

Colorado CTE Course – Scope and Sequence

Course Name	Air Control Systems		Course Details	Credit = 1.0	
			Course = 0.50 Carnegie Unit Credit		
Course Description	This course introduces students to the history of the FAA from its founding to the present day operation of the vast National Airspace System (NAS). Topics studied include the structure and classes of airspace, fundamentals of radar, the basic concepts and rules of separation of aircraft, the facilities which control air traffic and the duties of the positions within those facilities. Students will also learn about the FAA Orders and Directives which dictate procedures for control of air traffic as well as flight operations. (This course covers all competencies of AVT 116 and AVT 117.)				
Note:	This is a suggested scope and sequence for the course content. The content will work with any textbook or instructional resource. If locally adapted, make sure all essential knowledge and skills are covered.				
SCED Identification #	20053	Schedule calculation based on 60 calendar days of a 90-day semester. Scope and sequence allows for additional time for guest speakers, student presentations, field trips, remediation, or other content topics.			
All courses taught in an approved CTE program must include Essential Skills embedded into the course content. The Essential Skills Framework for this course can be found at https://www.cde.state.co.us/standardsandinstruction/essentialskills					
Instructional Unit Topic	Suggested Length of Instruction	CTE or Academic Standard Alignment	Competency / Performance Indicator	Outcome / Measurement	CTSO Integration
Overview of Air Traffic Control		Identify the skills, techniques and procedures for managing air traffic related to airports, airlines, government, nongovernmental and general aviation organizations. Understand the national and international	Student is expected to: A) Describe the role and responsibilities of an air traffic controller. B) Identify key milestones in general air traffic control historical development; C) Describe major legislation and changes in technology affecting the growth and development of commercial air service in the US including the relevance of current federal regulations and other guidance relating to airline operations and air traffic control;		

		aviation environment. Demonstrate knowledge of the Federal Aviation Regulations (FAR's), Transportation Security Regulations (TSAR's), and airport system planning, as they relate to air traffic control. Explore general air control historical development.	D) Identify issues relating to aviation safety as mandated by the Federal Aviation Administration (FAA), Environmental Protection Agency (EPA), and the Occupational Safety and Health Administration (OSHA); E) Describe how safety management systems (SMS) work to decrease airport and aircraft accidents; F) Discuss system structure, basic procedures, and operational rules for air traffic control; G) Identify the functions of air traffic control; and H) Identify components of the air transportation infrastructure.		
Terminology A. Air Traffic Controller Phraseology 1. What it is 2. Why it is Important 3. Examples of Correct Phraseology 4. Examples of Incorrect Phraseology B. Acronyms and Abbreviations 1. Definitions 2. Examples C. Correct Phraseology Usage		Understand and apply appropriate terms, phrases, acronyms, and symbols for air traffic control.	Understand and apply appropriate terms, phrases, acronyms, and symbols for air traffic control. Student is expected to: A) Demonstrate an understanding of the importance of proper Air Traffic Phraseology; B) Utilize the proper use of acronyms and abbreviations; C) Demonstrate the proper usage of phraseology in various situations; D) Apply the proper communications methods in uncontrolled airspace transmissions;		

1. Heading and Altitude Change 2. Weather Deviation 3. Departure/Approach Clearance 4. Vector Clearance 5. Traffic Advisories 6. Amended Clearance D. Readbacks 1. Definition 2. Examples of Clearances and Readbacks E. Communications in Uncontrolled Airspace 1. Blind Transmissions 2. CTAF 3. Unicom 4. Position Reporting 5. Part-Time Towers F. Effective vs. Ineffective Communication 1. Effective Two-Way Communication 2. Accident Report Study 1: Accident Related to Consequences of Ineffective Communication G. ATC Phraseology Application 1. Role-Playing Scenario 1: Ineffective Communication H. Did You Say What You Meant to Say?			E) Demonstrate effective communications in the air traffic environment; F) Exercise air traffic control phraseology in scenario base environment; G) Ensure proper, thorough communication; H) Apply proper air traffic control methods in a scenario based environment; I) Examine the repercussions of improper phraseology utilization; J) Investigate accident and incident data relating to communication misunderstandings; K) Utilize role play scenarios in communication misunderstandings; L) Accomplish proper radio communication in scenario based activities; M) Demonstrate transfer of radar identification in scenario based activities; N) Examine proper usage of air traffic control phraseology and control symbology; and O) Exhibit knowledge of proper air traffic control communication priorities and formats for interphone communication.		
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1. Listening to Yourself 2. Accident Report Study 2: Accident Related to Failure to Say What was Meant to be Said I. ATC Phraseology Application 1. Role-Playing Scenario 2: Failure to Say What was Meant to be Said J. Consequences of Incorrect Phraseology 1. What Constitutes Incorrect Phraseology 2. Accident Report Study 3: Accident Related to Consequences of Incorrect Phraseology K. ATC Phraseology Application 1. Role-Playing Scenario 3: Incorrect Phraseology L. Communications Misunderstandings 1. How Communications Misunderstandings Occur 2. Accident Report 4: Accident Related to Communication Misunderstandings M. ATC Phraseology Application					
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1. Role-Playing Scenario 4: Communications Misunderstandings					
General ATC manual information A. Introduction to FAA orders and manuals B. Letters of agreement (LOA's) C. Standard operating procedures (SOP's)		Research FAA order and manual content. Demonstrate knowledge of Federal Aviation Regulations (FAR) and the U.S. air traffic control system interactions, including FAA publications.	Use and apply general air traffic controller manual information. Student is expected to: A) Understand how to apply FAA orders and find manual content; B) Define Letters of Agreement; and C) Understand how to interpret standard operating procedures for air craft control.		
General Control A. Route and Navaid description B. Basic navigation C. Satellite navigation		Knowledge of airports, airspace, and air traffic control.	Explain the integration of airports, airspace, and air traffic control in managing the National Airspace System. Student is expected to: A) Understand the ATM System Current Functional Structure; B) Identify US Air Traffic Control Center Airspace; C) Define high and low center sectors and TRACONS; D) Define Terminal Area Control Points and Fixes; E) Define ATC Control Loo Radar Surveillance Limits; and F) Identify the information on a Radar Display		

