



Runway Incursion Avoidance

Overview

WHAT

- Practical guidance to increase the safety and efficiency of aircraft movement on the airport surface

WHY

- Runway incursions can lead to serious accidents with significant damage to aircraft and even loss of life
- With increasing air traffic, runway incursions have been on the rise

CONTENT

- Runway Incursions
- Taxi Instructions
- Plan, Review, & Brief
- Appropriate Flight Deck Activities
- Airport Markings, Signs, & Lights
- Airport Operations & Runway Incursions



Runway Incursions

Overview

Any occurrence involving an aircraft, vehicle, person, or object that creates a collision hazard or results in the loss of separation with an aircraft taking off, landing, or intending to land

- Average of 3 runway incursions per day
- Airport/Taxiing Challenges
 - Situational Awareness
 - Distractions
- Causal Factors
 - Failure to comply with ATC instructions
 - Lack of airport familiarity
 - SOP nonconformance



Runway Incursions

Preventive Practices

- Maintain situational awareness
- Review airport layouts & know airport signage
- Review NOTAMs
- Study & use proper phraseology
- Write down complex taxi instructions
- Readback all runway crossing and hold short instructions
- Request progressive taxi instructions, when necessary
- Turn on lights when taxiing
- Check for traffic before entering any runway or taxiway
- When landing, clear the runway ASAP and wait for taxi instructions



Taxi Instructions

Controlled Field

- Clearance must be obtained:
 - Prior to moving onto the movement area while tower is in operation
 - Prior to crossing *any* runway
- When assigned taxi instructions, ATC specifies:
 - The runway or point to taxi to
 - Route (taxi instructions)
 - Hold short instructions or runway cross clearances
- Always readback:
 - Runway assignment
 - Any clearance to enter a specific runway
 - Any instruction to hold short of a specific runway



Taxi Instructions

Uncontrolled Field

- Announce intentions on CTAF
 - Use taxi diagram for planned route
- Monitor CTAF and maintain situational awareness
 - Apply right-of-way rules
 - Give way when appropriate or when safety dictates



Plan, Brief, Review

- Route Planning
 - Airport Diagram
 - Check for pre-designated, or standard taxi routes
- Taxi Brief
 - Ground Procedures
 - Checklists & Communication
 - Expected route and any abnormalities or unusual procedures
 - Critical locations
 - Low visibility operations
 - Expectations of Others
 - Sterile cockpit
 - Airport diagrams
 - Cell phones/electronic devices
- Record & Review
 - Write down ATC taxi instructions
 - Review the route given

