ASEN 1400 / ASTR 2500

Syllabus, Spring 2019

Summary

Gateway to Space is a course designed to grant students experience in designing, building, and flying a small payload on a weather balloon. This course will demand teamwork, and many hours building, programming, testing and analyzing data collected during a weather balloon flight. Students should expect multiple required extra classroom sessions to support reviews, launch and specialty skill workshops. At the end of the semester, the students should be able to; apply the engineering process to future projects, evaluate a balloonsat design and performance, and analyze and explain collected data from the balloon flight.

Lecture:

ITLL 1B50 Tues. and Thur. 9:30 - 10:45 AM

Instructor:

Geoffrey Lake
Email: geoffrey.lake@colorado.edu
Office Hours: Tues 11AM - 12PM, Location: Seebass Forum Room (ECAE 153)
Thurs 8:15 – 9:15AM, Location: Seebass Forum Room (ECAE 153)

Course Assistants:

The course assistants are a great resource for your class. Each has taken the class before and is familiar with the building of a balloonsat, as well as being on teams. Students are expected to utilize their knowledge. Course assistants will provide 1 hour a week in scheduled office hours. They are also available for an additional hour per week to meet by appointment, or answer email.

Shannon Chott
Email: shch2534@colorado.edu
Office Hours: 1:00pm - 2:00pm
Location: ITLL Mezzanine

Sara Reitz
Email: Sara.Reitz@colorado.edu
Office Hours: Mon 10:00am – 11:00am

Location: Aerospace Breakout Room

Alexis Sotomayor
Email: Alexis.Sotomayor@colorado.edu
Office Hours: Wed 3:00pm - 4:00pm
Location: TBD

Internet Information

Class website on Canvas (canvas.colorado.edu) will be used to post and submit assignments.

Email List: The course email list provided through Canvas will be utilized for the course email list. Make sure you enable email notifications from Canvas.

Prerequisites

There are no prerequisites for this class.

Required Texts

Hadfield, C., (2013), *An Astronaut's Guide to Life on Earth: What Going to Space Taught Me About Ingenuity, Determination, and Being Prepared for Anything.* New York, NY: Little, Brown and Company

NASA Systems Engineering Handbook, Revision 2, June 28, 2017
Downloadable at: https://www.nasa.gov/connect/ebooks/nasa-systems-engineering-handbook

References

Colorado SpaceGrant Gateway to Space Archive: https://spacegrant.colorado.edu/boulderstudents/gateway-to-space-home

Camera Instruction Sheet: https://spacegrant.colorado.edu/images/GatewayToSpace/2013/Files/Camera%20A3400IS.pdf

Manes, M., "Foamcore Payload Construction," Proceedings of the First National Small Balloon Symposium, EOSS, 06/1993
https://spacegrant.colorado.edu/images/GatewayToSpace/2016_Fall/files/FOAMCORE.pdf

Learning Goals

The goals of this class are to prepare you for a career in engineering and science through an introduction to the engineering process, and common lifecycle phases of a space program. This course will require that you understand and utilize the engineering process and program lifecycle as well as develop the necessary skills to design, build, test, launch and analyze a balloonsat. In addition, the course intends to introduce all students to the complexity of effective teaming through the project-based course. Finally, the course intends to develop the necessary presentation and communication skills necessary to work effectively in a team and with stakeholders.

Course Calendar

Refer to Schedule 2019 document posted on Canvas (https://canvas.colorado.edu).

Required Hardware

As part of the course you will design, build, and fly a balloonsat. The Aerospace Engineering Sciences (AES) department has invested in many components which will make up your balloonsat, including data loggers, Arduino computers, goPro cameras, and other commonly used components.

The course will **loan** you equipment that includes, but is not limited to; Arduino, GoPro, accelerometers, temperature sensors, soldering irons, etc…The equipment is the property of the AES department and you are responsible for treating all the hardware appropriately and will be held responsible for fixing or replacing the hardware. ALWAYS place the hardware in the provided padded anti-static bags and cases when not in use, and do not expose to excessive heat (i.e. do not leave in your car!).

Some equipment is consumable (replaced every semester) and is your responsibility to acquire and bring to class. Many of these items are used by your team and can be cost shared. ***Some*** items that you will need to acquire through the semester are:

9-Volt batteries (to power your balloonsat)

Dry ice (for thermal testing of balloonsat)

More details will be presented throughout the semester. Your program will require the purchase, integration and analysis of an additional payload. Your team will get up to a $200 budget to purchase all required sensors and hardware to complete that payload.

