*Prepares Students for College and Careers*

# ▲ Unmanned Aircraft Systems (UAS) II

**COURSE CODES:**

**▲ROP 67028 ▲WUHSD 0000 ▲ERUSD 0000 ▲STATE (CALPADS) 8132**

**Course Leads to:** Post-Secondary Education
**Industry Sector:** Information and Communication Technologies
**Career Pathway:** Software and Systems Development - 174
**Classroom Hours:** 180 **Course Level:** Capstone
**Work Based Learning:** 180 (optional)

Approved Textbook/Curriculum: sUAS Safety Certification Level I (Unmanned Safety Institute)

**POST-SECONDARY EDUCATION**

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|---|---|
| Articulation with College | No |
| Dual Enrollment with College: | No |
| UC Approved a-g elective credit: | No |

**COLLEGE MAJORS**

Aeronautical Science
Unmanned Aircraft Systems
Remote Sensing
Geographic Information Systems

**INDUSTRY CERTIFICATIONS**

FAA Remote Pilot Certificate (107)

**NEXT STEPS**

Post-Secondary Education

**EMPLOYMENT**

**Related Careers (O*NET)**

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| 15-1151 | Computer Support Services |
| 17-2061 | Computer Hardware Engineers |
| Pending | UAV/UAS Programmer |
| Pending | UAV/UAS Technician |
| Pending | UAV/UAS Software Engineer |
| 17-2199 | Robotics Engineers |
| 27-4031 | Camera Operators |
| 49-2091 | Avionics Technicians |
| 15-1199 | Geospatial Information Scientists |

**Prerequisites:**
Must have an overall minimum GPA of 2.5. Completion of Unmanned Aircraft Systems (UAS) I with a 70% or better.

**Course Description:**
This course will build upon UAS 1 to expand understanding of the Unmanned Aircraft Systems and their technologies. This course focuses on the pilot and how a team concept is critical to safe operations in the field. This course will include the start of a "Flight Mission Project," which will encompass all the knowledge gained in the classroom and outside resources. The emphasis of this course is on system operations and communication technologies for supporting and piloting unmanned aerial vehicles (drones). Students will have many opportunities to pilot and support flying operations of a professional UAS, while preparing for the Small UAS Safety Certification exam from USI.

Integrated throughout the course are standards for Career Ready Practice and Academic Content Standards which include: appropriate technical skills and academic knowledge; communication skills; career planning; applied technology; critical thinking and problem solving; personal health and financial literacy; citizenship, integrity, ethical leadership and effective management; work productively while integrating cultural and global competence; creativity and innovation; reliable research strategies, and environment, social and economic impacts of decisions.

## COURSE OUTLINE

### I. ORIENTATION

A. Introduce course and facilities
B. Discuss syllabus and major objectives
C. Explain attendance, grading, classroom procedures, code of conduct
D. Complete course safety requirements/test

### II. CAREERS IN UNMANNED DRONES

A. Explain the impact of pre-service activities on employability (e.g., financial irresponsibility, criminal record, improper social media behavior, etc.)
B. Describe the physical fitness requirements
C. Discuss environmentally-sound practices and sustainability within the industry sector.
D. List the eligibility requirements for information and communications industry positions.
E. Identify the steps in the hiring process from application to employment.

### III. PREPARING FOR COLLEGE AND CAREERS

A. Review and Discuss California CTE Model Curriculum Standards for Career Ready Practice
B. Create an Education Plan and a Career Plan aligned with personal goals
C. Create a Resumé
D. Create a Career Portfolio
E. Complete a handwritten/hand-printed Job Application neatly, legibly and with no corrections or mistakes
F. Practice a professional job interview
G. Evening of Excellence Essay

### IV. UAS PERSONNEL

A. Describe the human factors involved in UAS operations.
B. Identify the roles and responsibilities, personal characteristics, psychological qualities, training and certification requirements for:
    1. Processing information
    2. Human performance efficiencies
    3. Cognitive performance moderators and errors
    4. Humans and automation
    5. Human-computer interface design

### V. PROCESSING INFORMATION FOR UAS OPERATIONS

A. Demonstrate understanding about the human brain and how its information-processing system affects response to stimuli, mental development, and memory.
B. Describe human sensory reception (sight, hearing, smell, taste, and touch) and how humans sense and react to external and internal environments.
C. Discuss how a person's experiences, beliefs, and culture affect or shape their perception of the world around them.
D. Identify key processing points in working memory and long-term memory; identify and explain the biological processes related to how memory is stored.
E. Describe how the human mind changes to perform new tasks-the role of prior knowledge and the importance of a positive growth mindset.
F. Explain how task-switching and multitasking are executive functions that involve the ability to unconsciously and consciously shift attention between one task and another.
G. Discuss the role of the basal ganglia in habit formation and how new learned tasks emerge through associative learning to become habits.
H. Identify the cognitive, emotional, and relational characteristics that differentiate an expert or master compared to a novice or beginning learner.

