RUNWAY SAFETY

A Pilot's Guide to Safe Surface Operations

www.faa.gov/runwaysafety

FEDERAL AVIATION ADMINISTRATION

2nd Edition

Introduction

Traffic levels rise. Airports expand. And you, the pilot, are expected to understand how to safely taxi to and from runways. Add all the various combinations of weather, time of day, airplane type, and language skill to the mix, and the risk of an error increases.

A Pilot's Guide to Safe Surface Operations was created for you. It is not intended to cover everything there is to know about surface safety. Rather the guide focuses on five areas that are important in surface operations:

Planning Your Surface Operation Page 4

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Airfield Markings, Signs, and Lights Page 21

Each section identifies safety measures you can take to avoid errors that lead to runway incursions. Runway incursions are a serious safety concern. Runway collisions have involved combinations of air carrier aircraft, commuter aircraft, general aviation, and ground vehicles. Several have resulted in fatalities. It doesn't take much to be involved in a runway incursion.

Introduction

Although the guide is focused on surface movement for single pilot operations, the information is also valid for flight crew operations. However, operational coordination procedures between crewmembers are not addressed.

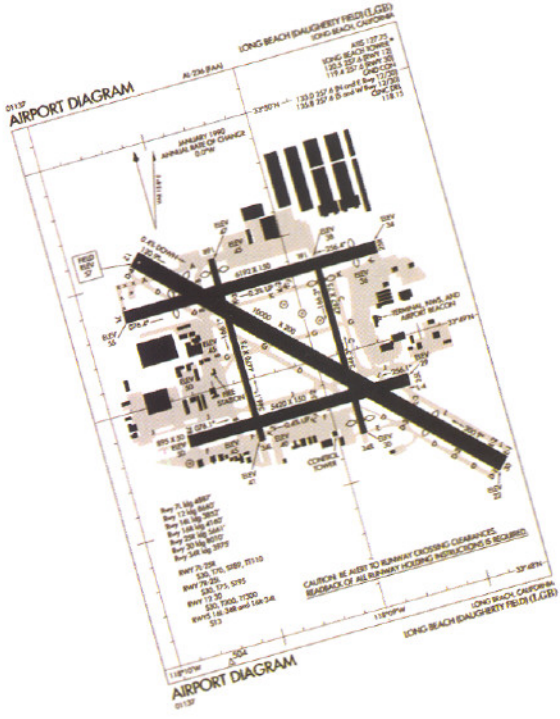
Visit www.faa.gov/runwaysafety to download two advisory circulars (ACs) that provide more details on standard operating procedures (SOPs) for surface operations. AC 91-73A is for single-pilot operations, and AC 120-74A is for flight crews. Additional information on surface movement can be found in the Aeronautical Information Manual (AIM) at www.faa.gov/atpubs.

Planning Your Surface Operation

Thorough planning is essential for safe taxi operations. You should give as much attention to planning the airport surface movement of your flight as you give to other phases of flight.

- **Anticipate your taxi route**. Base your plans on information from the Automatic Terminal Information Service (ATIS), Notices to Airmen (NOTAMS), recent experience at that airport, and a review of the airport diagram.
- **Focus pre-taxi plans on the departure airport,** and pre-landing plans on the arrival airport.
- **Take time to study the airport layout** of your departure and arrival airports.
- **Have an airport diagram readily available** to use not only during the planning phase, but also during taxi.
- **Check the expected taxi route** against the airport diagram or taxi chart. Pay special attention to any complex intersections (for example, more than two crossing pavements along the taxi route).
- **Identify when you should be in "heads up" mode** on the taxi route (for example, transitioning through complex intersections, and crossing intervening runways).
- **Verify your assigned route** after receiving taxi instructions from the controller.

Planning Your Surface Operation



Airport diagrams provide the layout and names of runways and taxiways, and show the location of major facilities on the airfield. They are available through various sources, such as:

- FAA's National Aeronautical Charting Office (NACO)
- Airport/Facility Directory (A/FD)
- Instrument Approach Plates (IAP)
- Direct User Access Terminal Service (DUATS)
- FAA's runway safety website (www.faa.gov/runwaysafety)

Following good operating procedures while taxiing increases the safety of the surface operation. This section focuses on some of the common tasks that you should incorporate into your taxi procedures.

