

UAS Workshop



Summer 2022 Syllabus

Instructors

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About this Course

Description

Unoccupied Aircraft Systems (UAS), or drones, provide us with new ways to map, monitor, and measure our changing landscape. UAS are relatively inexpensive, easy to operate, and can deploy rapidly. Advances in digital image processing allow one to go from flying a drone to working with accurate maps and 3D models in a matter of hours. These factors make UAS ideal for many applications in which speed, accuracy, resolution, cost, and timeliness are key factors.

This course provides professionals with a comprehensive overview of UAS. It covers flight safety, flight planning, flight operations, data processing, data analytics, and information dissemination. The materials in this course provide participants with an immersive introduction to UAS technology, with a focus on hands-on applied learning using real-world scenarios. The course will consist of online sessions with instructors, self-paced tutorials, and an optional in-

person flight operations components held on the UVM campus. Technologies that participants will be exposed to will include UAS platforms, UAS sensors, flight planning software, image processing software, desktop Geographic Information Systems (GIS), and web mapping. Students will work closely with members of the University of Vermont UAS Team, one of the most experienced drone groups in the United States.

Topics of Study

- **Organizational Considerations:** Policies, procedures, capabilities and limitations, cost-benefit analysis, training, and information technology.
- **Regulations:** Certification, airspace classes, waivers, and risk assessment.
- **Platforms:** Multi-rotor and fixed-wing UAS.
- **Sensors:** True-color, multispectral, thermal, and LiDAR.
- **Flight Planning:** Risk assessment, flight planning software, flight logging software, mission checklists, and pre-flight checklists, mapping missions, point-of-interest missions, and inspection missions.
- **Flight Operations:** Employing multi-rotor and fixed-wing UAS platforms to collect data.
- **Data Processing:** Processing UAS images, video, and LiDAR to create products.
- **Data Analysis:** Visualization, image interpretation, volume calculations, spectral analysis, thermography.
- **Data Sharing and Dissemination:** Web applications.



Format

This course is offered with a hybrid approach of online content and optional in-person learning on UVM's campus.

Live Online Sessions

The virtual component consists of a series of one-hour online sessions during August 1st-5th and 8th-9th. These seven sessions will serve to introduce UAS concepts and allow participants to begin working on a series of self-paced learning modules. A time that best suits the schedule of the most participants will be selected, and recordings of the sessions will be made available for review.

Self-Paced Learning Modules

Throughout the course, participants will work through a series of self-paced modules in which they employ UAS technology to assist with a particular problem. The module themes range from developing a 3D model of a rock slope, to calculating the volume of wood chips used for biomass energy production, to mapping invasive species. The instructional staff will assist participants using online discussion forums and virtual meetings. These modules will be available for the duration of the course, from August 1st-19th.



Orientation

The first module will introduce students to the virtual learning environment and software packages used in the course.

UAS Mapping

The second module will focus on understanding regulations, becoming familiar with flight planning concepts, simulated data collection, photogrammetric data processing, analysis of geospatial data, and the use of web mapping applications.

3D Modeling & Volume Estimation

The third module will focus on flight planning and processing to develop 3D models using UAS photogrammetry. Students will measure and analyze the different types of generated models and learn how to estimate volumes using UAS-generated 3D data.

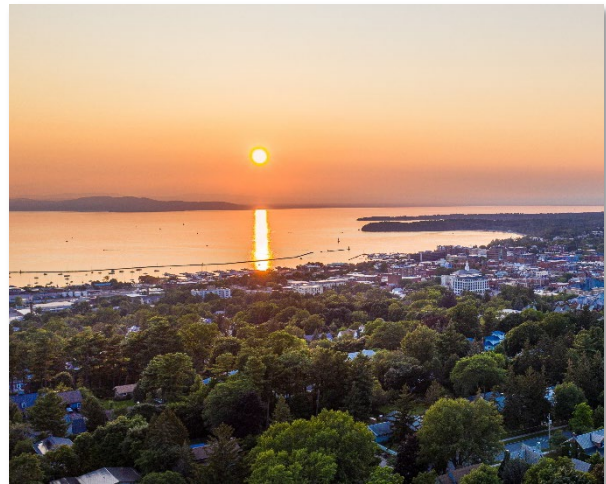
Multispectral Imaging

The final module covers processing of multispectral imagery with the goal of mapping vegetation and invasive species. Students will practice data collection, processing, and analysis of multispectral imagery before disseminating their results through a web mapping application.

In-Person Flight School (Optional)

This course offers an option to attend three days of in-person flight school instruction on UVM's campus from August 15th-17th. This portion of the course is optional for participants but provides real-world flight experience with a variety of UAS platforms and sensors, as well as hands-on instruction with industry-standard UAS and geospatial software packages. Participants will be able to develop proficiency in piloting skills on a National Institute of Standards and Technology (NIST) sUAS Test Lane and will conduct end-to-end UAS mapping workflows including flight planning, flight operation, and data processing, analysis, and sharing. Additional learning outcomes will be dependent both on weather and topics of particular interest to the participants.

