NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

September 6, 2017

Group Chairman's Factual Report

OPERATIONAL FACTORS

DCA17FA076

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A. ACCIDENT

Location: Ypsilanti, Michigan (MI)
Date: March 8, 2017
Time: 1452 EST (1952Z)
Airplane: Boeing MD-83, Registration: N786TW

B. OPERATIONAL FACTORS GROUP

David Lawrence
Group Chairman
Operational Factors Division (AS-30)
National Transportation Safety Board

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Technical Pilot
Boeing Company

C. SUMMARY

On March 8, 2017, about 1452 EST, Ameristar Air Cargo, Inc. dba Ameristar Charters flight 9363, a Boeing MD-83, N786TW, ran off the end of runway 23L after executing a rejected takeoff at Willow Run Airport (YIP), Ypsilanti, Michigan. (The MD-83 was manufactured by McDonnell Douglas, which merged with Boeing in August 1997.) All 110 passengers and 6 crewmembers evacuated the airplane. One passenger was reported to have received a minor injury. The airplane sustained substantial damage (no post-crash fire occurred). The airplane was operating under the provisions of 14 Code of Federal Regulations (CFR) Part 121 as an on-demand charter flight and was destined for Washington Dulles International Airport (IAD), Dulles, Virginia. Daytime visual meteorological conditions prevailed at the time of the accident.

D. DETAILS OF THE INVESTIGATION

On March 9, 2017, the Operational Factors Group (Ops Group) Chairman launched to YIP to assist the Investigator-in-Charge (IIC) with documentation of the accident and collection of perishable information. An Ops Group[1] was formed on-scene, and began documenting the accident airplane's cockpit and cabin, flight crew documents, and personal effects. Additional documentation was requested from the operator and FAA, and witness statements were obtained.

On March 10, 2017, the Ops Group spoke with several Kalitta Air employees who assisted the passengers after the evacuation. The Ops Group collected additional witness statements, flight attendant statements, ground crew statements, and toured the Air Traffic Control (ATC) tower with the NTSB Meteorological Group Chairman. The Ops Group interviewed the Captain on the accident flight and the pilot of a Beechcraft Baron approaching YIP about the time of the accident.

[1] See Attachment 15 – Party Forms.

Additional FAA documentation for the crew and operator were requested, and the operator provided the Ops Group with company manuals and records.

On March 11, 2017, the Ops Group obtained security camera video of the accident takeoff and interviewed the Check Airman on the accident flight, who was also the Chief Pilot for the company. Fueling records were requested for uplift and analysis documentation. Field notes were begun for group review, and the on-scene portion of the Ops investigation concluded.

Between April 10, 2017 and April 12, 2017, the Ops Group conducted interviews of Ameristar Air Cargo personnel at their offices in Addison, Texas. On April 11, 2017, the Ops Group conducted MD-83 simulator testing at the American Airlines training facility in Dallas, Texas.

Between April 24, 2017 and May 10, 2017, additional documentation on the accident flight was obtained from the operator and FAA, a review of the pilot's certification and FAA medical information was conducted, and weight and balance information for the accident flight was reviewed with the operator. On May 11, 2017, the Ops Group interviewed the FAA Principal Operations Inspector for the Ameristar Air Cargo Air Carrier certificate.

E. FACTUAL INFORMATION

1.0 History of Flight

According to Ameristar Air Cargo records and review of the aircraft logbook, on March 6, 2017, the pilots and flight attendants flew from Lincoln Airport (LNK), Lincoln, Nebraska, to YIP, departing LNK at 2331 EST (0431Z) and arriving YIP at 0105 EST (0605Z).[2] The crew parked the airplane at the AvFlight flight services facility located on the west side of the airport, facing the airplane to the north. The crew overnighted at a local hotel, and while Ameristar Air Cargo mechanics worked on several logbook write-ups, the airplane did not operate again until the accident flight on March 8, 2017 at 1452 EST (1952Z).

On March 7, 2017, at 1559 EST (2059Z), the crew was notified by email of a scheduled charter the following day from YIP to Washington Dulles International Airport (IAD) with a show time of 1230 EST (1730Z) on March 8, 2017 and a departure time of 1430 EST (1930Z). The crew was then scheduled to reposition the airplane from IAD to Purdue University Airport (LAF), Lafayette, Indiana, to spend the night in LAF that evening.

According to interviews, the crew left the hotel about 1130 EST (1630Z), and arrived at the airplane, which was parked at the Avflight west side ramp facing to the north. The flight attendants arrived at the airplane about 1145 EST (1645Z). Upon arrival to the airplane, the crew noticed that the reversers had been deployed to prevent the wind from flowing back through the engines, and they stowed them once they got onboard. About 1240 EST (1740Z), the crew prepared to reposition the airplane to the AvFlight east facility where they would meet their charter passengers. The crew could not reach the ground controller by radio for a clearance to taxi, and they called the tower via a cell phone and were advised that the airport had lost power and was uncontrolled (no

[2] Source: Aircraft logbook page #62954.

ATC services) since the tower was evacuated due to the high winds. The crew then taxied to the AvFlight west ramp via taxiways Bravo, Golf and Echo, and parked the airplane on the east ramp (AvFlight east) facing to the south.[3]

Following receipt of the flight release and passenger boarding, the pilots began taxiing the airplane to runway 23L about 1435 EST (1935Z) via the east ramp, taxiways Echo, Echo1 and runway 27. According to interviews, the pilots ran all the required checklists and briefings, and when holding short of runway 27, they coordinated their IFR (instrument flight rules) departure release with the Flight Service Station (FSS) via cell phone. The pilots planned to use the V-speeds based on a 146,000 pound departure using the airport analysis provided to them, and decided to increase the rotation speed on takeoff due to the high winds at YIP. The Captain in the left seat was the pilot flying (PF), and the Check Airman in the right seat was the pilot monitoring (PM).

Both pilots indicated that the initial takeoff roll on runway 23L was normal until the Captain in the left seat attempted to rotate the airplane. According to the Captain's interview, the airplane would not rotate once they reached their rotation speed, and he elected to reject the takeoff.[4] About 1452 EST (1952Z), the airplane exited the end of runway 23L and came to rest in a field just beyond the departure end of runway 23L. The crew subsequently conducted an evacuation of the airplane. There was no post-crash fire, and the airplane sustained substantial damage.

2.0 Flight Crew Information

The accident crew consisted of a DC-9 Captain in the left seat of the cockpit receiving differences training,[5] a Check Airman in the right seat providing the training to the Captain, four flight attendants and one Ground Security Coordinator (GSC).[6] There were 109 charter passengers from the University of Michigan onboard the airplane.

According to Ameristar records, the Captain and Check Airman began flying together on November 14, 2016, and conducted 9 separate flights together for a total of 17 hours and 25 minutes.

