Project One Milestone (Individual) Worksheets

MILESTONE 1 (INDIVIDUAL) – COVER PAGE

Team Number: Thurs-48

Please list full name and MacID.

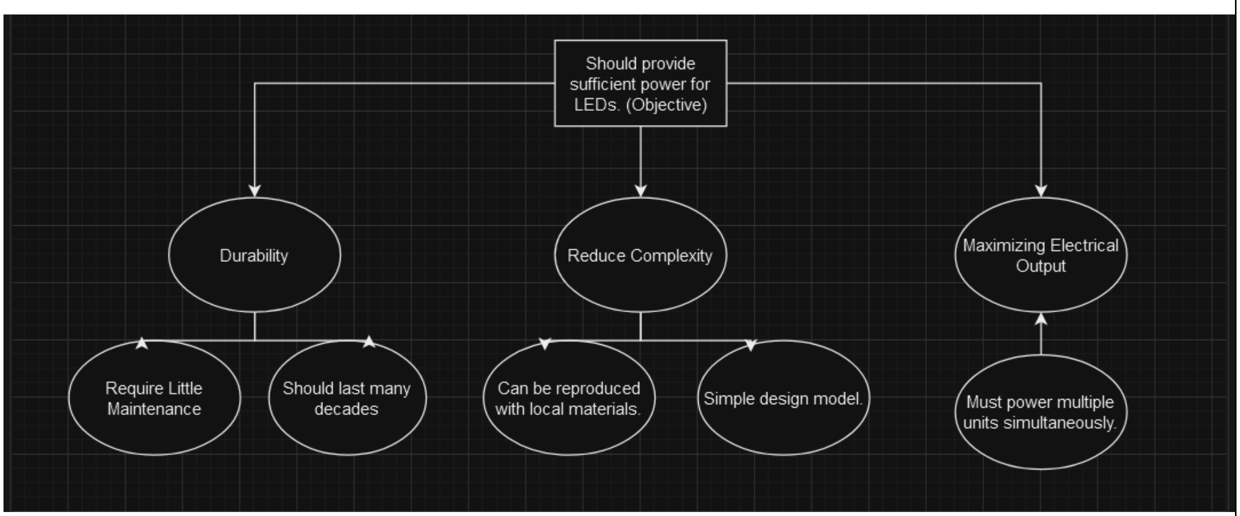
Full Name:	MacID:
Shadi El-Fares	elfaress

MILESTONE 1 (STAGE 2) – PRELIMINARY OBJECTIVE TREE

Team ID: Thurs-48

This is an individual deliverable each team member will complete ***during*** Design Studio 3.

→ Review the 4 different engineering scenarios outlined in the Project 1 module
→ The Project **Manager** will assign each team member one scenario
→ Complete a preliminary objective tree for your assigned scenario on the following page

Name: Shadi El-Fares	MacID:elfaress
Engineering Scenario #:	Scenario 2
Enter title of assigned scenario EWB Humanitarian Aid Mission	
Insert individual preliminary objective tree diagram for assigned scenario in the space below 	

MILESTONE 2 (INDIVIDUAL) – COVER PAGE

Team Number: Thurs-48

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Full Name:	MacID:
Shadi El-Fares	elfaress

MILESTONE 2 (STAGE 0) – RESEARCH MEMO

Team ID: Thurs-48

This is an individual deliverable and should be completed by each team member **prior** to Design Studio 3.

Summary of wind turbine blade technology and potential design considerations.

Each individual research memo should be ***no more than one page***, excluding references.

Introduction:

Blades are the essential components of a wind turbine that transform wind kinetic energy into electricity. Their design was influenced by the complex interplay of aerodynamics, materials, and efficiency factors. This summary explores the complex state of wind turbine blade technology at present, stressing the essential design components that influence its functioning and effectiveness in converting wind energy.

Design Factors:

Aerodynamics and Blade design: Improved wind energy capture depends significantly on blade shape, which is usually curved like an airplane wing. This aerodynamic design generates lift, allowing for efficient conversion of wind energy.

Materials and Construction: Fiberglass or carbon-fiber composites, which are both lightweight and robust, must be utilized to ensure the blade's durability. This is essential to producing long-lasting, affordable blades, materials and structure are essential elements of blade design.

