Airport Markings and Signs

Session Time: Four, 50-minute sessions

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

For ease and safety of operations at unfamiliar airports, signage, markings, and lighting are standardized.

An airport's rules and procedures are published and readily available to pilots.

ESSENTIAL QUESTIONS

1. How do the various markings and signs at an airport help pilots to safely and efficiently navigate to and from runways for takeoff and landing?

LEARNING GOALS

Students Will Know

- The six different types of signs that are used at airports.
- The different types of markings that pilots may encounter when taxiing on an airport surface.
- The three types of runways (visual, non-precision instrument, and precision instrument), and how their markings differ.

Students Will Be Able To

- *Identify* different types of airport signs and markings. (DOK-L1)
- *Distinguish* between different markings and signs, and explain how a pilot should react to them. (DOK-L2)
- *Analyze* an airport diagram, and interpret airport information contained in one. (DOK-L3)

ASSESSMENT EVIDENCE

Warm-up
Students will begin by watching a video of a Citation Sovereign as it taxis to the runway and takes off from Fort Lauderdale. Students are to take notes regarding the different markings and signs that they observe around the airport—particularly along the taxiways and runways. The teacher will then ask questions and facilitate a discussion regarding airport markings and signs. Students will also be encouraged to note radio communications taking place in the video; this topic will be covered in a later lesson.

Formative Assessment
In this activity, students will demonstrate their knowledge of what they have learned so far regarding airport signs and markings. Students will use their notes to interpret the signs and markings and complete the worksheet.

Summative Assessment
In this activity, students will demonstrate their knowledge of what they learned throughout the course. Students will analyze an airport diagram and complete the worksheet.

LESSON PREPARATION

MATERIALS/RESOURCES

- Airport Markings and Signs Presentation
- Airport Markings and Signs Student Activity 1
- Airport Markings and Signs Student Activity 2
- Airport Markings and Signs Student Activity 3
- Airport Markings and Signs Student Activity 4
- Airport Markings and Signs Student Resource (Flashcards)
- Airport Markings and Signs Teacher Notes 1
- Airport Markings and Signs Teacher Notes 2
- Airport Markings and Signs Teacher Notes 3
- Airport Markings and Signs Teacher Notes 4

Build Your Own Airport Activity

- One gray foam sheet, 12” 18”
- One black foam sheet, 12” 18”
- Two pieces white foam board, 20” 30”
- One roll white craft tape, 1/4” wide
- One roll yellow craft tape, 1/4” wide
- Orange post-it notes
- Toothpick or other craft stick about 2–3” long
- Clear tape
- Three pieces of green felt
- One pack, white 1” numbers
- Ruler
- Tape measure or yard stick
- Scissors
- Exacto knife or box cutter
- Tacky glue
- 17 magnets
- 17 washers

LESSON SUMMARY

Lesson 1: Introduction to Airports and Airport Data
Lesson 2: Airport Markings and Signs
Lesson 3: Airport Lighting

The lesson will begin with a warm-up in which students take notes on a video, then consider what they may already know or assume about airport markings and signs. Students will then complete an activity where they explore an airport diagram. Following this, they will learn about the various airport signs and basic markings then complete a Formative Assessment that quizzes them on what they have learned.

Students then dig deeper into various airport markings and the variety of runways on which they appear. Students will answer questions about these markings and challenge themselves with critical thinking as they learn how all markings and signs inform pilots. This includes an activity in which students quiz each other with flashcards, which will prepare them for the ‘Build Your Own Airport’ activity immediately following.

Finally, students will complete the Summative Assessment that concludes the lesson. If time allows, the Going Further section allows students (individually or as a class) to explore more familiar airports and airport diagrams, gather and share their insights/observations, and draw new conclusions. A video emphasizes why it's critical that pilots always be aware of airport markings and signs.

BACKGROUND

Like road signs along a highway, airport signs help pilots navigate while taxiing at airports. The amount and complexity of signage at an airport depends upon the airport's size and type of operations. For example, airports that specialize in serving cargo aircraft, helicopters, or international aircraft will likely have signage more specific to their operations.

At a nontowered airport, pilots are responsible for staying vigilant by scanning for other aircraft visually and monitoring activity on their radios. At these airports, pilots are responsible for proper separation of aircraft on the terminal areas, taxiways, and runways. Frequent and consistent radio communication is critical at nontowered airports.

At towered airports, by contrast, pilots receive taxi instructions from ground controllers located inside the airport's control tower. They also receive clearance to cross active runways, take off, and land from controllers who are located inside the same control tower.

Regardless of the type of airport, it is critical for pilots to understand and take note of the various airport signs and markings that they are likely to encounter. The signs used in the United States are also common around the world, so understanding the signs and airport markings in this lesson allows students to navigate airports across the globe.

MISCONCEPTIONS

At towered airports, the surface area is divided into two parts: a "movement area" and a "non-movement area." These terms can be confusing—particularly "non-movement area." Students may think it sounds like an area in which aircraft movement is prohibited, but this is not the case. A non-movement area simply refers to all ramps and aprons that are not controlled by ATC, which means that pilots can move or taxi the airplane in these areas without seeking clearance from or communicating with the control tower. Movement areas, by contrast, refer to all surface areas under ATC control.

DIFFERENTIATION

To support struggling learners in the **EXPLORE** section of the lesson plan, consider pairing students up with one another so that they can help each other complete Student Activity 1.

To promote retention and understanding in the **EXPLAIN** section of the lesson plan, have students continue taking notes on the different types of signs and markings using the notes they started when watching the "Airport Markings" video.

A key part of learning airport markings and signs is the ability to memorize both how they look and what they mean. These notes may help students feel more confident and have greater success when they review the flashcards in the **EXTEND** section of the lesson plan.

LEARNING PLAN

ENGAGE

SESSION 1

Teacher Material: Airport Markings and Signs Presentation

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

Slide 4-6: Conduct the **Warm-Up**.

Warm-Up

Have students watch the following video of a Citation Sovereign as it taxis to the runway and takes off from Fort Lauderdale Executive (KFXE). As they watch, have students take notes regarding the different markings and signs that they observe around the airport—particularly along the taxiways and runways.

- "Cockpit view takeoff Fort Lauderdale Sovereign CE680" (Length 4:20) https://video.link/w/XZHs

For teachers who are unable to access Safe YouTube links, the video can also be found here: https://www.youtube.com/embed/ezH_-kN_tFc?start=0&end=260

When the video ends, advance to Slide 5.

- Ask students to describe and, if possible, explain the various markings and signs observed in the video. Speculate about the information that they may be conveying.

Student answers will vary based on their knowledge and experience. Airport signs and markings include taxiway centerline markings, hold short lines, present taxiway signs, taxiway turn-on signs, runway number signs, etc. While students will not yet know the correct terms for these markings and signs, they can describe those that they see and infer data from them.

- How are the pilots maintaining situational awareness while taxiing to the runway?

Pilots are maintaining situational awareness by both communicating with ground control (ATC) and by following the airport diagram (like a 2D overhead map) on the cockpit multi-function display (MFD). Pilots must also actively confirm that intersections are clear prior to crossing.

We're not correcting wrong answers here, because this warm-up is simply to engage students' minds and to engage in discussion so that they become interested to discover whether or not their assertions were correct as the lesson proceeds. Once the discussion is wrapping up, go to Slide 6.

- What radio communications did you pick up on? How did the airport signs and markings play into how the pilots communicated with ground control? Name several examples if you can.

Student answers will vary based on what they perceived as well as their knowledge and experience. One example is the 'hold short' double solid line at which the pilots were stopped at the beginning of the video. The pilots had to receive clearance to advance past the 'hold short' line and taxi onto the main taxiway from a ground controller. Another example is the hold short line as the aircraft was #1 in sequence on the taxiway waiting to taxi onto the active runway. The aircraft had to receive a clearance from the tower to cross this double-yellow line denoted with a red square with white runway numbers. On each side of that hold line, there are flashing lights to alert pilots there is a hold line.

Once again, we are not correcting wrong answers here, but simply encouraging a lively discussion and knowledge sharing as a class. Once the discussion wraps up, go to the next slide.

EXPLORE

Teacher Materials: Airport Markings and Signs Presentation, Airport Markings and Signs Teacher Notes 1
Student Material: Airport Markings and Signs Student Activity 1

Slide 7: Provide a copy of **Airport Markings and Signs Student Activity 1** to all students. Ask students to review the diagram and recall the video. Instruct them to individually complete the worksheet and answer the questions. Sample answers are provided in **Airport Markings and Signs Teacher Notes 1**.

EXPLAIN

Teacher Materials: Airport Markings and Signs Presentation, Airport Markings and Signs Teacher Notes 2
Student Material: Airport Markings and Signs Student Activity 2

SESSION 2

Slide 8: As students learned in the first lesson, an airport is defined as "any area of land or water used or intended for landing or takeoff of aircraft." This session focuses on the ground environment at an airport, and looks at how pilots move to and from runways to take off or land.

The following video reveals the various airport signs and their meanings. Advise students to take notes, because they will answer questions at the end.

- "Airport Signage" (Length 4:26)
  https://video.link/w/J8Lq

For teachers who are unable to access Safe YouTube links, the video can also be found here: https://www.youtube.com/watch?v=VCDo9xJk4YE

Questions

Red signs with white letters are most frequently used as what in relation to runways?

Runway holding position signs alerting the pilot to where the runway environment begins.

What color background and lettering is used to indicate the taxiway that the pilot is currently on?

Black background and yellow lettering.

What precision instrument approach equipment (3 letters) has a critical area often indicated on a taxiway with a red sign and white letters?

ILS (instrument landing system)

What are some examples of yellow background/black letter destination signs?

RAMP, MIL, TERM, CUSTOMS, FBO, FUEL, noise abatement procedures

Slide 9: Like road signs along a highway, airport signs help pilots navigate while taxiing at airports. The amount and complexity of signage at an airport depends upon the airport's size and type of operation. At a nontowered airport, pilots are responsible for scanning for other aircraft visually and monitoring radio calls. They must maintain proper separation of aircraft both on the terminal areas and taxiways, as well as on runways. Frequent and consistent radio communication is critical at these airports. At towered airports, by contrast, pilots receive taxi instructions from ground controllers located inside the airport's control tower. They also receive clearance to cross active runways, take off, and land from tower controllers located inside the control tower. Regardless of airport type, it is critical for pilots to understand and be aware of airport signs and markings that they are likely to encounter.

Slide 10: There are six types of signs that might be found at airports.

- Mandatory instruction signs
- Location signs
- Direction signs
- Destination signs
- Information signs
- Runway distance remaining signs

Questions

Using the knowledge that you've already gained, match each sign on this slide to its category.

Answers from left to right, top to bottom:

Destination sign
Location sign
Runway distance remaining sign
Information sign
Mandatory instruction sign
Direction sign

Slide 11: Mandatory instruction signs have a red background with white text. They denote an entrance to a runway, critical area, or prohibited area.

Location signs have a black background with yellow text and a yellow border. They are used to identify either the taxiway or runway on which the aircraft is currently located. They do not have arrows.

Direction signs have a yellow background with black text and arrow(s). They identify the designation and direction of taxiway(s) intersecting either a runway or another taxiway.

Slide 12: Destination signs look similar to direction signs. They too have a yellow background with black text and arrow (s), but these signs show the direction to take off runways, terminals, customs, FBOs, etc.

Information signs also have a yellow background with black text. These signs provide pilots with specialized information, such as areas that cannot be seen from the control tower, radio frequencies, noise abatement areas /procedures, etc. The airport manager/operator determines the need, size, and location of information signs.

Runway distance remaining signs have a black background with white numbers. The numbers on this sign indicate the distance of the remaining runway in thousands of feet.

Slide 13: Now that students have learned about airport signage, airport markings will be explained next. The following video reveals the various airport markings and their meanings. Due to the length of this video, pause at approximately halfway in order to break for questions so students don't lose interest or get overwhelmed. (The second half will be played with the following slide.) Advise students to take notes, because they will answer questions at the end of each slide.

- "Airport Markings" (Length 7:07; pause video at 3:33 [to be resumed on next slide]) https://video.link/w/HCLq

For teachers who are unable to access Safe YouTube links, the video can also be found here: https://www.youtube.com/watch?v=MrrL92AH23A

Questions

Runway numbers correspond to what?

To the runway's magnetic heading.

Other runways at the same airport oriented to the same heading (especially common at large /major airports) would be designated with what letters at the end? What do those letters stand for?

C for center, L for left, and R for right.

For what reasons would large X's be painted or marked along a runway?

If a runway is closed, either permanently or temporarily, or if it is unsafe for any reason.

What term is used for a portion of a runway that is not suitable for landing, but is suitable for taxi, takeoff, and slowdown upon landing from the opposite direction? How is this portion marked?

A displaced threshold. White arrows.

Slide 14: Continue the video. Students are to take notes, because they will answer questions at the end.

- "Airport Markings" (Length 7:07; start video at 3:33 and play until the end) https://video.link/w/HCLq

For teachers who are unable to access Safe YouTube links, the video can also be found here: https://www.youtube.com/watch?v=MrrL92AH23A

Questions

The center of a major taxiway is painted with what marking and color?

A solid yellow line.

What is the purpose of runway holding position markings? What do they look like?

They signify where a taxiway comes into contact with a runway and that aircraft must get permission before crossing the double yellow lines. There are four yellow lines; two dashed lines on the runway side and two solid lines on the taxiway side.

What color are the ILS critical area taxiway markings?

Black background with solid yellow parallel and perpendicular lines (like a ladder).

Do you always have to hold short of the ILS critical areas? When would you have to hold short of this area?

No. Hold short only when instructed to do so by the tower/ATC.

What are airport parking areas called?

Ramps or non-movement areas

What is the purpose of lead-in and lead-off lines?

They are curved lines guiding aircraft off of and onto runways.

Slide 15: Like signs, runway markings can vary depending upon the type of operations at an airport. While a runway used only under basic visual flight rules (VFR) might have just centerline markings and runway numbers, airports with instrument flight rules (IFR) operations that serve more advanced or commercial aircraft will likely have runways with additional markings.

Although airport runways are laid out based on the surrounding communities (both residential and commercial) and terrain, significant thought is also given to local prevailing winds. Since headwinds and diminished crosswinds are ideal for takeoffs and landings, orienting runways based on the prevailing winds yields operational benefits to inbound and outbound aircraft.

Runway numbers reference magnetic, rather than true, north. A runway is numbered by dividing its magnetic heading by ten (rounded to the nearest whole number), and dropping the last digit. For example, a runway with a magnetic heading of 358 degrees would become runway 36. Numbers always refer to the approach direction to the runway. If a runway is numbered 36 on one end, its other end will be numbered 18, as this is the reciprocal. Occasionally, a runway number will change when—due to the slow shifting of the magnetic pole—its magnetic heading changes to an extent that the number needs to be increased or decreased.

- "Scientists scramble to keep up with earth's changing magnetic North Pole" (Length 2:39) https://video.link/w/q83s

For teachers who are unable to access Safe YouTube links, the video can also be found here: https://www.youtube.com/watch?v=sPVr45IchX0

Questions

Team up into groups of 3 or 4 to discuss and describe an example of how this may occur. The team with the first thorough and correct explanation wins!

Example: Runway 31 may have had a magnetic bearing of 313 degrees (310 degrees true plus a 3 degrees west magnetic variation) when built in 1995. However, in 2020, its magnetic bearing shifts to 318 (310 degrees true plus an 8 degrees west magnetic variation). Therefore, due to rounding, runway 31 will be repainted and renamed to runway 32.

Slide 16: Sometimes, it becomes necessary to relocate the threshold of the runway; for example, if a beginning portion of a runway is closed due to construction or maintenance. While there are different methods for marking a relocated threshold, a common way to highlight the change is to mark the relocated threshold by a ten-foot-wide white bar across the width of the runway. Yellow arrowheads are then placed across the width of the runway just prior to the threshold bar.

When a runway threshold is relocated, the closed portion of the runway is not available for use by aircraft for takeoff or landing, though it can be used for taxiing.

Slide 17: A displaced threshold is similar to a relocated runway threshold in that it refers to an area of the runway that cannot be used for landings. There are important differences, however. A displaced threshold is not temporary, but is designated either to provide suitable obstacle clearance for landing/final approach aircraft or to ensure safe pavement

conditions. While some pavements or surfaces are durable enough to withstand the impact of landing heavy aircraft, others are only durable enough to withstand aircraft taxiing or taking off. And unlike a relocated runway threshold, the portion of the runway prior to the displaced threshold may be used for takeoff.

To mark a displaced threshold, a ten-foot wide white threshold bar is located across the width of the runway, and white arrows are located along the centerline in the area between the beginning of the runway and the displaced threshold. White arrowheads are located across the width of the runway just prior to the threshold bar.

Slide 18: The runway safety area (RSA) is a surface surrounding the runway that has been prepared, or found suitable, for reducing the risk of damage to aircraft that might undershoot, overshoot, or otherwise veer from the runway. RSAs—which vary in dimensions—are typically graded and mowed, and can be used by emergency vehicles should a situation warrant.

Lateral boundaries of an RSA are often identified by the presence of runway holding position signs and markings on the adjoining taxiway stubs. If operating at a non-towered airport, it is important that pilots never enter an RSA without making sure of adequate separation from other aircraft.

RSA boundary signs can be found at some airports, particularly those with control towers. These signs, which have a yellow background with black markings, are visible to pilots as they exit the runway. At towered airports, controllers may ask pilots to report when clear of the runway; these boundary signs make it easier to do this. An aircraft has departed an RSA boundary only when the entire aircraft has passed the sign and its associated painted pavement markings.

Slide 19: It is vitally important that pilots know how to identify runway holding positions (where to *hold short* of an active runway), because noncompliance with a runway holding position marking may result in the filing of a deviation against a pilot by the controlling air traffic facility or the FAA. A pilot deviation (PD) is an action of a pilot that violates any Federal Aviation Regulation—not just in the air, but also when operating on an airport surface. Runway holding positions are identified with a combination of markings and signs.

Runway holding position signs have white characters on a red background. They can be found on taxiways that intersect a takeoff runway, or on taxiways that meet a takeoff runway threshold. If a taxiway arrives at a holding position at the threshold of a runway, the sign will likely only show the designation of that runway (e.g. “36”). If, however, the intersection occurs somewhere else on the runway (between the thresholds), the sign shows the location of both runway thresholds. For example, the sign “18-36” indicates that the threshold for runway 18 is to the left and runway 36 is to the right.

Collocated with runway holding position signs are holding position markings. These markings consist of four yellow lines—two solid and two dashed—that extend across the width of the taxiway to indicate where the aircraft should stop when approaching a runway. The aircraft must stop before any portion of it crosses the first solid line, and—if at a towered airport—hold until clearance to cross has been received. If the tower is closed or the airport is nontowered, pilots may taxi onto the runway only if it is clear of other aircraft and there are no aircraft on final approach. In this instance, pilots should communicate their present position, that they are crossing the hold line, and their intentions. This should be communicated on the airport CTAF.

When an aircraft is exiting a runway, the same markings can be seen from the other side, and the aircraft is approaching the double dashed lines. An ATC clearance is not required to cross the marking when exiting the runway. To be fully clear of the runway, every portion of the aircraft (including the tail section and all associated antennas) must cross both the dashed and the solid lines.

Slide 20: The ILS broadcasts lateral and vertical (glideslope) approach signals to arriving aircraft, guiding them to the runway. To ensure a quality, unobstructed broadcast signal, these ILS antennae have critical areas that must be kept clear of obstacles, including aircraft. Taxiways often extend into ILS critical areas, and most of the time this is of no concern. However, when ceilings and visibility are diminished, it is vital that these areas remain clear, because approaching aircraft rely upon a constant and unobstructed signal. During these situations, ATC protects ILS critical areas by instructing taxiing aircraft to “hold short” of the areas until inbound aircraft have either landed or are no longer on final approach. When this occurs, it is important that no part of the aircraft extends into or beyond the markings.

ILS critical areas are identified by both signs and markings. The ILS critical area hold sign is outlined in black, and has white characters on a red background. It is installed adjacent to ILS holding position markings. These markings appear on the pavement as a horizontal yellow ladder extending across the width of the taxiway.

Slide 21: Holding position markings for taxiway/taxiway intersections consist of a single dashed yellow line extending across the width of the taxiway. These markings can be found painted across taxiways where ATC normally holds aircraft short of a taxiway intersection. If no taxiway holding position mark is present, then an aircraft should stop at a point that allows adequate clearance from other aircraft on an intersecting taxiway. In other words, an aircraft should yield to others that are already established on the taxiway onto which the aircraft will be turning.

Slide 22: If a runway or taxiway is closed temporarily, painted yellow X's or raised lighted yellow X's will be placed at the ends of the runway; closed taxiways are marked in a similar manner. Depending on the reason for the closure, the duration of the closure, and other factors, it is possible that a visual indication will not be present. This is another reason why it is important for pilots to frequently check NOTAMs and listen to the ATIS (both discussed in the previous lesson) for runway and taxiway closure information.

If a runway or taxiway has been permanently closed, the runway threshold, runway designation, and touchdown markings are covered or removed and X's are placed at each end of the runway and, typically, at 1,000-foot intervals.

Slide 23: Taxiway direction signs have a yellow background and black characters, which identify the designation of intersecting taxiways. Arrows indicate the direction that an aircraft would need to turn to place it on the designated taxiway. Direction signs are usually placed near an intersection, and are typically seen on the left side. The signs—along with similar painted markings on the surface—indicate the direction toward a different taxiway, leading off a runway, or out of an intersection.

Taxiway centerline markings are solid yellow lines that extend down the center of a taxiway. At most towered airports, enhanced taxiway centerline markings are also used. These enhanced markings consist of yellow dashed lines on either side of the normal centerline marking, and are intended to alert pilots of an upcoming runway. They typically extend up to 150 feet prior to a runway holding position marking, and are used to reduce the number of runway incursions that occur during taxi.

Slide 24: Destination signs have black characters on a yellow background, and are used to indicate a destination at an airport. These signs have an arrow showing the direction of the taxi route to that destination. When a turn is necessary to reach a destination, the sign will indicate the turn prior to the intersection. The types of destinations that might be indicated by these signs include runways, aprons, terminals, military areas, civil aviation areas, cargo areas, international areas, and fixed-based operators (FBOs).

If two or more destinations can be reached by using the same taxi route, a dot is used on the sign between the different destinations. If, however, the destinations can be reached by different routes, then a vertical black bar will separate the destinations on the sign, with different directions accompanying the two routes.

Slide 25: Conduct the **Formative Assessment**.

Formative Assessment

In this activity, students will demonstrate what they have learned regarding airport markings and signs. Provide each student with a copy of the **Airport Markings and Signs Student Activity 2** worksheet. Ask students to reference their notes taken throughout the lesson so far to interpret the signs and markings and answer the questions. Answers can be found in **Airport Markings and Signs Teacher Notes 2**.

[DOK-L2; *distinguish*]

EXTEND

Teacher Materials: Airport Markings and Signs Presentation, Airport Markings and Signs Teacher Notes 3
Student Materials: Airport Markings and Signs Student Activity 3, Airport Markings and Signs Student Resource Flashcards

SESSION 3

Slide 26: Runway markings differ depending upon the type of runway that an airport has. There are three types of runway markings: visual, non-precision instrument, and precision instrument. The chart on the slide shows the different markings that are associated with each type of runway.

Questions

Based on the chart, what's the difference between visual and non-precision runway markings?

These markings would be the same if the runway is at least 4,000 feet long and intended to be used by international commercial aircraft. If not, threshold and/or aiming point markings may be missing.

Based on the chart, what two markings differentiate a precision instrument runway from the others? Why do you think these are necessary for precision runways? Be specific.

Precision runways have touchdown zone and side stripe markings.These two markings serve as visual indications pilots can use to fly precision (vertical and lateral instrument guidance) approaches. These additional markings allow pilots to fly approaches in marginal conditions before breaking out of the weather and landing. Without these markings, it would be much more difficult to determine where an aircraft is in relation to the runway.

Slide 27: Some markings are universal and common to all paved runways. These include the designator, which refers to the runway numbers and/or letters identifying the runway. Also, universally present are uniformly spaced white stripes that mark the centerline of a runway and provide guidance for takeoffs and landings.

Slide 28: The aiming point markings, which are present on all runways 4,000 feet or longer used by jet aircraft, serve as a visual aiming point for landing aircraft. These aiming point markings look like two white rectangular stripes. They are located on each side of the runway centerline, and are about 1,000 feet from the landing threshold.

These bars give pilots' eyes a focus point during the workload-intensive, last 100 feet or so of descent prior to flaring and touchdown. Like a bullseye on a target, it helps pilots be more precise in their final descent to touchdown.

Slide 29: There are two potential configurations for runway threshold markings. Some runways have eight longitudinal stripes of uniform dimensions marking the threshold. Others have different numbers of stripes, related to the width of the runway. Regardless of the number of stripes, all runway threshold markings identify the same thing: the beginning of the runway that is available for landing. The table on the slide shows the correlation between the number of stripes and runway width.

Questions

If a pilot sees 12 stripes on the threshold of a runway, what can he or she assume about the runway's width?

The pilot can assume that the runway is at least 150 feet (45 m) wide, and less than 200 feet (60 m).

Slide 30: Touchdown zone markings, as the name implies, identify the touchdown zone for landing aircraft, and are intended to provide pilots with distance information in 500-foot increments. These markings consist of groups of one, two, and three rectangular bars arranged in pairs on both sides of the runway centerline. Note that, as depicted, aiming point markings are typically substituted for the second set of touchdown zone markings. Touchdown zone markings are required only on precision instrument runways.

Slide 31: Side stripes—another feature of precision instrument runways—are painted around the edges of a runway, creating a contrast between the runway and the area around it. These stripes make it easier for pilots approaching the runway to distinguish between the landing surface and the surrounding terrain, especially during periods of low visibility, low ceilings, and precipitation.

Questions

Why do you think side stripes are a requirement for precision runways?

Answer will vary based on students' ideas. Possible answer: While this would not seem too important during good weather/VFR operations, they assist pilots significantly during low visibilities, low ceilings, and precipitation. When it's difficult to make out the runway environment in poor weather, these side stripes highlight the runway boundaries, making it easier to land.

Slide 32: Print the **Airport Markings and Signs Student Resource Flashcards** one-sided, then fold each page in half so the image to be identified appears on one side and the description of that image appears on the other side. You can prepare a full set of flashcards for each student pair, or just print one set for students to share.

Split the students up into pairs of two. Give each pair a complete or partial set of flashcards. Instruct the students to take turns quizzing each other on the flashcards they have. If students have partial sets of flashcards, have them rotate sets to another group when done, until all students have been quizzed on all flashcards. Advise them to pay close attention, because their knowledge of this information will be assessed both in the following **Airport Markings and Signs Student Activity 3** and at the end of the lesson in **Airport Markings and Signs Student Activity 4** (the Summative Assessment).

Note: there are no Student Activity worksheets or Teacher Notes for this activity because the answers are already on the back of the flashcards and the students will quiz each other.

(Flashcards obtained from AOPA: http://www.nxtbook.com/nxtbooks/aopa/runwaysafetyflashcard/index.php#/1)

Teaching Tips

If time allows, this would be a good time to show the "Delta and Southwest very close call on takeoff" (Length 3:24) video and discuss. This would help to break up Student Activity 3 and Student Activity 4. The link is provided in the **Going Further** section of this lesson plan.

Slide 33: To enhance students' understanding of airport markings, the class will be split into 3 or 4 groups and each group will build their own miniature airport. If time or resources are lacking, this activity may also be completed as a class, dividing tasks so that each student makes a contribution. Another option is to have each student take one or two steps in the process so that the project moves faster. This project will run through the end of SESSION 3 and about halfway through SESSION 4 so that there is enough time remaining to complete the Summative Assessment.

Give each student group the **Airport Markings and Signs Student Activity 3** worksheet. If time permits and students want to create their own airport components, they may do that, as long as they use the appropriate runway markings. At the end of the project, assess the students' work for accuracy. Then, if time allows, have a class discussion based on the questions provided in **Airport Markings and Signs Teachers Notes 3**.

EVALUATE

Teacher Materials: Airport Markings and Signs Presentation, Airport Markings and Signs Teacher Notes 4
Student Material: Airport Markings and Signs Student Activity 4

SESSION 4

Slides 34-41: Quiz students on the Private Pilot Knowledge and Part 107 Remote Pilot Knowledge Test questions.

Slide 42: Conduct the **Summative Assessment**.

Summative Assessment

In this activity, students will demonstrate their knowledge of airport markings and signs by analyzing an airport diagram and answering the questions. Provide students with the **Airport Markings and Signs Student Activity 4** worksheet. Answers can be found in **Airport Markings and Signs Teacher Notes 4**.

[DOK 3; *analyze*]

Summative Assessment Scoring Rubric

- Follows assignment instructions
- Postings show evidence of one or more of the following:
    - Knowledge of airport markings and signs
    - Provides details about the airport markings and signs
- Contributions show understanding of course 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 most components of the airport diagram, demonstrates a strong grasp of the information it is conveying, and offers a reasonable taxiing scenario.
7-8 Correctly understands most components of the airport diagram, as well as the information it is conveying, with some errors, and offers a generally reasonable taxiing scenario, with some errors.
5-6 Correctly understands some components of the airport diagram, as well as the information it is

conveying, with errors, and offers a generally reasonable taxiing scenario, with an incomplete and/or flawed taxi route.
0-4 Provides few, if any, correct responses about the airport diagram, and shows poor understanding of information that is being conveyed by it.

GOING FURTHER

Teacher Material: Airport Markings and Signs Presentation

Slide 43: The following video reveals the criticality of not just understanding the airport environment, including its markings and signs, but also how clearly receiving, understanding, and acting upon clearances from tower is vitally important. During the video, have students pay close attention to the radio transmissions and the airport diagram to see how the tower directs the aircraft. Have students take notes and write down the critical actions (be they right or wrong) taken by the pilots and the critical radio transmissions made by both aircraft and the control tower. Questions will be asked at the end.

- "Delta and Southwest very close call on takeoff" (Length 3:24)
  https://video.link/w/gTRq

For teachers who are unable to access Safe YouTube links, the video can also be found here: https://www.youtube.com/watch?v=b26NcJCLZI4

Questions

What do you think was critical information communicated by tower? Think of at least two communications.

Answers will vary based on students' opinions. Probable answers:

Tower communicated that there was an aircraft with a similar callsign, which the aircraft acknowledged (though it didn't help).

Tower told both aircraft to "stop, stop, stop!" when they were on a collision course, which both aircraft were quick to act upon.

Multiple aircraft transmitted at once blocking anyone's ability to understand what was said.

Tower said, 'no delay', which may have made both aircraft feel rushed which caused the confusion and error.

You may also consider guiding students through the following activity:

1. Navigate to https://skyvector.com, then click on airports at the top:

1. Ask the students if there's a particular airport (perhaps a local one) that they have flown out of, are familiar with, or are curious about. Then type in either that airport's name or ICAO ID (if known) and click search:

1. The airport diagram is on the left-hand side of the airport's data page. Click it:

1.

Ask the students to examine the diagram and see if there's anything new that they haven't seen thus far. Challenge the students to decipher the diagram, as time allows.

STANDARDS ALIGNMENT

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

- **PA.I.D.R5** Limitations of air traffic control (ATC) services.
- **PA.I.D.S2** Apply pertinent information from appropriate and current aeronautical charts, Chart Supplements; NOTAMs relative to airport, runway and taxiway closures; and other flight publications.
- **PA.I.F.K2** Factors affecting performance, to include:
    - **PA.I.F.K2d** d. Airport environment
- **PA.II.A.R3** Environment (e.g., weather, airports, airspace, terrain, obstacles)
- **PA.II.D.K1** Current airport aeronautical references and information resources including Chart Supplements, airport diagram, and appropriate references.
- **PA.II.D.K2** Taxi instructions/clearances.
- **PA.II.D.K3** Airport markings, signs, and lights.
- **PA.II.D.K6** Procedures for:
    - **PA.II.D.K6b** b. Radio communications at towered and non-towered airports

REFERENCES

Pilot's Handbook of Aeronautical Knowledge: 13-16 through 13-24
FAA Airport Diagram of Fort Lauderdale Executive Airport (FXE): https://skyvector.com/files/tpp/1908/pdf/05942AD.PDF

FAA Airport Sign and Marking Quick Reference Guide: https://www.faa.gov/airports/runway_safety/publications/media/QuickReferenceGuideProof8.pdf
AIM 0203:http://tfmlearning.faa.gov/Publications/atpubs/AIM/Chap2/aim0203.html
FAR AIM 115: http://www.faraim.org/faa/aim/aim-115.html
SkyVector: https://skyvector.com