MEASUREMENT OF WINGLET EFFICIENCY OF FLYING WING AIRCRAFT

By:

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OBJECTIVE

- To quantify forces and vibration at the wing with winglet.
- To know the performance of wing with winglet using UTM open wind tunnel testing.
- To analyse the forces produce at different aircraft's wings with pitch angle up to 40^{o}.

SCOPE

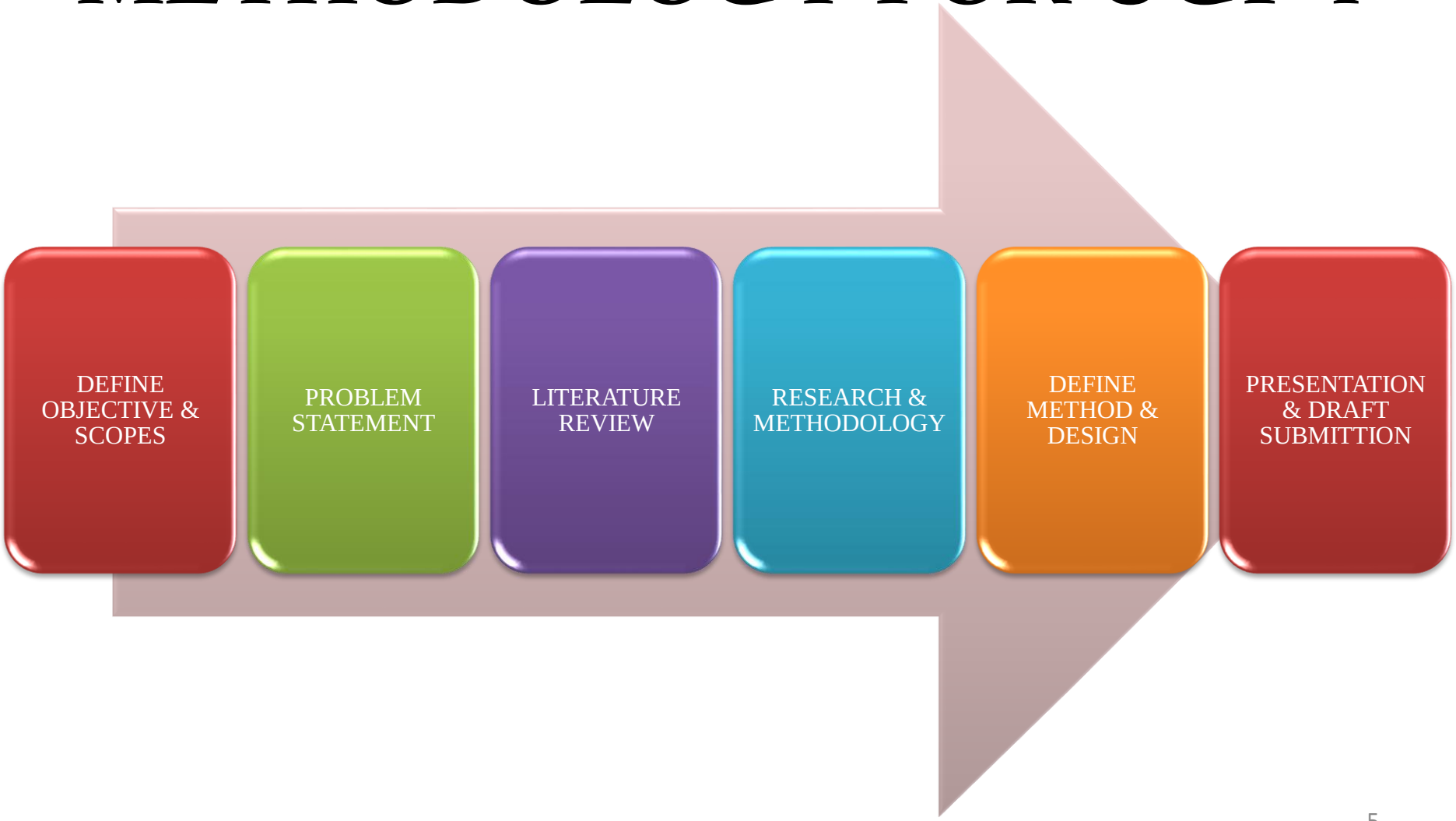
- Literature review studied on the shapes, sizes and configuration of the winglets that have been used on flying aircraft.
- The experiment will be executed at wind speed ranging from 10 to 20 m/s.(Until the vibration exist)
- Design from Styrofoam and carrying payloads navigation as well as the existing electronic parts such as flight controller, battery and etc.

WORK PLAN UGP 1

No	Task		Week (UGP1)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
1	Registration	Plan																	
		Actual																	
2	Problem Statement	Plan																	
		Actual																	
3	Objective & Scope	Plan																	
		Actual																	
4	Literature Review	Plan																	
		Actual																	
5	Research & Methodology	Plan																	
		Actual																	
6	Design & Analysis	Plan																	
		Actual																	
7	Presentation	Plan																	
		Actual																	

