Introduction to Aerospace and Aviation

PEIMS Code: N1304672
Abbreviation: INTAEAVI
Grade Level(s): 9–11
Award of Credit: 1.0

State Approved Innovative Course

- Districts must have local board approval to implement innovative courses.
- In accordance with Texas Administrative Code (TAC) §74.27, school districts must provide instruction in all essential knowledge and skills identified in this innovative course.
- Innovative courses may only satisfy elective credit toward graduation requirements.
- Please refer to TAC §74.13 for guidance on endorsements.

Course Description:

The *Introduction to Aerospace and Aviation* course will provide the foundation for advanced exploration in the areas of professional pilot, aerospace engineering, and unmanned aircraft systems. Students will learn about the history of aviation, from Leonardo da Vinci's ideas about flight to the Wright brothers and the space race. Along the way students will learn about the innovations and technological developments that have made today's aviation and aerospace industries possible. The course includes engineering practices, the design process, aircraft structure, space vehicles past and present, and a look toward future space exploration.

Students will also learn about the wide variety of exciting and rewarding careers available to them. The Introduction to Aerospace and Aviation course will inspire students to consider aviation and other aerospace careers while laying the foundation for continued study in grades 10-12.

Essential Knowledge and Skills:

(a) General Requirements: This course is recommended for students in grade 9-11. Students shall be awarded one credit for successful completion of this course.

(b) Introduction.

(1) Career and technical education instruction provides content aligned with challenging academic standards and relevant technical knowledge and skills for students to further their education and succeed in current or emerging professions.

(2) The Transportation, Distribution, and Logistics Career Cluster focuses on planning, management, and movement of people, materials, and goods by road, pipeline, air, rail, and water and related professional support services such as transportation infrastructure planning and management, logistics services, mobile equipment, and facility maintenance.

(3) The *Introduction to Aerospace and Aviation* course will provide the foundation for advanced exploration in the areas of professional pilot, aerospace engineering,

and unmanned aircraft systems. Students will learn about the history of aviation, from Davinci's ideas about flight to the Wright brothers and the space race, along the way students will learn about the innovations and technological developments that have made today's aviation and aerospace industries possible. The course includes engineering practices, the design process, aircraft structure, space vehicles past and present, and a look toward future space exploration.

(4) Students are encouraged to participate in extended learning experiences such as career and technical student organizations and other leadership or extracurricular organizations.

(5) Statements that contain the word "including" reference content that must be mastered, while those containing the phrase "such as" are intended as possible illustrative examples.

(c) Knowledge and Skills.

(1) The student demonstrates professional standards/employability skills as required by and the aerospace and aviation industries. The student is expected to:

(A) demonstrate the principles of group participation and leadership related to citizenship and career preparation;

(B) identify and demonstrate employers' expectations and appropriate work habits;

(C) differentiate between professional and unprofessional behaviors;

(D) identify and demonstrate effective communication and appropriate interaction in a professional setting;

(E) research aviation resources, information systems, and technology;

(F) demonstrate awareness of the technical knowledge and skills related to health and safety in the workplace, as specified by appropriate governmental regulations and an understanding of personal responsibility in this area;

(G) explain the role of the employee in creating a successful and profitable workplace, including personal responsibility; and

(H) apply reasoning skills to a variety of simulated workplace situations in order to make ethical decisions.

(2) The student applies academic skills to the requirements of aerospace and aviation. The student is expected to:

(A) demonstrate oral and written communication skills needed to communicate effectively with individuals from various cultures such as fellow workers, management, and customers;

(B) explain the documents related to aviation and aerospace, including aeronautical charts, graphs, aircraft system diagrams; and

(C) demonstrate understanding of standard Aviation measurement systems (Statute and Nautical).

