NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

January 14, 2020

Group Chairman's Factual Report

OPERATIONAL FACTORS/HUMAN PERFORMANCE

DCA19MA143

Table Of Contents

A. ACCIDENT

Operator: Miami Air
Location: Jacksonville, Florida
Date: May 3, 2019
Time: 2142 EDT[1]
0142Z
Airplane: Boeing 737-81Q, N732MA, Biscayne 293

B. OPERATIONAL FACTORS/HUMAN PERFORMANCE GROUP

Shawn Etcher
Group Chairman – Operational Factors
Operational Factors Division (AS-30)
National Transportation Safety Board

Katherine Wilson
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Human Performance Division (AS-60)
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P. Warren Abrams - Member
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The Boeing Company
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Steve Joffrion - Member
Chief of Flight Standards
Miami Air
Miami, FL 33122

Darrin Nelson - Member[2]
Accident Investigation Committee
International Brotherhood of Teamsters
Miami, FL 33122

C. SUMMARY

On May 3, 2019, at 2142 eastern daylight time, Miami Air flight 293, a Boeing 737-81Q registration N732MA, was landing on runway 10 at Jacksonville Naval Air Station (NIP), Jacksonville, Florida, when it departed the end of the runway, contacted a stone embankment, and came to rest in shallow water in St. Johns River. The 2 pilots, 4 flight attendants, 1 mechanic, and 136 passengers were not seriously injured[3]. The airplane was substantially damaged. Flight 293

[1] All times in the report will be in eastern daylight time, also known as local lime, except as noted. At the time of the accident local time was UTC -4 hours.
[2] On July 11, 2019, Paul McDonagh was replaced by the International Brotherhood of Teamsters and Darrin Nelson was assigned to the Operational Factors group.
[3] Source: Attachment 19 – Memorandum for Record – Email Conversation [Excerpt] and Attachment 8 - Accident Flight's Dispatch Paperwork on pg. 59 showed a total of 142 souls on board; however, was only a preliminary passenger count.

was a non-scheduled passenger flight from Leeward Point Field (MUGM), Naval Station Guantanamo Bay, Cuba, to NIP.

D. DETAILS OF THE INVESTIGATION

The Operational Factors group was formed on May 5, 2019 and interviews with the flight crew were conducted later that day. The first officer was interviewed first and subsequently the captain was interviewed; summaries of their interviews are located in attachment 1 of this report.

On May 6, 2019, the group interviewed the manager of SMS[4] and the director of safety and security and then repositioned from the accident scene to Miami Air's headquarters in Miami to interview company personnel.

On May 7, 2019, the group reconvened at the Miami Air headquarters where the group interviewed the mechanic that was occupying the cockpit jumpseat, the chief pilot, the director of training, and the director of flight control.

On May 8, 2019, the group met at the Miami Air headquarters where the group interviewed the flight operations quality assurance (FOQA) representative, the dispatcher that prepared the accident flight's flight plan, the vice president of flight operations, and the dispatcher that was on duty at the time of the accident and who had been flight following the accident airplane.

On May 9, 2019, the group met at the Miami Air headquarters where the group interviewed a dispatcher that came on duty shortly after the accident and the director of system operations. The group also received a tour of the dispatch office at Miami Air and was given a demonstration of Miami Air's online safety reporting system.

On July 16, 2019, the group reconvened at the Miami Air headquarters where the group interviewed the Miami Air chief of flight standards.

On July 17, 2019, the group met at the FAA Certificate Management Office in Miramar, Florida and interviewed the aircraft program manager, principal operations inspector (POI), supervisory safety inspector, and a former aviation safety inspector on the Miami Air certificate.

E. FACTUAL INFORMATION

1.0 History of Flight[5]

The crew consisted of a captain, first officer (FO), four flight attendants and a mechanic that was sitting in the cockpit jumpseat. The day of the accident was day 2 of a 3-day pairing, which consisted of three flight legs; a round trip from NIP-MUGM and a final leg from NIP to Norfolk Naval Station (Chambers Field) (NGU), Norfolk, Virginia. However, due to mechanical delays the NIP to NGU leg was removed and the crew was reassigned to deadhead from NIP to

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[4] Safety Management System.
[5] Sources: Attachment 1 – Flight Crew Interview Summaries and Statements, and Attachment 4 - Sun Country Pilot Statement and Interview Summary.

Miami International Airport (MIA), Miami, Florida. The flight crew departed the hotel for NIP at 0730 according to the limousine service. The proposed departure time of their first flight of the day was 0925. According to the Flight Crew Trip Pairing, the total time for the flight from NIP to MUGM was projected for 2 hours and 20 minutes. The captain stated that he had never flown with the accident first officer as this was one of the first officer's initial operating experience (IOE) flights.

The crew stated that when they arrived at the airplane for their first flight of the day, the No.1 engine thrust reverser light was illuminated, and it was written in the aircraft logbook. The captain had the mechanic, assigned to the flight, and would be seated in the cockpit jumpseat, troubleshoot the reverser light. The crew did their preflight and other required items while the mechanic investigated the problem. The mechanic indicated he could not reset the light, so they decided to defer the No. 1 engine thrust reverser per the FAA approved Minimum Equipment List (MEL). The captain then ran the performance numbers with the MEL restrictions, and new weight and balance numbers with the MEL penalties applied. They started the engines and taxied out. During taxi out, the No. 2 engine duct pressure decreased to 0 psi. They got clearance for takeoff but declined it to troubleshoot the problem. After clearing the runway, they noticed the No. 1 engine duct pressure was now at zero. They taxied clear of the runway and taxiway and went back to the ramp to address the duct pressure issue. Being unable to fix the duct pressure problem, they deferred the engine bleed air shutoff valves per the MEL. and used the auxiliary power unit (APU) for engine start and used one pack for flight, which restricted their flight to MUGM to 17,000 feet. They re-calculated the flight plan performance and fuel burn numbers for the flight at 17,000 feet, which required an amended release and additional fuel was added to allow for the new maximum altitude.

According to interviews, the preflight and boarding activities were "normal" in NIP as well as in MUGM. The flight, again, taxied out to runway 10 for a takeoff at NIP. The takeoff occurred at 1325, which was four hours behind schedule. Visual meteorological conditions were present at the time and the FO conducted the takeoff. Both crew members noted that the taxi out was "quick" and there were no delays for departure.

The flight down to MUGM was uneventful and was flown at 16,000 feet. As part of Miami Air policy, the captain was required to perform the landing and takeoff at MUGM.

The return flight back to NIP was also filed to be flown at 17,000 feet because the MEL restrictions were still in place. The captain was the pilot flying (PF) and the FO was the pilot monitoring (PM). The accident flight's dispatch paperwork showed the projected flight time to be 2 hours and 15 minutes. The crew reviewed the paperwork, weather, and noted that thunderstorms were in the forecast for their scheduled time of arrival at NIP. The flight plan also listed Orlando International Airport (MCO), Orlando, Florida, as the alternate airport. The enroute portion of the flight to NIP was uneventful.

According to flight crew interviews, about 30 minutes prior to landing in NIP, they were deviating around weather as they approached the Jacksonville area. According to the captain, the weather was "nothing serious." However, he further stated there was no ATIS[6] available at NIP

[6] Automated Terminal Information System.

and their closest ATIS was at Jacksonville International Airport (JAX), Jacksonville, Florida, approximately 16 miles to the north of the destination airport. It should be noted that on March 28, 2019 the ATIS frequency was NOTAMed[7] as operational at NIP, see Section 5.1 of this report for further NOTAM information. Based on the flight plan weather information the crew had for NIP, they set up for an RNAV (GPS) approach to runway 10 and briefed the autobrake setting as 2. As they got closer to the airport, and were talking to Jacksonville Approach Control, they got additional weather reports from the air traffic controller. The crew requested, and then set up, the RNAV (GPS) approach to runway 28 into the FMS.

The crew was given a frequency change to NIP approach control; they received an additional weather report from approach control which reported the winds at 340 degrees at 4 knots. Based on the thunderstorms on, around, and moving towards the east of the airport, the crew asked for and received clearance for the RNAV (GPS) approach to runway 10[8]. According to the flight crew's interviews, they could see the runway "the entire time they were on final approach" even though it was "raining hard" at the time.

According to the captain, when he contacted the arrival approach controller, he was told they would be given PAR[9] guidance and that they should contact tower upon landing. However, he could not recall if they were cleared for the PAR approach or the RNAV approach, but they did fly the RNAV approach. He further stated that he "had his hand on the [weather] radar a couple of times," however, there was not a solid line of weather and he could see the city in the distance. He further reported that on short final it started "raining very hard." He further stated that he thought he had aimed beyond the 1,000-foot mark on the runway and that he received two separate ground proximity warning system (GPWS) "don't sink" alerts when they were below 200 feet on the radio altimeter but prior to the 50-foot automated callout. He also stated that he replied "correcting" or something similar to the GPWS alerts and that he never thought to go-around.

According to the captain, after touchdown, he applied brake pressure and disengaged the autobrakes; however, the airplane was not decelerating. He did not notice any antiskid activation. He stated he also deployed the No. 2 engine thrust reverser and applied enough pressure to the thrust reverser lever that it left a mark on his fingers. The airplane began to "slide a little to the right." He said he never released brake pressure and corrected with rudder to get the airplane back on centerline.

According to the first officer, they had visually acquired the runway lights approximately three to four miles outside the final approach fix. Approximately one mile from the runway, they encountered a "rain shower" and the airplane had drifted to the right, to which the captain corrected back to the extended centerline.

[7] Notice to Airmen.
[8] This would result in an approximate 2 knot tailwind component, which was within the tailwind component limitation for the airplane of 15 knots requiring specific takeoff or landing performance data when over 10 knots of tailwind component.
[9] Precision Approach Radar – provides both vertical and lateral guidance, as well as range, much like an instrument landing system (ILS). Source FAA-H-8083-16B, Chapter 4 "Approaches" pg. 4-72.

According to the flight crew, after landing the captain used the No. 2 engine operative thrust reverser. However, the first officer did not make the required 80-knot callout as the last airspeed he recalled seeing was about 100 kts.

The first officer further stated that he recalled seeing the end of the departure end of the runway coming and the captain saying "we're going in." When the airplane went into the grass, he felt some bumps, and heard the airplane "hitting the wall;" he grabbed the "dashboard" with both hands. After the airplane came to rest, the first officer stated that the captain called for the evacuation.

According to the mechanic that was required to be seated on the cockpit jumpseat for takeoff and landings, he visually acquired the runway lights, but he could not recall how far out on final they were when he first saw them. He recalled they were in "heavy rain" and the captain had turned on his wipers only to the highest setting. He did not observe any lights in the cockpit, other than the reverser light on the overhead panel, during the approach or after the airplane landed. When asked, he did not recall seeing the green auto arm light for the speed brake illuminate. He further stated that at some point along the runway the airplane veered to the right and the captain stowed the No. 2 engine thrust reverser, and then once back on the centerline, the captain re-deployed the reverser.

A flight crew from another air carrier was waiting at the ramp for the Miami Air flight to land; that crew was scheduled to take Miami Air's passengers to NGU. The captain of that flight stated that prior to the accident flight's landing there had been a lot of lightning in the area but not at the time of the landing; however, they further stated that it was "blinding rain" and that the accident airplane first became visible to them just prior to landing. They reported that the ATIS at NIP was reporting light winds and 5 miles of visibility, which they would not associate with a thunderstorm.

2.0 Flight Crew Information

2.1 The Captain

The captain was 55 years old. At the time of the incident he was based at MIA. He reported approximately 7,500 hours of total flight experience and approximately 1,000 of those hours were as pilot in command in the B-737. He began flying at age 16 in another country flying piston aircraft. He came to the United States and earned his FAA certificates. He flew turboprops and jet aircraft. Prior to being employed at Miami Air he flew for AmeriJet International, and IBC Airways. While at Miami Air he has been a first officer, ground instructor, flight instructor, simulator instructor and line check airman. Two weeks prior to the accident he became Miami Air's only aircrew program designee (APD).

He described himself as "very healthy" and did not have problems with his vision or hearing. He wore readers sometimes, but they were not required per his medical. He did not take any prescription medication or illicit drugs, nor drink alcohol; he did smoke. In the 72 hours before the accident, he did not take any medications, prescription or nonprescription, that would have affected his performance. He reported no problems falling asleep or staying asleep. He had never seen a doctor for or been diagnosed with a sleep disorder. In the 12 months before the accident, he had not had any changes in his health, finances or personal life, either good or bad, that would have affected his performance on the day of the accident. He had not been involved in any previous accidents or incidents, never been disciplined for his performance or received any commendations.

2.1.1 The Captain's Pilot Certification Record

FAA Records of the captain indicated the following:

Private Pilot – Airplane Single-Engine Land; Limitations – Issued on the Basis of Argentina Pilot License, Not Valid for Agricultural Aircraft Operations certificate issued December 19, 1989.

Commercial Pilot – Airplane Single-Engine Land; Limitations – Carrying Passengers in Airplanes for Hire is Prohibited at Night and on Cross Country Flights of More than 50 NM certificate issued April 25, 1990.

Notice of Disapproval - Commercial Pilot Airplane Multiengine Land was issued on September 23, 1992. Unsatisfactory items: Pilot Operations 1 and Flight, Single-Engine Service Ceiling and Propeller System.

Commercial Pilot – Airplane Single and Multiengine Land; Limitation – Carrying Passengers for Hire is Prohibited at Night or on Cross Country Flight of More than 50 NM certificate issued September 24, 1992.

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane certificate issued September 25, 1992.

Ground Instructor – Instrument certificate issued February 24, 1993.

Airline Transport Pilot – Airplane Multiengine Land, SA-227; Commercial Privileges – Airplane Single-Engine Land certificate issued March 10, 2006.

Airline Transport Pilot – Airplane Multiengine Land, SF-340, SA-227; Commercial Privileges – Airplane Single-Engine Land certificate issued February 25, 2007.

Airline Transport Pilot – Airplane Multiengine Land, B-727, SA-227, SF-340; Commercial Privileges – Airplane Single-Engine Land; Limitations - B-727 SIC Privileges Only certificate issued September 28, 2007.

Notice of Disapproval – Airline Transport Pilot, B-737 was issued on April 16, 2008. Unsatisfactory items: Approaches to Stalls, Precision and Non-Precision Approaches, Engine Out ILS Uncoupled, Rejected Takeoff.

Airline Transport Pilot – Airplane Multiengine Land, B-727, SA-227, SF-340, B-737; Commercial Privileges – Airplane Single-Engine Land; Limitations – B-727 SIC Privileges Only; B-737 Circling Approach – VMC Only; English Proficient certificate issued April 17, 2008.

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

AIRLINE TRANSPORT PILOT (issued April 17, 2008)
Airplane Multiengine Land
B-727, SA-227, SF-340, B-737
Commercial Privileges – Airplane Single-Engine Land

MEDICAL CERTIFICATION FIRST CLASS (Issued November 16, 2018)
Limitations: None

2.1.3 The Captain's Training and Proficiency Checks Completed

A summary of the captain's recent training events at Miami Air was as follows[10]:

Date of Hire – Miami Air	March 16, 2008
Date of Aircrew Program Designee B737	April 19, 2019
Date of Most Recent Check Airman Observation of Duties by FAA[11]	May 14, 2018
Most Recent Annual Line Check	October 14, 2018
Check Airman Observations of Duties by Administrator	November 18, 2016
Proficiency Check Pilot – Simulator	May 14, 2018
Recent Recurrent Proficiency Check	June 3, 2018
Most Recent Line Oriented Flight Training	December 21, 2018
Line Oriented Flight Training – Initial	July 24, 2015
Initial Operating Experience (OE)[12]	April 26, 2008
Upgrade Operations Experience (OE)[13]	November 20, 2015
Initial Ground School	February 22, 2008
Emergency Training & Drills	June 1, 2018
Windshear Training	December 21, 2018
Weather Radar Training[14]	May 31, 2018
Bounced Landing Training	May 10, 2018
Fatigue Risk Management	June 1, 2018
Safety Management System	June 1, 2018
Initial RNAV Approach – Training	March 5, 2008

[10] Source: Attachment 6 - Flight Crew Training Records.
[11] Source: Title 14 *CFR* 121.413(a)(2) *Within the preceding 24 calendar months that person satisfactorily conducts a check or supervises operating experience under the observation of an FAA inspector or an aircrew designated examiner employed by the operator. The observation check may be accomplished in part or in full in an airplane, in a flight simulator, or in a flight training device.*
[12] Initial OE began April 26, 2008 and concluded on May 30, 2008. The OE was accomplished in 50:40 as a first officer.
[13] Upgrade OE began October 12, 2015 and concluded on November 20, 2015. The training was recorded as being conducted in a B-737-800 and was accomplished in 62:42.
[14] Was conducted as part of the 2018 – B737NG Recurrent Training "Instruments Nav Comm Radar."

Recurrent Electronic Flight Bag Training[15]	June 1, 2018

2.1.4 The Captain's Flight Times[16]

Previous 48 hours	5:01
Preceding 30 days	5:01
Preceding 90 days	45:12
Preceding 12 months	170:39
Total Hours B737[17]	2,204:12
Total Flight Hours[18]	7,500

2.1.5 The Captain's Pre-Accident Activities

The captain did not recall his sleep on April 30, 2019, but reported he was on 30 hours rest through May 1. He said there was nothing unusual about his activities during this time but he did not recall what he did. On April 30, cellular telephone records[19] indicated activity beginning at 0730 and ended at 1757 with extended breaks in activity[20] from 0735 until 1336 and 1338 until 1442. On May 1, cellular telephone records indicated activity beginning at 741 and ending at 2154 with extended breaks in activity from 0745 until 1302, 1322 until 1710 and 1723 until 2153. He reported going to bed about 2130. On May 2 he reported awakening about 0500-0530. He took a commercial flight to Jacksonville, Florida, that was scheduled to depart Miami at 1028 and arrive at 1149; there he had 18 hours and 16 minutes of rest. A limousine shuttle service picked up the crew from JAX and took them to the hotel; the captain checked in at 1253. He discussed training with the accident first officer from about 1630 until 1730, walked to get dinner, watched TV and talked with his wife. Cellular telephone records for May 2 indicated activity beginning at 0729 and ending at 2338 with extended breaks in activity from 0826 until 1319, from 1326 until 1626, 1632 until 2002, 2018 until 2137 and 2148 until 2337. He reported going to sleep "pretty early", about 2100-2130. On May 3, the day of the accident, he awoke about 0500, without his watch. He had coffee and read the newspaper; he did not eat breakfast. He checked out of the hotel at 0716; the limousine service was scheduled to pick up the crew at 0730 and took them to NIP for a 0755-report time. Cellular telephone records from May 3 indicated activity beginning at 0653 until 1330 with extended breaks in activity from 0654 until 1121, and 1123 until 1255.

2.2 The First Officer

The first officer was 48 years old and was employed at Miami Air since October 13, 2018; he began training on January 3, 2019. He reported approximately 7,500 hours of total flight experience and about 18 hours were in the B-737.

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[15] Recurrent electronic flight bag training included, in part, landing data inputs in the Boeing OPT. Initial EFB training was conducted on April 29, 2008.

[16] Source: Miami Air documentation and pilot statement.

[17] Although he could not recall exactly the captain estimated that he had 2,000 hours as a first officer and about 1,000 hours as a captain on the B737. Source: Attachment 1 – "Flight Crew Interview Summaries."

[18] The captain estimated his total hours during his interview. Source: Attachment 1 – "Flight Crew Interview Summaries"

[19] Cellular telephone records include outbound calls and text messages and inbound calls not routed to voicemail in duration greater than 30 seconds.

[20] Extended breaks in activity include any breaks in cellular telephone use over 60 minutes.

He learned to fly at a flight school in another country where he earned his private pilot certificate. After moving to the United States he attended a flight school at a local airport near Miami, Florida where he obtained his pilot certificates, including his flight instructor certificate. After he obtained his ratings, he was a freelance flight instructor in the Miami area until being hired by Miami Air.

The first officer had not flown with the captain prior to this trip, but the captain did administer his type ride in the B-737 simulator on February 27, 2019, with an FAA inspector present.

The first officer described his health as "good, standard" and did not have any problems with his vision or hearing. He did not take any prescription medication or use illicit drugs. He did smoke and thought he smoked a "normal" amount for him that day. He did not drink alcohol and he had not taken any medication, prescription or nonprescription, within the 72 hours preceding the accident. He did not have a sleep disorder. In the 12 months prior to the accident, he did not have any changes in his health or personal life that would have affected his performance; he did not think any changes to his financial situation would have affected his performance. He had been involved in two previous accidents – one when training in a twin-engine airplane and the nose gear collapsed due to a mechanical issue, and the other was when flying a Cessna 172.

2.2.1 The First Officer's Pilot Certification Record

Private Pilot – Airplane Single-Engine Land; Limitations – Issued on the Basis of and Valid Only when accompanied by Argentina Pilot License. All Limitations and Restrictions on the Argentina License Apply certificate issued March 24, 1999.

Private Pilot – Airplane Single-Engine Land; Limitations – Issued on the Basis of, and Valid Only when Accompanied by Argentina Pilot License. All Limitations and Restrictions on the Argentina Pilot License Apply. Instrument Airplane U.S. Tests Passed certificate issued August 25, 1999.

Commercial Pilot – Airplane Single-Engine Land, Instrument Airplane certificate issued on March 28, 2000.

Notice of Disapproval – Certificated Flight Instructor – Airplane was issued January 4, 2001. Unsatisfactory items: Areas of Operation III; Entire Flight Portion.

Flight Instructor – Airplane Single-Engine certificate issued February 15, 2001.

Flight Instructor – Airplane Single-Engine, Instrument Airplane certificate issued September 23, 2002.

Flight Instructor – Airplane Single and Multiengine, Instrument Airplane certificate issued October 13, 2004.
Renewed: October 12, 2006, October 29, 2008, July 26, 2010, October 23, 2012, October 22, 2014, October 18, 2016, and October 16, 2018.