Airport traffic control terminal A. General B. Airport conditions C. Runway in use selection		Understand and apply knowledge of general air traffic flow requirements and constraints on airports.	Review terminal airport traffic control environment and constraints. Student is expected to: A) Identify general airport operations; B) Understand blocking and Airport Acceptance Rate (AAR) and Operationally Acceptable Level of Traffic (OALT); C) Understand downstream flow constraints; D) Identify airport capacity and other environmental limits; E) Understand airport physical characteristics including number and length of runways, geometrical configurations of runways and airfield layout; and F) Identify requirements for runway selection.		
Control Tower Operations A. Taxi and ground movement procedures B. Spacing and sequencing C. Departure procedures and separation D. Arrival procedures and separation E. Helicopter operations		Knowledge of and the ability to apply tower operations.	Examine airport control tower operation procedures. Student is expected to: A) Demonstrate knowledge of fundamentals of aircraft separation in radar, non-radar, and terminal environments, as well as operating techniques of ATC facilities in visual and instrument conditions; B) Understand how air traffic controls use taxi and ground movement procedures; C) Explain the purpose of the Final Approach Spacing Tool (FAST);		

			D) Identify separation requirements of arrival on same runway; E) Identify basics of queuing theory ; F) Identify separation requirements for departing aircraft; and G) Explain the basic concept of runway configuration capacity envelopes.		
Instrument flight rules (IFR) operations A. Navaid use limitations B. Clearances C. Departure procedures D. Route assignment E. Altitude assignment and altitude verification F. Holding aircraft G. Arrival procedures H. Approach clearance procedures		Understand FAA procedures related to Instrument Flight Rules (IFR).	Review Instrument Flight Rules (IFR) operations. Student is expected to: A) Define NAVAID use and discuss its limitations; B) Understand the order of procedure related to clearance and use appropriate phraseology; C) Identify procedures related to gate departure including ground stop and ground delay; D) Explain how clearance for IFR Flight plan is granted; E) Understand pushback request and clearance; F) Understand how routes are assigned and explain the ATS route system; G) Understand the importance of route structure transitions based on NAVIDs or RNAV; H) Understand procedures to determine altitude assignment and verification and use appropriate phraseology; I) Explain how the RVR Measuring System is used; J) Identify procedures related to aircraft holding and use appropriate phraseology;		

			K) Understand concepts related to final approach, parallel approach, and normal operating zone; L) Define the no transgression zone; M) Define converging approach; N) Identify landing requirements; O) Understand the Approach light systems and identify airport lighting aids; P) Identify Land and Short Hold (LAHSO) procedures; Q) Understand taxiing and arrival procedures and clearances for ramp/gate, active runway, and runway entry points; R) Identify procedures for take-off and transition of control from airport to Center; and S) Identify surface control tools in the tower and cockpit.		
Radar A. General B. Beacon systems C. Radar identification D. Transfer of radar identification E. Radar separation F. Radar vectoring G. Radar departure procedures H. Radar arrival procedures I. Radar approaches, terminal J. Automation, terminal K. Automation, en route		Knowledge of and the ability to apply radar operations.	Explore radar operation development and evolution of current procedures. Student is expected to: A) Define ATCRBS and explain how it is used in air traffic control; B) Understand fundamental concepts of radar and radar identification; C) Explain the use of primary and secondary radar systems in air traffic control; D) Understand how CARTS and STARTS systems are used; E) Define speed overtake; F) Define vectoring and radar circuit		

