

TEAM #321

WORCESTER POLYTECHNIC INSTITUTE

GOAT WORKS

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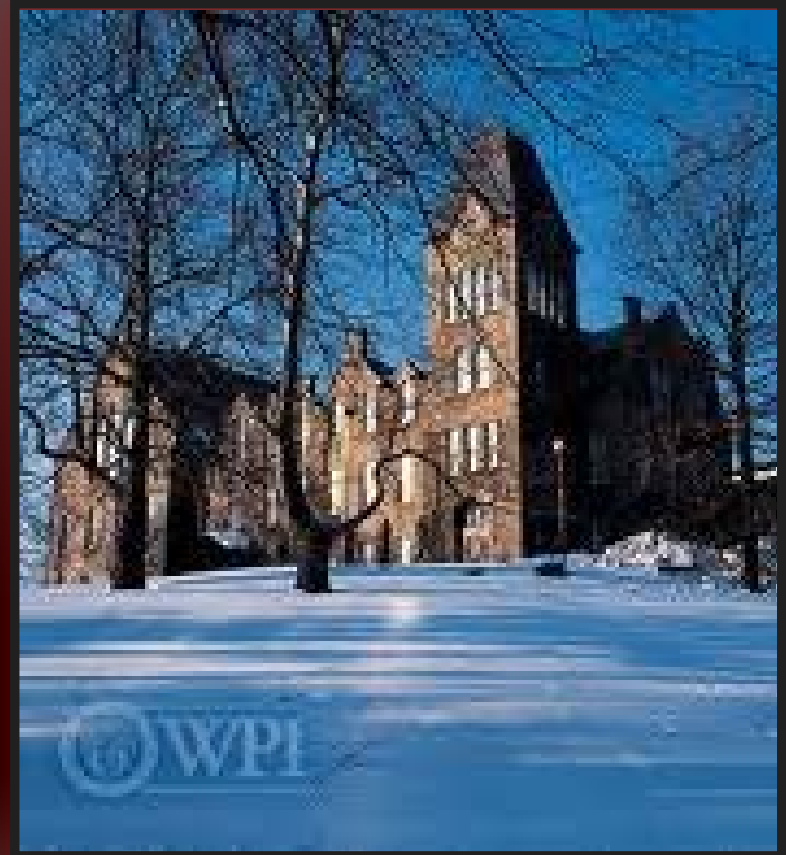


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Keegan Mehrtens
Carlos Sarria-Pardo

Advisor: Professor David Olinger
Co-Advisor: Professor Simon Evans

PRESENTATION OVERVIEW

- Introduction
- Engineering Process
- Research
- Calculations
- Experimentation
- Final Design Summary
- Manufacturing Cycle
- Conclusion



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SAE AERO DESIGN, MICRO CLASS

Requirements for Success [1]