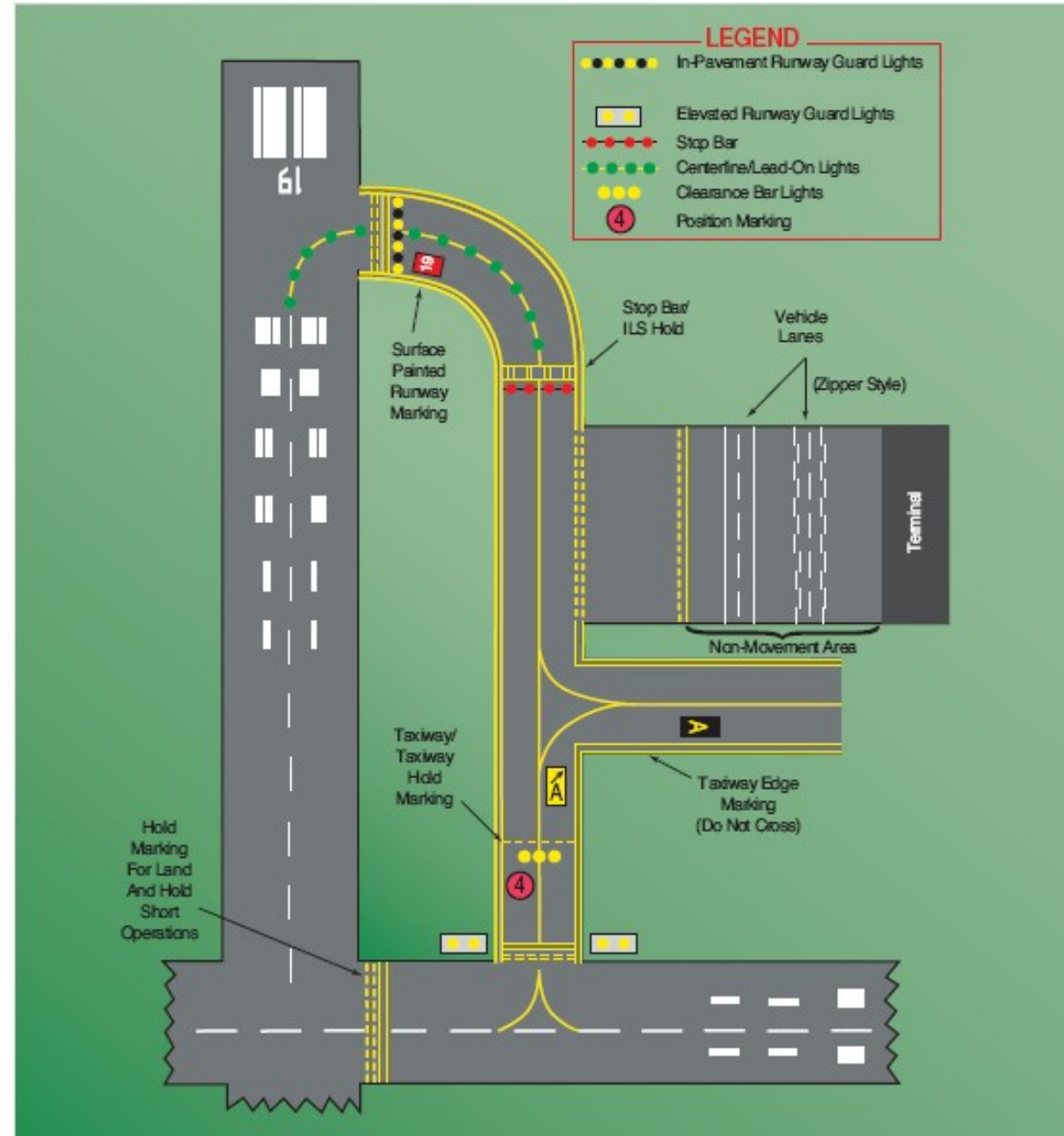


Appropriate Flightdeck Activities

- Workload should be at a minimum during taxi
 - All “heads down” activities should only be accomplished when stopped
- Sterile cockpit
- Taxiing Near other Aircraft
 - Keep eyes outside, taxi slowly, and be alert
 - Continuous Loop Process
 - Always be aware of where you are and what’s coming next
 - Monitor other aircraft’s progress and location



