IPRO 317-VTOL Aircraft for the Masses

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Allow Us To Introduce...

- VTOL – Vertical Take off and Landing
• The Volar consists of a twin-rotor configuration
• VTOL aircraft does not need a tail rotor
• Full control over the movement of the VTOL aircraft and a limited take-off sequence has been conducted.
• In X-Plane Version 8.0, both a small-scale and full-scale prototype simulation have been successfully executed.
Construction and Testing Objectives

- Complete airframe, gimbal control, engine test of aircraft, and test with rotors attached
- Design, determine placement, and install wing and tail structures.
- Achieve operational flight status; begin tests outdoors
- Improve design of components throughout the testing process.
Progress

• Completed construction of all servo motors and control arms for the gimbal mechanism
• Balanced and attached rotors and achieved engine startup
• Reinforced gimbal structure
• Diagnosed problems
• Limiting blocks for gimbal motion
• Constructed tail control surface and servo and cleaned up wiring and controls
• Achieved lift and directional thrust during tests with rotors
Obstacles and Setbacks

• Loss of engine control during tests

• Replacement of main gear

• Difficulty of obtaining parts
X-Plane

What is it?
• Flight simulation, Plane design

How does it work?
• Blade element theory- user specifies geometry, program numerically integrates over defined surfaces and sums to get net forces
Objectives
Full Scale model

- Wingspan: 22ft
- Fuselage length: 15ft
- 140hp reciprocating engine
- Propeller radius: 10.6ft
- Empty weight: 8,500lb
Full Scale Model

Progression of Assignments

• Updated older volar file from an obsolete version of X-Plane

• Added rudder for increased stability and yaw control

• Optimization
Future Goals

• Fuel efficiency predictions
• Implement more realistic model of the propeller control mechanism
• Analyze stresses developed on airframe during normal flight
Prototype Scale Model

- Wingspan: 2.84ft
- Fuselage length: 3ft
- 1.8hp reciprocating engine
- Propeller radius: 2ft
- Empty weight: 9lb
Prototype Scale Model

Progression of Assignments

• Model designed based on the previously built physical prototype
• Improving on the parameters of the physical prototype
• Implementation of the defining volar characteristics on a prototype scale
Prototype Scale Model

Future Goals

• Optimizations made in the computer model will be implemented into the physical prototype.
Micro Scale Model

- Wingspan: 1.8ft
- Fuselage length: 1.66ft
- 0.2hp reciprocating engine
- Propeller radius: 1.67ft
- Empty weight: 0.7lb
Micro Scale Model

Progression of Assignments

• Research on electric RC helicopter specifications
• Based on available parts, new model was designed from the ground up in X-Plane using the basic Volar geometric design
Micro Scale Model

Future Goals

• Conversion of reciprocating engine to electric motor

• Stability and overall flight control improvements
• NCIIIA grant proposal
  – Spreadsheet of budget
  – Resumes of team members
  – Narrative explaining need
Operation VTOL

Volar...reach for the solar

Introducing The Volar. The number one, affordable VTOL aircraft.
<table>
<thead>
<tr>
<th>Part Needed</th>
<th>Quantity</th>
<th>Price Per Unit</th>
<th>Total Price</th>
</tr>
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<tbody>
<tr>
<td>Mazda 2 Rotor Engine</td>
<td>1</td>
<td>2000</td>
<td>$2,000</td>
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<tr>
<td>Carbon Fiber Composite</td>
<td>100 lbs</td>
<td>$3.5 per lb</td>
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<td>Servo Motors</td>
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<td>$120</td>
<td>$600</td>
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<tr>
<td>Machine Shop Labor</td>
<td>150 Hours</td>
<td>$60 Per Hour</td>
<td>$9,000</td>
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<tr>
<td>Nuts, Bolts and Accessories</td>
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<tr>
<td>Flight Avionics</td>
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<tr>
<td>Batteries</td>
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<td>$215</td>
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<tr>
<td>Plane Power Alternator</td>
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<td>Aircraft Electrical System</td>
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<tr>
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<tr>
<td>1.5&quot; Fiberglass Round Tube</td>
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<tr>
<td>2&quot; Fiberglass Square Tube</td>
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<td><strong>Grand Total</strong></td>
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Conclusion

X-Plane
• Important to save on resources and time during construction
• Allows predictions for flight characteristics, power requirements, and construction elements

Construction
• Successful testing and completion of prototype
• Working gimbal mechanism and robust airframe
• Significant progress in vehicle construction
Thank You From IPRO 317