North Dakota Aviation

Content Standards

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Adapted from *Standards for Technological Literacy*, International Technology Education Association, 2007. Also the Remote Pilot-Small Unmanned Aircraft Systems Airman Certification Standards, FAA, June 2018.
https://www.faa.gov/training_testing/testing/acs/media/uas_acs.pdf

It is the policy of the North Dakota State Board for Career and Technical Education not to discriminate in its educational programs, activities, or employment policies as required by Final Regulation implementing Title IX of the 1972 Education Amendments, Title VI of the Civil Rights Act of 1964, Section 504 of the Rehabilitation Act of 1973.

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Career and Technical Education Standards Introduction

Mission

The mission of the State Board for Career and Technical Education (CTE) is to work with others to provide all North Dakota citizens with the technical skills, knowledge, and attitudes necessary for successful performance in a globally competitive workplace.

Vision

The State Board for Career and Technical Education (CTE) is committed to providing career awareness, work readiness skills, occupational preparation, and retraining of workers throughout the state. Career and technical education will span all educational levels, providing youth with exploration opportunities and the foundation skills needed to enter the world of work while providing adults with skills needed to enter, re-enter, or advance in the workforce.

Goal

North Dakota Career and Technical Education's goal is to create a competitive and knowledgeable work force. This is accomplished through a variety of educational program areas that are organized to prepare students for careers in their chosen fields, to take leadership roles, and balance their multiple roles in life. CTE programs prepare students with the knowledge and skills to make informed career choices, to integrate and apply academic concepts, to prepare for successful participation in a global society, and to engage in lifelong learning.

Standards Development Process

Standards development is a multi-phase process. Existing and/or industry standards are the basis for the North Dakota Program Standards. A team of expert secondary and postsecondary teachers, business and industry representatives, and the state program supervisor draft the standards document. Once the document is finalized, the State Board for Career and Technical Education approves and adopts the standards.

Course Frameworks are also developed by the writing team. A framework includes a brief overview of the course content, topical units of study, and identifies the standards recommended for inclusion within the course. The frameworks are tailored to prepare young people for the opportunities in North Dakota. School Districts will use the frameworks as a guide for developing curriculum that reflects local needs.

Key Principles of Career and Technical Education

We believe that Career Technical Education:

1. **Draws its curricula, standards, and organizing principles from the workplace.**
   The workplace provides the context, objectives, and organizing constructs for instruction and assessment. The workplace also defines the standards of performance necessary, including those required for academic, technical, and employability skills.

2. **Is a critical and integral component of the total educational system, offering career-oriented benefits for all students.**
   CTE classes offer educational benefits to students pursuing careers requiring specific technical skills as well as providing a strong foundation for those pursuing a traditional four-year (or more) degree.

3. **Is a critical and integral component of the workforce development system, providing the essential foundation for a thriving economy.**
   Preparation of a well-prepared, qualified workforce requires solid academics, good work ethics, and specific technical skills as well as the ability to communicate, work with others, solve problems, and use information. CTE contributes directly to this preparation by providing a curriculum tied to specific workplace requirements.

4. **Maintains high levels of excellence supported through identification of academic and workplace standards, measurement of performance (accountability), and high expectations for participant success.**
   Career Technical Education is committed to continuous improvement, attention to industry certification, and the development of highly qualified teachers.

5. **Is robust and flexible enough to respond to the needs of the multiple educational environments, customers, and levels of specialization.**
   CTE involves a large and complex delivery system that (1) integrates career exploration, (2) provides effective tools for organizing all curricula, (3) facilitates the teaching and use of technology, (4) is integrated into the total learning experience, (5) enhances the learning of academic subjects, (6) teaches broad occupational skills, (7) includes all aspects of the industry, (8) teaches how to balance family and work responsibilities, (9) provides job-specific training, (10) is offered at multiple levels of the educational continuum, and (11) is delivered through a variety of educational environments.