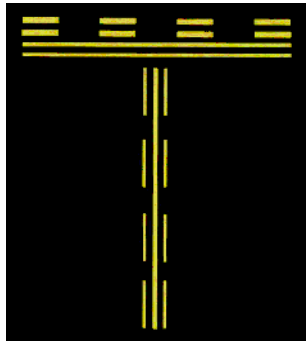
Airport Markings, Signs, & Lights



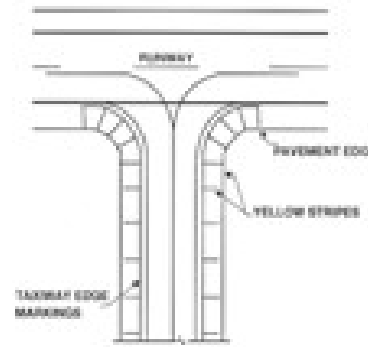
Airport Markings, Signs, & Lights

Taxiway

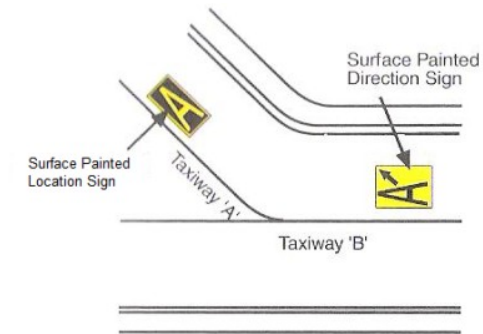
- Centerline Markings



- Shoulder Markings



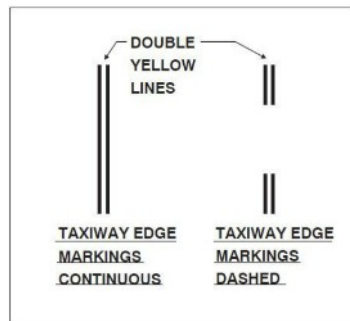
- Location Signs



- Direction Signs



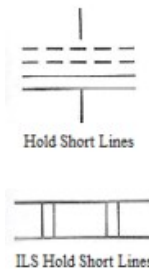
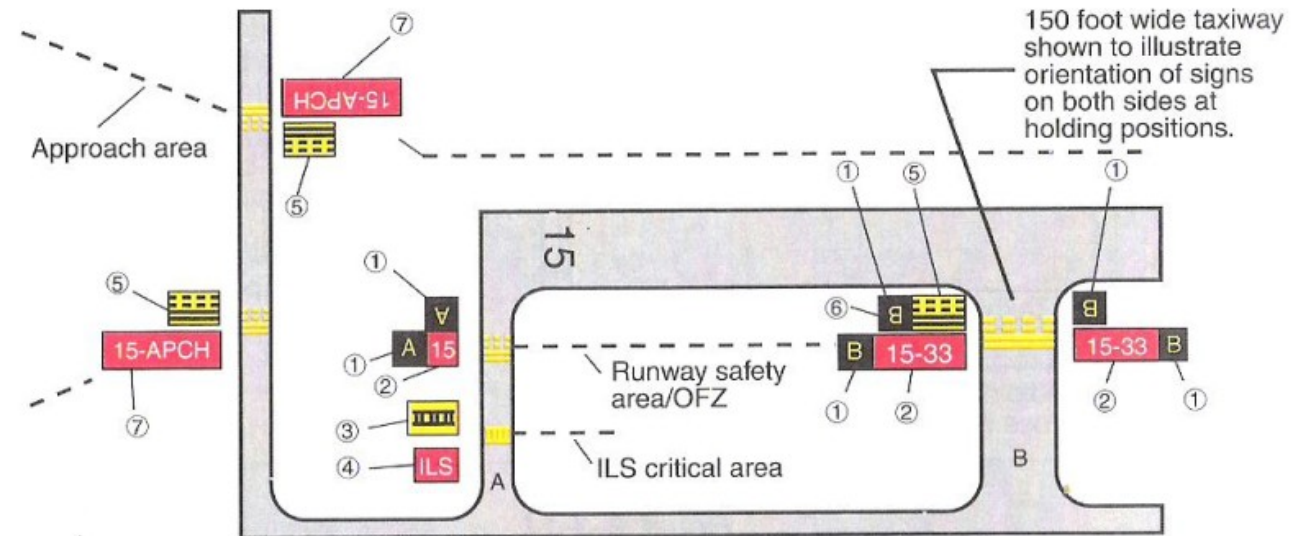
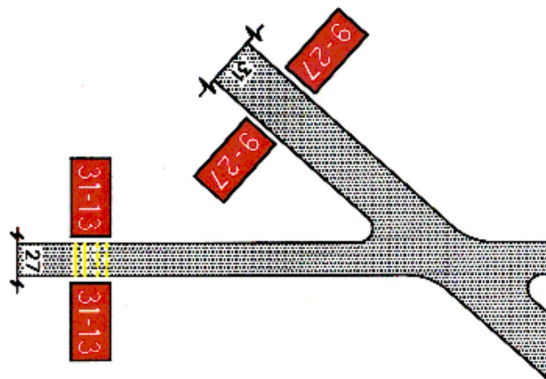
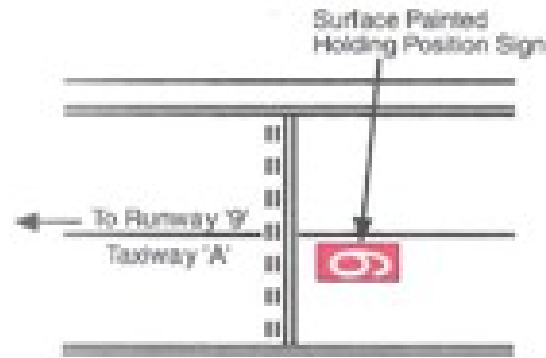
- Position Markings



Airport Markings, Signs, & Lights

Holding Position

Show where an aircraft is supposed to stop when approaching a runway



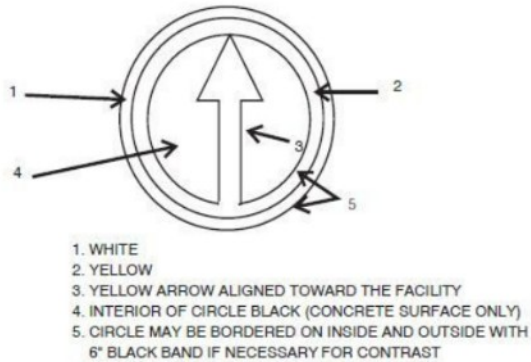
- ① Taxiway location
- ② Holding position sign
- ③ ILS critical area boundary sign
- ④ ILS holding position sign
