UAV FORGE

Inspiring Innovation for Personal Autonomous Systems at UCI

UCI Samueli
School of Engineering

BACKGROUND

The origins of the project can be traced back to a defunct DARPA (Defense Advanced Research Projects Agency) competition wherein participants were required to design and implement a portable UAV that would fly a designated mission profile for under $10,000. The competition was shuttered after none of the competing teams were able to fully meet requirements. UAV Forge was then later restarted as a senior design project here at UCI
as a continuation of efforts to develop an aerial system that could satisfy all competition requirements.

OVERVIEW

UAV Forge is a research project dedicated toward the design, fabrication, and testing of unmanned aerial vehicles (UAV) in addition to developing the software required to operate them. The primary application for these UAVs is to provide surveillance / reconnaissance capability to frontline users in a law enforcement or military context without endangering personnel.

OBJECTIVE

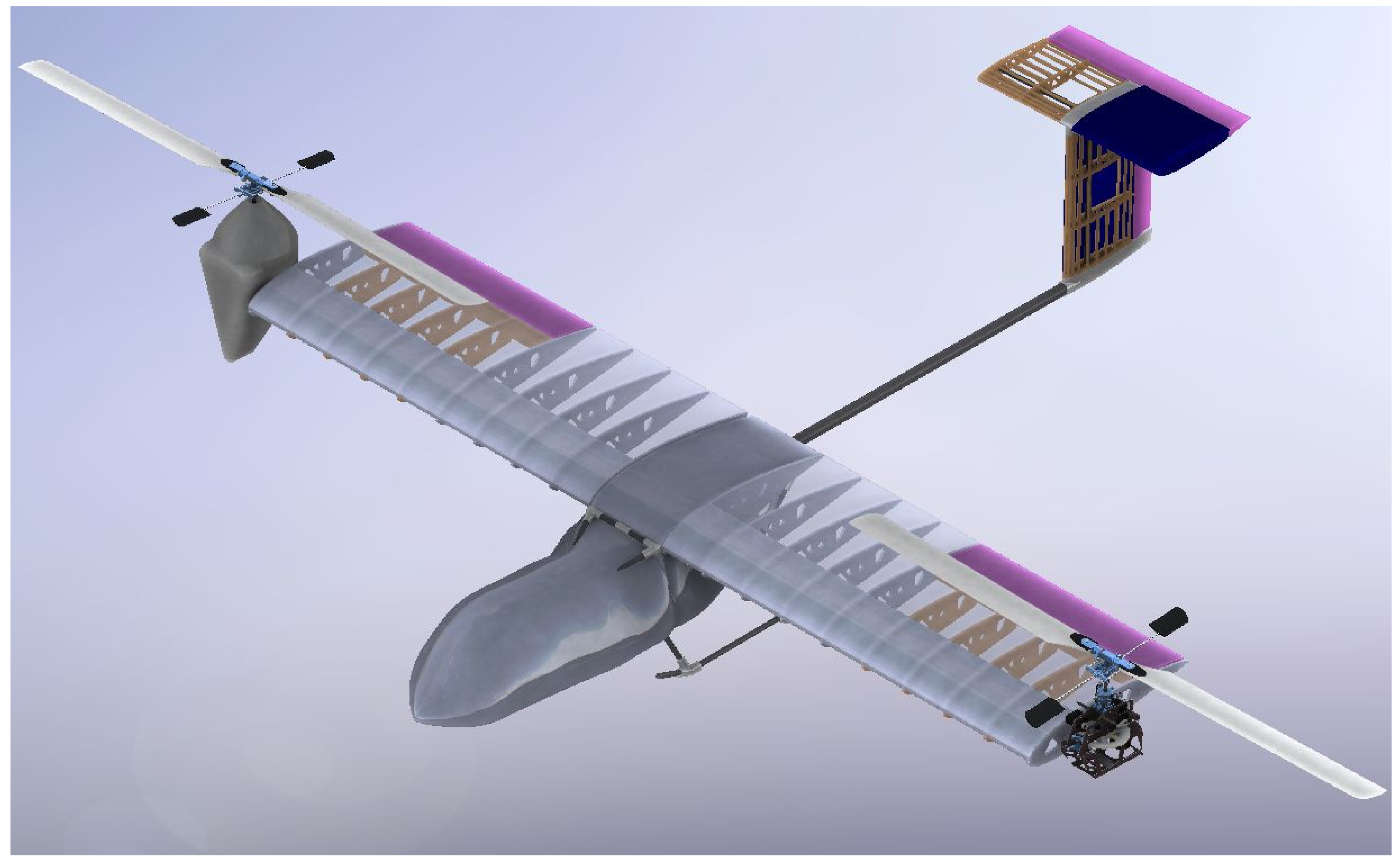
Our objective is simple: create a flight vehicle system that will adequately satisfy the DARPA competition requirements.