2.1 The Captain

The Captain occupying the left seat was 54 years old and resided in Mequon, Wisconsin, and was a DC-9 captain receiving differences training on the MD-83.[7] He was hired by Ameristar Air

[3] See Figure 6 of this Factual Report.
[4] According to FAA Advisory Circular (AC) 120-62 Takeoff Safety Training Aid (dated September 12, 1994), a rejected takeoff is "a takeoff that is discontinued after takeoff thrust is set and initiation of the takeoff roll has begun."
[5] The captain in the left seat was already type rated in DC-9 series airplanes, and receiving training to operate as pilot in command of the MD-83. According to the Ameristar Air Cargo Check Airman/Instructor Guide (dated November 1, 2016), "difference training" was defined as "Training required for flight crewmembers who have qualified and served on a particular type of Ameristar Air Cargo, Inc.-operated aircraft, when the Administrator [FAA] finds that such training is necessary before a flight crewmember serves in the same capacity on a variation of that aircraft or due to training differences. This training may be included in Recurrent, Initial, Transition or Upgrade Training for the airplane. FAR 121.400 & 121.418."
[6] The GSC was also a flight attendant for Ameristar Air Cargo and assisted in the security screening and boarding of the passengers, but not acting in the capacity of a flight attendant.
[7] According to the FAA-approved Airplane Flight Manual (AFM), the Boeing MD-83 is a variant of the DC9 (DC-9-

Cargo on January 25, 2016, and had flown on the DC-9 previously as a first officer (FO) and captain. He also was a proficiency Check Airman for Ameristar Air Cargo in the DC-9 simulator.[8]

According to his resume on file with Ameristar Air Cargo, he previously was an FO for Ryan International Airlines, and flew the MD-80 from June 2011 until he was furloughed prior to his employment with Ameristar Air Cargo. From October 2010 to March 2011 he flew as an FO on the B-747 for Evergreen International Airlines, and from August 1998 to November 2008, he flew as an FO on the DC-9 and MD-80 for Midwest Airlines. He also was employed with Mesaba Airlines in Detroit from December 1993 to August 1998, and flew as a captain on the SF-340.

According to his interview, he held an Airline Transport Pilot certificate with type ratings on the B-747, DC-9, and SF-340. He also held a Flight Instructor certificate. According to FAA records, he had 15,750 flight hours.

He held a first-class medical certificate dated January 27, 2017 with a limitation to possess glasses for near and intermediate vision. According to his interview with the NTSB, he had glasses in his possession at the time of the accident.

According to his interview, he had never been fired, terminated or asked to resign from an employment, and had never failed a check ride. A review of the FAA PTRS[9] database showed no records or reports of any previous aviation incidents or accidents involving the Captain.

According to Ameristar Air Cargo records, he had flown into YIP ten times with Ameristar Air Cargo between April 17, 2016 and March 6, 2017, and his last three flights were with the Check Airman (January 8, 2017, January 15, 2017 and March 6, 2017).

2.1.1 The Captain's Pilot Certification Record[10]

Private Pilot – Airplane Single Engine Land certificate issued May 15, 1984.

Commercial Pilot – Airplane Single Land, Instrument Airplane certificate issued April 29, 1986.[11]

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83). The MD-80 series aircraft included the MD-83 variant. For the purposes of this Factual Report, the terms "MD-80" and "MD-83" are used interchangeably.

[8] According to the Ameristar Air Cargo Check Airman/Instructor Guide (dated November 1, 2016), a Check Airman (Simulator) was "a person who is qualified to conduct flight checks or instruction, but only in a flight simulator or in a flight training device for a particular type of airplane in accordance with the Ameristar Air Cargo, Inc.'s approved training program. FAR121.411." According to FAA records, the Captain was approved by the Principal Operations Inspector (POI) on February 6, 2017 as a Proficiency Check Pilot – Simulator on the MD-83, effective February 2, 2017.

[9] The Program Tracking and Reporting Subsystem (PTRS) is a comprehensive information management and analysis system used in many Flight Standards Service (AFS) job functions. It provides the means for the collection, storage, retrieval, and analysis of data resulting from the many different job functions performed by Aviation Safety Inspectors (ASIs) in the field, the regions, and headquarters. This system provides FAA managers and inspectors with the current data on airmen, air agencies, air operators, and many other facets of the air transportation system. Source: FAA.

[10] Source: FAA.

[11] The pilot's certificate stated, "Holder does not meet the pilot-in-command flight experience requirements of ICAO." The certificate was issued under FAA Exemption 3825 for training received at the University of North Dakota, a 14

Notice of Disapproval – Certified Flight Instructor Airplane issued September 30, 1987. Areas of reexamination: Entire flight test.

Flight Instructor – Airplane Single Engine certificate issued July 29, 1988.

Flight Instructor – Airplane Single Engine. Instrument Airplane certificate issued August 17, 1989.
Last renewed: October 20, 2011.

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane certificate issued February 27, 1990.

Airline Transport Pilot – Airplane Multiengine Land, Commercial Privileges Airplane Single Engine Land certificate issued September 15, 1993.

Notice of Disapproval – SF340 ATP Type Rating issued on July 21, 1996. Areas of reexamination: All required approaches, missed approaches and landings, V_1 engine failure.

Airline Transport Pilot – Airplane Multiengine Land, SF340; Commercial Privileges Airplane Single Engine Land certificate issued August 5, 1996.

Airline Transport Pilot – Airplane Multiengine Land, DC-9[12], SF340 (DC-9 SIC[13] Privileges only, DC-9 Circ Apch VMC only); Commercial Privileges Airplane Single Engine Land certificate issued November 3, 2005.

Airline Transport Pilot – Airplane Multiengine Land, B-747, DC-9, SF340 (B-747, DC-9 SIC Privileges only; B-747, DC-9 Circ Apch VMC only); Commercial Privileges Airplane Single Engine Land certificate issued November 14, 2010.

Airline Transport Pilot – Airplane Multiengine Land, B-747, DC-9, SF340 (B-747 SIC Privileges only; B-747, DC-9 Circ Apch VMC only); Commercial Privileges Airplane Single Engine Land certificate issued August 8, 2011.

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

Airline Transport Pilot (certificate issued August 8, 2011)
Airplane Multiengine Land; B-747 (SIC), DC-9, SF-340 type ratings.

Medical Certificate - First Class (issued January 27, 2017)
Limitations: Holder shall possess glasses for near/intermediate vision

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CFR Part 141 aviation school.

[12] According to FAA Order 8900.1, Figure 5-88 "Pilot Certification Aircraft Type Designations – Airplane," the DC-9 and MD-83 (DC-9-83) series airplanes are common type ratings. See also FAA AC 61-89E *Pilot Certificates: Aircraft Type Ratings,* dated August 4, 2000.

[13] Second in command.

2.1.3 The Captain's Training and Proficiency Checks Completed[14]

Ameristar Air Cargo Date of Hire	January 25, 2016
Date Upgraded to Captain on DC-9	February 26, 2016
Date of Most Recent Proficiency Training	February 4, 2017
Date of Most Recent Proficiency Check (DC-9)	November 4, 2016
Date of Most Recent PIC Line Check (DC-9)	February 2, 2017

2.1.4 The Captain's Flight Times[15]

The Captain's flight times, according to Ameristar Air Cargo:

Total pilot flying time	15,518
Total Pilot-In-Command (PIC) time	4,752
Total DC-9 series flying time	8,495
Total flying time last 24 hours	0
Total flying time last 30 days	30
Total flying time last 90 days	68
Total flying time last 12 months	228

2.2 The Check Airman

The Check Airman for Ameristar Air Cargo was 41 years old and resided in The Colony, Texas. He was hired by Ameristar Air Cargo March 31, 2004 and was a check airman on the MD-83. He was qualified on the DC-9, MD-83 and B-737 for the company. On the accident flight, he occupied the right seat of the airplane and was providing differences training to the Captain in the left seat as a Check Airman.[16]

Prior to Ameristar Air Cargo, from 1999 to 2000 he was employed by Ameristar Jet Charters as a Captain on the Lear Jet and Falcon 20 flying Part 135 on-demand passenger and freight operations, and from 1998 to 1999 as a Captain for GTA Air Inc., flying Part 135 cargo operations from Dallas Love Field (DAL).

