Summary:
The DBF team of UIUC invites all students to participate in its annual Individual Design Project.

Students 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.

For the Spring 2016 semester, students will work to complete a remote-controlled trainer aircraft.

Aircraft Requirements:
- The aircraft may be of any configuration, except lighter-than-air.
- Total aircraft weight in its unloaded configuration must not exceed 15 lbs.
- Must be propeller driven and electric powered with an unmodified over-the-counter model electric motor. May use multiple motors and/or propellers. May be direct drive or with gear or belt reduction. Motors may be any commercial brush or brushless electric motor.
- All batteries must use Lithium Ion (LiPo) technology. For safety, battery packs must have shrink-wrap or other protection over all electrical contact points. The individual cells must be commercially available and the manufacturers label must be readable/documented (i.e. clear shrink wrap preferred). All battery disconnects must be "fully insulated" style connectors.
  
  NOTE: Radios receivers and servos must operate on a separate battery pack from the airplane’s propulsion system. The two battery packs may be wrapped together, but must have two separate circuits.
- Before flight, all vehicles will undergo a safety inspection. This inspection may include, but is not limited to:
  o Verify all components adequately secured to vehicle. Verify all fasteners tight and have either safety wire, locktite (fluid) or nylock nuts. Clevises on flight controls must have an appropriate safety device to prevent their disengaging in flight.
  o Verify propeller structural and attachment integrity.
  o Visual inspection of all electronic wiring to assure adequate wire gauges and connectors in use.
  o Radio range check, motor off and motor on.
  o Verify all controls move in the proper sense.
  o Check general integrity of the payload system.
  o All aircraft will be lifted with one lift point at each wing tip to verify adequate wing strength (this is "roughly" equivalent to a 2.5g load case) and to check for vehicle cg location. Teams must mark the expected empty and loaded cg locations on the exterior of the aircraft. This test will be made with the aircraft filled to its maximum payload capacity.
Radio fail-safe check. All aircraft radios must have a fail-safe mode that is automatically selected during loss of transmit signal. The fail-safe will be demonstrated on the ground by switching off the transmit radio.

- There is no set limit on cost of construction, but feasibility based on cost is at the discretion of the Chief Engineer. Each iteration of the aircraft should cost no more than roughly $200, including all electronic components.

Mission Profiles:
Flight Course:
The orientation (direction) of the flight course will be adjusted based on traffic at the Armory Track during flight days. The nominal flight course is shown in the Figure below.

![Course Layout Shown to Scale](image)

Mission 1: Cruise Mission
- Empty configuration (no payload)
- Takeoff within the prescribed field length.
- Fly four laps within a total 5 minute window
- Time starts when the throttle is advanced for take-off.
- A lap is complete when the aircraft passes over the start/finish line in the air (The landing is not part of the 5 minute time window).

Mission 2: Passenger Flight
- 3 lap payload flight
- Payload will be a cabin filled with passengers, modeled as a factory-sealed 20oz bottle of fluid (i.e. water, soda, etc.)
- Fly three laps within a total 5 minute window.
- Time starts when the throttle is advanced for take-off.
• A lap is complete when the aircraft passes over the start/finish line in the air (The landing is not part of the 5 minute time window).

Mission 3: High/Low Sortie
• 2 lap payload flight
• Same payload as Mission 2
• Time starts when throttle is advanced for take-off
• Within a 5 minute window, fly:
  • Takeoff and climb to 50ft within 10 seconds
  • Perform usual 180 turn
  • Descend to max altitude of 15ft
  • Perform usual 360 turn. At no time during the turn should any part of the airplane exceed 15ft altitude.
  • Ascend to at least 50 ft
  • Perform usual 180 turn
  • Cruise to next 180 turn, repeat

Design Proposal:
As a way for us to review your preliminary design, you will be required to submit a design proposal by 5PM on March 18th. This proposal will be a dimensioned, 3-view drawing. The drawing does not need to be an exact representation of your design, but should include at least:
• Locations and dimensions of all control surfaces
• Propulsion system configuration and locations
• Locations of electronics
• Estimated CG location
• Estimated neutral point location
• Detailed drawings of aircraft structure and any attachment points

Proposals must be submitted in PDF format by e-mail to secretary.uiuc.dbf@gmail.com.

Design Report:
A capstone summary on your design project, you will also be required to submit a design report by 5PM on May 4th. This will include an updated 3-view drawing of your aircraft, as well as a short summary of your progress this semester, including:
• Conceptual design process, and how/why you picked your configuration
• A short summary of all the technical aspects of your design:
  • Aerodynamics
  • Stability and Controls
  • Propulsion
  • Structures
• A short summary of prototyping - both manufacturing and flight tests

There is no limit on the length of the proposal, but it is expected to be about 4-5 pages in length including the 3-view drawing.

Reports must be submitted in PDF format by e-mail to secretary.uiuc.dbf@gmail.com.
References: