

AERO/EE/CS F658, Unmanned Aircraft Systems (UAS) Operations

Spring 2024

Course Information

Instructor: Dr. Michael Hatfield, ELIF136
Phone: 907.987.2610, Email: mchatfield@alaska.edu
Office Hours: MW/1:00-4:00; TH/10:00-1:00
*You may schedule an appointment or just drop by. The best way to reach me outside of office hours is via email.

Lectures: MWF 11:45-12:45
Location: DUCK344 (UAF)/TBD (UAA) + Zoom

Prerequisites: Graduate Standing or instructor permission.

Textbook: Designing Unmanned Aircraft Systems, A Comprehensive Approach (2nd Ed), Jay Gundlach, AIAA Education Series

References: Other reference materials may be required or posted electronically on Canvas during this course.

Methodology: Course will be delivered as a hybrid model. Lectures will be delivered via classroom face-to-face methodology and Zoom connectivity supported. Students will participate actively within a small group setting to tackle a designated UAS mission design, culminating with a final report and briefing on their data products and mission results. Design team activities may be accomplished either face-to-face or via remote means.

Course Content: This course covers the use of unmanned aircraft systems (UAS), sensors, subsystems, and support infrastructure required to conduct a selected mission set. Course emphasis is on mission analysis, planning, and conduct for selected operation, to include definition of user requirements and constraints, identification of appropriate assets, flight planning considerations, and data analysis requirements. Team will coordinate resources for conduct of mission and report results and lessons learned to user.

Credits: 3

Important Dates:

January 16:	First day of classes
January 26:	Last day to drop (course does not appear on academic record)
March 29:	Last day to withdraw ('W' appears on academic record)
April 29:	Last day of classes

Course Policies

E-mail

You are expected to regularly check your alaska.edu email address. This address will be used for class correspondence – announcements, homework problems clarifications, etc. If you are not using the official UAF email address, please forward it to your address of choice.

Attendance and Professionalism

Class attendance is counted upon. Excessive absences, tardiness, walking in and out during class, or other unprofessional behavior will result in points deducted from your grade. If you miss a class, lecture slides and other handouts are available on Blackboard or can be obtained from the instructor.

Plagiarism

As a UAF student, you are subject to UAF's Honor Code:

"Students will not collaborate on any quizzes, in-class exams, or take-home exams that will contribute to their grade in a course, unless permission is granted by the instructor of the course. Only those materials permitted by the instructor may be used to assist in quizzes and examinations.

Students will not represent the work of others as their own. A student will attribute the source of information not original with himself or herself (direct quotes or paraphrases) in compositions, theses and other reports. No work submitted for one course may be submitted for credit in another course without the explicit approval of both instructors.

Violations of the Honor Code will result in a failing grade for the assignment and, ordinarily, for the course in which the violation occurred. Moreover, violation of the Honor Code may result in suspension or expulsion."

Statement of Non-Discrimination

Non-Discrimination

The University of Alaska is an affirmative action/equal opportunity employer and educational institution. The University of Alaska does not discriminate on the basis of race, religion, color, national origin, citizenship, age, sex, physical or mental disability, status as a protected veteran, marital status, changes in marital status, pregnancy, childbirth or related medical conditions, parenthood, sexual orientation, gender identity, political affiliation or belief, genetic information, or other legally protected status. The University's commitment to nondiscrimination, including against sex discrimination, applies to students, employees, and applicants for admission and employment. Contact information, applicable laws, and complaint procedures are included on UA's statement of nondiscrimination available at www.alaska.edu/nondiscrimination. For more information, contact the UAF Department of Equity and Compliance, uaf-deo@alaska.edu/907.474.7300.

Students with Disabilities

I will work with the Office of Disability Services to provide reasonable accommodation to students with disabilities. Disability Services is located in 208 Whitaker, 474-5655, fydso@uaf.edu.

Masks or face shields will be required for individuals accessing campus this fall. For additional assistance or accommodations, students can contact [UAF Disability Services](#) and employees and visitors can contact [UA Human Resources](#) to receive guidance or request a reasonable accommodation.

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Grading

Point Summary

Mission Analysis Report	10%
Mission Analysis Presentation	5%
Mission Operations Plan	10%
Mission Operations Presentation	5%
Mission Results Report	10%
Mission Results Presentation	10%
Homework	10%
Exam1 (Midterm)	10%
Exam2 (Final)	10%
Team Video	5%
Team Website	5%
Conference Paper	5%
Class Participation	5%

Plus/Minus grading will be used.