(3) The student examines the history of aviation from its primitive beginnings to early powered flight. The student is expected to:

(A) investigate and describe how the earliest attempts of human flight were based on images of animals in flight;

(B) summarize how inventors used gliders and balloons to further their knowledge of flight;

(C) explain how engineering practices can be applied to Davinci's earliest flying inventions and to recent aircraft models;

(D) describe the scientific method the Wright brothers used to solve the power, control, and lift problems they encountered;

(E) differentiate between early and more modern airfoil designs of wings and propeller blades and identify the strengths and weaknesses in each; and

(F) identify aviation manufacturing pioneers such as Glen Curtis, Bill Boeing, Clyde Cessna, Lloyd Stearman, Walter Beech, and Olive Ann Mellor and their contributions that improved on the work of the Wright Brothers.

(4) The student analyzes innovations in aircraft design and manufacture and traces the practical applications that lead to the establishment of aircraft as an essential military tool. The student is expected to:

(A) explain the influence of World War I on aviation and aircraft design;

(B) identify and describe aviation innovations brought about by World War II; and

(C) analyze and interpret data to draw conclusions about early engine design and airplane performance in World War I versus engine design and airplane performance in WWII.

(5) The student analyzes technological advancements and events in space exploration. The student is expected to:

(A) explain the origins of practical rocket design and how World War II started the early race between the United States and the Soviet Union toward space;

(B) describe and summarize events and innovations, such as Warner Von Braun's V1 and V2 rockets, that were key to the advancement of space exploration;

(C) summarize key objectives of National Aeronautics and Space Administration's (NASA) three space programs that led to a man on the moon;

(D) explain how NASA engineers and the crew of Apollo 13 used basic engineering principles to solve the multiple related system failures that resulted from explosions aboard the spacecraft and enabled the craft and crew to return to earth safely; and

(E) describe the challenges that must be solved by engineers for the colonization of Mars to become a reality.

(6) The student researches events and explains innovations that led to the jet age. The student is expected to:

(A) explain how Newton's Third Law related to the creation of thrust from a jet engine;

(B) describe the five main components of a jet engine and explain the significance of each;

(C) identify and describe features of a jet aircraft that came about as a result of jet engines;

(D) identify and summarize the origins of commercial airline service;

(E) summarize developments and innovations in navigation systems that occurred as aircraft began to be used for commercial purposes;

(F) summarize how lessons learned from the first failed airline services pointed the way to modern commercial airline flight; and

(G) analyze the impact of the jet engine on world travel and the social changes that came about as a result of international travel.

(7) The student describes innovations of modern aircraft navigation and how these innovations impact the industry. The student is expected to:

(A) explain how the “glass cockpit” and fly-by-wire innovations helped pilots fly airplanes more safely;

(B) investigate and identify features of Visual Flight Rules (VFR) on aeronautical charts;

(C) explain criteria for the use of composites in aircraft design;

(D) define various composite structural materials and identify ways in which composites are used in aviation and aerospace; and

(E) explain current navigational technology and predict what it might look like in the future.

(8) The student summarizes current and possible future impact of the aviation and aerospace industry on the environment. The student is expected to:

(A) describe aviation’s current impact on the environment such as noise, air quality, and carbon footprint;

(B) identify the connection between advancements in technology and the potential to positively impact the environment;

(C) identify and summarize several major developments in aviation that will reduce aviation’s impact on the environment such as electric aircraft, fan blade technology, biofuels, and noise abatement practices;

(D) summarize the challenges and opportunities related to supersonic commercial travel; and

(E) explain potential benefits to society from autonomous aircraft.

(9) The student describes current and future challenges to the aerospace and aviation industries due to new and emerging technologies. The student is expected to:

(A) summarize how innovation and technology help solve airspace capacity and integration limitations and increase safety;

(B) describe the challenges to integrating unmanned aircraft systems into the national airspace system; and

(C) summarize how modern aircraft use innovations in autonomy to help flight crews manage their flights and issues that come with automation of aircraft.