Legend	
Plan	
Actual	

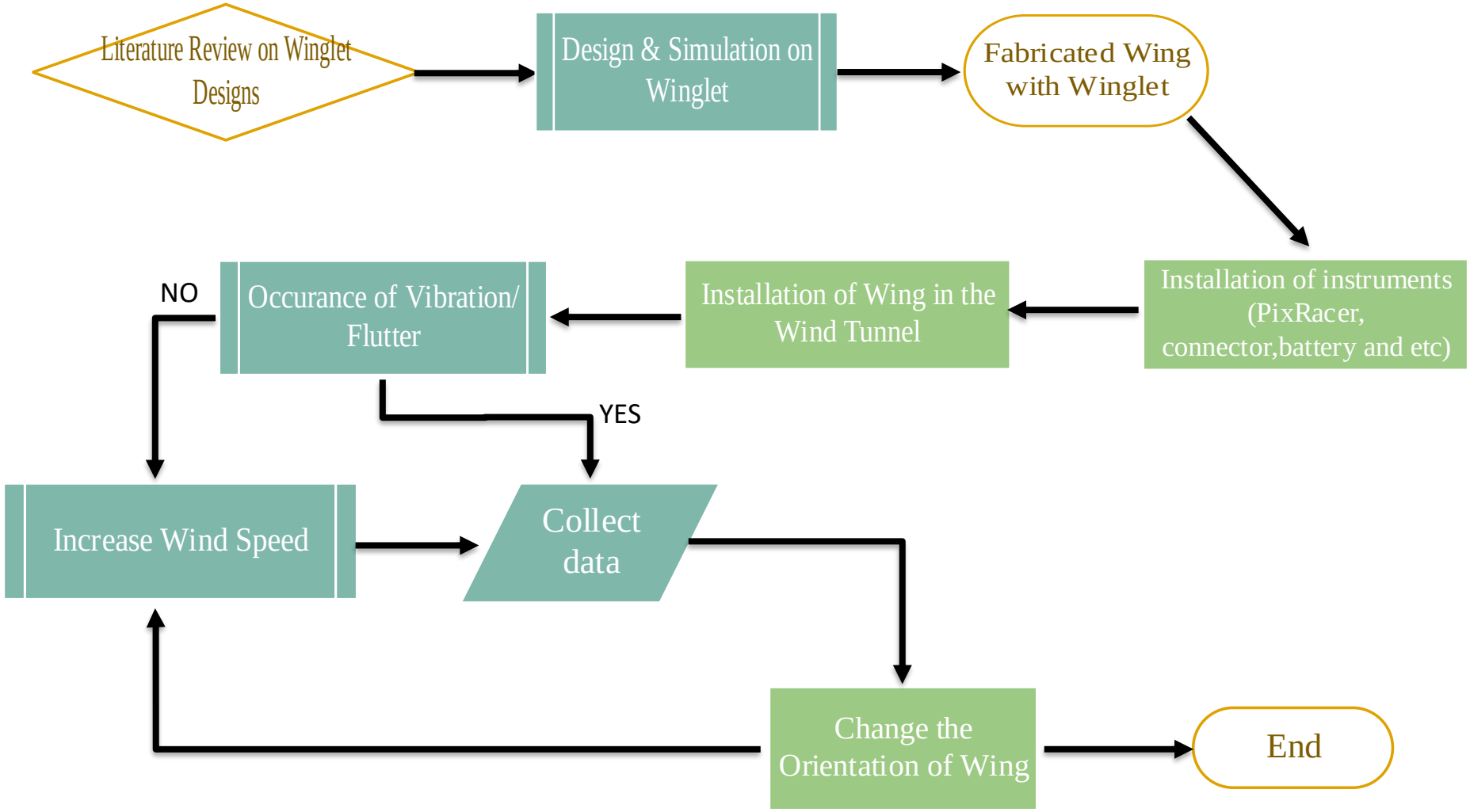
METHODOLOGY FOR UGP 1



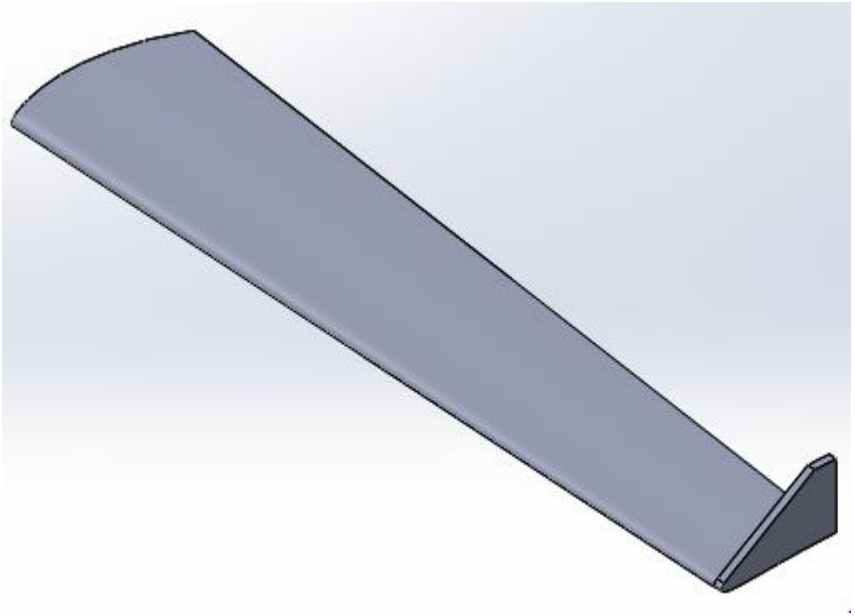
WORK PLAN UGP 2

No	Task		Week (UGP2)															
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1	Design,Fabricate,Experimental & Data Collection	Plan																
		Actual																
2	Discussion	Plan																
		Actual																
3	Conclusion/ Recommendation	Plan																
		Actual																
4	Thesis Writing	Plan																
		Actual																

METHODOLOGY FOR UGP 2

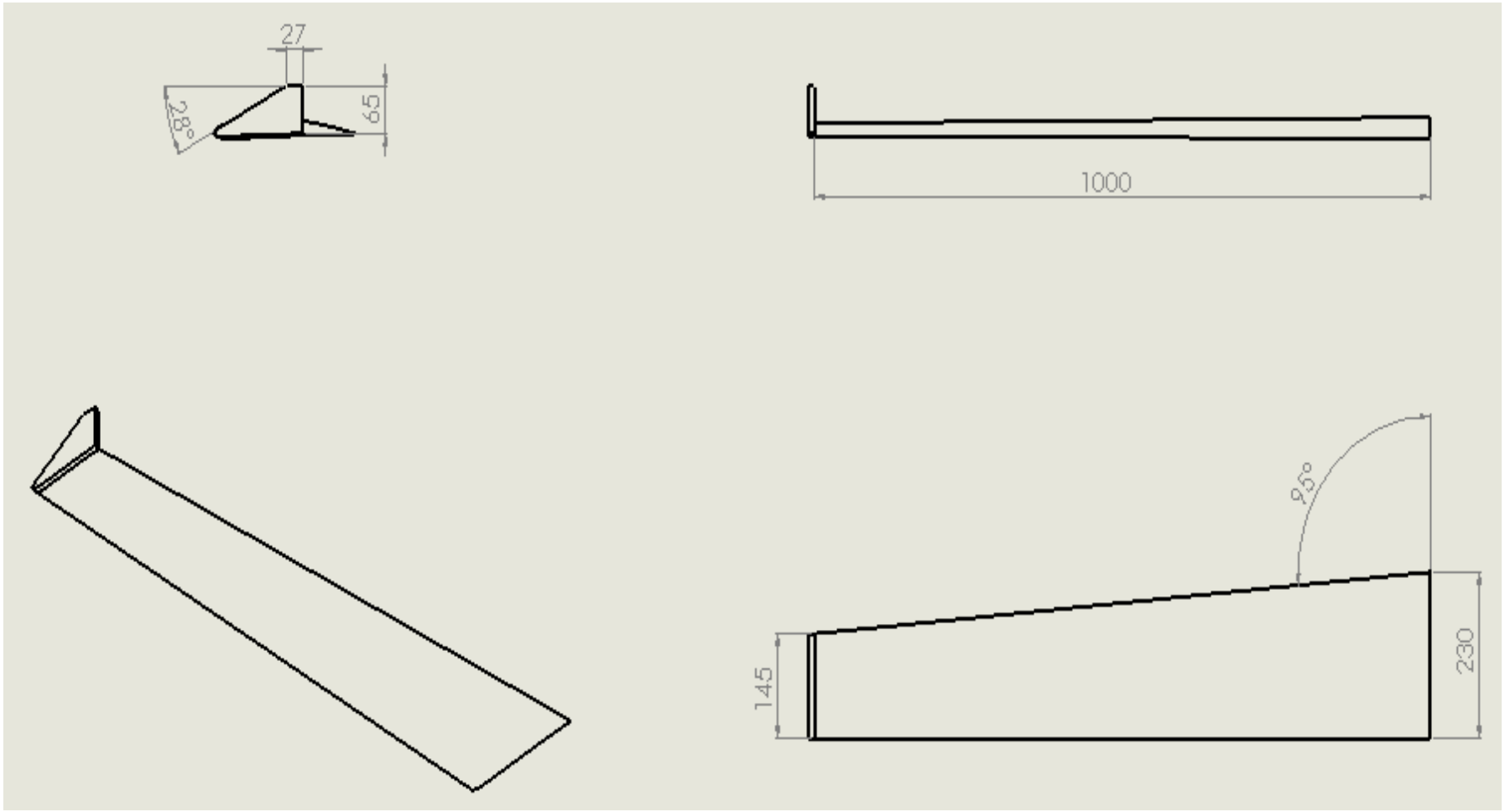


CURRENT DESIGN & ANALYSIS (UGP 1)



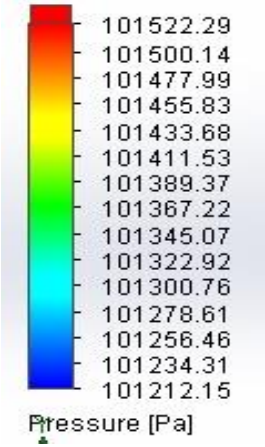
- Simulations done by SolidWorks.
- Flow type = Laminar and turbulent.
- Velocity Parameters = 15 m/s.
- Thermodynamic parameters = Applied.
- Static Pressure = 101 kPa.
- Material = High Impact Polystrene.

