**UAV mapping and GIS data processing**

***Training course for* *NSF eelgrass drone mapping project***

University of Central Florida, Citizen Science GIS

**Instructor:**

Dr. Timothy Hawthorne, [Timothy.hawthorne@ucf.edu](mailto:Timothy.hawthorne@ucf.edu)

Dr. Bo Yang, [Bo.Yang@ucf.edu](mailto:Bo.Yang@ucf.edu)

**Teaching assistant:**

Michael Feinman, [mlfeinman@Knights.ucf.edu](mailto:mlfeinman@Knights.ucf.edu)

Hunter Searson, [h.searson12@Knights.ucf.edu](mailto:h.searson12@Knights.ucf.edu)

**Course description**

The UCF portion of the project uses Unmanned Aerial Systems (UAS), i.e. drones, to measure eelgrass meadow extent, patchiness, and dynamics through time. Drone imagery will be collected at least annually in coordination with *in situ* sampling which will also be used to validate the imagery by ground-truthing across a range of points within each meadow. We create this training course for our eelgrass mapping partners to learn how to fly the drone for collecting data and performing the data analysis in Geographic Information Systems (GIS). This training course contains topics on flying DJI drones, preflight & planning, FAA part 107 examination, Drone2Map user guide, and ArcGIS drone image analyses.

**Course Materials**

Training documents & Sample data: [OneDrive](https://1drv.ms/f/s!AqgbJT_jEQK6m_0obBGSuMyBWiy9OA)

**Course Objectives**

1. Basic knowledge of drone, setup and maintenance.
2. Learn how to fly drone, manual manipulation and auto-pilot.
3. Learn FAA regulations, sectional charts, and prepare to take the part 107 exam.
4. Safety guidelines when flying drone.
5. Learn to use DJI GS Pro for auto-pilot flying and collecting field data.
6. *In situ* measurements guide, collecting field data and Ground Control Points (GCPs).
7. Use Esri Drone2Map for stitching and geo-referencing the drone imagery.
8. Data management and cloud storage of drone imagery.
9. Basic GIS analysis on drone imagery, digitizing, multi-spectral band math, vegetation index and image classification.

**Course outline:**

* Introduction to flying drone
  + 20 minute lecture on drone and basic manipulation.
  + Read the “Phantom 4 user manual” in the course material and setup the drone.
  + 1.5-hour practice flying with the help of TA, get familiar with drone manipulating, fly around and take picture/video using the drone.
* Advanced drone flying
  + Read the “CSGIS\_Preflight\_Planning\_Document” in the course material, learn to use DJI GS Pro app for auto-pilot and safety guidelines.
  + 2-hour practice flying via auto-pilot with the help of TA, collecting images for mapping, and transfer images from drone to computer.
* Processing the drone imagery to mapping products
  + Learn the “CSGIS\_Drone2map User Guide”.
  + 1-hour lab session for Drone2Map data processing.

**Note**: Drone2Map software package could be downloaded from course material resources folder. Sample data are provided in course folder.

* Drone imagery and eelgrass mapping principles
  + 40 minute lecture for drone eelgrass mapping principles.
  + 30 minute discussion followed by the lecture to discuss eelgrass drone mapping.
* Data analysis in GIS software
  + Learn the “CSGIS\_ ArcGIS based Image Analyses Manual”
  + 1-hour lab session for GIS analysis on drone imagery, digitizing, multi-spectral band math, vegetation index and image classification.

**Note**: ArcMap software package could be downloaded from course material resources folder. Sample data are provided in course folder.

* Self-study for FAA part 107 exam
  + 10-hour study for “CSGIS\_Instruction for FAA Part 107 Examination” as well as “remote\_pilot\_study\_guide” for taking the exam.
  + Take the FAA part 107 exam to legally fly drone independently. This is required if we are to use any imagery flown by your team for research and publication purposes.

**Online Training Course**

FAA Certificated Remote Pilots

<https://www.faa.gov/uas/getting_started/part_107/remote_pilot_cert/>

1. FAA B4UFLY Mobile App

<https://www.faa.gov/uas/recreational_fliers/where_can_i_fly/b4ufly/>

1. AirMap Web App

<https://app.airmap.io/>

1. Getting Started with Drone2Map

<https://www.esri.com/training/catalog/5818b7c0cb8f0d76650b23ce/getting-started-with-drone2map-for-arcgis/>

1. Get Started with ArcMap

<https://www.esri.com/training/catalog/57660c89bb54adb30c94541c/get-started-with-arcmap/>

1. Drone Imagery Storage

<https://www.esri.com/training/catalog/5b60c3fcacdec7716b3fa9e8/estimate-storage-capacity-with-drone-imagery/>

1. Create 2D products Using Drone2Map

<https://www.esri.com/training/catalog/58c8457b2d3f0c765b29e571/creating-2d-products-using-drone2map-for-arcgis/>

1. Create 3D Products Using Drone2Map

<https://www.esri.com/training/catalog/58ae238e7bbdb43a01208d41/creating-3d-products-using-drone2map-for-arcgis/>

1. Inspect Assets Using Drone2Map

<https://www.esri.com/training/catalog/58bee241997517212b6c9de7/inspect-assets-using-drone2map-for-arcgis/>

1. Streamline Imagery Workflows with Drone2Map

<https://www.esri.com/training/catalog/57e2a9c79799c32d370ea859/streamline-imagery-workflows-with-drone2map-for-arcgis/>

1. Working with Full Motion Video in ArcGIS

<https://www.esri.com/training/catalog/5806637ec82bd5746b9143dd/working-with-full-motion-video-in-arcgis/>

1. Bring Drone Imagery into ArcGIS

<https://www.esri.com/training/catalog/57eb17f9ee85c0f5204b9ca3/drone2map-for-arcgis%3A-bring-drone-imagery-into-arcgis/>

1. Earth Imagery at Work

<https://www.esri.com/training/catalog/57aba196cbc441087e0d2395/earth-imagery-at-work/>