

ASEN 5519 Special Topic Uncrewed Aircraft Systems in the National Airspace System Spring 2024



INSTRUCTOR: Brian M. Argrow, Glenn L. Murphy Distinguished Professor
Smead Aerospace Engineering Sciences

TIME: T, Th, 8:30 am – 9:45 am

OFFICE: AERO 261, **HOURS:** Tue 10:00 – 11:00 am, Wed 09:00 – 10:00 am

E-MAIL: brian.argrow@colorado.edu

COURSE WEBSITE: <https://canvas.colorado.edu>.

PURPOSE

This course is designed to explore and understand current issues related to the integration of Uncrewed Aircraft Systems (UAS) into the National Airspace System (NAS). The course starts with an historical overview of UAS leading to systems operating today, in terms of the physical characteristics, performance, and applications. The structure of the NAS, and technologies and the evolving regulatory environment for managing aircraft separation are discussed, including the influence of public perception on regulations and laws for the operations of UAS in the NAS.

LEARNING GOALS

- Develop historical knowledge of UAS and the applications that drive their development.
- Develop knowledge of the physical characteristics and performance of UAS and emerging eVTOL aircraft.
- Develop knowledge of regulations and policies required to operate UAS in the NAS.
- Develop knowledge of technologies to enable sensing, detection, and collision avoidance.

- Understand the FAA safety risk management process, airworthiness certification, and emerging UAS standards.
- Understand regulatory and public perception challenges for NAS integration.

TOPICS

1. UAS physical characteristics, categorization, performance, and applications
2. National Airspace System (NAS)
3. Aviation safety and assessing the risk of UAS integration into the NAS
4. Current regulations and policies for UAS certification and operations in the NAS
5. Certification challenge for increasingly autonomous UAS
6. UAS traffic management
7. New entrants into the NAS

PREREQUISITES BY TOPIC

Students should be familiar with the basics of aircraft performance (e.g., basic aerodynamics, stability and control, structures, propulsion) typically required for a BS-level degree in aeronautical or aerospace engineering. Students must be able to employ computing environments such as MATLAB or Python. Student should have the capability of BS-level technical writing with mastery of spelling and grammar in American English.

ASSIGNMENTS

Readings from reports and research papers will be assigned. Students will provide written assessments and lead discussions of these papers. All assignments will be submitted electronically on the course website. Individual and/or group projects will be assigned that might require multiple weeks of effort. Some projects will require MATLAB programming.

GRADING

Reading quiz	10%
Homework	20%
Exams (2)	30%
Projects (3)	40%

ADDITIONAL ITEMS

Classroom Behavior

Students and faculty are responsible for maintaining an appropriate learning environment in all instructional settings, whether in person, remote, or online. Failure 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 Infectious Disease

Members of the CU Boulder community and visitors to campus must follow university, department, and building health and safety requirements and all applicable campus policies and public health guidelines to reduce the risk of spreading infectious diseases. If public health conditions require, the university may also invoke related requirements for student conduct and disability accommodation that will apply to this class.

If you feel ill and think you might have COVID-19 or if you have tested positive for COVID-19, please stay home and follow the [guidance of the Centers for Disease Control and Prevention \(CDC\) for isolation and testing](#). If you have been in close contact with someone who has COVID-19 but do not have any symptoms and have not tested positive for COVID-19, you do not need to stay home but should follow the [guidance of the CDC for masking and testing](#).

Accommodation for Disabilities, Temporary Medical Conditions, and Medical Isolation

If you qualify for accommodations because of a disability, please submit your accommodation letter from Disability Services to your instructor 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. If you have a required medical isolation for which you require adjustment, please inform your instructor as soon as possible, so that we can set appropriate accommodation.

Preferred Student Names and Pronouns

CU Boulder recognizes that students' legal information does not 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 (including use of paper writing services or technology [such as essay bots]), 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. Visit [Honor Code](#) for more information on the academic integrity policy.

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 [protected-class](#) discrimination and harassment, sexual misconduct (harassment, exploitation, and assault), intimate partner violence (dating or domestic violence), stalking, 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 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 must inform OIEC when they are made aware of incidents related to these policies regardless of when or where something occurred. This is to ensure that individuals impacted receive outreach from OIEC about resolution options and support resources. To learn more about reporting and support for a variety of concerns, visit the [Don't Ignore It](#) page.

Religious Accommodations

Campus policy requires faculty to provide reasonable accommodations for students who, because of religious obligations, have conflicts with scheduled exams, assignments or required attendance. Please communicate the need for a religious accommodation in a timely manner. In this class, please inform your instructor at least two weeks in advance to provide accommodation. See the [campus policy regarding religious observances](#) for full details.

Mental Health and Wellness

The University of Colorado Boulder is committed to the well-being of all students. If you are struggling with personal stressors, mental health or substance use concerns that are impacting academic or daily life, please contact [Counseling and Psychiatric Services \(CAPS\)](#) located in C4C or call (303) 492-2277, 24/7.

Free and unlimited telehealth is also available through [Academic Live Care](#). The [Academic Live Care](#) site also provides information about additional wellness services on campus that are available to students.