

Bachelor of Science in Unmanned Systems to be offered by Indiana State University

Program Description

1. Characteristics of the Program

a. Campus(es) Offering Program:

Indiana State University, Terre Haute, IN

b. Scope of Delivery (Specific Sites or Statewide):

Indiana State University, Terre Haute, IN

c. Mode of Delivery (Classroom, Blended, or Online):

Blended

d. Other Delivery Aspects (Co-ops, Internships, Clinicals, Practica, etc.):

Internships, Field Trips

e. Academic Unit(s) Offering Program:

College of Technology – the suggested CIP Code for the new program is (49.0101) Aeronautics/Aviation/Aerospace Science and Technology, General. This CIP Code is for a program that focuses on the general study of aviation and the aviation industry, including in-flight and ground support operations. Includes instruction in the technical, business, and general aspects of air transportation systems.

2. Rationale for the Program

a. Institutional Rationale (Alignment with Institutional Mission and Strengths)

• Why is the institution proposing this program?

- The Bachelor of Science (B.S.) in Unmanned Systems is specifically designed to address the need of students who wish to pursue opportunities and careers in this new and burgeoning field.ⁱ The industry term is “unmanned”, but the systems are completely dependent upon humans. People must operate, maintain, and support the vehicles, communications networks, computer systems, and other infrastructure elements in support of operations, research, testing, and development.
- Capabilities in unmanned systems (mobile robotics) provide new methods to address problems such as disaster response, crisis management, crop yield improvement, construction, and generally repetitive, dirty, or dangerous missions.ⁱⁱ In addition, industries such as entertainment, journalism, insurance, logistics, and many more see the use of unmanned systems as a competitive advantage for the future of their business.
- However, the most important component in any unmanned system is the human element.ⁱⁱⁱ The human element requires education and training. The degree will

- prepare graduates to become successful and advance their careers while contributing to the development of an educated workforce in Indiana. Students will need to complete 120 credit hours at ISU to earn a Bachelor of Science.
- The focus of the B.S. is to provide professionals the opportunity to gain expertise needed for self-enrichment and to expand their professional roles in various technology positions in numerous applicable areas; thus, creating an interdisciplinary nature to the program. Just as computer systems are used in every aspect of human life today, unmanned systems will eventually be embedded in every field and industry. Even though the program is viewed as a technology field, the B.S. course of studies will incorporate activities that will provide extensive experiential learning and require students to communicate and collaborate on projects.
 - Regardless of age, gender or ethnicity, we intend to attract those persons wanting to advance their professional careers and serve their community. To that end we will make a concerted effort to attract and accept a diverse student body population.
 - Academic program offerings at Indiana State University are based on our institutional mission, state and national workforce needs, student interest, and faculty support. The special identity for Indiana State University is to be noted for a tradition of strong community engagement and service learning.
- **How is it consistent with the mission of the institution?**
 - The B.S. in Unmanned Systems is based on the ISU mission, which states "Indiana State University combines a tradition of strong undergraduate and graduate education with a focus on community and public service. We integrate teaching, research, and creative activity in an engaging, challenging, and supportive learning environment to prepare productive citizens for Indiana and the world" (Indiana State University, 2008).
 - The mission of the B.S. is to support human capital development for the 21st century in an emerging field filled with opportunity to have immense impact on community and public service. This program will allow students to enter into the workforce as leaders in the areas of unmanned systems where they may apply their knowledge and skills to many areas of societal need, i.e. agriculture, border security, public safety, logistics, risk management, and many more. This program will allow students to enter into the workforce with the knowledge and skills necessary to trained entry level professionals.
 - **How does this program fit into the institution's strategic and/or academic plan?**
 - The B.S. in Unmanned Systems will directly support the following goals of the ISU Strategic Plan, *The Pathway to Success*:

- o Goals One and Four, to increase the student enrollment at ISU by creation of new education and training programs that will prepare students for careers in exciting and dynamic industries; and, to bring greater prominence to the University by use of advanced technology to address current and future social issues.
- o Goal Two, to provide significant experiential learning within their major through hands-on training and internships.
- o Goal Three, to foster community engagement and social well-being by involving students and faculty in real-world events, exercises, and research in challenging areas.
- o Other Indiana institutions have faculty and departments involved in research and education surrounding unmanned systems or robotics. However, the B.S. in Unmanned Systems at ISU will be the only undergraduate program with a multi-domain emphasis (water, land, and air).
- o The University carefully reviews all potential new programs and ensures that they address market needs. Supporting the B.S. will provide an avenue to meet the above mentioned goals and to also provide opportunities for professionals to enter into exciting new careers. In addition, the B.S. in Unmanned Systems will contribute to workforce development.
- **How does this program build upon the strengths of the institution?**
 - o The program will emphasize the applicability and benefits of unmanned systems to diverse industries. Students will be encouraged to seek knowledge of other disciplines and explore how the technology may be used. In addition, they will be encouraged to seek minors or a second major in areas of intense interest and become technology professionals in those fields. This interdisciplinary approach of the B.S. builds on the strength of the current technology programs and others within the University. The program will use multiple strategies to encourage student interaction and collaboration.
 - o The proposed program is designed to meet the needs of both active professionals and the highest academic integrity possible. This program will set Indiana State University on a level separate from other Indiana programs as the only multi-domain emphasis (land, water, air) in Unmanned Systems Technology. The Unmanned Systems program at Purdue focus is on aviation.

b. State Rationale

- **How does this program address state priorities as reflected in *Reaching Higher, Achieving More*?**
 - Completion - The Bachelor of Science in Unmanned Systems will require 120 undergraduate credit hours. Students will have to complete the foundational studies courses requirements. The core courses consist of 49 credit hours. In addition, students will be encouraged to complete a minor in an area of interest where unmanned systems will be a key technology in the future. Typical full-time students will be able to complete the Core requirements of the program in three years.
 - This degree will fill gaps that currently exist for Indiana students who wish to pursue B.S. degrees in unmanned systems with applicability to aviation, criminology, computer science, and earth and environmental science, for examples. The program is student-centered focusing on the needs of the learner; and, mission driven as it supports several initiatives at the departmental, collegiate, and university levels. It is workforce aligned as it provides a path for students to attain a college degree that prepares them for opportunities in a highly skilled and growing industry.
 - According to *Reaching Higher / Achieving More*, focusing on student success by creating efficient pathways and incentives for completion of degrees and certificates will assist the State in staying competitive with other States. The program will contribute to the challenge of doubling the number of college degrees and certificates produced by 2025.
 - Productivity - the B.S. uses existing courses already developed; and, equipment and facilities already in place.

