TEAM #321
WORCESTER POLYTECHNIC INSTITUTE
GOAT WORKS

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PRESENTATION OVERVIEW

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

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Requirements for Success

- Empty Weight
- Payload Fraction
- Operational Availability
- Assembly Time
- Electric Powered
- Carrying Case Dimensions
~ Competition History ~
~ Trade Secrets ~

- 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 –
EXPERIMENTATION

~ Test Data To Verify Calculations ~

Wind Tunnel  Wing Loading  Thrust Stand
“TINA”

~ Final Design Specifications ~

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wingspan</td>
<td>50.20 in</td>
</tr>
<tr>
<td>Length</td>
<td>29.75 in</td>
</tr>
<tr>
<td>Empty Weight</td>
<td>0.825 lbs</td>
</tr>
<tr>
<td>Payload Fraction</td>
<td>72.73 %</td>
</tr>
</tbody>
</table>
WING ASSEMBLY

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

- Orville Wright [5]

- 10° Polyhedral -
- Tapered Chord -
- 2 Piece Wing -
- Glenn Martin 4 Airfoil -

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FUSELAGE

~ Synchronizes All Sub-Assemblies ~

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

~ Collapsible Boom Design ~

- Locking Mechanism -

- Pull / Pull Control System -
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 -
## ELECTRONICS

~ Minimal Weight, Maximum Performance ~

<table>
<thead>
<tr>
<th>Component</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Motor</td>
<td>E-flite Park Flyer, 1360KV</td>
</tr>
<tr>
<td>Propeller</td>
<td>10 x 5, with Prop Saver</td>
</tr>
<tr>
<td>Servos</td>
<td>Hi-Tec MG-65</td>
</tr>
<tr>
<td>ESC</td>
<td>Erc 25A, Programmable</td>
</tr>
<tr>
<td>Battery</td>
<td>Tenergy 11.1V 900 mAh 25C</td>
</tr>
<tr>
<td>Transmitter</td>
<td>Spectrum DX5e TX</td>
</tr>
<tr>
<td>Receiver</td>
<td>Spectrum AR600, 5-Channel</td>
</tr>
</tbody>
</table>
FINAL ASSEMBLY

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

GOAT WORKS
MANUFACTURING CYCLE

~ Repeatability and Efficiency ~

1. SolidWorks Modeling
2. AutoCAD Tolerancing

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MANUFACTURING CYCLE

~ Repeatability and Efficiency above all else ~

3. Laser Cutting

4. Construction
MANUFACTURING CYCLE

~ Repeatability and Efficiency ~

5. Skin Coating
6. Final Product
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 –

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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?
REFERENCES


THRUST VS. DRAG

Graph showing the relationship between speed (miles per hour) and force (ounces) for drag and thrust.
LIFT VS. DRAG

![Graph showing lift coefficient vs. drag coefficient with data points for 54.0 mph Wind Tunnel, 18 mph Full Scale, and Theoretical Drag Coefficient.](image)

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LIFT VS. ANGLE OF ATTACK

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STABILITY ENVELOPE

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