



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 23, 2020

Specialist's Report

AIR TRAFFIC CONTROL

DCA19IA036

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A. INCIDENT

Location: Burbank, California
Date: December 6, 2018
Time: 0902 Pacific standard time (PST)
1702 coordinated universal time (UTC)
Airplane: Boeing 737-7H4, SWA278, N752SW

B. AIR TRAFFIC CONTROL INVESTIGATOR

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National Transportation Safety Board

C. SUMMARY

On December 6, 2018, about 0905 Pacific standard time (PST), Southwest Airlines flight 278, a Boeing 737-7H4, N752SW, overran runway 08 during the landing roll at Bob Hope Airport (KBUR), Burbank, California, and came to rest in the engineered materials arresting system (EMAS) at the departure end of the runway. None of the 117 passengers and crew onboard were injured and the airplane sustained minor damage. The regularly scheduled passenger flight was operating under the provisions of 14 *Code of Federal Regulations* Part 121 from Metropolitan Oakland International Airport (KOAK), Oakland, California to KBUR.

D. FACTUAL INFORMATION

1.0 History of Flight

The following timeline was produced using certified audio re-recordings provided by the Federal Aviation Administration (FAA) and a written transcript was not produced by the FAA since it was not required. Times were in PST and rounded to the nearest minute, and altitudes were indicated in feet above mean sea level (msl).

- 1608 KOAK Air Traffic Control Tower (ATCT) cleared SWA278 for takeoff from runway 30.
- 1610 KOAK ATCT transferred radar and communications with SWA278 to Northern California Terminal Radar Approach Control (NCT TRACON).
- 1611 SWA278 checked in with NCT TRACON at 1,000 feet and the pilot was issued an unrestricted climb to flight level (FL) 190. A few seconds later the controller instructed the pilot to turn left to a 250 heading toward KTINA.
- 1612 NCT TRACON instructed the pilot to turn left and proceed direct to KTINA.
- 1615 NCT TRACON transferred radar and communications with SWA278 to Oakland Air Route Traffic Control Center (ZOA ARTCC).

NOTE: Unable to obtain recordings of communications with ZOA ARTCC until radar and communications were transferred to Los Angeles (ZLA) ARTCC, however, information provided in this case do not indicate concern with handling or services provided by ZOA ARTCC.

- 1633 SWA278 checked in with the ZLA ARTCC sector 26 radar (R26) controller at FL330.
- 1635 The R26 controller issued an amended routing to SWA278 clearing the flight to KBUR via the ROKKR Two Arrival, HIHWY transition. The pilot acknowledged.
- 1636 The R26 controller instructed the pilot of SWA278 to descend via the ROKKR Two Arrival, except maintain 9,000 feet. The pilot acknowledged.
- 1641 The R26 controller transferred communications with SWA278 to the sector 15 radar (R15) controller.
- 1642 SWA278 checked in with the R15 controller on the ROKKR Two Arrival; the R15 controller acknowledged and confirmed with the pilot that he was descending to 9,000 feet and issued the KBUR altimeter setting.
- 1646 The R15 controller instructed the pilot of SWA278 to descend via, except maintain 13,000 feet. The pilot acknowledged.
- 1647 The R15 controller transferred radar and communications with SWA278 to the sector 13 radar (R13) controller.
- 1648 SWA278 checked in with the R13 controller descending through 15,200 to 13,000 feet on the ROKKR Two Arrival. The controller then cleared the pilot to descend via, except maintain 9,000 feet, and issued the KBUR altimeter setting. The pilot acknowledged.
- Immediately after that, the R13 controller broadcasted an advisory for all aircraft on frequency that there was moderate to extreme precipitation around the airport, with nothing but light chop rides being reported so far and requested pilots to advise if they experienced worse.
- 1649 The R13 controller instructed the pilot of SWA278 to turn left 20 degrees and to expect the ROKKR Two Arrival and requested no delay in the descent. The pilot acknowledged.
- 1650 The pilot of SWA278 asked the R13 controller if they wanted him to descend all the way to 9,000 feet or if they were going back to the ROKKR. The controller confirmed that he was cleared to descend to 9,000 feet, cleared direct ROKKR and to cross ROKKR at or above 9,000 feet. The pilot acknowledged.
- 1651 The R13 controller transferred radar and communications with SWA278 to Southern California Terminal Radar Approach Control (SCT TRACON).

A few seconds later, SWA278 checked in with the SCT TRACON MORR sector radar (RM) controller level at 9,000 feet on the ROKKR Two Arrival, the controller responded and advised the pilot to expect the ILS Z runway 8 approach and instructed him to descend and maintain 8,000 feet. The pilot acknowledged and advised he was in receipt of ATIS information "Hotel."

- 1653 The RM controller instructed the pilot of SWA278 to descend and maintain 7,000 feet and transferred radar and communications to the WDLR sector radar (RW) controller. The pilot acknowledged.

A few seconds later, SWA278 checked in with the RW controller at 8,000 feet descending to 7,000 feet. The RW controller acknowledged and cleared SWA278 for the ILS Z runway 8 approach at MIKEI, the initial approach fix. The pilot acknowledged.

- 1655 The RW controller advised the pilot of SWA278 that a King Air had reported a 15-knot loss on final about 10 minutes earlier. The pilot acknowledged and asked if there had been an altitude associated with the report, to which the controller replied in the negative and advised a Challenger jet had just went around at BUR as well.

- 1656 SWA2088 checked in with the RW controller level at 8,000 feet, also inbound to KBUR, and in receipt of ATIS information "Hotel." The controller acknowledged and advised that ATIS information "Juliet" had just become current. The pilot acknowledged.

A few seconds later the RW controller called BUR tower and asked if the Challenger jet had given the reason for the go around, and the tower controller advised it was because of winds and just could not land.

- 1657 The RW controller advised both SWA278 and SWA2088 that the Challenger jet had executed a go around due to winds. Both pilots acknowledged.

- 1659 The RW controller transferred radar and communications with SWA278 to KBUR ATCT. The pilot acknowledged.

A few seconds later, SWA278 checked in with the KBUR ATCT local (LC) controller, on the ILS Z approach to runway 8. The LC acknowledged and advised the pilot of medium to heavy precipitation between him and the airport, winds from 260 at 9 knots, and cleared him to land runway 8. The pilot acknowledged.

- 1700 The LC advised the pilot of SWA278 that braking action was reported good 10 minutes earlier by a Boeing 737, as well as, an area of heavy precipitation directly over the airport. The pilot acknowledged.

- 1701 The LC broadcasted a wind check that reported wind from 270 at 10 knots. No acknowledgement.

1702 The LC broadcasted a wind check that reported wind from 270 at 11 knots. No acknowledgement.

2.0 Surface Weather Observations

2.1.1 Automated Surface Observing System

KBUR was equipped with a federally installed and maintained Automated Surface Observation System (ASOS) that was located at 34.20055° north latitude, 118.3586° west longitude, at an elevation of 778 feet. The ASOS provided some operational weather information for use by air traffic control (ATC), and was the source of METAR and SPECI observations from KBUR, which were augmented by KBUR air traffic control tower personnel.¹ The Meteorological Aerodrome Reports (METAR) and Special (SPECI) reports issued surrounding the period were documented, with cloud heights reported above ground level, wind directions referenced to true north and visibility reported in *statute* miles. The following conditions were reported surrounding the time of the incident:

[0853 PST] METAR KBUR 061653Z 28011KT 1 1/2SM +RA BR FEW004 OVC013 08/08 A2991 RMK AO2 SLP122 P0033 T00830083=

[0915 PST] SPECI KBUR 061715Z 29008KT 1SM +RA BR FEW005 BKN013 OVC031 08/08 A2993 RMK AO2 AIRCRAFT MISHAP P0026 T00830078=

KBUR weather observation at 0853 PST (1653Z): wind from 280° at 11 knots, visibility 1 and ½ miles in heavy rain and mist, few clouds at 400 ft, ceiling overcast at 1,300 feet, temperature and dew point temperature 8° Celsius (C), altimeter 29.91 inches of mercury (Hg). Remarks: automated observation system with a precipitation discriminator, sea level pressure of 1012.2 hectopascals (hPa), liquid equivalent precipitation of 0.33 inches since 0753 PST, temperature 8.3° C, dew point temperature 8.3° C.

KBUR special weather observation at 0915 PST (1715Z): wind from 290° at 8 knots, visibility 1 mile in heavy rain and mist, a few clouds at 500 feet, ceiling broken at 1,300 feet, overcast at 3,100 feet, temperature and dew point temperature 8° C, altimeter 29.93 inches of Hg. Remarks: automated observation system with a precipitation discriminator, aircraft mishap, liquid equivalent precipitation of 0.26 inches since 0853 PST, temperature 8.3° C, dew point temperature 7.8° C.

For more detailed weather information please see the Meteorologist's Weather Study in the public docket for this investigation.

2.1.2 Surface Weather System

KBUR was equipped with two federally installed and -maintained single sensor model F-420 Surface Weather Systems (SWS), one for runway 8 and one for runway 15. The runway 8 SWS was located at 34.20067° north latitude, 118.3587° west longitude, at an elevation of 778

¹ KBUR was a Limited Aviation Weather Reporting Station (LAWRS).

feet. This system provided instantaneous wind information to ATC applicable to runway 8. The wind was displayed on a digital direct read instrument located at the local control position in the KBUR ATCT that provided a 2-minute average wind for runway 8 at the top, and instantaneous wind direction and magnitude on a digital analogue dial-type indicator on the left side of the display (figure 3).

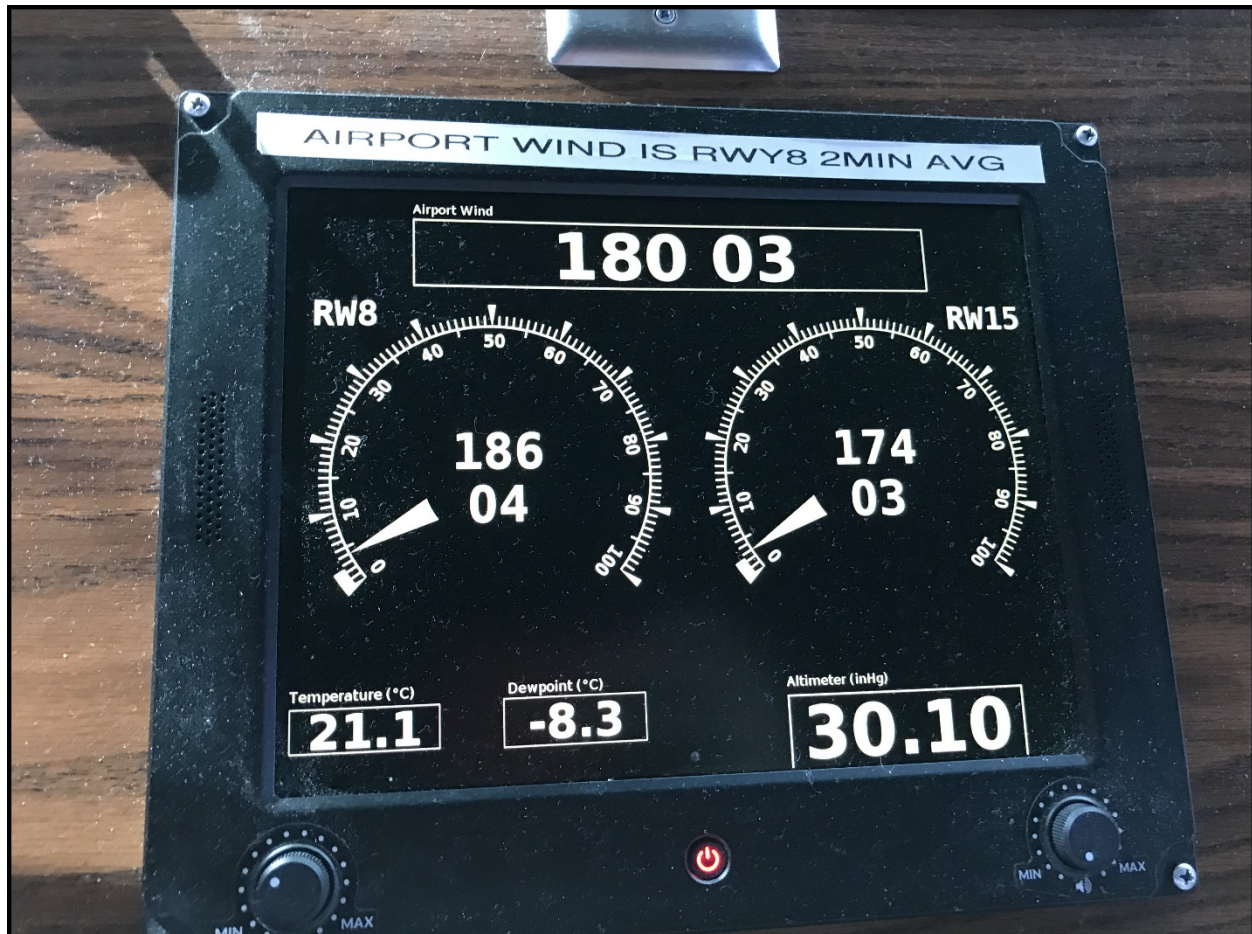


Figure 1 - Photograph of the SWS display located at the local control position in the tower

2.1.3 Wind Source

The ASOS was the official wind source for operational purposes. However, because the ASOS provided an “averaged” wind, it was common practice for ATCTs to use direct read instrumentation where available for issuing “instantaneous” wind to pilots, especially when providing wind for landing and departure. It was also common for airports to have more than one source of wind available based on airport or runway configuration. KBUR had three wind sources available to its ATCT (figure 4), the ASOS, a SWS for runway 8 and a SWS for runway 15. The ASOS (which was used for the “official” wind) and the runway 8 SWS (which was an operational source used for “direct read” or instantaneous wind information provided directly to pilots during landing/departure) were located approximately 800 feet apart and were both on the north side of the approach end of runway 8. The wind that was available on the Automatic Terminal Information Service ATIS was from the ASOS.

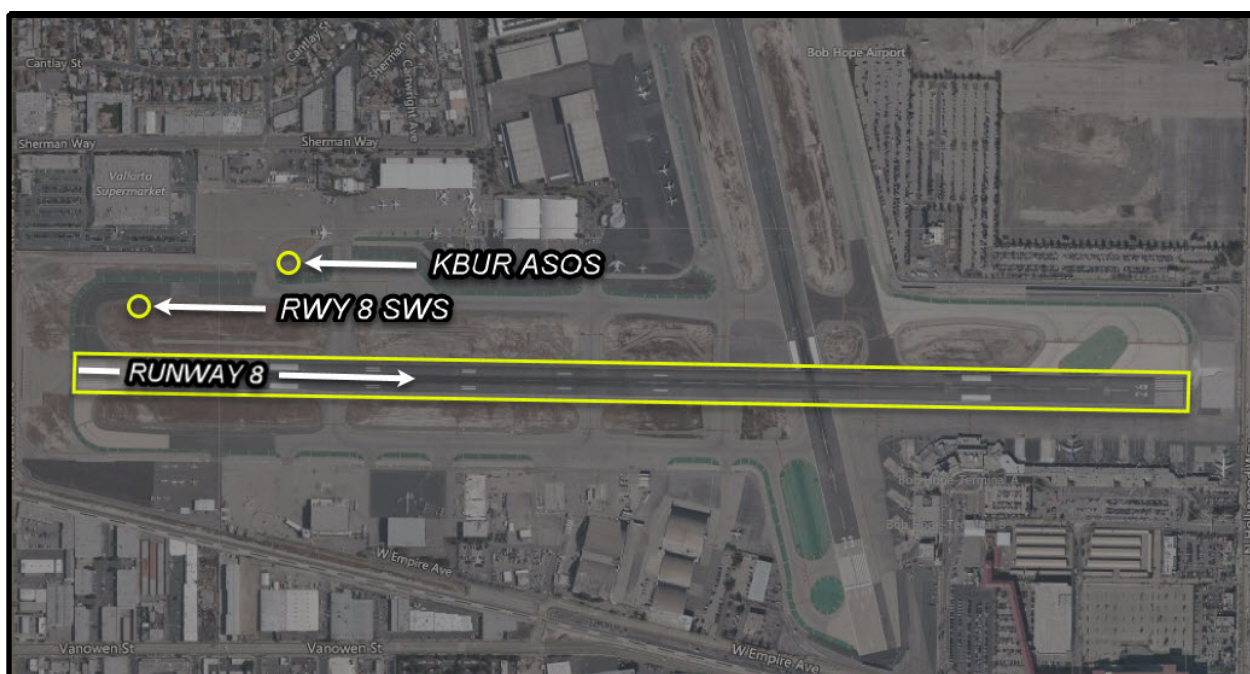


Figure 4 - KBUR Runway 8 with KBUR ASOS and runway 8 SWS locations depicted

2.2 Automatic Dependent Surveillance-Broadcast Information

The Automatic Dependent Surveillance-Broadcast (ADS-B) is a surveillance technology through which an aircraft determines its position via satellite navigation and periodically broadcasts it, enabling it to be tracked. This information can be received by air traffic control ground stations as a replacement for secondary surveillance radar, as no interrogation signal is needed from the ground. It can also be received by other aircraft to provide situational awareness and allow self-separation. ADS-B is "automatic" as it requires no pilot or external input, however it is also "dependent" as it depends on data from the aircraft's navigation system.

ADS-B is different from surveillance radar. Surveillance radars are pulse-type radars that continually transmit high power radio frequency (RF) pulses. Primary surveillance radar does not require any cooperation from the aircraft and bearing is measured by the position of the rotating radar antenna when it receives the RF pulses that are reflected from the aircraft skin. Range is measured by measuring the time it takes for the RF energy to travel to and from the aircraft. Secondary surveillance radar depends on active replies from the aircraft transponder and will provide a position along with "Mode C" altitude information as well. ADS-B data are also produced at a higher temporal resolution than radar data, providing returns about every second as opposed to surveillance radars that provide returns of between 4-6 seconds from Airport Search Radars, and of between 10-12 seconds from Air Route Surveillance Radars.

ADS-B data for the accident flight were provided by the FAA, were of good quality and were used to produce figures 1-2. According to ADS-B data, SWQ9745/B737 landed about 12 minutes prior to SWA278. According to the FAA's post-event services rendered telcon (SRT), the KBUR ATCT air traffic manager (ATM) said the approach speeds for B737 aircraft averaged

about 130 knots. According to ADS-B data, the ground speeds of SWA278 averaged more than 150 knots for the last 3 miles on final (figure 1).

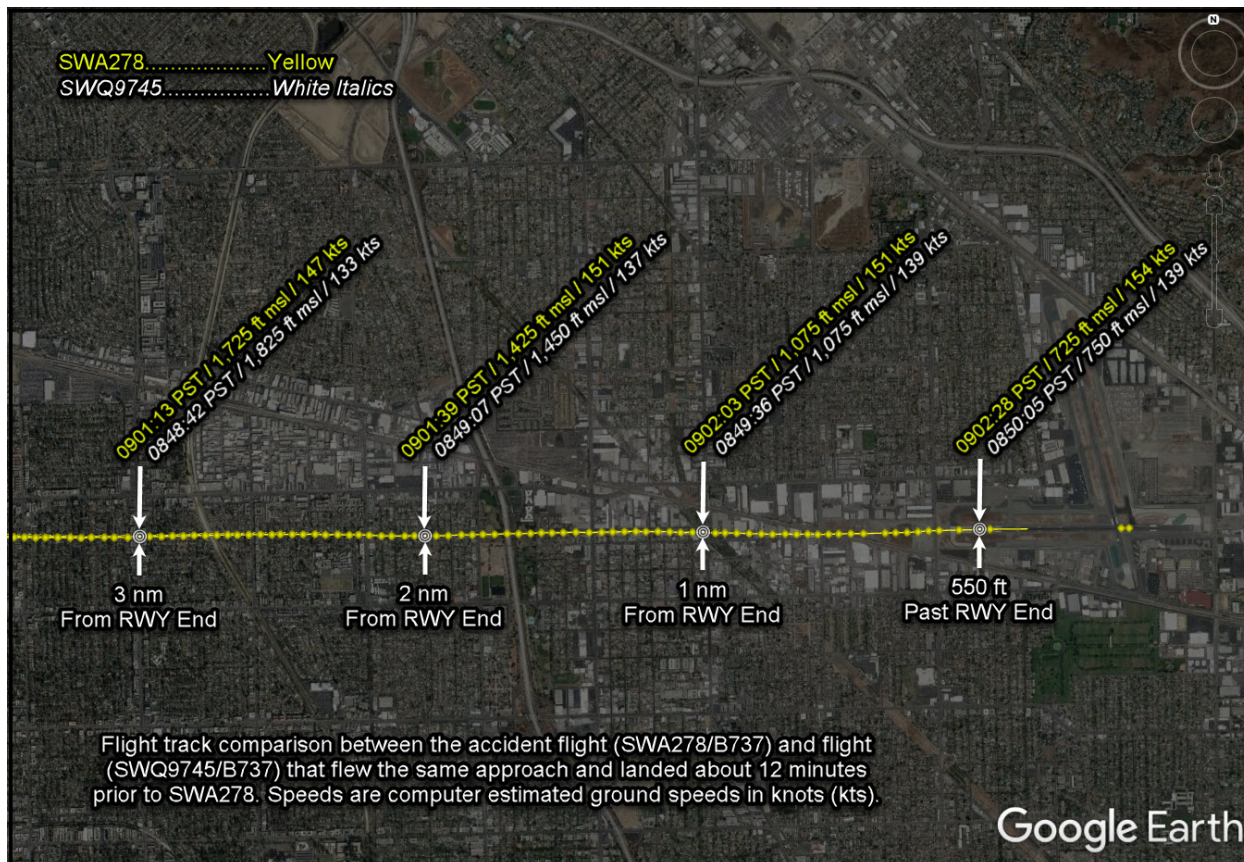


Figure 2 - Flight track comparison between SWA278 and SWQ9745 that landed about 12 minutes prior to SWA278

According to the SRT the ATM also stated that the estimated touchdown area for B737 aircraft on runway 8 was usually around taxiway D8, and SWA278 touched down around the intersection of runway 8 and taxiway D7. Taxiway D8 was located about 1,280 ft from the end of runway 8, and taxiway D7 was about 1,300 ft east of taxiway D8 (figure 2).

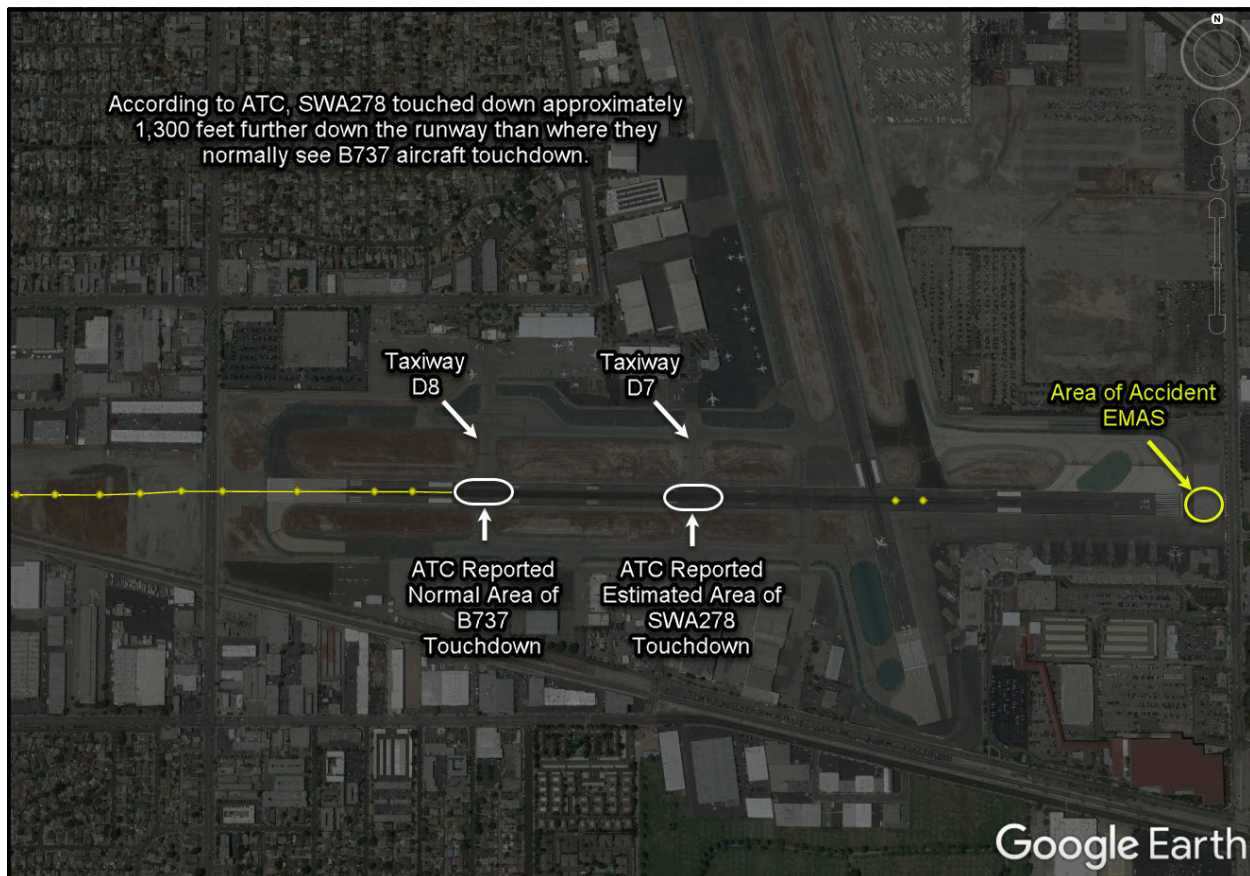


Figure 3 - SWA278 flight track information with D8 and D7 taxiways, and area of accident depicted

E. ATC PROCEDURES

3.0 Issuance of Weather Information

3.1 FAA Order JO 7110.65X, *Air Traffic Control*, stated in part:

2-6-4. ISSUING WEATHER AND CHAFF AREAS

- a. Controllers must issue pertinent information on observed/reported weather and chaff areas to potentially affected aircraft. Define the area of coverage in terms of:
 1. Azimuth (by referring to the 12-hour clock) and distance from the aircraft and/or
 2. The general width of the area and the area of coverage in terms of fixes or distance and direction from fixes.

NOTE—Weather significant to the safety of aircraft includes conditions such as funnel cloud activity, lines of thunderstorms, embedded thunderstorms, large hail, wind shear, microbursts, moderate to extreme turbulence (including CAT), and light to severe icing.

- b. Inform any tower for which you provide approach control services of observed precipitation on radar which is likely to affect their operations.

c. Use the term “precipitation” when describing radar–derived weather. Issue the precipitation intensity from the lowest descriptor (LIGHT) to the highest descriptor (EXTREME) when that information is available. Do not use the word “turbulence” in describing radar–derived weather.

1. LIGHT.
2. MODERATE.
3. HEAVY.
4. EXTREME.

d. **TERMINAL:** In STARS, ARTS, and other systems that display six levels of precipitation intensities, correlate precipitation descriptors from subparagraph c as follows:

1. Level 1 = LIGHT
2. Level 2 = MODERATE
3. Levels 3 and 4 = HEAVY
4. Levels 5 and 6 = EXTREME

2–6–5. DISSEMINATING OFFICIAL WEATHER INFORMATION

TERMINAL. Observed elements of weather information must be disseminated as follows:

- a. General weather information, such as “large breaks in the overcast,” “visibility lowering to the south,” or similar statements which do not include specific values, and any elements derived directly from instruments, pilots, or radar may be transmitted to pilots or other ATC facilities without consulting the weather reporting station.
- b. Specific values, such as ceiling and visibility, may be transmitted if obtained by one of the following means:
 1. You are properly certificated and acting as official weather observer for the elements being reported.
 2. You have obtained the information from the official observer for the elements being reported.
 3. The weather report was composed or verified by the weather station.
 4. The information is obtained from a FAA approved automation surface weather system.
- c. Differences between weather elements observed from the tower and those reported by the weather station must be reported to

4.0 PIREP Solicitation and Dissemination

4.1 FAA Order JO 7110.65X, *Air Traffic Control*, stated in part:

2–6–2. PIREP SOLICITATION AND DISSEMINATION

Emphasis must be placed on the solicitation and dissemination of PIREPs. Timely dissemination of PIREPs alerts pilots to significant weather reports. PIREPs also provide information required by ATC to provide for the safe and efficient use of airspace. This includes reports of strong frontal activity, squall lines, thunderstorms, light to severe icing, wind shear and turbulence (including clear air turbulence) of moderate or greater intensity, braking action, volcanic eruptions and volcanic ash clouds, detection of sulfur gases in the

cabin, and other conditions pertinent to flight safety. Controllers must provide the information in sufficient detail to assist pilots in making decisions pertinent to flight safety.

d. Disseminate PIREPs as follows:

1. Relay pertinent PIREP information to concerned aircraft in a timely manner.

5.0 Wind Information

5.1 FAA Order JO 7210.3Z, *Facility Operations and Administration*, stated in part:

2-10-1. WIND INSTRUMENT SENSORS

Air traffic managers must designate in a facility directive which wind sources must be used for operational purposes.

- a. Towers equipped with LLWAS may use direct dial or LLWAS wind information for weather observations, except where automated wind information is available.
- b. Approach control facilities may use direct dial, LLWAS, or automated display wind information for operational purposes.
- c. FSSs must use direct dial or automated display wind information for operational purposes.

5.2 FAA Order JO 7110.65X, *Air Traffic Control*, stated in part:

3-5-3. TAILWIND COMPONENTS

When authorizing use of runways and a tailwind component exists, always state both wind direction and velocity.

3-10-1. LANDING INFORMATION

Provide current landing information, as appropriate, to arriving aircraft. Landing information contained in the ATIS broadcast may be omitted if the pilot states the appropriate ATIS code. Runway, wind, and altimeter may be omitted if a pilot uses the phrase "have numbers." Issue landing information by including the following:

- c. Surface wind.

5.3 Burbank ATCT Order 7110.2J, *Standard Operating Procedures*, stated in part:

2-2-2. WIND SOURCES

- a. The ASOS is the official wind source for operational purposes. If another wind source is used, the source location must be specified (e.g., "Runway 15 wind calm," "...Runway 8 wind zero two zero at seven," etc.).
- b. The primary wind source for weather observations is ASOS. The ASOS reports wind oriented to true north, which must be converted to magnetic orientation for a manual ATIS broadcast. The D-ATIS automatically converts true north to magnetic north for D-ATIS broadcast.
NOTE-The magnetic variation for this area is 12° East.
- c. SWS is the primary wind source for Runway 8 and Runway 15.

Submitted by:

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