Position Paper

How Can Higher Education Best Support UAS Growth in America?

Dr. Brent A. Terwilliger
UAS Discipline Chair
Embry-Riddle Aeronautical University-Worldwide

When considering how academia can assist with the domestic growth of unmanned aerial systems (UAS), including integration of UAS in the National Airspace System (NAS); it is necessary to consider what primary users and developers have said already. The National Aeronautics and Space Administration (NASA) and Department of Defense (DoD) have been long standing proponents of unmanned aircraft technology and operations, recognizing the value for research, information gathering, communications, and warfare (DoD, 2011a; DoD, 2011b; NASA, 2013; NASA, 2011b). From use in environmental protection to improving the effectiveness of agriculture (e.g., precision agriculture), the impacts and implications of this technology have been and will continue to be far reaching (AUVSI, 2013; GAO, 2013; NASA, 2011b).

NASA has identified several key challenges with integration into the NAS, including ensuring safe separation in airspace; providing secure and scalable command and control; using robust and certified pilot control interfaces; and providing standardized safety certifications/regulations (Walker, 2012). The DoD recommends three MUSTs as part of the strategy for UAS integration: a) aircraft must be certified as airworthy, b) pilots must be qualified to operate in appropriate classes of airspace, and c) flight operations must be in compliance with applicable regulatory guidance (DoD, 2011a). Ensuring successful integration will require the development of new technologies, processes, and regulations (Walker, 2012).

The worldwide UAS market is expected to reach $89 billion in the next ten years, with 62% of the anticipated R&D being performed in the US with an approximate value of $28.5 billion for the same period (GAO, 2013). Academia represents a major stakeholder, a third leg in a stool, with the others being Government and industry. As the educators of tomorrow's innovators, researchers, operators, and maintainers, it is imperative that we support and encourage clear communication among the three parties. Having a comprehensive and shared view of our needs will provide a path forward for defining an effective and rewarding UAS curriculum, while ensuring the growing capabilities and needs of the other stakeholders are fulfilled.

The first aspect of academic involvement is use of academic and educational institutions in the performance of research and development (R&D) to identify new and novel solutions to UAS challenges. Our students bring new thoughts, perspectives, and creative energy to problem solving. It may be possible to realize and affect significant change if we leverage our diverse networks of colleagues, faculty, students, alumni, and

partners (i.e. industry and Government) to identify innovative solutions or advances for UAS technologies, processes, and regulations.

Secondly, all the stakeholders need to work together to educate the public and lawmakers on what UAS truly are, their intended uses, and typical system capabilities and limitations. Encouraging community outreach (e.g., science, technology, engineering, and mathematics [STEM]), publication and presentation of R&D results, and maintaining currency on the latest regulatory and certification activities may prevent unnecessarily restrictive legislation (e.g., privacy and usage). As the DoD has recommended, we need to "engage as one" (DoD, 2011, p. 3). By working collectively in the same direction we can reach a broader audience to convey the benefits of this technology, while continuing to serve as stewards of our respective domains (i.e., education, service, and economic endeavor).

The third aspect is identifying what "our" individual needs are. For example, "the FAA expects small UAS (sUAS) to experience the greatest near-term growth in civil and commercial operations because of their versatility and relatively low initial cost and operating expenses" (FAA, 2011, p. 3). The low-cost, expedient assembly, and simplicity of operation are just a few of the traits desirable to researchers and users (Chao, Jensen, Han, Chen, & McKee, 2009; NASA, 2011a; Spigelmire & Baxter, 2013). To realize the full potential of sUAS as tools for academia, we need to establish and fully understand an operational framework supporting R&D, training, and education opportunities. Such activities will ensure the US maintains a leadership role in UAS innovation, now and into the future.

Finally, there is an increasing disparity between the "growing UAS fleet" (Chesebro, n.d., p. 8) and the development of the requisite infrastructure to support their use. This discontinuity is present in the areas of "training; service, support and maintenance; and data management" (Chesebro, n.d., p.8) and must be addressed and overcome if the industry is to reach its full projected potential (GAO, 2013). Focus could be placed on Governmental policy changes, achieving stakeholder alignment, and educational curriculum development to start to address this continuously expanding gap. Ensuring clear paths for communication and collaboration, among all the stakeholders, will facilitate the efficient and meaningful exchange of ideas, experience, and knowledge to address or prevent such shortcomings in the future.

