Pilot Communications in the Airport Environment

Session Time: Three, 50-minute sessions

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

Coordinating ATC expectations and pilot intentions is a key element of aviation safety.

Pilots are always required to maintain vigilance outside the aircraft to maintain safe flight.

ESSENTIAL QUESTIONS

1. Whether in a towered or nontowered environment, how can a pilot use communication to maintain situational awareness and operate safely?

LEARNING GOALS

Students Will Know

- Common ATC instructions that can be expected by pilots operating at towered airports
- Communications practices that pilots can use at nontowered airports to ensure that their position is known
- About pilot deviations and runway incursions, and how both can be avoided through good communications practices

Students Will Be Able To

- *Interpret* the meaning of common phrases used by ATC and other pilots in the airport environment. [DOK-L2]
- *Compare* the communications practices that pilots should use at towered and nontowered airports. [DOK-L3]
- *Apply concepts* to determine ways in which aircraft incidents at airports can be avoided. [DOK-L3]

ASSESSMENT EVIDENCE

Warm-up
As a class, students will listen to a live air traffic control (ATC) broadcast and try to follow along as pilots are given directions. The students will then discuss any patterns they hear and why certain responses are important to communication.

Formative Assessment
Working in pairs, students will answer questions that demonstrate an understanding of pilot communications procedures in the airport environment.

Summative Assessment
Working individually, students will explain the importance of precise radio communications, apply their understanding to respond appropriately in different scenarios, and describe ways to reduce the potential for mishaps related to communications and airport operations.

LESSON PREPARATION

MATERIALS/RESOURCES

- Pilot Communications and the Airport Environment Presentation
- Pilot Communications and the Airport Environment Student Activity 1
- Pilot Communications and the Airport Environment Student Activity 2
- Pilot Communications and the Airport Environment Student Activity 3
- Pilot Communications and the Airport Environment Teacher Notes 1
  - Internet-capable device for each student (or single overhead classroom display of the internet)
- Pilot Communications and the Airport Environment Teacher Notes 2
- Pilot Communications and the Airport Environment Teacher Notes 3

LESSON SUMMARY

Lesson 1: Introduction to Airports and Airport Data
Lesson 2: Airport Markings and Signs
Lesson 3: Airport Lighting
Lesson 4: Traffic Patterns
Lesson 5: Communications
Lesson 6: ATC
Lesson 7: Pilot Communications and the Airport Environment
Lesson 8: Airport Safety and Pilot Considerations

The lesson begins with a **Warm-Up** in which students listen to actual air traffic control communications in order to introduce them to the world of pilot communications. This is followed by a review of the four steps in radio communication, and the four W's method of constructing a message.

During the next session students review key phrases and what they mean to ATC and pilots. Students develop an understanding of the pilot's role in air traffic communications and the safe operation of the aircraft. Working in pairs or small groups, students use the FAA Runway Simulator in an activity that lets them practice communicating on the ground. They then brainstorm ideas for increasing pilot situational awareness on the ground before sharing those ideas with the whole group.

In the third session, students learn the causes of runway incursions and pilot deviations, reviewing examples of incidents that have occurred due to breakdowns in communication. They also learn ways pilots can reduce the potential for incidents with effective communication, and answer sample FAA Private Pilot and Remote Pilot Knowledge Exam questions relating to communications. Finally, a **Summative Assessment** is conducted to evaluate student knowledge of the material presented in this lesson.

BACKGROUND

Not every aircraft is required to have a radio, but radios are key pieces of safety equipment in aircraft. They allow pilots to talk to air traffic controllers and each other to improve the efficiency and safety of flight and ground operations.

Air traffic communications can seem very complex, particularly in an airport environment. However, much of the radio traffic in the airport environment follows set patterns and repeated phrases that can be studied and learned. Pilots prepare themselves by studying key phrases used by ATC, including how they are typically constructed and what they mean. In addition, pilots can improve their efficiency on the radio with practice.

Pilots use other aids to help them communicate and augment their understanding. For example, they will reference an airport diagram while listening to taxi instructions, and write down complex instructions they will need to remember.

Radio communications are necessary for flight safety as ATC actively manages the flow of aircraft. However, pilots remain ultimately responsible for the safe operation of their aircraft.

MISCONCEPTIONS

There are several misconceptions that can arise when discussing aircraft communications at and around airports: air traffic control (ATC) talks only to airplanes in the air; controllers talk only to one airplane at a time; and ATC is the final authority when it gives directives on the radio.

