02_Taking Flight-Early Aviation Innovations

Content Area: **Technology**
Course(s):
Time Period: **Full Year**
Length: **21 Days and Ongoing**
Status: **Published**

General Overview, Course Description or Course Philosophy

Students will follow the path of aviation from its primitive beginnings to the dawn of powered flight. They will consider how observing birds influenced the earliest human attempts at flight before moving on to explore the first successful flight technologies, including lighter-than-air aircraft and gliders. The unit will culminate with an understanding of the technologies, innovative engineering, and design processes developed by the Wright Brothers. They'll also examine how the Wright Brothers' approach to problem solving is helping today's engineers address new challenges as they strive to break boundaries in aviation and aerospace.

OBJECTIVES, ESSENTIAL QUESTIONS, ENDURING UNDERSTANDINGS

ESSENTIAL UNDERSTANDINGS

- The intended purpose and use of an aircraft drives aircraft design considerations and construction techniques, materials, and components. (EU1)
- A deep understanding of how an aircraft operates enables a pilot to fly the aircraft to its maximum capabilities in both normal and abnormal situations. (EU6)

ESSENTIAL QUESTIONS

- What is the most important part of an aircraft?
- Are there any parts of an aircraft we can do without?

CONTENT AREA STANDARDS

TECH.8.1.12.A.2	Produce and edit a multi-page digital document for a commercial or professional audience and present it to peers and/or professionals in that related area for review.
TECH.8.2.12.C.6	Research an existing product, reverse engineer and redesign it to improve form and function.
TECH.8.2.12.C.7	Use a design process to devise a technological product or system that addresses a global problem, provide research, identify trade-offs and constraints, and document the process through drawings that include data and materials.
TECH.8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.

TECH.8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.

RELATED STANDARDS (Technology, 21st Century Life & Careers, ELA Companion Standards are Required)

CRP.K-12.CRP2	Apply appropriate academic and technical skills.
CRP.K-12.CRP4	Communicate clearly and effectively and with reason.
CRP.K-12.CRP6	Demonstrate creativity and innovation.
CRP.K-12.CRP7	Employ valid and reliable research strategies.
CRP.K-12.CRP8	Utilize critical thinking to make sense of problems and persevere in solving them.
CRP.K-12.CRP11	Use technology to enhance productivity.
CRP.K-12.CRP12	Work productively in teams while using cultural global competence.
9-12.HS-ETS1-2	Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering.
9-12.HS-ETS1-1	Analyze a major global challenge to specify qualitative and quantitative criteria and constraints for solutions that account for societal needs and wants.
9-12.HS-ETS1-3	Evaluate a solution to a complex real-world problem based on prioritized criteria and trade-offs that account for a range of constraints, including cost, safety, reliability, and aesthetics, as well as possible social, cultural, and environmental impacts.

STUDENT LEARNING TARGETS

Declarative Knowledge

Students Will Know

1. Names of major components of aircraft
2. Where major components of aircraft are located
3. How major components of aircraft influence flight
4. Location and function of primary structural components of unmanned aircraft.
5. Role of various components in sustaining and controlling flight.
6. How multirotor UAS are stabilized and controlled using a single flight system and no moving control surfaces
7. Types of materials used in the construction of historic and modern aircraft
8. Strengths and weaknesses of various material types
9. Safety design features of modern general aviation, commercial, and military aircraft and UAS.
10. How safety features prevent accidents and improve survivability.
11. Similarities and differences in the construction of unmanned aircraft and traditional aircraft
12. Types of materials used in the construction of popular unmanned aircraft
13. Considerations made when determining what materials to use in the construction of unmanned aircraft

Procedural Knowledge

Students Will Be Able To

1. Identify the location of the major components of fixed-wing airplanes, rotorcraft, and lighter than-air aircraft. (DOK-L1)
2. Explain the function of major components of fixed wing airplanes, rotorcraft, and lighter-than-air aircraft. (DOK-L2)
3. Make observations about the functionality of various aircraft components using simulated flight. (DOK-L2)
4. Identify and recognize the location and function of components that make UAS flight possible. (DOK1)
5. Explain and analyze the effects of UAS flight control and stabilization systems. (DOK-L2, L4)
6. Identify the types of materials that have been used in aircraft construction. (DOK-1)
7. Formulate an aircraft design based on the strengths and weaknesses of various material types. (DOK-3)
8. State a safety issue and create a proposal for a new aircraft safety device to solve for the issue. (DOKL1, L4)
9. Categorize safety design features of modern aircraft. (DOK-L2)
10. Compare the construction materials used in unmanned and manned aircraft. (DOK-L2)
11. Analyze which materials should be used to build a drone based on the drone's purpose. (DOK-L4)

EVIDENCE OF LEARNING

Formative Assessments

Warm-up

Students will observe photographs of three different types of aircraft and discuss what components they see and how those components might influence flight.