c. Evidence of Labor Market Need

i. National, State, or Regional Need

- **Is the program serving a national, state, or regional labor market need?**
 - The primary geographic region to be served by the ISU B.S. in Unmanned Systems is Indiana and the Mid-western United States; however, the program also meets an important emerging professional need nationwide. The identified professions are in demand and a Bachelor of Science degree will increase the competitive advantage of our students in the marketplace.
 - According to a recent study by the Aerospace Industries Association (AIA), “A highly skilled and robust aerospace workforce is essential to our national security and economic prosperity.”^{iv} Yet today, the industry, with many company sites in Indiana,

- faces impending retirements and a shortage of trained technical graduates, which is a situation that is forecasted to worsen within the decade. Some companies address this issue by outsourcing work around the globe. In aerospace and defense, however, security requirements dictate that most design work on military systems must be done by U.S. citizens. Thus the need for U.S. developed technical talent is particularly acute to ensure a world-class aerospace workforce ready to lead in a global economy.
- The Commission on the Future of the U.S. Aerospace Industry recommended “that the nation immediately reverse the decline in and promote the growth of a scientifically and technologically trained U.S. aerospace workforce...”^v adding that “the breakdown of America's intellectual and industrial capacity is a threat to national security and our capability to continue as a world leader.”^{vi}
 - The Commission also recommended that resolving the crisis will require government, industry, labor and academia to work together. AIA is urging Congress, industry trade associations, education institutions, and other stakeholders to acknowledge the need to develop a highly-skilled and robust aerospace workforce and to demonstrate a willingness to address these issues through policy, programs and investment.
 - As an industry, AIA and its member companies are facing this issue through engaging education and workforce development programs, supporting initiatives that improve our nation’s education and innovation systems, and campaigning to raise awareness of our workforce needs and opportunities.
 - According to the Congressional Unmanned Systems Caucus 2012 Science and Technology Fair, in a 2012 market study the Teal Group estimated that UAV spending will almost double over the next decade to \$11.4 billion annually, totaling just over \$89 billion in the next ten years.^{vii} The study also predicted that the United States will account for 62% of the worldwide research, development, testing and evaluation spending on UAV technology over the next decade, and 55% of the procurement.
 - According to a recent report, SHRM® Workplace Forecast May 2013, “Skills issues, specifically a shortage of skilled workers and a lack of science, technology, engineering and math (STEM) graduates in the U.S. compared to other countries, seem to have gained a new prominence and are now among the top trends that HR professionals think will affect the workplace in the coming years. This finding may be due to a more competitive global business environment and more specialized and technically demanding jobs; it may also be linked to another top trend, large numbers of Baby Boomers leaving the workforce.”^{viii}

ii. Preparation for Graduate Programs or Other Benefits

- **How does the program prepare students for graduate programs or provide other benefits to students besides preparation into the labor market?**
 - This program is a Bachelor of Sciences degree (B.S.). The program will provide students with the foundation to pursue a graduate degree if they wish to continue their education in multiple disciplines.

iii. Summary of Indiana DWD and/or U.S. Department of Labor Data

- **Summarize the evidence of labor market demand for graduates of the program as gleaned from employment projections made by the Indiana Department of Workforce Development and/or the U.S. Department of labor.**
- Employment projections for graduates of the program were determined by a careful investigation of the State of Indiana May 2012 State Occupational Employment and Wage Estimates.^{ix} Since this is an emergent field, there are no dedicated occupational codes. Overall growth in the field is projected within the following areas:
 - Code 17-0000 Architecture and Engineering (including technician classes) – 8%
 - Code 19-000 Life, Physical and Social Science Occupations- 14%
 - Code 27-3000 Media and Communication Workers – 25%
 - Code 33-0000 Protective Service Occupations – 4%
 - Code 37-0000 Building and Grounds Cleaning and Maintenance Occupations – 3%
 - 41-9000 Other Sales and Related Workers (including Real Estate) – 14%
 - 45-0000 Farming, Fishing, and Forestry Occupations – 14%

iv. National, State, or Regional Studies

- **Summarize any National, State, or Regional studies that address the labor market need for the program.**
 - The Association for Unmanned Vehicle Systems International (AUVSI) is the recognized leader and largest group advocate for the use of all unmanned systems worldwide. AUVSI's *The Economic Impact of Unmanned Aircraft Systems Integration in the United States* report, released March 12, 2013, shows the economic benefit of UAS integration into the National Airspace. AUVSI's findings show that in the first three years of integration more than 70,000 jobs will be created in the United States with an economic impact of more than \$13.6 billion. This benefit will grow through 2025 when we foresee more than 103,000 jobs created through airspace integration and economic impact of \$82 billion. ^x

- These highly skilled positions have starting salaries around \$55,000 per year and many have the potential to increase to upwards of \$100,000 or more per year. The small number of Unmanned Aerial Systems (UAS) applications in the United States today foreshadows how an expanded integration will yield significant economic benefits. Some states have already fostered an environment conducive to UAS manufacturing, testing and development – and have generated a significant amount of jobs in the process. For example:
 - According to a report prepared by the Arizona Commerce Authority, UAS and related industries provided about 42,365 jobs to the state’s residents in 2010.
 - A report prepared for the North Dakota Aeronautics Commission in 2010 estimates the UAS industry in the state supports 231 jobs with a total payroll of \$8.3 million. It also estimates the total economic impact from UAS businesses in North Dakota at approximately \$27.1 million.
 - A small business in Kansas expects its company to grow from 12 employees to between 50 and 100 in the next 12 to 18 months. The new positions are expected to range from pilots and software engineers to finance staff and supply chain managers.
- The AUVSI study finds that the precision agriculture industry is expected to be the largest market for UAS technology. UAS will help farmers monitor crops and distribute pesticides, which could not only help improve efficiency, but also reduce the total amount of pesticides sprayed, saving money and reducing environmental impact.
- AUVSI further states that the public safety sector will benefit from the tremendous potential for UAS technology. UAS have the capability to help police and firefighters— who put themselves into harm’s way every day to protect the communities they serve — do their job safely and efficiently.
- The study also finds that state and local governments currently spend millions of dollars on search and rescue, disaster preparedness, law enforcement, fire prevention and other critical services. These agencies, using unmanned systems and skilled operators, maintainers, and service personnel can accomplish those same tasks more efficiently and with less expense, saving time, taxpayer dollars and lives in the process.
- Furthermore, the AUVSI study provided economic forecasts for the State of Indiana in 2015. The forecasts were based on a number of factors, including 1) comparable sales from other countries; 2) survey results; 3) land ratios; and 4) a literature search on adoption rates of new technology. The benefits to the State of Indiana are derived from precision farming and public safety:

