AOPA 11th Grade Aviation STEM Curriculum Standard Alignment

Overview: This course is foundational for both manned and unmanned aviation, and will prepare students to take either of two Federal Aviation Administration tests: the Private Pilot Knowledge Test or the Part 107 Remote Pilot Knowledge Test. Topics include: pre-flight procedures, airspace, radio communications, aviation phraseology, regulations, airport operations, aviation safety, weather, cockpit management, and emergency procedures.

The Flying Environment, Semester 1

Unit 1 Aviation Weather Theory

Description: What makes weather, and why does it matter to pilots? In this unit, students will examine the building blocks of weather. Early lessons will cover broad concepts, such as heat exchange, the role of atmospheric water, and the movement of air masses. Later lessons will focus on understanding specific weather phenomena, including clouds and fog, thunderstorms, and wind shear.

Next Generation Science Standards

Three-dimensional Learning

- **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.
  - Science and Engineering Practices
    - Asking Questions and Defining Problems
    - Constructing Explanations and Designing Solutions
  - Disciplinary Core Ideas
    - ETS1.A: Defining and Delimiting Engineering Problems
  - Crosscutting Concepts
    - None

- **HS-ESS2-3** - Develop a model based on evidence of Earth's interior to describe the cycling of matter by thermal convection.
  - Science and Engineering Practices
    - Developing and Using Models
  - Disciplinary Core Ideas
    - ESS2.A: Earth Materials and Systems
  - Crosscutting Concepts
    - Energy and Matter

Common Core State Standards

- **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.

- **RST.9-10.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.

• **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 to other information and to display information flexibly and dynamically.
• **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.
FAA Airman Certification Standards
Private Pilot
• **PA.I.C.K3** Meteorology applicable to the departure, en route, alternate, and destination under VFR in Visual Meteorological Conditions (VMC) to include expected climate and hazardous conditions such as: ○ **PA.I.C.K3a** a. Atmospheric composition and stability ○ **PA.I.C.K3b** b. Wind (e.g., crosswind, tailwind, wind shear, mountain wave, etc.) ○ **PA.I.C.K3c** c. Temperature ○ **PA.I.C.K3d** d. Moisture/precipitation ○ **PA.I.C.K3e** e. Weather system formation, including air masses and fronts ○ **PA.I.C.K3f** f. Clouds ○ **PA.I.C.K3g** g. Turbulence ○ **PA.I.C.K3h** h. Thunderstorms and microbursts ○ **PA.I.C.K3i** i. Icing and freezing level information ○ **PA.I.C.K3j** j. Fog ○ **PA.I.C.K3k** k. Frost
• **PA.I.C.R1** Factors involved in making the go/no-go and continue/divert decisions, to include: ○ **PA.I.C.R1a** a. Circumstances that would make diversion prudent ○ **PA.I.C.R1c** c. Hazardous weather conditions to include known or forecast icing or turbulence aloft ○ **PA.I.C.R2b** b. Aviation weather reports and forecasts
• **PA.I.C.S1** Use available aviation weather resources, obtain an adequate weather briefing, and correlate weather information to make a competent go/no-go decision.
• **PA.I.C.S2** Discuss the implications of at least three of the conditions listed in K3a through K3k above, using actual weather or weather conditions in a scenario provided by the evaluator.

Unit 2 Aviation Weather Services

Description: To fly safely, pilots must have good insight into the weather around them. Weather observations, forecasts, and charts are vital to a pilot's understanding of the weather both before takeoff and as a flight progresses. In this unit, students will learn about the sources of weather observations, including radiosondes, radar, satellites, and more. They'll also learn about various weather products and services available to pilots and how to interpret these essential tools to make good decisions about the viability of a proposed flight.

