Introduction to Aviation and Aerospace - UAS

Level: 1
Career Cluster: Advanced Manufacturing
Program: Engineering
Pathway: Aerospace Engineering Technician, Engineering Applications - UAS

Course Catalog Description

Introduces students to aviation, aerospace, and drone (UAS) career pathways, systems, and the role of flight in society. Students explore aerodynamics, aircraft and drone systems, weather, navigation, safety, regulations, and space exploration.

Summary

This course introduces students to the aviation, aerospace, and drone industry through the study of career pathways, foundational systems, and the role of flight in modern society. Students examine the history of aviation, drones, and space exploration while building an understanding of aerodynamics, aircraft and UAS structures, propulsion systems, control systems, and the engineering concepts that make flight possible. The course also explores the flight environment, including atmosphere, weather, hazards, airports, airspace, navigation, and flight planning, with an emphasis on how these factors affect safety and operations for both crewed and uncrewed aircraft. Students analyze human factors, risk management, FAA regulations, Remote ID, and the ethical, legal, and professional responsibilities connected to aviation, aerospace, and drone careers. In addition, students investigate postsecondary opportunities in Colorado and evaluate how aviation, aerospace, and drone technologies influence transportation, infrastructure, mapping, media, agriculture, emergency response, and global connectivity. Through introductory design, analysis, and communication activities, students apply what they learn to aviation, aerospace, and drone-related problems and begin developing technical and career-ready skills.

Notes

This revised course by adding a stronger and more intentional emphasis on aviation, aerospace, and uncrewed aircraft systems (UAS). In addition to broad aviation concepts, the new version includes drone operations, regulations, Remote ID, LAANC, navigation, mission planning, and current industry applications. The course is also more clearly organized into sequenced topical sections and places greater emphasis on career exploration, professionalism, leadership, work-based learning, and Colorado postsecondary opportunities. It also strengthens connections between technical content, safety, engineering design, and career readiness so students can better understand both foundational concepts and real-world applications. The revised structure gives instructors a more coherent progression of content and better supports classroom implementation through clearly defined outcomes and modernized course language. Overall, the revisions modernize the course, improve clarity for instruction, and better align the content to current aviation and drone industry expectations.

Student Learning Outcomes

1. Career Exploration and Postsecondary Opportunities

***Objective**: Students will explore and analyze career pathways related to engineering and drones by examining professional roles, tools, work environments, ethical and legal responsibilities, certifications, professional organizations, and Colorado postsecondary education options 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. Foundations of Aviation, Aerospace, and Drone Systems

***Objective:** Students will understand and analyze the aviation, aerospace, and drone industry and evaluate the role of crewed and uncrewed flight systems in society.*

5) Define aviation, aeronautics, and astronautics.
6) Describe major sectors of the aviation, aerospace, and drone industry.
7) Explain how aviation and drone systems influence transportation, data collection, infrastructure, and global connectivity.
8) Analyze the impact of aerospace and drone technologies on society and the economy.
9) Evaluate how aviation, drone, and space systems support modern infrastructure and operations.

2. History of Aviation and Space Exploration

***Objective:** Students will analyze historical developments and evaluate their impact on modern aviation, drone, and aerospace systems.*

10) Identify key events in the history of flight and uncrewed aircraft.
11) Describe milestones in aviation, drone development, and space exploration.
12) Analyze how technological advancements influenced crewed and uncrewed flight.
13) Compare early flight systems to modern aircraft, drones, and spacecraft.
14) Evaluate the significance of major aviation, drone, and aerospace innovations.

3. Principles of Flight and Aerodynamics

Objective: *Students will apply and analyze aerodynamic principles to explain how aircraft and drones achieve and maintain flight.*

15) Define lift, drag, thrust, and weight.
16) Explain how aerodynamic forces interact during crewed and uncrewed flight.
17) Describe how airfoils and rotor systems generate lift.
18) Analyze factors affecting flight performance for aircraft and drones.
19) Apply aerodynamic principles to predict aircraft and drone flight behavior.

