



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 18, 2017

Group Chairman's Factual Report

OPERATIONAL FACTORS

DCA16IA200

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A. INCIDENT

Operator: Delta Air Lines, Inc.
Flight: 2845
Location: Rapid City, South Dakota
Date: July 7, 2016
Time: 2042 Mountain Daylight Time (MDT)¹
Airplane: Airbus A-320-211, N333NW

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C. SUMMARY

On July 7, 2016, about 2042 MDT (0242Z), Delta flight 2845 (DAL2845), an Airbus 320-211, registration N333NW, mistakenly landed at Ellsworth Air Force Base (RCA), Rapid City, South Dakota, which was 5.8 nautical miles north-northwest of the intended destination, Rapid City Regional Airport (RAP), Rapid City, South Dakota. The flight had been cleared to land runway 14 at RAP, which was 8,701 feet long and 150 feet wide. However, the flight landed on runway 13 at RCA, which was 13,497 feet long and 300 feet wide. There were no injuries to the 123 passengers and 6 crew members. The airplane was not damaged. The flight was being operated under the provisions of *Title 14 Code of Federal Regulations Part 121* as a regularly scheduled passenger flight from Minneapolis-St. Paul International/Wold-Chamberlain Airport (MSP) Minneapolis, Minnesota. Visual meteorological condition prevailed at the time and civil twilight conditions existed.

D. DETAILS OF THE INVESTIGATION

The NTSB conducted interviews of both the incident flight crew members. Manuals and training material from Delta Air Lines were requested and reviewed, and certification records from the FAA were obtained and reviewed.

¹ All times are mountain daylight time (MDT) based on a 24-hour clock, unless otherwise noted.

The group interviewed the First Officer on July 13, 2016, via teleconference. The group interviewed the Captain on July 14, 2016, via teleconference.

E. FACTUAL INFORMATION

1.0 History of Flight

DAL2845 was a scheduled flight from MSP to RAP. The first officer (FO) preflighted the incident airplane prior to the departure. According to interviews, the captain had requested a 10-minute early departure from their dispatcher out of MSP.

According to the crew, the departure from MSP was uneventful and the flight climbed to FL320² and subsequently climbed to FL340, which was lower than the filed altitude of FL360. The captain was the pilot flying (PF) and the FO was the pilot monitoring (PM). According to interviews with the flight crew, the cruise and descent were uneventful.

Prior to arrival into the RAP area, the crew used previously obtained RAP weather information. Considering the wind from the west at 5 knots the crew anticipated and briefed the ILS³ 32 approach; however, due to the captain's personal procedure he also briefed the RNAV/GPS⁴ 14 approach at RAP. Prior to contacting Ellsworth Approach Control, the FO obtained the ASOS⁵ weather for RAP, which included wind from 140 degrees at 4 knots. The captain conducted the approach briefing, which included briefing the 10-7⁶ page, an anticipated taxi route to the gate after landing, and the close proximity of RCA to RAP.

After contacting Ellsworth approach control the crew was advised to expect the visual approach for runway 14 and were provided vectors east of the airport. About 6,900 feet msl⁷ and abeam the ZUDIM⁸ intersection they began performing a "high energy descent" profile. About 6 miles from RAP the controller provided the flight with a left turn for the base leg of the approach; however, the crew requested an extended downwind. After turning onto the base leg the captain reported that an airport was in sight and he "thought it was RAP," at which time he selected a direct radial to the ZUDIM intersection. Once the flight was cleared for the approach to runway 14, the captain armed the approach. The captain reported that the airplane captured the approach about 5 miles from ZUDIM. The FO reported that he observed his navigation display (ND) and the flight was straight on the "correct" navigation line to the runway. Although captured on the lateral guidance of the approach, the flight was above the vertical approach path, the captain

² FL refers to Flight Level which is provided in a numerical format which in this example is 32,000 feet above mean sea level (msl)

³ Instrument Landing System

⁴ RNAV: Area Navigation.

⁵ Automated Surface Observations System

⁶ The information provided by the 10-7 charts was operator specific and included operation frequency, gate number information at the specific airport, airport specific procedures for departures and arrivals, general information, and Special Notes. For further information, see Section 9.3 of this report

⁷ Mean Sea Level

⁸ ZUDIM was an intersection depicted on the RNAV (GPS) RWY 14 approach. The intersection was the final approach fix for the approach and was approximately 5.2 nautical miles from the approach end of runway 14. See Attachment 7 - RAP Charts

disconnected the autopilot, and commanded the FO to clear his flight director and set the missed approach altitude. The captain reported that about 500 feet agl⁹ he did not observe the PAPI lights; however, he remained “focused on the visual approach.” As they approached the runway, the captain retarded the thrust levers to idle at which point they realized that they were landing at RCA. According to both crewmembers the landing runway 13 was “uneventful” and they cleared the runway onto taxiway “D” and notified the RAP air traffic control tower.

2.0 Flight Crew Information

The incident flight crew consisted of a captain, first officer, and 4 flight attendants.

2.1 The Captain

The captain was 60 ½ years old. He held an Airline Transport Pilot (ATP) certificate with type ratings on the Airbus A-320 and A-330, and the Boeing 747 with Second-in-Command privileges. He also held a commercial pilot certificate for instrument helicopter, a flight engineer certificate, and an FAA first-class medical certificate dated April 8, 2016. He was originally hired with Republic Airways on June 9, 1986, which merged with Northwest Airlines in October of 1986, and subsequently merged with DAL in January of 2010. At the time of the incident, he was based in Salt Lake City, Utah.

Prior to joining DAL, the captain was a flight engineer on the Boeing 727, then became a First Officer (FO) on the B727, B757, and then on the B747 out of Anchorage, Alaska. He remained an FO on the B747 until the Anchorage base was closed, at which time he flew the Airbus A-330. He transitioned to captain of the Airbus A-320 in June of 2010. He flew at Cascade Airways, which was subsequently merged with Horizon. Prior to that he had been an Army helicopter pilot on the Huey, Bell Jet Ranger, and the Hughes 500, crew chief, and a pilot on the C23 Sherpa¹⁰, which he had flown the last 6 years that he was in the military.

The captain reported that he had only one accident while in the military, which was a transmission filter issue, and no accidents or incidents during his civilian career. A review of FAA records found no prior accident, incident, or enforcement actions.

2.1.1 The Captain’s Pilot Certification Record

FAA records of the captain indicated the following:

Private Pilot – Airplane Single-Engine Land certificate issued June 3, 1974.

Commercial Pilot – Airplane Single-Engine Land certificate issued December 7, 1979.

Commercial Pilot – Airplane Single-Engine Land; Instrument Airplane certificate issued December 7, 1979.

Flight Instructor – Airplane Single-Engine Land certificate issued March 14, 1980.

⁹ Above Ground Level

¹⁰ The C23 was a military designation for a twin-engine Shorts Brothers manufactured fixed wing airplane and is a variant of the Shorts 330.

Flight Instructor – Airplane Single-Engine Land; Instrument Airplane certificate issued May 8, 1980. Renewed May 4, 1982.

Flight Instructor – Airplane Single and Multiengine; Instrument-Airplane certificate issued October 21, 1982. Renewed June 8, 1984, May 16, 1986, May 15, 1988, May 27, 1990, May 21, 1992.

Notice of Disapproval – Commercial Pilot – Airplane Multiengine Land issued September 28, 1982. Areas for Reexamination: Emergency Procedures.

Commercial Pilot – Airplane Single and Multiengine Land; Instrument Airplane certificate issued October 1, 1982.

Commercial Pilot – Airplane Single and Multiengine Land; Rotorcraft-Helicopter; Instrument Airplane and Helicopter certificate issued May 3, 1983.

Flight Engineer- Turbojet Powered certificate issued September 8, 1986.

Commercial Pilot – Airplane Single and Multiengine Land; B-747, Rotorcraft-Helicopter; Instrument Airplane; Instrument Helicopter; B-747 SIC¹¹ Privileges Only certificate issued January 8, 2006.

Airline Transport Pilot – Airplane Multiengine and Single-Engine Land; Rotorcraft-Helicopter; B-747; A-330; B747 SIC Privileges Only; English Proficient; Commercial Privileges certificate issued May 15, 2010.

Notice of Disapproval – Airline Transport Pilot Multiengine Land Airplane A-320 issued April 4, 2011. Areas for reexamination: Preflight Preparation; Inflight Maneuvers; Normal and Abnormal Procedures.

Notice of Disapproval – Airline Transport Pilot Multiengine Land Airplane; A-320 issued April 6, 2011. Areas for reexamination: Emergency Procedures.

Airline Transport Pilot – Airplane Single-Engine Land; Airplane Multiengine Land; A-320; A330; B-747; Commercial Pilot Privileges; Rotorcraft Helicopter; Instrument Helicopter; [Limitations]; English Proficient; B-747 SIC Privileges Only certificate issued April 11, 2011.

2.1.2 The Captain's Pilot Certificates and Ratings Held at Time of the Incident¹²

AIRLINE TRANSPORT PILOT (issued May 15, 2010)

Airplane Single-Engine Land

Airplane Multiengine Land

A320 A330 B747

Commercial Privileges Rotorcraft Helicopter, Instrument Helicopter

¹¹ Second-in-Command

¹² Source: FAA

Limitations: B747 Second in Command Privileges Only

FLIGHT ENGINEER (issued September 8, 1986)

Turbojet powered

FLIGHT INSTRUCTOR (issued October 21, 1982)

Airplane Single-Engine

Airplane Multiengine

Instrument - Airplane

MEDICAL CERTIFICATION FIRST CLASS (Issued April 8, 2016)

Limitations:

02 MUST WEAR CORRECTIVE LENSES

76 NOT VALID FOR ANY CLASS AFTER

2.1.3 The Captain's Training and Proficiency Checks Completed¹³

Delta Air Lines Seniority Date	June 9, 1986
Date Upgraded to Captain on A320	April 11, 2011
Date of initial Type Rating on A320	April 11, 2011
Date of Most Recent Proficiency Check (LOE/MV ¹⁴)	September 23, 2015
Date of Most Recent Check (MV/SIM ¹⁵)	September 22, 2015
Date of Most Recent PIC Line Check	January 28, 2015

2.1.4 The Captain's Flight Times

The incident captain's flight times provided to the NTSB¹⁶:

Total pilot flying time	25,800 ¹⁷
Total Pilot-In-Command (PIC) time ¹⁸	5,228:27
Total A320 flying time	2,980:27
Total A320 PIC time	2,980:27
Total flying time last 24 hours ¹⁹	5:27
Total flying time last 7 days ²⁰	15:31
Total flying time last 30 days ²¹	15:31
Total flying time last 90 days	78:29
Total flying time last 12 months	490

¹³ Source: Delta Air Lines, Inc.

¹⁴ Line Operating Experience/Maneuvers Validation

¹⁵ Simulator

¹⁶ Source: Captain's Interview Summary (attachment 1 – Flight Crew Interview Summaries) and Delta Air Lines, Inc.

¹⁷ Delta Air Lines' personnel records reveal 13,886:25 hours of total flight experience as a Delta Air Lines pilot

¹⁸ Hours are based solely on flight records provided by Delta Air Lines, and a review of the captain's pre-employment application, dated October 15, 1985 which listed total pilot in command time as 2,248 hours.

¹⁹ Flight time includes incident flight from MSP to RCA

²⁰ Flight Time includes incident flight

²¹ Personnel records indicated that the captain was on vacation for the entire month of June 2016

2.1.5 The Captain's 72-Hour History

According to interviews and Delta Air Lines, Inc. records, on July 4, 2016, the captain commuted to Salt Lake City International Airport (SLC) from his home in Alaska and stayed at a hotel near SLC. On July 5, 2016 he reported for the two-day trip at 0843 for flight 933 from SLC to Cancun International Airport (CUN), Cancun, Quintana Roo, Mexico. The flight arrived at CUN at 1512 local (1412 MDT). He was off duty for 23:33 hours.

On Thursday, July 6, 2016, the captain had a departure time of 1614 local (1514 MDT). He operated flight 934 from CUN to SLC and arrived at 1947 MDT. He stayed at a local airport hotel that he always stayed at when commuting to work, went to a nearby hotel restaurant for dinner, returned to his room about 90 minutes after he first arrived at the hotel, performed some stretches, and went to sleep. He reported that he typically will get between 8 and 9 hours of sleep at night.