Table of Contents

Standard 1	***BASICS AND CONTROL SYSTEMS***	
Topic 1.1	**Aircraft Basics**	
	Student Competencies	
	1.1.1	Identify the components of different types of aircraft, both exterior and interior.
	1.1.2	Compare and contrast categories and classes of aircraft: airplane, rotorcraft, glider, powered-lift, and lighter-than-air.
	1.1.3	Compare and contrast the various categories into which aircraft are organized during certification: normal, experimental, restricted, acrobatic, utility, and transport.
Topic 1.2	**Aircraft Flight Instruments**	
	Student Competencies	
	1.2.1	Identify the seven basic/standard instruments.
	1.2.2	Describe the operation/limitations of the pitot-static system.
	1.2.3	Describe the operation/limitations of the gyroscopic system.
	1.2.4	Describe the operation/limitations of the magnetic system.
	1.2.5	Describe how instruments will function when the pitot-static system is blocked.
	1.2.6	Explain how the principles of gyroscopic procession and rigidity in space affect the gyroscopic instruments.
	1.2.7	Explain how to cope with magnetic compass errors.
Topic 1.3	**Flight Systems**	
	Student Competencies	
	1.3.1	Explain the function of the battery, alternator, and magneto.
	1.3.2	Discuss fuel systems.
	1.3.3	Explain the cycle of an internal combustion engine.
	1.3.4	Describe common errors with the induction system.
	1.3.5	Compare differences between fixed pitch and constant speed propellers.
	1.3.6	Explain the operation and limitations of the flight control system (primary and secondary).
	1.3.7	Explain the operation and limitations of the powerplant.
	1.3.8	Explain the operation and limitations of the gear system.
	1.3.9	Explain the operation and limitations of the environmental system.
Topic 1.4	**Aircraft Construction**	
	Student Competencies	
	1.4.1	Construct a model aircraft.
	1.4.2	Interpret plans/instructions for homebuilt aircraft.
	1.4.3	Identify techniques used for homebuilt aircraft.
	1.4.4	Assemble/re-assemble a full-scale aircraft part (e.g., fuselage, empennage, wing).

Standard 2		***SCIENCE OF FLIGHT***
Topic 2.1	**Aerodynamics of Flight**	
	Student Competencies	
	2.1.1	Describe and explain the relationship the four forces of flight.
	2.1.2	Define the angle of attack and critical angle of attack.
	2.1.3	Describe the types of drag, both parasite and induced.
	2.1.4	Explain various wing shapes and how wing tip vortices are created.
	2.1.5	Discuss and compare the four main types of wing flaps and the advantages and disadvantages to their uses.
	2.1.6	Explain how Newton's Third Law and Bernoulli's principle affect lift.
	2.1.7	Identify the parts of an airfoil (e.g., chord line, relative wind, camber, leading edge, trailing edge).
	2.1.8	Describe the aerodynamics of a stall.
	2.1.9	Define static and dynamic stability.
	2.1.10	Discuss the aerodynamics of a spin.
	2.1.11	Describe the hazards of wake turbulence.
	2.1.12	Explain ground effect.
Topic 2.2	**Weather Theory**	
	Student Competencies	
	2.2.1	Identify the gases and ratios found within the atmosphere.
	2.2.2	Describe factors that affect atmospheric weather patterns.
	2.2.3	Identify and explain the various family of clouds.
	2.2.4	Explain the formation of clouds and the conditions necessary to form each type.
	2.2.5	Explain and compare the various types of precipitation.
	2.2.6	Explain the importance of atmospheric stability and cloud formation.
	2.2.7	Compare dew point and humidity.
	2.2.8	Identify the various stages of thunderstorms and the hazards to flight.
	2.2.9	Describe conditions that would be necessary for fog formation
Topic 2.3	**Weather Products and Reports**	
	Student Competencies	
	2.3.1	Identify Terminal Aerodrome Forecast (TAF) codes (e.g., TEMPO, FM).
	2.3.2	Explain, analyze, and apply TAFs.
	2.3.3	Explain the importance of a winds aloft forecast.

	2.3.4	Identify abbreviations (e.g., RA, BR, and SN) used in METAR weather reports.
	2.3.5	Decode, analyze, and apply METARs.
	2.3.6	Analyze weather graphics.
	2.3.7	Determine weather products issuance and valid times.
	2.3.8	Describe how to obtain official weather briefings and FAA approved sources or products.
	2.3.9	Predict weather conditions in an area based on available data.
	2.3.10	Interpret current atmospheric conditions at an airport.
Topic 2.4	**Weight and Balance**	
	Student Competencies	
	2.4.1	Define weight and balance terms (e.g., center of gravity, basic empty, weight and useful load).
	2.4.2	Identify the methods of calculating weight and balance.
	2.4.3	Explain the effects of weight on aircraft performance.
	2.4.4	Explain the effects of forward/aft center of gravity on aircraft performance.
	2.4.5	Determine the center of gravity using the computation method.
Topic 2.5	**E6B Flight Computer**	
	Student Competencies	
	2.5.1	Calculate Time/Distance/Rate problems.
	2.5.2	Compute groundspeed and wind correction angle.
	2.5.3	Demonstrate accurate multi-step calculations using a flight computer.
Topic 2.6	**Performance Calculations**	
	Student Competencies	
	2.6.1	Determine aircraft performance problems.
	2.6.2	Determine aircraft performance predictions using current aircraft information and atmospheric conditions.
	2.6.3	Compare predicted aircraft performance vs. actual aircraft performance (actual or simulated).
	2.6.4	Determine predicted aircraft performance changes if a modification to airframe or powerplant occurs.