Next Generation Science Standards

Three-dimensional Learning

- **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.
  - Science and Engineering Practices
    - Asking Questions and Defining Problems
    - Constructing Explanations and Designing Solutions
  - Disciplinary Core Ideas
    - ETS1.A: Defining and Delimiting Engineering Problems
  - Crosscutting Concepts
    - None
- **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.
  - Science and Engineering Practices
    - Constructing Explanations and Designing Solutions
  - Disciplinary Core Ideas
    - ETS1.B: Developing Possible Solutions
  - Crosscutting Concepts
    - None

Common Core State Standards

- **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.
- **RST.9-10.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- **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 to other information and to display information flexibly and dynamically.
- **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.

FAA Airman Certification Standards

Private Pilot

- **PA.I.C.K1** - Acceptable sources of weather data for flight planning purposes.
- **PA.I.C.K2** - Weather products and resources required for preflight planning, current and forecast weather for departure, en route, and arrival phases of flight.
- **PA.I.C.R2** - Limitations of:
  - **PA.I.C.R2a** a. Onboard weather equipment
  - **PA.I.C.R2b** b. Aviation weather reports and forecasts
  - **PA.I.C.R2c** c. Inflight weather resources

Remote Pilot

- **UA.III.A.K1** Internet weather briefing and sources of weather available for flight planning purposes.
- **UA.III.A.K2** Aviation routine weather reports (METAR).
- **UA.III.A.K3** Terminal aerodrome forecasts (TAF).
- **UA.III.A.K4** Weather charts.
- **UA.III.A.K5** Automated surface observing systems (ASOS) and automated weather observing systems (AWOS).

Unit 3 Airport Operations

Description: Every flight begins and ends at an airport. To keep airports running smoothly and safely, pilots need to understand the “rules of the road.” Signs and pavement markings help pilots navigate the complex and sometimes busy world of the airport. Specialized lighting makes it easier to find your way at night. In this unit, students will learn the meaning and function of the many signs and markings used at airports.

Next Generation Science Standards

Three-dimensional Learning

- **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.
  - Science and Engineering Practices
    - Asking Questions and Defining Problems
    - Constructing Explanations and Designing Solutions
  - Disciplinary Core Ideas
    - ETS1.A: Defining and Delimiting Engineering Problems
  - Crosscutting Concepts
    - Systems and System Models

- **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.
    - Science and Engineering Practices
        - Constructing Explanations and Designing Solutions
    - Disciplinary Core Ideas
        - ETS1.B: Developing Possible Solutions
    - Crosscutting Concepts
        - Influence of Science, Engineering, and Technology on Society and the Natural World
- **HS-ETS1-4** - Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
    - Science and Engineering Practices
        - Using Mathematics and Computational Thinking
    - Disciplinary Core Ideas
        - ETS1.B: Developing Possible Solutions
    - Crosscutting Concepts
        - Systems and System Models

Common Core State Standards

- **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.
- **RST.9-10.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 9-10 texts and topics.
- **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 to other information and to display information flexibly and dynamically.
- **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.
- **RST.11-12.2** - Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
- **RST.11-12.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.
- **WHST.11-12.6** - Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
- **WHST.11-12.8** - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific

task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
• **WHST.11-12.9** - Draw evidence from informational texts to support analysis, reflection, and research.
FAA Airman Certification Standards
Private Pilot
• **PA.I.B.K1** General airworthiness requirements and compliance for airplanes, including   ○ **PA.I.B.K1a** Certificate location and expiration dates
• **PA.I.B.K3** Equipment requirements for day and night VFR flight.
• **PA.I.B.R1** Inoperative equipment discovered prior to flight.
• **PA.I.B.S1** Locate and describe airplane airworthiness and registration information
• **PA.I.B.S2** Determine the airplane is airworthy in a scenario given by the evaluator.
• **PA.I.B.S3** Apply appropriate procedures for operating with inoperative equipment in a scenario given by the evaluator.
• **PA.I.D.R5** Limitations of air traffic control (ATC) services.
• **PA.I.D.S2** Apply pertinent information from appropriate and current aeronautical charts, Chart Supplements; NOTAMs relative to airport, runway and taxiway closures; and other flight publications.
• **PA.I.F.K2** Factors affecting performance, to include: ○ **PA.I.F.K2d** d. Airport environment
• **PA.II.A.R3** Environment (e.g., weather, airports, airspace, terrain, obstacles).
• **PA.II.D.K1** Current airport aeronautical references and information resources including Chart Supplements, airport diagram, and appropriate references.
• **PA.II.D.K2** Taxi instructions/clearances.
• **PA.II.D.K3** Airport markings, signs, and lights.
• **PA.II.D.K6** Procedures for: ○ **PA.II.D.K6b** b. Radio communications at towered and non-towered airports
• **PA.II.E.K1** Airport information resources including Chart Supplements, airport diagram, and appropriate references.
• **PA.III.A.K1** How to obtain proper radio frequencies.
• **PA.III.A.K2** Proper radio communication procedures and ATC phraseology.
• **PA.III.A.K3** ATC light signal recognition.
• **PA.III.A.K4** Appropriate use of transponders.
• **PA.III.A.K5** Lost communication procedures.
• **PA.III.A.K6** Equipment issues that could cause loss of communication.
• **PA.III.A.K7** Radar assistance.
• **PA.III.A.K9** Runway Status Lighting Systems.

• **PA.III.A.R1** Poor communication.
• **PA.III.A.R2** Failure to recognize and declare an emergency.
• **PA.III.A.R3** Confirmation or expectation bias.
• **PA.III.A.S1** Select appropriate frequencies.
• **PA.III.A.S2** Transmit using phraseology and procedures as specified in the AIM.
• **PA.III.A.S3** Acknowledge radio communications and comply with instructions.
• **PA.III.B.K1** Towered and nontowered airport operations.
• **PA.III.B.K2** Runway selection for the current conditions.
• **PA.III.B.K3** Right-of-way rules.
• **PA.III.B.K4** Use of automated weather and airport information.
• **PA.III.B.R1** Collision hazards, to include aircraft, terrain, and wires.
• **PA.III.B.R2** Distractions, loss of situational awareness, and/or improper task management.
PA.III.B.S1 Identify and interpret airport/seaplane base runways, taxiways, markings, signs, and lighting.
• **PA.IV.A.R2d** Wake turbulence (Task A. Normal Takeoff and Climb)
• **PA.IV.A.S6** Clear the area; taxi into the takeoff position and align the airplane on the runway centerline.
• **PA.IV.B.R2d** Wake turbulence (Task B. Normal Approach and Landing).
• **PA.IV.C.R2d** Wake turbulence (Task C. Soft-Field Takeoff and Climb Approach and Landing)
• **PA.IV.D.R2d** Wake turbulence (Task D. Soft-Field Approach and Landing)
• **PA.IV.E.R2d** Wake turbulence (Task E. Short-Field Takeoff and Maximum Performance Climb (ASEL, AMEL))
• **PA.IV.F.R2d** Wake turbulence (Task F. Short-Field Approach and Landing (ASEL, AMEL))
• **PA.IV.M.R2d** Wake turbulence (Task M. Forward Slip to a Landing (ASEL, ASES))
• **PA.V.B.K4** Relationship of rectangular course to airport traffic pattern.
Remote Pilot
• **UA.II.B.K1** Basic weather minimums.
• **UA.II.B.K2** ATC authorizations and related operating limitations.
• **UA.II.B.K3** Operations near airports.
• **UA.II.B.K4** Potential flight hazards. ○ **UA.II.B.K4a** Common aircraft accident causal factors
• **UA.II.B.K5** The NOTAM system including how to obtain an established NOTAM through Flight Service.
• **UA.V.A.K1** Airport operations with and without an operating control tower.
• **UA.V.A.K2** The description and use of a Common Traffic Advisory Frequency (CTAF) to monitor manned aircraft communications.
• **UA.V.A.K3** Recommended traffic advisory procedures used by manned aircraft pilots, such as self-announcing of position and intentions.

