Becoming an Air Traffic Controller

Session Time: Two, 50-minute sessions

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

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

Understand the importance of professionalism, ethics, and dedication as they relate to all aviation/aerospace operations. (EU4)

ESSENTIAL QUESTIONS

1. How important to aviation are air traffic controllers?
2. What does it take to be a successful air traffic controller?

LEARNING GOALS

Students Will Know

- The skills and abilities needed to be a successful air traffic controller
- What post-secondary training is necessary to become a controller

Students Will Be Able To

- *Compare* their personal strengths/interests against a career as an air traffic controller (DOK-L2)
- *Identify* and *use* essential skills required to be an air traffic controller (DOK-L1, L2)

ASSESSMENT EVIDENCE

Warm-up
Students will watch a video and then list the skills and abilities they think an air traffic controller must have in order to succeed.

Formative Assessment
Students will use the skills needed to be an effective controller through a simulation activity. “Controllers” will be evaluated based on their ability to maintain efficient and safe aviation operations.

Summative Assessment
Students will complete an assessment that asks them to consider the experience and skills required of an air traffic controller. They also will reflect on their own interest in becoming controllers and whether or not they would be good in this role.

LESSON PREPARATION

MATERIALS/RESOURCES

- Becoming an Air Traffic Controller Presentation
- Becoming an Air Traffic Controller Student Activity 1
- Becoming an Air Traffic Controller Student Activity 2
- Becoming an Air Traffic Controller Teaching Aid 1
- Becoming an Air Traffic Controller Teaching Aid 2

ATC Simulation Activity (per class)

- Large flat area (parking lot, football field, gymnasium, wide hallway)
- Sidewalk chalk, masking tape, or spray paint
- Measuring tape

LESSON SUMMARY

Lesson 1: Becoming an Air Traffic Controller
Lesson 2: Becoming an Aircraft Mechanic

This lesson introduces students to a career as an air traffic controller. Students will begin by watching a video of the kinds of things that air traffic controllers do on a daily basis and how they operate as a team. While the students watch the video, they will write about the skills and abilities that air traffic controllers must have. After the video concludes, students will provide their answers and teachers will create a list on a board.

During a class discussion, students will learn what an air traffic controller does, the skills and abilities air traffic controllers must have to succeed, the education and training they need to get hired, and the other important aspects of making air traffic control a career.

The second session of the lesson will involve an activity that requires students to use many of the skills required to be a successful air traffic controller. The ATC simulation is designed to give students the experience of being a controller at a busy airport. Student "pilots" will simulate taxiing and flying aircraft by walking around an "airport" in a traffic pattern while being directed by student "controllers." The purpose of the activity is to help students realize the communication and planning skills necessary to be an effective controller.

After participating in the simulation, students will complete an assessment that asks them to consider the experience and skills required of an air traffic controller. They also will reflect on their own interest in becoming a controller and whether or not they would be good in this role.

BACKGROUND

During peak travel times in the United States, 5,000 aircraft are in the sky at any given time. These aircraft move more than 2.5 million passengers in and out of U.S. airports every day. The task of ensuring the safe operation of aircraft in our national airspace system falls on air traffic controllers. They must coordinate the movements of thousands of aircraft each day, keep them at safe distances from one another, direct them during takeoff and landing from airports, direct them safely around weather, and ensure that all this happens smoothly with minimal delays.

The FAA manages the U.S. air traffic control (ATC) system. The vast majority of air traffic controllers are FAA /government employees. To become a controller, a person must apply through the federal civil service system and pass a written test assessing their abilities to perform a controller's duties. Those accepted into the FAA's training program attend the FAA Academy in Oklahoma City, OK. After graduation from the academy, a person must accumulate on-the-job experience at various air traffic facilities across the country.

Students also may join the military to become controllers. The requirement to become a controller in the military is a high school diploma or a GED with 15 college credits (Air Force). Many military controllers join the FAA air traffic control workforce after completing their military commitments.

The basic requirements to become a controller are:

- Be a U.S. citizen
- Be age 30 or younger (on the closing date of the application period)
- Pass a medical examination and a security investigation
- Pass the FAA air traffic pre-employment tests
- Speak English clearly enough to be understood over communications equipment
- Have three years of progressively responsible work experience, a bachelor's degree, or a combination of post-secondary education and work experience that totals three years

There are three types of air traffic controllers:

Tower controllers – direct the movement of vehicles on runways, taxiways, and ramps (a ramp is an aircraft parking area). They check flight plans, clear pilots for takeoff or landing, and direct the movement of aircraft and other traffic on the runways and in other parts of the airport. Most work from control towers, watching the traffic they control.

Approach and departure controllers – ensure that aircraft traveling within an airport's airspace maintain minimum separation for safety. They give clearances to enter controlled airspace and hand off control of aircraft to en route controllers. They use radar equipment to monitor flight paths and work in buildings known as terminal radar approach control facilities (TRACONs). Approach and departure controllers manage aircraft until about 20 miles to 50 miles from the airport and up to about 17,000 feet. They then hand the aircraft off to en route controllers.

En route controllers – monitor aircraft once they leave airport airspace. They work at air route traffic control centers (ARTCCs) located throughout the country but not typically at airports. They turn aircraft over to the airport's approach controllers when the aircraft are about 20 miles to 50 miles from the airport.

LEARNING PLAN

ENGAGE

Teacher Material: Becoming an Air Traffic Controller Presentation

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

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

Warm-Up

Show students a video that has a number of air traffic controllers; describe how they coordinate the movement of aircraft to maintain safe distances among them.

- "What Is Air Traffic Control?" (Length 4:46)
  http://video.link/w/Y5De

While the students watch the video, ask them to write down the skills and abilities that controllers must have. Students will revisit the skills and abilities needed to become an air traffic controller later in the lesson.

After the video concludes, ask students to provide their answers in class discussion and make a list on a board. Collect student work and grade according to completeness and participation.

[DOK 2; *predict, summarize*]

Answers may include: intense focus; ability to handle pressure and stress; multitask; concentrate for long periods of time; make decisions quickly, communicate clearly; prioritize tasks; understand complex situations, such as the impact of changing weather patterns.

EXPLORE

Teacher Material: Becoming an Air Traffic Controller Presentation

Slide 5: Discuss with students what air traffic controllers do. Emphasize to students that a controller's main role is to coordinate the safe movement of aircraft. They are critical to the prevention of accidents and have assisted pilots in dangerous situations by providing options to alternative airports in case of bad weather. An example of this was highlighted in the aviation weather lesson in Unit 6. Students will recall in that instance, the pilot did not take the advice of ATC.

While controllers' primary concern is safety, they also must direct aircraft efficiently to minimize delays. They manage the flow of aircraft into and out of the airport airspace, guide pilots during takeoff and landing, and monitor aircraft, as they travel through the skies.

Slide 6: Watch a video about how one controller recognized that a pilot was struggling and saved his life:

- "Pilot Saved By Quick Thinking Air Traffic Controller" (Length 2:06)
  http://video.link/w/mzOd

Questions

After watching the video, ask students, "What actions did the air traffic controller take that may have saved the pilot's life?"

She listened and recognized something wasn't normal because the pilot didn't respond as expected. She repeatedly tried to call him; she listened again. She recognized he might be suffering from hypoxia and urged him to descend repeatedly. She guided him to a safe altitude (13,000 feet) where oxygen was more plentiful.

EXPLAIN

Teacher Material: Becoming an Air Traffic Controller Presentation

Slide 7: In the following student discussion, students will learn more about what controllers do, the roles they play in maintaining safe air travel, the skills and abilities they must have to succeed, the education and training they need to get hired, and the other important aspects of making air traffic control a career.

Begin by sharing that there are three types of controllers who have different functions, depending on what segment of flight an aircraft is in.

Slide 8: Tower controllers direct the movement of vehicles on runways, taxiways, and ramps (a ramp is an aircraft parking area). They check flight plans, clear pilots for takeoff or landing, and direct the movement of aircraft and other traffic on the runways and in other parts of the airport. Most work from control towers, watching the traffic they control.

Slide 9: Approach and departure controllers ensure that aircraft traveling within an airport's airspace maintain minimum separation for safety. They give clearances to enter controlled airspace and hand off control of aircraft to en route controllers. They use radar equipment to monitor flight paths and work in buildings known as terminal radar approach control centers (TRACONs). Approach and departure controllers control an aircraft until about 20 miles to 50 miles from the airport and up to about 17,000 feet. They then hand the aircraft off to an en route controller.

