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

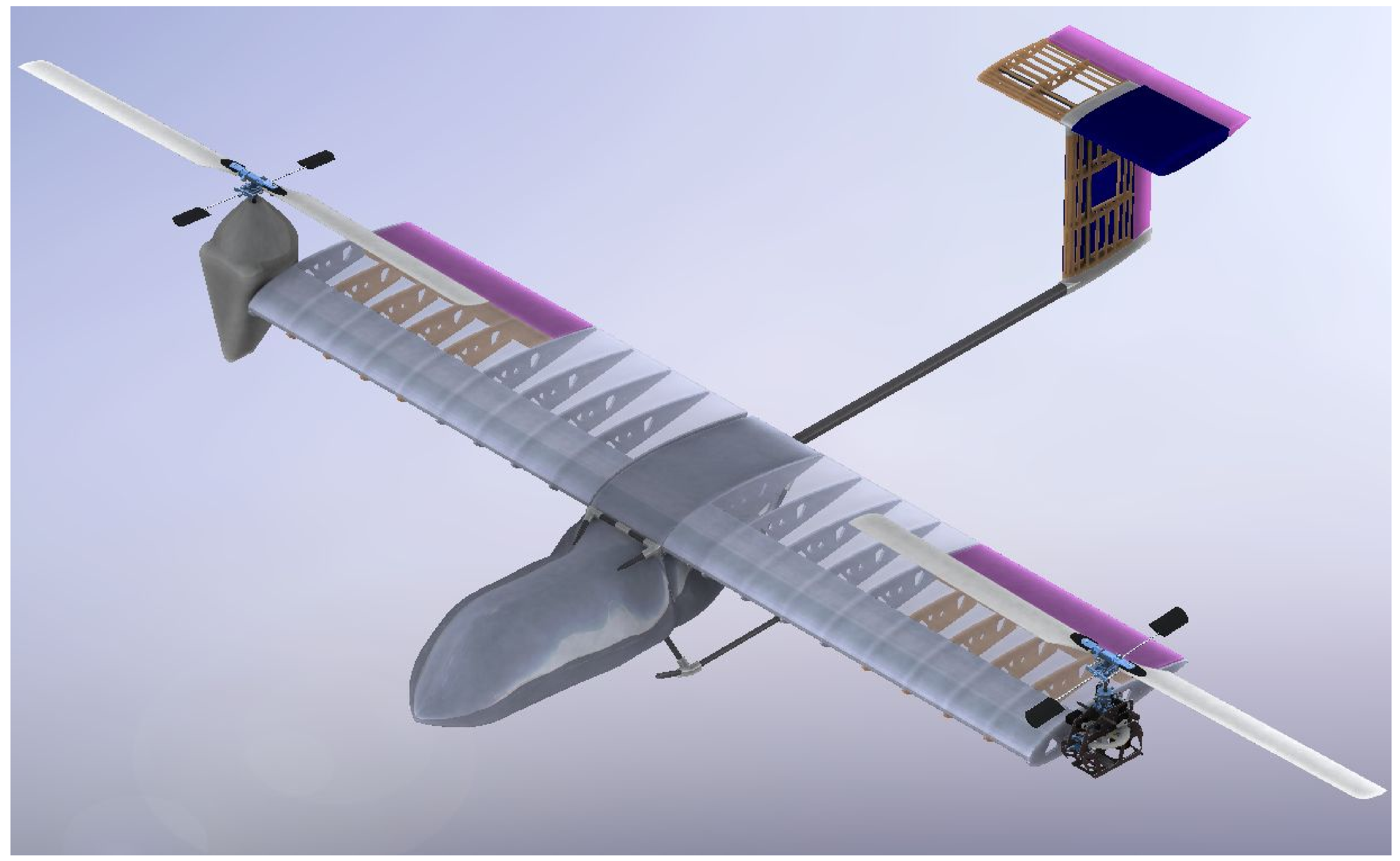
Our objective is simple: create a flight vehicle system that will adequately satisfy the DARPA competition requirements.