According to his interview, he held an Airline Transport Pilot certificate with type ratings on the B-737, DA-20, DC-9, and Lear Jet, and held a Flight Instructor and Ground Instructor (Advanced) certificates. He held a first-class medical certificate dated September 8, 2016 with no limitations.

[14] Source: Ameristar Air Cargo.
[15] Source: Ameristar Air Cargo.
[16] According to the Ameristar Air Cargo Check Airman/Instructor Guide (dated November 1, 2016), a Check Airman (Airplane) was "a person who is qualified, and permitted, to conduct flight checks or instruction in an airplane, in a flight simulator, or in a flight training device for a particular type airplane in accordance with Ameristar Air Cargo, Inc.'s approved training program. FAR 121.411." According to FAA records, the Check Airman was approved by the POI on November 19, 2012 as a Line Check Airman (all seats) on the DC-9-15 and DC-9-83, effective November 7, 2012.

According to his interview, he had never been fired, terminated or asked to resign from an employment, and had never failed a check ride. A review of the FAA PTRS database showed no records or reports of any previous aviation incidents or accidents involving the Check Airman.

According to Ameristar Air Cargo records, he had flown 152 flights into YIP with Ameristar (53 times on the MD-83) between January 1, 2003 and March 6, 2017.

2.2.1 The Check Airman's Certification Record[17]

Private Pilot – Airplane Single Engine Land certificate issued July 2, 1997.

Private Pilot – Airplane Single Engine and Multiengine Land certificate issued July 25, 1997.

Private Pilot – Airplane Single Engine and Multiengine Land, Instrument Airplane certificate issued September 22, 1997.

Notice of Disapproval – Commercial Single Engine (first failure) issued October 22, 1997. Areas of reexamination: Area of Operation V (B & C) Chandelles and Lazy Eights.

Commercial Pilot – Airplane Single and Multiengine Land, Instrument Airplane certificate issued October 28, 1997.

Notice of Disapproval – Certified Flight Instructor Airplane (first failure) issued December 1, 1998 - Areas of reexamination: Area of Operations II through XV.

Ground Instructor - Advanced certificate issued December 1, 1998.

Airline Transport Pilot – Airplane Multiengine Land, DA-20; Commercial Privileges Airplane Single Engine Land certificate issued February 26, 2001.

Airline Transport Pilot – Airplane Multiengine Land, DA-20, LR-Jet; Commercial Privileges Airplane Single Engine Land certificate issued March 24, 2001.

Airline Transport Pilot – Airplane Multiengine Land, DA-20, LR-Jet, B-737 (SIC Privileges Only); Commercial Privileges Airplane Single Engine Land certificate issued November 3, 2005.

Airline Transport Pilot – Airplane Multiengine Land, DA-20, LR-Jet, B-737; Commercial Privileges Airplane Single Engine Land certificate issued March 22, 2006.

Airline Transport Pilot – Airplane Multiengine Land, DA-20, LR-Jet, B-737, DC-9 (DC-9 Circ Apch – VMC Only); Commercial Privileges Airplane Single Engine Land certificate issued February 13, 2007.[18]

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[17] Source: FAA.
[18] The FAA added "English Proficient" to the pilot's ATP certificate on June 23, 2008.

2.2.2 The Check Airman's Certificates and Ratings Held at Time of the Accident

Ground Instructor - Advanced (certificate issued December 1, 1998)

Airline Transport Pilot (certificate issued June 23, 2008)[19]
Airplane Multiengine Land, DA-20, LR-Jet, B-737, DC-9 (DC-9 Circ Apch – VMC Only); Commercial Privileges Airplane Single Engine Land

Medical Certificate First Class (issued September 8, 2016)
Limitations: None

2.2.3 The Check Airman's Training and Proficiency Checks Completed[20]

Ameristar Air Cargo Date of Hire	March 31, 2004
Date upgraded on MD-80	September 20, 2011
Date of Initial Type Rating on DC-9	February 13, 2007
Date of Most Recent Proficiency Training	February 11, 2016
Date of Most Recent Proficiency Check	January 31, 2017
Date of Most Recent PIC Line Check	June 9, 2016

2.2.4 The Check Airman's Flight Times[21]

The Check Airman's flight times, according to Ameristar Air Cargo:

Total pilot flying time	9,660
Total PIC time	7,240
Total DC-9 series flying time	2,462[22]
Total flying time last 24 hours	0
Total flying time last 30 days	19
Total flying time last 90 days	50
Total flying time last 12 months	170

3.0 Medical and Pathological Information

Both pilots were drug and alcohol tested post-accident with negative results.

4.0 Airplane Information

The accident airplane was a McDonnell Douglas DC-9 (MD-83), registration number N786TW, serial number 53123. It was a fixed wing multiengine aircraft with 2 turbine air generator engines

[19] The FAA re-issued the pilot's ATP due to a lost certificate.
[20] Source: Ameristar Air Cargo.
[21] Source: Ameristar Air Cargo.
[22] According to Ameristar Air Cargo records, the Check Airman had 2,047 hours as PIC in DC-9 series airplanes.

(JT8D-219) and 147 passenger seats and 8 crewmember seats. The airplane was manufactured on March 13, 1992, and was registered to Sierra American Corp. in Wilmington, Delaware. At the time of the accident, the operator reported the airplane had 41,008.6 total flight hours and 39,472 total flight cycles.

Per the Ameristar Air Cargo Operations Specifications (OpSpecs) A001, Ameristar Air Cargo was authorized to conduct operations under the provisions of 14 *CFR* Part 121 using the MD-83 in passenger and cargo operations, under day/night, VFR/IFR conditions, and in accordance with 14 *CFR* 119.21(a)(3) supplemental operations. The airplane was listed on OpSpecs D085, issued to Ameristar Air Cargo Inc, Certificate number MJYA749T.