Air Traffic Control (ATC) Instructions

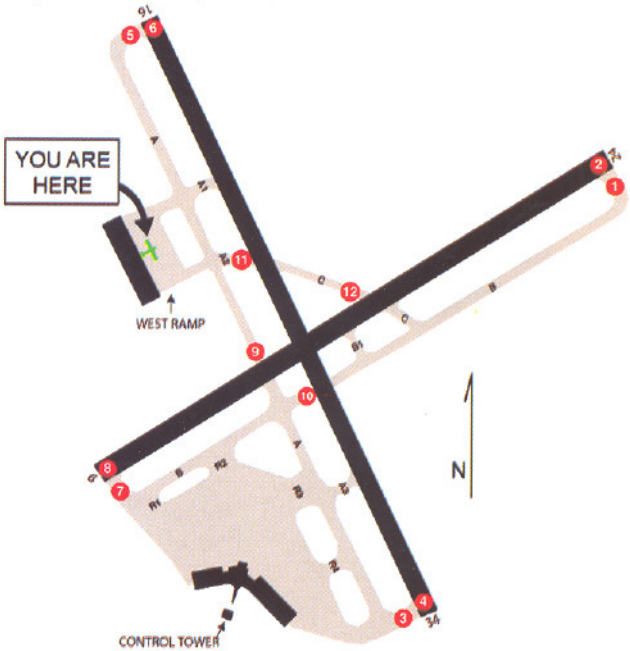
Once taxi instructions are received, you should:

- Write down taxi instructions, especially instructions that are complex. This can help reduce your vulnerability of forgetting part of the instruction.
- Monitor ATC instructions/clearances issued to other aircraft.
- Be especially vigilant if another aircraft has a similar sounding call sign.
- Listen carefully to avoid taking an instruction/clearance intended for someone else.
- Ask immediately if you are uncertain about any ATC instruction or clearance.
- Read back all instructions/clearances with your aircraft call sign.
- Remember an ATC instruction to taxi to a runway **is not** a clearance to cross the assigned takeoff runway, or to taxi on that runway at any point. It **is** a clearance to cross other runways that intersect the taxi route to that assigned takeoff runway.
- Advise ATC if you anticipate a delay, or are unable to comply with their instructions.
- Look for light gun signals from the tower if you suspect radio problems.

Taxi Procedures

Check your understanding of ATC instructions

You, call sign N123, are on the West Ramp and have informed the tower that you want to takeoff on the runway specified in each of four scenarios. (Assume that you need the full length of the runway for takeoff.) The controller's taxiing instructions to you are provided. Select a circled number on the airport diagram to indicate where you are required to stop.



Scenario A
"N123, Taxi to Runway 16" Answer _____

Scenario B
"N123, Taxi to Runway 34" Answer _____

Scenario C
"N123, Taxi to Runway 6" Answer _____

Scenario D
"N123, Taxi to Runway 24 via Alpha 2 and Charlie" Answer _____

Answers – A-5, B-3, C-9, D-12 For information, visit www.faa.gov/runwaysafety

Read back instructions to enter a runway, "hold short," or "position and hold."

Do not merely acknowledge the ATC instructions or clearances by using your call sign and saying "Roger" or "Wilco" – Instead read back the entire instruction or clearance including the runway designator and aircraft call sign.
NOTE: Controllers are required to receive a readback of all hold short instructions issued.

TIP - Reading back the instructions in a slightly different format than what was given (such as "Hold Short Nineteen Right", instead of "Hold Short One Niner Right"), will help you remember it better and might give the controller a better chance at catching any readback errors.

Situational Awareness

When taxiing on the airfield, you need to be aware of your location on the airfield, and how that location relates to your intended taxi route, and to other aircraft and vehicles that may be operating on the airfield. This is commonly referred to as "situational awareness." Maintain situational awareness by:

- understanding and following ATC instructions and clearances;
- using an airport diagram;
- knowing the meaning of the visual aids available at the airport, such as airfield markings, signs, and lights;
- monitoring the radio and using the airport diagram to assist you in locating other aircraft and vehicles that may be on the airfield;

- avoiding distractions;

Maintain a "sterile" cockpit. You must be able to focus on your duties without being distracted by non-flight related matters like engaging in conversation about good restaurants, tee times, or who is going to meet you at the airport.

- using aircraft lights to convey location and intent; and,
- minimizing "heads down" activities while the aircraft is moving.

TIP - If you become uncertain about your location on the airport movement area, make sure you are clear of any runway and STOP THE AIRCRAFT. Advise ATC and, if necessary, request progressive taxi instructions.

While Taxiing

- Use extra caution when directed to taxi on a runway, especially at night and during reduced visibility conditions.
- Use all resources available to keep your aircraft on its assigned taxi route, including:
    - airport diagrams;
    - airfield markings, signs, lights; and
    - heading indicators.
- Make sure you comply with hold short or crossing instructions when approaching an entrance to an active runway.
- Scan the full length of the runway and the approaches before entering or crossing any runway, even if you have received a clearance.

After Landing

- Use utmost caution after landing on a

runway where the exit taxiways intersect another runway.

- Do not exit onto another runway without ATC authorization.
- Do not accept last minute turnoff instructions from the tower unless you clearly understand the instructions and are certain that you can comply.
- Do not initiate non-essential communications or actions after landing until you have exited and cleared all runways.

Position and Hold

ATC uses "position and hold" instruction when a takeoff clearance cannot be immediately issued due to traffic or other reasons.

Pay close attention when instructed to "position and hold," especially at night or during periods of low visibility. Before entering the runway, remember to:

- Scan the full length of the runway, and
- Scan for aircraft on final approach or landing roll out.

TIP - Consider lining up slightly to the left or right of the centerline (approximately 3 feet) when holding in position at night so landing aircraft can differentiate your aircraft from runway lights and markings.

When placing you into "position and hold," ATC should advise you of any delay in receiving your takeoff clearance, for example, landing or departing aircraft, wake turbulence, or traffic on an intersecting runway.

- If landing traffic is a factor, ATC is required to:

- Inform you of the closest traffic that is cleared to land, touch-and-go, stop-and-go, or to make an unrestricted low approach on the same runway; and,
- Advise the landing traffic that you are in position and holding on the runway they are landing on.

- If you have been advised of a reason for the delay or the reason is clearly visible, you should expect an imminent takeoff clearance once the reason is no longer an issue.
- If a takeoff clearance is not received within a reasonable time after instructed to "position and hold," contact ATC.

TIP - Take care to note the position of traffic and, while you are awaiting takeoff clearance, keep track of the amount of time that passes after you have received the "position and hold" instruction.

- When ATC issues intersection "position and hold" and takeoff clearances, the intersection designator will be used.
- If full-length and intersection departures are being used at the same time, the term "full-length" will be included in the clearance.

Did You Know?

There have been some collisions and several incidents involving aircraft holding in position waiting for a takeoff clearance. The FAA's analysis of those collisions and incidents indicate that TWO MINUTES or more elapsed between the time an instruction was issued to "position and hold" and the resulting collision, land over, or go around by an aircraft cleared to land. Contact ATC anytime you have a concern about a potential conflict.

Aircraft Lights

During daytime as well as nighttime operations, exterior aircraft lights may be used to make an aircraft operating on the airport surface more conspicuous, and to convey location and intent to other pilots.

Use Exterior Aircraft Lights as Follows:

- **Engines Running –** Turn on the rotating beacon.
- **Taxiing –** Prior to commencing taxi, turn on navigation/position, strobe*, taxi, and logo lights, if available.
- **Crossing a Runway –** All exterior lights should be illuminated when crossing a runway. You should consider any adverse effects to safety that illuminating the forward facing lights will have on the vision of other pilots or ground personnel during runway crossings.
- **Entering the Departure Runway for Position and Hold –** Turn on all exterior lights * (**except landing lights**) to make your aircraft more conspicuous to aircraft on final and to ATC.
- **Takeoff –** Turn on landing lights **when takeoff clearance is received**, or when commencing takeoff roll at an airport without an operating control tower.

**Strobe lights should not be illuminated if they will adversely affect the vision of other pilots or ground personnel.*

Aircraft Lights

TIP - Turn off your taxi lights when stopped, yielding, or as a consideration to other pilots or ground personnel.

Standardized Aircraft Lighting						
= Turn on	Rotating beacon	Navigation/Position lights	Strobe light*	Taxi lights	Logo lights	Landing lights
Engine(s) running	✓					
Taxiing	✓	✓	✓	✓	✓	
Crossing a runway	✓	✓	✓	✓	✓	✓
Entering departure runway for position and hold	✓	✓	✓	✓	✓	
Takeoff	✓	✓	✓	✓	✓	✓

** Strobe lights should not be illuminated if it will have an adverse effect on others.*

Communications

Effective pilot/controller communications are key to safe surface operations. You can help enhance the controller's understanding by responding appropriately and using standard phraseology. Guidelines for clear and accurate communications:

- Use proper communications procedures when contacting ATC. Your initial transmission should contain these elements:
    - Who you are calling;
    - Your call sign;
    - Where you are located; and
    - What you want to do, if it is short.
- State your position whenever making initial contact with any tower or ground controller, regardless of whether you have previously stated your position to a different controller.
- Use standard ATC phraseology at all times in order to facilitate clear and concise pilot/controller communications.
- Focus on what ATC is instructing. Do not perform any non-essential tasks while communicating with ATC.

Good Radio Technique

Prepare first; your transmission should be well thought out. Before keying your transmitter, know what you want to say and check to make sure you are on the proper frequency.

Communication with ATC should be concise and to the point. For unusual situations or lengthy communications, initial contact should be established first.

Acknowledge all clearances with your aircraft call sign. It is permissable to begin or end your transmission with your call sign.

- Read back all instructions/clearances to enter a specific runway, hold short of a runway, or "position and hold," including the runway designator.
- When holding in position for takeoff and when on final approach, actively monitor the assigned tower frequency, or the Common Traffic Advisory Frequency (CTAF), for potential conflicts involving your runway.
- Read back all takeoff and landing clearances, including the runway designator.
- If unfamiliar with the taxi routes at an airport, ask for progressive taxi instructions.
- When you are instructed to monitor a frequency, you should listen without initiating contact. The controller will initiate contact.
- Clarify any misunderstanding or confusion concerning ATC instructions or clearances.

What's that aircraft doing on the runway?

Question: You are approaching an airport and have received a landing clearance. As you continue your approach, you notice an aircraft sitting on the runway you are cleared to land on. What should you do?

Answer: Never land on a runway that is occupied by another aircraft. In all probability, the controller is aware of the traffic and is planning to issue a takeoff clearance to that aircraft in a timely fashion. But mistakes do happen, and if you are uncomfortable with the spacing, do not hesitate to ask the controller about the traffic and be prepared to execute a go around.

Examples of Taxi Instructions

Initial Call-up with Specific Requests

Make clear any special requests on initial contact

Example:

Pilot: O'Hare Ground, Gulfstream Six Seven Six Kilo, ACME Aviation, with information Alpha, request taxi to Runway Two Two Left.

Controller: Gulfstream Six Seven Six Kilo, O'Hare Ground, taxi to Runway Two Two Left.

"Position and Hold"

Read back all "position and hold" instructions, including the runway designator and intersection.

Example full-length departure:

Controller: November Three Eight Six, Runway Two Seven position and hold, traffic landing Runway Three Right.

Pilot: Position and hold Runway Two Seven, November Three Eight Six.

Example intersection departure:

Controller: November Six Eight Six Two Six, Runway Three Six at Golf Four, position and hold.

Pilot: Position and hold, Runway Three Six at Golf Four, November Six Eight Six Two Six.

Takeoff Clearance/Landing Clearance

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

Example:

Controller: November Two Seven Two Six Two, Charlotte Tower, Runway Five, cleared for takeoff.

Pilot: November Two Seven Two Six Two, cleared for takeoff, Runway Five.

Example:

Controller: Delta Two Twenty-Two, Boston Tower, Runway Four Right, cleared to land.

Pilot: Delta Two Twenty-Two cleared to land, Runway Four Right.

"Land and Hold Short"

Land and hold short instructions require a pilot readback.

Example:

Controller: American Two Hundred, DFW Tower, cleared to land Runway One Eight Right, hold short of Taxiway Alpha for crossing traffic.

Pilot: American Two Hundred cleared to land Runway One Eight Right, hold short of Taxiway Alpha.

Braking Action Reports

When a braking action report is requested, the condition should be described in the following terms only:

1) **Good**
2) **Fair**
3) **Poor**
4) **Nil**

Braking actions that affect only a portion of a runway or taxiway should be reported as such.

Example:

Controller: America West Fifty-Two say braking action.

Pilot: America West Fifty-Two, braking action on Runway Two Two is good first half of the runway, fair on the second half.

Controller: America West Fifty-Two, Roger.

Runway Exiting

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

Example:

Controller: Continental Thirty-Two, turn right on Taxiway Golf Two and contact ground Point Niner.

Pilot: Continental Thirty-Two, right on Golf Two, ground Point Niner.

Initial Contact after Exiting Runway

Example:

Pilot: Concord Ground, November Three Eight One Six Juliet, clearing Runway Two at Bravo, taxi to ACME Aviation.

Controller: November Three Eight One Six Juliet, Concord Ground, taxi to the Ramp.

Glossary of Phraseology

This section contains a glossary of phraseology commonly used in surface operations. For a complete listing of all ATC phraseology, consult the Aeronautical Information Manual (AIM).

- **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.
- **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.
- **NEGATIVE** - "No," or "permission not granted," or "that is not correct."
- **"POSITION AND HOLD"** - Used by ATC to inform a pilot to taxi onto the departure runway in takeoff position and hold. ***It is not authorization for takeoff.*** It is used when takeoff clearance cannot immediately be issued because of traffic or other reasons.
- **READ BACK** – Repeat my message back to me.

- **ROGER** – I have received all of your last transmission. It should not be used to answer a question requiring a yes or no answer. (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").
- **WITHOUT DELAY** – With a sense of urgency, proceed with approved instructions in a rapid manner.
- **WILCO** – I have received your message, understand it, and will comply with it.

Airfield markings, signs, and lights are designed to assist you in navigating around the airfield and during landing and takeoff.

Airfield Markings – Understanding the Differences

Let's review the color and meaning of these items. In understanding airfield markings, remember the following principles.

Color

- **Runway markings are white** (although yellow taxiway centerlines may lead on, lead off, or cross the runway).
- **Taxiway markings are yellow.**
- **Markings on aprons and in ramp areas may include other colors** besides yellow (for example, it is common to mark vehicle roadways in white).

A vehicle roadway on an apron area. The edges of this roadway are highlighted with white zipper markings. At many airports, the edges of the roadway are identified by solid white stripes. You may taxi across these roadways, but you should not taxi on them.

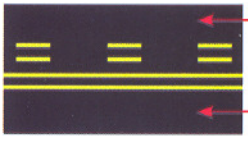
Taxiway marking patterns

- If a marking pattern consists of two or more lines - some of which are solid and some of which are dashed,
  - It is always permissible to cross from the dashed side to the solid side.
  - **ATC permission is always required to cross from the solid side to the dashed side** at an airport with an operating control tower.

Non-movement area boundary marking

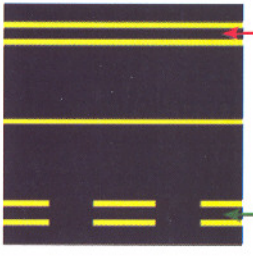
  - **When instructed to "Hold Short," always stop prior to first solid line** of the holding position marking.

Runway holding position marking



  - Never cross solid double yellow lines on the edge of a taxiway. However, it is permissible to cross dashed, double yellow lines.

Taxiway with edge markings



Airfield Signs – How to Get from Here to There Safely

Along with airfield markings and lights, airfield signs are designed to assist you in navigating around the airfield.

- It is essential that you understand the color-coding and meaning of these four types of signs when taxiing on an airfield.

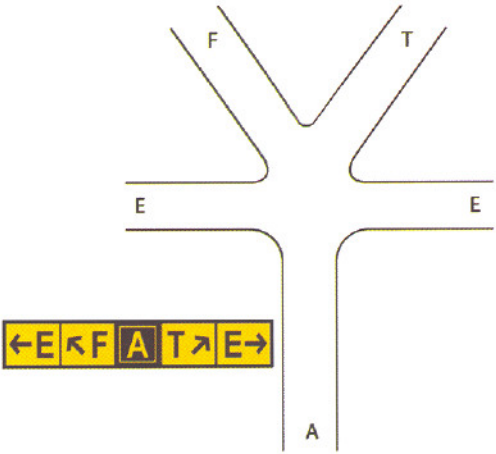
1. **Location Sign:** Identifies the taxiway or runway you are currently located on. It has a yellow inscription on a black background. *Remember: Black Square, You're There.*

2. **Mandatory Instruction Sign:** Identifies the entrance to a runway or critical area, and areas prohibited for use by aircraft. It has a white inscription on a red background.

3. **Direction Sign:** Identifies the designations of taxiways leading out of an intersection along with an arrow indicating the approximate direction of turn needed to align the aircraft on that taxiway. They are located prior to the intersection, normally on the left side. It has a black inscription on a yellow background.

4. **Destination Sign:** Identifies with arrows the directions to specific destinations on the airfield (for example, runways, terminals, and fixed base operators). It also has a black inscription on a yellow background. *Remember: Yellow Array Points the Way.*

- Examples of Airfield Sign Usage:
  - **Sign Arrays:** Grouping of direction signs. Orientation of signs is from left to right in a clockwise manner. Left turn signs are on the left of the location sign and right turn signs are on the right of the location sign.

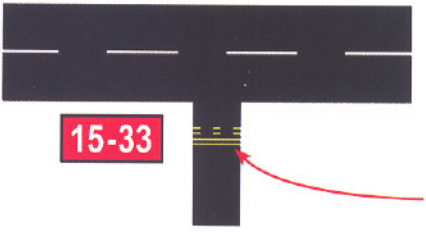


  - **Holding position sign:** This sign is located next to the yellow holding position markings painted on taxiways that intersect a runway. This sign indicates that the threshold for Runway 15 is to your left; the threshold for Runway 33 is to your right.

Did You Know?

A majority of runway incursions result from pilots acknowledging ATC hold short instructions and then proceeding across the hold short line anyway.

Runway holding position markings on taxiways identify the locations where an aircraft is required to stop when it does not have authorization to proceed onto the runway (you will also see a red and white holding position sign). When instructed by ATC to "Hold short of runway 'xx,'" you should read back and stop so no part of the aircraft extends over the first solid line of the holding position marking. Keep your head up– setback distances to runway holding position markings can vary by runway, even at the same airport. When approaching the holding position marking, you should not cross the marking without ATC clearance at a controlled airport, or without making sure that there is adequate separation from other aircraft at uncontrolled airports. An aircraft exiting a runway is not clear of the runway until all parts of the aircraft have crossed the applicable holding position marking



Stop so that no part of the aircraft crosses this line.

TIP - If you are facing solid lines, be sure you are cleared to enter or cross the runway. The dashed lines are always on the side toward the runway.

Airfield Lights

There are many different lighting combinations that may be located on some airports, especially where aircraft operations are conducted in the lower visibility ranges. For taxiing operations during Visual Meteorological Conditions (VMC), you should remember the following:

- Runway edge lights are white (although on the last 2,000 feet of an instrument runway the edge lights will be yellow).
  Note: Picture also shows runway centerline and touchdown zone lights.

- Taxiway edge lights or reflectors are blue.

- Taxiway centerline lights or reflectors are green.

TIP - Never taxi across a row of illuminated red lights. This is a stopbar — do not proceed until the lights are turned off.

- Runway guard lights are flashing yellow lights (either in the pavement or located on the side of the taxiway) and highlight a runway holding position.

Holding position for Runway 14-32 on Taxiway Bravo. An above ground runway guard light is installed between the holding position sign and pavement marking.

Runway holding position as viewed from a taxiway centerline. This holding position has both above ground and in-pavement runway guard lights.

International Civil Aviation Organization (ICAO) Phonetics

A – Alfa

B – Bravo

C – Charlie

D – Delta

E – Echo

F – Foxtrot

G – Golf

H – Hotel

I – India

J – Juliet

K – Kilo

L – Lima

M – Mike

N – November

O – Oscar

P – Papa

Q – Quebec

R – Romeo

S – Sierra

T – Tango

U – Uniform

V – Victor

W – Whiskey

X – X-ray

Y – Yankee

Z – Zulu

0 – Zee-ro

1 – Wun

2 – Too

3 – Tree

4 – Fow-er

5 – Fife

6 – Six

7 – Sev-en

8 – Ait

9 – Niner

For more information on runway safety, visit www.faa.gov/runwaysafety.

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