Empty Weight

Assembly Time

Payload Fraction

Electric Powered

Operational Availability

Carrying Case Dimensions

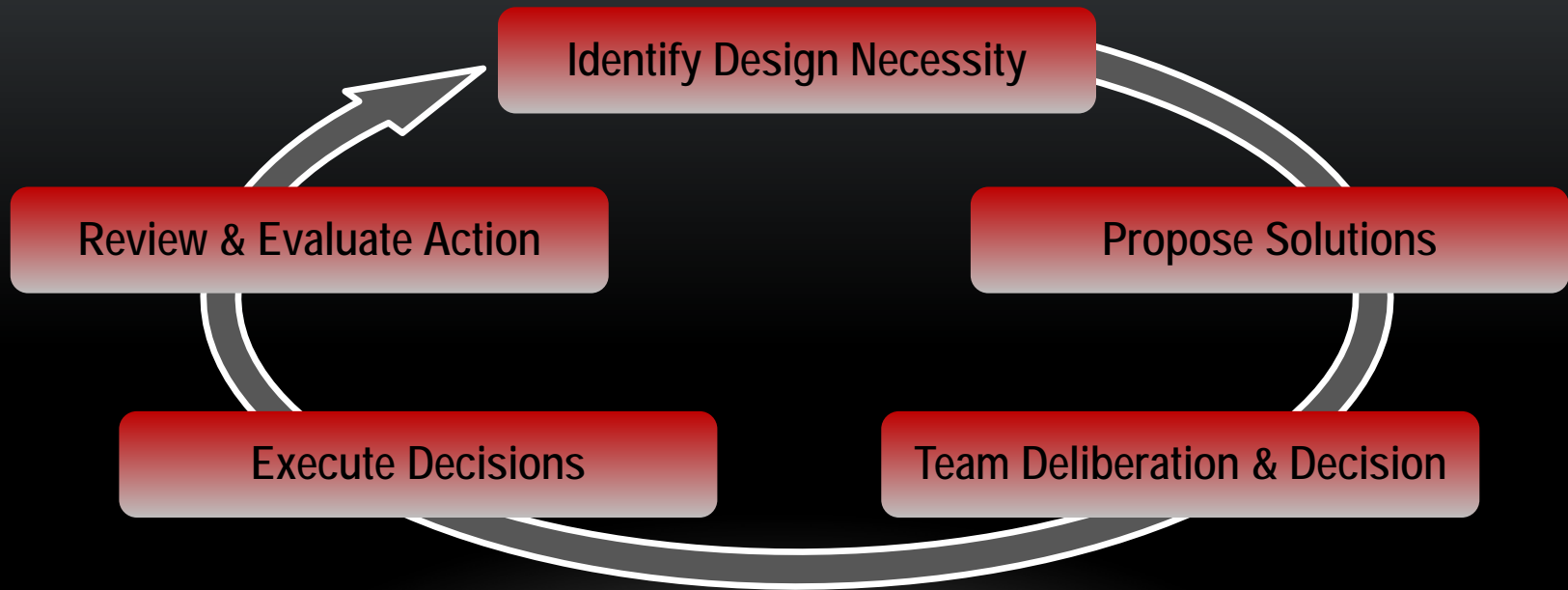


GOAT WORKS

ENGINEERING PROCESS

~ Low Empty Weight ~

~ Reliable & Simple Manufacturing ~



GOAT WORKS

RESEARCH



[2]

~ Competition History ~
~ Trade Secrets ~



[3]

- Past Design Entries -
- RC Forums and Online Guides-
- Local Hobby Shops –
- Nearby RC Organizations and Clubs-

GOAT WORKS

CALCULATIONS

~ Accurately Predict Performance ~

~ Justify Design Decisions ~

- Required Electronics -
- Payload Prediction -
- Wing Sizing -

- Stability Analysis -
- Wing Loading -
- Lift and Drag -

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EXPERIMENTATION

~ Test Data To Verify Calculations ~

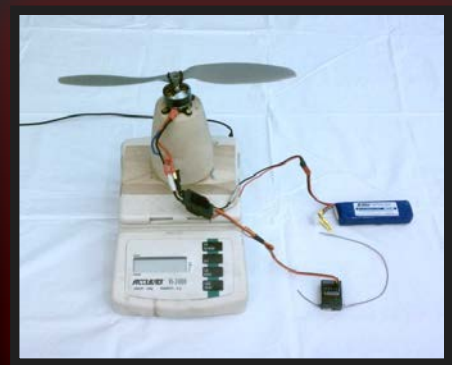
Wind Tunnel



Wing Loading



Thrust Stand



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"TINA"

~ Final Design Specifications ~

Wingspan: 50.20 in

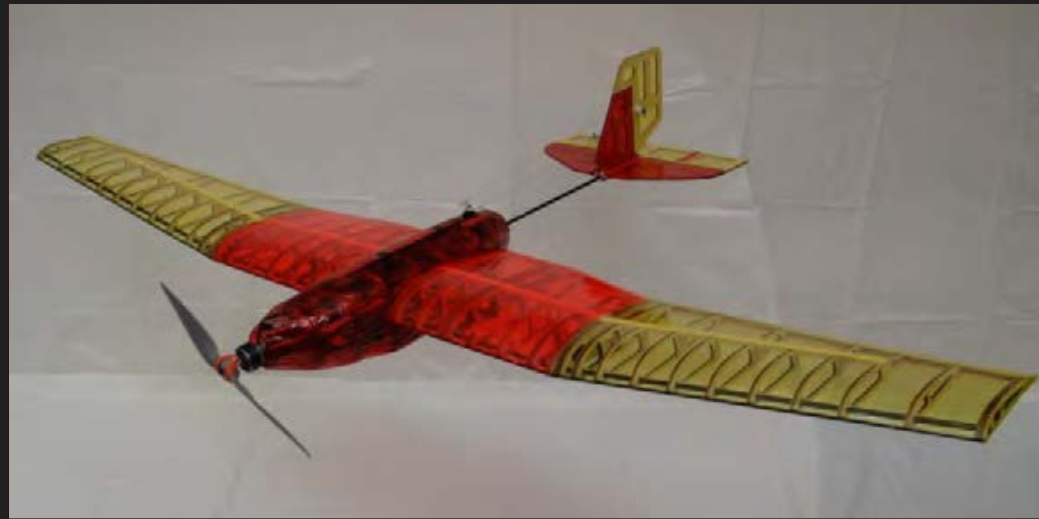
Empty Weight:

0.825 lbs

Length: 29.75 in

Payload Fraction:

72.73 %



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WING ASSEMBLY

"The airplane stays up because it doesn't have the time to fall."