4.1 Airplane Dimensions

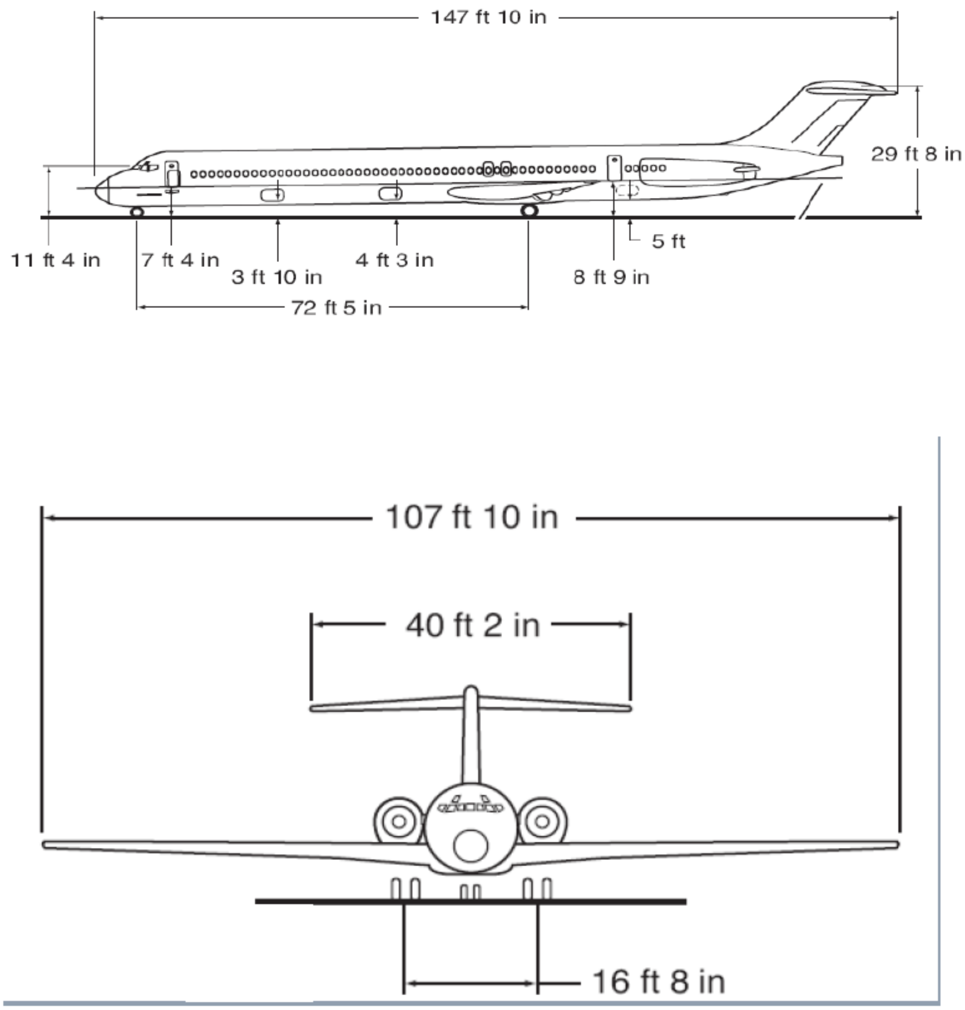

Figure 1: MD-83 dimensions.[23]

[23] Source: Ameristar Air Cargo DC-9 Aircraft Operating Manual (AOM), Volume II, page 1-83-1.

5.0 Weight and Balance

The Ameristar Air Cargo passenger and baggage weight program was defined in OpsSpecs A099. Large cabin aircraft (greater than 71 seats) were authorized to use either actual weights or standard average weights for both passengers and baggage.[24] For the accident flight, Ameristar Air Cargo used 195 pounds per passenger standard weight, which included 16 pounds per passenger for carry-on baggage weight, and standard average weights for the baggage.[25]

For baggage weight, OpsSpecs A099-2 authorized Ameristar Air Cargo to use a standard 30 pounds per plane-side loaded bag, and a standard 60 pounds for heavy checked bags.[26] Bags that were estimated to be over 50 pounds were considered "heavy" and the standard 30-pound weight was doubled to 60 pounds. Baggage that was estimated to exceed 100 pounds was required to be weighed and considered freight.

According to interviews, Ameristar Air Cargo did not calculate half-weights for children, or use actual passenger/baggage weights for sports charters.[27] FAA AC 120-27E, page 21, stated the following in part:

> *Actual passenger weights should be used for nonstandard weight groups (sports teams, etc.) unless average weights have been established for such groups by conducting a survey in accordance with the procedures established in Section 3 of this chapter. When such groups form only a part of the total passenger load, actual weights, or established average weights for the nonstandard group, may be used for such exception groups and average weights used for the balance of the passenger load. In such instances, a notation should be made in the load manifest indicating the number of persons in the special group and identifying the group; e.g., football squad, etc.*

5.1 Ameristar Air Cargo Calculated Weight and Balance

Initial weight and balance estimates were made by the flight follower using an Ameribalance weight and balance software, as approved by the Ameristar Air Cargo OpSpecs A025-3. Following actual loading of the passengers and baggage, the pilots manually completed the weight and balance and entered the data on the Ameristar Air Cargo MD-83 Load Manifest and Takeoff Information form.[28]

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[24] According to OpSpecs A099, for "actual weights," Ameristar Air Cargo could use either the actual weight of all passengers and bags, or use solicited ("asked") passenger weight plus 10 pounds, and actual weight of the bags. For the accident flight, the crew used standard average weights for both the passengers and baggage.

[25] According to the Ameristar Air Cargo DC-9 AOM, Volume I, Section 7-3B, page 5 (and FAA AC 120-27E), a carry-on bag weight of 16 pounds per passenger was included in the standard passenger weights.

[26] For additional information on standard passenger and baggage weights, see FAA AC 120-27E Aircraft Weight and Balance Control (dated June 10, 2005).

[27] According to interviews, the accident flight was a chartered flight carrying the University of Michigan men's basketball team, coaching staff, band members, cheerleaders, and support personnel.

[28] According to the Ameristar Air Cargo DC-9 AOM, Volume I, Weight and Balance, page 1, "the MD-83 Load Manifest and Takeoff Information Form is used to combine flight planning and weight and balance in one form. The center of gravity and trim is determined by calculations using a laptop computer and listed in the appropriate blanks. The form is printed with a carbonless yellow duplicate. The white copy is retained by the pilot, and the yellow copy

The following weight and balance information was recorded on the Ameristar Air Cargo MD-83 Load Manifest and Takeoff Information document completed by the accident crew prior to departure.[29]

WEIGHT & BALANCE (maximum certificated weights in **bold**)[30]		
	Basic Operating Weight (+ crew weight)	87,304
	Flight Attendant weight (4)	720
	Passenger weight[31]	21,450
	Baggage/Cargo Weight	5,002
	Zero Fuel Weight	114,476
	Maximum Zero Fuel Weight	**122,000**
	Fuel Weight (pounds)[32]	31,000
	Ramp Weight	145,476
	Maximum Taxi Weight	**161,000**
	Taxi Fuel Burn	400
	Actual Takeoff Weight	145,076
	Maximum Takeoff Weight (field length limited)	146,400
	Maximum Takeoff Weight	**160,000**
	Estimated Fuel Burn (IAD)	10,276
	Estimated Weight on Landing (IAD)	134,800
	Maximum Landing Weight	**139,500**
	Takeoff CG (% of MAC)[33]	11.7
	CG Limits (FWD/AFT)	3.7/22.1
	Stab Trim	7.0
	Takeoff Flaps[34]	15
	$V_1/V_R/V_2$ (146,000 pound speed card)[35]	139/142/150
	Landing V_{REF} (40 degrees)	135

is to be forward to the ADS headquarters by U.S. Mail, or other means, after the pilot completes the requirements of the form."

[29] See Attachment 3 – Flight Release Paperwork.

[30] Source: Ameristar Air Cargo MD-83 Cockpit Operating Manual (COM) – Limitations, page 1-6.

[31] According to the Ameristar Air Cargo DC-9 AOM, Volume I, Section 7-3B, page 1 (and FAA AC 120-27E), passenger weight was assumed 195 pounds each (winter weight) to include a carry-on bag weight of 16 pounds per passenger. For additional information, see Attachment 5 – Weight and Balance Documents.

[32] According to the Boeing MD-80 Series Airplane Characteristics for Airport Planning, dated December 1989, the maximum usable fuel capacity for the MD-83 was 46,773 pounds (6,981 gallons).

[33] Mean Aerodynamic Chord.

[34] The flap setting of 15 degrees was the detent the flap handle lever was placed in. The pilots further adjusted the flaps to 16.4 degrees for takeoff. See Section 12.3 Flaps of this Factual Report for further details on the flap setting.

[35] According to the crew interviews, they increased their rotation speed by 5 knots due to the high winds at YIP.

5.2 Actual Baggage and Passenger Weights

Following the accident, the NTSB weighed each bag in the airplane's cargo compartments (A, B, C1, C2, D1, and D2) and the carry-on baggage, using the scale found onboard the airplane.[36] The total actual weight of the checked baggage was 6,352.5 pounds (the planned weight for the accident flight was 5,002 pounds). The total actual weight of the carry-on baggage was 1,461.6 pounds (the planned standard weight was 1,760 pounds). Actual passenger weights could not be determined.

