Reducing the Effects of a Mounting System

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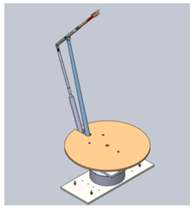
Introduction

The cylindrical shapes of the model mounting system are very intrusive on flows. Airfoil shapes are much less intrusive. This is why the airfoil shape is chosen for the shape of wings and shrouds. By covering the cylinders with a shroud with an airfoil shape, they will have less intrudence on the data results, leading the data to become more accurate.



CAD model of mounting system

Objective & Impact of Professor's Research

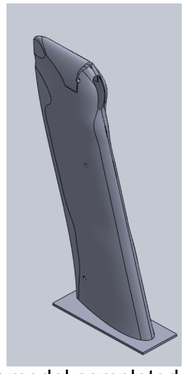
Currently , the mounting structure in the dryden wind tunnel causes interference on the data being collected for either a wing or plane. For my research, I needed to formulate a method to reduce this interference. The objective of this research is to make a shroud that is aerodynamic and durable and use it to cover the trunnion and linear actuator. When the shroud was completed, I ran tests in the wind tunnel with and without the shroud to see if the shroud straightened the flow. This straightened flow would lead to more accurate tests of models. The result of this could lead to a better and more sustainable plane or wing design.

Picture of shroud with fiberglass on it. PC: James Croughan

Research Process

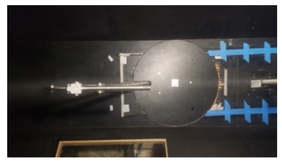
Method: To accomplish this task, I created a shroud using a design program called SolidWorks. The shroud was required to cover the trunnion and the actuator. The chord length of the airfoil couldn't be longer than 10 inches. Also, I had to make a hole for the horizontal arm to pass through. Several different sized airfoil were used to create the shroud seen below. The airfoils were acquired by using an airfoil database. The shroud was 3D printed in eight pieces due to the size capacity of the printer. To provide structure and strength to the shroud, I covered the existing shroud with fiberglass. To gather data, I used a smoke at a full and half height to see the streamlines.

Picture of shroud



CAD model completed shroud

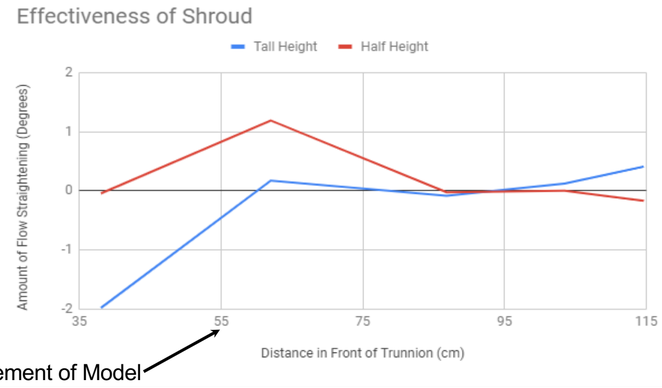
Time Frames: At the beginning of SHINE, I practiced using Solidworks by looking at tutorials. Then, I began to make simple shrouds and wings to better understand how the shrouds are designed. The actual designing of the shroud took me around seven days to complete. Adding the fiberglass, bondo, and sanding took me a total of three days. I spent a day gathering results in the wind tunnel.



Picture of mounting system without the shroud.

Results

- This data shows two lines which are the tall and half heights.
- The area where the model is typically placed was positively affected by the shroud. The models are typically placed in the 55 to 65 centimeter area on the x-axis.
- In the other areas, the shroud did not provide much improvements due to its size.



Advice for Future SHINE Students

For future SHINE students, I recommend using this program to open up your knowledge to things that you have never seen or learned about before. Also, don't be afraid to ask questions about a topic you are unfamiliar with. When you make a mistake, you should not be discouraged because it is part of the program. The PHD mentors will always help you, and they have the best intentions for you because they want to see you succeed. Lastly, make the most of this program because you are only in the SHINE program for a short amount of time.

Picture of Marco sanding his shroud. PC: James Croughan

Skills Learned

- Basics of aerodynamics
- Solidworks
- Basics of MATLAB
- Learned how to import airfoil coordinates into Solidworks
- Learned how to apply fiber glass on a 3D printed model

Acknowledgements

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