- Indiana ranked 20th in a rank ordering of Total UAS manufacturing by state for agriculture uses in 2015, with \$6,686,613 in labor, \$10,029,919 in parts, and \$181,176 in tax revenues
- Indiana also ranked 20th in a rank ordering of Total UAS manufacturing by state for public safety uses in 2015, with \$286,569 in labor, \$429,854 in parts, and \$7,795 in tax revenues
- With regard to the Agriculture “derived demand” (i.e., the products that are used as inputs are manufactured by other companies and the producer must purchase inputs for their finished goods) Indiana had \$3,942,731 in labor, \$5,914,081 in parts, and \$109,126 in tax revenues
- In similar fashion, the Public Safety “derived demand” in Indiana showed \$171,941 in labor, \$257,912 in parts, and \$4,677 in tax revenues
- As far as the Total Economic and Employment Impacts of Agriculture Spending, Indiana showed expected benefits of \$6,686,613 in labor, \$10,029,919 in parts, and \$181,876 in tax revenues, for a total economic impact of \$31,853,499 (using a multiplier of 1.8850 derived in the study)
- Similarly, the Total Economic and Employment Impacts of Public Safety Spending, Indiana showed expected benefits of \$286,569 in labor, \$429,854 in parts, and \$7,795 in tax revenues, for a total of \$1,365,150 (using the same multiplier)

v. Surveys of Employers or Students and Analyses of Job Postings

- **Summarize the results of any surveys or employers or students and analyses of job postings relevant to the program.**
 - None available.

vi. Letters of support

- **Letters of support (included in Appendix 5) were received from:**
 - Mr. Matthew Konkler, Executive Director, National Center for Complex Operations
 - Mr. John Hill, Executive Director, Indiana Department of Homeland Security
 - Mr. Duane Embree, Executive Director, Indiana Department of Defense Development
 - Ms. Carol Curran, President/CEO, Phoenix Data Corporation
 - Mr. Bill Foraker, Executive Director, Terre Haute International Airport
 - Mr. David Fleet, Futron Corporation
 - Mr. Mike Cooper, CEO Black Bird Group, LLC.
 - Mr. Carl Boss, Director of Business Development, Garrity Tool Company
 - Dr. Todd Jochem, ISU Alum, CEO of multiple unmanned system companies

3. Cost and Support for the Program

a. Costs

i. Faculty and Staff

- **Of the faculty and staff required to offer this program, how many are in place now and how many will need to be added (express both in terms of number of full- and part-time faculty and staff, as well as FTE faculty and staff)?**
 - Presently, the Unmanned Systems program resides within the Aviation Technology Department. The program will utilize current faculty and staff from the department.
 - The Unmanned Systems (UMS) group currently has two faculty members who hold M.S. degrees. There will be a search for a tenure-track faculty member with a Ph.D. degree to replace a recent resignation.
 - The program will utilize existing courses and require no new courses to be developed.
 - As the program grows, the UMS department will hire on faculty and staff as necessary.

ii. Facilities

- **Summarize any impact offering this program will have on renovations of existing facilities, requests for new capital projects (including a reference to the institution's capital plan), or the leasing of new space.**
- No changes needed to facilities.

iii. Other Capital Costs (e.g. Equipment)

- **Summarize any impact offering this program will have on other capital costs, including purchase of equipment needed for the program.**
- Purchase of equipment to support student learning has already occurred through the Center for Unmanned Systems and Human Capital Development. No capital needs exist.

b. Support

i. Nature of Support (New, Existing, or Reallocated)

- **Summarize what reallocation of resources has taken place to support this program.**
 - Program will utilize existing support. No changes to existing programs are necessary.

ii. Special Fees above Baseline Tuition

- **Summarize any special fees above baseline that are needed to support this program.**
 - Regular undergraduate tuition will be in place for this program. Two existing courses have lab fees in place for this program. For the maintenance classes there are lab fees associated with the classes to purchase new robots parts, equipment, and replacement parts for robots used in class. Each student will build a small unmanned vehicle they will keep over the course of the program.

4. Similar and Related Programs

a. List of Programs and Degrees Conferred

- i. Similar Programs at Other Institutions
 - There are currently no programs within the State of Indiana that are similar to the Unmanned Systems Program.
- ii. Related Programs at the Proposing Institution
 - There is only one related program at Indiana State University currently applicable to unmanned systems: the Minor in Unmanned Systems, Department of Aviation Technology, in place since the spring semester of 2011. As of fall 2014, there are 156 students enrolled in the minor of Unmanned Systems and 65 graduates with a minor.

b. List of Similar Programs Outside Indiana

University	Degree Name	Delivery Mode
University of North Dakota	B.S. in Aeronautics with a Major in Unmanned Aircraft Systems Operations	Online/ Campus
Embry-Riddle Aeronautical University – Daytona Campus	B.S. in Unmanned Aircraft Systems Science	Online/ Campus
Kansas State University	B.S. in Unmanned Aircraft Systems	Online/ Campus
Northwestern Michigan College	Minor	Online/ Campus
Sinclair Community College	Certificate	Campus

c. Articulation of Associate/Baccalaureate Program

- N/A

d. Collaboration with Similar or Related Programs on Other Campuses

- The UMS Department is currently in collaboration with Kansas State University, University of North Dakota, and Embry-Riddle Aeronautical University.

5. Quality and Other Aspects of the Program

a. Credit Hours Required/Time To Completion

- The proposed program will require all students to complete 120 credit hours of undergraduate coursework including 49 credit hours in core curriculum. Included are the Foundational Studies required for a Bachelors of Science degree. All students will be required to complete a minimum of 45 credit hours of the coursework at the 300-400 level and to earn a GPA of at least a 2.0 on a 4.0 scale. All core curriculum hours must be passed with a C grade (2.0 Grade Point) or higher.
- Successful graduation will be based upon students completing the required coursework shown below with a minimum cumulative grade point average (GPA) of 2.0 on a 4.0 scale. Students will be required to complete a minimum of 120 credits; and, a minimum of 45 of the 120 credit hours are required at the 300-400 level. Each UMS & AVT Core course in the degree must be passed with a C grade (2.0 points) or higher. AVT 141 (6 credit hours) will substitute for UMS 181 (3 credit hours). AVT142 (3 credit hours) will substitute for AVT143 (3 credit hours).