• **UA.V.A.K4** Aeronautical advisory communications station (UNICOM) and associated communication procedures used by manned aircraft pilots.
• **UA.V.A.K5** Automatic Terminal Information Service (ATIS).
• **UA.V.A.K6** Aircraft call signs and registration numbers.
• **UA.V.A.K7** The phonetic alphabet.
• **UA.V.A.K8** Phraseology: altitudes, directions, speed, and time.
• **UA.V.B.K4** Traffic patterns used by manned aircraft pilots.

• **UA.V.B.K6** Sources for airport data:
  ○ **UA.V.B.K6a** a. Aeronautical charts
  ○ **UA.V.B.K6b** b. Chart Supplements

Unit 4 Introduction to Aeronautical Charts and Airspace

Description: A good flight starts with a good plan, and the first thing a pilot may turn to is a map. In aviation, the maps are known as aeronautical charts, and they provide a wealth of information for pilots. Knowing how to read the charts is critical for any pilot, and this unit provides an introduction to the main features of the charts as well as an introduction to the National Airspace System which governs where and under what circumstances drone and manned pilots may fly their aircraft.

Common Core State Standards

• **RST.11-12.2** - Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
• **RST.11-12.4** - Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to *grades 11-12 texts and topics*.
• **WHST.11-12.6** - Use technology, including the Internet, to produce, publish, and update individual or shared writing products in response to ongoing feedback, including new arguments or information.
• **WHST.11-12.8** - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the strengths and limitations of each source in terms of the specific task, purpose, and audience; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and overreliance on any one source and following a standard format for citation.
• **WHST.11-12.9** - Draw evidence from informational texts to support analysis, reflection, and research.

FAA Airman Certification Standards

Private Pilot

• **PA.I.D.K1** Route planning, including consideration of different classes and special use airspace (SUA) and selection of appropriate and available navigation/communication systems and facilities.

• **PA.I.D.K2** Altitude selection accounting for terrain and obstacles, glide distance of the airplane, VFR cruising altitudes, and the effect of wind.
• **PA.I.D.S1** Prepare, present, and explain a cross-country flight plan assigned by the evaluator including a risk analysis based on real-time weather, to the first fuel stop.
• **PA.I.D.S2** Apply pertinent information from appropriate and current aeronautical charts, Chart Supplements; NOTAMs relative to airport, runway and taxiway closures; and other flight publications.
• **PA.I.E.K1** Types of airspace/airspace classes and associated requirements and limitations.
• **PA.I.E.K2** Charting symbology.
• **PA.I.E.K3** Special use airspace (SUA), special flight rules areas (SFRA), temporary flight restrictions (TFR), and other airspace areas.
• **PA.I.E.R1** Various classes and types of airspace.
• **PA.I.E.S1** Explain the requirements for basic VFR weather minimums and flying in particular classes of airspace.
• **PA.I.E.S2** Correctly identify airspace and operate in accordance with associated communication and equipment requirements.
• **PA.I.E.S3** Explain the requirements for operating in SUA or within a TFR. Explain SATR (special air traffic rules) and SFRA operations, if applicable.
• **PA.VI.A.K1** Pilotage and dead reckoning.
• **PA.VI.A.K2** Magnetic compass errors.
• **PA.VI.A.K3** Topography.

• **PA.VI.A.K4** Selection of appropriate:
  ○ **PA.VI.A.K4a** Route
  ○ **PA.VI.A.K4b** Altitude(s)
  ○ **PA.VI.A.K4c** Checkpoints

• **PA.VI.A.R1** Collision hazards, to include aircraft, terrain, obstacles, and wires.
• **PA.XI.A.K5** Night orientation, navigation, and chart reading techniques.
• **PA.XI.A.R1** Collision hazards, to include aircraft, terrain, obstacles, and wires.
Remote Pilot

• **UA.II.A.K1** General airspace
  ○ **UA.II.A.K1a** Class B controlled airspace
  ○ **UA.II.A.K1b** Class C controlled airspace
  ○ **UA.II.A.K1c** Class D controlled airspace
  ○ **UA.II.A.K1d** Class E controlled airspace
  ○ **UA.II.A.K1e** Class G uncontrolled airspace

• **UA.II.A.K2** Special-use airspace, such as prohibited, restricted, warning areas, military operation areas, alert areas, and controlled firing areas.