			G) Read flight progress strips and their markings; H) Explain how air traffic controllers prioritize the separating of radar arrivals and departures; I) Identify how air traffic controllers initiate and receive radar handoffs; J) Identify procedures to issue departure clearances; K) Identify procedures to issue approach clearances; and L) Compare and contrast terminal and en route automation.		
Non-radar A. General B. Initial separation of successive departing aircraft C. Initial separation of departing and arriving aircraft D. Lateral separation E. Vertical separation		Knowledge of and the ability to apply non-radar operations.	Explore non-radar operations and development of current standards. Student is expected to: A) Identify separation assurance considerations including personal safety buffer, minimum separation standard, procedural safety buffer, surveillance uncertainty and hazard zone; B) Define Wake Turbulence requirement; C) Understand how to apply separation requirements to departing and arriving aircraft; D) Understand separation methods and minimum requirements of lateral aircraft separation; E) Understand separation methods and minimum requirements of vertical aircraft separation; and F) Identify FAA procedures for timed approaches.		

Visual A. General B. Visual separation application C. VFR on top D. Approaches E. Special VFR (SVFR) F. Radar services to VFR aircraft		Be able to demonstrate knowledge in single-engine VFR flight environment to the private pilot standard.	Investigate visual separation rules, application and standards. Student is expected to: A) Understand VFR conditions and restrictions for use; B) Use appropriate phraseology for approach control and visual holding of VFR aircraft; C) Understand the protocol for visual separation application; D) Understand the procedures for clearing VFR-on-top requests; E) Understand when visual approach procedures can be applied and when a vector for visual approach can be initiated; and F) Understand when Special VFR procedures can be applied and how they are used for fixed wing aircraft and helicopters.		
Airspace classifications (FAR 91) A. Terminal radar service area (TRSA) B. Class A airspace requirements C. Class B airspace requirements D. Class C airspace requirements E. Class D airspace requirements F. Class E airspace requirements G. Class G airspace requirements		Understand FAR 91 regulations for airspace classifications.	Demonstrate knowledge and requirements FAR part 91 airspace classifications. Student is expected to: A) Identify the characteristics of airspace classifications; B) Understand how the VFR chart applies to airspace requirements; C) Explain the information presented on the DUAT flight plan; and D) Review example procedures.		

Offshore / oceanic procedures A. General B. Coordination C. Longitudinal separation D. Lateral separation E. Offshore / oceanic transition procedures F. Separation from airspace reservations G. North Atlantic ICAO region H. Caribbean ICAO region I. Pacific ICAO region J. North American ICAO region, Arctic region		Identify offshore and oceanic requirements and procedures.	Demonstrate knowledge of offshore and oceanic requirements and procedures. Student is expected to: G) Understand how the ATC Service regulates operations in offshore airspace areas including VFR flight plans, altimeter setting, and separation; H) Understand general coordination and transfer of control and communications requirements; I) Identify the requirement for application and separation methods for longitudinal separation; J) Identify the requirement for application and separation methods for lateral separation; K) Identify offshore/oceanic transition procedures for altitude/flight level transition, course divergence, and radar identification; L) Explain the concept of separation from airspace reservations and identify its procedure; M) Understand application and separation requirements for the North Atlantic ICAO Region; N) Understand application and separation requirements for the Caribbean ICAO Region; O) Understand application and separation requirements for the Pacific ICAO Region; and		
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			P) Understand application and separation requirements for the North American ICAO Region.		
Special Flights A. General B. Special interest flights C. Special operations D. Special use and ATC assigned airspace Fuel dumping Jettisoning of external stores Unmanned free balloons Parachute operations Unidentified flying object reports E. Experimental aircraft operations			Explore special interest flight handling procedures. Student is expected to: - Understand the expectations of air traffic control to assist special flight operations; - Define the criteria for aircraft to be consider under special operations; - Identify the applications and procedures for Special Use, ATC-Assigned Airspace, and Stationary ALTRVs; - Understand the requirements for fuel dumping; - Understand the applications for jettisoning of external stores; - Identify the procedures for unmanned free balloons and derelict balloons within the jurisdiction of air traffic control; - Understand the coordination of parachute operations within the various airspace classifications; and - Identify the procedure for the reporting of Unidentified Flying Objects (UFOs).		
Emergencies A. General Emergency assistance B. Overdue aircraft Information to be forwarded to ARTCC		Knowledge of aviation safety and human factors. Interpret and apply procedures	Respond appropriately to emergency situations and procedures. Student is expected to: Understand the procedures and information requirements for air traffic control response in providing emergency assistance;		

