ASEN 2804 – Spring 2023

Aerospace Vehicle Design Laboratory

Lab: M/W 8:30 – 10:20 am (Section 001 / Room Aero 141 PILOT)
M/W 10:35 – 12:25 am (Section 002 / Room Aero 141 PILOT)

T/TH 8:30 – 10:20 am (Section 003 / Room Aero 141 PILOT)
T/TH 10:35 am – 12:25 pm (Section 004 / Room Aero N100 COPILOT)

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Class Canvas Website:

Slack:

Gradescope Site:

Texts (Optional):   Anderson, **Introduction to Flight**, 8th or 9th ed. (hardcopy or electronic version)
Sellers, **Understanding Space: An Introduction to Astronautics**, 3rd or 4th ed.

Pre/Co-requisites: (PR) ASEN 1320; (PR or CR); ASEN 2704, 2012

Required Equipment / Software
- Access to a computer or laptop
- Computational / Programming Software
  - Many assignments will require access to a computer and basic programming skills. Computer programming skills are a prerequisite for this class, e.g. GEEN 1300, ASEN 1320/CSCI 1300. We will not teach computer programming, although we will make an effort to formulate the assignments to emphasize proper computing skills.
  - MATLAB is highly recommended but not required. You can download a free MATLAB license for your personal computer from CU at https://oit.colorado.edu/software-hardware/software-downloads-and-licensing/matlab. You can also use MATLAB Online for this course at https://matlab.mathworks.com/.
  - Use of Excel, Pyton, or any other programming language is allowed; however, you must consider ease of integration across your team members as some consistency across your team is required.
- Any CAD software of your choice

Course Material Costs: This course does not require the purchase of a textbook; however, material fees for the fabrication of your vehicle are required. The lab will provide basic fabrication materials and tools to build your prototype vehicle at no cost; however, all students are expected to contribute an additional $5 towards their team fabrication budget for this course to augment the provided materials with any additional fabrication needs not provided. *Total in-pocket expenses by students is capped at up to $5 and cannot be exceeded by any team or individual regardless of willingness to spend more to ensure all teams operate on the same constrained budget. Materials provided by the course do not count against your budget costs.*

Course Objectives: To introduce the theory and methods for design and analysis of aerospace vehicles through a design project framework. Specific learning objectives are:
1. **Gain experience as a member of an engineering team on an applied, multi-disciplinary aerospace engineering design problem**
   a. Demonstrate ability to integrate lower division engineering knowledge towards meeting engineering design requirements
   b. Exercise engineering judgement in an open-ended, complex engineering design problem
   c. Exercise engineering agility in developing design solutions under conditions of uncertainty
   d. Gain exposure to problems that arise from integration of sub-components / sub-disciplines in an aerospace system
   e. Gain exposure to project management methods for work breakdown schedules, Gantt charts, and milestone design reviews
2. **Develop and assess first-order models in the design of an aerospace system (Application of lower-division engineering concepts)**
   a. Conduct experimentation and/or benchmarking to validate components of engineering models used in design
   b. Identify key design parameters and conduct parametric sizing and sensitivity analysis to optimize your design for requirements
   c. Discuss concept of uncertainty in models and understand why first-order models are useful
3. **Analyze performance of an aerospace system**

a. Develop technical skills in hands on rapid prototyping for the purpose of conceptual design risk and uncertainty mitigation
   b. Compile, condition, and analyze experimental data
4. **Develop effective technical communication and team skills necessary for both intra-team coordination as well as formal technical reviews.**

Course Structure: This course is meant to serve as an integrator of your lower division engineering knowledge as well as preparation for the first semester of your senior capstone project course (ASEN 4018) through exposing you to multidisciplinary team-based engineering and concepts of basic project management. While you will have more choice in the type of project, team structure, and project management of your senior project, this course will pre-define for you the project, team structure and roles, and project management flow to provide you experience before you have full responsibility for all these aspects in ASEN 4018.

Team Structure: The team size will be 6-8 students depending on section enrollment. Team structure is standard for all teams with half of the team members assigned to each of the following sub-team roles.
- Boost-Ascent Sub-Team
- Glide Sub-Team

The Project Management Team (PM Team) will be comprised of the leads for the two sub-teams. As this is a position has some non-technical management responsibilities that not many students have familiarity with doing, it is important to setup specific expectations for this role. The PM Team will have the following authorities and responsibilities for the team:
- Authorities:
  - Establish team schedule (within the context of the overall course project timeline)
  - Establish task timeline for sub-team deliverables (what each sub-team is required to provide for major team milestones)
- Responsible for:
  - Broad technical knowledge across all sub-teams for entire project
  - Coordinate/Lead the integrated milestone submissions conceptual design process
  - Facilitate leveling of knowledge across sub-teams and identification of critical inter-dependencies
  - Structured Team Meeting agendas/notes submissions

PMs will receive the same sub-team assessment scores as their assigned sub-team, but may also receive a score bonus of up to 5% (variable based on performance) on their individual sub-team grade based on how effectively they do their PM duties due to the added responsibilities of the position. PM Bonus will be additive only (i.e. you may not get the bonus, but it will not reduce your overall grade).