ATC isn't just concerned with aircraft that are airborne; they also control airplanes on the ground. ATC ensures that aircraft taxiing on the airport surface don't interfere with each other, and they manage a traffic flow that includes aircraft on the ground and in the air. In an operating control tower, there will be a local controller who works with airplanes in the air around the airport and those taking off and landing. There may also be another person in the tower at the ground control position. That controller is responsible for aircraft, vehicles, and personnel in the movement areas of the airport. Sometimes, a third controller is in the tower as well: the clearance delivery controller. This person is generally concerned with conveying approved routes of flight to pilots flying on instrument flight plans.

An ATC radio frequency may have numerous pilots using it simultaneously. It is not like a phone line, which is dedicated to communication between two people. Pilots who want to talk to ATC must interweave their conversations with the others already in progress, realizing that due to equipment limitations or other reasons, they may not even hear the other pilots with whom ATC is speaking.

Finally, because controllers often sound authoritative on the radio, pilots may need to be reminded that ATC is not the final authority for control of the aircraft. While regulations do say that pilots should follow ATC clearances and instructions, the final decision to act on those instructions always rests with the pilot, and it is the pilot—not ATC—who is responsible for the result of following those instructions. Pilots are not expected to follow instructions that they feel are unsafe; they can simply say "unable," if necessary. Flight safety is paramount, so pilots are encouraged to tell controllers if they cannot safely comply with an instruction. As always, the pilot-in-command (PIC) is ultimately responsible for the safe operation of the aircraft.

DIFFERENTIATION

To aid in comprehension, encourage students to take notes on common ATC and pilot phrases and their meanings. This can be done by having students create a table in their notebooks with sections dedicated to a phrase, its definition, and an example of its use.

Before revealing the answers to the two scenarios on slides 10-16, break students into pairs to create an appropriate initial radio call for both scenarios.

LEARNING PLAN

ENGAGE

Teacher Material: Pilot Communications and the Airport Environment Presentation

Session 1

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

Slides 4-5: Conduct the **Warm-Up**.

Warm-Up

Have students listen to a live air traffic ground control frequency as controllers give directions to pilots taxiing their aircraft to and from the runways at a major airport.

On a classroom device that all students can hear, go to https://www.liveatc.net/. In the search box, type **KORD**, which is the airport identifier code for Chicago O'Hare International Airport. The resulting page will have the air traffic radio feeds from all of the various control facilities around Chicago O'Hare.

Find the section for "**KORD Ground**" and select that link to listen to live interactions between the pilots and the ground controllers.

(If the KORD radio feed is not working, consider using either the archives of recorded frequencies or choose another airport. You can use a local airport with which students may be familiar, but large airports like Newark (KEWR) or LaGuardia (KLGA) are more likely to have regular live radio transmissions.)

Note: If you choose to use an archive recording, you will have the opportunity to pause the radio chatter and replay portions of the recording. This may be helpful since the quality of the recording makes it difficult to understand what is being said sometimes.

While listening to the radio chatter, have students reference the airport diagram on the slide to try to figure out where the planes on the ground are and where they are going, based on the controller's instructions and the pilots' responses. If you wish to provide a link to the airport diagram for students to view on their devices, use this link for the KORD example: https://www.google.com/url?q=http://aeronav.faa.gov/d-tpp/1910/00166ad.pdf%23nameddest%3D(ORD)&sa=D&ust=1570551370360000&usg=AFQjCNFy_s5BsYv6KKbNj2UxGifwLLl0pQ

(If another airport is used, have the students access the airport diagram on the FAA website: https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dtpp/search/. Search by airport identifier, and then sort by the "Procedure" column. One of the first results alphabetically should be the "Airport Diagram.") After a radio call, it may be helpful to mute the audio while the students attempt to identify where the aircraft are and where they are going.

Ask: What patterns in the radio calls do you hear?

Answers will vary, but students may note that ATC gives instructions by calling aircraft by their call signs ("American 2238" for example), and pilots then repeat or "read back" those instructions to ATC. The phonetic alphabet is used when identifying taxiways and letters in call signs.

Ask: Why do you think this readback is important?

When pilots read back the instructions from ATC, it gives ATC an opportunity to make sure the transmission was heard and understood correctly by the correct aircraft.