4. Aircraft, Drone, and Flight System Design

Objective: *Students will examine and evaluate aircraft and drone components, control systems, and design considerations.*

20) Identify major aircraft and drone components and structures.
21) Describe the function of wings, fuselage, frames, propellers, and control surfaces.
22) Analyze how design influences performance, stability, and safety.
23) Compare different aircraft and drone configurations.
24) Evaluate the relationship between structure, payload, and function.

5. Propulsion, Power, and Energy Systems

Objective: *Students will analyze and compare propulsion and power systems used in aviation, drones, and aerospace.*

25) Describe how aircraft engines and drone motors produce thrust.
26) Differentiate between propeller, jet, rocket, and electric propulsion systems.
27) Explain the relationship between fuel, battery power, airflow, and propulsion.
28) Analyze performance and efficiency factors in propulsion and power systems.
29) Evaluate propulsion systems for different aviation, drone, and aerospace applications.

6. Flight Environment and Atmosphere

Objective: *Students will analyze atmospheric conditions and evaluate their effects on flight operations.*

30) Describe layers of the atmosphere and their characteristics.
31) Explain how air pressure and temperature affect aircraft and drone flight.
32) Analyze the relationship between altitude and flight performance.
33) Evaluate environmental factors that influence crewed and uncrewed flight conditions.
34) Predict how atmospheric changes impact aircraft and drone operations.

7. Aviation Weather and Hazards

Objective: *Students will interpret weather information and evaluate its impact on aviation and drone safety.*

35) Identify common weather patterns affecting aviation and drone operations.
36) Explain the formation of clouds, storms, and wind systems.

37) Interpret basic weather charts, forecasts, and flight weather resources.
38) Analyze weather hazards such as turbulence, icing, storms, and wind shear for safe flight planning.
39) Evaluate how weather conditions affect aircraft and drone flight decisions.

8. Airports, Airspace, Regulations, and Flight Operations

Objective: *Students will analyze airport systems, airspace, and UAS regulations and evaluate how they support safe flight operations.*

40) Describe the layout and function of airports and common UAS operating environments.
41) Identify different types of airspace and summarize key regulations for crewed and uncrewed aircraft.
42) Explain the role of air traffic control systems, LAANC, and authorization procedures.
43) Analyze how airport and drone operations ensure safety and efficiency.
44) Evaluate procedures related to registration, Remote ID, and compliant flight operations.

9. Navigation and Flight Planning

Objective: *Students will apply navigation principles and evaluate flight planning strategies for aircraft and drones.*

45) Identify basic navigation tools and methods used in aviation and drone operations.
46) Explain concepts such as heading, altitude, distance, waypoints, and geofencing.
47) Apply navigation techniques to plan routes and simple drone missions.
48) Analyze the role of GPS and technology in modern navigation systems.
49) Evaluate factors influencing flight planning and preflight decisions.

10. Human Factors and Safety in Aviation

Objective: *Students will analyze human performance factors and evaluate their role in aviation and drone safety.*

50) Describe how human factors affect flight operations and remote pilot performance.
51) Explain the impact of fatigue, stress, and environment on performance.
52) Analyze safety procedures, checklists, and risk management strategies.
53) Evaluate accident and incident case studies to determine causes.
54) Recommend strategies to improve aviation and drone safety.

11. Space Flight and Aerospace Exploration

Objective: *Students will understand and analyze principles of space flight and evaluate space exploration technologies.*

55) Describe the basics of manned and unmanned space flight.
56) Explain how rockets operate using propulsion principles.
57) Analyze challenges associated with space travel.
58) Evaluate the impact of space exploration on technology and society.
59) Compare aviation and space systems.

12. Aviation Engineering Applications and Project

Objective: Students will apply engineering concepts to design, test, and communicate aviation, aerospace, or drone solutions.

