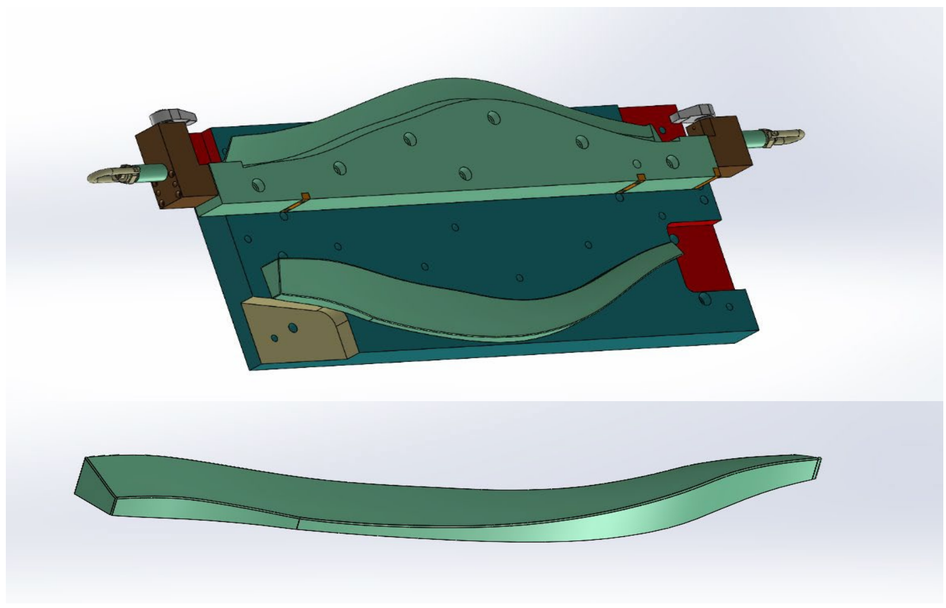
Vacuum Nest Block For GTF Sheath

Project Description:

Our joint project this semester involves the shaping of individual turbine blade sheaths. All of Pursuit Aerospace's turbines pass through a Nest Block, where the blade is supported for the machining to be done, one side at a time. To machine the other side, the blade is flipped by the nest block. However, this process presents several complications with the Nest Block. The existing mechanism leads to subpar performance regarding the dimensions of the metal leading edges and sheaths. Additionally, the blade lacks the necessary support and contact between the nest block and the blade is inconsistent, leading to the blade's thickness not being held within tolerance at certain locations. Given these factors, the process lacks a high repeatability factor when it comes to the dimensions of the blade.



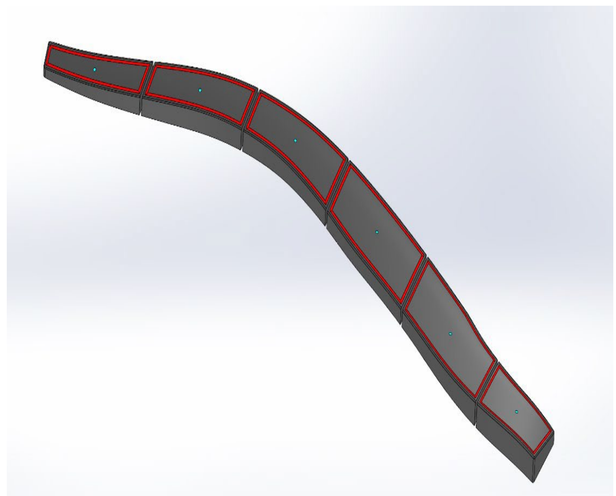
Design Options/Possible Solutions:

To address these issues, our goal is to redesign the Nest Block as well as a vacuum seal holder that ensures full-body contact with the turbine blades. The equipment will feature increased adjustability, a higher percentage of blade contact, and improved repeatability and consistency of the blade's dimensions. By resolving these challenges, we aim to reduce deflection rates, enhance usability, and improve the accuracy of blade manufacturing, ultimately minimizing future problems.

