NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

March 30, 2017

Operations Group Chairman's Factual Report

OPERATIONAL FACTORS/ HUMAN PERFORMANCE

DCA17IA020

Contents

A. INCIDENT

Operator:	Eastern Air Lines
Location:	New York, New York
Date:	October 27, 2016
Time:	1942 EDT[1]
Airplane:	Boeing 737-7L9, N278EA

B. OPERATIONAL FACTORS / HUMAN PERFORMANCE GROUP

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C. SUMMARY

On October 27, 2016, about 1942 Eastern Daylight Time, Eastern Air Lines flight 3452, a Boeing 737-700, registration N278EA overran runway 22 during landing roll at New York's La Guardia Airport (LGA). The chartered passenger flight, operated under the provisions of Title 14 *Code of Federal Regulations* Part 121, originated from Fort Dodge Regional Airport (FOD), Fort Dodge, Iowa. The flight departed about 1623 CDT[2]. The 9 crew and 39 passengers evacuated the aircraft via airstairs. Night instrument meteorological conditions prevailed at the time of the incident and an instrument flight plan had been filed.

D. DETAILS OF THE INVESTIGATION

Friday, October 28, 2016

Operational Factors/Human Performance Group Chairmen arrived at Hangar 6 at Washington Reagan International Airport (DCA) for the 0700 flight onboard the FAA Gulfstream IV, N1, to New York LaGuardia Airport (LGA). The flight arrived about 0810 landing on runway 31. Upon deplaning the incident aircraft was visually seen parked on the ramp and had been removed from the Engineering Material Arresting System (EMAS) and grass at the end of runway 22. An

[1] All times are Eastern Daylight Time (EDT) unless otherwise stated
[2] Central Daylight Time

organizational meeting was conducted by the Investigator in Charge (IIC), and a visual exterior examination of the airplane was conducted. At the time of the exterior examination, the main cabin door was sealed; thus, an interior examination of the incident aircraft took place in the early afternoon. The airplane exhibited minor damage to the engines in the form of a bent fan blade on the left engine and damage to the cowl on the right engine. The interior of the aircraft was examined and photographed. In addition, the flight logs were documented. The automatic deployment function of the speed brakes was inoperative and maintenance on this item was deferred per the Minimum Equipment List (MEL), on October 26, 2016. A deferral sticker was placarded on the speed brake handle.

Saturday, October 29, 2016

The Operational Factors/Human Performance Group interviewed the flight crew at the Fairfield Inn and Suites, Conference Room 102, in Flushing, New York. The First Officer was the first to be interviewed, beginning about 0900, followed immediately by the captain at 1140. Following the interviews, the group reconvened at the Port Authority Police Station building 137 where findings from the interviews were discussed with the IIC along with potential future follow-on investigation activities. The group began compiling the interview summaries and were subsequently released by the IIC to return to Washington, DC.

Tuesday, November 29, 2016

Some of the Operational Factors/Human Performance Group[3] reconvened at the Eastern Air Lines Group headquarters in Miami, Florida. The group conducted interviews of the Vice President of Flight Operations, two Captains that had recently flown with the incident first officer, a first officer that had recently flown with the incident Captain, the Chief Inspector, and the Chief Pilot.

Wednesday, November 30, 2016

Some of the Operational Factors/Human Performance Group[4] continued to interview Eastern Air Lines personnel at the airline's headquarters. The interviewees included a first officer who had recently flown with the incident captain, Director of Training, Director of Maintenance, and the Director of Safety in training.

Thursday, December 1, 2016

Some of the Operational Factors/Human Performance Group[5] members reconvened at the FAA's Certificate Management Office in Miramar, Florida. The group interviewed the Eastern Air Lines Principal Operations Inspector (POI) and a Front Line Manager (FLM) who was, until his promotion about four months prior to the incident, the POI for Eastern Air Lines.

[3] Group members that were in attendance were Shawn Etcher, Sathya Silva, and Robert Hendrickson. Terry Austin was unable to attend.
[4] Group members that were in attendance were Shawn Etcher, Sathya Silva, and Robert Hendrickson. Terry Austin was unable to attend.
[5] Group members that were in attendance were Shawn Etcher, Sathya Silva, and Robert Hendrickson. Terry Austin was unable to attend.

E. FACTUAL INFORMATION

1.0 History of the Flight

Eastern Air Lines flight 3452 was a chartered flight from FOD to LGA. The preflight inspection had been conducted by the incident first officer prior to their departure. The flight was originally scheduled to depart at 1500 CDT; however, due to a ground delay they received a departure time of 1622 CDT. The passengers boarded the aircraft and the doors were reported closed at 1610.

According to the crew, the departure from FOD was uneventful. According to an online flight tracking program, the flight climbed to FL390[6] before it began its descent for landing, which was higher than its filed altitude of FL370. The captain was the pilot monitoring (PM) and the first officer was the pilot flying (PF). According to interviews with the crewmembers, the enroute and descent were uneventful; however, both pilots reported rain during the final 15 minutes of the incident flight, and classified the rain as moderate to heavy.

Prior to the arrival into the New York area, the captain obtained LGA's ATIS[7] weather information. The incident crew reported that the wind was 130 degrees at 9 knots and anticipated and briefed the ILS[8] 22 approach. The first officer conducted the approach briefing, which included minimum altitude and visibility for the approach, who was to manually deploy the speed brakes, and their anticipated taxi route after landing to their parking location. The flight was issued holding instructions; however, prior to their arrival at the holding fix, the hold was canceled and they were subsequently provided vectors to the final approach for the ILS 22. Both crewmembers stated that they completed the approach checklist after descending through 18,000 feet mean sea level (msl) and that they completed the landing checklist once they were configured for landing, which was near the final approach fix for the ILS 22.

The first officer reported that the autopilot and autothrottles were engaged beginning about 2,500 feet after their takeoff from FOD. The crew visually acquired runway 22 at LGA between 600 and 700 feet above ground level (agl). The first officer reported that he disconnected the autopilot and autothrottles, as required by Eastern Air Lines standard operating procedure, about 300 feet agl and continued to use flight director guidance. The first officer further recalled that during the flare he heard the captain say "put it down, put it down;" however, when asked approximately where the airplane touched down on the runway, he was not certain. The captain reported that during the flare the airplane had floated initially and that he estimated that the airplane's main landing gear touched down about 3,000 feet past the approach end of runway 22, flight data recording information indicated that airplane's main landing gear touched down on the runway about 4,242 feet beyond the runway threshold. The captain further reported that, as briefed, he manually deployed the speed brakes, announced that the speed brakes had deployed, and then stated "reversers normal." Both crewmembers reported that the autobrake system was set to 3 and that the standard for Eastern Air Lines was autobrake 2. The first officer reported that he decided to

6 FL refers to Flight Level which was provided in numerical format which in this example was 39,000 feet above mean sea level (msl)
7 Automatic Terminal Information Service
8 Instrument Landing System

override the autobrakes, by applying brake pedal pressure, when the runway end red lights "were close," prior to that point he thought he only had his feet on the rudders. The captain reported that he also applied maximum braking as they approached the end of the runway, and that he had also applied right rudder in order to veer the airplane to the right instead of going straight towards the approaching roadway.

Once the airplane came to a stop, the captain made an announcement to the passengers and flight attendants to remain in their seat, as there was no indication of a fire or other catastrophic issue. After which, they communicated to ground personnel to provide a set of airstairs at the rear of the airplane to allow the occupants to exit.

1.1 Previous Arrivals – Crew Statements[9]

Flight crews from the four flights that landed at LGA within 10 minutes of the incident flight reported braking as "good" or "fair." One crew reported noticing the antiskid brake system pulsating during the landing roll out. Others reported that there was no hydroplaning or decrease in braking performance. The flight crews also reported that it was raining at the time and there was some turbulence on the approach. The crews stated that visibility was "good" below the clouds, and the cloud bases reported varied between 500 and 900 feet msl. Most of the crews also reported a slight crosswind during the landing. One crewmember, who observed the incident flight during the flare, reported that the incident airplane was still "a few feet in the air" when they were making their turn from the "Bravo" taxiway; however, he could not recall the intersecting taxiway. Another crewmember reported, while taxiing "northeast, about intersection C, I noticed a B737 landing on runway 22 moving faster than normal for its location on the landing runway."

1.2 Eyewitness Statements

An eyewitness observed the airplane from a building located off airport property, with a view of the landing runway. That eyewitness categorized the airplane as "moving fast" before departing the end of the runway. Another eyewitness, who was a Port Authority of New York and New Jersey Police Officer and escorting the awaiting motorcade, stated that he had been monitoring the tower frequency for the arriving airplane. As the airplane came into his line of sight, moving from his left to right, it was moving "faster than other aircraft typically travel when in that general area of the airfield. Seconds later I heard radio transmissions wherein the ATCT [air traffic control tower] controller yelled, 'Stop! Eastern! Stop!'."

2.0 Flight Crew Information

The incident flight crew consisted of a captain (CA), first officer (FO), 5 flight attendants, a mechanic, and a ground service coordinator.

2.1 The Captain

According to Eastern Air Lines' records, FAA records, and interview statements, the following information pertained to the captain:

Age at the time of the incident:	58
Seniority Date of hire at Eastern Air Lines:	June 25, 2015
Prior aviation employment:	Centurion Air Cargo

[9] Source: Attachment 6 – Flight Crew Statements from Previous Flight in LGA

The captain resided in Florida. He held an Airline Transport Pilot (ATP) certificate for airplane single- and multiengine land, with type ratings on the Boeing B-737[10], CL-65[11], DC-8[12], HS-114[13], L-188[14], DC-10[15], and MD-11[16]. He also held an FAA first-class medical certificate dated July 20, 2016. He was hired by Eastern Air Lines on June 25, 2015 as a first officer, and upgraded to captain in February 2016. At the time of the incident, he was based in Miami, Florida.

Prior to joining Eastern Air Lines, the captain was a pilot at Centurion Air Cargo where he was hired as a first officer on the DC10 in 2005, and subsequently upgraded to captain on the MD11 in 2010. In 2003, he was hired by Mesa Airlines flying the CL65 out of Philadelphia where he flew as a first officer for one year and a captain for one year. In June of 2002, he flew for FineAir which later became Arrow Air. He flew for US Airways in 1999 flying the B737-200 aircraft and was subsequently furloughed in December 2001. In 1994 he flew the DC-8 for Fine Air. He had flown for TPI Airlines flying freight in the L-1011[17] for 2 years. Prior to TPI Airlines he flew for Galaxy Airlines as a first officer on the L-188. Prior to Galaxy Airlines he flew for a Part 135 operator flying from Fort Lauderdale to the Bahamas, while there he was a check airman.

The captain reported that he had two previous incidents. One of the events occurred when he was about 20 years old while flight instructing, in which the student he was instructing, misconfigured the airplane on short final and the airplane experienced a hard landing. Another incident occurred when he worked for Galaxy Airlines in which he had declared a medical emergency. 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 October 27, 1977.

Private Pilot – Airplane Single and Multiengine Land certificate issued February 19, 1978.

Private Pilot – Airplane Single and Multiengine Land; Instrument Airplane certificate issued June 30, 1978.

Commercial Pilot – Airplane Single and Multiengine Land; Instrument Airplane certificate issued August 4, 1978.

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10 The Boeing Company B-737-100, B-737-200, B-737-300, B-7373-400, B-737-500, B-737-600, B-737-700C, B-737-800, B-737-900. Source FAA Order 8900.1 Figure 5-88.
11 Bombardier Inc. CL-600-2B19, CL-600-2C10, CL-600-2D24, CL-600-2D15. Source FAA Order 8900.1 Figure 5-88.
12 The Boeing Company DC-8-11, DC-8-12, DC-8-21, DC-8-31, DC-8-32, DC-8-33, DC-8-41, DC-8-42, DC-8-43, DC-8-51, DC-8-52, DC-8-53, DC-8F-54, DC-8-61, DC-8-61F, DC-8-62, DC-8-62F, DC-8-63, DC-8-63F, DC-8-71, DC-8-71F, DC-8-72, DC-8-72F, DC-8-73, DC-8-73F. Source FAA Order 8900.1 Figure 5-58.
13 Hawker Siddeley Aviation Ltd., UK DH-114 Heron. Source FAA Order 8900.1 Figure 5-58.
14 Lockheed Aircraft Corp., USA Electra 188, P-3, EA. Source FAA Order 8900.1 Figure 5-58.
15 The Boeing Company DC-10-10, DC-10-10F, DC-10-15, DC-10-30, DC-10-30F, DC-10-40, DC-10-40F. Source FAA Order 8900.1 Figure 5-58.
16 The Boeing Company MD-10-10F, MD-10-30F, MD-11, MD-11F. Source FAA Order 8900.1 Figure 5-58.
17 Lockheed Aircraft Corp., USA L-1011 Tristar. Source FAA Order 8900.1 Figure 5-58.

Ground Instructor – Advanced Ground Instructor, Instrument Ground Instructor certificate issued October 23, 1978.

Flight Instructor – Airplane Single-Engine certificate issued January 23, 1979.

Flight Instructor – Airplane Single-Engine Instruments Airplane certificate issued August 10, 1979.

Notice of Disapproval of Application – Multiengine Instructor issued September 21, 1979. Areas for reexamination: Oral and Flight.

Flight Instructor – Airplane Single and Multiengine, Instruments Airplane certificate issued September 30, 1979. Renewed September 21, 1981, September 19, 1983, September 23, 1985. Reinstated November 13, 1987. Renewed October 31, 1989, October 11, 1991

Airline Transport Pilot – Airplane Single-Engine Land; Commercial Privileges Airplane Multiengine Land certificate issued August 3, 1981.

Airline Transport Pilot – Airplane Single and Multiengine Land certificate issued on December 21, 1981.

Airline Transport Pilot – Airplane Single and Multiengine Land; HS-114 certificate issued on December 8, 1983.

