Advanced Aeronautical Charts

Session Time: Two, 50-minute sessions

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

Comprehensive preflight planning is an integral (and regulatory) component of safety for all flights.

A wide range of resources is required when planning a flight.

Planning a safe and successful flight involves compliance with applicable Federal Aviation Regulations and guidance from the Aeronautical Information Manual.

ESSENTIAL QUESTIONS

1. What details on an aeronautical chart will allow a pilot to navigate by reference to objects on the ground?

LEARNING GOALS

Students Will Know

- The meaning of aeronautical chart symbols, including navigation facilities and uncommon symbols.
- How to interpret rules for flight in specially designated areas depicted on some terminal area charts.

Students Will Be Able To

- *Identify* different aeronautical chart symbols and what they mean. [DOK-L1]
- *Evaluate* a prescribed route of flight to determine appropriate landmarks. [DOK-L3]

ASSESSMENT EVIDENCE

Warm-up
In pairs, students will examine a VFR sectional chart and identify symbology as a refresher from prior lessons. This will lead to the lesson discussion about what these symbols look like from the air and how they are used to navigate.

Formative Assessment
In two teams, the class will attempt to quickly identify chart symbology, identify the source for the symbol's definition, and understand the application of that symbol to pilot navigation.

Summative Assessment
Working individually, students will analyze a provided flight route around the New York City area for landmarks and other references that could be seen and used by the pilot during flight. Students will then determine if there are any potential issues with the route and if they would have planned it differently.

LESSON PREPARATION

MATERIALS/RESOURCES

- Advanced Aeronautical Charts Presentation
- Advanced Aeronautical Charts Student Activity 1
- Advanced Aeronautical Charts Student Activity 2
- Advanced Aeronautical Charts Student Activity 3
- Advanced Aeronautical Charts Student Activity 4
- Advanced Aeronautical Charts Teacher Notes 1
- Advanced Aeronautical Charts Teacher Notes 2
- Advanced Aeronautical Charts Teacher Notes 3
- Advanced Aeronautical Charts Teacher Notes 4
- **Internet-capable device (per student) or classroom overhead display with internet access**
- **Sporty's Sectional Training Chart: VFR sectional chart Segment + Legend**
- **FAA Aeronautical Chart User's Guide**
  https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/aero_guide/media/editions/cug-complete.pdf

LESSON SUMMARY

Lesson 1: Advanced Aeronautical Charts
Lesson 2: Latitude, Longitude, and Time

The lesson will begin with students refreshing their knowledge of VFR sectional chart symbology learned in prior lessons. Students will then learn about pilotage, review what landmarks and other references represented by symbols look like from the air, and apply the use of those symbols to the creation and navigation of flight routes. At the end of this first session, students will review all classes of airspace including special-use airspace (SUA).

The next session will begin with a formative assessment in which students will check their understanding of information presented to date. Students will then review terminal area charts and the complexities of special flight rule areas (SFRAs), using New York City as an example.

Finally, students will review relevant Private Pilot Knowledge Test questions and complete a summative assessment in which they will analyze a proposed flight route based on their knowledge of symbols, pilotage, and airspace.

BACKGROUND

Pilots plan flight routes using VFR sectional charts, and they fly those routes with the charts as a reference as they look out the window and navigate to their destination. This is possible because the symbology and shapes on the charts very closely resemble the real world. Thus, using the charts, pilots are able to identify points on the ground and determine their actual location, as well as their location in reference to other areas of significance like restricted airspace or flight hazards.

As pilots fly closer to higher-density areas, like some major cities, they can use terminal area charts that zoom in and provide greater detail. Finally, there are portions of the United States where unique circumstances require different rules than normal. Examples include the national security flight restrictions around Washington DC and the special rules in effect in high traffic density and popular flight areas like the Hudson River in New York City. Flight in these areas is not prohibited, but pilots do have to be aware of and follow very specific rules in those areas.

The wide variety of rules, restrictions, chart symbols, and airspace configurations can seem daunting, but pilots properly prepare in their preflight planning by reviewing their flight route, researching any unique issues, and altering their route if necessary. Only once they are satisfied that they are fully prepared do they take off and fly the route in accordance with their preparation and all FAA regulations.

