Airmail and the Transcontinental Airway System

Session Time: One, 50-minute session

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

Appreciate the rich, global history of aviation/aerospace and the historical factors that necessitated rapid industry development and expansion. (EU1)

Develop an uncompromising safety mindset, understanding that growth and development in the aviation/aerospace industry must always be accompanied by responsive safety initiatives. (EU6)

Appreciate the global nature of the modern aviation/aerospace industry and embrace the discovery and inclusion of cultures outside the learner's typical experience. (EU7)

ESSENTIAL QUESTIONS

1. Was it practical to build a beacon system across America to guide pilots?

LEARNING GOALS

Students Will Know

- The origins of the U.S. airmail system
- Challenges associated with aircraft navigation in the early 1900's
- How the transcontinental beacon system developed and modernized aircraft navigation in its era

Students Will Be Able To

- *Summarize* developments and innovations in navigation systems that occurred as aircraft began to be used for commercial purposes. (DOK L-2)

ASSESSMENT EVIDENCE

Warm-up
Students will think about how pilots were able to navigate long distances in the early 1900s and consider how technology has improved the accuracy of navigation today.

Formative Assessment
Students will answer a series of questions about the transcontinental airway system and the beacon system that was employed to aid in pilot navigation.

Summative Assessment
Students will write two journal entries through the lens of an airmail pilot. One of these entries will be from the perspective of a pilot in the early 1900s while the other will be from a modern day pilot's perspective.

LESSON PREPARATION

MATERIALS/RESOURCES

- Airmail and the Transcontinental Airway System Presentation
- Airmail and the Transcontinental Airway System Student Activity

LESSON SUMMARY

Lesson 1 - Beginnings of U.S. Commercial Airline Service
Lesson 2 - Aviation and World War I
Lesson 3 - Airmail and the Transcontinental Airway System

This lesson teaches students about the originations of airmail in the United States and how the transcontinental airway system was developed. Students will learn about the challenges early airmail pilots faced and how the government responded to the need to create a nationwide navigation system to improve safety and efficiency for commercial airmail services.

As a warm-up, students will first think about how pilots navigated long distances in the early 1900s and consider how technology has improved navigation today. A class discussion will teach students about the first airmail flight and the challenges posed to pilots of that era. A video summarizes the benefits derived of carrying mail by air.

A series of slides will also teach students about the development of the transcontinental airway system which allowed pilots to navigate more reliably and most important, fly at night.

Students will answer a series of questions about the transcontinental airway system and the beacon system that was employed to aid in pilot navigation. Finally, students will write journal entries from the perspective of two different airmail pilots.

BACKGROUND

Airmail started long before airplanes were developed. The carrier pigeon was first used by armies before the birth of Christ to send long distance messages. Mail delivery using airplanes started on May 15, 1918, when the first regularly scheduled service took place, flown by the Army Air Service. The route, between New York and Washington, D.C., was 218 miles long and included one stop in Philadelphia. One round trip was made each day. The U.S. postal service took over the route from the Army on August 10, 1918.

In the early years of airmail service, the mail traveled by air only during the day because pilots lacked navigation systems for nighttime flying. Pilots did not have reliable charts and there were no radios or radar services. In 1924, the government decided on a system of flashing beacon towers and giant concrete aviation navigation arrows to point the way.

The government built a series of 1,550 lighted towers marking 18,000 miles of airways. They ran from New York to San Francisco, and everywhere in between, at roughly 10 miles intervals. The beacons sat on top of steel towers that rose up to 80 feet high. Each tower sat on top of or nearby a concrete arrow which pointed to the next arrow or beacon on the route.

The transcontinental airway system reduced the delivery time of a letter across the country from more than 80 hours to about 30 hours.

MISCONCEPTIONS

Students may believe that airmail has always been a function of the U.S. postal service, when in fact, the Army flew the mail for the postal service in its early years.

DIFFERENTIATION

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

LEARNING PLAN

ENGAGE

Teacher Material: Airmail and the Transcontinental Airway System Presentation

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

Slide 4: Conduct the **Warm-Up**. Students will think about how pilots were able to navigate long distances in the early 1900s and consider how technology has improved the accuracy of navigation today. Collect student papers for grading when they are completed. Take no more than 5 minutes of class time to complete the warm-up. [DOK-L2; infer]

Warm-Up

Have students respond to the questions using three to five complete sentences. If time allows, have students share their answers.

- Pilots in the early years of aviation had few navigation tools. What did they do to keep from getting lost?
- Compare your answers to the tools that have been developed to help today's pilots navigate successfully.

