

Wrong Surface Landings

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April 10, 2019



U.S. Department of Transportation

Volpe Center

Advancing transportation innovation for the public good

Sources of Risk of Wrong Surface Landings

- **Design induced** – Risks associated with airport layout, physical characteristics of runways and taxiways, runway designations
- **Dynamic** – Risks associated with temporary conditions such as airport construction that will change with phases of construction
- **Airport Specific** – Most effective risk mitigation strategies result from airport-specific analysis and solutions

Overview

- Landing on the ‘wrong’ runway
 - Miami: the problem, process, and resulting solution
- Wrong Runway Takeoff
 - Lexington
- Landing on Taxiway
 - Seattle: the problem, process, and resulting solution
- Close call – landing on taxiway
 - SFO: what went wrong, what went right?
- What can be done?

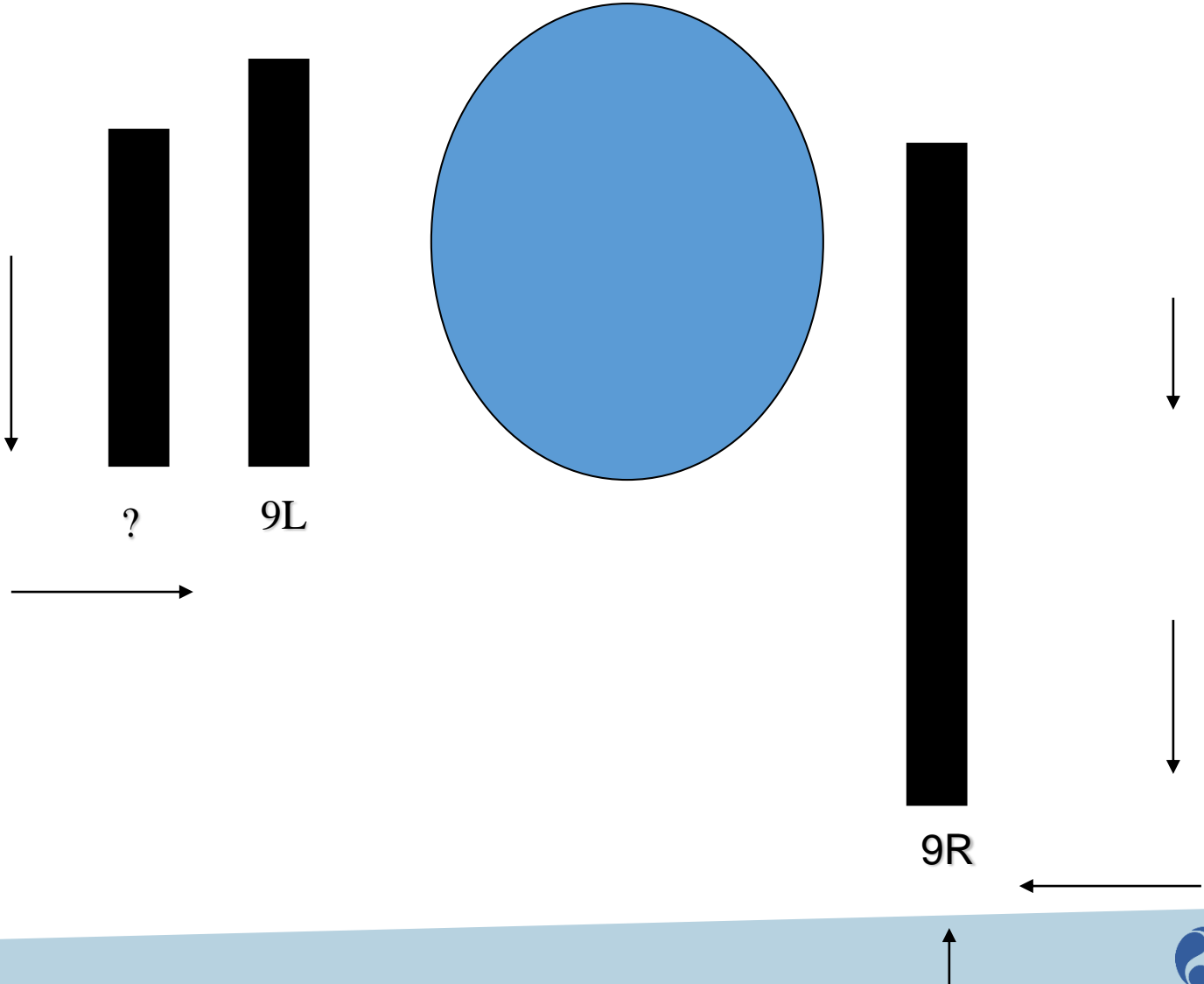
Example of Design-Induced – When Expectations Don't Match Reality

