

Advanced Flight- UAS

Level: 4

Career Cluster: Advanced Manufacturing

Program: Engineering

Pathway(s): Engineering Applications UAS

Course Catalog Description

A capstone aviation and UAS course focused on crewed and uncrewed flight operations, safety, navigation, and decision-making through simulation and applied mission planning. Students build skills in flight planning, weather, emergency procedures, drone regulations, and career readiness in aviation and unmanned aircraft systems.

Summary

UAS course that prepares students for postsecondary training and careers by developing advanced knowledge and applied skills in crewed and uncrewed flight operations, safety, and decision-making. Through simulation-based learning, students interpret regulations, airspace, weather, and flight data; analyze aerodynamics, aircraft and drone systems, and performance; create flight and mission plans; and apply abnormal and emergency procedures in realistic scenarios. The course emphasizes risk management, human factors, technical communication, and professional aviation and remote pilot practices while supporting readiness for FAA knowledge expectations related to both piloted aircraft and small UAS pathways.

Notes

This revised Advanced Flight course expands the previous version from a more general advanced drone and flight experience into a more clearly sequenced capstone course that emphasizes both crewed and uncrewed aviation knowledge, technical skill application, and career readiness. Compared to the old course, the updated document adds stronger alignment to FAA-informed content areas such as safety and risk management, navigation and airspace, meteorology, abnormal and emergency procedures, aeronautical decision-making, technical documentation, and simulation-based performance analysis, while also making expectations more explicit through objective statements and measurable student outcomes. New sections for final project assessment, leadership, and work-based learning strengthen the course's connection to authentic industry practice and reinforce employability, communication, and postsecondary planning. Overall, the revisions make the course more rigorous, more coherent across advanced aviation and UAS topics, and better aligned to current instructional, workforce, and pathway expectations.

Student Learning Outcomes

1. Career Exploration and Postsecondary Opportunities

Objective: *Students will analyze career pathways in engineering and drones by exploring industry roles, workplace expectations, required education, certifications, professional organizations, and postsecondary opportunities available in Colorado in order to make informed academic and career decisions.*

- 1) Identify employment opportunities in various fields with a focus in the area of engineering and drones
 - a. Recognize the work typically performed, tools and technology used, and nature of work environments
 - b. Identify potential certifications within the careers
 - c. Find membership organizations associated with the careers
 - d. Understand the necessary education associated within the careers
- 2) Define professionalism within the context of engineering and drones
 - a. Criticism and evaluation
 - b. Presentation
 - c. Assessment
- 3) Recognize laws, regulations, and ethics significant to the fields of engineering and drones
- 4) Identify postsecondary opportunities offered in the state of Colorado
 - a. Technical college, community college, 4-year institutions
 - b. Certificates, associates, bachelor, and advanced degree opportunities

2. Aviation Safety, Regulations, and Risk Management

Objective: *Students will demonstrate proficiency in aviation and UAS safety, regulations, and risk management by interpreting FAA guidance, applying safe operating procedures, and evaluating flight hazards in order to make sound, safety-driven decisions in normal, abnormal, and emergency conditions.*

- 5) Understand aviation and UAS safety requirements, regulations, registration expectations, and workplace health practices.
- 6) Interpret airspace classifications, airport layouts, UAS operating limitations, and safety symbols relevant to crewed and uncrewed flight operations.
- 7) Apply established safety procedures to normal, abnormal, and emergency flight scenarios.
- 8) Analyze potential flight hazards related to airspace, airport environments, and operational conditions.
- 9) Evaluate flight scenarios to determine appropriate safety responses and risk mitigation strategies.

3. Advanced Aerodynamics and Physics of Flight

Objective: *Students will apply advanced aerodynamics and physics of flight concepts to explain performance and stability, analyze nonstandard conditions, and support technical decisions in order to predict aircraft behavior and optimize safe flight operations.*

- 10) Explain advanced aerodynamic principles affecting aircraft and multirotor or fixed-wing UAS performance and stability.
- 11) Apply principles of lift, drag, thrust, and weight to flight scenarios.
- 12) Analyze how changes in aerodynamic forces influence aircraft performance under non-standard conditions.
- 13) Use physics concepts to support technical decision-making during advanced flight operations.