Size and Length: It's crucial to balance the blades' sizes and lengths. Although longer blades are more effective in capturing wind energy, they have design issues with weight and stability. Achieving the proper balance increases the turbine's total efficiency since it produces the best performance and structural integrity.

Rotor-Generator Connection: The turbine's maintenance requirements and effectiveness are impacted by how the rotor blades are connected to the generator. Direct-drive connections offer simplicity while shafts and gearboxes can increase spin, enabling smaller generators. The choice has an impact on the turbine's reliability and overall performance.

References (adhere to IEEE notation)

***references do not count toward word count / page limit

[1] M. McGugan, "Design of wind turbine blades," SpringerLink, https://link.springer.com/chapter/10.1007/978-3-319-39095-6_2 (accessed Sep. 27, 2023).

[2] A. E. Tutorials, "Wind turbine blade design, flat, bent or curved," Alternative Energy Tutorials, https://www.alternative-energy-tutorials.com/wind-energy/wind-turbine-blade-design.html (accessed Sep. 27, 2023).

[3] "How a wind turbine works - text version," Energy.gov, https://www.energy.gov/eere/wind/how-wind-turbine-works-text-version (accessed Sep. 27, 2023).

MILESTONE 3A (INDIVIDUAL) – COVER PAGE

Team Number: Thurs-48

Please list full name and MacID.

Full Name:	**MacID:**
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MILESTONE 3A (STAGE 2) – MATERIAL SELECTION: MPI AND MATERIAL RANKING

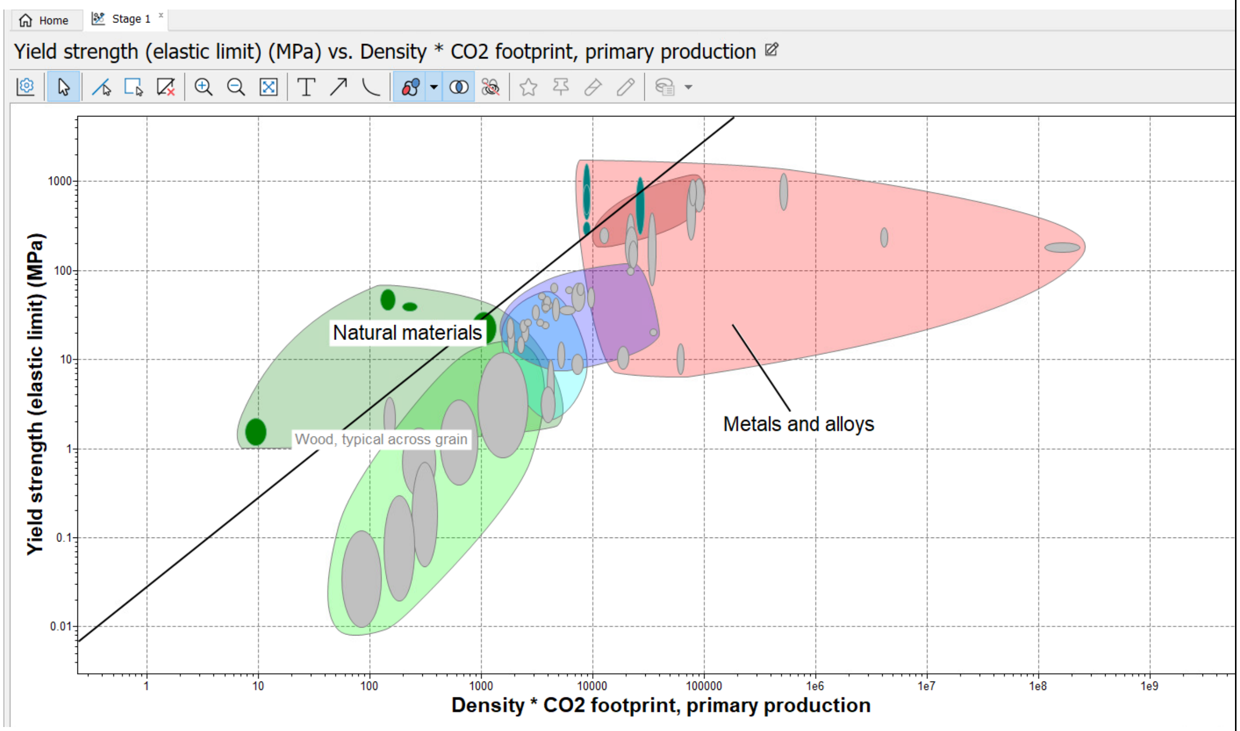
Team ID: Thurs-48

Document the results of your materials selection and ranking on the following pages.