MISCONCEPTIONS

Pilots don't just hop into a plane and go flying. Rather, the safest and most effective flight is one that is well-planned. In their flight planning, pilots use specially-designed charts to carefully plan a flight route to their destination. The features on these charts are designed to reflect the real world, making them an invaluable tool for pilots as they navigate by reference to landmarks and other features on the ground.

Pilots can't just fly at whatever altitude they want. Charts give pilots information about elevation, hazards, obstructions, airspace restrictions, and geographic features that help them best plan not only the route but also the altitude they need to fly to complete a flight safely.

DIFFERENTIATION

To promote deeper understanding and clarification to struggling learners in the EXPLORE, EXPLAIN, and EXTEND sections of the lesson plan, consider incorporating the following additional learning activities:

- Watching instructional videos about aeronautical charts
- Creating personal Quizlets to practice terms and/or symbols that are challenging to recall
- Drawing an area of a sectional chart depicting a fictional location
- Identifying landmarks using a sectional chart and satellite view of the same area
- Ensuring fluency with www.skyvector.com
- Engaging in the obscure chart symbols challenges on this web page: https://www.boldmethod.com/blog/quizzes/2018/11/six-vfr-chart-symbols-that-are-rare-do-you-know-them/ and this web page: https://www.boldmethod.com/blog/quizzes/2019/09/six-strange-vfr-sectional-chart-symbols-do-you-know-them/
- Furthermore, be sure to provide a link and awareness to the typical sectional chart legend as well as the full Chart Users Guide: https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/aero_guide/media/editions/cug-complete.pdf
- To promote student engagement and participation during the EXPLAIN section of the lesson plan, have students perform a think-pair-share activity before answering questions as a whole class. This will give students an opportunity to share their thoughts and confirm understanding before the answers are revealed to the class as a whole.

LEARNING PLAN

ENGAGE

Teacher Materials: Advanced Aeronautical Charts Presentation, Advanced Aeronautical Charts Teacher Notes 1
Student Materials: Advanced Aeronautical Charts Student Activity 1, **Sporty's Sectional Training Chart: VFR sectional chart Segment + Legend, FAA Aeronautical Chart User's Guide**

Session 1

Slides 1-3: Introduce the topic and learning objectives of the lesson.

Slide 4: Conduct the **Warm-Up**.

Warm-Up

Students need to recall common aeronautical chart symbols that they saw in previous lessons, which will prepare them to analyze route planning on sectional charts. The slide contains an excerpt of the Memphis Sectional.

Have the students look at the area around Memphis and identify the difference between Memphis International Airport (MEM), which is printed in blue, and West Memphis Airport (AWM), just to the northwest of Memphis, which is printed in magenta. Ask

Why are MEM and AWM different colors?

According to the chart legend, blue airports have control towers, while magenta airports do not.

Divide the students into pairs. Distribute and have the students complete **Advanced Aeronautical Charts Student Activity 1**. Sample responses are available in **Advanced Aeronautical Charts Teacher Notes 1**.

[DOK-L1; *recall*]

Teaching Tips

If the Sporty's Sectional Training Chart is not available, download digital copies of the sectional charts from the FAA or use SkyVector. All activities in this lesson can be accomplished with any of the three chart sources. However, there are a few questions that refer to material in the margins of full charts which are not present on the Sporty's product. Finally, to complete the final "Going Further," students will require a copy of the New York TAC and SFRA, which can be accessed from SkyVector or the FAA website.

To use SkyVector:

1. Go to www.skyvector.com.
2. On the upper-left part of the screen, click on the globe icon (labeled "Charts")
3. Click in the rectangle for Memphis (Memphis will appear as a label when you are in the correct box)
4. Near the upper-right of the screen, click the word "Layers"
5. With the layers pop-up window open, UNCHECK the boxes for "Text Weather," "Temporary Flight Restrictions," and "SIGMETs."
6. Now the map appears as a normal sectional chart. Remind students that if they zoom out to see the entire chart, the legend and other data in the margins will be available.
7. Center the map near Memphis, TN, and accomplish the lesson material.

