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NATIONAL TRANSPORTATION SAFETY BOARD

Washington, D.C.

Air Traffic Control Specialist's Report

(9 Pages)

NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

October 29, 2018

Specialist's Report

AIR TRAFFIC CONTROL

DCA18MA142

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A. ACCIDENT

Location: Philadelphia, Pennsylvania
Date: April 17, 2018
Time: 1103 eastern daylight time (EDT)[1]
1503 coordinated universal time (UTC)
Airplane: Southwest Airlines flight 1380, Boeing 737-700, N772SW

B. AIR TRAFFIC CONTROL INVESTIGATOR

Andy Olvis
Air Traffic Control Investigator
Operational Factors Division (AS-30)
National Transportation Safety Board

C. SUMMARY

On April 17, 2018, at 1103 eastern daylight time, Southwest Airlines flight 1380, a Boeing 737-7H4, N772SW, experienced a left engine failure and loss of engine inlet and cowling during climb at about flight level (FL) 320. Fragments from the engine inlet and cowling struck the wing, fuselage, and one cabin window, resulting in a depressurization. The flight crew conducted an emergency descent and diverted into Philadelphia International Airport (KPHL), Philadelphia, PA. Of the 144 passengers and five crewmembers onboard, one passenger received fatal injuries and eight passengers received minor injuries. The airplane sustained substantial damage. The regularly scheduled domestic passenger flight was operating under 14 *Code of Federal Regulations* Part 121 from LaGuardia Airport (KLGA), Queens, New York, to Dallas Love Field (KDAL), Dallas, Texas.

D. DETAILS OF THE INVESTIGATION

The air traffic control (ATC) investigator did not travel for this investigation. A request to review available ATC data pertaining to the accident was made by the investigator in charge (IIC) and assigned to an ATC investigator. The ATC accident package, radar, and communications data were requested from the Federal Aviation Administration's (FAA) New York Air Route Traffic Control Center (ZNY ARTCC), the Philadelphia Terminal Radar Approach Control (PHL TRACON) facility, and the United States Air Force (USAF) 84th Radar Evaluation Squadron (RADES). The air traffic control investigator reviewed the provided radar and communications data in developing this specialist's report.

E. FACTUAL INFORMATION

1.0 History of Flight

At about 1041, the KLGA Air Traffic Control Tower (ATCT) local (LC) controller instructed the crew SWA1380 to line up and wait on runway 31, and at about 1042 the LC advised the crew of SWA1380 of landing traffic on a two-mile final and cleared the flight for takeoff from

[1] All times are eastern standard time (EST) unless otherwise noted.

runway 31. SWA1380 departed KLGA runway 31 and communications were transferred to New York TRACON (N90) at 1043.

At about 1043, the pilot of SWA1380 contacted the N90 LaGuardia Area, departure (RDC) controller and advised they were climbing to 5,000 feet. The RDC controller first instructed the crew of SWA1380 to climb to 15,000 feet, and then instructed them to turn left and proceed direct to the fix ZIMMZ, and the crew acknowledged.

At about 1046, communications with SWA1380 were transferred to the N90 Liberty Area, West (RLW) controller. The RLW controller also instructed the crew of SWA1380 to proceed direct ZIMMZ and to climb and maintain 17,000 feet; the crew acknowledged. At about 1051 communications with SWA1380 were transferred to ZNY ARTCC.

At 1051:46, the crew of SWA1380 contacted ZNY sector 39 and reported level at 17,000 feet. The ZNY sector 39 (R39) controller instructed the crew to climb and maintain FL240 (24,000 feet); the crew acknowledged. At 1053:29, the R39 controller amended the altitude and instructed the crew of SWA1380 to climb to FL220 and the crew acknowledged.

At 1056:53, the R39 controller instructed the crew of SWA1380 to climb and maintain FL280; the crew acknowledged.

At 1057:35, the R39 controller instructed the crew of SWA1380 to climb and maintain FL380; the crew acknowledged.

At 1100:52, communications with SWA1380 were transferred to ZNY sector 10. At 1101:33 the crew of SWA1380 established communications with the sector 10 (R10) controller at FL300 climbing to FL380. The R10 controller acknowledged.

At 1104:21, the R10 controller instructed the crew of SWA1380 to proceed direct to VINSE; there was no reply from the crew of SWA1380. The controller again issued the clearance direct to VINSE; again, there was no reply. At 1104:50, the R10 controller transmitted “Southwest thirteen eighty if you’re trying to get me all I hear is static”.

At 1104:54, the crew of SWA1380 transmitted “Southwest thirteen eighty has an engine fire descending.” The R10 controller asked the crew of SWA1380 to confirm they were descending. The crew responded, “yes sir we’re single engine descending have a fire in number one.” The R10 controller then asked the crew which airport they would like to go towards, and the crew requested vectors to the closest airport. The R10 controller suggested the airport in Middletown Pennsylvania and issued a vector of 250 degrees. The crew of SWA1380 advised the R10 controller “…we're looking at uh Philly…”.

At 1105:52, the R10 controller cleared the crew of SWA1380 direct to the Philadelphia airport via direct[2]. The crew acknowledged the clearance.

[2] Direct means to proceed straight to the airport NAVAID or Lat/Long position.

At 1106:51, the R10 controller attempted to clarify with the crew of SWA1380 that there was a fire and that the aircraft was single engine because of the fire. The crew responded, "actually there's no fire but we are single engine". The R10 controller responded, "okay you are single engine now okay cleared direct to Philly and uh I guess just uh can you maintain one one eleven thousand". The crew advised they could, and the R10 controller instructed the crew to maintain 11,000 feet.

At 1107:51, the R10 controller asked the crew of SWA1380 if they needed anything standing by at the airport. The crew responded they were requesting trucks and that it was engine number 1 on the captain's side. The R10 controller acknowledged and transferred communication to ZNY sector 25 (R25).

At 1108:13, the crew of SWA1380 contacted the R25 controller and stated, "center Southwest thirteen eighty declaring an emergency going through seventeen thousand need your local altimeter". The R25 controller issued the Baltimore altimeter and confirmed SWA1380 was descending to 11,000 feet. The crew advised the R25 controller there were 149 persons on board the aircraft and 3 plus hours of fuel.

At 1109:10, the R25 controller instructed the crew of SWA1380 to descend and maintain 8,000 feet; the crew acknowledged. The R25 controller then confirmed with the crew that they were requesting "…all sorts of assistance at the airport correct". The crew responded that they needed the fire truck on the captain's side after landing. The R25 associate controller coordinated the request with the PHL Air Traffic Control Tower (ATCT) approach controller.

At 1110:08 the R25 controller asked the crew of SWA1380 if the engine was still on fire, the crew responded "negative". The R25 controller then transferred communications with SWA1380 to PHL ATCT.

At 1111:02, the PHL ATCT North Departures (ND) sector controller established communications with SWA1380 and instructed the crew to descend to 6,000 feet; the crew acknowledged. The ND controller asked the crew to verify the fuel remaining and the number of people onboard the aircraft, the crew responded "…one hundred and forty-nine souls on board five hours of fuel". The ND controller vectored SWA1380 to the east and asked the crew for their fuel in pounds and the exact nature of the emergency. The crew responded, "engine ah engine severe damage engine failure and exact pounds of fuel six, seventeen, twenty-one thousand".

At 1113:44, the ND controller asked the crew of SWA1380 if they wanted an extended final or a turn directly at the runway. The crew responded they would like an extended final approach to the runway. Communications with SWA1380 were transferred to the PHL ATCT North Arrivals (NA) sector.

At 1114:10, the crew of SWA1380 contacted the NA controller and requested "… we need a single channel no more channel switching". The NA controller responded "…you're where you should be maintain four thousand and ah do you need any further assistance from me what type of final do you want I heard short or long". The crew responded they needed a long final. The NA controller advised the crew he would set them up for a 25-mile final approach to the runway. The

crew of SWA1380 responded that 20 miles was good but that they may need a shorter final approach.

At 1115:28, the crew of SWA1380 advised the NA controller “yeah we have part of the aircraft missing so we're going to need to slow down a bit”. The NA controller advised the crew that speed was at their discretion and to maintain any altitude above 3,000 feet.

At 1116:31, the crew of SWA1380 requested to turn inbound to the runway. The NA controller instructed the crew to turn southbound and advised them of the airport location.

At 1117:03. The crew of SWA1380 advised the NA controller that they were requesting “medical” to meet the aircraft for injured passengers. The NA controller acknowledged and asked if the aircraft was on fire. The crew responded that the aircraft was not on fire but that part of it was missing; that there was a hole and that “someone went out”.

At 1117:37, the crew of SWA1380 reported the airport in sight and was cleared for the visual approach to runway 27 left by the NA controller. Communications were transferred to the PHL ATCT Local Control East (LCE) controller.

At 1118:45, the crew of SWA1380 contacted the LCE controller and was cleared to land on runway 27 left.

At 1121:17, the LCE controller advised the crew of SWA1380 “…right turn when you're able you wanna stop wherever you need to it's fine”. The crew responded they would be stopping next to the fire trucks.

At 1122:13, the crew of SWA1380 asked for a frequency to speak with the fire chief, and LCE issued a frequency of 135.1.

The remaining transmissions were pertinent to the fire department and pilots after the aircraft was stopped; air traffic controllers facilitated communications but did not assist in the fire department response.

2.0 Radar Data

2.1 Radar Sensors

Radar data for this report was obtained from the FAA ZNY ARTCC and PHL TRACON, and the USAF 84th RADES. ZNY ARTCC provided En Route Intelligence Tool (ERIT) radar data in .RS4 format[3]. The data provided primary radar target information from 1500 UTC until 1600 UTC. PHL TRACON provided a Plot Play Back (.PPB) radar file from 1500 UTC to 1535 UTC. The USAF 84th RADES provided radar data that was used to provide altitude data for primary targets from 1500 UTC until 1530 UTC. All radar data was of good quality and useable to the investigation.

[3] RS4 is a radar data collection and analysis software tool developed by the United States Air Force.

In general, two types of radar are used to provide position and track information for aircraft cruising at high altitudes between airport terminal airspaces, and for those operating at low altitude and speeds within terminal airspaces.

Air Route Surveillance Radars (ARSRs) are long range (250 nautical mile) radars used to track aircraft cruising between terminal airspaces. ARSR antennas rotate at 5 to 6 rotations per minute (rpm), providing a radar return every 10 to 12 seconds; there is no weather data associated with the radar return. The ARSR radar has the capability to provide height data for primary targets, however the FAA does not record that data. The height data from the ARSR sensors located near the accident location was obtained from the USAF 84th RADES.

Airport Surveillance Radars (ASRs) are short range (60 nautical mile) radars used to provide air traffic control services in terminal areas. ASR antennas rotate at 13 to 14 rpm, providing a radar return every 4.6 to 5 seconds The ASR radar can detect precipitation and is displayed in six levels on the controllers display or the tower display workstation (TDW). The weather data is updated every 60 seconds.

A radar detects the position of an object by broadcasting an electronic signal that is reflected by the object and returned to the radar antenna. These reflected signals are called primary returns. Knowing the speed of the radar signal and the time interval between when the signal was broadcast and when it was returned, the distance, or range, from the radar antenna to the reflecting object can be determined. Knowing the direction, the radar antenna was pointing when the signal was broadcast, the direction (or bearing, or azimuth) from the radar to the object can be determined. Range and azimuth from the radar to the object define the object's position.

To improve the consistency and reliability of radar returns, aircraft are equipped with transponders that sense beacon interrogator signals broadcast from radar sites, and in turn broadcast a response signal. Even if the radar site is unable to sense a weak reflected primary return, it will sense the response signal broadcast by the transponder and be able to determine the aircraft position. The response signal can also contain additional information, such as the identifying Mode 3 or "beacon code" for the aircraft, and the aircraft's pressure altitude (also called "Mode C" altitude). These transponder derived signals are called secondary returns. SWA1380 was assigned a beacon code of 2656.

2.2 Radar Targets

At 1103:34, the plotted FAA radar data indicated the aircraft reported Mode C altitude was 32,500 feet[4] (see figure 1). At 11036:46, the aircraft reported Mode C altitude was 32,400 feet, and at 1103:58 the aircraft reported Mode C altitude was 31,200 feet (see figure 2). FAA ATC audio recordings indicated that at 1104:54 the crew reported an engine fire and was descending.

Primary radar data provided by the USAF 84th RADES indicated primary targets adjacent to the flight track of the accident aircraft first appeared at 1104:35. Two targets separated by about 1.13 nautical miles (nm) appeared at 1104:35 at an altitude of 27,200 feet (see figure 3). The radar data indicated multiple primary targets drifting away from the aircraft flight track to the southwest and descending (see figure 4).

[4] FAA radar data uses the aircraft reported Mode C altitude in hundreds of feet.

3.0 Weather

SWA1380 landed at KPHL at about 1121. The current KPHL weather observation at 1054 EDT was, wind from 290° at 18 knots with gusts to 27 knots, visibility of 10 miles or greater, a broken ceiling at 4,800 ft above ground level (agl), broken skies at 8,000 ft agl, temperature of 7° Celsius (C), dew point temperature of -4° C, and an altimeter setting of 29.75 inches of mercury. Remarks: automated station with a precipitation discriminator, peak wind from 270° at 28 knots at 1042 EDT, sea level pressure 1007.2 hPa, temperature 7.2° C, dew point temperature -4.4° C, 3-hourly pressure decrease of 0.2 hPa.

METAR KPHL 171454Z 29018G27KT 10SM BKN048 BKN080 07/M04 A2975 RMK AO2 PK WND 27028/1442 SLP072 T00721044 58002=

See the Meteorology Group Chairman's Factual Report for details.

F. LIST OF ATTACHMENTS

Attachment 1: Radar Graphics

Submitted by:

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Andy Olvis
Senior Air Traffic Investigator

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