Using a Drone as a Vehicle for Learning

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Blended Learning in the Arts & Sciences
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Introductions

- Anne Marchant, Shenandoah University, Center for Teaching, Learning & Technology
- Beth Dodson, Shenandoah University Math Department
- Will Marchant, UC Berkeley Space Sciences Lab
About the Workshop

- This session describes a freshman seminar in which a drone was used in a mock humanitarian aid mission to map a disaster area and deliver aid.
- Since drones have applications in many fields, the model presented here may be applicable to other classes where **aerial photography, mapping, and/or payload delivery** might be useful.
- This workshop is intended to spark ideas for creating engaging experiential learning environments.
Learning Objectives

Participants will leave the workshop with an understanding of what’s involved in conducting a drone-based class, including cost, necessary skills, supporting technologies, legal and safety considerations, and staffing.
Workshop Plan

1) Course organization
2) How the technology supports learning outcomes
3) Try your hand with the flight simulator
4) Brainstorming session
Before we begin...
Let’s meet you and find out if you have:
1) Any background or particular interest in drones?
2) Specific questions or concerns about using drones for educational purposes?
About the Course

-This is the story of a First Year Seminar course conducted Fall 17
-16 students enrolled
-2 faculty, 1 student mentor, 1 volunteer aerospace engineer
-Seminar outcomes based on global perspectives
More About the Course

- Students researched disasters in developing countries.
- As a class, we decided which disaster to focus on for our mission.
- We held discussions on intercultural understanding, communication, and implicit bias.
2 DGI Phantom 4 Pro drones
4 micro SD cards (16/32 GB)
Fli Fli Airdrop system
Spare rotors
Adafruit GPS/Datalog system (SDRAM card)

First aid kit
2 drone landing pads
Sun shades and lawn chairs
Water
“Props” for mock scenario

Sample video
The Teams

- Safety
- Documentation
- Pre-flight operations
- Flight operations

- Post flight operations
- Data management
- Set design and management
- Website
Inclusivity

- A new technology is an opportunity for all!
- Make sure all feel empowered!
- This class had 12 men and 4 women students. We were interested to see that the women were the first to volunteer for each new flight challenge.
GPS

- Class talk on how GPS works
- Exercises working with latitude, longitude, and datums (and yes “datums” is correct!).
The Mission

- Photograph and video the mock disaster area
- Drop medical supplies
- Produce a flight map to help with ground operations and geolocate areas of the disaster scenes
GPS

- Acquired NMEA data from a GPS card affixed to the drone. (Data saved to a SDRAM card.)
- Students ran a script to convert the data to a .kml file to import into Google Maps and Google Earth.
Data Products

Student Website

Documentary Video
Location, Location, Location

● One challenge was to find a large, safe place to fly, away from vehicles and foot traffic.

● An athletic field worked well.

● Setting up two teams in the middle worked well.
Legal Stuff*

- The drone pilot needs to be FAA registered. This number needs to be on the drone.
- Need to notify airports within 5 miles.
- Drone certification exception: educational purposes.
- AMA membership comes with insurance
- Must keep the drone within line of sight and below 400 ft.
- See: https://www.faa.gov/uas/getting_started/

*There may be other restrictions that may apply in your location.
Safety Stuff

- Don’t fly where there is a lot of foot traffic, near parking lots or where it may be a distraction to motorists.
- Keep a first aid kit handy.
- Don’t fly over groups of people—an eccentric gust of wind can spell disaster! (Think: aerial lawnmower…)
- Students should have a healthy respect for the rotors.
Common Sense Stuff

- Don’t fly when there are aircraft in the area
- Don’t fly when there is an emergency situation
- Don’t fly in wind, rain or when there is a threat of lightning
- Respect privacy--if you are unsure, ask permission
Drone Care and Feeding

- Batteries for the drone and controller need charging before each flight.
- The drone and controller firmware (internal software) need to be updated before each flight.
Lessons Learned

- The DJI Phantom is designed to work with home networks, not enterprise networks. We couldn’t connect it directly to our campus network.
- Require students to turn off their cell phones during flights.
- Have students download the B4UFLY app
Payload Drop

We used a Fli Fli drop system to deliver a “payload” of M&Ms (mock medication).

Lesson learned! Keep the payload tightly bound to the drone!

Students really enjoyed this activity!
Hobbyists and enthusiasts can be a great source of support:

- Local model airplane club
- Campus flight club
- Local AMA chapter
- Students, faculty, or staff with drone experience

➢ Need adequate staffing to keep students focused.
Let’s Fly...

...Like an Eagle!

While you’re waiting...
Let’s Brainstorm...

How might you incorporate a drone into a class you might teach? How might aerial photography, video, mapping or payload delivery enhance a course?

In groups of two or three, kick some ideas around and then report back to the workshop.
Any questions?

What else would you need to feel that you could use a drone successfully in your course?
But I want more...

**FAA Rules and Guidelines**

**FAA letter on educational exception**

**Know before you fly**

**FAA video on UAS Maps**

**AMA Safety Policies**

**DJI No Fly Zones**

**DJI Documentation**

**Review of Drone Models**

### Getting Certified

**Test Centers:**
https://www.faa.gov/training_testing/testing/media/test_centers.pdf

**Test Prep Materials:**
https://www.faa.gov/uas/getting_started/part_107/remote_pilot_cert/

**Sample Exam:**
https://www.faa.gov/training_testing/testing/test_questions/media/ua_g_sample_exam.pdf
More on GPS...

Arduino Board:
https://www.adafruit.com/product/2795

GPS Board:
https://www.adafruit.com/product/3133

Tutorial:
Adafruit Ultimate Featherwing GPS Documentation

Photo credit: Will Marchant, 2017