Formative Assessment

Students will build a simple model airplane, label the components, and describe the functions of each in a provided activity sheet.

Warm-up Students predict what kinds of components are required for UAS flight. They will sketch a UAS and label as many components as they can.

Formative Assessment

Students are asked to conduct research in order to determine how it is possible to control the flight of multirotor drones and how computer software aids the process.

Warm-up Students are asked to list materials that have been used in the construction of aircraft throughout history. They will discuss if any one of these materials is superior for all applications and to justify their response.

Formative Assessment

Students complete a SWOT analysis of fabric, metal, and composite construction materials for aircraft.

Warm-up

Students are asked to compare the relative safety of modern automobiles to modern aircraft.

Formative Assessment

Students will read a flight scenario that describes a series of mishaps. As the mishaps unfold, students will be asked to research what kind of aircraft safety feature would be employed to keep the pilots, passengers and aircraft safe.

Warm-up

Students are asked to discuss what materials they think would be most appropriate in the construction of drones and why.

Formative Assessment

Students will evaluate three different types of drones and their primary missions. Students will list characteristics each drone needs for the mission and then list material(s) best suited to the drone type and justify their choices.

Summative Assessments

Students will synthesize what they have learned about the components of various aircraft types and the

function(s) of each component.

Have students write a paragraph describing how the flight control system of a rotor drone works with the propellers to provide control in flight.

Students present designs for an aircraft for their personal use with details about the materials selected for the design, justification of those selections, and the implications for use of those materials.

Students will categorize various aircraft safety features and describe how they work and how they provide an added layer of safety.

Summative Assessment Students will summarize this section by writing several paragraphs discussing the considerations that engineers must make when choosing materials for both manned and unmanned aircraft.

RESOURCES (Instructional, Supplemental, Intervention Materials)

How Aircraft Are Made

● Unit 2.A Lesson 1 – Manned Aircraft Components Modeling an Airplane's Components (per student)-Cardboard-Paper towel or toilet paper rolls-Scissors-Tape or Glue-Markers

● Unit 2.A Lesson 2 – Unmanned Aircraft Components Drone Flying Activity (one per class)-Drone options for the classroom

▪ Tello Quadcopter Drone- $99 (Amazon) ▪ SYMA X5C 2.4G 6 Axis Gyro HD Camera RC Quadcopter with 2.0MP Camera- $36 (Amazon)

▪ DROCON Drone For Beginners X708W Wi-Fi FPV Training Quadcopter With HD Camera - $80 (Amazon)

● Unit 2.B Lesson 1 – Aircraft Structural Materials Build-A-Plane Activity-Rolled paper or poster board-Markers

MATERIALS/RESOURCES

Manned Aircraft Components Presentation Manned Aircraft Components Student Activity

1 Manned Aircraft Components Student Activity

2 Manned Aircraft Components Teacher Notes

1 Manned Aircraft Components Teacher Notes

2 Manned Aircraft Components Teaching Aid Modeling an Airplane's Components (per student) Cardboard Paper towel or toilet paper rolls Scissors Tape or Glue Markers

Recommended Student Reading Pilot's Handbook of Aeronautical Knowledge Chapter Three, Aircraft Construction
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/05_phak_ch3.pdf

Helicopter Flying Handbook Chapter Four, Helicopter Components, Systems and Sections
https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/helicopter_flying_handbook/media/hfh_ch04.pdf

Unmanned Aircraft Components Presentation

Unmanned Aircraft Components Student Activity

Unmanned Aircraft Components Teacher Notes

Drone Flying Activity (one per class)

Drone options for the classroom Tello Quadcopter Drone- $99 (Amazon)

SYMA X5C 2.4G 6 Axis Gyro HD Camera RC Quadcopter with 2.0MP Camera- $36 (Amazon)

DROCON Drone For Beginners X708W Wi-Fi FPV Training Quadcopter With HD Camera - $80 (Amazon)

Aircraft Structural Materials Presentation

Aircraft Structural Materials Student Activity 1

Aircraft Structural Materials Student Activity 2

Aircraft Structural Materials Teaching Notes

Build-A-Plane Activity Rolled paper or poster board Markers

Aircraft Safety Features Presentation

Aircraft Safety Features Student Activity

Aircraft Safety Features Teacher Notes

Propose A New Safety Innovation Activity (per team)

Unmanned Aircraft Materials Presentation

Unmanned Aircraft Materials Student Activity

Unmanned Aircraft Materials Teacher Notes

Poster board Markers Post-it notes

INTERDISCIPLINARY CONNECTIONS

Interdisciplinary connections are outlined in each unit of study.

ACCOMMODATIONS & MODIFICATIONS FOR SUBGROUPS

Accommodations & Modifications are outlined in each unit of study.