

**Assessment of unmanned aerial systems programs in collegiate aviation**

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**ABSTRACT**

Unmanned Aerial Systems (UAS), or drone applications have experienced tremendous growth over the past several years. Their capabilities and technology have penetrated many aspects of the modern world. They are being used for everything from emergency response and agricultural research, to entrepreneur businesses and package deliveries. Experienced aviators and amateurs alike are being tapped as operators. At present, the Federal Aviation Administration estimates there will be 1.3 million certified UAS pilots by the year 2020 (Moore, 2017). Aircraft Owners and Pilots Association, which has the most significant membership of any association in the aviation industry, has recently added a new line of membership for drone pilots (Moore, 2017). New regulations, 14 CFR Part 107 have also been created, by the FAA, to adopt specific rules for the operation of small Unmanned Aircraft Systems in the National Airspace System (Federal Aviation Administration, 2016). Because of this growth, the authors of this paper, examine collegiate aviation programs and their curriculums to understand better how aviation education is evolving and educating students for this ever-changing and dynamic new industry.

Keywords: Collegiate Aviation, UAS, 14 CFR Part 107, Drone

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## INTRODUCTION

Unmanned Aerial Systems (UAS) or drone usage for agriculture monitoring, oil and gas exploration, law enforcement, aerial imaging, and many more areas are ever increasing across the United States. According to the Association for Unmanned Vehicle Systems International's March 2013 report, *The Economic Impact of Unmanned Aircraft Systems Integration in the United States*, the economic impact of Unmanned Aerial Systems into the United States' National Airspace System will total nearly \$82.1 billion by 2025 and create an estimated 100,000 new jobs. (International, 2013). With revolutionary aviation industrial growth comes the need for new federal regulations on licensing and operations. In August 2016, The Federal Aviation Administration released a new set of rules and regulations for drone pilots under FAA Part 107- Small Unmanned Aircraft Systems (Federal Aviation Administration, 2016). In addition to new regulations, there is the increasing need for programs to train and educate new drone pilots. Collegiate aviation programs across the country are trying to stay ahead of the curve by developing UAS degree programs. This paper examines the collegiate aviation programs and their curriculum to see how collegiate aviation education is evolving in this ever-changing and dynamic industry.

## BACKGROUND

The origin of drone usage dates back to the mid-1800s, when Venice, Italy was attacked by Austria using unmanned balloons carrying explosive devices (RedOrbit, 2014). The United States' started using drones in the early 1900s when a military program was developed to use unmanned airplanes as torpedo bombers in World War I (Sifton, 2012). The military application of drone usage ebbed and flowed throughout the next few decades, and in the late 1900s, we encountered the first public's usage of commercial drone usage. Initially, public usage of most unmanned aircraft applications was a personal hobby, considered as a model airplane and unregulated by the FAA. It was not until June 1981, when the FAA issued Advisory Circular 91-57, officially recognizing unmanned aircraft as a hazard to other aircraft, persons, or property, and recommended a set of voluntary operating standards for model aircraft operators (Federal Aviation Administration, 1981). The FAA began authorizing drone usage for public universities and federal agencies in the early 1990s, but by the mid-2000s more interests began to increase on the commercial use of UASs (Carey, 2016). The FAA was then mandated in the *FAA Modernization and Reform Act of 2012* to establish rules for operating UAS in the National Airspace System (House of Representatives, 2012). In 2016, the FAA released a new set of regulations under Title 14 Code of Federal Regulations Part 107 -Small Unmanned Aircraft Systems, and ever since there has been an exponential increase in public commercial drone usage and application. As a result of this increase, many institutions of higher education have adopted some form of UAS education, including certification programs, associate degrees, bachelor degrees, and graduate programs. As of 2018, seven institutions offered a bachelor of science degree in unmanned systems (University Aviation Association, 2018).

## METHODOLOGY

Understanding that curricula may vary from program to program, the authors used web-based qualitative evaluation research to compile material for the article. According to Babbie

(2001), qualitative research is less structured compared to quantitative evaluation research. The researchers identified universities that have UASs programs by using reports from the University Aviation Association (UAA) public database; then collected qualitative program information on UASs curriculums through each specific universities' public websites. The researchers then implemented a grounded theory method to establish significant focus areas within the seven different curriculums. This type of research begins with observations rather than hypotheses and seeks to discover patterns (Babbie, 2011).