REQUIREMENTS

The project requirements closely mirror the original DARPA competition specifications. As such, major requirements include:

- VTOL (Vertical Take-Off / Landing) capability
- Autonomous waypoint navigation
- Obstacle avoidance mechanism
- Observation system (Real-time video or photograph transmission)
- 2.0 mile range
- Vehicle control user interface

Design and Approach



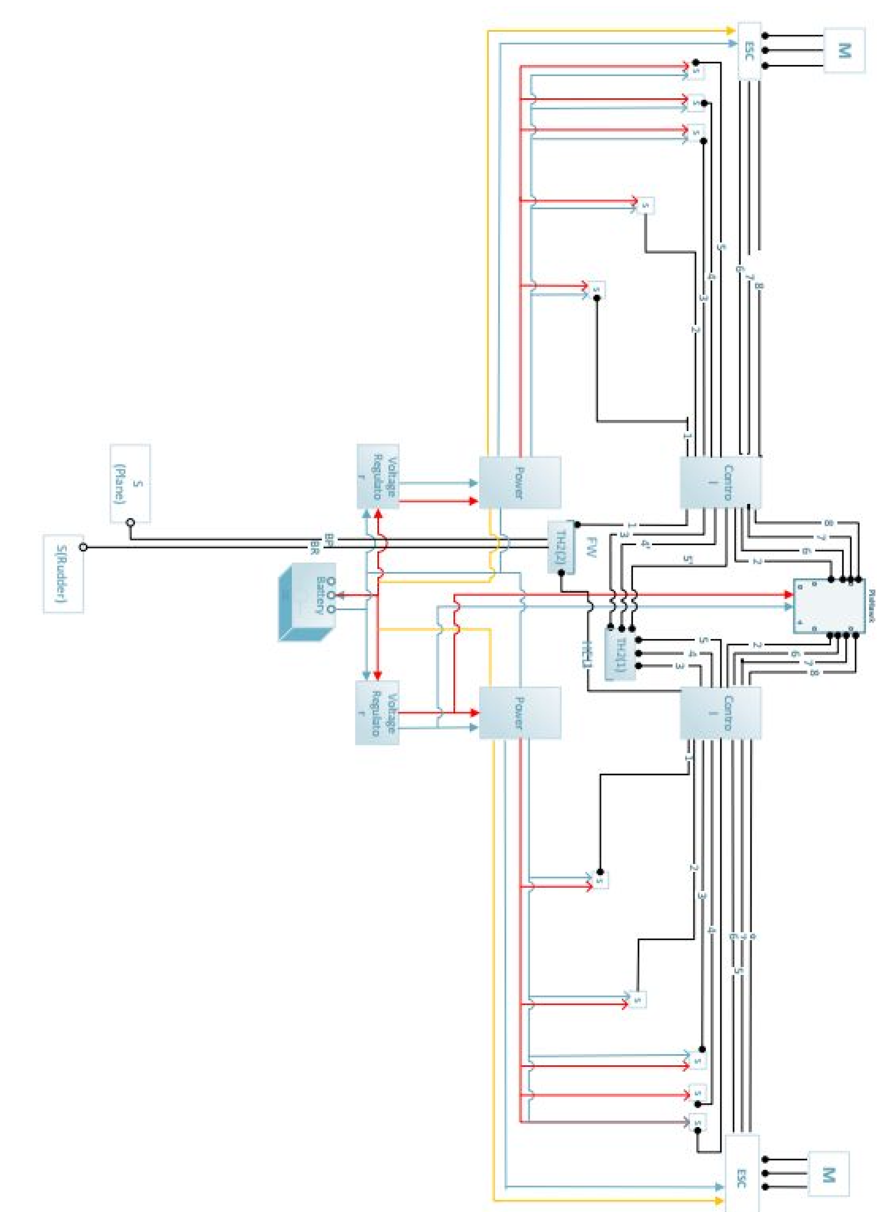
Tiltrotor is our approach to retain power efficiency and range of conventional fixed wing plane while having the nimble hover/VTOL capability of a helicopter. Such configuration will require sophisticated control system to maintain vehicle stability, especially during transition between fixed wing mode and helicopter mode. In addition to a dedicated autopilot, a secondary controller is added to translate control signal to different actuators depending on the flight mode, e.g. helicopter mode, aircraft mode, or transition mode.

