NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 24, 2018

Group Chairman's Factual Report

AIR TRAFFIC CONTROL

DCA17IA148

Table of Contents

A. INCIDENT

Location: San Francisco International Airport (SFO), San Francisco, California
Date: July 7, 2017
Time: 2356 Pacific daylight time (PDT)
0656 Coordinated Universal Time (UTC), July 8, 2017 [1]
Airplane: Air Canada flight 759 (ACA759), Airbus A320

B. AIR TRAFFIC CONTROL GROUP

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C. SUMMARY

On July 7, 2017, about 2356 Pacific daylight time, Air Canada flight 759 (ACA759), an Airbus A320, Canadian registration C-FKCK, was cleared to land on runway 28R at San Francisco International Airport, San Francisco, California, but instead lined up on parallel taxiway C, where four air carrier airplanes (a Boeing 787 followed by an Airbus A340, another Boeing 787, and a Boeing 737) were awaiting takeoff clearance. ACA759 overflew the first airplane on the taxiway and descended below 100 ft above the ground, and the ACA759 flight crew initiated a go around. The flight was operated under the provisions of 14 *Code of Federal Regulations* Part 129 as an international scheduled passenger flight from Toronto/Lester B. Pearson International Airport, Toronto, Canada, with 135 passengers and 5 crewmembers on board. Night visual meteorological conditions prevailed at the time of the incident. The airplane was not damaged, and no injuries were reported.

D. DETAILS OF THE INVESTIGATION

On, July 16, 2017, the ATC group and the NTSB Operational Factors (OPS) group chairman convened at the SFO airport traffic control tower (ATCT), San Francisco, California. The air traffic manager (ATM) provided a briefing on the incident, followed by a tour of the tower. The group interviewed[3] the SFO local controller (LC)/ controller in charge (CIC) that had been on break when the incident occurred. The NTSB Human Performance (HP) group chairman participated in the interview via telephone.

[1] All times are expressed in Pacific daylight time (PDT) unless otherwise noted.
[2] Dan Bartlett (NTSB) was the ATC Group Chairman for this investigation until his retirement in February 2018.
[3] All interviews are included in Attachment 1 – Interview Summaries

On July 17, 2017, the ATC group and OPS group chairman reconvened at SFO ATCT and interviewed the SFO ATM, and a front-line manager (FLM). The HP group chairman participated in the interview via telephone.

On July 18, 2017, the ATC group and OPS group chairman reconvened at SFO ATCT and interviewed the SFO LC/CIC controller. The group conducted a telephone interview with the Northern California terminal radar approach control (NCT TRACON) ATM. The HP group chairman participated in the interview via telephone.

On July 19, 2017, the group and OPS group chairman reconvened at SFO ATCT and conducted a telephone interview with the NCT Area B, Boulder sector approach controller. The HP group chairman participated in the interview via telephone.

E. FACTUAL INFORMATION

1.0 History of Flight[4]

About 2330, the pilot of ACA759 checked in with the NCT area B, Boulder sector approach controller saying, "NorCal good evening Air Canada 759 is with you on the DYAMD 3[5]." The Boulder sector controller instructed the pilot, "…at ARCHI [reporting point] join the FMS Bridge visual approach[6] for 28R." The pilot acknowledged the instructions. (Figure 1 is the illustrated FMS Bridge visual approach chart for runway 28R.)

At 2346:19, the Boulder sector controller instructed ACA759 to turn right direct to TRDOW and join the FMS approach to runway 28R. The pilot acknowledged the instructions, and the Boulder sector controller instructed the pilot to report San Francisco Airport or the bridges (San Mateo Bridges) in sight.

At 2346:25, The pilot of ACA759 reported, "ok we have the bridges in sight Air Canada 759." Five seconds later the Boulder sector cleared ACA759 for the FMS bridge visual approach runway 28R. The pilot acknowledged the instructions.

At 2350:48, the Boulder sector controller instructed ACA759 to contact the SFO tower. The pilot acknowledged the instructions.

At 2351:07, the pilot of ACA759 checked in with SFO ATCT, and reported that they were on the FMS Bridge visual runway 28R. The combined local control/controller in charge (LC/CIC) controller issued ACA759 a landing clearance for runway 28R. The pilot acknowledged the instructions.

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[4] The times and transmissions included in this report were derived from certified FAA audio playback of NCT TRACON and SFO ATCT communications.

[5] DYAMD 3 is a- standard terminal arrival (STAR). A STAR is a preplanned instrument flight rule (IFR) air traffic control arrival procedure published for pilot use in graphic and/or textual form. STARs provide transition from the en route structure to an outer fix or an instrument approach fix/arrival waypoint in the terminal area. (See Operational Factors/Human Performance Chairmen Factual Report for details.)

[6] The FMS (flight management system) Bridge visual approach for runway 28R is a version of the Quiet Bridge visual approach for runway 28 L/R. It is coded with global position system (GPS) coordinates and can be included in an FMS database for approved operators.

At 2355:45, the pilot of ACA759 transmitted to the LC/CIC controller, “Just want to confirm, this is Air Canada 759, we see some lights on the runway there, across the runway. Can you confirm we’re cleared to land?”

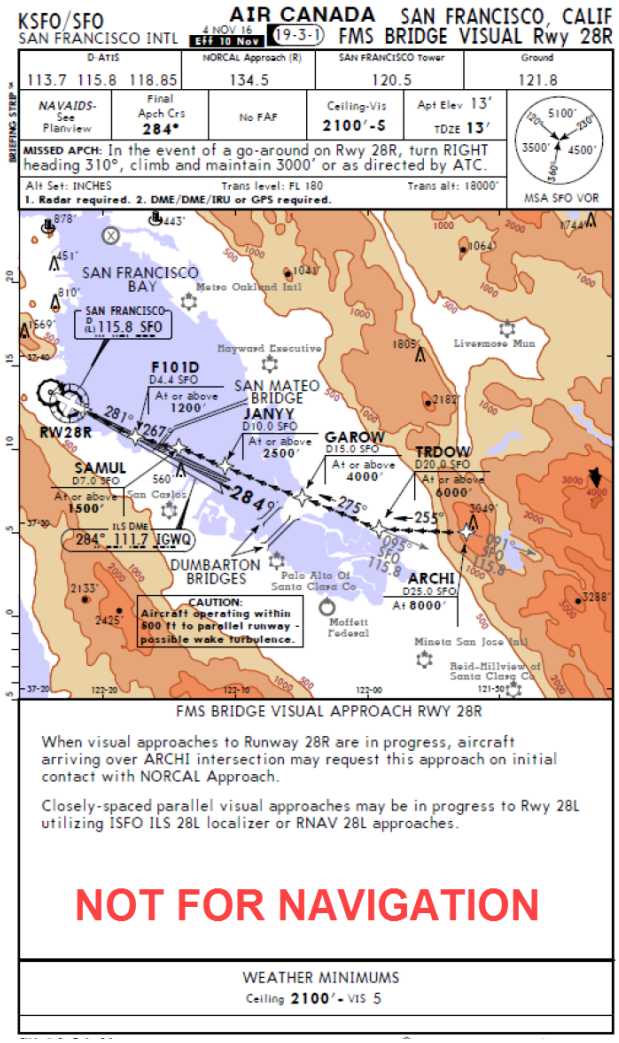

Figure 1. Air Canada FMS Bridge Visual runway 28R approach chart.

At 2355:52, the LC/CIC controller responded, “… confirmed cleared to land runway 28 right. There's no one on runway 28 right but you.” The pilot of ACA759 replied, “OK, Air Canada 759.”

[The LC/CIC controller said in his interview that he had just visually scanned the runways from departure end to approach end when ACA759 asked for confirmation on the landing

clearance. He then checked the radar display[7] and the ASSC[8] display (airport surface surveillance capability), and rescanned runway 28R before advising the pilot that runway 28R was clear. He looked at the ASSC display and saw the data symbol for ACA759 just right of centerline, and the bars on the runway were up [indicating the runway was clear]. He said that the position of ACA759 (data symbol) on the ASSC was normal for the Bridge visual approach.]

At 2355:59, a transmission was broadcasted over the local control frequency, "where is that guy going?" Three seconds later, another transmission was broadcasted, "He's on the taxiway." [Crew statements from United Airlines flight 1 (UAL1) indicated they made those transmissions [9]]

At 2356:09, the LC/CIC controller instructed ACA759 to go around. The pilot acknowledged that he was going around. The LC/CIC controller advised the pilot that he appeared to have been lined up for taxiway C.

[The LC/CIC controller said in his interview that he had been receiving transmission from a couple of other pilots when he heard, "where is he going." He looked at the ASSC and ACA759 [data symbol] was no longer visible on the display. He said that he was not concerned that ACA759 [data symbol] disappeared from the ASSC because he had observed the airplane visually, in sight, out of the window. When ACA759 was about one-tenth of a mile on final, he noticed that the airplane looked "extremely strange" regarding its proximity to the aircraft on taxiway C, and the taxiway itself. It was at that point, he made the decision to send ACA759 around. He said that there was no indication that ACA759 was in the wrong place until the airplane was on short final.] (Figure 2 is a radar plot that depicts the location of ACA759 from the time the flight reported seeing lights on the runway until the flight was issued a go around by SFO ATCT.)

Radar data indicated that four aircraft occupied taxiway C when ACA759 over flew the taxiway. The four aircraft, in sequence for takeoff on runway 28R were United Airlines flight 1 (UAL1), a Boeing 787-900, Philippine Airlines flight 115 (PAL115), an Airbus A340-300, United Airlines flight 863 (UAL863), a Boeing 787-900, and United Airlines flight 1118 (UAL1118), a Boeing 737-900. (Figure 3 is a radar screen shot that depicts the positions of the airplanes on the taxiway at the time of the incident.)

At 2356:55 the LC/CIC controller instructed the pilot of ACA759 to "contact NorCal [NCT] 135.1, we'll catch you in a couple of minutes." The pilot acknowledged the instructions and contacted NCT. The combined Boulder/Diablo sector controller vectored ACA759 for a visual approach to runway 28R.

About 0011, ACA759 landed on runway 28R without further incident.

[7] SFO was equipped with a standard terminal automation replacement system (STARS) tower display workstation (TDW). Section 4.2 of this factual report describes the equipment.
[8] SFO was equipped with the airport surface surveillance capability (ASSC) system, which was one of three airport surface detection equipment (ASDE) systems deployed in the national airspace system (NAS). Section 4.1 of this factual report describes the equipment.
[9] See Operational Factors/Human Performance Chairmen Factual Report, Attachment 3 – Airplane Crews on Taxiway "C" Statements.

Figure 2. Radar plot that depicts the location of ACA759 from the time the flight reported lights on the runway until the flight was issued a go around by SFO ATCT.

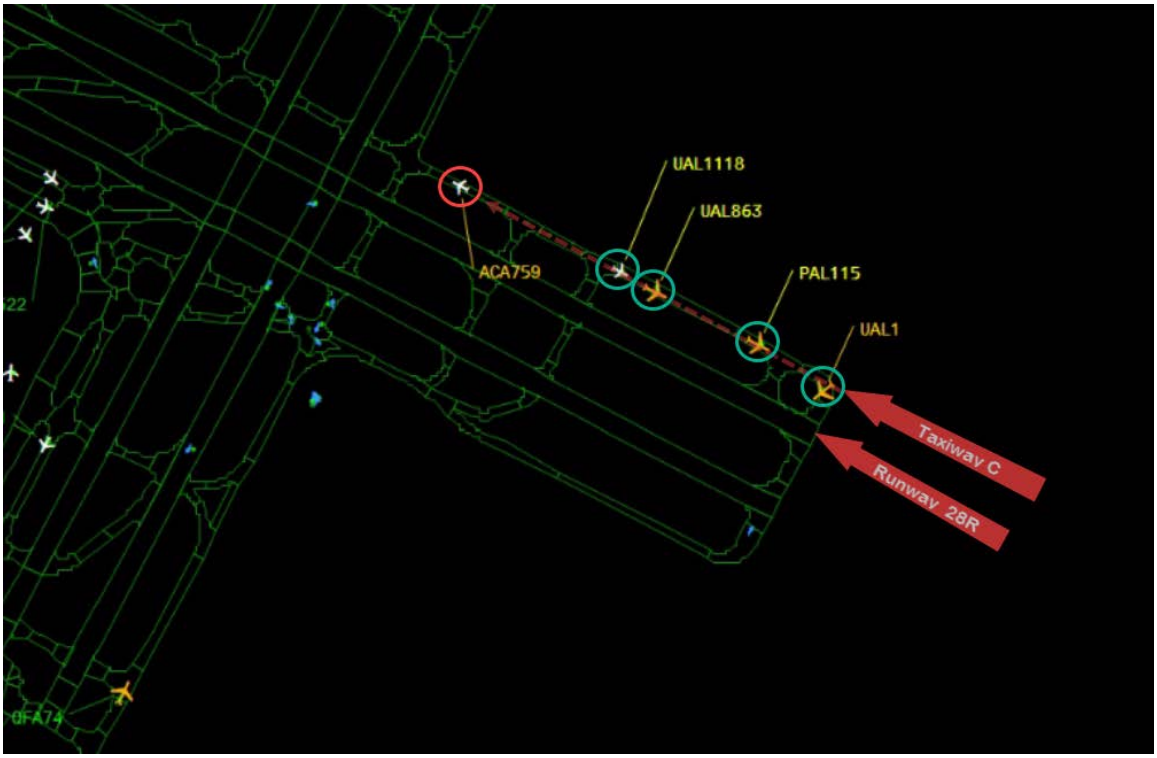

Figure 3. Radar screen shot that depicts the positions of the airplanes on the taxiway at the time of the incident.

2.0 Weather Information

The SFO weather for July 7, 2017 was obtained from the KSFO automated surface observation system (ASOS). The surface aviation weather observations (METARs) at the time of, and following the incident were:

> METAR KSFO 080556Z 29012KT 10SM CLR 17/09 A2993 RMK AO2 SLP135 T01720094 10244 20172 51010

KSFO routine weather observation at 2256 PDT: wind from 290° at 12 knots, visibility 10 statute miles or more, sky clear, temperature 17° Celsius (C), dew point 9° C, altimeter 29.93 inches of mercury (Hg).

> METAR KSFO 080656Z 29009KT 10SM CLR 16/09 A2992 RMK AO2 SLP132 T01610089

KSFO routine weather observation at 2356 PDT: wind 290° at 9 knots, visibility 10 statute miles or more, sky clear, temperature 16° C, dew point 9° C, altimeter 29.92 inches of mercury (Hg).

3.0 Radar Data

Certified radar data was provided by NCT. The radar source data was obtained from the Oakland (OAK) ASR-9 antenna located in Oakland, CA, and Mountain view (NUQ) ASR-9 antenna located in San Jose, CA.

4.0 Air Traffic Control Equipment

4.1 Airport Surface Surveillance Capability (ASSC)

SFO was equipped with the airport surface surveillance capability (ASSC) system, which was one of three airport surface detection equipment (ASDE) systems deployed in the national airspace system (NAS).

FAA order 7110.65W, Air Traffic Control, Pilot/Controller Glossary, “Airport Surface Detection Equipment (ASDE),” described the use and purpose of ASDE equipment:

> Airport Surface Detection Equipment (ASDE)- Surveillance equipment specifically designed to detect aircraft, vehicular traffic, and other objects, on the surface of an airport, and to present the image on a tower display. Used to augment visual observation by tower personnel of aircraft and/or vehicular movements on runways and taxiways. There are three ASDE systems deployed in the NAS:
>
> a. ASDE-3- a Surface Movement Radar.

b. ASDE-X- a system that uses an X-band Surface Movement Radar, multilateration and ADS-B [Automatic Dependent Surveillance-Broadcast].
c. Airport Surface Surveillance Capability (ASSC)-a system that uses Surface Movement Radar, multilateration and ADS-B.

An integral part of the ASSC system was the safety logic system software. FAA order 7110.65W, "Air Traffic Control," Pilot/Controller Glossary, defined the purpose and use of the "Safety Logic System" and the "Safety Logic System Alerts." The paragraphs stated in part:

Safety Logic System-

A software enhancement to ASDE-3, ASDE-X, and ASSC, that predicts the path of aircraft landing and/or departing, and/or vehicular movements on runways…Visual and aural alarms are activated when the safety logic projects a potential collision. The Safety Logic System for ASDE-X and ASSC is an integral part of the software program.

Safety Logic System Alerts-

a. Alert-
An actual situation involving two real safety logic tracks (aircraft/aircraft, aircraft/vehicle, or aircraft/other tangible object) that safety logic has predicted will result in an imminent collision, based upon the current set of Safety Logic parameters.

b. False Alert-
1. Alerts generated by one or more false surface-radar targets that the system has interpreted as real tracks and placed into safety logic.
2. Alerts in which the safety logic software did not perform correctly, based upon the design specifications and the current set of Safety Logic parameters.
3. The alert is generated by surface radar targets caused by moderate or greater precipitation.

c. Nuisance Alert-
An alert in which one or more of the following is true:
1. The alert is generated by a known situation that is not considered an unsafe operation, such as LAHSO or other approved operations.
2. The alert is generated by inaccurate secondary radar data received by the Safety Logic System.
3. One or more of the aircraft involved in the alert is not intending to use a runway (for example, helicopter, pipeline patrol, non-Mode C overflight, etc.).

d. Valid Non-Alert-

A situation in which the safety logic software correctly determines that an alert is not required, based upon the design specifications and the current set of Safety Logic parameters.

e. Invalid Non-Alert-
A situation in which the safety logic software did not issue an alert when an alert was required, based upon the design specifications.

The SFO ATCT ASSC display presented aircraft and vehicle positions overlaid on a map of the airport's runways, taxiways and approach corridors. The ASSC display included a two-dimensional display of the extended runway centerlines, which extended out to about 2 1/2 nautical miles (nm). (Figure 4 is a photo of the ASSC display at SFO. The bottom portion of the photo shows the airport movement areas, and the top portion of the photo shows the extended runway centerlines for runway 28R and 28L.)

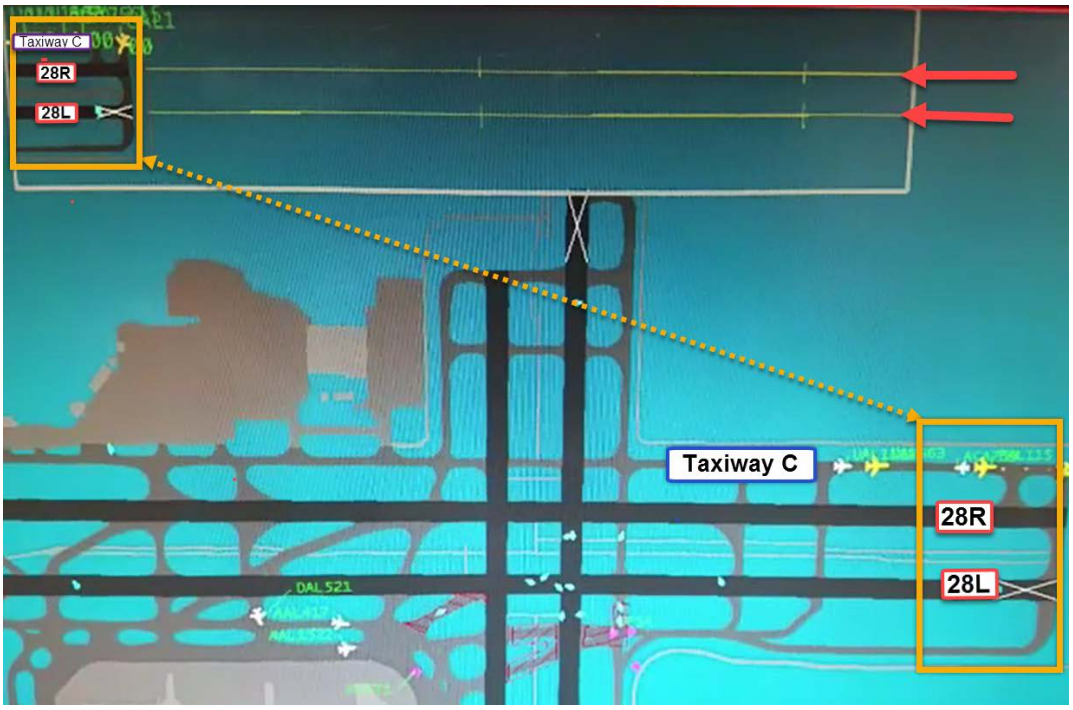

Figure 4. Photo of the ASSC display at SFO.

The intended use and purpose of any ASDE system by air traffic control was described in FAA order 7110.65W, Air Traffic Control, Section 6 Airport Surface Detection Procedures, paragraph 3-6-1, Equipment Usage, which stated in part:

b. Use ASDE systems to augment visual observation of aircraft landing or departing, and aircraft or vehicular movements on runways and taxiways, or other parts of the movement area.

4.2 Tower Display Workstation (TDW)

SFO ATCT was equipped with an operating standard terminal automation replacement system (STARS) TDW. The intended use and purpose of that equipment, in a non-approach control tower, was described in FAA order JO 7110.65W, Air Traffic Control, "Use of Tower Radar Displays," paragraph 3-1-9, which stated in part:

> b. Local controllers may use certified tower radar displays for the following purposes:
>
> 1. To determine an aircraft's identification, exact location, or spatial relationship to other aircraft.
>
> 2. To provide aircraft with radar traffic advisories.
>
> 4. To provide information and instructions to aircraft operating within the surface area for which the tower has responsibility.
>
> NOTE- Unless otherwise authorized, tower radar displays are intended to be an aid to local controllers in meeting their responsibilities to the aircraft operating on the runways or within the surface area. They are not intended to provide radar benefits to pilots except for those accrued through a more efficient and effective local control position. In addition, local controllers at nonapproach control towers must devote the majority of their time to visually scanning the runways and local area; an assurance of continued positive radar identification could place distracting and operationally inefficient requirements upon the local controller.

5.0 Air Traffic Control Staffing

At the time of the incident the SFO ATCT was appropriately staffed with two CICs. About 2349, all the control positions and frequencies were consolidated and operated from the LC position by one CIC. At the time of the incident one CIC was working in the tower cab, and the other CIC had left the tower cab and was on a break.

6.0 Air Traffic Control Procedures

6.1 Approach Information

En route and terminal approach controllers were required to provide approach information to pilots. The requirements were contained in FAA order 7110.65W, Air Traffic Control, paragraph 4-7-10, "Approach Information," which stated in part:

> a. Both en route and terminal approach control sectors must provide current approach information to aircraft destined to airports for which they provide approach control services. This information must be provided on initial contact or as soon as possible thereafter. Approach information contained in the ATIS (automatic terminal information service) broadcast may be omitted if the pilot states the appropriate ATIS code. For pilots destined

to an airport without ATIS, items 3-5 below may be omitted after the pilot advises receipt of the automated weather; otherwise, issue approach information by including the following:

1. Approach clearance or type approach to be expected if two or more approaches are published and the clearance limit does not indicate which will be used.

2. Runway if different from that to which the instrument approach is made.

3. Surface wind.

4. Ceiling and visibility if the reported ceiling at the airport of intended landing is below1,000 feet or below the highest circling minimum, whichever is greater, or the visibility is less than 3 miles.

5. Altimeter setting for the airport of intended landing.

6.2 Line up and Wait (LUAW) Operations

FAA order 7210.3Z, Facility Operation and Administration, paragraph 10-3-8, "Line Up and Wait (LUAW) Operations, provided guidance to controllers on LUAW operations. The paragraph stated in in part:

a. The ATM must:

1. Determine an operational need exists before conducting LUAW operations.

2. Before authorizing LUAW operations, conduct a review of the impact that airport configuration and local conditions may have on the application of LUAW procedures.

3. Prepare a facility directive. The directive must prescribe items (a) through (d). Items (e) through (i) must be included if applicable.

(a) Local procedures for conducting these operations.
(b) Methods to assist the local controller in maintaining awareness of aircraft positions on the airport, for example, annotating flight progress strips or marking the location of aircraft with color-coded chips on a magnetic diagram of the airport.
(c) The consolidation and staffing of positions.
(d) The requirements necessary for issuing a landing clearance with an aircraft holding in position.
(1) The safety logic system must be operated in full core alert runway configuration.
(2) The reported weather must be ceiling of 800 feet or more.
(3) The reported visibility must be 2 miles or more.
(e) Runway geometry, for example, the physical configuration of runways and other airport movement areas.
(f) Weather conditions, time of day, for example, prevailing light conditions.
(g) Fleet mix.
(h) Traffic volume; complexity restrictions.

(i) Obstructions or limitations to visibility from controller-to-aircraft and aircraft-to-aircraft perspectives.

4. Local control position must not be consolidated/combined with any other non-local control position. For example, local control must not be consolidated/combined with the front-line manager/controller-in-charge (CIC) position, clearance delivery, flight data, ground control, cab coordinator, etc. Local control can be combined with other local control positions to include tower associate (local assist) or local monitor position. When a Class B/helicopter position with defined control tower airspace is established, this position can be combined with local control.

5. The tower associate (local assist) position or a local monitor position must be staffed to permit more than one aircraft at a time to LUAW on the same runway between sunrise and sunset.

6. The front line manager/CIC position should not be combined with any other position.

6.3 Single Person Midnight Operations

FAA order 7210.3Z, Facility Operation and Administration, paragraph 2-6-13, "Single Person Midnight Operations" described the requirements and expectations for consolidating to a single person operation during a midnight shift. The paragraph stated in part:

a. In order to ensure that a receiving controller is prepared to accept an aircraft, coordination between facilities/operational areas must be accomplished either manually via landline, or positively acknowledged via automation, (for example, acceptance of the handoff by keystroke entry), when an operational area is operated with one ATCS [air traffic control specialist] between the hours of 0000L to 0500L.

3. Facilities must have local procedures to be used during the hours identified above. Such procedures are to be placed into local SOP or LOAs between facilities.

c. When operations permit, it is expected that functions will be consolidated to facilitate breaks in up/down facilities during midnight shifts.

The NCT and SFO ATCT Letter of Agreement (LOA), "Coordination and Control Procedures," provided specific requirements and expectations between these two facilities. Paragraph 21 stated in part:

Single Person Midnight Operations:

a. Each facility must advise when going to a single person midnight operation.

6.4 FLM or CIC General Duties and Responsibilities

SFO order 7220.2K CHG 2, Standard Operating Procedures, Chapter 2, "General Position Duties and Responsibilities," paragraphs 2-8-1 and 2-8-3, provided general duty requirements for the FLM/CIC, which stated in part:

2-8-1. General Position Duties and Responsibilities:

The Front Line Manager (FLM)/ Controller-in-Charge (CIC) shall supervise and direct overall Tower operation and take action to ensure efficient traffic flow in accordance with current directives and letters of agreement.
2-8-3. General Duties:

The FLM/CIC shall perform the following:

d. Ensure positions are staffed as traffic demands dictate; take into consideration position assignments, position relief, training assignments and processing leave requests.

1. To the maximum extent possible, between the hours of 6:30am and 10:00pm, do not close LCA [local control assist] or combine it with any other position. Should staffing prohibit this from occurring, the first preference in combining positions will be FLM/CIC to CD/FD. If employee certifications prohibit, FLM/CIC may be combined to LCA, but the two positions will be de-combined as soon as practical. The expectation is that the FLM/CIC, LC, LCA, GC and CD/FD positions should be open and de-combined from all other positions during the hours listed above and as long as staffing permits.

6.5 Relief Periods

FAA order 7210.3Z, Facility Operation and Administration, paragraph 2-6-6, "Relief Periods" provided guidance to the watch supervisor for ensuring breaks, and the responsibilities of the watch supervisor while a controller was taking a break. The paragraph stated in part:

a. Personnel performing watch supervision duties are responsible for ensuring that breaks are administered in an equitable manner and applied so as to promote the efficiency of the agency. They are also responsible for ensuring that breaks are of a reasonable duration.

NOTE− Breaks to recuperate are provided to enable employees to engage in activities necessary to rejuvenate themselves in order to effectively manage fatigue.

b. Personnel performing watch supervision duties are responsible for knowing the whereabouts of employees to ensure their availability for position assignments.

c. Personnel performing watch supervision duties must not condone or permit individuals to sleep during any period duties are assigned. Any such instance must be handled in accordance with applicable Agency policy and the applicable collective bargaining agreement.

F. PREVIOUS SAFETY RECOMMENDATIONS

As a result of a taxiway landing at Hartsfield-Jackson Atlanta International Airport (ATL), Atlanta, Georgia in 2009, the NTSB submitted two recommendations to the FAA regarding the expansion of ASDE capabilities to detect taxiway landings (Attachment 2-

Previous Safety Recommendations). Synopsis of the incident that occurred, and recommendations A-11-012 and A-11-013, stated in part:

> On October 19, 2009, about 0605 eastern daylight time, a Boeing 767, N185DN, operating as Delta Air Lines flight 60, landed on taxiway M at Hartsfield-Jackson Atlanta International Airport (ATL), Atlanta, Georgia. The flight was operating as a 14 Code of Federal Regulations Part 121 flight from Rio de Janeiro/Galeão-Antônio Carlos Jobim International Airport to ATL with 11 crewmembers and 182 passengers. No injuries to the crew or passengers were reported, and the airplane was not damaged. Night visual meteorological conditions prevailed.
>
> Recommendation A-11-012 stated:
> Perform a technical review of Airport Surface Detection Equipment–Model X to determine if the capability exists systemwide to detect improper operations such as landings on taxiways.
>
> Recommendation A-11-013 stated:
> At those installation sites where the technical review recommended in Safety Recommendation A-11-12 determines it is feasible, implement modifications to Airport Surface Detection Equipment–Model X to detect improper operations, such as landings on taxiways, and provide alerts to air traffic controllers that these potential collision risks exist.

The response[10] from the FAA Administrator regarding recommendations A-11-012 and A-11-013, stated in part:

> The ability to accurately predict that an aircraft is arriving to a taxiway is not possible without significant degradation in performance, timeliness, and accuracy of safety logic alerts for the more likely event of an aircraft arriving to a closed or occupied runway. These same performance trade-offs exist today at some airports with close parallel and offset threshold runways. Adding arrival to taxiway alerts will only increase the need for performance trade-offs, such as: Degradation of the Airport Surface Detection Equipment-Model X system's ability to provide correct and timely predictions to the associated parallel runway; Additional false alerts due to incorrectly predicting an aircraft landing on a taxiway and A real alert being missed if a runway is occupied during the false prediction to an associated taxiway. I believe that we have effectively addressed these safety recommendations and I consider our actions complete.

The NTSB's response to the FAA regarding the response to recommendations A-11-012 and A-11-013, stated in part:

> The FAA replied that it does not plan to take the recommended actions because it believes that the ability to accurately predict that an aircraft is arriving on a taxiway is not possible without significant degradation in performance, timeliness, and accuracy of

[10] Safety recommendation history and responses for A-11-012 and A-11-013 are located at https://www.ntsb.gov/safety/safety-recs/_layouts/ntsb.recsearch/Recommendation.aspx?Rec=A-11-013

safety logic alerts for the more likely event of an aircraft arriving on a closed or occupied runway. The FAA pointed out that these same performance tradeoffs exist today at some airports with close parallel and offset threshold runways. The NTSB acknowledges that the recommended review would need to consider performance tradeoffs of the type that the FAA discussed in its letter; however, simply concluding (1) that the performance tradeoffs would outweigh the safety benefits of providing the recommended capabilities without performing the review and (2) that performance tradeoffs at some airports outweigh the value of providing the capability at any airport does not constitute an acceptable response to these recommendations. However, the FAA indicated that it considers its action in response to these recommendations to be complete; consequently, Safety Recommendations A-11-12 and -13 are classified CLOSED—UNACCEPTABLE.

G. LIST OF ATTACHMENTS

Attachment 1 – Interview Summaries
Attachment 2 – Previous Safety Recommendations

Submitted by:

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Betty Koschig
Senior Air Safety Investigator