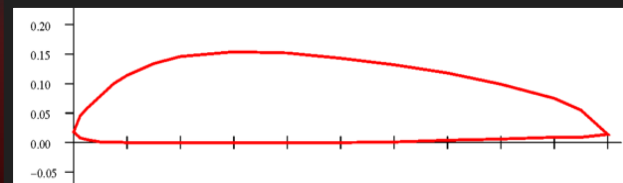
- Orville Wright [5]

- 10° Polyhedral -

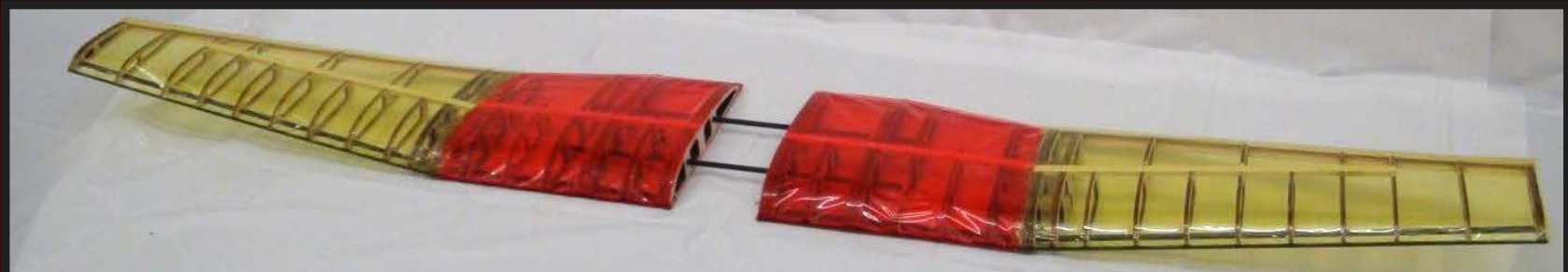
- Glenn Martin 4 Airfoil -

- Tapered Chord -

- 2 Piece Wing -



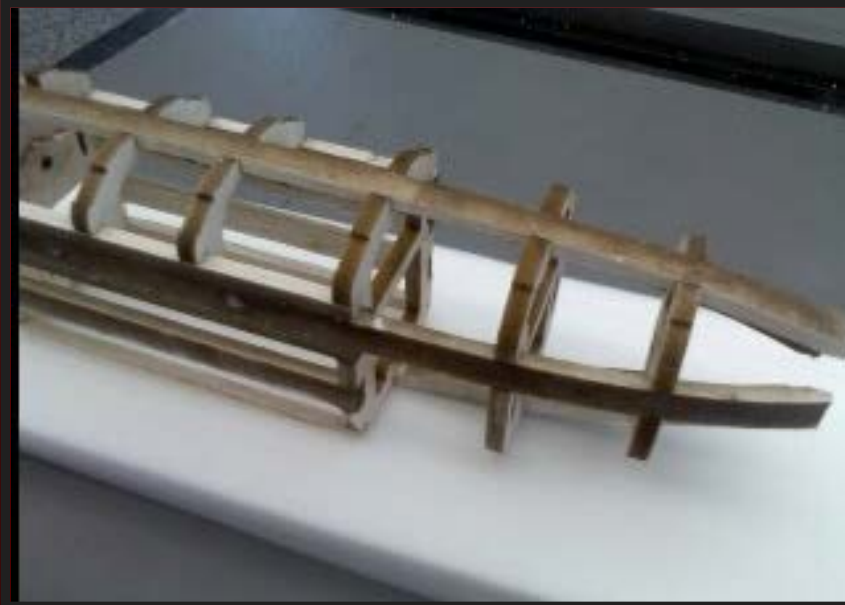
[6]