60) Apply engineering design processes to solve aviation- or drone-related problems.
61) Design a model or concept for an aircraft, drone, or aerospace system.
62) Construct or simulate a prototype or design solution.
63) Evaluate design performance using testing or analysis.
64) Present and defend engineering solutions using technical communication.
65) Reflect on design decisions, engineering processes, and operational constraints.

13. Leadership

Objective: *Students will demonstrate leadership skills, ethical decision-making, and professional responsibility in aviation, aerospace, and drone-related learning experiences.*

66) Demonstrate leadership skills through participation in individual and collaborative aviation, aerospace, and drone-related activities.
67) Apply effective communication, teamwork, and problem-solving strategies in technical and classroom settings.
68) Exhibit professionalism, accountability, and ethical behavior aligned to industry expectations.
69) Evaluate how leadership contributes to safety, productivity, and positive team outcomes in aviation and drone operations.
70) Reflect on personal strengths, growth areas, and leadership development goals.

14. Work-Based Learning

Objective: *Students will connect classroom learning to aviation, aerospace, and drone careers through career awareness, industry engagement, and work-based learning experiences.*

71) Identify the purpose and value of work-based learning experiences in aviation, aerospace, and drone-related fields.
72) Explore industry roles and expectations through guest speakers, site visits, job shadows, mentorship, and workplace experiences.
73) Demonstrate appropriate workplace behaviors, communication skills, and safety practices during career-connected learning activities.
74) Analyze how classroom knowledge and technical skills apply to real-world aviation, aerospace, and drone occupations.
75) Reflect on work-based learning experiences to inform future education, training, and career goals.

15. 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: Introduction to Aviation, Aerospace, and Drone Systems
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.	Students participate in collaborative class discussions about aviation, aerospace, and drone systems and careers, work together on exploratory activities and introductory investigations, and listen actively while contributing ideas during foundational flight and UAS learning.
Standard 1: Oral Expression and Listening	Prepared Graduate 2 – Oral Presentations	Deliver effective oral presentations for varied audiences and varied purposes.	Students orally explain basic aviation, aerospace, and drone concepts, present findings from introductory research on flight-related careers, and share summaries of learned content with

			peers and instructors.
Standard 2: Reading for All Purposes	Prepared Graduate 4 – Informational Texts	Read a wide range of informational texts to build knowledge.	Students read and interpret informational texts related to aviation history, drone development, and aerospace systems, technical explanations of aircraft, UAS operations, and navigation, and career-focused materials outlining roles, training, and pathways.
Standard 2: Reading for All Purposes	Prepared Graduate 5 – Language in Context	Understand how language functions in different contexts.	The course introduces foundational aviation, aerospace, and drone vocabulary, discipline-specific terminology used across technical, historical, regulatory, and career contexts, and strategies for understanding unfamiliar technical terms.
Standard 3: Writing and Composition	Prepared Graduate 7 – Informational Writing	Craft informational/explanatory texts using techniques specific to the genre.	Students write brief explanatory summaries of aviation and drone concepts, produce informational writing related to flight systems, regulations, and careers, and organize information clearly

			to demonstrate understanding of introductory content.
Standard 3: Writing and Composition	Prepared Graduate 9 – Writing Process	Demonstrate mastery of their own writing process.	At an introductory level, students plan, draft, and revise short written explanations and reflections, focus on clarity and appropriate technical vocabulary, and produce polished written products aligned to course expectations.
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.	Students research aviation, aerospace, and drone career options, gather information about training, certification, and industry expectations, and use sources ethically to report findings and compare career pathways.