Participants will be responsible for transportation, meals, and lodging (if required) during this portion of the workshop. The instructional team will provide access to a variety of UAS platforms and sensors and a state-of-the-art computer lab with a variety of software packages. The in-person training is limited to a maximum of 12 participants to allow for significant hands-on experience and instructor interaction. An **additional course fee of \$500** will be required to attend the in-person instructional portion of the course, accounting for UAS equipment and computer lab fees. The cost of on-campus parking is not included.



Technology

Participants will need access to a computer (Windows, Mac, or Chromebook) with a broadband internet connection (Five Mbps upload/download minimum). The only software required is a free virtual machine client and thus participants will need to be able to install this software on their computer. All participants will be provided access to a virtual Windows desktop running the software used in the course, which consists of flight planning, photogrammetry, and GIS applications. Accounts will also be provided for web-based mapping.

Prerequisites

There are no formal educational prerequisites for this course, though participants must be comfortable using desktop computers. A basic familiarity with the Windows operating system and simple tasks, such as unzipping a file, navigating to specific file locations, and launching different software packages, are fundamentals required for this course.

Course Materials

E-Learning Platform

This course will use UVM's Blackboard environment to host discussions, course content, and submissions. The Rise 360 course environment will host the self-paced learning modules.

Textbook

There is no textbook requirement for this course.

Required Purchase

No purchase is required for this course.

Schedule

The course will run from Monday, August 1st – Friday, August 19th, 2022. Formal class days will be weekdays with instructional support available over the weekend. Scheduling times of the online lectures and help sessions will be arranged to best accommodate the schedule of the participants.

The final week of the course will incorporate the optional in-person instruction from Monday, August 15th – Wednesday August 17th. Participants who elect to complete only the online portion of the course will have an open schedule to complete the remaining self-paced course modules. During this week, live instructional assistance and support via the online discussion board will be available each day. All submissions of the course modules should be completed by 11:59pm on Friday, August 19th.



Sunday	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday
Jul 31	Aug 1	2	3	4	5	6
	Module 0: Orientation		Module 1: UAS Mapping			
	9:00am Online lecture 1 (time TBD)	Online lecture 2 (time TBD)	9:00am Online lecture 3 (time TBD)	9:00am Online lecture 4 (time TBD)	9:00am Online lecture 5 (time TBD)	
7	8	9	10	11	12	13
	Module 1: UAS Mapping		Module 2: 3D Modeling			
	9:00am Online lecture 6 (time TBD)	9:00am Online lecture 7 (time TBD)				
14	15	16	17	18	19	20
	Module 2: 3D Modeling		Module 3: Multispectral Imaging			
		Optional in-person instruction (UVM campus)				

Course schedule

Course Badge

Upon satisfactory completion of the course, participants are eligible to receive a digital badge certifying their knowledge in implementing UAS technology and their proficiency in UAS data processing and analytics.

To earn the **UAS Analytics** badge, participants must demonstrate comprehension of the course material by:

- Attending and/or viewing the recording of each online course lecture.
- Completing all course modules with a 70% grade or better. All modules must be submitted by 11:59pm on the final date of the course.
- Participation in discussions during lectures, online live help sessions, and/or on the Blackboard discussion board.

To earn the **UAS Flight Operations** badge, participants must attend the in-person module of the workshop and demonstrate comprehension of the course material and flight skills by:

- Attending in-person training modules.
- Successful completion of at least one NIST UAS Open Test Lane.
- Completion of end-to-end mapping workflow, including flight plan generation, data collection, data processing, and data sharing.

Policies

Our Common Ground

The University of Vermont is an educationally purposeful community seeking to prepare students to live in a diverse and changing world. We who work, live, study, teach, do research, conduct business, or participate in the University of Vermont are members of this community. As members, we believe in the transforming power of education and agree to help create and foster an environment where we can discover and reach our true potential.

We aspire to be a community that values:

RESPECT. We respect each other. We listen to each other, encourage each other and care about each other. We are strengthened by our diverse perspectives.

INTEGRITY. We value fairness, straightforward conduct, adherence to the facts, and sincerity. We acknowledge when things have not turned out the way we had hoped. As stewards of the University of Vermont, we are honest and ethical in all responsibilities entrusted to us.

INNOVATION. We want to be at the forefront of change and believe that the best way to lead is to learn from our successes and mistakes and continue to grow. We are forward-looking and break new ground in addressing important community and societal needs.

OPENNESS. We encourage the open exchange of information and ideas from all quarters of the community. We believe that through collaboration and participation, each of us has an important role in determining the direction and well-being of our community.

JUSTICE. As a just community, we unite against all forms of injustice, including, but not limited to, racism. We reject bigotry, oppression, degradation, and harassment, and we challenge injustice toward any member of our community.

RESPONSIBILITY. We are personally and collectively responsible for our words and deeds. We stand together to uphold our common ground.

Instructor Roles & Responsibilities

Your instructor will oversee all aspects of the course. You should expect your instructor and teaching assistants to be knowledgeable, professional, approachable, and take an interest in your performance in this course.

Participant Roles & Responsibilities

Students should be guided by UVM's "Our Common Ground" principals throughout this course. Students requiring any accommodations for this course should notify the instructors at the start of class.