GOAT WORKS

FUSELAGE

~ Synchronizes All Sub-Assemblies ~



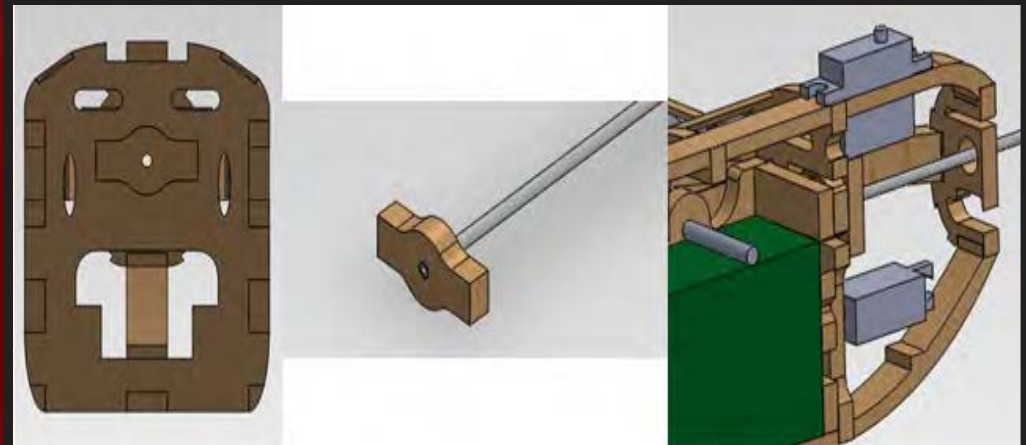
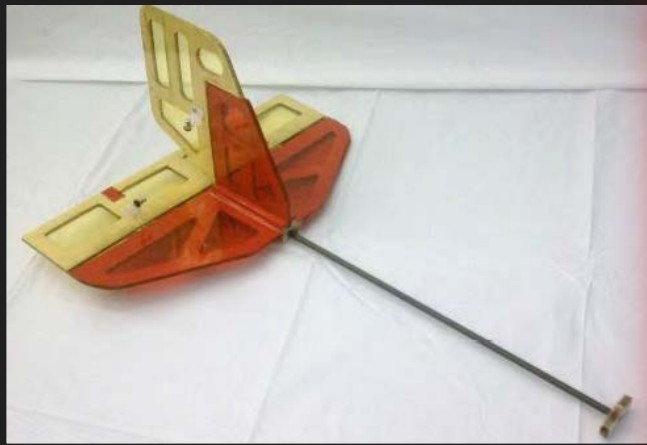
- Former & Longeron -
Configuration
- Houses Electronics -
- Encloses Payload Bay -
- Controllable P-factor -

GOAT WORKS

TAIL ASSEMBLY

~ Collapsible Boom Design ~

- Locking Mechanism -
- Pull / Pull Control System -

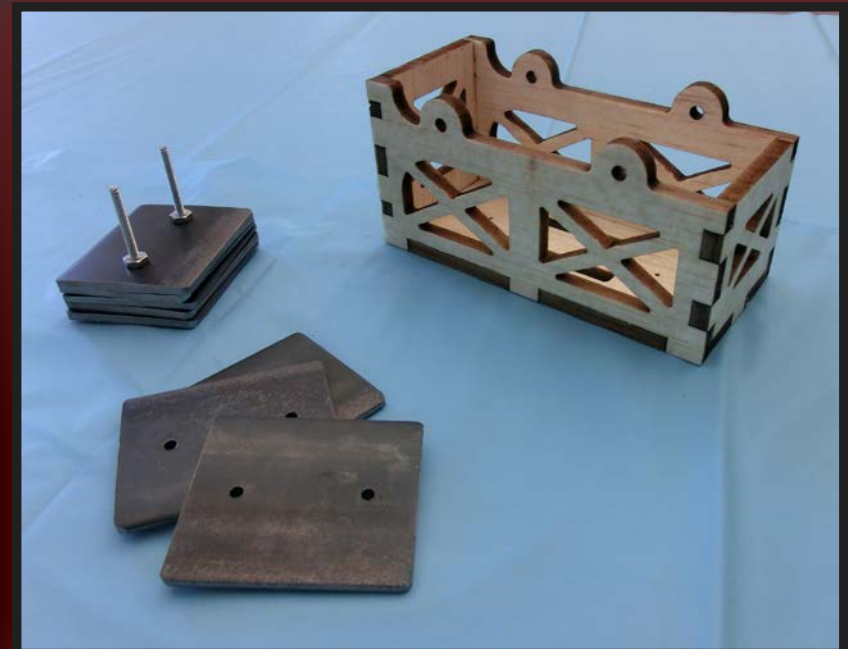


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PAYLOAD AND PAYLOAD BAY

~ Removable Payload Enclosure ~

- Required: 2"x 2"x 5"-
- Secured by main wing struts -
- Reinforced for belly landings -
- Adjustable payload weight -



