MAE 189 Project 3: Fixed Wing Test Bed (FWTB)

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Sponsored by Dr. David Copp and UAV Forge

OVERVIEW

FWTB is a project team contracted by UAV Forge to design a fixed wing Unmanned Air Vehicle (UAV) that can complete certain tasks listed under AUVSI SUAS competition rulebook.

Objective: The main goal is to design, build, and fly a fixed wing aircraft that can integrate and test hardware needed for an imaging system and drop system.

Challenge: Design a fixed wing aircraft capable of carrying a 4 pound payload while still having a 20 minute flight time

EXISTING SOLUTIONS

Figure 1. Reference model aircraft.

FWTB's project follows a fixed-wing cargo plane model made by one of the team members, Jordan Louie, as the basis for designing and constructing the current aircraft. The reference plane was not built to follow any specifications or applications related to FTWB's requirements and attributes and was mainly built as a hobby craft.

SOLUTION

Calculations were done to determine the theoretical specifications of the plane. It was determined that the airframe weight could be no more than 2 ½ pounds. Due to this weight constraint, the team opted for a single wing, conventional tail, and carbon fiber spar fuselage.

HARDWARE FOR TESTING

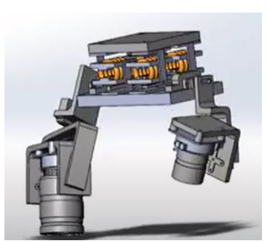


Figure 2. Imaging System

Both the imaging and parachute systems will be able to be tested on the testbed aircraft.

Figure 3. Parachute System

Figure 4. Constructed model of the aircraft.

THE AIRCRAFT

Specifications:

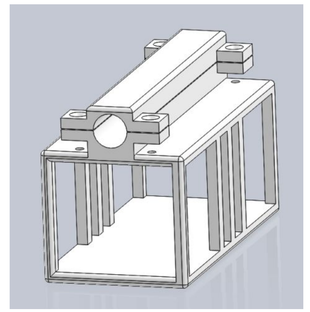
Wingspan: 8 feet
Length: 6 feet
Weight: 6 pounds without payload
Payload Capacity: 4 pounds
Maximum Takeoff Weight: 10 pounds
Maximum Flight Time Without Payload: 40 minutes
Aspect Ratio: 9.6:1
Wing Loading Without Payload: 15 oz/ft^2

Power:

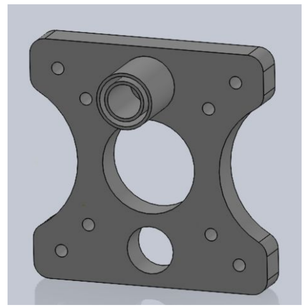
Battery: 6 cell 6600 mAh
Motor: Turnigy 300 kV
Electronic Speed Controller: Hobby King 80 Amp
Radio Receiver: Futaba R617FS
Radio Transmitter: Futaba T7C

IMPACT ON SOCIETY AND ENVIRONMENTAL CONCERNS

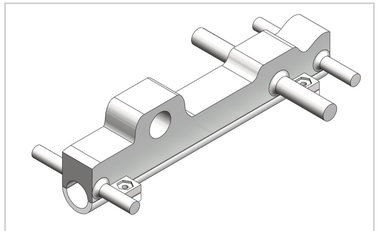
High endurance fixed wing aircraft capable of payload delivery and/or imaging will be instrumental in transporting vital goods to more remote areas for a low price. Fixed wing aircraft like the one featured above are relatively cheap to construct and operate.



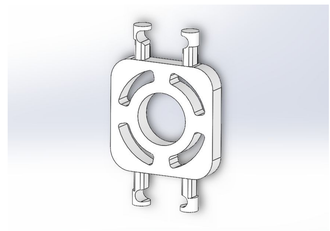
Battery Attachment



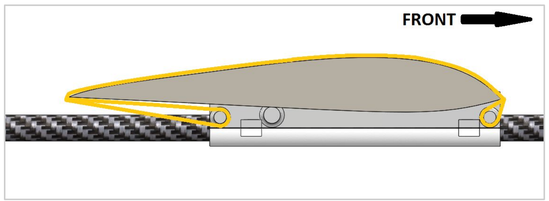
Motor Mount



Wing Attachment



Spar Holder



Future Work: The team was able to verify that the aircraft is indeed capable of flight, however the aircraft did suffer a crash. Despite crash damage, the wings, main spars, and all power components are still functionable. The wing attachment mechanism needs to be redesigned to better secure the wing. Shown in Figure 3 is damage to the wing attachment mechanism sustained before the crash. This crack is presumed to be the main reason behind the crash.

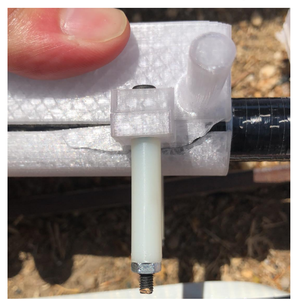


Figure 3. Wing attachment post-test flight showing a crack.

UCI Samueli
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Flight Test and Crash