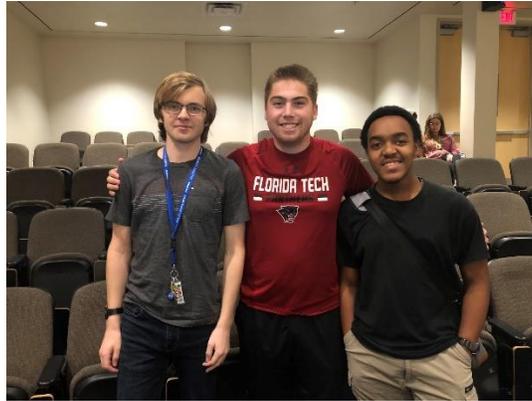


Teams Teaching Aerospace  
Star Raisers, Group 2



## Site Visits:

### Visit One: Harris Design Center



From left to right, \_\_\_\_, \_\_\_\_, \_\_\_\_, \_\_\_\_

All team members (----) visited the Harris Design Center on Thursday September 26th, 2019 after our afternoon classes. We learned about the use of the space; the Harris Design Center is mainly used by junior and senior design teams, some personal projects and some clubs. They have free classes for certification for many types of machines including, vacuum forming, manual mill and lathe, laser cutting and plasma cutting. They also have collaboration space that can be used by students when reserved. The Harris Design Center and the Maker Space in Olin Engineering Complex are like “sisters” and operate together and allow students to create things for school projects and for clubs and outside projects. (Nathan)

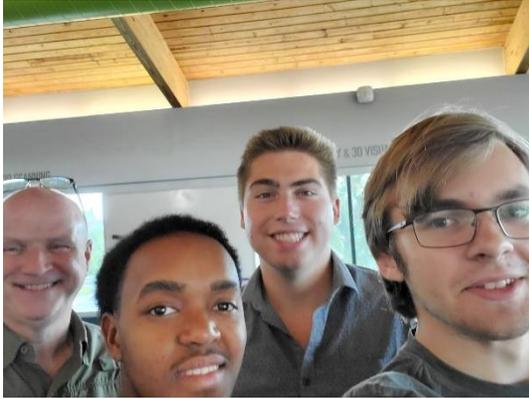
### Visit Two: Olin Engineering Maker Space



From left to right, ----- and Student MakerSpace Worker

All members (----) visited the Maker Space in Olin Engineering Complex (OEC) on Thursday September 26th, 2019 after our afternoon classes. We learned a lot about what the Makerspace is for; its function being for students to make things for personal or school projects and learning how to use many different types of 3D printers and assorted CNC machines they have. The Makerspace is used a lot typically by the Juniors and Seniors for their design projects but are there for anyone while they are open. The makerspace also allows clubs and teams to use it as both a planning space and work space. Lastly the Makerspace allows students to also be in charge and get some management experience on top of using it themselves. (Nathan)

### Visit Three: DSL



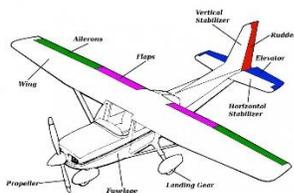
From left to right, DSL Leader, .....

All members went to the DSL on Thursday October 2nd, 2019 after his afternoon classes. He learned a lot about the space and its capabilities. Talking to the person in charge of DSL he learned that the DSL supports 3D printing for students, a recording studio, a quiet meeting or presenting space and computers that have single, double and triple screens. The DSL also has augmented reality and lots of other technology to allow students to edit any media they want or really accomplish anything they want in the realm of tech. The space is mainly used by upperclassmen as they can be used for upper level classes but are also there for fun to allow students to de-stress and have a fun time while learning at a high-level institution. (Nathan)

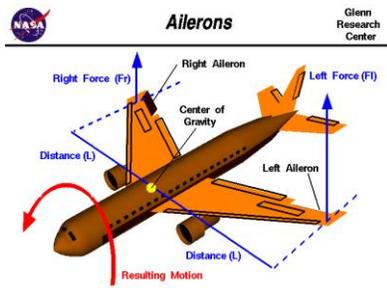
## Project Idea:

### Aerospace Concept:

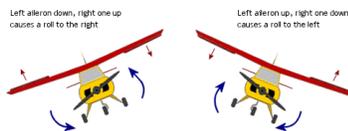
Group Two, The Star Raisers wants to build a model that will show and explain concepts around ailerons and how they can affect airplane flight including turning, adjustment and increasing/decreasing lift. This is an important aspect of an airplane and allows easy control of the aircraft in flight. Due to this reason we believe that this is an important concept for engineering students like ourselves to know and is not only a fun thing to learn about but also an easy way to explain flight to younger students that might be interested in engineering or flight. Without the use of ailerons planes would mainly have to rely on the tail using its elevators and rudder to try and steer the back end around to turn. This would reduce the maneuverability of an aircraft immensely. (Nathan)



*This image shows all of the parts of the aircraft including its vertical and horizontal stabilizers with its elevators and rudder. (Nathan)*



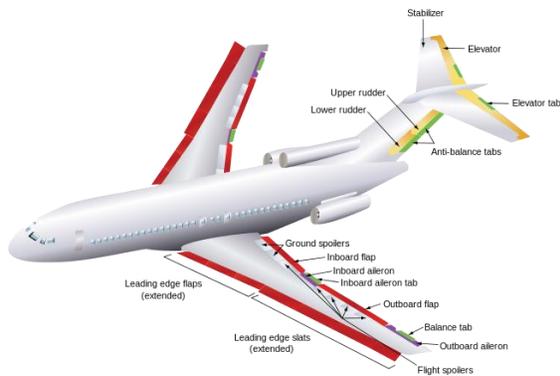
***This image shows how the ailerons on a commercial jet impact the movement overall of the aircraft around its CG. (Nathan)***