- ⑤ Runway safety area/OFZ and runway approach area boundary sign
- ⑥ Taxiway location sign-optional, depending on operational need
- ⑦ Holding position sign for approach areas



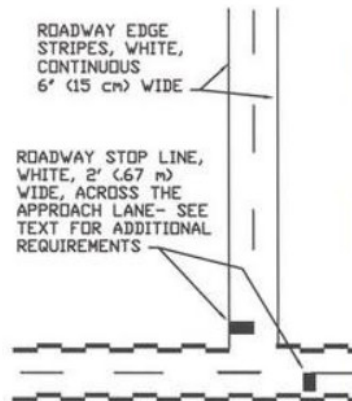
Airport Markings, Signs, & Lights

Other

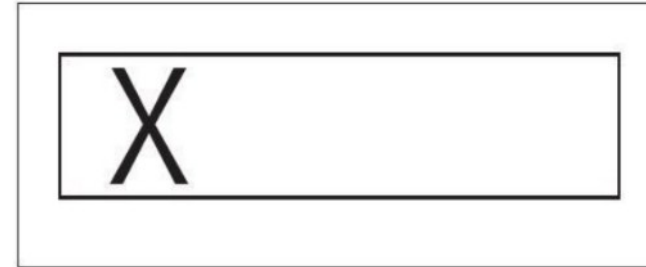
- VOR Checkpoint



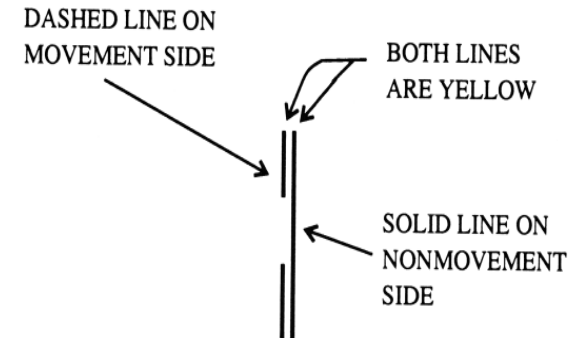
- Vehicle Roadway



- Closed Runway



- Nonmovement Area Boundary



Airport Markings, Signs, & Lights

Runway

NOTES

1. Required on runways serving category C & D aircraft, and for runways intended for international commercial air transport
2. Required on 4,200' or longer runways serving categories C & D airplanes
3. Required on 4,200' or longer instrumented runways
4. Used when the full runway pavement width may not be available for use as a runway

Runway Surface Marking Scheme	Threshold Approach Category		
	Visual Approach	Non-precision Approach (Approaches with vertical guidance not lower than 0.75 statute mile visibility)	Precision Approach (Approaches with vertical guidance lower than 0.75 statute mile visibility)
Runway diagram			
Landing Designator	Required	Required	Required
Centerline	Required	Required	Required
Threshold	Note 1	Required	Required
Aiming Point	Note 2	Note 3	Required
Touchdown Zone	(not applicable)	(not applicable)	Required
Edge Markings	Note 4	Note 4	Required

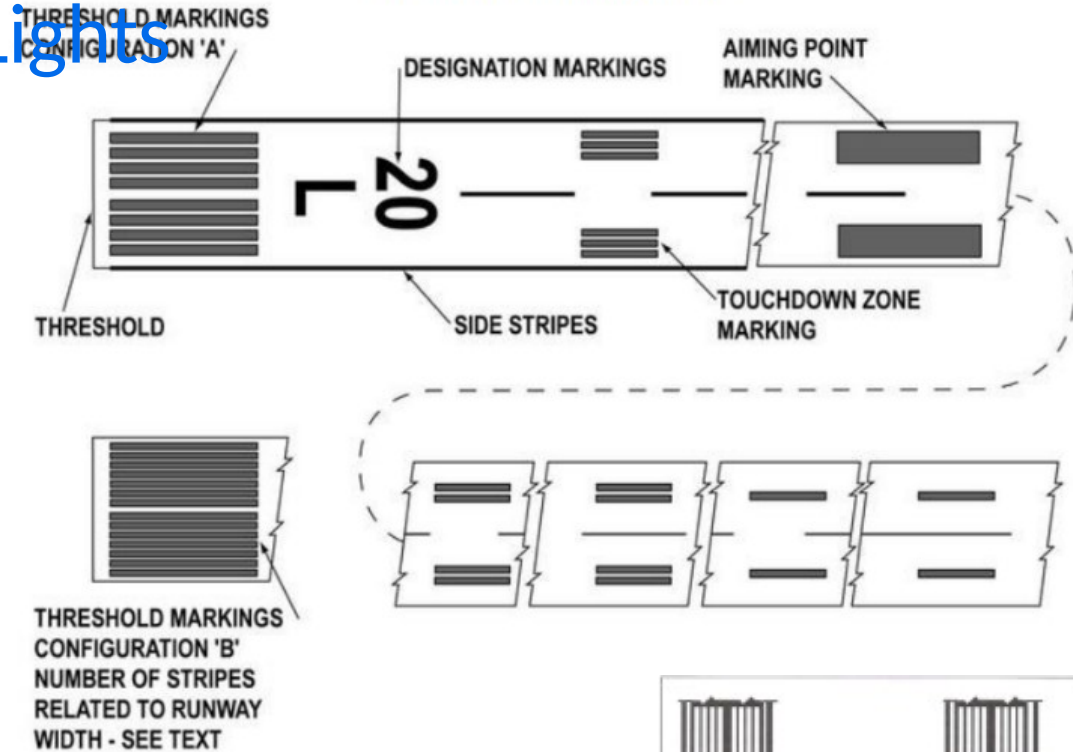


Airport Markings, Signs, & Lights

Runway

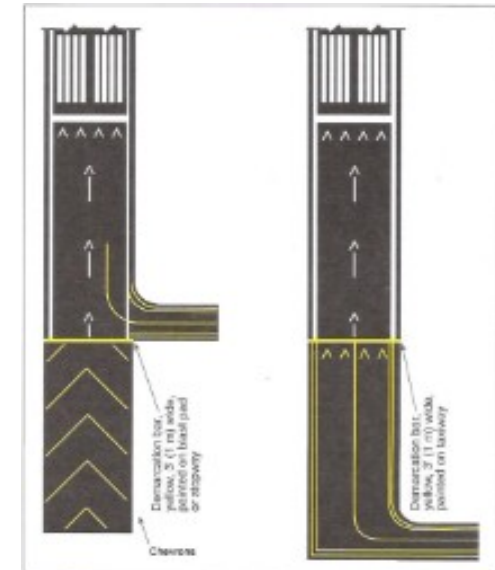
- Designators
- Centerline Markings
- Aiming Point Markings
- Touchdown Zone Markers
- Side Stripes
- Shoulder Markings
- Threshold Markings
- Blast Pad / Stopway Area

Precision Instrument Runway Markings



Number of Runway Threshold Stripes

Runway Width	Number of Stripes
60 feet (18 m)	4
75 feet (23 m)	6
100 feet (30 m)	8
150 feet (45 m)	12
200 feet (60 m)	16

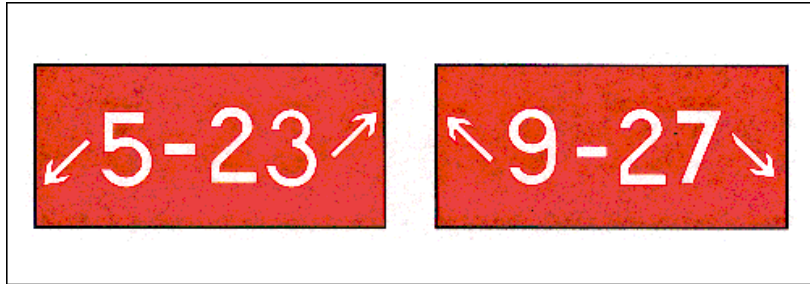


Airport Markings, Signs, & Lights

Mandatory Instruction

Denote entrance to runway or critical area, or area where aircraft are prohibited

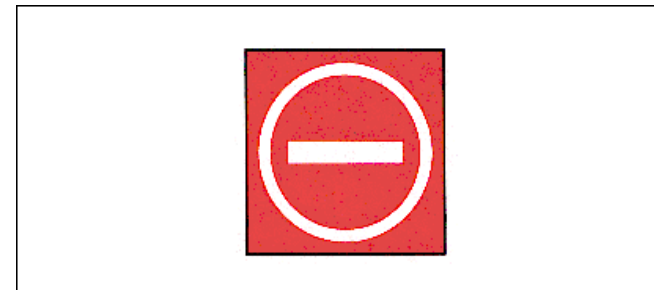
- Runway Hold Position Sign



- ILS Critical Area Hold Position



- No Entry Sign

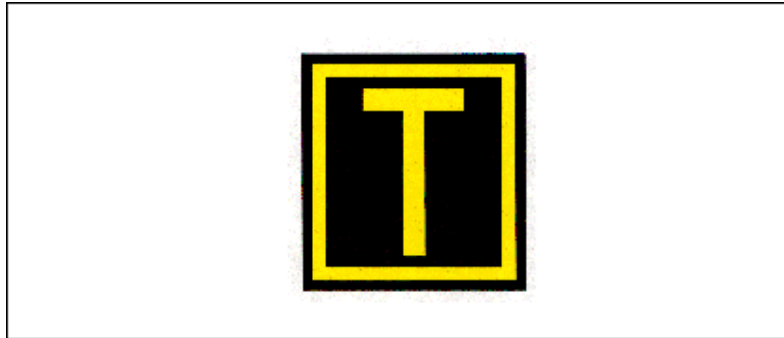


Airport Markings, Signs, & Lights

Location

Identify either a taxiway or runway on which the aircraft is located

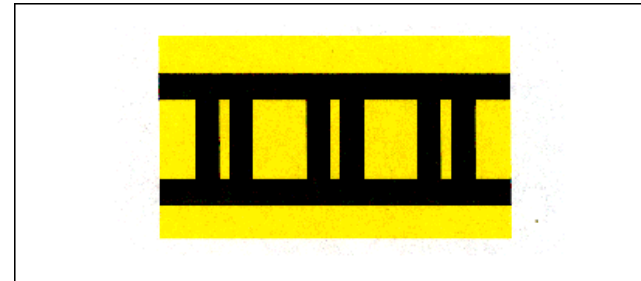
- Taxiway Location Sign



- Runway Boundary Sign



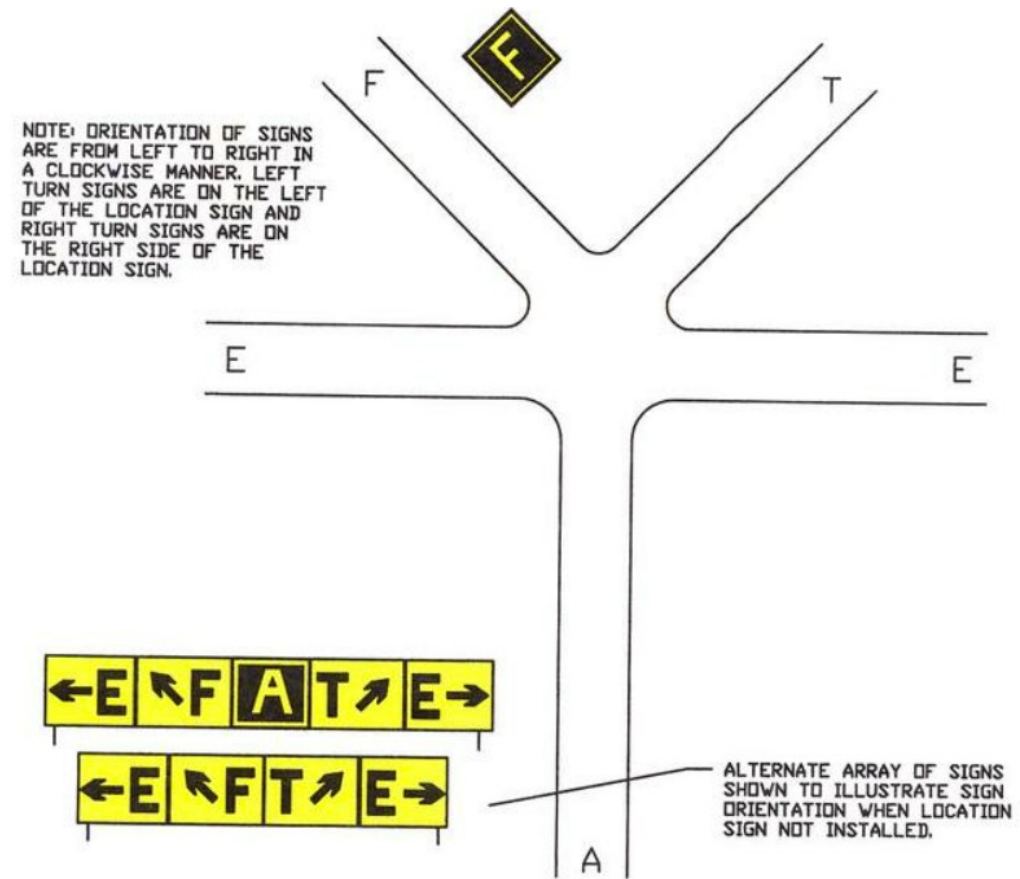
- ILS Critical Area Boundary Sign



Airport Markings, Signs, & Lights

Direction

Identify the designations of intersections



Airport Markings, Signs, & Lights

Destination & Information

- Destination – Indicate a destination on the airport:
 - Runways
 - Aprons
 - Terminals
 - Military Areas
 - Civil Aviation Areas
 - Cargo Areas
 - International Areas
 - FBOs
- Information – Provide information on things like:
 - Areas the tower can't see
 - Radio frequencies
 - Noise abatement procedures



Airport Markings, Signs, & Lights

Runway Distance Remaining

Informs pilots of the distance remaining on the runway in thousands of feet



Airport Markings, Signs, & Lights

Taxiway

- Taxiway Edge Lights
 - Outline the edges of taxiways at night or with restricted visibility
 - Blue lights
- Taxiway Centerline Lights
 - Facilitate taxiing during low visibility conditions
 - Steady green lights along the centerline
- Clearance Bar Lights
 - Increase visibility of a holding position in low visibility, or indicate the location of an intersecting taxiway
 - Three in-pavement steady yellow lights
- Runway Guard Lights
 - Enhance visibility of taxiway and runway intersections
 - Elevated flashing yellow lights on each side of a taxiway, or a row of in-pavement yellow lights across the taxiway
- Stop Bar Lights
 - Confirm ATC clearance to enter / cross an active runway in low visibility conditions
 - Row of red, steady in-pavement lights across the entire taxiway and elevated lights on either side of the taxiway



Airport Markings, Signs, & Lights

Runway

- Runway Edge Lights
 - Outline the edges of runways
 - White lights
 - Instrument runways have yellow lights the last 2,000' or half, whichever is shorter
 - Lights marking the end of the runway – Red toward the runway (end) and green outward (threshold)
 - Classified based on brightness: High intensity runway lights (HIRL), Medium (MIRL), Low (LIRL)
- Runway End Identifier Lights (REIL)
 - Installed to provide rapid / positive identification of the approach end of a runway
 - Pair of synchronized flashing lights located on each side of the runway threshold



Airport Markings, Signs, & Lights

Runway

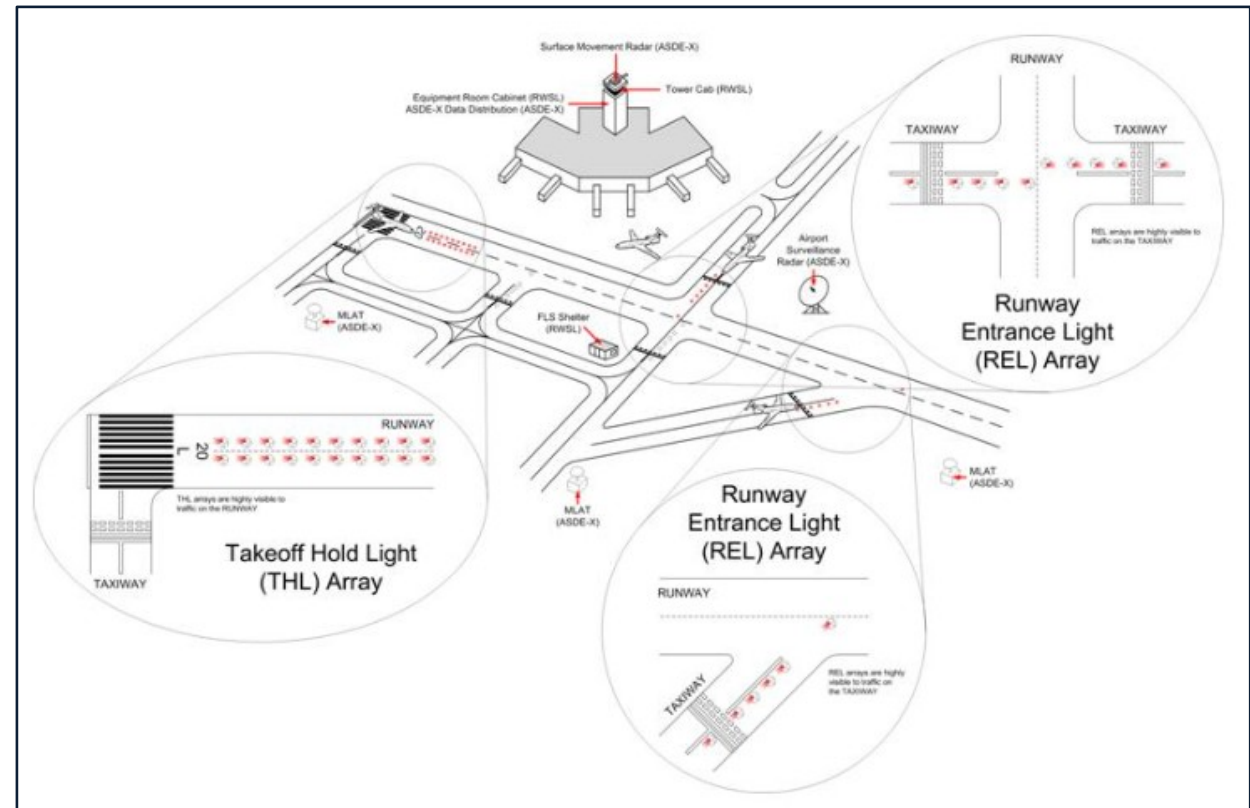
- Runway Centerline Lighting System (RCLS)
 - Installed on some precision runways to facilitate landing in adverse conditions
 - White lights until the last 3,000' where they alternate red / white until the last 1,000' which are all red
- Touchdown Zone Lights (TDZL)
 - On some precision runways to indicate the touchdown zone in adverse visibility
- Taxiway Centerline Lead-Off Lights
 - Provide visual guidance for exiting the runway
 - Alternating green/yellow lights from the runway centerline to 1 light position beyond the hold position
- Taxiway Centerline Lead-On Lights
 - Provide visual guidance for entering the runway
 - Same color as lead-off lights. Bi-directional – 1 side emits light for lead-on and the other for lead-off
- Land and Hold Short Lights
 - Used to indicated the hold short point on runways approved for LAHSO
 - Row of pulsating white lights installed across the runway



Airport Markings, Signs, & Lights

Runway Status (RWSL)

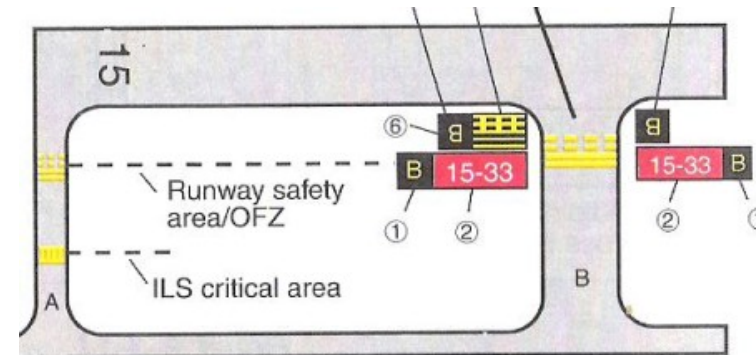
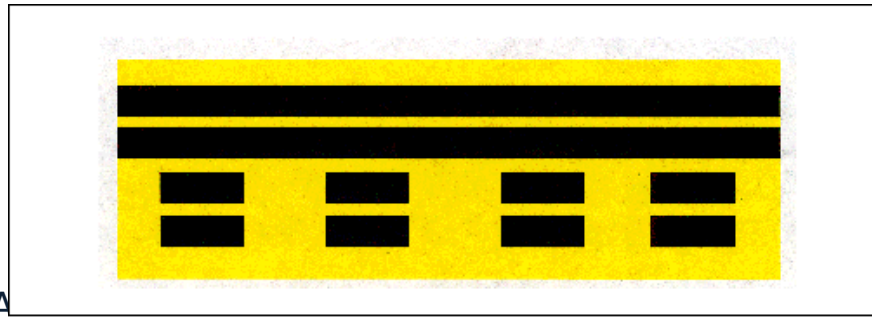
- Automated system providing a direct indication that a runway is safe
 - Installed at several major US airports
 - Used in conjunction with ATC
 - ATC & RWSL must agree
- Runway Entrance Lights (REL)
 - In pavement red lights
 - Warn aircraft waiting to cross/enter a runway that there is conflicting traffic
- Takeoff Hold Lights (THL)
 - In-pavement red lights
 - Warn aircraft in the takeoff position that the runway is occupied



Airport Operations & Runway Incursions

Hold Lines

Indicate where to stop when approaching a runway without a clearance to enter



- Approaching from the solid side (entering runway):
 - Cross the dashed lines and stop when fully beyond solid lines
- Approaching from the solid side (entering runway):
 - At controlled airports, pilots must not cross without ATC clearance
 - At uncontrolled airports, pilots must ensure adequate separation from other aircraft
- Clarify with ATC if there's any confusion, never assume



Airport Operations & Runway Incursions

Landing & Rollout

- Plan Ahead
 - Brief the landing runway & exit/taxi plan
- Exiting the runway entirely
 - Advise ATC if unable to fully clear the runway
- Do not cross another runway without a clearance



Airport Operations & Runway Incursions

Night ops: Exterior Lighting

- Starting Engines
 - Rotating beacon on
- Taxiing
 - Navigation, position, & anti-collision lights on
 - Taxi light on when moving or intending to move, off when stopped or yielding
- Crossing a Runway
 - All exterior lights should be illuminated
- Entering a Runway for Takeoff or to Line Up & Wait
 - Turn on all lights except landing lights
 - Line up approximately 3' off the centerline
- Cleared for Takeoff or Starting Takeoff Roll
 - Landing lights on



Airport Operations & Runway Incursions

Night ops: Considerations

- Taxi slower
- Be more cautious
 - Reduced visibility & less time to react
- Sterile cockpit



Airport Operations & Runway Incursions

Low Visibility

AIM 4-3-19

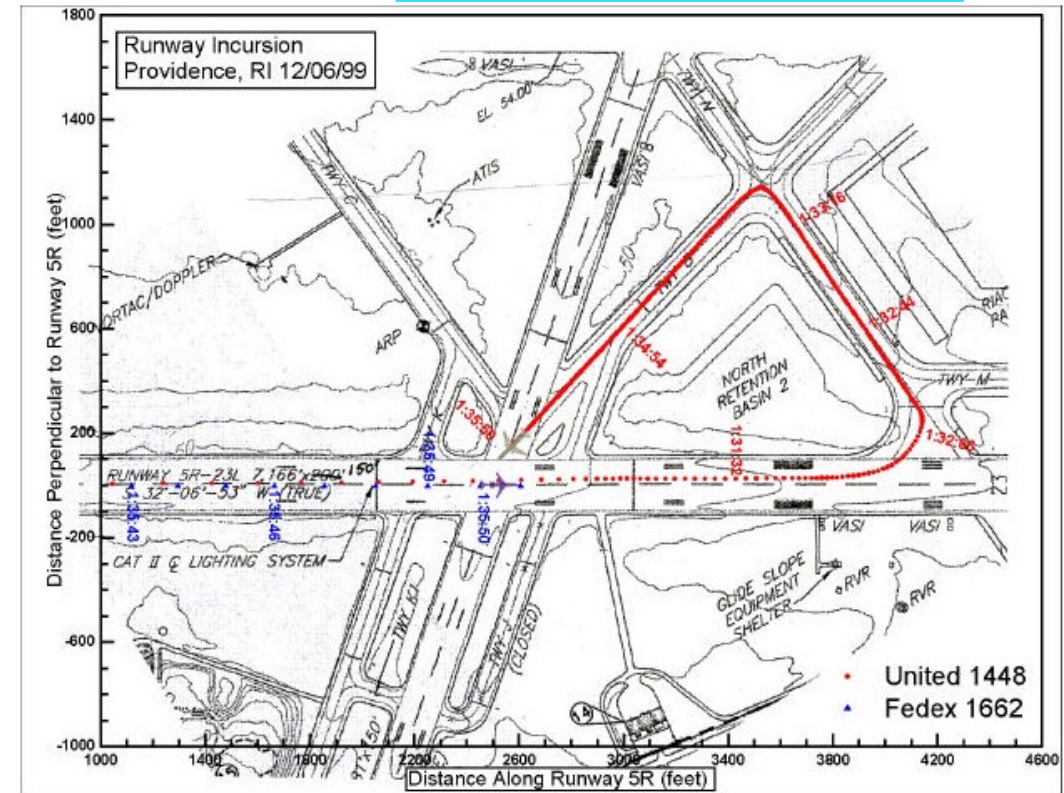
- Focus entire attention on the safe operation of the aircraft while it is moving
- Taxi slowly
- Focus should be outside
- Sterile cockpit
 - Withhold checklists & nonessential communication until stopped with the brakes set
- Notify the controller of difficulties or at the first indication of becoming disoriented



United 1448

Case Study

- UAL1448 lands on runway 5R
- Cleared to taxi N & T, and report across 16
- Become disoriented and turn onto B, back toward 5R
 - They stop and advise the controller they believe the airplane is on an active runway
- FDX1662 departs 5R passing near 1448
- PVD clears US Airways 2998 for takeoff from 5R
 - 2998 declines the clearance because of their concern about 1448's position potentially saving numerous lives



United 1448

Case Study

Close Calls
Effective communication within the cockpit and with the Tower is a must. See what happens when communication breaks down on a flight in Providence.

AIRBOYD

REPLAY

AUDIO TRANSCRIPT
United 1448, affirmative, cross Runway 16, join taxiway November, Tango on the other side.

The Tower has no way of knowing United has veered off course, and inadvertently directs them onto an active runway



Not to scale. Planes are enlarged for illustration purposes.



United 1448

Case Study

RISK MANAGEMENT CONCEPTS

- Low Visibility
- Night Operations
- Entering/Crossing Runways
- Loss of Situational Awareness





Questions?