July 7, 2016, the day of the incident, was the first day of a three-day rotation. The captain had a departure time of 1116 MDT and operated flight 2284 from SLC to Sacramento International Airport (SMF), Sacramento, California. After arriving at the gate in SMF they had 1:13 hours on the ground and he had a café mocha. He then operated flight 1981 from SMF to MSP and arrived at 1812 central daylight time (CDT) (1712 MDT). While in MSP they had an airplane change during their 1:44 hours on the ground, he ate a fast food dinner and had an ice cream cone. The third flight of the day was the incident flight. The incident flight, 2845, pushed back from the gate at 2003 CDT, departed MSP at 2026 CDT, and arrived at RCA at 2044 MDT. After landing at RCA, and remaining on the airplane for 2:21 hours he then operated the flight from RCA to RAP arriving at 2331 MDT.

2.1.6 The Captain's Previous Experience at RAP

According to Delta Air Lines' records the captain's previous experience flying into RAP was December 4, 2014, and a subsequent departure from RAP on December 6, 2014. No other records of previous experience with the airport were located.

2.2 The First Officer

The FO was 51 years old and resided in Utah. He had an ATP certificate with a type rating on the Airbus A-320. He also had a first-class medical certificate dated January 4, 2016. His date of hire with Delta Air Lines was May 2000. At the time of the incident, he was based at SLC.

Prior to Delta Air Lines he had been an Air Force pilot flying F-15E, F-117, and for his last 3 years in the military he flew the U2. About 18 months after being hired at Delta Air Lines he was deployed in the military service, which continued for 11 years. Prior to the incident he had been flying again at Delta Air Lines for 3 ½ years.

A review of FAA records found no prior accident, incident, or enforcement actions.

2.2.1 The FO's Pilot Certification Record

Student Pilot Certificate – Gliders certificate issued August 13, 1986.

Private Pilot – Glider Aero Tow Only certificate issued February 22, 1987.

Private Pilot – Airplane Single-Engine Land; Glider Aero Tow Only certificate issued July 1, 1988.

Commercial Pilot – Airplane Multiengine Land; Limited to Center Thrust; Private Pilot Privileges; Airplane Single-Engine Land; Glider Aero Tow; Instrument Airplane certificate issued May 8, 1991.

Airline Transport Pilot – Airplane Multiengine Land; Private Pilot Privileges Airplane Single-Engine Land; Glider Aero Tow certificate issued July 12, 1998.

Flight Engineer – Turbojet Powered certificate issued July 31, 2000.

Airline Transport Pilot – Airplane Multiengine Land; A320; Private Pilot Privileges; Airplane Single-Engine Land; Glider; Limitations; English Proficient; A320 Circling Approach – VMC²² Only certificate issued April 12, 2013.

2.2.2 The FO's Pilot Certificates and Ratings Held at Time of the Incident²³

AIRLINE TRANSPORT PILOT (issued April 12, 2013)

Airplane Multiengine Land

A320

Private Privileges Airplane Single-Engine Land; Glider

Limitations: A-320 Circling Approaches – VMC Only

FLIGHT ENGINEER (issued July 31, 2000)

Turbojet Powered

MEDICAL CERTIFICATION FIRST CLASS (Issued January 4, 2016)

Limitations: 02 MUST WEAR CORRECTIVE LENSES

2.2.3 The FO's Training and Proficiency Checks Completed²⁴

Delta Air Lines Seniority Date	May 22, 2000
Date of Initial Type Rating on the A320	April 12, 2013
Date of Most Recent Proficiency Check (LOE/MV)	May 15, 2016
Date of Most Recent Simulator Check (MV/SIM)	May 14, 2016
Date of Most Recent Line Check	December 16, 2015

2.2.4 The FO's Flight Times

The incident FO's flight times provided to the NTSB²⁵:

²² Visual Meteorological Conditions

²³ Source FAA

²⁴ Source: Delta Air Lines

²⁵ Source: First Officer Interview Summary (attachment 1) and Delta Air Lines Inc.

Total pilot flying time ²⁶	7,600
Total Pilot-In-Command (PIC) time ²⁷	1,383
Total A320 flying time	2,324:31
Total flying time last 24 hours ²⁸	5:27
Total flying time last 7 days ²⁹	23:01
Total flying time last 30 days	86:07
Total flying time last 90 days	219:47
Total flying time last 12 months	743

2.2.5 The FO's 72-Hour History

According to interviews and Delta Air Lines, Inc. records, on July 4, 2016, the FO was off duty. Typically, on his time off he would go to sleep about 2300 and wake up about 6 ½ to 7 hours later.

On July 5, 2016, he reported for a two-day trip at 0843. The departure time was 0938 for flight 933 from SLC to CUN. The flight arrived at CUN at 1512 local (1412 MDT). He was off duty for 23:33 hours.

On Thursday, July 6, 2016, the FO had a departure time of 1614 local (1514 MDT). He operated flight 934 from CUN to SLC and arrived at 1947. He drove the 35 minutes to his residence.

July 7, 2016, the day of the incident, was the first day of a three-day rotation. The FO awoke about 0600 and drove his wife to the SLC airport for a personal trip out of the country. He had a departure time of 1116 MDT and operated flight 2284 to SMF. After arriving at the gate in SMF he had 1:13 hours on the ground and he acquired some food to consume on the next flight. He then operated flight 1981 from SMF to MSP and arrived at 1812 CDT (1712 MDT). While in MSP the crew had an airplane change during their 1:44 hours on the ground and he and the captain each had an ice cream cone. The third flight of the day was the incident flight. The incident flight, Delta 2845, pushed back from the gate at 2003 CDT and departed MSP at 2026 CDT and arrived at RCA at 2044. After landing at RCA, and remaining on the airplane for 2:21, he then operated the flight from RCA to RAP, as the PF, arriving at 2331.

2.2.6 The FO's Previous Experience at RAP

According to Delta Air Lines' records and the crew interview summaries, the FO had not flown into RAP while employed at Delta Air Lines, nor had the FO flown into RAP or RCA at any time prior to his employment with Delta Air Lines.

²⁶ Delta Air Lines' Personnel Record revealed 3,228:41 of those hours were flown as a Delta pilot, 906:34 of those hours were as a second officer on the B-727 aircraft

²⁷ Source: Delta Application for Employment. Flight time included 51 hours of Single-Engine Piston; 1-hour Multiengine Piston; and 1,331 hours multiengine Jet

²⁸ Flight time includes incident flight

²⁹ Flight time includes a trip that began on June 30 and ended July 3; however, did not include the 3:42 hours on the 30th; as well as the incident flight

3.0 Flight Crew Roles and Responsibilities

3.1 Captain

The Delta Air Lines' Flight Operations Manual Chapter 3 "Operational Policy" stated the following in regards to the captain's responsibilities:

The captain is designated as aircraft commander and has full responsibility for the safe operation of the aircraft. The captain directs the activities of all crewmembers in a manner which promotes maximum safety, efficiency and operational effectiveness.

- *The captain is in complete command of the aircraft and has authority over all assigned crewmembers from the time they report for duty until termination of the flight. This includes transportation to and from the layover facility.*
- *The captain's orders will receive prompt compliance from all crewmembers.*
 - *Differences from written procedures or other instructions should be brought to the captain's attention.*
 - *If, after involving the expanded team as appropriate, the order still stands, it is to be obeyed.*

The captain sets the example for all crewmembers with regard to proper conduct, appearance, alertness, discipline, adherence to operating procedures, and standards of proficiency. The captain is expected to foster open communication, and to be receptive to input from all crewmembers, toward the shared goal of a safe flight operation.

The following duties and responsibilities apply to all captains:

- *Allow only current and qualified pilots to occupy a control seat.*
- *Allow admission to the flight deck to authorized persons only.*
- *Allow an authorized line check pilot to assume command upon notification that the captain is being relieved of command.*
 - *Flight control must be notified if the captain is relieved during flight.*

3.2 First Officer

The Delta Air Lines' Flight Operations Manual Chapter 3 "Operational Policy" stated the following in regards to the FO's responsibilities:

The first officer's primary responsibility is to assist the captain in the safest and efficient operation of the aircraft while performing assigned duties.

The first officer is also charged with the responsibility of immediately informing the captain of unsafe condition or improper handling which could place the aircraft in jeopardy.

3.3 Operational Philosophy

The Delta Air Lines operational philosophy was defined in the Delta Air Lines FOM, Section 3.1 "General." That section of the FOM stated, in part, the following:

Flight Operations standardization efforts discourage unsafe practices, carelessness, complacency, and the development of individual procedures, while promoting operational flexibility, good judgment, and professionalism.

All aspects of Delta's flight operations will be conducted in accordance with the following operational priorities:

Safety,

FAR³⁰, ATC, and company policy compliance,

Passenger comfort,

Schedule, and

Economy.

Safety is always paramount to our operational priorities. Any time the safety of our passengers, crew or assets is in question the operation must be stopped.

3.4 PF/PM Duties and Responsibilities

The Delta Air Lines A319/320/321 Flight Crew Training Manual, Chapter 9 "Human Factors" stated the following:

- *PF – Primary responsibilities are to fly the aircraft, listen, respond and adhere to ATC clearances. Maintain situational awareness through periodic communication with PM. Involve PM if any problems or difficulties are encountered.*
- *PM – Primary responsibilities are to maintain constant situational awareness, prioritize threats, manage the highest threat by building (expanding) a CRM team for input, create enough time to formulate a plan of action, communicate that plan as necessary and continue to actively monitor the PF as able.*

3.4.1 Pilot Flying and Pilot Monitoring Priorities

The Delta Air Lines' Flight Operations Manual Chapter 3 "Operational Policy" stated the following in regards to the Pilot Flying (PF) and Pilot Monitoring (PM) Priorities:

Pilot Flying (PF): *The PF's primary responsibility is to fly the aircraft in a safe manner, compliant with FARs, ATC instructions, and company policy. The PF should not allow any distraction from executing these primary responsibilities:*

- *Fly the aircraft in accordance with the company priorities specified above; and*
- *Provide backup to the Pilot Monitoring (PM)*

Pilot Monitoring (PM): *The PM's primary responsibility is to ensure that the PF flies the aircraft in a safe and compliant manner. If the PM believes or is unsure about whether or not the aircraft is being operated in a safe and compliant manner, the PM will immediately bring any concern to the PF's attention. The PM should not allow any distractions from executing these primary responsibilities:*

- *Provide backup to the PF in the execution of his duties;*

³⁰ Federal Aviation Regulations

- *Communications; and*
- *Administrative duties*

3.4.2 Crew Duties and Responsibilities

The Delta Air Lines' A319/320/321 Operations Manual "Normal Procedures – Philosophy and Assumptions" stated the following:

The captain retains final authority for all actions directed and performed.

Crew duties are divided between the pilot flying (PF), pilot monitoring (PM), captain (C), and first officer (F).

The captain's general responsibilities during ground operations include:

- *Calling for checklists, and*
- *Taxiing*

The first officer's general responsibilities during ground operations include:

- *Monitoring taxi,*
- *Checklist reading,*
- *Communications, and*
- *Tasks requested by the captain*

The captain is responsible for assigning the PF role. Normally the PF/PM roles remain unchanged throughout the flight but the captain may change the assignments at any time due to operational needs.

The PF's general responsibilities during flight are:

- *Flight path management and airspeed control,*
- *Aircraft configuration,*
- *Navigation, and*
- *Calling for checklists.*

The PM's general responsibilities during flight are:

- *Monitoring flight path, airspeed, aircraft configuration, and navigation;*
- *Checklist reading;*
- *Communications; and*
- *Tasks requested by the PF.*

3.5 Automation Policy

The Delta Air Lines policy on the use of automation was defined in the Delta Air Lines FOM, Section 3.2 "Automation Policy." That section of the FOM stated the following:

Automation is provided to enhance safety, maximize efficiency, reduce pilot workload, and improve operational capabilities. Pilots should use the available automation at the level most appropriate to achieve these objectives.

Pilots should maintain proficiency in the use of all levels of automation and the skills required to shift between levels of automation. The level of automation used should permit both pilots to maintain a comfortable workload distribution and situational awareness.

3.6 Title 14 Code of Federal Regulations (CFR)

CFR 121.533 “Responsibility for operational control: Domestic operations” stated:

- (a) Each certificate holder conducting domestic operations is responsible for operational control.*
- (b) The pilot in command and the aircraft dispatcher are jointly responsible for the preflight planning, delay, and dispatch release of a flight in compliance with this chapter and operations specifications.*
- (c) The aircraft dispatcher is responsible for –*
 - (1) Monitoring the progress of each flight;*
 - (2) Issuing necessary information for the safety of the flight; and*
 - (3) Cancelling or redispersing a flight if, in his opinion or the opinion of the pilot in command, the flight cannot operate or continue to operate safely as planned or released*
- (d) Each pilot in command of an aircraft is, during flight time, in command of the aircraft and crew and is responsible for the safety of the passenger, crewmembers, cargo, and airplane.*
- (e) Each pilot in command has full authority in the operation of the aircraft, without limitation, over other crewmembers and their duties during flight time, whether or not he hold valid certificates authorizing him to perform the duties of those crewmembers.*

4.0 Medical and Pathological Information

Both pilots completed drug screening tests on July 8, 2016. Results of these tests for both pilots were negative³¹.

The captain told NTSB Staff that he felt he was in good health, even though he is pre-diabetic, which he controlled with diet, and that he does monitor his blood sugar in order to keep his level “in check.” He further stated that he took Metformin and a “small dose” of Lipitor© and that it was documented on his flight physical. He told NTSB Staff that his first class medical certificate contained two limitations: that it was not valid for any class after³² and that he must wear corrective lenses. He told NTSB staff that at the time of the incident he was wearing his glasses, which were bi-focal.

³¹ Both pilots tested negative for the following drugs: Amphetamines class, Cocaine Metabolites, Marijuana (THC), Ecstasy, Opiates, 6-Monoacetylmorphine, and Phencyclidine (PCP).

³² This was issued for a special issuance medical certificate in which a pilot has a medical condition(s) that are generally disqualifying, but yet are stable enough to be considered safe to fly for a period of time that was shorter than the maximum expiration date for a medical certificate, it further does not permit a certificate to be downgraded in class

The FO told NTSB Staff that he took Lipitor© in the morning, and took an over the counter medication, Allegra©, for seasonal allergies but otherwise did not take prescription medications, and considered his health very good.

5.0 Aircraft Information



Photo 1: Incident Airplane (Registration N333NW)

The incident airplane was an Airbus A320-211 (Registration N333NW), Serial No. 0329, and was manufactured in 1992. The registered owner was Delta Air Lines, Inc., and it held a transport category airworthiness certificate dated July 10, 1992. The airplane had a maximum ramp weight of 170,635 pounds, and had a total passenger seating capacity of 160, and contained 4 flight crew seats and 5 cabin crew seats. A review of NTSB and FAA records found that the incident airplane had not been involved in any previous incidents that merited a formal investigation or accidents.³³

The airplane was powered by two CFM56 series engines. Each engine was managed by a Full Authority Digital Engine Control (FADEC) system which provided engine indications and thrust limit displays on the upper Electronic Centralized Aircraft Monitoring (ECAM). Power settings for the CFM56 were based on a percentage of N1³⁴.

5.1 Weight and Balance

Delta Air Lines used the Aircraft Weight and Balance System (AWABS) as the primary means of producing the Weight Data Record (WDR). The landing performance used by AWABS was based on the longest runway shown as open in the station file.³⁵

³³ NTSB source: http://www.nts.gov/_layouts/ntsb.aviation/index.aspx FAA source

³⁴ N1 refers to rotational speed of the low pressure turbine as a percentage of nominal "full thrust" value.

³⁵ Source: Delta Air Lines Flight Control Operations Manual pp. 3.3.1 thru 3.3.2

The automated system incorporated programmed MEL/CDL items, runway closures, restrictions, NOTAMS, and runway conditions. There was no performance related MEL or CDL items for the incident airplane.

The final weight and balance for the flight from MSP to RAP, was transmitted to the incident airplane via ACARS at 2000 CDT (0100Z). The final weight and balance for the flight from RCA to RAP was transmitted to the incident airplane via ACARS at 2248 (0448Z).

5.2 Weight and Balance for MSP to RAP (Incident Flight)

WEIGHT & BALANCE (maximum certificated weights in bold)	
Empty Operating Weight ³⁶	96,140
Baggage/Cargo Weight	2,220
Passenger Weight (123 passengers x 190 lbs./Passenger ³⁷)	23,370
Zero Fuel Weight	121,218
Maximum Zero Fuel Weight	133,379
Fuel Weight	19,200
Ramp Weight	140,568
Maximum Taxi Weight	167,330
Taxi Fuel Burn	459
Actual Takeoff Weight	139,959
Maximum Takeoff Weight (Structural) ³⁸	166,448
Maximum Allowable Takeoff Weight	150,503
Estimated Fuel Burn to RAP ³⁹	8,622
Estimated Weight on Landing	131,804
Actual Landing Weight ⁴⁰	130,720
Maximum Landing Weight	142,198
CG (Takeoff)	27.6

5.3 Weight and Balance for RCA to RAP (Reposition Flight)

WEIGHT & BALANCE (maximum certificated weights in bold)	
Empty Operating Weight ⁴¹	96,140
Baggage/Cargo Weight	2,220
Passenger Weight (123 passengers x 190 #/Passenger)	23,370
Zero Fuel Weight	120,541

³⁶ This weight includes the basic operating weight of the airplane, the flight crew, 4 flight attendants, and crew luggage.

³⁷ Source: Delta Flight Control Operations Manual pg. 4.2.1

³⁸ Source: NTSB 6120.1 Accident/Incident form completed by a representative of Delta Air Lines

³⁹ The planned flight route had an estimated fuel burn of 8,304 pounds; however, the crew was issued a modification to their filed flight plan which was also listed on the dispatch paperwork as “w1” (see attachment ##)

⁴⁰ Source: 6120.1 Accident/Incident form completed by a representative of Delta Air Lines

⁴¹ This weight includes the basic operating weight of the airplane, the flight crew, 4 flight attendants, and crew luggage.

Maximum Zero Fuel Weight	133,379
Fuel Weight	9,060
Ramp Weight	129,542
Maximum Taxi Weight	167,330
Taxi Fuel Burn	145
Actual Takeoff Weight	130,033
Maximum Takeoff Weight (Structural)	166,648
Maximum Allowable Takeoff Weight	132,397
Estimated Fuel Burn to RAP	3,309
Estimated Weight on Landing	126,088
Maximum Landing Weight	142,198
CG (Takeoff)	29.3

5.4 Minimum Equipment List (MEL) or Configuration Deviation List (CDL)

The incident airplane had the following MEL/CDL items logged⁴²:

MEL ITEMS FOR SHIP NUMBER 3233

01 M31-31-00E - CLASS II MTC MSG ON ECAM STATUS PAGE - FAULTS
IND BY ACMS
EXPIRES 25OCT16 AT 2359Z

02 M31-55-01 - SYSTEM DATA ACQUISITION CONCENTRATOR UNITS
/SDAC/
EXPIRES 10JUL16 AT 2359Z

03 M33-10-01A - COCKPIT AND INSTRUMENT PANEL LIGHTING SYSTEM
EXP

HD 2845 08JUL0440 RL RCA
IRES 11JUL16 AT 2359Z

04 M25-28-01A - STORAGE BIN / CABIN/GALLEY/LAVATORY STORAGE
COMPT/CLOSETS
EXPIRES 17JUL16 AT 2359Z

⁴² Source: Delta Air Lines, Inc. Dispatch Release via ACARS (Reference Attachments 3 and 4)

5.5 Airplane Dimensions⁴³

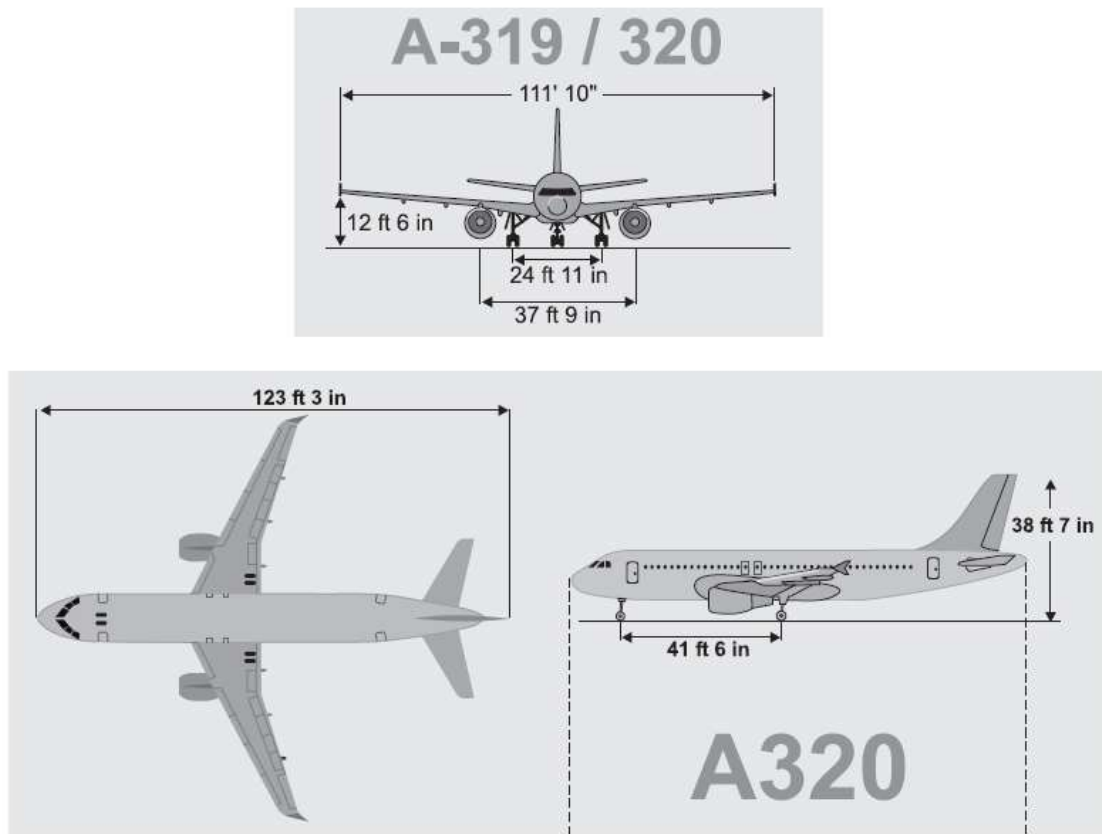


Figure 1: Airplane Dimensions

6.0 Meteorological Information

Airport weather observations from RAP were obtained from the National Weather Service by an NTSB Meteorologist. Airport weather information found in the METAR⁴⁴ for RAP originated from an Automated Surface Observing System (ASOS), but these report could have been augmented by a local Certified Weather Observer. The following METARs were issued for RCA and RAP for the time period surrounding the incident:

[1752 MDT] METAR KRAP 072352Z VRB04KT 10SM CLR 24/08 A2996 RMK AO2 SLP125 T02440078 10256 20217 58006=

[1852 MDT] METAR KRAP 080052Z 17003KT 10SM CLR 24/08 A2996 RMK AO2 SLP125 T02440078=

[1952 MDT] METAR KRAP 080152Z 15003KT 10SM CLR 22/11 A2997 RMK AO2 SLP130 T02220106=

⁴³ Source: Delta Air Lines, A319/320 Operations Manual, Volume 2, Chapter 6 “Dimensions/General Arrangement”

⁴⁴ Meteorological Terminal Air Report. Source:

[http://www.skybrary.aero/index.php/Meteorological_Terminal_Air_Report_\(METAR\)](http://www.skybrary.aero/index.php/Meteorological_Terminal_Air_Report_(METAR))

(Incident occurred at 2042 MDT)

[2052 MDT] METAR KRAP 080252Z 12003KT 10SM CLR 19/10 A2998 RMK AO2 SLP135 T01890100 53007=

[1758 MDT] METAR KRCA 072358Z COR AUTO 14007KT 10SM CLR 25/08 A2995 RMK AO2 SLP125 T02540082 10262 20219 57005 \$ COR 0009=

[1858 MDT] METAR KRCA 080058Z 17005KT 10SM CLR 25/08 A2996 RMK AO2A SLP128 T02480080 \$=

[1958 MDT] METAR KRCA 080158Z 17004KT 10SM CLR 23/10 A2996 RMK AO2A SLP128 T02290097 \$=

(Incident occurred at 2042 MDT)

[2058 MDT] METAR KRCA 080258Z 19004KT 10SM CLR 21/09 A2998 RMK AO2A SLP135 T02110094 52008 \$=

According to the United States Naval Observatory, Astronomical Applications Department website,⁴⁵ official sunset was at 2038 and the end of civil twilight was 2113. According to NTSB Meteorological staff, the sun would have been at an azimuth from RAP of about 304 degrees true and about 1 degree below the horizon at the time of the incident.

7.0 Air Traffic Control (ATC)

See the Air Traffic Control Group Chairman's Factual Report.

8.0 Communications

There were no known communication difficulties at the time of the incident nor during the repositioning flight.

9.0 Airport Information

9.1 Rapid City Regional Airport (RAP)

Rapid City Regional Airport was located 8 miles southeast of Rapid City, South Dakota, had a field elevation of 3,204 feet msl, and was located at a latitude/longitude of N44°02.7'/W103°03.4'. The airport was owned and managed by the city of Rapid City. The airport was serviced by an FAA Air Traffic Control Tower that was in operation from 0600 to 2200 local time. The ATCT was in operation at the time of the incident. Radar services to DAL2845 were provided by Ellsworth Approach Control, located at the Ellsworth Air Force Base.

⁴⁵ Source: USNO Website

<http://aa.usno.navy.mil/rstt/onedaytable?ID=AA&year=2016&month=7&day=7&state=SD&place=Rapid+City>

9.1.1 RAP Runway Information

RAP had two runways designated as 5/23 and 14/32. Runway 5/23 was 3,601 feet long and 75 feet wide and was an asphalt runway and was noted as not available for scheduled air carrier operations with aircraft designed for 10 passenger seats or more. Runway 14/32 was 8,701 feet long and 150 feet wide, the surface was concrete and grooved. Runway 5/23 was equipped with MIRL (medium intensity runway lights), runway 14 was equipped with HIRL (high intensity runway lights) and REIL⁴⁶, and runway 32 was equipped with HIRL and MALSR (medium-intensity approach light system with runway alignment indicator lights). Runways 5 and 23 were equipped with a 2-light PAPI on the left side and runway 14 and 32 were equipped with a 4-light PAPI on the left side of the runway with a 3.00-degree glide path angle.

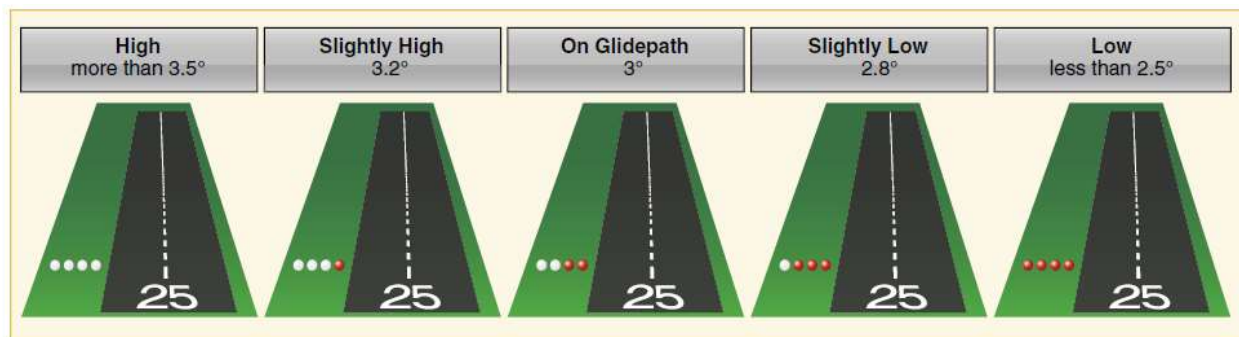


Figure 2: 4-Light Precision Approach Path Indicator (PAPI)⁴⁷

Runway 32 was serviced by an ILS⁴⁸, RNAV⁴⁹, and VOR⁵⁰ approaches. Runway 14 was serviced by an RNAV and a VOR approach.

⁴⁶ Runway End Identifier Lights – According to Aeronautical Information Manual, Section 2-1-3 “REILs are installed at many airfields to provide rapid and positive identification of the approach end of a particular runway. The system consists of a pair of synchronized flashing lights located laterally on each side of the runway threshold. REILs, may be either omnidirectional or unidirectional facing the approach area. They are effective for: a. identification of a runway surrounded by a preponderance of other lightning, b. identification of a runway which lacks contrast with surrounding terrain c. identification of a runway during reduced visibility.”

⁴⁷ Source Pilots Handbook of Aeronautical Knowledge FAA-H-8083-25A Section 13 “Airport Operations” note runway number is not applicable to any specific runway and was utilized only for illustration purposes.

⁴⁸ Instrument Landing System

⁴⁹ Area Navigation

⁵⁰ Very High Omni-directional Range

9.1.2 RAP Charts⁵¹

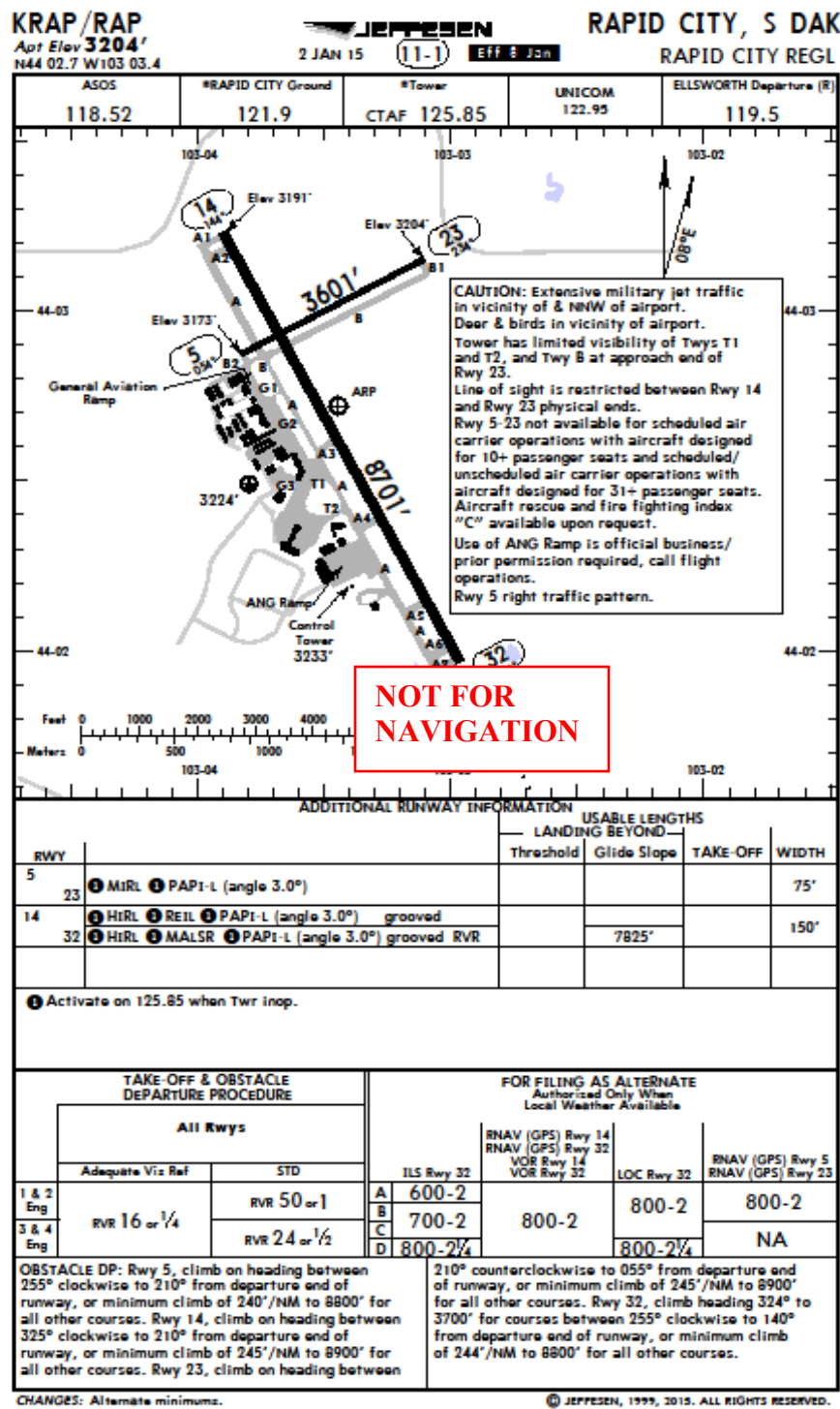


Figure 3: RAP Airport Diagram Chart

⁵¹ See Attachment 7 - RAP Charts

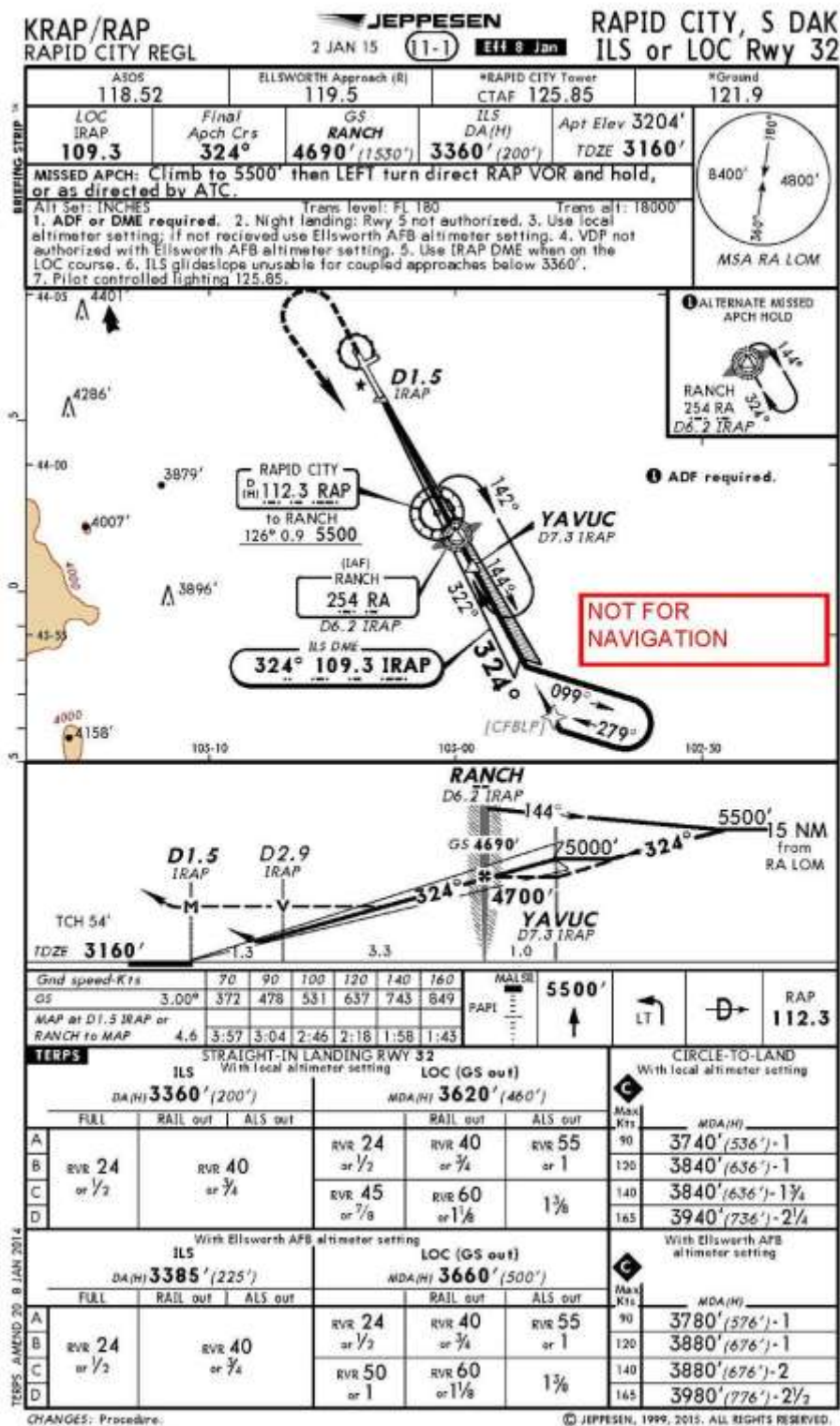


Figure 4: RAP ILS32 Approach Chart

KRAP/RAP
RAPID CITY REGL

JEPPESEN
24 APR 15 (12-2) E11 30 Apr

RAPID CITY, S DAK
RNAV (GPS) Rwy 14

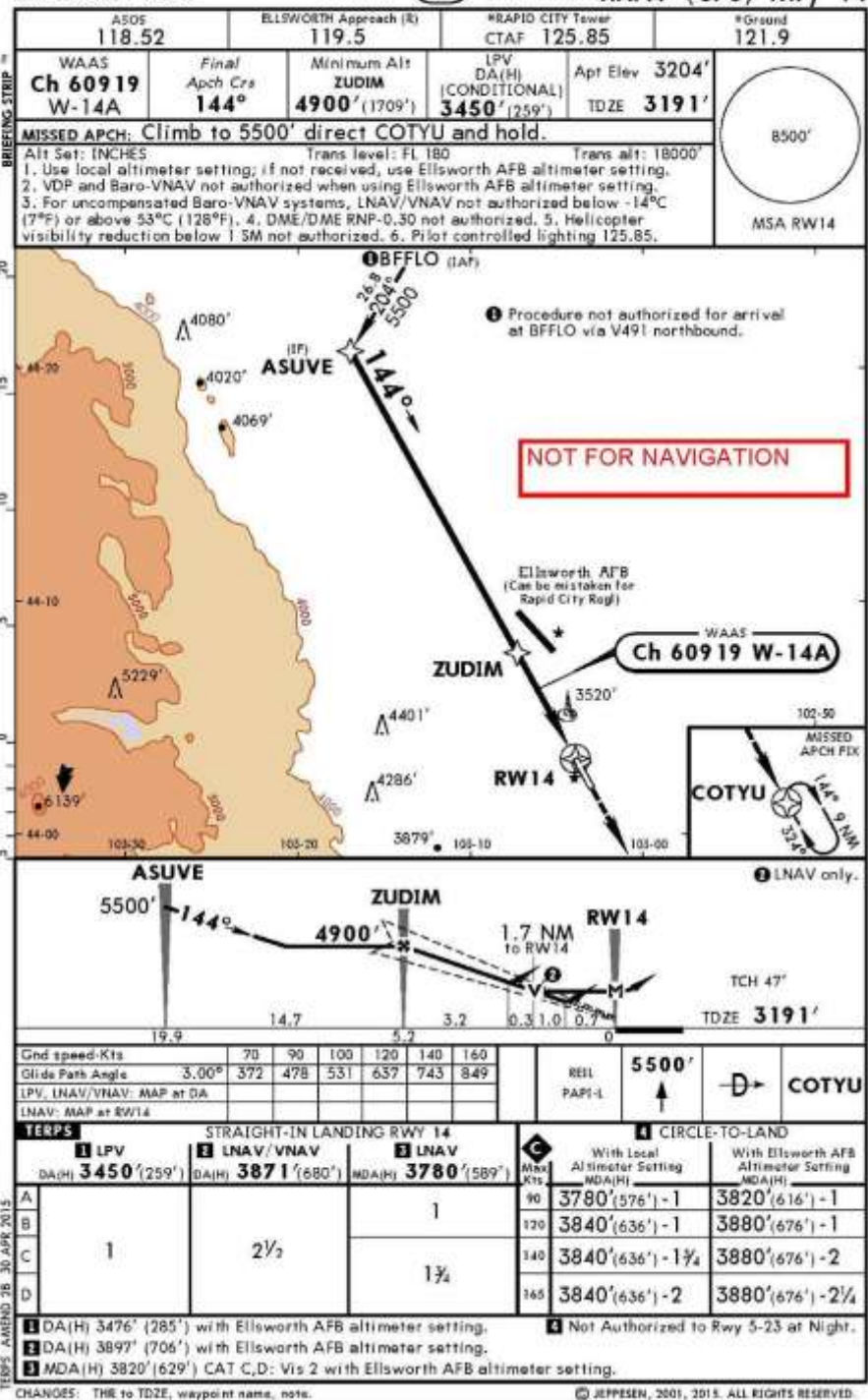


Figure 5: RAP RNAV (GPS) 14 Approach Chart

9.2 Ellsworth Air Force Base (RCA)

Ellsworth Air Force Base was located 5 miles northeast of Rapid City, South Dakota, had a field elevation of 3,276 feet msl, and was located at a latitude/longitude of N44°08.7'/W103°06.2'. The airport was owned by the United States Air Force. The airport was serviced by an Air Force Air Traffic Control Tower that was in operation on the day of the incident from 0800 to 2100 local time. The airport was also equipped with a military airport beacon,⁵² which operated from sunset to sunrise.

9.2.1 RCA Runway Information

RCA had a single runway designated as 13/31. Runway 13/31 was 13,497 feet long and 300 feet wide, the surface was concrete and grooved. Both runways had a 4-light PAPI located on the left side of the runway with a 3.00-degree glide path angle, HIRL, ALSF-1⁵³, and REIL. Each runway was served by an ILS approach.

9.2.2 RCA Charts⁵⁴

⁵² Source: Pilot's Handbook of Aeronautical Knowledge Chapter 13 Airport Operations "Some of the most common beacons are: flashing white and green for civilian land airports; - flashing white and yellow for a water airport; - flashing white, yellow, and green for a heliport; and - two quick white flashes alternating with a green flash identifying a military airport."

⁵³ Source: Aeronautical Information Manual, Pilot/Controller Glossary "ALSF-1 – Approach Light System with Sequenced Flashing Lights in ILS Cat-1 configuration."

⁵⁴ See Attachment 8 - RCA Charts

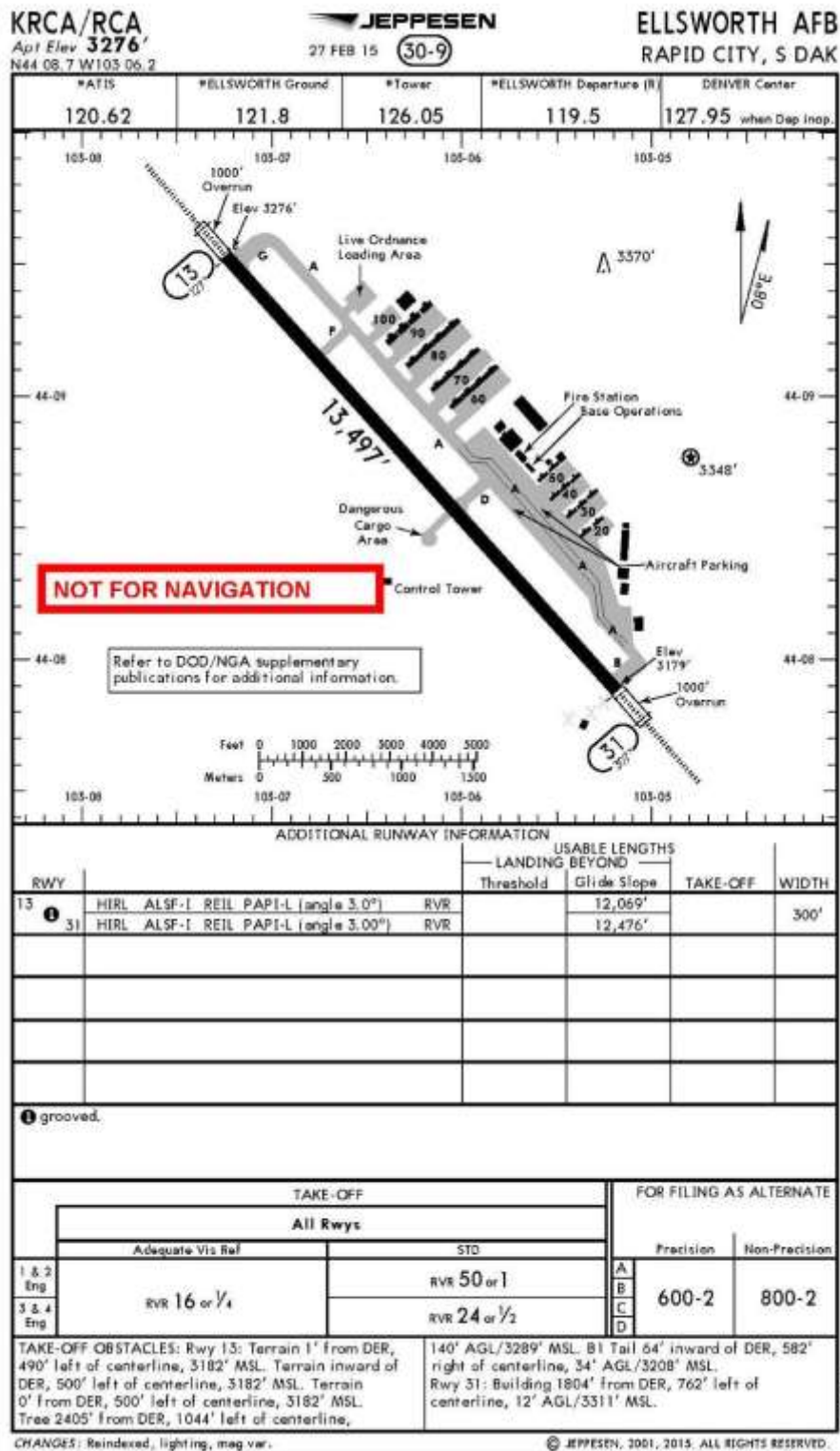


Figure 6: RCA Airport Diagram Chart

KRCA/RCA
RAPID CITY, S DAK

JEPPESEN
22 MAY 15 (31-1) E14 28 May

ELLSWORTH AFB
LS or LOC Y Rwy 13

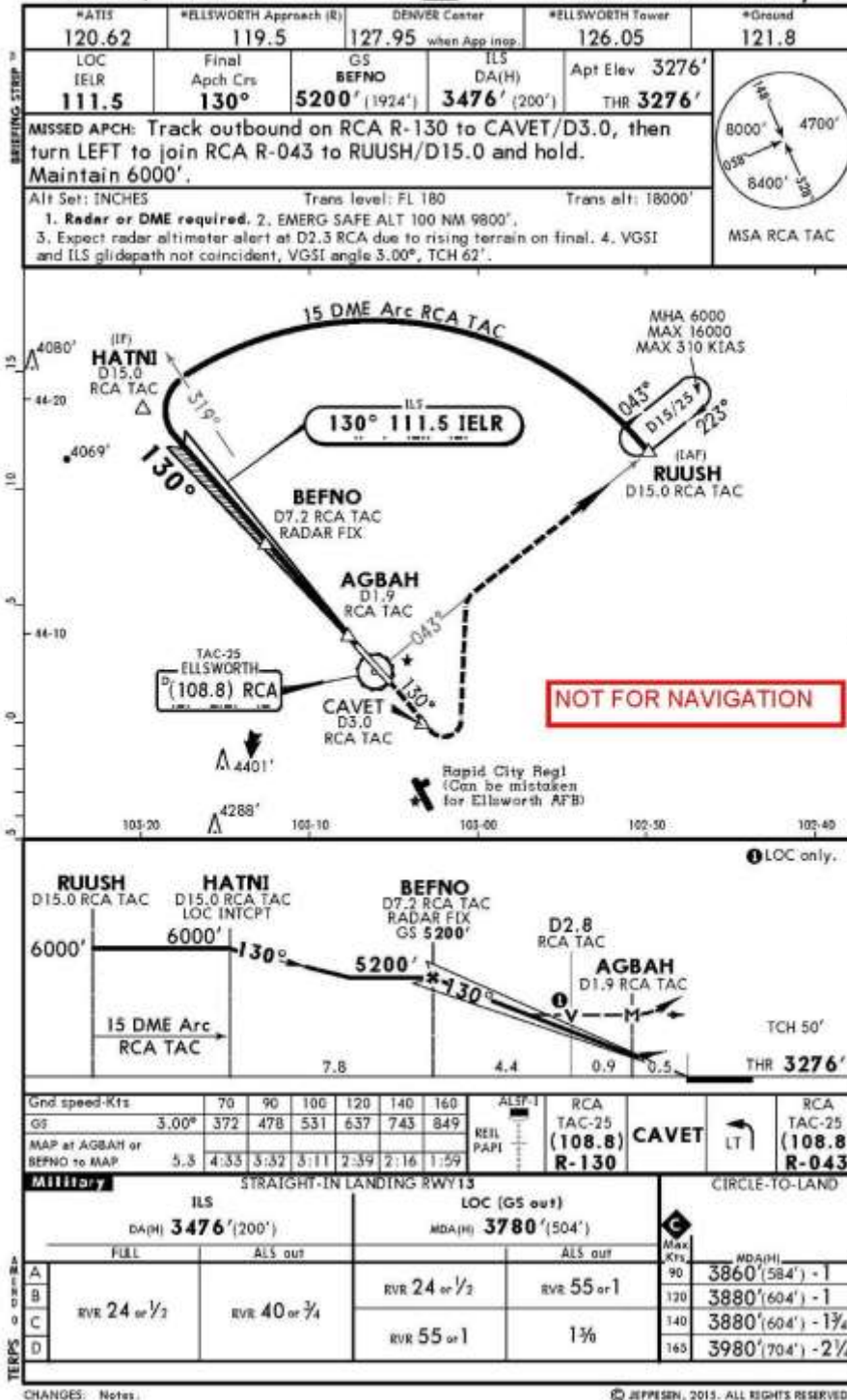


Figure 7: RCA ILS 13 Approach Chart

9.3 Delta Air Lines' Operational Specific 10-7 and 10-7a Pages

Delta Air Lines began service into RAP via the merger with Western Airlines in 1987. Delta Air Lines provided Delta pilots with operational specific information on airports that are served by Delta Air Lines. The information is provided as a 10-7 page, also known at Delta as the “green page,” within the Jeppesen Chart structure. The information provided by the 10-7 charts includes operation frequency, gate number information at the specific airport, airport specific procedures for departures and arrivals, general information, and Special Notes. The 10-7 page for RAP provided within the special notes section the following information:

SPECIAL NOTES

CAUTION

Ellsworth AFB lies northwest of RAP on final approach for Rwy 14. These airports have similar runway alignment and can be mistaken for each other.

Airport Operations Without An Operating Control Tower

- **Tower Hours:** 0600-2300 LT
- Refer to AM SUP, 3-Ops Specs, Operations At Airports Without An Operating Control Tower.
- ASOS available via VHF.
- Closeout/Activate Flight Plan with Center or FSS: 1-888-766-8267

Figure 8: Delta 10-7 Chart [Excerpt]

The 10-7A page for RAP provided a caution under the “Arrivals” section with the following information:

ARRIVALS

CAUTION

Utilize ILS glideslope and/or PAPI guidance to avoid visual illusions due to sloping terrain on Rwy 14 and 32.

Snow Removal: When tower is closed, if snow removal is in progress, announce ETA on CTAF as early as possible in order to alert snow plow crews.

Figure 9: Delta 10-7A Chart [Excerpt]

10.0 Company Overview

Delta Air Lines, Inc. operated Delta Air Lines (“Delta”) and Delta Shuttle. Delta Air Lines along with their code share agreements provided scheduled air transportation both within the United States and international markets.

According to the Delta Air Lines Operation Specification A001-1, Delta Air Lines was authorized to conduct operations in accordance with FAA-approved Operation Specification, certificate number DALA026A. Delta was authorized to conducted Domestic, Flag, Supplemental operations, and *14 CFR Part 91* flights. The following items document the operations Delta Air Lines was authorized to conduct:

- Delta Air Lines OpSpecs
- Delta Air Lines Flight Control Operations Manual
- Delta Air Lines Flight Operations Manual
- FAA-approved manuals and programs

Delta Air Lines was based in Atlanta, Georgia. Delta Air Lines began in 1924 as a crop-dusting operation and in 1929 began operating its first passenger flights from Dallas, Texas to Jackson, Mississippi, via Shreveport and Monroe, Louisiana. In 2008 Northwest Airlines merged with Delta and began a single operation on January 31, 2009. Delta began operating A-320 series aircraft as part of the merger.⁵⁵ As of July 1, 2016, Delta had a total of 820 aircraft of which 150 were considered for “Transoceanic” use, 620 were considered for “domestic” use, and 69 of those were the A320-200 series aircraft.

As of July 27, 2016, Delta had approximately 80,000 employees, of which 13,099 were pilots, who were based at one of nine pilot bases, one of which was the SLC base.

10.1 Management Organization

Delta’s Senior Vice-President of Flight Operations was responsible for both the flying operations of the airline and the training of the airline’s flight crews. This position had the following divisions report to him: Vice-President of Flying Operations & Chief Pilot, Managing Director of Flight Training, Managing Director Technical & Operations Support, and Managing Director of Crew Resources & Schedules.

11.0 Relevant Systems

11.1 Electronic Flight Instrument System (EFIS)

The incident airplane was an Airbus A-320-212 airplane, equipped with an electronic flight instrumentation system. The system included 6 flat panel displays, of which 2 were considered the Primary Flight Displays (PFD) and 2 were considered Navigation Displays (ND), which provided flight and navigation information in a digital format. The center two screens make up the Electronic Centralized Aircraft Monitor (ECAM) system.

⁵⁵ Source: <http://www.deltamuseum.org/exhibits/delta-history>

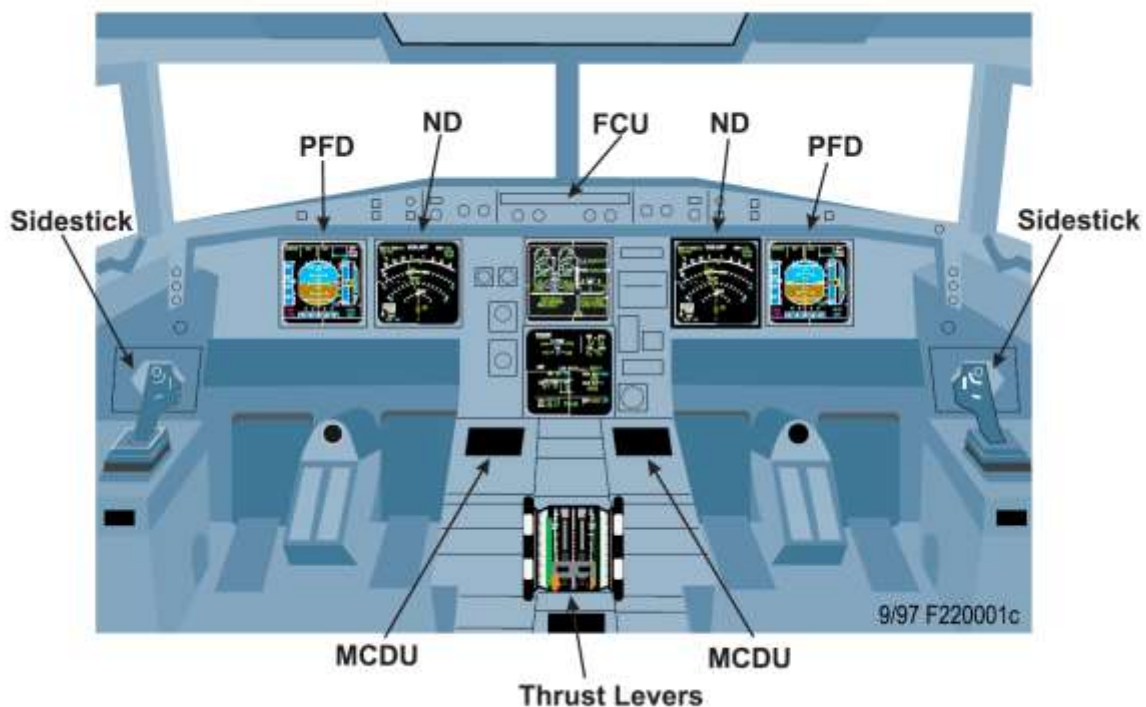


Figure 10: Cockpit EFIS Layout Diagram⁵⁶

11.2 Primary Flight Display

According to the Delta Air Lines Airbus 319/320 Operations Manual Volume 2, Chapter 31 “Flight Instruments,” the PFDs were the outer display unit on both the captain’s and first officer’s instrument panels. Information displayed on the PFD consists of the following:

- Aircraft attitude
- Flight director commands,
- Indicated airspeed,
- Aircraft heading and/or track
- Aircraft altitude (MSL and AGL),
- Aircraft vertical velocity
- Traffic alert and Collision Avoidance System (TCAS) command,
- Vertical path indications
- ILS information, and
- Flight Mode Annunciations (FMA).

11.3 Navigation Display (ND)

According to the Delta Air Lines Airbus 319/320 Operations Manual, Volume 2, Chapter 31 “Flight Instruments,” the NDs were located inboard of each PFD on the instrument panel. Information included on the ND consists of the following:

⁵⁶ Source Delta Air Lines Airbus 319/320 Operations Manual Volume 2 Chapter 22

Range markings,
Flight plan,
Navigation aids,
Weather radar,
TCAS displays
Position,
Heading, and
Speeds (TAS⁵⁷ and GS⁵⁸)

Navigation information can be depicted on the ND in 5 different modes. The modes are selected with the EFIS control panel. The modes are ROSE ILS, ROSE VOR, ROSE NAV, ARC, and PLAN.

Certain information can be displayed in all ND map modes (ROSE NAV, ARC, and PLAN). This information is:

The aircraft position symbol,
The aircraft heading,
The selected heading (or track),
Ground speed,
True airspeed,
Wind direction and speed,
The selected navaid information,
The TO waypoint bearing, range, and ETA⁵⁹
The selected approach, and
The chronometer display

11.3.1 ND ROSE VOR Mode⁶⁰

The ROSE VOR mode provides a VOR display similar to a conventional HSI⁶¹ as well as additional VOR information.



Figure 11: ROSE VOR Mode⁶²

⁵⁷ True Airspeed

⁵⁸ Ground speed

⁵⁹ Estimated Time of Arrival

⁶⁰ Source: Delta Air Lines' A319/320 Operations Manual Volume 2, Chapter 31 "Flight Instruments" pg. 31.20.55

⁶¹ Horizontal Situation Indicator

11.3.2 ND ROSE NAV Mode⁶³

The ROSE NAV mode provides:

A depiction of the aircraft position with reference to the flight plan inserted into the FMS, and

Additional information associated with the flight plan.

The ROSE NAV mode is depicted with a full compass rose oriented to the aircraft heading. This mode is particularly useful:

For maintaining orientation when being vectored near an airport prior to approach, and

When performing NDB and VOR approaches, allowing the head and tail of the bearing pointers to be monitored.

Five different types of flight plans can be displayed. Each type of flight plan can be recognized by the color used to depict the flight plan segment. The color of the ND flight plan corresponds to the color of the MCDU flight plan segment. The flight plane types are the:

Active flight plan,

Secondary flight plan.,

Temporary flight plan,

Alternate flight plan, and

Missed approach



Figure 12: ROSE NAV Display⁶⁴

Airports and Runways

⁶² Source: Delta Air Lines A319/320 Operations Manual Volume 2 pg. 31.20.42

⁶³ Source: Delta Air Lines A319/320 Operations Manual Volume 2 Chapter 31 "Flight Instruments" pp. 31.20.55 thru 31.20.65

⁶⁴ Source: Delta Air Lines A319/320 Operations Manual Volume 2 Chapter 31 "Flight Instruments" pg. 31.20.45

Destination Runway – When entered via the MCDU, the destination runway and the runway identifier are depicted in white. In some cases, parallel or crossing runways are also depicted.

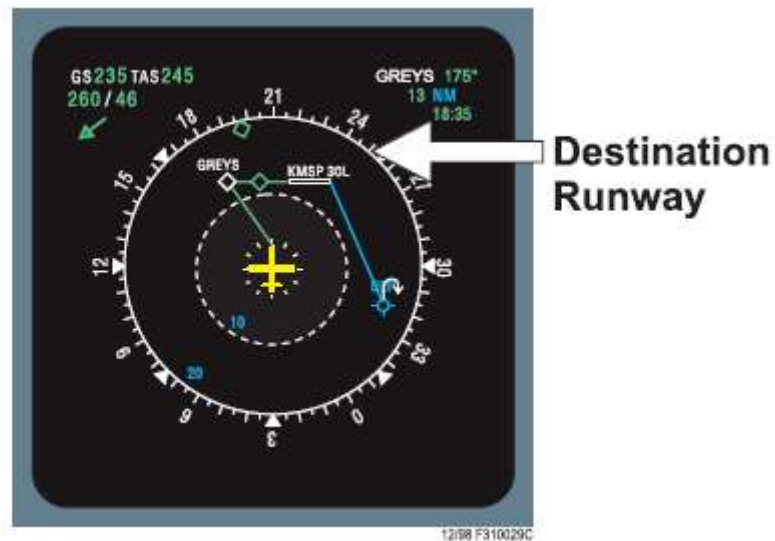


Figure 13: ROSE NAV Display with Runway⁶⁵

11.4 EFIS Color Codes

According to the Delta Air Lines, Airbus 319/320 Operations Manual, Volume 2 Chapter 31, colors are used on the EFIS displays to depict the importance of the indication, message, or failure, or to separate information into groups. In general, the colors correspond to colors used on the MCDU. The general rules for colors are as follows:

RED- indicates a failure or condition which requires immediate crew response.

AMBER – indicates a failure or condition requiring crew awareness but not immediate response.

GREEN – indicates engaged flight guidance modes, flight director commands, NDB⁶⁶ navaid information, and FMGC⁶⁷ navigation information.

WHITE – indicates titles, display scales, and VOR navaid information

BLUE – indicates armed flight guidance modes, VOR/CDI⁶⁸, and tuned navaid display.

MAGENTA – indicates messages and indications which identify flight plan constraints, and to depict ILS navaid information.

12.0 Manuals and Guidance Material

Delta Air Lines was required to keep current an approved airplane flight manual for each type of airplane that it operates. Manuals required to be onboard the aircraft were specified in the FOM.

⁶⁵ Source: Delta Air Lines A319/320 Operations Manual Volume 2 pg. 31.20.64

⁶⁶ Non-Directional Beacon

⁶⁷ Flight Management Guidance Computer

⁶⁸ Course Deviation Indication

12.1 Approach Briefing

The Delta Air Lines' Flight Operations Manual Section 3.3 "Operational Policy – Communication," dated January 14, 2016, stated the following:

The PF will conduct an approach briefing as soon as adequate information is available and while pilot workload is at a minimum. If transfer of control is required due to the approach required, e.g. CAT II/III, it should be completed in conjunction with the approach brief. The approach briefing should be completed prior to top of descent. If a runway change occurs after the approach briefing has been completed, re-brief the approach accordingly.

- *Positive confirmation of the new runway must be established for last minute runway changes. Retune navigation aids and set the inbound course*
- *Altimeter bugs may be changed to reflect a modified approach clearance to the same runway.*

Note: *Refer to Volume I, section NP.11 and NP.20 for guidance on briefing runway changes for landing.*

For all approaches, the pilot flying should consider and brief the appropriate items from the NATS guide below. If an approach is to be flown in actual instrument conditions or night VMC, a complete approach plate briefing must be conducted.

The acronym NATS identifies each major category of the approach briefing.

- *NOTAMS.*
 - *ATIS advisories.*
 - *Flight plan messages.*
 - *CHART CHANGE NOTICES.*
- *Arrival/Approach chart/Automation.*
 - *Weather/wind considerations.*
 - *Arrival airspeed and altitude restrictions.*
 - *Designated approach/runway*
 - *Pertinent runway information (reference 10/20-9A page):*
 - *Approach and runway lighting,*
 - *Usable landing distance,*
 - *Runway conditions affecting stopping distance (ungrooved/contaminated), and*
 - *Non-standard runway width.*
 - *Type of approach, including level of automation to be used.*
 - *Jeppesen approach chart number and date.*
 - *Navigation aid(s), frequency/runway identification.*
 - *Inbound course.*
 - *Initial approach altitude, as required.*
 - *FAP or FAF altitude.*
 - *Barometric altitude at marker beacon, as required.*

- *Approach minima (MDA, DA, DDA, DH, AH).*
- *Radio/barometric altimeter bug settings.*
- *Missed approach plan, including the go-around procedure, callouts and the maneuver.*
- *Transition level/height, if other than FL180, Terrain considerations, and Taxi considerations:*
 - *Brief a taxi plan. Use the taxi chart to brief the expected route, hot spots, hold short points, and any abnormalities (e.g. construction on a 10-8 page). Include in the briefing a situation where another runway might be crossed.*
- *Special Pages (Airway Manual).*

12.1.1 Runway, Intersection, Departure, Performance Data, or Approach Changes, or Go-Around

The Delta A319/320/321 Operations Manual “Normal Procedures” Section NP.11 “Normal Checklist Instructions” stated:

Landing

In the event a runway or approach change occurs after completing a checklist the pilot flying (PF) should call for the runway/approach change items. After the necessary procedural steps are accomplished, the pilot monitoring (PM) will verbalize each change item (if not previously briefed) by stating the challenge to the items. The designated crewmember(s) will respond with either:

- *“NO CHANGE” for an item, or*
- *The appropriate checklist response for the item that changed.*

Note: *If the landing runway assignment is changed and the captain determines the runway change can be accomplished visually, the captain may choose to waive the runway change items.*

12.1.2 Approach Procedure

The Delta A319/320/321 Operations Manual “Normal Procedure – Amplified Procedures” Section NP 20 provided the following chart:

Pilot Flying	Pilot Monitoring
Approaching transition level:	
	If other than FL 180, Call "TRANSITION LEVEL."
• Altimeters - Set local altimeter setting	

Pilot Flying	Pilot Monitoring
When arrival, approach, or runway changes prior to landing:	
• FMS data must be modified. • After updating/verifying any changed items, complete the Runway Change boxed items for the Descent and Approach checklists and their associated procedures. Note: If the landing runway assignment is changed and the captain determines the runway change can be accomplished visually, the captain may choose to waive the "runway change" items.	

Pilot Flying	Pilot Monitoring
• Anti-Ice - As required	
Before descending through approximately 10,000 feet AFE:	
• Flight and navigation instruments - Set • Verify correct arrival and approach selected in FMS.	
At approximately 10,000 feet AFE:	
• (C) SEAT BELTS switch - Cycle OFF-ON to sound cabin chime twice.	
• FMS flight phase - Activate APPR PHASE, as desired.	
Note: This action may be delayed if the use of managed speed is desired to comply with speed constraints on the arrival.	
Call "APPROACH CHECKLIST."	Accomplish the Approach checklist.

Approach Checklist

- Flight & nav instruments verified C&F
Ensure correct arrival and approach procedures are entered.
- Cabin notification complete C
Ensure that the cabin chime signal has been sounded twice.
- FMS flight phase APPR/DES PM
Ensure the desired FMS flight phase is active on the PERF page.
- Altimeters ____, xckd C&F
Ensure the captain, first officer, and standby altimeter/ISIS barometric settings and barometric reference (IN or HPA) are correctly set. Verbalize the local altimeter setting.

Figure 14: Amplified Approach Procedures⁶⁹

⁶⁹ Source: A319/320/321 Operations Manual pp NP.20.53-NP.20.54

12.2 Visual Approach

The Delta OM, “Normal Operational Information – Approach Guidance⁷⁰” stated the following:

The following guidance supplements visual approach preparations. FMS guidance is an aid to promote more precise ground track and altitude control. Do not sacrifice outside visual vigilance while using FMS capabilities.

*Company Page and
Attention All Users page.....Reference as applicable
Autopilot..... As desired
FMS approach procedure.....Select and verify
RNAV Visuals are normally coded in the FMS database as RNV RWYXX-V*

Charted Visual Approaches may include waypoints or reference points that differ by name from FMS coded waypoints.

*RNV RWY-V glidepath angles may exceed 3.0 degrees
CSTR pb.....Select
EFIS (I)LS pb.....De-select
When cleared for the approach:
APPR pb..... Select
Note: With RNV Approach procedure selected from the Nav Database, LOC-G/S modes will not arm regardless of ILS tuning status.*

When approaching the descent point:

The blue descent arrow indicates FINAL will engage when the descending leg of the vertical profile (“brick”) is intercepted.

Correct TO waypoint..... Verify

*No later than 1,000 feet AGL:
Missed approach altitude..... Set as desired*

*No later than 500 feet HAA:
Autopilot.....Disengage*

*Additional information:
If missed approach instruction are not published, straight-out guidance may be inserted into the approach for crew convenience.*

12.2.1 Visual Approach Training

A review of the Delta Air Lines Flight Crew Training Manual (FCTM) stated the following

⁷⁰ Source: Delta A319/320/321 Operations Manual pp NOI.3.17 and NOI.3.18

about visual approaches⁷¹:

Visual Approach – General

The recommended landing approach path is approximately 3°. Once the final approach is established, the aircraft configuration remains fixed and only small adjustments to the glide path and approach speed are necessary. This results in the same approach profile under all conditions.

Downwind and Base Leg

When entering the traffic pattern, airspeed should be “S” speed, Flaps 1. If a slower speed is required, select Flaps 2 and maintain “F” speed. Turn off the flight directors if not being followed.

If possible, maintain 1,500’ AFE⁷² on downwind. Turn base leg so as to have a final of no less than three miles. Begin descent so as to intercept a 3° descent path to the runway. If the downwind leg is extended, maintain 1,500’ AFE until intercepting the 3° descent path, using the 300 feet per mile rule of thumb. If the final approach is five miles long, for example, leave 1,500’ AFE at the point in the base turn that allows the aircraft to rollout on final at 1,500’ AFE.

The landing configuration should normally be established by five miles from touchdown. Unless a long final is anticipated, this may require completing the flaps and gear sequence while in the base turn. If the aircraft does not arrive on final on the desired glide path, make the necessary adjustments back to the profile as early as possible to comply with the stabilized approach criteria.

Internal Visual Cues

Select the ILS or VFR approach to the intended runway. Make the runway (or other appropriate point on final) the active waypoint and set the intercept course. Use the cross track indication to establish the desired downwind leg displacement. Use the glideslope or donut to reference the vertical path to the runway. Reference the RWY symbol on the ND in rose nav mode (10-mile scale) for the turn to base leg. Initiate the turn to final when the cross-track error is approximately 1.5.

Final Approach

Once established on final approach and on glide path, select the flight directors back on and arm the APPR pb and use the ILS for guidance on final if available. If there is no ILS to the runway, visually maneuver to the runway using all available cues (e.g., VASI⁷³, PFD, descent path indicator). Turn off the flight

⁷¹ Source FCTM pg. 5.45

⁷² Above Field Elevation

⁷³ Visual Approach Slope Indicator

directors if not being followed, select FPA if desired.

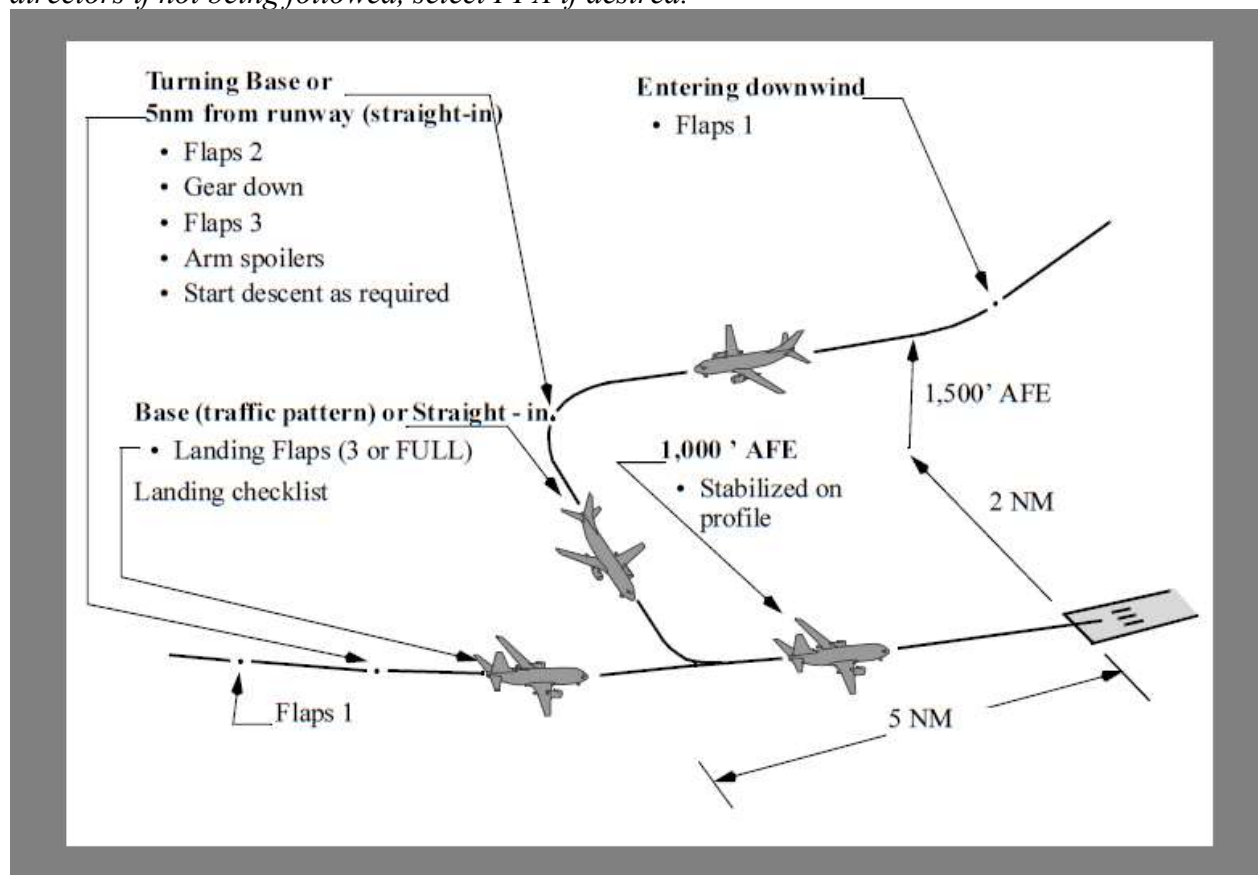


Figure 15: Visual Approach Procedures⁷⁴

12.3 High Energy Approach

The Delta Air Lines' A319/320/321 Flight Crew Training Manual, page 5.46 "High Energy Approach" stated the following:

The efficiency of the A319/320/321's wing combined with the autopilot/autothrust relationship make it difficult to 'go down' and 'slow down' at the same time. To expedite traffic flow, ATC often clears aircraft for a visual approach when the aircraft is high and/or fast in relation to its distance from the airport. There are varying extremes of 'slam-dunks' and, therefore, a variety of methods a pilot can employ to successfully execute a stabilized approach.

The technique detailed below is by no means a substitute for adequate planning or lack of situational awareness. In the most extreme 'slam-dunk' situations, the best rate of descent (approx. 3,000'/min and 1,000'/nm) can be achieved with the gear down, flaps 3 (flaps 2 A321), and full speed brakes (autopilot must be off for an A320) at a speed of 170-180 knots with idle thrust. Though the initial portion of this technique is performed with the A/P and F/Ds on, there may be situations where keeping this automation engaged throughout the entire maneuver may not be desirable. In such cases, the pilot may simply continue to the 'if a more aggressive descent desired' section.

⁷⁴ Source: Flight Crew Training Manual pg. 5.43

Assuming the approach phase has been activated, a technique that works well is; 'Slow Down' 2' (flaps 2) Go Down.'

Procedure:

- *Select 170 KIAS*
- *Extend the landing gear at 240 knots or below.*
- *Set a target altitude (typically FAF altitude, but no lower than 1,5000 feet HAT⁷⁵).*
- *Extend the flaps to 1 & 2 on schedule.*
- *At 190 (A321 205 knots) knots, pull OP DES*
- *Extend the flaps to 3 at 175 knots (A319/320 only; A321 leave flaps 2).*
- *Extend speed brakes – FULL (1/2 on A320)*
- *Maintain VFE – 10 knots using SEL SPED*
- *Arm the APPR p/b if applicable.*

If a more aggressive descent desired (A320 only):

- *Disconnect A/P and extend speedbrakes FULL.*
- *If maneuvering without referencing FD's; command them off and activate managed speed (to keep thrust at idle).*
- *Descent, at VFE-10 knots (approximately 5° nose down).*

Upon intercepting the vertical path:

- *Select managed speed.*
- *Stow the Speed Brakes when extra drag is no longer required. It may be necessary to leave the speed brakes extended until reaching VAPP in order to lose the last 15 knots and achieve the stabilized approach criteria.*
- *Turn on the F/Ds and select the APPR pb (if an instrument approach is available) or select FPA if desired.*
- *Ensure landing flaps set.*

At this point, autothrust will maintain VAPP and the flight directors will be in HDG-V/S until capturing the ILS.

This profile requires approximately 13 nm in a no wind environment to lose 7,000 feet. More specifically:

- *Slowing from 250 KIAS to 175 KIAS in level flight at 10,000 feet with landing gear down, full speedbrakes, and extending the flaps to 3 will take approximately 4 nm.*
- *The descent from 10,000 feet to 3,000 feet at 175 KIAS in Open Descent will result in an average descent rate of 3,000 fpm and will take approximately 8 nm.*
- *Slowing from 175 KIAS to VAPP in level flight at 3,000 feet with gear down, full speedbrakes, and Flaps FULL will take approximately 1 nm.*

⁷⁵ Height Above Touchdown

12.4 Missed Approach, Go-Around, Rejected Landing Guidance

The Delta FOM, Chapter 3 “Operations Policy” pp. 3.4.10 and 3.4.11 stated in part:

The PF, PM, and relief pilot(s) are responsible for monitoring the approach. If any flight crewmember recognizes conditions outside the stabilized approach criteria a “Go-Around” must be called. If a “Go-Around” is called by any flight crewmember, the “Go-Around” must be honored.

Refer to specific aircraft FCTM, QRH, and Volume 1 for Missed Approach/Go-Around/Rejected Landing procedure....

If an ATC clearance would result in an unstabilized approach, do not accept the clearance, and submit an ASR

12.5 Stabilized Approach

The Delta OM, Chapter “Normal Procedures” pg. NP.12.3 stated, in part:

Delta defines a stabilized approach as maintaining a stable speed, descent rate, and lateral flight path while in the landing configuration.

WARNING: At any altitude, if the following stabilized approach criteria cannot be established and maintained, initiate a go-around. Do not attempt to land from an unstable approach.

No lower than 1000 feet AFE:

- *Be fully configured for landing (gear and landing flaps extended).*
- *Maintain a stabilized descent rate not to exceed 1,000 fpm.*
- *Be aligned with the intended landing runway.*

No lower than 500 feet AFE:

- *Be on target airspeed.*
- *The engines are stabilized at the thrust setting required to maintain the desired airspeed and rate of descent.*

Crossing the Runway Threshold:

- *Position to make a normal landing in the touchdown zone.*

12.6 Operations Specification

Operations Specifications C070 “Airport Authorized for Scheduled Operations” stated the following:

The certificate holder is authorized to conduct scheduled passenger and cargo operations between the regular, refueling, and provisional airports specified in the following table. Except for alternate airports, the certificate holder shall not use any other airport in the conduct of scheduled passenger and cargo operations. The certificate holder shall

maintain a list of alternate airports which can be used and shall not use any alternate airport unless it is suitable for the type of aircraft being used and the kind of operation being conducted.

According to the “Airports Authorized for Scheduled Operations” listed under Operations Specifications C070, Rapid City Regional (RAP) was an approved Regular Airport⁷⁶.

13.0 Aviation Safety Reporting System (ASRS)⁷⁷ Reports

A review of wrong airport landing data provided by ASRS revealed that in the previous 20 years approximately 600 wrong airport landings or near landings had been voluntarily reported. Of those approximate 600 voluntarily reported events, 6 occurred while attempting to land at RAP and resulted in a landing or landing attempt at RCA. Four of those reported were conducted by general aviation aircraft, which consisted of piston and turbojet aircraft, and two of those events were done during commercial air carrier passenger operations.

14.0 Recent Investigated Wrong Airport Landings

14.1 DCA14IA037

On January 12, 2014, about 1808 CST (0008Z), Southwest Airlines flight 4013 (SWA4013), a Boeing 737-7H4, registration N272WN, mistakenly landed at M. Graham Clark Downtown Airport (KPLK), Branson, Missouri, which was 6 miles north of the intended destination, Branson Airport (KBBG), Branson, Missouri. The flight had been cleared to land on runway 144 at KBBG, which was 7,140 feet long; however, landed on runway 12 at KPLK, which was 3,738 feet long. Night visual meteorological conditions prevailed at the time. The flight crew visually acquired the airport and completed the flight via visual reference. However, the flight crew failed to comply with the company guidance to monitor all available navigational information and subsequently indicated that they had misidentified KPLK as KBBG.

14.2 DCA13IA016

On November 21, 2013, about 2120 local time, a Boeing 747-400LCF (Dreamlifter) landed at the wrong airport in Wichita, Kansas, in night VMC conditions. The airplane was being operated as a cargo flight from John F. Kennedy International Airport, Jamaica, New York, to McConnell Air Force Base, Wichita, Kansas. Instead, the flight crew mistakenly landed the airplane at Colonel James Jabara Airport, Wichita, Kansas. The flight crew indicated that during their approach to the airport, they saw runway lights that they misidentified as McConnell Air Force Base. The flight was cleared for the RNAV GPS 19L approach, and the flight crew saw Jabara but misidentified it as McConnell. The flight crew then completed the flight by visual reference to the Jabara runway. Once on the ground at Jabara, the flight crew was uncertain of their location until confirmed by the McConnell Air Force Base tower controller. The Jabara runway was 6,101 feet long, whereas McConnell runways were 12,000 feet long.

⁷⁶ Regular Airport: An airport approved under scheduled service to a community as the regular stop to that community. Source: Delta Air Lines Operations Specifications C070 b

⁷⁷ ASRA collects, analyzes, and responds to voluntarily submitted aviation safety incident reports in order to lessen the likelihood of aviation accident. Source: <https://asrs.arc.nasa.gov/overview/summary.html>

15.0 Previous Recommendations and Guidance

In April, 2014, the NTSB issued a Safety Alert for landings at the wrong airport. In the Safety Alert, pilots were guided to use the following tools to prevent landings at the wrong airport:

Adhere to standard operating procedures (SOPs), verify the airplane's position relative to the destination airport, and use available cockpit instrumentation to verify that you are landing at the correct airport.

Maintain extra vigilance when identifying the destination airport at night and when landing at an airport with others in close proximity.

Be familiar with and include in your approach briefing the destination airport's layout and relationship to other ground features; available lighting such as visual glideslope indicators, approach light systems, and runway lighting; and instrument approaches.

Use the most precise navigational aids available in conjunction with a visual approach when verifying the destination airport.

Confirm that you have correctly identified the destination airport before reporting the airport or runway is in sight.

F. LIST OF ATTACHMENTS

Attachment 1: Flight Crew Interview Summaries

Attachment 2: Flight Crew History

Attachment 3: ACARS Dispatch Release MSP-RAP

Attachment 4: ACARS Dispatch Release RCA-RAP

Attachment 5: ACARS Communication

Attachment 6: Delta 10-7 Airport Pages

Attachment 7: RAP Charts

Attachment 8: RCA Charts

Attachment 9: U.S. Naval Observatory Sun and Moon Data for RAP

Attachment 10: NASA ASRS Reported Wrong Airport Landing Events for RAP

Attachment 11: Operations Group Party Members

Submitted by:

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