***This image shows the movement that is caused by putting each respective aileron up or down and its direction of roll. (Nathan)***

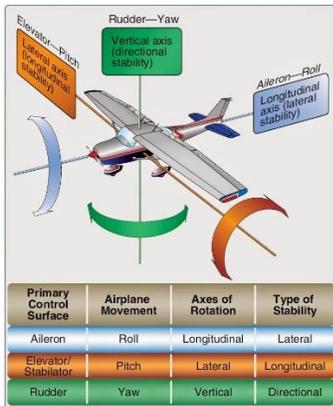
**Planned Visual Aid:**

The visual aid will rely on using the Makerspace at Olin Engineering Complex to 3D print parts to a model of a 3D plane. These parts will have movable ailerons, flaps, rudder and elevators to allow for the use of the model in not just with explanations about ailerons but also the other components. This allows our visual aid to be able to be reused many times over for several basic, yet important concepts of flying aircraft. Due to this fact our in-expensive model is essentially even cheaper because of its use for up to three concepts. (Nathan)



***This image is an example of what we will try and make our model look like while simplifying some of the spoilers and inboard/outboard flaps even though we will talk about the difference in sizes and placements. (Nathan)***

We will also include other diagrams like many of these pictures and like the following to help illustrate what the ailerons are doing to the plane and what would happen without them and their differing positions. (Nathan)



Our main audience will be high school and older students that already have a pretty basic grasp of airplanes and educate them on how the airplanes they fly in or see work and how they can move about. Our visual aid will also be color coded according to each part to allow kids and students to be able to recognize the parts of the aircraft easier and faster. (Nathan)

### **Future Planning and Work:**

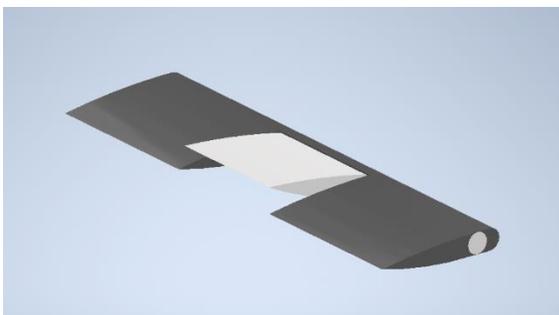
As we continue our planning, we are going to create a CAD model inside Autodesk Inventor that will detail the plane on a 1:200 scale model and print it in the makerspace using their 3D printers. We want to make the parts out of different colors allowing us to color code the parts and allow for easier differentiation of the different parts.

### **Chosen Project:**

We decided to go with the first project that uses an airplane wing to show how an aileron works and interacts with the air when moved on the wing of an aircraft like was suggested by Dr. Demoret after submitting our preliminary report. (Nathan)

## Final Phase:

### **Visual Aid Description:**



*This picture is showing our wing design with the movable aileron in the middle to demonstrate roll from the movement of itself. (Nathan)*

To begin with, our group wanted to explain the basic function of an aileron so first we had to design a wing. Going with the simplest thing, we decided on a rectangular wing. We still intended for it to look reminiscent to an actual wing so we designed our own airfoil. The design we made was asymmetrical. Once we had our aileron's shape, it was extruded with a space towards the center left vacant. This would be where the aileron would actually be mounted. Once the wing was made, the only task left was to design an aileron that perfectly fit in the vacant spot. After designing the aileron, all that was left was to make a rod to hold both components together. This is what will enable the flapping mechanic associated with ailerons. (Bruce)

### **Visual Aid Demonstration:**



*This photo shows Nathan explaining how an aileron works to his roommate (Nathan)*

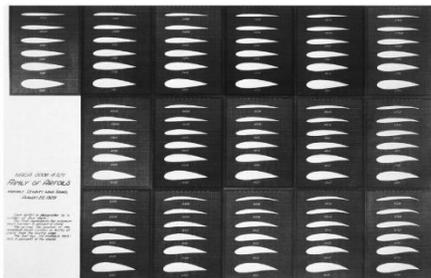
We explained to several people how ailerons work and showed how they affect planes when moved with direction and the effect they have on the plane.

### **Lessons Learned:**

During this project I have learned about the actual dynamics of wings and the overall history of flight. I have always been more interested in space so to learn and hear more about aviation has helped me better understand all of the aerospace field subject matter. (Nathan)

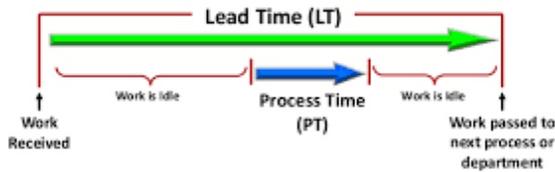


I expanded upon my knowledge on the use of NACA's original Airfoil diagram and used existing designs as reference. I also learned the importance of project management and dividing the job at hand. (Bruce)



During this process I learned a lot about manufacturing a product. The initial idea was to have the parts 3-D printed at the makerspace. So, I went to the makerspace and learned how to use the 3DWOX Desktop software. The software is used to turn the stl file into code for the printer to run. Another lesson that I learned was to budget sufficient lead time for manufacturing as our print couldn't be fabricated in time due to back up at the makerspace. So, I also got to learn how to make a model airplane wing out of balsa wood which was enjoyable. (Aidan)

### Lead Time vs. Process Time



Lead Time = Elapsed time; Throughput time; turnaround time  
 Process Time = Touch time; work time; cycle time