Standard 3		***GROUND AND INFLIGHT OPERATIONS***
Topic 3.1	**Airport Operations**	
	Student Competencies	
	3.1.1	Discuss and explain each leg of standard and nonstandard traffic patterns.
	3.1.2	Describe how runway numbers are determined.
	3.1.3	Recognize various types of airports (controlled and uncontrolled).
	3.1.4	Explain the purpose of a displaced threshold.
	3.1.5	Explain the purpose of a blast pad.
	3.1.6	Recognize visual aids and their purpose (e.g., signs, lights, and markings).
	3.1.7	Create an airport diagram using appropriate signs, lights, and markings.
	3.1.8	Demonstrate a standard traffic pattern using the simulator.
Topic 3.2	**Airspace**	
	Student Competencies	
	3.2.1	Compare the classes of controlled and uncontrolled airspaces and airports.
	3.2.2	Identify the airspace dimensions needed for each class of airspace.
	3.2.3	Recognize various classes of airspace on sectional charts.
	3.2.4	Identify the minimum weather requirements for each class of airspace.
	3.2.5	Categorize the pilot qualifications needed for each class of airspace.
	3.2.6	Explain the aircraft requirements for each class of airspace.
	3.2.7	Determine when it would be necessary to request a special VFR clearance.
	3.2.8	Identify airspace at a given location using a sectional chart.
	3.2.9	Determine special use airspace on a sectional chart.
Topic 3.3	**Flight Communication**	
	Student Competencies	
	3.3.1	Demonstrate use of the phonetic alphabet and numbers.
	3.3.2	Convert local times to Zulu time and vice versa.
	3.3.3	Discuss the purpose of the following facilities/frequencies: ground control, tower, CTAF, Unicom, FSS, approach/departure control, ATIS and enroute center.
	3.3.4	Describe the purpose of an airplane's transponder.
	3.3.5	Explain the standard and emergency squawk codes.
	3.3.6	Explain light gun signals and their purpose.
	3.3.7	Demonstrate flight in a simulated tower environment.
	3.3.8	Explain proper communication procedures in an emergency situation.
	3.3.9	Describe lost communications procedures.

Topic 3.4	Navigation	
	Student Competencies	
	3.4.1	Identify pilotage and dead reckoning techniques.
	3.4.2	Explain when radio navigation would be beneficial.
	3.4.3	Plan a flight using VOR navigation techniques.
	3.4.4	Plan a flight using GPS navigation techniques.
	3.4.5	Demonstrate appropriate radio navigation techniques using VOR and GPS.
	3.4.6	Determine the most appropriate radio navigation technique for a flight.
Topic 3.5	**Cross Country Flight Planning**	
	Student Competencies	
	3.5.1	Demonstrate use of flight planning tools (e.g., AFD, E6B, and Plotter Sectional charts).
	3.5.2	Plan a XC flight using multiple navigation techniques.
	3.5.3	Complete nav-log for preflight planning.
	3.5.4	Demonstrate a XC flight using a flight simulator.