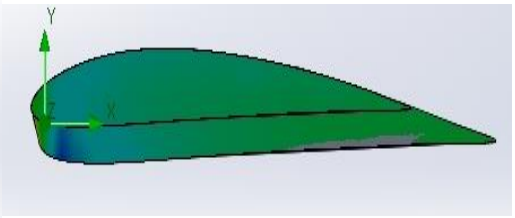
DETAILS ON DESIGN

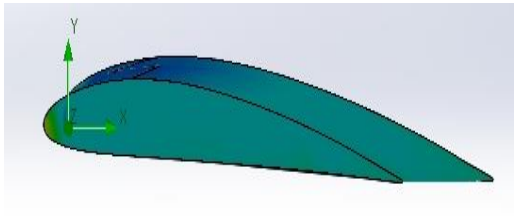


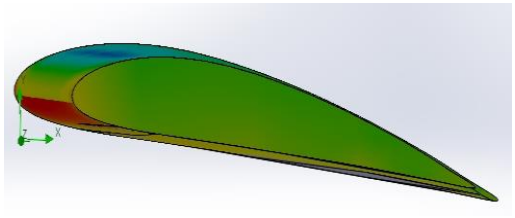
(AIRFOIL NACA 4412)

PRESSURE DISTRIBUTION









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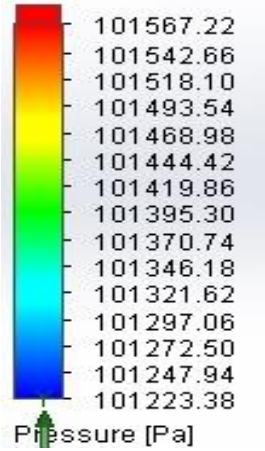
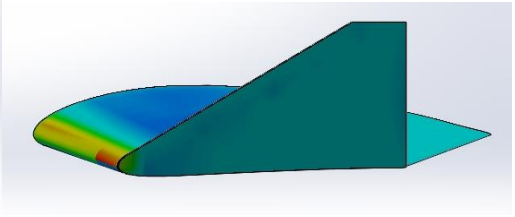
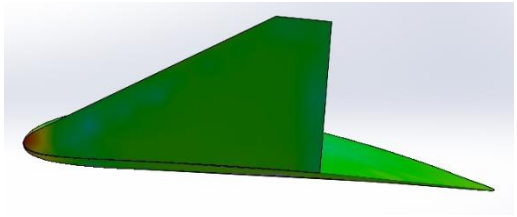
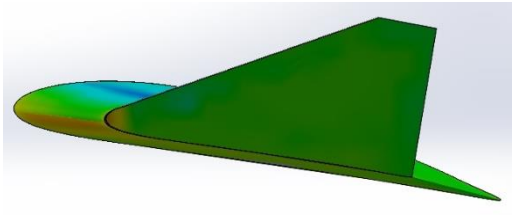


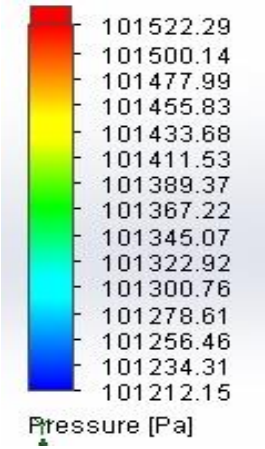






SIDE VIEW

PRESSURE DISTRIBUTION



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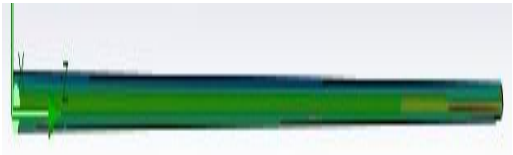

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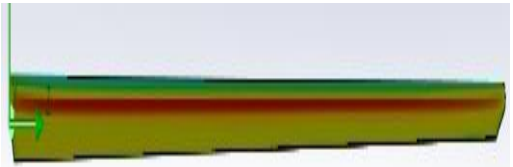

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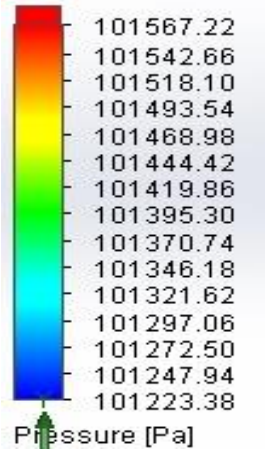
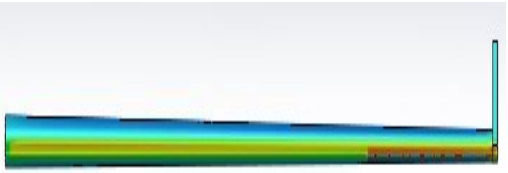
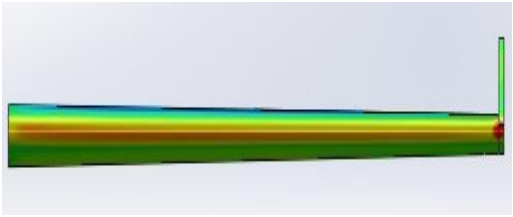
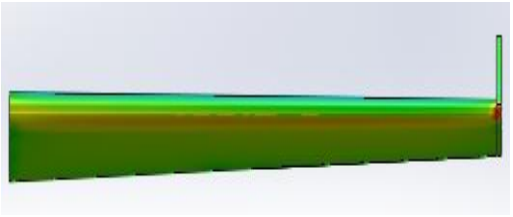


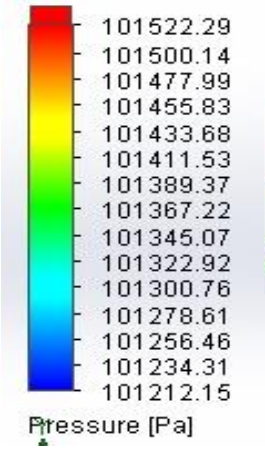


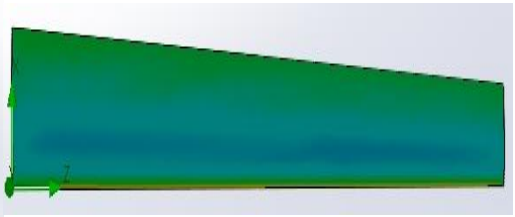




FRONT VIEW

PRESSURE DISTRIBUTION





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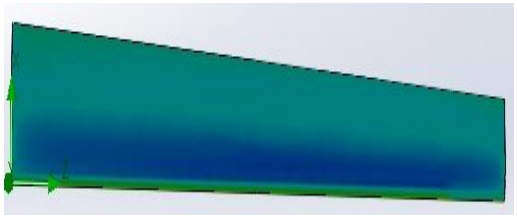

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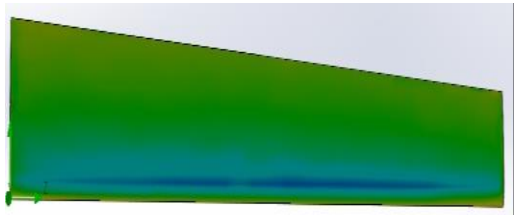

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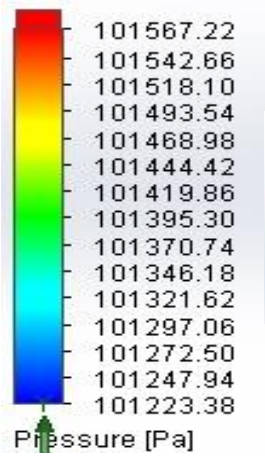
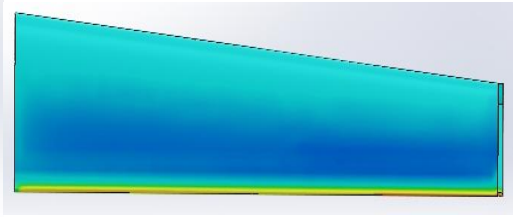
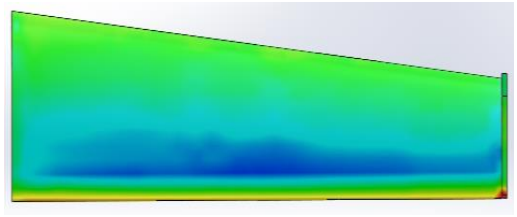
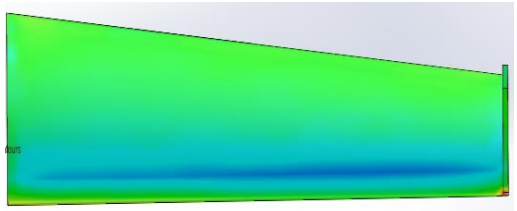


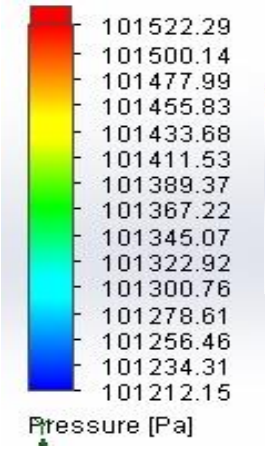


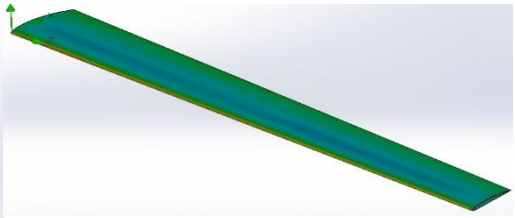




TOP VIEW

PRESSURE DISTRIBUTION





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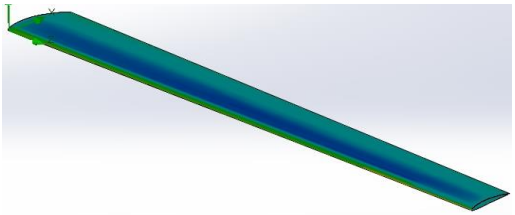