Airline Transport Pilot – Airplane Singe and Multiengine Land; HS-114, L-188 certificate issued on October 21, 1985

Airline Transport Pilot – Airplane Single and Multiengine Land; HS-114, L-188, DC-8 certificate issued on May 30, 1991.

Airline Transport Pilot – Airplane Single and Multiengine Land; B-737, DC-8, HS-114, L-188 certificate issued on June 15, 2002.

Airline Transport Pilot – Airplane Single and Multiengine Land; B-737, DC-8, HS-114, L-188, CL-65; CL-65 Circling Approaches VMC[18] Only certificate issued on December 21, 2003.

Airline Transport Pilot – Airplane Single and Multiengine Land; B-737, CL-65, DC-8, HS-114, L-188, DC-10; DC-10 SIC[19] Privileges Only; CL-65, DC-10 Circling Approaches VMC Only certificate issued on May 25, 2006.

Airline Transport Pilot – Airplane Single and Multiengine Land; B-737, CL-65, DC-8, HS-114, L-188, DC-10, MD-11; English Proficient; DC-10 SIC Privileges Only; CL-65, DC-10, MD-11 Circling Approaches VMC Only certificate issued December 11, 2008.

[18] Visual Meteorological Conditions
[19] Second in Command

2.1.2 The Captain's Pilot Certificate and Ratings Held at the Time of the Incident[20]

AIRLINE TRANSPORT PILOT (issued December 11, 2008)
Airplane Single-Engine Land
Airplane Multiengine Land
B-737, Cl-65, DC-8, HS-114, L-188, DC-10, MD-11

Limitations: English Proficient; DC-10 SIC Privileges Only; CL-65, DC-10, MD-11 Circling Approaches VMC Only

FLIGHT INSTRUCTOR (reissued October 11, 1991)
Airplane Single-Engine
Airplane Multiengine
Instrument - Airplane

MEDICAL CERTIFICATION FIRST CLASS (Issued July 20, 2016)
Limitations:

19: MUST WEAR CORRECTIVE LENSES & POSSESS GLASSES FOR NEAR & INTERMEDIATE VISION.

2.1.3 The Captain's Training and Proficiency Checks[21]

A summary of the captain's recent training events at Eastern Air Lines was as follows:

Eastern Air Lines Seniority Date	June 25, 2015
FAA Observation as Captain on B-737[22]	February 8, 2016
Date of initial Type Rating on B-737[23]	June 15, 2002
Date of Most Recent Recurrent Ground School	August 28, 2016
Date of Most Recent Proficiency Check[24]	September 15, 2016
Date of Most Recent Fatigue Awareness	August 27, ,2016
Date of Most Recent Proficiency Training	March 16, 2016
Date of Most Recent FAA Observation	February 8, 2016
Date of Most Recent Line Check	September 10, 2015

2.1.4 The Captain's Flight Times and Currency

According to Eastern Air Lines' records and interview summaries, the following information was provided on the Captain's flight currency:

[20] Source: FAA
[21] Source: Eastern Air Lines
[22] Source: Attachment 1 – Flight Crew Interview Summaries. Eastern Air Lines records indicate that the captain conducted the observation flight from Miami to San Jose, Costa Rica
[23] Source: FAA – Airmen Certification Branch
[24] According to Eastern Air Lines Pilot Training Records, a proficiency check is required within the preceding 12 months, and within the preceding 6 calendar months, either a proficiency check or proficiency training.

Total pilot flying time[25]	21,000
Total Pilot-In-Command (PIC) time[26]	14,767
Total B737 flying time[27]	3,000
Total B737 PIC time[28]	202:06
Total flying time last 24 hours	1:26
Total flying time last 7 days	10:50
Total flying time last 30 days	28:20
Total flying time last 90 days	75:20
Total flying time last 12 months	308:48

2.1.5 The Captain's 72-Hour History

For the Captain's 72-hour history reference the Human Performance Group Chairman Report associated with this incident.

2.1.6 The Captain's Previous Experience at LGA

According to the Captain he had been to LGA for Eastern Air Lines on a previous trip. He further reported that during that trip he flew into and out of LGA on two separate occasions. According to Eastern Air Lines records, the Captain operated a flight on September 26, 2016, from Manchester, New Hampshire, to LGA, which arrived at 2023Z (1623 local) and another flight on September 29, 2016, from Harrisburg, Pennsylvania, to LGA, which arrived at 2143Z (1743 local). Records also reported that the Captain had operated a flight on September 29, 2016, which departed from LGA at 1649Z (1249 local). No other operations into or out of LGA were noted for the 12 months preceding the incident. All of the flights would have been conducted during day visual meteorological conditions.

A review of the weather at LGA, recorded at 2051Z (1651 local), around the time of the flight's arrival, on September 26, 2016, indicated wind from 170 degrees at 11 knots, 10 statute miles of visibility, and the lowest cloud layer recorded as few at 5,000 feet agl.

A review of the weather at LGA, recorded at 2151Z (1751 local), around the time of the flight's arrival, on September 29, 2016, indicated wind from 080 degrees at 16 knots with gusts to 22 knots, 10 statute miles of visibility, and the lowest cloud layer recorded as few at 3,000 feet agl.

2.2 The First Officer

According to Eastern Air Lines' records, FAA records and interview statements, the following information pertained to the first officer.

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[25] Eastern Air Lines personnel records indicated an undated pre-employment resume provided by the captain, which indicated 20,638 total hours of flight experience.

[26] Hours are based solely on information provided by Eastern Air Lines, and a review of the captain's pre-employment application.

[27] Source: Captain's Interview Summary (Attachment 1 – Flight Crew Interview Summaries). He estimated he had between 2,500 and 3,000 hours of experience in the B737 of which some had accrued during his time with a previous employer.

[28] Flight time does not include any flights after October 26, 2016 UTC.

Age at the time of the incident:	49
Seniority Date of hire at Eastern Air Lines:	December 1, 2015
Prior aviation employment:	Republic Airlines

The First Officer resided in Florida. He had an ATP certificate for Airplane Multiengine Land with Commercial Privileges for Airplane Single-Engine Land, and with type ratings on the B-737, CE-500[29], ERJ-170[30] and ERJ-190. He also had a first-class medial certificate dated October 11, 2016. At the time of the incident, he was based in Miami, Florida.

Prior to Eastern Air Lines he was employed by Republic Airlines as a pilot flying the ERJ170. In 2007, he began flight instructing, which he did for about 5 years. He began flight training in 2002.

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

2.2.1 The FO's Pilot Certification Record

Private Pilot – Airplane Single-Engine Land certificate issued December 23, 2003.

Private Pilot – Airplane Single-Engine Land; Instrument Airplane certificate issued July 12, 2004.

Commercial Pilot – Airplane Single-Engine Land; Instrument Airplane certificate issued on January 4, 2006.

Commercial Pilot – Airplane Single and Multiengine Land; Instrument Airplane certificate issued on February 23, 2006.

Notice of Disapproval of Application – Flight Instructor Airplane Single-Engine issued November 2, 2007. Areas for Reexamination: I. Technical Subject Areas, III. Preflight Preparation.

Flight Instructor – Airplane Single-Engine certificate issued November 6, 2007.

Flight Instructor – Airplane Single-Engine; Instrument Airplane certificate issued February 27, 2008.

Flight Instructor – Airplane Single and Multiengine; Instrument Airplane certificate issued October 7, 2008. Renewed August 13, 2010, September 26, 2012.

Commercial Pilot – Airplane Single and Multiengine Land; Instrument Airplane; CE-500; English Proficient; CE-500 SIC Privileges Only certificate issued on September 23, 2011.

[29] Textron Aviation Inc. 500, 501, 550, S550, 551, 560. Source FAA Order 8900.1 Figure 5-88.

[30] Embraer S.A. ERJ-100 STD, ERJ 170-100 LR, ERJ 170-100 SU, ERJ 170-100 SE, ERJ 170-200 STD, ERJ 170-200 LR, ERJ 170-200 SU, ERJ 190-100 STD, ERJ 190-100 LR, ERJ 190-100 SU, ERJ 190-100 IGM, ERJ 190-100 ECJ, ERJ 190-200 STD, ERJ 190-200 LR, ERJ 190-200 IGM. Source FAA Order 8900.1 Figure 5-88.

Commercial Pilot – Airplane Single and Multiengine land; Instrument Airplane; CE-500, ERJ-170; ERJ-190; English Proficient; CE-500, ERJ-170, ERJ-190 SIC Privileges Only; ERJ-170, ERJ-190 Circling Approach – VMC Only certificate issued April 9, 2012.

Airline Transport Pilot – Airplane Multiengine Land; ERJ-170, ERJ-190, CE-500; Commercial Pilot Privileges Airplane Single-Engine Land; CE-500 SIC Privileges Only; ATP-ERJ-170, ERJ-190 Circling Approach – VMC Only; English Proficient certificate issued March 28, 2013.

Airline Transport Pilot – Airplane Multiengine Land; B-737, CE-500, ERJ-170, ERJ-190; commercial Pilot Privileges Airplane Single-Engine Land; English Proficient; CE-500 SIC Privileges Only, ATP Circling Approach – VMC Only, B-737, ERJ-170, ERJ-190 Circling Approaches – VMC Only certificate issued February 8, 2016.

2.2.2 The First Officer's Pilot Certificates and Ratings Held at the Time of the Incident[31]

AIRLINE TRANSPORT PILOT (issued February 8, 2016)
Airplane Multiengine Land
B-737, CE-500, ERJ-170, ERJ-190
Commercial Pilot Privileges Airplane Single-Engine Land
English Proficient

Limitations:
CE-500 SIC Privileges Only
ATP ERJ-170, ERJ-190 Circling Approaches – VMC Only

FLIGHT INSTRUCTOR (reissued September 26, 2012)
Airplane Single-Engine
Airplane Multiengine
Instrument Airplane

MEDICAL CERTIFICATION FIRST CLASS (Issued October 11, 2016)
Limitations: 01 MUST HAVE AVAILABLE GLASSES FOR NEAR VISION

2.2.3 The FO's Training and Proficiency Checks Completed

Eastern Air Lines Seniority Date[32]	November 30, 2015
Date of Basic Indoctrination	December 7, 2015
Date of Fatigue Risk Management Training	December 7, 2015
Date of Initial Type Rating on the B-737[33]	February 8, 2016
Date of Most Recent Proficiency Check	February 2, 2016

[31] Source: FAA
[32] Source: Eastern Air Lines Personnel Records which included a letter to the FO stating that the first day of training was scheduled for November 30, 2015
[33] Source: FAA – Airmen Certification Branch

Date of Most Recent LOFT[34]	February 10, 2016
Date of Most Recent Line Check[35]	April 14, 2016

2.2.4 First Officer's Flight Times

The incident FO's flight times provided to the NTSB[36]:

Total pilot flying time[37]	6,200
Total Pilot-In-Command (PIC) time[38]	3,137
Total B-737 flying time[39]	225:25
Total flying time preceding 24 hours	1:26
Total flying time preceding 7 days	10:50
Total flying time preceding 30 days	35:16
Total flying time preceding 90 days	57:12
Total flying time preceding 12 months	220:22

2.2.5 The FO's 72-Hour History

For the FO's 72-hour history reference the Human Performance Group Chairman Report associated with this incident.

2.2.6 The FO's Previous Experience at LGA

According to the FO[40], the most recent experience flying into LGA was "a long time ago." He further characterized it as more than 2 years prior to the incident while working at his previous employer.

2.3 Medical and Pathological Information

Both pilots completed alcohol and drug screening tests on October 28, 2016. Results of these tests for both pilots were negative[41]. For further information reference the Human Performance Group Chairman Report associated with this incident.

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[34] Line Oriented Flight Training

[35] Source: Eastern Air Lines and Attachment 4 - Eastern Air Lines Personnel Interview Summaries – Chief Pilot interview pg. 20. Line check was accomplished on a flight from Miami to Havana Cuba with the Chief Pilot.

[36] Source: First Officer Interview Summary (attachment 1), Eastern Air Lines, and the FAA, the times do not include the incident flight unless noted otherwise. The incident flight would be an additional 2:19

[37] Source: FAA Airman Certificate and/or Rating Application dated February 2, 2016, during an interview with the FO on October 29, 2016 he estimated approximately 6,400 hours of total flight experience

[38] Source: FAA Airman Certificate and/or Rating Application dated February 2, 2016

[39] Source: Eastern Air Lines, the FO reported during an interview that the only time he has flown the B737 was at Eastern Air Lines

[40] Source: Attachment 1 – Flight Crew Interview Summary

[41] Both pilots tested negative for the following drugs: Benzodiazepine, Amphetamines, Cocaine Metabolites, Marijuana (THC), Barbiturates, Opiates, Methadone, and Phencyclidine (PCP). Both pilots submitted blood samples for alcohol testing, which tested negative. The blood samples were submitted by the first officer at 0224 and by the captain 0222.

3.0 Flight Crew Roles and Responsibilities

3.1 Captain

3.1.1 Primary Duties and Responsibilities

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

> ***Primary Duties /Responsibilities***
>
> *· Responsible for ensuring the flight is operated in accordance with all applicable FARs, Eastern's approved/accepted, as applicable, manuals, the OpSpecs, Company regulations and scheduling policies as applicable to the pilot's duties, and may not operate an aircraft in a careless or reckless manner so as to endanger the life or property of another.*
> *· The Captain is the Pilot-In-Command (PIC) of the aircraft. The PIC has authority over all assigned crewmembers on his flight throughout the flight duty time.*
> *· Act as the Infight Security Coordinator (ISC), and is responsible for the safe operation of the flight, crew coordination and awareness, passenger comfort and satisfaction, maintenance of schedule, and economic operation.*
> *· Act as the senior representative of Eastern on each flight and is responsible for delivering the product to our passengers.*
> *· Must familiarize himself with the appropriate weather, fuel requirements, alternates, departure and arrival airport information such as runway lengths, elevation, etc. Also, any know traffic delays, performance and weight data pertinent to the intended flight.*
> *· Maintain all flight records on the flight deck as defined in this FOM[42].*
> *· Enter all mechanical irregularities that affect safety of flight in the Aircraft Logbook.*
> *· Prepare Safety reports for irregularities or incidents as required in accordance with the procedures defined in FOM Chapter 1.*
> *· Maintain proficiency and qualifications as outlined in the FOTM[43].*
> *· Exercise emergency authority when required as defined in FOM 11.3.*
> *· Understand and actively participate in the Eastern Safety Management System, remaining vigilant for hazards/associated safety risks and for reporting safety issues to Safety or the Chief Pilot 91.103(a); 91.103(b)(1);91.103(b)(2); 91.111*
> *· The Captain (PIC) has the authority to delegate duties but maintains the responsibility to ensure the task or function is completed.*

3.1.2 Procedural Responsibilities

The Eastern Air Lines' Flight Operational Control Manual Chapter 3 "Flight Policies and Procedures" stated the following in regards to the Captain's procedural responsibilities:

[42] Flight Operations Manual
[43] Flight Operations Training Manual

Each Captain (PIC) of an Eastern aircraft is, during flight time, in command of the aircraft and crew and is responsible for the safety of the passengers, crewmembers, cargo, and aircraft. The Captain (PIC) has full control and 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. 121.537(d)

Each Captain (PIC) of an Eastern aircraft is responsible for the preflight planning and the operation of the flight in compliance with this chapter and the operations specifications. 121.537(e)

No Eastern pilot may operate an aircraft, in a careless or reckless manner, so as to endanger life or property. 121.537(f)

No Eastern Captain (PIC) may begin a flight unless he is thoroughly familiar with reported and forecast weather conditions on the route to be flown. 121.599(b)

Each Captain (PIC) shall obtain all available current reports or information on airport conditions and irregularities of navigation facilities that may affect the safety of the flight. 121.603(a)

During a flight, the Captain (PIC) shall obtain any additional available information of meteorological conditions and irregularities of facilities and services that may affect the safety of the flight. 121.603(b)

3.2 First Officer

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

Primary Duties /Responsibilities

Responsible for complying with all applicable CFRs, Eastern's approved/accepted, as applicable, manuals, the OpSpecs, Company regulations and scheduling policies as applicable to the pilot's duties and may not operate an aircraft in a careless or reckless manner so as to endanger the life or property of another. 91.13(a); 91.13(b); 91.111

The First Officer is the Second-in-Command (SIC). He will report to the Captain immediately after checking in, assist the Captain in preparing the flight plan, and familiarize himself with the weather, NOTAM[44]s, aircraft status, and other pertinent factors for the flight

In the case of the Captain's incapacitation, the First Officer will assume all the duties of the Captain and should remain in the First Officer's seat to accomplish these duties.

[44] Notices to Airman

The First Officer will be responsible to the Captain for the preflight, through-flight, and postflight of the aircraft.

The First Officer will at all times conduct himself in a professional manner to maintain the image of Eastern and its crew as responsible to public safety.

Maintain all flight records in the flight deck as assigned by the Captain

Prepare Online safety reports for irregularities or incidents as required in accordance with the procedures defined in FOM Chapter 1.

Maintain proficiency and qualifications as outlined in the FOTM

Exercise emergency authority when required. Refer to Emergency Authority in FOM Chapter 11.

Understand and actively participate in the Eastern SMS[45], remaining vigilant for hazards/associated safety risks and for reporting safety issues to supervisors.

3.3 Crew Duties

The Eastern Air Lines 737 Flight Crew Operations Manual, Chapter NP, "Normal Procedures – Introduction" stated the following in regards to crew duties:

Preflight and postflight crew duties are divided between the captain and first officer. Phase of flight duties are divided between the Pilot Flying (PF) and the Pilot Monitoring (PM).

Each crewmember is responsible for moving the controls and switches in their area of responsibility the phase of flight areas of responsibility for both normal and non-normal procedures are show in the Area of Responsibility illustrations in this section. Typical panel locations are shown the preflight and postflight areas of responsibility are defined by the "Preflight Procedure – Captain" and (Preflight Procedure – First Officer."
The captain may direct actions outside of the crewmember's area of responsibility.

The general PF phase of flight responsibilities are:
- *taxiing*
- *flight path and airspeed control*
- *airplane configuration*
- *navigation*

The general PM phase of flight responsibilities are:
- *Checklist reading*
- *Communications*
- *Tasks asked for by the PF*
- *Monitoring taxing, flight path, airspeed, airplane configuration and navigation*

[45] Safety Management System

PF and PM duties may change during a flight. For example, the captain could be the PF during taxi but the PM during takeoff through landing.

Normal procedures show who does a step by crew position (C, F/O, PF. Or PM):
in the procedure title, or
in the far right column, or
in the column heading of a table
The mode control panel is the PF's responsibility. When flying manually, the PF directs the PM to make the changes on the mode control panel.

The captain is the final authority of all tasks directed and done.

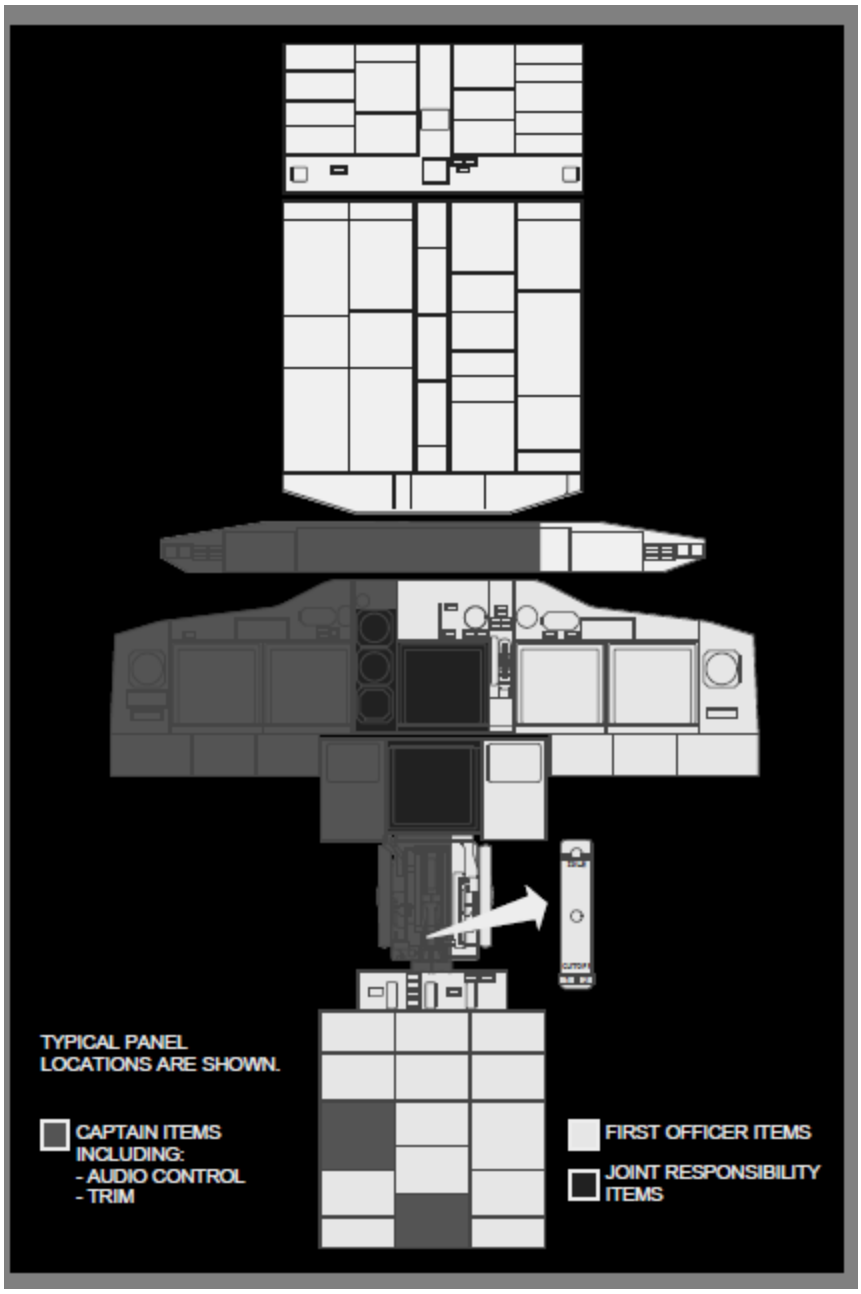


Figure 1: Areas of Responsibility - Captain as Pilot Flying or Taxiing[46]

[46] Source: Eastern Air Lines B737 Flight Crew Operations Manual pg. NP.11.6

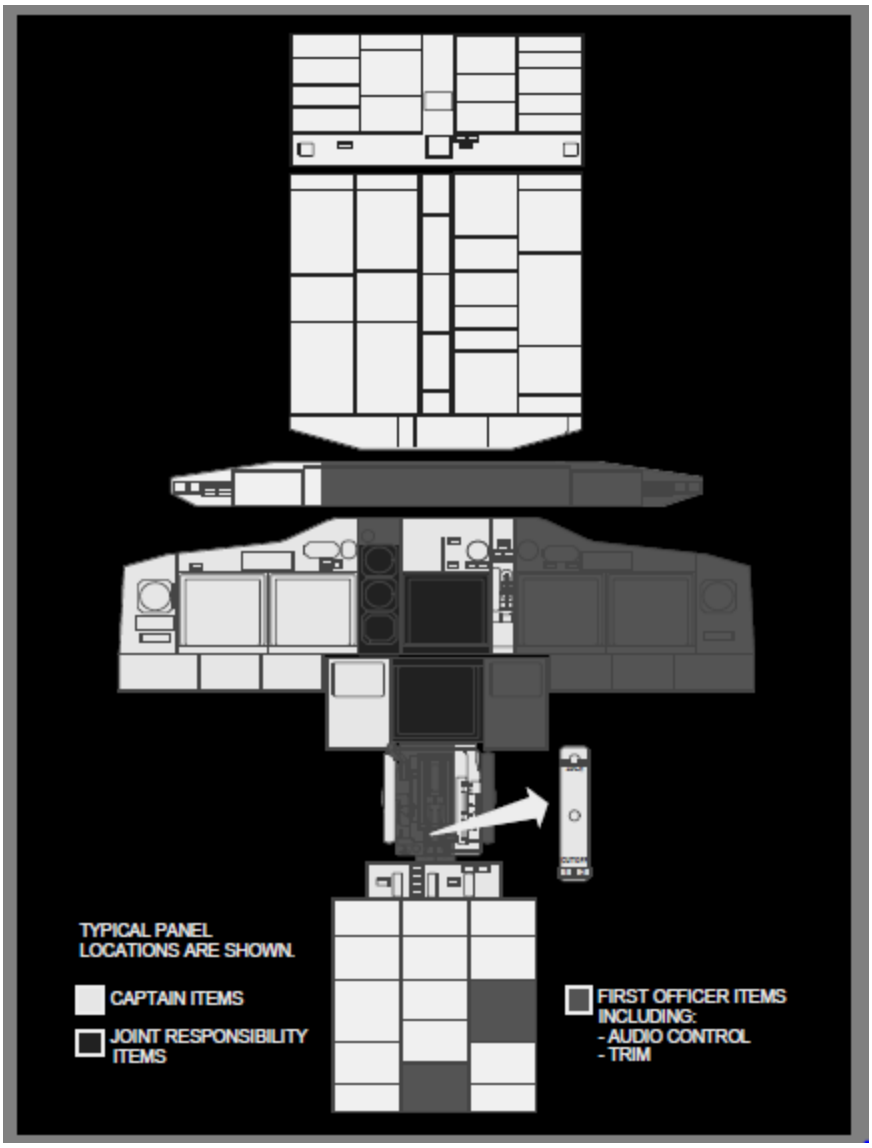


Figure 2: Areas of Responsibility – First Officer as Pilot Flying[47]

3.4 Safety Statement

The Eastern Air Lines Flight Operations Manual (FOM), Chapter 1 "Introduction," stated the following:

> ***Safety Statement***
> *1. The first – (and top) – priority of Eastern Air Lines is the safety and security of our customers and co-workers.*
>
> *2. We strive to be the world leader in safety and recognize that running a safe operation is the key to our success. To reach this goal, we rely on our approved and accepted*

[47] Source Eastern Air Line B737 Flight Crew Operations Manual p. NP.11.7

manual system, Safety Management System (SMS) as well as the sound judgment and experience of our employees.

3. Safety must be the first and foremost consideration in every decision and facet of our company. We are committed to a culture of safety, security, and quality as fundamental priorities.

4. We will meet this commitment by ensuring sufficient resources are available to develop, implement, maintain and continually improve the Eastern operational standards. Eastern Air Lines' strategies and processes are aimed at achieving the highest level of safety performance.

3.5 Code of Federal Regulations

3.5.1 Operation Control – Supplemental Operations.

CFR 121.533 "Responsibility for operational control: Supplemental operations" stated:

(a) *Each certificate holder conducting supplemental operations -*

(1) *Is responsible for operational control; and*

(2) *Shall list each person authorized by it to exercise operational control in its operator's manual.*

(b) *The pilot in command and the director of operations are jointly responsible for the initiation, continuation, diversion, and termination of a flight in compliance with this chapter and the operations specifications. The director of operations may delegate the functions for the initiation, continuation, diversion, and termination of a flight but he may not delegate the responsibility for those functions.*

(c) *The director of operations is responsible for cancelling, diverting, or delaying 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. The director of operations is responsible for assuring that each flight is monitored with respect to at least the following:*

(1) *Departure of the flight from the place of origin and arrival at the place of destination, including intermediate stops and any diversions therefrom.*

(2) *Maintenance and mechanical delays encountered at places of origin and destination and intermediate stops.*

(3) *Any known conditions that may adversely affect the safety of flight.*

(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 passengers, crewmembers, cargo, and aircraft. The pilot in command has full control and 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.*

(e) *Each pilot in command of an aircraft is responsible for the preflight planning and the operation of the flight in compliance with this chapter and the operations specifications.*

(f) *No pilot may operate an aircraft, in a careless or reckless manner, so as to endanger life or property.*

3.5.2 Supplemental Operations

According to the Code of Federal Regulations:

Supplemental operation means any common carriage operation for compensation or hire conducted with any airplane described in paragraph (1) of this definition that is a type of operation described in paragraph (2) of this definition:

(1) *Airplanes:*

(i) *Airplanes having a passenger-seat configuration of more than 30 seats, excluding each crewmember seat;*

(ii) *Airplanes having a payload capacity of more than 7,500 pounds; or*

(iii) *Each propeller-powered airplane having a passenger-seat configuration of more than 9 seats and less than 31 seats, excluding each crewmember seat, that is also used in domestic or flag operations and that is so listed in the operations specifications as required by § 119.49(a)(4) of this chapter for those operations; or*

(iv) *Each turbojet powered airplane having a passenger seat configuration of 1 or more and less than 31 seats, excluding each crewmember seat, that is also used in domestic or flag operations and that is so listed in the operations specifications as required by § 119.49(a)(4) of this chapter for those operations.*

(2) *Types of operation:*

(i) *Operations for which the departure time, departure location, and arrival location are specifically negotiated with the customer or the customer's representative;*

(ii) *All-cargo operations; or*

(iii) *Passenger-carrying public charter operations conducted under part 380 of this chapter.*

4.0 Airplane Information

Photo 1: Incident Airplane (Registration N278EA)

The incident airplane was a Boeing 737-7L9, FAA registration N278EA, Serial No. 28006, and was manufactured in 1998. The registered owner was Wells Fargo Bank Northwest NA Trustee, and it held a transport category airworthiness certificate. The airplane had a maximum taxi weight of 69,626 kilograms (kg)[48], had a total passenger seating capacity of 64[49], and contained 2 flight crew seats and 7 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[50] as prescribed in 49 *CFR* Part 830.2, "Definitions." However, according to interview summaries of Eastern Air Lines personnel, the incident airplane was involved in an event in which the left wingtip made contact with a light pole during parking in March of 2016.

The airplane was powered by two General Electric CFM-56-7B-22 engines. Power settings for the CFM56 were based on a percentage of N1[51].

5.0 Weight and Balance

Eastern Air Lines used the Jeppesen JetPlanner and a Nomograph as the primary means of producing the Weight and Balance and performance data for each flight. Following the calculations, the Weight and Balance information was to be loaded into the aircraft flight management computer by the flight crew.

[48] Source: Attachment 10 - Weight and Balance Information
[49] Source: Eastern Air Lines Operations Specifications A003-1
[50] NTSB source: http://www.ntsb.gov/_layouts/ntsb.aviation/index.aspx FAA source
[51] N1 refers to rotational speed of the low pressure turbine as a percentage of nominal "full thrust" value.

5.1 Weight and Balance for FOD to LGA (Incident Flight)[52]

WEIGHT & BALANCE (in kg[53]) (maximum certificated weights in **bold**[54])	
Basic Operating Weight[55]	39,612
Basic Operating Weight plus 3 ACM[56]	39,911
Baggage Weight (14 kg/bag standard bag)[57]	560
Cargo Weight	605
Passenger Weight (37passengers x 86 kg./Passenger[58])	3,182
Zero Fuel Weight	44,258
Maximum Zero Fuel Weight	**54,657**
Fuel Weight	14,000
Ramp Weight	58,258
Maximum Taxi Weight[59]	**69,626**
Taxi Fuel Burn	227
Actual Takeoff Weight	58,258
Maximum Takeoff Weight (Structural)	**69,399**
Maximum Allowable Takeoff Weight	62,619
Estimated Fuel Burn to LGA[60]	4,560
Estimated Weight on Landing	53,471
Actual Landing Weight[61]	56,197
Maximum Landing Weight	**58,059**
CG (Takeoff)	18.2

According to operator and manufacturer guidance, the airplane was within the approved center of gravity and weight limits for landing on runway 22 at LGA.

5.2 Minimum Equipment List

The incident airplane had the following MEL/CDL items logged[62]:

MEL 27-07 AUTO SPOILER DID NOT DEPLOY ON LANDING

52 Source: Eastern Air Lines Load Manifest Calculation Control Sheet, located in the airplane following the incident
53 In order to convert kilograms to pounds multiple by 2.205
54 Source: Boeing 737 Flight Crew Operations Manual – Limitations- Operating Limitations Pgs. L.10.3 – L.10.4 and Eastern Air Lines Weight and Balance Manual pg. 3-27
55 This weight includes the basic operating weight of the airplane, the flight crew, all required flight attendants, fully stocked galleys of catering, and supplies.
56 Additional Crew Member
57 Source: Eastern Air Lines Weight and Balance Manual section 2.10.6
58 Source: Eastern Air Lines Weight and Balance Manual section 2.10.4
59 Source: Boeing 737 Flight Crew Operations Manual – Limitations- Operating Limitations
60 The planned flight route had an estimated fuel burn of 4,560 kg from the Jeppesen Flight Plan
61 Source: 6120.1 Accident/Incident form completed by a representative of Eastern Air Lines, Weight at Time of Accident/Incident was listed as 123,915 pounds
62 Source: Eastern Air Lines Flight Planning Envelope. See Attachment 8 - Incident Flight On Board Paperwork

5.2.1 MEL 27-07 Auto Speed Brake System

The MEL was divided into three sections: Remarks or Exceptions, Maintenance Procedure, and Operations Procedure. The MEL noted that the deferral was listed as a Category C, when it pertained to the repair interval category. Category C required that the item would be repaired within 10 consecutive calendar days excluding October 26, 2016, the day the malfunction was recorded in the Aircraft Logbook. The MEL also noted that there was one auto speed brake system; however, that there were none required for operation. The MEL contained the following information:

OPERATIONAL RESTRICTION - Performance Impact

EFFECTIVITY - N276EA, N277EA, and N278EA ONLY

Cat.	No. Inst.	No. Req.		
C	1	0	(M)	(O)

Under the Remarks section contained the following:

REMARKS OR EXCEPTIONS

May be inoperative provided:

a) System is deactivated,
b) Operations are conducted in accordance with AFM, and
c) Speed Brake Load Alleviation System is considered inoperative

PLACARD

Install INOP Placard (EAL-F-TO-004) on speed brake control lever.

Under the Maintenance Procedure section contained the following:

Maintenance Procedure:

Accomplish this task to prepare the airplane for flight with the auto spoiler system inoperative (AMM 27-00-00-040-802)

SUBTASK 27-00-00-710-007

1. *Make sure that the manual speed brake operates correctly.*

SUBTASK 27-00-00-010-001

2. *Open this circuit breaker and install safety lock:*

F/O Electrical System Panel, P6-2

Row	Col	Number	Name
B	9	C00440	FLIGHT CONTROL AUTO SPEED BRAKE

SUBTASK 27-00-00-930-006

3. Attach an INOP placard to the speed brake control lever.

Under the Operations Procedure stated the following:

Operations Procedure

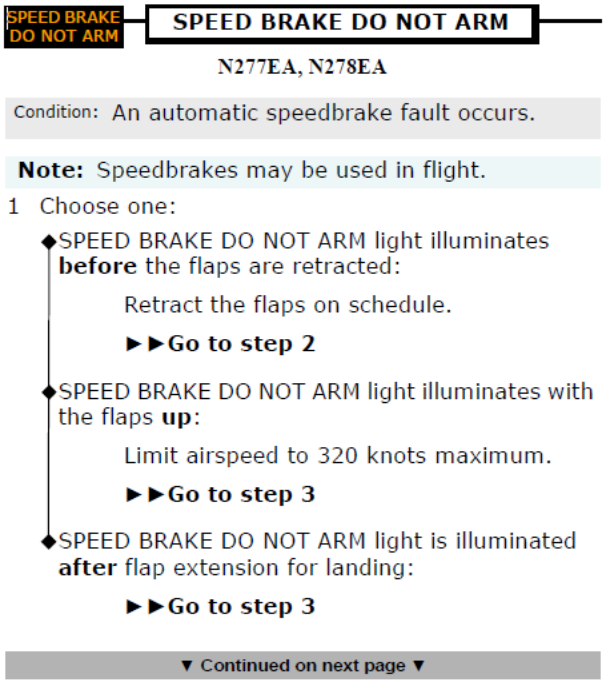
Prior to takeoff, make sure that the speed brake lever is in the full down detent.
Base landing performance on manual speed brakes.
Extend speed brakes manually for rejected takeoff or landing.
For rejected takeoff:

A. Simultaneously close the thrust levers, disengage the authothrottles and apply maximum manual wheel brakes or verify operation of RTO autobrakes.
B. Manually raise SPEED BRAKE lever.
C. Apply the maximum amount of reverse thrust consistent with conditions.

For landing, use the SPEED BRAKE DO NOT ARM non-normal checklist (QRH[63] 9.16)

5.2.2 SPEED BRAKE DO NOT ARM - QRH 9.16

The SPEED BRAKE DO NOT ARM checklist located on pages 9.17-9.19 of the Eastern Air Lines QRH stated the following:


SPEED BRAKE DO NOT ARM

SPEED BRAKE DO NOT ARM

N277EA, N278EA

Condition: An automatic speedbrake fault occurs.

Note: Speedbrakes may be used in flight.

1 Choose one:

- SPEED BRAKE DO NOT ARM light illuminates **before** the flaps are retracted:

  Retract the flaps on schedule.

  ►►**Go to step 2**

- SPEED BRAKE DO NOT ARM light illuminates with the flaps **up**:

  Limit airspeed to 320 knots maximum.

  ►►**Go to step 3**

- SPEED BRAKE DO NOT ARM light is illuminated **after** flap extension for landing:

  ►►**Go to step 3**

▼ Continued on next page ▼

[63] Quick Reference Handbook

▼SPEED BRAKE DO NOT ARM continued▼

2 Choose one:

◆SPEED BRAKE DO NOT ARM light **stays illuminated** after the flaps are retracted:

Limit airspeed to 320 knots maximum.

►►**Go to step 3**

◆SPEED BRAKE DO NOT ARM light **extinguishes** after the flaps are retracted:

►►**Go to step 3**

3 **Checklist Complete Except Deferred Items**

Deferred Items

Descent Checklist

Pressurization . . . . . LAND ALT ___

Recall . . . . . Checked

Autobrake . . . . . ___

Landing data . . . . . VREF ___, Minimums ___

Approach briefing . . . . . Completed

Approach Checklist

Altimeters . . . . . ___

▼ Continued on next page ▼

▼SPEED BRAKE DO NOT ARM continued▼

Additional Deferred Item

Choose one:

◆SPEED BRAKE DO NOT ARM light **is extinguished** after flap extension for landing:

■ ■ ■ ■

◆SPEED BRAKE DO NOT ARM light **is illuminated** after flap extension for landing:

Do **not** arm the speedbrakes for landing. Manually deploy the speedbrakes immediately upon landing. Increased force may be needed to move the SPEED BRAKE lever to the UP position.

►►**Go to Landing Checklist below**

Landing Checklist

ENGINE START switches . . . . . CONT

Speedbrake . . . . . **DOWN detent**

Landing gear . . . . . Down

Flaps . . . . . ___, Green light

■ ■ ■ ■

Figure 3: QRH 9.16 Speed Brake DO NOT ARM Checklist

5.3 Landing Performance

Boeing 737 Flight Crew Operations Manual – Eastern Air Lines, Performance Inflight, Chapter PI, Section 16, "Text – Advisory Information – Normal Configuration Landing Distance" stated the following:

> *The normal configuration distance tables are provided as advisory information to help determine the actual landing distance performance of the airplane for different runway surface condition and brake configurations.*

Boeing 737 Flight Crew Operations Manual - Eastern Air Lines, Performance Inflight, Chapter PI, Section 12, "Advisory Information" provided a "Normal Configuration Landing Distance, Flaps 30" table. The table provided the following guidance for the flight crew:

> *For maximum manual braking and manual speedbrakes, increase reference landing distance by 50 meters.*
>
> *For autobrake and manual speedbrakes, increase reference landing distance by 45 meters.*
>
> *Reference Distance included an air distance allowance of 305 meters from the threshold to touchdown.*

5.3.1 Computer Generated Maximum Landing Weight Chart

According to the flight crew, prior to departure from FOD the flight paperwork included landing performance charts based on maximum landing weight for a specific runway, at a given temperature and windspeed. The following chart was one of the charts located in the flightdeck following the incident[64].

[64] Source: Attachment 8 – Incident Flight On Board Paperwork

B737-700W/CFM56-7B22 LANDING PERFORMANCE

Runway Surface Condition	Wet		KLGA
Approach Climb Flap	15		LAGUARDIA
Landing Flap	30		RWY 22
Air Conditioning	Auto		7001 ft
Anti-Icing	Off		SLOPE: 0.13
Anti-Skid	On	Location:	NEW YORK
Thrust Reverse credit	All Reversers Operative	Elevation:	21 ft
QNH	30.41	Date:	27 Oct 2016

OATC	0 kts			5 kts			10 kts		
	MLW	MQTW	MQTT	MLW	MQTW	MQTT	MLW	MQTW	MQTT
0	58059 S	77823	62	58059 S	79073	62	58059 S	80351	62
2	58059 S	77525	62	58059 S	78771	62	58059 S	80038	62
5	58059 S	77051	62	58059 S	78324	62	58059 S	79577	62
8	58059 S	76585	62	58059 S	77885	62	58059 S	79126	62
11	58059 S	76127	62	58059 S	77443	62	58059 S	78682	62
14	58059 S	75677	62	58059 S	76980	62	58059 S	78246	62
17	58059 S	75232	62	58059 S	76523	62	58059 S	77816	62
20	58059 S	74792	62	58059 S	76071	62	58059 S	77375	62
23	58059 S	74366	62	58059 S	75626	62	58059 S	76918	62
26	58059 S	73951	62	58059 S	75189	62	58059 S	76489	62
29	58059 S	73544	62	58059 S	74760	62	58059 S	76028	62
32	58059 S	73149	62	58059 S	74345	62	58059 S	75594	62
35	58059 S	72760	62	58059 S	73937	62	58059 S	75165	62
37	58059 S	72499	62	58059 S	73664	62	58059 S	74878	62
40	58059 S	72109	62	58059 S	73265	62	58059 S	74458	62
43	58059 S	71721	62	58059 S	72874	62	58059 S	74049	62
46	58059 S	71343	62	58059 S	72492	62	58059 S	73650	62
49	58059 S	70974	62	58059 S	72115	62	58059 S	73264	62
52	57569 A	70614	62	57569 A	71745	62	57569 A	72891	62
55	NA	NA	NA	NA	NA	NA	NA	NA	NA
58	NA	NA	NA	NA	NA	NA	NA	NA	NA
61	NA	NA	NA	NA	NA	NA	NA	NA	NA
64	NA	NA	NA	NA	NA	NA	NA	NA	NA
67	NA	NA	NA	NA	NA	NA	NA	NA	NA
70	NA	NA	NA	NA	NA	NA	NA	NA	NA

Legend

S The selected maximum computational weight

A The approach climb limited weight

Figure 4: Maximum Landing Weight for Runway 22 LGA

5.4 Boeing Guidance

According to the Vice-President of Flight Operations and the Manager of Training – Eastern Air Lines, the Boeing 737 – Flight Crew Training Manual and the Boeing 737 – Flight Crew Operations Manual – Eastern Air Lines was utilized as their systems training material and procedures manual.

5.4.1 Boeing Guidance – Speed Brakes

The Boeing 737 Flight Crew Training Manual, Chapter 6, "Landing" provided the following information on the use of speed brakes:

> *The speed brakes can be fully raised after touchdown while the nose wheels are lowered to the runway, with no adverse pitch effects. The speed brakes spoil the lift from the wings, which places the airplane weight on the main landing gear, providing excellent brake effectiveness.*
>
> *Unless speed brakes are raised after touchdown, braking effectiveness may be reduced initially as much as 60%, since very little weight is on the wheels and brake application may cause rapid antiskid modulation.*

Normally, speed brakes are armed to extend automatically. Both pilots should monitor speed brake extension after touchdown. In the event auto extension fails, the speed brakes should be manually extended immediately.

Pilot awareness of the position of the speed brake lever during the landing phase is important in the prevention of over-run. The position of the speed brakes should be announced during the landing phase by the PM. This improves the crew's situational awareness of the position of the spoilers during landing and builds good habit patterns which can prevent failure to observe a malfunctioned or disarmed spoiler system.

5.4.2 Boeing Guidance – Automatic Brakes

The Boeing 737 Flight Crew Training Manual, Chapter 6 "Landing" provided the following information on the autobrake system:

Use of the autobrake system is recommended whenever the runway is limited, when using higher than normal approach speeds, landing on slippery runways, or landing in a crosswind.

For normal operation of the autobrake system select a deceleration setting.

Settings include:

- *MAX: Used when minimum stopping distance is required. Deceleration rate is less than that produced by full manual braking*

- *3: Should be used for wet or slippery runways or when landing rollout distance is limited. If adequate rollout distance is available, autobrake setting 2 may be appropriate*

- *1 or 2: These settings provide a moderate deceleration suitable for all routine operations.*

Experience with various runway conditions and the related airplane handling characteristics provide initial guidance for the level of deceleration to be selected.

Immediate initiation of reverse thrust at main gear touchdown and full reverse thrust allow the autobrake system to reduce brake pressure to the minimum level. Since the autobrake system senses deceleration and modulates brake pressure accordingly, the proper application of reverse thrust results in reduced braking for a large portion of the landing roll.

The importance of establishing the desired reverse thrust level as soon as possible after touchdown cannot be overemphasized. This minimizes brake temperatures and tire and brake wear and reduces stopping distance on very slippery runways.

The use of minimum reverse thrust as compared to maximum reverse thrust can double the brake energy requirements and result in brake temperatures much higher than normal.

After touchdown, crewmembers should be alert for autobrake disengagement annunciations. The PM should notify the PF anytime the autobrakes disengage.

If stopping distance is not assured with autobrakes engaged, the PF should immediately apply manual braking sufficient to assure deceleration to a safe taxi speed within the remaining runway.

5.4.3 Boeing Guidance – Landing Roll

The Boeing 737 Flight Crew Training Manual, Chapter 6 "Landing" provided the following guidance about the landing roll:

Avoid touching down with thrust above idle since this may establish an airplane nose up pitch tendency and increase landing roll.

After main gear touchdown, initiate the landing roll procedure. If the speed brakes do not extend automatically, move the speed brake lever to the UP position without delay. Fly the nose wheels smoothly onto the runway without delay. Control column movement forward of neutral should not be required. Do not attempt to hold the nose wheels off the runway. Holding the nose up after touchdown for aerodynamic braking is not an effective braking technique and results in high nose gear sink rates upon brake application and reduced braking effectiveness.

To avoid possible airplane structural damage, do not make large nose down control column movements before the nose wheels are lowered to the runway.

To avoid the risk of a tail strike, do not allow the pitch attitude to increase after touchdown. However, applying excessive nose down elevator during landing can result in substantial forward fuselage damage. Do not use full down elevator. Use an appropriate autobrake setting or manually apply wheel brakes smoothly with steadily increasing pedal pressure as required for runway condition and runway length available. Maintain deceleration rate with constant or increasing brake pressure as required until stopped or desired taxi speed is reached.

5.4.4 Boeing Guidance - Factors Affecting Landing Distance

The Boeing 737 Flight Crew Training Manual, Chapter 6 "Landing" provided the following guidance in regards to factors that affect the landing distance:

Advisory information for normal and non-normal configuration landing distances is contained in the PI chapter of the QRH. Actual stopping distances for a maximum effort stop are approximately 60% of the dry runway field length requirement. Factors that affect stopping distance include: height and speed over the threshold, glide slope angle, landing flare, lowering the nose to the runway, use of reverse thrust, speed brakes, wheel brakes and surface conditions of the runway.

***Note**: Reverse thrust and speed brake drag are most effective during the high speed portion of the landing. Deploy the speed brake lever and activate reverse thrust with as little time delay as possible.*

***Note**: Speed brakes fully deployed, in conjunction with maximum reverse thrust and maximum manual antiskid braking provides the minimum stopping distance.*

Floating above the runway before touchdown must be avoided because it uses a large portion of the available runway. The airplane should be landed as near the normal touchdown point as possible. Deceleration rate on the runway is approximately three times greater than in the air.

Height of the airplane over the runway threshold also has a significant effect on total landing distance. For example, on a 3° glide path, passing over the runway threshold at 100 feet altitude rather than 50 feet could increase the total landing distance by approximately 950 feet. This is due to the length of runway used up before the airplane actually touches down.

Glide path angle also affects total landing distance. As the approach path becomes flatter, even while maintaining proper height over the end of the runway, total landing distance is increased.

The section went on to provide diagrams showing "typical increases in landing distance" using Flaps 40. One of the diagrams included the incident aircraft make and model.

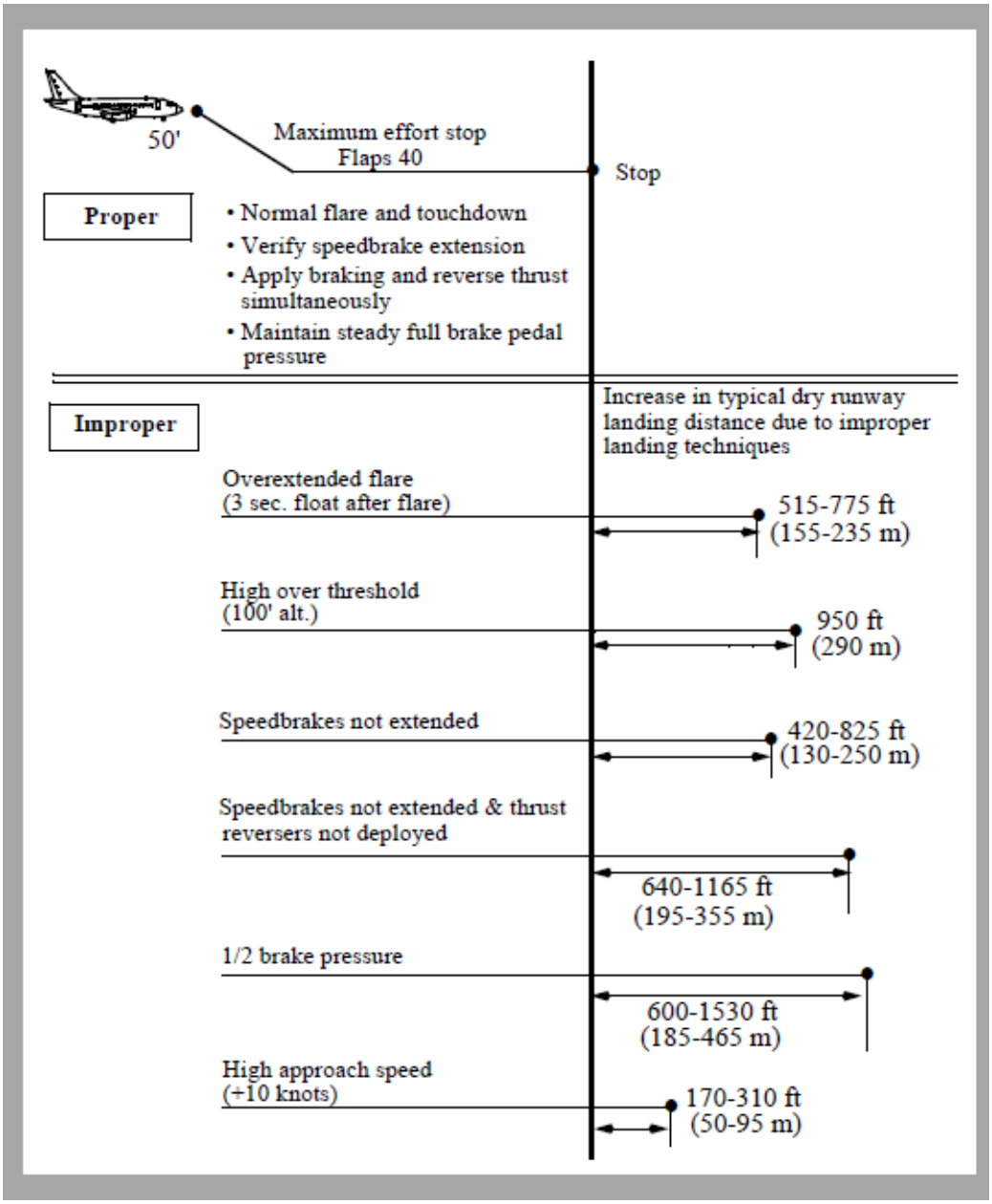


Figure 5: Factors Affecting Landing Distance for Boeing 737-600 through 737-900ER Aircraft

6.0 Relevant Systems

6.1 Autobrake

According to the Boeing 737 Flight Crew Operations Manual, the autobrake select switch comprised of an "OFF," "RTO," and setting of "1," "2,", "3," and "MAX," as well as "AUTO BRAKE DISARM" and "ANTISKID INOP" lights. The switch was located on the forward center panel.

The "OFF" setting deactivated the system.

The “RTO” setting automatically applied maximum brake pressure in the event that the thrust levers were retarded to idle at or above 90 knots.

The “1,2,3, or MAX” settings were manually selected by the flight crew in order to achieve the desired deceleration rate during landing. In order for the flight crew to select “MAX” the switch would have to be pulled out and then rotated to the “MAX” position.

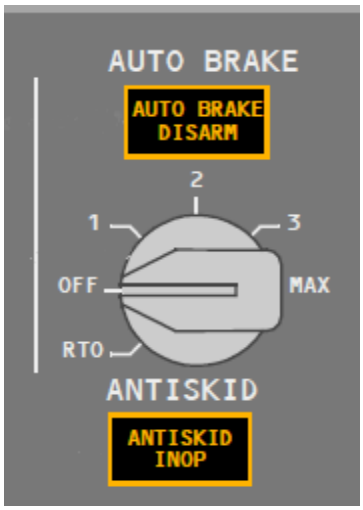


Figure 6: Autobrake and Antiskid Controls[65]

The autobrake system uses hydraulic system B pressure to provide maximum deceleration for rejected takeoff and automatic braking at preselected deceleration rated immediately after touchdown. The system operates only when the normal brake system is functioning.

Following touchdown, the autobrake application began when:
- Both forward thrust levers are retarded to IDLE
- The main wheels spin-up

In order for the pilots to disarm the autobrake system they may move the selector switch to the “OFF” positon. After braking has begun a pilot may do any of the following actions in order to disarm the system immediately and the “AUTO BRAKE DISARM” light would illuminate:
- Moving the SPEED BRAKE lever to the down detent
- Advancing the forward thrust lever(s), except during the first 3 seconds after touchdown for landing
- Applying manual brakes

In a Boeing Flight Crew Operations Manual Bulletin for Eastern Air Lines, Boeing recommended “the use of manual braking to disarm the autobrake system.”[66]

[65] Source: Boeing 737 Flight Crew Operations Manual pg. 14.10.4
[66] Source: Flight Crew Operations Manual Bulletin for Eastern Air Lines, Number EKV-5(P)2 issued April 26, 2016

6.2 Speed Brakes

The following guidance was provided by the Boeing 737 Flight Crew Operations Manual – Eastern Airlines, in regard to the incident aircraft's speed brake system:

SPEED BRAKE Lever
DOWN (detent) – all flight and ground spoiler panels in faired position.

ARMED –

- *automatic speed brake system armed*
- *upon touchdown, the SPEED BRAKE lever moves to the UP position, and all flight and ground spoilers extend.*

N277EA, N278EA
50% –

- *if the speed brakes are deployed beyond the 50% position and the speed brake load alleviation feature is activated;*
- *the speed brake lever moves to this position*
- *all flight spoilers retract to one-half of their maximum position for inflight use.*

FLIGHT DETENT – all flight spoilers are extended to their maximum position for inflight use.

UP – all flight and ground spoilers are extended to their maximum position for ground use.

SPEED BRAKE ARMED Light
Light deactivated when SPEED BRAKE lever is in the DOWN position.

Illuminated (green) – indicates valid automatic speed brake system inputs.

SPEED BRAKE DO NOT ARM Light

N277EA, N278EA

- *indicates an abnormal condition or test input to the speed brake load alleviation system when the flaps are raised, or*
- *during landing, indicates wheel speed has dropped below 60 kts, and the speed brake lever is not in the DOWN position.*

SPEED BRAKES EXTENDED Light
Illuminated (amber) –

- *in–flight -*
  - *SPEED BRAKE lever is beyond the ARMED position, and*
  - *TE flaps extended more than flaps 10, or*
  - *radio altitude less than 800 feet*
- *on the ground -*
  - *SPEED BRAKE lever is in the DOWN detent,*

• *ground spoilers are not stowed.*

***Note**: On the ground, the SPEED BRAKES EXTENDED light does not illuminate when hydraulic system A pressure is less than 750 psi.*

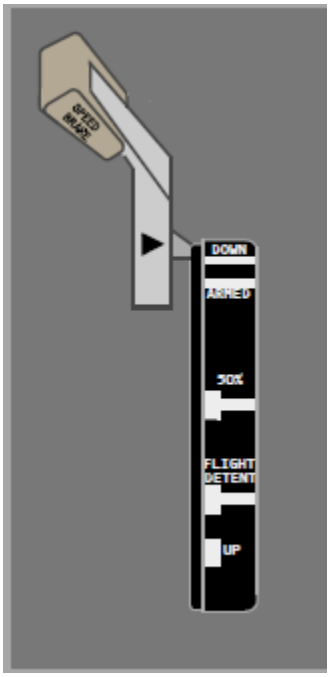


Figure 7: Speed Brake[67]

6.3 Thrust Reversers

The following information was provided by the Boeing 737 Flight Crew Operations Manual[68] regarding the thrust reverser system:

> ***Thrust Reverser***
>
> *Each engine is equipped with a hydraulically operated thrust reverser, consisting of left and right translating sleeves. Aft movement of the reverser sleeves causes blocker doors to deflect fan discharge air forward, through fixed cascade vanes, producing reverse thrust. The thrust reverser is for ground operations only and is used after touchdown to slow the airplane, reducing stopping distance and brake wear.*
>
> *Hydraulic pressure for the operation of engine No. 1 and engine No. 2 thrust reversers comes from hydraulic systems A and B, respectively. If hydraulic system A and/or B fails, alternate operation for the affected thrust reverser is available through the standby hydraulic system. When the standby system is used, the affected thrust reverser deploys and retracts at a slower rate and some thrust asymmetry can be anticipated.*

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67 Source: Boeing 737 Flight Crew Operations Manual pg. 9.10.11

68 Source: Boeing 737 Flight Crew Operations Manual "Engines, APU – Engine System Description" pgs. 7.20.14 thru 7.20.15

The thrust reverser can be deployed when either radio altimeter senses less than 10 feet altitude, or when the air/ground safety sensor is in the ground mode. Movement of the reverse thrust levers is mechanically restricted until the forward thrust levers are in the idle position.

When reverse thrust is selected, an electro–mechanical lock releases, the isolation valve opens and the thrust reverser control valve moves to the deploy position, allowing hydraulic pressure to unlock and deploy the reverser system. An interlock mechanism restricts movement of the reverse thrust lever until the reverser sleeves have approached the deployed position. When either reverser sleeve moves from the stowed position, the amber REV indication, located on the upper display unit, illuminates. As the thrust reverser reaches the deployed position, the REV indication illuminates green and the reverse thrust lever can be raised to detent No. 2. This position provides adequate reverse thrust for normal operations. When necessary, the reverse thrust lever can be pulled beyond detent No. 2, providing maximum reverse thrust.

Downward motion of the reverse thrust lever past detent No. 1 (reverse idle thrust) initiates the command to stow the reverser. When the lever reaches the full down position, the control valve moves to the stow position allowing hydraulic pressure to stow and lock the reverser sleeves. After the thrust reverser is stowed, the isolation valve closes and the electro–mechanical lock engages.

The REVERSER light, located on the aft overhead panel, illuminates when the thrust reverser is commanded to stow and extinguishes 10 seconds later when the isolation valve closes. Any time the REVERSER light illuminates for more than approximately 12 seconds, a malfunction has occurred and the MASTER CAUTION and ENG system annunciator lights illuminate.

> ***Note:*** *A pause in movement of the reverse thrust levers past detent No. 1 toward the stow position may cause MASTER CAUTION and ENG system annunciator lights to illuminate. A pause of approximately 18 seconds engages the electro-mechanical lock and prevents the thrust reverser sleeves from further movement. Cycling the thrust reversers may clear the fault and restore normal operation.*

When the reverser sleeves are in the stow position, an electro–mechanical lock and a hydraulically operated locking actuator inhibit motion to each reverser sleeve until reverser extension is selected. Additionally, an auto–restow circuit compares the actual reverser sleeve position and the commanded reverser position. In the event of incomplete stowage or uncommanded movement of the reverser sleeves toward the deployed position, the auto–restow circuit opens the isolation valve and commands the control valve to the stow position directing
hydraulic pressure to stow the reverser sleeves. Once the auto–restow circuit is activated, the isolation valve remains open and the control valve is held in the stowed position until the thrust reverser is commanded to deploy or until corrective maintenance action is taken.

WARNING: Actuation of the thrust reversers on the ground without suitable precautions is dangerous to ground personnel.

7.0 Meteorological Information

The captain obtained the ATIS information via the VHF[69] radio frequency. The flight crew had on board at the time of the incident weather reports and forecasts that were part of the flight release[70].

See the Weather Study Report located in the docket associated with this incident.

8.0 Air Traffic Control (ATC)

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

9.0 Communications

There were no known communication difficulties at the time of the incident.

10.0 Airport Information

Airport information was obtained from the FAA Aeronautical Information Services – National Flight Data Center (NFDC) and the digital Supplemental Chart (d-SC). The airport was owned and managed by the city of New York. The airport was serviced by an FAA ATCT that was in operation 24-hours a day. The ATCT was in operation at the time of the incident. At the time of the incident, LGA's field elevation was reported at 20.6 feet above msl. and the airport was located approximately 4 miles to the east of New York City, New York. The airport had 4 hard surface runways. NFDC data indicated that runway 22 was 7,001 feet long, 150 feet wide, and had a touchdown zone elevation of 12.4 feet msl. The runway had 7,001 feet of landing distance available (LDA) and when landing beyond the glide slope the runway had 5,979 feet available. The runway was made of asphalt and concreate, grooved, and the surface condition was considered good. The d-SC data indicated that there was an EMAS installed.

Runway 22 had precision instrument runway markings, high intensity runway lights, centerline lighting, touchdown zone lights, REIL[71], ALSF-1[72], and a 4-light precision approach path indicator (PAPI) located on the right side of the runway with a visual glide path angle of 3.0 degrees. The runway was also serviced by 2 ILS approaches, one of which was certified for Cat-II approaches, an LDA/DME approach, and an RNAV (GPS) approach.

---

[69] Very High Frequency

[70] Source: Attachment 1 – Flight Crew Interview Summaries

[71] 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."*

[72] The Aeronautical Information Manual defined ALSF-1 as Approach Light System with Sequenced Flashing Lights in ILS Cat-I configuration

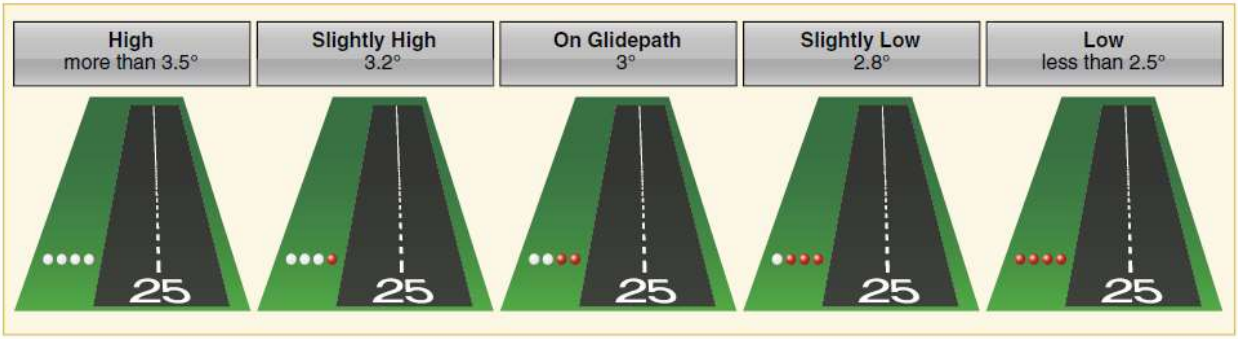

Figure 8: 4-Light Precision Approach Path Indicator (PAPI)[73]

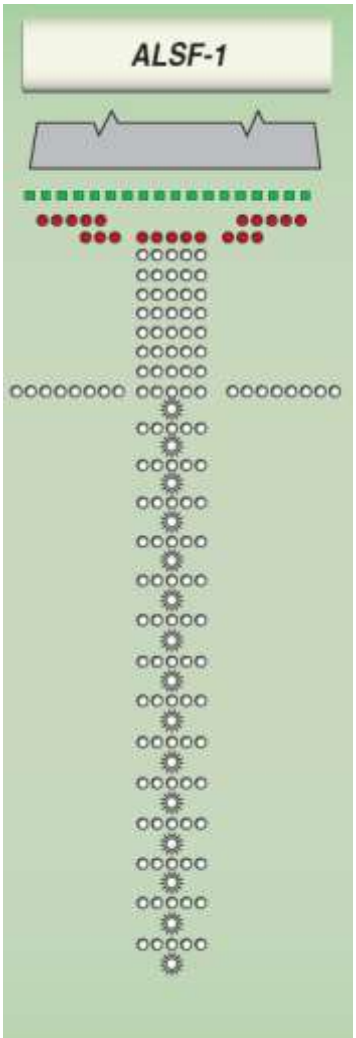

Figure 9: ALSF-1 Lighting[74]

[73] 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.
[74] Source: FAA Instrument Flying Handbook (FAA-H-8083-15B)

10.1 Applicable LGA Charts

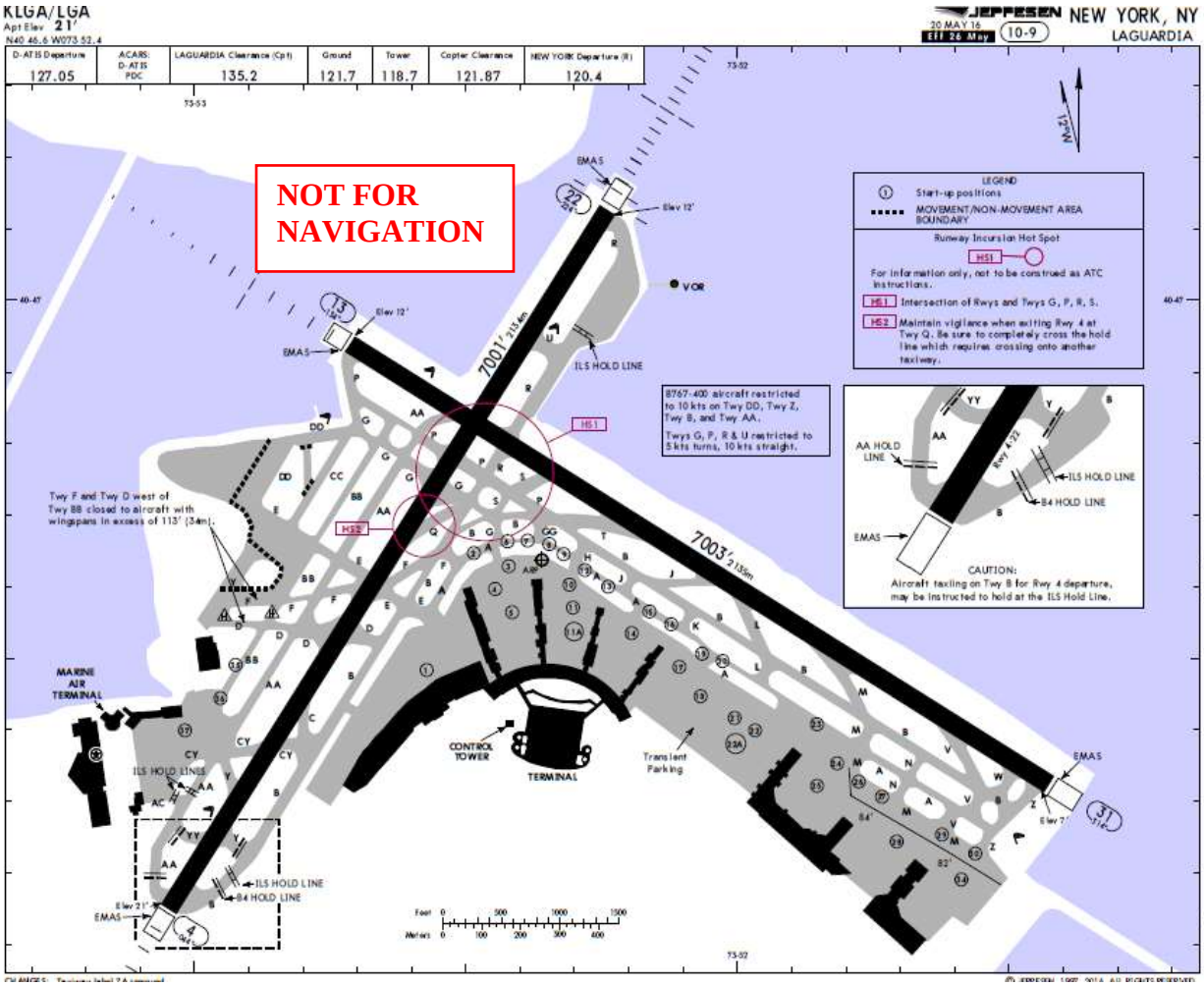

Figure 10: LGA Airport Diagram Chart

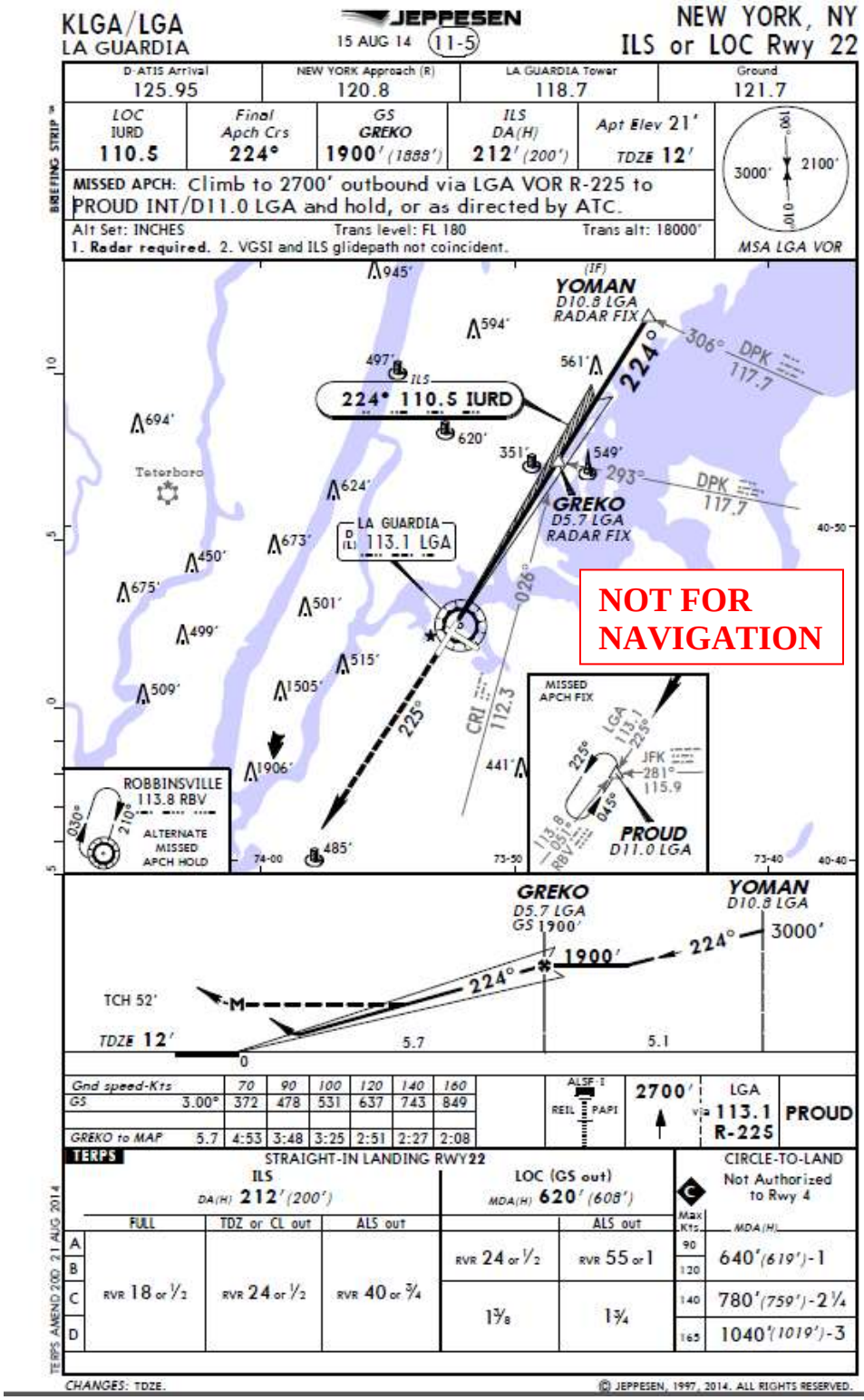

Figure 11: LGA ILS22 Approach Chart

11.0 Company Overview[75]

Eastern Air Lines, Inc. received certification as to operate as a Part 121 Supplemental carrier on May 15, 2015. Subsequently, Eastern Air Lines began scheduled charter services to Havana, Cuba and four other cities in Cuba. Prior to the incident the airline also launched charter service to Guyana, Trinidad, Costa Rica, Venezuela, as well as other Latin American and Caribbean destinations.

The airline's operations was based at the Miami International airport, which was the only base for Eastern Air Lines at the time of the incident.

The airline, at the time of the incident, had a fleet of 5 Boeing 737 aircraft. The incident aircraft was a 737-700 series and the remaining 4 aircraft, were Boeing 737-800 series.

At the time of the incident, Eastern Air Lines had 64 pilots[76], all of which were based at the MIA base.

11.1 Management Organization

Eastern Air Lines' Vice-President of Flight Operations was responsible for both the flying operations of the airline, the training of the airline's flight crews, the OCC, and ground operations. This position had the following divisions report to him: Chief Pilot, Manager of Flight Operations Training, Director of Inflight, Director of OCC, Manager of Flight Standards, and Manager of Charter Operations.

Eastern Air Lines' Director of Safety and Security reported directly to the Chief Executive Officer (CEO). The Director of Safety in training was hired about 2 week prior to the incident.[77]

12.0 Manuals and Guidance Material

Eastern 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 Flight Operations Manual. Chapter 1.0 "Flight Operations Manual Introduction" provided the following purpose of the manual:

> *The Flight Operations Manual sets forth policies, procedures, instruction and information necessary for Eastern's Flight Operation's personnel to perform their duties with the highest degree of safety and responsibility in compliance with federal, state, local laws and approved accepted Company manuals.*

12.1 Approach Procedure

The Eastern Air Lines Flight Operations Manual, Section 9.10.2 "Approach Briefing" provided the following chart:

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[75] Source: Eastern Air Lines web site http://easternairlines.aero/about/history
[76] Source: Attachment 4 - Eastern Air Line Personnel Interview Summaries
[77] Source: Attachment 4 - Eastern Air Line Personnel Interview Summaries

Approach Briefing
This briefing is given by the planned Pilot Flying to the planned Pilot Monitoring before initial descent if possible. Ensure Pilot Flying transfers control to the planned Pilot Monitoring during the brief.
Night conditions or weather less than 2000 / 3
Approach Name and Runway
Approach Chart Date
Primary Navaid Frequency
Final Approach Course
Final approach verification altitude
DA(H) or MAP
TDZE
Required visibility
Day conditions with weather greater than or equal to 2000 / 3
Electronic/visual means to identify runway
For All Approaches
Highest MSA
Planned runway turnoff and taxi route/hotspots
Landing performance
Landing flaps and autobrakes
· Any applicable special considerations such as - MEL item(s) - Unique airport advisory page(s) briefing items - Unique noise abatement procedures - Unique engine failure during missed approach procedures - Unique transition altitude - Significant terrain/obstacles in terminal area relative to approach routing - Significant weather conditions
Any other known risks and intentions
Go Around/Missed Approach
For RNAV Arrivals
In addition to the normal arrival briefing the following items will be briefed when conducting RNAV STARs. These items will be briefed again if there is a change to the initial clearance given by ATC and all items checked again. - Arrival Briefing RNAV or Non-RNAV - Verify STAR Name, Initial/Feeder Fix, and Runway transition - Waypoint sequence, Altitudes and Speed restrictions, RNP requirements (if applicable) **NOTE:** If vectored off course ATC must assign an Altitude, if on a ("Descend VIA") **NOTE:** If unable RNP advise ATC request different Non RNAV Arrival

Figure 12: Eastern Air Lines Approach Briefing[78]

12.1.1 Eastern Air Lines Autobrake Policy

According to interviews with the incident crewmembers Eastern Air Lines preferred autobrake setting was 2. However, in interviews with Eastern Air Lines' personnel, there was no guidance provided by the operator on the preferred autobrake setting and that pilots would reference the performance chart when selecting the autobrake setting.[79] A review of Eastern Air Lines manuals

[78] Source: Eastern Air Lines Flight Operations Manual Revision 1 dated May 15, 2015, pg. 9-82
[79] SRCE: Attachment 4 – Eastern Air Lines Personnel Interview Summaries pp. 23, 36, and 41

and performance charts indicated no specific recommended setting and provided performance numbers for the four available landing autobrake settings.

12.2 Landing Procedure – ILS

The Boeing 737 Flight Crew Operations Manual – Eastern Airlines "Normal Procedures – Amplified Procedures" Section NP 21 provided the following chart:

Pilot Flying	Pilot Monitoring

Initially
• If on radar vectors
  • HDG SEL
  • Pitch mode (as needed)
• If enroute to a fix
  • LNAV or other roll mode
  • VNAV or other pitch mode	

	Notify the cabin crew to prepare for landing. Verify that the cabin is secure.
Call "FLAPS ___" according to the flap extension schedule.	Set the flap lever as directed. Monitor flaps and slats extension.
When on localizer intercept heading: • verify that the ILS is tuned and identified • verify that the LOC and G/S pointers are shown.	
Arm the APP mode. If a dual channel approach is desired, engage the second autopilot.	
Note: When using LNAV to intercept the final approach course, LNAV might parallel the localizer without capturing it.	
Use LNAV or HDG SEL to intercept the final approach course as needed.	
Verify that the localizer is captured. Verify the final approach course heading.	
	Call "GLIDESLOPE ALIVE."
At glideslope alive, call: • "GEAR DOWN" • "FLAPS 15"	
	Set the landing gear lever to DN. Verify that the green landing gear indicator lights are illuminated. Set the flap lever to 15. Set the engine start switches to CONT.

Pilot Flying	Pilot Monitoring
Set the speed brake lever to ARM. Verify that the SPEED BRAKE ARMED light is illuminated.	
At glideslope capture, call "FLAPS ___" as needed for landing.	Set the flap lever as directed.
Set the missed approach altitude on the MCP.	
Call "LANDING CHECKLIST."	Do the LANDING checklist.
At the final approach fix (LOM, MKR, DME), verify the crossing altitude.	
Monitor the approach.	
For a single channel approach, disengage the autopilot and disconnect the autothrottle no later than the minimum use height for single autopilot operation.	

Figure 13: Amplified Landing Procedure - ILS

12.3 Landing

The Boeing 737 Flight Crew Training Manual, dated June 30, 2016, page 8.14 stated in part:

> *Fly the airplane onto the runway at the recommended touchdown point. Flare only enough to achieve an acceptable reduction in the rate of descent. Do not allow the airplane to float. Floating just above the runway surface to deplete additional speed wastes available runway and increases the possibility of a tail strike. Do not risk touchdown beyond the normal touchdown zone in an effort to achieve a smooth landing.*

The manual also provided the following guidance on page 5.6:

As the airplane crosses the runway threshold it should be:

- *Stabilized on approach airspeed to within +10 knots until arresting descent rate at flare*
- *On a stabilized flight path using normal maneuvering*
- *Positioned to make a normal landing in the touchdown zone (the first 3,000 feet or first third of the runway, whichever is less).*

The Eastern Air Lines Flight Operations Manual, dated September 21, 2016, Chapter 25 "Acronyms and Definitions," page 25-25 defined the touchdown zone as:

> *The first 3000 feet of runway past the threshold or the first 1/3 of the usable runway length, whichever is shorter.*

12.4 Landing Roll Procedure

The Boeing 737 Flight Crew Operations Manual – Eastern Air Lines "Normal Procedures – Amplified Procedures" Chapter NP, Section 21 provided the following chart:

Landing Roll Procedure

Pilot Flying	Pilot Monitoring
If an autoland was accomplished, disengage the autopilot. Control the airplane manually.	
Verify that the thrust levers are closed. Verify that the SPEED BRAKE lever is UP. Without delay, fly the nose wheel smoothly onto the runway.	Verify that the SPEED BRAKE lever is UP. Call "SPEED BRAKES UP." If the SPEED BRAKE lever is not UP, call "SPEED BRAKES NOT UP."
Monitor the rollout progress.	
Verify correct autobrake operation.	
WARNING: After the reverse thrust levers are moved, a full stop landing must be made. If an engine stays in reverse, safe flight is not possible.	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Apply reverse thrust as needed.	Verify that the forward thrust levers are closed. When both REV indications are green, call "REVERSERS NORMAL". If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER ENGINE NUMBER 1", or "NO REVERSER ENGINE NUMBER 2", or "NO REVERSERS".
By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.	Call "60 KNOTS."
After the engines are at reverse idle, move the reverse thrust levers full down.	
Before taxi speed, disarm the autobrake. Use manual braking as needed.	

Figure 14: Amplified Landing Roll Procedures[80]

12.5 Missed Approach, Go-Around, Rejected Landing Guidance

The Eastern FOM, Section 9.11 "Landing or Go-Around" stated in part:

[80] Source: Boeing 737 Flight Crew Operations Manual pg. NP.21.64

Execute a missed approach when:

- *Arrival at the MAP or DH and visual reference to the runway environment is insufficient to complete the landing*
- *A safe landing is not possible.*
- *Instructed by ATC*

According to interviews with Eastern Air Lines' management personnel, Rejected landing were initiated around 50 feet agl and were prompted by the simulator instructors, who provided simulated tower instructions that a truck was on the runway. According to the manager of training at Eastern Air Lines, go-arounds are conducted as missed approaches and rejected landings are performed for scenarios such as an aircraft still being on the runway. He further provided that at about 50 feet agl, the simulator instructor would instruct the pilot to go-around.

During interviews with other Eastern Air Lines' pilots, a few stated they had conducted go-arounds while line flying. One stated it was due to low visibility and another pilot stated he had done one after being instructed by ATC to go-around due to spacing with a preceding aircraft.

At the time of the incident Eastern Air Lines did not teach go-arounds being initiated after the airplane made contact with the runway.

12.6 Stabilized Approach Criteria

The Eastern Air Lines Flight Operations Manual, Chapter 9 "Flight Policies – Phase of Flight" pg. 9-86 stated, in part:

> *Pilots will fly all approaches in accordance with the following rate of descent and flight parameters unless non-normal conditions require deviation and are briefed. (flaps, non-normal, etc.)*

WARNING

DO NOT ATTEMPT TO LAND FROM AN UNSTABILIZED APPROACH. THE DECISION TO GO AROUND IS NOT AN INDICATION OF POOR JUDGMENT, BUT RATHER GOOD JUDGMENT.

Precision Approaches in IMC
The aircraft should be stabilized no lower than 1000' above touch down zone elevation (TDZE).
Non-Precision Approaches in IMC
The aircraft should be stabilized, except for engine spooling, no later than the final approach fix (FAF). Descent rates should not exceed 1500 feet per minute (fpm). Aircraft should be fully stabilized by 1,000 feet above TDZE
Visual Approaches in VMC
The aircraft should be stabilized by 500 feet above TDZE.
Flight Parameters
To be stabilized, all of the following conditions must be achieved prior to, or upon, reaching this stabilization height: · The aircraft is on the correct lateral flight plan, · The aircraft is in the desired landing configuration, · The thrust is stabilized above idle, to maintain the target speed on the desired glide path, · No excessive flight parameter deviation. If the aircraft is not stabilized on the approach path in landing configuration, at 1000 feet (above TDZE) in instrument conditions, or at 500 feet (above TDZE) in visual conditions, a go-around must be initiated. If an aircraft is not stabilized as described in Stabilized Approach or Flight Parameters, a go around should be initiated.

Figure 15: Stabilized Approach Guidance

12.7 Rejected Landing Procedures

The FOM 9.11.5 provided the following table for conducting a rejected landing:

Step	Action
In the event of a rejected landing:	
1	Execute the rejected landing procedure as listed on the Jeppesen Airport page. NOTE: If no rejected landing procedure is listed, then follow ATC instructions.
2	Notify ATC as soon as practical, and
3	Remain clear of clouds.

Figure 16: Rejected Landing Procedure

12.8 Bounced Landing Recovery

Eastern Air Lines ground school PowerPoint training in "Bounced Landing Recovery"[81] provided the following slide:

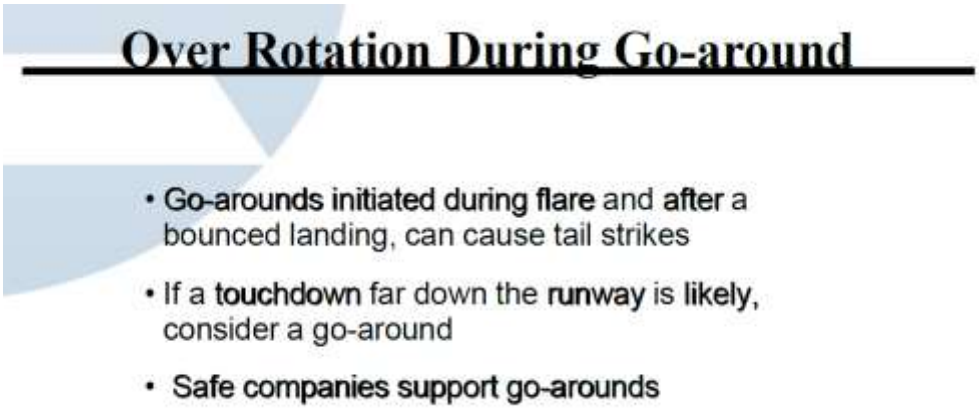

Figure 17: Eastern Air Lines Over Rotation Guidance

12.9 FAA Oversight

During an interview with the former Director of Safety of Eastern Air Lines, he stated that he had resigned from Eastern about 4 weeks prior to the incident. During his time as the Director of Safety for Eastern Air Lines he "seldom" interacted with the FAA POI or anyone else at the FAA. Other management personnel stated they interacted with the FAA daily or multiple times per week, via telephone, email, or in person either at the FAA's office or at Eastern Air Lines office. The manager of training stated that he did not directly interact with the POI and usually went through Vice-President of Flight Operations and the Chief Pilot. The Vice-President of Flight Operations stated that they had been assigned a new POI within the preceding 5months and that the interaction with that POI as "really great."

During an interview with the current FAA POI[82], he stated that he communicates with the Director of Operations and the Chief Pilot at Eastern the most, but has also communicated with the Director of Training. He categorized the communication as "very good." He further provided that Eastern Air Lines was the only certificate he managed and that FAA resources were limited as they only had one person in the office that was able to conduct checkrides in the Boeing 737. He estimated that he was at Eastern Air Lines' operations a "couple of times a week;" however, he has not taken part in Eastern Air Lines' pilot training. He also stated that the training for a go-around was similar to the syllabus utilized by other airlines, and he "assumed" that they did some of the go-around in the flare and some in low visibility. They have also discussed, following the incident, training go-arounds once the airplane was on the ground and that was still in need of further discussion.

During an interview with the former FAA POI, he stated that he had been the assigned POI with Eastern prior to receiving their operating certificate. He stated that part of his duties included reviewing the airline's manuals as well as changes to the manuals, and surveillance, with the most

[81] Source: Attachment 14 - Eastern Air Lines Training Module 7 – "Bounced Landing Recovery"
[82] Source: Attachment 5 – FAA Interview Summaries

important part being surveillance. He went to the airline's headquarters about once or twice a week. He also stated that he interacted with most of the Operations Management, Director of Safety, Director of Training, as well as the Chief Executive Officer. He stated that the most challenging part of working with Eastern Air Lines was the former Director of Safety, who he classified as "old school" and did not utilize the most up to date information available when beginning to start the airline's Safety Management System. He further stated that the CEO attempted to have him removed from the certificate four times when he had requested the airline to do something.

12.10 Transfer of Aircraft Control

12.10.1Flight Operations Manual

The FOM 9.11.7 "Transfer of Aircraft Control After Landing" stated:

The PF shall ensure the aircraft is slowed to a taxi speed if transferring control after landing.

12.10.2Operations Control Manual

The Operations Control Manual, Section 6.3 "Emergency Authority" stated, in part, the following:

Captain Emergency Authority

In an emergency situation that requires immediate decision and action, the Captain (PIC) may take any action that he considers necessary under the circumstances. In such a case, he may deviate from prescribed operations, procedures and methods, weather minimums, and the FOM / QRH / FCOM, to the extent required in the interests of safety. 121.559(a)

12.11 Evacuation

The FOM Chapter 11 "Emergency/Non-Normal Procedures" provided the following guidance:

Evacuation Not Required

When an evacuation is not warranted, an announcement should be made as soon as possible after landing to inform passengers and flight attendants –

"This is the Captain. Please remain seated with your seat belt fastened."

This announcement is short and directive and comes from an authoritative source.

It will also provide initial guidance to the Flight Attendants and does not alleviate the necessity to communicate directly with the Flight Attendants.

Once the situation is stabilized, a second announcement should be made to inform the passengers –

If emergency equipment is dispatched, advise the passengers emergency equipment may be visible outside the aircraft.

13.0 Runway Condition Assessment Matrix

The Eastern Air Lines Flight Operations Manual, Chapter 22 "Deicing/Anti-icing," Revision 6, dated September 23, 2016, provided the following guidance for Runway Condition Assessment Matrix (RCAM):

> *Effective October 1st, 2016 the FAA is establishing a new method to be used by airport operators to perform assessments of runway conditions and by pilots to interpret reported runway conditions.*
>
> *The previous three reports, Braking Action Reports, Surface Condition Reports and Surface Friction Mu Reports will be obsolete. The FAA is implementing the use of the Runway Condition Assessment Matrix (RCAM). This methodology communicates actual runway conditions to pilots in terms that directly relate to expected aircraft performance. This methodology was based on recommendations from the Takeoff and Landing Performance Assessment (TALPA) Aviation Rulemaking Committee (ARC).*
>
> *The RCAM is presented in a standardized format, based on airplane performance data supplied by airplane manufacturers, for each of the stated contaminant types and depths. The RCAM replaces subjective judgments of runway surface conditions with objective assessments tied directly to contaminant type and depth categories.*
>
> *The airport operator will use the RCAM to assess paved runway surfaces, report contaminants present, and through the assistance of the Federal NOTAM System, determine the numerical Runway Condition Codes (RwyCC) based on the RCAM. The RwyCCs apply to paved runways and may be the same or vary for each third of the runway depending on the type(s) of contaminants present. RwyCCs will replace Mu reports which will no longer be published in the NOTAM system. Additionally, contaminant coverage will be expressed in percentage terms for each third of the runway, beginning at the Runway end from which it was assessed. This is typically the runway end primarily in use.*
>
> *Pilot braking action reports will continue to be solicited and will be used in assessing braking performance. Effective October 1, 2016, the terminology "Fair" will be replaced by "Medium" and pilot braking action reports will now describe conditions as Good, Good to Medium, Medium, Medium to Poor, or NIL. This will harmonize the NAS with ICAO standards.*
>
> *Additionally, it will no longer be acceptable for a federally obligated airport to report a NIL braking action condition. NIL conditions on any surface require the closure of that surface. These surfaces will not be opened until the airport operator is satisfied that the NIL braking condition no longer exists.*
>
> ***Instructional Notes:** The RCAM braking action codes and definitions are shown below. The Assessment Criteria is associated with how an airport operator conducts and reports a runway condition assessment for a paved runway. The Control/Braking Assessment Criteria is associated with the pilot's experience with braking action.*

Assessment Criteria		Control/Braking Assessment Criteria	
Runway Condition Description	RwyCC	Deceleration or Directional Control Observation	Pilot Reported Braking Action
• Dry	6	—	—
• Frost • Wet (includes damp and 1/8 inch depth or less of water) *1/8 inch (3mm) depth or less of:* • Slush • Dry Snow • Wet Snow	5	Braking deceleration is normal for the wheel braking effort applied AND directional control is normal.	Good
-15°C and Colder outside air temperature: • Compacted Snow	4	Braking deceleration OR directional control is between Good and Medium.	Good to Medium
• Slippery When Wet (wet runway) • Dry Snow or Wet Snow (any depth) over Compacted Snow *Greater than 1/8 inch (3 mm) depth of:* • Dry Snow • Wet Snow *Warmer than -15°C outside air temperature:* • Compacted Snow	3	Braking deceleration is noticeably reduced for the wheel braking effort applied OR directional control is noticeably reduced.	Medium
Greater than 1/8 inch(3 mm) depth of: • Water • Slush	2	Braking deceleration OR directional control is between Medium and Poor.	Medium to Poor
• Ice	1	Braking deceleration is significantly reduced for the wheel braking effort applied OR directional control is significantly reduced.	Poor
• Wet Ice • Slush over Ice • Water over Compacted Snow • Dry Snow or Wet Snow over Ice	0	Braking deceleration is minimal to non-existent for the wheel braking effort applied OR directional control is uncertain.	Nil

The airplane operator will use the pilot's version of the RCAM to assess the effects of a given contaminant(s) as indicated by the associated RwyCC prior to landing or departing. Airplane operators cannot adjust the RwyCC. However, the airport operator may adjust (downgrade or upgrade) the RwyCC based on multiple variables in their overall assessment. This may cause the RwyCC to differ from the category of the reported contaminant(s).

When an airport condition (FICON) NOTAM includes RwyCCs, it is an indicator that more than 25% of the overall runway coverage or cleared width is contaminated and performance impacts are likely. When a runway is less than 25% contaminated, RwyCCs will not be generated, and performance impacts are less likely.

Eastern Airlines [sic] will not operate if RwyCC is reported 0, "NIL".

F. LIST OF ATTACHMENTS

Attachment 1: Flight Crew Interview Summaries
Attachment 2: Captain's Written Statement to the Company
Attachment 3: Cabin Crew Written Statements

Attachment 4: Eastern Air Line Employees Interview Summaries
Attachment 5: FAA Interview Summaries
Attachment 6: Flight Crew Statements and Interview Summaries from Preceding Flights
Attachment 7: Eyewitness Statements
Attachment 8: Incident Flight On-Board Paperwork
Attachment 9: Flight Crew Operations Manual – Procedures
Attachment 10: Weight and Balance Information
Attachment 11: Load Manifest Calculation Control Sheet
Attachment 12: Minimum Equipment List [Excerpt]
Attachment 13: Weather for Captain's Previous Flight to LaGuardia
Attachment 14: Eastern Air Lines Training Module 7 – Bounced Landing
Attachment 15: Eastern Air Lines Organization Chart
Attachment 16: LaGuardia Airport Diagram and Runway 22 Approach Charts

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