



NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

July 15, 2019

Group Chairman's Factual Report

OPERATIONAL FACTORS

DCA16IA215

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A. INCIDENT

Location: Wood, South Dakota
Date: August 11, 2016
Time: 2010 central daylight time (0110Z)¹
Airplane: Airbus A-320, N632JB

B. OPERATIONAL FACTORS GROUP

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C. SUMMARY

On August 11, 2016, about 2010 central daylight time, JetBlue Airways flight 429, an Airbus A-320-232, N632JB, encountered severe turbulence while in cruise flight at flight level (FL) 320², resulting in minor damage to the airplane and minor injuries to the 3 flight attendants and 28 passengers. The flight subsequently declared an emergency and diverted to the Rapid City Regional Airport (RAP), Rapid City, South Dakota. There were 2 pilots, 3 flight attendants, and 146 passengers on board. The flight was conducted under Title 14 *Code of Federal Regulations (CFR)* Part 121 as a regularly scheduled passenger flight from General Edward Lawrence Logan International Airport (BOS), Boston, Massachusetts to Sacramento International Airport (SMF), Sacramento, California. Day instrument meteorological conditions prevailed.

D. DETAILS OF THE INVESTIGATION

The Operational Factors Group did not launch on the investigation. Information was gathered from various sources, including interviews with the flightcrew, the incident dispatcher, and the incident dispatcher’s supervisor at the time of the incident, and written statements from the flight attendants.

¹ All times will be listed as central daylight time (CDT) unless otherwise noted. At the time of the incident CDT was universal time coordinate (Z) - 5 hours.

² A level of constant atmospheric pressure related to a reference datum of 29.92 inches of mercury, stated in three digits that represent hundreds of feet. Source: Aeronautical Information Manual “Pilot/Controller Glossary.”

E. FACTUAL INFORMATION

1.0 History of Flight

The flight was scheduled to depart BOS at 2125Z. According to a review of ACARS³ data, the flight release was generated at 1924Z. The flight had an original destination of SMF.

According to the incident flight's dispatcher, his workload was "heavy" for "one man," especially when he compared it to when he started at JetBlue in 2007⁴. He further stated that he was aware of the weather from the panhandle of Florida up through the upper midwest.

Flight 429 pushed back from the gate in BOS at 2125Z with two pilots, three flight attendants, and 146 passengers⁵. The flight departed the gate at BOS at the scheduled time, and then climbed to FL320⁶. The captain was the pilot flying (PF) and the first officer (FO) was the pilot monitoring (PM).

According to both crewmembers, the flight had done some deviations during cruise but the seatbelt sign was off for "a little while." They queried air traffic control if a higher altitude was smoother but decided to remain at FL320, as that was the reported smoother altitude. The onboard radar was depicting some precipitation near the Crazy Woman VOR⁷, and the captain informed the flight attendants of the upcoming weather and turned the seatbelt sign back on.

After the flight exited some of the precipitation that was depicted on their radar as green in color, or light precipitation, they observed a cumulonimbus cloud. They requested and were granted a left deviation; however, the airplane encountered the turbulence as it flew through the edge of the cloud. The FO stated that it "felt like they went up and then dropped" and the autopilot disconnected, which he reengaged during their descent into RAP, about 10,000 feet msl.

According to flight attendant statements and their interviews with the FAA, after the pilots had called and reported that the turbulence they were encountering would continue, they were instructed to "wrap things up." One of the flight attendants made a public address announcements to the passengers to remain seated with their seatbelts on. The turbulence continued for about 10 minutes and once it smoothed out one of the flight attendants got up from a flight attendant jumpseat to shut a lavatory door and went to address a flight attendant call light that was pressed by a passenger. The aircraft encountered turbulence again, which resulted in one flight attendant striking her head on the ceiling of the aircraft and another flight attendant falling onto the galley floor and subsequently being thrown into the air.

³ Aircraft Communication Addressing and Reporting System (ACARS) – a digital data link system for the transmission of messages between aircraft and ground stations via VHF, SATCOM, and/or HF (high frequency) (Source http://www.skybrary.aero/index.php/Aircraft_Communications_Addressing_and_Reporting_System).

⁴ SRCE: Attachment 2 - Dispatcher Interview Summaries, pg. 1.

⁵ According to information provided by JetBlue the composition was 122 adult passengers, 23 children, and 1 infant. Source Attachment 7 – JetBlue Aerodata Report.

⁶ FL320 is the height above mean sea level (msl) at standard atmospheric pressure measured in hundreds of feet (i.e. FL320 is 32,000 feet msl).

⁷ Very-High frequency Omnidirectional Range

Once both crewmembers determined that the airplane was under control, the captain contacted the flight attendants via the interphone and was informed that three of the flight attendants were injured. The captain decided to divert to RAP, transferred control of the airplane to the FO (who then remained pilot flying for the duration of the flight), and exited the cockpit to assess the injuries.

After returning to the cockpit, the captain sent a message via ACARS to their dispatcher that they were diverting to RAP, and continued as PM.

After the flight landed at RAP, the captain taxied the airplane to a gate where ambulances were standing by.

2.0 Flight Crew Information

The flight crew consisted of a captain, a first officer, and 3 flight attendants. The incident flight occurred on day 2 of a 4-day pairing. The first day the crew had a report time of 1727Z and operated two flights, with their day terminating at Baltimore/Washington International Thurgood Marshall Airport (BWI), Baltimore, Maryland at 0145Z. On the day of the incident they began their day at 1723Z with a deadhead⁸ flight from BWI to BOS, where they had a 96-minute layover before beginning the incident flight.

2.1 The Captain

The captain was 54 years old and based at John F. Kennedy International Airport (JFK), Jamaica, New York. His date of hire with JetBlue was March 4, 2009. He had been a captain on the Airbus for about 9 months. He reported that his total flight time was approximately 10,000 hours, of which approximately 800 hours were as pilot in command in the incident aircraft make and model.

While in his 30's he decided to become a pilot. His background included flight instructing for two years, flying a Beech King Air 200 for a local corporation, as well as flying Cessna Caravans for another corporation. He was subsequently hired to fly a Cessna CE560 Ultra airplane, then was hired by a regional airline flying EMB-145⁹ aircraft, and then hired by JetBlue Airways in 2009. He had a first-class medical certificate with a limitation to have glasses for near vision, and he reported that he was wearing them at the time of the incident. He had not flown with the incident FO prior to the incident pairing. He reported that he had an airplane accident around 2000 in which, while acting as a flight instructor, the student turned off the fuel to the operating engine during a single engine maneuver in a light twin airplane. The airplane subsequently ditched in a nearby lake.

The captain was current and qualified under JetBlue and FAA requirements. A review of the FAA PTRS¹⁰ database showed only the one accident, listed above, involving the captain.

⁸ Deadhead is a term used to describe crewmembers being repositioned while seated in the passenger cabin. They are considered on duty but not operating the flight

⁹ Embraer S.A. EMB-135, ER, EMB-135LR, EMB-135KE, EMB-135KL, EMB-135BJ, EMB-145, EMB-145ER, EMB-145MR, EMB-145LR, EMB-145XR, EMB-145MP, EMB-145EP. Source: FAA Order 8900.1 Figure 5-88.

¹⁰ PTRS – Program Tracking and Reporting Subsystem was a comprehensive information management and analysis system used in many Flight Standards Service job functions. It provided the means for the collection, storage, retrieval, and analysis of data resulting from the many different job functions performed by Aviation Safety

2.1.1 The Captain's Pilot Certification Record

Private Pilot – Airplane Single-Engine Land certificate was issued January 12, 1998.

Notice of Disapproval – Instrument Airplane was issued on July 18, 1998. Unsatisfactory items: Area of Operation (AOA) III. C – Holding Procedures – entry, AOA VI. C – ILS¹¹ Approach – descent below DH¹².

Private Pilot – Airplane Single-Engine Land, Instrument – Airplane certificate was issued on August 8, 1998.

Notice of Disapproval – Commercial Pilot was issued on October 31, 1998. Unsatisfactory items: Chandelles and eights on pylons.

Commercial Pilot – Airplane Single-Engine Land, Instrument Airplane certificate was issued December 15, 1998.

Notice of Disapproval – Commercial Multiengine Land was issued on February 25, 1999. Unsatisfactory Items: AOA IX – Engine failure during slow flight – Failed to retract gear and flaps, AOA IX – Circling approach – Circled to wrong runway, all other AOA's Sat – Go-arounds not performed.

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane certificate was issued on April 3, 1999.