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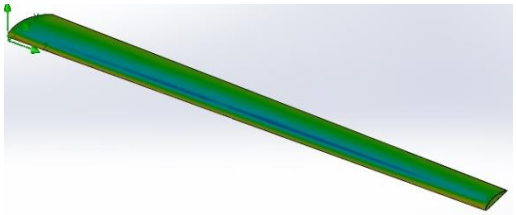

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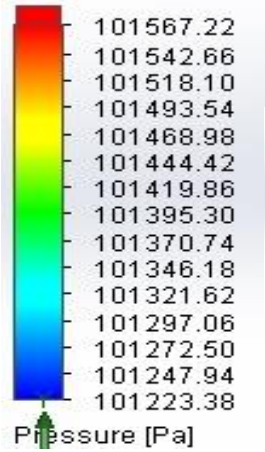
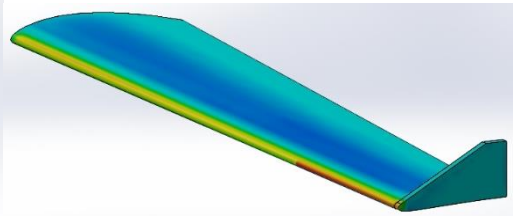
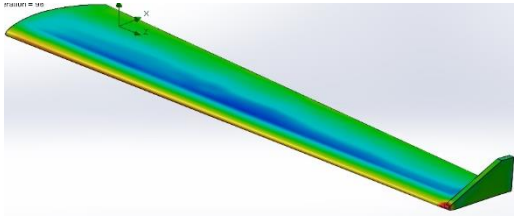
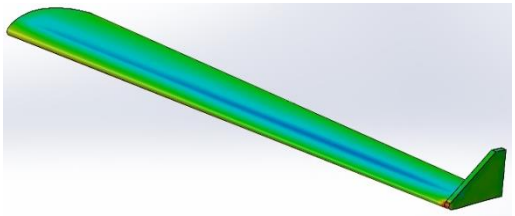


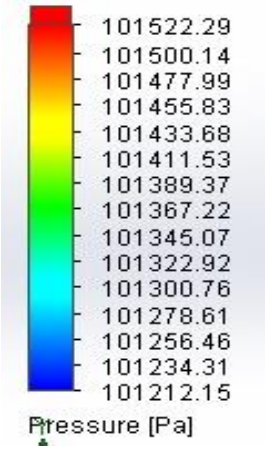


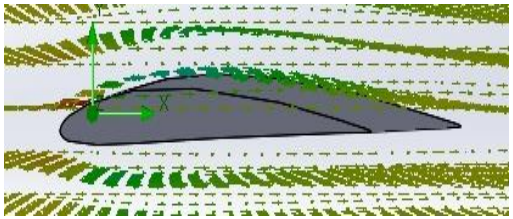


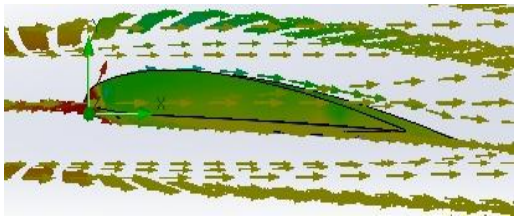


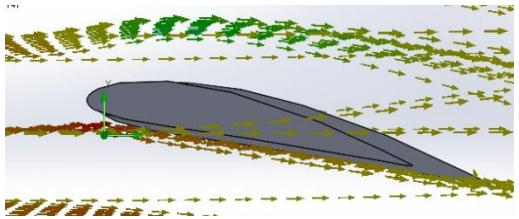
ISOMETRIC VIEW

PRESSURE DISTRIBUTION









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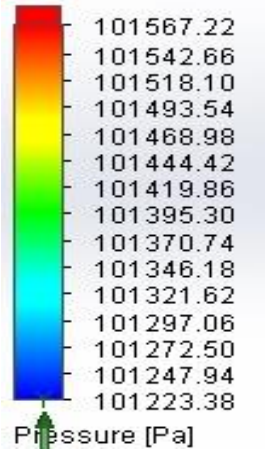
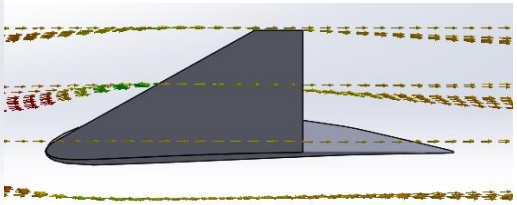
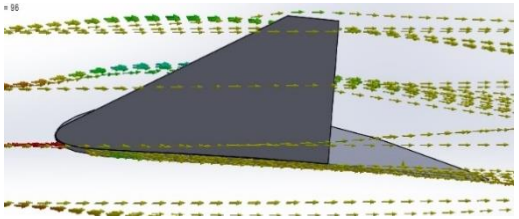
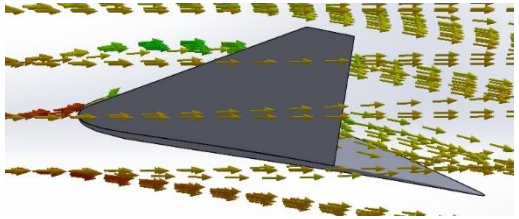