Post-accident calculations of the weight and balance for the accident flight using actual baggage weights and assumed passenger weights showed a takeoff weight of 146,426.5 pounds. Ameristar Air Cargo was asked to recalculate the performance numbers for the accident flight using the Ameribalance software, inputting the known baggage weights and location on the airplane, including assumed passenger weights, and determined that the center of gravity (C.G.) was 10.4 with a forward/aft C.G. limit of 3.7/22.1 respectively. A flaps 15 takeoff would have resulted in a stabilizer trim setting of 7.10. For additional information, see Attachment 5 – Weight and Balance Documents.

6.0 Meteorological Information[37]

Ameristar Air Cargo used a Jeppesen program to develop their flight plans, which would automatically populate the flight release with the most current weather. The original flight plan was generated at 1700Z. According to the Flight Follower for the accident flight, the flight plan did not get accepted by ATC initially, and he generated a new flight release at 1713Z changing the routing for the flight, and did not update the weather from the 1700Z release.

According to the flight release provided to the pilots for the accident flight, the forecast for YIP indicated the following:

```
KYIP 081401Z 0814/0912 23028G42KT P6SM SKC
     FM081600 24033G47KT P6SM SKC
     FM082100 26034G48KT P6SM SKC
     FM082300 26025G38KT P6SM FEW250
     FM090100 26014KT P6SM FEW150 SCT250
     FM090600 27009KT P6SM SCT150 BKN250=
```

Figure 2: Graphical YIP forecast from the accident flight release.[38]

The flight release included one METAR[39] observation for YIP at 1653Z indicating the following:[40]

[36] The actual weighing of each bag was conducted by the NTSB Structures Group Chairman on March 9, 2017.
[37] For detailed weather information, see Meteorological Group Chairman's Factual Report.
[38] See Attachment 3 – Flight Release Paperwork, page 4 of the release.
[39] Meteorological Terminal Aviation Routine Weather Reports or Meteorological Aerodrome Reports (METARs) are taken manually by NWS, FAA, contractors, or supplemental observers. METAR reports are also provided by Automated Weather Observing System (AWOS), Automated Surface Observing System (ASOS), and Automated Weather Sensor System (AWSS). Source: AIM 7-1-1.
[40] See Attachment 3 – Flight Release Paperwork.

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METAR KYIP 081653Z 26035G50KT 10SM CLR 11/M11 A2981 RMK AO2 PK WND
     26055/1639 SLP095 T01061106=
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Figure 3: Graphical YIP METAR from accident flight release.[41]

At 1753Z, YIP issued a partial (no current average and gust wind, prevailing visibility, sky condition, temperature or dew point temperature) METAR indicating the following:

METAR KYIP 081753Z A2979 RMK A02 PK WND 24046/1656 SLPNO 58012 $=

Post-accident review of METAR reports indicated the following:

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KYIP 081722Z 0818/0918 25032G48KT P6SM FEW060 FM082100 26031G46KT
 P6SM SCT070 FM082300 26024G36KT P6SM SKC FM090100 27014KT P6SM SKC
 FM090800 25008KT P6SM BKN150 FM091600 26008KT P6SM SCT060 OVC080=

METAR KYIP 081953Z A2980 RMK AO2 SLPNO $=
METAR KYIP 081853Z A2977 RMK AO2 SLPNO ?=
METAR KYIP 081753Z A2979 RMK AO2 PK WND 24046/1656 SLPNO 58012 $=


END 0004 WEATHER/NOTAM REPORTS 000 GRAPHIC 004 NON-GRAPHIC 000 NOTAM
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Figure 4: Post-accident observations and pre-accident forecasts.[42]

According to the flight crew, prior to departure they attempted to obtain the most current weather information at YIP via the ATIS (Automatic Terminal Information Service).[43] However, due to the power outages at the airport, they were only able to obtain an altimeter setting, and no ceiling, visibility or wind information. The Check Airman used his cell phone to call the ATIS frequency, and stated he got the 1253 CDT (1853Z) weather that was "just an updated version of the previous weather with winds about 260 at 40 knots." [44] The pilot of a single-engine Beechcraft Baron approaching YIP about the time the accident airplane was taxiing out for departure stated that he also attempted to listen to the YIP ATIS, but the ATIS was not broadcasting any information.[45]

Because of the power outage at the airport, the Automated Surface Observing System (ASOS) was not reporting ceiling, visibility, temperature, dew point temperature or wind magnitude and direction at the time of the accident. A review of the 1853Z METAR indicated that only the altimeter was recorded. The Check Airman stated that he also used his cell phone to check weather at Detroit Metropolitan Wayne County Airport (DTW) and got the 1353 CDT (1953Z) weather at

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[41] See Attachment 3 – Flight Release Paperwork, page 3 of the release.

[42] Source: Ameristar Air Cargo. This information was generated post-accident, and not included in the flight paperwork provided to the pilots.

[43] Automatic Terminal Information Service (ATIS) is the continuous broadcast of recorded non-control information in selected high activity terminal areas. Its purpose is to improve controller effectiveness and to relieve frequency congestion by automating the repetitive transmission of essential but routine information. The information is continuously broadcast over a discrete VHF radio frequency or the voice portion of a local NAVAID. Arrival ATIS transmissions on a discrete VHF radio frequency are engineered according to the individual facility requirements, which would normally be a protected service volume of 20 NM to 60 NM from the ATIS site and a maximum altitude of 25,000 feet AGL. Source: Aeronautical Information Manual, Section 4-1-13.

[44] See Attachment 1 – Interview Summaries.

[45] See Attachment 2 – Witness Statements.

DTW.[46] The most recent complete METAR observation obtained by the pilots for YIP airport prior to their departure was the 1653Z observation, which was recorded 2 hours and 59 minutes prior to the accident (1952Z).

Title 14 *CFR* 121.119 Weather reporting facilities stated the following in part:

> *(a) No certificate holder conducting supplemental operations may use any weather report to control flight unless it was prepared and released by the U.S. National Weather Service or a source approved by the Weather Bureau. For operations outside the U.S., or at U.S. Military airports, where those reports are not available, the certificate holder must show that its weather reports are prepared by a source found satisfactory by the Administrator.*
>
> *(b) Each certificate holder conducting supplemental operations that uses forecasts to control flight movements shall use forecasts prepared from weather reports specified in paragraph (a) of this section.*

According to the Ameristar Air Cargo General Operations Manual (GOM),[47] Chapter 4, Paragraph 4.10.1 page 29, all Ameristar Air Cargo flights were required to be filed and flown under IFR. Paragraph 4.10.2 of the GOM also stated the following in part:

> *The ceiling and visibility values in the main body of the latest weather report control VFR and IFR takeoffs and landings and for instrument approach procedures on all runways of an airport. However, if the latest weather report, including an oral report form the control tower, contains a visibility value specified as runway visibility or runway visual range for a particular runway of an airport, the specified value controls for VFR and IFR landings and takeoffs and straight-in instrument approaches for that runway.*

The Ameristar Air Cargo GOM, Paragraph 4.2.10 Weather, Sources of Weather Information, stated the following in part:

> *The departure and destination airports must have available approved weather reporting facilities that include at least the ceiling, visibility, altimeter, temperature wind direction and wind velocity. Pilots must obtain this weather using their aircraft radios. Any of the following satisfies the requirements of this paragraph:*
>
> 1. *AWOS-3 or above;*
> 2. *A flight Service Station receiving hourly weather information from departure/destination airport;*
> 3. *An operating control tower; or*

[46] Detroit Metropolitan Wayne County Airport (DTW) was located about 8 nautical miles to the east of YIP.
[47] The Ameristar Air Cargo GOM was an FAA-accepted manual (February 23, 2017) that "set forth the operating authority, corporate structure, administrative procedures and crewmember personnel duties and responsibilities as well as the overall general operations, procedures and policies to be adhered to by Ameristar Air Cargo, Inc. (AAC) and its employees." Source: Ameristar Air Cargo GOM, Chapter 1, page iii. The Ameristar Air Cargo GOM also contained the operator's Operations Specifications.