- Students are strongly encouraged to pursue a Minor field of study, especially in areas where unmanned systems may play a large role in the future. By learning and understanding another field of expertise, students will be able to effectively apply the technology to a business area. Suggested minors include Aviation Technology, Criminology and Criminal Justice, Geographic Information Science, Computer Engineering Technology, Computer Science, Communication, and Business Administration. Many other ISU minors are available as well as the opportunity to obtain a double major.
- **Note: UMS483, UMS485, and UMS491 require compliance with the International Traffic in Arms Regulations (ITAR) imposed by the State Department of the United States. These courses are open to US Citizens only. To complete either the Bachelor of Science or the minor in Unmanned Systems, the student must be a US citizen.**

Unmanned Systems Core Courses: 21 Credits

- UMS 181 – Flight Theory for Non-Aviation Majors – 3 Credits *
- UMS 281 – Introduction to Unmanned Systems - 3 Credits
- UMS 382 – Mechanics of Unmanned Systems - 3 Credits
- UMS 385 – Human Factors of Unmanned Systems - 3 Credits
- UMS 483 – Payloads and Sensors - 3 Credits
- UMS 485 – Communications and Data Links - 3 Credits
- UMS 491 – Advanced UAS Operations - 3 Credits

Aviation Department Core Courses: 28 Credits

- AVT 130 – Introduction to Aviation Technology - 2 Credits
- AVT 143 – Introduction to Flight - 1 Credit **
- AVT 223 – Aviation Weather Services - 3 Credits
- AVT 307 – Airport Operations - 3 Credits
- AVT 309 – Aviation Security and Emergency Management - 3 Credits
- AVT 323 – Air Traffic Control Systems - 3 Credits
- AVT 325 – Crew Resource Management - 3 Credits
- AVT 405 – Aviation Law - 3 Credits
- AVT 425 – Aviation Safety Management Systems - 3 Credits
- AVT 430 – Aviation Career Planning - 1 Credit
- AVT 471 – Topics for Aviation Majors – 3 Credits

* AVT 141 – Private Pilot Theory (6 Credits) will substitute for UMS 181 (3 Credits).

** AVT 142 – Private Pilot Flight I will substitute for AVT 143 – Introduction to Flight.

- Appendix 10 includes an example 4-year plan for the student.

b. Exceeding the Standard Expectation of Credit Hours

- N/A

c. Program Competencies or Learning Outcomes

- **List the significant competencies or learning outcomes that students completing this program are expected to master.**

- The mission of the Indiana State University Bachelor of Science in Unmanned Systems degree is to create a student-centered educational environment that engages individuals to help them fulfill their career goals by obtaining a bachelor's degree with general skills necessary for success and advancement in the workplace. At the completion of this program the graduate will be able to:

- 1:** Students will demonstrate knowledge of primary unmanned systems components to include the vehicle, sensors, ground control station (GCS), data links, and personnel.
- 2:** Students will perform analyses related to design, construction, and maintenance of system vehicles.
- 3:** Students will utilize instruments, methods, software, and techniques to produce an effective simulated operational mission requiring the use of all system components.
- 4:** Students will demonstrate a working knowledge of flight safety operations in the use of unmanned systems.
- 5:** Students will apply and demonstrate fundamental methods and elementary technique in determining appropriate application process in data analysis.
- 6:** Students will understand regulations and rules as they apply to unmanned systems and component uses.
- 7:** Students will demonstrate system solutions and integration.

d. Assessment

- **Summarize how the institution intends to assess students with respect to mastery of program competencies or learning outcomes.**

- The College of Technology extensively reviews student outcomes. These evaluation procedures will apply to the BS in Unmanned Systems program and include: student course evaluation; student evaluation of learning resources, support, advising, and distance education and technology; exit surveys; student satisfaction; and alumni surveys. Student retention and graduation rates

are compiled and analyzed annually. All these procedures are necessary to provide extensive ongoing evaluation that express competency, achievement, and areas of recommended changes.

- The Unmanned Systems program will produce graduates that have mastered a combination of educational and operational practiced experience that will prepare students for the operational environment of Unmanned Systems. The UMS program will provide the skills relating to the unmanned systems area, focusing on education, training, practical application, research development, theoretical and practical operations of unmanned systems. Working in the classroom to operating vehicles in the field, students will receive hands on experience with varying types of vehicles including air, land, and maritime.
- Evaluation forms will be adapted to include specifics of the BS in Unmanned Systems program outcomes. The college faculty will review evaluation results and make necessary curriculum changes. This process will enable the program to reflect on and discuss the overall quality of the students learning experience and to identify strategies (curricular and co-curricular) for program improvement.
- An Assessment Plan is attached for review.

e. Licensure and Certification

- N/A

f. Placement of Graduates

- Currently there are graduates from the ISU unmanned systems minor that have been placed in jobs working within the unmanned systems industry. These positions include sales, customer service, pilot, sensor operator, observer, and mission planner. They are working directly with customers in emergency management, agriculture, energy, communications, and academia.
- ISU has relationships with industry partners to provide internships and career opportunities to students. Students who graduate from the major will be eligible for entry level positions as mission support analysts, pilots, sensor operators, visual observers, imagery analysts, programmers, and other support personnel.

g. Accreditation

- There is currently no accreditation for this degree.

6. Projected Headcount and FTE Enrollments and Degrees Conferred

- Please see appendix 12. The early numbers of completion shown are anticipated because some students are currently enrolled in the Minor and are wanting to complete the major as soon as it is available.

Appendix 1: Institutional Rationale, Detail (This appendix should contain links to the institution's strategic and/or academic plan or the plans themselves.)

Link to:

ISU STRATEGIC PLAN

[Indiana State University Strategic Plan](#)

<http://irt2.indstate.edu/ir/index.cfm/sp/index>

GOAL 1: INCREASE ENROLLMENT AND STUDENT SUCCESS

Document can be found at: [ISU Strategic Plan Goal One](#)

<http://irt2.indstate.edu/ir/assets/splan/goals/stratplangoal1.pdf>

GOAL 2: ADVANCE EXPERIENTIAL LEARNING

Document can be found at: [ISU Strategic Plan Goal Two](#)

<http://irt2.indstate.edu/ir/assets/splan/goals/stratplangoal2.pdf>

GOAL 3: ENHANCEEE COMMUNITY ENGAGEMENT

Document can be found at: [ISU Strategic Plan Goal Three](#)

<http://irt2.indstate.edu/ir/assets/splan/goals/stratplangoal3.pdf>

GOAL 4: STRENGTHEN AND LEVERAGE PROGRAMS OF DISTINCTION AND PROMISE

Document can be found at: [ISU Strategic Plan Goal Four](#)

<http://irt2.indstate.edu/ir/assets/splan/goals/stratplangoal4.pdf>

Appendix 2: Summary of Indiana DWD and/or U.S. Department of Labor Data, Detail (This appendix should contain the detailed tables, upon which the summary of the labor market demand is based.)

The May 2012 State Occupational Employment and Wage Estimates for Indiana contains numerous tables. There are too many to include in the document.

Link to the tables:

[May 2012 State Occupational Employment and Wage Estimates for Indiana](http://www.bls.gov/oes/2012/may/oes_in.htm)

http://www.bls.gov/oes/2012/may/oes_in.htm

Appendix 3: National, State, or Regional Studies, Detail (This appendix should contain links to the studies cited or the studies themselves.)

Link to:

AUVSI's economic impact report released March 12, 2013;

[*The Economic Impact of Unmanned Aircraft Systems Integration in the United States*](#)

<http://www.auvsi.org/resources/economicreport>

Appendix 4: Surveys of Employers or Students and Analyses of Job Postings, Detail (This appendix should contain links to the surveys or analyses cited, or the documents themselves.)

None available.

