# Composite Door Stop Beam

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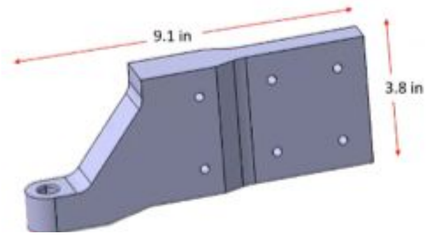
## INTRODUCTION/MOTIVATION

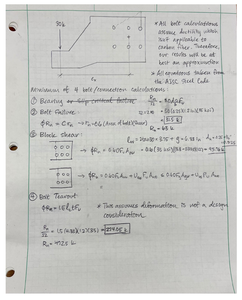
**Background Information:** This project aims to innovate aircraft door stop beams for Boeing, replacing aluminum with carbon fiber composite alternatives. We seek to evaluate how different carbon fiber layup orientations affect the strength of these door stop beams. This initiative seeks to enhance safety, increase payload capacity, and streamline manufacturing processes.

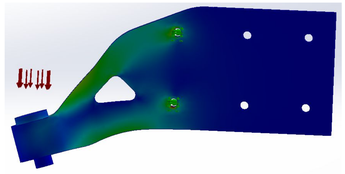
- $4000 budget
- Must fit within the envelope of the original design
- Must manufacture and test 3 composite versions of the part
- Must support minimum distributed load of 30 kips
- Constraints: Manufacturing quality




## DESIGN PROCESS

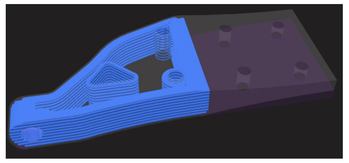
- **Proposed solution:**
  Utilize multiple carbon fiber manufacturing methods to create optimal, composite versions of the original part
- **Resources needed:**
  Onyx Carbon Fiber 3D printer and associated materials, Carbon Fiber Prepreg, CNC fabric cutter, Autoclave



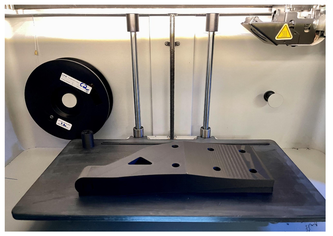


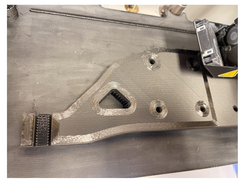
finite element analysis using Solidworks, iteration 5

## MANUFACTURING



Iteration V (Above) Eiger model, Concentric Continuous Carbon Fiber Filament shown in Blue
Iteration V completed print (Below)





Iteration V During print (Above)

Hand Layup Process (Above)

## TESTING

Testing Apparatus (Left)
Iteration V (Test I)[Right]: Local failure caused by cupping of washer


Iteration IV (Left): Combined shear, tensile, and buckling failure
Iteration V (Test I) [Right]

Tensile coupon testing on the Instron [Left]

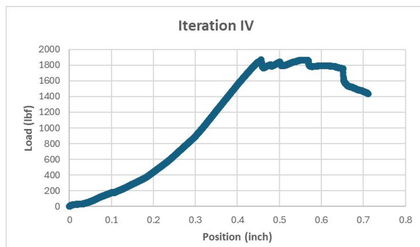

Iteration V (Test II) [Above], Combined Failure Mechanism

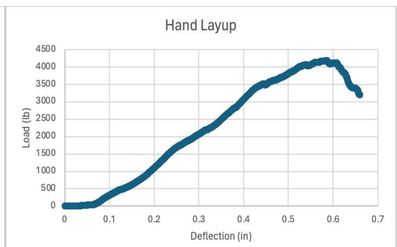
## RESULTS/VALIDATION

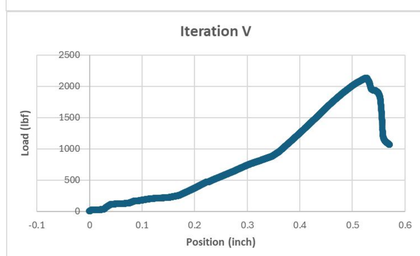


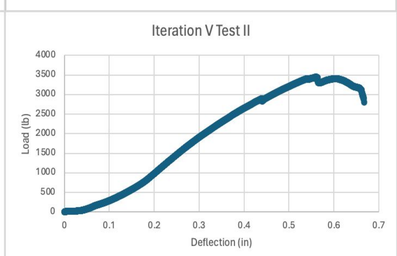
| | Iteration IV | Iteration V (Test II) | Hand Layup |
|---|---|---|---|
| Load: | 1.89 Kip | 3.45 Kip | 4.19 Kip |
| Failure: | Combined | Combined | Bearing at load application point |

**Stops needed:** To satisfy the total force requirement of 30 kips, we would need use 10 stops using Iteration 5.

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- **Prepreg Material Provider: Shannon Dong**
- **Composite Shop Manager: Kyle Luiten**
- **Material Science Lab Manager: Carter Beamish**

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**CITATIONS**