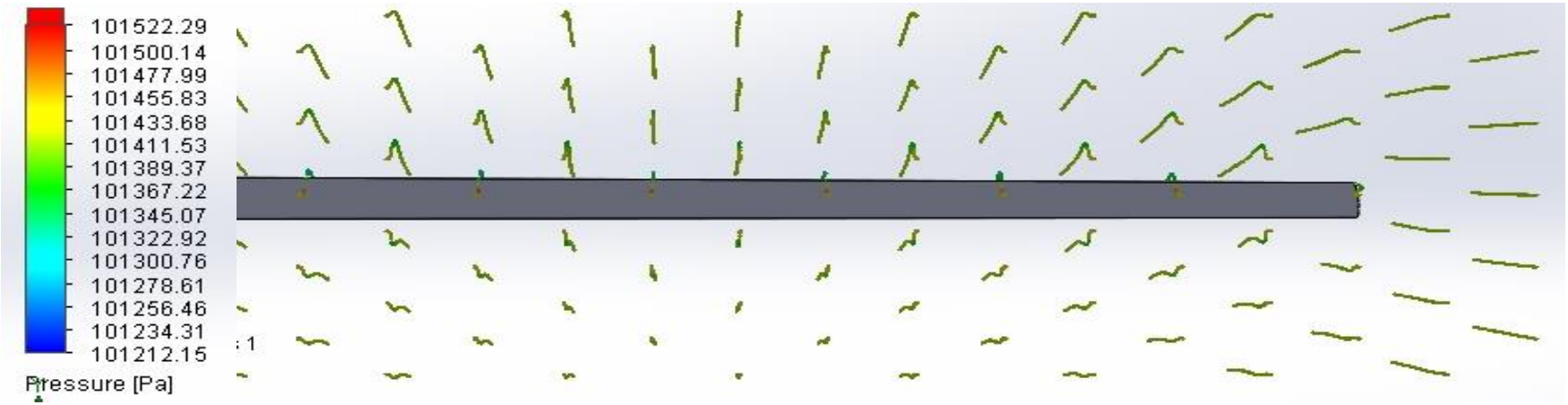


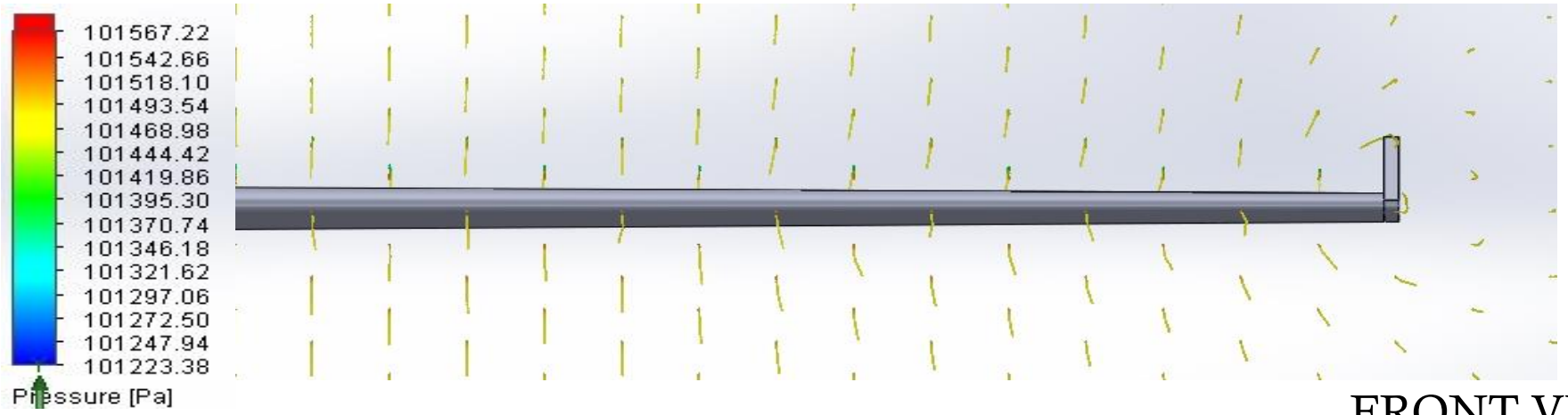




SIDE VIEW

PRESSURE DISTRIBUTION

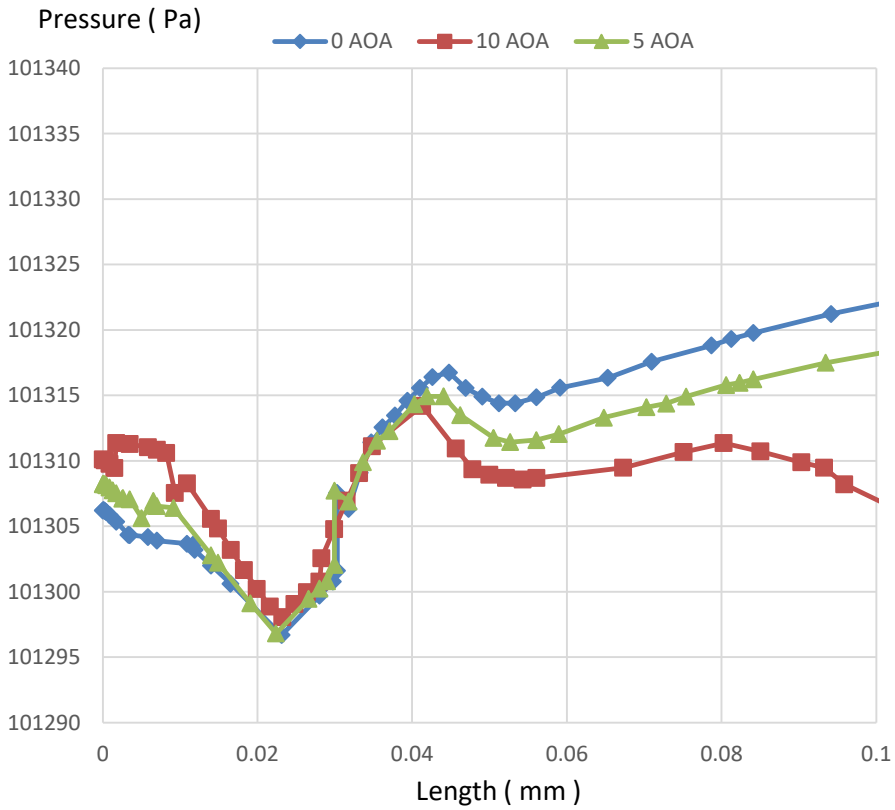




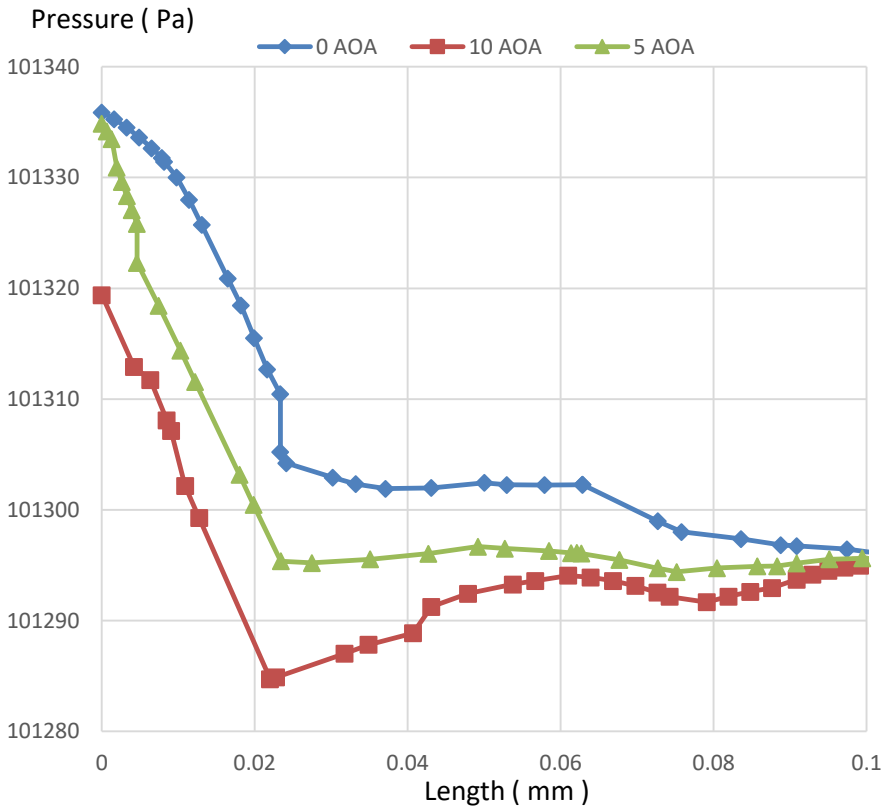
FRONT VIEW

RESULTS

PRESSURE DISTRIBUTION LOWER WINGSPAN

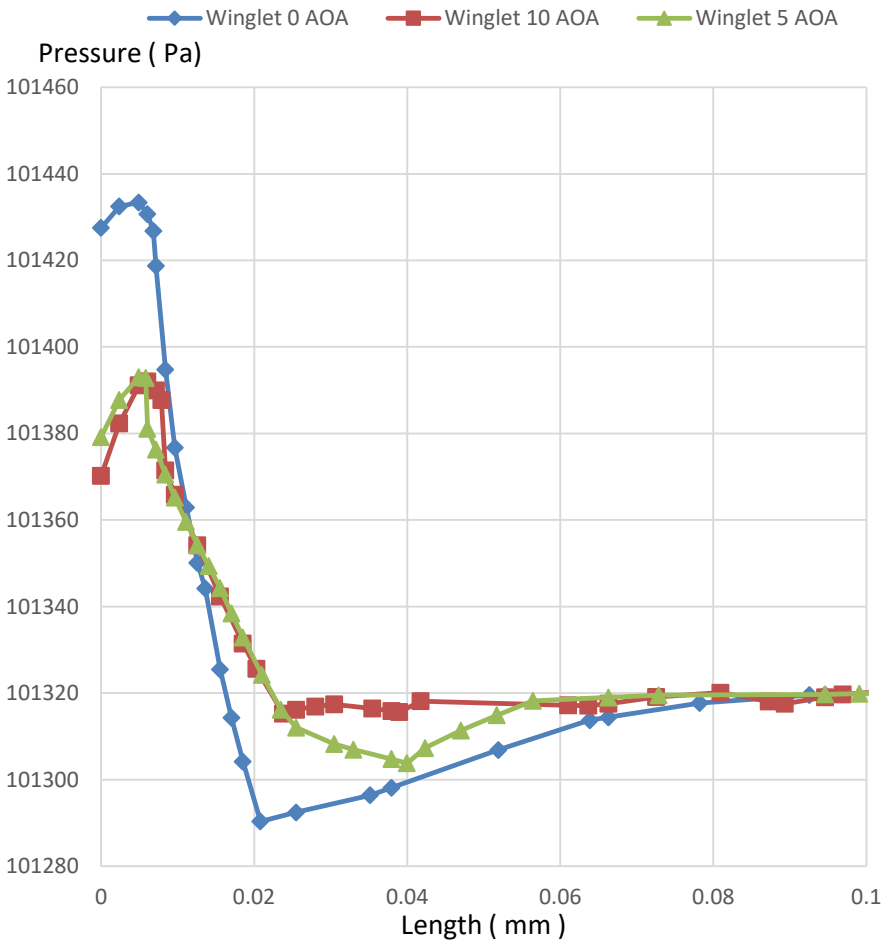


PRESSURE DISTRIBUTION UPPER WINGSPAN

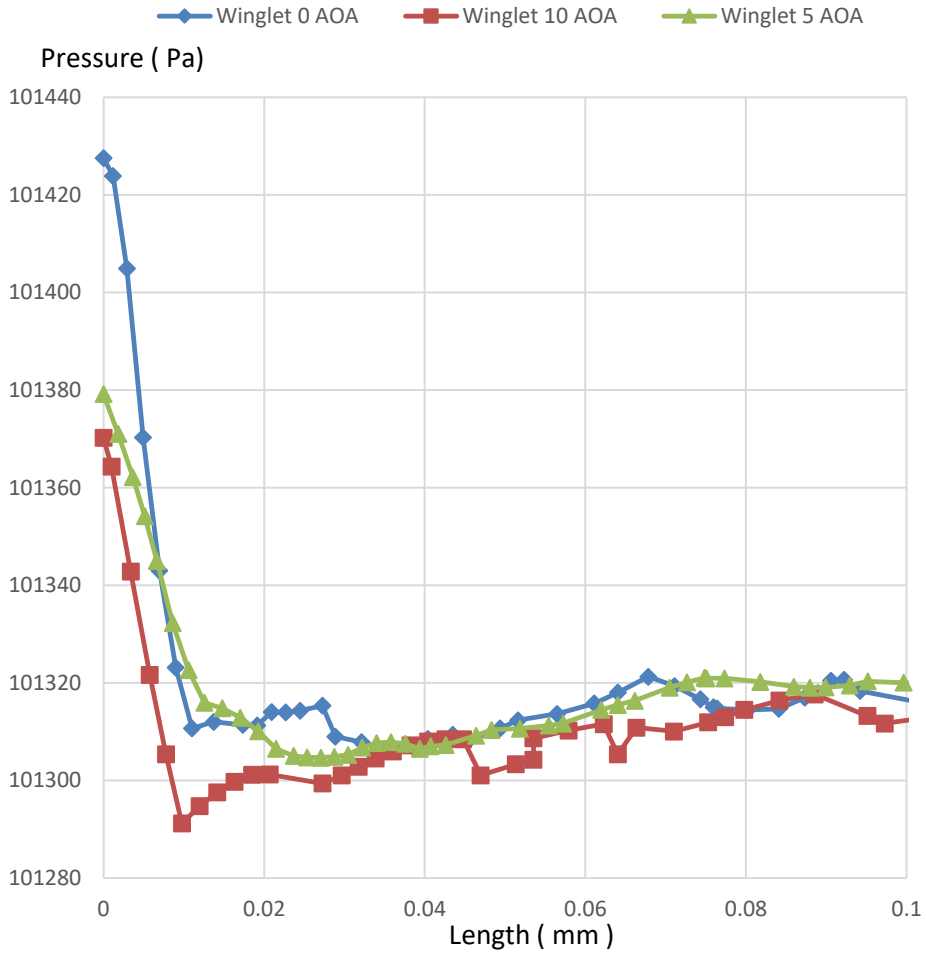


RESULTS