Performance Expectations

Assigned reading is to be completed before class. Readings will be assigned in advance and will consist of reviewing short sections of the text and supplementary materials (instructor's lesson slides).

Homework is generally due at the beginning of next class period, unless otherwise noted by the instructor. Presentation slides and reports due at beginning of class periods. Late submissions will not be accepted without prior arrangement. Early coordination of work with instructor is encouraged.

Exams

There will be one 1-hour exam and one 2-hour final exam. No makeup exams will be given except for documented extenuating circumstances. If you anticipate an absence (work commitments, intercollegiate sports), talk to your instructor before the exam to make arrangements. If the absence is unexpected (illness, family or personal difficulties), please inform your instructor at the earliest possible opportunity.

Class Participation

The grade for class participation will depend on: (1) Attendance and asking and answering questions in class; (2) Participation in group activities; (3) Feedback by team members.

Class Project

Consists of 2 project reviews (both briefing & written reports), culminating with a final project briefing and final report. Final briefing and report are cumulative and should address instructor feedback provided during the semester. All submissions are to be shared by the entire team, and each member's work must be delineated. More details for the Mission Analysis are provided at the end of this syllabus.

Project Teams

AERO 658 projects will be accomplished by small teams of (~2-4) students, depending on the class size and complexity of the desired missions/products. Project reports/briefings will be team effort with in-

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depth coverage all major aspects of a UAS/sensor suite supporting the approved mission set. Mission sets will be either representative or actual data sets of interest to agencies and researchers. Guidance for accomplishment of the flight missions/data products will be provided by instructor upon assignment of the project.

Mission Analysis

The mission analysis phase is based upon a specific mission need statement provided to the team outlining the mission set to be performed. Students are required to justify which real-world UAS and sensor suites are best suited for the mission given various factors (eg, flight performance/endurance time/max payload, asset availability/costs, data analysis required).

Mission Operations

The mission operations phase builds upon the mission analysis, adding realistic planning for various aspects of field operations (eg, logistics, transportation, communications, safety, data collection/reduction). Planning is conducted from the perspective of a grant proposal involving UAS and from a mission director perspective charged with executing/overseeing a flight campaign.

Mission Results

The mission results highlights significant aspects of the previous phases and details results of the mission campaign (eg, mission results, data products, data processing techniques, flight anomalies, mission data anomalies, lessons learned). The briefing includes the final team video detailing significant aspects of the team's efforts throughout the course.

Review Process

Guest reviewers are subject matter experts (SMEs) from their fields. SMEs will be provided from the UAS flying ops world, scientific researchers, and agency representatives conducting research similar to what is being asked of that specific team for their operations (USFS, BLM, AFS, NOAA...). Prior to the delivering presentations/reports, SMEs will be provided with expectations on products and mission analysis and will then provide qualitative inputs to be considered by the instructor in evaluation of these.

Evaluation of Reports/Briefings

For all reports, students are required to highlight those aspects of the reports which they have personally worked on. Reports will receive a team score as a baseline, and individual grades for the students may be raised/lowered with respect to this baseline grade based on the quality of their individual inputs. Similarly, groups receive a baseline grade for their presentations. Individual students' grades may be adjusted up/down based on their performance.

Conference Papers

The conference paper deliverable is meant to introduce students to the general process of submitting technical papers for consideration at a professional conference (eg, ASEE, AIAA, IEEE...). Papers are accomplished by incorporating the materials teams have generated for their final report and converting this into a format acceptable for the professional organization (ASEE, IEEE, ASME...). The instructor will provide samples of successful conference papers for students to pattern submissions after.

Safety

Student Protections

UAF embraces and grows a culture of respect, diversity, inclusion, and caring. Students at this university are protected against sexual harassment and discrimination (Title IX). Faculty members are designated as responsible employees which means they are required to report sexual misconduct. Graduate teaching assistants do not share the same reporting obligations. For more information on your rights as a student and the resources available to you to resolve problems, please go to the following site:

- <https://catalog.uaf.edu/academicsregulations/students-rights-responsibilities/>

Emergency Notification Plan

Students will receive Emergency Notifications via email or phone. Please check your UAOnline account to confirm your Emergency Notification settings. In any cases where you do not have access to your devices, as your instructor, I will take responsibility to relay any emergency notifications. For more information, please refer to the following resources:

- UAF Student Handbook
 - <https://www.uaf.edu/handbook/>
- UAF Emergency Response Checklists
 - Resources include checklists for emergency situations, such as
 - Active Shooter/Violent Intruder
 - Fire or Explosion
 - Bomb Threat
 - Medical Emergency
 - ...and many others
 - Please take the time to familiarize yourself with these resources at
 - <https://www.uaf.edu/police/campus-safety-clery/emergency-procedures.php>
- UAF Emergency Notification information
 - UAF uses the Rave Guardian App
 - <https://www.ravemobilesafety.com/solutions/campus-safety>
 - Settings for your UAF account are managed via UAOnline
- Where to find information during an emergency
 - UAF on Alert: <http://uafalert.alaska.edu>
 - Facebook and Twitter: @uafairbanks

COVID

Students should keep up-to-date on the university's policies, practices, and mandates related to COVID-19 by regularly checking this website:

- <https://sites.google.com/alaska.edu/coronavirus/uaf/uaf-students?authuser=0>

Further, students are expected to adhere to the university's policies, practices, and mandates and are subject to disciplinary actions if they do not comply.

AERO 658 Student Learning Outcomes

Course Goals: The student will be able to:

- Gain a broad understanding of UAS as an enabler for scientific research and public service missions
- Appreciate unique challenges of the Alaska environment affecting UAS operations
- Appreciate vital legal and ethical considerations in the use of drones for business or personal use
- Investigate the ability of specific UAS/sensor packages in supporting mission requirements
- Understand mission planning considerations, such as flight planning and data requirements planning
- Know airspace and FAA regulations governing the use of UAS for mission accomplishment

Learning Outcomes: Upon completing this course, the student will be able to:

- Conduct a mission analysis for proposed mission set including the following:
- Investigate user requirements for data satisfying mission objectives
- Determine potential UAS and sensor assets capable of performing the selected mission
- Recommend best UAS and sensor combination based on mission requirements, asset performance, and logistics considerations such as asset availability, reliability, and support costs
- Effectively plan mission, schedule resources, conduct mission, perform data analysis, and create final data product
- Clearly and concisely communicate decisions made, results of mission, and lessons learned in both verbal and written form

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Syllabus

Meeting	Date	Chapter	Topic	Assignments/Notes
	January 15 Monday	Alaska Civil Rights Day		
1	January 17 Wednesday		Course Admin; Course Overview	
2	January 19 Friday		Course Overview (2)	
3	January 22 Monday		Mission Analysis	
4	January 24 Wednesday		Classes of UAS	
5	January 26 Friday		UAS/Subsystems	
6	January 29 Monday		Sensors & Capabilities	
7	January 31 Wednesday		Sensors & Capabilities	
8	February 2 Friday		Part 107 [Guest Lecturer]	
9	February 5 Monday		Scientific Missions [Guest Lecturer]	
10	February 7 Wednesday		Communications & Data Handling Subsystems	
11	February 9 Friday		Data Analysis Tools Overview [Guest Lecturer]	
12	February 12 Monday		Mission Discussion with User	
13	February 14 Wednesday		Mission Analysis	
14	February 16 Friday		Mission Analysis	
15	February 19 Monday		Presentation of Preliminary Mission Analysis	
16	February 21 Wednesday		Team Planning	
17	February 23 Friday		Team Planning	
18	February 26 Monday		Team Planning	Draft Mission Analysis Due
19	February 28 Wednesday		Team Planning	
20	March 1 Friday		Airspace SME Q&A [Guest Lecturer]	
21	March 4 Monday		Team Presentations, Mission Analysis	

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Meeting	Date	Chapter	Topic	Assignments/Notes
22	March 6 Wednesday		Team Presentations	
23	March 8 Friday		Team Presentations	
	March 11-15	Spring Break		
24	March 18 Monday		Remote Sensing SME [Guest Lecturer]	
25	March 20 Wednesday		E1: Exam 1	
26	March 22 Friday		Ops Planning Scenarios	
27	March 25 Monday		Ops Planning Scenarios	Final Mission Analysis Due
28	March 27 Wednesday		Contingency Planning	
29	March 29 Friday		Contingency Planning	
30	April 1 Monday		Team Presentations, MO	
31	April 3 Wednesday		Team Presentations, MO	
32	April 5 Friday		Team Presentations, MO	Draft Mission Operations Plan Due
33	April 8 Monday		Team Planning	
34	April 10 Wednesday		Team Planning	
35	April 12 Friday		Team Planning	
36	April 15 Monday		Team Planning	
37	April 17 Wednesday		Team Planning	
38	April 19 Friday		Feedback & Discussion	
39	April 22 Monday		Final Team Briefings	Final Mission Operations Plan Due
40	April 24 Wednesday		Final Team Briefings	
41	April 26 Friday		Final Team Briefings	
42	April 29 Monday		Course Wrap up	Team Report, Video & Website Due