Slide 10: En route controllers monitor aircraft once they leave airport airspace. They work at air route traffic control centers (ARTCCs) located throughout the country but not typically at airports. They turn aircraft over to the airport's approach controllers when the aircraft are about 20 miles to 50 miles from the airport.

Each ARTCC is assigned airspace based on the geography and altitude of the area in which it is located. As an airplane approaches and flies through an ARTCC's airspace, en route controllers guide the airplane along its route. They may adjust the flight path of aircraft for safety and collision avoidance.

As an airplane goes along its route, en route controllers hand the plane off to the next ARTCC, approach control, or tower along the path, as needed. En route controllers pay special attention to aircraft as they descend and get closer to the busier airspace around an airport.

Slide 11: Communication plays a critical role in air traffic controllers' work. They must be clear, concise, and use proper terms when speaking. They must speak clearly so listeners can understand, and they must listen closely to others and ask questions when needed.

Air traffic controllers must be able to concentrate in a room where multiple conversations occur at once. For example, in a large airport tower, several controllers may be speaking with several pilots at the same time.

Finally, they also need keen decision-making skills. Controllers must make quick decisions. For example, when a pilot requests a change of altitude or heading to avoid poor weather, the controller must respond quickly so the airplane can operate safely and not jeopardize other aircraft in the vicinity.

Slide 12: Air traffic controllers must be able to do arithmetic accurately and quickly. They often need to compute speed, time, and distance problems, and recommend heading and altitude changes.

They also must have good organizational skills. Controllers need to be able to prioritize tasks, as they may be required to guide several pilots at the same time.

Air traffic controllers must be able to solve problems and understand complex situations, such as the impact of changing weather patterns on an airplane's flight path. Controllers must be able to review important information and provide pilots with an appropriate solution. If one solution doesn't work, a controller has to quickly determine another appropriate course of action. Spacing aircraft at various speeds, altitudes, and directions requires fast, critical thinking in four dimensions.

Slide 13: Using what students just learned, ask them to add to the list of skills and abilities they made after watching the *"What Is Air Traffic Control"* video during the **ENGAGE** section of this lesson.

Slide 14: Share with students the FAA's basic requirements to be an air traffic controller. Highlight that a college degree is not a requirement to be an air traffic controller, but three years of "responsible work experience" in aviation is a requirement. There are more than 35 colleges and universities that have FAA-approved programs. These programs offer associate's, bachelor's, and master's degrees.

Slide 15: Explain to students the application process to become an air traffic controller, and share information about the FAA training program.

Teaching Tips

If time allows, teachers may have students do a mini-research project on the FAA's requirements and process. More information can be found at https://www.faa.gov/jobs/career_fields/aviation_careers/.

Slide 16: Students also can be qualified as air traffic controllers through the military.

Enlisted members of the military can become air traffic controllers as long as they have high school diplomas or general equivalency diplomas with 15 college college credits (Air Force).

Share with students a video where Air Force controllers describe their job. Ask students to list the ways in which the job of controlling aircraft is different between civilian and military controllers.

- "U.S. Air Force: Air Traffic Control" (Length 2:16)
  http://video.link/w/j6Ke

Questions

Ask students, "In what ways do civilian and military controllers differ?"

There are few differences between military and civilian controllers. They share airspace; they use the same language and phraseology; they even use the same phone lines/system to communicate and coordinate with one another. The primary difference is that military controllers focus primarily on military-only aircraft. In addition, they may control very fast aircraft and more maneuverable aircraft (like fighters).

Slide 17: Controllers make excellent salaries and require less education and experience than most other jobs in aviation. According to the U.S. Bureau of Labor Statistics, the median pay for an air traffic controller in 2017 was $124,540 per year.

In the last lesson, students learned that to be an airline pilot, a minimum of 1,500 hours of pilot-in-command time is required. This requirement alone can be a financial burden to many students.

EXTEND

Teacher Material: Becoming an Air Traffic Controller Presentation, Becoming an Air Traffic Controller Teaching Aid 1, Becoming an Air Traffic Controller Teaching Aid 2
Student Material: Becoming an Air Traffic Controller Student Activity 1

Slides 18-21: Conduct the Formative Assessment. The remainder of the lesson will involve an activity that requires students to use many of the skills required to be a successful controller. Provide students copies of Becoming an Air Traffic Controller Student Activity 1 for a description of the activity, roles, rules, and directions for the ATC simulation.