Early Design Concepts:

<u>Vacuum Seal:</u>
Added channeling to the fixture to create a fluid exit path, allowing the sheath to be fully sealed when the air is pumped out.

<u>Part Division:</u>
To increase the block's flexibility and movement capabilities, the original piece will be divided into multiple smaller segments to allow for a tighter fit.



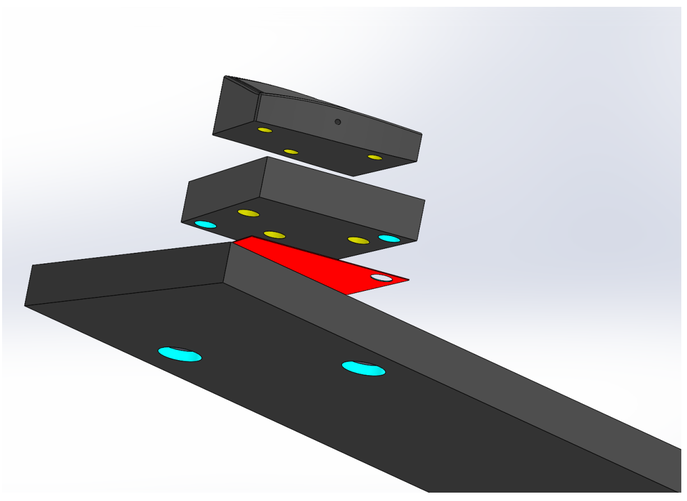
Future Implementations:

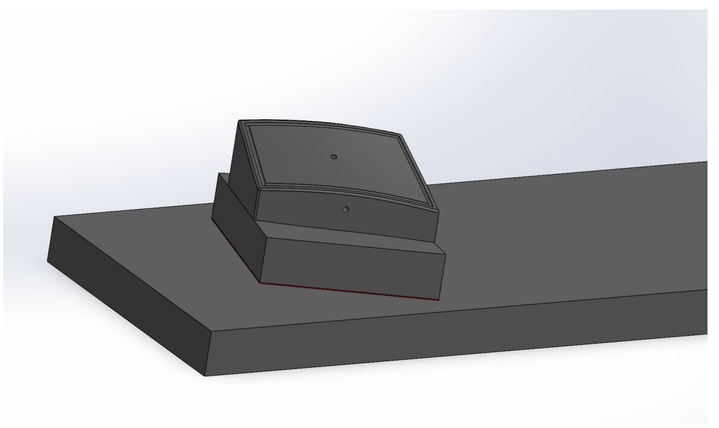
Our group will be using a SmartVac3 system provided by Pursuit Aerospace for the vacuum setup. Additionally,
we are considering combining a shim leveling system with the vacuum to enhance the final project. This integration aims to improve adjustability, ensure better blade contact, and ultimately lead to more accurate manufacturing, reducing potential issues and decreasing production time for each blade.

See Below for Image Credit

SmartVac3 Vacuum System:

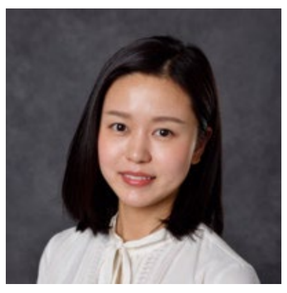
- Utilizes the Venturi Principle
- Between 80-100 psi pressure
- 0.8 CFM at 14 psi ambient
- 1/8" NPT Vacuum Inlets





Semester Deliverables:

1. Running CFD Simulations on proposed vacuum system
2. Performing Stress/Strain Analysis to ensure structural integrity and longevity
3. Model and manufacture system prototype for Spring reevaluation



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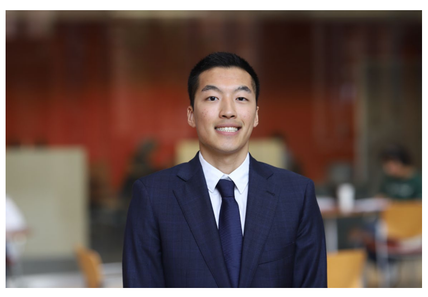

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Image provided by Pierson Workholding