→ All different types of steel (carbon steels, alloy steels, stainless steels) have very similar Young's moduli. **For this stage in Project 1, please group all variations of steels into one family as "steel"**. Please put **steel** in your material ranking list only once and indicate in a bracket which steels made the top ranks.

→ Each team member is required to complete this worksheet

Material Property Chart		
Assigned MPI	**Functional Constraint**	**Objective**
$MPI = \frac{\sigma_y}{\rho CO_2}$	$\sigma < \sigma_y$	Minimizing carbon footprint would allow for turbines to be more sustainable throughout the manufacturing process.
Insert a screenshot of the material property chart with MPI guideline. Please clearly label the top 5 materials with their names in the plot.		



Material Ranking					
	Rank 1	Rank 2	Rank 3	Rank 4	Rank 5
Assigned MPI:	Wood, typical along grain	Bamboo	Cork	Steel (Low Alloy, High Carbon, Medium Carbon, Low Carbon, Stainless)	Paper and Cardboard

MILESTONE 3B (INDIVIDUAL) – COVER PAGE

Team Number: Thurs-48

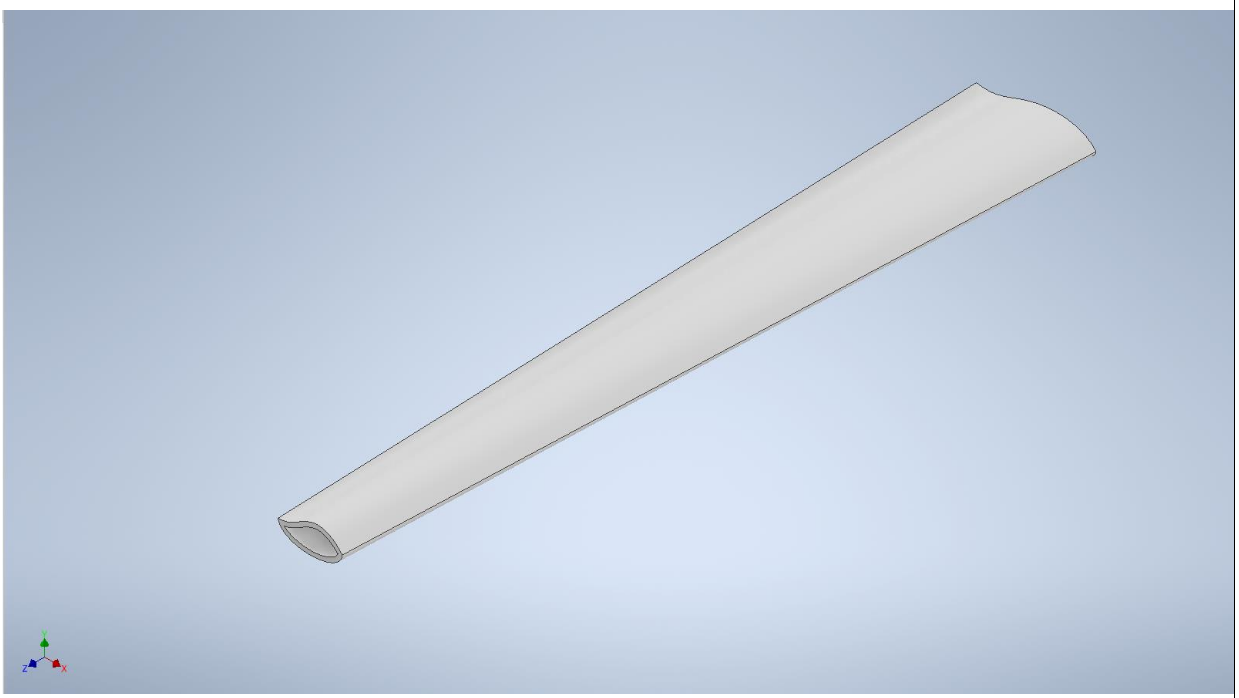
Please list full name and MacID.