To download charts from FAA.gov:

1. Go to https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/vfr/.
2. Scroll down to the desired chart ("Memphis") and click on the PDF option.
3. These files are very large and may take time to download or refresh on some computers or internet connections.

Teachers and students should consider downloading the sectional chart (and any terminal area charts near) where their school is located. This will allow students to work with a familiar area when planning trips in later lessons.

While the digital charts are useful, it would be helpful to purchase a class set of paper sectional charts that cover the area where your school is located. If a terminal area chart is indicated on the sectional you choose, ordering a class set of those would be helpful as well.

EXPLORE

Teacher Materials: Advanced Aeronautical Charts Presentation, Advanced Aeronautical Charts Teacher Notes 2
Student Materials: Advanced Aeronautical Charts Student Activity 2, **Sporty's Sectional Training Chart: VFR sectional chart Segment + Legend**

Slide 5: The FAA Pilot Handbook of Aeronautical Knowledge defines "pilotage" as navigation by reference to landmarks or checkpoints on the ground. It is navigation from one visually identifiable point to the next one. Importantly, this does not mean pilots look down from their airplanes and follow along the ground. Rather, they look *forward* to see what references they can see out in front of the airplane, and they fly to that reference point. From there, they look forward to their next landmark, and continue along that path. The FAA has designed VFR sectional charts to aid in pilotage by creating the sectionals to closely reflect the real-life appearance of the terrain and objects on the ground as viewed from the air. In general, the curves of a road on the map will match the curves the pilot sees when they look out the window at the road. Pilots can look out the aircraft window at a lake and find a similarly-shaped lake on the sectional—assuming no recent significant weather events like storms, floods, or droughts have caused temporary changes to the landscape.

To give students the opportunity to practice choosing VFR reference points that pilots might be able to use for VFR navigation, divide the students into groups of four to five and distribute **Advanced Aeronautical Charts Student Activity 2**. Sample responses are available on **Advanced Aeronautical Charts Teacher Notes 2**. As the students complete the routes in the activity, if time permits, consider having one or two groups share their analysis with the class so other groups can compare their ideas.

EXPLAIN

Teacher Material: Advanced Aeronautical Charts Presentation
Student Materials: Sporty's Sectional Training Chart: VFR sectional chart Segment + Legend, FAA Aeronautical Chart User's Guide

Slide 6: There are a variety of cultural features which can make excellent landmarks for pilotage. Landmarks like those we've been finding are known as waypoints: "points along the way." When flying, pilots should use some of these landmarks as waypoints to fly to for navigation; others should be used as waypoints to avoid.

As discussed previously, the representation of the sectional assumes no significant weather events have caused temporary changes to the landscape. For example, sectionals have a distinct symbol for non-perennial lakes—that is, those that don't always have water in them. The unique symbology lets pilots know there may not be a "lake" where they expect one!

Interstates, railways, and power lines are useful navigation aids, particularly because they generally move from one cultural center to another (often where pilots or passengers are going). However, flying along a road is not always efficient, because it is not always the shortest distance between two points. Also, because navigating along a road can be convenient, pilots must watch for other pilots who may have decided to do the same thing!

Sometimes, there are no useful landmarks along the shortest route to the destination. It may be necessary to follow a less-direct route in order to maintain navigational awareness.

Slide 7: Interstates, railways, and power lines are generally easy to see from the air if the pilot is looking along the path of the road, rail line, or power line. This is particularly true for high tension power lines that cut through forested areas. However, when approaching them perpendicularly, these landmarks can be difficult to see until the pilot is almost on top of them. When approaching an interstate at a perpendicular angle, it is often easier to see the commercial truck traffic moving across the highway than it is to see the road itself.

The slide contains an image looking along a power line through a forest, as well as a second image showing what the symbols for roads, power lines, and railways look like on the sectional.