### VI. POSITIVE AIRCRAFT PERFORMANCE

A. Demonstrate understanding about how developing coping skills improve mental and emotional well-being and are tools that help humans adjust to stressful, difficult, or traumatic situations.
B. Describe the benefits of experience and the role of human factors found in safe UAS operations.
C. Understand key concepts of situation assessment, planning, and management as it relates to risk

avoidance and safe UAS operations.

D. Today's pilots face many airspace challenges; explain the pilot's need for timely, specific and accurate information.
E. Compare and contrast how the internal environment (aircraft position, procedures, checklists, automation, aircraft attitude and performance) and the external environment (airspace, meteorological conditions, terrain, obstacles, and the operating culture) impact threat and error management.
F. Discuss the human factors such as failures of compliance, lack of effective communication, lack of procedures, or lack of proficiency or experience and how they contribute to risk, errors, and poor decision-making.

**VII. HUMANS AND AUTOMATION**

A. Demonstrate understanding how UAS operations is a system within a much larger system controlled by the Federal Aviation Administration responsible for national aviation safety and regulatory oversight.
B. Compare and contrast the advantages and disadvantages of operations performed by technology vs. humans.
C. Explain how the role of human work changes from production to overseeing performance in a highly automated work environment.
D. Describe the level of information the UAS operator requires to be successful.
E. Describe how unmanned aircraft systems are posed to revolutionize entire industries, if not society itself.
F. Discuss how the human operator skillset has shifted man-machine work environment to include judgement, adaptability and logic.
G. Describe models of intelligent behavior and what distinguishes hums from machines.

**VIII. PERSONNEL THAT SUPPORT THE UAS OPERATION**

A. Demonstrate understanding of how UAS personnel use crew resource management (CRM) to reduce errors that can have substantial negative impact or loss of property or life.
B. Identify how CRM training procedures and the effective use of available resources improves crew performance to be successful.
C. Explain how independent systems make up the larger UAS flight operation.
D. Identify UAS operations objectives and how the objectives are addressed and achieved.
E. Describe the use of CRM (foci on interpersonal communication, leadership, and decision making) and how it is used for improving air safety.
F. Describe how tactics, techniques and procedures (TTP) help achieve maximum efficiency of the UAS mission.
G. Understand situational awareness (SA) and specifically how to use the observe, orient, decide and act (OODA) loop.

**IX. HOW UAS PERSONNEL MAKE DECISIONS**

A. Demonstrate understanding about the important role of aeronautical decision-making (ADM) and that even 'small' decisions can have a large impact on flight safety.
B. Identify and discuss the steps in the Aeronautical Decision Making (ADM) systematic approach to aeronautical safety.
C. Describe antidotes to the six hazardous attitudes UAS pilots must confront to ensure flight safety.
D. Analyze and evaluate the three types of stress UAS pilots need to deal with; physical, physiological or psychological.
E. Explain the DECIDE decision making model.
F. Explore the preflight risk management process for focusing on hazards using the POSE checklist.
G. Describe the TEAM mnemonic used to produce a risk mitigation list.

**X. SAFETY MANAGEMENT**

A. Demonstrate understanding that safety and a safety mindset is required in every aspect of UAV light and from every member of the flight crew.
B. Identify strategies that help instill a safety mindset in the workplace.
C. Discuss the focus from the government and industry on the importance of aeronautical safety.
D. Explain the responsibilities of an FAA certificated Remote Pilot-including licensure
E. Discuss the safety assurance process for UAS operations.
F. Describe how to identify and resolve operational safety hazards.
G. Explain the process of a UAV accident investigation-who is involved, and how data is collected,

analyzed, and reported. Identify appropriate debriefing processes to prevent future occurrences.
H. Identify the types of risk management data, and how the data is collected and analyzed.

**XI. UAS KEY ISSUES**

A. Demonstrate understanding about key issues impacting current and future civil UAS operations.
B. Discuss lack of access to appropriate aeronautical radio frequency spectrum and infrastructure.
C. Explain inconsistent patchwork of FAA, state and local regulations.
D. Discuss UAS traffic management in the crowded future of aviation.
E. Discuss key issues impacting current and future civil UAS operations in the following areas:
   1. Lack of access to appropriate aeronautical radio frequency spectrum and infrastructure.
   2. Inconsistent patchwork of state and local regulations.
   3. Rogue operators.
   4. UAS traffic management.
   5. Lack of FAA resources and its inconsistent procedures.

**XII. INFORMATION AND COMMUNCIATION TECHNOLOGY**

A. Use technical reading, writing, and communication skills to work effectively with diverse groups of people, including users with less technical ability.
B. Recognize the scope of the duties ICT support staff have and tiered levels of support in UAS operations.
C. Describe and apply the principles of a customer oriented IT service approach for supporting end users.
D. Follow laws, regulatory guidelines, policies and procedures to ensure the security and integrity of information systems.
E. Take preventative measures to reduce security risks.
F. Use available resources to identify and resolve problems using knowledge bases, forums, and manuals.
G. Use a logical and structured approach to isolate and identify the source of problems and to resolve problems.
H. Use specific problem-solving strategies appropriate to troubleshooting, eliminating possibilities, or guess an check.

## ESSENTIAL STANDARDS AND KEY ASSIGNMENTS

**INDUSTRY SECTOR:** Information and Communication Technologies

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| **ESSENTIAL PATHWAY STANDARD – C2.0** |
| Define and analyze systems and software requirements |
| **KEY ASSIGNMENT** |
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| **ESSENTIAL PATHWAY STANDARD –** |
| |
| **KEY ASSIGNMENT** |
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| **ESSENTIAL PATHWAY STANDARD – C10.1** |
| Describe models fo intelligent behavior and what distinguishes human from machines. |
| **KEY ASSIGNMENT** |
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| CTE MODEL CURRICULUM STANDARDS FOR CAREER READY PRACTICE |
|---|
| 1. **Apply appropriate technical skills and academic knowledge.** Career-ready individuals readily access and use the knowledge and skills acquired through experience and education. They make connections between abstract concepts with real-world applications and recognize the value of academic preparation for solving problems, communicating with others, calculating measures, and performing other work-related practices. |
| 2. **Communicate clearly, effectively, and with reason.** Career-ready individuals communicate thoughts, ideas, and action plans with clarity, using written, verbal, electronic, and/or visual methods. They are skilled at interacting with others: they are active listeners who speak clearly and with purpose, and they are comfortable with terminology that is common to workplace environments. Career-ready individuals consider the audience for their communication and prepare accordingly to ensure the desired outcome. |
| 3. **Develop an education and career plan aligned with personal goals.** Career-ready individuals take personal ownership of their educational and career goals and manage their individual plan to attain these goals. They recognize the value of each step in the educational and experiential process, and they understand that nearly all career paths require ongoing education and experience to adapt to practices, procedures, and expectations of an ever-changing work environment. They seek counselors, mentors, and other experts to assist in the planning and execution of education and career plans. |
| 4. **Apply technology to enhance productivity.** Career-ready individuals find and maximize the productive value of existing and new technology to accomplish workplace tasks and solve workplace problems. They are flexible and adaptive in acquiring and using new technology. They understand the inherent risks—personal and organizational—of technology applications, and they take actions to prevent or mitigate these risks. |
| 5. **Utilize critical thinking to make sense of problems and persevere in solving them.** Career-ready individuals recognize problems in the workplace, understand the nature of the problems, and devise effective plans to solve the problems. They thoughtfully investigate the root cause of a problem prior to introducing solutions. They carefully consider options to solve a problem and, once agreed upon, follow through to ensure the problem is resolved. |
| 6. **Practice personal health and understand financial literacy.** Career-ready individuals understand the relationship between personal health and workplace performance. They contribute to their personal well-being through a healthy diet, regular exercise, and mental health activities. Career-ready individuals also understand that financial literacy leads to a secure future that enables career success. |
| 7. **Act as a responsible citizen in the workplace and the community**. Career-ready individuals understand the obligations and responsibilities of being a member of a community and demonstrate this understanding every day through their interactions with others. They are aware of the impacts of their decisions on others and the environment around them, and they think about the short-term and long-term consequences of their actions. They are reliable and consistent in going beyond minimum expectations and in participating in activities that serve the greater good. |
| 8. **Model integrity, ethical leadership, and effective management.** Career-ready individuals consistently act in ways that align with personal and community-held ideals and principles. They employ ethical behaviors and actions that positively influence others. They have a clear understanding of integrity and act on this understanding in every decision. They use a variety of means to positively impact the direction and actions of a team or organization, and they recognize the short-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture. |
| 9. **Work productively in teams while integrating cultural and global competence.** Career-ready individuals contribute positively to every team, as both team leaders and team members. To avoid barriers to productive and positive interaction, they apply an awareness of cultural differences. They interact effectively and sensitively with all members of the team and find ways to increase the engagement and contribution of other members. |
| 10. **Demonstrate creativity and innovation.** Career-ready individuals recommend ideas that solve problems in new and different ways and contribute to the improvement of the organization. They consider unconventional ideas and suggestions by others as solutions to issues, tasks, or problems. They discern which ideas and suggestions may have the greatest value. They seek new methods, practices, and ideas from a variety of sources and apply those ideas to their own workplace practices. |
| 11. **Employ valid and reliable research strategies.** Career-ready individuals employ research practices to plan and carry out investigations, create solutions, and keep abreast of the most current findings related to workplace environments and practices. They use a reliable research process to search for new information and confirm the validity of sources when considering the use and adoption of external information or practices. |
| 12. **Understand the environmental, social, and economic impacts of decisions.** Career-ready individuals understand the interrelated nature of their actions and regularly make decisions that positively impact other people, organizations, the workplace, and the environment. They are aware of and utilize new technologies, understandings, procedures, and materials and adhere to regulations affecting the nature of their work. They are cognizant of impacts on the social condition, environment, workplace, and profitability of the organization. |

**CTE ANCHOR STANDARDS**—Common Core English Language Arts Alignment

**1: Academics**
Analyze and apply appropriate academic standards required for successful industry sector pathway completion leading to postsecondary education and employment. Refer to the industry sector alignment matrix for identification of standards. Note: alignment listed within each sector Anchor Standard

**2: Communications Language Standard**
Acquire and accurately use general academic and domain-specific words and phrases sufficient for reading, writing, speaking, and listening at the (career and college) readiness level; demonstrate independence in gathering vocabulary knowledge when considering a word or phrase important to comprehension or expression. LS 9-10, 11-12.6 Anchor Standard

**3: Career Planning and Management Speaking and Listening Standard**
Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data. SLS 11-12.2 Anchor Standard

**4: Technology Writing Standard**
Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments and information. WS 11-12.6 Anchor Standard

**5: Problem Solving and Critical Thinking Writing Standard**
Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem, narrow or broaden the inquiry when appropriate, and synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. WS 11-12.7 Anchor Standard

**6: Health and Safety Reading Standards for Science and Technical Subjects**
Determine the meaning of symbols, key words, and other domain-specific words and phrases as they are used in a specific scientific or technical context. RSTS 9-10 11-12.4 Anchor Standard

**7: Responsibility and Flexibility Speaking and Listening Standard**
Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners, building on others' ideas and expressing their own clearly and persuasively. SLS 9-10 11-12.1 Anchor Standard

**8: Ethics and Legal Responsibilities Speaking and Listening Standard**
Respond thoughtfully to diverse perspectives; synthesize comments, claims, and evidence made on all sides of an issue; resolve contradictions when possible; and determine what additional information or research is required to deepen the investigation or complete the work. SLS 11-12.1d Anchor Standard

**9: Leadership and Teamwork Speaking and Listening Standard**
Work with peers to promote civil, democratic discussions and decision making; set clear goals and deadlines; and establish individual roles as needed. SLS 11-12.1b Anchor Standard

**10: Technical Knowledge and Skills Writing Standard**
Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information. WS 11-12.6 Anchor Standard

**11: Demonstration and Application**
Demonstrate and apply the knowledge and skills contained in the industry-sector anchor standards, pathway standards, and performance indicators in classroom, laboratory, and workplace settings, and the career technical student organization.