- MIA – Designation of New Runway
- Problem:
 - Even before the new runway was opened, pilots were lining up to land on it.
 - Regional runway safety office requested a human factors study from Office of Runway Safety.

Known considerations

- Laws of Perceptual Grouping
 - Pre-attentive grouping – help predict how people divide items (runways) into perceptual groups (pairs)
 - Proximity
 - Similarity
- Pilots may not “see” all of the runways due to visibility conditions and/or attentional tunneling.

MIA parallels



The process (2-day meeting)

- Working group consisted of users and stakeholders.
- Looked at the data of MIA incidents and similar events at other airports
- Discussed the nature of the problem (why is this happening)
- Considered all designation options
- Reached consensus on the solution
- Once implemented – problem was solved

Designation Options

- Proposed Designation: Keep 9L and 9R as is
 - Engineering proposed designation for new runway as 8
- ICAO designation would be 9L, 9C, 9R
 - does this match expectations?

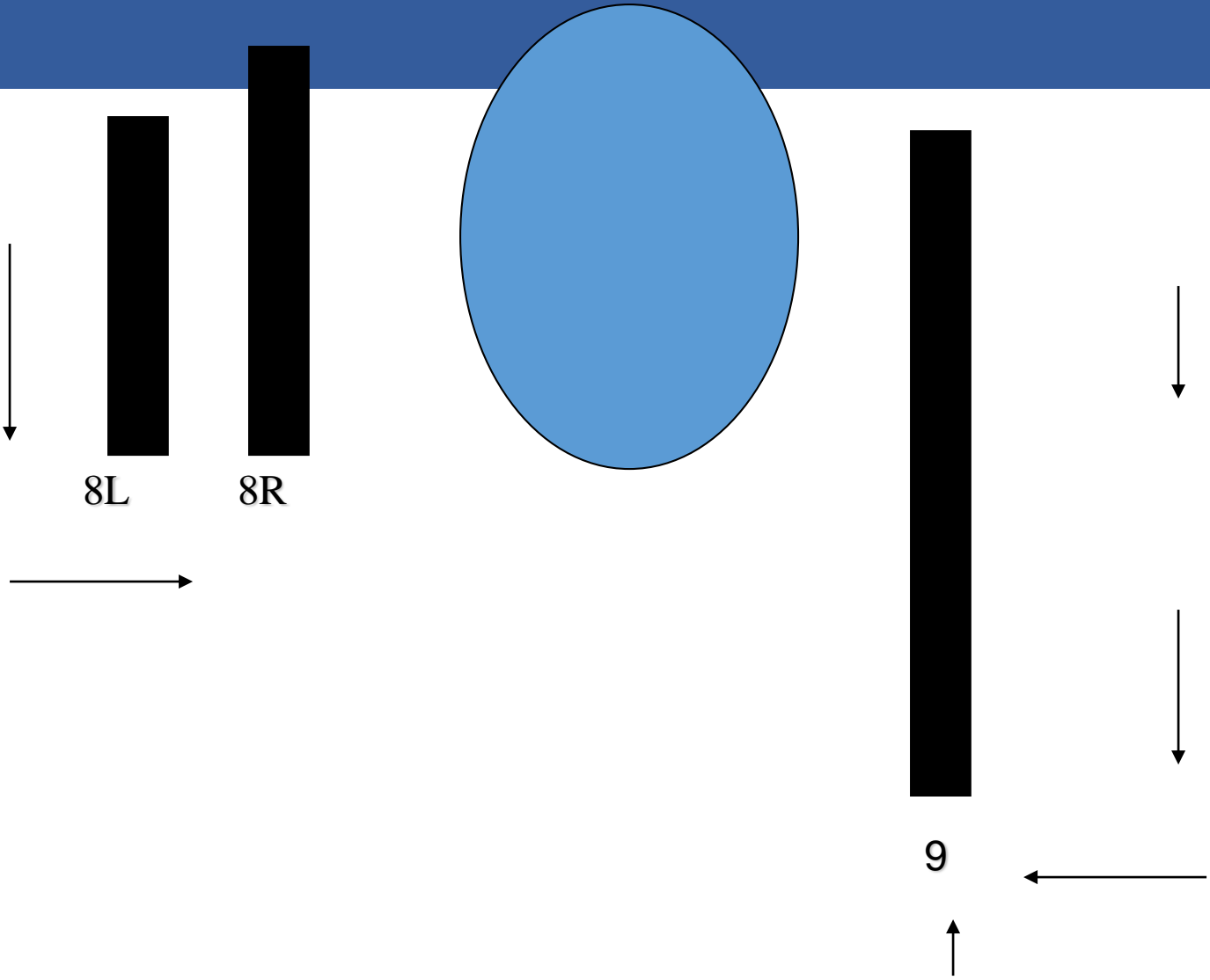
Key issues and questions

- Key issues about the users, tasks, and environment:
 - Most (about 75%) of the operations are to the East.
 - Foreign carriers almost always land on 9R.
- Key human factors questions:
 - What are the pilots likely to see as they approach each runway?
 - What are the pilots likely to *expect* as they approach each runway?

MIA - Solution

- To minimize the changes of pilots landing on the wrong runway – set up reality to match logical expectations.

Final Designations

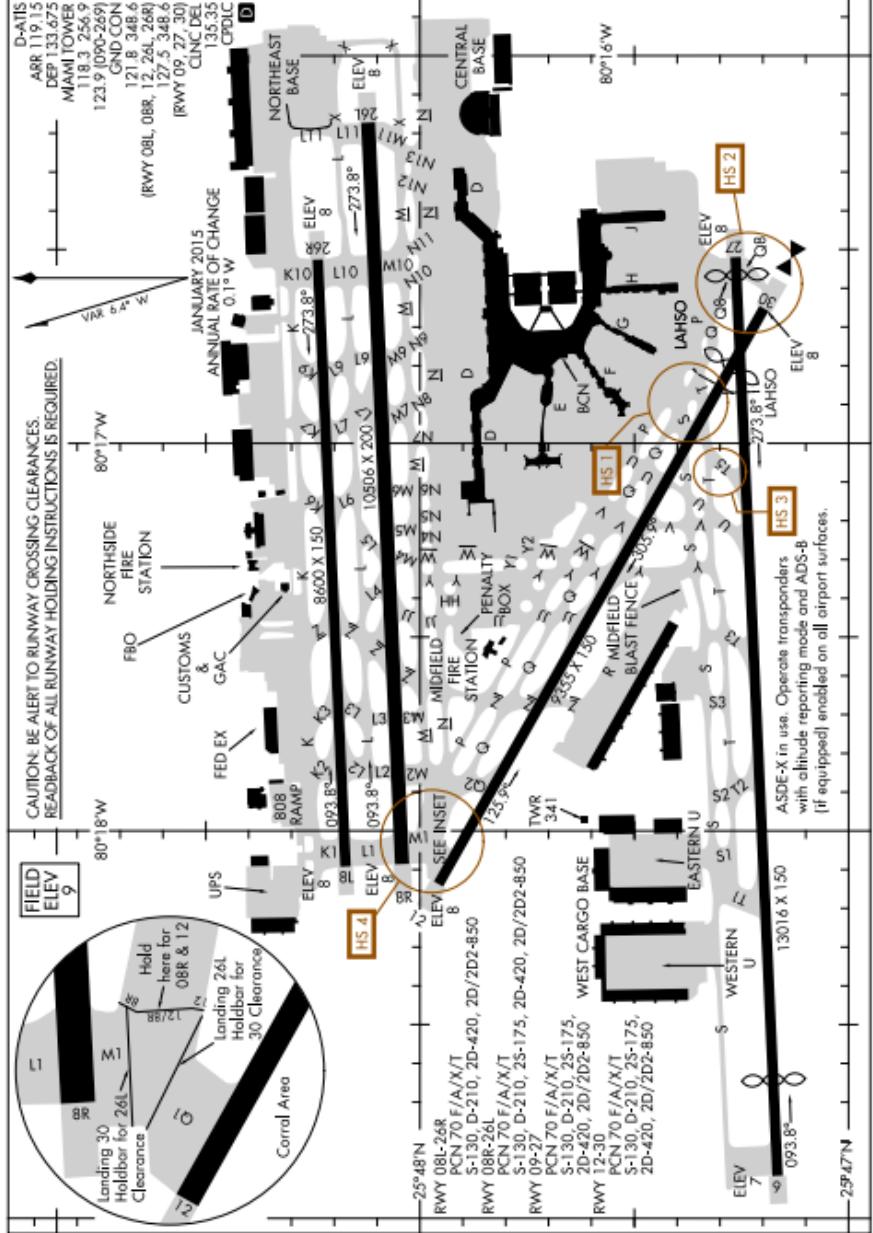


18312
AIRPORT DIAGRAM

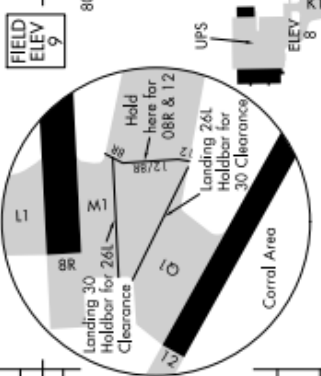
AL-257 (FAA)

MIAMI INTL (MIA)
MIAMI, FLORIDA

SE-3, 28 MAR 2019 to 25 APR 2019



CAUTION: BE ALERT TO RUNWAY CROSSING CLEARANCES.
REARBACK OF ALL RUNWAY HOLDING INSTRUCTIONS IS REQUIRED.



18312
AIRPORT DIAGRAM

MIAMI, FLORIDA
MIAMI INTL (MIA)

SE-3, 28 MAR 2019 to 25 APR 2019

Construction-specific challenges

- Changes on the airport surface can result in situations where expectations do not match reality
- As portions of taxiways close, so do reference points
- Risk of “forgetting” about noted changes
 - Confirmation bias
 - Reverting to habit

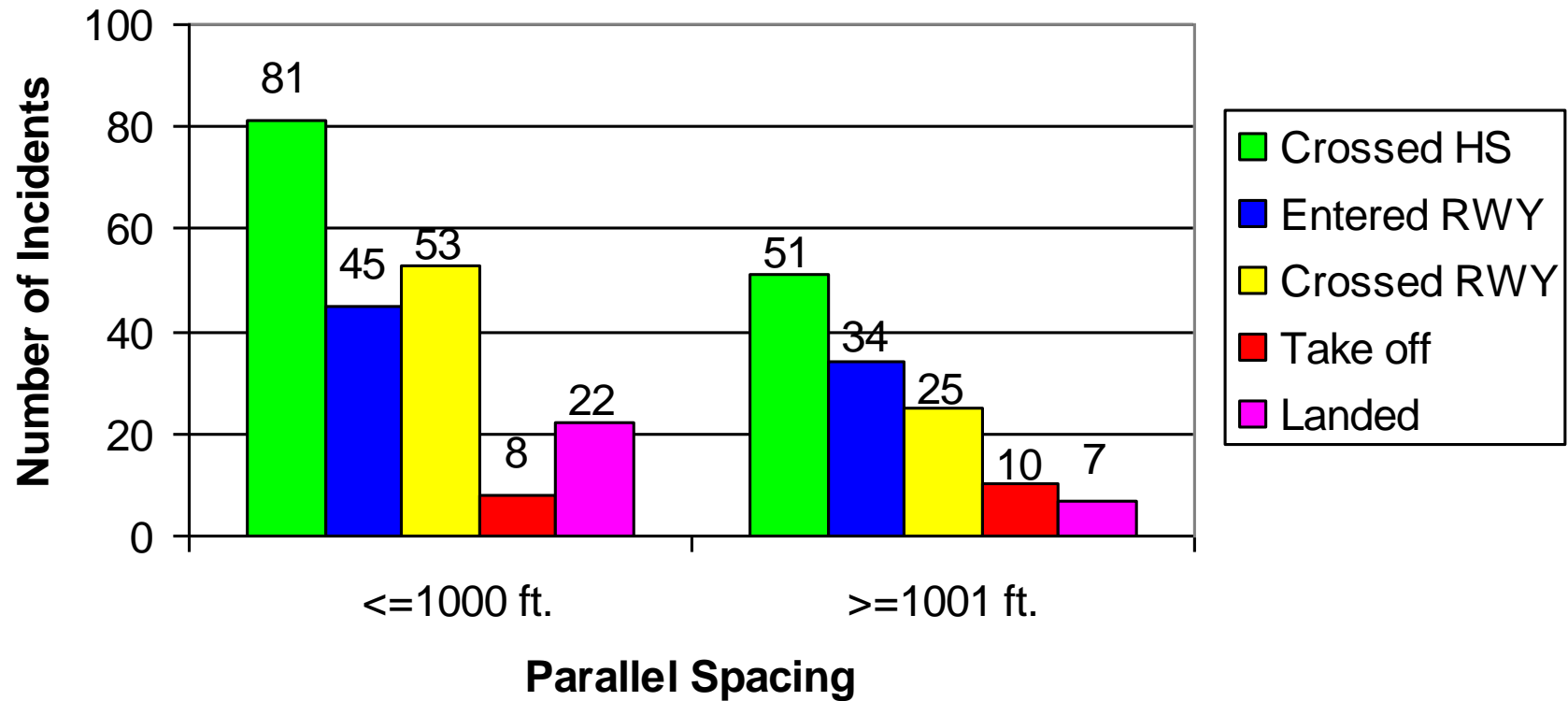
Confirmation Bias

- Refers to the tendency to selectively attend to information that confirms our expectation.
- Information that contradicts our belief is either not noticed or is discounted as either incorrect or unimportant.

Landings on Wrong Runways or Taxiways

- Most wrong surface landings involve surfaces parallel to the assigned runway
- Closely-spaced parallels (less than 1000' centerline-to-centerline) are particularly problematic

FY04-FY07: Select Activity Without Authorization by Parallel RWY Spacing



SEA

- Soon after Taxiway Tango was commissioned in October 1999, pilots began lining up for (and in three cases, landed on) it after being cleared to land on Runway 16R.
- Taxiway Tango is much wider than the average taxiway and at 180' (shoulder to shoulder), it is nearly as wide as Runway 16R (200').
- Even experienced air carriers who were familiar with SEA had made this mistake.

Proposed fixes

- May 2000 - An “ X” was placed at the taxiway threshold.
- March 2003 - A larger “X” was placed at the taxiway threshold.
- NTSB suggested painting a serpentine line and “TAXIWAY” on Tango
 - *but approach to the runway is usually straight in and pilots are deciding which surface to land on miles from the threshold*

The process – Take 2

- Analyze the data – conditions under which these errors occurred.
- Convene stakeholders (including pilots involved in the errors)
- Discuss possible solutions to prevent the errors.

Landings and close calls on Tango

- Tended to occur mid-November to March as pilots broke out of the clouds for a visual approach and rain showers were followed by sun, creating a reflection on the surfaces of the runways and taxiways.
- “looked like three sheets of aluminum foil”
- Note that no markings are visible under glare

Another suggestion:

- “Put *‘Don’t Land on Tango’* on the ATIS”

BUT - Human Factors 101 – Tell people what TO DO (not what not to do)

- E.g., When cleared to land on Runway 16R, confirm that you are lined up for Runway 16R and not taxiway T which is located 600’ to the west of Runway 16R and is as long and as wide as Runway 16R.

Post-implementation survey

- In an unpublished survey of 54 air carrier pilots conducted by the airport in March 2005, only 5% judged the announcement on the ATIS to be “not effective” in helping to prevent landings on Tango; 7% considered the flashing approach lights to be ineffective.
- (ATIS info was removed when info was published on airport diagram.)

SEA

- March 2003. REILS were placed at Runways 16L and 16R, approach lights for Runway 16R were on during the day and warnings were published on the charts and on the ATIS.
- Runway safety areas were extended and widened.
- Even better - Flashing approach lights were installed on the runways.
 - flashing lights attract attention more effectively than steady lights
 - unidirectional REILS are designed to be seen when lined up for the runway, and so are less visible when off to one side.

“Something did not look right” - SFO

- On July 7, 2017, about 2356 Pacific daylight time (PDT), Air Canada flight 759 (ACA759), an Airbus A320, C-FKCK, was cleared to land on runway 28R at San Francisco International Airport (SFO), but instead lined up for parallel taxiway C, where four air carrier airplanes (a Boeing 787, an Airbus A340, another Boeing 787, and a Boeing 737) were awaiting takeoff clearance....The flight crew initiated a go-around, and the airplane reached a minimum altitude of about 60 ft and overflew the second airplane on the taxiway before starting to climb.
- In post incident interviews, both pilots stated that, during their first approach, they believed the lighted runway on their left was 28L and that they were lined up for 28R. They also stated that they did not recall seeing aircraft on taxiway C but that *something did not look right to them.*

- “Although multiple cues were available to the flight crew to distinguish runway 28R from taxiway C (such as the green centerline lights and flashing yellow guard lights on the taxiway), sufficient cues also existed to confirm the crew’s expectation that the airplane was aligned with the intended landing runway (such as the general outline of airplane lights—in a straight line—on taxiway C and the presence of runway and approach lights on runway 28R, which would also have been present on runway 28L when open). As a result, once the airplane was aligned with what the flight crewmembers thought was the correct landing surface, they were likely not strongly considering contradictory information. The cues available to the flight crew to indicate that the airplane was aligned with a taxiway did not overcome the crew’s belief, as a result of expectation bias, that the taxiway was the intended landing runway.” (NTSB 2018)

When in doubt...

- During a post-incident interview, the captain stated that, as the airplane was getting ready to land, “things were not adding up” and it “did not look good,” so he initiated a go-around.
- The first officer reported that he thought that he saw runway edge lights but that, after the tower controller confirmed that the runway was clear, he then thought that “something was not right”; as a result, the first officer called for a go-around because he could not resolve what he was seeing.
- The first officer’s callout occurred simultaneously with the captain’s initiation of the go-around maneuver.

Situation Awareness

- The ATC voice recording also indicated that, at 2355:59, another pilot stated on the tower frequency, “where is that guy going?”. The voice on the transmission was later identified as that of the captain from the first airplane on taxiway C, United Airlines flight 1 (UAL1)...ACA759 overflew UAL1 at an altitude of 100 ft; about the same time, the UAL1 captain stated, over the tower frequency, “he’s on the taxiway.” About the same time as the UAL1 captain’s second transmission, the flight crew from the second airplane on taxiway C, Philippine Airlines flight 115 (PAL115), turned on that airplane’s landing gear and nose lights, illuminating a portion of the taxiway and the UAL1 airplane.

What can be done?

- Ensure that risks associated with airport layout, physical characteristics of runways and taxiways, runway designations are minimized by design.
- Taxiways that resemble runways can be identified (by geofencing) in ASDE-X as a closed runway.
- Risks associated with temporary conditions such as airport construction need to be pre-empted and managed.

What can we do? - Pilots

- Verify the runway assignment just as you verify altitude assignments.
- Check the runway assignment against the airport diagram.
 - Where is the assigned runway with reference to the parallel?
 - Is the assigned runway longer or shorter than the parallel?
- Beware of ‘get-done-itis’ and be prepared to take a step back and reassess.
- Remember that when something doesn’t ‘feel right’ – it usually isn’t right.

ASDE-X Taxiway Arrival Prediction

- ASDE-X Taxiway Arrival Prediction or ATAP, is based on existing Runway Arrival Predictions (RWAP). Specifically, any aircraft that is predicted to land on a taxiway within 3,000 feet or 20 seconds of the taxiway threshold will generate an alert.
- ATAP is currently functional: SEA, ATL, DFW, CLT, BDL, and PHL

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