Evaluation & Assessments: The course has two main deliverables that are assessed as part of your team and individual grade. All team members will receive the same team grade, but the sub-team portion of the overall grade for each deliverable will be applied with a larger weight to just the individuals in the sub-team. Additionally, a grade multiplier will be applied to your individual sub-team grade based on peer and instructor evaluations that may substantially raise or lower your individual / sub-team grade received from the baseline. The breakdown of the grades and their weight is as follows:

- **Overall Team Grade Deliverables (All team members receive the same overall grade)**
  - Milestone #1: Model Development & Validation Report
  - Milestone #2: Preliminary Design Review Presentation
  - Structured Team Meeting Notes

- **Individual Grades (Only sub-team members receive the component of the overall deliverable that they are responsible for times a multiplier based on peer and instructor evals)**
    - Sub-Team Portion of Milestone #1
    - Sub-Team Portion of Milestone #2
    - Individual Pre-Milestone Prep Quiz
    - Instructor & Peer Performance Evaluation Multiplier: Performance evaluations after each of the two main deliverables based on how much each individual team member is supporting the overall sub-team and team effort and the quality of their individual work for each of the three main deliverables will result in a "multiplier" for the individual's sub-team points that may raise or lower the individual's sub-team grade substantially.

Assignment Summary & Weights

Team grade:	2 x Milestones	40% (20% each)
	5 x Team Meeting Updates	10% (2% each)
Individual Grades:		
	2 x Sub-team portions of Milestones*	40% (20% each)
	2 x Individual Pre-Milestone Prep Quiz	10% (5% each)
TOTAL:		**100%**

*Sub-team Milestone grade will be adjusted for each student by a performance evaluation weighting

- Please verify all your scores and grades on Canvas and Gradescope within 2 weeks after they are posted; requests to change a score need to be made within this period. All regrade requests should be submitted to Gradescope using the "regrade request" functionality.
- We reserve the right to make minor changes to this distribution of weights based on variations in assignments.
- The standard grading scale will be utilized for this course with a C = 73%.
- Minor adjustments may be made in the determination of final letter grades and with grade cut lines, but there is no "curving" in this course.
- To receive a course grade of C or better (which is required to fulfill the prerequisite for junior-year courses), students must receive a C or better in the individual coursework portion of the class. Stated differently, the students who receive an individual grade of C- or lower will not receive any team grades.

Course Delivery: All labs will be conducted in-person only. Due to the emphasis on team learning objectives of the course and reliance on sub-team integration, students are expected to attend all scheduled lab periods in person, and attendance for will be a part of a student's individual grade determination. Lab sections and instruction will NOT be recorded.

Final Exam: There is no final exam for this course. Milestone #2 serves are your final project assignment.

Office Hours / Team Mentors: Office hours will be held throughout the week by both the instructor and teaching assistants for the course (see Canvas page for specific times and locations). Additionally, each student team will be assigned a team mentor from the teaching assistant/teaching fellow instructional team who will be their primary mentor throughout the lab course. This mentor will also advise the course instructor on team performance as feedback into evaluations.

Evaluated Outcomes

The Department of Aerospace Engineering Sciences has adopted a policy of assigning grades according to evaluated outcomes (Ox) in each course. Each assignment designed and graded to assess some combination of several or a few of the following outcomes:

O1   Professional context and expectations (ethics, economics, etc.)
O2   Historical perspective and vision
O3   Multidisciplinary, system perspective
O4   Written, oral, graphical communication ability
O5   Knowledge of key scientific/engineering concepts
O6   Ability to define and conduct experiments, use instrumentation
O7   Ability to learn independently, find information
O8   Ability to work in teams
O9   Ability to design systems
O10   Ability to formulate and solve problems
O11   Ability to use and program computers

Evaluation of these outcomes allows an assessment of your performance and provides a major portion of the process we use for continuous assessment and improvement of the entire AES undergraduate curriculum. The model for these outcomes derives from several sources including the "*Desired Attributes of an Engineer*" as defined by The Boeing Company, and "curriculum reviews" from major aerospace corporations including The Boeing Co., Lockheed Martin Corp. and Ball Aerospace Corp. These inputs were combined with the AES faculty vision of the desired attributes of an aerospace engineer and the requirements of the Accreditation Board for Engineering and Technology (ABET) to produce this list of evaluated outcomes. Each assignment designed and graded to assess some combination of these outcomes.

Additional Administrative Notes:
1. All questions regarding course content (material, homework, quizzes, lab assignments) should be posted to the course Slack workspace or asked over Zoom during lab, recitation, or office hours. Slack posts regarding quizzes or lab assignments that are received 24 hours or less before the deadlines will not be responded to. All other questions, concerns, or issues not regarding course content should be e-mailed to the instructor. E-mails and Slack posts will be responded to during business hours, i.e. Monday through Friday, 8:00 am – 5:00 pm MST/MDT.