Slide 8: Mines or rock quarries and outdoor theaters can also make effective VFR navigation points because of their unique appearance and visibility from the air. The image on the right side of the slide shows the symbol for a mine. The pair of images at the bottom of the slide shows the sectional representation of a drive-in movie theater and then a satellite view of that same theater.

Slide 9: Race tracks often stand out as visible landmarks due to their unique construction, not unlike sports stadiums. However, like sports arenas, there are often temporary flight restrictions (TFRs) in effect when larger race tracks host events. Pilots must be aware of the restrictions associated with these landmarks if they intend to use them for navigation.

The bottom pair of images shows a small race track in Pennsylvania on the chart and on a satellite view. The smaller track is displayed as an oval on the chart. The right pair of images shows Kansas City Speedway, a major race track, which is depicted on the sectional with the diamond—just like a sports stadium—instead of the oval due to its larger size. Just like a sports stadium, these tracks often have TFRs during race events.

Slide 10: Power plants can also make effective navigation points. The smokestacks or cooling towers are often prominent features, and the steam from the plants can rise and make them visible for many miles. Notably, however, the FAA has strongly advised pilots to avoid circling or loitering around power plants due to national security concerns.

The full text of the FAA NOTAM with this advisory can be found at https://notams.aim.faa.gov/ and reads as follows [emphasis added]:

FDC NOTAM #6/8818, issued 03/23/2016, permanent

!FDC 6/8818 FDC ...SPECIAL NOTICE...IN THE INTEREST OF NATIONAL SECURITY AND TO THE EXTENT PRACTICABLE, **PILOTS AND UAS OPERATORS ARE STRONGLY ADVISED TO AVOID THE AIRSPACE ABOVE OR IN CLOSE PROXIMITY** TO CRITICAL INFRASTRUCTURE AND OTHER SENSITIVE LOCATIONS SUCH AS **POWER PLANTS (NUCLEAR, HYDRO-ELECTRIC, OR COAL), DAMS, REFINERIES, INDUSTRIAL COMPLEXES, MILITARY FACILITIES, CORRECTIONAL AND LAW ENFORCEMENT FACILITIES** UNLESS OTHERWISE AUTHORIZED. PILOTS AND UAS OPERATORS **SHOULD NOT CIRCLE AS TO LOITER IN THE VICINITY OVER THESE TYPES OF FACILITIES**.

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Slide 11: Space launch areas (Mojave, California, is in the image in the upper-right corner) may or may not have visible features making them useful for navigation. However, not unlike the symbol for glider activity, the space launch symbol should alert pilots to be aware of the activity and potential NOTAMs or TFRs that may impact their navigation.

Other areas along the ground may influence or potentially have an adverse impact on a pilot's navigation. Areas of "intense radiation" like the solar farm northwest of KTPH (middle image) should probably be avoided due to the intense glare. Tethered balloons (southwest of KDMN, bottom-right image) should be avoided because their tethers are often not visible.

Other symbols are somewhat more rare. For example, L06 (bottom left image) is an airport that is below sea level and has a "minus" field elevation. There's an "objectionable airport" a few miles northwest of C89 (bottom-center image). ("objectionable" often means it's a private airport that's very close to an active airport, which results in conflicting airspace.)

Slides 12-13: Then there are unique airports like Sky Harbor Regional Airport (KDYT), in Duluth, Minnesota.

Questions

Why does KDYT have two lines for the runway in its data block? Encourage students to look both at the Sectional and the Chart Supplement to gather information for their response.

KDYT has two very different runways: one traditional hard surface, and one waterway for seaplanes. The second line in the data block is for the waterway. Note also there is a "dash" where the lighting information would be, since there is no lighting on water.

Slide 14: VORs are displayed with a VOR symbol. VORs are ground-based navigational aids which will be detailed in future lessons about radio navigation. On the sectional, the VORs are surrounded by a compass rose oriented to magnetic north—which is different than true north by the amount of magnetic variation in the vicinity. The compass rose has degree markings labeled every 30 degrees around the circle.

VORs are labeled with a data box that contains the name, identifier, frequency, and visual depiction of the Morse code identifier for that VOR. Pilots can tune to this frequency using a navigation radio in the aircraft, and use the VOR signal to fly a selected course.

