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Teaching with Drones: The Challenges and the Opportunities

There are several academic institutions embracing the proliferation of drone technology. What many are learning is that properly integrating drone technology into inquiry-based learning presents challenges as well as opportunities. One of the main drivers for the implementation of drones, or unmanned aerial vehicles (UAVs), into academic is the economy. In a 2013 report, the *Association for Unmanned Vehicle Systems International* forecasted that by 2025 the UAV industry would generate more than 100,000 new jobs and realize an economic impact of \$82 billion. This forecast includes education on learning to fly UAVs and teaching everything from engineering better vehicle design to analyzing the science from sensor output. This requires educators to focus on a dedicated approach to developing a viable educational program. For research institutions, it requires a comprehensive understanding of how to craft relevant research proposals that support the growth and vitality of the UAV industry.

At the United States Military Academy, our team of professors have worked over the past two years to integrate drones into an existing geospatial information science program. We spent a considerable amount of time determining how our students would end up using drone technology in the field. We wanted our students to quickly move past the “cool factor” of operating drones and delve into the science and technology because that is where the real learning occurs, the skills are developed, and the possibilities are explored. We wanted to determine if drones could improve the geospatial workflow. We also wanted to learn if new hardware and software would provide unique experiences that allowed our students to gain new perspectives towards solving problems. We wanted to implement drones into real-world projects and determine if performance improved within an established timeline and finite budget.

Using drone hardware and software, our students created geospatial products from the information collected by the drone’s sensor packages. We also learned that the workflows and the datasets matter more than delving into specifics such as the intricacies of hardware components or software programs. It helped us change our curriculum for the better. Speed - of development, of processing, and of implementation- is now the key factor in how students will embrace the possibilities stemming from drone education.

The ability to truly plan a project provided experiences with mission planning in a real-world setting and the application of drone technology provided the best learning opportunity for our students.

As a military academy, we focused on incorporating drones in the curriculum where it created career options for our graduates. Our graduates utilize the geospatial skills they learn in our program in the Army, and also when they leave military service. Some students go into public and private industries after they complete their mandatory military commitment. They might work in various government organizations like the Department of Defense and Department of Transportation. Others students use their talents and experience to work for hardware and software companies in the geospatial industry.

The Future of Drones in the Classroom

The drone sector rapidly changes, so does the policy governing it. Federal Aviation Administration (FAA) Part 107 has opened up countless opportunities for professionals to take advantage of drone technology, and those same opportunities are being realized in the classroom. Until Part 107 became official in 2016, filing for and receiving a Section 333 Exemption from the FAA had been the only way to legally operate a drone for commercial purposes in the United States. Today, the advantageous technological and legal landscape allows more colleges and universities to explore a drone curriculum. Academic institutions and their departments see how drone technology is employed on construction site surveys, environmental assessments, hurricane relief efforts, infrastructure inspections, and utilities planning, and want to educate their students in a rapidly proliferating field of study.

A current challenge we are dealing with is based on a recent Army directive. In August 2017, the United States Army is-

Photogrammetric Engineering & Remote Sensing
Vol. 83, No. 12, December 2017, pp. 807–808.
0099-1112/17/807–808

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and Remote Sensing
doi: 10.14358/PERS.83.12.807

sued a memorandum to discontinue the use of DJI UAS due to cyber vulnerabilities associated with DJI products. It directed Army units to cease all use, uninstall all applications, batteries, and storage media. Although this might not impact all colleges and universities, it does impact those who have any relationships with the United States Army for research, development, short courses or other Department of Defense collaboration efforts. It also presents a challenge as to how we will review and purchase drone technology in the future.

Drones Proliferation: The Future Is Here and Now

I recently stated in an interview that “It’s really about the proliferation.” Drones are popping up everywhere, and as the proliferation of courses increases, expectations increase with higher resolution imagery, faster processing software, and shorter workflow timelines. What we see happening over time is that it will become a standard part of equipment that we use for various courses, particularly in science and engineering disciplines. Opportunities to learn how to optimize data from drones, engineer a new workflow, and determine what industry sectors stand to benefit the most from drone applications are on the immediate horizon. As the technology proliferates and new uses are discovered, more challenges will present themselves, but so will future opportunities, which keeps me optimistic about teaching with drones.

For ASPRS members, the UAV educational challenges present numerous opportunities for the future. Collaboration between the public and private sectors includes developing and testing technology to increase product-to-market timelines. Looking at strategies for enhanced student intern programs may include having students in the geospatial sciences working UAV research projects for longer terms and working various aspects of drone technology. Colleges and university curriculum developers can implement drone education by partnering with private industry to select appropriate technologies by attending private industry conferences, technical forums, and drone training courses. This reduces the instruction learning curve associated with these technologies and allows for developing a curriculum that meets current educational needs, anticipates future technological training requirements, and expands the scope of UAV research initiatives.

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