GOAT WORKS

ELECTRONICS

~ Minimal Weight, Maximum Performance ~

Motor:	E-flite Park Flyer, 1360KV
Propeller:	10 x 5, with Prop Saver
Servos:	Hi-Tec MG-65
ESC:	Erc 25A, Programmable
Battery:	Tenergy 11.1V 900 mAh 25C
Transmitter:	Spectrum DX5e TX
Receiver:	Spectrum AR600, 5-Channel

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FINAL ASSEMBLY

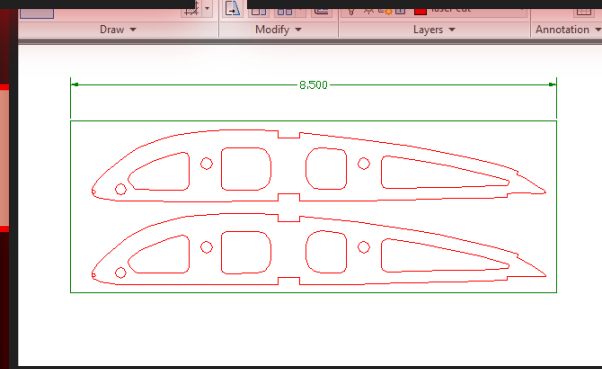
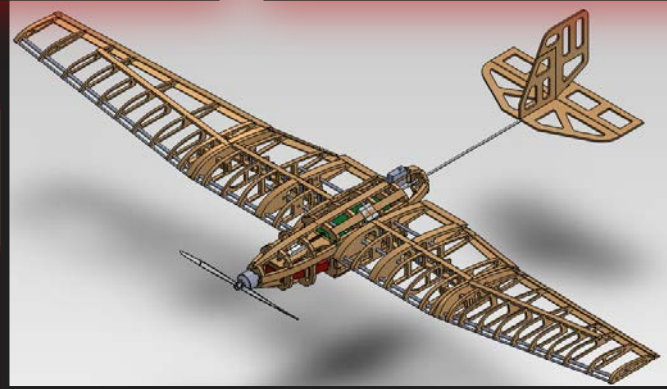
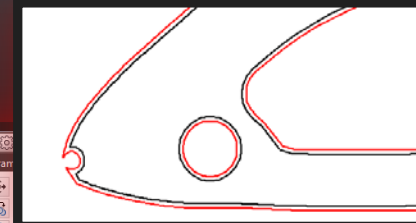
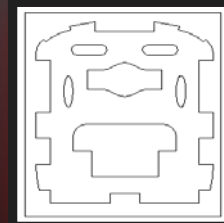
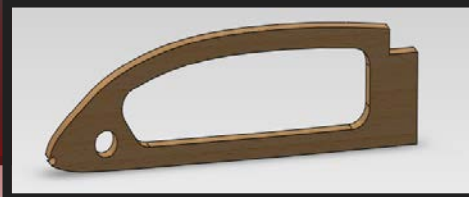
*“Simplicity is the ultimate sophistication.”
- Leonardo da Vinci*