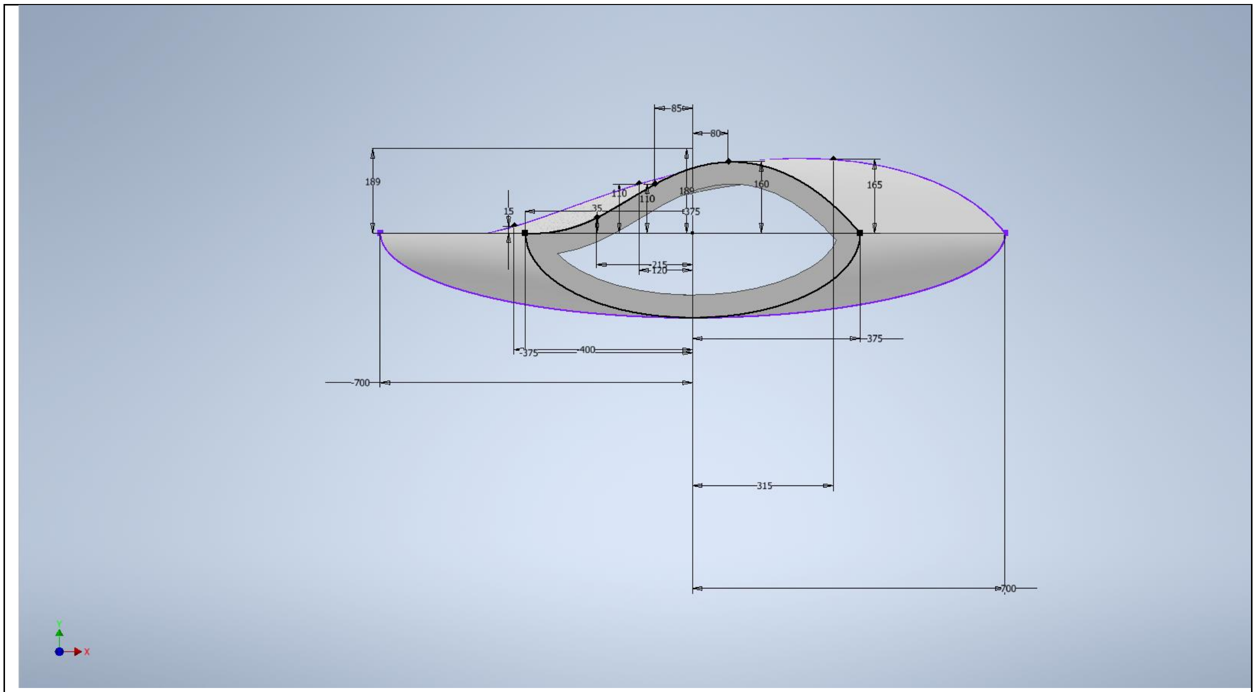
Full Name:	MacID:
Shadi El-Fares	elfaress

MILESTONE 3B – DESIGN EMBODIMENT

1. Solid Model of Turbine Blade

Insert screenshots of your solid model in multiple views (please show evidence of accurate CAD modeling by showing measurements including volume).

