



# National Transportation Safety Board

Taxiway Overflight

Air Canada Flight 759, Airbus A320-211, C-FKCK

San Francisco, California

July 7, 2017

Human Performance

presentation



# Overview

- Crew expectations
- Crew awareness of parallel runway closure
- Cues and recognition of misalignment
- Mitigations for expectation bias
- Crew fatigue

# Crew Expectation During Approach

- Crew expected to see two parallel runways
  - Intended to fly approach to right side
  - Runway 28L closed and unlit
- Expectation bias resulted in misalignment and delayed go-around
- Expectation bias difficult to recognize

# Crew Awareness of Runway 28L Closure

- Runway closure notice to airmen (NOTAM) issued
- Crew reviewed NOTAMs before flight
- Closure information not recalled during approach
- Presentation and priority of closure information not effective

# Runway 28L Closure Information – Preflight

## Runway

```

**NEW**SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z DA7026/17
SFO 07/026 SFO RWY 10R/28L CLSD 1707080600-1707081500

**NEW**SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z DA7025/17
SFO 07/025 SFO RWY 01R/19L CLSD 1707080600-1707081500

**NEW**SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z 1A2281/17
RWY 10R/28L CLSD

**NEW**SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z 1A2280/17
RWY 01R/19L CLSD

SFO 02 Jun 2017 1357z - 21 Jul 2017 1500z 1A1951/17
RWY 28L ALS U/S
    
```

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ACA 0759 CYYZ/KSFO 08.JUL.2017/0656 [printed: 07JUL2313z]

SFO 10 Apr 2017 0700z - 30 Nov 2017 1200z DA046/17  
 SFO 07/026 SFO **RWY 10R/28L CLSD** 1707080600-1707081500  
 10 ANM MWM SFO 251PT (240PT AGL) FLAGGED AND LOTO  
 1704100700-1711301200

TEMP WAT CHARTS NOT REQD.

SFO 24 Mar 2017 2244z - 16 Dec 2017 1200z DA3212/17  
 SFO 07/027 SFO **RWY 01R/19L CLSD** 1707080600-1707081500  
 11 ANM MWM SFO 251PT (240PT AGL) FLAGGED AND LOTO  
 1703242254-1711301200

TEMP WAT CHARTS NOT REQD.

SFO 21 Mar 2017 1929z - 31 Jul 2017 1300z 1A075/17  
 WATSON WAT CHARTS U/S  
 SFO 03 Feb 2017 1340z - 03 Aug 2022 1340z DA2007/17  
 SFO 07/027 SFO **RWY 01R/19L CLSD** 1707080600-1707081500  
 W ARCH SFO SFO 01L 134PT (125PT AGL) FLAGGED AND LOTO  
 1702031340-2208031340

TEMP WAT CHARTS NOT REQD.

SFO 03 Feb 2017 1340z - 03 Aug 2022 1340z DA2025/17  
 SFO 07/025 SFO **RWY 01R/19L CLSD** 1707080600-1707081500  
 W ARCH SFO SFO 01L 134PT (125PT AGL) FLAGGED AND LOTO  
 1702031340-2208031340

TEMP WAT CHARTS NOT REQD.

SFO 04 Nov 2016 0934z - PSM 1A2850/16  
 WATSON WAT CHARTS U/S  
 SFO 11 Oct 2016 2035z - 11 Apr 2018 2300z DA10047/17  
 SFO 10/027 SFO **RWY 01R/19L CLSD** 1707080600-1707081500  
 11 ANM MWM SFO 250PT (240PT AGL) LOTO 1610112035-1804112300

TEMP WAT CHARTS NOT REQD.

SFO 07 Jul 2016 1857z - 10 Nov 2017 0100z DA7029/17  
 SFO 07/025 SFO **RWY 01R/19L CLSD** 1707080600-1707081500  
 11 ANM MWM SFO 250PT (240PT AGL) FLAGGED AND LOTO  
 1607071857-1711301000

TEMP WAT CHARTS NOT REQD.

SFO 11 Feb 2016 1646z - 01 Aug 2017 2300z DA2027/17  
 SFO 07/027 SFO **RWY 01R/19L CLSD** 1707080600-1707081500  
 10 ANM MWM SFO 250PT (240PT AGL) FLAGGED AND LOTO  
 1602111646-1708012300

TEMP WAT CHARTS NOT REQD.

SFO 19 Sep 2007 1546z - UFN CN815/07 - CD NOTAM  
 THE INFORMATION CONTAINED HEREIN IS FOR INFORMATIONAL PURPOSES ONLY. IT IS NOT A  
 QUALIFICATION AIRPORT. THE CAPTAIN MUST MEET CERTAIN REQUIREMENTS TO  
 OPERATE INTO THIS AIRPORT. SEE FOM 5.4.5.2 OR USPOBSEN AIR CANADA  
 "AIRPORT QUALIFICATION" PAGE.

\*\*\*NEW\*\*SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z DA7026/17

SFO 07/026 SFO **RWY 10R/28L CLSD** 1707080600-1707081500

\*\*\*NEW\*\*SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z DA7025/17

SFO 07/025 SFO **RWY 01R/19L CLSD** 1707080600-1707081500

\*\*\*NEW\*\*SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z 1A2281/17

**RWY 10R/28L CLSD**

\*\*\*NEW\*\*SFO 08 Jul 2017 0600z - 08 Jul 2017 1500z 1A2280/17

**RWY 01R/19L CLSD**

SFO 02 Jun 2017 1357z - 21 Jul 2017 1500z 1A1951/17

**RWY 28L ALS U/S**

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Air Canada

# Runway 28L Closure Information – In flight

07/08/2017 06:21:11

QU DDLXCXA

ATSACXA 080621

DAI

AN C-FKCK

- /ATSACXA.TI2/KSFO ARR ATIS Q

0556Z SFO ATIS INFO Q.0556Z. 31012KT 10SM CLR 17/09 A2993 (TWO NINER NINER THREE)

QUIET BRIDGE VA IN USE. LNDG RWYS 28R. DEPG RWYS 1L. NOTAMS. RWYS 28L, 10R

CLSD, RWYS 1R, 19L CLSD. TWY J CLSD, TWY S1 CLSD. TWY F CLSD BETWEEN TWY L, RWY

1L, TWY F1 CLSD BTWN TWY L, RWY 1L. RWY 28L ALS OTS, RWY 28L/10R CL LGTS OTS

MULTIPLE CRANES UP TO 275 FEET, WEST AND SOUTH OF SFO AIRPORT. ASSC IN USE AC TVT

TRNSPNDR WITH MODE C ON ALL TYS AND RWYS. READBACK OF ALL RWY HOLDING

INSTRUCTIONS IS REQUIRED. ALL ACFT ARE RQRD TO INCL ACFT CLSGN IN ALL RDBKS AND<

ACKMTS. ...ADVS YOU HAVE INFO Q.281B

# Cues of Alignment

- Several cues supporting crew expectation that taxiway C was runway 28R
  - Construction lighting on runway 28L consistent with ramp lighting
  - Runway 28R looked similar to runway 28L
  - Taxiway C had features partially resembling runway 28R features

# Illustration of Potential Alignment Cues

**Expectation:** Surface ahead (taxiway C) was runway 28R

Supporting cue

Contradicting cue

*Note: This figure is an illustration.*



# Illustration of Potential Alignment Cues

**Expectation:** Surface ahead (taxiway C) was runway 28R

Supporting cue

Contradicting cue

*Note: This figure is an illustration.*

Runway 28R  
edge lighting

Runway 28R  
approach lighting

Green (not white)  
centerline lights

Taxiway in-pavement  
guard lights (flashing)

Features consistent with  
runway edge lighting

Features consistent with  
runway centerline  
lighting

Conflicting cues often overlooked with expectation bias

# Crew Recognition of Misalignment

- Crew perceived lights across runway
- Additional contradictory cues became available
- Crew's delay recognizing misalignment consistent with expectation bias

# Expectation Bias Mitigations

- Methods to overcome expectation bias include
  - Providing information of normal and non-normal aspects of environment
  - Introducing salient information of actual situation

# Fatigue

- Crew fatigued
  - Awake for extended time
  - Reported feeling tired
  - Time of incident corresponded with 3:00 a.m. eastern time
- Fatigue increases susceptibility to expectation bias
- Canadian flight and duty time regulations reviewed

# Summary

- Recommendations proposed to
  - Improve presentation of preflight and in-flight information
  - Equip airplanes with systems that alert when not aligned with runway surface
  - Develop technology that alerts when airplane not aligned with its assigned runway

# Summary

- Recommendations proposed to
  - Research methods to more effectively signal runway closure at night
  - Improve Canadian reserve regulations to better address fatigue



# National Transportation Safety Board