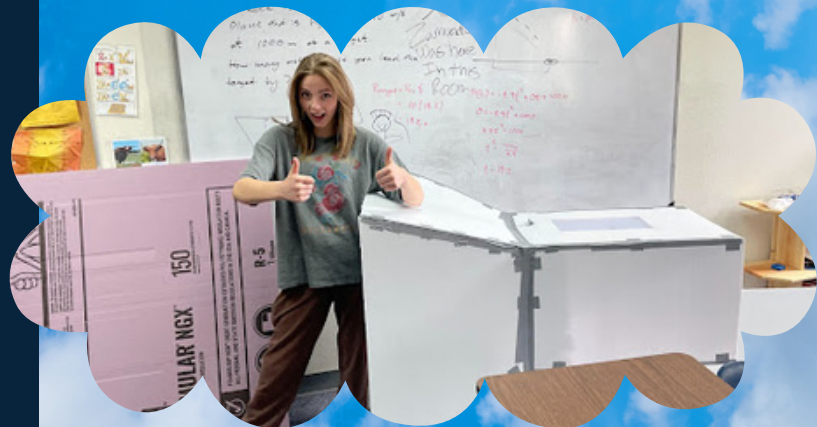
Big Wind Tunnel

By Katherine F. '25 & Sofie M. '24

March 8, 2023

Today, our main focus was building the large wind tunnel. Previously, we made smaller wind tunnels in small groups. Today, though, we combined all our ideas to make one fine-tuned wind tunnel. We used one of the preexisting tunnels as a base because it was large enough to work. We added about two feet of foam to elongate the tunnel so that we could test more types of airfoils. This was a super fun Activity, as it required us to all work together and share our ideas.

For us, one thing that stood out was the amount of bonding our group did. We all had to get along and help each other if the wind tunnel was going to work, so we learned how to work together as one team. It was a lot of fun and we learned a lot!



I Believe I Can iFly!

By Kashmala K. '26 & Sarah G. '26

March 8, 2023



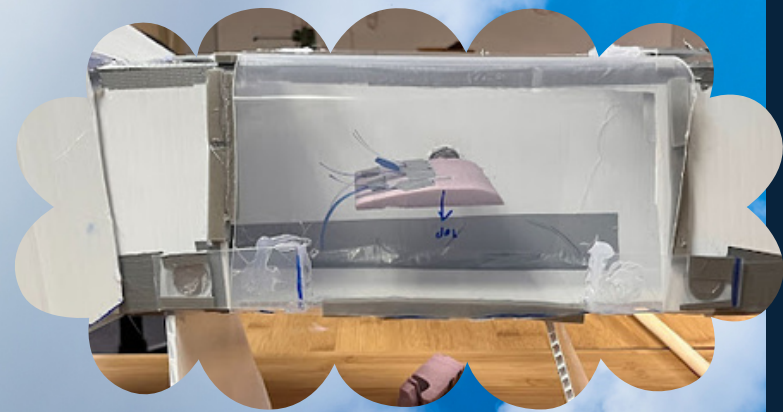
The day started with a short lesson on freefall and the drag of a wing, after about 30 minutes we got in the vans and took a bumpy drive to iFLY. When we arrived we each got wristbands and a short demonstration on how the fans in the wind tunnel work, we were shown an example of a propeller. They gave us an exclusive tour to see the air vents, and how the water works to cool down the air. There were many cool things about how the air vents worked, and it was very interesting learning the processes of how the water worked to cool down the air and such. Next, our group went to gear up for flight the instructors gave us our suits, helmets, glasses, ear plugs and head caps to be prepared for the experience. Then, everyone went into this small room to watch a brief video on the hand signals to understand, and many other basics to the indoor sky-diving experience. It was a bit nerve-racking at first, maybe very exciting to others, but in the end, the experience was amazing and definitely worth it. Then unfortunately our time was up for the other group to go. Everyone quickly changed back, and we went to create our own parachutes in groups. Essentially, everyone used a tissue, string, pencil, and a weight to test our little parachutes. After everyone had gotten a chance to skydive Mr. Wade ordered pizza. When everyone finished eating we started heading back to school, Once we had reached school for the rest of the day we worked on our wind tunnel. In my group we worked on extending the test section of the wind tunnel, and the group worked on another section of the tunnel.

Small-Scale Wind Tunnels

By Noah R. '26 & Xander T. '24
March 9, 2023



Wind tunnels are a device that can tell you how much resistance and lift a wing or object on a plane is getting. If you look at a video or picture of one, you can see the sound barrier being broken. The wind tunnel helps the U.S Military find out how they can make airplanes better, as well as helping NASA fix problems with rockets and other military aircraft.



We built smaller-scale versions of the same wind tunnels. To do so, our teachers put us into three groups. We learned how to calculate the dimensions and airflow expectations we would need, and then began to build the wind tunnels themselves. Our tunnels were made out of corrugated plastic, paper, and straws while the wind models came from cut foam blocks. The models could be as big as the group wanted but wind tunnels just needed a 5-inch testing box. Out of the three groups' models, all the students choose their preferred design. While making modifications, we felt would improve the tunnel and allow for precise measurements. We encountered challenges along the way such as sealing the tunnel and minimizing turbulence in the airflow.

