GEO 592: UAV-BASED FIELD RESEARCH

UNIVERSITY OF NORTH CAROLINA WILMINGTON
DEPARTMENT OF EARTH AND OCEAN SCIENCES

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Course description:
Welcome to the first offering of GEO592 UAV-Based Field Research in the Department of Earth and Ocean Sciences at UNCW! UAV/UAS stands for an unmanned aerial vehicle/system and is more generically referred to as a 'drone'. The use of UAVs in the geospatial and remote sensing fields is a cutting-edge yet rapidly evolving technology and this class aims to introduce you to basic theoretical, regulatory, practical, and interpretation elements as they pertain to UAV-based remote sensing and photogrammetry. The course will be organized into four distinct sections:
1. Introduction to remote sensing and photogrammetry
2. Basics of UAS regulatory frameworks
3. Field data collection using small UAVs
4. Introduction to UAV-collected data processing using Pix4D

Student learning outcomes:
Upon completing this 1-credit hour course, students will be able to:
1. Describe the relevant basic remote sensing and photogrammetry principles governing the use of UAVs;
2. Be familiar with the Federal Aviation Administration (FAA) and NC Department of Transportation (DOT) small UAS permitting process, regulatory framework and rules and regulations governing the use of UAVs for different purposes;
3. Be prepared to conduct at least one UAV flight on their own and collect original field data in an area of potential applicability towards their Master's projects;
4. Understand the post-flight image processing workflow in the specialized software package Pix4D and derive UAV products such as orthomosaics, digital surface models, and 3-dimensional meshes.
5. Gain an appreciation for both the opportunities and risks/pitfalls presented by the use of UAV technology.

Course structure:

The course will be structured into four modules as follows:

I. **Module 1 – introduction to remote sensing and photogrammetric principles as they pertain to UAV data collection**
    a. August 18th - introduction, course syllabus, logistics planning
    b. August 25th – intro to remote sensing and photogrammetry (12 to 1PM)
    c. Sept. 1st – no class meeting; FAA pilot test assignment
    d. Sept. 8th – intro to remote sensing and photogrammetry continued (12 to 1PM);

II. **Module 2 – rules and regulations governing the use of UAVs (including an overview of the FAA small UAS pilot certification process)**
    a. Sept. 8th - FAA test description and main components (1 to 2PM)
    b. Sept. 15th – FAA test simulation (on your own time); completion of practice test;
    c. Extra credit (throughout the semester): take and pass the FAA small UAS pilot certification
    d. Sept. 22nd – no class meeting.

III. **Module 3 – field data collection using the 2 DJI Phantom 4 Pro UAVs owned by the department, Dr. Pricope's DJI Mavic Pro and eBee Plus equipped with the SODA and Parrot Sequoia multispectral camera**
    a. *Sept. 29th* – fieldtrip to Orton Creek Preserve; exposure to drone flying, practice, hands-on experience on small drones for all students (12 to 4PM)
    b. *October 20th* – fieldtrip to Orton Creek/TBA to fly the eBee Plus and/on smaller drones (12 to 4PM);
    c. Open dates: potential to check out the UNCW DJI Phantom drones for project-related work (with assistance, depending on situation).

IV. **Module 4 – data processing and image product derivation using the Pix4D software**
    a. Oct. 27th - – introduction to Pix4D UAV-collected data processing (12 to 1PM)
    b. Nov. 3rd – introduction to Pix4D UAV-collected data processing continued; logistics planning on data processing allocations to various students if using UNCW machines (12 to 1PM)
    c. Nov. 10th and 17th – data processing of individual flights (12 to 2PM or on your own time depending on processing arrangements)
    d. Dec. 4th – final processing deliverable to Dr. Pricope and final exam (covering basics of remote sensing, photogrammetry and UAS regulatory framework, as well as basics of data processing and UAV-derived data products).

Recommended course readings:
Lillesand, T., Kieffer, R., and Chipman, J. 2015. Remote Sensing and Image Interpretation, 7th edition. John Wiley and Sons, US. (especially chapter 3, Basic principles of photogrammetry and the UAV-explicit sections).

Marshall. D., Barnhart, R., Shappe, E. and Most, M. 2016. Introduction to Unmanned Aircraft Systems, Second edition. CRC Press, Taylor and Francis Group.

A variety of other papers and articles that will be posted online to Blackboard such as: I. Colomina, P. Molina, Unmanned aerial systems for photogrammetry and remote sensing: A review, ISPRS Journal of Photogrammetry and Remote Sensing, Volume 92, 2014, Pages 79-97, ISSN 0924-2716, http://dx.doi.org/10.1016/j.isprsjprs.2014.02.013

Useful web links:
The Remote Sensing Core Curriculum - http://www.r-s-c-c.org/
The Remote Sensing Tutorial - http://rst.gsfc.nasa.gov/
Land Process Distributed Active Archive Center - https://lpdaac.usgs.gov/
Earth Resource Observation and Science Center - http://glovis.usgs.gov/
NASA's Earth Observing System Data and Information System - http://reverb.echo.nasa.gov/reverb/#utf8=%E2%9C%93&spatial_map=satellite&spatial_type=rectangle
NASA Observatory - http://earthobservatory.nasa.gov/
USGS and Remote Sensing - http://remotesensing.usgs.gov/index.php

Course grading scheme:
Comprehensive exam: 30%
Attendance in field data collection: 10%
Proposed plan to incorporate drone research into our thesis/final project and associated literature review/annotated bibliography: 20%
Final product generation and presentation (based on original data collection by graduate students outside of class): 40%

One examinations will be administered towards the end of the semester covering the basics of photogrammetry and remote sensing as they apply to UAV data collection and processing. The exam will use a short-answer, problem solving, image interpretation and essay questions as format. Make-up exams are not given unless written proof/documentation of the emergency which caused you to miss the exam is given.

Grading Scale:
Your final grade will be calculated from your percentage of 100 possible points.

Scale: 100-94% = A; 93-90% = A-; 89-87% = B+; 86-84% = B; 83-80% = B-; 79-77% = C+; 76-74% = C; Anything below a C is a failing grade.

Classroom and Attendance Policies

Attendance in lecture and lab will be important to your success in this course. The exams and labs will be based on lecture material as well as on readings. Second, the class schedule is rigorous, and you will quickly fall behind if you repeatedly miss class.

In the College of Arts and Sciences, instructors strive to create an atmosphere of mutual trust and respect in which learning, debate, and intellectual growth can thrive. This means paying attention in class, no conversations with friends, reading the newspaper, arriving late/leaving early, or littering the classroom. Such behavior is disruptive to the instructor and to your fellow classmates. **Cell phones are off and put away during class**.

ACADEMIC DISHONESTY POLICY

Academic dishonesty will not be tolerated and will result in disciplinary action by the university. Academic dishonesty is defined in the Graduate Catalog pertaining but not limited to cheating and plagiarism. It is the student's responsibility to maintain high standards of ethical conduct, intellectual integrity and to be familiar with the definition of academic dishonesty." For more details refer to the College of Arts and Sciences section of the Graduate Catalog.

STUDENTS WITH DISABILITIES

University of North Carolina Wilmington is committed to providing access to programs and services for qualified students with disabilities. If you are a student with a disability and require accommodation to participate and complete requirements for this class, notify me immediately and contact the Disability Resource Center for verification of eligibility and determination of specific accommodations.

*The instructor reserves the right to make changes in the syllabus when necessary to meet learning objectives, to compensate for missed classes, or for similar reasons.