4. *A certified weather observer that is capable of transmitting the current weather to the pilots at least 30 minutes before estimated time of arrival or departure and must begin in time to provide pilots with an observation before beginning an approach or departure. Basics weather watch must not be discontinued until the arrival or departure is completed.*

Title 14 *CFR* 121.651 Takeoff and landing weather minimums: IFR: All certificate holders, stated the following in part:

> *(a) Notwithstanding any clearance from ATC, no pilot may begin a takeoff in an airplane under IFR when the weather conditions reported by the U.S. National Weather Service, a source approved by that Service, or a source approved by the Administrator, are less than those specified in -*
>
> > *(1) The certificate holder's operations specifications; or*
> >
> > *(2) Parts 91 and 97 of this chapter, if the certificate holder's operations specifications do not specify takeoff minimums for the airport.*

In a response to an NTSB inquiry during the investigation for a legal interpretation of 14 *CFR* 121.651, and whether the existence of weather reporting capabilities of the conditions (visibility, ceiling, winds) at the time of departure satisfied 14 *CFR* 121.651(a), or if the weather received prior to the power loss at the airport constituted knowledge of the weather conditions required by the regulation, or if the weather reporting capabilities had to be operational at the airport at the time of departure under Part 121 or 121 Supplemental regulations, the FAA responded in a letter dated Jun 8, 2017 that stated in part:

> *Although 121.651(a) is silent on the operational capabilities of weather facilities and the recency of reported weather, reported weather conditions are a precondition for takeoff, which indicates a nearness in time. Furthermore, part 121 contains other weather report and aircraft performance regualtions that require reports of weather conditions that are occurring at the time of takeoff. For example, 121.189(e) requires, in relevant part, "correction . . . for the ambient temperature and wind components at the time of ta keoff" when determining maximum weights, minimum distances, and flight paths.*
>
> *Accordingly, to operate consistently with 121.651(a) and other related regulations, a pilot must have a reasonable certainty that conditions existing at the time of takeoff have been accurately reflected by the weather report that is used to determine the flight will meet or exceed the required minimums and thereby ensure safe operation of the aircraft.*[48]

Title 14 *CFR* 121.599(b) Familiarity with weather conditions, stated the following:

[48] See Attachment 10 – FAA Response 17-125.

(b) Supplemental operations. No pilot in command may begin a flight unless he is thoroughly familiar with reported and forecast weather conditions on the route to be flown.

6.1 Real-Time Mesoscale Analysis (RTMA)

In order to calculate their takeoff speeds and performance, the pilots needed the most current temperature at YIP, but were unable to obtain it from the ATIS because of the power loss at the airport. The YIP ATIS would broadcast the most current weather as recorded by the ASOS, but the ASOS was not operational due to the power loss and no ATIS was being broadcast.

According to the FAA Information for Operators (InFO) 15006, dated June 3, 2015, in response to missing surface temperature reports, the FAA solicited the assistance of the National Weather Service (NWS) in developing an alternative system for reporting surface temperature that operators, pilots, and aircraft dispatchers could easily use.[49] The NWS developed an RTMA surface temperature report that provides a simple hourly report of surface temperature at an airport every hour, 24 hours a day.

Operators were permitted to use RTMA surface temperature in the absence of a surface temperature not reported by an ASOS, AWOS or human observer. Ameristar Air Cargo guidance for obtaining RTMA temperatures was located in the Ameristar Air Cargo GOM, Chapter 4 (Appendix F), page 1, and required the flight follower to access an online website to obtain RTMA temperature values for a specific airport.

The Ameristar Air Cargo GOM, Paragraph 4.2.10, stated the following in part:

> *Pilots arriving or departing an uncontrolled airport that has automated weather broadcast capability (ASOS/AWOS) should monitor the broadcast frequency, advise the controller that they have the "one –minute weather" and state intentions prior to operating within the Class B, Class C, Class D or Class E surface areas. In the event of a missing temperature from an AWOS, ASOS, ATIS or is NOTAMed as missing, follow the procedure for obtaining a Real-Time Mesoscale Analysis (RTMA) temperature as outlined in Appendix F of this Chapter.*

According to interviews, the Check Airman contacted the Director of Operations, who provided him an RTMA temperature at YIP of 10.3° C at 1747Z, and the Check Airman wrote the temperature, time and Director of Operations name down on the MD-83 Load Manifest and Takeoff Information form for the flight.[50]

7.0 Airport Information[51]

Willow Run Airport (YIP) was located 24 miles southwest of Detroit, Michigan at an elevation of 715.8 feet (latitude/longitude 42-14-24.1000N / 083-31-51.2000W). The airport was served by

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[49] https://www.faa.gov/other_visit/aviation_industry/airline_operators/airline_safety/info/all_infos/media/2015/InFO15006.pdf.
[50] See Attachment 3 – Flight Release Paperwork.
[51] Source: http://www.airnav.com/airport/KYIP.

six runways (27/09, 23R/5L, 23L/5R). The accident flight departed on runway 23L. The airport was served by a 24-hour ATC tower, and had a lighted windsock located to the left of runway 23L. According to interviews, the crew used the wind sock to determine the most favorable runway for takeoff.

7.1 YIP Runway 23L

The accident flight departed on runway 23L. According to the Jeppesen 20-9A chart, the runway was 7,543 feet long and 161 feet wide. It was concrete/grooved and in good condition[52] with a 0.2% upslope gradient (runway 23L elevation was 701.5 feet and runway 5R elevation was 714.4 feet).

8.0 YIP Chart

According to the Ameristar Air Cargo OpSpecs A009 Airport Aeronautical Data, the company used enroute and approach charts supplied by Jeppesen.

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[52] Source: http://www.airnav.com/airport/KYIP.

