ASEN 6316: Extravehicular Activity

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Lecture: T/Th 2:30 – 3:45 pm, AERO N240
Office Hours: M 8:00-9:00, W 4:00 – 5:00 pm
Zoom: https://cuboulder.zoom.us/j/98575306074; pw: 1969. The same zoom room will be used for both Lecture and Office Hours.

1. Overview

Extravehicular activity (EVA) is critical for human spaceflight to achieve tasks such as habitat construction, hardware repair, and planetary exploration. These activities are complex, requiring substantial preparation to be executed safely and successfully. EVA has enabled us to accomplish some of the greatest feats of the space program, such as the Apollo moonwalks and Hubble Space Telescope repair missions. Despite its many advantages, these activities are not without cost to the astronauts who perform EVA. Much of the technology used to perform EVA is based on heritage designs and proven technology, enabling an exceptionally high safety record despite the potential risks associated with EVA. As we transition back to EVA on the surface of celestial bodies, such as the Moon or Mars, advancements in EVA hardware and new paradigms in operations will be required.

This course is designed to expose students to all aspects of EVA (see 3. Topics Covered). Although not a traditional academic topic, this course will draw upon the academic elements of design, engineering, technology development, physiology, operations, human-machine interaction, and geology to provide an interdisciplinary look at this topic. The primary learning objectives are:

- Develop a historical perspective on EVA to enable an understanding of current capabilities and technologies.
- Distinguish between the requirements, needs, and challenges for performing EVA in all anticipated environment regimes.
- Investigate solutions to address current needs in EVA.

This course will be offered in person, and through virtual formats (synchronously or asynchronously) this semester. Lectures will be recorded via lecture capture, but if possible, I strongly encourage you to make the scheduled class time rather than watching the filmed lectures online. This class is most fruitful with active discussions, often resulting from questions asked by students. I recognize that distance many will not be able to attend synchronously on zoom, but I will strive to maintain an interactive atmosphere as much as possible via the Canvas website and the group project.

2. Assessment

Table 1 outlines the material by which student performance will be assessed. This course will have 2 exams and we will not use the time-slot assigned during finals week, unless

needed for schedule accommodations (see below). Students will engage in a team-based design project. Distribution of the project assessment is shown in Table 2. Additional details on timeline and due dates can be found in the course schedule document.

Table 1: Distribution of course assessments

Exams (2)	30%
Homework (3)	30%
Design Project	30%
In-Class EVA Presentation	10%
	100%

Table 2: Distribution of project assessment

Project proposal	5%
Mid-semester project review	5%
Final project deliverables	15%
Peer evaluation	5%
	30%

No late homework is accepted in this class and you are not permitted to reschedule your EVA presentation. I recognize, though, that extenuating circumstances may arise. Please email me immediately if you have an extenuating circumstance. I reserve the right to approve, reject, or partially approve with a credit deduction based upon your condition. Note, that since I like to bring in external guests, which may cause last-minute changes to the schedule.

All exams must be completed during the time scheduled, and I will not give make-up exams. However, if granted per guidelines above, if you must miss an exam, a single make-up exam will be given to anyone in that circumstance.

3. Topics Covered

The following topics will be addressed, both in lecture and through relevant readings: pressure garments, life support systems, health concerns, planetary geology, exploration, training analogs, tool design, transportation systems, and operations. Additional details can be found in the course schedule document.

4. Textbook

The required textbook for the class is Thomas and McMann. U.S. Spacesuits, 2nd ed. ISBN 978-1-4419-9566-7. It is important to get the 2nd edition since it is substantially updated from the original version of the text. Additional readings will be assigned from other resources, but I will provide PDFs since some sources are out of print or from a larger text not required for purchase.

For additional reading that may be of interest, but not required, please see:

- Peter Eckart, Spaceflight Life Support and Biospherics. Springer, 1996. (Available through the CU E-library)

- Nicholas de Monchaux, Spacesuit: Fashioning Apollo. MIT Press, 2011.
- Thomas J. Kelly, Moon Lander. Smithsonian Books, 2001.
- Dave Mindell, Digital Apollo. MIT Press, 2008

5. 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 policies on classroom behavior and the Student Code of Conduct.

6. Requirements for COVID-19

There will be no in-person elements associated with this class. As a matter of public health and safety due to the pandemic, all members of the CU Boulder community and all visitors to campus must follow university, department and building requirements, and public health orders in place to reduce the risk of spreading infectious disease. For more information, see the policies on COVID-19 Health and Safety and classroom behavior and the Student Code of Conduct. If you require accommodation because a disability prevents you from fulfilling these safety measures, please see the "Accommodation for Disabilities" statement on this syllabus.

All students who are new to campus must complete the COVID-19 Student Health and Expectations Course. Students who have tested positive for COVID-19, have symptoms of COVID-19, or have had close contact with someone who has tested positive for or had symptoms of COVID-19 must stay home. In this class, if you are sick or quarantined, please let me know. The aforementioned accommodations should enable you to successfully complete all course deliverables, but I appreciate you communicating your situation early with me.

7. 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.

8. 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.

9. 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 policy may include: 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 the Honor Code (honor@colorado.edu); 303-492-5550). Students found responsible for violating the academic integrity policy will be subject to nonacademic sanctions from the Honor Code as well as academic sanctions from the faculty member. Additional information regarding the Honor Code academic integrity policy can be found at the Honor Code Office website.

10. Sexual Misconduct, Discrimination, Harassment and/or Related Retaliation

The University of Colorado Boulder (CU Boulder) is committed to fostering an inclusive and welcoming learning, working, and living environment. CU Boulder will not tolerate acts of sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, or protected-class discrimination or harassment by members of our community. Individuals who believe they have been subject to misconduct or retaliatory actions for reporting a concern should contact the Office of Institutional Equity and Compliance (OIEC) at 303-492-2127 or cureport@colorado.edu. Information about the OIEC, university policies, anonymous reporting, and the campus resources can be found on the OIEC website.

Please know that faculty and graduate instructors have a responsibility to inform OIEC when made aware of incidents of sexual misconduct, dating and domestic violence, stalking, discrimination, harassment and/or related retaliation, to ensure that individuals impacted receive information about options for reporting and support resources.

11. 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, please let me know as soon as possible if you have a conflict. The aforementioned COVID-19 accommodations for assessment should enable you to successfully complete all class elements, but please let me know at a minimum of 2 weeks in advance.

See the campus policy regarding religious observances for full details.