GOAT WORKS

MANUFACTURING CYCLE

~ Repeatability and Efficiency ~



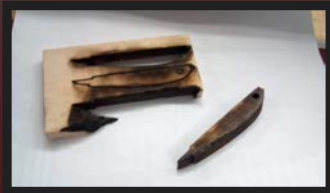
1. SolidWorks Modeling

2. AutoCAD Tolerancing

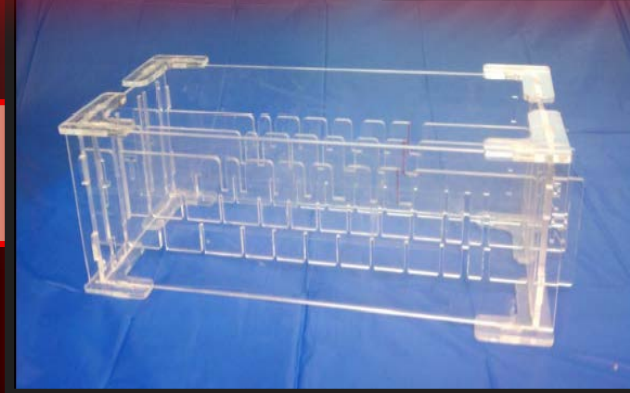
GOAT WORKS

MANUFACTURING CYCLE

~ Repeatability and Efficiency above all else ~



3. Laser Cutting



4. Construction

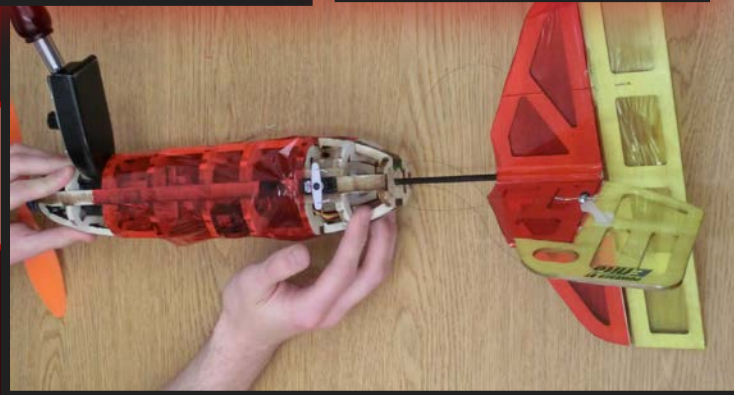
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MANUFACTURING CYCLE

~ Repeatability and Efficiency ~



[7]



5. Skin Coating



6. Final Product

GOAT WORKS

CONCLUSION

“It is possible to fly without motors, but not without knowledge and skill.”

- Wilbur Wright [5]

Predicted Flight Score: 105.6

7.5 points above last year's first place [9]

- Commitment-

- Enthusiasm-

- Knowledge –

- Teamwork –

GOAT WORKS

SPECIAL THANKS

David J. Olinger, Ph.D., Associate Professor, WPI

Simon W. Evans, Ph.D., Assistant Professor, WPI

Mr. Scott Annis, President, Millis Model Aircraft Club

Mr. Mickey Callahan, Program Coordinator, Millis Model Aircraft Club

Mr. Neil Whitehouse, Lab Machinist II, WPI

Eduardo Voloch, US Army National Guard Officer Candidate

The American Institute of Aeronautics and Astronautics

The Quinapoxet Model Flying Club

The South Shore Radio Control Club

The Wachusett Barnstormers

Tina, Muse & Namesake

GOAT WORKS

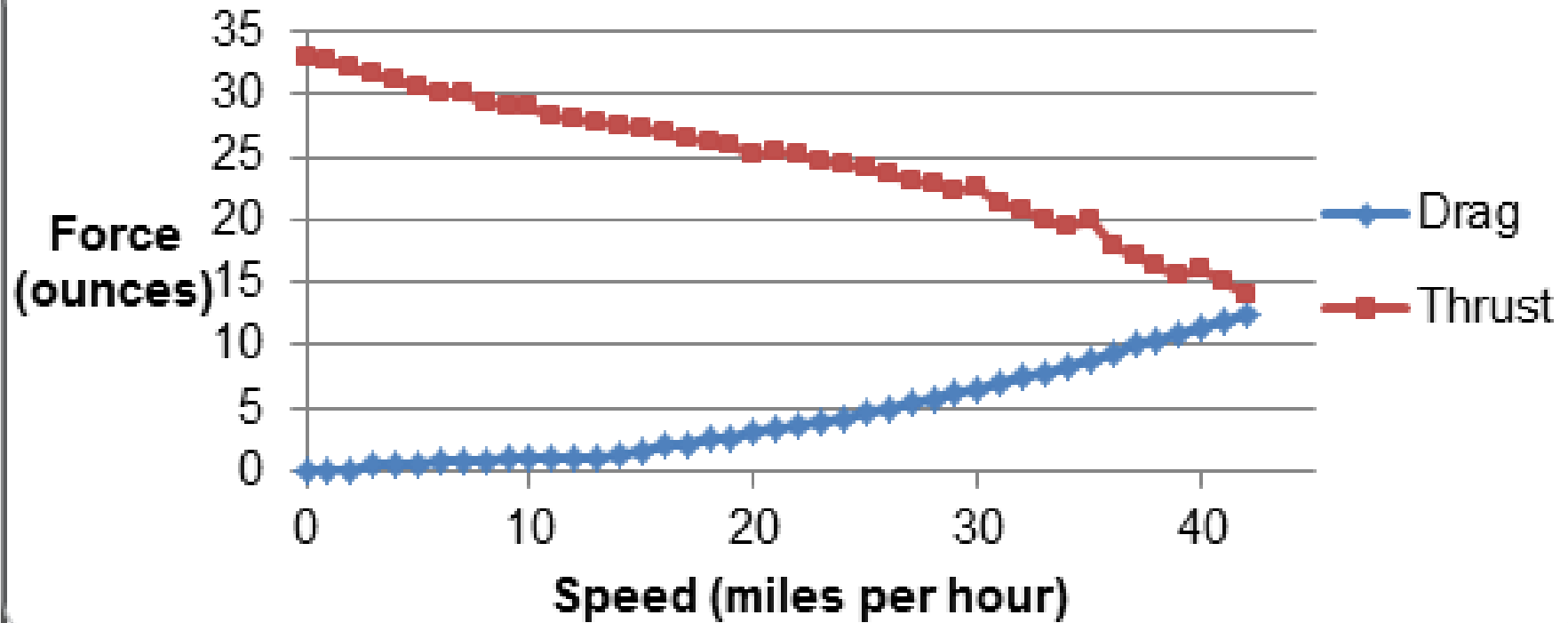
QUESTIONS?