2. We reserve the right to make changes to the weekly course schedule based on occurring events that require different dispositions. We will give sufficient advance notice through announcements in class and posting on the web. Changes to this syllabus and assignments-table may be announced at any time during class periods. We will post the current syllabus and assignments-table on the web. Both are dated in the footnote.

3. Canvas will be used to send out announcements, to provide comments to you daily on class activities, and to provide general information about course assignments.

4. Assignment Issues:

   - Collaboration on quizzes, using another student's work as your own, or allowing another student to use your work as their own is considered academic misconduct and will not be tolerated. If you are caught in any of these activities, you will be reported to the Honor Council and be subject to an academic penalty.

   - Regrade requests must be submitted to the professors within 2 weeks of the grade posting to Canvas. Regrade requests should be submitted through Gradescope using the "regrade request" functionality. Regrade requests should not be e-mailed to a member of the instructional team. Regrade requests

are only considered if you believe there was an error in the grading per the written rubric. Regrade requests are not to argue against the grading rubric, as we carefully design this for each quiz.

CLASSROOM BEHAVIOR
Both students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote or online. 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 race, color, national origin, sex, pregnancy, age, disability, creed, religion, sexual orientation, gender identity, gender expression, veteran status, political affiliation or political philosophy. For more information, see the classroom behavior policy, the Student Code of Conduct, and the Office of Institutional Equity and Compliance.

REQUIREMENTS FOR COVID-19
As a matter of public health and safety, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements and all public health orders in place to reduce the risk of spreading infectious disease. CU Boulder currently requires COVID-19 vaccination and boosters for all faculty, staff and students. Students, faculty and staff must upload proof of vaccination and boosters or file for an exemption based on medical, ethical or moral grounds through the MyCUHealth portal.

The CU Boulder campus is currently mask-optional. However, if public health conditions change and masks are again required in classrooms, students who fail to adhere to masking requirements will be asked to leave class, and students who do not leave class when asked or who refuse to comply with these requirements will be referred to Student Conduct and Conflict Resolution. For more information, see the policy on classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please follow the steps in the "Accommodation for Disabilities" statement on this syllabus.

If you feel ill and think you might have COVID-19, if you have tested positive for COVID-19, or if you are unvaccinated or partially vaccinated and have been in close contact with someone who has COVID-19, you should stay home and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). If you are fully vaccinated and have been in close contact with someone who has COVID-19, you do not need to stay home; rather, you should self-monitor for symptoms and follow the further guidance of the Public Health Office (contacttracing@colorado.edu). Immediately notify your instructors of your illness and we will coordinate with you to mitigate course issues that arise due to illness.

ACCOMMODATION FOR DISABILITIES
If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your faculty member in a timely manner so that your needs can be addressed. Disability Services determines accommodations based on documented disabilities in the academic environment. Information on requesting accommodations is located on the Disability Services website. Contact Disability Services at 303-492-8671 or dsinfo@colorado.edu for further assistance. If you have a temporary medical condition, see Temporary Medical Conditions on the Disability Services website.

PREFERRED STUDENT NAMES AND PRONOUNS
CU Boulder recognizes that students' legal information doesn't always align with how they identify. Students may update their preferred names and pronouns via the student portal; those preferred names and pronouns are listed on instructors' class rosters. In the absence of such updates, the name that appears on the class roster is the student's legal name.

HONOR CODE

All students enrolled in a University of Colorado Boulder course are responsible for knowing and adhering to the Honor Code. Violations of the Honor Code may include, but are not limited to: plagiarism, cheating, fabrication, lying, bribery, threat, unauthorized access to academic materials, clicker fraud, submitting the same or similar work in more than one course without permission from all course instructors involved, and aiding academic dishonesty. All incidents of academic misconduct will be reported to Student Conduct & Conflict Resolution (honor@colorado.edu); 303-492-5550). Students found responsible for violating the Honor Code will be assigned resolution outcomes from the Student Conduct & Conflict Resolution as well as be subject to academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found on the Honor Code website.

SEXUAL MISCONDUCT, DISCRIMINATION, HARASSMENT AND/OR RELATED RETALIATION
CU Boulder is committed to fostering an inclusive and welcoming learning, working, and living environment. University policy prohibits sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, protected-class discrimination and harassment, and related retaliation by or against members of our community on- and off-campus. These behaviors harm individuals and our community. The Office of Institutional Equity and Compliance (OIEC) addresses these concerns, and individuals who believe they have been subjected to misconduct can contact OIEC at 303-492-2127 or email cureport@colorado.edu. Information about university policies, reporting options, and support resources can be found on the OIEC website. Please know that faculty and graduate instructors have a responsibility to inform OIEC when they are made aware of any issues related to these policies regardless of when or where they occurred to ensure that individuals impacted receive information about their rights, support resources, and resolution options. To learn more about reporting and support options for a variety of concerns, visit Don't Ignore It.

RELIGIOUS HOLIDAYS
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 attendance. In this class, all conflicts with scheduled exams, quizzes, or assignments should be coordinated within the first two weeks of class (NLT 1 Feb) to ensure enough time to plan any adjustments that result. See the campus policy regarding religious observances for full details.