Free Resource Links

1. Career Exploration and Postsecondary Opportunities

- CareerOneStop (career exploration certifications salary education pathways) www.careeronestop.org
- O*NET Online (career profiles tools workplace skills job expectations) www.onetonline.org
- Bureau of Labor Statistics Occupational Outlook Handbook (job outlook education pathways salary data) www.bls.gov/ooh
- Colorado Community College System (Colorado programs degrees certificates pathways) www.cccs.edu

2. Foundations of Aviation, Aerospace, and Drone Systems

- NASA STEM (aerospace systems engineering applications innovation) www.nasa.gov/stem
- FAA UAS (drone basics safety rules registration educational resources) www.faa.gov/uas
- FAA Educational Users (school drone use educational operations FRIA guidance) www.faa.gov/uas/educational_users
- FAA Aviation Education (aviation fundamentals systems safety operations) www.faa.gov/education

3. History of Aviation and Space Exploration

- Smithsonian Air and Space Museum (history of flight aerospace milestones) airandspace.si.edu
- NASA History Office (space missions aviation milestones exploration timeline) history.nasa.gov
- FAA History (aviation development innovation milestones) www.faa.gov/about/history
- National Geographic Space (aerospace exploration history technology impacts) www.nationalgeographic.com/space

4. Principles of Flight and Aerodynamics

- NASA Aeronautics (lift drag thrust weight flight principles) www.nasa.gov/aeronautics
- FAA UAS (drone flight basics rotor systems safety guidance) www.faa.gov/uas
- PhET Simulations (forces motion aerodynamics interactive models) phet.colorado.edu
- CK 12 Physics Concepts (forces motion energy flight principles) www.ck12.org

5. Aircraft Structures and Design

- Smithsonian Aircraft Collection (aircraft parts structure design) airandspace.si.edu/collections
- FAA UAS (drone design categories components safety requirements) www.faa.gov/uas
- NASA Aircraft Design (aircraft engineering structural design concepts) www.nasa.gov/aeronautics/research/aircraft-design
- Aerospace Engineering Guide (aircraft structures design materials systems) fiveable.me/introduction-aerospace-engineering

6. Aircraft Propulsion and Engines

- NASA Propulsion (jet engines rockets thrust generation systems) www.grc.nasa.gov/www/k-12/airplane/propulsion.html
- FAA UAS (drone motors batteries power systems operational basics) www.faa.gov/uas
- MIT Aerospace Programs (propulsion systems energy efficiency design) micromasters.mit.edu/pom
- All About Circuits (energy systems electronics propulsion basics) www.allaboutcircuits.com

7. Flight Environment and Atmosphere

- NOAA Education (atmosphere weather climate aviation impacts) www.noaa.gov/education
- NASA Climate (atmosphere layers pressure temperature systems) climate.nasa.gov
- National Weather Service (atmospheric systems aviation weather understanding) www.weather.gov
- CK 12 Earth Science (atmospheric science environmental systems) www.ck12.org

8. Aviation Weather and Hazards

- Aviation Weather Center (weather charts hazards aviation safety) aviationweather.gov
- FAA UAS (weather safety drone operations airspace planning) www.faa.gov/uas
- FAA Weather Safety (weather impacts flight operations risk awareness) www.faa.gov/pilots/safety
- NOAA Weather Resources (storms wind hazards atmospheric systems) www.noaa.gov/weather

9. Airports, Airspace, Regulations, and Flight Operations

- FAA Airspace Resources (airspace classifications airport operations regulations) www.faa.gov/air_traffic/publications
- FAA UAS (Part 107 Remote ID registration LAANC airspace safety) www.faa.gov/uas

- Air Traffic Control Overview (ATC systems communication safety operations)
  www.faa.gov/air_traffic
- National Airspace System Overview (flight operations systems structure safety)
  www.faa.gov/about/office_org/headquarters_offices/ato/service_units/systemops/nas

10. Navigation and Flight Planning

- FAA Aeronautical Navigation (flight planning charts navigation systems)
  www.faa.gov/air_traffic/flight_info/aeronav
- FAA UAS (mission planning preflight LAANC Remote ID operational rules)
  www.faa.gov/uas
- SkyVector Charts (flight planning mapping route design tools)
  skyvector.com
- NASA Navigation Systems (satellite navigation positioning flight guidance)
  www.nasa.gov

