Introduction to Commercial 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. What are the three main segments of aviation in the United States?
2. What kinds of social, economic, political, and technical problems does commercial aviation help solve?
3. What kinds of challenges and opportunities does commercial aviation face now and what challenges and opportunities will it face in the future?

LEARNING GOALS

Students Will Know

- The characteristics and uses of commercial aviation
- Challenges that commercial operators must overcome to stay profitable
- Careers available in the growing field of commercial aviation

Students Will Be Able To

- *Identify* and *explain* commercial aviation (DOK-L2)
- *Explain* and *analyze* how commercial aviation solves the challenges it faces (DOK-L3, L4)
- *Predict* possible challenges and solutions for the future of commercial aviation (DOK-L2)

ASSESSMENT EVIDENCE

Warm-up
Students write short descriptions about how commercial aviation has positively and negatively impacted themselves, families, economies, globalization and the environment.

Formative Assessment
Students write a fictional article about a challenge faced by a cargo or passenger air carrier.

Summative Assessment
Use a “five things” assessment to determine how well students have understood the main points of the lesson.

LESSON PREPARATION

MATERIALS/RESOURCES

- Introduction to Commercial Aviation Presentation
- Introduction to Commercial Aviation Student Activity

LESSON SUMMARY

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

This lesson introduces commercial aviation to students and presents the opportunities and challenges faced by commercial air carriers. Students will begin by thinking about how commercial aviation has affected the world in several very big ways. Students will then learn what defines commercial aviation and its purpose. They will be asked to list three needs that modern commercial aviation helps meet and brainstorm three challenges facing the commercial aviation industry today.

A presentation will share different ways that air carriers innovate to be profitable and how those innovations or ideas may affect passengers. The presentation also introduces the idea of government regulation and identifies some of the careers available in commercial aviation. Based on what they have learned about commercial aviation, students will generate a list of challenges posed by increased demand for commercial aviation.

Finally, students will use the “five things assessment” to demonstrate their understanding of the main points of the lesson.

This lesson is intended as a baseline introduction to commercial 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.

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. Passenger air carriers, such as American, United and Southwest, and cargo air carriers, such as FedEx and UPS, operate the majority of commercial aviation flights in the United States.

As the name suggests, commercial aviation operations are businesses designed to generate a profit. They also must follow strict and highly complex regulations, which vary from the regulations that govern military and general aviation.

MISCONCEPTIONS

Not all aviation businesses that generate profit are categorized as commercial aviation. For example flight instruction, sightseeing, and surveying are categorized as general aviation.

DIFFERENTIATION

To support student writing in the **ENGAGE** and **EXTEND** sections of the lesson plan, the teacher may provide examples of the type of writing that the students are expected to do. This allows students to identify effective elements to incorporate in their own writing.

To support verbal reasoning in the class discussion, organize the class into groups for Think-Pair-Share instead of a whole group discussion. This allows learners to think about the question, discuss their thoughts with a partner before sharing with the larger group. It encourages all students to participate and practice skills, including metacognition.

To promote reflective thinking and guided inquiry in the **ENGAGE** section of the lesson plan, circulate around the classroom and assist students who might have trouble coming up with ideas for the warm-up. Ask questions that provoke their own ideas for possible answers.

To support student motivation in the **EXTEND** section of the lesson plan, allow students the option to create a poster instead of a newspaper article to present the same information (fictional air carrier, challenge faced, how challenge was overcome).

LEARNING PLAN

ENGAGE

Teacher Material: Introduction to Commercial Aviation Presentation

In the United States, millions of people fly on commercial aircraft every year. But even if someone never flies on an airliner, commercial aviation has a significant impact on their daily life.

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

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

Collect student papers for grading when they are finished. Each response is worth up to 2 points for a total of up to 10 points. [DOK 3; formulate, hypothesize]

Warm-Up

Have each student write 2-4 complete sentences about how commercial aviation has positively and negatively impacted each category listed below. The categories are listed on slide 4. Ask students to use their own paper.

- Yourself
- Families
- Economies
- Globalization
- The environment

Teaching Tips

If time allows, ask students to share experiences they have had when flying on a commercial airline.

EXPLORE

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

Slides 5-7: Introduce the concept of commercial aviation and how much of the U.S. aircraft fleet is classified as commercial.

Inform students that today's discussion will address just commercial aviation. Lesson 2 will address military aviation. Lesson 3 will address general aviation.

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, air ambulance, crop dusting, and more.

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As the name suggests, commercial aviation operations are businesses designed to generate a profit. They also must follow strict and highly complex regulations, which vary from the regulations that govern military and general aviation.

While commercial aviation operates the fewest number of airplanes, it moves millions of people on more than 20,000 flights each day.

Slide 8: Provide students with **Introduction to Commercial Aviation Student Activity.** Ask students to fill out the graphic organizer by listing three needs that modern commercial aviation helps meet and three challenges facing the commercial aviation industry. Allow students to discuss their answers.

Questions

Needs met by commercial aviation:

Moving people from one place to another quickly; moving objects (packages, mail, commercial goods of all types) from one place to another quickly; moving more easily over difficult terrain like oceans, deserts, or mountains; making long-distance travel more affordable; and making long-distance travel safer.

Challenges faced by commercial aviation:

Increasing air traffic; workforce shortages; competition from future modes of transportation like orbital travel; UAS in national airspace; improvements to other modes of transportation like high-speed trains; infrastructure problems such as aging airports or runways that are too short to accommodate the largest airplanes; not enough airports in rural communities; noise and environmental issues, public concern (associated with safety and maintenance topics); and complex regulations.

Teaching Tips

Optional Approach: You may ask students to work in pairs or small groups to compile their answers.

EXPLAIN

Teacher Material: [Introduction to Commercial Aviation Presentation]

Slide 9: Explain the differences in these three types of passenger aircraft: long distance jet, regional jet, and turboprop.

- Long Distance Jet: A large passenger or cargo aircraft capable of flying across the country or around the world non-stop
- Regional Jet: A regional jet is a smaller passenger aircraft that is designed to fly approximately 100 people. They typically feed larger airline carrier hubs from smaller markets.
- Turboprop: Turboprops are small aircraft that are most efficient at low altitudes and speeds under 250 mph. This allows the aircraft to operate efficiently and burn less fuel. They are used at small regional airports with short runways and are most efficient for short-distance travel.

Review the specifications of each type of passenger aircraft discussed on the previous slide.

Slide 10-12: Passenger airliners transport more than just passengers. They carry cargo and operate as part of a complex network requiring crew with many different skills to function and remain on time.

Air crew: Pilots and cabin crew, air carriers are required to have flight attendants for the flight, just like captains and first officers.

Ground crew: All the support staff required to service the aircraft on the ground

- Baggage
- Fuel
- Custodial
- Catering

Airplanes are scheduled to maximize the number of trips possible (revenue) in the shortest time including their maintenance, air and ground crews.

Long Distance Jets

Size: 100 ft long x 111t ft wingspan - 200+ ft long x 250+ft wingspan

Capacity: 130 - 500+ passengers

Range: 3,000nmi - 9,000nmi

Fuel Efficiency per seat: 70mpg - 120mpg

Regional Jets

Size: 80 ft long x 65 ft wingspan - 120 ft long x 94 ft wing span

Capacity: 70-120 passengers

Range: 940nmi - 2,500nmi

Fuel Efficiency per seat: 60mpg - 100mpg

Turboprops

Size: 64 ft long x 70 ft wingspan - 107 ft long x 93 ft wing span

Capacity: 50 - 90 passengers

Range: 700nmi - 1,200 nmi

Fuel Efficiency per seat: 50mpg - 90mpg

Slides 13-15: Lead a discussion on what air carriers do to maximize profit. Ask students how these actions affect passengers.

Before beginning this class discussion, ensure that students have an understanding of the definition of profit, which is the amount of income that remains after accounting for all expenses, debts, additional income streams and operating costs.

Answers to the questions are on slides 14 and 15.

What can airlines do to maximize profit?

- Redesign seats and cabins to fit more people in each airplane
- Charge fees for services like checking bags
- Reduce services like catering
- Carry cargo in addition to passengers and bags
- Charge premium fares for seats with more legroom
- Make tradeoffs between aircraft range and weight-carrying capacity
- Maximize efficiency by flying less popular routes less often or with smaller aircraft
- Negotiate for better prices on fuel and equipment

How do those decisions affect passengers?

- Reduced comfort
- Less convenient travel schedules or routes
- New options or classes of service
- Lower or higher costs depending on which services they want and need

Teaching Tips

Optional Approach: Time permitting, place students with a partner or in small groups to complete this discussion.

Slides 16-19: Present information on cargo aircraft.

As part of the presentation, show students a video of UPS Worldport to demonstrate how one major cargo carrier is addressing the challenges it faces.

- "UPS Worldport Tour" (Length 8:14)

  http://video.link/w/ddJd

Teaching Tips

Optional Discussion: Ask students what types of cargo can be transported via aircraft.

Examples include:

- Mail and other packages
- Medical equipment and supplies
- Automotive parts
- Hazardous materials, such as explosives and/or radioactive substances
- Heavy equipment, such as engines and various types of vehicles
- Humanitarian and disaster relief aid
- Live animals

Slides 20-21: Present information on FAA regulations for commercial aviation. Lead a brief discussion on how regulations in these areas enhance safety.

Ask students how regulations in the areas listed on the slide enhance safety. Correct responses are included on slide 21.

- Maintenance and equipment regulations decrease the likelihood of equipment failure
- Weather regulations ensure pilots, controllers, dispatchers, and airport operators are aware of how weather impacts aviation decision-making
- Training, qualifications, and employee rest are regulated to ensure that crew members and maintenance workers are fully prepared to deal with issues that could impact passenger and aircraft safety

Slide 22: Take a poll to gauge interest for each career that is common to commercial aviation. Show parts of videos as time permits (videos are listed in the reference section of this document.) Lead a short discussion with students on the careers that interest them and which careers they would like to learn more about this year.

EXTEND

Teacher Material: Introduction to Commercial Aviation Presentation

Slide 23: Conduct the **Formative Assessment.**

In the presentation, students discussed the various challenges that passenger and cargo airlines encounter. These challenges present themselves often in news broadcasts, as airlines struggle to find solutions.

Each group submits one article that is worth up to 10 points for each student in the group. You may choose to have groups read their articles to the class before they hand them in. [DOK 4; design, create]

Formative Assessment

Working in groups of 2 or 3, have groups write a 4-5 paragraph newspaper article about a fictional passenger or airline. In the article, ask groups to write about a challenge the fictional passenger or airline

recently faced and the steps it is has taken to overcome this challenge. Students should have an original title for their article and a fictional name for the airline.

EVALUATE

Teacher Material: [Introduction to Commercial Aviation Presentation]

Slide 24: Conduct the **Summative Assessment.**

Provide students with the opportunity to ask questions that they have before completing the summative assessment. Have students complete their work using their own paper and collect them at the end of class. Each of the "five things" is worth up to 2 points for a total of up to 10 points. [DOK 2; summarize]

Summative Assessment

About 5-10 minutes before the end of class, have each student write five things they learned during class. Have students use a complete sentence to describe each of the five things they learned.

GOING FURTHER

Have students explore Boeing's Commercial Market Forecast to see what the industry is predicting about its future and how that matches or differs from the class' predictions about challenges the industry will face as a result of increased demand. Boeing's "About Our Market" section: http://www.boeing.com/commercial/market/?cm_re=July_2016-_-Roadblock-_-Current+Market+Outlook

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

http://airlines.org/glossary/commercial-aviation/
https://www.faa.gov/data_research/aviation/aerospace_forecasts/
https://www.faa.gov/air_traffic/by_the_numbers/
http://www.boeing.com/commercial/market/?cm_re=July_2016-_-Roadblock-_-Current+Market+Outlook