If a VOR is located on an airfield, then the VOR symbol is replaced with a white dot indicating the relative location of the VOR on the airfield.

Slide 15: Also depicted on sectional charts are military training routes, which are designated IFR military training routes (IR) and VFR military training routes (VR). They are represented by gray shaded lines and are marked IR and VR. There are no restrictions on general aviation pilots crossing or flying along those routes, but pilots should be cognizant of the potential for high-speed, low-altitude military training traffic in those areas. Flight service is a good source to determine whether military training routes are active, and air traffic control is a good source for traffic information if the routes are being used.

Similarly, blue-shaded lines indicate federal airways known as Victor airways because they are based on VOR signals. Victor airways stretch four miles on either side of the centerline, making them eight nautical miles wide. They normally start 1,200 feet AGL and extend up to but do not include 18,000 feet MSL. They originate at VORs and cross at intersections, which are also labeled on sectionals. The VOR-to-VOR distance along a Victor airway is depicted in a box directly above or below the Victor airway identifier.

Slide 16: Airspace has been discussed in previous lessons and is displayed throughout the sectional. Ask the following questions about the airspaces shown on the slide.

Questions

What airspace goes from the surface to 1,200 AGL at 2A6?

Class G

Why is there a faded magenta ring around 6M7?

Indicates Class E starts at 700 ft AGL instead of 1,200 ft AGL

A blue dashed line around an airport like KNQA indicates which airspace?

Class D

Slides 17-21: As a review, call on students to answer the question below and fill in the table on the slides. After students complete each airspace class, advance the slide to display the correct answer(s) for that class. The table fills in each class of airspace as the slides advance.

Questions

What are the communication and weather requirements for Class B, Class C, Class D, Class E, & Class G airspace?

Class B: *Must receive explicit permission to enter—a clearance is required. Minimum VFR weather: 3 statute miles (SM) visibility, remain clear of clouds*

Class C and D: *Must establish two-way radio communication to enter. Minimum VFR weather: 3 SM visibility, remain 500 ft below, 1,000 ft above, and 2,000 ft horizontally away from clouds.*

Class E: *No radio required. Below 10,000 ft MSL, same VFR weather minima as Class C and D. At or above 10,000 ft MSL, weather minima grow to 5 SM visibility, remain 1,000 ft below, 1,000 ft above, and 1 SM horizontally away from clouds.*

Class G: *No radio required. Minimum VFR weather is dependent on altitude and day/night:*

Below 1,200 ft AGL, day: 1 SM, remain clear of clouds
Below 1,200 ft AGL, night: same as C, D, and E

1,200 ft AGL to 10,000 MSL, day: 1 SM, 1,000 ft above, 500 ft below, 2,000 ft horizontal
1,200 ft AGL to 10,000 MSL, night: 3 SM, 1,000 ft above, 500 ft below, 2,000 ft horizontal

Above 10,000 MSL: 5 SM, 1,000 ft above, 1,000 ft below, 1 SM horizontal

Slides 22-23: VFR sectional charts also display special use airspace, which is generally identified by different border markings. The FAA Aeronautical Chart User's Guide has a full list of the special use airspace markings. Slide 23 shows the airspace table as the answer to the third question on the slide.

Questions

What types of SUA can you recall?

In the images on slide 22, the left image is a restricted area. The center image is a military operations area; however, the markings are the same for an alert area, so students may identify it as such. The right image is a national security area.

Students may give various answers. SUA was explored in Grade 11, Semester 1, Unit 4, Section A, Lesson 2.

Prohibited areas, restricted areas, military operations areas, warning areas, alert areas, air defense identification zones, special flight rules areas, national security areas, and controlled firing areas are all potential answers.

How is it marked?

Colored border with hashed lines

Can you fly through Special Use Airspace (SUA)?

It depends on the restrictions associated with the type of airspace and its current status.

Where would you find more information on the SUA on a sectional?

Sectionals have a table on the margin listing all SUAs and associated data, including the frequencies used.

