Group 5
Enhanced Agility of MAV's Using Adaptive Structures

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Overview

Introduction

Design Concept

Test Setup

Cost Analysis

Conclusion

Future Work

Introduction

Motivation:

- Unmanned Aerial Vehicle (UAV) operating limitations

Project Focus:

- Implementation and Testing of adaptive structures in Micro-Air Vehicle (MAV)

ure 1: http://www.skilluminati.com/research
try/there_is_only_one_war_and_it_is_a_class_war/

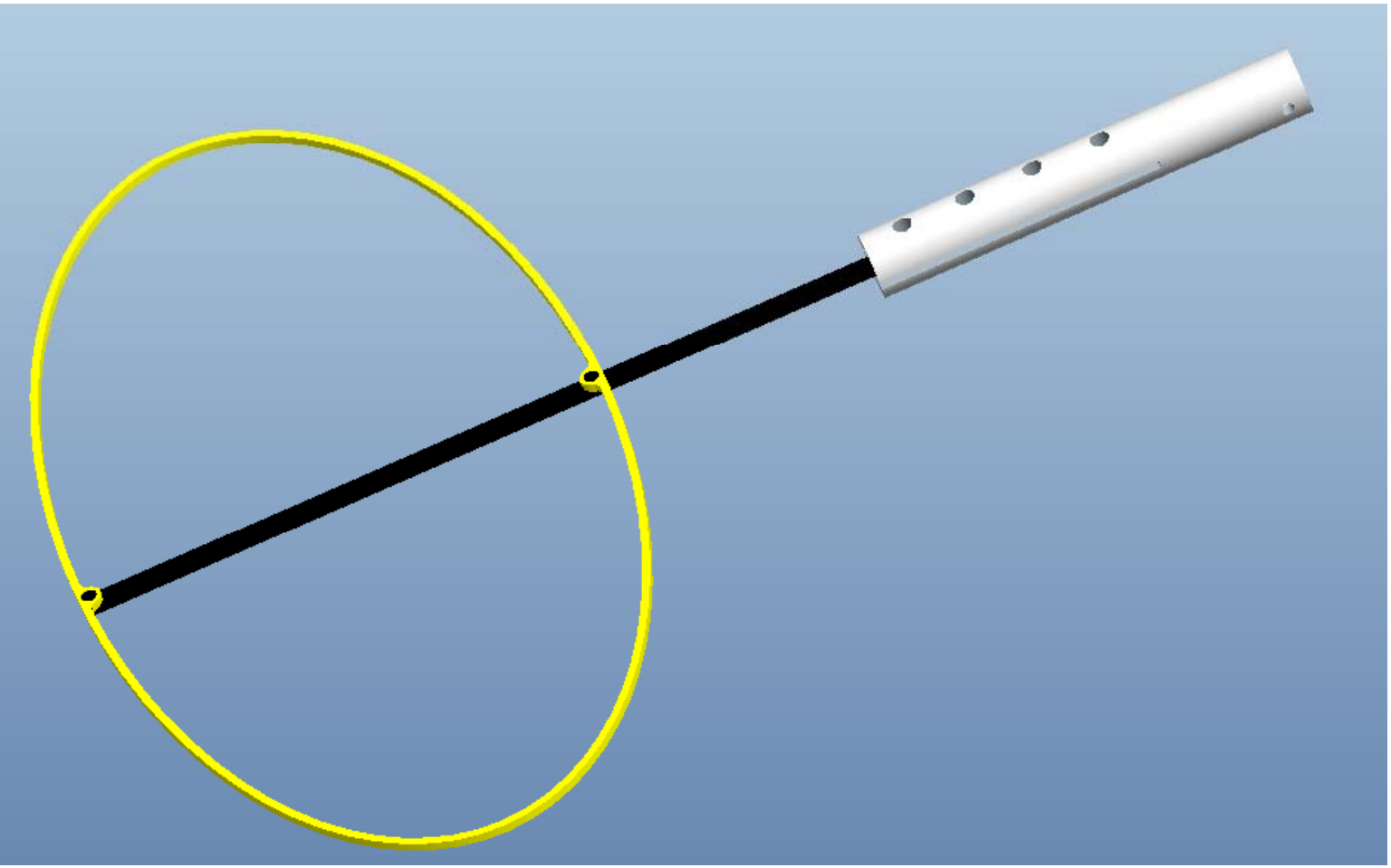
Figure 2: http://defense-update.com/products/p/predator.htm

Introduction

Project Specifications:

- Compatible with test equipment
- Reconfigurable
- Operating Range: Re < 10^5
- Largest Airfoil Dimension: ≤ 20 cm