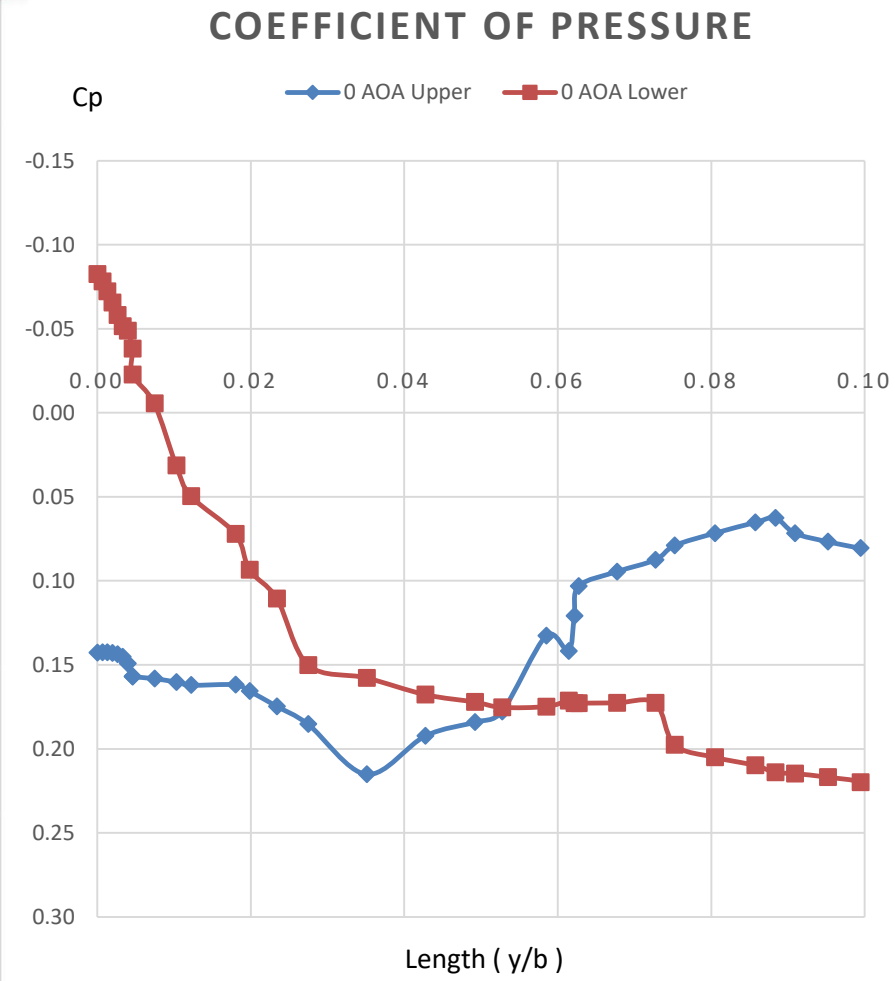
PRESSURE DISTRIBUTION LOWER WINGSPAN



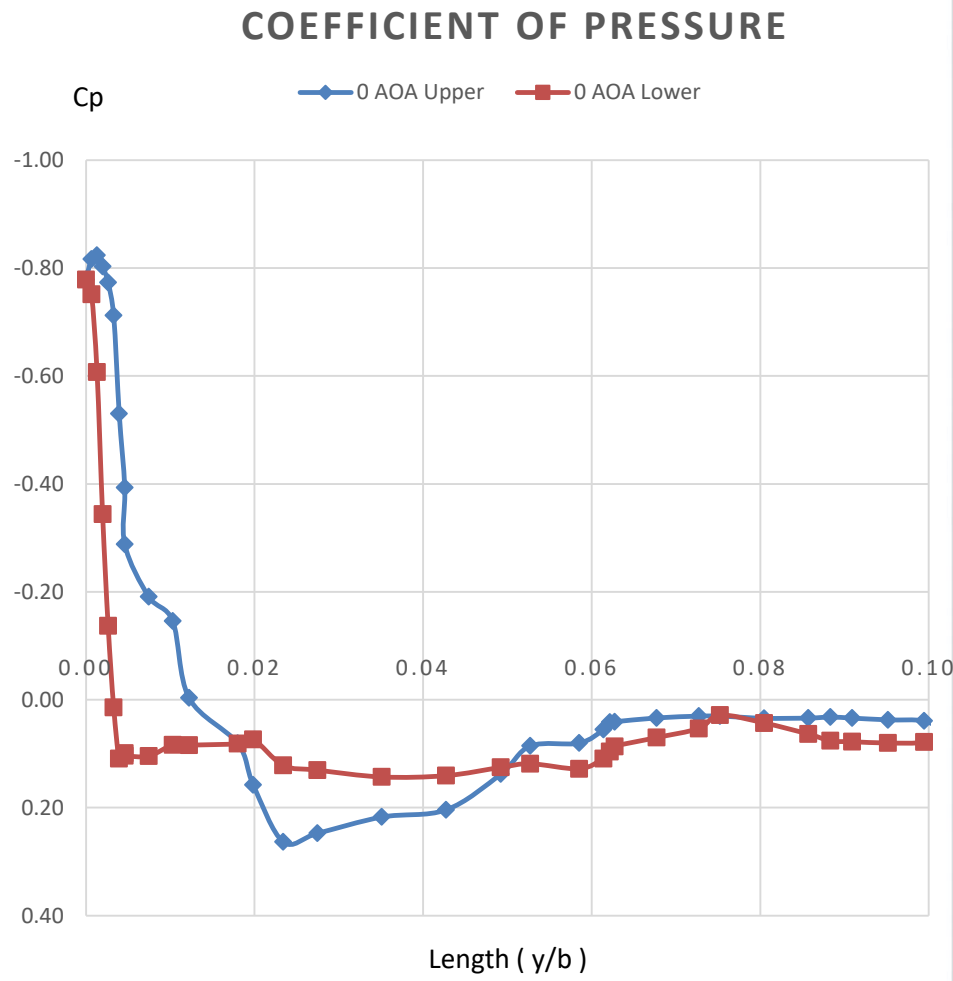
PRESSURE DISTRIBUTION UPPER WINGSPAN



RESULTS

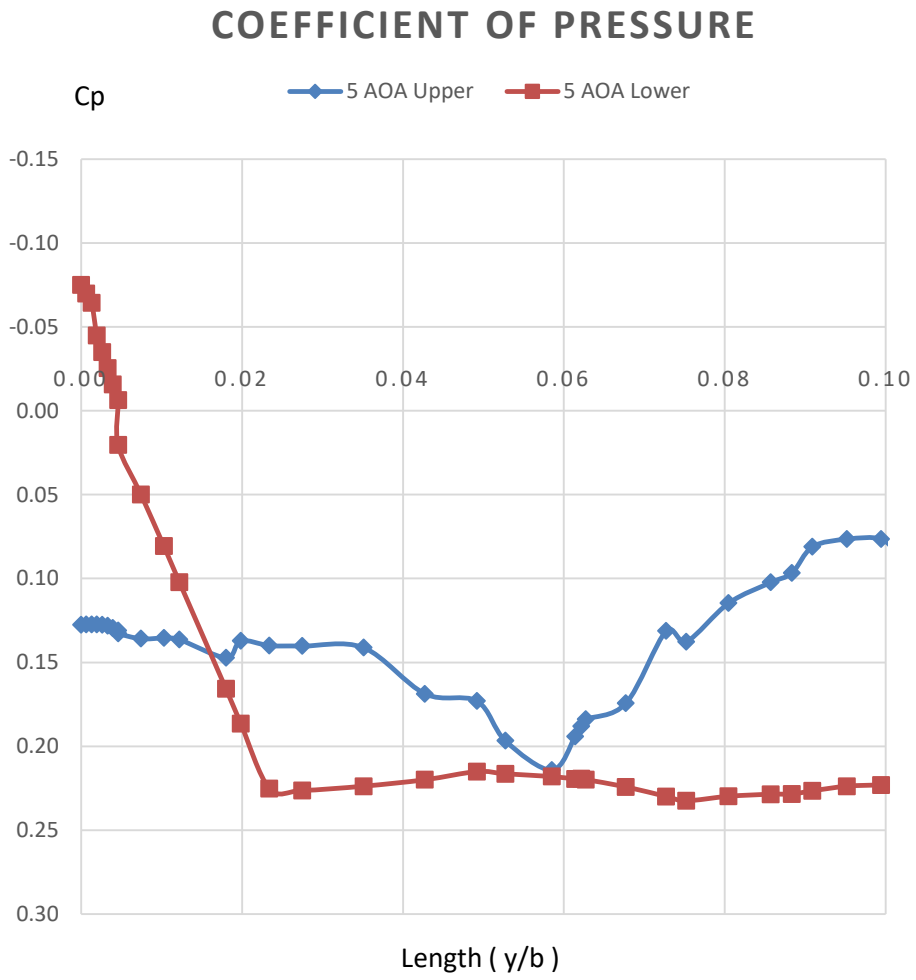


Without Winglet

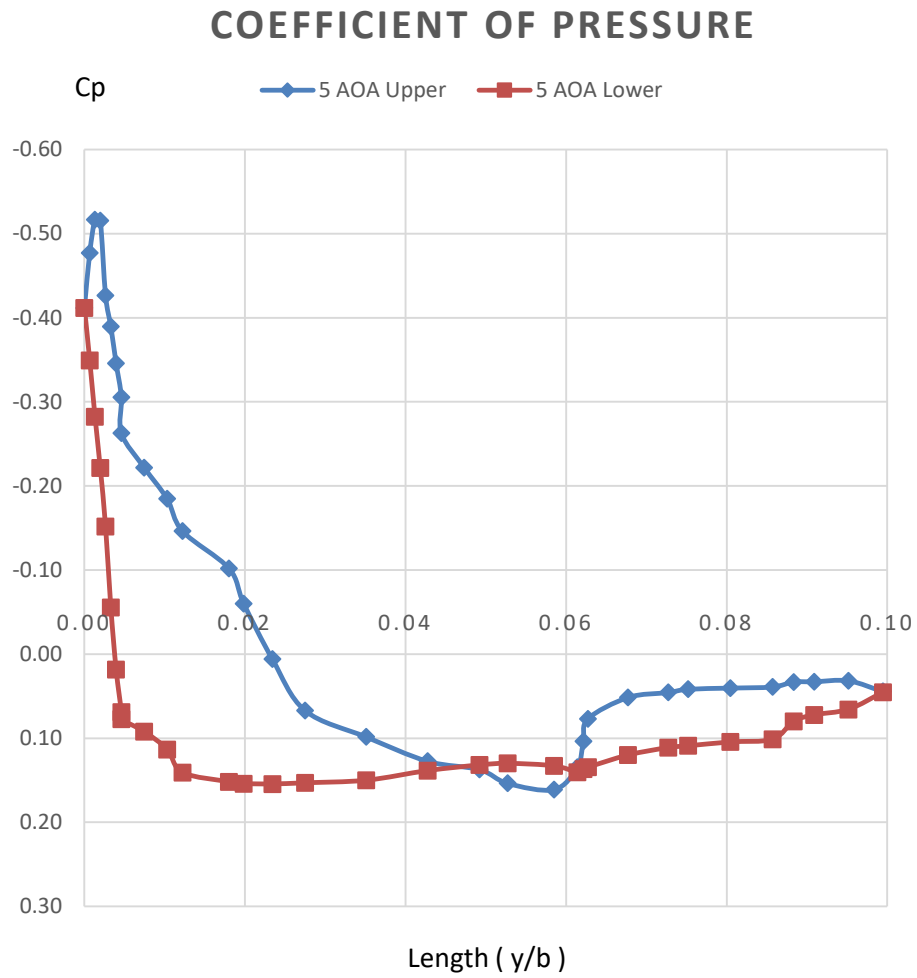


With Winglet

RESULTS

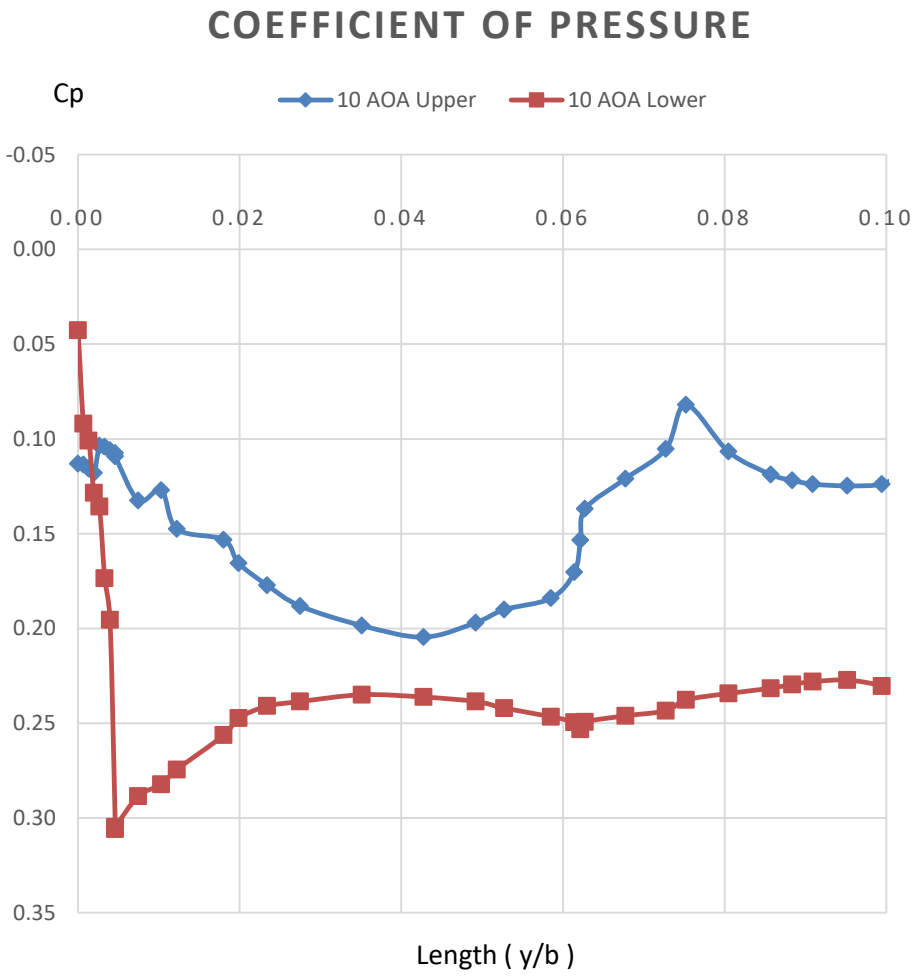


Without Winglet

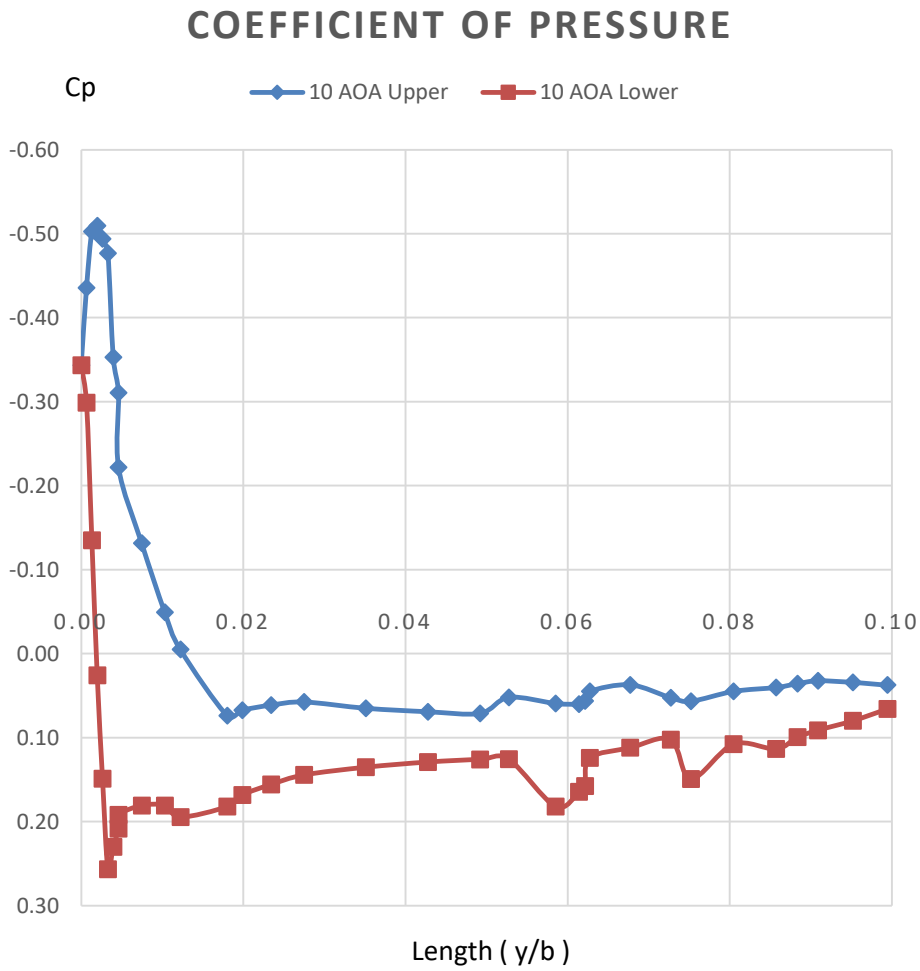