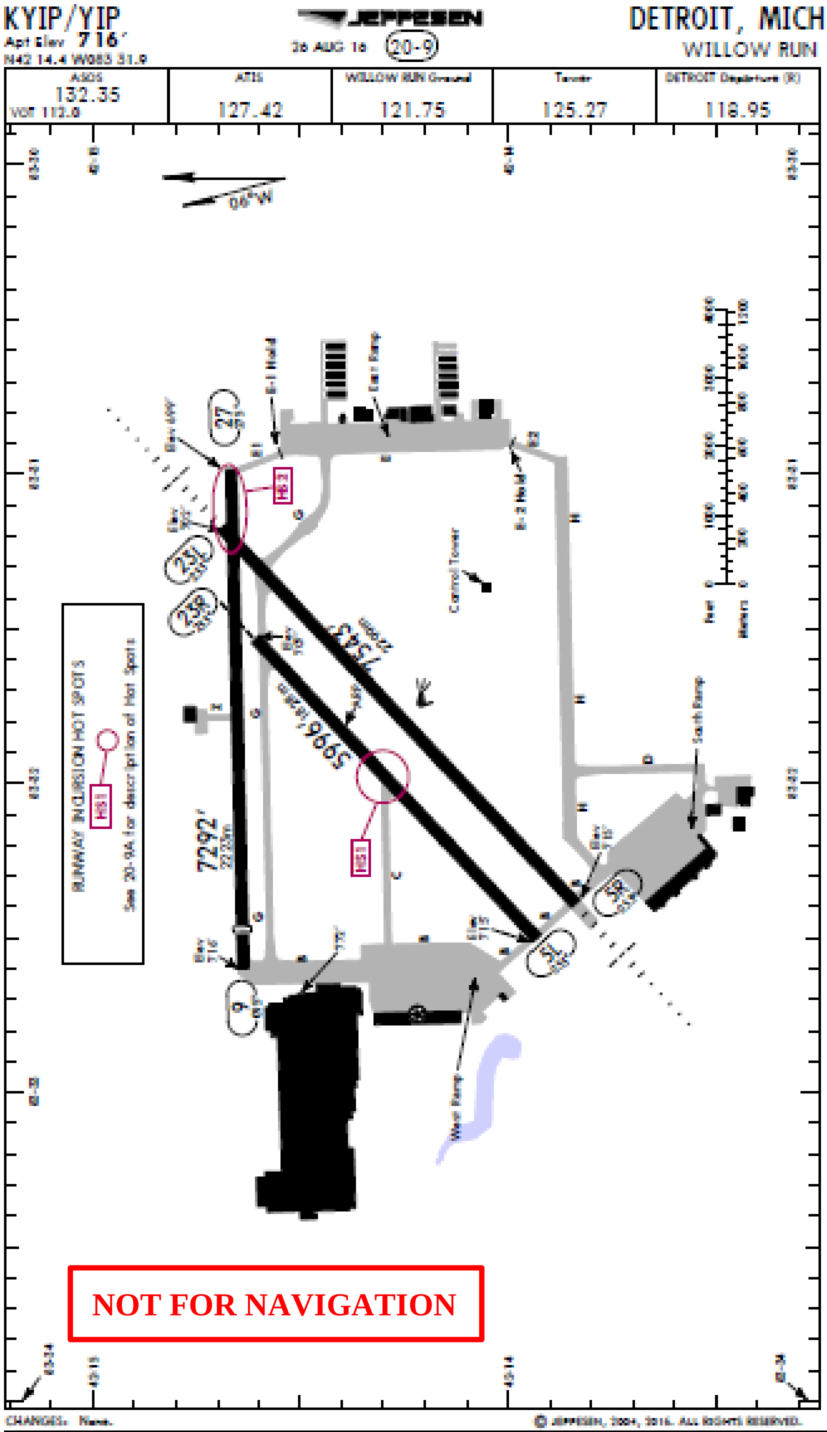

Figure 5: Jeppesen YIP 20-9 Airport Chart.[53]

53 Source: Jeppesen.

KYIP/YIP

JEPPESEN

26 AUG 16 (20-9A)

DETROIT, MICH
WILLOW RUN

GENERAL

48 hour prior permission required for unscheduled aircraft operations with more than 30 passenger seats requiring Index C or greater.

Helicopter takeoffs and landings on the south ramp prohibited, taxi only.

Birds in vicinity of airport.

ADDITIONAL RUNWAY INFORMATION

RWY		USABLE LENGTHS LANDING BEYOND Threshold	Glide Slope	TAKE-OFF	WIDTH
5R	HIRL CL MALSR TDZ RVR		6431' 1960m		161' 49m
❶ 23L	HIRL CL MALSR PAPI-L (angle 3.0°)		6498' 1981m		

❶ Grooved.

RWY		Threshold	Glide Slope	TAKE-OFF	WIDTH
5L					150' 46m
23R	MIRL PAPI-L (angle 3.0°) grooved	❷ 5596' 1706m			

❷ Last 400' (122m) is unavailable for landing distance computations.

RWY		Threshold	Glide Slope	TAKE-OFF	WIDTH
9 ❸	MIRL PAPI-L (angle 3.04°) grooved	6716' 2047m			160' 49m
27	MIRL grooved	❹ 6716' 2047m			

❸ Center 80' portion of runway grooved.
❹ Last 576' (176m) is unavailable for landing distance computations.

NOT FOR NAVIGATION

RUNWAY INCURSION HOT SPOTS (HS1)

For information only, not to be construed as ATC instructions.

HS1 Complex Rwys/Twy intersection.

HS2 Twy E1 to Rwy 27 or Rwy 23L wrong runway departure risk.

TAKE-OFF

	Rwys 5L, 5R, 9, 23L, 23R		Rwy 27		
	Adequate Vis Ref	STD	▮ With Mim climb of 206'/NM to 1000' Adequate Vis Ref	STD	Other
1 & 2 Eng	RVR 16 or 1/4	RVR 50 or 1	1/4	1	300-1 1/2
3 & 4 Eng		RVR 24 or 1/2		1/2	

▮ Alternatively, with standard take-off minimums and a normal 200'/NM climb gradient, take-off must occur no later than 1300' prior to departure end of runway.

FOR FILING AS ALTERNATE

	ILS Rwy 5R	ILS Rwy 23L	LOC Rwy 5R LOC Rwy 23L	RNAV (GPS) Rwy 5R RNAV (GPS) Rwy 23L RNAV (GPS) Rwy 23R VOR-A	Authorized Only When Local Weather Available RNAV (GPS) Rwy 5L RNAV (GPS) Rwy 9
A B C	600-2	600-2	800-2	800-2	800-2
D		700-2 1/4		800-2 1/4	800-2 1/4

AMEND 10A

CHANGES: Rwy 23R landing beyond threshold.

Figure 6: Jeppesen YIP 20-9A Airport Chart.[54]

[54] Source: Jeppesen.

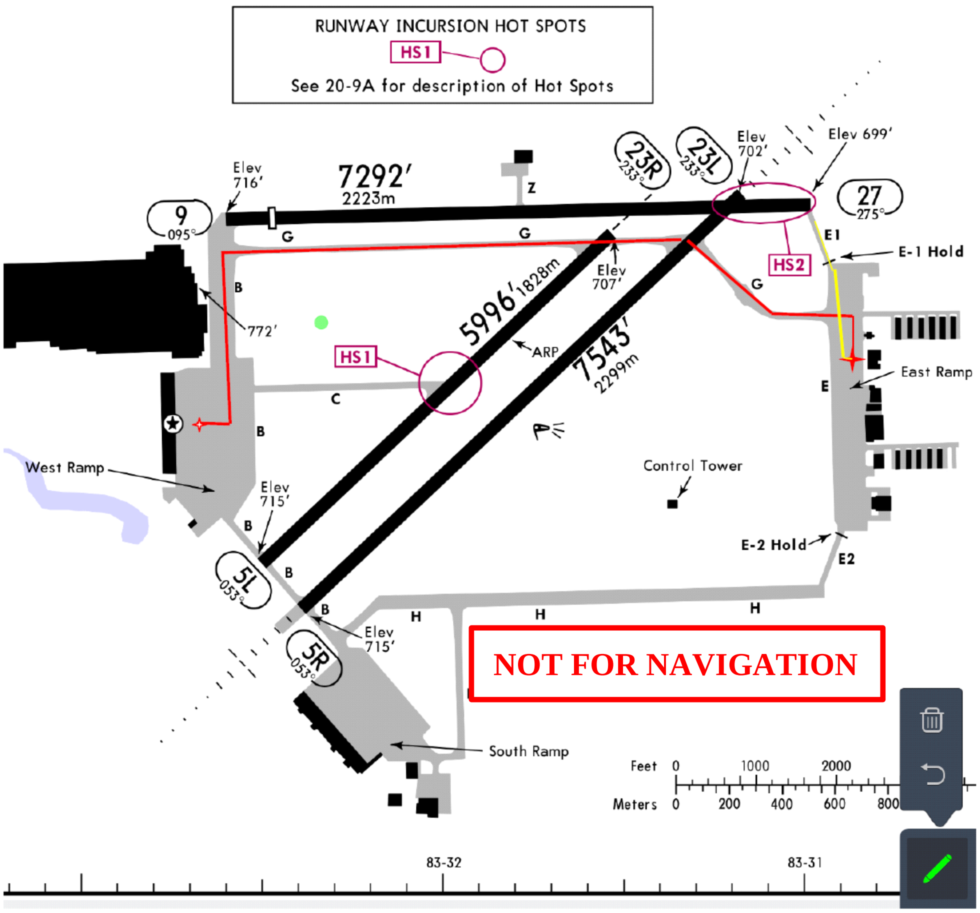

Figure 7: Taxi/takeoff routes for the airplane at YIP. The red line depicts the taxi route for the repositioning of the airplane, and the yellow line depicts the taxi to takeoff route.[55]