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



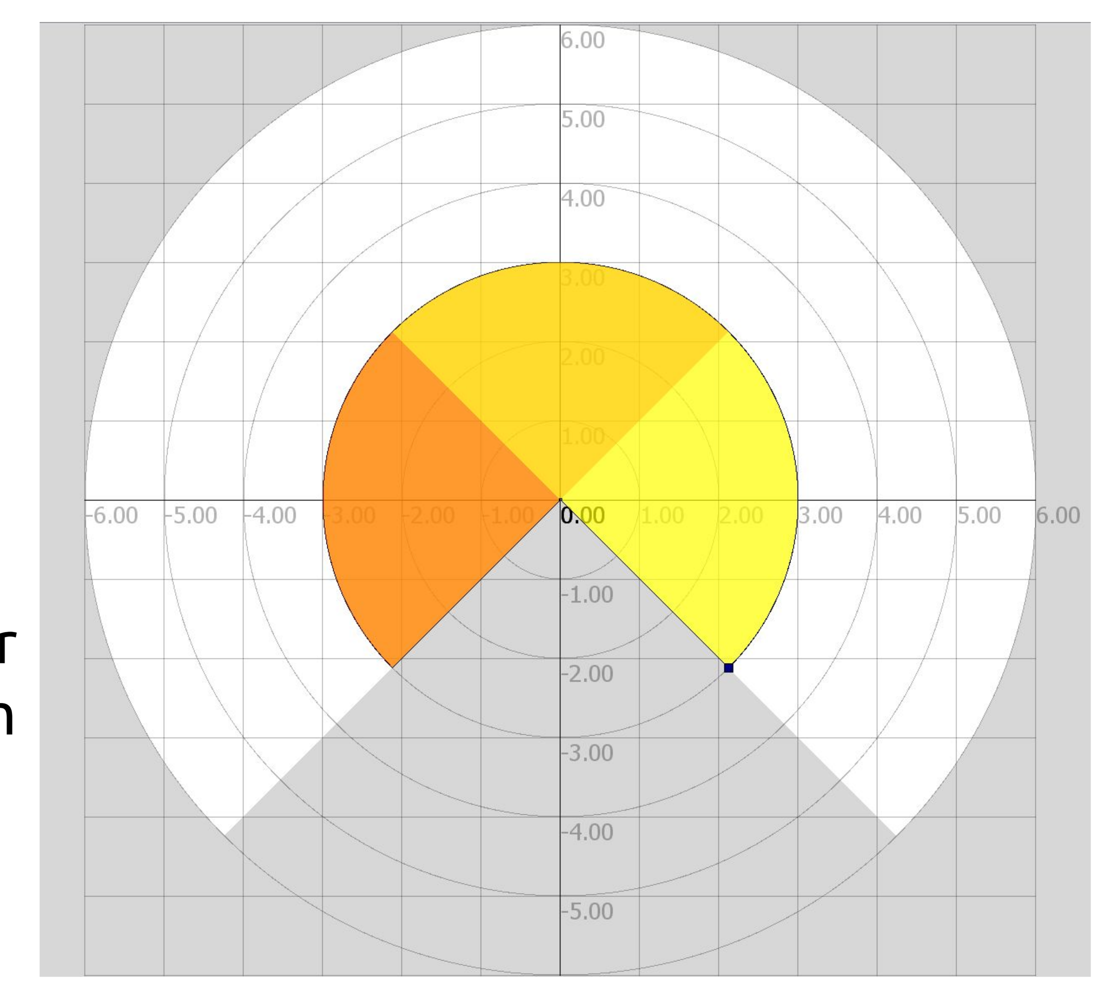
Our newest approach to satisfy, or even go beyond, the DARPA requirements is to build a tiltrotor system. It is a mix to retain power efficiency and range of conventional fixed wing plane while having the nimble hover/VTOL ability of a helicopter. Such configuration will require sophisticated control system to maintain vehicle stability, especially during transition between fixed wing mode and helicopter mode.

Progress

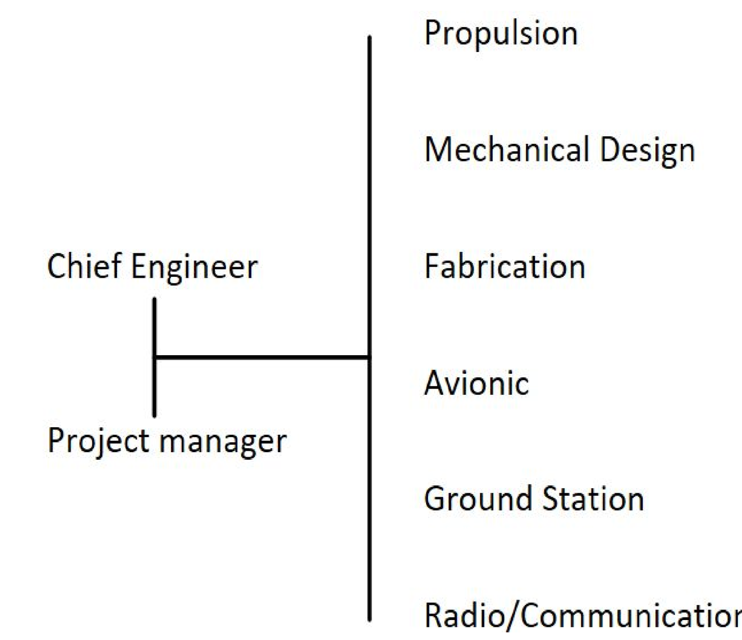
While designing and building the tiltrotor, we also built a brand new quadcopter for our avionics team as test platform for various sensors and flight controller. And it was successfully flown autonomously, from take-off to landing at designated waypoints with just a flip of a switch.

Obstacle Avoidance

Our current approach on obstacle avoidance involves a sensor system using an Arduino Due as the aggregator for sensor data. The sensor data is used by the flight controller to calculate changes in the current flight path that are needed to avoid detected obstacles. In the case of the quadcopter, we are currently using the Pixhawk flight controller and plan to modify the existing firmware to contain our obstacle avoidance algorithms. For initial testing, we will utilize simpler sensors such as a sonar/ultrasonic sensor before moving to more complicated sensors such as a LiDAR system (cross-sectional view of our LiDAR scanning profile below).



Team Structure



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