4. Aircraft Systems and Performance Analysis

Objective: *Students will analyze aircraft systems and performance by identifying system functions and interdependencies, interpreting performance data, and diagnosing anomalies in order to determine corrective actions that maintain safe, efficient operations.*

- 14) Identify major aircraft and UAS systems, including control, propulsion, power, communication, and navigation components, and explain their interdependencies.
- 15) Apply system knowledge to evaluate aircraft performance under varying conditions.
- 16) Analyze system malfunctions and performance anomalies to determine appropriate corrective actions.
- 17) Interpret aircraft performance data to support safe operational decisions.

5. Navigation, Airspace, and Flight Planning

Objective: *Students will develop navigation, airspace, and flight planning skills by using aeronautical charts and digital planning resources, analyzing airspace requirements for crewed and uncrewed operations, and evaluating route alternatives in order to create accurate, regulation-compliant flight and mission plans that prioritize safety and efficiency.*

- 18) Apply navigation principles to plan and simulate flight routes and drone mission paths.
- 19) Analyze airspace requirements, Remote ID expectations, and operational restrictions when developing crewed flight plans and UAS mission plans.
- 20) Evaluate alternative routing decisions based on safety, weather, and airspace constraints.
- 21) Demonstrate accurate flight planning using aviation charts and navigational resources.

6. Meteorology and Hazardous Weather Operations

Objective: *Students will evaluate meteorological conditions affecting crewed and uncrewed flight by interpreting weather data and forecasts, identifying hazardous weather patterns, and applying go/no-go decision strategies in order to plan and conduct operations that reduce weather-related risk.*

- 22) Explain meteorological concepts relevant to flight operations.
- 23) Analyze weather data to identify hazardous flight conditions.
- 24) Evaluate go/no-go decisions based on weather forecasts and in-flight observations.
- 25) Apply weather-related decision-making strategies to abnormal conditions.

7. Abnormal and Emergency Procedures

Objective: *Students will apply abnormal and emergency procedures by using standard operating checklists, troubleshooting aircraft and UAS malfunctions, and evaluating response effectiveness*

in order to execute safe, controlled actions that protect people, equipment, and the operating environment.

- 26) Apply standard operating procedures for abnormal and emergency crewed flight and UAS situations, including lost link, low battery, and system alerts.
- 27) Analyze aircraft malfunctions using troubleshooting and diagnostic techniques.
- 28) Evaluate response effectiveness and decision-making under simulated emergency conditions.
- 29) Demonstrate safe and controlled responses that maintain the safety of flight.

8. Aeronautical Decision-Making and Human Factors

Objective: *Students will strengthen aeronautical decision-making by analyzing human factors, evaluating choices under stress and time pressure, and practicing scenario-based problem solving in order to demonstrate sound judgment and risk-aware behaviors during advanced flight operations.*

- 30) Analyze human factors that influence pilot performance and flight safety.
- 31) Evaluate decision-making processes under stress, time pressure, and abnormal conditions.
- 32) Demonstrate judgment training through scenario-based problem solving.

9. Flight Data Interpretation and Simulation

Objective: *Students will interpret and apply flight data by analyzing performance trends, fuel usage, and system behavior in order to refine flight planning, improve operational decision-making, and justify actions taken across varied scenarios.*

- 33) Interpret flight and UAS mission data, telemetry, and performance outputs.
- 34) Analyze trends in performance, fuel usage, and system behavior across scenarios.
- 35) Use simulation results to refine decision-making and flight planning.

10. Technical Communication and Documentation

Objective: *Students will communicate technical aviation and UAS information by documenting flight plans, mission plans, safety analyses, and outcomes using appropriate terminology and professional formats in order to produce clear, accurate records and presentations aligned to industry expectations.*

- 36) Document flight plans, drone mission plans, safety analyses, and operational outcomes using aviation and UAS terminology.
- 37) Communicate technical information clearly through written and oral formats.
- 38) Create structured reports reflecting professional aviation standards.

11. Final Project Assessment

Objective: *Students will complete and present a capstone aviation or UAS project by applying technical knowledge, safety practices, planning, analysis, and professional communication in order to demonstrate career readiness and mastery of course competencies through an authentic final assessment.*

- 39) Design and complete a capstone aviation or UAS project that integrates technical skills, safety procedures, and course concepts.
- 40) Analyze project data, processes, and outcomes to evaluate effectiveness and identify improvements.
- 41) Present project findings, technical decisions, and reflections using professional aviation and UAS communication formats.

12. Leadership

Objective: *Students will demonstrate leadership in aviation and UAS settings by collaborating with others, managing responsibilities, communicating professionally, and contributing to team goals in order to build workplace readiness and effective professional habits.*

- 42) Demonstrate leadership behaviors such as initiative, accountability, adaptability, and ethical decision-making during individual and team tasks.
- 43) Collaborate effectively with peers by contributing ideas, resolving problems, and supporting shared aviation or UAS objectives.
- 44) Communicate leadership growth through reflection, feedback, and professional interactions connected to aviation and aerospace contexts.

13. Work-Based Learning

Objective: *Students will connect classroom learning to aviation and UAS careers by engaging in work-based learning experiences, career preparation activities, and professional documentation in order to strengthen employability skills and understand industry expectations.*

- 45) Participate in work-based learning experiences such as industry presentations, job shadows, mentorships, simulations, or internship-related activities connected to aviation and UAS.
- 46) Create and refine career documents such as resumes, cover letters, portfolios, or interview responses aligned to aviation and aerospace opportunities.
- 47) Evaluate workplace expectations, employability skills, and postsecondary pathways relevant to aviation and UAS careers.

14. Career and Technical Student Organizations

Objective: *Using the CTSO Resource Document, chapter activities will provide some of the best opportunities CTSO members will have to learn by doing. A successful program of work creates a positive learning atmosphere in the classroom. CTSO members learn how to accept responsibility, work as a team, manage a budget, and handle success and failure. Per the CTE Admin Handbook, CTSOs are embedded into curriculum.*

Professional Development

Prepare each member for entry into the workforce and provide a foundation for success in a career. Becoming a professional does not stop with acquiring a skill, but involves an increased awareness of the meaning of good citizenship and the importance of labor and management in the world of work.

Community Service

Promote and improve goodwill and understanding among all segments of the community through services donated by CTSO chapters, and to instill in its members a lifetime commitment to community service.

Business and Industry Connections

Increase awareness of quality job practices and attitudes, and increase the opportunities for employer engagement and eventual employment.

Financial Leadership

Plan and participate in activities to allow all members to carry out the chapter's projects. Educate members on their own personal finance for current and future success.

Public Relations

Make the general public aware of the good work that students in career and technical education are doing to better themselves and their community, state, nation, and world.

Social Activities

To increase cooperation in the school and community through activities that allow CTSO members to get to know each other in something other than a business or classroom setting.

Academic Standards Alignment

Colorado CTE courses are required to integrate academic and essential skills into course content. The following academic standards have been identified as aligned to this course and should be integrated throughout instruction.

[CO CTE Academic Standards Resources](#) (Rubrics, integration strategies, etc)
[CDE Colorado Academic Standards Online](#) (Online standards lookup tool)

Note: Mathematics and Science standards will be added in the future. Visit the [Colorado Academic Standards](#) page for the most current version.

Reading, Writing and Communicating Crosswalk

Course: Advanced Flight

Colorado Academic Standards – Reading, Writing, and Communicating

Standard	Prepared Graduate Competency	Description	Course Evidence / Alignment
Standard 1: Oral Expression and Listening	Prepared Graduate 1 – Collaboration	Collaborate effectively as group members or leaders who listen actively and respectfully; pose thoughtful questions, acknowledge the ideas of others; and contribute ideas to further the group's attainment of an objective.	Students communicate and make decisions collaboratively in flight scenarios; discuss procedures, risks, and responses with instructors and peers; and demonstrate shared responsibility for safety of flight.
Standard 1: Oral Expression and Listening	Prepared Graduate 2 – Oral Presentations	Deliver effective oral presentations for varied audiences and varied purposes.	Students verbally explain flight decisions and emergency responses; communicate procedures, diagnostics, and safety justifications; and respond orally to instructor prompts during scenario-based simulations.

Standard 2: Reading for All Purposes	Prepared Graduate 4 – Informational Texts	Read a wide range of informational texts to build knowledge and to better understand the human experience.	Students read and interpret FAA regulations and guidance; weather briefings and charts; technical flight documentation; safety procedures; and aircraft systems information.
Standard 2: Reading for All Purposes	Prepared Graduate 5 – Language in Context	Understand how language functions in different contexts, command a variety of word-learning strategies to assist comprehension, and make effective choices for meaning or style when writing and speaking.	Students use discipline-specific aviation terminology; practice precise communication suited to safety-critical environments; and apply context-dependent language during abnormal and emergency procedures.
Standard 3: Writing and Composition	Prepared Graduate 6 – Craft arguments	Craft arguments using techniques specific to the genre.	Students justify flight decisions and corrective actions; defend responses to abnormal and emergency conditions using evidence and reasoning; and explain why chosen actions best meet safety and regulatory constraints.
Standard 3: Writing and Composition	Prepared Graduate 7 – Informational Writing	Craft informational/explanatory texts using techniques specific to the genre.	Students write explanations of flight procedures; document problem-solving strategies and outcomes; and produce reports demonstrating

			technical understanding of aerodynamics and aircraft systems.
Standard 3: Writing and Composition	Prepared Graduate 9 – Writing Process	Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.	Students iteratively refine written plans and responses and produce clear, accurate, professional documentation that reflects aviation standards.
Standard 4: Research Inquiry and Design	Prepared Graduate 10 – Research and Ethics	Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.	Students analyze weather data, system diagnostics, and aeronautical information; evaluate multiple sources to make sound flight decisions; and apply researched information ethically to maintain safety of flight.

Free Resource Links

1. Career Exploration and Postsecondary Opportunities

- You Can Fly: High School Curriculum (career exploration / curriculum)
<https://youcanfly.aopa.org/high-school/high-school-curriculum>
- AOPA Air Safety Institute: Online Courses (professional learning / safety)
<https://www.aopa.org/training-and-safety/online-learning/online-courses>
- FAA Handbooks and Manuals Library (study resources / reference)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation

2. Aviation Safety, Regulations, and Risk Management

- FAA Risk Management Handbook (risk management)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/risk_management_handbook
- Pilot's Handbook of Aeronautical Knowledge (regulations / safety foundations)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak
- 14 CFR Part 107 – Small Unmanned Aircraft Systems (drone regulations / operating rules) <https://www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107>
- FAA Remote Identification of Drones (Remote ID / compliance)
https://www.faa.gov/uas/getting_started/remote_id

3. Advanced Aerodynamics and Physics of Flight

- NASA Beginner's Guide to Aeronautics (aerodynamics)
<https://www1.grc.nasa.gov/beginners-guide-to-aeronautics/>
- NASA K-12 Airplane Aerodynamics (aerodynamic principles / activities)
<https://www.grc.nasa.gov/WWW/k-12/airplane/>
- Pilot's Handbook of Aeronautical Knowledge (aerodynamics / performance)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak

4. Aircraft Systems and Performance Analysis

- Airplane Flying Handbook (aircraft operations / systems)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook
- Pilot's Handbook of Aeronautical Knowledge (aircraft systems / performance)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak
- FAA Handbooks and Manuals Library (reference / systems)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation

5. Navigation, Airspace, and Flight Planning

- Aeronautical Information Manual (airspace / procedures)
https://www.faa.gov/air_traffic/publications/media/AIM-Basic-w-Chg1-and-Chg2-dtd-3-21-24.pdf
- SkyVector Aeronautical Charts (navigation / flight planning) <https://skyvector.com/>
- FAA UAS Facility Maps (drone airspace / authorization planning)
https://www.faa.gov/uas/commercial_operators/uas_facility_maps

- FAA B4UFLY and LAANC Resources (airspace awareness / mission planning)
<https://www.faa.gov/uas>

6. Meteorology and Hazardous Weather Operations

- FAA Aviation Weather Handbook (weather / hazardous conditions)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/faq-h-8083-28b-aviation-weather-handbook
- Aviation Weather Center (METAR/TAF / forecasts)
<https://www.aviationweather.gov/>
- NWS JetStream Weather School (weather basics / instruction)
<https://www.weather.gov/jetstream/>
- FAA UAS Safety Resources (drone safety / weather and airspace awareness)
<https://www.faa.gov/uas>

7. Abnormal and Emergency Procedures

- Airplane Flying Handbook (abnormal and emergency procedures)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook
- FAA Risk Management Handbook (emergency decision-making / risk controls)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/risk_management_handbook
- AC 107-2A and FAA UAS Policy Library (UAS contingencies / guidance)
https://www.faa.gov/uas/resources/policy_library
- Become a Certificated Remote Pilot (remote pilot procedures / Part 107)
https://www.faa.gov/uas/commercial_operators/become_a_drone_pilot

8. Aeronautical Decision-Making and Human Factors

- Pilot's Handbook of Aeronautical Knowledge (ADM / human factors)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak
- FAA Risk Management Handbook (decision-making frameworks)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/risk_management_handbook
- FAA WINGS Pilot Proficiency Program (scenario training / safety)
https://www.faa.gov/WINGS/pub/learn_more.aspx

9. Flight Data Interpretation and Simulation

- NTSB Aviation Accident Database (data analysis / case studies)
<https://www.nts.gov/Pages/AviationQueryv2.aspx>
- Pilot's Handbook of Aeronautical Knowledge (performance data / interpretation)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak
- SkyVector Flight Planning Tools (route planning / chart data)
<https://skyvector.com/>

10. Technical Communication and Documentation

- Aeronautical Information Manual (aviation communication / procedures)
https://www.faa.gov/air_traffic/publications/media/AIM-Basic-w-Chg1-and-Chg2-dtd-3-21-24.pdf
- Pilot's Handbook of Aeronautical Knowledge (flight publications / documentation)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak
- FAA Handbooks and Manuals Library (reference / technical sources)
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation

11. Final Project Assessment

- Colorado Graduation Guidelines: Capstone (capstone criteria / portfolio assessment)
<https://ed.cde.state.co.us/postsecondary/grad-capstone>
- AOPA UAS Capstone Lesson Plan (capstone planning / project development)
https://download.aopa.org/HS/Curriculum/12UAS/12_UAS_6_A_1_LessonPlan.pdf
- UAS Capstone Project Rubric (project assessment / presentation rubric)
https://schools.utah.gov/cte/_cte/strands/UASCapstoneRubric.pdf
- NASA High School Engineering Challenge (design challenge / project rubric)
<https://www.nasa.gov/directorates/armd/2025-dwu-hs-design-challenge/>

12. Leadership

- FAA Safety Team (safety culture / leadership development)
<https://www.faa.gov/faasteam>
- FAASafety Mission and Resources (teamwork / positive safety culture)
<https://www.faasafety.gov/about/mission.aspx>
- AOPA High School Aviation STEM Curriculum (leadership / collaboration in aviation pathways) <https://youcanfly.aopa.org/high-school/high-school-curriculum>

13. Work-Based Learning

- FAA Students and Entry-Level Careers (career exploration / postsecondary pathways)
<https://www.faa.gov/jobs/students>
- FAA Internships (internships / workplace readiness)
<https://www.faa.gov/jobs/students/internships>
- FAA Gateways Program (federal internships / career pathways)
<https://www.faa.gov/jobs/students/gateways>
- Denver International Airport Getting Your Wings (career readiness / workshops)
<https://www.flydenver.com/business-and-community/ceea/career-pathways/getting-your-wings/>



Technology Student Association – National Competitive Events

Flight Endurance

Objective: *Students will design, build, test, document, and fly a rubber-band-powered model aircraft that meets TSA Flight Endurance requirements for construction, inspection, documentation, and flight performance.*

- Research model aircraft design, flight technology, aerodynamics, propulsion, stability, endurance, and trim factors.
- Design and construct a model aircraft that meets TSA requirements for wingspan, chord, fuselage length, propeller size, weight, wheels, landing gear, and rubber motor.
- Prepare a flight box that safely contains the model and meets TSA size requirements.
- Maintain a flight log documenting previous test flights, winds, time aloft, flight pattern, and trim adjustments.
- Prepare a documentation portfolio that includes technical attributes, part identification, modification analysis, assembly drawings, and scaled engineered drawings.
- Conduct test flights and make trim adjustments to improve endurance, stability, and landing performance.
- Participate in official flight trials, inspection, and scoring procedures using TSA competition criteria.

Resources

- Technology Student Association – Flight Endurance competition guidelines
<https://tsaweb.org/competitions-programs/tsa/themes-problems>
- NASA Glenn Research Center – Beginner’s Guide to Aeronautics
<https://www1.grc.nasa.gov/beginners-guide-to-aeronautics/>
- Academy of Model Aeronautics – Model aircraft and flight resources
<https://www.modelaircraft.org/>
- National Free Flight Society – Free-flight aircraft resources
<https://freeflight.org/>



Technology Student Association – National Competitive Events

Geospatial Technology

Objective: Students will collect, analyze, map, synthesize, and defend geospatial data in response to the annual TSA Geospatial Technology challenge.

- Research the annual TSA Geospatial Technology challenge and identify the geographic issue or prediction being investigated.
- Collect geospatial data such as imagery, boundaries, transportation data, earth observations, historical maps, or basemaps.
- Use an online mapping platform to represent and analyze geospatial data.
- Prepare a digital documentation portfolio explaining the challenge, collected data, analysis maps, prediction, resources, and work log.
- Create a visual infographic map that communicates the predicted outcome and clearly supports it with data.
- Present and defend the team's prediction during the semifinal presentation/interview.
- Evaluate the final entry using TSA criteria for data use, prediction quality, visual communication, analysis, creativity, and presentation.

Resources

- Technology Student Association – Geospatial Technology competition guidelines
<https://tsaweb.org/competitions-programs/tsa/themes-problems>
- ArcGIS Online – Mapping and geospatial analysis tools
<https://www.arcgis.com/>
- FAA – Aeronautical Charts and Chart Users' Guide
<https://www.faa.gov/airtraffic/flightinfo/aeronav/digitalproducts/aeroguide/>
- NASA Earthdata – Earth observation and geospatial data
<https://www.earthdata.nasa.gov/>



Technology Student Association – National Competitive Events

Extemporaneous Speech

Objective: *Students will prepare and deliver a timed speech on a selected TSA topic using effective organization, technical understanding, and professional communication skills.*

- Review TSA Extemporaneous Speech procedures, expectations, time limits, and evaluation criteria.
- Prepare to speak on a range of STEM, technology, engineering, leadership, or current-issue topics.
- Select or receive a topic and organize a clear speech within the allotted preparation time.
- Develop a focused introduction, logical supporting points, and a concise conclusion.
- Deliver a three-to-five-minute speech using professional voice, pacing, body language, and audience awareness.
- Address the selected topic with relevant content, reasoning, examples, and technical vocabulary.
- Evaluate the speech using TSA criteria for delivery, content, organization, time adherence, and overall communication effectiveness.

Resources

- Technology Student Association – Extemporaneous Speech competition guidelines
<https://tsaweb.org/competitions-programs/tsa/themes-problems>
- National Speech & Debate Association – Public speaking resources
<https://www.speechanddebate.org/>
- Federal Aviation Administration – Pilot’s Handbook of Aeronautical Knowledge
<https://www.faa.gov/regulationspolicies/handbooksmanuals/aviation/phak>
- Federal Aviation Administration – Airplane Flying Handbook
<https://www.faa.gov/regulationspolicies/handbooksmanuals/aviation>