Because Chicago O'Hare is a large, complex airport, the radio calls may also appear complex. However, the basic instructions and the format in which they are delivered are fairly standard and apply even to smaller, simpler airports.

EXPLORE

Teacher Material: Pilot Communications and the Airport Environment Presentation

Slide 6: Show the video. Ask students to try to keep track of the different types of air traffic controllers with whom the pilots interact, and how the pilots transition from one controller to another:

- "KLM Cockpit Tales: Part 5 – How pilots communicate with Air Traffic Control" (Length 2:36) https://safeYouTube.net/w/BRjr

For teachers who are unable to access Safe YouTube links the video can also be found here: https://youtu.be/TL_8ghkS2FI

While it may seem complex, all radio communications follow a basic pattern. As shown in the video, pilots contact ATC with requests (for example, a request for landing), ATC provides a clearance (to land), and pilots repeat these clearances back to ATC to ensure they were heard correctly. This basic flow of communications is the same, regardless of the size or complexity of the airport.

EXPLAIN

Teacher Materials: Pilot Communications and the Airport Environment Presentation, Pilot Communications and the Airport Environment Teacher Notes 1, Pilot Communications and the Airport Environment Teacher Notes 2
Student Materials: Pilot Communications and the Airport Environment Student Activity 1, Pilot Communications and the Airport Environment Student Activity 2

Slides 7-8: Federal Aviation Regulations (FAR 91.123) require pilots to follow all ATC instructions, whether on the ground or in the air. While sometimes intimidating for new pilots, talking to ATC is actually a simple process. A repeatable pattern of communication is always followed.

At **slide 7**, ask students to recall the four steps of radio communications discussed in the 3.A.5 Communications lesson, then advance to **slide 8** to fill in the blanks.

1. **Listen** before transmitting. Others may be in the middle of a conversation you didn't hear.
2. **Know** what you're going to say before you key the radio switch.
3. **Speak** clearly so that others can understand you.
4. **Listen** for a response.

Slide 9: When transmitting in the "speak" phase of those four steps, pilots should use the four W's method discussed in previous lessons:

- **Who** are you talking to? State the name of who you are calling.
- **Who** are you? State your aircraft identification.
- **Where** are you? State your position.
- **What** do you want? State your request.

Every pilot should check the weather prior to contacting the tower. If the weather is provided through an automated terminal information system (ATIS), it will include a letter designator. A pilot's initial contact with ATC should include a statement that the current ATIS has been obtained if ATIS is available at the airport. Look for the example in the coming slides.

Slides 10-14: Have the students apply the four W's to the following two scenarios. In the first scenario, the slide builds with each portion of the radio call:

Scenario 1: A pilot at Frederick Municipal Airport in a Cessna 172 is parked on the ramp and is ready to taxi for takeoff. What might the initial radio call might be?

- Who are you talking to? *Frederick Tower…*
- Who are you? *… Cessna 54321…*
- Where are you? *…is at the parking ramp…*
- What do you want? *…ready to taxi for departure…with Bravo*

Bravo, in this case, is the identifier of the current ATIS.

Slides 15-16: In the second scenario, the second slide provides the complete response; the request is to land, and the ATIS designator is Delta.

Scenario 2: A pilot is 10 miles to the west of the airport in a Piper Warrior and is inbound for landing. The radio call the pilot would make is:

"Frederick Tower, Warrior 12345, 10 miles to the west, inbound for landing with Delta."

Slide 17: After that initial radio call, the rest of the conversation will take on a pattern of ATC giving instructions and the pilot reading them back. There are potentially many aircraft on the frequency, so the aircraft callsign should be included in all transmissions. The readback with callsign gives ATC the opportunity to clarify any misunderstandings and ensure that instructions were given to the correct aircraft.

Pilots who are uncertain about a radio call from ATC should not hesitate to ask for clarification. No special verbiage is required—simply saying "say again" or having a plain English conversation is often the best way to clear up confusion. A pilot who is unfamiliar with an airport on the ground can also ask for "progressive taxi instructions," in which the ground controller will give the pilot continuous turn-by-turn directions until the final parking destination on the airport is reached.

Session 2

Slide 18: When all pilots and controllers regularly use standardized formats for their radio calls, it makes radio transmissions easier to understand even in complex environments. Knowing what to expect to hear helps pilots and controllers process information and instructions. Some standard terminology is explained in the following slides.