Design Concept



Design Concept: Elliptical Wing

Ellipse

- Major Axis: 20cm
- Minor Axis: 10cm
- 1/16” thickness

Material:

- Aluminum

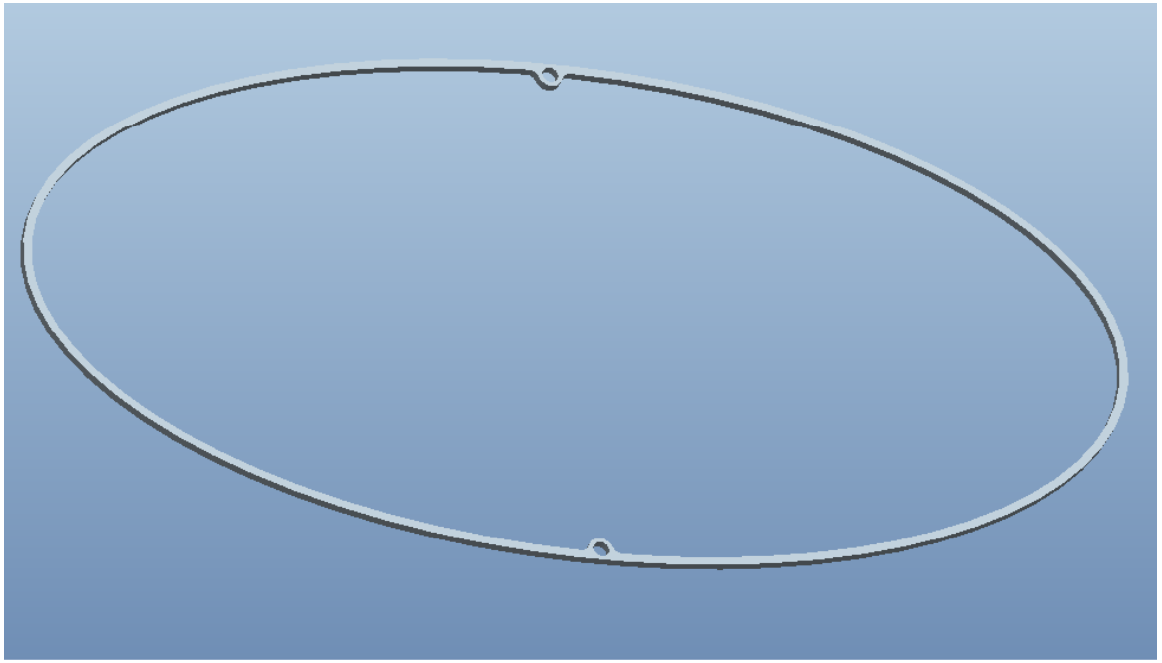


Figure 4: Elliptical Wing

Design Concept: Frame Connector

Minimal Affect on Flow

Press Fit

Non-conductive

Zero Delfection

