About this Course

Description
This course will study Unoccupied Aircraft Systems (UAS) or drones. UAS have provided 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.

The University of Vermont is pleased to offer a rigorous, three-week course on drone technology, providing participants with an immersive introduction to drones, ranging from certification to data analytics. Technologies that participants will be exposed to will include drone platforms, drone 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.
**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.

**Data Processing:** Photogrammetric processing of UAS imagery.

**Data Analysis:** Visualization, image interpretation, volume calculations, spectral analysis, thermography.

**Dissemination:** Web applications

**Prerequisites**
There are no formal educational prerequisites for this course, though participants should 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.

**Required Purchase**
Each participant is required to obtain a license for Pix4Dmapper, which is the photogrammetry software used for this course work. The fee for a 4-month student license of this software is $99. Prior to the start of the course, an email will be sent by the instructional staff with information on how to purchase the license. A 12-month early student license is also available for $249 if you would like to continue using the software after the course has been completed. Should you or your organization already have access to an active Pix4Dmapper license, you may utilize that license for the course instead.

**Format**
This three-week course is conducted virtually. Over the first two weeks, there will be a one-hour live session held each day (a time that best suits participants will be selected), which will also be recorded. Throughout the course, participants will work through a series of self-paced modules in which they employ drone technology to assist with a particular problem. The third week of the course will provide participants additional time to complete the course modules, with regular online help sessions available with the instructional team. 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 students through the use of online discussion forums and virtual meetings.

**Technology**
Participants will need access to a computer (Windows, Mac, or Chromebook) with a broadband internet connection (5 Mbps upload/download minimum). The only software required is a free virtual machine thin 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.

**Components**
This course consists of four modules: 1) introduction, 2) flight planning, image processing, & change detection, 3) 3D modeling & volume estimation, 4) multispectral imagery.

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

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.

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.

Course Materials

E-Learning Platform
This course will use UVM’s Blackboard environment.

Textbook
There is no textbook requirement for this course.

Schedule

The course will run from Monday, February 7th to Friday, February 25th, 2022. Formal class days will be weekdays with instructional support available over the weekend. One-hour live sessions will be scheduled each day during the first two weeks of the course, with recordings made available. Scheduling times of the lectures and help sessions will be arranged to best accommodate the schedule of the participants.

The final week of the course (February 21-25) will be an open schedule to allow participants 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, February 25th.

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.

Student Roles & Responsibilities
Student 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.

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 badge, participants must demonstrate comprehension of the course material by:

- Attending and/or viewing the recording of each 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.