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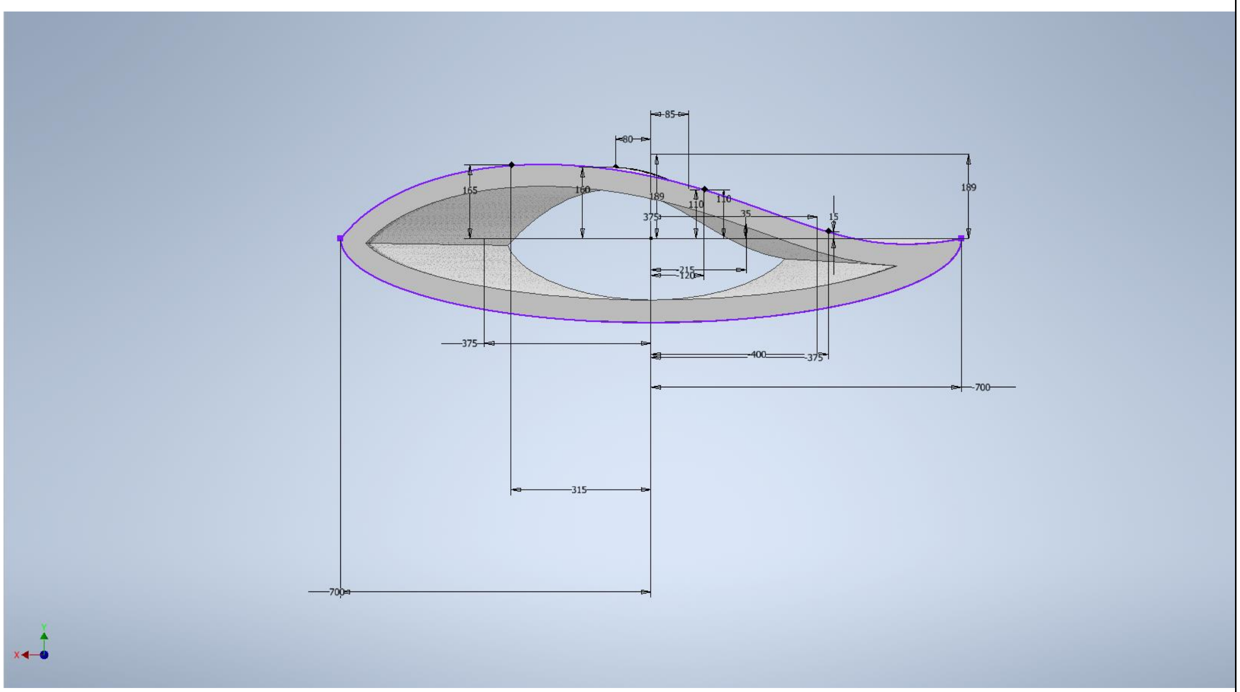
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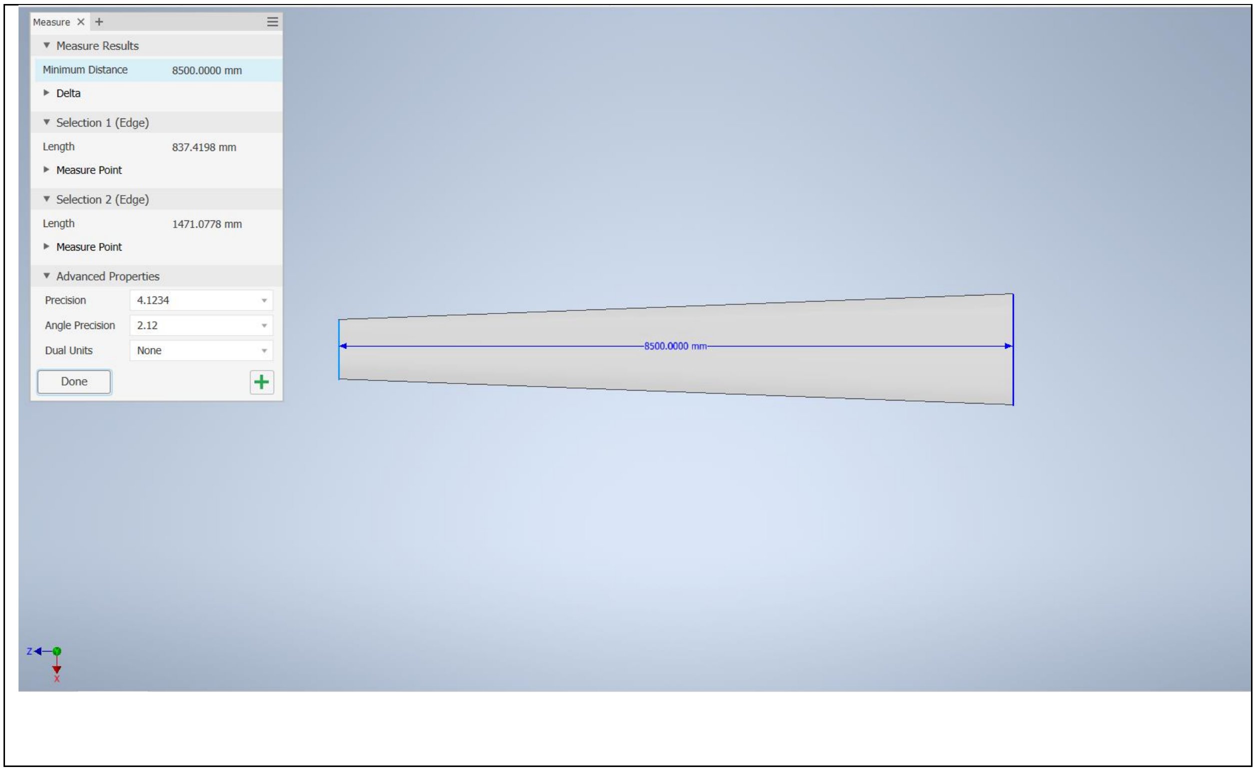
Measure
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Minimum Distance 8500.0000 mm
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Selection 1 (Edge)
Length 837.4198 mm
Measure Point
Selection 2 (Edge)
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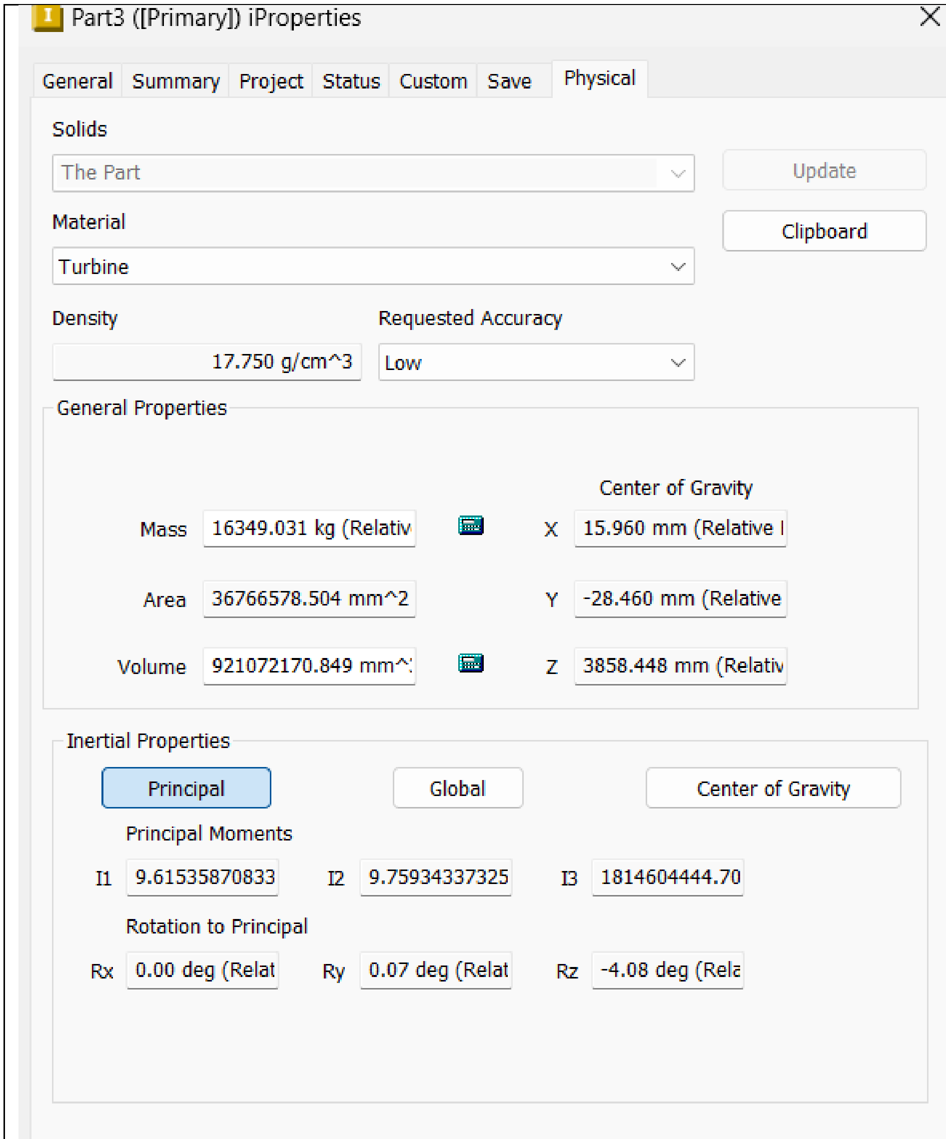
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Global
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Principal Moments