Questions

Possible answers include:

Pilots got lost quite often in the early years. While some airplanes had compasses, they weren't very reliable. Pilots often looked for landmarks, like towns, racetracks, rivers, mountains hills, etc. Others used automobile maps for reference and followed railroad tracks. This technique of navigating by reference to landmarks or checkpoints is called "pilotage."

Today's pilots use GPS for navigational purposes, have much more accurate and detailed maps, and can be in near constant radio contact with air traffic control.

EXPLORE

Teacher Material: [Airmail and the Transcontinental Airway System Presentation]

Slides 5-6: Airmail started long before airplanes were developed. The carrier pigeon was first used by armies before the birth of Christ to send long distance messages. Airmail became practical at the end of World War I. Airplanes were more reliable and could fly longer distances.

Slide 7: Mail delivery using airplanes started on May 15, 1918, when the first regularly scheduled service took place, flown by the Army Air Service. The route, between New York and Washington, D.C., was 218 miles long and included one stop in Philadelphia. One round trip was made each day. The U.S. postal service took over the route from the Army on August 10, 1918.

The pilots chosen to fly the first scheduled airmail routes were Lieutenants Howard Culver, Torrey Webb, James Edgerton and George Boyle.

Slide 8: Boyle was selected to pilot the first airplane out of Washington, DC. After all his preparations, Boyle hopped into his airplane and was unable to start it. The airplane had not been fueled.

Lieutenant Boyle finally got his Curtiss Jenny, loaded with 124 pounds of airmail, in the air. His assignment was to fly to Philadelphia, the midway stop between the Washington and New York route. He did not make it there that day because he got lost and his airplane was low on gas. Boyle crash landed in rural Maryland, less than 25 miles away from Washington.

The other flights operated as scheduled that day.

Slide 9: Show students the video about the origination of airmail service and discuss the following questions with students.

- "Airmail: The Quest For Speed" (4:55)

  http://video.link/w/0VUd

Questions

1. What drove the need for airmail?

   People wanted to communicate faster, be more connected and do business more efficiently.

2. Who was the first to fly airmail routes?

   The Army Air Service flew the first scheduled airmail routes. About three months after the first scheduled route began, the U.S. Postal Service took over.

3. Why was flying the airmail so dangerous?

   Lack of instrumentation and tools to navigate, crude airplanes with open cockpits, flying in bad weather.

4. How has airmail become faster in modern times?

   Air carriers like FedEx and UPS are dedicated to just flying mail (not passengers); airplanes are much faster or more capable (they can fly in all weather); and powerful computers and logistics systems have sped up sorting and distribution.

EXPLAIN

Teacher Material: Airmail and the Transcontinental Airway System Presentation

Slide 10: Airmail pilots took significant risks to keep the mail on schedule. With open cockpits, weather was even more of an issue. What were other dangers to pilots?

Slide 11: The "Jenny" was an invaluable trainer for pilots during the first World War. Manufactured from 1917-1925 by the Curtiss Aeroplane Company, this airplane became synonymous with the Barnstorming Era where daring pilots would perform exciting flights for communities all over the country, really sparking a national love of aviation that would eventually lead to a fascination with aviation that ignited the commercial airline industry. The Jenny was powered by a 90HP, OX-5 engine, notorious for random failures, making piloting them a very risky activity. The Jenny was a favorite of this era because there were so many surplus aircraft left over after the war ended.

Slide 12: In the early years of airmail service, the mail traveled by air only during the day because pilots lacked navigation systems for nighttime flying. Pilots did not have reliable charts and there were no radios or radar services. In 1924, the government decided on a system of flashing beacon towers and giant concrete aviation navigation arrows to point the way.

Slides 13-14: As the Air Mail Service experienced more success, routes were expanded from the east coast to Chicago, Nebraska, and eventually San Francisco in 1920 (a 2,629 mile stretch from New York to San Francisco). Flying saved a day in delivery time over travel by rail. Flying by night significantly decreased additional delivery time.

Slide 15: The government built a series of 1,550 lighted towers marking 18,000 miles of airways. Beacons were erected to help ensure safe transit of mail at night as an innovation guiding pilots to fields in which they could land in regular or emergency situations.

Slide 16: Beacons were placed on 50-foot windmill towers and concrete foundations in the shape of giant arrows measuring between 50 and 70 feet long. The arrows were painted yellow to increase visibility.

EXTEND

Teacher Material: Airmail and the Transcontinental Airway System Presentation
Student Material: Airmail and the Transcontinental Airway System Student Activity

Slide 17: Conduct the **Formative Assessment**. Students will answer a series of questions about the transcontinental airway system and the beacon system that was employed to aid in pilot navigation. Answers are included below. [DOK 2; *estimate*; *infer*]

Formative Assessment

Have students complete Airmail and the Transcontinental Airway System Student Activity. Instruct students to answer questions individually, then share their answers with a partner before holding a full class discussion.