Overview

The world of aerospace engineering is growing quickly and becomes more interdisciplinary every year. The major aerospace products such as aircraft and satellites are becoming more complex and intelligent in part due to the explosion of information technology. This course is designed to expose the student to the engineering process and interdisciplinary skills needed to design, build, test, fly and analyze a satellite surrogate and experience an abbreviated program life-cycle.

This course has been developed to provide engineers and scientists with the fundamentals of the engineering discipline and provide exposure to a variety of spacecraft subsystems and program roles. The students are expected to work as a team to define the requirements for a chosen payload to be integrated

In this course you will "**learn by doing,**" constructing a ballonsat that will require some team members to perform actions such as, program the controlling computer (Arduino), solder a data logging board, test the satellite for survival in extreme environments, and analyze and interpret collected data.

Class Format

This class is a Freshman level Aerospace Engineering Sciences elective designed to provide students with a background in systems engineering and project experience working within teams to create a small satellite. The course meets twice each week for a total of 3.5 hours. In addition, there are extra class events outside of normally scheduled class times. These extra class times are required and may occur on weekends (Launch) and evenings (workshops and reviews). See schedule for more details.

The course has a variety of formats for class time, including lectures, in-class team time, workshops, and reviews. Lectures will be given by either the professor or a guest lecturer. All lectures will begin promptly and students are expected to be present and ready at the scheduled time. Lecture slides will be posted before class and students are encouraged to review them prior to class and be prepared with questions.

In-class team time will provide teams time to meet and work on building their satellite with faculty assistance available. Additional build times will need to be arranged by the student teams outside of the scheduled class time. In-class team time will require all team members and necessary equipment and hardware to be present. Some in-class team time will be testing that will coincide with lecture time.

Workshops will be held to instruct students in Arduino coding, and soldering. These will begin for the entire class in the scheduled time slot, with additional instruction for a subset of the teams at a later time. All students are expected to attend the scheduled time workshop and teams will designate attendees for the detailed workshops.

Reviews will be held throughout the semester, where each team will present the progress and results of their balloonsat development to the instructor, course assistants and fellow classmates. Reviews consist of a team presenting their material and then answering questions from the reviewers. Students are expected to attend all team reviews and be prepared to ask questions. **ALL students** will be expected to present *no less* than twice throughout the semester. Teams will break up their presenters as they choose within the constraint that every team member will present in at least 2 separate reviews.

Logistics

1. Homework

- **a.** All homework is to be submitted via Canvas (canvas.colorado.edu) by the due date and time. Late submitted homework will be given a 0 for the assignment.
- **b.** All students are allowed to drop the grade of 1 homework during the course of the semester.
- **c.** ***Students are expected to work independently on designated homework.*** All work submitted ***must be your own***, you may only discuss higher-level concepts with your classmates. **You may not sit over another person's shoulder instructing them on the proper way to complete the assignment.** We will check your assignments for similarities and penalize you accordingly.
- d. ***Team homework will be completed as a team and submitted individually.*** Your grade on a team homework will be a function of your team's grade and effort put into the homework as judged by your peers.

2. Reviews

- a. Review presentations will be submitted as a team by the due date and time listed on the schedule. Late submissions will receive a 10% loss of points for the assignment for each 24-hour period that it is late.
- b. Students are expected to attend all reviews and be prepared to ask and answer questions.
- c. Reviews will be separated between class time and evening. All presentations are due at the same time. Team time slots will be assigned by the professor.

d. All students on a team will present a minimum of 2 times within the semester. Teams may sort who speaks at their discretion.

3. **In class team time**
   a. Teams are expected to utilize in-class team time to assemble their satellite with teacher supervision. All students are expected to attend at the beginning and may break up into smaller teams and leave after attendance is taken and announcements are made.
4. **Inter-team Collaboration**
   a. Teams are allowed to collaborate between each other, **but may not share code that is not provided by the instructor unless explicitly approved by the instructor.** Approval may be granted if program managers from 2 groups formulates an agreement and presents it to the instructor. Sharing of code between teams without approval from the instructor will result in disciplinary action.

Course Grading

The course is graded half on an individual basis, and half on a team basis. Figure 1 summaries the percentages of your grade.

Individual Grade		Team Grade	
5 %	Attendance and 1-minute reports	5 %	Requirements Review
5 %	Spatial Visualization Test (pass/fail)	5 %	Preliminary Design Review
5 %	Homework	5 %	Critical Design Review
15 %	Peer reviews	5 %	Launch Readiness Review
20 %	Final Exam	30 %	Final Review and Design Document
50 %	Sub total	50 %	Sub total

Figure 1: Grading Rubric

Attendance will be taken every day. Sign only for yourself and no other students. Signing for another student will be considered cheating and a violation of the Honor Code. 1-minute reports will be filled out on the day of class by midnight via Canvas. Medical absences require a doctor's note to be excused.

