Boeing Payload Capable Drone – D.O.R.I.S.

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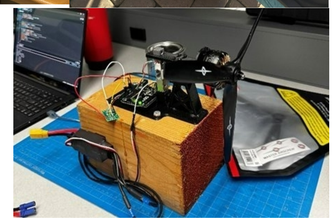
Abstract

The DORIS (Drone Operated Reconnaissance & Interchange System) Project is designed to develop a high-capacity payload drone for remote delivery applications. The goal is to optimize thrust-to-weight ratio, enhance flight stability, and improve payload handling capabilities. The project employs a quadcopter design with iFlight XING X4214 660KV motors and HQProp 16x8 inch propellers to achieve optimal performance. Testing includes thrust analysis, power consumption evaluation, and endurance trials. The anticipated outcome is a robust UAV capable of carrying varying payloads with precision and efficiency. The implications of this research extend to commercial and emergency response applications.

Methods

- Used parts from Hi-Jax Boeing Drone V1:
  - Remote control
  - Various electrical components
- 3D printed parts designed by the team:
  - Frame supports
  - Payload mounts
  - Motor mounts
  - Drone legs
- Frame Construction:
  - Thin birch wood (cut into shape)
  - Strengthened with fiberglass sheets
- Purchased components:
  - Batteries
  - Motors
  - Propellers
  - Octagonal carbon fiber tubing (for arms)
  - Magswitch magnets (for payload system)
  - Wire basket (to cover electronics)



Testing Procedure:

- Motor thrust tested using a team-built apparatus and coded analysis
  - Measured average thrust and current at varying thrust percentages
  - Limited tests to 60% thrust to avoid motor strain during static testing
- Field testing conducted to observe flight performance
  - Iterated and refined the drone design as needed based on results

Conclusion

The D.O.R.I.S. drone demonstrates a high-capacity payload drone optimized for thrust-to-weight ratio, maneuverability, and endurance. The iterative design process allowed for improvements in structural integrity, material selection, and performance efficiency.

Key findings include:

- The selected motor-propeller combination effectively met the thrust requirements.
- Battery efficiency and weight distribution were crucial for flight stability.
- 3D-printed components reduced weight while maintaining structural strength.
- Future work will focus on refining flight stability, optimizing power consumption, and integrating autonomous navigation for real-world applications. These advancements will further enhance the drone's potential for commercial and emergency response missions.

Requirements

Customer Requirements:

- High Mobility – The drone needs to be highly maneuverable.
- Complete Recon Mission – The drone needs to complete the Boeing Recon Mission.
- Payload Capacity – The drone can carry a payload that is a third of its own weight.
- Battery Capacity – The battery must be capable of at least 10 minutes of flight.

Engineering Requirements:

- Thrust to Weight Ratio – The goal ratio is for the thrust is 3:1
- Compact Design – The drone should be under 5 feet in height, width, and length.
- Payload Weight – The payload must be at least 30% of the weight of the drone.
- Time of Flight – The minimum requirement for the time in the air is 10 minutes.
- Total Cost – The budget is $3,000 and an additional 10% ($300) must be fundraised by the team.
- Meet FAA Requirements - The team must meet the regulations set by the Federal Aviation Administration for Unmanned Aircraft Systems (UAS).

Results

Figure 1: 3D CAD Design of The DORIS Drone

16x8 Propeller		
Percent Thrust (%)	Average Thrust (g)	Average Current (A)
0	0	0.31
15	339	3.65
30	2714	12.5
45	5647	29.89
60	6779	54.61

Table 1: Data Motor Testing

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