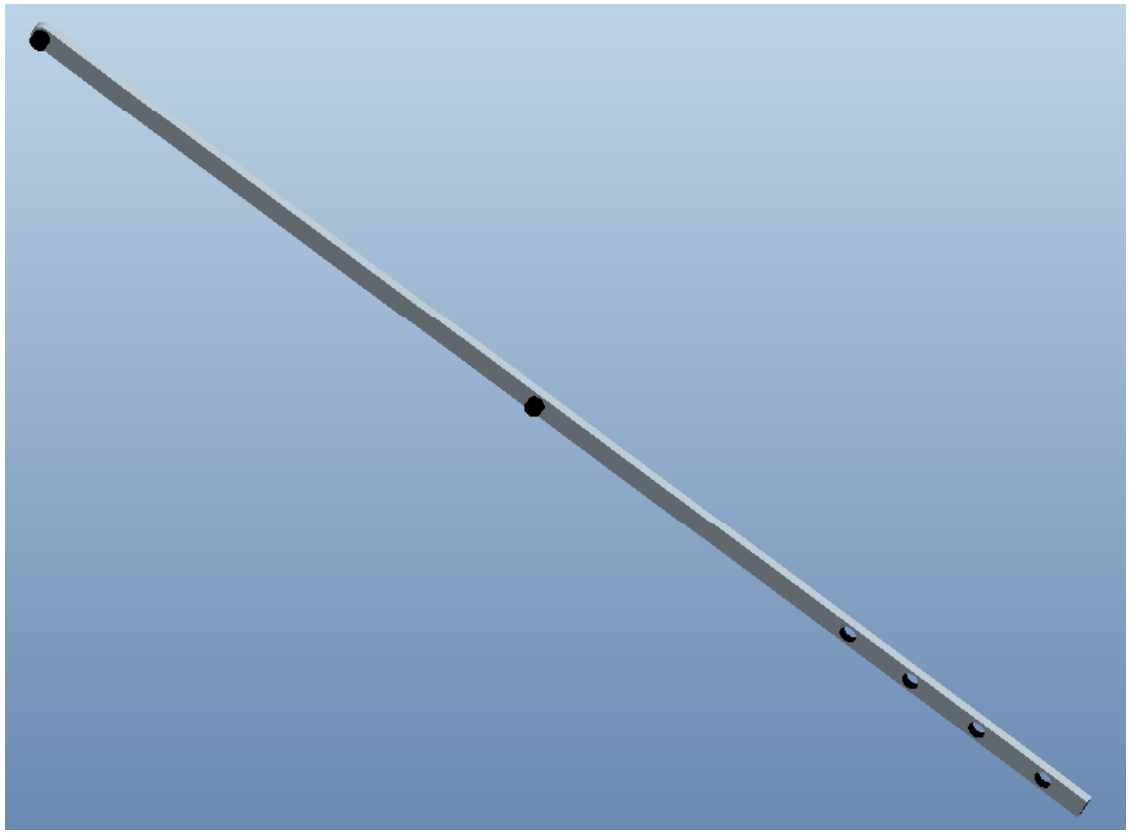


Figure 5: Elliptical Wing

Design Concept: Sting Connector

Non Conductive

Press Fitting

Remain Immobile

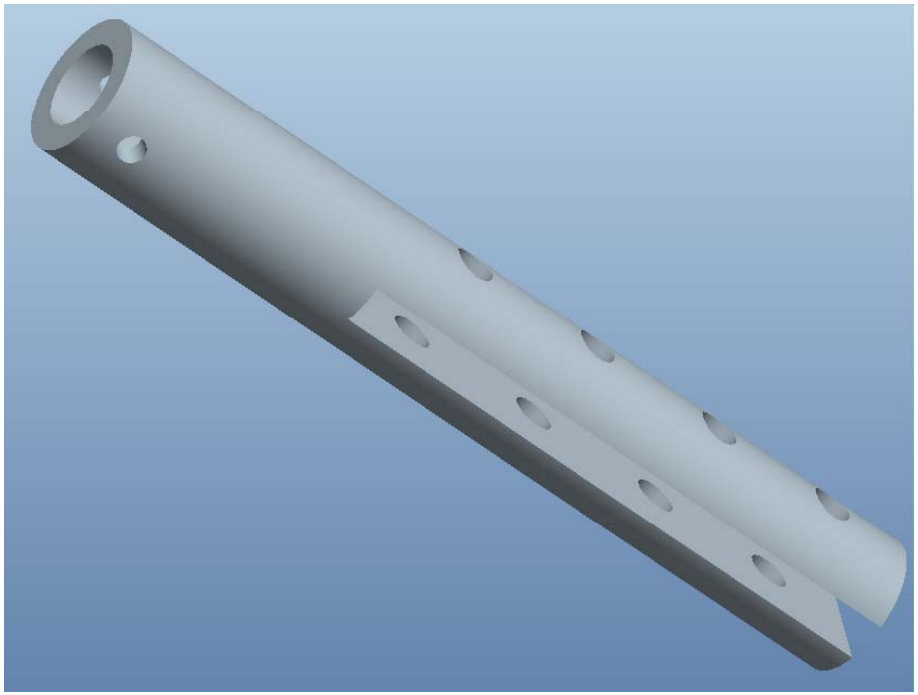


Figure 6: Sting balance connector

Design Concept: Wing Membrane

Materials:

- High strength bonding (VHB) tape
- Carbon Grease

Preparation:

- 300% Strain

Figure 7: VHB Tape 4910

Testing

REEF testing facilities

- Low speed wind Tunnel
- Sting Balance

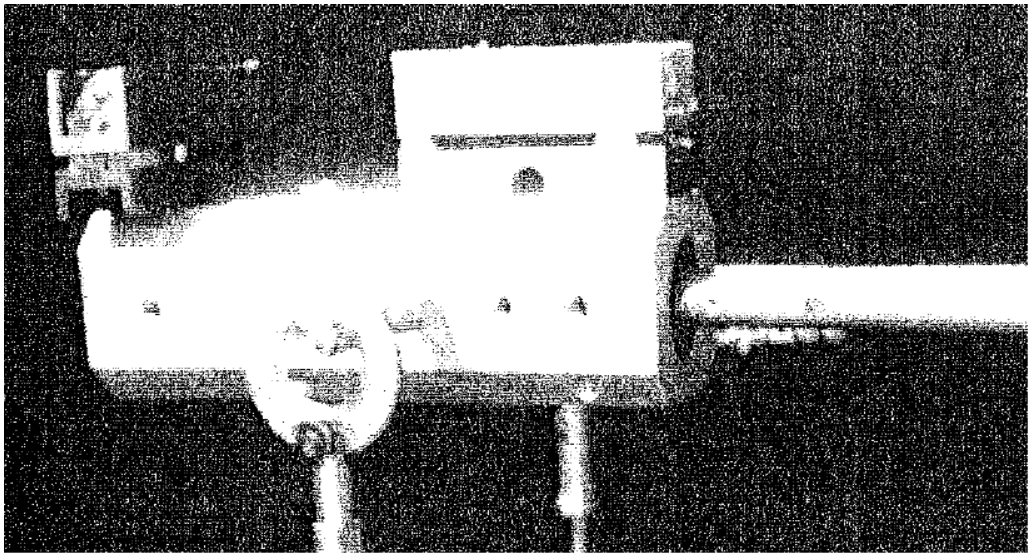


Figure 7: Sting Balance

Test Parameters:

- Wind Tunnel Velocity
- Angle of Attack
- Applied Voltage

Two test configurations:

- Leading Edge
- Rolling

Testing Leading Edge

Vary Electrode Thickness

- 0.4 in
- 0.8 in
- 1.2 in

Focus:

- Increase Lift
- Increase Critical Attack Angle

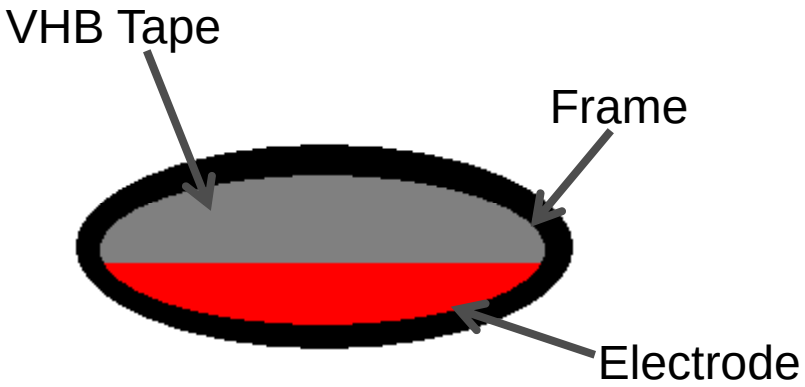


Figure 8: Electrode Placement

Testing Roll

Vary Electrode Thickness

- 1.32 in
- 2.64 in
- 3.96 in

Focus:

- Viability

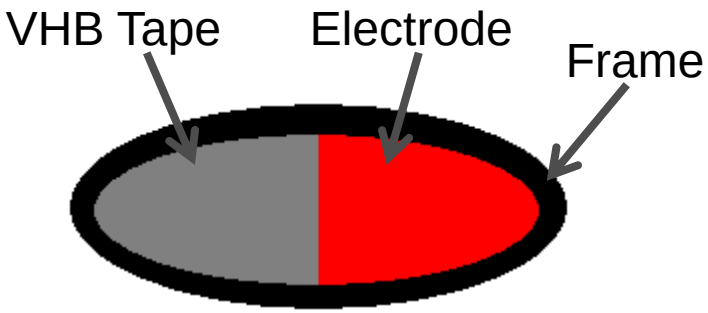


Figure 9: Electrode Placement

Cost Analysis

Material	Vendor	Purpose	Number required	Part Cost	Total cost
Aluminum	eMachineShop.com	Wing body	1	$36.66	$36.66
3M-VHB	McMaster-Carr	Actuating Material	2	$25.03	$50.06
Carbon Grease	Circuit Specialists	Electrode	1	$12.40	$12.40
Small Gauge Electrical Wire	Hardware World	Electrical Wiring	1	$6.78	$6.78
Sting Connector	FAMU-FSU College of Engineering	Plastic	1		
X-Acto Knife with Blades	Amazon	Cutting	1	$8.84	$8.84
Gasoline	BP	Transportation	20	$2.79	$55.80
	FAMU-FSU College of Engineering	Insulation Material	1		
Total Cost					$170.54

Future Plans

Conference call with client

Proper placement of electrodes

Final material selection and ordering

Finalize Design

Flow Visualization

Schedule time at Eglin's REEF facilities

References

Hays Michael, Jeff Morton, Ben Dickinson, and William Oates. "Aerodynamic Control of Micro Air Vehicle Wings."

Acknowledgements

Dr. Ben Dickinson
Dr. William Oates
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