Standard 4	***PEOPLE, TRENDS, AND CAREERS IN AVIATION***	
Topic 4.1	**Events and Trends in Aviation**	
	Student Competencies	
	4.1.1	Discuss important people in aviation history and their contribution to the field of aviation.
	4.1.2	Determine the progression of aviation technology (e.g., Pre-Heavier than air flight, gliders (pre-Wright brothers), World War I and II, the jet age, and NextGen aviation).
	4.1.3	Identify and explain current issues (including socio-economic challenges) in aviation.
	4.1.4	Describe how events in aviation history are changing the future of aviation.
Topic 4.2	**Aviation Training Requirements**	
	Student Competencies	
	4.2.1	Describe flight training processes.
	4.2.2	Determine the period of time for medical certificate validity.
	4.2.3	Identify the mission of aviation organizations (e.g., AOPA, EAA, CAP).
	4.2.4	Determine FAA Pilot certificate requirements.
Topic 4.3	**Aviation Physiology**	
	Student Competencies	
	4.3.1	Explain the PAVE checklist.
	4.3.2	Discuss the IMSAFE checklist.
	4.3.3	Describe the medical qualifications requirements for pilots.
	4.3.4	Identify and explain the various parts of the vestibular system, how the kinesthetic sense affects humans, and the function of the human eye.
	4.3.5	Identify each type of hypoxia and associated causes.
	4.3.6	Describe symptoms of hypoxia.
	4.3.7	Describe corrective actions for hypoxia.
	4.3.8	Explain the development of night vision.
	4.3.9	Discuss the importance of spatial awareness and disorientation.
	4.3.10	Describe the effect on pilot performance time at various altitudes.
Topic 4.4	**Aviation Careers**	
	Student Competencies	
	4.4.1	Identify career opportunities in aviation.
	4.4.2	Identify current career trends in aviation.
	4.4.3	Discuss pathways to an aviation career.
	4.4.4	Create an educational plan to pursue an aviation career.

Standard 5	*UNMANNED AIRCRAFT SYSTEMS*	
Topic 5.1	**Basic understanding of statute**	
	Student Competencies	
	5.1.1	Demonstrate understanding of the applicability and definitions of 14 CFR part 107 to unmanned aircraft operations.
	5.1.2	Understand how to report accidents and demonstrate compliance to code.
Topic 5.2	**Operating Rules**	
	Student Competencies	
	5.2.1	Identify the responsibility and authority of the remote PIC.
	5.2.2	Discuss rules of UAS operation under hazardous conditions.
	5.2.3	Explain the definitions of daylight operation and visual line of sight (VLOS).
	5.2.4	Determine the authorized and prohibited usages of an sUAS (ex. Multiple sUAS, hazardous material, operations over human beings, etc.).
	5.2.5	Understand the importance of rules governing flight path, general airspace considerations, and reporting.
	5.2.6	Demonstrate the operating limitations for sUAS, including maximum groundspeed, altitude, visibility, and cloud clearance).
Topic 5.3	**Airspace Classification**	
	Student Competencies	
	5.3.1	Understand the significance of airspace Class B, C, D, E, and G as they pertain to UAS.
	5.3.2	Identify special-use airspace where UAS usage may be prohibited.
	5.3.3	Demonstrate knowledge of other airspace areas and entities (MTRs, TFRs, Parachute Jump Operations, NSU, VFR routes, Air Traffic Control, and operations near airports).
	5.3.4	Identify potential flight hazards associated with airspace (including smoke, precipitation, wires, emergency aircraft, and structures).
Topic 5.4	**Sources of Weather**	
	Student Competencies	
	5.4.1	Demonstrate correct usage of internet weather briefings and sources of weather for UAS flight planning purposes.
	5.4.2	Understand METAR weather reports, terminal aerodrome forecasts (TAF), automated surface observing systems (ASOS), and automated weather observing systems (AWOS) as they apply to UAS.
	5.4.3	Identify weather factors and their effects on performance of an sUAS (ex. Density altitude, wind, currents, air masses, icing, fog, lightning, thunderstorms, ceiling, etc.).

Topic 5.5	Loading and Performance	
	Student Competencies	
	5.5.1	Demonstrate understanding of general loading and performance with effects of loading changes and balance, stability, and center of gravity.
	5.5.2	Identify the importance and use of performance data to calculate the effect.
Topic 5.6	**Operations**	
	Student Competencies	
	5.6.1	Demonstrate understanding of airport operations with and without an operating control tower.
	5.6.2	Describe and use Common Traffic Advisory Frequency (CTAF).
	5.6.3	Demonstrate self-announcing of position of intentions, aircraft call signs, registration numbers, the phonetic alphabet, and phraseology.
	5.6.4	Identify types of airports, ATC towers, runway markings, signage, security Identification Display Areas (SIDA), and sources of airport data.
	5.6.5	Demonstrate safety, emergency planning, and proper communication through safe usages and risk management.
	5.6.6	Demonstrate correct Aeronautical Decision-Making (ADM) and Crew Resource Management (CRM).
	5.6.7	Identify and mitigate physiological hazards whiling using an sUAS.
	5.6.8	Understand the importance of basic maintenance and preflight inspection of an sUAS.