2. Information to be forwarded to RCC 3. ALNOT 4. Traffic restrictions 5. Traffic resumption 6. Communications failure, NORDO aircraft C. Control aircraft D. Oceanic emergency procedures E. Ground missile emergencies F. Hijacked aircraft G. VFR aircraft weather difficulty H. ELT reports I. Aircraft bomb threats		to aircraft and vehicle emergencies.	B) Understand how the orientation of aircraft applies in emergency situations; C) Identify various emergency protocols by emergency type (hijacking, weather related, etc.); D) Understand ELT reporting requirements; E) Define overdue aircraft and explain the what is means to issue ALNOT; F) Identify the information to be collected and forwarded to ARTCC and RCC; G) Identify the procedures to issue and cancel ALNOT; H) Define control actions and identify their requirements; I) Understand the application and phases of oceanic emergency procedures; and J) Understand the information relay and rerouting process for ground missile emergencies.		
Traffic management procedures A. General B. Duties and responsibilities C. Canadian airspace procedures D. Air Traffic Control System Command Center (ATCSCC) E. Traffic management programs F. Delay reporting		Analyze Traffic Management Procedures and responsibilities. Knowledge and ability to apply Air Traffic Management in an integrated setting.	Analyze Traffic Management Procedures and responsibilities. Student is expected to: A) Explain the purpose of the Traffic Management procedures and the role of the Coordinator-in-Charge, Operations Supervisor-in-Charge; B) Understand Collaborative Decision Making (CDM) and efforts to improve the Traffic Flow Management (TFM) system; C) Discuss time-based flow management;		

			D) Identify applications and airspace classification protocols for Canadian Airspace; E) Discuss delay reporting and protocols; and F) Investigate how the ERAM decision support tools are applied for strategic planning.		
IFR military training routes A. Interceptor operations B. Special interest sites		Investigate the application so IFR for military training routes.	Investigate the application so IFR for military training routes. Student is expected to: A) Explore IFR Military Training Routes, their usage and procedures for inceptor operations and special interest flights.		
Air defense identification zones C. Definition D. ATC procedures in ADIZ		Define air defense identification zones and understand their procedures.	Evaluate roles and responsibilities for Air Defense Identification Zone (ADIZ) operations. Student is expected to: A) Define Air Identification Zone (ADIZ); and B) Identify the role and procedures for air traffic control in ADIZ.		
Military operations A. Military aerial refueling operations B. Military operations above flight level 600 C. Military special use frequencies D. Fuel dumping 1. Information requirements 2. Routing 3. Altitude assignment 4. Separation Minima		Investigate requirements for air operation and control for military operations.	Explain military operations, separation standards, responsibilities and procedures. Student is expected to: A) Investigate procedures and phraseology related to military operations including: - Military aerial refueling operations - Military operations above flight level 600 - Military special use frequencies - Fuel dumping		

5. Information dissemination E. Special use airspace 6. Separation from' 7. Transition active SUA's and ATCAA's F. Areas of nuclear radiation avoidance G. Ground missile emergencies			i. Information requirements ii. Routing iii. Altitude assignment iv. Separation Minima v. Information dissemination e. Special use airspace i. Separation from' ii. Transition active SUA's and ATCAA's f. Areas of nuclear radiation avoidance g. Ground missile emergencies		
Aeronautical charts A. VFR charts B. IFR charts C. SID's D. STARS E. Approach charts F. Airport/Facility/Directory		Interpret aeronautical chart information and usage.	Interpret aeronautical chart information and usage. Student is expected to: A) Practice reading and using information contained in aeronautical charts; and B) Investigate airport facility information and directories.		

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)

Reading, Writing, & Communicating

Standard 1: Oral Expression and Listening

- **Prepared Graduate 1:** 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.

- **Prepared Graduate 2:** Deliver effective oral presentations for varied audiences and varied purposes.

Standard 2: Reading for All Purposes

- **Prepared Graduate 3:** Read a wide range of literary texts to build knowledge and to better understand the human experience.
- **Prepared Graduate 4:** Read a wide range of informational texts to build knowledge and to better understand the human experience.
- **Prepared Graduate 5:** 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.

Standard 3: Writing and Composition

- **Prepared Graduate 6:** Craft arguments using techniques specific to the genre.
- **Prepared Graduate 7:** Craft informational/explanatory texts using techniques specific to the genre.
- **Prepared Graduate 8:** Craft narratives using techniques specific to the genre.
- **Prepared Graduate 9:** Demonstrate mastery of their own writing process with clear, coherent, and error-free polished products.

Standard 4: Research Inquiry and Design

- **Prepared Graduate 10:** Gather information from a variety of sources; analyze and evaluate its quality and relevance; and use it ethically to answer complex questions.

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