Appendix 5: Letters of Support, Detail

April 1, 2014

Dr. Richard Baker
Indiana State University
650 Cherry St.
Terre Haute, IN

Dear Dr. Baker,

I am writing to express my support for Indiana State University's pursuit of a Bachelor of Science degree in Unmanned Systems.

As you are well aware, the unmanned systems/autonomous vehicle sector is one of the fastest growing sectors in the world. Conservatively, the economic impact of the unmanned systems sector within the US alone is expected to range between \$85-\$92 billion in the next six years (2014-2020).

There are also state implications that must be considered in the growth of this important sector. The state of Indiana's growth opportunities are contingent on advancements within the academic, regulatory, technical, manufacturing, operations and finance sectors. In other words, pursuit of this sector will create economic and employment opportunities that currently do not exist in Indiana.

Indiana State University has a tremendous opportunity to both lead and support the advancement of this industry within Indiana and the region. I encourage you to continue your strategic pursuit and do all possible to establish academic programs that will ultimately be beneficial to the state and citizens of Indiana.

Sincerely,



Mathew J. Konkler
Executive Director, National Center for Complex Operations
mkonkler@usncco.com



MICHAEL R. PENCE, Governor
STATE OF INDIANA

INDIANA DEPARTMENT OF HOMELAND SECURITY
302 West Washington Street
Indianapolis, IN 46204

April 17, 2014

Dr. Richard Baker, Ph.D.
Director, Center for Homeland Security & Crisis Leadership
Indiana State University
Terre Haute, IN 47809

Dear Dr. Baker:

During our meetings this past year, I have been encouraged by your interest in and support of the Indiana Department of Homeland Security, specifically, regarding the increasingly important matter of Unmanned Systems (US). Additionally, our agency has had conversations with other university personnel within the state.

Our agency worked closely with private sector interests, other states and several Indiana agencies to participate in the recently awarded Unmanned Aerial Systems (UAS) pilot program in which six sites were identified by the Federal Aviation Administration (FAA) to assist in development of UAS into the country's civilian airspace. While Indiana was not selected as one of those sites, Indiana hosted a conference which had extensive representation from industry, government and military participants. Through that event, it was readily apparent that economic investment is significant not only in the research and development of such systems, but also related to their deployment. Several presenters posited that the world-wide UAS industry was potentially worth 70-80 billion dollars. Once the research and development starts producing applications, there will be considerable demand for educated and trained employees to operate them.

Indiana's agricultural industry, just one example, will benefit hugely from such systems in order to deploy their use in a variety of applications. Currently, those trained in the use of Unmanned Systems come primarily from the military. As the FAA begins to introduce these devices throughout the country, there will be a significant demand for educated and well-trained experts. This will involve integration of aeronautical knowledge with vocational aptitude for operating devices in a variety of settings.

Not only will there be a need for end users of such systems, but attorneys, business owners and government regulators will all be seeking candidates with the requisite knowledge, skills and abilities associated with them.



An Equal Opportunity Employer

In closing, I believe the potential for Indiana to benefit from early engagement of Unmanned Systems education, resulting in graduates from institutions of higher learning, will be immense. Thank you for your ongoing commitment to Indiana's security and emergency preparedness efforts.



John Hill
Executive Director
Indiana Department of Homeland Security



Indiana Office of Defense Development (IODD)

16 April 2014

FROM: Duane Embree, Executive Director, Indiana Office of Defense Development

TO: Dr. Richard Baker, Director, Center for Unmanned Systems & Human Capital Development, Indiana State University, Terre Haute, IN 47809

SUBJECT: Support of the need for education and training in unmanned systems/robotics as a career area for future graduates of universities in Indiana

Dr. Baker,

This letter is in support of the need for education and training in unmanned systems and robotics as a career area for future graduates of universities in Indiana. Initially created for military applications and now expanding rapidly into the commercial sector, the uses of unmanned systems are currently growing faster than education and training requirements can be met. Of particular importance to Indiana are the opportunities to train future developers, operators and maintainers of unmanned and robotic systems. Providing sufficient training and education to produce a qualified workforce will provide great jobs for Hoosiers and significantly enhance Indiana's ability to compete in the new economy that is being created by this technology.

Educational programs such as a Bachelor of Science in Unmanned Systems in Indiana colleges and universities are critical to meeting that need.

Duane Embree
Executive Director,
Indiana Office of Defense Development



Women's Business Enterprise **NAICS: 541513, 541330, 541611**
WBENC: Women's Business Enterprise **Cage Code: 3GAL3**
National Council
Small Disadvantaged Business **SeaPort-e Prime: N00178-06-D-4841**
8(a) Certified: 303103

Dr. Biff Williams
 Vice President Academic Affairs and
 Indiana State University
 200 North 7th St.
 Terre Haute, IN 47809

Provost

Letter of Support for Indiana State University 4 Year Degree Program in Unmanned Systems

Phoenix Data Corporation strongly supports Indiana State University's plan to provide a 4 Year Degree program for Unmanned Systems and considers it an honor to be able to support their initiative with this letter of endorsement.

Unmanned Systems is one of the fastest growing industry areas inside DoD, Federal and commercial markets. This growth area has been highlighted by the recent interest in Congress and the official designation of National UAV Test Sites by the FAA as required by the FAA Modernization and Reform Act of 2012. Indiana, in partnership with the state of Ohio, provides a strong capability inside this market space with its Military Operation Areas associated with the Atterbury Complex. Indiana will be a strong leader in this industry, providing training environments in all three domains of land, air and maritime testing in a single location. Indiana State University is already a critical partner in Indiana, along with the Indiana Economic Development Corporation (IEDC), the Office of Defense Development, the Indiana National Guard and the Sagamore Institute. The addition of this 4 year degree program greatly strengthens Indiana State University's position as a national leader in the future of aviation and unmanned systems.

The upcoming Unmanned Aircraft Systems Airspace Operations Challenge (UAS AOC), part of NASA's Centennial Challenge Program designed to promote technology advancements in the area of UAS, to be held here in Indiana, is only the tip of the iceberg for immediate revenue growth and the addition of new jobs inside the state and nation. The future landscape for the UAS industry covers many communities to include defense, intelligence, law enforcement, homeland security, agriculture and other scientific communities. DoD's budget request, along, for fiscal year 2014 was \$4.1 Billion. In a recent article in "Market Research Media", the projection was for the U.S. Military UAV market to generate \$86.5 Billion revenues over the period 2013-2018. In addition to the U.S. military market, the global military markets and commercial markets are predicted to see increasing demand, even in a budget restraint environment. These numbers equate to significant job growth.

Phoenix Data Corporation, along with many other companies, will need highly educated, skilled technical men and women to fill these future requirements. Indiana State University's 4 Year Degree Program will be a key partner with those of us in industry to fill these future positions, and at the same time, strengthen the state's Buy Indiana program.