Progress

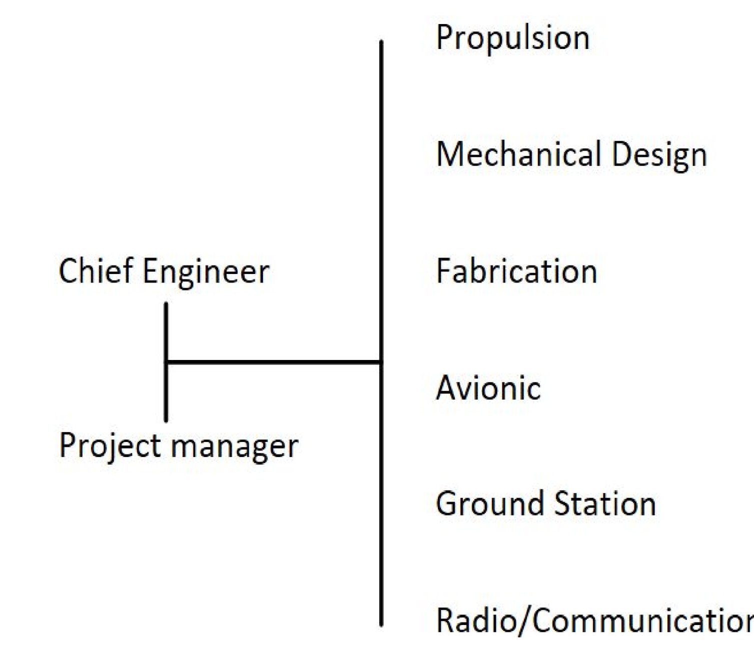
A bicopter prototype is built to test the helicopter mode control system. It shares the same rotor set as the actual tiltrotor, and they are identical in span size. Test results from the prototype will be used to reconfigure and improve the actual tiltrotor.

Avionics

Our main focus towards our onboard electronics systems involve our custom power/data layout. In order to provide proper voltage/current to each servo in our tilt rotor system and to ensure the dual controller/mixer system was switching properly, we designed a supply system and a switching circuit to accommodate the fixed wing and helicopter flight modes. In addition, we have now eliminated the need for an Arduino to interface with sensors - we have modified the Pixhawk firmware to contain interface code to our sensors.



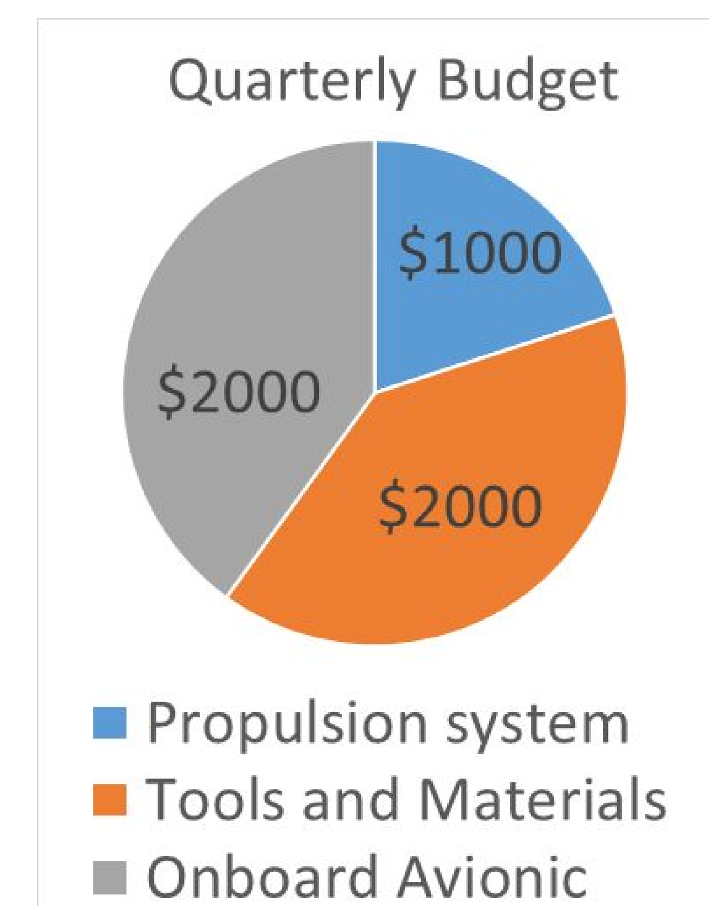
Team Structure



Project Advisors

Haithem E. Taha
Professor, Advisor

Colin Sledge
ECT Lab Manager



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