

Appendix I

Runway Incursion Avoidance

Introduction

Runway safety is a significant challenge and a top priority for everyone in aviation. In the United States, an average of three runway incursions occur daily. Each of these incidents have the potential to cause significant damage to both persons and property. Runway incursions are a serious safety concern and have involved air carrier aircraft, military aircraft, general aviation (GA), and pedestrian vehicles. [Figure 1-1] Several runway incursions have resulted in collisions and fatalities. Fatalities have occurred at both towered and nontowered airports. A few seconds of inattention can cause a runway incursion.

Standardized A		Rotating beacon
Turn on	Engine(s) running	Taxiing
Crossing a runway	Entering departure runway for line up and wait	Takeoff
* Strobe lights should not be illuminated if it has an adverse effect on other aircraft or vehicles		

Pilot/Controller Common Phraseology	
"KNOWLEDGE"	Let me know that you received my message.
"ADVISE INTENTIONS"	Tell me what you intend to do.
"AFFIRMATIVE"	Yes.
"FINAL"	Commonly used when on the final approach or aligned with the runway.
"HOLD FOR"	(takeoff or landing) Stay in position.
"HOLD SHORT"	No.
"HOW DO YOU HEAR ME?"	Not applicable.
"IMMEDIATE"	Immediate action.

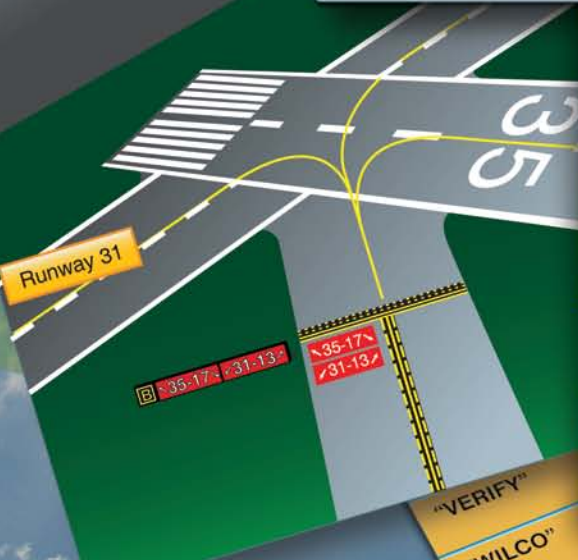




Figure 1-1. Runway incursions are a top FAA safety concern that involves pilots, air traffic control (ATC), and ground operations.

You are expected to taxi an airplane safely whether moving to or from a runway or otherwise moving about the airport. Scenarios such as bad weather, low visibility, construction, airport unfamiliarity, time of day, distractions, fatigue, and miscommunications with air traffic control (ATC) add greatly to the challenge of surface navigation.

This chapter is designed to help you attain an understanding of the risks associated with surface navigation and is intended to provide you with basic information regarding the safe operation of aircraft at towered and nontowered airports. This chapter focuses on the following major areas:

- Runway incursion overview
- Taxi route planning
- Taxi procedures
- Communications
- Airport signs, markings and lighting

Each section identifies best practices to help you avoid errors that may potentially lead to runway incursions. Although the chapter pertains mostly to surface movements for single-pilot operations, all of the information is relevant for flight crew operations as well.

Additional information about surface operations is available through the following sources:

- Federal Aviation Administration (FAA) Runway Safety website—www.faa.gov/go/runwaysafety
- FAA National Aeronautical Navigation Services (AeroNav), formerly known as the National Aeronautical Charting Office (NACO)—www.faa.gov/air_traffic/flight_info/aeronav
- Airport/Facility Directory (A/FD)—www.faa.gov/air_traffic/flight_info/aeronav/productcatalog/supplementalcharts/airportdirectory

- Automatic Terminal Information Service (ATIS)
- Notice to Airmen (NOTAMS)—http://www.faa.gov/pilots/ft_plan/notams
- Advisory Circular (AC) 91-73, part 91 and part 135, Single-Pilot and Flight School Procedures During Taxi Operations
- Aeronautical Information Manual (AIM)—www.faa.gov/air_traffic/publications/atpubs/aim/
- AC 120-74, parts 91, 121, 125, and 135, Flight Crew Procedures During Taxi Operations

Runway Incursion Overview

Approximately three runway incursions occur each day at towered airports within the United States. The potential that these numbers present for a catastrophic accident is unacceptable. A runway incursion is formally defined by the FAA as “any occurrence at an aerodrome involving the incorrect presence of an aircraft, vehicle, or person on the protected area of a surface designated for the landing and takeoff of aircraft.” The following are examples of pilot deviations, operational incidents (OI), and vehicle (driver) deviations that may lead to runway incursions.

Pilot Deviations:

- Crossing a runway hold marking without clearance from ATC
- Taking off without clearance
- Landing without clearance

Operational Incidents (OI):

- Clearing an aircraft onto a runway while another aircraft is landing on the same runway
- Issuing a takeoff clearance while the runway is occupied by another aircraft or vehicle

Vehicle (Driver) Deviations:

- Crossing a runway hold marking without ATC clearance

According to FAA data, approximately 65 percent of all runway incursions are caused by pilots. Additionally, 75 percent of the 65 percent of runway incursions are caused by GA pilots.

Causal Factors of Runway Incursions

Detailed investigations of runway incursions over the past 10 years have identified three major areas contributing to these events:

- Failure to comply with ATC instructions

- Lack of airport familiarity
- Nonconformance with standard operating procedures

Clear, concise, and effective pilot/controller communication is paramount to safe airport surface operations. You must fully understand and comply with all ATC instructions. It is mandatory to read back all runway “**hold short**” instructions verbatim.

Taxiing on an unfamiliar airport can be very challenging, especially during hours of darkness or low visibility. Ensure you have a current airport diagram, remain “heads-up” with eyes outside, and devote your entire attention to surface navigation per ATC clearance. All checklists should be completed while the aircraft is stopped. There is no place for non-essential chatter or other activities while maintaining vigilance during taxi. [Figure 1-2]



Figure 1-2. *Heads-up, eyes outside.*

Runway Confusion

Runway confusion is a subset of runway incursions and often results in you unintentionally taking off or landing on a taxiway or wrong runway. Generally, you are unaware of the mistake until after it has occurred.

In August 2006, the flight crew of a commercial regional jet was cleared for takeoff on Runway 22 but mistakenly lined up and departed on Runway 26, a much shorter runway. As a result, the aircraft crashed off the end of the runway.

Causal Factors of Runway Confusion

There are three major factors that increase the risk of runway confusion and can lead to a wrong runway departure:

- Airport complexity
- Close proximity of runway thresholds
- Joint use of a runway as a taxiway

Not only can airport complexity contribute to a runway incursion; it can also play a significant role in runway confusion. If you are operating at an unfamiliar airport and need assistance in executing the taxi clearance, do not hesitate to ask ATC for help. Always carry a current airport diagram and trace or highlight your taxi route to the departure runway prior to leaving the ramp.

If you are operating from an airport with runway thresholds in close proximity to one another, exercise extreme caution when taking the runway. *Figure 1-3* shows a perfect example of a taxiway leading to a runway and a runway with a displaced threshold. If departing on Runway 36, ensure that you set your aircraft heading “bug” to 360°, and align your aircraft to the runway heading to avoid departing from the wrong runway. Before adding power, make one last instrument scan to ensure the aircraft heading and runway heading are aligned.

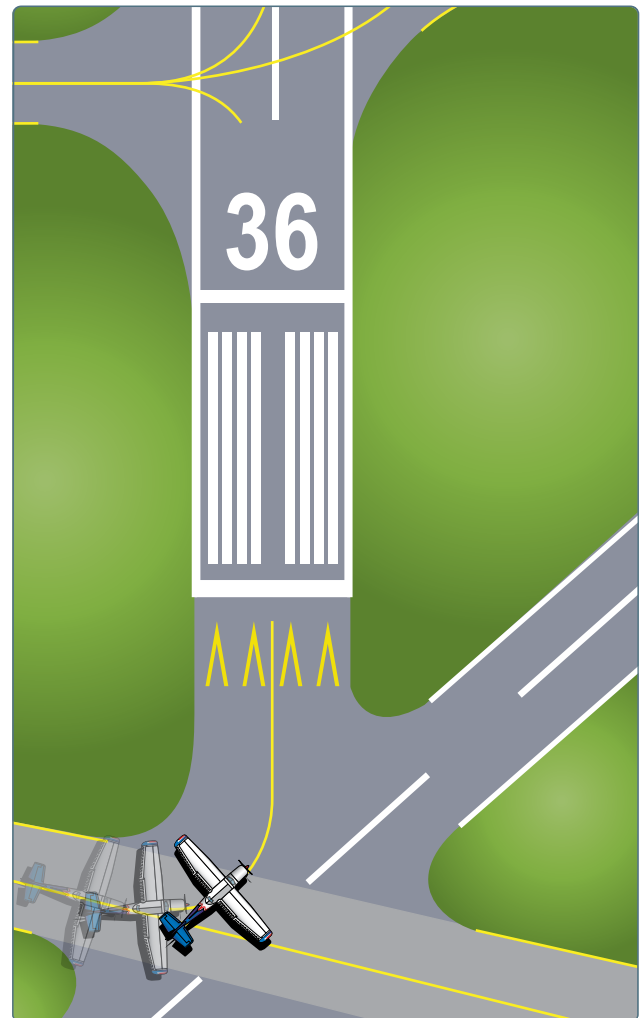


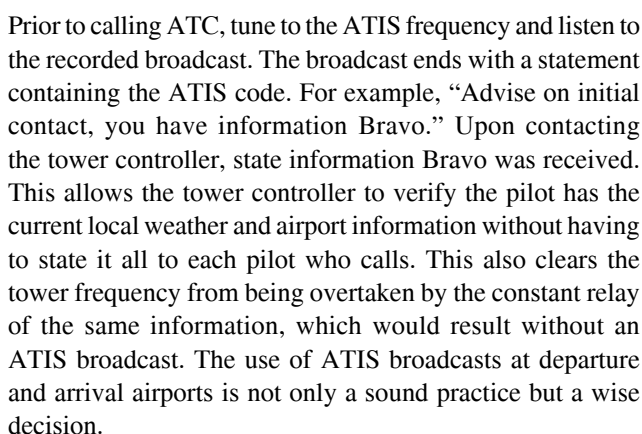
Figure 1-3. *Relocated threshold.*

other information essential to planned en route, terminal, or landing operations. Exercise good judgment and common sense by carefully regarding the information readily available in NOTAMs. For more detailed information on NOTAMs, refer back to Chapter 1 of this handbook.

Automated Terminal Information Service (ATIS)

The Automated Terminal Information Service (ATIS) is a recording of the local weather conditions and other pertinent non-control information broadcast on a local frequency in a looped format. It is normally updated once per hour but is updated more often when changing local conditions warrant. Important information is broadcast on ATIS including weather, runways in use, specific ATC procedures, and any airport construction activity that could affect taxi planning.

When the ATIS is recorded, it is given a code. This code is changed with every ATIS update. For example, ATIS Alpha is replaced by ATIS Bravo. The next hour, ATIS Charlie is recorded, followed by ATIS Delta and progresses down the alphabet with every update starting back at Alpha after a break in service of 12 hours or more.



Airport/Facility Directory (A/FD)

The Airport/Facility Directory (A/FD) is a pilot's manual that provides information on airports and other aviation facilities. The directory includes data that cannot be readily depicted in graphic form, including airport hours, runway widths, lighting codes, and fuel available. *[Figure I-5]*

Airport Diagram

It is essential to have a current airport diagram available for the departure airport, as well as the arrival airport for safe operations. *[Figure 1-6]* In the back section of each A/FD volume are full page airport diagrams that can help you plan surface operations. Time should be taken to study the airport diagram and anticipated taxi routes based on the information provided from the ATIS and NOTAMs.

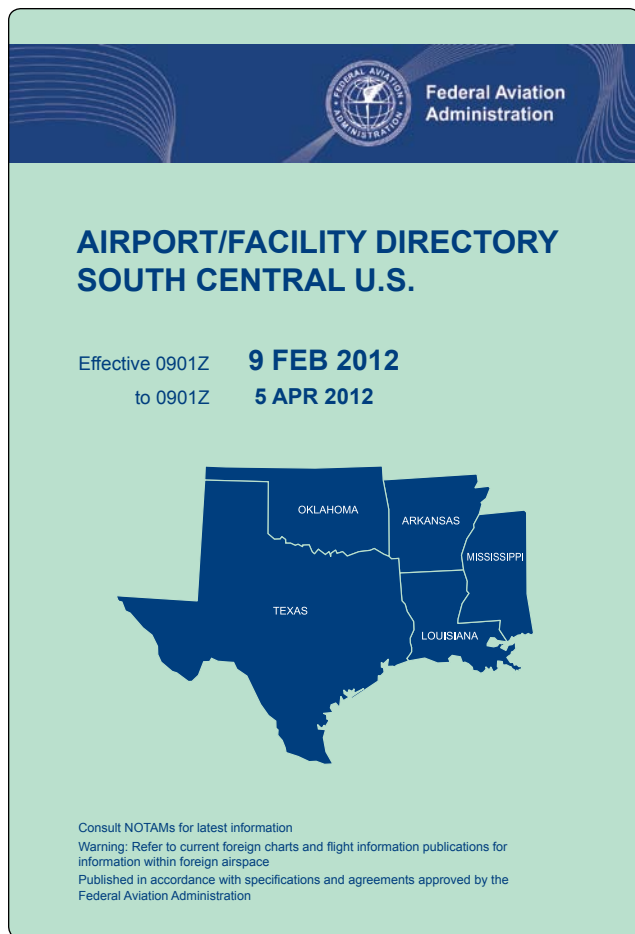


Figure 1-5. Airport Facility Directory (A/FD).

You should not take for granted that the anticipated taxi route will be the same taxi route received from ATC, which is why it is so important to write down and read back the taxi clearance from ATC. Current airport diagrams are available for download at www.faa.gov/airports/runway_safety/diagrams.

Hot Spots

An airport “**hot spot**” is typically a complex or confusing taxiway/taxiway or taxiway/runway intersection. This area of increased risk has either a history of, or potential for, runway incursions or surface incidents due to a variety of causes including airport layout, traffic flow, airport marking, signage, and lighting.

You should pay special attention to any complex intersections or areas designated on the airport diagram as “**hot spots**” to reduce the risk of a runway incursion. “**Hot spots**” are depicted on airport diagrams as open circles or polygons designated as “HS 1,” “HS 2,” etc. [Figure 1-7] “**Hot spots**” will remain charted on airport diagrams until the increased risk has been reduced or eliminated.

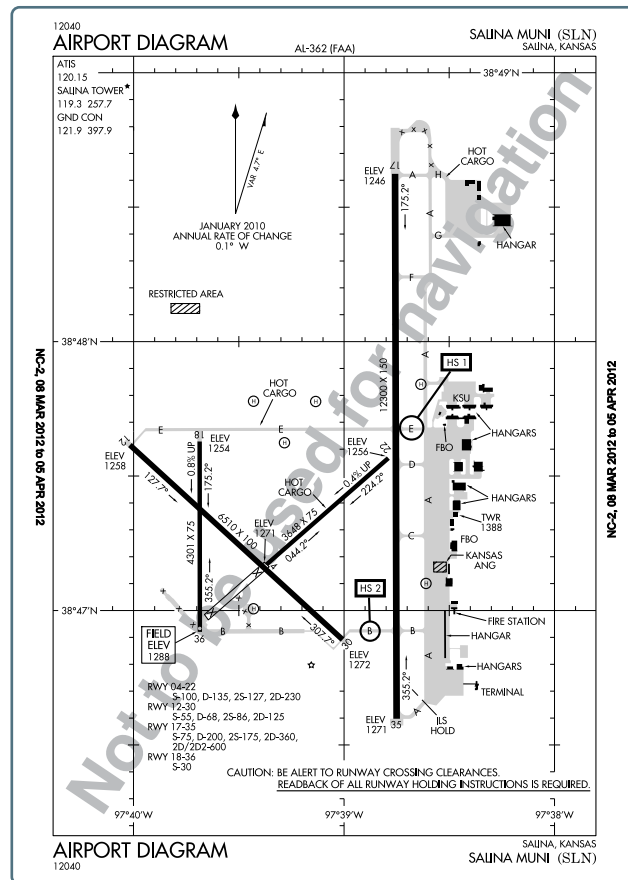


Figure 1-6. Obtain airport diagrams from the Airport Facility Directory (A/FD) or www.faa.gov/airports/runway_safety/diagrams.

Being proactive by knowing all possible taxi routes and maintaining taxi route awareness helps mitigate runway incursions, especially when navigating through complex intersections, known “**hot spots**” areas, and intervening runways.

Taxi Procedures

It is important for you to learn and understand how to safely follow taxi procedures. This section addresses specific ATC instructions that may be issued while taxiing and procedures that you should follow. For more information on detailed taxi procedures to be followed at towered airports, refer to Chapter 4 of the Aeronautical Information Manual (AIM).

Situational Awareness (SA)

Situational Awareness (SA) means understanding what is going on around you. Also, understanding is more than just information gathering—it requires gathering the right information, being able to analyze it, and making decisions.

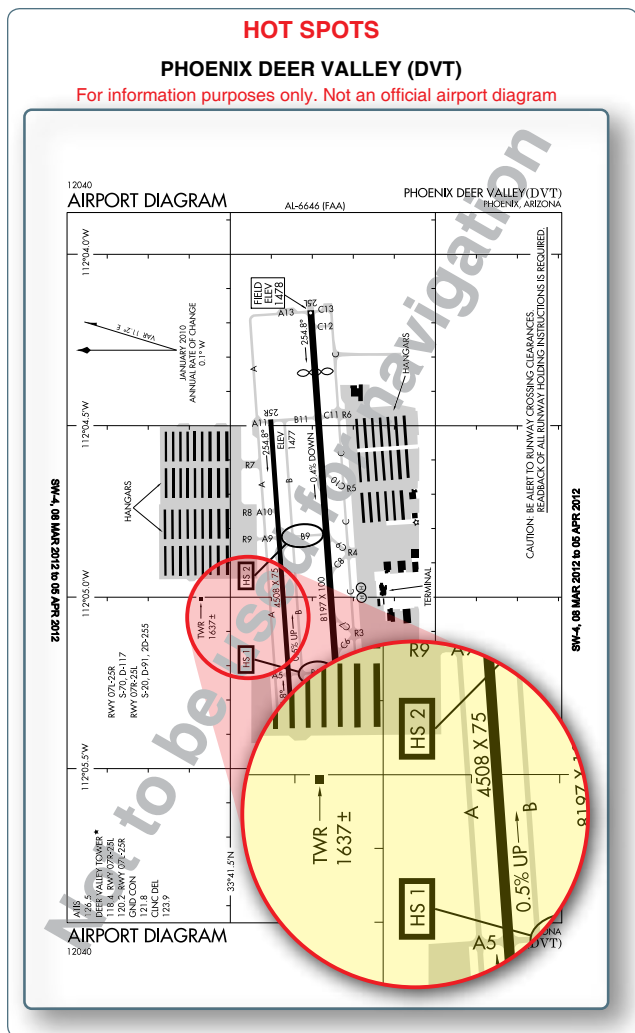


Figure 1-7. Airport diagram for Phoenix Deer Valley (DVT), Phoenix, Arizona showing where the “hot spots” are located on the airport.

SA should be used at all times when operating on an airfield. For example, prior to brake release for taxi, minimize cockpit tasks, observe “sterile flight deck” procedures, and always practice a “heads up, eyes out” mode while taxiing. Remain especially vigilant of “**hold short**,” crossing clearances, and “**hot spots**,” if applicable. When taxiing, be aware of your location as it relates to the intended taxi route, other aircraft that are taxiing, and vehicles operating on the airport. [Figure 1-8] If in doubt, stop, remain clear of the runway, and contact ATC.

The following excerpt, taken from the A/FD, is an example of information available to you that helps mitigate the loss of SA: “Taxiing aircraft should use caution in early morning and late afternoon hours. Sun glare may make visual recognition of signs and pavement markings difficult.” [Figure 1-9]



Figure 1-8. When taxiing, be aware of your location as it relates to the intended taxi route, other aircraft, and vehicles operating on the airport.



Figure 1-9. Low sun angle is obscuring the runway holding position sign and marking at a taxiway/runway intersection.

Movement and Non-Movement Area Boundary

At towered airports, the airport surface area is divided into two parts: non-movement area and movement area. The non-movement area is defined as ramps and aprons and is not controlled by ATC, which means you may move or taxi the airplane without clearance or communications with the control tower.

The movement area is defined as all taxiways and runways and is under the jurisdiction of the control tower, so a taxi clearance is required prior to entering into the movement area. The boundary between the ramp and the taxiways is called the non-movement area boundary and is defined by two yellow lines: one solid and one dashed. [Figure 1-10] The solid line is located on the non-movement area side while the dashed yellow line is located on the movement area side. Once you are ready to taxi, ATC should be contacted for taxi instructions. After a taxi clearance is received, movement to cross the non-movement area boundary marking and onto the taxiway is authorized.



Figure 1-10. Non-movement area boundary marking.

ATC Instructions

Title 14 of the Code of Federal Regulations (14 CFR) part 91, section 91.123 requires you to follow all ATC clearances and instructions. Request clarification if you are unsure of the clearance or instruction to be followed. If you are unfamiliar with the airport or unsure of a taxi route, ask ATC for a “progressive taxi.” Progressive taxi requires the controller to provide step-by-step taxi instructions.

The final decision to act on ATC’s instruction rests with you. If you cannot safely comply with any of ATC’s instructions, inform them immediately by using the word “UNABLE.” There is nothing wrong with telling a controller that you are unable to safely comply with the clearance.

Another way to mitigate the risk of runway incursions is to write down all taxi instructions as soon as they are received from ATC. [Figure 1-11] It is also helpful to monitor ATC clearances and instructions that are issued to other aircraft. You should be especially vigilant if another aircraft has a similar sounding call sign so there is no mistake about who ATC is contacting or to whom they are giving instructions and clearances.

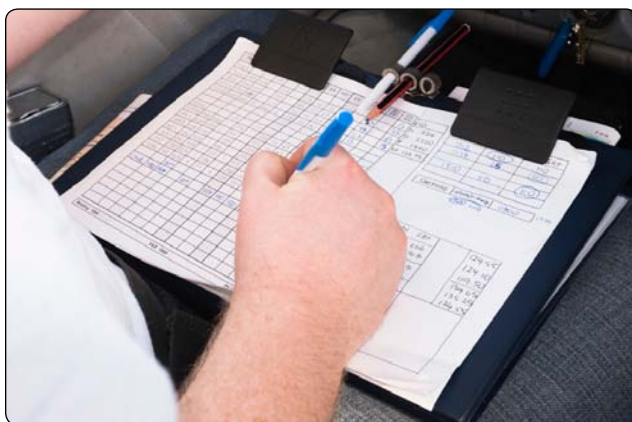


Figure 1-11. A pilot writing down instructions from ATC.

Read back your complete ATC clearance with your aircraft call sign. This gives ATC the opportunity to clarify any misunderstandings and ensure that instructions were given to the correct aircraft. If, at any time, there is uncertainty about any ATC instructions or clearances, ask ATC to “say again” or ask for progressive taxi instructions.

ATC Instructions—“Hold Short”

The most important sign and marking on the airport is the hold sign and hold marking. These are located on a stub taxiway leading directly to a runway. They depict the holding position or the location where the aircraft is to stop so as not to enter the runway environment. [Figure 1-12] For example, Figure 1-13 shows the holding position sign and marking for Runway 13 and Runway 31.

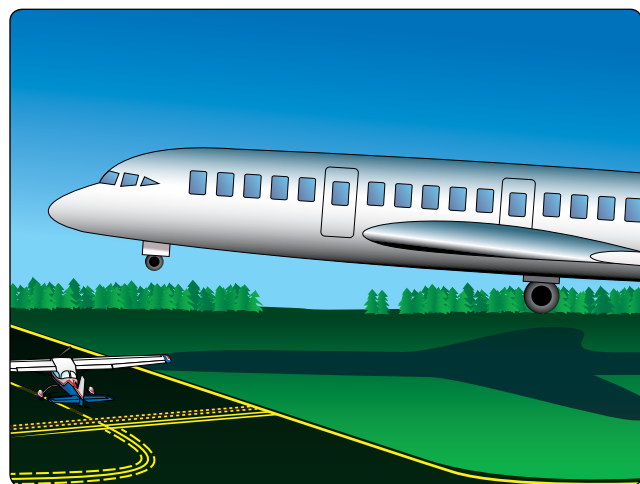


Figure 1-12. Do NOT cross a runway holding position marking without ATC clearance.



Figure 1-13. Runway 13-31 holding position sign and marking located on taxiway Charlie.

When ATC issues a “**hold short**” clearance, you are expected to taxi up to, but not cross any part of the runway holding marking. At a towered airport, runway hold markings should never be crossed without explicit ATC instructions. Do not enter a runway at a towered airport unless instructions are given from ATC to cross, takeoff from, or “line up and wait” on that specific runway.

ATC is required to obtain a read-back from the pilot of all runway “**hold short**” instructions. Therefore, you must read back the entire clearance and “**hold short**” instruction, to include runway identifier and your call sign. *Figure 1-14* shows an example of a controller’s taxi and “**hold short**” instructions and the reply from the pilot.



Figure 1-14. Example of taxi and “**hold short**” instructions from ATC to a pilot.

ATC Instructions—Explicit Runway Crossing

As of June 30, 2010, ATC is required to issue explicit instructions to “**cross**” or “**hold short**” of each runway. Instructions to “**cross**” a runway are normally issued one at a time, and an aircraft must have crossed the previous runway before another runway crossing is issued. Exceptions may apply for closely spaced runways that have less than 1,000 feet between centerlines. This applies to all runways to include active, inactive, or closed. *Figure 1-15* shows communication between ATC and a pilot who is requesting a taxi clearance.

Extra caution should be used when directed by ATC to taxi onto or across a runway, especially at night and during reduced visibility conditions. Always comply with “**hold short**” or crossing instructions when approaching an entrance to a runway. Scan the full length of the runway and the final approaches before entering or crossing any runway, even if ATC has issued a clearance.



Figure 1-15. Communication between ATC and a pilot who is requesting taxi procedures.

ATC Instructions—“Line Up and Wait” (LUAW)

ATC now uses the “line up and wait” (LUAW) instruction when a takeoff clearance cannot be issued immediately due to traffic or other reasons. The words “line up and wait” have replaced “position and hold” in directing you to taxi onto a runway and await takeoff clearance.

An ATC instruction to “line up and wait” is not a clearance for takeoff. It is only a clearance to enter the runway and hold in position for takeoff. Under LUAW phraseology, the controller states the aircraft call sign, departure runway, and “line up and wait.” Be aware that “traffic holding in position” will continue to be used to advise other aircraft that traffic has been authorized to line up and wait on an active runway. Pay close attention when instructed to “line up and wait,” especially at night or during periods of low visibility. Before entering the runway, remember to scan the full length of the runway and its approach end for other aircraft.

There have been collisions and incidents involving aircraft instructed to “line up and wait” while ATC waits for the necessary conditions to issue a takeoff clearance. An OI caused a 737 to land on a runway occupied by a twin-engine turboprop. The turboprop was holding in position awaiting takeoff clearance. Upon landing, the 737 collided with the twin-engine turboprop.

When ATC instructs you to “line up and wait,” they should advise you of any delay in receiving your takeoff clearance. Possible reasons for ATC takeoff clearance delays may include other aircraft landing and/or departing, wake turbulence, or traffic crossing an intersecting runway. If landing traffic is a factor, ATC is required to:

- Inform you of the closest traffic requesting a full-stop, touch-and-go, stop-and-go, option, or unrestricted low approach on the same runway.

- Advise the landing traffic that traffic is holding in position on the same runway.
- If advised of a reason for the delay, or the reason is clearly visible, expect an imminent takeoff clearance once the reason is no longer an issue.
- If a takeoff clearance is not received within 90 seconds after receiving the “line up and wait” instruction, contact ATC immediately.
- When ATC issues intersection “line up and wait” instructions and takeoff clearances, the taxiway designator is included.

NOTE: At night or in low visibility, consider lining up slightly left or right of centerline when holding for takeoff so that your aircraft is visible and can be differentiated from runway lights.

ATC Instructions—“Runway Shortened”

You should review NOTAMs in your preflight planning to determine any airport changes that will affect your departure or arrival. When the available runway length has been temporarily or permanently shortened due to construction, the ATIS includes the words “warning” and “shortened” in the text of the message. For the duration of the construction when the runway is temporarily shortened, ATC will include the word “shortened” in their clearance instructions. Furthermore, the use of the term “full length” will not be used by ATC during this period of the construction. Some examples of ATC instructions are:

- “Runway 36 shortened, line up and wait.”
- “Runway 36 shortened, cleared for takeoff.”
- “Runway 36 shortened, cleared to land.”

When an intersection departure is requested on a temporarily or permanently shortened runway during the construction, the remaining length of runway is included in the clearance. For example, “Runway 36 at Echo, intersection departure, 5,600 feet available.” If following the construction, the runway is permanently shortened, ATC will include the word “shortened” until the A/FD is updated to include the permanent changes to the runway length.

Pre-Landing, Landing, and After-Landing

While en route and after receiving the destination airport ATIS/landing information, review the airport diagram and brief yourself as to your exit taxiway. Determine the following:

- Are there any runway hold markings in close proximity to the exit taxiway?
- **Do not cross any hold markings or exit onto any runways without ATC clearance.**

After landing, use the utmost caution where the exit taxiways intersect another runway, and do not exit onto another runway without ATC authorization. Do not accept last minute turnoff instructions from the control tower unless you clearly understand the instructions and are at a speed that ensures you can safely comply. Finally, after landing and upon exiting the runway, ensure your aircraft has completely crossed over the runway hold markings. Once all parts of the aircraft have crossed the runway holding position markings, you must hold unless further instructions have been issued by ATC. Do not initiate non-essential communications or actions until the aircraft has stopped and the brakes set.

Aircraft Lights

The use of aircraft exterior lights during all flight operations make an aircraft operating on the airport surface more conspicuous and help convey location and intent to you and ATC. Some examples of aircraft exterior light usage are listed below and shown in *Figure 1-16*.

























Standardized Aircraft Lighting						
	Rotating beacon	Navigation/Position lights	Strobe light*	Taxi lights	Logo lights	Landing lights
 Turn on						
Engine(s) running						
Taxiing						
Crossing a runway						
Entering departure runway for line up and wait						
Takeoff						
* Strobe lights should not be illuminated if doing so will have an adverse effect on other aircraft or vehicles.						

Figure 1-16. Standard aircraft lighting.

- Engines running—before starting engines, turn on the rotating beacon.
- Taxiing—prior to commencing taxi, turn on navigation/position, strobe (only if the use of them does not adversely affect other aircraft), taxi, and logo lights, if available.

- Crossing a runway—illuminate all external lights when crossing a runway. You should consider any possible adverse affects that illuminating the forward facing lights may have on the vision of other pilots or ground personnel during runway crossings.
- “Line up and wait”—when entering the departure runway without takeoff clearance, turn on all exterior lights (except landing lights) to make your aircraft more conspicuous.
- Departure runway—when entering the departure runway after takeoff clearance is received or when commencing takeoff roll, turn on landing lights.

Nontowered Airports

Many GA airports, even those with operating ATC towers, may not have airport signage and markings that are required at airports certificated by the FAA. In fact, you may observe a wide range of airport signage and markings from one GA airport to the next.

There is no substitute for alertness while in the vicinity of an airport. It is essential that pilots be alert and look for other traffic and exchange traffic information when approaching or departing an airport without an operating control tower. This is of particular importance since other aircraft may not have communication capability or, in some cases, pilots may not communicate their presence or intentions when operating into or out of such airports. To achieve the greatest degree of safety, it is essential that all radio-equipped aircraft transmit/receive on a common frequency identified for the purpose of airport advisories.

An airport may have a full or part-time tower or Flight Service Station (FSS) located on the airport, a full or part-time UNICOM station, or no aeronautical station at all. There are three ways for pilots to communicate their intention and obtain airport/traffic information when operating at an airport that does not have an operating tower: by communicating with an FSS, a UNICOM operator, or by making a self-announced broadcast.

Many airports are now providing completely automated weather, radio check capability, and airport advisory information on an automated UNICOM system. These systems offer a variety of features, typically selectable by microphone clicks, on the UNICOM frequency. Availability of the automated UNICOM is published in the A/FD and approach charts.

NOTE: Line up and wait/holding in position is not recommended at nontowered airports.

Communications

In order to have safe surface operations, it is imperative that you maintain good communication with ATC. The controller’s understanding can be enhanced by you responding appropriately and using standard phraseology. *Figure 1-17* shows a detailed glossary of phraseology that is commonly used in surface operations. Guidelines for clear and accurate communications include the use of proper communication procedures when contacting ATC. Your initial transmission to ATC should contain the following elements:

- Who you are—aircraft’s complete call sign.
- Where you are on the airport.
- What you want—you should think about what you want to say before communicating it.
- Alphabetical code for the ATIS.

NOTE: You must be alert for stuck microphones.

Prior to contacting ATC, transmissions should be well thought out before keying the transmitter. Know what needs to be said and always check the radio frequencies to ensure that the proper one is being used to transmit. Communication with ATC should be concise and to the point. For unusual situations or lengthy communications, initial contact should be established. Then, in the next transmission, describe the situation. Keep in mind that other aircraft are waiting to contact ATC, so transmissions should be kept to a minimum unless it is an emergency situation.

While communicating with ATC, focus on what the controller is instructing and do not perform any non-essential tasks. Refer to the AIM, Chapter 5, Section 5, Pilot/Controller Roles and Responsibilities. **Read back any “hold short” of runway instructions issued by ATC.** This read back should include the specific runway designator and taxiway intersection when appropriate, so if there are any misunderstandings or errors, they are obvious to ATC.

A read back presents the first and most efficient opportunity to catch any miscommunications. It provides a “reality check” in two ways: it tells the controller, “This is what the pilot heard;” and it provides the controller the opportunity to reaffirm that is what he/she meant to say. For detailed information about radio communication phraseology and techniques, refer to Chapter 4, Section 2 of the AIM.

Understanding the NOTAMs for the airport is very important when communicating with ATC. NOTAMs provide information regarding taxiway/runway closures. With proper knowledge of the airport’s NOTAMs, you can assist ATC.

Pilot/Controller Common Phraseology	
“ACKNOWLEDGE”	Let me know that you have received my message.
“ADVISE INTENTIONS”	Tell me what you plan to do.
“AFFIRMATIVE”	Yes.
“FINAL”	Commonly used to mean that an aircraft is on the final approach course or is aligned with a landing area.
“HOLD FOR”	(takeoff clearance, release, landing/taxiing aircraft, etc.) Stay in place where you are currently located.
“HOLD SHORT”	November 477ZA, runway four, taxi via Echo, hold short runway two five at taxiway Delta.
“HOW DO YOU HEAR ME?”	A question relating to the quality of the transmission or to determine how well the transmission is being received.
“IMMEDIATELY”	Used by ATC or pilots when such action compliance is required to avoid an imminent situation.
“LINE UP AND WAIT”	Used by ATC to inform a pilot to taxi onto the departure runway in takeoff position and LINE UP and WAIT. <u>It is not authorization for takeoff.</u> It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons.
“NEGATIVE”	“No” or “permission not granted” or “that is not correct.”
“READ BACK”	Repeat my message back to me.
“ROGER”	I have received all of your last transmission. <u>It should not be used to answer a question requiring a yes or no answer.</u> (See Affirmative, Negative)
“STAND BY”	Means the controller or pilot must pause for a few seconds, usually to attend to other duties of a higher priority. Also means to wait, as in “stand by for clearance.” The caller should reestablish contact if a delay is lengthy. “Stand by” is not an approval or denial.
“UNABLE”	Indicates inability to comply with a specific instruction, request, or clearance.
“VERIFY”	Request confirmation of information (for example, “verify assigned altitude”).
“WILCO”	I have received your message, understand it, and will comply with it.
“WITHOUT DELAY”	With a sense of urgency, proceed with approved instructions in a rapid manner.
For a complete listing of all ATC phraseology, consult the Aeronautical Information Manual (AIM).	

Figure 1-17. Standard phraseology that should be used between pilots and ATC.

For example, if ATC clears you to taxi on a closed taxiway or runway, you can inform them. If you are unsure of any portion of the taxi clearance, request clarification and/or progressive taxi instructions. It is important for you to know that you can request assistance.

NOTE: When instructed to “monitor” a particular frequency, listen on the frequency and stand by for instructions. Under normal circumstances, do not initiate communications.

Examples of Taxi Instructions

Initial Call-up with Specific Requests

Pilot: Teterboro ground, Gulfstream November 322ZQ, ACME aviation, with information Alpha, request taxi to Runway one niner.

Controller: November 322ZQ, Teterboro ground, Runway one niner, taxi via Lima.

“Line Up and Wait”

Controller: November 523QQ, Runway two seven, “line up and wait,” traffic landing Runway three right.

Pilot: November 523QQ, Runway two seven, “line up and wait.”

“Line Up and Wait” on Intersecting Runways

“Line up and wait” can be authorized on intersecting runways. When this is done, traffic advisories shall be issued to both aircraft.

Departure Instructions for Two Aircraft

Controller: November 523QQ, Runway three six at Golf four, “line up and wait,” traffic departing Runway two seven.

Pilot: N523QQ, Runway three six at Golf four, “line up and wait.”

Controller: November 144NM, Runway two seven, cleared for takeoff, traffic holding in position Runway three six.

Departure and Arrival Instructions for Two Aircraft

Controller: November 477ZA, Runway six, “line up and wait,” traffic landing Runway two seven.

Pilot: November 477ZA, Runway six, “line up and wait.”

Controller: November 234AG, Runway two seven, cleared to land, traffic holding in position Runway six.

Intersection Departure Clearance

ATC must state the name of the intersection to you before a “line up and wait” instruction. You should question ATC if this does not happen. You should state that they are at an intersection when requesting a takeoff clearance. A controller must also state the name of the intersection when issuing a takeoff clearance.

Controller: November 477ZA, Runway four, Taxiway Bravo, “line up and wait.”

Pilot: “Line up and wait,” Runway four, Taxiway Bravo, November 477ZA.

Ensure that when you read back a clearance for an intersection “line up and wait” or intersection takeoff, you state the name of the intersection, even if the controller did not include it in the clearance.

Landing Clearance

ATC may withhold or rescind a landing clearance when an aircraft is in “line up and wait” on the runway.

Landing Clearance Withheld

Controller: November 477ZA, Runway four, continue, traffic holding in position.

Landing Clearance Cancelled

Controller: November 477ZA, landing clearance cancelled, traffic holding in position, continue.

Takeoff Clearance/Landing Clearance

Read back all landing and takeoff clearances with a call sign, including the runway designator.

Controller: November 123QY, Charlotte tower, Runway four right, cleared to land.

Pilot: November 123QY, cleared to land, Runway four right.

Controller: November 123QY, Charlotte tower, Runway five, cleared for takeoff.

Pilot: November 123QY, cleared for takeoff, Runway five.

Land and “Hold Short” Clearance

Land and “hold short” instructions require your acceptance and read back.

Controller: November 123QY, Waterloo Tower, Runway three six, cleared to land, hold short Runway three zero for departing traffic.

Pilot: November 123QY, cleared to land Runway three six, hold short Runway three zero.

Figure 1-18A and B shows an example of the land and “**hold short**” holding position.

Runway Exiting Clearance

After landing and reaching taxi speed, you are expected to exit the runway at the first available taxiway or as instructed by ATC. You should remain on the tower frequency until advised to contact ground control.

Controller: Unity three two, turn right on Taxiway Golf two and contact ground point niner when clear of the runway.

Pilot: Unity three two, right on Golf two, ground point niner.

Initial Contact After Landing and Clearing the Runway

Pilot: Lincoln ground, November 123QY, clear of Runway two at Bravo, taxi to the ramp.

Controller: November 123QY, Lincoln ground, taxi to the ramp via Bravo.

Light Gun Signals

ATC has a backup system if radio communication fails. Controllers use a light gun that flashes different colors to instruct you what to do. Refer to the Pilot’s Handbook of Aeronautical Knowledge, Chapter 13, Airport Operations, for a light gun signal illustration. Even a failed radio transmission is not an excuse for proceeding without a proper clearance. If you are on a runway or taxiway and radio communication with ATC fails, you should:

1. Turn toward the tower.
2. Flash your landing lights several times.
3. Wait for the light signal from ATC.
4. Be patient. If ATC’s attention is diverted, it may take a few minutes for a response.
5. If your radios are working, try a frequency other than the one you are currently using.
6. Call ATC via cell phone if you have the number available.

Signs, Markings, and Lighting

It is important for you to know the meanings of the signs, markings, and lights that are used on airports as surface navigational aids. All airport markings are painted on the surface, whereas some signs are vertical and some are painted on the surface. An overview of the most common signs and markings are described on the following pages. For more detailed information on runway signs and markings, refer to the AIM.

Runway Holding Position Sign

Noncompliance with a runway holding position sign may result in the FAA filing a Pilot Deviation against you.

A runway holding position sign is an airport version of a stop sign. [Figure 1-19] It may be seen as a sign and/or its characters painted on the airport pavement. The sign has white characters outlined in black on a red background. It is always colocated with the surface painted holding position markings and is located where taxiways intersect runways. On taxiways that intersect the threshold of the takeoff runway, only the designation of the runway may appear on the sign.



Figure 1-19. Runway holding position sign at takeoff end of Runway 14 with colocated Taxiway Alpha location sign.

If a taxiway intersects a runway somewhere other than at the threshold, the sign has the designation of the intersecting runway. The runway numbers on the sign are arranged to correspond to the relative location of the respective runway thresholds. Figure 1-20 shows “18-36” to indicate the threshold for Runway 18 is to the left and the threshold for Runway 36 is to the right. The sign also indicates that you are located on Taxiway Alpha.

If the runway holding position sign is located on a taxiway at the intersection of two runways, the designations for both



Figure 1-20. Runway holding position sign at a location other than the takeoff end of Runway 18-36 with colocated Taxiway Alpha location sign.

runways are shown on the sign along with arrows showing the approximate alignment of each runway. [Figure 1-21A and B] In addition to showing the approximate runway alignment, the arrows indicate the direction(s) to the threshold of the runway whose designation is immediately next to each corresponding arrow.

This type of taxiway and runway/runway intersection geometry can be very confusing and create navigational challenges. Extreme caution must be exercised when taxiing onto or crossing this type of intersection. Figure 1-21A and B shows a depiction of a taxiway, runway/runway intersection and is also designated as a “hot spot” on the airport diagram. In the example, Taxiway Bravo intersects with two runways, 31-13 and 35-17, which cross each other.

Surface painted runway holding position signs may also be used to aid you in determining the holding position. These markings consist of white characters with a black border on a red background and are painted on the left side of the taxiway centerline. Figure 1-22 shows a surface painted runway holding position sign that is the holding point for Runway 32R-14L.

You should never allow any part of your aircraft to cross the runway holding position sign (either a vertical or surface painted sign) without a clearance from ATC. Doing so poses a hazard to yourself and others.

When the tower is closed or you are operating at a nontowered airport, you may taxi past a runway holding position sign only when the runway is clear of aircraft, and there are no aircraft on final approach. You may then proceed with extreme caution.

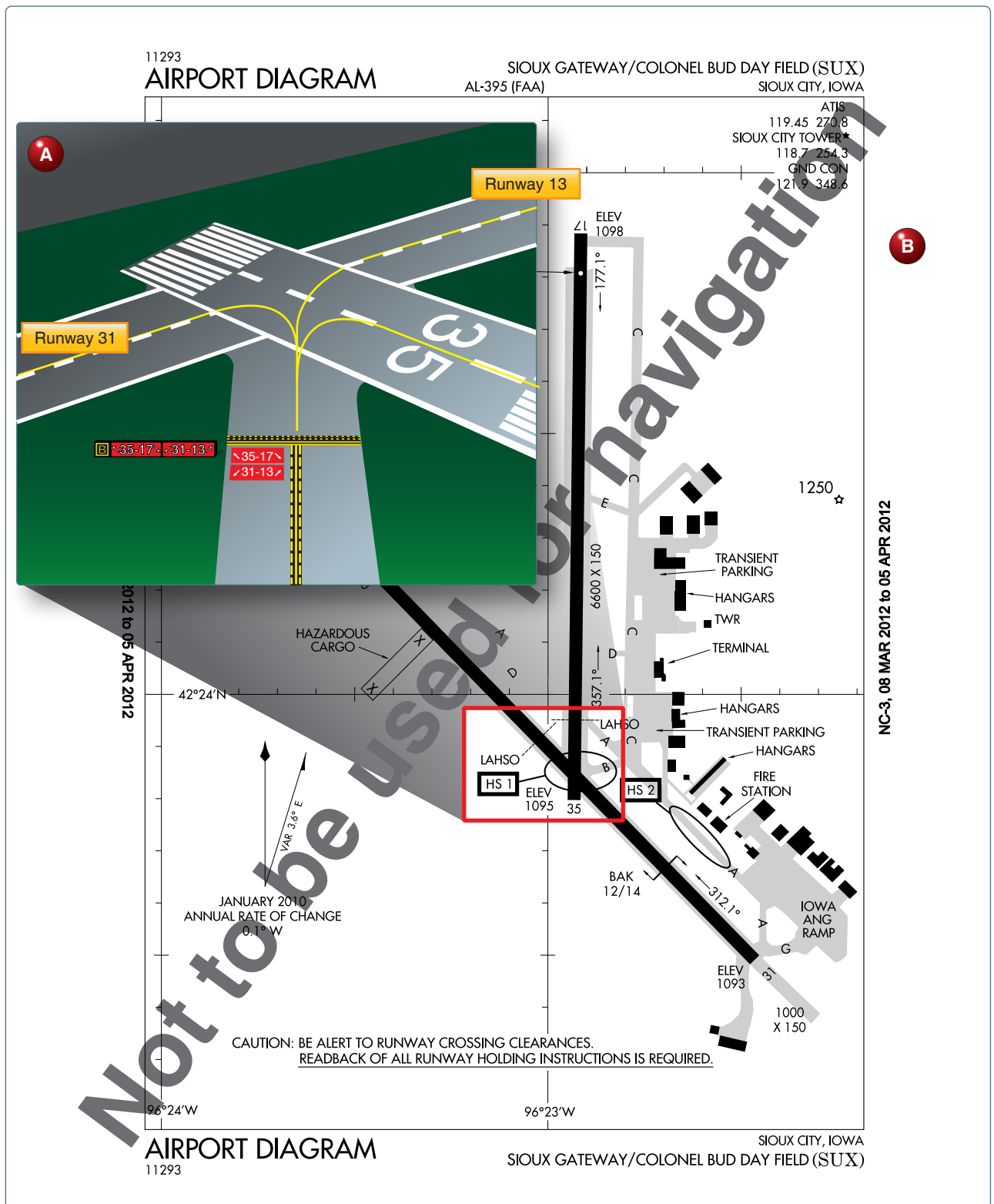


Figure 1-21. (A) Taxiway Bravo location sign collocated with runway/runway intersection holding signs at Sioux Gateway Airport (SUX)
(B) Airport diagram of Sioux Gateway Airport (SUX), Sioux City, Iowa. The area outlined in red is a designated "hot spot" (HS1).



Figure 1-22. Surface painted runway holding position signs for Runway 32R-14L along with the enhanced taxiway centerline marking.

Runway Holding Position Marking

Noncompliance with a runway holding position marking may result in the FAA filing a Pilot Deviation against you.

Runway holding position markings consist of four yellow lines, two solid and two dashed, that are painted on the surface and extend across the width of the taxiway to indicate where the aircraft should stop when approaching a runway. These markings are painted across the entire taxiway pavement, are in alignment, and are collocated with the holding position sign as described above.

As you approach the runway, two solid yellow lines and two dashed lines will be visible. Prior to reaching the solid lines, it is imperative to stop and ensure that no portion of the aircraft intersects the first solid yellow line. Do not cross the double solid lines until a clearance from ATC has been received. [Figure 1-23] When the tower is closed or when



Figure 1-23. Surface painted holding position marking along with enhanced taxiway centerline.

operating at a nontowered airport, you may taxi onto or across the runway only when the runway is clear and there are no aircraft on final approach. You should use extreme caution when crossing or taxiing onto the runway and always look both ways.

When exiting the runway, the same markings will be seen except the aircraft will be approaching the double dashed lines. [Figure 1-24] In order to be clear of the runway, the entire aircraft must cross both the dashed and solid lines. An ATC clearance is not needed to cross this marking when exiting the runway.



Figure 1-24. Runway holding position markings as seen when exiting the runway. When exiting the runway, no ATC clearance is required to cross.

Enhanced Taxiway Centerline Markings

At most towered airports, the enhanced taxiway centerline marking is used to warn you of an upcoming runway. It consists of yellow dashed lines on either side of the normal solid taxiway centerline and the dashes extend up to 150 feet prior to a runway holding position marking. [Figure 1-25A and B] They are used to aid you in maintaining awareness during surface movement to reduce runway incursions.

Elevated Runway Guard Lights

Elevated runway guard lights (ERGL), commonly known as “wig-wag” lights, are collocated with the runway hold position signs and surface painted hold position markings. They consist of a pair of elevated flashing yellow lights installed on either side of the taxiway near the holding position sign. [Figure 1-26A] Alternatively, they may be a row of in-pavement yellow lights installed across the taxiway at the holding position marking. [Figure 1-26B] Runway guard lights are effective visual aids for helping you identify the runway holding position.



Figure 1-25. (A) Enhanced taxiway centerline marking. (B) Enhanced taxiway centerline marking and runway position marking.

Runway Safety Area Boundary Sign

In addition to the runway hold marking, some taxiway stubs also have a runway safety area boundary sign that faces the runway and is visible to you only when exiting the runway. This sign has a yellow background with black markings and is typically used at towered airports where a controller commonly requests you to report clear of a runway. This sign is intended to provide you with another visual cue that is used as a guide to determine when you are clear of the runway safety boundary area. The sign shown in *Figure 1-27* is what you would see when exiting the runway at Taxiway Kilo, and is out of the runway safety area boundary when the entire aircraft passes the sign and the accompanying surface painted marking.

Land and Hold Short Operations (LAHSO)

When simultaneous operations (takeoffs and landings) are being conducted on intersecting runways, Land and Hold Short Operations (LAHSO) may also be in effect. LAHSO is an ATC procedure that may require your participation and compliance. As pilot in command (PIC), you have the final authority to accept or decline any LAHSO clearance.



Figure 1-26. (A) Elevated flashing yellow runway guard lights also referred to as “wig-wag” lights. (B) In-pavement flashing yellow runway guard lights.



Figure 1-27. Runway safety area boundary sign and marking located on Taxiway Kilo.

If issued a land and hold short clearance, you must be aware of the reduced runway distances and whether or not you can comply before accepting a land and hold short clearance. You do not have to accept a LAHSO clearance. Pilots should only receive a LAHSO clearance when there is a minimum ceiling of 1,000 feet and 3 statute miles of visibility.

Runway holding position signs and markings are installed only on those runways used for LAHSO. The signs and markings are placed at the LAHSO point to aid you in determining where to stop and hold the aircraft and are located prior to the runway/runway intersection. [Figure 1-28]



Figure 1-28. Runway holding position sign and marking for LAHSO.

The holding position sign has a white inscription with black border around the numbers on a red background and is installed adjacent to the holding position markings. If you accept a land and hold short clearance, you must comply so that no portion of the aircraft extends beyond these hold markings.

If receiving “cleared to land” instructions from ATC, you are authorized to use the entire landing length of the runway and should disregard any LAHSO holding position markings located on the runway. If you receive and accept LAHSO instructions, you must stop short of the intersecting runway prior to the LAHSO signs and markings.

Below is a list of items which, if thoroughly understood and complied with, will ensure that LAHSO operations are conducted properly.

- Know landing distance available.
- Be advised by ATC as to why LAHSO are being conducted.
- Advise ATC if you cannot comply with LAHSO.
- Know what signs and markings are at the LAHSO point.
- LAHSO are not authorized for student pilots who are performing a solo flight.
- Generally, LAHSO are not authorized with air carrier operations.
- Generally, LAHSO are not authorized at night.
- LAHSO are not authorized on wet runways.

If you accept the following clearance from ATC: “Cleared to land Runway 36 hold short Runway 23-5,” you must either exit Runway 36 or stop at the holding position prior to Runway 23-5.

Location Signs and Markings

Taxiway location signs and markings and runway location signs aid you in identifying the taxiway or runway on which you are currently located. They have a black background with yellow characters. These signs may stand alone or be collocated with direction or runway holding position signs. [Figure 1-29A and B]

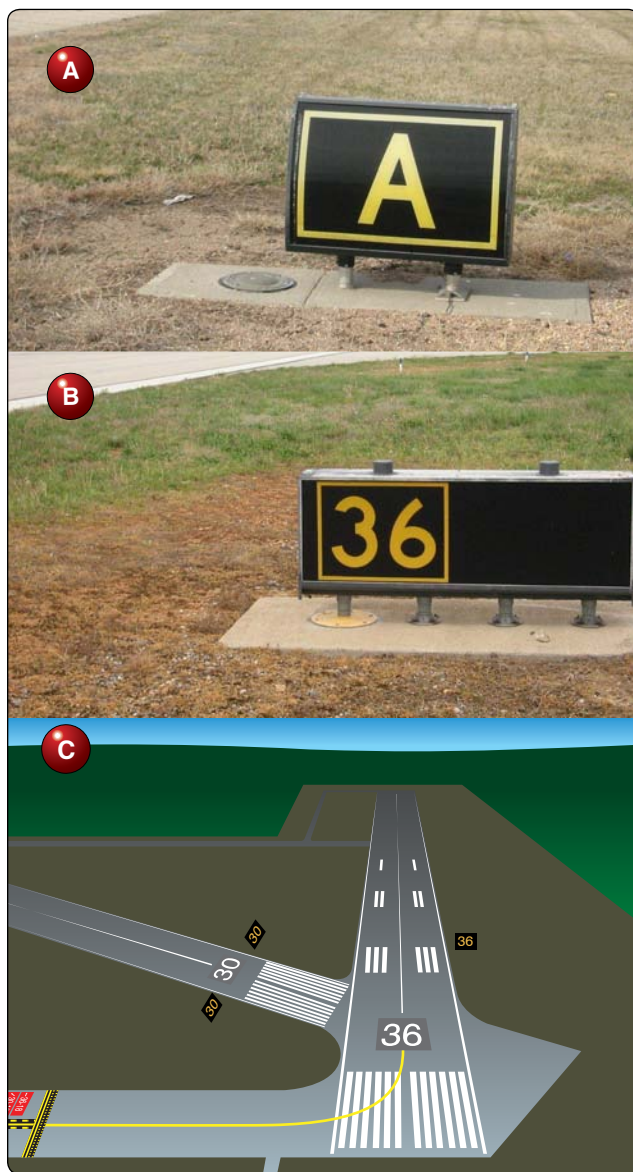


Figure 1-29. (A) Taxiway Alpha location sign. (B) Runway 36 location sign. (C) Runway thresholds of Runway 30 and Runway 36, which are nearly collocated.

Runway location signs are intended to complement the information available to you through your aircraft magnetic compass. They are installed in areas where the proximity of two or more runways could cause you to be confused. *Figure 1-29A and B* shows that Taxiway Alpha and Runway 36 are stand alone location signs and are not associated with any other sign.

Complex airport geometry, a single taxiway leading to multiple runway thresholds, and/or the close proximity of multiple runway thresholds can lead to confusion and a higher risk of you departing on the wrong runway. At airports where these risk factors are present and the proximity of two runway thresholds could cause confusion, runway location signs may be present. Cross-check your aircraft compass heading with the assigned takeoff runway heading prior to brake release. *Figure 1-29C* shows the thresholds of Runway 30 and Runway 36, which are collocated. Runway location signs are present on these runways along with the runway designation numbers.

NOTE: Runway designation surface painted markings are large white block numbers and are located at the threshold of the runway.

Surface painted taxiway location markings are normally located on airports where there has been a history of navigation confusion. *[Figure 1-30]* These signs and markings are designed to help you navigate difficult or potentially confusing intersections. If ever in doubt about your taxi clearance, ask ATC for help.

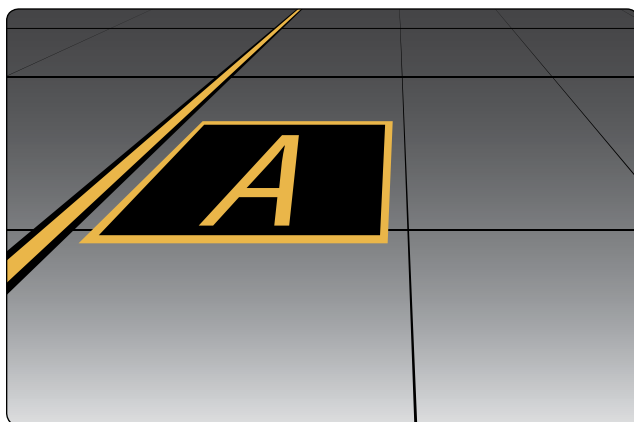


Figure 1-30. Surface painted Taxiway Alpha location sign.

Taxiway Direction Signs and Marking

Taxiway direction signs have a yellow background and black characters, which identifies the designation or intersecting taxiways. Arrows indicate the direction of turn that would place the aircraft on the designated taxiway.

[Figure 1-31] Direction signs are normally located on the left side of the taxiway and prior to the intersection. These signs and markings (with a yellow background and black characters) indicate the direction toward a different taxiway, leading off a runway, or out of an intersection. *Figure 1-31* shows Taxiway Delta and how Taxiway Bravo intersects ahead at 90° both left and right.



Figure 1-31. Taxiway Bravo direction sign with a collocated Taxiway Delta location sign. When the arrow on the direction sign indicates a turn, the sign is located prior to the intersection.

Taxiway direction signs can also be displayed as surface painted markings. *Figure 1-32* shows Taxiway Bravo as proceeding straight ahead while Taxiway Alpha turns to the right at approximately 45°.



Figure 1-32. Surface painted taxiway direction signs.

Figure 1-33A and B shows an example of a direction sign at a complex taxiway intersection. *Figure 1-33A and B* shows Taxiway Bravo intersects with Taxiway Sierra at 90°, but at 45° with Taxiway Foxtrot. This type of array can be displayed with or without the taxiway location sign, which in this case would be Taxiway Bravo.



Figure 1-33. (A) Orientation of signs is from left to right in a clockwise manner. Left turn signs are on the left and right turn on the right. In this view, the pilot is on taxiway Bravo. (B) Direction sign array at a complex taxiway/taxiway intersection.

Destination Signs

Destination signs have black characters on a yellow background indicating a destination at the airport. These signs always have an arrow showing the direction of the taxi route to that destination. [Figure 1-34] When the arrow on the destination sign indicates a turn, the sign is located prior to the intersection. Destinations commonly shown on these types of signs include runways, aprons, terminals, military

areas, civil aviation areas, cargo areas, international areas, and fixed-base operators. When the inscription for two or more destinations having a common taxi route are placed on a sign, the destinations are separated by a “dot” (•) and one arrow would be used as shown in Figure 1-35. When the inscription on a sign contains two or more destinations having different taxi routes, each destination is accompanied by an arrow and separated from the other destination(s) on



Figure 1-34. Destination sign to the fixed-base operator (FBO).



Figure 1-35. Runway destination sign with different taxi routes.

the sign with a vertical black message divider as shown in *Figure 1-35*. The example shown in *Figure 1-35* shows two signs. The sign in the foreground explains that Runway 20 threshold is to the left, and Runways 32, 2, and 14 are to the right. The sign in the background indicates that you are located on Taxiway Bravo and Taxiway November will take you to those runways.

Holding Position Signs and Markings for an Instrument Landing System (ILS)

The instrument landing system (ILS) broadcasts signals to arriving instrument aircraft to guide them to the runway. Each of these ILSs has a critical area that must be kept clear of all obstacles in order to ensure quality of the broadcast signal. At many airports, taxiways extend into the ILS critical area. Most of the time, this is of no concern; however, during times of poor weather, an aircraft on approach may depend on a good signal quality. When necessary, ATC will protect the ILS critical area for arrival instrument traffic by instructing taxiing aircraft to “**hold short**” of this critical area.

The ILS critical area boundary sign has white characters, outlined in black, on a red background and is installed adjacent to the ILS holding position markings. [Figure 1-36] The holding position markings for the ILS critical area appear on the pavement as a horizontal ladder and consist of two solid yellow lines spaced two feet apart connected by pairs of solid lines spaced ten feet apart extending across the width of the taxiway.



Figure 1-36. Instrument landing system (ILS) holding position sign and marking on Taxiway Golf.

When instructed to “hold short of the ILS critical area,” you must ensure no portion of the aircraft extends beyond these markings. If ATC does not instruct you to hold at this point, then you may bypass the ILS critical area hold position markings and continue with your taxi. *Figure 1-36* shows that the ILS hold sign is located on Taxiway Golf and the ILS ladder hold position marking is adjacent to the hold sign.

Runway Approach Area Holding Position Signs and Markings

At some airports, it is necessary to hold an aircraft on a taxiway located in the approach or departure area for a runway so the aircraft does not interfere with operations on that runway. In these situations, a sign with a designation of the approach end of the runway followed by a “dash” (–) and letters “APCH” will be located at the holding position on the taxiway. Holding position markings will be located on the taxiway pavement. [Figure 1-37] In this example, the sign may protect the approach to Runway 32 and/or the departure for Runway 14. If you are expected to “**hold short**” of a runway approach (“APCH”) area, ATC will issue instructions.



Figure 1-37. Runway 32 approach area sign and marking on Taxiway Alpha.

Holding Position Markings for Taxiway/Taxiway Intersections

Holding position markings for taxiway/taxiway intersections consist of a single dashed yellow line extending across the width of the taxiway. [Figure 1-38] They are painted on taxiways where ATC normally holds aircraft short of a taxiway intersection. When instructed by ATC “hold short of Taxiway X,” you should stop so that no part of your aircraft extends beyond the holding position marking. When the marking is not present, you should stop your aircraft at a point that provides adequate clearance from an aircraft on the intersecting taxiway.

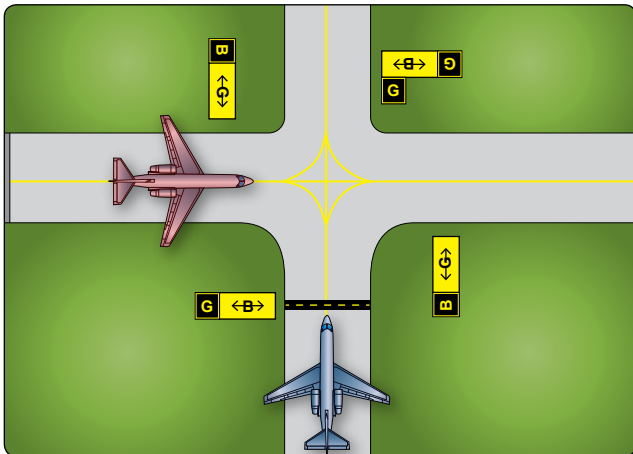


Figure 1-38. Holding position marking on a taxiway.

Marking and Lighting of Permanently Closed Runways and Taxiways

For runways and taxiways that are permanently closed, the lighting circuits are disconnected. The runway threshold, runway designation, and touchdown markings are obliterated and yellow “Xs” are placed at each end of the runway and at 1,000-foot intervals.

Temporarily Closed Runways and Taxiways

For temporarily closed runways and taxiways, a visual indication is often provided with yellow “Xs” or raised lighted yellow “Xs” placed at each end of the runway. Depending on the reason for the closure, duration of closure, airfield configuration, and the existence and the hours of operation of an ATC tower, a visual indication may not be present. As discussed previously in the chapter, you must always check NOTAMs and ATIS for runway and taxiway closure information.

Figure 1-39A shows an example of a yellow “X” laid flat with an adequate number of heavy rubber weights to keep the wind from getting under and displacing the vinyl material. The black rubber weights are positioned along the edge giving the appearance of a black outline.

A very effective and preferable visual aid to depict temporary closure is the lighted “X” placed on or near the runway designation numbers. [Figure 1-39B and C] This device is much more discernible to approaching aircraft than the other materials described above.

Runway Edge and Centerline Lights

The runway edge lights are white, except on instrument runways where yellow replaces white on the last 2,000 feet or half the runway length, whichever is less, to form a caution zone for landings.

The lights marking the ends of the runway emit red light toward the runway to indicate the end of runway to a departing aircraft and emit green outward from the runway end to indicate the threshold to landing aircraft.

Centerline lights are located along the runway centerline and are spaced at 50-foot intervals. When viewed from the landing threshold, the runway centerline lights are white until the last 3,000 feet of the runway. The white lights begin to alternate with red for the next 2,000 feet. For the last 1,000 feet of the runway, all centerline lights are red. [Figure 1-40]

Taxiway Edge Lights or Reflectors

Taxiway edge lights or reflectors are blue in color and used to outline the edges of taxiways. [Figure 1-41]

Runway Designation Marking

Runway numbers and letters are determined from the approach direction. The runway number is the whole number nearest one-tenth the magnetic azimuth of the centerline of the runway, measured clockwise from the magnetic north.

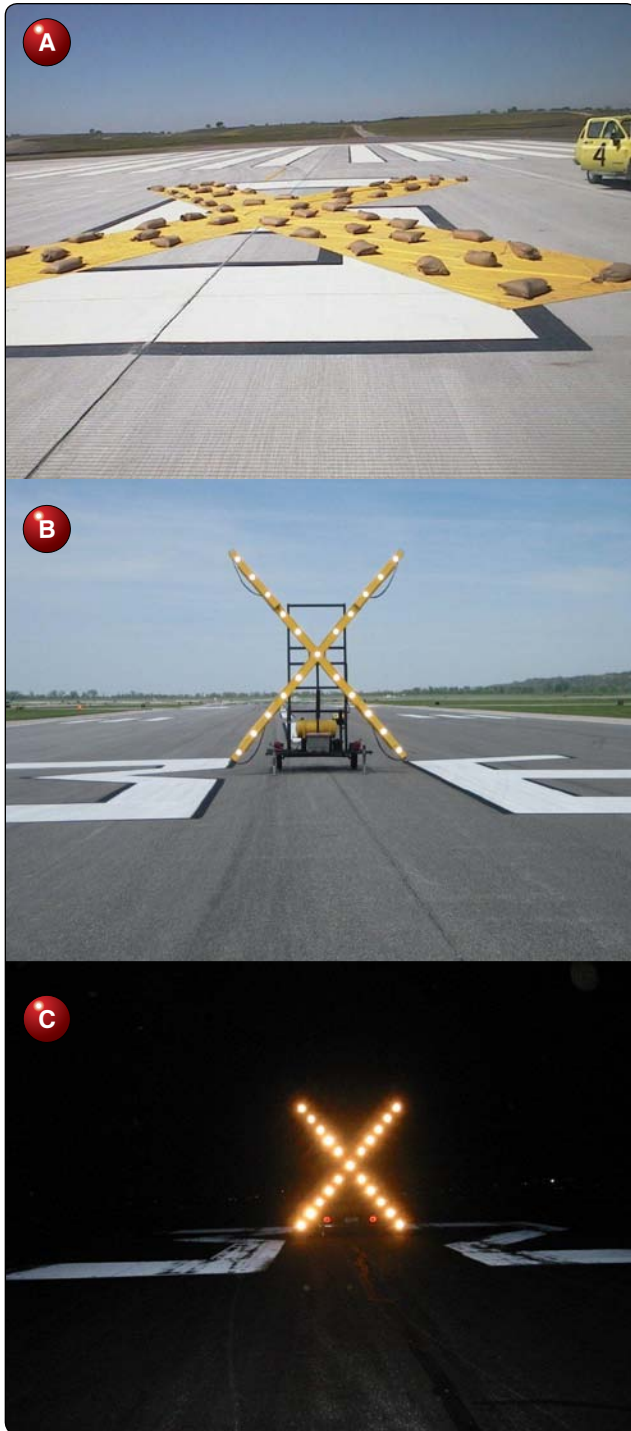


Figure 1-39. (A) Yellow “X” placed on surface of temporarily closed runways. (B) Lighted “X” placed on temporarily closed runways. (C) Lighted “X” at night showing a temporarily closed runway.

In the case where there are parallel runways, the letters differentiate between left (L), right (R), or center (C). [Figure 1-42] For example, if there are two parallel runways, they would show the designation number and then either L or R beneath it. For three parallel runways, the designation number would be presented with L, C, or R beneath it.



Figure 1-40. Runway lights.

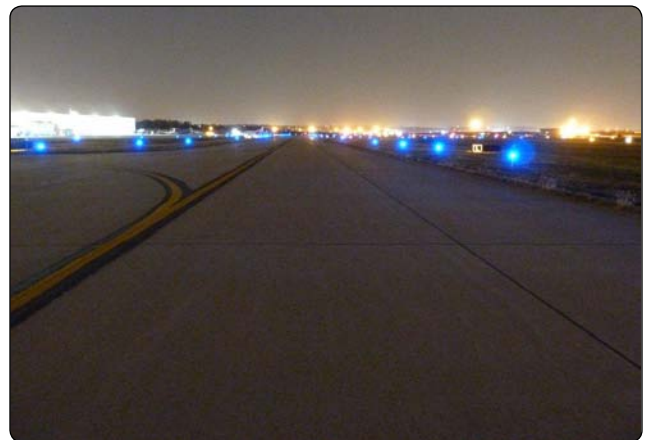


Figure 1-41. Blue taxiway edge lights.

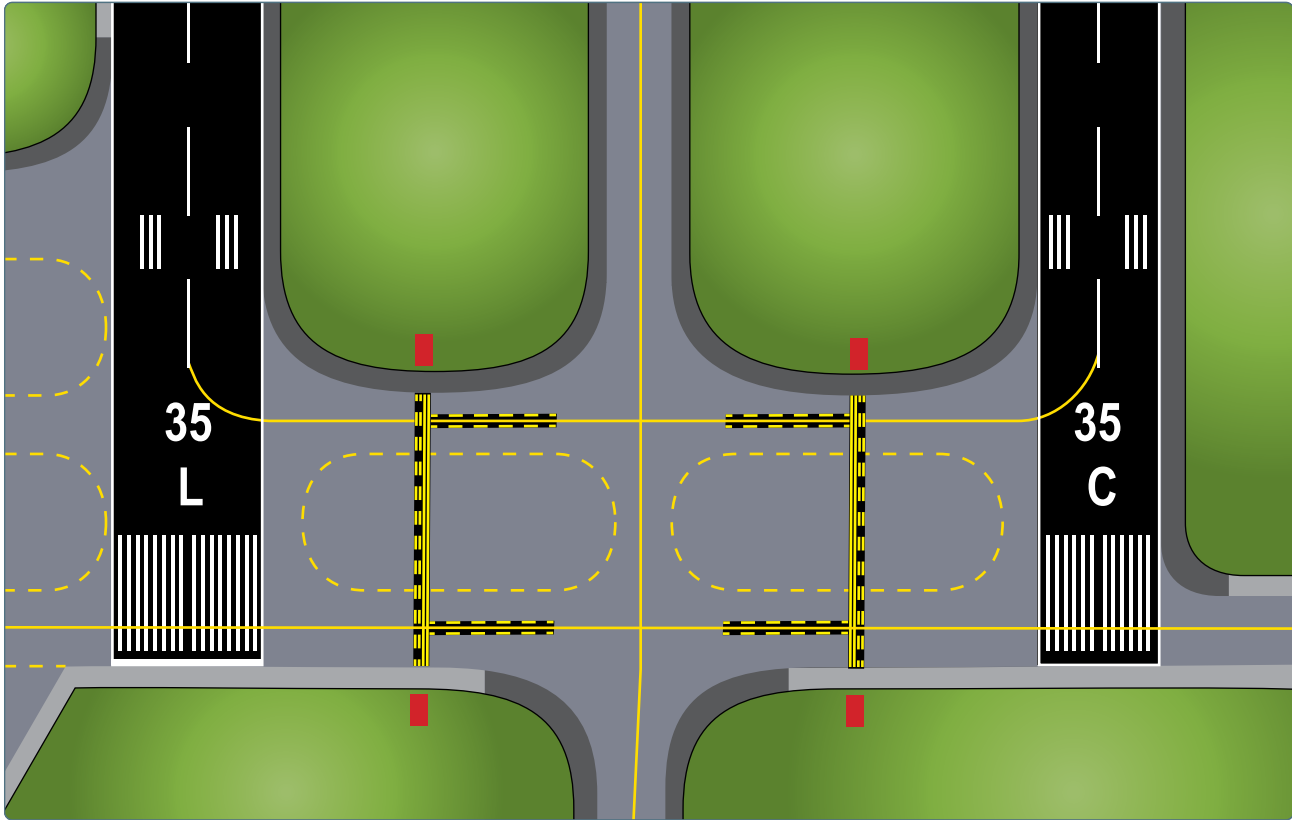


Figure 1-42. *Two of three parallel runways.*