Airline Transport Pilot – Airplane Multiengine Land; Commercial Privileges – Airplane Single-Engine Land certificate issued October 19, 2006.

Airline Transport Pilot – Airplane Multiengine Land; B-737; Commercial Privileges – Airplane Single-Engine Land, English Proficient, B-737 Subject to the Pilot in Command Limitation(s), B-737 Circling Approach VMC Only certificate issued February 27, 2019.

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

AIRLINE TRANSPORT PILOT (issued February 27, 2019)
Airplane Multiengine Land
B-737
Commercial Pilot Privileges Airplane Single-Engine Land

FLIGHT INSTRUCTOR (dated October 16, 2018.)
Airplane Single-Engine
Airplane Multiengine
Instrument Airplane

MEDICAL CERTIFICATION FIRST CLASS (issued January 30, 2019)
Limitations: None

2.2.3 The First Officer's Training and Proficiency Checks Completed

A summary of the first officer's recent training events at Miami Air was as follows:

Date of Hire – Miami Air	January 03, 2019
Initial Proficiency Check	March 13, 2019
Line Oriented Flight Training	March 1, 2019
Initial Type Rating on B-737[21]	February 27, 2019
Initial Maneuvers Training	February 19, 2019
Initial RNP AR Approaches	March 13, 2019
Initial Ground School	February 1, 2019
Initial Crew Resource Management[22]	March 4, 2019
Initial Performance Training	February 1, 2019
Emergency Training & Drills	March 4, 2019
Windshear Training	February 19, 2019
Weather Radar Training	February 14, 2019
Fatigue Risk Management	January 6, 2019
Safety Management System	January 8, 2019
RNAV Approach[23]	February 14, 2019
PAR Approach	March 13, 2019

[21] Initial Type Rating was conducted in a Level D simulator and was conducted with the accident captain as the checkairman and was observed by the FAA.
[22] CRM training was part of the initial ground school training. It consisted of a lecture and exercises.
[23] RNAV training was conducted during simulators 2, 3, 4, and 5.

Electronic Flight Bag Training	March 13, 2019
Most Recent FAA Observation	February 27, 2019

2.2.4 The First Officer's Flight Times[24]

Preceding 48 hours	5:01
Preceding 30 days	18:20
Preceding 90 days	18:20
Total Flight Experience[25]	7,528
Total Flight Experience – B-737	18:20

2.2.5 The First Officer's Pre-Accident Activities

In the 3 days prior to the accident, the first officer stated his sleep was routine, going to sleep about 2230 and waking up about 0630; he did not have any issues staying asleep. He said there was nothing unusual that would have caused him to not follow his routine. On April 30, cellular telephone records indicated activity beginning at 0613 and ending at 2244 with extended breaks in activity from 0614 until 1638m 1638 until 1740, 1742 until 1829, and 1836 until 2234. On May 2, he took a commercial flight to Jacksonville that was scheduled to depart Miami at 1028 and arrive at 1149; there he had 18 hours and 16 minutes of scheduled rest. He traveled with the captain via limousine shuttle service from the airport to the hotel; he checked in to the hotel at 1259. He reported going to bed about 2230. Cellular telephone records indicated activity on May 2 beginning at 0735 until 1700 with extended breaks in activity from 1328 until 1507 and 1535 until 1636. On May 3, the day of the accident, he reported awakening about 0630. He had breakfast at the hotel and checked out at 0717. He took the same scheduled shuttle as the captain to NIP and reported for duty at 0755. The remainder of the day he snacks and a sandwich and also drank coffee and other caffeinated beverages. Cellular telephone records indicated activity beginning at 0529 and ending at 1950 with extended breaks in activity from 0530 until 0716, 1440 until 1704 and 1704 until 1808.

2.3 Flight Crew Trip Paring

The following trip pairing was the original pairing for the flight crew at the time of their report in Miami on May 2, 2019. It includes both time in UTC and local station time.

[24] Source: Miami Air records and pilot statement.
[25] FAA medical certification information.

Miami Air | **Details for Crew Route 292 on Thu, May 2 2019** | Page : 1

Thu ,02 May 2019 | Time : 13:15

Times in UTC, Cockpit Rules

Flight	DEP	ARR	DEP Time	ARR Time	Dep Date	Trip Day	DHC	Tail #	AC	Block Hours	FDP Begin	FDP End	Acclim FDP Begin	Acclim FDP End	Allowable FDP	Duty Begin	Duty End
AA4021	MIA	JAX	1428	1549	Thu02May	1	DHC									12:58	
LIMO84	JAX	NIP	1609	1709			DHC										17:39
18:16	Rest																4:41
	(05/02/19 17:39)																
292	NIP	NBW	1325	1545	Fri03May	2		N732MA	738	2:20	11:55		7:55			11:55	
293	NBW	NIP	1745	2010				N732MA	738	2:25							
293	NIP	NGU	2140	2330				N732MA	738	1:50		23:30		19:30			24:00
13:51	Rest									6:35	NIPM	11:35			13:00		12:05
	(05/04/19 00:00)																
LIMO93	NGU	ORF	1351	1451	Sat04May	3	DHC									13:51	
DL2074	ORF	ATL	1621	1809			DHC										
DL1998	ATL	MIA	1909	2111			DHC										21:41
																	7:50

Times in Local Station

Flight	DEP	ARR	DEP Time	ARR Time	Dep Date	Trip Day	DHC	Tail #	AC	Block Hours	FDP Begin	FDP End	Acclim FDP Begin	Acclim FDP End	Allowable FDP	Duty Begin	Duty End
AA4021	MIA	JAX	1028	1149	Thu02May	1	DHC									8:58	
LIMO84	JAX	NIP	1209	1309			DHC										13:39
18:16	Rest																4:41
	(05/02/19 13:39)																
292	NIP	NBW	0925	1145	Fri03May	2		N732MA	738	2:20	7:55		7:55			7:55	
293	NBW	NIP	1345	1610				N732MA	738	2:25							
293	NIP	NGU	1740	1930				N732MA	738	1:50		19:30		19:30			20:00
13:51	Rest									6:35	NIPM	11:35			13:00		12:05
	(05/03/19 20:00)																
LIMO93	NGU	ORF	0951	1051	Sat04May	3	DHC									9:51	
DL2074	ORF	ATL	1221	1409			DHC										
DL1998	ATL	MIA	1509	1711			DHC										17:41

Figure 1: Original flightcrew pairing.

2.4 Roles and Responsibility

According to the Miami Air Flight Operations Manual the following information was provided to all crewmembers about the responsibility of the respective position:

Captains

Captains report to the Chief Pilot. During flight time the Captain holds a joint responsibility with the Dispatcher for safety of flight. The Captain is responsible for compliance with Miami Air policy, 14 CFRs, Company Operations Specifications and other rules applicable to a particular flight. The Captain will have the most current information available pertaining to the conduct of the flight. If the Captain deviates from established regulations and procedures he/she will contact the Chief Pilot as soon as practicable and report the circumstances of the incident on an Irregularity Report.

A good Captain is a leader as well as a manager. The Captain should be highly skilled in handling the aircraft. Equally important is the Captain's confidence in his/her own abilities. The Captain is responsible for 1) the safety of all crewmembers, passengers and/or cargo on board the aircraft when the doors are closed, 2) the operation and safety of the aircraft from the moment the aircraft is ready to move for the purpose of taking off until the moment it finally comes to rest at the end of the flight and the engine(s) are shut down, and 3) ensuring checklists are complied with. [FLT 1.3.6] He/she has full control and authority in the operation of the aircraft, without limitation, over other crewmembers and their duties during flight time. A Captain should be thoroughly proficient with regard to technical knowledge of the aircraft, Company procedures, routes, Air Traffic Control and other resources. It is the Captain's responsibility to lead a coordinated crew effort.

Positive delegation of responsibility by the Captain to all crewmembers in every situation is essential.

Finally, the Captain must ensure that cockpit communications are precise and each crewmember on the flight deck as well as in the cabin understands crucial information with regard to flight status. No pilot may operate an aircraft in a careless or reckless manner so as to endanger life or property.

In addition to general crew duties and responsibilities, the Captain will be responsible for the following:
• With the assistance from the Dispatcher, for the proper preflight planning, delay and dispatch or release of the flight in accordance with the applicable 14 CFRs, Company Operations Specifications and this manual. Whenever the Captain knows of conditions, including airport and runway conditions, that are a hazard to safe operations, the Captain shall restrict or suspend operations until those conditions are corrected.
• Verifying the airworthiness of the aircraft after reviewing the Aircraft Logbook and performing a preflight inspection. No aircraft may depart with any defect affecting airworthiness unless processed in accordance with the MEL/CDL.
• The Captain has the authority to reject an aircraft prior to departure if dissatisfied with any aspect of the airworthiness and/or maintenance status of the aircraft.
• Ascertain that the planned fuel load and actual fuel on board are correct for the specific flight conditions and comply with the fuel requirements as specified in the Dispatch/Flight Release section of this manual and the 14 CFRs. The Captain must ensure the flight is not commenced unless sufficient fuel is on board the aircraft to complete the planned flight safely.
• After performing the exterior preflight inspection, determining whether de-icing is necessary in accordance with the de-icing procedures in this manual. The Captain has the authority to order deicing whenever deemed necessary
• Downline the Captain must contact Dispatch and Crew Scheduling prior to hotel departure to obtain a route briefing to include any possible changes in the schedule. This procedure will insure [sic] Company departments do not contact the Captain about non-essential information during rest.
• The Captain shall verify that a copy of the Weight and Balance Manifest, dispatch/Flight Release and flight plan are on board the aircraft and the flight plan has been filed prior to each departure and that any mechanical discrepancies have been properly addressed in the aircraft logbook.
• Review current airfield and route information prior to being dispatched or released to that airport. By signing the Dispatch/Flight Release, the Captain certifies his or her familiarity with the airports and routes to be used in compliance with 121.443, 121.445.
• Consider making the landing when an emergency is declared. Whenever a Captain uses emergency authority he/she shall inform the company at the earliest possible time. In addition he/she will send a written report (Irregularity Report) including any deviations from 14 CFRs through to the Vice President of Flight Operations to the administrator and the pilot in command shall send his report within ten (10) days.

• At the end of each flight or series of flights, ensure that all flight records have been completed and filed (including the Dispatch/Flight Releases, flight plans and Weight and Balance Manifests). Ensure that the aircraft logbook is properly closed.

• Ensure that each mechanical irregularity that has occurred during flight time is entered into the aircraft logbook at the end of that flight time. At the end of each flight sequence, the Captain will sign the logbook page indicating that the entries are complete and the times are accurate. Before each flight the Captain will ascertain the status of each irregularity that was entered in the log at the end of the preceding flight. [121.563]

• Ensure presence of all cockpit and cabin crewmembers at report time. Contact Crew Scheduling if all crewmembers are not present at report time.

• Certify the accuracy of the Weight and Balance Manifest. Weight and Balance procedures and data are contained in the AOM and Airport Analysis Manual carried aboard each aircraft. [121.665]

• Whenever a Miami Air International pilot encounters a meteorological condition or an irregularity in a ground navigational facility, in flight, and that irregularity is considered a safety factor to other flights, the pilot will notify the appropriate ground station as soon as practicable. [121.561]

• A Miami Air International pilot will not begin a flight unless he/she is thoroughly familiar with all reported and forecasted weather conditions on the route to be flown. [121.599]

• Ensure all DMIs listed on the Flight Release have a DMI sticker installed. If not, report the missing sticker to Maintenance Control.

• Supervise the loading of the aircraft and verify that the cargo nets are installed and the doors are closed and locked. The Captain may delegate the supervision of the loading to another flight crewmember, the flight mechanic, or a Miami Air representative.

NOTE: "Direct supervision" means the ability to detect when errors have been made on the loading of the individual aircraft. Supervisory employees need not be physically present for the entire loading, but must inspect each load, determine the presence and condition of HAZMAT, assure that barrier nets are in place after loading, and that doors are properly closed and locked.

• All Captains have been trained as First Officers and as Additional Pilot Crewmembers and may serve in that capacity.

First Officer

The First Officer is second in command of the aircraft. In the event the Captain becomes incapacitated in flight, most senior typed rated cockpit crewmember (either the First Officer or APC) that is part of the working crew, will assume the duties and responsibilities of command of the aircraft and conduct the flight to a safe landing. This landing may be at the intended destination, or when necessary a closer suitable airport, depending on the First Officer's evaluation of the conditions and circumstances. He/she will, therefore, be familiar with the duties and responsibilities of the Captain in addition to performing his/her own duties and assignments. In all situations, the First Officer will be assertive and will actively engage himself/herself within a coordinated crew environment. The First Officer must use all available resources, including cockpit and cabin crewmembers, as well as communications with Miami Air and federal agencies.

In addition to general crew duties and responsibilities, the First Officer will be responsible for the following:
• Assisting the Captain in preflight planning.
• Perform other duties as may be assigned by the Captain.
• Comply with all applicable 14 CFRs and Company regulations, policies and directives.
• Prepare and complete the Weight & Balance Manifest. (The Captain may delegate this responsibility to another crewmember depending on the workload of each crewmember.)
• Perform a preflight check of the required manuals on board the aircraft.
• Perform the preflight, through flight and post flight inspections of the aircraft.
• Verify with the Captain that the Fuel on Board is equal to or greater than the fuel required. When necessary, supervise, monitor and train fuel vendors during refueling procedures.

2.5 Medical and Pathological Information

Toxicology tests were performed by the laboratory at FAA Forensic Sciences on samples from the captain and first officer. Samples from both pilots tested negative for carbon monoxide, ethanol and a wide range of drugs, including major drugs of abuse. Samples from the captain detected medications used to treat high blood pressure in his blood and urine, however, these medications would not have affected performance.

3.0 Aircraft Information

Photo 1: Accident airplane (Courtesy of AeroPX Aviation Online Photos).

The accident airplane N732MA, Serial No. 30618, was a B-737-81Q, and was manufactured in 2001 and issued an airworthiness certificate in April of 2001. It was owned by Wells Fargo Trust Co., registered on April 26, 2001 as a transport category aircraft, and operated by Miami Air International since its original registration. The airplane was powered by 2 CFM56-7B26 engines each capable of producing 26,300 lbs of thrust. The airplane's airworthiness certificate was issued in April of 2001. The airplane had the following MEL (Minimum Equipment List) and Configuration Deviation List (CDL) deferred maintenance items:

78-01-03	*NBR-1 ENG REVERSER LIGHT ILLUM.*
23-18B	*SATCOM FAULT LIGHT ILLUM.*
21-01-06	*RT A/C PACK INOP.*
25-10	*WIFI INOP.*

For detailed airworthiness information see the Airworthiness Group Chairman report located in the docket associated with this accident.

3.1 Minimum Equipment List

The Miami Air 737-800 MEL-CDL provided guidance on the respective MEL/CDLs that affected the performance of the aircraft or communication with the aircraft, below. A MEL had four repair categories and must affect repairs of inoperative instrument and equipment items, deferred in accordance with the MEL, at or prior to the repair times established by the following letter designators. The categories were listed as:

A. Repair Category A. This category item must be repaired within the time interval specified in the "Remarks or Exceptions" column of the aircraft operator's approved MEL. For time intervals specified in "calendar days" or "flight days", the day the malfunction was recorded in the aircraft maintenance record/logbook is excluded. For all other time intervals (i.e., flights, flight legs, cycles, hours, etc.), repair tracking begins at the point when the malfunction is deferred in accordance with the operator's approved MEL.

B. Repair Category B. This category item must be repaired within three 3 consecutive calendar-days (72 hours), excluding the day the malfunction was recorded in the aircraft maintenance record/logbook. For example, if it were recorded at 10 a.m. on January 26th, the 3-day interval would begin at midnight the 26th and end at midnight the 29th.

C. Repair Category C. This category item must be repaired within 10 consecutive calendar-days (240 hours), excluding the day the malfunction was recorded in the aircraft maintenance record/logbook. For example, if it were recorded at 10 a.m. on January 26th, the 10-day interval would begin at midnight the 26th and end at midnight February 5th.

D. Repair Category D. This category item must be repaired within 120 consecutive calendar-days (2880 hours), excluding the day the malfunction was recorded in the aircraft maintenance log and/or record.

3.1.1 MEL 78-01-03

78-01 **Thrust Reverser Systems**
78-01-03 **-800**

Interval	Installed	Required	Procedure
C	2	1	(M) (O)

One may be inoperative provided:

a. Thrust reverser is locked in forward thrust position.
b. Appropriate performance adjustments are applied.

MAINTENANCE (M)

1. Deactivate and secure the associated thrust reverser (AMM 78-00-00/901).

   NOTE: With the thrust reverser secured closed, one or both sync locks may be inoperative provided the sync lock is verified to be in the locked position.

2. Prevent movement of the reverse thrust handle by any appropriate means (e.g. lockwire the thrust reverser handle to the appropriate forward thrust lever).

OPERATIONS (O)

NOTE: Thrust reverser deactivation per AMM can result in the illumination of the MASTER CAUTION and ENG annunciation when performing a Master Caution recall.

For Inoperative Thrust Reverser:

1. The wet runway / obstacle limited weight and V1 associated with the reduced weight must be reduced to account for the inoperative thrust reverser. Refer to the Takeoff and Landing Section of the Flight Planning and Performance Manual or AOM for the appropriate penalties.
2. Takeoff Wet (1100 kg)/2 kts V1 Reduction.
3. Prior to landing, set the GROUND PROXIMITY RUNWAY INHIBIT switch to RUNWAY INHIBIT (if installed).
4. Dry, no penalty.

Operations into narrow runways with thrust reverser inop is prohibited.

3.1.2 MEL 23-18B

23-18 **Satellite Communication System (SATCOM)**
***
23-18B **Procedures Do Not Require Use**

Interval	Installed	Required	Procedure
D	1	0	

Miami Air procedures do not require its use.

3.1.3 MEL 21-01-06

According to a representative of Miami Air[26] and the MEL/CDL the listed MEL should have been displayed as 21-01-01-06, instead of the 21-01-06 that was listed on the dispatch release.

[26] Source: Attachment 19 – Memorandum for Record – Email Conversation [Excerpts].

21-01 **Air Conditioning Packs**

21-01-01 **All Passenger Configuration (All Models)**

21-01-01-06 **-800**

Interval	Installed	Required	Procedure
C	2	0	**(M) (O)**

Except for ER operations, both may be inoperative provided:

a. Flight is conducted in an unpressurized configuration.

b. Recirculation fan(s) operates normally.

c. Both E/E equipment cooling exhaust fans operate normally.

d. Procedures are established and used to ensure lower cargo compartments remain empty or are verified to contain only empty cargo handling equipment, ballast (ballast may be loaded in ULDs), and/or Fly Away Kits.

e. Airplanes with Auxiliary tanks installed, auxiliary tanks remain empty or auxiliary fuel is included as part of zero fuel weight.

MAINTENANCE (M)

Configure airplane for unpressurized flight (AMM 21-00-00/901):

1. Manually position the outflow valve in the full open position.
   A. Position the Pressurization Mode selector to MAN.
   B. Hold the VALVE toggle switch in the OPEN position until valve position indicator indicates full open.
2. Deactivate (locked closed) the flow control and shutoff valve for the associated pack:
   A. For the left flow control and shutoff valve, disconnect and stow the D488 or D15830 electrical connector.
   B. For the right flow control and shutoff valve, disconnect and stow the D492 or D15834 electrical connector.
   C. Do these steps to lock the flow control and shutoff valve in the closed position:
      1) Pull out the manual control shaft.
      2) Push in the manual control shaft.
3. Open and collar the P6-4 Panel circuit breaker A/C OVERBOARD EXH VALVE RECONFIG CONT.
4. Position one of the PACK switches in HIGH and placard.
5. For passenger cabin telecommunications system installed, open and collar P6-1 Panel circuit breaker ENTERTAINMENT PASS TEL CTU.

OPERATIONS (O)

1. Limit altitude to 10,000 ft. for passenger flights.

2. Non-passenger flights above 10,000 ft. require flight crew to be on oxygen.
3. Except for ditching, keep the outflow valve in the full open position.
4. Limit climb and descent rates to 500 FPM. to avoid passenger discomfort.
5. Position the ISOLATION VALVE switch to CLOSE after starting engines.
6. To improve passenger cabin and crew compartment temperatures:
   A. If possible, pre-condition the cabin to a low temperature prior to dispatch. A low initial cabin temperature will result in a lower peak temperature.
   B. Maintain the highest allowable flight altitude.
   C. Minimize cabin heat by pulling the shades down and turning off unnecessary lights.
   D. Position RECIRC FAN switch(es) to AUTO.
   E. Estimated stabilized temperatures at the end of 30 minutes of flight are shown in this table:

      NOTE 1: Limit number of passengers to 45.

      NOTE 2: Prolonged operation at TAT below 10 degrees C / 50 degrees F can cause freezing of unheated water systems located in the aft lower lobe.

      NOTE 3: Operation at TAT above 32 degrees C / 90 degrees F is not recommended due to the resulting high temperatures in the passenger and crew cabins.

TAT Degrees C	No. of Passenger	Passenger Cabin Temperature		Crew Cabin Temperature	
		Degrees F	Degrees C	Degrees F	Degrees C
-1	0	50	10	70	21
-1	45	70	21	75	24
10	0	70	21	90	32
10	45	80	27	95	35
21	0	90	32	110	43
21	45	95	35	110	43
32	0				
32	45				

7. The affected cargo compartment will be emptied or verified to carry only allowable items as defined in the Introduction Chapter. Alternatively, arrangements will be made to have the FAK removed and shipped by alternate means. FAK corrections must be made on the weight and balance manifest. Prior to departure, a crewmember or designated individual will verify that the affected cargo compartment is either empty or containing empty cargo restraints, only.

3.1.4 MEL 36-05-02

According to a representative of Miami Air[27], after the flight taxied back to the gate maintenance discovered that the temperature controller for the right air condition pack was not working and that both Pressure Regulator and Shut Off Valves (PRSOV) were inoperative. In coordination between the pilots and maintenance control it was determined that MEL 36-05-02 with the APU operating for the entire flight would provide better passenger comfort. However, the dispatch release was not updated and corrected with this MEL number.

[27] Source: Attachment 19 – Memorandum for Record – Email Conversation [Excerpt]

36-05 Engine Bleed Air Shutoff Valves (PRSOV)

36-05-02 -800

Interval	Installed	Required	Procedure
C	2	0	(M) (O)

Except for ER operations beyond 120 minutes, may be inoperative provided:

a. Valve is secured closed before engine start.

b. Airplane is not operated in known or forecast icing conditions.

MAINTENANCE (M)

For -800:

Lock the associated engine bleed air valve in the closed position (AMM 36-00-00/901).

For All Models:

1. Deactivate the leading edge slats in the retracted position (AMM 27-81-00/201).
2. Deactivate the associated thrust reverser (AMM 78-31-00/201).
3. Gain access to the engine bleed air valve by opening the appropriate fan cowl panel (AMM 71-11-02/201) and thrust reverser (AMM 78-31-00/201).
4. Lock the engine bleed air valve in the CLOSED position.
   A. Turn the override nut to align the position indicator with the CLOSED position.
   B. Loosen the lock screw/knob bolt and push in locking knob to lock valve in closed position.
   C. Retighten lock screw/knob bolt.
5. Close fan cowl panel (AMM 71-11-02/201) and thrust reverser (AMM 78-31-00/201).
6. Activate the thrust reverser (AMM 78-31-00/201).
7. Activate the leading edge slats (AMM 27-81-00/201).

OPERATIONS (O)

NOTE 1: Use of the APU bleed air is limited to 17,000 feet. One air conditioning pack will be unusable when dispatching with: (1) the right engine bleed inoperative, (2) the left engine bleed inoperative and flight altitude greater than 17,000 feet, or (3) both engine bleeds inoperative.

NOTE 2: When dispatching with a single engine bleed on for takeoff (airplane pressurized), V1(MCG) should be determined based on AC packs OFF. Takeoff performance should be based on AC packs AUTO.

1. Do not dispatch into known or forecast icing conditions.
2. Associated engine bleed switch is selected to the OFF position.
3. For left engine bleed inoperative:
   A. At altitudes 17,000 feet and below, operate the left pack using the APU bleed air, the right pack using the right engine bleed and the isolation valve CLOSE.
   B. At altitudes above 17,000 feet, operate with the APU bleed air OFF.
      1) Limit altitude to FL 250.
      2) Operate the left pack using the right engine bleed, the right pack OFF and isolation valve OPEN.
4. For right engine bleed inoperative:
   A. Limit altitude to FL 250.
   B. Operate the left pack using the left engine bleed, right pack OFF, and isolation valve CLOSE.

      NOTE: At altitudes 17,000 feet and below, increased air flow will occur when flaps are extended (takeoff and landing) and the APU is used instead of engine bleed to supply bleed air to the operating pack. Refer to Boeing Operations Manual, NO ENGINE BLEED TAKEOFF AND LANDING PROCEDURE.
5. For both engine bleeds inoperative:
   A. Limit altitude to 17,000 feet.
   B. Operate the left pack using APU bleed and isolation valve CLOSE. Refer to Boeing Operations Manual, NO ENGINE BLEED TAKEOFF AND LANDING PROCEDURE.

4.0 Weight and Balance

The following weight and balance information was taken from the dispatch flight release. Limitations are indicated in **bold** type. All weights below are in kilograms (kg).

Basic Operating Weight		43,920.6
Passenger (136 total)	12,702.0	
Cargo/Baggage	3,199.6	
Total Payload		15,901.6
Zero Fuel Weight		59,822.2
Maximum Zero Fuel Weight		**62,731**
Takeoff Fuel		12,800.5
Taxi Fuel[28]		300
Takeoff Weight		72,622.7
Maximum Takeoff Weight		**79,015**
Planned Fuel Burn		7,700
Planned Landing Weight		64,922.7
Maximum Landing Weight		**66,360**

5.0 Meteorological Information

The last recorded weather, prior to the accident, was the NIP METAR[29], which recorded the following ATIS information:

SPECI KNIP 040122Z 35004KT 5SM +TSRA BR SCT008 BKN018CB OVC030 24/22 A2998 RMK AO2 TSB04 FRQ LTGIC OHD TS OHD MOV E T1 SET P0010 T02440222 $=

For detailed weather information see the Meteorology Group Chairman report located in the docket associated with this accident.

5.1 Weather Packet

The accident flight weather packet and proposed route of flight for all of their scheduled flights for the entire day, was provided to the crew before their first flight and was prepared at 1025Z. The packet was 62 pages in length and contained weather information such as TAF[30], SIGMETs[31], AIRMETs, [32]current weather, graphical weather charts for various times, and NOTAMs[33].

Additionally, the accident flight dispatch release, including fuel requirements, was computed at 1650Z. Additionally, another weather packet was generated at 1727Z, and included, beginning on page 9, the departure, destination and alternate weather which contained the most

[28] Source: Miami Air B737 Flight Operations Manual Chapter 2, Section 3.6.3.I pg. 248.
[29] Meteorological Aerodrome Reports.
[30] Terminal Area Forecast.
[31] Significant Meteorological Information.
[32] Airman's Meteorological Information.
[33] Notices to Airman.

current available surface observation, TAF, NOTAMs, Flight Hazards and Area Forecasts and Enroute Weather.

The TAF for KNIP provided to the accident crew was:

```
KNIP
  TAF AMD KNIP 0312/0407 24006KT 9999 VCSH SCT025 BKN100 BKN250
    QNH2995INS TEMPO 0312/0316 9000 -RA SCT008 BKN015 OVC060 FM031600
    18009KT 9999 VCTS SCT030CB BKN120 BKN250 QNH2988INS TEMPO
    0317/0323 VRB20G30KT 4800 TSRA BR SCT010 BKN020CB OVC080 FM040400
    VRB05KT 9999 SCT030 BKN080 QNH2992INS T23/0312Z T27/0321Z AMD 1205
    FN20015
```

The NIP Operational NOTAMs provided to the crew contained 15 NOTAMs:

```
KNIP: OPERATIONAL NOTAMS
- KNIP M0157/19 13MAR1137-10JUN2359
   RWY 14/32 CLSD FM SS TO SR DLY LGTS UNAVBL.
- KNIP M0161/19 18MAR1215-15MAY1200
   RWY 32 PAPI U/S .
- KNIP M0171/19 19MAR2026-17JUN1400
   OBST TWY ALPHA TWO CLSD SOUTH OF TWY ALPHA.
   NO ENGINE  RUNUPS AUTHORIZED ON ALPHA TWO.
- KNIP M0194/19 28MAR1251-30MAY2300
   RWY 10 TORA 8,003FT, TODA 8,003FT, ASDA 8,006FT, LDA
   8,006FT.
- KNIP M0196/19 28MAR1254-30MAY2300
   RWY 28 TORA 8,002FT, TODA 8,002FT, ASDA 8,003FT, LDA
   8,003FT.
- KNIP M0198/19 28MAR1309-30MAY2300
   OBST TWY ALPHA ONE CLSD NORTH OF TWY ALPHA.
- KNIP M0200/19 28MAR1319-25JUN2300
   ATIS VHF 124.35MHZ COMMISSIONED TOWER ATIS NOW
   OPERABLE.
- KNIP M0223/19 09APR1306-08JUL0905
   TWY D TWY DELTA ONE RESTRICTED TO SMALL ACFT
   UNDER TOW
- KNIP M0248/19 23APR1315-08MAY1315
   OBST CRANE 301329N0814002W (.5NM SOUTH SOUTHEAST
   KNIP) 187FT  MSL (180FT AGL) NOT LGTD APCH MIN FOR RNAV (GPS) RWY
   28  LNAV/VNA CAT A 321-3/4 308 (300), CAT B 332-3/4 319 (400), CAT
   C
    340-3/4 327(400), CAT D 351-3/4 338 (400); LNAV CAT A/B 400-3/4
    427(500-3/4), CAT C/D 400-1 427 (500-1).
- KNIP M0264/19 03MAY1700-03MAY1800
   AD CLSD DUE TO A CEREMONY IN HANGAR 117. QUIET
   HRS WILL  BE IN EFFECT FM 1700Z-1800Z (1300L-1400L). THE

(KNIP - Continued)
    FLWG  RESTRICTIONS WILL APPLY IN THE VICINITY OF THE FLWG
    HANGARS,  BUILDINGS AND ASSOCIATED APNS: 116, 117, 118, 124, 140,
    868 AND  1122: 1) NO OPNS ON RWY 10/28, 14/32 OR HELIPADS 1
    AND 2.  NO TAKE-OFFS, L ANDINGS OR TOUCH AND GOES ON ANY RWY OR
    HELIPAD.  2) NO PRACTICE APPROACHES OR PATTERN WORK. 3) NO ACFT
    TAXIING  4) NO GSE MVT OR USE TO INCLUDE A/C, PWR OR AIR
    CARTS. 5) NO  HOT REFUELING, MAINT TURNS, HIGH PWR TURNS, APU
    TURN OR  ENGINE STARTS
  - KNIP V0015/19 18MAR1741-18JUN1200
    [US DOD PROCEDURAL NOTAM] INST APCH PROC
    NOT  AUTHORIZED RY 32.
  - KNIP V0019/19 28MAR1253-31MAY1600
    [US DOD PROCEDURAL NOTAM] INST APCH PROC
    AMENDMENT  PAR W/OUT GS RWY 10 CAT A-E 400-5/8 379 (400-5/8). STEP
    DOWN FIX AT  2NM FM TDZ MIN 660.
  - KNIP V0021/19 28MAR1259-31MAY1600
    [US DOD PROCEDURAL NOTAM] INST APCH PROC
    AMENDMENT  ASR RWY 10 S- CAT AB 440-5/8 419 (500-5/8) CAT C-E
    440-3/4
    419  (500-3/4). STEP DOWN FIX AT 2NM FM THR MIN 740.
  - KNIP V0023/19 28MAR1312-31MAY1200
    OBST RWY 28 OVERRUN CONST PROJECT. IFR TO
    MINIMUMS: ADD  OBSTACLES RWY 28 MEN AND EQPT UP TO 1,241 FM
    DER, 25FT AGL  OR 40FT MSL LEFT AND RIGHT OF CL.
```

5.2 Weather Overlay

The following figures, were created by the Ops Group Chairman and verified for accuracy by the Meteorology Group Chairman, are of both approach charts, RNAV 10 and RNAV 28, overlaid on the weather radar and ground track. For more information on weather radar data see the Meteorology Group Chairman factual report in the docket associated with this accident.

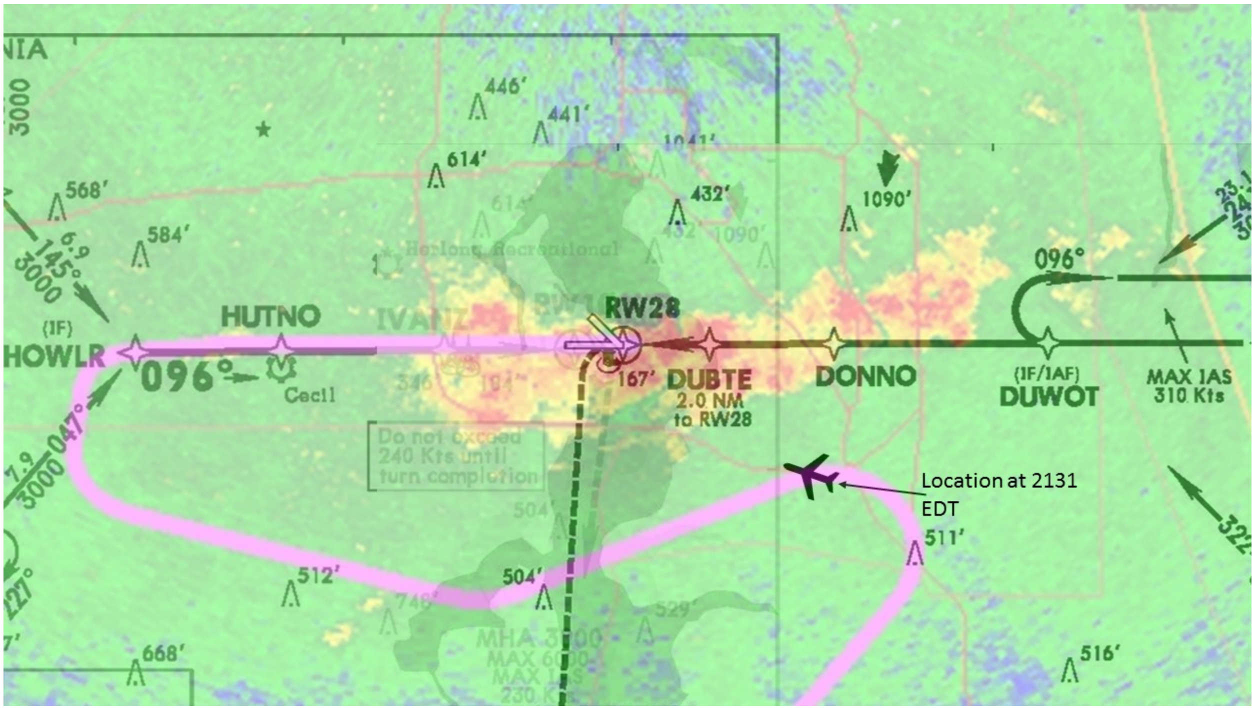


Figure 2: 2131 EDT.

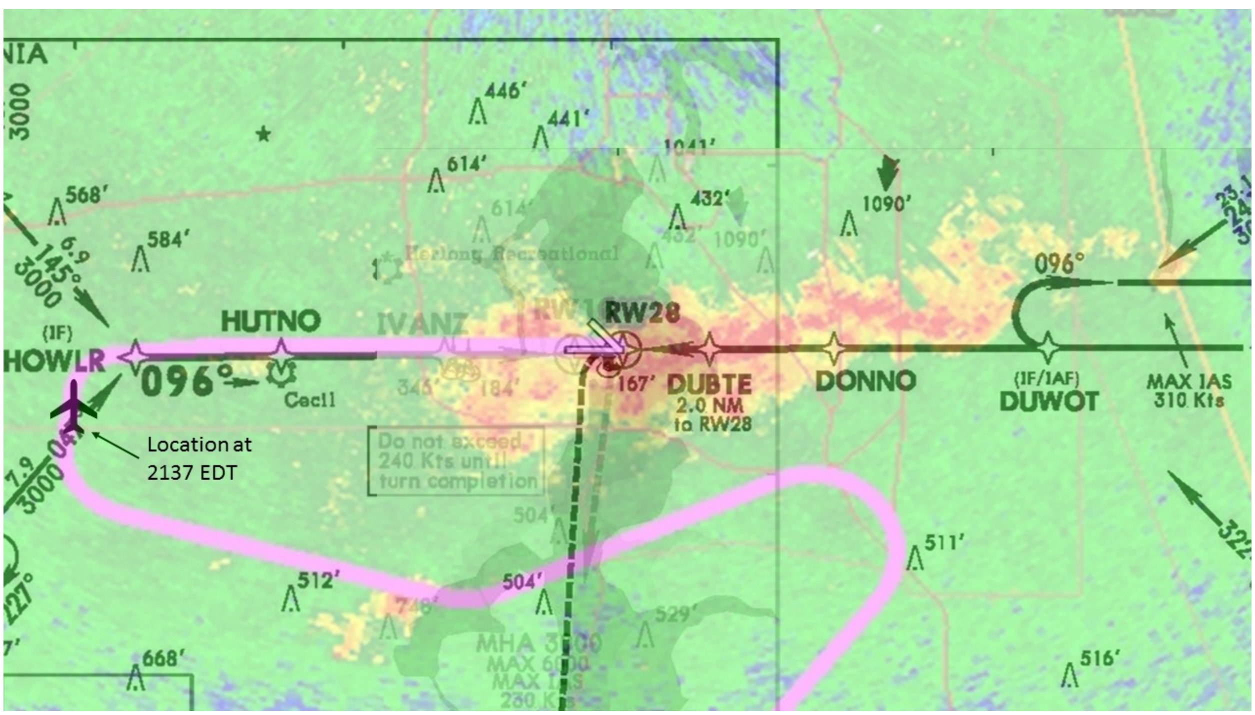


Figure 3: 2137 EDT.

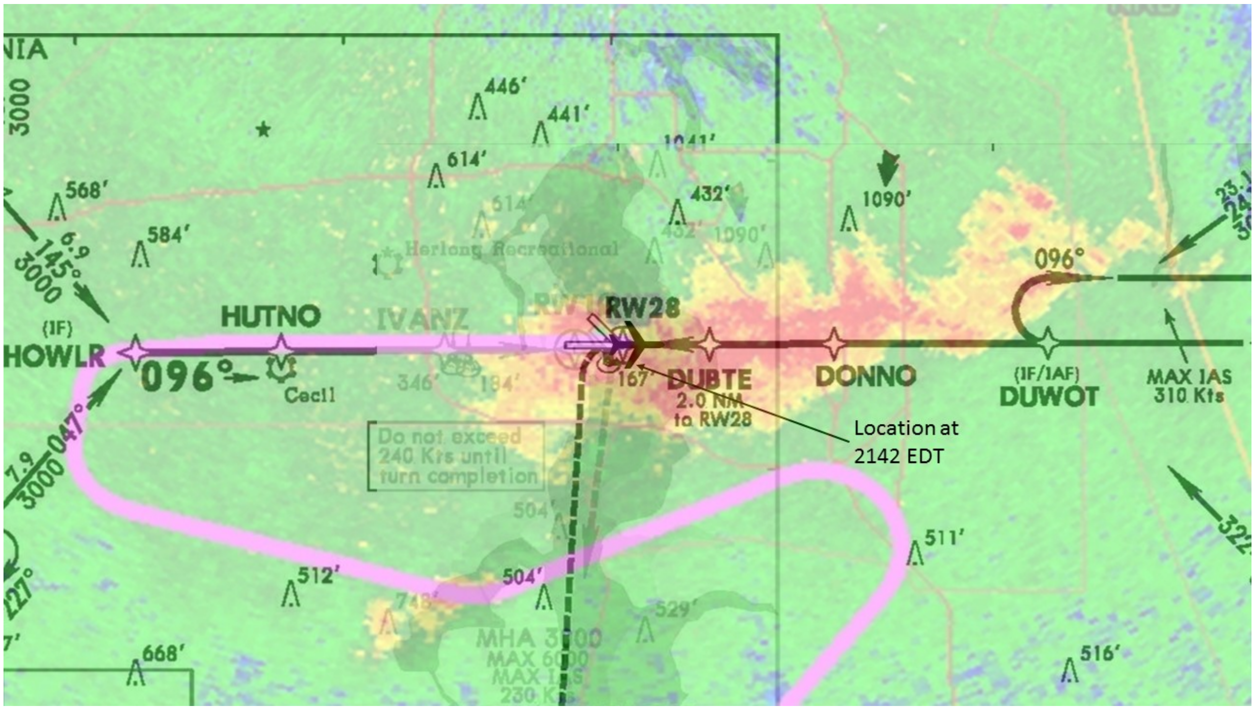


Figure 4: 2142 EDT.

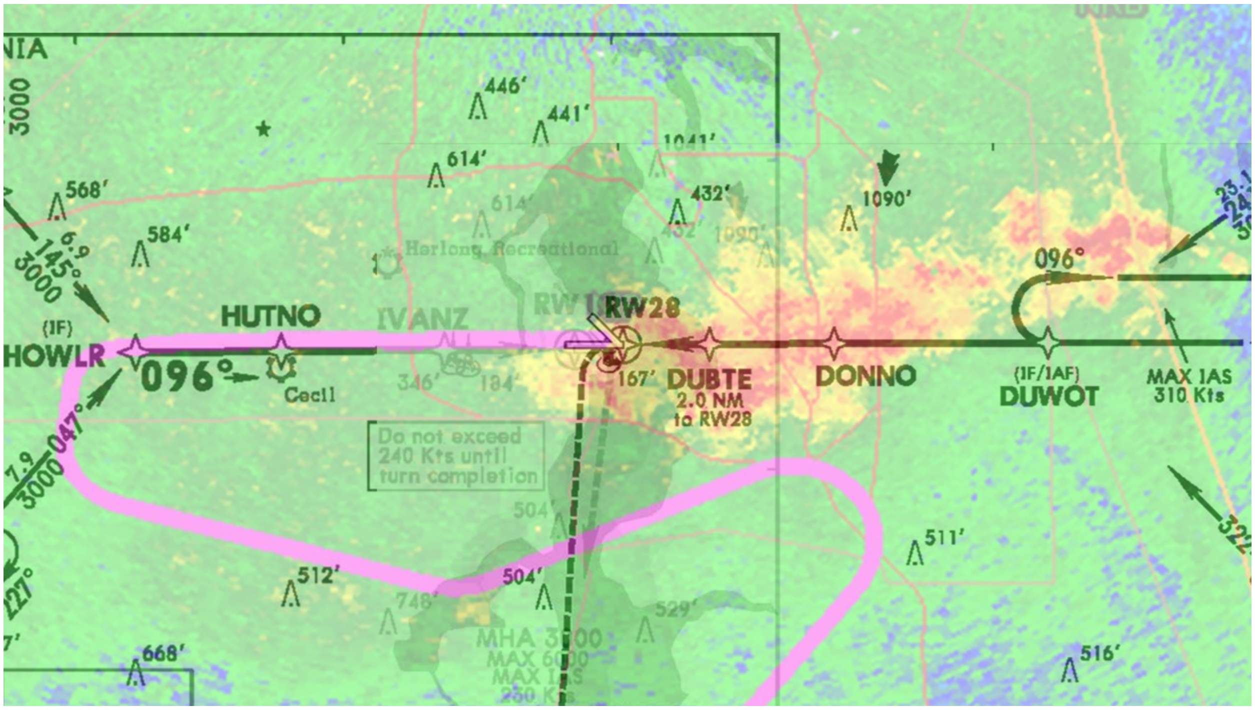


Figure 5: 2155 EDT.

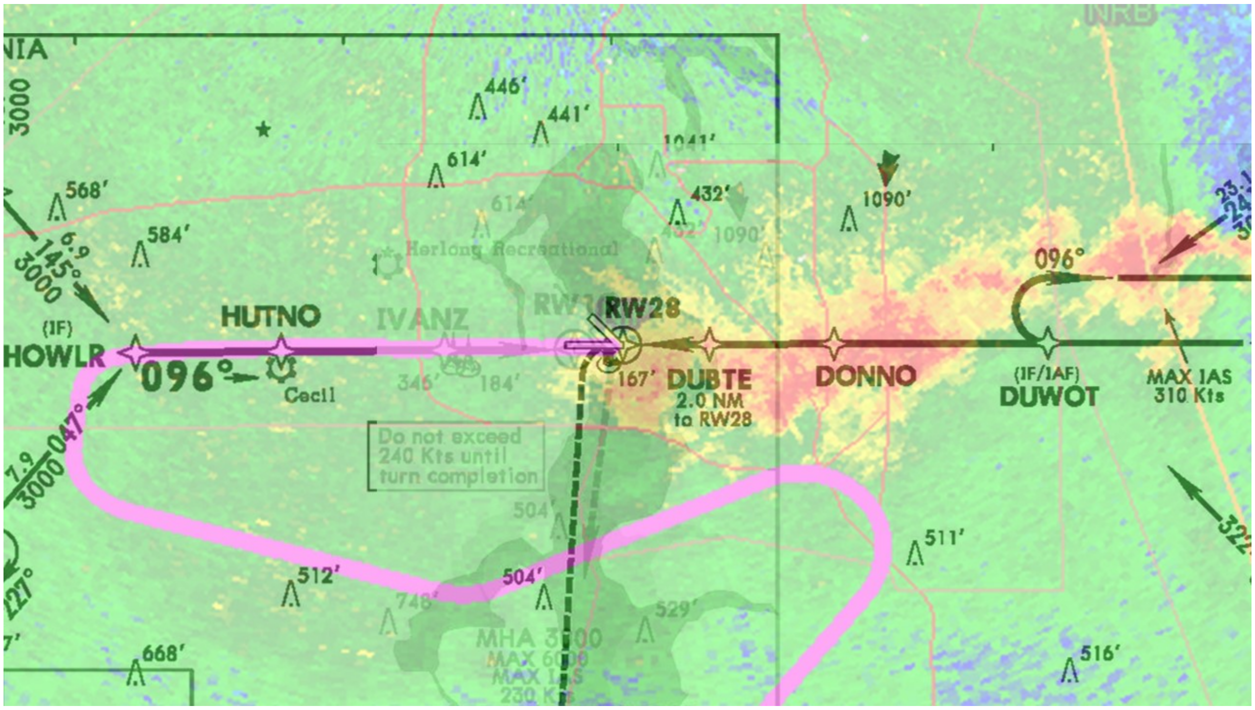


Figure 6: 2200 EDT.

6.0 Miami Air Dispatch

Miami Air's dispatch office included 8 dispatchers, 2 of which were on duty at a time and 6 desks, one of which was dedicated as the supervisor desk. Each desk consisted of 2 computer screens, a phone, and other necessary items. The supervisor's desk also included a phone that was dedicated for contacting an aircraft in flight via the satellite phone that was in each aircraft.

Dispatchers were provided the Weather Services International (WSI) desktop tool, Jeppesen Flight FliteDeck Pro planning software, as well as two monitors with the ability to display flight following. The accident dispatcher utilized weather from NavTech, WSI, Jeppesen, Enhanced Weather Information System (EWINS), and ODES; however, he liked the NavTech weather because "it was easy to read with big displays." Each dispatcher worked a 5-day work week and worked an average of 6 or 8 flights per shift, which could include domestic and/or international flights.

Flight operations were also managed by two flight boards that were color coded to indicate if a flight was on time, if there was a change to the flight, as well as if the aircraft was in flight. The flight boards were located in front of the dispatcher desks mounted on the wall and co-located with two radar screens to monitor flights that were airborne.

If a dispatcher needed to contact a flight, they could do so via ARINC[34], ATC, Satellite phone or via radio, if within their company VHF[35] frequency radio range. The dispatcher on duty at the time of the accident was contacted by the accident flightcrew while enroute at 2015.

[34] Aeronautical Radio, Incorporated.
[35] Very High Frequency.

6.1 Accident Dispatcher

The accident dispatcher was 62 years of age and was the manager of Miami Air's flight dispatch for the previous 3 to 4 years. On the day of the accident he arrived to work around 1425, saw on the flight operations board that the accident flight was delayed and was briefed by the outgoing dispatcher the aircraft was "restricted to 17,000 feet or lower" because of an inoperative pack. Although he did not recall being briefed on the inoperative thrust reverser, he did remember seeing it on the sheet.

He tracked the flight on the WSI system and noted moisture aloft and convective SIGMET alerts; which were only over the water and not near the planned flight path. He further stated the only concern he had about the flight was whether the route out of MUGM was on airways that would accommodate the altitude restriction imposed by the MEL.

The accident captain had contacted him while on the ground at MUGM to provide the arrival time and to correct an incorrect flight time on the accident flight's flight plan. The only item they discussed was the enroute weather for the flight. The captain called again to report the door was closing and they would be departing on the accident flight.

The dispatcher received a radio call on the company VHF frequency from the accident captain about 0015Z requesting the latest weather report. He recalled the KNIP METAR he saw was issued at 2353Z and reported 10 SM of visibility, a 5-degree temperature/dewpoint spread and that there were cumulonimbus clouds to the south and southwest of the airport. He also stated that there was no precipitation reported on the METAR at the time.

6.2 Flight Monitoring

Miami Air Flight Operations Manual (FOM), Chapter 2, provides the following information about Miami Air's flight monitoring tools:

> *Flight Monitoring Tools*
>
> *The primary means for monitoring fuel status and flight time remaining is the Aircraft Flow Board which contains tail numbers, flight numbers, scheduled/actual departure and arrival times, and any delayed or cancelled flight information. Actual OOOI (Out/Off/On/In) times will be relayed to Dispatch via SATCOM (if available), VHF (ARINC), HF (ARINC or Stockholm Radio), and SITA/AFTN. Dispatchers will insure [sic] the Aircraft Flow Board is updated with the latest times. The Ground Ops Coordinator will enter the times into the AIMSCrew Tracking System. Dispatchers will use the information on the Aircraft Flow Board to keep abreast of flight time remaining and specific aircraft position.*
>
> *The primary means for monitoring the enroute, destination, and alternate weather and airfield status is the Jeppesen FliteManager Alert Program. The Dispatch manual provides specific details on the use of FliteManager and other secondary means for monitoring.*

The Miami Air Dispatch Manual, Chapter 6 "General – Flight Following Procedures" stated, in part:

Once a flight has been released the Dispatcher is responsible for monitoring the progress of that flight, notifying the PIC of any information necessary to maintain the safe operation of that flight, and canceling or re-dispatching that flight if, in the opinion of the Dispatcher or PIC, the flight cannot operate or continue to operate safely as planned or released. Also, the Dispatcher must ensure that all Federal and Company rules and regulations are complied with during the entire flight operation.

Flight Following procedures are in place to enhance the safety of all Miami Air Flight Operations. These procedures are clearly defined in the Miami Air Dispatch Manual, Flight Operations Manual (FOM), and FAR Part 121.

6.3 Procedures for Flight Tracking

The Miami Air Dispatch Manual, Chapter 6, "Procedures for Flight Tracking" stated, in part:

Each 737-800 aircraft is equipped with an Iridium Satellite Phone and is considered to be the primary means of communication between the aircraft and Flight Control. Flight crews will normally call in their departure and arrival times to Dispatch. The Ground Ops coordinator or Dispatcher will update the flight information sources as stated below. The Dispatcher(s) on duty are responsible for ensuring all flight information is captured and disseminated as required, the Ground Ops Coordinator on duty will assist the Dispatcher with this process.

NOTE: 7 3 7 - 4 0 0 aircraft are not equipped with Sat Phones.

Flight crews may also pass flight information to Dispatch via VHF or HF communications. All en-route radio calls will be logged on the Radio Communications Log in Dispatch and kept for 30 days.

7.0 Airport Information

Jacksonville Naval Air Station – Towers Field was located about 4 miles south of Jacksonville, Florida, had an estimated field elevation of 22.5 feet msl, and was located at a latitude/longitude of N30˚14.02'/W081˚40.56'. The air station was owned by the United States Navy and was serviced by a Military Air Traffic Control Tower (ATCT) that was in operation 24 hours a day. The ATCT was in operation at the time of the accident. Approach radar services to the accident flight were provided by Jacksonville Approach control.

7.1 NIP Charts

The KNIP airport was served by three instrument approach procedures; RNAV (GPS) RWY 10, RNAV (GPS) RWY 28, and the RADAR PAR RWYS 10, 28 and ASR RWYS 10, 28, 32 at the time of the accident.

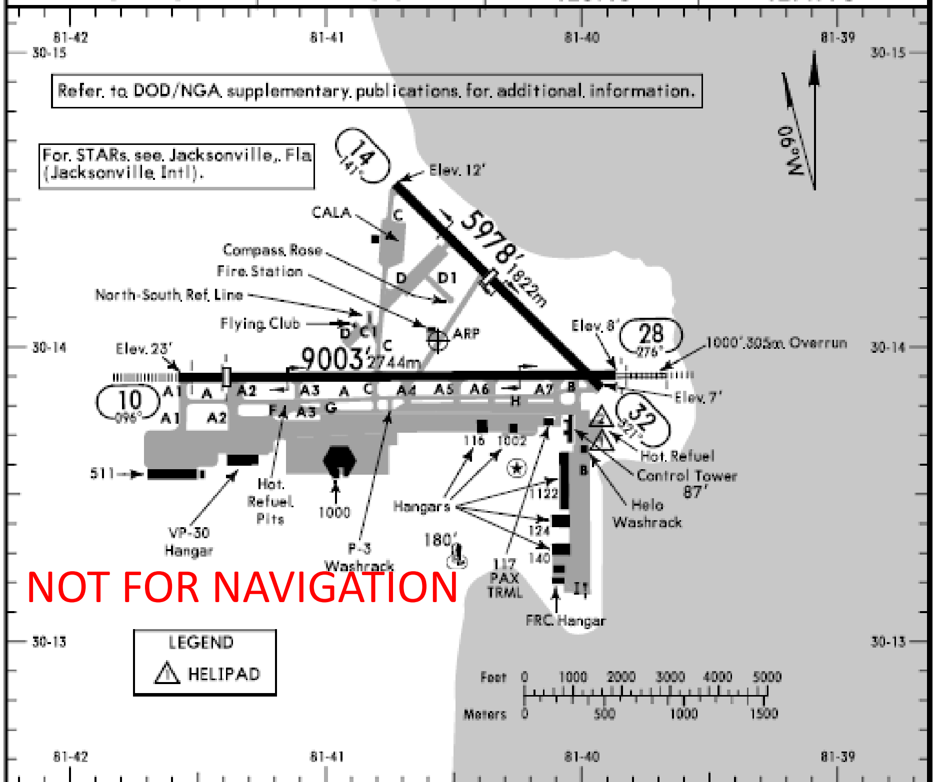
7.1.1 KNIP Airport Diagram

KNIP/NIP
Apt Elev 23'
N30 14.0 W081 40.6

JEPPESEN
22 FEB 19 (30-9) Eff 28 Feb

JACKSONVILLE NAS
JACKSONVILLE, FLA

NAVY JACKSONVILLE Clearance	Ground	Tower	JACKSONVILLE Departure (R)
134.775	128.6	125.15	127.775



ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS — LANDING BEYOND Threshold	Glide Slope	TAKE-OFF	WIDTH
10	❶ HIRL, CL, ALSF-I, PAPI-L (angle 3.00°)	8006' 2440m			200' 61m
28	❶ HIRL, CL, SALS, PAPI-L (angle 3.00°)			8002' 2439m	
14	HIRL	3244' 989m			200' 61m
32	HIRL, REIL				

❶ Activate on 134.775.

TAKE-OFF & DEPARTURE PROCEDURE

	All Rwys	
	Adequate Vis Ref	STD
1 & 2 Eng	1/4	1
3 & 4 Eng		1/2

DEPARTURE PROCEDURE: Rwy 10, Diverse departures only authorized between 116° through 276° clockwise.

Rwy 14, Diverse departures only authorized between 095° through 320° clockwise.

Rwy 32, Diverse departures only authorized between 351° through 141° counter clockwise.

AMEND 2

CHANGES: Lighting.

Figure 7: NIP Airport Page

7.1.2 KNIP Approach Chart for RNAV Runway 10

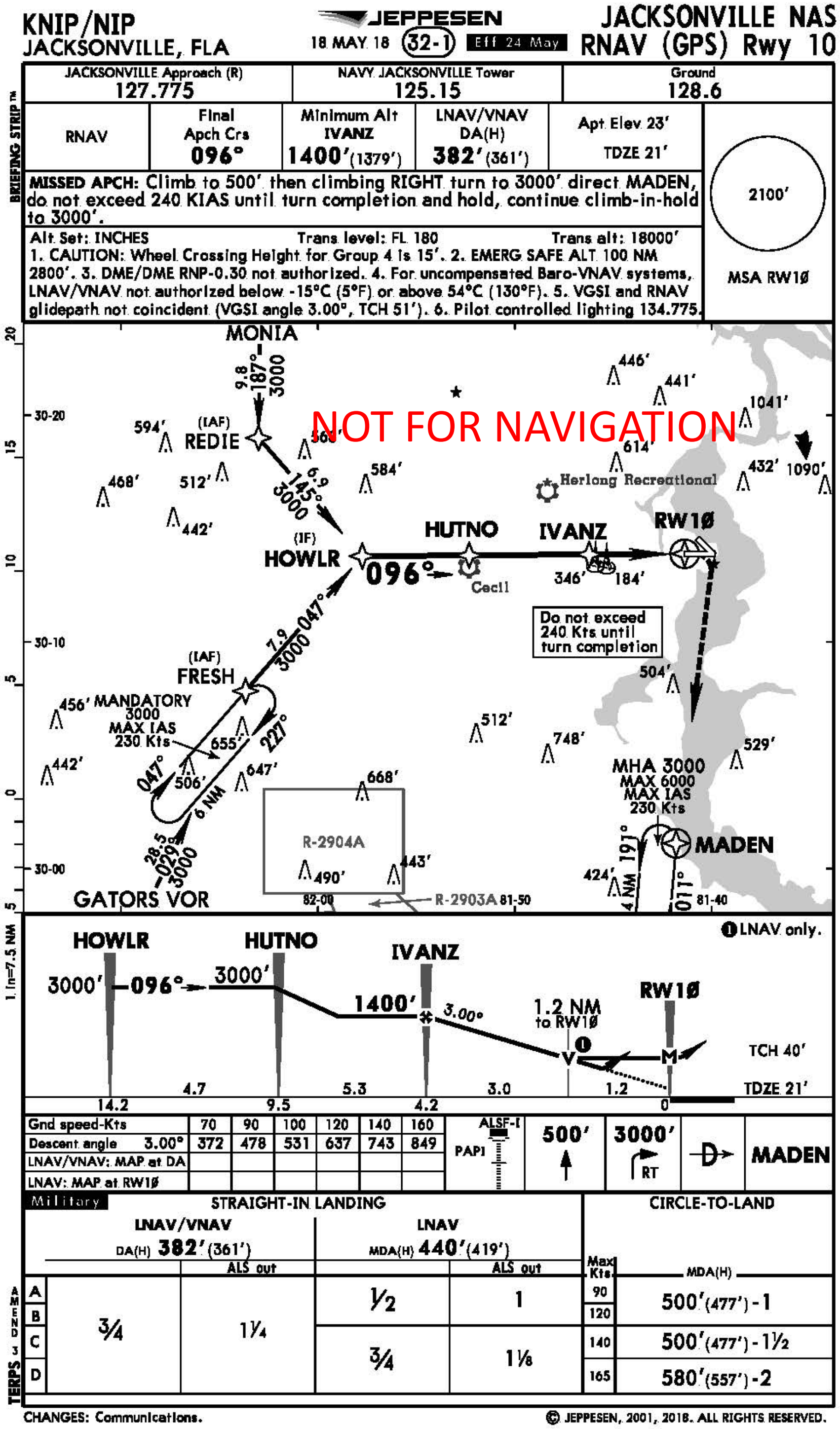


Figure 8: KNIP RNAV Runway 10 Approach Page (Accident Flight Approach)

8.0 Company Overview

According to Miami Air International's website[36] and chronological events provided by a representative of Miami Air International, Inc, discussion of beginning a charter company began in January of 1988. In February 1990, the name "Miami Air" was selected for the charter company and in June of that same year a certificate request had been filed with the Department of Transportation. On October 11, 1991 FAA and DOT certification was received and the first commercial flight was conducted on October 15, 1991 which was a round trip flight from MIA to Havana, Cuba, with one of two B-727 aircraft. In January 1993, Miami Air was approved to provide charter service to transport Department of Defense passengers.

In 2001, Miami Air acquired the accident aircraft and began replacing the eight B-727 aircraft they had with B-737-800 aircraft. At the time of the accident Miami Air International had five total aircraft, all of which were B-737-800.

Personnel from the Department of Defense Commercial Airlift Division conducted a biennial review of Miami Air International, Inc. on August 22 through 25, 2016. The survey's recommendation was:

> *Miami Air International, Inc. meets the DOD commercial Air Transportation Quality and Safety Requirements for continued participation in the DOD Air Transportation Program.*

Miami Air International conducted their pilot training in house using their own instructors and leased local simulators to fulfil required pilot training.

9.0 Organizational and Management Information

According to OpsSpecs A006, dated February 10, 1998, the required management positions at Miami Air International Inc. were vice president of flight operations, vice president of maintenance, director of safety and security, chief pilot, and director of quality assurance.

Additionally, the chain of command within a flight crew was listed as captain, most senior 737 type rated cockpit crewmember (either the first officer or APC[37]) that is part of the working crew, then the remaining cockpit crewmember assigned to the working crew first officer, additional pilot crewmember (if applicable), and purser, followed by flight attendants according to company seniority.

10.0 FAA Oversight

The FAA Certificate Management Office (CMO) for Miami Air was located in Miramar, Florida. The operation's staffing for the Miami Air Certificate Management Team (CMT) consisted of five inspectors, a principal operations inspector (POI)[38], principal maintenance

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[36] Source: http://www.miamiair.com/history.asp
[37] Additional Pilot Crewmember.
[38] Principal Operations Inspector – is responsible for all operational matters concerning the administration of the air carrier's certificate, including management of an aircrew designated examiner program. Source: http://fsims.faa.gov/PICDetail.aspx?docId=8900.1,Vol.13,Ch2,Sec2_SAS

inspector (PMI)[39], principal avionics inspector (PAI), cabin safety inspector (CSI), and aircrew program manager (APM)[40].

According to the Miami Air POI they had two geographical inspectors that they shared with the office as well.

A review of the FAA's Program Tracking and Reporting Subsystem (PTRS) showed the following surveillances were conducted at Miami Air International during 2017 and until the date of the accident in 2019.

Activity	Act No.	2019[41]	2018	2017
Observation of Check Airmen in a Simulator (Annual)	1642		3	3
Enroute Surveillance	1643 or 1644	5	5	1
Surveillance and Approval of Check Airman Enroute/Simulator[42]	1672	0/2[43]	0/0	0/2
Observation of Ground School	1626	0	2	0

Table 1: FAA Observations Conducted at Miami Air from January 1, 2017 to May 3, 2019.

11.0 Relevant Systems

11.1 Speed Brakes

The Miami Air, 737-800 Operations Manual – Vol 2, "Flight Controls – System Description" provided the following, in part, information on the Speed Brakes:

The speed brakes consist of flight spoilers and ground spoilers. Hydraulic system A powers all four ground spoilers, two on the upper surface of each wing. The SPEED BRAKE lever controls the spoilers. When the SPEED BRAKE lever is actuated all the spoilers extend when the airplane is on the ground and only the flight spoilers extend when the airplane is in the air.

The SPEEDBRAKES EXTENDED light provides an indication of spoiler operation in-flight and on the ground. In-flight, the light illuminates to warn the crew that the speed

[39] Principal Maintenance Inspector – is responsible for the approval and surveillance of the air operator's maintenance program for operations conducted under parts 121, 125, or 129. Source: FAA Order 8300.13A, Chapter 1, "Introduction," Section 8.a., dated January 11, 2013.
[40] Aircrew Program Manager – an appropriately trained Operations inspector who is also specifically trained by an air carrier to oversee the certification activity and to manage the surveillance of that air carrier's training and qualification program in a specific aircraft type. Source: http://fsims.faa.gov/PICDetail.aspx?docId=8900.1,Vol.13,Ch2,Sec2_SAS
[41] This includes **only** the time from January 1 until May 3 of 2019.
[42] The numbers include a total of Type Rating Equipment Examination (Oral) or Type Rating Practical Test (Simulator).
[43] Both surveillance entries were conducted on April 19, 2019 and the accident captain was being observed, for his APD certification, conducting a PC check oral and practical test in a simulator, of note, this was the only 1672 code noted during the time period requested. Source: Attachment 6 - Flight Crew Training Records.

brakes are extended while in the landing configuration or below 800 feet AGL. On the ground, the light illuminates when hydraulic pressure is sensed in the ground spoiler shutoff valve with the speed brake lever in the DOWN position.

Ground Operation

During landing, the auto speed brake system operates when these conditions occur:

- *SPEED BRAKE lever is in the ARMED position*
- *SPEED BRAKE ARMED light is illuminated*
- *radio altitude is less than 10 feet*
- *landing gear strut compresses on touchdown*

  Note: *Compression of any landing gear strut enables the flight spoilers to deploy. Compression of the right main landing gear strut enables the ground spoilers to deploy.*
- *both thrust levers are retarded to IDLE*
- *main landing gear wheels spin up (more than 60 kts).*

The SPEED BRAKE lever automatically moves to the UP position and the spoilers deploy.

If a wheel spin-up signal is not detected, when the air/ground system senses ground mode (any gear strut compresses) the SPEED BRAKE lever moves to the UP position and flight spoiler panels deploy automatically. When the right main landing gear strut compresses, a mechanical linkage opens the ground spoiler bypass valve and the ground spoilers deploy.

If the SPEED BRAKE lever is in the DOWN position during landing or rejected takeoff, the auto speed brake system operates when these conditions occur:

- *main landing gear wheels spin up (more than 60 kts)*
- *both thrust levers are retarded to IDLE*
- *reverse thrust levers are positioned for reverse thrust.*

The SPEED BRAKE lever automatically moves to the UP position and spoilers deploy.

After an RTO or landing, if either thrust lever is advanced, the SPEED BRAKE lever automatically moves to the DOWN detent and all spoiler panels retract. The spoiler panels may also be retracted by manually moving the SPEED BRAKE lever to the DOWN detent.

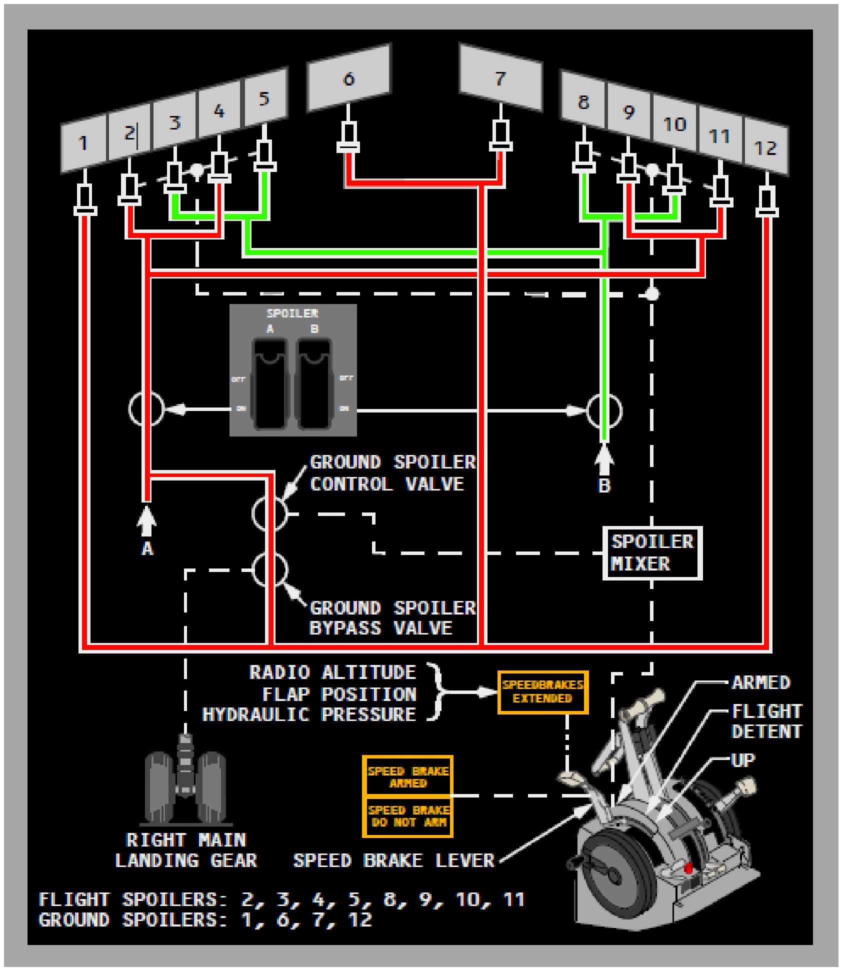

Figure 9: Speed Brakes Schematic
(Source Miami Air 737-800 Operations Manual -Vol 2).

11.2 Thrust Reversers

The Miami Air, 737-800 Operations Manual – Vol 2, "Engines, APU – Engine System Description" provided the following information on the thrust reverser system:

Each engine is equipped with a hydraulically operated thrust reverser, consisting of left and right trnslating 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 operion 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, alernate operation for the affect 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.

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 *revers 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 eployed position, the REV indication illuminates green and the reverse thrust lever can be raised to detent No. 2. This position provides adequate revers thrust for normal operations. When necessary, the reverse thrust lever can be pulled betyond 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 poosition, 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 elctro-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 annunicator lights to illuminate. A pause of approximately 18 seconds engages the elctro-mechanical lock and prevents the thrust reverser sleeves from further movement. Cycling the thrust reversers may clear the fault and restor normal operation.*

When the revers sleees are in the stow position, an electro-mechanical lock and hydraulically operated locking actuator inhibit motion to each ereverser 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 revers sleeves toward the deployed position, the auto-restow circuit opens the isolation vlae and commands the control valve to the stow position directing hydraulic pressure to stow the reverser sleeves. Once the auto-restow circuit is stowed activated, the isolation valve remains open and the contorl valve is held in the stowed position until the thrust revers 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 personnnel.

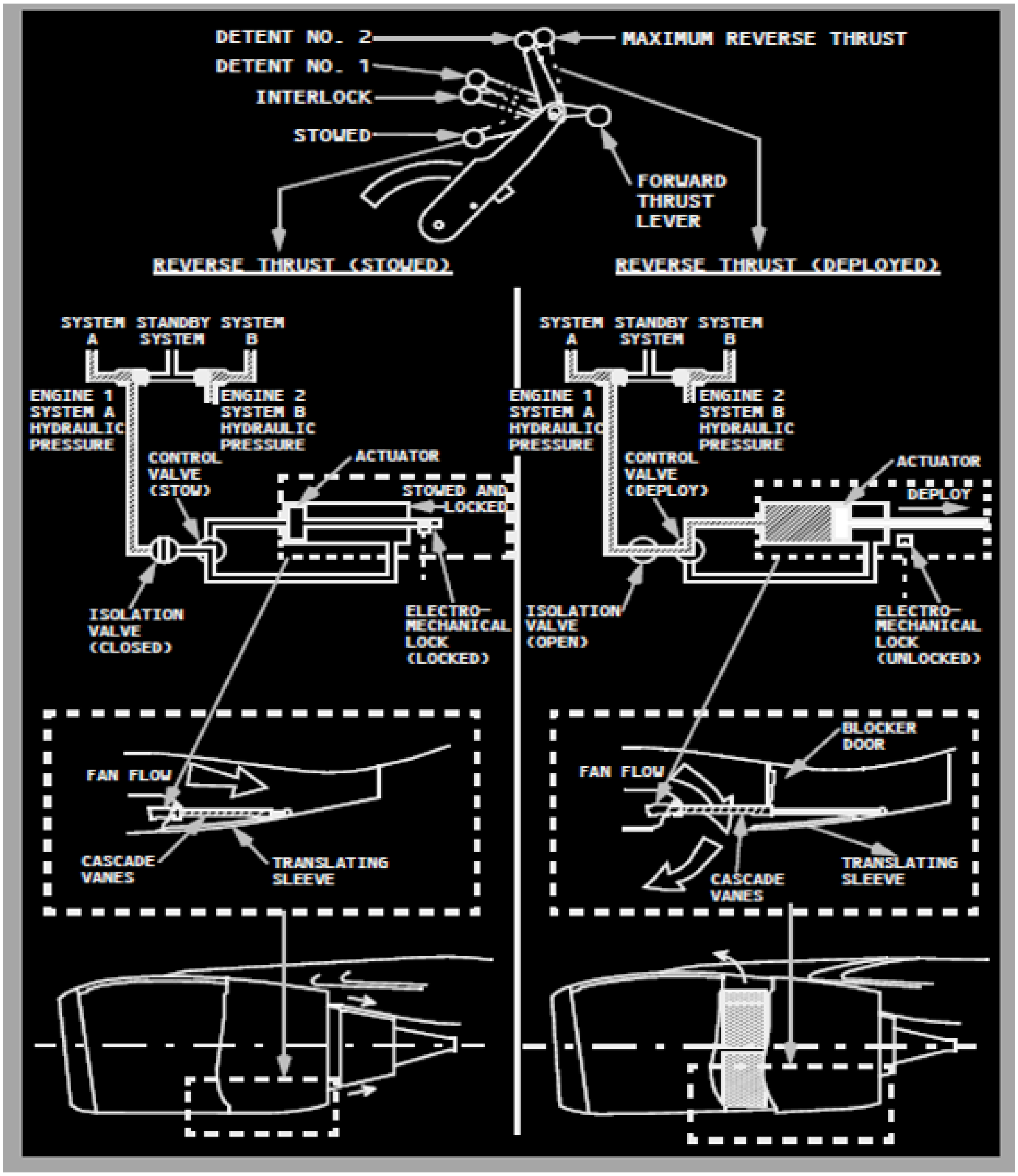

Figure 10: Thrust Reverser Schematic (Source: Miami Air 737-800 Operations Manual Vol. 2).

12.0 Relevant Procedures

12.1 Approach Briefing

Miami Air's Flight Operations Manual, Chapter 2, provided the following guidance for briefing an instrument approach:

> *An approach briefing will be accomplished prior to every approach. Normally, the Pilot Flying (PF) will accomplish the approach briefing. However, the Pilot Flying (PF) has the*

option of assigning the Pilot Monitoring (PM) to accomplish the approach briefing. The briefing should include all cockpit crewmembers.

The Captain will ensure that flying and monitoring responsibilities are positively delegated during the briefing.

Minimum briefing content should vary with approach and weather conditions:

1. Name of the Approach
For example: ILS-DME to Runway 27L.
2. Date of the Approach Chart
3. Primary Nav Aid Frequency.
4. Final Approach Course.
5. Crossing Altitude.

On an ILS approach, it will be the altitude where the approach crosses the outer marker or a selected appropriate point if depicted on the approach chart (e.g. a charted intersection, a DME fix or a radar fix; typically at 1500 feet AGL.) The crossing altitude shall be expressed as MSL.

On a non-precision approach, it will be the altitude when the approach crosses the FAF, or a selected appropriate point if depicted on the approach chart (e.g. a DME fix). The crossing altitude shall be expressed as MSL.

6. Minimum altitude (Decision Altitude, Decision Height, Derived Decision Altitude, Minimum Descent Altitude).
7. Missed approach point, if applicable.
8. Initial missed approach instructions consisting of initial heading and altitude.
9. Review the initial steps of the missed approach maneuver.
10. The anticipated taxi route to the gate or parking area.
11. A discussion of unusual or abnormal conditions or any pertinent information. For example, high terrain, transition level other than FL180, potential for runway incursions on taxi-in (hot spots).
12. For Category II/III approaches, it is recommended to review the following items:

- *Approach lighting.*
- *Runway remaining lighting.*
- *Expected runway exit.*
- *Airport Diagram.*
- *Expected runway route (SMGCS/1200 RVR or less).*

12.2 Instrument Approach Procedures

Miami Air's OpsSpec C052 provided authorization to conduct instrument approach procedures using RNAV (GPS) guidance. RNAV (GPS) was listed as a "*nonprecision approach procedures without vertical guidance*." The Miami Air 737 Operations Manual, Section "Normal Procedures – Amplified Procedures" provided the following vertical speed (V/S) procedure guidance:

General

V/S procedures must be used on the following approaches:

- *No coded GP angle on the LEGS page.*
- *In WGS-84 non-compliant country or non-compliant area.*
- *Pilot Constructed approaches.*
- *VNAV[44] will not engage.*
- *Gradient Path not within 2.75 degrees to 3.50 degrees.*

Use LVL CHG or V/S prior to the FAF, and V/S after the FAF.

Cross the FAF at published crossing altitude to avoid excessive rates of descent inside the FAF.

Preparation Procedures

Set inbound course.

Minimums set to DDA (MDA + 50 ft)

Select approach procedure:

- *Verify approach chart waypoints and altitudes against the FMC LEGS page (No modifications after FAF).*
- *Select the runway and insert on the Descent page on line 3R for V/B reference (recommendation).*

Approach reference page-----Select flap setting.

Brief the Approach

Complete the Descent Approach Checklist.

Tune and select (LOCs, VORs, ADFs, as required).

EFIS Panel:

- *Navigation Display select MAP MODE and 10 mile scale (RNAV approach only).*

CDU:

- *Pilot Flying selects Descent Page/ Pilot Monitoring selects the LEGS page, if RNAV approach.*

[44] Vertical Navigation

Approach Procedure

Roll Mode:

• For RNAV approach use LNAV (WGS 84 compliant airspace / at least one operational GPS)
• For LOC, LDA approaches use VOR/LOC or LNAV. For BC-LOC approaches use LNAV. For LOC, BC-LOC or LDA approaches, raw data must be monitored if LNAV is used.
• For VOR or ADF approaches use HDG SEL or LNAV. It is recommended raw data be monitored.

MCP Altitude:

• Set charted altitudes as approach is flown in LVL CHG or V/S down to FAF altitude.
• Verify altitude hold on FMA or present descent will cross FAF at charted altitude.
• No later than the FAF, set MCP to DDA or nearest higher 100 foot altitude.

At FAF, verify crossing altitude and FMA displays V/S.

• Set target approach speed based upon tower reported winds.
• Final approach speed is Vref plus one half the headwind plus all of the gusts. The minimum approach speed is Vref+5 with a maximum of Vref+20.

Descend to DDA using V/S based upon:

• Charted descent rates based upon ground speed, or
• If available, use VNAV PATH on ND or Vertical Deviation on Descent page as a reference, or
• Matching charted approach gradient path and Vertical Bearing (V/B) on Descent Page of FMC.
• Establish a 3 degree path by calculating a vertical speed based upon the airplane's ground speed on final. Use a V/S equal to ½ of the ground speed X 10. e.g.140 kts GS---700 fpm, 160 kts GS---800 fpm.

At 1000 ft AFL, PM calls "1000 feet" and sets Missed Approach altitude (PF acknowledges).

PM------ calls "100 above" at 100 feet above DDA (acknowledged by PF).

PM------calls "Approach lights" or "runway" and direction (e.g. 12 o'clock) when approach lights or runway environment is in sight.

PF--------calls "Minimums" at DDA.

PF------- If suitable visual reference established call "Visual."

Autopilot and Autothrottle must be disengaged by no later than 50 feet below DDA.

Missed approach is required if:

• At DDA, runway or approach lights not in sight.
• UNABLE REQD NAV PERF-RNP message displayed without runway in sight (RNAV Approach).
• If the airplane symbol on the 10 mile scale from the FAF inbound is not touching the LNAV track (RNAV Approach).

12.3 VNAV Approach

The Miami Air, 737 Operations Manual, "Normal Procedures – Amplified Procedures" provided the follow guidance for VNAV approach to an airport:

General

Autopilot or Flight Director must be used.

At least one FMC, one VOR, one IRU in NAV mode and one GPS must be operational.

LNAV/VNAV DA minimums not authorized using a remote altimeter or airport temperature is either above/below approach chart minimum/maximum temperature.

Set a DDA when using remote altimeter, or with the airport temperature either below/above approach chart minimum/maximum temperature (MDA+50 ft). Must be conducted to a WGS-84 compliant approach. An approach is WGS-84 approved if either (GPS) or (GNSS) or (RNP) appears in the title of the approach. Do not use VNAV on Pilot Constructed approaches.

Preparation Procedures

Set inbound course.

Minimums are set to VNAV DA as published.

If no LNAV/VNAV DA minimums indicated, a MDA can be converted to a DA if procedures on VNAV Checklist (Ops Form 620) are used.

DDA is set if MDA cannot be converted to a DA.

Select approach procedure and then go to the LEGS page:

• *Verify approach chart waypoints and altitudes against the FMC LEGS page (No modifications after FAF).*
• *A 2.75 - 3.50 degree gradient path must be displayed.*
• *Make the FAF waypoint a "hard" altitude.*
• *Select the runway and place on the Descent page on line 3R for V/B reference (recommendation).*

Approach Reference page:

• *Select flap setting*
• *Set wind correction (½ head wind + all of the gusts, maximum 20 kts)*

Brief the Approach

Complete the Descent Approach Checklist.

EFIS panel - Navigation Display, select MAP mode and 10 mile scale.

CDU - Pilot Flying selects Descent page, Pilot Monitoring selects the LEGS page.

Approach Procedure

Roll Mode:

• *For an RNAV approach use LNAV (WGS 84 airspace/Minimum of one GPS operational).*
• *For LOC, LDA approaches, use VOR/LOC or LNAV.*
• *For BC-LOC approaches use LNAV.*
• *LOC, BC-LOC, LDA approaches must be backed up with raw data if LNAV used.*
• *For VOR approaches use VOR/LOC or LNAV. It is recommended that raw data be monitored.*
• *For ADF approaches use HDG SEL or LNAV it is recommended that raw data is monitored.*

VNAV:

• *Select when established on course on approach procedure or flaps extended.*
• *VNAV path deviation limits: 50 feet low or 75 feet high after the Final Approach Fix.*

MCP Altitude:

• *Initially set to FAF altitude.*
• *No sooner than two miles prior to FAF set MCP to DA/DDA or nearest 100 feet increment above the DA/DDA.*

FAF:

- *Verify crossing altitude and FMA displays VNAV PATH.*
- *Contact the tower for landing clearance.*
- *Captain's and First Officer's altimeters must be within + or - 100 feet at the FAF.*

At 1000 feet AFL, PM calls "1000 feet" and sets Missed Approach altitude (PF acknowledges).

PM------ calls "100 above" when 100 feet above DA or DDA. (PF acknowledges)
PM------calls "Approach lights" or "Runway" and direction (e.g. 12 o'clock) when approach lights or runway environment in sight.
PF--------calls "Minimums" at DA or DDA.
PF------- If suitable visual reference established, call "Visual."

Autopilot and Autothrottle must be disengaged by no later than 50 below the DA or DDA.

Missed approach is required for any of the following:

- *At DA/DDA runway or approach lights not in sight.*
- *UNABLE REQD NAV PERF-RNP message displayed without runway in sight (RNAV approach).*
- *If the airplane symbol on the 10 mile scale from the FAF inbound is not touching the LNAV track (RNAV approach) anytime from the FAF to the DA/DDA.*

12.4 Instrument Approach – Using V/S

The Miami Air, 737 Quick Reference Handbook (QRH), "Maneuvers-Flight Patterns," provided the following pictorial guidance on conducting an instrument approach using vertical speed (V/S) to an airport:

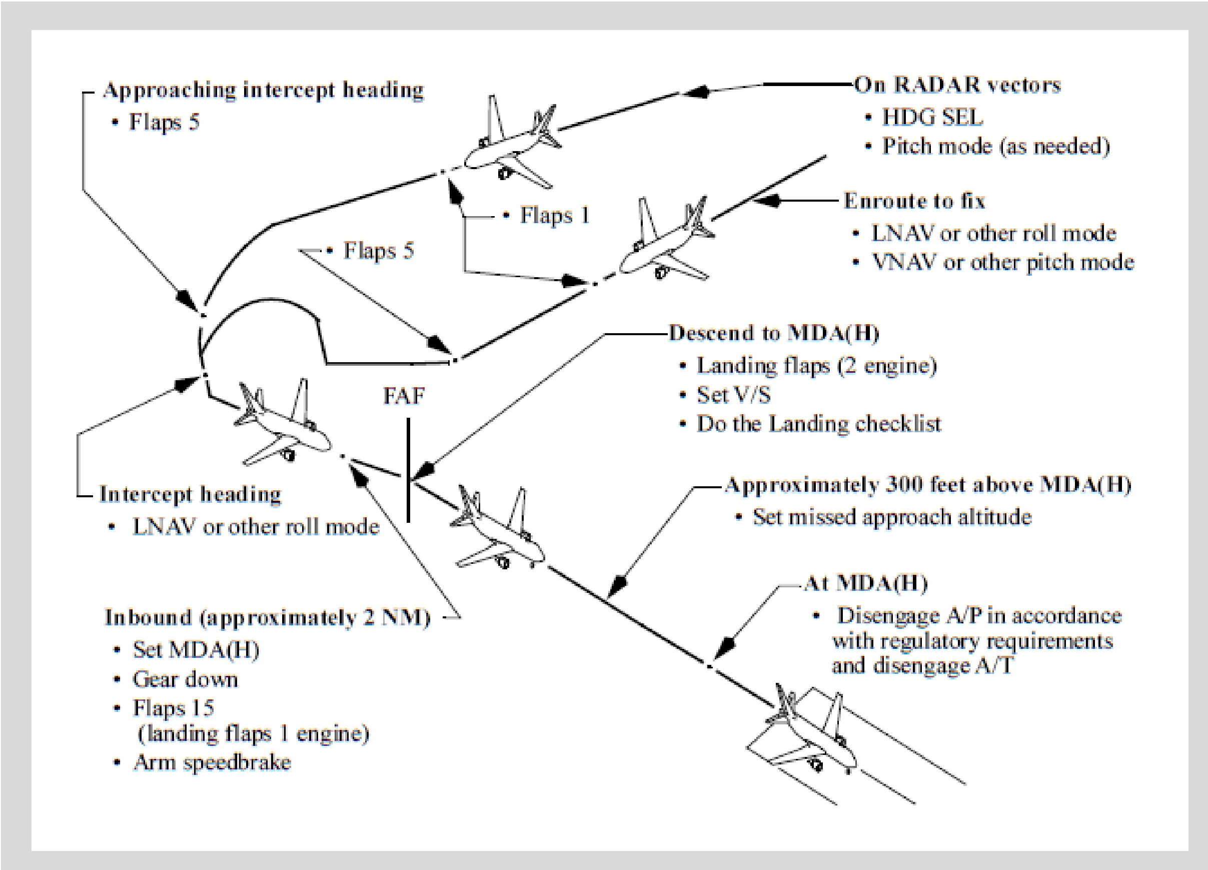

Figure 11: Instrument Approach using Vertical Speed (V/S) Guidance (Source: Miami Air 737 Quick Reference Handbook Maneuvers Section 2.3).

12.5 Landing Crosswind Guidelines

The Miami Air, 737 Operations Manual, "Normal Procedures – Amplified Procedures," provided the following guidance for landing with various runway conditions:

> *Crosswind guidelines are not considered limitations. On slippery runways, crosswind guidelines are a function of runway surface condition, airplane loading, and assume proper pilot technique. The following crosswind guidelines are based on steady wind (no gust) and either all engines operating or one engine inoperative. Gust effects were evaluated and tend to increase pilot workload without significantly affecting the recommended guidelines.*

Runway Conditions	Crosswind – Knots *
Dry	33/35 ***
Wet	25 ***
Standing Water/Slush	15
Compact Snow **	25 ***
Dry Snow **	25 ***
Slippery/Good **	25 ***
Slippery/Medium **	20 ***
Slippery/Poor **	15 ***

Figure 12: Crosswind Guidelines (30 & 40 Flaps) (Source: Operations Manual NP.20.83)

***Note**: Reduce crosswind guidelines by 5 knots on wet or contaminated runways whenever asymmetric reverse thrust is used.*

***Note**: With the yaw damper inoperative, do not exceed flaps 30 if crosswinds exceed 30 knots.*

**Winds measured at 33 feet (10 m) tower height and apply for runways 148 feet (45m) or greater in width.*

*** Landing on untreated ice or snow should only be attempted when no melting is present.*

**** Sideslip only (zero crab) landings are not recommended with crosswinds in excess of 15 knots at flaps 15, 18 knots at flaps 30, or 21 knots at flaps 40. This recommendation ensures adequate ground clearance and is based on maintaining adequate control margin. Maximum crosswind for autolands are: Category I or better weather: 20 knots; Category II or III weather: 15 knots.*

12.6 Tailwind Limits

The Miami Air 737 Operations Manual, Chapter L "Limitations", Section 10 "Operating Limitations" listed the following operational limits for the accident airplane:

Runway slope	+/– 2%
Maximum Takeoff and Landing Tailwind Component	15 knots (specific takeoff or landing performance data required when over 10 knots tailwind component)
Maximum speeds	Observe Vmo, gear and flap placards
Maximum Operating Altitude	41,000 ft
Maximum Takeoff and Landing Altitude (pressure altitude)	8,400 ft
Turbulent Penetration	280 knots /.76 M, whichever is lower

Figure 13: Operational Limits (Source AOM Vol 1 L.10.1).

12.7 Preflight Guidance

The FOM, Chapter 2, section "Crew Briefing" stated:

1 Crew Briefing

The Captain will conduct a crew briefing each day and any time there is a crew change. The briefing should include all the cockpit and cabin crewmembers and should cover the following items:

- *Introduction of crewmembers.*
- *Departure, enroute and destination weather considerations.*
- *Logbook write-ups, MEL items and required MEL procedures.*
- *Crew coordination and communication during normal, abnormal and emergency situations.*
- *Other pertinent information (such as whether the flight will be operating over water, whether passenger oxygen should be briefed, etc.)*
- *The Captain should also let the flight attendants know, prior to engine start, whether the aircraft will push back or taxi out.*
- *Security items, as appropriate. See FOM Chapter 2: Security Procedures .*
- *All Miami Air procedures must be followed. Within the limits of prescribed procedures, there is latitude for individual technique. If there are particular techniques the Captain or crew prefers, they should discuss them at the briefing.*

The FOM, Chapter 2, section "Preflight Requirements" stated:

1 Preflight Requirements

Before each flight using an aircraft with inoperative equipment, the Captain must assess the weather, the field conditions, the number of inoperative items, and the resulting crew workload and decide if the flight can be operated safely with the inoperative equipment.

***2** The Captain should ascertain that an adequate amount of log pages are sufficient (one page per leg) to complete the flight or series of flights while away from station. He/She will request an additional aircraft logbook if in doubt.*

See Attachment 11 for additional information on preflight preparation.

12.8 Crosswind and Tailwind Component Limits

The Miami Air FOM, Chapter 2 "Normal Operations," provided the following guidance for "Crosswind and Tailwind Component Limits":

1. ***Crosswind and Tailwind Component Limits***
   No landing will be attempted with a tailwind when the braking action is reported as anything less than "Good".
2. *For tailwind landings, a critical tailwind is stated on the landing weight page. If the tailwind exceeds this figure, a weight penalty is stated in the adjoining column. By applying this penalty, a landing may be made with a tailwind above the critical tailwind (but never exceeding max tailwind limit).*
3. *Headwind computations for takeoff are used only after consultation with the Captain. Headwind component is computed on the basis of the reported steady wind.*

12.9 Descent Approach Checklist

The Miami Air, 737 Operations Manual, "Normal – Procedures- Amplified Procedures" provided the following guidance for the Descent Approach Checklist:

Descent Approach Checklist

The PF shall call for the Descent Approach checklist no later than 18,000 feet MSL. Where the transition level is lower, the checklist should be completed down to "Altimeters Transition." The Pilot Monitoring reads aloud the challenges and responses. Shoulder Harness checklist item is a [sic] all crew response (Captain, F/O, and jumpseat rider.)

Fasten Belts ....ON

Shoulder Harness...ON

Captain responds first, followed by First Officer, then cockpit jumpseat rider.

Anti-Ice .... DECLARE

Air Cond & Pressurization .... Checked & Set

Verify/Reset Landing altitude.

Verify cabin descending / climbing.

Confirm Cabin Altitude, Cabin Rate and Differential Pressure are appropriate.

Duct pressure should be 18-50 psi with split between left and right duct pressure needles not exceeding 16 psi.

Approach Speeds...Set

Select Approach Reference Page and verify correct flap setting and correct Vref set on PFD.

Note: *Approach speed bug must always be set at or above the top of the minimum maneuvering speed (amber) band.*

Approach Briefing.. COMPLETED

As per FOM.

Minimums .... SET & XCHECKED

Verify DA/DDA/DH for approach is set on both sides as appropriate.

Autobrake ....DECLARE

Recall ....CHECKED

Check for any annunciator lights. Announce (if appropriate) any annunciator illuminated and the associated non-normal (example, ELECT - IDG Inop.)

Altimeters Transition................................. _______ SET & XCHECKED

Set when cleared below transition level and descent has begun.

At 10,000 feet MSL:

"Flight Attendants Arrival Check Please." May adjust altitude for higher altitude airports.

The Captain turns on Fixed Landing lights and Runway Turnoff lights. In addition, if nighttime, turn on Logo lights and Wing Illumination Lights.

LVL CHG or V/S will normally be used below 10,000 feet MSL for descents unless operating on a published STAR/FMSP, in a holding pattern or on a VNAV approach.

LVL CHG is the preferred mode for altitude changes of more than 1000 feet. Vertical Speed is preferred if the altitude change is 1000 feet or less.

The FMC Descent page provides the best guidance when to accomplish deceleration/configuration changes for the approach and landing.

Terrain Display:

At least one Pilot shall have TERR display selected if Terrain/Obstacles are a factor.

10 miles from landing:

"Flight Attendants, Landing Check Please."

12.10 Approach Briefing

The Miami Air FOM, Chapter 2, section “Approach”, subsection “1 Approach Briefing”, stated:

An approach briefing will be accomplished prior to every approach. Normally, the Pilot Flying (PF) will accomplish the approach briefing. However, the Pilot Flying (PF) has the option of assigning the Pilot Monitoring (PM) to accomplish the approach briefing. The briefing should include all cockpit crewmembers. The Captain will ensure that flying and monitoring responsibilities are positively delegated during the briefing. Minimum briefing content should vary with approach and weather conditions.

Information to be included in the briefing should include name of approach, date of approach chart, primary navaid frequency, final approach course and crossing altitude, minimum altitudes, missed approach point (if applicable), initial missed approach instructions consisting of initial heading and altitude, review of initial steps of missed approach maneuver, anticipated taxi route, discussion of unusual or abnormal conditions or any pertinent information, and CAT II/III approach items.

Subsection “2 Approach Altitude Callouts” stated:

Altitude callouts will normally be made by the Pilot Monitoring (PM) during an approach. The Pilot Flying (PF) the aircraft shall verbally acknowledge all callouts. Any crewmember should challenge the absence of any callouts. The verbal acknowledgment of callouts and the challenge of the absence of any callout serve as a warning of subtle incapacitation.”

Subsection “3 Approach in Instrument Conditions (IMC)” stated:

- *Crossing Altitude (e.g. "LAWNN at 1500 feet" (PM) / "LAWNN at 1500 feet") (PF) (Use barometric altimeter for this callout).*
- *"1,000 feet" above the field level. (PM) / "1,000 feet" above the field level. (PF)*
- *Any significant deviation from glide path or MDA below 1,000 feet should be called out. Immediate corrective action will be taken or the approach will be abandoned. (PM)*
- *"100 above" (100 feet above minimums) (DA, DH or, DDA) (PM)/ "100 above" (PF) (Use barometric altimeter for this callout).*
- *"Minimums" at DA, DH or DDA. (PF) (Use barometric altimeter for this callout). On Category II, Category III and autoland approaches, the PM calls out "minimums". (Use radio altimeter for this callout).*
- *For autoland approaches, the Pilot Monitoring will call out "Flare Arm" when the white Flare annunciation appears on the FMA (approximately 1500 feet AGL). The Pilot Flying will confirm the "Flare Arm" on the FMA and acknowledge by repeating "Flare Arm".*

NOTE: Whether in instrument or visual conditions, when the pilot flying has the approach lights or runway environment in sight and expects these visual references to remain in sight, he/she will call out "visual". Upon hearing "visual", the pilot monitoring will cease altitude awareness callouts. However, the pilot monitoring will

always callout, out "1000 feet" and the pilot flying will always acknowledge the "1000 feet" callout."

Subsection "4 Approach in Visual Conditions (VMC)" stated: *"'1,000 feet' above the field*".

12.11 Landing Checklist

The Miami Air, 737 Operations Manual, "Normal – Procedures – Amplified Procedures" provided the following Landing Checklist:

Landing Checklist

PM reads items with responses as indicated.

When cleared to land, the Captain turns on the Landing Lights, Runway Turnoff Lights and Taxi Light.

F/A Signal	GIVEN	PM
"Flight Attendants Landing Check Please" at approximately 10 miles prior to landing.		
Engine Start switches	CONT	PM
Speedbrake	ARMED, GREEN LIGHT	PM
Armed by the Captain.		
Landing Gear	DOWN, 3 GREEN	PF
Flaps	_____°, GREEN LIGHT	PF

Figure 14: Landing Checklist.

12.12 Landing on Slippery Runways

The Miami Air, 737 Operations Manual, "Normal Procedures – Amplified Procedures" provided guidance to flight crews when landing on slippery runways. The guidance stated:

When landing on slippery runways (braking action less than good), it is recommended to land with Max Auto brakes selected. On landing rollout allow the aircraft to decelerate in Max Auto until stopping on runway is assured.

12.13 Commitment to Stop Point on Landing

The Miami Air, 737 Operations Manual "Normal Procedures – Amplified Procedures" provided the following guidance:

A go around will not be attempted after the thrust reversers are deployed on landing.

12.14 Bounced Landing

The Miami Air, 737 Operations Manual "Normal Procedures – Amplified Procedures" provided the following guidance and policy:

If a bounced landing occurs, re-establish the normal landing attitude, roll wings level, and if necessary, add thrust to control the rate of descent. Do not push over, since this will probably cause another bounce and may damage the nose gear. Do not increase the pitch *attitude above the normal landing attitude since this will only increase the height of the bounce and may cause an approach to stall condition followed by a tail strike. After the airplane touches down the second time, use normal landing procedures. When a high, hard bounce occurs, initiate a go-around. If speedbrakes are deployed or reverse thrust is initiated, do not attempt a go-around.*

12.15 Landing Roll Procedure

The Miami Air, 737 Operations Manual, "Normal Procedures – Amplified Procedures" provided the following guidance and assignment of duties during the landing roll.

PILOT FLYING	PILOT MONITORING
Ensure thrust levers at idle.	
Verify autothrottle disengages automatically (autoland approach). On Autoland, disengage the autopilot manually.	Verify autothrottle is disengaged. On Autoland, confirm the autopilot is disconnected after touchdown.
Verify SPEED BRAKE lever (ground spoilers) - UP. Do not attempt a Go-Around if the speed brakes have been deployed.	Verify SPEED BRAKE lever UP. Call out "SPEED BRAKES UP." If SPEED BRAKE lever not UP, call "NO SPEED BRAKES."
Verify proper auto brake operation. (If in use)	
Announce "Manual Braking" when brakes are manually applied or when the PM selects Autobrakes to OFF, as directed by PF.	
Without delay, raise reverse thrust levers to the interlocks, hold light pressure until release, and then apply reverse thrust up to the maximum amount consistent with conditions. Do not attempt a Go-Around if reverse thrust has been selected.	Verify reverser operation. Call "NO REVERSE" or "___ REVERSER ONLY", is appropriate.
By 80 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed, approximately 30 knots.	Call "80 KNOTS"
Approaching taxi speed, move the reverse thrust levers to the full down position.	Verify "REV" indication extinguished.
Prior to taxi speed, disarm the auto brake, call "manual braking" and continue manual braking as required.	

Figure 15: Miami Air Assignment of Duties during Landing Roll

The objective of a stabilized approach is to arrive at the flare point at the correct airspeed in trim and with stable thrust. The landing itself should be within the touchdown zone and on the center of the runway.

Selecting reverse thrust immediately after touchdown will provide rapid deceleration.

After touchdown the PM will monitor automatic speedbrake operation. He/she will call "SPEED BRAKES UP" or "NO SPEED BRAKES", as appropriate.

Do not attempt to hold the nose wheel off the runway. Aerodynamic braking is not an effective braking technique.

Unless speedbrakes are raised after touchdown, braking effectiveness may be reduced initially as much as 60%, since very little weight will be on the wheels and brake application may cause rapid anti-skid modulation.

If reverser is not selected or the reverser does not activate on selection, the PM will call "NO REVERSE", "LEFT REVERSER ONLY", "RIGHT REVERSER ONLY" as applicable. Failure of a reverser will require immediate application of wheel brakes.

Move the thrust levers aft to the interlock position, then to the number 2 reverse thrust detent. The normal target reverse thrust is approximately 80% N1 for passenger comfort, but if required, up to go around thrust is available. Maintain reverse thrust as required until the airspeed approaches 80 knots. At this point start reducing the reverse thrust so that the reverse levers are moving down at a rate commensurate with the deceleration rate of the airplane. The thrust levers should be positioned to reverse idle by taxi speed (approximately 30 knots), then to full down after the engines have decelerated to idle. The pilot monitoring should call out "80 KNOTS" to assist the pilot flying in scheduling the reverse thrust. If an engine surges during reverse thrust operation, quickly select reverse idle on both engines.

WARNING: The reverse thrust levers should be moved from idle reverse to stowed with a single motion in not more than approximately 3 seconds. This eliminates the possibility of REVERSER fault lights illuminating.

Normally, a constant brake pedal pressure should be maintained. Either increasing or decreasing the pressure recycles the anti-skid computer memory and temporarily reduces braking effectiveness. If additional braking pressure is required, increase brake pedal pressure.

When using auto brakes, immediate initiation of reverse thrust at main gear touchdown and full reverse thrust will allow the auto brake system to reduce brake pressure to the minimum level. Since the auto brake system senses deceleration and modulates brake pressure accordingly, the proper application of reverse thrust will result in reduced braking for a large portion of the landing roll.

To achieve a minimum distance landing on short runways, the aircraft should be landed at the 1000 foot point, even if a few knots high on airspeed. The speedbrake handle should be verified as fully deployed, and reverse thrust and wheel brakes applied immediately to achieve desired braking. The auto brakes should be selected to give the required *deceleration based on runway length, and overridden if necessary with smooth application of desired pedal brakes.*

It should be remembered that maximum manual braking yields far more deceleration than maximum autobraking. However, braking effort is often reduced by the pilot after the initial maximum effort, and the auto brake will usually give a smoother retardation than manual braking. Any delay in performing these actions after touchdown will markedly increase the stopping distance.

12.16 Missed Approach Guidance

The Miami Air, 737 Operations Manual, Chapter 2 "Normal Procedures – Amplified Procedures" provided the following guidance on when a missed approach would be accomplished:

Accomplish a missed approach if any of the following conditions exist:

Failure of the ILS/Autoland guidance system (airborne or ground based). However, following a failure of the autoland system, if the Captain determines that the safest course of action is to continue, the approach may continue to a landing.

Within the Decision Region (300 to 100 feet AFL):

- *Localizer deviation exceeds 1/3 dot (2/3 dot in expanded scale).*
- *Glide Slope deviation exceeds 1/2 dot.*
- *Sustained localizer or glide slope oscillations.*

After passing DH visual cues are lost.

Landing will not occur in the first 3000 feet of the runway.

12.17 Go-Around Callout and Immediate Response

The Miami Air, 737 Operations Manual, "Normal Procedures – Amplified Procedures" dated March 28, 2018 provided the following policy in regard to go-arounds:

For the purpose of flight safety, the following policy is instituted:
• Either the PF or the PM may make a go-around callout, and
• PF's immediate response to a go-around callout by the PM is execution of a missed approach.
Note: The go-around response is mandatory.

12.17.1 Go-Around/Missed Procedure

The Miami Air, 737 Operations Manual, Chapter 2 "Normal Procedures – Amplified Procedures" provided the following guidance on conducting a Go-Around/Missed Approach:

General

The use of LNAV should be used to reduce workload.

Once the decision to "Go-around" has been made, it must not be revoked.

On a single autopilot approach, when the TOGA button is pushed, the autopilot will disengage and the go-around will have to be flown manually until the autopilot can be re-engaged.

If the autothrottle is armed or engaged and the aircraft is below 2000 ft AGL, pressing a TO/GA button will engage the A/T in G/A mode. The thrust levers will advance to a reduced go-around thrust and give a 1000-2000 fpm climb rate. Once established in the climb the F/D pitch commands target speed for each flap setting. If the A/T is disengaged, it may be reengaged at or above 400 feet AGL.

If the flight director is off when the TO/GA button is pressed, the AFDS will automatically engage in the TO/GA mode and the flight director command bars will appear. Upon selection of a roll mode the flight director command bars will disappear.

Procedure

Push the TO/GA button.

The autopilot will disengage for single channel approach, if engaged.

> *Call "GO AROUND THRUST" ....PM insures G/A thrust is set*
> *Call "FLAPS 15" .... PM selects flaps 15*

Start an initial rotation to 15 degrees and follow the Flight Director commands.

> *With a positive rate of climb*
> *(altimeter and VSI) .... PM Calls "POSITIVE RATE."*
> *Call "GEAR UP" .... PM positions gear lever to UP*

If full GA thrust is required, push the TO/GA button a second time.

Insure missed approach altitude is set in MCP altimeter window.

The MCP speed window blanks, the FMC commands climb and flap target speeds.

The Autothrottle should be re-engaged (typically at 400 ft AGL), if disengaged.

> *Above 400 ft AGL,*
> *select the appropriate roll mode ....PM selects LNAV or HDG SEL.*
> *Verify on FMA.*
> *Advise ATC of missed approach ....PM advises ATC*
> *Tune and select radio aids, as required ....PM selects radio aids*

If two autopilots were engaged for the approach, the second autopilot will disconnect at ALT ACQ.

Hand Flown Missed Approach

Retract flaps on schedule.

When airspeed accelerates to existing flap minimum maneuvering speed, select next flap setting.

If "ALT ACQ" occurs prior to flap retraction, the MCP speed window opens at current speed, BUG UP to flaps up speed and continue flap retraction.

12.18 Landing Performance Data

12.18.1 Takeoff and Landing Performance Assessment (TALPA)

Miami Air Flight Operations Manual, Chapter 2 "Normal Operations," provided the following guidance for TALPA:

1 Takeoff and Landing Performance Assessment
New Definitions

Runway Condition Code (RCC) -	*the RCC is a numerical descriptor of runway conditions based on defined contaminants for each runway third.*
Wet Runway -	*A runway is considered "wet" when more than 25% of the runway surface area is covered by any visible dampness or water that is 1/8 inch or less in depth. A damp runway that meets this definition is considered wet, regardless of whether or not the surface appears reflective. If frost is reported on a runway, the runway is also considered "wet."*
Contaminated Runway -	*A runway is considered "contaminated" when more than 25% of the runway surface is covered by either:* • *more than 1/8 inch of water, dry or wet snow, or* • *any depth of:* o *compacted snow* o *wet or dry snow over compacted snow* o *slush* o *ice* o *wet ice* o *slush over ice* o *water over compacted snow* o *dry snow or wet snow over ice*
Dry Runway -	*A runway is considered "dry" if it is neither "wet" nor "contaminated."*

2 Procedures

• A Runway Condition Assessment Matrix (RCAM) will be used to determine and report runway condition.
• Through the NOTAM system, pilots will receive a numerical (0 through 6) runway condition report using numerical value Runway Condition Codes (RCC) derived from the RCAM.
• Pilots will give braking action reports using descriptive terminology (e.g. "good," "medium," "poor" and "nil"). "Medium" has replaced the term "Fair" in braking action reports, which pilots will continue to provide.

At the heart of the TALPA ARC recommendations is the "Runway Condition Assessment Matrix" or simply the "Matrix." The "Matrix" identifies 7 "Runway Condition Codes." These Codes are derived from runway "Assessment Criteria" that includes type of contaminant (frost, slush, dry snow, wet snow, compacted snow, and ice), depth of contaminant and temperature. From the Runway Condition Codes, pilots can determine the anticipated runway braking action and more importantly the correct[45] *"Runway Condition" to enter in the OPT. The tower will issue an RCC Report for each 1/3 of the runway; touchdown, midpoint and rollout. For example, an RCC Report might read 5, 5, 3.*

3 Matrix RCC and Pilot Braking Action Equivalent

6 - Dry
5 - Good
4 - Medium Good
3 - Medium
2 - Medium Poor 1 - Poor
0 – Nil

Upon receiving a RCC report, Miami Air pilots will "translate" the report into an equivalent braking action (e.g. good, good to medium, medium, medium to poor, poor or nil) for the OPT calculation.

NOTE: If the PIREP braking action category is "Good to Medium" use the "Medium" for OPT computations. If the PIREP braking action category is "Medium to Poor," use "Poor" for OPT computations.

NOTE: If the RCC report includes multiple codes, use the most restrictive. For a RCC report of 5, 5, 3, a pilot should use "3" for OPT computations.

NOTE: Pilots should use "Dry," "Wet," "Slippery Good," "Slippery Medium" or "Slippery Poor" for OPT computations. Do not use "Standing Water," "Slush," "Compact Snow" or "Dry Snow."

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[45] Runway condition code.

NOTE: Use the RCC that is applicable to the runway length being used. For example, assume an aircraft is landing on a very long runway (e.g. 12,000 feet), the aircraft is light weight and the aircraft will be stopped well before the last 1/3 of the runway. Assume also the RCC is 5, 5, 3. It would not be necessary to compute the landing distance based on the RCC of 3. Only the first 2/3rd of the runway would be used and therefore, only an RCC of 5 should be used for OPT computations.

Assessment Criteria		Control/Braking Assessment Criteria	
Runway Condition Description	**RCC**	**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
-15ºC 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 -15ºC 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

Figure 16: Runway Condition Assessment Matrix (Source: Miami Air FOM, Chapter 2, Figure 1).

A. RCC report is 5, 5, and 5. Looking at the "Matrix," locate the "Code" column and find "5." Moving to the right of the "Matrix," find the "PIREP" column. An RCC of "5" translates into a PIREP of "Good." Therefore, the pilot would use a "Runway Condition" of "Slippery Good" for the OPT takeoff or landing calculation.

Exception: Tower reports the runway is "Wet" with an RCC of 5, 5, 5. Use "Wet" for OPT computations, not "Slippery Good."

B. *RCC report is 4, 4, and 4. The RCC falls into "good to medium" PIREP category. Use "Slippery Medium" for the OPT calculation; or if the RCC report falls in the "Medium to Poor" category, use the "Slippery Poor" for the OPT calculation.*

See Note #1 above.

3. *RCC report is 5, 5 and 3. The lowest reported RCC is 3 (Medium)". Therefore, use "Slippery Medium" for OPT computation. See Note #2 above.*

4. *Tower reports the runway is covered with "Compact Snow" and the OAT is warmer than -15°C. RCC is 3, 3, 3. Use "Slippery Medium" for OPT computation.*

See Note #3 above

12.18.2 Onboard Performance Tool (OPT)

The Miami Air, 737 Operations Manual "Appendix B- Takeoff and Landing" provided, in part, the following guidance on the use of the Onboard Performance Tool (OPT):

The Onboard Performance Tool (OPT) is an EFB application used to calculate performance. The OPT will be used in conjunction with Form OPS-513 in order to record calculations.

Landing Information

Landing Distance Required Calculation - Prior to landing (Enroute page)

If conditions have not changed or have improved since accomplishing pre-departure calculations, it is not necessary to calculate the required landing distance.

A new landing distance required calculation is mandatory if conditions have changed or worsened, such as:

1. Actual landing runway is shorter from the runway used for pre-departure calculation, or
2. Runway conditions have changed requiring greater runway length (less of a headwind, stronger tailwind, braking action reports have worsened), or
3. Flap configuration has changed due to non-normal configuration (e.g. asymmetrical flaps.), or
4. Destination airport has changed.
***Note**: The enroute landing distance calculation is not required if all of the following conditions exist:*
- *Runway is 7000 feet or longer*
- *Landing flaps are either 30 or 40 degrees*
- *Airport elevation is 3000 feet MSL or lower*
- *Tailwind is 5 knots or less*

• *Airport temperature is 40 degrees C or less*
• *Braking action is good or better.*

In the Performance - Landing - ENROUTE page enter appropriate information in data fields, including anticipated landing weight.
• *Input all the environmental conditions using current METAR or ATIS data.*
• ***COND** (runway condition), select current reported runway condition.*
• ***FLAP** (landing flaps) select landing flaps.*
• ***BLDs** (engine bleeds) select Eng Bleed ON or Eng Bleed OFF, as appropriate.*
• ***A/I** (anti-ice) select OFF, ENGINE or ENG+WING, as appropriate.*
• ***BRKS** (brakes) select Autobrake setting of 1, 2, 3, or MAX. Selecting OFF assumes maximum manual braking and yields shortest landing distance. If stopping distance is critical, use MAX Manual if Dry or Wet; use MAX Auto for all other conditions.*
• ***NNC** (non-normal condition) select condition from popup list that may be applicable.*
• ***REVr** (reverser) select One Inoperative if both thrust reversers are operational. Select No Credit if one or both are inoperative.*
• ***LCatg** (Landing Category) select CAT III if conducting approach to less than CAT II weather minimums, otherwise select Manual.*
• ***VRefADD** enter a Vref add-on of 0 knots unless gusts exist. Add-on may not exceed 20 knots.*
• ***LANDING WT** Enter the anticipated landing weight. When all entries have been made (all buttons green, no blank fields) the CALC button in the upper right of the screen becomes active. Press CALC.*

Calculation displayed opposite the Landing Distance Required field includes actual landing distance plus an additional 15%. This distance must be equal to or less than the available runway length. If the calculation exceeds the landing distance available, the Landing Distance Required calculation will be displayed in amber.

The landing distance available will be displayed below the landing distance required field. If ARPT INFO > LANDING DETAILS, is selected, additional landing details are displayed.

MEL and CDL Adjustments

Clicking on the MEL button will display the MEL Chapters screen. Select the appropriate MEL Chapter, then the desired MEL item. A check mark will appear to the right of the MEL item and a summary of all active MEL items appear at the bottom.

***Note**: Selection of certain MEL items will prevent OPT from performing a takeoff or landing calculations.*

Verification Procedures

• Two OPT qualified crewmembers must verify all data entries and calculations by any available method. By signing the Weight and Balance form OPS-513, the Captain acknowledges the verification process.
• If two OPT qualified crewmembers are not available to verify all data entries, dispatch must supply OPT takeoff/landing OPT calculations.

12.18.3 Landing Distance Calculation Rules

The Miami Air "Redbook"[46], "Operational", pg. 12, dated August 5, 2012, provided the following information on landing distance calculations based on the runway conditions:

<table>
<tr><th>Runway Conditions</th><th>DISPATCH
(accomplished prior to takeoff)</th><th>ENROUTE
(prior to beginning approach)*</th></tr>
<tr><td>Dry or Wet

(Wet = Good)</td><td>-800
Use OPT
"Dispatch Related Landing Info"</td><td rowspan="2">Use OPT
"Enroute Related Landing Info" See Note 2.</td></tr>
<tr><td>Slippery</td><td>-800
Use OPT "Enroute Related Landing Info"
See Note 1.</td></tr>
</table>

1. When dispatching to an airport where the anticipated runway conditions are slippery (other than dry or wet), it is recommended to have a 15% safety factor (OPT adds 15% automatically). If this recommendation cannot be met, the flight may still be dispatched with Dispatcher approval, if the "wet" dispatch requirements can be met. The Dispatcher would normally approve if, at the ETA, Enroute Landing requirements can be satisfied (landing distance for the slippery conditions plus 15%).

2. Compute the enroute landing distance if conditions have worsened since dispatch. The enroute landing distance computation is not required if:

- *Runway length at least 7,000 feet,*
- *Airport elevation no greater than 3,000 feet,*
- *Airport temperature not greater than 40°C,*
- *Braking action good or better,*

[46] The Miami Air "RedBook" was located in the cockpit and contained the following "caution": Information provided is intended only as a quick reference book for Miami Air cockpit crewmembers. If any discrepancies exists between information contained in this reference book and the most current MAI FOM or B-737 AOM Vol I, MAI B-737 AOM or FOM information will prevail.

- *Landing flaps 30° or 40°,*
- *Tailwind no greater than 5 knots,*
- *No more than one thrust reverser inoperative and,*
- *Max manual braking.*

12.19 Transition from Instrument to Visual

The Miami Air FOM, Chapter 2, section "Transition to Instrument to Visual" stated:

1 Transition from Instrument to Visual

The transition from instrument to visual flight during an approach in reduced visibility is a very critical time in an approach. Pilots are presented with a number of problems not encountered during approaches in
weather with a well-defined ceiling and good visibility below the clouds.

***2** When the aircraft descends below a ceiling with good visibility below, the visual cues required to control the aircraft are distinct and there is immediate recognition of the aircraft's position relative to the runway.*

***3** With reduced visibility, visual cues are indistinct and not easily acquired. Discerning aircraft position laterally and vertically relative to the runway is difficult.*

***4** The visibility, wind, and expected visual cues, affect the view of the runway environment that the pilot*
should expect to see. The crew briefing should include a discussion of when, where and how the runway
environment will appear during the approach.

***5** The transition to visual flight should not be made until the runway is clearly in sight. The pilot monitoring should describe what he/she sees to the pilot flying. When the approach lights are clearly identified, the pilot monitoring will call out "Approach Lights." When the runway environment (runway lights, touchdown lights, runway/threshold markings etc.) is clearly identified, the pilot monitoring will call out "Runway." In low visibility conditions, the visual horizon is quite close to the aircraft. A pilot on the glide slope will perceive that he/she is high and instinctively increase the descent rate. An immediate missed approach should be made at Decision Altitude, Decision Height or DDA if the pilot monitoring has not called "Approach Lights" or "Runway". An immediate missed approach should be made if visual cues are lost after descending below DDA, DH or DA.*

12.20 Stabilized Approach

The Miami Air FOM, Chapter 2, dated April 14, 2016 stated the following in regard to Stabilized Approaches:

The approach profiles contained in the Flight Crew Training Manual are intended as guidelines for configurations during approaches. Weather and traffic conditions may require deviations from the standard profiles.

However, no later than 1000 feet AFL, the airplane must be:

- *Fully configured with the landing checklist complete.*
- *At a sink rate of no greater than 1000 feet per minute*.*
- *Stabilized at the proper approach speed.*
- *Trimmed for zero control forces and;*
- *Engines spooled up.*
- *On glideslope*

** momentarily exceeding 1000 feet per minute is permitted as long as the rate of descent is immediately reduced to at or below 1000 feet per minute.*

Pilots should be alert for higher than normal descent rates as an indication of possible windshear. On any runway which has operating vertical descent guidance equipment (PAPI, VASI or ILS glide slope) the aircraft will be flown at or above the glide slope until 200 feet AFL. "Duck Under" approaches are not authorized.

It is critical to flight safety that both the PF and the PM should be able to call for a go-around if either pilot believes an unsafe condition exists. The crew will comply with the following:

1. *Either the PF or the PM may make a Go-Around callout, and*
2. *The PF's immediate response to a Go-Around callout by the PM is execution of a missed approach.*

If the aircraft is not stabilized by 1,000 feet AFL or at any point thereafter, a Missed Approach is MANDATORY.

12.21 Standard Crew Callouts

The Miami Air FOM, Chapter 2, section "Standard Crew Callouts" stated:

1 Below 10,000 Feet MSL

On descent, when passing 10,000 feet MSL, the Pilot Monitoring will make a public address announcement saying: "Flight Attendants, arrival check please." Upon hearing this command, the Purser will ring the cockpit chime button once to signify receipt of this message. If the destination airport elevation is significantly higher than sea level, the Pilot Monitoring will make this announcement before 10,000 feet MSL so as to allow the Flight Attendants sufficient time to prepare the cabin for landing.

***2** Crewmembers shall maintain a sharp look out for traffic during descent and approach. The use of landing lights in VMC while in or near the vicinity of high density airports is encouraged; however, the use of landing lights is recommended only so long as such does not cause cockpit disorientation or distraction.*

__3__ Below 10,000 feet MSL the cockpit door will not be opened and the flight attendants should not enter or call the cockpit during this critical phase of flight, except in the event of an emergency. Conversation in the cockpit below 10,000 feet MSL should be kept to a minimum consistent with good cockpit management and operating procedures.

__4__ Prior to landing, (approximately 10 miles out) so that the Flight Attendants have adequate time to return to their seats before landing, the Pilot Monitoring will make a public address announcement saying: "Flight Attendants, landing check please." Upon hearing this command from the Pilot Monitoring, the Purser will ring the cockpit chime button once to confirm the following:

- *Passenger seat belts are fastened [91.107]*
- *Food, beverage, and passenger service equipment has been secured in its stowed position. [91.535, 121.577]*
- *The flight attendants are in their seats for landing.*

NOTE: Pilots will not land until confirming the above items have been completed.

12.22 Ground Proximity Warning

The Miami Air FOM, Chapter 2, section "Ground Proximity Warning", stated:

1 Ground Proximity Warning

The Ground Proximity Warning System does not require crew inputs and is silent during all normal flight maneuvers. If a warning is activated, it requires immediate positive action by the crew unless visual conditions exist which positively confirm the reason for the warning. In the absence of such visual conditions, an immediate positive pull up will be executed and a climb established until the warning ceases.

12.23 International Flights

12.23.1 Fuel Requirement

Miami Air, Flight Operations Manual, Chapter 2 "Normal Operations," provided the following guidance on fuel requirements for any international flight operated by Miami Air.

1 [121.645 "b"]
Any flight that originates or terminates outside the 48 contiguous United States and the District of Columbia is considered an International Flight.

NOTE: Flights between the 48 contiguous United States and the US. Virgin Islands, Alaska, Hawaii, and the Commonwealth of Puerto Rico are considered international.

2 For operations outside the 48 contiguous United States and the District of Columbia, the minimum fuel required for dispatch or release will be computed as follows:

- *To fly to and land at the airport to which it is dispatched or released (Including takeoff, climb, enroute, descent, approach, and landing.) [FLT 3.3.3.II];*
- *Thereafter, to fly for a period of 10% of the total time required to fly from the airport of departure to, and land, at the airport to which it was dispatched or released;*
- *After that, to fly and land at the most distant alternate airport specified in the Flight Release, if an alternate is required; and*
- *After that, to fly for 30 minutes at holding speed at 1,500 feet above the alternate airport under standard temperature conditions.*

3

Table 1: International Fuel Requirements Table

1	2	3	4	Required Fuel
Fuel to Destination	10% of time en route Consumption at the last Cruise altitude	Fuel to Alternate	30 minutes holding speed at 1500' above the alternate	(1) + (2) + (3) + (4)

Table 2: International Fuel Requirements

12.24 Pilot Reaction Time

The Miami Air FOM, chapter 2, section “Pilot Reaction Time” stated:

1 Pilot Reaction Time

At 100 feet AGL on a 3-degree glide slope, an aircraft is approximately 1900 feet from the touchdown point[47]. If the aircraft's final approach speed is 130 knots (214 feet/sec.), the pilot has 9 seconds to bring visual cues into the cross-check, adjust to visual flight and make any required corrections. If the pilot anticipates the view out the window by analyzing the weather and studying the airport chart, it will take considerably less time to make the transition to visual flight than it will if he/she is surprised or confused by what he/she sees.

13.0 Miami Air Safety Program

Miami Air had a safety management system (SMS) in place. As a part of the program, all employees received SMS training; details were outlined in the Miami Air SMS Manual. According to the SMS Manual, Chapter 6, “SMS Training for All Company Employees”, the training included basic principles of safety management, overview of SMS manual, proper safety culture, importance of complying with the safety policy and procedures that comprise the SMS, Miami Air International’s past safety record, including areas of systemic weakness, safety goals and objectives, voluntary and mandatory reporting systems, requirements for ongoing internal

[47] The Miami Air FOM, chapter 2, section “Landing” stated, in part: “The desired touchdown point for landing is 1,000 feet down the runway. An acceptable touchdown zone is plus 500 feet or minus 250 feet from the desired touchdown point.”

assessment of organizational safety performance (e.g., employee surveys, focus groups, safety audits and assessments), reporting accidents, incidents, and perceived hazards, safety promotion and dissemination of company information, and human and organizational factors.

The Miami Air FOM, Chapter 1, section "Safety Program" described three elements of the safety program:

1. *RAMP (Risk Assessment and Management Program) - This program analyzes risks prior to flight and based on the point values assessed requires mitigating action by the appropriate management position.*

2. *ASAP (Aviation Safety Action Program) - ASAP is a voluntary, self-reporting program which uses employee input to identify significant safety concerns and issues; operational deficiencies; non-compliance with regulations; deviations from company policies and procedures; and unusual events. In partnership with all the relevant departments, labor organizations and the FAA, each report is investigated and corrective actions determined based on a non-disciplinary approach to flight safety.*

3. *FOQA (Flight Operations Quality Assurance) - This program attempts to identify data from flights where deviations from norms take place by downloading information from the aircraft flight data recorder. The objective is to pick out potential problems and correct them before they lead to accidents. The information from the flight data recorder is de-identified so that managers will concentrate on solutions to the problem rather than disciplinary actions against individuals. A separate FAA approved FOQA Manual defines the parameters to be monitored and the process for downloading and analyzing the data. The FOQA Analyst (an IBT member) will analyze the data and issue quarterly reports on trends to both Management and the pilot workforce. The FOQA Analyst will immediately report any structural exceedances to the Director of Quality Control.*

Additionally, Miami Air had a voluntary, confidential, non-punitive reporting program for its employees to report safety concerns as discussed in the Miami Air SMS Manual, Chapter 4, section "Voluntary Reporting Program". Safety concerns could be submitted verbally or in writing to the any member of the Safety Office, but Miami Air encouraged employees to submit reports using the online ProSafeT program. Miami Air also had a Suggestion Box located in the crew room or to call the confidential Safety Hotline. Items that should be reported include but are not limited to short or long landings, go-arounds, EGPWS "pull up" warnings, runway incursion, serious loss of breaking, and pilot fatigue.

14.0 Miami Air FRMP

Miami Air had a Fatigue Risk Management Program (FRMP). Details were outlined in the Miami Air FRMP Supplement to the FOM. The FRMP Supplement, Section "Authority and Responsibility" stated, in part:

Employee Responsibility and Accountability

Employees are responsible for minimizing the risks associated with non-work sources of fatigue. All employees are responsible for:

- *Ensuring they understand and fulfill their responsibilities with respect to appropriate sections of the FRMP.*
- *Ensuring they successfully complete all relevant training.*
- *Using their training to identify, report, and manage any actual or potential risks linked to fatigue.*
- *Using their scheduled time away from work to obtain an amount of sleep sufficient to minimize the risks of fatigue-related accidents and injuries.*
- *Managing commutes to work in a manner, which ensures a minimum impact to individual fatigue levels.*
- *Informing the appropriate individual if they have not obtained sufficient sleep.*

The Miami Air FRMP Supplement, section "Policy" stated:

Miami Air Flight Operations has an open communications policy for reporting fatigue-related issues. We acknowledge the presence of fatigue in our operation and the risk it presents to flight safety. Miami Air is committed to preventing, managing and mitigating fatigue to improve pilot crewmember awareness.

Fatigue prevention, and mitigating the effects of fatigue, is a joint responsibility between management and pilot crewmembers. Miami Air schedules will be built in accordance with all applicable FARs and the IBT Collective Bargaining Agreement (CBA). Also, schedules will be analyzed and compared with data collected from actual operations employing Safety Management System methodology to identify trends or risks associated with schedules, pairings, or trips.

Miami Air will promptly remove any pilot crewmember from duty when that pilot crewmember is deemed, or reports, they are not fit for duty due to fatigue.

According to the Miami Air FRMP Supplement, section "Fatigue Reporting System," Miami Air pilots not fit for duty were required to submit a report via the Web Based Application Tool (WBAT) or Form SMS-101; the form must be completed or faxed within 12 hours after the completion of the duty period in which the event occurred. "*Under normal circumstances the Director of Safety will convene a Fatigue Risk Review Panel (FRRP) meeting within 5 working days of receipt of the report*." Pilots could also opt to submit a report for circumstances in which the pilot was "'tired' but still 'fit for duty'".

15.0 Boeing Guidance

15.1 Approach Briefing

The Boeing 737NG Flight Crew Training Manual, Section 5 "Approach and Missed Approach" provided the following guidance for the approach briefing:

Before the start of an instrument approach, the PF should brief the PM of his intentions in conducting the approach. Both pilots should review the approach procedure. All pertinent approach information, including minimums and missed approach procedures, should be reviewed and alternate courses of action considered.

As a guide, the approach briefing should include at least the following:

- *weather and NOTAMS at destination and alternate, as applicable*
- *type of approach and the validity of the charts to be used*
- *navigation and communication frequencies to be used*
- *minimum safe sector altitudes for that airport*
- *approach procedure including courses and heading*
- *vertical profile including all minimum altitudes, crossing altitudes and approach minimums*
- *speed restrictions*
- *determination of the Missed Approach Point (MAP) and the missed approach procedure*
- *landing distance required for current conditions compared to landing distance available*
- *other related crew actions such as tuning of radios, setting of course information, or other special requirements*
- *taxi routing to parking*
- *any appropriate information related to a non-normal procedure, including non-normal configuration landing distance required versus landing distance available*
- *management of AFDS.*

15.2 Descent Procedures

The Boeing Flight Crew Operations Manual (FCOM), Section 21 "Normal Procedures – Amplified Procedures" provided the following guidance about "Descent Procedures":

YA860, YC904 - YD251, YD253

Verify VREF on the APPROACH REF page.	Enter VREF on the APPROACH REF page.

Set the RADIO/BARO minimums as needed for the approach.	
Set or verify the navigation radios and course for the approach.	
	Check landing performance.

Pilot Flying	Pilot Monitoring
	Set the AUTO BRAKE select switch to the needed brake setting.
Do the approach briefing.	
Call "DESCENT CHECKLIST."	Do the DESCENT checklist.

Table 3: Descent Procedures (Source: Boeing 737 FCOM).

15.3 Reverse Thrust and Crosswind

The Boeing Flight Crew Training Manual, Chapter 6 "Landing" provides the following guidance for Reverse Thrust Operation:

> *Awareness of the position of the forward and reverse thrust levers must be maintained during the landing phase. Improper seat position as well as long sleeved apparel may cause inadvertent advancement of the forward thrust levers, preventing movement of the reverse thrust levers.*
>
> *The position of the hand should be comfortable, permit easy access to the autothrottle disconnect switch, and allow control of all thrust levers, forward and reverse, through full range of motion.*
>
> ***Note:*** *Reverse thrust is most effective at high speeds.*
>
> *After touchdown, with the thrust levers at idle, rapidly raise the reverse thrust levers up and aft to the interlock position, then to the number 2 reverse thrust detent. Conditions permitting, limit reverse thrust to the number 2 detent. The PM should monitor engine operating limits and call out any engine operational limits being approached or exceeded, any thrust reverser failure, or any other abnormalities.*
>
> *Maintain reverse thrust as required, up to maximum, until stopping on the remaining runway is assured.*
>
> *When stopping is assured and the airspeed approaches 60 KIAS start reducing the reverse thrust so that the reverse thrust levers are moving down at a rate commensurate with the deceleration rate of the airplane. The reverse thrust levers should be positioned to reverse idle by taxi speed, then to full down after the engines have decelerated to idle. Reverse thrust is reduced to idle between 60 KIAS and taxi speed to prevent engine exhaust re-ingestion and to reduce the risk of FOD. It also helps the pilot maintain directional control in the event a reverser becomes inoperative.*
>
> ***Note:*** *If an engine surges during reverse thrust operation, quickly select reverse idle on both engines.*

The PM should call out 60 knots to assist the PF in scheduling the reverse thrust. The PM should also call out any inadvertent selection of forward thrust as reverse thrust is canceled.

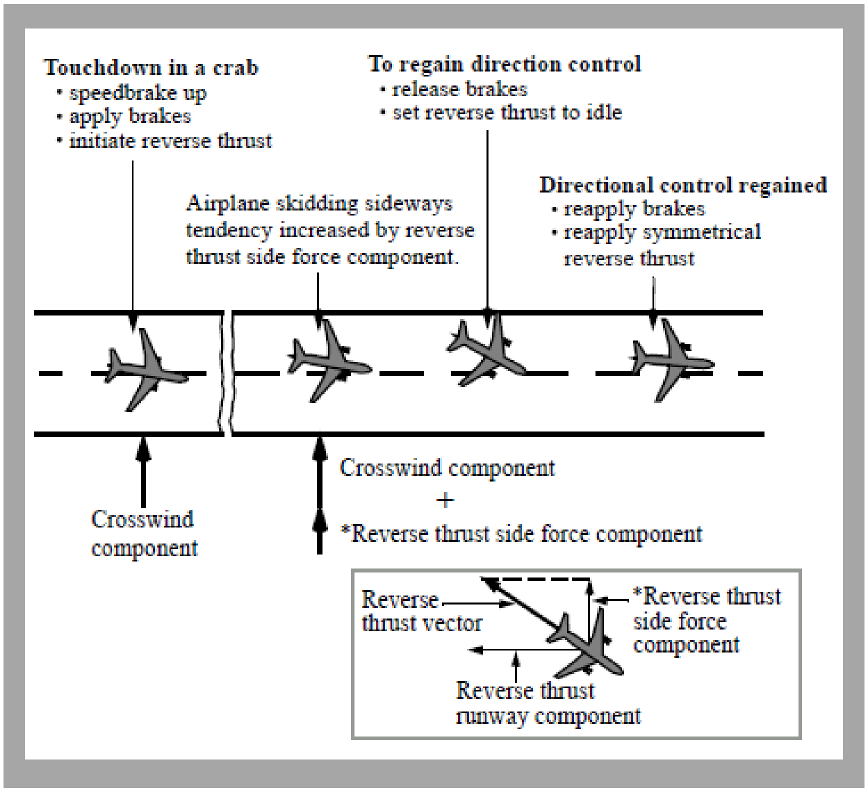

Figure 17: Directional Control with a Crosswind (Source: Boeing Flight Crew Training Manual).

This figure shows a directional control problem during a landing rollout on a slippery runway with a crosswind. As the airplane starts to weathervane into the wind, the reverse thrust side force component adds to the crosswind component and drifts the airplane to the downwind side of the runway. Also, high braking forces reduce the capability of the tires to corner.

To correct back to the centerline, release the brakes and reduce reverse thrust to reverse idle. Releasing the brakes increases the tire-cornering capability and contributes to maintaining or regaining directional control. Setting reverse idle reduces the reverse thrust side force component without the requirement to go through a full reverser actuation cycle. Use rudder pedal steering and differential braking as required, to prevent over correcting past the runway centerline. When directional control is regained and the airplane is correcting toward the runway centerline, apply maximum braking and symmetrical reverse thrust to stop the airplane.

Note: *Use of this technique increases the required landing distance.*

Reverse Thrust - EEC in the Alternate Mode

Use normal reverse thrust techniques.

Reverse Thrust - Engine Inoperative

Asymmetrical reverse thrust may be used with one engine inoperative. Use normal reverse thrust procedures and techniques. One thrust lever (operating engine) or both thrust levers may be brought to the reverse idle position. If directional control becomes a problem during deceleration, return the thrust lever to the reverse idle detent.

16.0 FAA Guidance

16.1 SAFO 15009

FAA Safety Alert for Operators (SAFO) 15009, "Turbojet Braking Performance on Wet Runways," dated August 11, 2015, provided, in part the following guidance:

Landing overruns which occur on wet runways typically involve multiple contributing factors such as long touchdown, improper use of deceleration devices, tailwind and less available friction than expected. Several recent runway landing incidents/accidents have raised concerns with wet runway stopping performance assumptions. Analysis of the stopping data from these incident/accidents indicated the braking coefficient of friction in each case was significantly lower than expected for a wet runway as defined by the Federal aviation Administration (FAA) in Federal Air Regulation (FAR) 25.109 and Advisory Circular (AC) 25-7C methods These incidents/accidents occurred on both grooved and ungrooved or non-Porous Friction Course overlay (PFC) runways. The data indicates that applying a 15% safety margin to wet runway time-of-arrival advisory data as, recommended by SAFO 06012, may be inadequate in certain wet runway conditions.

The root cause of the wet runway stopping performance shortfall is not fully understood at this time; however issues that appear to be contributors are runway conditions such as texture (polished or rubber contaminated surfaces), drainage, puddling in wheel tracks and active precipitation. Analysis of this data indicates that 30 to 40 percent of additional stopping distance may be required in certain cases where the runway is very wet, but not flooded.

For non-grooved or non-PFC runways, experience has shown that wheel braking may be degraded when the runway is very wet. If active moderate or heavy precipitation exists, the operator should consider additional conservatism in their time-of-arrival assessment.

As stated initially the other common contributing factors for wet runway excursions are long touchdown, improper application of deceleration devices and tailwind landings. Aircraft operators should review their flight training programs to ensure flight crews are familiar with the assumptions used in creating the data used for the time-of-arrival assessment such as the assumed distance from threshold to touchdown, recommended uses of deceleration devices; aircraft operators should also ensure flight crews are aware of the wind assumed in the original dispatch calculations for the flight. Advisory Circular 91-

79A has been recently updated to address these issues and operators should review the guidance contained therein.

16.2 SAFO 19003

FAA SAFO 19003[48], "Turbojet Braking Performance on Wet Runways," dated July 2, 2019 was an update to SAFO 15009 and included, in part, the following additional information:

Takeoff and Landing Performance Assessment (TALPA) procedures implemented by the FAA on October 1, 2016, added new insight as to how flightcrews can evaluate runway braking performance prior to landing. TALPA defines WET as "Includes damp and 1/8-inch depth or less of water." while CONTAMINATED is "greater than 1/8-inch of water."

These overruns have occurred on grooved and smooth runways during periods of moderate to heavy rain. Analysis of these incidents/accidents indicates that the braking coefficient of friction in each case was significantly lower than expected, and that 30 to 40 percent additional stopping distance may be required if the runway transitions from wet to contaminated based on the rainfall intensity or reported water contamination (greater than 1/8-inch depth). For the operational in-flight landing assessment determining whether the runway is wet or potentially contaminated is the pilot's responsibility.

16.3 SAFO 19001

FAA SAFO 19001, "Landing Performance Assessment at Time of Arrival," dated March 11, 2019, included, in part, the following:

Landing Distance Assessment at Time of Arrival. *There is no specific regulation requiring operators to assess landing distance requirements at time of arrival, however the FAA encourages operators to adopt such procedures to ensure that a safe landing can be made. Additionally, the FAA highly encourages operators to use their FAA-approved landing performance data and any associated manufacturer-provided supplemental/advisory data in concert with the AC 91-79-generated RCAM[49] Braking Action Codes to conduct an adequate landing distance assessment at the time of arrival. This is particularly important when the landing runway is contaminated or not the same runway analyzed for preflight calculations. The following are best practices for conducting a landing distance assessment at time of arrival.*

a. Timeliness. *An assessment is initially performed when landing weather and field conditions are obtained, usually around Top of Descent (TOD). It is important to note the time of the latest Field Condition report and any associated reliable braking action reports. A number of overruns have occurred when pilots were provided with a runway condition that was no longer reliable given changes in meteorological conditions. Pilots are strongly advised to review the weather conditions and compare that to the time of the latest braking action report. The assessment should include consideration of how much deterioration in field conditions can be tolerated, the minimum RwyCC(s), and Field Condition (FICON)*

[48] Source: https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/safo/all_safos/

[49] Runway Conditions Assessment Matrix.

or Braking Action Reports needed to safely land, should those factors deteriorate from the ones used in the TOD landing distance

b. Source of Data. *When possible, the Operational Landing Distance data used is advisory data based on the recommendations of AC 25-32. This data may be provided by the manufacturer. If it is not provided by the manufacturer, data developed by a performance data provider may be used.*

16.4 Pilots Handbook of Aeronautical Knowledge

The Pilots Handbook of Aeronautical Knowledge, Chapter 11, "Aircraft Performance," provided, in part, the following guidance about water on the runway and dynamic hydroplaning:

Water on the runways reduces the friction between the tires and the ground and can reduce braking effectiveness. The ability to brake can be completely lost when the tires are hydroplaning because a layer of water separates the tires from the runway surface. This is also true of braking effectiveness when runways are covered in ice.

When the runway is wet, the pilot may be confronted with dynamic hydroplaning. Dynamic hydroplaning is a condition in which the aircraft tires ride on a thin sheet of water rather than on the runway's surface. Because hydroplaning wheels are not touching the runway, braking and directional control are almost nil. To help minimize dynamic hydroplaning, some runways are grooved to help drain off water; most runways are not.

Landing at higher than recommended touchdown speeds exposes the aircraft to a greater potential for hydroplaning. And once hydroplaning starts, it can continue well below the minimum initial hydroplaning speed.

On wet runways, directional control can be maximized by landing into the wind. Abrupt control inputs should be avoided. When the runway is wet, anticipate braking problems well before landing and be prepared for hydroplaning. Opt for a suitable runway most aligned with the wind. Mechanical braking may be ineffective, so aerodynamic braking should be used to its fullest advantage.

17.0 Other Guidance

17.1 Flight Safety Foundation

In 2000, Flight Safety Foundation produced an "Approach-and-Landing Accident Reduction (ALAR)" briefing note in the Flight Safety Digest, for "Wet or Contaminated Runways"[50] which provided the following guidance:

Defining Runway Condition

Dry Runway

[50] Source: https://flightsafety.org›files›alar_bn8-5-wetrwy.

The European Joint Aviation Authorities (JAA) defines dry runway as "one which is neither wet nor contaminated and includes those paved runways which have been specially prepared with grooves or porous pavement and maintained to retain 'effectively dry' braking action even when moisture is present."

Damp Runway

JAA says that a runway is considered damp "when the surface is not dry, but when the moisture on it does not vie it a shiny appearance."

Wet Runway

JAA says that a runway is considered wet "when the runway surface is covered with water, or equivalent, less than specified [for a contaminated runway] or when there is sufficient moisture on the runway surface to cause it to appear reflective but without significant areas of standing water."

Contaminated Runway

JAA says that a runway is contaminated "when more than 25 percent of the runway surface area [whether in isolated areas or not) within the required length and width being used is covered by the following:

- *"Surface water more than 3.0 mm [millimeters] (0.125 in [inch]) deep, or by slush or loose snow, equivalent to more than 30 mm (0.125 in) of water;*
- *"Snow which has been compressed into a solid mass which resists further compression into a solid mass which resists further compression and will hold together or break into lumps if picked up (compacted snow); or,*
- *"Ice, including wet ice."*

The U.S. Federal Aviation Administration says that a runway is considered contaminated "whenever standing water, ice, snow, slush, frost in any form, heavy rubber, or other substances are present."

Operational Guidelines

When the destination-airport runways are wet or contaminated, the crew should:

- *Consider diverting to an airport with better runway conditions or a lower crosswind component when actual conditions significantly differ from forecast conditions or when a system malfunction occurs;*
- *Anticipate asymmetric effects at landing that would prevent efficient braking or directional control (e.g., crosswind);*
- *Avoid landing on a contaminated runway without antiskid or with only one thrust reverser operational;*

- *For inoperative items affecting braking or lift-dumping capability, refer to the applicable:*
    - *AOM/QRH for in-flight malfunctions; or,*
    - *Minimum equipment list (MEL) or dispatch deviation guide (DDG) for known dispatch conditions;*
- *Select autobrake mode per SOPs (some AOMs/QRHs recommend not using autobrakes if the contaminant is not evenly distributed);*
- *Approach on glide path and at the target final approach speed;*
- *Aim for the touchdown zone;*
- *Conduct a firm touchdown;*
- *Use maximum revers thrust as soon as possible after touchdown (because thrust reverser efficiency is higher at high airspeed);*
- *Confirm the extension of ground spoilers;*
- *Do not delay lowering the nosewheel on the runway. This increases weight-on-wheels and activates aircraft systems associated with the nose-landing gear squat switches;*
- *Monitor the autobrakes (on a contaminated runway, the selected deceleration rate may not be achieved);*
- *As required or when taking over from autobrakes, apply the pedal brakes normally with a steady pressure;*
- *For directional control, use rudder pedals (and differential braking, as required); do not sue the nosewheel-steering tiller;*
- *If differential braking is necessary, apply braking on the required side and release the braking on the opposite side; and,*
- *After reaching taxi speed, use nosewheel steering with care.*

18.0 Aviation Safety Reporting System (ASRS) Reports

18.1 NIP NASA ASRS Reports

In a review of NASA ASRS[51] reports associated with NIP from 1990 to the date of the accident revealed 12 ASRS reports with varying reasons of reporting. Of the 12 reports 1 involved a B737 aircraft that crossed the holdshort line without permission; however, no report during that time frame, indicated any concerns with runway conditions or hydroplaning.

18.2 Hydroplaning NASA ASRS Reports

In a review of NASA ASRS reports from 1999 to the date of the accident revealed 121 incident records associated with Part 121 aircraft hydroplaning, sliding/skidding or braking issues during landing roll due to weather related runway surface conditions.

[51] National Aeronautics and Space Administration Aeronautical Safety Reporting System.

Condition	Total[52]	B-737
Rain	57	18
Ice/Snow	52	9
Thrust Reverser Inoperative	4	0
Non-Grooved Runway[53]	1	0
Unknown[54]	8	2

Table 4: ASRS Data for Part 121 Events for Weather Related Runway Surface Conditions.

19.0 Previous NTSB Recommendations

A-01-054

To the FAA - For all 14 Code of Federal Regulations Part 121 and 135 operators, require the use of automatic brakes, if available and operative, for landings during wet, slippery, or high crosswind conditions, and verify that these operators include this procedure in their flight manuals, checklists, and training programs. (Closed – Acceptable Alternate Action)

A-01-055

To the FAA - Establish a joint Government-industry working group to address, understand, and develop effective operational strategies and guidance to reduce thunderstorm penetrations, and verify that these strategies and guidance materials are incorporated into air carrier flight manuals and training programs as the strategies become available. The working group should focus its efforts on all facets of the airspace system, including ground- and cockpit-based solutions. The near-term goal of the working group should be to establish clear and objective criteria to facilitate recognition of cues associated with severe convective activity and guidance to improve flight crew decision-making. (Status: Closed – Unacceptable Action)

A-01-069

To the FAA - Define detailed parameters for a stabilized approach, develop detailed criteria indicating when a missed approach should be performed, and ensure that all 14 Code of Federal Regulations Part 121 and 135 carriers include this information in their flight manuals and training programs. (Closed – Unacceptable Action)

A-10-026

To the FAA Develop more stringent standards for surveillance of 14 Code of Federal Regulations (CFR) Part 121 135, and 91K operators that are experiencing rapid growth, increased complexity of operations, accidents and/or incidents, or other changes that warrant increased oversight, including the following: (1) verify that inspector staffing is adequate to accomplish the enhanced surveillance that is promulgated by the new standards, (2) increase staffing for those certificates with insufficient staffing levels, and (3) augment the inspector staff with available and airplane-type-qualified inspectors from

[52] Total includes all aircraft make and model that reported this event during the dates requested and include all B-737 aircraft make and model that reported.
[53] Included in the above total for rain.
[54] Unknown included various possible factors however, specifically on the B737 it included performance calculation issues.

all Federal Aviation Administration regions and 14 CFR Part 142 training centers to provide quality assurance over the operators' aircrew program designee workforce. (Status: Closed – Acceptable Action)

A-10-115

To the FAA Work with U.S. airline operators to review and analyze operational flight data to identify factors that contribute to encounters with excessive winds and use this information to develop and implement additional strategies for reducing the likelihood of wind-related runway excursions. (Status: Closed – Unacceptable Action)

20.0 Changes Made Since the Accident

20.1 Flight Operations Manual Bulletin 19-05

Miami Air International provided FOM bulletin 19-05[55] to "All Miami Air Flight Crews" about "Approach Briefing update – Grooved Runway," dated May 20, 2019. The bulletin stated, in part, the following:

Procedure
The Approach Briefing item:

"A discussion of unusual or abnormal conditions or any pertinent information," now includes "landing on a non-grooved runway."

If landing on a non-grooved runway, the crew will accomplish the following:

- *An OPT Enroute Landing Distance calculation prior to the approach. (This gives the crew a better idea what Autobrake setting to use. Also, this step highlights if the Landing Distance Available vs Landing Distance Required is critical). If the ATIS or tower are reporting heavy rain at the airport, an approach may be made, however, a landing will not be attempted until conditions change. On very short flights, the OPT Enroute Landing Distance may be waived. For example, a flight from Fort Lauderdale to Miami may not allow enough time to perform the calculation. In that case, accomplish the enroute landing calculation before takeoff.*
- *In accordance with standard procedure, when performing OPT calculations, assume one less engine reverser credit than the number operational.*
- *Captain will make the landing if the runway condition is other than dry.*
- *40 degree flap landing, if the runway condition is other than dry.*
- *Request the longest runway compatible with the reported airport winds and runway conditions, if the runway condition is other than dry.*
- *No landing will be attempted with greater than a 5 knot tailwind component if the runway is other than dry.*

[55] Source: Attachment 14 – Miami Air Flight Ops Bulletins Post-Accident.

- *Request a wind check and the field condition (i.e. rain condition or standing water on the runway) from the tower at 1000 feet AFL.*
- *No landing will be attempted if the pilot observes heavy rain on the landing runway or the tower reports heavy rain on the landing runway.*
- *At touchdown, apply MAX AUTO braking if the runway condition is other than dry. After touchdown, the Captain may revert from Max Auto braking to "manual braking" after making the determination that the aircraft will stop well short of the runway.*

F. LIST OF ATTACHMENTS

Attachment 1 – Flight Crew Interview Summary and Statements
Attachment 2 – Miami Air Personnel Interview Summaries and Transcript
Attachment 3 – FAA Interview Transcripts
Attachment 4 – Sun Country Pilot Interview Summary and Statements
Attachment 5 – Flight Crew Pairing
Attachment 6 - Flight Crew Training Records
Attachment 7 – Flight Crew Hours
Attachment 8 – Accident Flight Dispatch Paperwork
Attachment 9 - KNIP Approach Charts
Attachment 10 – Minimum Equipment List [Excerpts]
Attachment 11 – Miami Air Flight Operations Manual [Excerpts]
Attachment 12 – Miami Air Operations Manual [Excerpts]
Attachment 13 – Miami Air Dispatch Manual [Excerpts]
Attachment 14 – Miami Air Flight Operations Bulletin 19-05
Attachment 15 –FAA PTRS Enroute Reports on Miami Air
Attachment 16 – FAA Safety Alert for Operators 15009
Attachment 17 – Boeing Flight Crew Training Manual [Excerpts]
Attachment 18 – Boeing 737 Flight Crew Operations Manual [Excerpts]
Attachment 19 – Memorandum for Record – Email Conversation [Excerpts]
Attachment 20 - Operational Factors Group – Certification of Party Representative

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