

# Unmanned Aerial Vehicle (UAV)<sup>1</sup>

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## The need:

Small Unmanned Aerial Vehicles (UAV's) are becoming key surveillance and delivery systems, capable of a variety of roles. They provide low risk battlefield surveillance systems, highly mobile and quickly deployed emergency response support systems, low cost aerial sensors for applications such as farming and game counting, pipeline inspection, aerial photography, as well as police and law enforcement applications. This extensive application spectrum generates the need for versatile, robust, and configurable UAV platforms that can be adapted to suit the different purposes.



## The key project design objective:

Student teams will design, fabricate, and demonstrate the flight capabilities of an unmanned, electric powered, radio controlled aircraft that can best meet the specified mission profile. The goal is a balanced design possessing good demonstrated flight handling qualities and practical and affordable manufacturing requirements while providing a high vehicle performance.

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<sup>1</sup> This project is specially suited for students that have taken the Aeronautics sequence

The detailed design parameters and specific mission requirements for the UAV are published by the American Institute of Aeronautics and Astronautics (AIAA) design build and fly competition, and will be posted on [www.aiaadbf.org](http://www.aiaadbf.org) starting August 31.

This is not a model airplane or drone competition but rather is a design project. As such full performance analysis of the vehicle must be performed based on industry practice. No construction, assembly or purchase of the design parts will begin until a complete design package has been produced.

### **Who is the final customer for this device;**

The UAV will be designed and built in accordance with the design criteria specified by the AIAA. The AIAA Design Build Fly competition is an international competition among student design teams. The contest is sponsored by the American Institute of Aeronautics and Astronautics (AIAA) and Raytheon Missile Systems.

This year's UAV capstone project will represent the starting point for future participation in the competition as a student club. While no participation is envisioned this year, the flight testing and scoring will take place locally and in accordance with the competition regulations.

### **Who will be supervising and evaluating the outcome of the project:**

Project review will include oversight by experts from aerospace experts from the Maine Aerospace Alliance as well as Professors Rubenstein and Friess.

### **UMaine Mechanical Engineering technical contact point:**

Professor Friess will supervise the mechanics, materials and manufacturing issues related to the project evaluation of this project. Mr. Abbadassa will provide oversight on the testing and construction of the machines. Day to day oversight of the project progress and deliverables for the class will be overseen by Professor Peterson.

### **The core Mechanical Engineering classes required as background for the project:**

Controls  
Design I & II  
Fluids  
Dynamics  
Strength of Materials  
Material Science  
Aeronautics

### **Resources available:**

This project is unique in that a wide range of people and equipment can be provided for the project. The design, build and test equipment used for the project is available in Crosby Laboratory.

### **End of year deliverables:**

The first term design documentation must be complete prior to any construction or component purchases. The design documentation must at all stages include a performance to design goals justification. For example, the design space for maneuverability versus speed is quite different. If the AIAA competition emphasizes maneuverability then design justification must focus on the design goals for the competition. The final design package will include an "as built" design package which will be checked against the actual completed system. These as built drawings (including vended parts list, controls schematic and a complete

detail drawing package) will be used along with the AIAA format design report and rated aircraft cost to evaluate the project.

A complete UAV must be operated within appropriate legal constraints and demonstrate the ability to meet the initial design projections. The final project will be scored, to the extent possible, against the AIAA design performance outcomes. The success of the 2015 team on meeting the goals of the competition and the inclusion of students who can continue the project is necessary in order for a competition project to be considered from UMaine.

## **Additional references**

Local radio control club: <https://www.facebook.com/PenobscotFunFlyers/info>

AIAA competition rules; [www.aiaadb.org](http://www.aiaadb.org)

Past competition websites:

- <http://dbf.ae.illinois.edu/about-us/the-competition-2015/>
- <https://www.youtube.com/watch?v=JTU0XTpRdOI>
- <http://www.dbf.gatech.edu>
- <http://rpidbf.tumblr.com/home>
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