Session 2

Slides 24-36: Complete the **Formative Assessment**.

Formative Assessment

Divide the class in half to create two teams. Each of the following slide pairs shows one symbol. As the first slide in a pair appears, each team will attempt to be the first to identify the VFR sectional chart symbol's meaning, as well as consider how the feature might impact flight planning. Other options include creating smaller teams, having teams take turns responding, or holding a class discussion for each slide.

For example, for the Chart Challenge 2 slide, the 4,200 foot runway length may be too short a runway to use for landing or takeoff depending on the pilot's aircraft or density altitude. Students may also state that a runway that long would be a prominent landmark. On the Chart Challenge 4 slide, the Class E extension indicated by the arrow may have no impact on flight planning.

Correct responses are provided in the second slide of each slide pair.

[DOK-L2; *identify*]

Slide 37: Terminal area charts (TACs) were covered in previous lessons last semester. Students should recall that the FAA publishes 30 TACs covering some of the busiest airspace in the United States. The scale is twice that of sectionals, which allows pilots to see greater detail in congested and populous areas.

TACs are available electronically from the FAA (https://www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/vfrcharts/terminalarea/) and on websites like SkyVector (www.skyvector.com). Paper charts are available at some pilot shops online and at airports.

The back of some TACs contain diagrams for special flight rules areas (SFRAs). SFRAs are places where there are requirements and procedures unique to that area. These areas are defined specifically in Title 14, Part 93 of the Code of Federal Regulations. Also called "Part 93 airspace," these areas include Washington DC, the Grand Canyon, LA, New York, and some others.

Slides 38-39: As an example, the Hudson River corridor on the back of the New York City TAC is one SFRA.

The slide contains an image of the corridor on the NYC TAC. However, it is most effective to view the SFRA either on SkyVector or on a paper chart. Slide 39 contains an excerpt of only the north half of the SFRA for reference if other resources are not available.

Teaching Tips

Using SkyVector, enter KJFK in the search box at the top left of the screen to center the chart in the New York area. On the top right of the screen, click the button for "New York TAC". Center the chart over the Hudson River, and a "NY SFRA" button will appear near the "New York TAC" button. Select the NY SFRA, and the back of the TAC will appear.

Zooming in to see the Hudson River clearly will help you to position the river under the small crosshairs at the center of the SkyVector window.

If you download a digital New York City TAC from the FAA, the SFRA appears as page 2.

Note that only a specific portion of the chart is the SFRA, as indicated by the blocked line border. The text area of the chart defines the boundaries of the SFRA and outlines required operation practices and communications procedures for aircraft operating within the SFRA. The SFRA procedures dictate a specific traffic flow, which is indicated by arrows. Illustrations of prominent landmarks are provided with names and mandatory reporting points. Some symbols are the same as those on sectionals, like the magenta diamond indicating a stadium (south of KTEB), the blue dashed line indicating KTEB's Class D, and the solid blue lines indicating the Class B airspace. The areas around Newark (KEWR) and LaGuardia (KLGA) are gray to highlight the Class B airspace beginning at the surface around those airports, and they are not part of the SFRA.

Each SFRA is unique and must be studied prior to flying in that area. Some SFRAs (like the one surrounding Washington DC) require pilots to log special training prior to flying in the airspace. While the complexity of SFRAs may seem intimidating, flights within them can be rewarding. For example, the New York SFRA allows pilots to fly and sightsee along the New York City skyline.

Slide 40: FAA regulations do not currently require general aviation pilots to carry aeronautical charts aboard the aircraft. Though not required, it is strongly recommended that all pilots carry current VFR charts due to their contributions to increasing pilot awareness and flight safety. Many pilots now fly with electronic versions of the charts, which may make it easier to ensure the pilot has access to a chart in the aircraft.

Slide 41: It is also important to make sure the charts are current so the pilot has the most accurate information possible. Fixed objects like towers and roads do not change often, though new towers are being built and other changes do occur. As a result, sectional charts are generally reprinted every six months. Significant changes that occur between chart publications are reflected either in NOTAMs or every 56 days in the Chart Supplement section titled "Aeronautical Chart Bulletin."