Flight Instructor – Instrument Airplane certificate was issued on July 2, 1999.

Flight Instructor – Airplane Single-Engine, Instrument – Airplane certificate was issued on July 2, 1999.

Notice of Disapproval – Flight Instructor Airplane Multiengine was issued on July 3, 1999. Unsatisfactory items: AOA V, Task A - Systems; AOA XIV, Tasks E through G - Emphasis on Engine Out Drill; AOA XV, Task A – Crosswind Landings.

Flight Instructor – Airplane Single and Multiengine, Instrument – Airplane certificate was issued on July 8, 1999.

Ground Instructor – Advanced certificate was issued on September 21, 1999.

Notice of Disapproval – Airline Transport Pilot was issued on December 3, 2000. Unsatisfactory Items: AOA II thru IX (First Attempt)¹³.

Inspectors in the field, the regions, and at FAA headquarters. The system provided managers and inspectors with current data on airmen, air agencies, air operators, and many other facets of the air transportation system. Source: FAA Flight Standards Automation System "Program Tracking and Reporting Subsystem Procedures Manual Reissue" Chapter 1, Section 1 "HISTORY" 1. Introduction.

¹¹ Instrument Landing System

¹² Decision Height

Notice of Disapproval – Airline Transport Pilot was issued on December 15, 2000. Unsatisfactory Items: AOA II through IX (Second Attempt).

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane, Private Privileges – Rotorcraft Helicopter certificated was issued on January 23, 2001.

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane, Private Privileges – Rotorcraft Helicopter, Instrument Helicopter certificate was issued on May 1, 2001.

Commercial Pilot – Airplane Single and Multiengine Land, Rotorcraft Helicopter, Instrument Airplane and Helicopter certificate was issued on June 5, 2001.

Airline Transport Pilot – Airplane Multiengine Land, Commercial Privileges – Airplane Single-Engine Land, Rotorcraft-Helicopter, Instrument Helicopter certificate was issued July 5, 2001.

Airline Transport Pilot – Airplane Multiengine Land, Commercial Privileges – Airplane Single-Engine Land, Rotorcraft-Helicopter, Instrument Helicopter, Glider certificate was issued September 2, 2001.

Flight Instructor – Airplane Single and Multiengine, Instrument – Airplane, Glider certificate was issued on December 7, 2001.

Airline Transport Pilot – Airplane Single-Engine Land and Sea, Airplane Multiengine Land, Commercial Privileges – Rotorcraft-Helicopter, Instrument Helicopter, Glider certificate was issued February 25, 2002.

Airline Transport Pilot – Airplane Single-Engine Land and Sea, Airplane Multiengine Land and Sea, Commercial Privileges – Airplane Single-Engine Land, Rotorcraft-Helicopter, Instrument Helicopter certificate was issued February 27, 2002.

Airline Transport Pilot – Airplane Single-Engine Land and Sea, Airplane Multiengine Land and Sea, Rotorcraft-Helicopter Commercial Privileges - Glider certificate was issued July 20, 2005.

Ground Instructor – Advanced and Instrument certificate was issued on January 4, 2007.

Flight Instructor – Airplane Single and Multiengine, Instrument – Airplane, Rotorcraft-Helicopter, Instrument Airplane and Helicopter certificate was issued on July 22, 2005. Renewed May 3, 2007, May 19, 2009 and July 18, 2011.

Airline Transport Pilot – Airplane Single-Engine and Multiengine Land and Sea, Rotorcraft-Helicopter, ERJ¹⁴-170, ERJ-190; Commercial Privileges – Glider; Limitations – ERJ-170, ERJ-

¹³ The Areas of Operations II thru IX are associated with the Flight portion of the practical test; however, no information was noted explaining the disapproval in those areas for this disapproval notice and the subsequent disapproval notice dated December 15, 2000.

¹⁴ Embraer S.A. ERJ 170-100 STD, ERJ 170-100 LR, ERJ170-100 SU, ERJ 170-100 SE, ERJ 170-200 STD, ERJ

190 SIC¹⁵ Privileges Only, Circling Approach – VMC¹⁶ Only certificate was issued July 16, 2007.

Airline Transport Pilot – Airplane Single-Engine Land; Airplane Single-Engine Sea; Airplane Multiengine Land EMB-145, ERJ-170, ERJ-190; Airplane Multiengine Sea; Rotorcraft-Helicopter; Commercial Privileges – Glider; Limitations – English Proficient, EMB-145, ERJ-170, ERJ-190 SIC Privileges Only, Circling Approach – VMC Only certificate was issued March 18, 2008.

Airline Transport Pilot – Airplane Single-Engine Land; Airplane Single-Engine Sea; Airplane Multiengine Land EMB-145, ERJ-170, ERJ-190; Airplane Multiengine Sea; Rotorcraft-Helicopter; Commercial Privileges – Glider; Limitations – English Proficient, EMB-145, ERJ-170, ERJ-190 Circling Approach – VMC Only; EMB-145 SIC Privileges Only certificate was issued September 5, 2014.

Airline Transport Pilot – Airplane Single-Engine Land; Airplane Single-Engine Sea; Airplane Multiengine Land; A-320¹⁷, EMB-145, ERJ-170, ERJ-190; Airplane Multiengine Sea; Rotorcraft-Helicopter; Commercial Privileges – Glider; Limitations – English Proficient, EMB-145, ERJ-170, ERJ-190, A-320 Circling Approach – VMC Only; EMB-145 SIC Privileges Only certificate was issued October 28, 2015.

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

Airline Transport Pilot (issued October 28, 2015)

Airplane Single-Engine Land

Airplane Single-Engine Sea

Airplane Multiengine Land

Airplane Multiengine Sea

Rotorcraft – Helicopter

Type Ratings in the A-320, EMB-145, ERJ-170, ERJ-190

Commercial Pilot (issued July 20, 2005)

Glider

Medical Certificate – First-Class (issued May 20, 2016)

Limitations: Must have available glasses for near vision

2.1.3 The Captain's Training and Proficiency Checks Completed¹⁸

Date of Hire (JetBlue)	March 4, 2009
Initial Threat and Error Management (CRM)	March 9, 2009
Initial Severe Weather Avoidance	March 9, 2009

170-200 – LR, ERAJ 170-200 SU, ERJ 190-100 STD, ERJ 190-100 LR, ERJ 190-100 IGW, ERJ 190-100 ECJ, ERJ 190-200 STD, ERJ 190-200 LR, ERAJ 190-200 IGW. Source: FAA Order 8900.1 Figure 5-88.

¹⁵ Second-in-Command

¹⁶ Visual Meteorological Conditions

¹⁷ Airbus A318, A319, A-320, A-321 Airbus. Source FAA Order 8900.1 Figure 5-58.

¹⁸ Source: Attachment 4 – Flight Crew Training Records and Summaries.

Most Recent FAA Observation Check ¹⁹	September 22, 2014
Date Upgraded to Captain on A-320	November 9, 2015
A-320 Operating Experience (OE)	November 8, 2015
Most Recent Line Check	November 9, 2015
Captain Leadership Training “Leading Edge”	March 24, 2015
Spring QDL ²⁰	March 12, 2016

The captain was current and qualified under JetBlue and FAA requirements.

2.1.4 The Captain’s Flight Times

The captain’s flight times based on the captain’s interview and JetBlue Airways employment records:

Total pilot flying time ²¹	10,000
Total pilot flying time at JetBlue	3,953:18
Total Pilot-In-Command (PIC) time at JetBlue	943:44
Total A-320 flying time	627:45
Total A-320 PIC time	627:45
Total flying time last 24 hours ²²	4:05

2.1.5 The Captain’s 72-Hour History

According to the captain, he reported for the incident pairing the day prior about 1320 eastern daylight time (EDT)²³. The incident trip was a 4-day pairing and at the time of the incident they were on day 2 of the pairing. He had finished a 4-day pairing on the 8th of August and was on a day off the day prior to reporting for the incident pairing. The first day of the 4-day pairing concluded in Baltimore where he spent the night. The day of the incident he reported at the airport in Baltimore about 1340 EDT for a deadhead flight to BOS and then after a layover in BOS they began the incident flight.

2.2 The First Officer

The FO was 39 years old and based at JFK. His date of hire was March 18, 2015. He had been a FO at JetBlue for about 17 months. He reported his total flight time was approximately 5,700 hours, of which about 766 hours were in the Airbus A-320 series aircraft.

2.2.1 The First Officer’s Pilot Certification Record

Private Pilot – Airplane Single-Engine Land certificate was issued on November 17, 2002.

¹⁹ The observation was conducted in an ERJ-190 aircraft following upgrade training to captain on that aircraft.

²⁰ Spring Quarterly Distant Learning (QDL) included modules in the following areas: Severe Weather/Windshear, using the WSI app, weather radar (philosophy, tilt basics, tilt, operational strategies – enroute), thunderstorms, microbursts, hot weather operations, heavy rain, and summer operations.

²¹ An approximate time based on the Captain’s Interview summary – see Attachment 1 – Flight Crew Interview Summaries and Statements.

²² Includes the incident flight plus 48 minutes from the previous night’s flight.

²³ At the time of the incident eastern daylight time was universal time coordinate (Z) – 4 hours after CDT + 1 hour.

Private Pilot – Airplane Single-Engine Land, Instrument – Airplane certificate was issued on March 16, 2003.

Commercial Pilot – Airplane Single-Engine Land; Instrument – Airplane certificate was issued on June 17, 2003.

Commercial Pilot – Airplane Single- and Multiengine Land; Instrument – Airplane certificate was issued on July 14, 2003.

Ground Instructor – Advanced and Instrument certificate was issued on August 13, 2003.

Notice of Disapproval – Flight Instructor Airplane was issued on October 12, 2003. Unsatisfactory items: Entire Oral Portion, AOA XII. Emergency Operations Task A. Emergency Approach and Landing (Simulated), AOA VII. Takeoffs, Landing, and Go-arounds Task I. Short-Field (Confined Areas (ASES) Approach and Landing

Flight Instructor – Airplane Single-Engine certificate was issued on October 17, 2003.

Flight Instructor – Airplane Single-Engine; Instrument – Airplane certificate was issued on December 8, 2003. Reissued on December 12, 2005, December 20, 2007, December 23, 2009, December 14, 2011, December 17, 2013, and December 15, 2015.

Commercial Pilot – Airplane Multiengine Land, Airplane Single-Engine Land; Instrument – Airplane; EMB-145; Limitation: EMB-145 SIC Privileges Only certificate was issued November 15, 2005.

Notice of Disapproval – Airline Transport Pilot was issued on October 3, 2007. Unsatisfactory Items: Single Engine ILS, Single Engine Missed Approach (1st Attempt).

Airline Transport Pilot – Airplane Multiengine Land; EMB-145; Commercial Privileges – Airplane Single-Engine Land; Limitation: ATP/EMB-145 Circle Approach VMC Only was issued on October 13, 2007.

Airline Transport Pilot – Airplane Multiengine Land; A-320, EMB-145; Commercial Pilot Privileges; Airplane Single-Engine Land; Limitations: English Proficient; ATP – Circle Approach – VMC Only; A-320, EMB-145 Circle Approach – VMC-Only certificate was issued on April 23, 2015.

2.2.2 The First Officer's Pilot Certificates and Ratings Held at Time of the Incident

Airline Transport Pilot (issued April 23, 2015)

Airplane Multiengine Land

Type ratings in the A-320, EMB-145

Commercial Pilot Privileges Airplane Single-Engine Land

Limitations: English Proficient, ATP – Circle Approach – VMC Only; A-320, EMB-145 Circle Approach – VMC Only.

Flight Instructor (renewed December 15, 2015)
Airplane Single-Engine
Instrument – Airplane

Ground Instructor (issued August 13, 2003)
Advanced
Instrument

Medical Certificate (issued March 7, 2016)
First-Class
Limitation: Must Wear Corrective Lenses

2.2.3 The First Officer’s Training and Proficiency Checks Completed²⁴

Date of Hire	March 18, 2015
Initial Basic Indoctrination Training	March 19-25, 2015
Initial Threat and Error Management (CRM)	March 23, 2015
Maneuvers Validation (MV)	April 17, 2015
Most Recent Line Check	May 9, 2015
A-320 Initial Operating Experience (IOE)	May 12, 2015
Line Operational Evaluation (LOE)	March 11, 2016
Spring QDL	March 26, 2016
Summer QDL	July 6, 2016

The FO was current and qualified under JetBlue and FAA requirements.

2.2.4 The First Officer’s Flight Times

The incident F/O’s flight times based on the FO’s interview and JetBlue Airways employment records:

Total pilot flying time ²⁵	5,700
Total SIC time at JetBlue Airways	766:40
Total flying time in A-320	766:40
Total flying time preceding 24 hours ²⁶	4:05

2.2.5 The First Officer’s 72-Hour History

According to the First Officer he commuted into JFK the day prior to the first day of the 4-day pairing and reported for the trip well rested. Following the pairing’s first overnight, he reported at BWI, “well rested” for the deadhead flight to BOS. When in BOS he was able to “grab a sandwich before the [incident] flight.” He stated that the crew were all “gelling well” and that this was the first pairing he had flown with the incident captain.

²⁴ Source: Attachment 4 – Flight Crew Training Summaries.

²⁵ An approximate time based on the First Officer’s Interview summary – see Attachment 1 – Flight Crew Interview Summaries and Statements.

²⁶ Includes the incident flight plus 48 minutes from the previous night’s flight.

2.3 Crew Roles and Responsibilities

2.3.1 Captain/Pilot-in-Command

JetBlue's Flight Operations Manual, Chapter 1 "General" provides the following guidance regarding the responsibilities of the Captain:

The pilot designated as Captain (PIC) for a flight or series of flights is charged with the responsibility of ensuring the safe operation of the aircraft according to the applicable Federal Aviation Regulations and established JetBlue policies and procedures.

The Captain has authority over assigned Flight Crewmembers (both Flight Deck and Inflight) from the time they report for duty until the termination of the flight. The Captain's instructions are to be promptly complied with by the other Crewmembers. Other Crewmembers should bring to the Captain's attention any instruction conflicting with company procedures, however, if the instruction still stands, it should be followed. Although not limited to the duties noted below, the Captain shall

- Be the final and complete authority with regard to matters concerning aircraft operation, safety and security of Customers and fellow Crewmembers*
- Maintain a high degree of proficiency and a thorough knowledge of the procedures and systems for the aircraft being operated*
- Determine the aircraft is airworthy, in accordance with the procedures outlined in the FOM and the applicable FCOM, and the appropriate preflight has been accomplished*
- Thoroughly familiarize himself/herself with existing and forecast weather prior to each flight*
- Concur with the Dispatcher the trip is flight-planned and fueled properly so the flight may be conducted safely and in accordance with current policies*
- Issue instructions to the First Officer and flight attendants, in preparation for or during flight, that ensure the safe and efficient operation of the aircraft. These instructions may complement or revise those duties specified under "First Officers" in this section*
- Ensure Inflight Crewmembers receive a pre-departure briefing. See also Cabin Crew Brief*
- Assist or provide assistance for the safe and smooth handling of Customers' baggage and cargo at terminal points where JetBlue Airports Crewmembers may not be available*
- Ensure Inflight Crewmembers and Customers are notified of turbulent weather conditions or other factors, which may affect the operation of the flight*
- Prior to pushback, ensure the completion of the weight and balance/planning and performance computations*
- Act as Inflight Security Coordinator*
- Ensure company issued Electronic Flight Bag (EFB) is maintained in an up to date condition in accordance with Electronic Flight Bag (EFB) Policy and Usage*

JetBlue's Flight Operations Manual, Chapter 10 further provides the following as duties:

Captains/Pilots-In-Command:

- *Report to their designated Base Chief Pilot.*
- *Must complete initial or recurrent training phases in the preceding twelve months.*
- *Maintain proficiency and competence as a required Crewmember on the aircraft to which assigned.*
- *Ensure company issued Electronic Flight Bag (EFB) is maintained in an up to date condition in accordance with Electronic Flight Bag (EFB) Policy and Usage.*
- *Ensure compliance with flight/duty time limitations and rest periods in accordance with established policies.*
- *Review General (as applicable) to ensure the airworthiness of the aircraft and coordinates with appropriate maintenance personnel for the accomplishment of any required maintenance.*
- *Perform other duties as assigned.*
- *Supervises other Crewmembers in the performance of their duties.*
- *Ensure flights are conducted in accordance with established company policies, Operations Specifications, and Federal Aviation Regulations for optimum safety, efficiency and passenger comfort.*
- *Conduct aircraft operations and related job assignments in accordance with policies established in the Flight Operations Manual and company manuals.*
- *When traveling on JetBlue flights, and if time permits, all capable Crewmembers are asked to assist with light cleaning of the aircraft.*

2.3.2 First Officer/Second-in-Command

JetBlue's Flight Operations Manual, Chapter 1 "General" provides the following guidance regarding the responsibilities of the First Officer:

The First Officer (SIC) is under the direct supervision of the Captain (PIC) during a flight assignment and shall carry out all instructions pertaining to the operation of the flight as directed by the Captain and as outlined in appropriate manuals.