(10) The student identifies the federal regulatory guidelines, safety organizations that are essential to today's aviation and space environment. The student is expected to:

(A) define aviation safety;

(B) examine concepts such as perceived and accepted risk;

(C) construct a basic safety management system; and

(D) compare the Federal Aviation Administration (FAA)'s responsibilities and functions against its mandate to keep aviation and private space travel safe and more efficient.

(11) The student examines a variety of aerospace and aviation careers. The student is expected to:

(A) summarize the career opportunities for pilots in general aviation, commercial aviation, and military aviation;

(B) describe the process for becoming a career manned aircraft or unmanned aircraft pilot;

(C) explain the skills and abilities required to be a professional aircraft or UAS pilot;

(D) compare personal strengths and interests with the skills and abilities required for various professional manned aircraft and unmanned aerial systems (UAS) pilots;

(E) identify and summarize career opportunities available with the FAA and National Transportation Safety Board (NTSB);

(F) explain the essential skills and abilities required to be an aerospace engineer;

(G) compare personal strengths and interests with the skills and abilities required to be an aerospace engineer;

(H) explain the essential skills and abilities required to be an air traffic controller; and

(I) compare personal strengths and interests with the essential skills and abilities required to be an air traffic controller.

(11) The student creates a plan for a career in aviation and aerospace. The student is expected to:

(A) construct a personal mission statement to serve as a guide in preparation for a career in aviation or aerospace;

(B) analyze various education, training, and certifications requirements in pursuit of a career in aviation, unmanned aerial vehicles, or aerospace; and

(C) determine the positives and negatives of a particular job based on skills needed and education or training required.

Recommended Resources and Materials:

Aircraft Owners and Pilots Association (AOPA) High School Aviation STEM Curriculum Project. Retrieved February 8, 2019 from https://youcanfly.aopa.org/high-school/high-school-curriculum

Federal Aviation Administration (Free downloadable PDF Aviation Handbooks) Retrieved February 8, 2019 from https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/

- Pilot Handbook of Aeronautical Knowledge FAA-H-8083-25B
- Airplane flying Handbook FAA-H-8083-3B
- Aeronautical Information Manual (AIM)
- Weather Services AC 00-45H
- Aviation Weather AC 00-6B
- Aeronautical Chart Users Guide
- Pilot Controller Glossary (with change 3) (Vocabulary)

National Aeronautics and Space Administration (NASA)

Various curriculum Ideas. Retrieved February 8, 2019 from https://www.nasa.gov/offices/education/about/index.html

NASA Johnson Space Center (Houston)

Various curriculum Ideas and tour information. Retrieved February 8, 2019 from https://www.nasa.gov/offices/education/centers/johnson/home/index.html

Organizations that support Youth in Aviation Education:

Experimental Aircraft Association (EAA). Retrieved February 8, 2019 from https://www.eaa.org/eaa

Commemorative Air Force (CAF).Retrieved February 8, 2019 from https://commemorativeairforce.org/pages/CAF-Education

Civil Air Patrol. Retrieved from https://www.gocivilairpatrol.com/programs/aerospace-education/join-as-an-aem

Integrating Technology into classroom
The use of Commercially available full-sized motion, non-motion or desktop flight simulation equipment, or a desktop flight simulator using off the shelf products and software can enhance the learning of aviation concepts. Reinforcing that students should use simulation equipment as they would a real aircraft enhances learning of how pilots fly safely and instills good aeronautical decision making.

Recommended Course Activities:

- written papers
- industry interviews
- multimedia videos
- visits to industry sites

Suggested methods for evaluating student outcomes:

- Tests, projects, and presentations.

- independent and group projects.
- Presentations and written reports

Teacher qualifications:

- Trade and Industrial Education: Grades 6-12
- Trade and Industrial Education: Grades 8-12
- Vocational Trades and Industry

Recommended experience in aviation such as Pilot Certificate, Airline Transport Certificate, Advanced Ground Instructor or Certified Flight Instructor certificate would be very helpful in teaching this course.

Additional information: