Traffic Patterns

Session Time: Two, 50-minute session(s)

DESIRED RESULTS

ESSENTIAL UNDERSTANDINGS

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

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

ESSENTIAL QUESTIONS

1. What must pilots know and do to maximize the safety of flight in airport traffic patterns?

LEARNING GOALS

Students Will Know

- Expectations pilots have of each other and the airport environment when taking off and landing
- The purpose of established, standard operating procedures for flying in an airport traffic pattern
- How to enter a traffic pattern when flying to a nontowered airport

Students Will Be Able To

- *Recall* the different legs of an airport traffic pattern. [DOK-L1]
- *Summarize* the need for standardized traffic pattern procedures. [DOK-L2]
- *Explain* how a pilot would enter an airport traffic pattern. [DOK-L3]

ASSESSMENT EVIDENCE

Warm-up
As a class, students will compare two videos of vehicle traffic in two different parts of the world and then discuss the measures taken to make road traffic safe and efficient, even in high-volume areas. The students will then discuss how these concepts might apply to air traffic near an airport, which will segue into the lesson.

Formative Assessment
In pairs, students will answer scenario-based questions to identify how to operate in the traffic pattern by discussing pattern practices and entry/right-of-way procedures.

Summative Assessment
Individually, students will identify the segments of a traffic pattern and explain the purpose of standardized patterns. Students will also answer scenario-based questions on pattern operations, pattern entry, and radio procedures, and perform an analysis of potential conflicts between aircraft in the pattern.

LESSON PREPARATION

MATERIALS/RESOURCES

- Traffic Patterns Presentation
- Traffic Patterns Student Activity 1
- Traffic Patterns Student Activity 2
- Traffic Patterns Student Activity 3
- Traffic Patterns Student Activity 4
- Traffic Patterns Student Activity 5
- Traffic Patterns Student Activity 6
- Traffic Patterns Teacher Notes 1
- Traffic Patterns Teacher Notes 2
- Traffic Patterns Teacher Notes 3
- Traffic Patterns Teacher Notes 4
- Traffic Patterns Teacher Notes 5
- Traffic Patterns Teacher Notes 6

Managing Airport Traffic: Student Activity 1 (per group)

- 11” 17” or 8.5” 11” sheets of paper, cut lengthwise
- Five (5) Sticky notes
- Black marker

Planning for the Traffic Pattern: Student Activity 3 (per group)

- Satellite Imagery (for example, Google Earth)
- Digital FAA products (https://www.faa.gov/air_traffic/flight_info/aeronav/digital_products/dafd/search/)
- AirNav (http://www.airnav.com/airports/)
- SkyVector (https://skyvector.com/)

Identifying Traffic Patterns: Student Activity 4 (per group)

- Pad of sticky notes
- Black marker
- Runway and labels from Student Activity 1

Flight Simulation: Student Activity 5

- Computer with flight simulation software or flight simulator
- Joystick or yoke
- Optional: Throttle quadrant, rudder pedals, additional monitors
- Masking tape may be used for a non-electronic simulation.

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 begins by asking students to consider how automobile traffic moves. Since this is something familiar to students, they are asked to consider how cars are kept moving along with as little congestion and as few accidents as possible. Students are then asked to apply those concepts to how aircraft maneuver around airports for takeoff and landing as they learn the segments of airport traffic patterns.

The next part of the lesson will discuss traffic pattern entry procedures, including methods for deciding which runway to use and how to enter a traffic pattern without creating a conflict with other aircraft.

Finally, traffic pattern hazards will be discussed, along with practices that pilots can follow to mitigate them.

BACKGROUND

If you've only flown on commercial airliners, you may never have experienced a standard Visual Flight Rules (VFR) traffic pattern. Air Traffic Control (ATC) vectors (directs) most airliners to line up with a runway miles from the threshold. The pilots then fly straight in to a landing. By contrast, pilots at nontowered airports, follow a standardized, rectangular path around the runway called the traffic pattern which is flown when visual flight rules (VFR) apply. The VFR traffic pattern was created as a safe and orderly way for traffic to approach and land at an airport without ATC services.

A VFR traffic pattern exists to provide pilots with an established path they can follow to set themselves up for a landing. Because traffic patterns are largely standardized, pilots can fly to different airports and integrate with other traffic, even in busy airspace. These paths have defined flows and established right-of-way rules, similar to those drivers might follow when entering or exiting a highway. Much like drivers use “rules of the road,” pilots use traffic patterns to safely and efficiently move around an airport’s airspace.

Like a busy intersection, a popular or busy airport can become a congested and unsafe place in the air above the runway. At an airport with a control tower, air traffic controllers manage the flow of aircraft and help pilots ensure adequate separation from other aircraft. But at nontowered airports, pilots need a standardized and consistent way to approach the airport to minimize the chance of midair collisions by knowing where to look for other pilots attempting to land at the same airport. This standardized method of flying around the runway in use is known as the traffic pattern.

MISCONCEPTIONS

Pilots are expected to follow the traffic pattern procedures outlined in the Aeronautical Information Manual (AIM), but pilots often debate whether those AIM procedures are *required*. The introduction to the AIM explicitly states that the publication is “not regulatory,” meaning it does not carry the same weight as aviation regulations, yet it also states that it contains “the fundamentals required in order to fly in the United States.” Some argue safety and common sense effectively render the recommendations in the AIM mandatory. Others point out that while many of the recommendations in the AIM may be good ideas, they cannot be made mandatory. For example, the AIM recommends radio calls within the traffic pattern, but the FAA does not even require aircraft to have radios in some airspace, which makes it impossible to *require* the radio calls. The AIM recommendations are considered the best practices for pilots, and the expectation is that pilots abide by those recommendations to ensure safe flight.

DIFFERENTIATION

To help learners retain concepts and information in the **EXPLAIN** section of the lesson plan, provide students with a pre-printed vocabulary list of traffic pattern terminology that includes definitions and a properly labeled diagram of the traffic pattern and airport for reference as needed.

LEARNING PLAN

ENGAGE

Teacher Material: Traffic Patterns Presentation

SESSION 1

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

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

Warm-Up

Ask the students to think about the question on the slide while they watch the following two short videos:

"How do we create a safe and orderly environment for driving?"

- "Crazy Indian Traffic Congestion" (Length 0:35)
  https://video.link/w/ipjt

For teachers who are unable to access Safe YouTube links the video can also be found here: https://www.youtube.com/embed/iEIk3RpV6RA?start=0&end=35

- "New York City Traffic Time Lapse Intersection" (Length 0:40)
  https://video.link/w/4qjt

For teachers who are unable to access Safe YouTube links the video can also be found here: https://www.youtube.com/embed/-WTkcCngT6w?start=0&end=40

The two videos contain markedly different results in traffic management.

Ask: Compare the two scenes. What steps do we take to avoid the first video and create efficient, safe traffic flow, even in high-volume traffic areas?

Responses may vary but may include: Rules of the road help everyone follow the same guidelines. Traffic signals and lane markings help communicate predictable procedures. There is a common understanding that other drivers will follow the rules. When drivers break the rules, agencies act to enforce the rules.

How do you think this might relate to airplane traffic near an airport?

Responses will vary as the students apply the prior response to an airplane/flying environment, but they may include the general concept that pilots need to have a set of common rules and an expectation that other pilots will follow those rules.

Option: In order to save time, you may choose to show only the scene from India. The discussion question to pose then becomes something along the lines of "What procedures or systems do governments put in place to avoid congestion like this?" and "What would happen if this kind of congestion occurred in the air above an airport as aircraft tried to land?"

[DOK-L2; *relate*]

EXPLORE

Teacher Materials: Traffic Patterns Presentation, Traffic Patterns Teacher Notes 1
Student Material: Traffic Patterns Student Activity 1

Slide 6: Divide the class into groups of 3 or 4 and distribute **Traffic Patterns Student Activity 1**. Have the students perform the activity and answer the accompanying questions. Further instructions and potential responses are available in **Traffic Patterns Teacher Notes 1**. After 10 to 15 minutes, have the groups share their ideas and responses with the other groups. Note that students will reuse these supplies while performing a similar **EXTEND** activity.

EXPLAIN

Teacher Materials: Traffic Patterns Presentation, Traffic Patterns Teacher Notes 2
Student Material: Traffic Patterns Student Activity 2

Slide 7: Just like an intersection full of cars, a busy airport is a "choke point" for air traffic, funneling airborne aircraft to a single point on the ground. Because airport airspace is a high-traffic area, pilots need to know how to fly around an airport safely. At an airport with a control tower, ATC actively manages the flow of aircraft and helps pilots ensure separation from other aircraft. At nontowered airports, pilots use recommendations and procedures from the FAA as well as their own good judgment to work together to ensure safe and efficient operations.

Because controllers actively manage airport traffic patterns at towered fields, this lesson will focus on nontowered airports. However, the same basic practices and principles apply to both types of airports.

The slide contains an image of an airplane at an airport with a control tower in the background.

Slide 8: At every airport, pilots should expect to use a standardized and consistent approach to the runway. This increases the predictability of all aircraft and gives all airborne pilots the chance to operate with the same basic set of expectations. This standardized approach is known as the **traffic pattern**. The shared understanding of how an airport traffic pattern works helps pilots know where to look for other aircraft, and helps them predict what other pilots are likely to do, even if they don't communicate anything on the radio. This increased awareness helps reduce the chances of potentially dangerous conflicts.

Slide 9: The airport traffic pattern is a rectangular shape, one side of which is the runway. Each portion of the rectangle is a "leg" of the traffic pattern. The traffic pattern for most single-engine general aviation aircraft is normally 1,000 feet above ground level (AGL), unless otherwise published. If an airport has a different traffic pattern altitude, it will be published in the Chart Supplement. While 1,000 feet is a round number, airport elevations rarely are. For ease of flying, most pilots will round the altitude off to a hundred. For example, a field with an elevation of 770 feet would have a traffic pattern altitude of 1,770 feet—or, rounded off, 1,800 feet.

Generally, the basic design of a traffic pattern is the same for nearly every airport. Any special deviations are published in the Chart Supplement, appear in NOTAMS, or are printed on aeronautical charts (maps for pilots). The most common differences are altitudes other than 1,000 feet AGL or right traffic patterns where all turns are to the right rather than to the left.

The slide contains a graphic with a runway and a red line representing the traffic pattern around the airport. Each leg is labeled. The wind is coming from the north (toward the viewer). This graphic will be used on subsequent slides, with each leg highlighted.

Slide 10: After an aircraft leaves the ground during takeoff, it begins the **departure** leg of the traffic pattern. An aircraft leaving the airport area to fly to another destination might continue to climb on the departure leg and exit the airport traffic pattern either straight ahead or with a 45-degree turn away from the runway (left for left traffic patterns and right for right traffic patterns). Pilots who want to practice landings may choose to stay in the traffic pattern.

Slide 11: If a pilot chooses to remain in the pattern (this is called "closed traffic"), he or she will climb on the departure leg until coming within 300 feet of the traffic pattern altitude. At this point, the pilot will turn 90 degrees left to the next leg of the traffic pattern: **crosswind**. The crosswind leg is so named because, ideally, the wind is blowing down the runway, and aircraft are landing into the wind. After taking off into the wind, a 90-degree left turn means the pilot is flying "across" the wind. In order for a pilot to maintain a rectangular ground track, it may be necessary to fly with the

aircraft's nose pointed partially into the wind (called crabbing) on the crosswind leg. On this leg, pilots continue to climb until they reach pattern altitude, at which point they set their power and trim for the manufacturer's recommended traffic pattern speed.

Slide 12: But which direction do pilots turn to fly the crosswind leg? The standard traffic pattern contains **left** turns. While most traffic pattern guidance from the FAA is advisory, in the Airman's Information Manual and relevant Advisory Circulars the direction of traffic patterns is regulatory, and details can be found in Part 91 of the Federal Aviation Regulations covering nontowered airport operations in Class G and E airspace:

91.126(b)(1). Each pilot of an airplane must make all turns of that airplane to the left unless the airport displays approved light signals or visual markings indicating that turns should be made to the right, in which case the pilot must make all turns to the right.

Slide 13: The "visual markings" to which the regulation refers are generally traffic pattern indicators found surrounding a wind indicator or segmented circle. The wind indicator could be a "landing direction indicator," also called a "tetrahedron," which points toward the wind, indicating the landing direction. A windsock indicates both the wind direction and the speed of the wind. The faster the wind blows, the straighter and more horizontal a windsock will become. As per FAA standards, a 15-knot wind will fully extend a properly functioning windsock.

Notice that a windsock is like a funnel. The wide end is where the wind enters, and the narrow opening is where the wind exits. A pilot needs to think about "flying into the small opening."

The slide contains a graphic depicting a windsock, tetrahedron, segmented circle, and traffic pattern indicators. The red arrow points toward the tetrahedron for emphasis. This graphic will be used on the next slide to highlight the traffic pattern indicators.

Slide 14: "Traffic pattern indicators" are arranged in "L" shapes around a segmented circle. The leg of the "L" shape that points to the center of the circle is the "landing strip indicator" and represents the runway; the other leg is the "traffic pattern indicator" and represents the base leg of the traffic pattern. Taken together and viewed from above, the "L" indicates the turn direction from base to final on the landing runway. Using the example on the slide, assume the airport has runways that are due north/south (36/18) and east/west (09/27). The traffic pattern indicators show that runways 27 and 18 would have right turns to final (right traffic), while runways 36 and 09 would have left turns to final (standard).

Questions

The photo at the bottom of the slide is the traffic pattern indicator from New Century Airport, Kansas (KIXD). (The windsock is not visible due to the resolution of the satellite photo, but its faint shadow can be seen.) KIXD has two runways, 18/36 and 04/21. Do any of the runways have right traffic patterns?

Both 36 and 04 are right traffic, based on the traffic pattern indicators on the bottom half of the segmented circle.

Slide 15: Besides the visual markers indicated in the regulation, how might pilots find out about a potential nonstandard traffic pattern? The answer is, as always, in preflight planning.

Because the standard traffic pattern is to the left, most nontowered airports will have no markings related to the traffic pattern on a VFR sectional. Airports with right patterns, however, will display an "RP" with the affected runway (for example, "RP 1, 24"). The Chart Supplement for the airport will also designate which runways, if any, have right traffic. The sectional excerpt on the slide is also from KIXD and shows "RP 4, 36," indicating that pilots should fly a right-hand traffic pattern to runways 04 and 36. The Chart Supplement excerpt for KIXD also shows "rgt tfc" for both 04 and 36.

Slides 16-17: Reasons an airport might publish a right pattern rather than a left pattern may be to avoid overflight of a town population, noise abatement, or to avoid a potential hazard. Pilots may not know why they are required to fly a right pattern at a particular airport.

This airport in Wells, NV, has right traffic for runways 01 and 08, which keeps all aircraft to the east and south. Using normal flight planning aids, it's difficult to see why. But if you look at internet satellite imagery, you can see a shooting range located to the northwest of the airport, directly under where a traffic pattern would be. While it is unlikely that bullets would be flying around at traffic pattern altitude, it's probably best to avoid flying over the range, and the local airport has created nonstandard traffic patterns to avoid it.

Questions

If time allows, ask the students why the airport symbol on the aeronautical chart only shows runway 08/26 and not 01/19. The answer is on slide 16 within the excerpt from the Chart Supplement. Runway 01/19 is a gravel and dirt runway. Only paved ("hard-surface") runways are depicted on aeronautical charts.

Slide 16 has graphics depicting the sectional chart and Chart Supplement information for Wells Municipal Airport /Harriet Field (KLWL), and **Slide 17** contains satellite imagery of the airport, with an inset highlighting the shooting range that would be under the traffic pattern to the northwest.

Slide 18: We looked at how pilots depart a pattern—using the departure and crosswind legs. Now let's look at the remaining legs. From crosswind, pilots will perform a second 90-degree turn, in the same direction they turned for the crosswind leg, to fly parallel to the runway in the opposite direction from which they just took off. On a typical day, this would put them flying with the wind, or downwind: thus, it is called the downwind leg of the traffic pattern. The **downwind** leg should be flown one-half to one mile away from the runway.

Teaching Tips

While on downwind, many pilots estimate their distance from the runway based on where the runway visually intersects their wing (for low-wing aircraft) or their wing struts (for high-wing aircraft), as it appears to them from the pilot's seat.

Downwind is typically the longest leg of a traffic pattern, and it is where many pilots begin their before landing checklist. Altitude on the downwind is maintained until the aircraft is abeam the approach end of the runway, at which point pilots set their power, speed, and configuration in accordance with their Pilot Operating Handbook. This normally results in a gradual descent. The downwind heading is held beyond the approach end of the runway until the runway threshold is approximately 45 degrees behind the pilot. Pilots approximate this by looking directly over their shoulder.

Slide 19: At this point, pilots begin another 90-degree turn to fly perpendicular to the runway. This is the **base** leg of the pattern.

The base leg continues until pilots are ready to turn toward the runway for their final approach. Prior to making this turn, pilots should look in the opposite direction to see if there are any aircraft flying a long final approach that could create a conflict.

Slide 20: If no other traffic is observed approaching the runway, pilots can turn to the **final** leg of the traffic pattern. Pilots should plan to roll out of this turn at least one-quarter mile from the end of the runway and approximately 500 feet above the runway. At this point, a landing is normally expected.

However, if a pilot feels there is any reason a safe landing is not assured, the pilot may decide not to land and try again. This is called a go-around. A go-around requires the pilot to climb back up to traffic pattern altitude and alter course slightly to the side of the runway. When executing a go-around, the pilot enters the **upwind** leg of the traffic pattern. After climbing to a safe altitude, pilots should fly parallel to the runway on the side opposite the downwind leg of the traffic pattern so they can more easily observe any departing traffic.

Questions

How can you explain why pilots on the departure leg are encouraged to fly straight out or at a 45-degree angle toward the downwind side of the pattern?

Student answers should include some realization that a departing aircraft may not see an aircraft on the upwind leg and a straight departure or turn away from the upwind leg helps avoid a midair collision.

Slide 21: While aircraft are typically expected to follow the same procedures for a traffic pattern, some will not; because the Aeronautical Information Manual (AIM) is nonregulatory, pilots are not bound to follow suggested practices.

The AIM recommends that pilots announce their position as they turn to the downwind, base, and final legs of the traffic pattern. More details on radio procedures will be addressed in a lesson that focuses on communications. At nontowered airports in Class E and Class G airspace, a radio may not be required, so pilots should not rely on other aircraft to always announce their position.

The regulation that directs airplanes to make left turns in a traffic pattern also directs helicopters and powered parachutes to “avoid the flow of fixed wing aircraft,” which means these pilots will often avoid a standard pattern. Agricultural aircraft are another exception, as they are allowed to deviate from the normal procedures found in Part 91 of the regulations and instead follow Part 137, which was written specifically for them. Part 137.45 states that crop dusters (more formally known as “agricultural aircraft”) are explicitly permitted to deviate from the traffic pattern normally required for other aircraft.

Even if every pilot follows the rules, not every aircraft will be making radio calls, and not every aircraft is required to follow the same traffic pattern. Taking this into account, pilots should always follow “see and avoid” techniques to maximize their flight safety in the traffic pattern.

Slide 22: Even at a single runway airport, pilots need to know which direction they’re going to land. Pilots want to land into the wind, and proper preflight planning should inform them about wind direction and available runways at their destination. Any time pilots approach an airport, one of the first things they should do is obtain current weather information for the airport. This normally comes from ASOS/AWOS or ATIS, depending on the facilities available. At a nontowered airport, pilots can use current wind information to determine the best runway to use.

If wind information is unavailable, pilots should listen to the airport’s common traffic advisory frequency (CTAF) to hear what runway other aircraft are using. Generally, pilots are expected to join the flow of established traffic.

If no weather information is available and no other traffic is in the pattern, pilots should plan to overfly the airport and observe the wind indicator (windsock, wind tee, or tetrahedron) to determine the best landing runway. In addition, pilots should see the segmented circle and/or pattern direction indicators, which should match the expected traffic pattern determined in preflight planning. Pilots who plan to fly directly over an airport should be at least 500 feet above traffic pattern altitude to avoid conflict with any aircraft already in the pattern.

Slide 23: Pilots intending to join the downwind leg of a traffic pattern should plan to fly a 45-degree entry to the pattern, much like using an on-ramp to merge with traffic on the highway. The 45-degree approach aligns them with the general traffic flow while still being able to look for other aircraft on the downwind leg.

Pilots joining a traffic pattern from the opposite side of the airport have two primary options: they can overfly the airport above the pattern and then descend to a 45-degree entry to the downwind leg, or they can fly overhead at pattern altitude and turn directly into the downwind leg after crossing the runway.

Pilots who plan to fly over the traffic pattern should be 500 feet above the 1,000-foot AGL pattern altitude to avoid the flow of traffic already in the pattern at the airport. However, at some airports there is a second, higher pattern for large or turbine aircraft at 1,500 feet AGL. In this case, pilots should fly 500 feet above the highest traffic pattern. The Chart Supplement for the airport normally includes information on multiple traffic patterns. After passing over the runway, pilots should plan to fly beyond the downwind leg to a point approximately two miles from the airport before beginning a descending turn to the 45-degree entry to the downwind leg.

The slide contains a graphic that illustrates how an aircraft could cross over the runway and perform a descending turn to enter the downwind leg of the pattern.

Slide 24: Pilots who choose to fly at pattern altitude and make a direct entry to downwind should not use this technique if the pattern is busy. Pilots should also remember that not every aircraft is required to have a radio, so flying at pattern altitude could create conflicts with other aircraft, even if nothing is heard on the airport frequency.

The slide contains a graphic that illustrates how an aircraft could cross over the runway and perform a direct entry turn to downwind.

Slide 25: If a nontowered airport has more than one runway, it is sometimes possible for both runways to be in use. For example, the winds may favor one runway, but a pilot may choose to fly on the other runway to accomplish crosswind landing training. Pilots who are approaching the airport and do not want to use the crosswind runway can still land on the other runway, though radio coordination with the other aircraft is necessary to ensure that their patterns and landings do not conflict.

Slide 26: If an airport has parallel runways, airport procedures will usually require pilots to fly a left traffic pattern to one runway and a right traffic pattern to the other, with a “no transgression zone” between the two runways. With parallel runways, it is important not to overshoot the turn to final approach to avoid impeding the final approach of the other runway, and turns on the departure leg should be made away from the other runway so as not to cause a conflict with traffic departing on the parallel runway.

At a nontowered airport, and especially at a field with more than one runway, all pilots must work together to ensure safe, efficient operations. Federal regulations do not cover every conceivable circumstance, and sometimes good judgment and common sense should prevail – as well as a desire to be a good neighbor to fellow aviators.

Slide 27: With this in mind, the right-of-way rules discussed in federal regulations still apply in the traffic pattern. One of the relevant regulations (91.113) states the following:

“Aircraft, while on final approach to land or while landing, have the right-of-way over other aircraft in flight or operating on the surface…When two or more aircraft are approaching an airport for the purpose of landing, the aircraft at the lower altitude has the right-of-way, but it shall not take advantage of this rule to cut in front of another which is on final approach to land or to overtake that aircraft.”

In essence, the pilot who is closest to landing (that is, the lowest) should be allowed to land first—but pilots shouldn’t dive down below another aircraft to “cut in front” of it.

Slide 28: Have the students watch the video that summarizes traffic pattern procedures.

- “Traffic Patterns” (Length 3:16)
  https://video.link/w/mS1t

For teachers who are unable to access Safe YouTube links the video can also be found here: https://www.youtube.com/embed/w_Bbs4K7L5U?start=0&end=196

Slides 29-30: Remember, a VFR traffic pattern is flown under VFR flight rules, and pilots are required to see and avoid other traffic, even if there is a control tower. Pilots should remain vigilant and continuously scan for other aircraft entering, exiting, and flying the traffic pattern, keeping an eye out for aircraft that may not be following the appropriate procedures.

Because "see and avoid" requires visibility, the FAA recommends pilots participate voluntarily in "Operation Lights On" and fly with their landing lights on, even during the day.

Pilots should also be cognizant of the limitations of their aircraft. Low-wing aircraft allow for limited downward visibility, and high-wing aircraft may not allow pilots to see traffic above them or to the inside of their turns. Pilots of both types of aircraft should consider dipping or raising their wings to check for conflicting traffic in their blind spots.

Pilots should also consider that conventional gear ("taildragger") airplanes often have limited visibility over the nose. Some ground and landing accidents have occurred as a result of this limitation to visibility.

Teaching Tips

The images at the bottom of the slide are from real-world incidents in which a low-wing aircraft collided with a high-wing aircraft during landing. The incidents are discussed in two articles available here:

https://www.aopa.org/news-and-media/all-news/2008/may/21/pilots-live-to-tell-about-dangers-in-the-pattern

https://www.premierflightct.com/newsletters/TrainingArticles/AvoidMidair.html

Next, ask the following questions and let the students discuss.

Questions

Where in the pattern do you think aircraft collisions are most likely to occur? During what time of day or weather do you think most collisions occur?

Encourage a collection of brainstorming responses and reasons, and then segue into the next slide, which will discuss the answers.

Slide 31: Despite established traffic pattern procedures, airplanes do occasionally collide in the pattern, but it may not be when or where you expect. In the traffic pattern, most collisions occur during daylight and in good weather, and 84 percent of collisions occur on final, short final, or the runway itself.

Pilots can help ensure safe pattern operations by following established procedures, continuously looking for other aircraft, monitoring the radio, and transmitting their own position reports for other pilots.

The slide contains a bar graph that shows where midair collisions tend to occur in traffic patterns. Final (34 percent), short final (16 percent), and the runway (34 percent) comprise 84 percent of mishaps.

Slide 32: Complete the **Formative Assessment**.

Formative Assessment

Divide the class into pairs and provide students with the **Traffic Patterns Student Activity 2** worksheet. Have each pair complete the assigned worksheet. Potential responses are available in **Traffic Patterns Teacher Notes 2**.

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

EXTEND

Teacher Materials: Traffic Patterns Presentation, Traffic Patterns Teacher Notes 3, Traffic Patterns Teacher Notes 4, Traffic Patterns Teacher Notes 5
Student Materials: Traffic Patterns Student Activity 3, Traffic Patterns Student Activity 4, Traffic Patterns Student Activity 5

Slide 33: This part of the lesson consists of three activities. As the teacher, you may choose...

- To divide the class into three groups, and each group performs one activity. If time allows, students can report on their experiences in a class discussion.
- To divide the class into three groups and each group rotates through the activities.
- To select one activity if time is at a premium.

Suggestions: First, divide the class into pairs and distribute **Traffic Patterns Student Activity 3**. Have the students work on completing the assignment for approximately 15 minutes, and then come together as a class to share insights and responses. Further instructions and potential responses are available in **Traffic Patterns Teacher Notes 3**.

- Once complete, divide the class into the same groups they were in for Student Activity 1. Distribute and have the groups complete **Traffic Patterns Student Activity 4**. Allow the groups to work for approximately 15 minutes, and then reconvene to share responses and insights. Further instructions and potential responses are available in **Traffic Patterns Teacher Notes 4**.
- If time allows and resources are available, distribute and complete **Traffic Patterns Student Activity 5**. Instructions and potential responses are available in **Traffic Patterns Teacher Notes 5**.

Teaching Tips

The "masking tape runway" in **Traffic Patterns Student Activity 5** is a common tool in military pilot training. If you walk into nearly any military aviation training facility, you'll see the local runway and traffic pattern permanently marked out on the floor. Military student pilots spend a lot of time walking around the pattern and practicing procedures, radio calls, etc. before their flights.

EVALUATE

Teacher Materials: Traffic Patterns Presentation, Traffic Patterns Teacher Notes 6
Student Material: Traffic Patterns Student Activity 6

Slides 34-47: Review the Private Pilot Knowledge Questions.

Slide 48: Conduct the **Summative Assessment**.

NOTE: Consider posting the links to the videos in the **REFERENCES** section for students to review before any assessments or for clarification.

Summative Assessment

Distribute **Traffic Patterns Student Activity 6**. In this summative assessment, students will individually identify the parts of a traffic pattern and the purpose of standardized patterns, answer scenario-based questions on pattern operations, pattern entry, and radio procedures, and perform an analysis of potential hazards between aircraft in the pattern.

Sample responses are available in **Traffic Patterns Teacher Notes 6**.

[DOK-L2; *explain*, DOK-L4; analyze]

Summative Assessment Scoring Rubric

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

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
        - Asking Questions and Defining Problems
        - Constructing Explanations and Designing Solutions
    - Disciplinary Core Ideas
        - ETS1.A: Defining and Delimiting Engineering Problems
    - Crosscutting Concepts
        - None
- **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 B: Traffic Patterns**
    - **PA.III.B.K1** Towered and nontowered airport operations
    - **PA.III.B.K2** Runway selection for the current conditions
    - **PA.III.B.K3** Right-of-way rules.
- **V. Performance and Ground Reference Maneuvers, TASK B: Performance and Ground Reference Maneuvers**
    - **PA.V.B.K4** Relationship of rectangular course to airport traffic pattern.

REMOTE PILOT

- **II. Airspace Classification and Operating Requirements, TASK B: Airspace Operational Requirements**
    - **UA.II.B.K3** Operations near airports.
    - **UA.II.B.K4** Potential flight hazards.
    - **UA.II.B.K4a** Common aircraft accident causal factors
- **V. Operations, TASK B: Airport Operations**
    - **UA.V.B.K4** Traffic patterns used by manned aircraft pilots.

REFERENCES

Advisory Circular AC 90-66B
https://www.faa.gov/documentLibrary/media/Advisory_Circular/AC_90-66B.pd

Pilot's Handbook of Aeronautical Knowledge, pages 14-20 through 14-22 https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/phak/media/16_phak_ch14.pdf

Airplane Flying Handbook, Chapter 7: Traffic Patterns, https://www.faa.gov/regulations_policies/handbooks_manuals/aviation/airplane_handbook/media/09_afh_ch7.pdf

Aeronautical Information Manual (AIM) Preface and 4-3

"Crazy Indian Traffic Congestion" (Length 0:35)
https://youtu.be/iEIk3RpV6RA
https://video.link/w/ZvNq

"New York City Traffic Time Lapse Intersection" (Length 0:40)
https://youtu.be/-WTkcCngT6w
https://video.link/w/NmBr

Title 14 Code of Federal Regulations Parts 91 and 137

Video: "Traffic Patterns" by Embry-Riddle Aeronautical University
https://www.youtube.com/watch?v=w_Bbs4K7L5U
https://video.link/w/Nscr

Video: FLY8MA: "Proper Traffic Pattern Entry - Nontowered Airports"
https://video.link/w/3GNq
https://www.youtube.com/watch?v=QYqcXbcR0Z0