In the event of an incapacitation of the Captain, the First Officer will assume authority over an aircraft and/or its Flight Crewmembers. Refer to Succession of Command.

First Officers shall:

- *Maintain a high degree of proficiency and a thorough knowledge of the procedures and systems for the aircraft being operated*
- *Be thoroughly familiar with existing and forecast weather prior to each flight*
- *Ensure company issued Electronic Flight Bag (EFB) is maintained in an up to date condition in accordance with Electronic Flight Bag (EFB) Policy and Usage.*
- *Provide the Captain with any applicable information which will assist the Captain in operational decision making*

JetBlue's Flight Operations Manual, Chapter 10 further provides the following as duties for the FO:

- *Maintain proficiency and competence as required Crewmember on the aircraft to which assigned*
- *Assist in the execution of assigned duties to provide safe and comfortable air transportation*
- *ensure that all flights are conducted in accordance with established company policies and the Federal Aviation Regulations*
- *Must have completed initial or recurrent training phases in the preceding 12 months.*
- *Maintains current medical qualifications appropriate to the crew position assigned.*
- *Conduct aircraft operations and related job assignments in accordance with policies established in the Flight Operations Manual and company manuals.*
- *Ensure compliance with flight/duty-time limitations and rest periods in accordance with established policies.*
- *Ensure company issued Electronic Flight Bag (EFB) is maintained in an up to date condition in accordance with Electronic Flight Bag (EFB) Policy and Usage.*
- *Assists the PIC, as requested, in the performance of flight-related assignments.*
- *Performs other duties as assigned.*
- *When traveling on JetBlue flights, and if time permits, all capable Crewmembers are asked to assist with light cleaning of the aircraft*

3.0 Incident Dispatcher

The incident dispatcher was 58 years old and his date of hire with JetBlue was November 7, 2007. According to the incident dispatcher, prior to becoming a dispatcher he was a load planner. He became a dispatcher in June 1987 and about five years later was employed at Lufthansa Airlines. In 2004 he worked for Saudi Airlines where he was employed until being hired at JetBlue.

He held a FAA Dispatcher certificate and had no flight time as a pilot.

3.1 Dispatcher Responsibilities

Flights operating under the provisions of 14 *CFR* 121 (such as the incident flight) were required to comply with 14 *CFR* 121.593 “Dispatching authority: Domestic operations” which states the following:

Except when an airplane lands at an intermediate airport specified in the original dispatch release and remains there for not more than one hour, no person may start a flight unless an aircraft dispatcher specifically authorizes that flight.

The dispatcher and pilot in command shared equal responsibility for the operational safety of a flight under the provisions of 14 *CFR* 121.597 “Flight release authority: Supplemental operations,” which states, in part:

- (a) No person may start a flight under a flight following system without specific authority from the person authorized by the operator to exercise operational control over the flight.*
- (b) No person may start a flight unless the pilot in command or the person authorized by the operator to exercise operational control over the flight has executed a flight release setting forth the conditions under which the flights will be conducted. The pilot in command may sign the flight release only when he and the person authorized by the operator to exercise operational control believe that the flight can be made with safety.*

The JetBlue, “Dispatch Resource Handbook” Section 3.10 “ATC Planning” stated, in part:

It is the responsibility of the Dispatcher to be aware of any information that is available that may affect the flight assigned to the dispatcher during the shift.

The Dispatcher is responsible for reviewing all current information and for communicating information affecting flights to the appropriate Crews in a timely manner, either by company radio, ACARS or ARINC phone patch.

JetBlue’s Flight Operations Manual, Chapter 1 “General” provides the following guidance regarding the responsibilities of the Dispatcher:

The Dispatcher is responsible for:

- *Preflight planning*
- *Issuing a legal dispatch release for each flight between specified points*
- *Monitoring the progress of each flight*
- *Issuing necessary information for the safety of the flight*
- *Canceling, delaying or re-dispatching a flight if, in the opinion of the Dispatcher or Pilot-In-Command, the flight cannot operate or continue to operate safely as planned or released*
- *Maintaining familiarity with the enroute weather for routes of flight over which they are dispatching*
- *Maintaining rapid and reliable communications between the Dispatcher and each flight for which the Dispatcher is responsible*
- *Providing the Captain with any information or condition, in the air or on the ground, which may affect the safety of the flight*
- *Conducting a weather analysis, determine NOTAM²⁷ and MEL²⁸ status, and prepare a release when satisfied the conditions permit*
- *Coordinating with ATC when flow control or other traffic situations indicate the need*
- *Filing flight plans in accordance with preferred routing when applicable*
- *Coordinating with Station Operations, System Operations and Maintenance Control*

3.2 Dispatcher Certification Records

Dispatchers were certified under the provisions of 14 CFR 65.55 “Knowledge requirements” and 14 CFR 65.57 “Experience or training requirements,” and qualified to dispatch under 14 CFR 121 per 14 CFR 121.463 “Aircraft dispatcher qualifications.”

The incident dispatcher held an FAA Aircraft Dispatcher certificate, dated February 9, 2015.

²⁷ Notice to Airmen

²⁸ Minimum Equipment List which is a list which provides for the operation of aircraft, subject to specified conditions, with particular equipment inoperative (which is) prepared by an operator in conformity with, or more restrictive than the master minimum equipment list established for the aircraft type. Source: [http://www.skybrary.aero/index.php/Minimum_Equipment_List_\(MEL\)](http://www.skybrary.aero/index.php/Minimum_Equipment_List_(MEL))

3.3 Dispatcher's Training Records²⁹

The training records for the incident dispatcher provided by JetBlue indicated the following:

JetBlue Date of Hire	November 7, 2007
Dispatch Basic Indoctrination	November 13, 2007
Initial Company Resource Management (ICRM)	November 14, 2007
Initial on the Job Training (IOJT)	December 30, 2007
Meteorology 101 (M101)	March 14, 2011
EWINS ³⁰ – Initial	October 7, 2013
Flight Plan Manager eLearning ³¹	July 17, 2015
Flight Plan Manager	September 9, 2015
Recurrent Ground (RG)	December 2, 2015
Recurrent Aircraft Systems Program (DRASP) ³²	December 2, 2015
Recurrent Competency Check (RCC) – A-320	December 8, 2015
Recurrent Flight Deck Operations	
Familiarization (RFAM) ³³ – E190	December 10, 2015

The incident dispatcher was current and qualified under JetBlue and FAA requirements.

3.4 Dispatcher Duty Times and Rest Requirements

Dispatcher duty times were governed under the provision of 14 *CFR* 121.465 “Aircraft dispatcher duty time limitations: Domestic and flag operations”, which states, in part:

(a) Each certificate holder conducting domestic or flag operations shall establish the daily duty period for a dispatcher so that it begins at a time that allows him or her to become thoroughly familiar with existing and anticipated weather conditions along the route before he or she dispatches any airplane. He or she shall remain on duty until each airplane dispatched by him or her has completed its flight, or has gone beyond his or her jurisdiction, or until he or she is relieved by another qualified dispatcher.

(b) Except in cases where circumstances or emergency conditions beyond the control of the certificate holder require otherwise—

(1) No certificate holder conducting domestic or flag operations may schedule a dispatcher for more than 10 consecutive hours of duty;

(2) If a dispatcher is scheduled for more than 10 hours of duty in 24 consecutive hours, the certificate holder shall provide him or her a rest period of at least eight hours at or before the end of 10 hours of duty.

²⁹ Source: Attachment 5 – Dispatch Training Records (Excerpt).

³⁰ Enhanced Weather Information System

³¹ This training was a self-study course which included training modules for Standard Briefing Package – Domestic No CDR (Code Departure Route) or Terrain, Position Report and Send Reanalysis, Position Report – Reroute – Send Reanalysis, Amend a Release – Remove MEL, Amend a Release – Change Captain, Standard Briefing Package – Flag Operations Non B043, Standard Briefing Package – Flag with B043, Change Alternate for Enroute Flight, Standard Briefing Package with Terrain Analysis – Domestic, and Standard Briefing Package with CDRs.

³² This was a self-study course which included training modules for A-320 Flight Control, A-320 Hydraulic, E190 Flight Control, E190 Hydraulic, E190 Power Plant, and A-320 Power Plant.

³³ Training records indicated all nine (9) instances of Flight Deck Familiarization (initial and recurrent) were accomplished in the E190 aircraft.

(3) Each dispatcher must be relieved of all duty with the certificate holder for at least 24 consecutive hours during any seven consecutive days or the equivalent thereof within any calendar month.

According to the incident dispatcher, he worked a 10-hour shift. The shift normally began at 1400 and ended at 0030, as it did the day of the incident. He described his typical duty day as the first hour normally consists of pass down flights from the morning dispatcher and that around 2100 the peak of the workload is decreasing.

4.0 Aircraft Information

According to FAA records, the incident airplane was an Airbus A-320-232, registration N632JB (Serial Number 2647) registered to JetBlue Airways. It was powered by two International Aero V2527-A5 engines. At the time of the incident, the airplane logbook contained only one deferral item, MEL-00-00-00A which stated “FMGC I11 Installed (Not a MEL).” At the time of the incident the airplane was equipped with 150 passenger seats, 6 flight attendant seats, and 4 cockpit seats.



Photo 1: Incident Airplane³⁴

5.0 Weight and Balance³⁵

WEIGHT & BALANCE (in pounds) (maximum certificated weights in bold)	
Basic Operating Weight	97,366
Total Payload ³⁶	28,276
Zero Fuel Weight	125,642

³⁴ Source: Jetphotos.net

³⁵ Source: JetBlue Airways see Attachment 7 – JetBlue Aerodata Report, and Attachment 8 – Operational Flight Plan.

³⁶ Total Payload included 122 adult passengers, 23 children, 1 infant, and baggage.

Maximum Zero Fuel Weight	134,480
Fuel	41,700
Ramp Weight	167,342
Maximum Taxi Weight	172,840
Taxi Fuel	400
Takeoff Weight	166,972
Maximum Takeoff Weight	171,958
Planned Trip Fuel	34,465
Planned Landing Weight	134,028
Maximum Landing Weight	142,200
Takeoff Center of Gravity (CG)	28.5% MAC ³⁷

For the takeoff, the forward CG limit was approximately 17% MAC and the aft CG limit was approximately 42% MAC, based on the JetBlue Limitations section of the FCOM.

6.0 Meteorological Information

According to interviews, the flight crew and dispatcher did not communicate directly prior to the flight, nor during the flight prior to the encounter with the turbulence, to discuss the weather for the flight.

For detailed information on the JetBlue Airways Meteorology department and weather information for this event, refer to the Weather Study located in the docket associated with this incident.

6.1 Operational Flight Plan

In a review of the operational flight plan³⁸ there were 13 SIGMETs, convective SIGMETs, thunderstorms, etc. that were forecasted and valid on or near the route of flight. Of those 13, the following weather information was provided for the area around where the incident occurred:

KZAU - - CHICAGO
 KZMP - - MINNEAPOLIS KZKC - - KANSAS CITY FP 111638Z - CONV
 VALID. 2016-08-12 06.00.00+00 UNTIL 2016-08-12 09.00.00+00
 TYPE. TS
 Dispatch ME
 11AUG16 B6429 BOS-SMF
 COVERAGE. SCT-BKN. LEVEL. FL350 - FL450
 AREA. 40NNE BDF - 35NNW STL - 50ENE PWE - 30NNE FOD ID. 24096
 (WSI/AVF)

KZDV - - DENVER
 KZAB - - ALBUQUERQUE KZKC - - KANSAS CITY FP 111742Z - CONV
 VALID. 2016-08-12 00.00.00+00 UNTIL 2016-08-12 03.00.00+00
 TYPE. TS

³⁷ Mean Aerodynamic Chord

³⁸ Source: Operational Factors – Attachment 8 – Operational Flight Plan.

COVERAGE. SCT-BKN. LEVEL. FL380 - FL450
AREA. 55W SLN - 50WSW MMB - 90WSW LBL - 35W HLC
ID. 23907 (WSI/SA)

KZMP - MINNEAPOLIS
WST 110000Z CONVECTIVE SIGMET 71C VALID UNTIL 2055Z
MN IA NE SD
FROM 30NNE FSD-40S MCW-50WSW FOD-40NE ONL-30NNE FSD
AREA TS MOV FROM 27030KT. TOPS TO FL450.

6.2 ACARS

JetBlue's A-320s were equipped with ACARS data link system which enabled the exchange of data and messages between an aircraft and a ground-based operation station over an ARINC³⁹ VHF radio network. JetBlue pilots were able to send/receive text messages between the airplane and the dispatcher utilizing the ACARS system.

A review of ACARS communication⁴⁰ between the incident flight and JetBlue Dispatch indicated that at 0110:07 a CFD WRN⁴¹ message was transmitted from the airplane which stated that the "HYD B RSVR LO LVL." Subsequently at 0110:11 another CFD WRN message was transmitted from the airplane which stated "HYD G RSVR LO LVL." AT 0110:14 another message was transmitted from the airplane which stated, "AUTO FLT AP OFF." No other messages were recorded being transmitted until 0111:52 which transmitted "ADIRU1/2/3 DISAGREE/IDAFS 1." All of which would have automatically transmitted by the airplane.

AT 0121:08 the dispatcher assigned to the flight initiated an ACARS message to the incident flight which stated "ARE U DIVERT TO RAP...?" and at 0121:49 the flight replied "EXTREME TURB, SEVERE INJURIES, DIVERTING RAP,," At 0139:43 an "ON EVENT" was transmitted which reported to JetBlue operations that the flight landed at RAP at 0139Z.

7.0 Communications

During the interview with the First Officer, he indicated difficulties on the frequency hearing ATC following the event. He described the difficulties as "terrible," and that he could only hear snippets of voice communication. It was also associated with the time in which the airplane entered heavy rain. The Captain reported that there was no communication issue with the First Officer nor with ATC that he could recall. For detailed communications with ATC, refer to the Air Traffic Control Group Chairman's Factual Report.

8.0 Relevant Systems and Guidance

8.1 Weather Radar System

According to the JetBlue A-320/A-321 Flight Crew Operations Manual (FCOM) Volume 2, Navigation (Page 15-46) and the AQP Indoc Weather Radar, the RDR-4000-Weather Radar,

³⁹ Aeronautical Radio, Incorporated

⁴⁰ Source: Operational Factors – Attachment 9 – ACARS Traffic Log.

⁴¹ Centralized Fault Display – which, according to JetBlue's FCOM (Flight Crew Operations Manual) Volume 2 Section 19.1.6 listed the main functions as acquiring and storing messages transmitted by the connected system BITES or by the flight warning computer (warning and caution titles) and detailing the maintenance phases.

which will be standard equipment on all new A-320 and A-321 aircraft, a two-weather radar system; however, at the incident airplane was not equipped with the RDR-4000 and was only equipped with the basic radar package. Only one transceiver was working at a time and it could display the weather image on the ND⁴², in any ND mode except PLAN.

According to JetBlue Airways Training Procedures “Weather Radar Training Tool”⁴³ in the section titled “what your radar sees” stated the following:

- *Weather Radar works by sending out signals that reflect off objects and return to the aircraft. These returns are displayed to the pilot on the radar screen.*
- *The amount of radar signals returned and displayed to you depends on the reflectivity of the object struck by the radar beam.*

Here’s a simple summary:

- *Radar is **good** at detecting:*
 - *Particles with high liquid content (rain, wet snow, wet hail, etc.)*
- *Radar is **unlikely** to detect:*
 - *Particles with little or no liquid content (Ice crystals, dry hail and dry snow)*
- *Radar **does not** detect:*
 - *Clouds or fog (droplets are too small)*
 - *Volcanic Ash or dust (no water at all)*
 - *Clear air turbulence or wind (no particles)*
- *The flight crew utilizes three primary controls to operate the radar:*
 - ***Tilt** is the vertical adjustment of the angle between the center of the beam and the horizon*
 - ***Range** is the distance from the aircraft to the radar returns being displayed. (This is determined by the range setting of the ND/MFD⁴⁴ map display).*
 - ***Gain** is the sensitivity adjustment of the radar receiver. (should usually be set to AUTO)*

8.1.1 Radar Color Scales

JetBlue University’s “Weather Radar – Training Tools” provided the following figure as it pertained to the A-320 weather radar display color scale for precipitation intensity:

⁴² Navigation Display

⁴³ The guidance provided to flight crews utilized terms from both JetBlue fleet aircraft, the A-320 and the EMB190 series aircraft

⁴⁴ The ND is the Navigation Displays associated with the A-320 series aircraft. The MFD is the Multifunction Display associated with the EMB190 aircraft



Figure 1: A-320 Radar Display Color Scale

8.2 Radar Control Panel

The weather radar control panel was located on the center console below the captain's radios. According to an interview with the captain, his habit was to adjust the radar until he "finds the tilt angle" that does what he felt was a "good job." Once he located that tilt angle, he leaves it, although he could not remember what tilt angle, he used for the incident flight it was usually set between 0 degrees and 5 degrees tilt up.⁴⁵

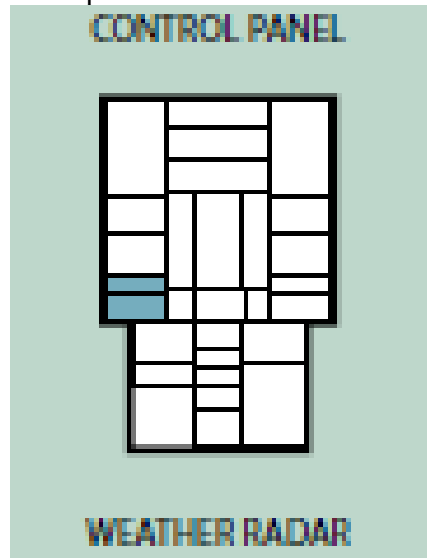


Figure 2: Location of the Weather Radar Control Panel and the RDR-4000 Controls⁴⁶

⁴⁵ Source: Attachment 1 – Interview Summaries.

⁴⁶ Source: JetBlue Airways Training Procedures Manual.



Figure 3: A-320 Weather Radar Control Panel⁴⁷

8.2.1 A-320 Radar Operating Modes⁴⁸

JetBlue University “Weather Radar – Training Tools” provided the following excerpt as it pertained to the A-320 weather radar:

There are three basic operating modes of the A-320 radar:

- *WX (weather mode **without** Turbulence notification)*
- *WX/TURB (Weather mode **with** Turbulence notification.). (This is the normally used mode)*
- *MAP (Ground mapping mode. NOT to be used for navigation)*

The WX and WX/TURB modes display the intensity of precipitation using three colors Green, Yellow, and Red with Green being associated with “Light” and Red being associated with “Heavy” respectively.

WX/TURB (Turbulence) Mode

- *This is the mode normally used in day-to-day operations.*
- *With **WX/TURB** selected, in addition to normal weather depiction, the radar also displays turbulent areas (within 40 NM).*
- *Areas of moderate to severe turbulence are displayed in Magenta*
- ***Note** that for the radar to detect and display turbulent areas, liquid water droplets are required. **Clear Air Turbulence CANNOT be detected** (no reflective particles)*

Gain Control

- *The GAIN knob has a detent for AUTO when turned fully counter-clockwise.*
- *When out of the AUTO detent, clockwise rotation of the knob increases the gain (sensitivity) of the radar*
- *If the GAIN knob is rotated counter-clockwise, **but not all the way into the AUTO detent**, the Radar Gain setting is at **minimum!** (At this setting weather returns would not be visible on the ND)*

⁴⁷ Source: JetBlue Airways Training Procedures Manual.

⁴⁸ Source: Attachment 10 - JetBlue University Weather Radar.

8.3 RDR-4000 Control Panel⁴⁹

According to JetBlue Airways Training Procedures “Weather Radar Training Tool”⁵⁰ the control panel was divided into three section. The left and right one-third of the panel controls the captain’s (left panel) and FO’s (right panel) displays which allowed the two sides to display different information simultaneously. The “ALL” and “ON PATH” modes automatically scan all of the airspace in front of the airplane from the surface to 60,000 feet msl, filter out ground clutter and display weather returns automatically.” In the “ON PATH” mode, only the weather determined to be within a band ranging from 4,000 feet below and 4,000 feet above the assumed altitude. Weather outside this band will not be displayed. While in the “ALL” mode all detected weather would be displayed. However, the “On Path” weather was shown in solid colors, and the “Off Path” weather was displayed in hash-marked colors. The “ELVEN” was the constant elevation mode. It displays weather that was manually selected by the pilot using the “ELEV DN/UP” control knob and the altitude that was selected and displayed on the ND. In this mode, only weather returns at the selected elevation were displayed and turbulence would not have been shown in this mode.

The center one-third applies controls to both the captain’s and FO’s displays. The WXR/PWS was the system’s power switch with “1” turning the unit to “On” and “Off” and “DEACT” turns the entire system off. The TURB was normally left in the AUTO position, allowing display of turbulence (in magenta) at ranges up to 40 NM. Gain is normally left in the AUTO position for automatic gain control (unless actively assessing weather).

The training procedures manual goes on to state, in part:

The enhanced features of the RDR-4000 make it very simple to operate. It is almost “set and forget.

System Operation – Enroute Caution

- *Threat: The automatic ground-return filtering of the RDR-4000 generates an unexpected consequence which could surprise you.*
 - *Recall that in older radars, you adjusted the tilt to a “parked” position, showing ground returns in the outer edge of the display. These ground returns allowed you to (1) verify the radar was working, and (2) detect “shadowing” when weather returns were severe.*
 - *Since the RDR-4000 filters out ground returns, you cannot detect radar shadows in the automatic modes, nor, o a clear day, do you have an immediate confirmation that the radar is working (it will just be blank).*
- **DEFENSE:** *Periodically select the MAP mode!*
 - *By momentarily selecting the MAP mode every so often, you regain the ability to verify radar function and detect shadows.*

⁴⁹ Source: JetBlue Airways Training Procedures Manual

⁵⁰ The RDR-4000 became standard equipment on all new A-320 and A-321 aircraft in 2014. The older A-320 aircraft were not slated to be retrofitted. The incident airplane did not have the RDR-4000.



Figure 4: RDR-4000 Control Panel⁵¹

8.4 Relevant Procedures, etc.

According to JetBlue Airways Training Procedures “Weather Radar Training Tool” in the section titled “Operating the Radar”⁵² stated, in part, the following:

By adjusting the tilt, the pilot controls where the radar is “looking” vertically

Tilt angle is displayed on the ND (A-320)/ MFD (E190)

- *Both aircraft have a +/- 15 degree range of tilt available*

All tilt control adjustments are calibrated relative to the horizon, not the aircraft attitude.

Tilt – Over Scanning

“Over scanning” occurs when tilt is adjusted too high. This means that the beam is pointed above the intended weather target, resulting in no returns being displayed on the radar screen.

Because the precipitation changes in size and composition with altitude, a typical thunderstorm will have different levels of radar reflectivity at different altitudes

In general, the area from the base of the storm to the freezing level of the storm contains the greatest amount of liquid moisture, and will provide you with the best reflectivity

With a typical summer thunderstorm, the areas of highest reflectivity is the zone from approximately 10,000 feet to 18,000 feet

Tilt Where to “Look”

*From **low** altitudes, tilt should be set to “look” up.*

⁵¹ Source: JetBlue Airways Training Procedures Manual

⁵² Attachment 10 - JetBlue Radar Training Tool

From **high** altitudes, tilt should be set to “look” **down**.

Tilt Parked Position

Here’s a valuable technique:

- To simplify you tilt adjustments, use the “**Parked Position**”
- To set the “parked” position, adjust the tilt so that ground returns are painted **on the outer edge** of the radar display
 - While the exact fraction of ground-return coverage is not important, anywhere between approx. 10% and 30% of the outer range of the screen is generally appropriate
- By using the “Parked” position with proper range control, you ensure...
 - That the radar is working properly (by evidence of ground returns)
 - That you’ll detect any hazardous weather containing precipitation along your route (helps avoid over scanning and under scanning)

8.4.1 Thunderstorm Avoidance

According to JetBlue Airways Training Procedures “Weather Radar Training Tool” in the section titled “Operational Strategies Weather Avoidance”⁵³ stated, in part, the following:

Treat every thunderstorm as hazardous!

- Strive to maintain at least 20 NM⁵⁴ lateral separation from severe weather
- When possible, deviate upwind instead of downwind
 - Avoid flying under the anvil
- Remember that radar is only one of the defenses in weather avoidance
- There are additional defenses that should be utilized such as:
 - ATC
 - Other Aircraft
 - Dispatch

8.4.2 Avoidance Distance Criteria

JetBlue’s Flight Operations Manual, Revision 9 “Pre-Departure/Planning – Weather Planning”, dated January 29, 2010, provided the following policy and table for avoidance distance criteria:

Weather radar is designed for weather avoidance rather than weather penetration and will not be used to penetrate thunderstorms (except in an emergency when no safer course of action is available).

Thunderstorm Avoidance *Treat every thunderstorm as hazardous and avoid their immediate proximity. For practical purposes, the below table should be observed:*

⁵³ Source: Attachment 10 – JetBlue Radar Training Tool (Excerpt)

⁵⁴ Nautical Mile

Precipitation Type	Avoidance Distance
Stratiform Rain. Stable air mass, layered clouds, no lightning present, shallow gradients.	May Penetrate.
Convective Shower. Round or oval echo shape, steep symmetrical gradient, radar top below 30,000, isolated cell, no lightning present.	Avoid by 3NM. <i>Potential Threats.</i> Moderate with occasional severe turbulence. Strong surface gusts, heavy rain, severe icing
General Thunderstorm. Lightning present, round or oval echo shape, steep symmetrical gradient, radar tops 30,000 to 35,000 feet, isolated storm.	Avoid by 10NM. <i>Potential Threats.</i> Moderate to severe turbulence, lightning strikes, severe icing, gusts to 50 knots, heavy rain in sheets
Severe thunderstorm. Pendant shape, asymmetrical gradients, notches, fingers, hooks or scalloped edges, radar top above 30,000 feet, southernmost cell in a line, cell movement faster than 10 knots, National Weather Service (NWS) reported as a level 5 or 6, prominent shadow	Below freezing level—Avoid by 10NM (upwind) 20NM (down wind). Above freezing level—Avoid by 20 NM. NOTE: Avoid flight below the anvil, remain 10NM upwind or if possible 1NM downwind for each knot of wind at altitude. For example wind at ALT taken from ND. 350/60, remain at least 60NM down wind of cell if possible to avoid hail encounters <i>Potential Threats.</i> Severe and extreme turbulence, large hail, severe icing, lightning strikes, tornadoes, water spouts, microbursts, gusts in excess of 50 knots, extreme rain, loss of lift (due to extreme rain)

Figure 5: Avoidance Distance Criteria⁵⁵

It further provided the following two warnings:

Flight beneath a convective shower or thunderstorm should not be attempted. Flight above a rapidly building thunderstorm should not be attempted with less than 5,000 feet vertical clearance from the cloud tops. Flight above any thunderstorm should not be attempted unless the pilot is assured of vertical clearance from the clouds.

Flight will not be planned through areas of severe thunderstorms unless there is no practical alternate route available. If no practical alternate route is available, flight may[be] planned through severe weather forecast areas only if all thunderstorms are avoided by at least 20 miles.

8.4.3 Severe Turbulence

According to the JetBlue FCOM Volume 1, Supplement Procedures Section 4.9, page 4-20, provided the following guidance to flight crews:

4.9.1 General

Whenever possible, avoid areas with known or forecasted severe turbulence. If turbulence is unavoidable, aim to keep the speed in the region of the target speed given in this section, so as to provide the best protection against the effect of gust on the

⁵⁵ Source: JetBlue FOM pg. 2-74 table 2.7 dated January 29, 2010.

structural limits, whilst maintaining an adequate margin above V_{LS} . Select IGN if heavy rain or severe turbulence is encountered.

Consider requesting a lower flight level to increase margin to buffet onset

Sufficient buffet margin exists at optimum altitude.

4.9.5 Thrust Setting (N1) For Recommended Speed

****EFFECTIVE ON A/C: ALL A320**

Severe Turbulence									
Speed and Thrust Setting For Recommended Turbulence Speed									
FL	SPD or MACH	Gross Weight (1000 lb)							
		100	110	120	130	140	150	160	170
		N1%							
390	0.76	76.0	77.1	78.5	80.1	-	-	-	-
370	0.76	74.9	75.9	76.8	78.1	79.5	-	-	-
350	0.76	74.5	75.2	76.0	76.9	78.0	79.3	-	-
330	0.76	74.6	75.0	75.7	76.5	77.3	78.2	79.3	80.5
310	275	74.2	74.5	75.0	75.6	76.3	77.1	78.0	79.1
290	275	73.0	73.3	73.8	74.4	75.0	75.8	76.6	77.6
270	275	71.7	72.1	72.5	73.1	73.8	74.5	75.3	76.2
250	275	70.5	70.8	71.2	71.8	72.5	73.2	74.0	74.9
200	275	66.9	67.2	67.7	68.2	69.0	69.8	70.5	71.3
150	250	60.1	60.7	61.4	62.3	63.4	64.5	65.6	66.8
100	250	56.4	56.9	57.5	58.3	59.2	60.3	61.6	62.8
50	250	53.0	53.6	54.1	54.8	55.6	56.5	57.5	58.6

Figure 6: Severe Turbulence Thrust Setting Chart

8.5 Dispatch Systems and Guidance

8.5.1 Flight Following Program

JetBlue's Dispatch Resource Handbook, Chapter 7 "Dispatch Flight Following Program" stated, in part:

The following tools satisfy all FAR requirements for Flight Following, and allow the Dispatcher to maintain operational control:

- Movement Control
- ACARS
- AirCom
- Flight Explorer
- ITM (Integrated Traffic Management)
- Flight Plan Manager

- NWS
- WSI

Operational Control is ultimately maintained by sustaining:

- *Access to OOOI⁵⁶ times for the flight*
- *A Navigational log*
- *Two-way communication with each flight*

8.5.2 Flight Explorer

JetBlue's Dispatch Resource Handbook, Chapter 7, provided the following information as it pertains to the Flight Explorer Flight Following tool:

Flight Explorer provides a visual representation of an aircraft's current position, the route flown, and the planned route. Also, through Flight Explorer, a number of tools can be overlaid to aid in flight planning as well as flight following.

Examples of these tools include, but are not limited to, the following:

- ***Flight Plan*** function: *shows how the flight was planned respective to its current position.*
- ***Show Route Flown*** function: *shows where the flight actually flew, up to its current position.*
- *NWS and WSI weather products.*
- ***VOR, Navaid, and SUA*** representation.

8.5.3 Integrated Traffic Management (ITM)

JetBlue's Dispatch Resource Handbook, Chapter 7, provided the following information as it pertains to the ITM, Flight Following tool:

Like Flight Explorer, ITM provides a visual representation of flight status.

- *ITEM provides the aircraft's position with more frequent position updates than does Flight Explorer.*
- *ITM provides situational awareness, not only to the enroute environment, but also to Terminal, and Ground movements. (Ground movements are based on airports that are equipped with ASDE-X capabilities.)*

Monitoring enroute and terminal weather takes precedence over all flight planning duties.

- *The ability to proactively monitor reports and trends based on all available information helps the Dispatcher to stay ahead of the flight.*
- *Proactive weather monitoring affords the Dispatcher time to determine if rerouting a flight, change a destination alternate, or address other flight contingencies, is necessary to conduct the flight legally and safely.*

⁵⁶ Out, Off, On, In times

8.6 Dispatcher Training

Flight dispatchers were required to be trained under the provisions of 14 *CFR* 121.415 “Crewmember and dispatcher training requirements” and 14 *CFR* 121.422 “Aircraft dispatchers: Initial and transition ground training.” The training curriculum for dispatchers was outlined in the JetBlue Flight Operations Training Manual (FOTM), Chapter 5 “JetBlue Dispatcher Training”.

According to a JetBlue Dispatch Support Manager, dispatchers do not interact with pilots during CRM training except during initial training, nor do they conduct training with pilots during recurrent training.

Flight dispatchers were also required to receive recurrent training to the requirements specified in 14 *CFR* 121.427 (a)(b)(c) and 14 *CFR* 121.463(c). The course must provide refresher training in those subjects and procedures as required by 14 *CFR* 121.422(a) and 14 *CFR* 121.629.

Dispatch Recurrent Training (RT)⁵⁷ included a total of 31 hours of training in the following areas:

Dispatcher Recurrent Training Plan (RT)	Course
Dispatcher Recurrent Ground	RG
JetBlue Recurrent Security	RSEC
JetBlue Recurrent Dangerous Goods/Hazmat	RHAZ
Dispatcher Recurrent Flight Deck Operations Familiarization	RFAM
Dispatcher Recurrent Competency Check	RCC

Figure 7: Dispatch Recurrent Training Plan

Recurrent dispatcher training was required each twelve (12) months by 14 *CFR* 121.433(c)(1)(ii).

Dispatchers were also required to receive an annual competency check. According to information provided to the NTSB by JetBlue, the objective of the Dispatch Recurrent Competency Check (RCC) was as follows:

This curriculum is designed to provide an evaluation mechanism to determine the competency of a JetBlue Dispatcher to continue releasing JetBlue aircraft.

No person may serve as a JetBlue Dispatcher unless within the preceding 12 calendar months the Dispatcher has satisfactorily completed a competence check.

⁵⁷ Source: JetBlue Flight Operations Training Manual (FOTM), Chapter 5.2.2 Dispatcher Recurrent Training

This course will fulfill the requirements of 14 CFR 121.427 and 14 CFR 121.433 (c) and determine the competency of an individual to dispatch aircraft in a safe, standardized, and efficient manner. A competency check will be administered by a designated Air Transport Supervisor during the course of a work shift at an operational Dispatch desk. The competency check will be administered using a competency check form...

All JetBlue Dispatchers shall successfully complete this check in conjunction with the successful completion of all other required training. This course satisfies all requirements for training denoted (RCC) in the Dispatcher Qualification Guidelines.

8.6.1 Dispatcher Recurrent – Dispatch Resource Management

The JetBlue FOTM, Chapter 5 “JetBlue Dispatcher Training” provided the following information about Dispatch Resource Management:

Objective

This curriculum is designed to provide recurrent Dispatch Resource Management training for Dispatchers who are currently serving with JetBlue Airways. It is used to focus on improving DRM techniques within the Dispatch department,

The course is designed to be taught through lectures, facilitated discussions, multimedia presentations, and handouts.

Curriculum Outline

- a. Cross-Functional Conflicts*
- b. Review key CRM and Threat & Error Management (TEM) Concepts*
- c. Conflict Management*
- d. Workload Management*
- e. DRM Group exercise*

The section listed one hour as the time allotted for DRM training.

8.6.2 Flight Leading

JetBlue’s Dispatch Resource Handbook, Chapter 7, provided the following information about “Flight Leading:”

Flight Leading is JetBlue’s method of giving Flight Following a more proactive role.

Flight Leading practices are encouraged as to keep pilots and Dispatchers ahead of their flights and aids in anticipation of particular dynamics that can affect a particular flight operation.

Examples of disruptions (dynamics) that can affect a flights operation included but are not limited to:

- AIRMETs on flight path.*

- *SIGMETs on flight path*
- *Weather on route*
- *PIREPs (company and other) that will affect the flight*
- *Anticipated arrival flow (Smooth or volume)*
- *Current holding ahead*
- *Runway in use at destination*
- *VIP movement*
- *Best ride altitude (Based on reports are (sic) charts)*
- *Better wind routing*
- *Expected gate issue at destination*
- *Updated destination weather (TAF)*
- *Braking Action*
- *Volcanic activity*

In order to provide Flight Leading, it is imperative to continually monitor each and every flight. When monitoring flights consider the following:

- *Plotting and examining the route for potential flight dynamics*
- *Periodically reviewing the latest weather charts to see how flights are affected*
- *Requesting PIREPS from flight ahead (or from Dispatchers with flights ahead)*
- *Calling the tower for updated BA reports*
- *Monitoring PASSUR⁵⁸ for potential holding*
- *Run scenarios (Sandbox) once airborne for better route optimization*
- *Notify the Crew of applicable ATC advisories*

All information should be clearly communicated to the flight crews. Communication should be made through AirCom using the “Flight Leading” dropdown option.

8.7 Company Resource Management

Dispatchers were required to receive Dispatch Resource Management Training per 14 *CFR* 121.404 “Compliance dates: Crew and dispatcher resource management training,” and 14 *CFR* 121.422(a)(1)(ix) “Approved dispatcher resource management (DRM) initial training.”

JetBlue’s Flight Operations Manual Section 1.9 “Crew Resource Management” provided the following excerpt:

The values extend what has been traditionally known as Crew Resource Management to become “Company Resource Management (CRM).” The concept is to know how to collect and accept information from multiple sources, process the data and make the best possible decisions in the interest of safety and efficiency. The concept also includes giving information so the decision maker can arrive at the best possible decision for action. Effective resource management recognizes human error is likely. The goal is to reduce the probability serious errors will occur, and to immediately detect and correct mistakes when they do happen.

⁵⁸ PASSUR – Integrated Traffic Management web-hosted platform. Source: <https://www.passur.com/>

Effective CRM requires all Crewmembers are skilled and knowledgeable in their respective disciplines. Without proficiency, no amount of management or leadership training will produce a safe and effective environment. This proficiency requirement includes not only the Flight Deck, but also cabin and ground Crewmembers being trained, skilled and confident in their duties.

9.0 FAA Guidance

9.1 Title 14 CFR 121

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

Each certificate holder conducting domestic operations is responsible for operational control.

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.

The aircraft dispatcher is responsible for –

Monitoring the progress of each flight;

Issuing necessary information for the safety of the flight; and

Cancelling or redischarging 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.

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.

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 holds valid certificates authorizing him to perform the duties of those crewmembers.

9.2 Turbulence Reporting Criteria Table

The Aeronautical Information Manual (AIM) Chapter 7 “Meteorology” provided the following table for the criteria of turbulence:

Intensity	Aircraft Reaction	Reaction Inside Aircraft	Reporting Term–Definition
Light	Turbulence that momentarily causes slight, erratic changes in altitude and/or attitude (pitch, roll, yaw). Report as Light Turbulence ; ¹ or Turbulence that causes slight, rapid and somewhat rhythmic bumpiness without appreciable changes in altitude or attitude. Report as Light Chop .	Occupants may feel a slight strain against seat belts or shoulder straps. Unsecured objects may be displaced slightly. Food service may be conducted and little or no difficulty is encountered in walking.	Occasional—Less than $\frac{1}{3}$ of the time. Intermittent— $\frac{1}{3}$ to $\frac{2}{3}$. Continuous—More than $\frac{2}{3}$.
Moderate	Turbulence that is similar to Light Turbulence but of greater intensity. Changes in altitude and/or attitude occur but the aircraft remains in positive control at all times. It usually causes variations in indicated airspeed. Report as Moderate Turbulence ; ¹ or Turbulence that is similar to Light Chop but of greater intensity. It causes rapid bumps or jolts without appreciable changes in aircraft altitude or attitude. Report as Moderate Chop . ¹	Occupants feel definite strains against seat belts or shoulder straps. Unsecured objects are dislodged. Food service and walking are difficult.	NOTE 1. Pilots should report location(s), time (UTC), intensity, whether in or near clouds, altitude, type of aircraft and, when applicable, duration of turbulence. 2. Duration may be based on time between two locations or over a single location. All locations should be readily identifiable.
Severe	Turbulence that causes large, abrupt changes in altitude and/or attitude. It usually causes large variations in indicated airspeed. Aircraft may be momentarily out of control. Report as Severe Turbulence . ¹	Occupants are forced violently against seat belts or shoulder straps. Unsecured objects are tossed about. Food Service and walking are impossible.	EXAMPLES: a. Over Omaha, 1232Z, Moderate Turbulence, in cloud, Flight Level 310, B707.
Extreme	Turbulence in which the aircraft is violently tossed about and is practically impossible to control. It may cause structural damage. Report as Extreme Turbulence . ¹		b. From 50 miles south of Albuquerque to 30 miles north of Phoenix, 1210Z to 1250Z, occasional Moderate Chop, Flight Level 330, DC8.
¹ High level turbulence (normally above 15,000 feet ASL) not associated with cumuliform cloudiness, including thunderstorms, should be reported as CAT (clear air turbulence) preceded by the appropriate intensity, or light or moderate chop.			

Figure 8: AIM Table 7-1-10 Turbulence Reporting Criteria Table

10.0 Previous Recommendations and Guidance

The following recommendation came from NTSB Accident DCA13MA133, which occurred in Birmingham, Alabama. *Require operators to develop an annual recurrent dispatcher resource management module for dispatchers that includes participation of pilots to reinforce the need for open communication. (A-14-073)*

Status: Open – Await Response

F. LIST OF ATTACHMENTS

- Attachment 1: Flight Crew Interview Summaries and Statements
- Attachment 2: Dispatch Interview Summaries and Statements
- Attachment 3: Cabin Crew Statements
- Attachment 4: Flight Crew Training Summaries (Excerpts)
- Attachment 5: Flight Crew Flight Times
- Attachment 6: Dispatch Training Records (Excerpts)
- Attachment 7: JetBlue AeroData Report
- Attachment 8: Operational Flight Plan
- Attachment 9: ACARS Traffic Log
- Attachment 10: Radar Training Tool (Excerpt)
- Attachment 11: Hazardous Weather Avoidance Criteria

Attachment 12: Flight Crew Pairing

Attachment 13: Dispatch Resource Handbook – Dispatch Flight Following Program

Attachment 14: Operational Factors Group – Party Forms

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