Introduction to General Aviation

Session Time: One, 50-minute session

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

Understand the operational differences between general, commercial, and military aviation as well as how these differences influence the modern aviation/aerospace industry. (EU2)

Develop interest in one or more aviation/aerospace career pathways and learn what is required to pursue future employment in the industry. (EU3)

ESSENTIAL QUESTIONS

1. How does general aviation compare to other segments of aviation in the United States?
2. Why is it important for general aviation to continue to innovate? What does the future hold for general aviation?

LEARNING GOALS

Students Will Know

- The characteristics of general aviation and its various missions
- Careers available in the field of general aviation

Students Will Be Able To

- *Identify* and *explain* general aviation. (DOK-L2)
- *Explain* and *analyze* the important roles played by general aviation. (DOK-L3,L4)
- *Compare* and *contrast* the roles and function of various general aviation aircraft. (DOK-L3)

ASSESSMENT EVIDENCE

Warm-up
Students will classify 10 terms as being most closely associated with commercial, military, or general aviation.

Formative Assessment
Students will create a concept map that ties together what they have learned about commercial, military and general aviation.

Summative Assessment
Students are asked to identify the various segments of aviation, cite examples of general aviation, and compare and contrast aircraft used for various general aviation missions.

LESSON PREPARATION

MATERIALS/RESOURCES

- Introduction to General Aviation Presentation
- Introduction to General Aviation Student Activity

LESSON SUMMARY

Lesson 1: Introduction to Commercial Aviation
Lesson 2: Introduction to Military Aviation
Lesson 3: Introduction to General Aviation

To begin the lesson, students will classify 10 terms as being most closely associated with commercial, military, or general aviation. This warm-up will also give students the opportunity to make predictions about general aviation.

During a class presentation, students will gain an understanding of what general aviation is, the types of missions it flies, and the aircraft it uses. Students will also learn that UAS flying is a part of general aviation. The students will discuss how UAS fit into each of the general aviation roles and missions described in the presentation. Students will also learn about the types of flying careers that are available in general aviation and discuss which careers interest them the most. At the end of the presentation, students will create a concept map that helps them organize the information they've learned about commercial, military and general aviation.

Finally, students will work individually to complete summative assessment questions which ask them to list the three segments of aviation, cite examples of general aviation, and compare and contrast aircraft used for various general aviation missions.

This lesson is intended as a baseline introduction to general aviation. This topic will receive more in-depth coverage later in the year.

BACKGROUND

In the United States, aviation is divided into three distinct segments: commercial, military, and general aviation.

General aviation (GA) consists of all civilian aircraft operations except scheduled airline operations, and military aviation. As the largest segment of the U.S. aircraft fleet, general aviation aircraft include everything from large jets to single-seat airplanes, and unmanned aircraft systems (UAS).

General aviation includes flying as diverse as overnight package delivery and a weekend visit back home; as different as emergency medical evacuation and inspection trips to remote construction sites; as complimentary as aerial application to keep crops healthy and airborne law enforcement to keep the peace.

An estimated 65 percent of general aviation flights are conducted for business and public services that need transportation more flexible than the airlines can offer. That flexibility can be a hometown businessman flying his own small airplane to see four clients on a one-day, 700-mile circuit, or it can be a CEO and five staff members working at 30,000 feet while en route to a major meeting. By scheduled airlines, the first trip could take up to four days and three hotel bills; the second would be impossible. Like the family automobile, the family airplane (owned or rented) can provide mobility and pleasure.

General aviation extends far beyond just the aircraft that are flown. The airport infrastructure across the U.S. is extremely vast, supporting all general aviation operations. When one thinks about an airport, the first thing that comes to mind are the large hub airports that commercial air carriers operate from. In reality, there are small general aviation airports spread far and wide, often times in the middle of a nearby community. These airports serve as operation hubs for general aviation providing facilities for flight training, maintenance, personal flying, and business aviation. Business

aviation uses these smaller airports because they are sometimes closer to the final destination than a large hub at the outskirts of a congested city.

At these general aviation airports, Fixed Base Operators (FBOs) provide services such as fuel and ground handling to the general aviation aircraft that visit, or are based at the airport. These FBOs many times also offer flight instruction, discovery flights, and sightseeing; giving everyone an opportunity to be involved in aviation.

MISCONCEPTIONS

Many people think that professional pilots are just those who fly for the airlines. In fact, general aviation has a wide variety of full time jobs for professional pilots including flight instructors, corporate pilots, law enforcement, aerial survey and mapping, and many more.

DIFFERENTIATION

To support low working memory, ask students to a create graphic organizer of the information provided during the **EXPLAIN** section of the lesson. Visually organizing the information during the presentation will help them link their knowledge to upcoming learning, and to help anticipate and understand the structure of new information.

LEARNING PLAN

ENGAGE

Teacher Material: Introduction to General Aviation Presentation

Slides 1-3: Introduce the topic and learning objectives for today's lesson.

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

Provide students an opportunity to use the information they have learned in the previous lessons about commercial and military aviation. This warm-up will also give students the opportunity to make predictions about general aviation. They will classify each term according the segment they think it belongs. [DOK 2; distinguish, classify]

1. Business jet
2. Firefighting airtanker
3. Air Force One
4. UPS 747 cargo carrier
5. Glider
6. United Airlines Airbus A320
7. Crop duster
8. Traffic helicopter
9. F-22 fighter jet
10. Medevac helicopter

Warm-Up

Ask students to individually write down the terms on slide four and classify each as commercial, military, or general aviation. Allow for a brief discussion for students to share and compare their answers.

Questions

1. general aviation 2. general aviation 3. military 4. commercial 5. general aviation 6. commercial 7. general aviation 8. general aviation 9. military 10. general aviation

EXPLORE

Teacher Material: Introduction to General Aviation Presentation

In this lesson, students will gain an understanding of what general aviation is, the types of missions it flies, and the aircraft it uses. Use **Introduction to General Aviation Presentation** to define general aviation, its scope and its primary missions.

Slides 5-8: Introduce the concept of general aviation (GA) and how much of the U.S. aircraft fleet is classified as GA.

General definitions of the three segments of aviation are:

- Commercial aviation consists of scheduled (daily, posted flights) and non-scheduled (custom scheduled to meet customer's needs) flights that carry passengers and cargo for compensation.
- Military aviation is used to defend the nation and its interests, and consists of the aircraft that enable or conduct aerial warfare.
- General Aviation is comprised of the operations that do not fall into commercial air carrier, or military operations: Flight instruction, corporate/business aviation, survey and inspection, law enforcement.

Explain to students that general aviation consists of all civilian aircraft operations except scheduled airline operations, and military aviation. As the largest segment of the U.S. aircraft fleet, general aviation aircraft include everything from large jets to single-seat airplanes, and unmanned aircraft systems (UAS).

A short video shows some examples of general aviation in action.

- "AOPA FLyBy Episode 20" (Length 4:46) http://video.link/w/2dJd

EXPLAIN

Teacher Material: Introduction to General Aviation Presentation

Slide 9: General aviation includes flying as diverse as overnight package delivery and a weekend visit back home; as different as emergency medical evacuation and inspection trips to remote construction sites; as complimentary as aerial application to keep crops healthy and airborne law enforcement to keep the peace.

Share the list of general aviation's many missions with students. Ask them to "add" to the list.

Slides 10-11: The most efficient and cost-effective way to conduct wildlife surveys, map wetland losses and soil erosion, follow bird migrations, patrol parklands, and detect pipeline spills is with general aviation aircraft. Specially equipped government and private aircraft gather information vital to the work of wildlife specialists, park rangers, prospectors, environmentalists, and many others.

Slides 12-13: Community planning is often accomplished by general aviation aircraft through aerial surveys. Aerial surveying is a method of collecting geomatics or other imagery by using airplanes, helicopters, UAS, balloons or other aerial methods. Typical types of data collected include aerial photography, and charts or maps made by analysing a region from the air. In many ways, aerial survey has better resolution and quality than data collected via satellite imagery. Aerial surveys can provide information on many things not visible from the ground.

In order to carry out an aerial survey, a sensor needs to be fixed to the interior or the exterior of the aircraft with line-of-sight to the target it is remotely sensing. With manned aircraft, this is accomplished either through equipment mounted

on the skin of the aircraft or mounted externally on a wing strut. With UAS, the sensor is typically mounted under or inside.

Slides 14-15: General aviation flies important documents and overnight packages on their way to offices, factories, and individuals under next-day time pressures. Express freight, like vital machine parts and mail to small towns, also move by fast and flexible general aviation to thousands of locations where the major air carriers don't fly.

Slides 16-17: "Ag" pilots treat more than 75 million acres of cropland each year, boosting production of the nation's agricultural bounty. Planting, too, can often be done more efficiently by air. Ninety-five percent of the U.S. rice crop is planted by aircraft. Ranchers use general aviation aircraft to manage herds and grazing land. Agriculture and general aviation are longtime partners in progress.

Show students a video about agricultural pilots.

- "Crop Dusters Manage Busy Season" (Length 1:37)
  http://video.link/w/5dJd

Slides 18-19: The majority of U.S. pilots are trained via general aviation. The only other source for pilot training in the U. S. is through the military. Flight schools are most commonly found at local general aviation airports.

Slides 20-21: Every day, general aviation transports blood supplies, vital transplant organs, and other time-critical, lifesaving elements. Air ambulances carry out medevac rescues and provide urgent transportation to trauma and other emergency centers. Many pilots volunteer their services (and often the use of their own aircraft) to transport patients who cannot endure land travel to distant, specialized treatment centers. Local volunteer pilot organizations provide such services at no cost to patients in need. Helicopter emergency medical evacuation is nearly doubling survival rates by getting accident victims to hospitals within the first critical "golden hour."

General aviation aircraft have also revolutionized law enforcement in federal, state, and local jurisdictions. Police use light airplanes and helicopters to patrol highways, apprehend suspects, back up ground units, monitor national borders, and locate lost children.

Slides 22-23: More and more people are discovering that general aviation is fast, efficient, and safe, opening a whole new vista of travel opportunities. For both business and personal travel, general aviation means going where you want to go (not just where the airlines go) when you want to go (free from airline schedules), and in a greater degree of privacy. The payoff is greater transportation flexibility and productivity than any other mode of travel can provide. But even those who never seize these advantages benefit, because general aviation works for the community, bolstering the economy and providing essential services.

Slide 24: Lead a discussion about how drones fit into each of the roles and missions described in the presentation. Ask students if where drones might be a better choice than traditional manned aircraft. Have students defend their choices.

Questions

Possible benefits of using drones:

Drones are often times more cost-effective to operate. Drones can enter areas that may be dangerous for airplanes or humans to go so they might be good for providing emergency services and for missions like aerial mapping.

Possible drawbacks to using drones:

In many cases, drones just can't carry the payload needed of some missions like crop dusting or transporting passengers.

Slides 25-26: Present information on the types of flying careers that are available in general aviation. Lead a short discussion with students on the careers that interest them and which careers they would like to learn more about this year.

These slides include optional videos that discuss a career as a flight instructor and an air ambulance pilot.

- "Real Life 101 Flight Instructor Career" (Length 6:56) http://video.link/w/7dJd
- "Day In The Life: Pilots" (Length 2:52) http://video.link/w/AdJd

EXTEND

Teacher Material: Introduction to General Aviation Presentation

Slide 27: Conduct the **Formative Assessment**.

In this assessment, students will create a concept map that helps them organize the information they've learned about commercial, military and general aviation. Take a few moments to do a brief recap with students before they begin the activity. Provide students up to 10 minutes to complete their concept maps. [DOK 4; synthesize, create]

Formative Assessment

Working in groups of two or three, students will create a concept map that ties together what they have learned so far in this section. Groups can use the concept map template shown on the slide, or they can use it as inspiration to create their own.

Teaching Tips

This lesson uses a concept map to assist students in organizing content into relationships. A concept map is a visual tool that helps show the relationship between ideas. Concept maps begin with a main idea and then branch out to show how the idea can be broken down into sub-topics. Concept maps can help students brainstorm new ideas and organize information. A concept map arranges related ideas in a hierarchy. Students start off broad and the sub-topics will get more and more specific. Students can use the map that is provided in the presentation, or construct their own.

EVALUATE

Teacher Material: Introduction to General Aviation Presentation
Student Material: Introduction to General Aviation Student Activity

Slide 28: Conduct the **Summative Assessment.**

Provide each student a copy of **Introduction to General Aviation Student Activity** to answer the questions below. Collect student work at the end of class and grade using the scoring rubric. [DOK 2; summarize, relate]

1. List the three segments of aviation
2. Describe what general aviation is and what it involves
3. List and describe three examples of general aviation

4. Compare and contrast the kinds of general aviation aircraft used for each example the students listed in the third question.

Summative Assessment

Students will work individually to complete summative assessment questions which ask them to list the three segments of aviation, cite examples of general aviation, and compare and contrast aircraft used for various general aviation missions.

Summative Assessment Scoring Rubric

- Follows assignment instructions
- Answers to questions shows evidence of one or more of the following
    - Knowledge of the 3 main segments of aviation
    - Knowledge of general aviation and how it differs from commercial and military aviation.
    - Ability to provide a specific scenario of how a type general aviation would be used
- Shows understanding of concepts covered in the lesson.

Points	Performance Levels
9-10	Consistently demonstrates criteria
7-8	Usually demonstrates criteria
5-6	Sometimes demonstrates criteria
0-4	Rarely to never demonstrates criteria

GOING FURTHER

General aviation pilots volunteer their time and airplanes to a wide variety of charitable causes. Have students watch the following news video about an organization called Pilots 'n Paws, and then have them research other charitable flying organizations and give a brief presentation on the types of work they do.

- "Pilots and Paws, Making a Difference" (Length 2:49) http://video.link/w/BdJd

Have students read the article "Disease Busters: Twenty-first Century Mosquito Contro" and ask them to write a brief report on the mission and safety enhancements described in the article. Also ask them to generate their own ideas about how to make low-level flying safer.
https://www.aopa.org/news-and-media/all-news/2015/april/pilot/f_disease

STANDARDS ALIGNMENT

NGSS STANDARDS

Three-dimensional Learning

- **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.
    - 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
        - Influence of Science, Engineering, and Technology on Society and the Natural World
- **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

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.9-10.2** - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- **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.

REFERENCES

www.aopa.org
https://gama.aero