• **UA.II.A.K3** Other airspace areas, such as Airport Advisory Services, Military Training Routes (MTRs), Temporary Flight Restrictions (TFRs), Parachute Jump Operations, Terminal Radar Service Areas (TRSAs), National Security Areas (NSA) and Visual Flight Rules (VFR) routes.
• **UA.II.A.K4** Air Traffic Control (ATC) and the NAS.
• **UA.V.B.K1** Types of airports, such as towered, uncontrolled towered, heliport, and seaplane bases.
• **UA.V.B.K2** ATC towers, such as ensuring the remote pilot can monitor and interpret ATC communications to improve situational awareness.
• **UA.V.B.K4** Traffic patterns used by manned aircraft pilots.
• **UA.V.B.K6** Sources for airport data: ○ **UA.V.B.K6a** a. Aeronautical charts ○ **UA.V.B.K6b** b. Chart Supplements

Unit 5 Post-Course Exam Review

Description: After a semester full of weather, airport operations, and navigation, it's time to review for the Post-Course Exam. In this unit, students become the teachers as they select topics to review from weather theory to types of airspace, plan review activities, and present their lessons or activities to their classmates.

Common Core State Standards

• **CCSS.ELA-LITERACY.RST.11-12.2 -** Determine the central ideas or conclusions of a text; summarize complex concepts, processes, or information presented in a text by paraphrasing them in simpler but still accurate terms.
• **CCSS.ELA-LITERACY.RST.11-12.4 -** Determine the meaning of symbols, key terms, and other domain-specific words and phrases as they are used in a specific scientific or technical context relevant to grades 11-12 texts and topics.
• **CCSS.ELA-LITERACY.RST.11-12.7 -** Integrate and evaluate multiple sources of information presented in diverse formats and media (e.g., quantitative data, video, multimedia) in order to address a question or solve a problem.
• **CCSS.ELA-LITERACY.RST.11-12.9 -** Synthesize information from a range of sources (e.g., texts, experiments, simulations) into a coherent understanding of a process, phenomenon, or concept, resolving conflicting information when possible.
• **CCSS.ELA-LITERACY.SL.11-12.1 -** Initiate and participate effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grades 11-12 topics, texts, and issues, building on others' ideas and expressing their own clearly and persuasively.
• **CCSS.ELA-LITERACY.SL.11-12.1.B -** Work with peers to promote civil, democratic discussions and decision-making, set clear goals and deadlines, and establish individual roles as needed.
• **CCSS.ELA-LITERACY.SL.11-12.1.C -** Propel conversations by posing and responding to questions that probe reasoning and evidence; ensure a hearing for a full range of positions on a topic or issue; clarify, verify, or challenge ideas and conclusions; and promote divergent and creative perspectives.
• **CCSS.ELA-LITERACY.SL.11-12.2 -** Integrate multiple sources of information presented in diverse formats and media (e.g., visually, quantitatively, orally) in order to make informed decisions and solve problems, evaluating the credibility and accuracy of each source and noting any discrepancies among the data.

• **CCSS.ELA-LITERACY.SL.11-12.4 -** Present information, findings, and supporting evidence, conveying a clear and distinct perspective, such that listeners can follow the line of reasoning, alternative or opposing perspectives are addressed, and the organization, development, substance, and style are appropriate to purpose, audience, and a range of formal and informal tasks.
• **CCSS.ELA-LITERACY.SL.11-12.5 -** Make strategic use of digital media (e.g., textual, graphical, audio, visual, and interactive elements) in presentations to enhance understanding of findings, reasoning, and evidence and to add interest.
• **CCSS.ELA-LITERACY.SL.11-12.6 -** Adapt speech to a variety of contexts and tasks, demonstrating a command of formal English when indicated or appropriate. (See grades 11-12 Language standards 1 and 3 here for specific expectations.)