Questions

1. What caused the need for the transcontinental airway system to be developed?

A need for mail to be delivered faster and more efficiently drove the development of the transcontinental airway system The system enabled pilots to navigate more safely at night.

2. What pushback might have been received by members of the community where beacons and arrows were built?

Members of the community may have had to give up their land. They may also have been fearful of airplanes navigating overhead.

3. What made flying long distances dangerous for a pilot prior to the development of the transcontinental airway system?

In the early years of airmail service, the mail traveled by air only during the day because pilots lacked navigation systems for nighttime flying. Pilots did not have reliable charts and there were no radios or radar services.

4. How did the transcontinental airway system help pilots navigate?

On top of the towers, beacons featured powerful lights that were visible for many miles. During the day, concrete arrows pointed the way.

5. Why was the transcontinental airway system so successful?

The beacon system was successful because it improved safety conditions and allowed for the carriage of more mail.

EVALUATE

Teacher Material: Airmail and the Transcontinental Airway System Presentation

Slide 18: Conduct the **Summative Assessment.**

Students will write journal entries from the perspective of two different airmail pilots. Prior to writing, ask students to brainstorm ideas they may wish to include regarding what an airmail pilot might experience during one of their routes. They should take no more than 10 minutes of class time to complete the assessment. [DOK-L3; Assess; Compare]

Summative Assessment Scoring Rubric

- Follows assignment instructions
- Journal entry shows evidence of one or more of the following
    - Knowledge of airmail system
    - Understanding of how the beacon system works
    - Understanding of how airmail has evolved over time
    - Responds to questions of audience and instructor
- 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

Summative Assessment

In groups of three to four, have students write two journal entries from the perspective of an airmail pilot. One should be from the perspective of an airmail pilot in the early 1900s and the other should be from the perspective of a modern airmail (e.g. UPS or FedEx) pilot. Students should write about the things each of the pilots might experience during one of their routes.

GOING FURTHER

Research the airplane first used for airmail service, the Curtiss Jenny. https://airandspace.si.edu/exhibitions/america-by-air/online/early_years/early_years03.cfm

Students can research where concrete arrows and beacons from the transcontinental airway system are located today: http://www.dreamsmithphotos.com/arrow/

For more information about beacons, please check out https://airandspace.si.edu/stories/editorial/lighthouses.

STANDARDS ALIGNMENT

NGSS STANDARDS

Three-dimensional Learning

- **HS-ESS3-2 – ESSE-2** - Evaluate competing design solutions for developing, managing, and utilizing energy and mineral resources based on cost-benefit ratios.
    - Science and Engineering Practices
        - Engaging in Argument from Evidence
    - Disciplinary Core Ideas
        - ESS3.A: Natural Resources
        - ETS1.B: Developing Possible Solutions
    - Crosscutting Concepts
        - Influence of Science, Engineering, and Technology on Society and the Natural World
- **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-ETS1-2** - 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
        - Constructing Explanations and Designing Solutions
    - Disciplinary Core Ideas
        - ETS1.C: Optimizing the Design Solution
    - 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
        - 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** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- **RST.9-10.7** - Translate quantitative or technical information expressed in words in a text into visual form (e.g., a table or chart) and translate information expressed visually or mathematically (e.g., in an equation) into words.
- **WHST.9-10.1** - Write arguments focused on discipline-specific content.
- **WHST.9-10.2** - Write informative/explanatory texts, including the narration of historical events, scientific procedures/ experiments, or technical processes.
- **WHST.9-10.4** - Produce clear and coherent writing in which the development, organization, and style are appropriate to task, purpose, and audience.
- **WHST.9-10.6** - 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.9-10.7** - Conduct short as well as more sustained research projects to answer a question (including a self-generated question) or solve a problem; narrow or broaden the inquiry when appropriate; synthesize multiple sources on the subject, demonstrating understanding of the subject under investigation.

- **WHST.9-10.8** - Gather relevant information from multiple authoritative print and digital sources, using advanced searches effectively; assess the usefulness of each source in answering the research question; integrate information into the text selectively to maintain the flow of ideas, avoiding plagiarism and following a standard format for citation.

- **WHST.9-10.9** - Draw evidence from informational texts to support analysis, reflection, and research.

REFERENCES

http://sometimes-interesting.com/2013/12/04/concrete-arrows-and-the-u-s-airmail-beacon-system/
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