Thank you,

President/CEO

Phoenix Data Corporation—Corporate Headquarters
 9045 E. 59th Street, 3rd Floor • Indianapolis, Indiana 46216
 Phone: 877.732.9595 / 317.354.1187 • Fax: 317.354.1369 • www.phoenixdatacorporation.com



April 17, 2014

Indiana Commission of Higher Education
101 W Ohio St Suite 550
Indianapolis, IN 46204

Commissioners,

The field of unmanned systems, and specifically Unmanned Aircraft Systems (UAS), is a rapidly growing market worldwide. The applications of UAS are boundless and offer many benefits for safety, security, information gathering, disaster mitigation and relief, and countless other commercial applications, most of which are yet to be envisioned. Presently, agriculture and agribusiness are the largest users of UAS technology and information worldwide, and as you can imagine, Indiana with its large agricultural base, stands to benefit greatly from the thoughtful implementation of these new tools.

Terre Haute International Airport has applied for a Certificate of Authorization (COA) from the FAA to begin UAS operations at our airport. We hope to be a leader in this field as it takes hold in Indiana, and we are looking for partners knowledgeable in UAS planning and operations to work with as this technology emerges.

With its cadre of applicable resources, Indiana could be a leader in the implementation of UAS, and in the development of new worldwide markets. One of the keys to the successful integration of this developing technology is the education and training of the workforce to staff such a market segment. Degree programs and other certifications in UAS will be essential to the growth of this new industry. I would urge the Commission to support and encourage, if not solicit, proposals for educational programs in this rapidly developing field in order to help Indiana get and stay in the lead as this new market unfolds.

Sincerely,

William J. Foraker
Executive Director



April 16, 2014

RE: The need for Unmanned Aircraft Systems (UAS) higher education

To whom it may concern,

Futron Corporation is currently serving as the principal investigator for a Transportation Research Board (TRB), Airport Cooperative Research Program (ACRP) project. The project is: ACRP 03-30 Impact of UAS on Airports. The output of this 15 month research project will be a Primer which provides airport operators with valuable information with regard to UAS, the current state of the industry, and future potential impacts on airports. The intent of the project is not to answer all the questions; rather, it is intended to spark interest, improve the knowledge base, and provide information necessary for airport operators to make decisions about UAS operations on and around their airport. Futron Corporation is currently half way through the project and has gathered a considerable amount of information.

UAS is very much an emerging industry. The military has a considerable amount of advanced knowledge of UAS operations; however, it is concentrated knowledge without much direct practical application to civilian aviation. Civilian aviation needs airport managers and UAS operators who understand the UAS industry before they learn from experience. They need education that is focused on UAS within the context of overall aviation. Universities that provide students with aviation opportunities such as learning to fly, learning how to manage airports, understand aeronautical engineering, and the practical impacts of aviation on our society should be encouraged to offer UAS degrees which will serve the students well and early in their quest for adding value in aviation.

UAS is on the brink of making a major impact on how civilian aviation exists in the United States and elsewhere in the world. There are a lot of public misconceptions right now; some are caused by the news media and some are human nature and the fear of the unknown. Universities provide the opportunity for young people to get ahead of public opinion and put it in motion knowledge in order to give them a chance to make a positive impact. UAS in aviation would be a wonderful degree for Universities, particularly those located in the state of Indiana to offer. As a former graduate of Indiana State University's aviation program and now a 25 year aviation professional who is actively working on UAS projects I strongly support Universities developing and providing UAS degrees.

The industry has a growing need for well-educated young people to take UAS from "drones" to their real use as tools for efficiency and safety. UAS will become part of the aviation industry more and more; the speed with which this occurs and the acceptance from society will depend a lot on how well our young people are prepared to show the advantages UAS provides.

Regards,

A handwritten signature in blue ink that reads "D.M. Fleet".

David M. Fleet
Technical Director, Airport Operations
Futron Corporation
(317) 490-0050 (mobile)

BLACK BIRD™

G R O U P

Innovating Combat Strategies for Tomorrow's Battles



Indiana State University UAS Letter of Support

Black Bird Group, llc was established to focus on bridging requirement gaps of Special Operations Forces (SOF), Department of Homeland Security and Whole of Government requirements combining SOF Subject Matter Experts with professional Engineering and Technical services to provide tailored solutions.

Unmanned Systems are an integral part of the Special Operations mission set and this area will continue to grow at a rapid rate though what is called SOF vision 2020. Given the unique mission sets, SOF is challenged with rapid requirement solutions which require close collaboration with Industry and academia. ISU is key to this!

There is a growing demand from SOF for Unmanned Systems collaboration with industry in the state of Indiana. Indiana State University-Unmanned Systems program is making strides/advancements and forging new paths into this critical sector that now is reaching far beyond the national security realm. Blackbird Group fully supports and will potentially benefit from the activities and advancements that ISU is currently engaged in.

Black Bird Group and SOF will require employees with advanced UAS education in order to meet design and development requirements through 2020.

/R

Mike Cooper
CEO

Black Bird Group, llc
mcooper@blackbirdgroup-llc.com
www.blackbirdgroup-llc.com



Black Bird Group is a Service Disabled Veteran Owned Small Business
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"Innovating Combat
Strategies for Tomorrow's
Battles"



GARRITY TOOL COMPANY, LLC
3555 S. Developers Rd.
Indianapolis, IN 46227
317-541-1400

February 27, 2014

Dr. Biff Williams
Vice President of Academic Affairs and Provost
Indiana State University
200 N. 7th St.
Terre Haute, IN 47807

Subject: 4 Year Unmanned Systems Program

Dear Dr. Williams:

Unmanned Systems are not a discussion for our future they are the topic of today! As a contract manufacturing company, specializing in aerospace applications, we have made a strategic decision to pursue unmanned systems, in any form, as a target market. This is a burgeoning market and industry that crosses all sectors. It is unfortunate that Unmanned Systems has become somewhat synonymous with DOD "Drones operated to either listen in or kill targets from the air". The truth is that unmanned systems are going to be prevalent in agriculture, utility companies, first responders, manufacturing / warehousing, assisted living, transportation, and of course national security.

Indiana, as a state, is well positioned to be a critical player in the unmanned arena. There is an industry, a culture, and an infrastructure that sets this state apart from all others. The state's current assets- MUTC, JPG, Camp Atterbury, Crane NAVSEA coupled with a dynamic Economic Development initiative and numerous industry stake holder groups has made Indiana well positioned to attract OEMS in the unmanned field. A logical extension of the industry component is the academic element. We need ISU to offer a 4 year program in all phases of unmanned operations.

Industry always identifies Workforce Development as a critical need. As a manufacturer I know we will not be tasked with producing components if there is not an available workforce to develop and apply the technologies that unmanned systems and ISU can offer. We need ISU to offer this program to prepare and grow a workforce that can fill the demand that is being created now.

I welcome any questions or comments you may have regarding the comments above. I would also be more than happy to bring an industry group together for any further discussion on this topic or the need for this program.

Sincerely,

Carl Boss – Director of Business Development – Garrity Tool Company

March 13, 2014

Dr. Biff Williams
Vice President and Academic Affairs and Provost
Indiana State University
200 N. 7th St.
Terre Haute, IN 47807

Dear Dr. Williams:

It is with great pride that I write this letter giving my highest recommendation for the 4 year Unmanned Systems Degree program being proposed by Indiana State University. I believe that I am uniquely qualified to provide some insight onto the past, current and ongoing importance of this program, from an academic as well as business perspective.

I graduated with a B.S. Degree in Electronics and Computer Technology from Indiana State in May of 1990. At that time, the only class related to Unmanned Systems was one on Robotics taught by Dr. Larry Heath. I took that class and immediately became fascinated by that field and those related to it such as computer vision, manipulation, and artificial intelligence. With the support and encouragement of Dr. Jerry Cockrell, Dr. Bob English, Dr. Heath and the rest of the faculty, I applied to and was admitted to Carnegie Mellon University's Robotics Institute where I earned a Ph.D. in Robotics in 1996. My course of study and research was 100% focused on unmanned systems - in my case, self-driving cars.

After graduation and a brief stay as a faculty member at Carnegie Mellon, I left the school to start and build two unmanned systems companies – AssistWare Technology and Applied Perception. AssistWare was focused on commercializing the self-driving car technology developed at Carnegie Mellon and turning it into a lane departure warning system for inattentive or drowsy drivers. Applied Perception had a similar unmanned systems focus, except in its case, it was on creating the sensing, intelligence, control, and human interface software to make military robots smart. Between 1999 when AssistWare began full time operation and 2009 after I had sold and left Applied Perception, both companies employed approximately 25 people focused solely on unmanned systems technologies. Since that time I have been active as an unmanned systems consultant, acting CEO of an unmanned air systems company, and expert witness in automotive safety field.

In every facet of my professional life, finding qualified unmanned systems professionals at all education levels has been extremely difficult even though the unmanned systems field has only now started to grow. Unmanned systems jobs are typically very well paying (\$55,000 -

\$125,000+) depending on experience and degree, and essentially involve working with cutting edge technology and creating new businesses or fundamentally changing existing one through the use of unmanned systems. The field is growing at a rapid pace and unmanned systems technologies are becoming ubiquitous in every facet of both technology and non-technology business. Multiple companies in the agriculture, transportation, technology, warehousing, defense, entertainment, communications, and service markets are being created on a monthly and even weekly basis that are being built around unmanned systems technology. There is even now a top 50 listing of the most influential robotics and unmanned systems companies in the world, and numerous trade publications, conferences, and networking groups exist that focus on this field.

I could continue on with more information (and in fact, welcome any questions you may have), but let me close by saying that Indiana State University and the College of Technology have a unique opportunity to create an academic program to directly address a proven and fast growing need for unmanned systems professionals. Indiana State will be counted in the handful of universities worldwide that offer such a degree and I believe that this program will be a magnet for both the College of Technology as well as for related, supporting degree programs at the University such as Business and Computer Science.

Thank you and please let me know if you have any questions,

Sincerely,

A handwritten signature in black ink that reads "Todd Jochem". The signature is fluid and cursive, with a long horizontal line extending from the end of the name.

Todd Jochem, Ph.D.

Appendix 6: Faculty and Staff, Detail (This appendix should contain a list of faculty with appointments to teach in the program and a brief description of new faculty positions yet to be filled.)

College	Department	Name	Title/Rank	Tenure Status	Degree
Technology	Aviation	To be Hired	Assistant Faculty	Tenure Track	Ph.D.
Technology	Aviation Technology	Richard Baker	Consultant	Contract	Ph.D.
Technology	Aviation Technology	Donald Bonte	Interim Director Unmanned System Center	Contract	B.S.
Technology	Aviation Technology	Jeffrey Hauser	Faculty Affiliate	N/A	M.B.A.
Technology	Aviation Technology	Jan Eglan	Faculty Affiliate	NA	Ph.D.
Technology	Aviation Technology	Gregory Betz	Instructor	N/A	M.S.
Technology	Aviation Technology	Gary Bullock	Instructor	N/A	M.S.
Technology	Aviation Technology	Tyler Amos	Graduate Assistant	N/A	B.S.

c. New Faculty

This program was designed to maximize the utilization of existing faculty resources. The department has developed an enrollment management plan that increases productivity and ensures delivery of both aviation and unmanned systems classes. The hiring model for the unmanned systems proposed undergraduate degree will fill the needs for additional faculty resources as the program grows.

Appendix 7: Facilities, Detail

Support services and facilities are already in place to support degree completion.

Appendix 8: Other Capital Costs, Detail (This appendix should contain additional information on other capital costs associated with the program.)

The proposed program currently has an agreement with the Center for Unmanned Systems and Human Capital Development at Indiana State University for any other capital costs.

Appendix 9: Articulation of Associate/Baccalaureate Programs, Detail

None

Appendix 10: Credit Hours Required/Time to Completion, Detail

B.S. in Unmanned Systems

Successful graduation will be based upon students completing the required coursework shown below with a minimum cumulative grade point average (GPA) of 2.0 on a 4.0 scale. Students will be required to complete a minimum of 120 credits; and, a minimum of 45 of the 120 credit hours are required at the 300-400 level. Each UMS & AVT Core course in the degree must be passed with a C grade (2.0 points) or higher. AVT 141 (6 credit hours) may substitute for UMS 181 (3 credit hours). AVT142 (3 credit hours) may substitute for AVT143 (3 credit hours).

Students are strongly encouraged to pursue a Minor field of study, especially in areas where unmanned systems may play a large role in the future. By learning and understanding an field of expertise, students will be able to effectively apply the technology to a business area. Suggested minors include Aviation Technology, Criminology and Criminal Justice, Geographic Information Science, Computer Engineering Technology, Computer Science, Communication, and Business Administration. Many other ISU minors are available as well as the opportunity to obtain a double major.

Note: UMS483, UMS485, and UMS491 require compliance with the International Traffic in Arms Regulations (ITAR) imposed by the State Department of the United States. These courses are open to US Citizens only. To complete either the Bachelor of Science or the minor in Unmanned Systems, the student must be a US citizen.

