

## 1 Logistics

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Office Hours: MW 1:00 - 2:00 and by appointment. However, you will have access to the lab at other times as well.

## 2 Overview

The goal of this project is to research, design, build, and test a subsonic wind tunnel. Ultimately, this device will be used by the department for research purposes as well as instruction. The wind tunnel should be able to characterize the forces and air flow around a small object or airfoil. The team is responsible for calibrating the instrument and demonstrating that the instrument functions appropriately.

At minimum, the testing chamber of the wind tunnel should be able to accommodate the testing of a medium sized model rocket. You should be able to adjust the height of the mount as well as the angle of attack. The minimum target speed of the wind tunnel should be 30 m/s, though a higher maximum speed is desirable.

For the most part, class will meet in the electronics laboratory. I expect students to show up during class times to work with their fellow teammates. Your final grade will be determined in part by peer evaluation (see below). We will have some formal classes during which we discuss a few things that relate to the project, as well as what I expect from you from your documentation.

## 3 Course Schedule

- January 5: First week, Introduction
- January 12: Abstracts due, Heritage Study due, Begin intro to Arduino
- January 19: Proposals due (including preliminary design), Continue Arduino Intro (sensors)
- January 26: Parts List Due, Orders Placed, **Design approved**, Subsystems build
- February 2: Subsystems Build
- February 9: Subsystems build
- February 16: Subsystems build

- February 23: Winter Break, catch up!
- March 2: Systems build
- March 9: Integration
- March 16: Integration/Testing
- March 23: Symposium practice (Symposium is March 27)
- March 30: Complete characterization of instrument/Measurement of forces on basic airfoil.
- April 6: Final Report Writing
- April 13: Final Report Writing
- April 22: (11:00): Final time, Final Presentations, all documents due, lab clean up completed

The instrument should be completed and characterized by April 3 so that you can have time to work on your final report with actual results! As part of this course, you will make a presentation at the Undergraduate Symposium on March 27. You should aim to have some results ready by then. Any delays in finalizing the characterization of the instrument/demonstrating its capabilities beyond April 3 may result in a lowering of your course grade.

## 4 Grading

Your final course grade will be determined based on:

- Team Feedback (10%): Since you are required to attend class, I will have the ability to observe how each team member is performing. Further, there will be team and individual review sessions approximately every two weeks so that I can evaluate progress on the project in a formal setting and ensure that any issues with team members can be discussed. Therefore, I expect to not have any surprises on team feedback at the end of the semester. Still, 10% of your grade will be based on end-of-term peer evaluations.
- Documentation (30%): In addition to proper documentation being necessary for any scientific project, this course serves as your writing intensive experience for the major. Throughout the semester, you will have to provide several documents to me, including an abstract for your symposium talk, the heritage study, the project proposal document, the parts list, and the final report. Each of these will be due on certain days. Some of these will be individual reports, some will be team reports. If they are turned in late, 50% will be reduced from that specific document for each day it is late. You must also maintain a team lab notebook throughout the project that I will look at periodically.

- **Hardware Testing and Progress Reporting (25%):** Testing your systems throughout and after the build is an important step in ensuring that the device operates properly. You will document your progress and each test on a website or blog that you create and maintain.
- **Characterization and demonstration (20%):** Once the device is built and operating correctly, it should be calibrated, the testing chamber should be characterized, and it should be used to measure the forces on some object, ensuring that the minimum goals of the project have been met.
- **Lab Stewardship (10%):** All teams must act responsibly in the lab. It is expected that teams keep their areas organized at all times, respect all of the equipment, and clean up their area when they are done with the semester.
- **Other(5%):** There are a few deadlines for certain deliverables during the course including 1) A preliminary design, a completed apparatus, and others that depend on the path you choose to take to complete the project. Failure to meet the deadlines established in class will result in points being deducted from your grade. Additionally, points will be deducted if you are regularly absent for class or otherwise not meeting the needs of your team throughout the course.

## **5 Keys to a successful project**

1. Complete a wind tunnel based on a well thought out design.
2. Attain a testing flow velocity of at least 30 m/s.
3. Demonstrate that the testing area is free of turbulence and outside the boundary layer.
4. Use the device to measure the lift and drag forces on and observe the flow patterns around at least 2 different objects.