The Spatial Visualization test ***must*** be passed to receive the 5% grade. It can be taken multiple times, and for students that fail the first opportunity there are workshops provided by the Integrated Teaching and Learning Laboratory (ITLL) to improve the skills necessary to pass.

If you have taken and passed this test in the past and can provide proof to the professor, you will get credit for this portion of the assignment without re-taking it.

Throughout the semester there will be some individual homework and some team homework. Each student on a team will turn in the same homework as well as a factor sheet. The factor sheet is an assessment of the level of effort of your peers. Your individual grade will be the product of the team grade and the average of the factor from your fellow team members. For example, if the team grade is 89/100, and your team members have given you the following LOE factors (.2, .5, .6, 1, 1, 1, 1), then your total grade would be .89*AVG(LOE) = 67/100.

Peer reviews will be given out to teams 2 times during the semester. Each student will grade and comment on their teammates. These reviews will require justification of assigned grades and specific examples where a reviewed team member excelled, or did not meet expectations.

Team grades will be assigned based on completed documentation as well as presentation. Reviews shall be graded by course assistants and instructor both from presentation material, presentation quality and question and answer phases. During reviews, a subset of the team will present, though all team members may be available to answer questions.

Grading Disputes

If you feel that a homework, exam, or review has been graded incorrectly you must submit your complaint in writing to the instructor. All complaints must be filed within 1 week after the assignment has been returned to the class. Your written request must clearly state your complaint. Be aware the entire assignment may be re-graded during the re-assessment process.

Accommodation Statement

I am committed to providing everyone the support and services needed to participate in this course. If you qualify for accommodations because of a disability, please submit to your professor a letter from Disability Services in a timely manner (for exam accommodations provide your letter at least one week prior to the exam) so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities. Contact Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu. If you have a temporary medical condition or injury, see Temporary Medical Conditions: Injuries, Surgeries, and Illnesses guidelines under Quick Links at Disability Services website and discuss your needs with me.

This course requires the use of Arduino software which has not yet been reviewed fully for accessibility. If you use assistive technology to access the course material, please contact your faculty member immediately to discuss. If you use assistive technology to access the course material, please contact your faculty member and Disability Services at 303-492-8671 or by e-mail at dsinfo@colorado.edu as soon as possible to discuss other effective means for providing equal alternate access.

Religious Observances

Campus policy regarding religious observances requires that faculty make every effort to deal reasonably and fairly with all students who, because of religious obligations, have conflicts with scheduled exams, assignments or required assignments/attendance. If this applies to you, please speak with me directly as soon as possible at the beginning of the term.

Classroom Behavior

Students and faculty each have responsibility for maintaining an appropriate learning environment. Those who fail to adhere to such behavioral standards may be subject to discipline. Professional courtesy and sensitivity are especially important with respect to individuals and topics dealing with differences of race, color, culture, religion, creed, politics, veteran's status, sexual orientation, gender, gender identity and gender expression, age, ability, and nationality. Class rosters are provided to the instructor with the student's legal name. I will gladly honor your request to address you by an alternate name or gender pronoun. Please advise me of this preference early in the semester so that I may make appropriate changes to my records. For more information, see the policies on *class behavior* and *the student code*.

Discrimination and Harassment

The University of Colorado Boulder (CU-Boulder) is committed to maintaining a positive learning, working, and living environment. CU-Boulder will not tolerate acts of discrimination or harassment based upon Protected Classes or related retaliation against or by any employee or student. For purposes of this CU-Boulder policy, "Protected Classes" refers to race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. Individuals who believe they have been discriminated against should contact the Office of Discrimination and Harassment (ODH) at 303-492-2127 or the Office of Student Conduct (OSC) at 303-492-5550. The *full policy on discrimination and harassment* has more information.

Honor Code

All students of the University of Colorado at Boulder are responsible for knowing and adhering to the academic integrity policy of this institution. Violations of this policy may include: cheating, plagiarism, aid of academic dishonesty, fabrication, lying, bribery, and threatening behavior. All incidents of academic misconduct shall be reported to the Honor Code Council (honor@colorado.edu; 303-735-2273). Students who are found to be in violation of *the academic integrity policy* will be subject to both academic sanctions from the faculty member and non-academic sanctions (including but not limited to university probation, suspension, or expulsion). The *Honor Code Office* has more information.