In response to the Cessna 172 asking to taxi for takeoff in the last slide, the ground controller would likely issue a clearance to taxi to the takeoff runway. The radio call would begin with the destination runway and include instructions to "**taxi via**" a particular route of taxiways on the airport's surface. For example,

"Cessna 54321, taxi Runway 17L. Taxi via Mike, Echo, Delta."

While sometimes referred to as a "taxi clearance," ATC will *not* say "cleared" in a taxi instruction, to avoid any misunderstandings in communications.

Slide 19: If there is another runway between a pilot and the intended departure runway, ATC will instruct pilots to "hold short" of the other runway. When ATC issues a "**hold short**" instruction, a pilot is expected to taxi up to but not allow any portion of the aircraft to extend beyond the runway hold marking. (Runway hold markings and signs were discussed in a previous lesson.)

Normally, an initial taxi instruction to taxi *to* a runway will *not* include a "hold short" instruction if there are no other runways in the pilot's path; pilots are expected to know not to enter the departure runway without clearance.

If a runway is to be entered or crossed, ATC will always issue explicit instructions. A pilot should never enter or cross a runway without these specific instructions. ATC regulations require controllers to hear a readback of all runway hold short instructions, so pilots should repeat hold short instructions, along with the runway identifier and aircraft callsign. If a pilot fails to read back a hold short instruction, ATC will repeat the instruction or remind the pilot to read it back.

Slide 20: As students watch the following video about taxi instructions, have them watch for potential breakdowns in communication and opportunities when communication could have been corrected.

- "Runway Safety: Over the Line" (Length 4:45)
  https://safeYouTube.net/w/dvkr

For teachers who are unable to access Safe YouTube links the video can also be found here: https://www.youtube.com/watch?v=-77ZdpybETU

Questions

Ask students what misunderstandings occurred between the pilot and controller in the video.

Student answers may include that the pilot did not seem to understand the taxi instructions a number of times, and the pilot did not seem to review or have a clear understanding of the taxiway layout at the airport. They may also think that having a number of taxiways with similar names is a problem, and the change in runway may have confused the pilot. The inattention of the pilot during his runup is a problem—the runup is when the engines are run at a high power setting to check engine performance before takeoff. A pilot must maintain firm brake pressure to prevent the aircraft from rolling during runup.

Slide 21: When issuing taxi instructions at an airport with more than one runway, ATC will always include explicit instructions to "cross" or "hold short" of intervening runways—and pilots will read back those instructions. This ensures that there is no ambiguity about when an aircraft will be on any given runway. Instructions to "**cross runway...**" are typically given one at a time, and an aircraft must have crossed the previous runway prior to a new crossing instruction being issued. This practice even includes runways that are inactive or closed.

Any time ATC issues an instruction to cross a runway, a pilot should always exercise extreme vigilance—particularly at night or when visibility is reduced. Prior to entering a runway, it is good practice to scan the entire runway and the final approach path, regardless of the fact ATC issued an instruction.

Slide 22: Pilots wanting to take off from a controlled airport must get explicit clearance from ATC. Pilots must hold short of the runway prior to hearing "**cleared for takeoff**." Only at this point may the aircraft enter the runway and initiate its takeoff roll.

Slide 23: "**Line up and wait**" is an instruction that allows pilots to enter the runway and align their aircraft for takeoff, but they must then continue to wait for explicit takeoff clearance. This instruction might be given if the runway is available, but takeoff clearance cannot yet be granted due to traffic or other reasons (for example, separation from previously departed aircraft, wake turbulence, or an aircraft crossing the runway on an intersecting taxiway). Pilots must remember "line up and wait" does not constitute a takeoff clearance.

Slide 24: ATC may tell an aircraft to "**report**" when it gets to a specific point on the airport or in the surrounding airspace. For example, tower may tell an aircraft approaching to land to "report base for Runway 16." When the aircraft arrives at the designated location, the pilot will simply say, "Skyhawk 54321 base, Runway 16."

Slide 25: As with takeoffs, pilots are only allowed to land on the runway at a tower-controlled airport after receiving the explicit "**cleared to land**" clearance. Like takeoff clearances, landing clearances will also include the aircraft's identification and the runway number to be used. As with all ATC communications, if pilots doubt their clearance, they should ask. It is common for a pilot to ask, "Confirm cleared to land?"

As a general rule, ATC most often expects arriving aircraft to land and taxi to their parking location. However, pilots who are training may want to make multiple landings or touch-and-goes. In that case, pilots may be "**cleared for the option**," which allows pilots to "make a touch-and-go, low approach, missed approach, stop and go, or full stop landing at the discretion of the pilot." (AIM, 4-3-22)

Slide 26: Some busy airports with intersecting runways may use "**land and hold short operations (LAHSO)**." In these cases, pilots landing on one runway may be expected to "hold short" of another crossing runway after they land. The Chart Supplement contains LAHSO information for U.S. airports. Pilots who are not sure they can land in the available distance and "hold short" of an intersecting runway, or who for any reason do not want to participate in LAHSO, can simply inform the controller. ATC will then find an alternate way to work the pilot into the flow of landing traffic.

Slide 27: A less common ATC remark is "**runway shortened**," which is added to clearances given to aircraft taking off or landing on a runway undergoing construction that has decreased its length.

Intersection takeoffs are relatively common for general aviation aircraft, which have relatively short takeoff rolls, when they are based at an airport with a long runway. The intersection departure enables them to shorten their taxi time and take off with sufficient runway still in front of them.

Slide 28: Distribute **Pilot Communications and the Airport Environment Student Activity 1**, which uses the FAA's online Runway Safety Pilot Simulator (https://www.runwaysafetysimulator.com). Have students complete the activity in small groups. Once they have completed the scenarios, give them time to discuss the question in their groups before bringing them together to share their ideas. Sample responses are found in **Pilot Communications and the Airport Environment Teacher Notes 1**.

Slide 29: Traffic pattern communications at nontowered airports follow the same basic construct and patterns as transmissions between pilots and ATC. There are only two significant differences. First, the calls are announced or "broadcast" to anyone listening to the common traffic advisory frequency (CTAF), as opposed to being transmitted to a specific individual. The second is that every radio call also *ends* with the first "W" (who is being talked to). This is because many nontowered airports share CTAFs, so beginning and ending radio calls with the name of the airport helps pilots know which airport a pilot is at. No permission is needed from a controlling agency for a pilot to enter the traffic pattern, land, taxi, or takeoff from a nontowered airport. As a result, vigilance on the part of pilots is required to ensure safe operations.

Slide 30: The Aeronautical Information Manual (AIM) recommends five radio calls at nontowered airports; these calls should be made10 miles out, on downwind, on base, on final, and after clearing the runway following a landing. While the AIM is not regulatory, these calls are generally considered good practice. In addition, pilots should consider making other radio calls that might increase the situational awareness of other pilots operating around the airport. For example, making a radio call to taxi to the runway at a nontowered airport, while not required, might help a pilot in the traffic pattern know to look for potential traffic joining the airport pattern. In addition, it is sometimes advisable to make a radio call directly to another aircraft. For example, if you reported your position 6 miles west of the airport at 3,000 feet, and another pilot reports his or her position as being 5 miles west of the airport but does not say specify an altitude, you might consider directly asking them to ensure the two of you are not at risk of collision. (Aircraft-to-aircraft communications do not normally occur at towered fields because the ATC "owns" the radio frequency.) However, the FAA has explicitly said pilots should not "correct" or otherwise argue with each other over the radio.

Slides 31-32: A pilot in a Skyhawk 54321 on downwind for Runway 18 at Mt. Hawley Auxiliary Airport (3MY) would say: "Mt. Hawley Traffic, Skyhawk 54321, downwind, Runway 18, Mt. Hawley."

Questions

What are the four W's in this radio call?

Who are you talking to? *Mt. Hawley traffic*
Who are you? *Skyhawk 54321*
Where are you? *Downwind for runway 18*
What do you want? *[not stated]*
and again:
Who are you talking to? *Mt. Hawley traffic*

Because the traffic pattern radio call is primarily a position report, the "what do you want" portion is often left out. However, the pilot could choose to say "downwind, Runway 18 for touch-and-go…", which would add that information.

What would the radio call for base be?

Responses may be some variation of "Mt. Hawley Traffic, Skyhawk 54321, base, Runway 18, [touch and go], Mt. Hawley."

If Skyhawk 54321 parked, filled up with gas, and then started back up to fly home, what radio call might the pilot make prior to taxiing to Runway 18 to takeoff?

"Mt. Hawley Traffic, Skyhawk 54321, taxi to Runway 18 for takeoff, Mt. Hawley."