Through considered and collaborative responses, the challenges in the domestic UAS domain can be surmounted or overcome. Involving and engaging all stakeholders, providing a collaborative framework for R&D, ensuring access to airspace is routine and available, and educating the public and policymakers will result in in an environment that fosters the technological and monetary growth expected from this field. As educators, it is our responsibility to add to the body of knowledge for our domains, contribute to our communities, serve as stewards of trust, and work collaboratively to educate and share our experience and knowledge. Only by working together, collectively as stakeholders

with our varying areas of expertise, can we address and rise up to meet the challenges set before us.

References

Association for Unmanned Vehicle Systems International. (2013). *Unmanned aircraft systems (UAS) – benefits for humanity: Saving time, saving money, and most importantly, saving lives*. Retrieved from http://higherlogicdownload.s3.amazonaws.com/AUVSI/656942e4-4448-41c3-877d-0c5f3ea40e63/UploadedImages/advocacy%20/AUVSI-Message.pdf

Chao, H., Jensen, A.M., Han, Y., Chen, Y., & McKee, M. (2009). AggieAir: Towards low-cost cooperative multispectral remote sensing using small unmanned aircraft systems. In Jedlovec, G. (Ed.), *Advances in Geoscience and Remote Sensing* (pp. 463-490). Riejeka, Croatia: InTech Europe. Retrieved from http://cdn.intechweb.org/pdfs/9548.pdf

Chesebro, J. (n.d.). *Unmanned aircraft systems* (UAS). Retrieved from http://www.trade.gov/mas/manufacturing/oaai/build/groups/public/@tg_oaai/documents/webcontent/tg_oaai_003781.pdf

Department of Defense. (2011a). *Unmanned aircraft system airspace integration plan* (v.2.0). Washington DC: Department of Defense, UAS Taskforce Airspace Integration Integrated Product Team. Retrieved from http://www.acq.osd.mil/sts/docs/DoD_2011_UAS_Airspace_Integration_Plan_(signed).pdf

Department of Defense. (2011b). *Unmanned systems integrated roadmap FY2011-2036* (Report no. 11-S-3613).Washington DC: Department of Defense. Retrieved from http://www.defenseinnovationmarketplace.mil/resources/UnmannedSystemsIntegratedRoadmapFY2011.pdf

Government Accountability Office. (2013). *Unmanned aircraft systems: Continued coordination, operational data, and performance standards needed to guide research and development* (Report no. GAO-13-346T). Testimony Before the Subcommittee on Oversight, Committee on Science, Space, and Technology, House of Representatives. Washington DC: United States Government Accountability Office. Retrieved from http://www.gao.gov/assets/660/652223.pdf

Federal Aviation Administration. (2013). *Fact sheet – unmanned aircraft systems (UAS).* Retrieved from http://www.faa.gov/news/fact_sheets/news_story.cfm?newsId=14153

Federal Aviation Administration. (2011). *Fact sheet: Unmanned aircraft systems (UAS).* Retrieved from http://www.faa.gov/about/initiatives/uas/media/uas_fact_sheet.pdf

National Aeronautics and Space Administration. (2013). *Unmanned Aircraft Systems Airspace Operations Challenge (UAS AOC).* Retrieved from http://www.nasa.gov/directorates/spacetech/centennial_challenges/uas/index.html

National Aeronautics and Space Administration. (2011a). *Are these the droids you're looking for*? Retrieved from http://www.nasa.gov/centers/dryden/Features/DROID_Auto-GCAS.html

National Aeronautics and Space Administration. (2011b). *Integrated Systems Research Program* (NF-2011-05-536-HQ). Retrieved from http://www.aeronautics.nasa.gov/pdf/isrp_factsheet_8_08_11.pdf

Spigelmire, M.F., & Baxter, T. (2013). Unmanned aircraft systems and the next war. *ARMY, 5,* 55-58. Retrieved from http://www.ausa.org/publications/armymagazine/archive/2013/05/Documents/Baxter_May2013.pdf

Walker, J. (2012, April). *NASA Unmanned Aircraft Systems (UAS) Integration in the National Airspace System (NAS) Project*. Presented at ICAO Regional Unmanned Aircraft Seminar Lima, Peru. Retrieved from http://info.publicintelligence.net/NASAUAS-NAS.pdf