Share a video that provides an example of the activity in order to give students a better understanding of the activity.

- "Traffic Pattern Exercise" (Length 4:58)
  http://video.link/w/36Ke

A slide provides a diagram with a "graphic" that could be drawn on the ground using chalk, masking tape, or any other creative way teachers may devise. This activity can be completed outdoors (in a parking lot or sports field) or indoors (gymnasium or wide hallway). Refer to Becoming an Air Traffic Controller Teaching Aid 1 for additional information on setting up the activity, including the airport graphic and dimensions that should be used. Becoming an Air Traffic Controller Teaching Aid 2 provides a score sheet that students may use to evaluate each other and their performance.

Formative Assessment

This ATC simulation is designed to give students the experience of being a controller at a busy airport. Student "pilots" will simulate taxiing and flying aircraft by walking around an "airport" in a traffic pattern while being directed by student "controllers." The purpose of the activity is to help students realize the communication and planning skills necessary to be an effective controller.

A simple point system to evaluate the controllers is included to encourage efficient and safe aviation operations. Scoring will be completed by either the teacher or a selected student "FAA scorekeeper." A simple scoresheet is provided in **Becoming an Air Traffic Controller Teaching Aid 1**.

If time remains during the first session of the lesson, teachers may want to go out and mark the airport with the students. Depending on class size, teachers may want to draw more than one airport in order to give all students several opportunities to act as "controllers."

[DOK 3; *assess*]

Teaching Tips

Alternately or in addition, students may perform their own air traffic control simulations online (one option is https://www.openscope.co/.) Review the tutorial with students, then provide them with the opportunity to perform their own simulations.

EVALUATE

Teacher Material: Becoming an Air Traffic Controller Presentation
Student Material: Becoming an Air Traffic Controller Student Activity 2

Slide 22: Conduct the **Summative Assessment.**

Summative Assessment

After participating in the air traffic control simulation, students will complete an assessment that asks them to consider the experience and skills required of an air traffic controller. Students also will reflect on their own interest in becoming a controller and whether or not they would be good in this role.

Provide students with **Becoming an Air Traffic Controller Student Activity 2.**

[DOK 3; *assess*, DOK 2; *summarize*]

Summative Assessment Scoring Rubric

- Completion of responses
- Responses show evidence of one or more of the following:
    - Understanding of the skills and abilities needed to be a successful controller
    - Knowledge of what post-secondary steps are necessary to become a controller
- Responses show an honest reflection of the student's interest in air traffic control as a career
- Responses show an understanding of the concepts covered in the lesson
- Responses show an in-depth thinking, including analysis or synthesis of lesson objectives

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

Refer to **Becoming an Air Traffic Controller Teaching Aid 1** for ideas on how to make the ATC simulation even more challenging.

Have students watch a video that explains how aviation has grown and how ATC has helped keep pilots safe over the years: http://video.link/w/UuEe

Taking your students to the local airport's air traffic control tower would be a meaningful experience for them. Check local listings for the ATC tower near you, and ask the tower manager for a tour for your students.

The National Air Traffic Controllers Association (NATCA) offers resources on its homepage on communications with air traffic control at various stages of a pilot's flight. Students may find some of these resources interesting and helpful: https://www.natca.org/.

Show students FAA-produced videos called "True Stories of Air Traffic Control": https://www.faa.gov/tv/?mediaId=1868

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
        - Constructing Explanations and Designing Solutions
    - Disciplinary Core Ideas

        - ETS1.C: Optimizing the Design Solution

- **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

- **RL.9-10.4** – Determine the meaning of words and phrases as they are used in the text, including figurative and connotative meanings; analyze the cumulative impact of specific word choices on meaning and tone (e.g., how the language evokes a sense of time and place, how it sets a formal or informal tone).
- **RST.9-10.1** – Cite specific textual evidence to support analysis of science and technical texts, attending to the precise details of explanations or descriptions.
- **SL.9-10.1.C** – Propel conversations by posing and responding to questions that relate the current discussion to broader themes or larger ideas; actively incorporate others into the discussion; and clarify, verify, or challenge ideas and conclusions.
- **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

https://www.faa.gov/jobs/students/schools/media/air-traffic-cti-schools.pdf
https://www.faa.gov/jobs/career_fields/aviation_careers/
https://www.natca.org/
https://www.travelandleisure.com/airlines-airports/number-of-planes-in-air
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