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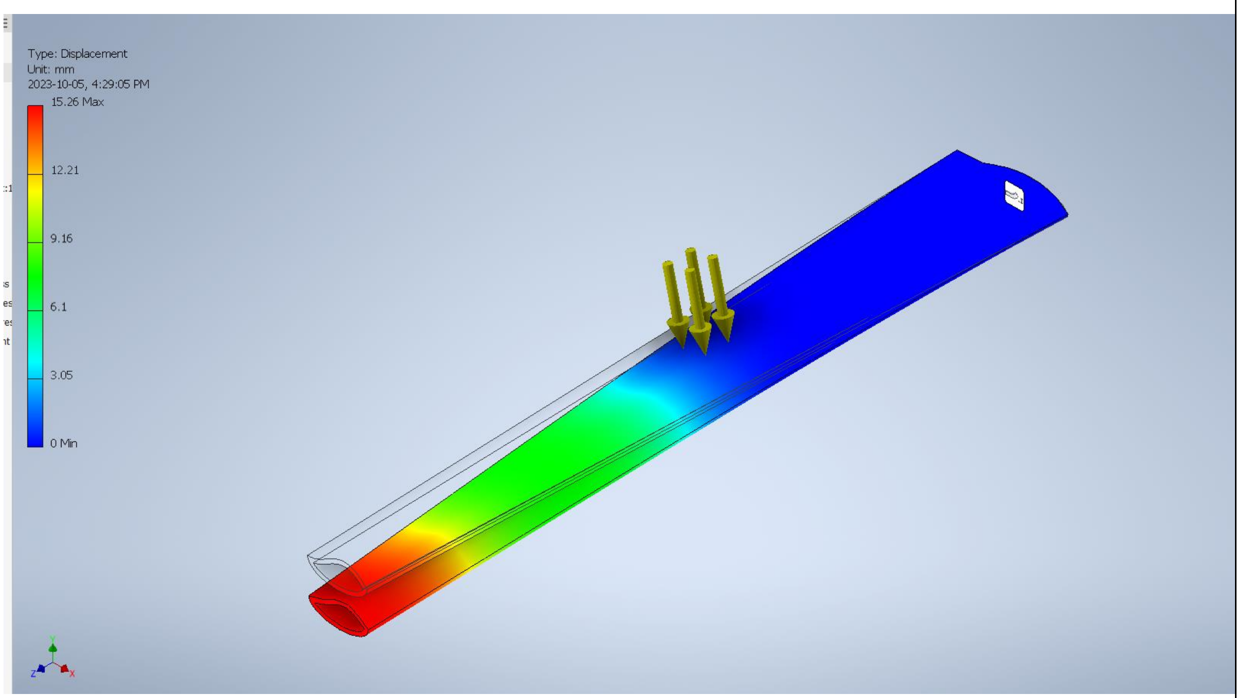
9.61535870833
I2
9.75934337325
I3
1814604444.70
Rotation to Principal
Rx
0.00 deg (Relat
Ry
0.07 deg (Relat
Rz
-4.08 deg (Rela

2. Deflection Simulation

Simulated deflection δ (mm):	15.26mm
Material Selected:	Silver
Insert screenshots of your deflection simulation and provide evidence of the simulated deflection. Must show scale that is present on the left side of the screen.	



MILESTONE 4 (INDIVIDUAL) – COVER PAGE

Team Number: Thurs-48

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Full Name:	MacID:
Shadi El-Fares	elfaress

MILESTONE 4 (STAGE 1) – ESTIMATE THICKNESS REQUIREMENT

Team ID: Thurs-48

Estimate the deflection of the turbine blade on the following page
→ Each team member is required to complete this worksheet

1. The title of the scenario

Estimate Thickness Requirement

2. Chosen Material

	Material Name	Young's Modulus (GPa)	Yield Strength (MPa)
Chosen Material	High Carbon Steel	210	678.5

Insert a screenshot of the simulation with the deflection value, and the assigned thickness.

3. Screenshot of Deflection

Assigned thickness, *t* from Table 1 (mm)	**50**
Estimated deflection δ (mm)	5.567

Insert screenshot of deflection simulation. Must show scale that is present on the left side of the screen.