GOAT WORKS

REFERENCES

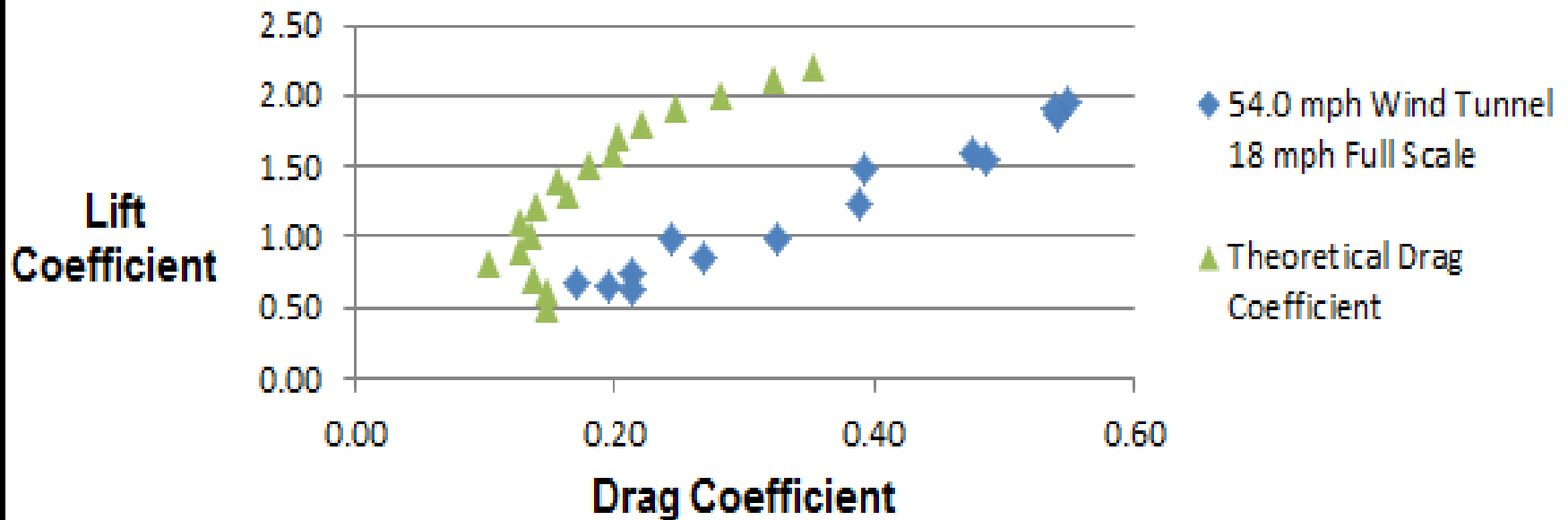
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<http://www.millismodelaircraftclub.com/>
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<http://students.sae.org/competitions/aerodesign/east/results/2011micro.pdf>
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THRUST VS. DRAG