Unmanned Systems Core Courses: 21 Credits

- UMS 181 – Flight Theory for Non-Aviation Majors – 3 Credits *
- UMS 281 – Introduction to Unmanned Systems - 3 Credits
- UMS 382 – Mechanics of Unmanned Systems - 3 Credits
- UMS 385 – Human Factors of Unmanned Systems - 3 Credits
- UMS 483 – Payloads and Sensors - 3 Credits
- UMS 485 – Communications and Data Links - 3 Credits
- UMS 491 – Advanced UAS Operations - 3 Credits

Aviation Department Core Courses: 28 Credits

- AVT 130 – Introduction to Aviation Technology - 2 Credits
- AVT 143 – Introduction to Flight - 1 Credit **
- AVT 223 – Aviation Weather Services - 3 Credits
- AVT 307 – Airport Operations - 3 Credits
- AVT 309 – Aviation Security and Emergency Management - 3 Credits
- AVT 323 – Air Traffic Control Systems - 3 Credits
- AVT 325 – Crew Resource Management - 3 Credits
- AVT 405 – Aviation Law - 3 Credits
- AVT 425 – Aviation Safety Management Systems - 3 Credits
- AVT 430 – Aviation Career Planning - 1 Credit
- AVT 471 – Topics for Aviation Majors - 3 Credits

- * AVT 141 – Private Pilot Theory (6 Credits) may substitute for UMS 181 (3 Credits).
 ** AVT 142 – Private Pilot Flight I may substitute for AVT 143 – Introduction to Flight.

4-Year Course Plan

Semester 1

UMS 181	3	Flight Theory for Non-Aviation Majors
AVT 130	2	Introduction to Aviation Technology
AVT 143	1	Introduction to Flight (UMS Sim)
Foundational Study	3	Communication
Foundational Study	3	English 101
<u>Foundational Study</u>	<u>3</u>	Historical Studies
Total	15	

Semester 2

UMS 281	3	Introduction to Unmanned Systems
AVT 223	3	Aviation Weather Services
Foundational Study	3	English 105
Foundational Study	3	Quantitative Literacy
<u>Foundational Study</u>	<u>3</u>	Social and Behavioral Studies
Total	15	

Semester 3

UMS 382	3	Mechanics of Unmanned Systems
AVT 307	3	Airport Operations
Foundational Study	3	Health and Wellness
Foundational Study	3	Fine and Performing Arts
<u>Foundational Study</u>	<u>3</u>	Foreign Language 1
Total	15	

Semester 4

UMS 385	3	Human Factors of Unmanned Systems
AVT 325	3	Crew Resource Management
Foundational Study	3	Literary Studies
Foundational Study	4	Laboratory Science
<u>Foundational Study</u>	<u>3</u>	Foreign Language 2
Total	16	

Semester 5

AVT 309	3	Aviation Security and Emergency Management
AVT 323	3	Air Traffic Control Systems
Foundational Study	3	Junior Composition
Foundational Study	3	Upper Division Integrated Elective
<u>Foundational Study</u>	<u>3</u>	Global Perspective and Cultural Diversity
Total	15	

Semester 6

UMS 483	3	Payloads and Sensors
AVT 425	3	Aviation Safety Management Systems
Foundational Study	3	Ethics and Social Responsibility
Foundational Study	3	Upper Division Integrated Elective
<u>Elective</u>	<u>3</u>	Elective
Total	15	

Semester 7

UMS 485	3	Communications and Data Links
AVT 405	3	Aviation Law
Foundational Study	3	Elective
Elective	3	Elective
<u>Elective</u>	<u>3</u>	Elective
Total	15	

Semester 8

UMS 491	3	Advanced UAS Operations
AVT 430	1	Aviation Career Planning
AVT 471	3	Topics
Elective	3	Elective
Elective	3	Elective
<u>Elective</u>	<u>1</u>	Elective
Total	14	

TOTAL CREDITS: 120

Appendix 11: Exceeding the Standard Expectation of Credit Hours, Detail (This appendix should contain detailed information on why it is necessary to exceed the standard credit hour expectation, such as links to relevant licensure and/or accreditation standards the standards themselves.)

N/A

Appendix 12:

Projected Headcounts and FTE Enrollments

Campus: ISU Terre Haute
 Program: Unmanned Systems
 Date: April 11, 2014

	Total Year 1 FY2015	Total Year 2 FY2016	Total Year 3 FY2017	Total Year 4 FY2018	Total Year 5 FY2019 [†] *
A. FULL-TIME EQUIVALENTS (FTEs)					
1. FTEs generated by Full-time students	20	30	45	55	70
2. FTEs generated by Part-time students	2	4	5	5	5
TOTAL	22	34	50	60	75
B. PROGRAM MAJORS (HEADCOUNT)					
1. Full-time students	20	30	45	55	70
2. Part-time students	4	8	10	10	10
TOTAL	24	38	55	65	80
C. PROGRAM COMPLETIONS	0	7	15	20	40

* If necessary, specify additional years up to the point at which the program is projected to achieve steady state.

Appendix 13: References

- i AUVSI. (2013, Mar. 12). *The Economic Impact of Unmanned Aircraft Systems Integration in the United States*. Publication. Vol. 2013. AUVSI Accessed 01 Apr. 2014. <<http://www.auvsi.org/resources/economicreport>>.
- ii Honeycutt, G. (2008, September). Unmanned systems down on the farm: Dull, dirty, dangerous, demanding. *Unmanned Systems*. 26 (9), 25-27.
- iii Fahlstrom, P.G., & Gleason, T.J. (2009). *Introduction to UAV systems* (3rd ed.). Columbia, MD: UAV Systems Inc.
- iv AIA Aerospace. "Workforce Issues." <Http://www.aia-aerospace.org/>. 19 Feb. 2014. Accessed 14 Mar. 2014 <http://www.aia-aerospace.org/industry_issues/workforce>.
- v AIA Aerospace. "Workforce Issues." <Http://www.aia-aerospace.org/>. 19 Feb. 2014. Accessed 14 Mar. 2014 <http://www.aia-aerospace.org/industry_issues/workforce>.
- vi AIA Aerospace. "Workforce Issues." <Http://www.aia-aerospace.org/>. 19 Feb. 2014. Accessed 14 Mar. 2014 <http://www.aia-aerospace.org/industry_issues/workforce>.
- vii "Unmanned Systems Caucus." <Congressional 2012 Science and Technology Fair ->. 20 Sept. 2012. Congressional Unmanned Systems Caucus. Accessed 01 Apr. 2014 <<http://unmannedsystemscaucus.mckee.house.gov/press/2012/09/congressional-unmanned-systems-caucus-2012-science-and-technology-fair.shtml>>.
- viii SHRM. "Future Workplace Trends." <Www.shrm.org>. Accessed 26 Mar. 2014. <http://www.shrm.org/research/futureworkplacetrends/documents/130146%20workplace_forecast_full_fnl.pdf>.
- ix U.S. Department of Labor/Bureau of Labor Statistics. "Indiana - May 2012 OES State Occupational Employment and Wage Estimates." <U.S. Bureau of Labor Statistics>. U.S. Bureau of Labor Statistics. 01 Apr. 2014 <http://www.bls.gov/oes/2012/may/oes_in.htm>.
- x AUVSI. (2013, Mar. 12). *The Economic Impact of Unmanned Aircraft Systems Integration in the United States*. Publication. Vol. 2013. AUVSI Accessed 01 Apr. 2014. <<http://www.auvsi.org/resources/economicreport>>.