11. Human Factors and Safety in Aviation

- FAA Human Factors (pilot performance fatigue safety management)
  www.faa.gov/pilots/safety
- FAA Part 107 Preflight Familiarization (weather airspace hazards crew briefing)
  www.ecfr.gov/current/title-14/chapter-I/subchapter-F/part-107/subpart-B/section-107.49
- NASA Human Integration (human performance aerospace systems)
  www.nasa.gov/hrp
- Flight Safety Foundation (aviation safety research risk analysis)
  flightsafety.org

12. Aviation Engineering Applications and Project

- NASA Aeronautics STEM (engineering design aircraft systems innovation student challenges)
  www.nasa.gov/aeronautics/aeronautics-stem
- NASA Sustainable Aviation STEM Toolkit (design challenges propulsion aircraft models engineering applications)
  www.nasa.gov/sustainable-aviation-stem-toolkit
- NASA Aerospace Resources (aerodynamics propulsion wind tunnels simulations student projects)
  www.grc.nasa.gov/WWW/k-12/aerores.htm
- FAA STEM Activities for Teachers and Students (aviation engineering design challenge drones airports projects)
  www.faa.gov/education/adopt-a-school/virtual-resources

13. Leadership

- FAA Safety Team (safety culture / leadership development)
  https://www.faa.gov/faasteam
- FAASTeam 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
- FAA Aviation and Space Education (aviation careers leadership pathways student opportunities)
  www.faa.gov/education

14. Work-Based Learning

- CareerOneStop GetMyFuture (career planning job exploration work experience students)
  www.careeronestop.org/GetMyFuture
- CareerOneStop Explore Careers (career profiles training pathways workplace expectations)
  www.careeronestop.org/ExploreCareers
- FAA Aviation Workforce and Education Programs (career pathways immersive experiences aviation workforce readiness)
  www.faa.gov/education/programs
- FAA Careers in Aviation and Space (career pathways drones aerospace industry roles)
  www.faa.gov/education/about/careers-aviation-and-space

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, and stability principles.
- Design and construct a model aircraft that meets TSA requirements for wingspan, chord, fuselage length, propeller size, weight, wheels, landing gear, and rubber motor.
- Create a flight box that safely contains the model and meets TSA size requirements.
- Prepare a documentation portfolio that includes flight logs, trim adjustments, modifications, assembly drawings, and scaled engineered drawings of structural parts.
- Conduct test flights and make trim adjustments to improve flight endurance and landing performance.
- Participate in official flight trials, inspection, and flight-time scoring procedures.
- Evaluate the final aircraft using TSA criteria for flight time, landing bonus, model inspection, flight box, documentation, and technical quality.

Resources

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

Technology Student Association – National Competitive Events

Drone Challenge (UAV)

Objective: *Students will design, build, document, program, test, and present an open-source UAV drone that meets TSA Drone Challenge requirements for safety, flight performance, documentation, and mission completion.*

- Research the annual TSA Drone Challenge specifications, mission requirements, drone safety expectations, and relevant aviation regulations.
- Design or modify an open-source UAV drone that meets TSA requirements for size, motors, propellers, guards, payload, camera, and mission function.
- Assemble and wire drone components, including motors, flight controller, electronic speed controllers, camera, antenna, and related systems.
- Document the UAV through a portfolio that includes photo logs, wiring schematics, programming explanation, engineered drawings, bill of materials, and work log.
- Program and configure the drone for controlled flight, stabilization, and mission-specific operation.
- Complete safety inspection, testing, flight practice, and mission-performance procedures.
- Participate in an interview explaining the drone design, programming, components, aviation safety decisions, and mission performance.

Resources

- Technology Student Association – Drone Challenge (UAV) competition guidelines https://tsaweb.org/competitions-programs/tsa/themes-problems
- Federal Aviation Administration – Drone safety and regulations https://www.faa.gov/uas
- ArduPilot Documentation – Open-source autopilot software https://ardupilot.org/
- PX4 Autopilot User Guide https://docs.px4.io/

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, demographics, 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/
- National Geospatial-Intelligence Agency – Geospatial resources https://www.nga.mil/
- NASA Earthdata – Earth observation and geospatial data https://www.earthdata.nasa.gov/