Many aviators are now transitioning to digital products and use electronic flight bags (EFBs) rather than paper charts. However, the FAA produces and updates the digital and paper charts at the same rate and on the same cycle, so there are no instant updates even to digital products. Even the digital charts on SkyVector are static until the FAA publishes the next scheduled update. Pilots are responsible for ensuring their charts, paper or electronic, are up-to-date.

EXTEND

Teacher Materials: Advanced Aeronautical Charts Presentation, Advanced Aeronautical Charts Teacher Notes 3
Student Materials: Advanced Aeronautical Charts Student Activity 3, **Sporty's Sectional Training Chart: VFR Sectional Chart Segment + Legend**

Slide 42: Students will have the opportunity to apply their knowledge of VFR sectional charts, symbology, and appropriate reference points. Divide the students into pairs and distribute **Advanced Aeronautical Charts Student Activity 3**. Sample responses are available on **Advanced Aeronautical Charts Teacher Notes 3**.

EVALUATE

Teacher Materials: Advanced Aeronautical Charts Presentation, Advanced Aeronautical Charts Teacher Notes 4
Student Material: Advanced Aeronautical Charts Student Activity 4

Slides 43-62: These lessons are building the knowledge to pass the FAA Private Pilot Knowledge test. The following questions resemble actual questions on the FAA exam. Review the Private Pilot Knowledge Test questions.

Slide 63: Conduct the **Summative Assessment**.

Summative Assessment

Distribute **Advanced Aeronautical Charts Student Activity 4**. In this summative assessment, students will individually identify landmarks and other features based on aeronautical chart symbology and analyze a flight route for hazards or concerns. Sample responses are available in **Advanced Aeronautical Charts Teacher Notes 4**.

[DOK-L2; *identify*, DOK-L3; *evaluate*]

Summative Assessment Scoring Rubric

- Follows assignment instructions
- Postings show evidence of one or more of the following:
    - Correct recall of chart symbology, pilotage techniques, and flight rules
    - Reasonable application of route analysis to a scenario
    - Evidence and explanation of the above that demonstrate understanding of the material
- Contributions show understanding of the concepts covered in the lesson
- Contributions show in-depth thinking including analysis or synthesis of lesson objectives

Points	Performance Levels
9-10	Correctly understands all chart symbology, pilotage techniques, and flight rules and makes a reasonable application of route analysis to scenarios, with explanation.
7-8	Correctly understands most chart symbology, pilotage techniques, and flight rules, with some

errors, and makes generally reasonable applications of route analysis to scenarios, with some incomplete analysis or errors.
5-6 Correctly understands some chart symbology, pilotage techniques, and flight rules, with errors, or makes generally reasonable applications of route analysis but lacks adequate explanation.
0-4 Provides few, if any, correct ideas about chart symbology, pilotage techniques, and flight rules, and/or makes analysis with inadequate explanation.

GOING FURTHER

Materials: Flight simulator, NYC Terminal Area Chart, NYC SFRA Chart

Simulator Activity

Slide 64: After learning about the NYC SFRA, students may wish to fly the SFRA route using a flight simulator. The teacher can assign students to simulators as appropriate and monitor how well their flight complies with the SFRA procedures.

Teaching Tips

Teachers may wish to assign pairs of students to the simulators in pilot and co-pilot roles. One student can fly the northbound leg of the route while the other monitors how well they are following the SFRA procedures. Upon reaching the northern end of the SFRA, near the Alpine Tower for example, students may switch roles for the southbound leg.

The FAA has a quick-reference guide for pilots to use for flight in the NYC SFRA: https://www.faasafety.gov/files/gslac/courses/content/79/776/kneeboard.pdf. Students may use this during their simulation in addition to the SFRA chart on the back of the NYC TAC.

STANDARDS ALIGNMENT

NGSS 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.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.

REFERENCES

FAA Pilot Handbook of Aeronautical Knowledge
Memphis VFR sectional chart
New York VFR sectional chart
New York TAC
FAA Aeronautical Chart User's Guide