Slide 33: Complete the **Formative Assessment**.

Formative Assessment

Divide students into pairs and provide them with the **Pilot Communications and the Airport Environment Student Activity 2** worksheet. After they have completed the questions, have the teams return to the group to share responses to the final questions in the activity. Sample responses can be found in **Pilot Communications and the Airport Environment Teacher Notes 2**.

(IF TIME PERMITS)

Have students answer Question #5 as a group.

[DOK-L3; *assess*, DOK-L2; *explain*]

EXTEND

Teacher Material: Pilot Communications and the Airport Environment Presentation

Session 3

Slide 34: Not all communications go as they should or as they are planned. According to the FAA, a runway incursion is an event on a runway "involving an aircraft, vehicle, person, or object on the ground that creates a collision hazard or results in a loss of required separation with an aircraft taking off, intending to take off, landing, or intending to land."

Runway incursions happen most often when an airplane crosses a hold short line while another aircraft is taking off or landing, and this error occurs most often as a result of a communications breakdown.

The Beechcraft Baron in the earlier video, which rolled forward onto the runway while another aircraft was landing, caused a runway incursion.

Slide 35: Following 10 years of investigations, the FAA determined that the most common reasons for runway incursions were:

- Failure to comply with ATC instructions
- Lack of airport familiarity
- Nonconformance with standard operating procedures

Slide 36: The FAA has several recommendations to help prevent a runway incursion, with the following specifically dealing with communications and airport/pattern operations. Pilots should:

- Read back all runway crossing and/or hold instructions.
- Review airport layouts as part of preflight planning, before descending to land, and while taxiing.

- Request progressive taxi instructions from ATC when unsure of the taxi route.
- Check for traffic before crossing any runway hold line and before entering a taxiway.
- Study and use proper phraseology in order to understand and respond to ground control instructions.
- Write down complex taxi instructions at unfamiliar airports.
- Keep the airport diagram in view during taxi so it may be referenced if necessary.
- During taxi, minimize distractions.

Slide 37: As discussed in **Pilot Communications and the Airport Environment Student Activity 1**, the FAA also identifies "hot spots" on airport diagrams. The FAA defines a "hot spot" as "a location on an airport movement area with a history of potential risk of collision or runway incursion, and where heightened attention by pilots and drivers is necessary." Often, if pilots review these hot spots in advance, they can understand why those particular areas warrant heightened attention. For example, an unusual taxiway intersection, if not understood in advance, may lead a pilot to turn onto a runway instead of the adjoining taxiway.

Hot spots are identified on airport diagrams, and they are explained in detail in the Chart Supplement so pilots can understand why those locations may be prone to errors.

Questions

Slides 37 and 38 have an image of the airport diagram for Charles B. Wheeler Downtown Airport in Kansas City, Missouri. The airport has three hot spots. Show **Slide 37** for a short time to allow students the opportunity to examine the Hot Spot areas.

Ask: Why do you think those three areas been designated hot spots by the FAA?

*The answers, according to the FAA, appear on **Slide 38**. Allow students to compare their ideas to those of the FAA.*

Slide 38: An excerpt from the Chart Supplement for Charles B. Wheeler Downtown Airport (KMKC) in Kansas City, Missouri, describes the three hot spots and their unique issues that have led to incidents in the past.

Slide 39: A runway incursion that is the fault of a pilot could result in a pilot deviation (PD). A PD is a pilot action that violates any Federal aviation regulation. While PDs should normally be avoided, the regulations do allow intentional deviations in response to certain traffic alerts and during emergencies. Pilots must notify ATC as soon as possible following an intentional deviation. If a pilot does deviate during an emergency, the pilot should file a detailed report within 48 hours with the chief of the appropriate ATC facility, if requested. By contrast, ATC will often notify pilots of unintentional deviations.

Unintentional pilot deviations can occur airborne or on the ground, and could be as simple as straying from an assigned heading or as direct as penetrating restricted airspace without permission. Entering a runway without permission would also likely result in a pilot deviation. In the example earlier from the Beechcraft Baron that accidentally crossed the hold short line, ATC told him on the radio to copy down a phone number to call. The "I have a phone number for you" call from ATC is normally an indication a pilot has a potential deviation. Such a phone call could result in nothing more than a conversation with the controller. In more serious situations, the phone call could be the first step in reporting the deviation to the FAA, which may choose to investigate the incident further and, if warranted, take action against the pilot.

Slide 40: The following video shows two examples of incidents involving communication breakdowns. After watching the video, have the students answer the accompanying questions:

- "Runway Safety – Critical Difference" (Length 5:07)
  https://safeYouTube.net/w/YX8u

For teachers who are unable to access Safe YouTube links the video can also be found here: https://www.youtube.com/watch?v=FqkNjuwLw3c

Questions

Are both of the incidents runway incursions?

Technically, only the first is a runway incursion. Due to the actions of ATC and the pilot on the ground in the second incident, who held his position, the runway incursion was avoided. Both should be treated for the serious incidents they are.

What can pilots do to help mitigate the risks that other pilots might present to them?

Listen to the radio to build awareness about where other aircraft are. Maintain a vigilant lookout, constantly searching for traffic, even when ATC gives a clearance. Prepare in advance by looking closely at an airport diagram to be sure you are familiar with the runways, traffic patterns, and taxiways at any airport you plan to visit. Reading about the airport in the Chart Supplement can also help since hot spots are explained in that document.

Looking out the window—the see and avoid concept—is a critical element; the pilot of the Cessna 210 on the ground in the second part of the video shows that checking to see if anyone is on final approach can prevent an incident or accident.

Slide 41: The following video shows another incident created by confusion but mitigated by an astute flight crew. Prior to the video, ask the students to watch for what the crew of the second airliner did to prevent a potential mishap:

- "Runway Safety: Providence, RI (2013)" (Length 4:22)
  https://safeYouTube.net/w/gykr

For teachers who are unable to access Safe YouTube links the video can also be found here: https://youtu.be/equVF3ULVw8

Questions

What did the crew of the second airliner (USAir 2998) do that prevented a potential incident?

Students may be inclined to say "held their position" or otherwise refused to move until the confusion was resolved, which is partially true but is not the first thing the flight crew did. As the incident unfolded, the crew listened to the radio, built an awareness of what was happening, and maintained a picture of the other aircraft and the airport environment around them. Then, the crew had the fortitude to decline a takeoff clearance even in the face of a forceful controller. The pilot, not the controller, is ultimately responsible for the safe operation of the aircraft. Visualizing the "big picture" is known as "maintaining situational awareness," and the crew of USAir 2998 did a good job maintaining situational awareness.

Slide 42 - OPTIONAL: The two prior videos make clear the point that runway incursions are a critical safety issue, so you may choose to skip this slide and video; however, the Tenerife accident remains the deadliest aviation disaster in history to this day, so it is notable in a historic light.

Poor communications discipline in the runway environment contributed to the deadliest aviation disaster in history. In 1977, two Boeing 747s collided on the runway at Los Rodeos Airport on the island of Tenerife in the Canary Islands, killing 583 people. A video from the Smithsonian re-enacts the buildup to the incident. As the students watch, have them write down and prepare to discuss the chain of events they believe led to the crash. After the video, discuss the students' observations.

- "This 1977 Plane Crash Occurred Right on the Runway" (Length 3:14)
  https://safeYouTube.net/w/dgqs

  For teachers who are unable to access Safe YouTube links the video can also be found here: https://www.youtube.com/watch?v=36XzwJqo_tg

EVALUATE

Teacher Materials: Pilot Communications and the Airport Environment Presentation, Pilot Communications and the Airport Environment Teacher Notes 3
Student Material: Pilot Communications and the Airport Environment Student Activity 3

Slides 43-50: Review the Private Pilot Knowledge Test questions.

Slide 51: Conduct the **Summative Assessment**.

Summative Assessment

Distribute **Pilot Communications and the Airport Environment Student Activity 3**. In this **Summative Assessment**, students will individually interpret common ATC phrases, understand communications procedures and the role of the pilot, and apply communications and planning concepts to avoid incidents at airports. Sample responses are available in **Pilot Communications and the Airport Environment Teacher Notes 3**.

[DOK-L3; *strategic thinking*]

Summative Assessment Scoring Rubric

- Follows assignment instructions
- Responses show evidence of one or more of the following:
  - Correct recall of the verbiage, conditions, and purposes of radio communications
  - Reasonable application of radio communications procedures to notional scenarios
  - 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 or almost all radio communications verbiage, conditions, and purposes and makes a reasonable application of communications procedures to scenarios, with explanation.
7-8	Correctly understands most radio communications verbiage, conditions, and purposes, with some errors, and makes generally reasonable applications of communications procedures to scenarios, with some incomplete analysis or errors.
5-6	Correctly understands some radio communications verbiage, conditions, and purposes, with errors, or makes generally reasonable applications of communications procedures but lacks adequate explanation.
0-4	Provides few, if any, correct ideas about radio communications verbiage, conditions, and purposes, and/or makes poor application of communications procedures with inadequate explanation.

GOING FURTHER

If time allows, have students complete the AOPA Air Safety Institute online course: "Say It Right: Mastering Radio Communication" available at: https://www.aopa.org/lms/courses/say-it-right/

This free course provides an overview of communications procedures throughout flight operations. Sections 1, 2, 3, 5, and 6 cover basic radio operations and towered/non-towered airports. Students should consider completing the other sections and taking the AOPA quiz at the end of the online course.

STANDARDS ALIGNMENT

NGSS STANDARDS

Three-Dimensional Learning

- **HS-ETS1-4** - Use a computer simulation to model the impact of proposed solutions to a complex real-world problem with numerous criteria and constraints on interactions within and between systems relevant to the problem.
    - Science and Engineering Practices
        - Using Mathematics and Computational Thinking
    - Disciplinary Core Ideas
        - ETS1.B: Developing Possible Solutions
    - Crosscutting Concepts
        - Systems and System Models

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

FAA AIRMAN CERTIFICATION STANDARDS

PRIVATE PILOT

III. Airport and Seaplane Base Operations

Task A. Communications, Light Signals, and Runway Lighting Systems

- Knowledge - The applicant demonstrates understanding of:
    - **PA.III.A.K1** How to obtain proper radio frequencies.
    - **PA.III.A.K2** Proper radio communication procedures and ATC phraseology.
- Risk Management - The applicant demonstrates the ability to identify, assess and mitigate risks, encompassing:
    - **PA.III.A.R1** Poor communication.
    - **PA.III.A.R2** Failure to recognize and declare an emergency.
    - **PA.III.A.R3** Confirmation or expectation bias.
- Skills - The applicant demonstrates the ability to:
    - **PA.III.A.S1** Select appropriate frequencies.
    - **PA.III.A.S2** Transmit using phraseology and procedures as specified in the AIM.
    - **PA.III.A.S3** Acknowledge radio communications and comply with instructions.

Task B. Traffic Patterns

- Knowledge - The applicant demonstrates understanding of:
    - **PA.III.B.K1** Towered and non-towered airport operations.
- Risk Management - The applicant demonstrates the ability to identify, assess and mitigate risks, encompassing:
    - **PA.III.B.R1** Collision hazards, to include aircraft, terrain, and wires.
    - **PA.III.B.R2** Distractions, loss of situational awareness, and/or improper task management.

REFERENCES

Pilot's Handbook of Aeronautical Knowledge: 14-28 through 14-35.

AOPA Air Safety Institute Safety Advisor: Operations at Towered Airports
https://www.aopa.org/training-and-safety/air-safety-institute/safety-publications/safety-advisors

AOPA Air Safety Institute Safety Advisor: Operations at Nontowered Airports
https://www.aopa.org/training-and-safety/air-safety-institute/safety-publications/safety-advisors

KLM Cockpit Tales: Part 5 – How pilots communicate with Air Traffic Control
YouTube Link: https://youtu.be/TL_8ghkS2FI (2:36)
Safe YouTube Link: https://safeYouTube.net/w/BRjr

Runway Safety: Over the Line
YouTube Link: https://www.youtube.com/watch?v=-77ZdpybETU (4:45)
Safe YouTube Link: https://safeYouTube.net/w/dvkr

Runway Safety – Critical Difference
YouTube Link: https://www.youtube.com/watch?v=FqkNjuwLw3c (5:07)
Safe YouTube Link: https://safeYouTube.net/w/BRjr

Runway Safety: Providence, RI (2013)
YouTube Link: https://youtu.be/equVF3ULVw8 (4:22)
Safe YouTube Link: https://safeYouTube.net/w/gykr

FAA FAASTeam Runway Safety Pilot Simulator
https://www.runwaysafetysimulator.com

FAA Air Traffic Organization Policy Order JO 7110.65W
https://www.faa.gov/regulations_policies/orders_notices/index.cfm/go/document.information/documentID/1031850