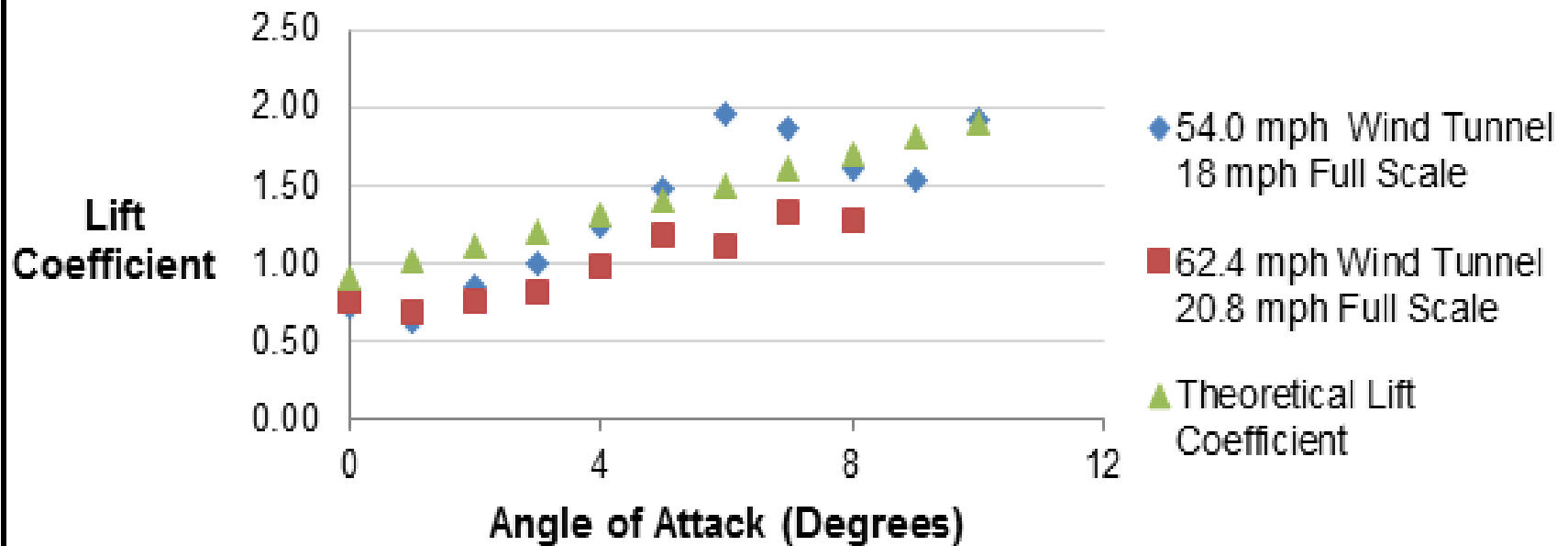
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LIFT VS. DRAG



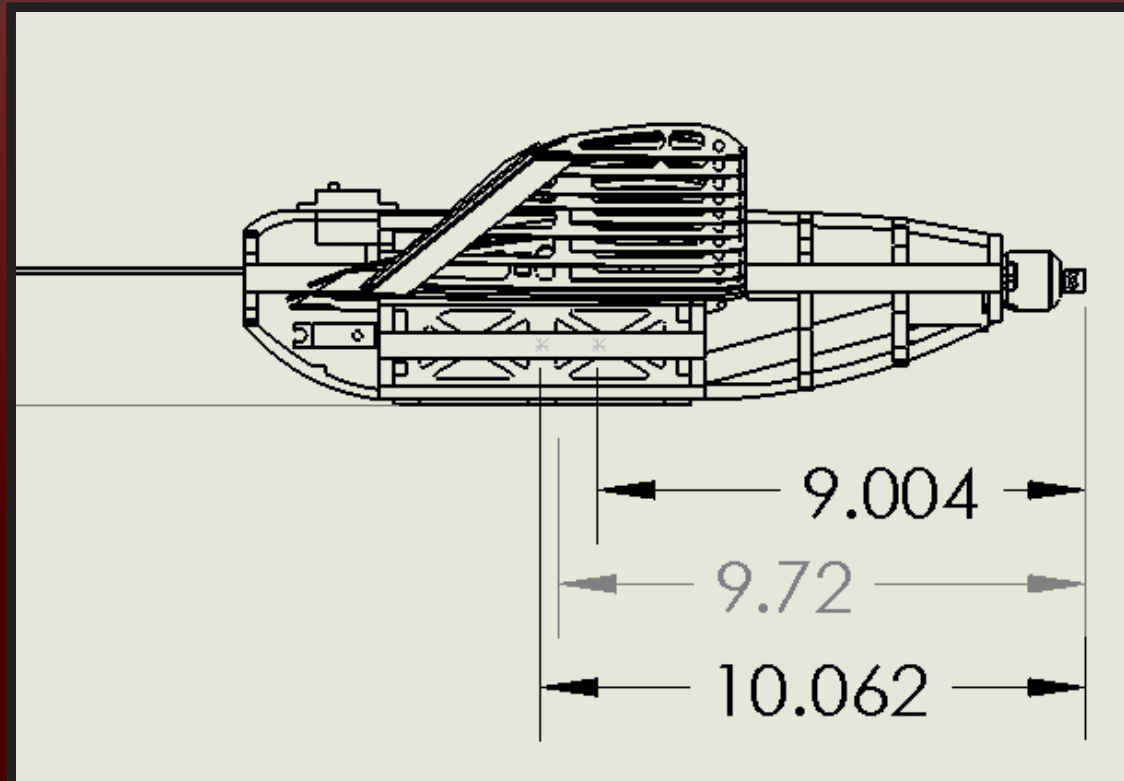
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LIFT VS. ANGLE OF ATTACK



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STABILITY ENVELOPE



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