Career Ready Practices

1. Act as a Responsible and Contributing Citizen and Employee

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 conscientious of the impacts of their decisions on others and the environment around them, think about the near-term and long-term consequences of their actions, and seek to act in ways that contribute to the betterment of their teams, families, community, and workplace. They are reliable and consistent in going beyond the minimum expectation and in participating in activities that serve the greater good.

2. Apply Appropriate Academic and Technical Skills

Career-ready individuals readily access and use the knowledge and skills acquired through experience and education to be more productive. They make connections between abstract concepts with real-world applications and make correct insights about when it is appropriate to apply the use of an academic skill in a workplace situation.

3. Attend to Personal Health and Financial Well-Being

Career-ready individuals understand the relationship between personal health, workplace performance, and personal well-being; they act on that understanding to regularly practice health diet, exercise and mental health activities. Career-ready individuals also take regular action to contribute to their personal financial well-being, understanding that personal financial security provides the peace of mind required to contribute more fully to their own career success.

4. Communicate Clearly, Effectively, and with Reason

Career-ready individuals communicate thoughts, ideas, and action plans with clarity, whether using written, verbal, and/or visual methods. They communicate in the workplace with clarity and purpose to make maximum use of their own and others' time. They are excellent writers; they master conventions, word choice and organization and use effective tone and presentation skills to articulate ideas. They are skilled at interacting with others; they are active listeners and speak clearly and with purpose. Career-ready individuals think about the audience for their communication and prepare accordingly to ensure the desired outcome.

5. Consider 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 and/or mitigate negative impact on other people, organizations and the environment. They are aware of and utilize new technologies, understandings, procedures, materials and regulations affecting the nature of their work as it relates to the impact on the social condition, the environment and profitability of the organization.

6. Demonstrate creativity and innovation

Career-ready individuals regularly think of ideas that solve problems in new and different ways, and they contribute those ideas in a useful and productive manner to improve their organization. They can consider unconventional ideas and suggestions as solutions to issues, tasks or problems, and they discern which ideas and suggestions will add greatest value. They seek new methods, practices and ideas from a variety of sources and seek to apply those ideas to their own workplace. They take action on their ideas and understand how to bring innovation to an organization.

7. Employ valid and reliable research strategies

Career-ready individuals are discerning in accepting and using new information to make decisions, change practices, or inform strategies. They use a reliable research process to search for new information and evaluate the validity of sources when considering the use and adoption of external information or practices. They use an informed process to test new ideas, information, and practices in their workplace situation.

8. Utilize critical thinking to make sense of problems and persevere in solving them

Career-ready individuals readily recognize problems in the workplace, understand the nature of the problem, and devise effective plans to solve the problem. They are aware of problems when they occur, quickly take action to address the problem, thoughtfully investigate the root cause of the problem prior to introducing solutions, and carefully consider the options to solve the problem. Once a solution is agreed upon, they follow through to ensure the problem is solved, whether through their own actions or the actions of others.

9. Model integrity, ethical leadership, and effective management

Career-ready individuals consistently act in ways that align to personal and community-held ideals and principles while employing strategies to positively influence others in the workplace. 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 apply insights into human behavior to change others' actions, attitudes, and/or beliefs. They recognize the near-term and long-term effects that management's actions and attitudes can have on productivity, morale, and organizational culture.

10. Plan education and career path aligned to personal goals

Career-ready individuals take personal ownership of their own educational and career goals, and they regularly act on a plan to attain these goals. They understand their own career interests, preferences, goals, and requirements. They have perspective regarding the pathways available to them and the time, effort, experience, and other requirements to pursue each, including a path of entrepreneurship. They recognize the value of each step in the educational and experiential process, and they recognize that nearly all career paths require ongoing education and experience. They seek counselors, mentors, and other experts to assist in the planning and execution of career and personal goals.

11. Use 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, being proficient with ubiquitous technology applications. They understand the inherent risks, personal and organizational, of technology applications, and they take actions to prevent or mitigate these risks.

12. Work productively in teams while using cultural/global competence

Career-ready individuals positively contribute to every team whether formal or informal. They apply an awareness of cultural differences to avoid barriers to productive and positive interaction. They find ways to increase the engagement and contribution of all team members. They plan and facilitate effective team meetings.