SPRING GROVE AREA SCHOOL DISTRICT

PLANNED COURSE OVERVIEW

Course Title: Exploring Aviation and Aerospace - Introduction to Flight	**Length of Course:** 15 cycles
Grade Level(s): 10	**Periods Per Cycle:** 6
Units of Credit: .5	**Length of Period:** 43 minutes
Classification: Elective	**Total Instructional Time:** 64.5 hours

Course Description

This course will introduce students to basic aircraft and unmanned aircraft systems (UAS) structures and their major components, principles of flight, and the fundamental physical laws affecting flight. Students will learn about basic aerodynamics and forces that act on aircraft in flight. This course will also introduce the main systems found on large and small airplanes and UAS. This course is the third course of eight courses over a four-year program to prepare students for careers in aviation.

Instructional Strategies, Learning Practices, Activities, and Experiences

Hands on Activities Lesson Objectives (Videos, Slide Shows) Digital Content	Formative Assessments Labs Group Projects	Online Resources Summative Assessments Engineering Projects

Assessments

Observation Discussions	Quizzes Exams	Unit Exams Projects

Materials/Resources

Next Generation Science Standards	All materials and resources are provided digitally via the AOPA curriculum; including lesson plans, activities, projects, and assessments	Various craft supplies and tools to complete hands-on activities

Adopted: 5/24/21
Revised:

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 1: Getting to Know Aircraft **Description:** Students will explore the types of aircraft operating in today's aviation environment, including traditional manned aircraft and remote piloted aircraft, or drones. They'll learn how the Federal Aviation Administration (FAA) categorizes aircraft and how to recognize aircraft of different types. Students will then investigate some of the factors affecting aircraft design, including how the aircraft will be used. This unit will give students a framework on which to build a deeper understanding of the variations in aircraft.	**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. - ETS1.A: Defining and Delimiting - ETS1.C: Optimizing the Design Solution **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. - ETS1.B: Developing Possible Solutions

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 2: How Aircraft are Made **Description:** Students will begin this unit by learning to identify the various parts of an aircraft, including the common and distinguishing features of airplanes, helicopters, unmanned aircraft, and some less common aircraft types. They will go on to look at aircraft construction with an emphasis on the materials used and the safety features of various aircraft types.	**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. - ETS1.A: Defining and Delimiting Engineering Problems - ETS1.B: Developing Possible Solutions **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. - ETS1.A: Defining and Delimiting Engineering Problems - ETS1.B: Developing Possible Solutions

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 3: Understanding Air **Description:** To understand flight, students must understand the medium in which aircraft operate. This unit will focus on the role air plays in flight, including its behavior as a fluid and the importance of air pressure. Students will also learn why the density of air is important, how it changes, and how to measure it. The concept of density altitude will be introduced.	**HS-PS2-1** – Analyze data to support the claim that Newton's second law of motion described the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. - PS1.A: Structure and Properties of Matter - PS2.A: Forces and Motion **HS-PS2-2** – Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. - PS2.A: Forces and Motion **HS-PS3-2** – Develop and use models to illustrate that energy at the macroscopic scale can be accounted for as a combination of energy associated with the motions of particles (objects) and energy associated with the relative position of particles (objects). - PS3.A: Definitions of Energy

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 4: Forces of Flight **Description:** This unit takes an in-depth look into the forces affecting aircraft in motion, including the four forces of flight—lift, weight, thrust, and drag. Students will start by gaining an understanding of how aircraft move above the surface of the Earth, including how the flight path is affected by forces such as wind. They will go on to explore how lift is produced, the role of airfoil design, how to calculate lift, and the meaning and significance of an aerodynamic stall. They will also learn how to determine weight and balance for an aircraft and how faulty weight and balance affect flight characteristics. Students will examine how the power developed by an aircraft engine is converted into thrust and how various types of drag affect aircraft performance.	**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. - ETS1.A: Defining and Delimiting Engineering Problems **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. - ETS1.B: Developing Possible Solutions **HS-ETS1-4** – Design a solution to a complex real-world problem by breaking it down into smaller, more manageable problems that can be solved through engineering. - ETS1.C: Optimizing the Design Solution **HS-PS2-1** – Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. - PS2.A: Forces and Motion - PS2.B: Types of Interactions **HS-PS2-2** – Use mathematical representations to support the claim that the total momentum of a system of objects is conserved when there is no net force on the system. - PS2.A: Forces and Motion - PS2.B: Types of Interactions **HS-PS2-3** – Apply scientific and engineering ideas to design, evaluate, and refine a device that minimizes the force on a macroscopic object during a collision. - PS2.A: Forces and Motion **HS-PS2-4** – Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. **HS-PS2-6** – Communicate scientific and technical information about why the molecular-level structure is important in the functioning of designed materials. - PS2.B1: Types of Interactions - Newton's law of universal gravitation and Coulomb's law provide the mathematical models to describe and predict the effects of gravitational and electrostatic forces between distant objects.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 5: Aircraft Stability and Control **Description:** In this unit, students will learn how aircraft are controlled and the role stability plays in aircraft performance. Students will first look at how stability, and instability, are designed into aircraft. They will also look at both primary and secondary flight controls and how they are used to manage pitch, roll, and yaw. Students will also explore flight controls for unmanned aircraft. Students will learn how an airplane turns during flight, with an emphasis on how airplanes make coordinated turns. The act of maneuvering an aircraft creates stresses that can affect the aircraft's performance and even its structural integrity. In this unit, students will also learn about the types of structural loads aircraft encounter during flight as well as the role of aircraft design in determining load limits. Finally, they will explore how the loads placed on an aircraft affect aerodynamic stalls and how flying in rough air can affect the loads on an aircraft.	**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. - ETS1.A: Defining and Delimiting Engineering Problems **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. - ETS1.B: Developing Possible Solutions **HS-ETS1-4** – Evaluate a solution to a complex real-world problem based on prioritized criteria and tradeoffs that account for a range of constraints, including cost, safety, reliability, and aesthetics as well as possible social, cultural, and environmental impacts. - ETS1.B: Developing Possible Solutions **HS-PS2-1** – Analyze data to support the claim that Newton's second law of motion describes the mathematical relationship among the net force on a macroscopic object, its mass, and its acceleration. - PS2.A: Forces in Motion - PS2.B: Types of Interactions - ETS1.A: Defining and Delimiting an Engineering Problem **HS-PS2-2** – Use mathematical representations to support the claim that total momentum of a system of objects is conserved when there is no net force on the system. - PS2.A: Forces and Motion - PS2.B: Types of Interactions **HS-PS2-4** – Use mathematical representations of Newton's Law of Gravitation and Coulomb's Law to describe and predict the gravitational and electrostatic forces between objects. - PS2.A: Forces and Motion - PS2.B: Types of Interactions

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 6: Career Skills **Description:** Students will continue planning for a career in aviation and aerospace. Students will work on practical skills for presenting themselves to potential employers, including developing an elevator speech, completing a job application, and developing a resume. Students will go on to learn what a career portfolio is, how it can be used to develop their career and prepare or revise their own personalized career portfolio.	**L.9-10.1** – Demonstrate command of the conventions of standard English grammar and usage when writing or speaking. **L.9-10.1A** – Use parallel structure. **L.9-10.1B** – Use various types of phrases (noun, verb, adjectival, adverbial, participial, prepositional, absolute) and clauses (independent, dependent; noun, relative, adverbial) to convey specific meanings and add variety and interest to writing or presentations. **SL.9-10.1C** – Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions. **SL.9-10.1D** – Respond thoughtfully to diverse perspectives, summarize points of agreement and disagreement, and, when warranted, qualify or justify their own views and understanding, and make new connections in light of the evidence and reasoning presented. **RST.9-10.2** – Determine the central ideas or conclusions of a text; trace the text's explanation or depiction of a complex process, phenomenon, or concept; provide an accurate summary of the text. **WHST.9-10.1D** – Establish and maintain a formal style and objective tone while attending to the norms and conventions of the discipline in which they are writing. **WHST.9-10.2** – Write informative/explanatory texts to examine and convey complex ideas, concepts, and information clearly and accurately through the effective selection, organization, and analysis of content. **WHST.9-10.2A** – Introduce a topic; organize complex ideas, concepts, and information to make important connections and distinctions; include formatting (e.g., headings), graphics (e.g., figures, tables), and multimedia when useful to aiding comprehension. **WHST.9-10.2C** – Use appropriate and varied transitions to link the major sections of the text, create cohesion, and clarify the relationships among the complex ideas and concepts.

CONTENT/KEY CONCEPTS	OBJECTIVES/STANDARDS
Unit 6: Career Skills (Cont'd)	**WHST.9-10.2D** – Use precise language and domain-specific vocabulary to manage the complexity of the topic. **WHST.9-10.4** – Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience. **WHST.9-10.5** – Develop and strengthen writing as needed by planning, revising, editing, rewriting, or trying a new approach, focusing on addressing what is most significant for a specific purpose and audience. **WHST.9-10.6**- Use technology, including the Internet to produce, publish, and update individual or shared writing products, taking advantage of technology's capacity to link other information and to display information flexibly and dynamically. **WHST.9-10.7** – Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation. **WHST.9-10.8** – Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation. **WHST.9-10.9** – Draw evidence from informational texts to support analysis, reflection, and research.