



Prepares Students for College and Careers

▲ Unmanned Aircraft Systems (UAS) I (g)

COURSE CODES:

▲ **ROP 67027** ▲ **WUHSD 8047** ▲ **ERUSD 0000** ▲ **STATE (CALPADS) 8131**

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

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

POST-SECONDARY EDUCATION	INDUSTRY CERTIFICATIONS	EMPLOYMENT
<p>Articulation with College: No Dual Enrollment with College: No UC Approved a-g elective credit: No</p> <p>COLLEGE MAJORS</p> <p>Aeronautical Science Unmanned Aircraft Systems Remote Sensing Geographic Information Systems</p>	<p>FAA Remote Pilot Certificate (107)</p> <p>NEXT STEPS</p> <p>Post-Secondary Education</p>	<p>Related Careers (O*NET)</p> <p>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</p>

Prerequisites:

Must have an overall minimum GPA of 2.5. Must be a sophomore, junior or senior to enroll.

Course Description:

This course is designed to provide a foundation into Unmanned Aircraft Systems introducing students to unmanned aircraft systems philosophy, history of civil aviation, functions of UAS services, laws and regulations affecting UAS operations, and the role of technology in the development of this industry. Students will experience hands-on activities including flight simulation, sUAS piloting, mission planning, and creating usable work product for photography/cinematography purposes. Students will learn to follow procedures established through the aviation standard operating procedures and best practices.

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 HISTORY

- A. Demonstrate understanding of the historical progression of flight and the aviation system that surrounds it today.
- B. Describe the history of UAS capability that stem from earlier research and development within the aeronautical industry.
- C. Understand how world events and earlier aeronautical discoveries impacted UAS research and development.
- D. Identify significant aircraft and iconic individuals in aviation such as Michelangelo, Wright Brothers, von Braun, and others.
- E. Describe how inter-governmental agency collaboration impacts UAS technology.

V. UAS OPERATION ISSUES

- A. Demonstrate understanding of current key concerns in UAS operations
- B. Describe the role of the Federal Aviation Agency (FAA) in UAS operations
- C. Discuss key issues impacting current and future civil UAS operations.
- D. Understand the reliability of UAS technology and discuss cybersecurity vulnerabilities inherent to unmanned versus manned flight operations and the challenge of securing UAV networks against attack.
- E. Explain the role of a ground visual operator (VLOS) in accordance with FAA regulations.
- F. Discuss how weather and wind can affect UAS flying capabilities.
- G. Explain how to manage wind forecasting using sites such as the Aviation Weather Channel, NOAA, UAV Forecast, NOTAM.
- H. Describe how UAS operating limitations relating to speed, weight, altitude, and maneuverability are set by manufactures of the UAS.
- I. Discuss how operational goals dictate the type of aircraft needed, and how variables such as weather conditions, day versus night flying, and other factors can affect overall cost and quality of the data recorded.
- J. Identify common organizational, technical and financial risks associated with the implementation and use of information and communication systems.

VI. UAS AS ROBOTIC AIRCRAFT

- A. Demonstrate knowledge of basic aviation principles and its relationship to UAS.
- B. Explain the robotic capabilities of a UAS.
- C. Identify major components of an aircraft, including UAS.
- D. Compare and contrast aircraft aerodynamics and performance, and identify the four forces (lift, thrust,

drag, weight) that act on an aircraft during flight.

- E. Describe advantages/disadvantages of several different UAS and describe the impact of weight and balance on its flight capabilities.
- F. Describe the basic concepts of Bernoulli's Principle and Newton's Laws.
- G. Compare manned and unmanned aircraft in maneuverability, cost, safety, risk, and endurance.

VII. DATALINKS CONNECTING PILOT TO UAS

- A. Demonstrate basic knowledge about Datalink systems (telemetry, image, video, etc.)
- B. Describe how UAS communication works and discuss key challenges in the current design of aeronautical communication systems.
- C. Explain four types of data link hardware configurations – system architecture, communication subsystem.
- D. Analyze the three types of datalinks – Line of Sight (LOS), Beyond Line of Sight (BLOS) and Tactical Data Communication.
- E. Correctly define RF communications and the use of carrier waves – Ku Bands, K band, S, L bands, C band, and X band.
- F. Explain datalink communication authorization methods and procedures, including datalink communication language, terms, and system information.
- G. Describe aeronautical datalink challenges – Long Distance, Frequency Spectrum, High Speed.
- H. Describe the importance of UAS and its ability to "sense and avoid".

VIII. CAREER OPPORTUNITIES WITH UAS

- A. Demonstrate knowledge about the impact UAVs have on the current global economy.
- B. Identify the roles and responsibilities, personal characteristics, psychological qualities, training and certification requirements for the following public service occupations: Law Enforcement UAS Pilot, Loss Prevention Specialist UAS Operator, Military Services – UAS team Member, Homeland Security UAS Operator.
- C. Discuss recent global developments and the important contribution UAVs provide to non-Public Safety UAV professional pilots.
- D. Compare and contrast roles and responsibilities for Public Safety and non-Public Safety UAV professional pilots
- E. Discuss the importance of maintaining professional conduct as a licensed UAV pilot.
- F. Explain the contributions made by UAS in commercial, industrial, and military applications.
- G. Describe the contribution of UAS and the role UAS play in academic or scientific applications.
- H. Explore the role of UAS in different industries i.e., film-making, real estate, agriculture/mining, mapping and industrial inspection business.

IX. STAGES OF A UAS OPERATION

- A. Demonstrate knowledge of the operational stages of an UAS operation.
- B. Discuss the steps required for preflight planning and briefing, including inspection of aircraft with preflight checklist, assessment of the operating location, briefing of crew members involved, weather check, and equipment checkouts.
- C. Explain UAS platforms, to include unmanned aerial vehicles, ground control stations, and ground support equipment.
- D. Describe flight procedures for Start, Take-off, In-Flight, Landing, and Shutdown.
- E. Identify post flight operations, including the post flight checklist, emergency procedures, Flight Area/Perimeter Management, and Accident/Incident Reporting.
- F. Use technical writing and communication skills to work effectively with diverse groups of people including those of varying technical abilities.

X. IMPACT OF ENVIRONMENTAL FACTORS ON UAS OPERATIONS

- A. Demonstrate understanding about the physical environment and its impact safe flight of UAVs.
- B. Explain the importance of situational awareness when flying BLOS in complex terrain (urban areas, mountains, canyons, etc.)
- C. Explain the role of UAS Traffic Management (UTM) in providing services such as airspace design, dynamic geo-fencing, severe weather and wind avoidance, congestion management, terrain avoidance, route planning, sequencing and spacing, and contingency management.
- D. Discuss ways in which UAVs are being used to help the environment such as aerial mapping and nature monitoring, renewable energy maintenance, disaster relief, wildlife protection, and agricultural sustainability solutions.

XI. SAFETY MANAGEMENT

- A. Demonstrate knowledge about the inherent risks and the importance of safety management systems for all UAS.

- B. Compare and contrast 'risk' and 'hazard' and discuss the analysis tools available to make informed decisions to balance risk exposure with mission benefits.
- C. Describe the factors of strategic risk management and explain what it means to 'assess at the 30,000 feet level.'
- D. Explain deliberate risk management, including the multi-step, analytical sequential process, and its linkage to strategic risk management.
- E. Explain how time-critical risk management is used to identify hazards, assess risks, and implement controls to reduce risk associated with UAS.
- F. Discuss the essential elements of a safety management system (SMS).
- G. Compare and contrast allowed risk and acceptable risk and the evaluation process to determine each.
- H. Explain emergency procedures for common UAS malfunctions: loss of power, changes in weather, loss of GPS signal, and airspace encroachment.

XII. INFORMATION AND COMMUNICATION TECHNOLOGY

- A. Create professional quality media, images and video clips using UAS technology.
- B. Follow laws, regulatory guidelines, policies and procedures to ensure the security and integrity of UAS information systems.
- C. Demonstrate how to communicate and interpret information clearly in UAS industry-standard visual and written formats.
- D. Analyze systems and software to best meet the needs of customers.
- E. Create effective interfaces between humans and technology.
- F. Install equipment, assemble hardware, and perform tests using appropriate tools & technology.
- G. Use a logical structured approach to isolate and identify the source of technical problems and propose solutions.
- H. Use specific problem-solving strategies appropriate to troubleshooting, eliminating possibilities, or guess and check when working with UAS technologies.

ESSENTIAL STANDARDS AND KEY ASSIGNMENTS
INDUSTRY SECTOR: Information and Communication Technologies

ESSENTIAL PATHWAY STANDARD – A1.0

Describe the role of information and communication technologies in organizations

KEY ASSIGNMENT

ESSENTIAL PATHWAY STANDARD – A2.0

Acquire, install, and implement software and systems.

KEY ASSIGNMENT

Design and submit a crew support plan as Pilot in Command including communication protocols, coordination of pilot meeting, staff scheduling, effective Crew Resource Management (CRM) role assignments/coverage, and associated timetables.

ESSENTIAL PATHWAY STANDARD – A3.0

Access and transmit information in a networked environment.

KEY ASSIGNMENT

Design and submit effective sUAS pre-mission, ground, flight, and post-mission operations equipment management plans, logistics, and logging requirements for a selected mission as Pilot in Command including key resource and logistical management plans.

ESSENTIAL PATHWAY STANDARD – A4.0

Administer and maintain software and systems.

KEY ASSIGNMENT

Match the type of industry application to appropriate payload (sensor) technology, data capture, data processing methodologies and work product output formats including relevant customer expectations.

ESSENTIAL PATHWAY STANDARDS – A5.0

Identify requirements for maintaining secure network systems.

KEY ASSIGNMENT

Demonstrate understanding of alternatives to propulsion systems with a focus on limitations to Lithium-ion polymer (LiPo) batteries including volatility, handling, safety equipment, storage, operational limitations, lifecycle, and responsible disposal. Articulate reasons why gasoline and solar powered sUAS technology is not feasible in the United States at this time.

ESSENTIAL PATHWAY STANDARDS – A6.0

Diagnose and solve software, hardware, networking, and security problems.

KEY ASSIGNMENT

Create a comprehensive special purpose aviation safety checklist according to FAA standards for 14 CFR part 107 legislation and following industry standards and aviation best practices such as IMSAFE, human factors in aviation, and checklist mentality parameters.

ESSENTIAL PATHWAY STANDARDS – A7.0

Support and train users on various software, hardware, and network systems.

KEY ASSIGNMENT

Demonstrate how to appropriately use an application to perform a successful airspace authorization request integrated with the Federal Aviation Administration (FAA) LAANC system. Demonstrate direct knowledge of the National Airspace System (NAS) used by aviation professionals (including sUAS pilots) in the United States. Understand airspace allocation restrictions including airspace classifications, NOTAMS, TFRs, special use areas and the UAS data exchange (LAANC.)

ESSENTIAL PATHWAY STANDARDS – A8.0

Manage and implement information, technology, and communication projects.

KEY ASSIGNMENT

Demonstrate how to appropriately use an application to perform a successful airspace authorization request integrated with the Federal Aviation Administration (FAA) LAANC system. Demonstrate direct knowledge of the National Airspace System (NAS) used by aviation professionals (including sUAS pilots) in the United States. Understand airspace allocation restrictions including airspace classifications, NOTAMS, TFRs, special use areas and the UAS data exchange (LAANC.)

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.

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.