With Winglet

RESULTS



Without Winglet



With Winglet

RESULTS & DISCUSSION

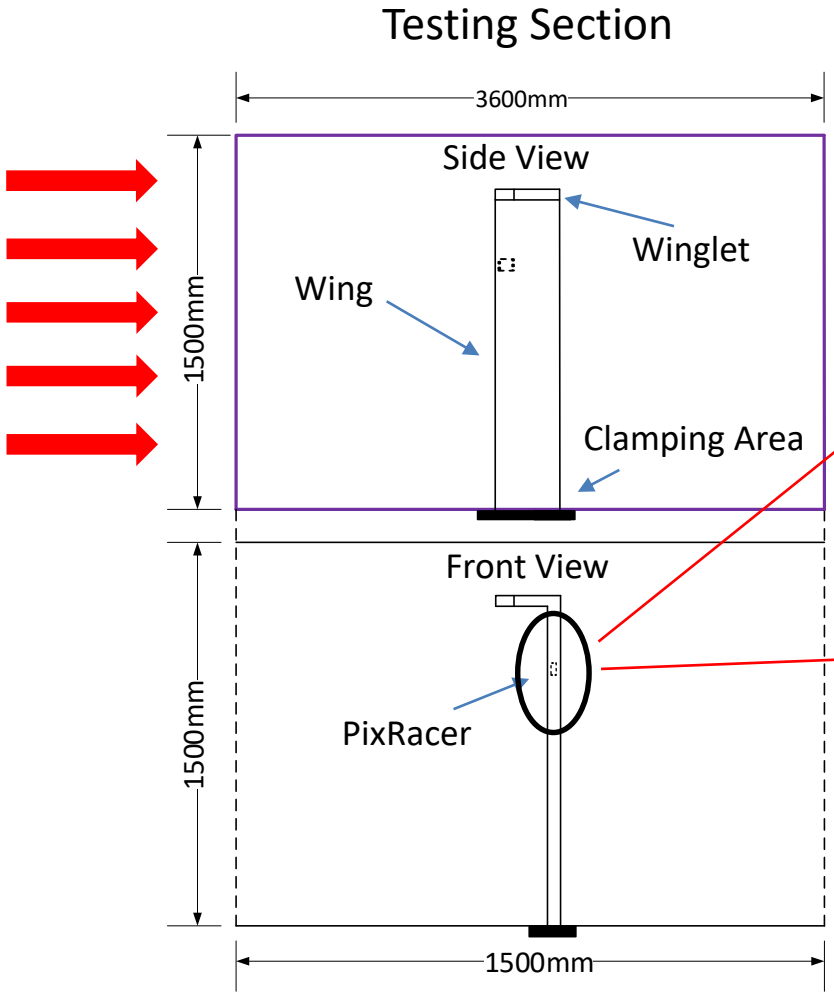
Without Winglet

- Pressure at lower wingspan is higher than upper.
- Lower wingspan-pressure are increase started at certain length.
- Upper wingspan-higher pressure at root and drop

With Winglet

- Pressure at lower and upper wingspan are almost same.
- High pressure started at root and drop.

EXPERIMENTAL SETUP FOR UGP 2



Receiver

DAQ System

Specification

- Pixracer V1.0 Flight.
- Weight Pixracer: 21.08g
- 36 x 36mm with 30.5 x 30.5mm hole grid with 3.2mm holes.
- MicroSD card reader, Micro USB.
- Power supply - 5-5.5VDC from USB.

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QUESTIONS
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ANSWERS