### **Embry-Riddle Aeronautical University**

Embry-Riddle Aeronautical University offers Bachelor of Sciences in Unmanned Aircraft Systems Science, with tracks in Professional UAS Pilot or UAS Operations and Unmanned Systems Application, with tracks in Administration, Operations, and Development. Some or all of these degree programs are available at all three (Daytona, Prescott, and Worldwide) campuses. The Bachelor of Science degree in Unmanned Systems Application degree program focuses on the: growth, innovative development, and effective use of unmanned systems technology across the respective domains (Embry-Riddle Aeronautical University, 2018).

### **Indiana State University**

Indiana State University, in Terre Haute, Indiana offers a Bachelor of Science in Unmanned Systems. Housed within the College of Technology and the Department of Aviation Technology, this degree allows students to learn regulations impacting the unmanned systems operations and the differences with manned systems. Students also demonstrate proficiency in unmanned systems programming, preflight, flight operations, post-flight inspection, and mission analysis and debriefing. Indiana State University is also unique in that it has a Center for Unmanned Systems and Human Capital Development. The center offers unmanned systems outreach to support human capital development in areas of homeland security, commercial enterprises, and civil authorities (Indiana State University, 2018).

### **Kansas State University – Polytechnic**

Kansas State University – Polytechnic offers two Bachelor of Science degrees in Unmanned Systems. The Bachelors in Unmanned Aircraft Systems Design and Integration focuses on computer science, electronic engineering, and mechanical engineering with unmanned systems. Students in this degree explore UAS subsystems and components. The Bachelor of Science degree in Unmanned Aircraft Systems Flight and Operations emphasis foundational courses in areas of unmanned flight. The degree coursework is designed for payload to platform integration with “Hands-on” flying throughout the curriculum (Kansas State University, 2018).

### **Letourneau University**

LeTourneau University, in Longview, Texas is a private, Christian university that offers a Bachelor of Science in Remotely Piloted Aircraft Systems. The degree offers three concentrations: Pilot, Technician, or Electronics. These concentrations offer experience with

ground-based rovers, multicopters, and fixed-wing platforms, hands-on experiences with small UAS aircraft maintenance, and an introduction to developing and programming robotics systems. The technician concentration touts the inclusion of an FAA Airframe and Powerplant (A&P) Certificate, and the pilot concentration includes an FAA Private Pilot's Certificate with Instrument Rating (LeTourneau University, 2018).

### **Lewis University**

Lewis University, in Romeoville, Illinois offers a Bachelor of Science in Unmanned Aircraft Systems. Lewis' degree program offers operations-focused curriculum combining both aviation and computer science. Students in the program learn to design, develop, and operate UAS to meet program objectives in an interdisciplinary curriculum. The program objectives include fundamental UAS operations, Crew Resource Management, computer science and engineering skills, aviation maintenance to UAS devices, and ethical issues (Lewis University, 2018).

### **Purdue University**

Purdue University, in West Lafayette, Indiana offers a Bachelor of Science in Unmanned Aerial Systems. According to the degree program description, the UAS major examines the entire system surrounding the unmanned aerial industry, including design, operation, sensor, commerce, and policy. Students learn the about different UAS aircraft, how they are made and how they work. Studies also include how UAS fit into larger aviation systems, including safety policies and regulations. Included in the unique features of this degree program is qualifying for certification as an unmanned aerial vehicle operator (Purdue University, 2018).

### **University of North Dakota**

In Grand Forks, North Dakota, The University of North Dakota offers a Bachelor of Science in Aeronautics degree in Unmanned Aircraft Systems Operations. The University of North Dakota's UAS program provides program outcomes such as demonstrating the science and technology of UAS operation, have a working knowledge of UAS technology, applying management skills in the UAS industry, and demonstrating UAS airmanship. The University of North Dakota also requires students to possess an FAA commercial pilot certificate to be in the program. (University of North Dakota , 2018).

## **CONCLUSION**

There is no doubt that there is a limited number of University Aviation Association member institutions that provide a bachelor's degree in the field of Unmanned Aerial Systems studies. Curriculums in higher education have not been able to keep pace with the growth of this ever-evolving unmanned aerial system industry. There is an excellent potential for many institutions to engage in UAS courses or programs.

Of the seven existing collegiate aviation programs in this study offering UAS bachelor degrees, through the grounded theory method, the authors observed some commonalities and patterns about their curricula. First, engineering colleges house a majority of these programs.

Second, the majority of the courses are intended to instruct how to build an unmanned aerial system or how to fly one.

The authors further conclude that coursework in business, entrepreneurship and business planning is needed. These types of teachings could help future curricula keep pace with the ever-changing and progressing UAS industry.

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