9.0 Electronic Flight Bag

Ameristar Air Cargo MD-83 pilots were issued Apple iPads as Class 1 Electronic Flight Bags (EFBs) approved by OpSpecs A061. The EFBs contained authorized software that included electronic flight manuals (located in the AirWatch Content folder), Jeppesen charts for approach, SIDs (standard instrument departure), STARs (standard terminal arrival) and enroute, and electronic Jeppesen text manuals.

According to the Ameristar Air Cargo GOM, section 5.D.62, the following manuals (either via EFB or physical manual) were required to be onboard the MD-83:

- *AOM Volume I*[56]

[55] Source: Ameristar Air Cargo Director of Operations, after consulting with the accident Check Airman.

[56] Manual information was contained in two volumes: the MD-83 Cockpit Operating Manual (FAA approved June 27, 2013) which contained aircraft limitations and supplemental procedures; and the Aircraft Operating Manual (AOM). The AOM contained two volumes; Volume I (FAA approved January 30, 2017) contained the aircraft checklists, Standard Operating Procedures – Amplified (SOPA), Standard Maneuvers and Configurations (SMAC), and performance and planning information. Volume II (FAA approved March 10, 2016) contained aircraft systems

- *AOM Volume II*
- *AOM Volume III (B737 only)*
- *GOM*
- *COM (DC-9/MD-83)*
- *Normal and Emergency checklists*

The Ameristar Air Cargo GOM, Section 5.D.62, page 14, contained the following note:

> *All maintenance controlled manuals have been removed from the aircraft. The Fuel Handbook has been placed on the iPad for flight crew reference.*

According to the Director of Operations, pilots were not responsible for items contained in the company's Aircraft Maintenance Manual (AMM).[57]

10.0 Uncontrolled Airport

According to FAA records, at 1217 EST (1717Z), the ATC tower issued an "ATC Zero" notification because the tower was evacuated due to the high winds at the airport. The airport was uncontrolled (no ATC services) at the time of the accident, and the tower was not operational again until 1842 EST (2342Z).

Title 14 *CFR* 121.117 Airports: Required data, stated in part:

> *(a) No certificate holder conducting supplemental operations may use any airport unless it is properly equipped and adequate for the proposed operation, considering such items as size, surface, obstructions, facilities, public protection, lighting, navigational and communications aids, and ATC.*

The Ameristar Air Cargo Operations Specifications C064 also covered operations at airports without an operating control tower for nonscheduled passenger and all-cargo operations. The authorization allowed these operations with the following provisions:

(1) *The airport is served by an authorized instrument approach procedure.*
(2) *The airport has an approved source of weather or in accordance with the provisions for conducting the flight under the eligible on-demand authorization.*
(3) *The airport has a suitable means for the pilot-in-command to acquire timely air traffic advisories and the status of airport services and facilities.*

information.

[57] According to the Ameristar GOM, chapter 1, page iii, the GOM "sets forth the operating authority, corporate structure, administrative procedures and crewmember personnel duties and responsibilities as well as the overall general operations, procedures and policies to be adhered to by Ameristar Air Cargo, Inc. (ACC) and its employees." The AMM was not listed as a part of the flight operations instructions to crewmembers.

(4) *The facilities and services necessary to safely conduct IFR operations are available and operational at the time of the particular operation.*[58]

The Ameristar Air Cargo GOM, Section 5.18 Radio Usage at Uncontrolled Airports, stated the following in part:

> *Pilots on inbound traffic should monitor and communicate as appropriate on the designated Common Traffic Advisory Frequency (CTAF) from 10 miles to landing. Pilots of departing aircraft should monitor/communicate on the appropriate frequency from start-up, during taxi, and until 10 miles from the airport.*

11.0 Ameristar Organizational and Management Information

Ameristar Air Cargo, Inc. was authorized by the FAA under certificate #MJYA749T and OpSpecs A001-1 to conduct supplemental operations in common carriage pursuant to 14 *CFR* 119.21(e).[59] Ameristar Air Cargo's principle base of operations was in Addison, Texas.

Ameristar Air Cargo, Inc. received initial certification on a B-737-230C aircraft in all-cargo 121 supplemental operations in September of 2000 serving primarily the auto parts industry. In 2005 Ameristar Air Cargo placed an additional 3 aircraft on its ops specs – all DC-9 freighters. Also in 2005, Ameristar Air Cargo placed a single B-737-2H4 passenger aircraft on its certificate and began flying sports teams and private charters.

According to the Director of Operations, in early 2006 both B737-230Cs were retired, and in September of 2011, MD-83s were placed in service also in passenger charter operations. In March – May, 2014, two B-737-200 passenger aircraft were placed on Ameristar's Certificate to augment its passenger private charter business, and one B-737-200 was retired.

According to OpSpecs D085, Ameristar Air Cargo operated 2 B-737's, 4 DC-9's, and 2 MD-83's (including the accident airplane).

According to the Ameristar Air Cargo organizational chart in the GOM, Chapter 1 (page 1), all line pilots, ground instructors and check airmen reported directly to the Check Airman. The Chief Pilot reported directly to the Director of Operations, who along with the Director of Safety reported to the President of the company. According to interviews, the company had about 16-17 individual pilots, and had about 20 Flight attendants. The pilots flew about 20-25 hours per month. By policy, pilots had an 18-day schedule which was on-call for the cargo operations. The average trip was about 1-1.5 hours. Some of their pilots were dual qualified on the MD-80 and B-737. The company did not have any union representing its employees.

[58] OpSpecs C064 also required all Ameristar Air Cargo Part 135 turbojet and all Part 121 operations in the terminal area to be conducted under instrument flight rules.
[59] Per OpSpecs A001-1, the Ameristar Air Cargo, Inc. was authorized to conduct operations under the following business names; Ameristar; Ameristar Charters.

According to the Director of Safety, since Ameristar Air Cargo was a small company, they did not have an ASAP[60] or FOQA[61] program, and had not conducted a LOSA[62] audit. Safety data collection was primarily through their irregularity reports and logbook entries. Voluntarily reporting of safety information was done via irregularity reports that went to the Director of Operations and the Chief Pilot, and forwarded to the Director of Safety for review. According to the Director of Safety, they typically would see about two irregularity reports per month.

Ameristar Air Cargo's Fatigue Risk Management Program (FRMP) was defined in OpSpecs A317, its FAA-approved fatigue education and awareness training (FEAT) program defined in OpSpecs A319, and according to the Director of Safety, they "basically leave it up to the individual to announce if they are fatigued, and if they are, they are taken off the schedule." Fatigue risk management was trained during initial and recurrent ground training.

Ameristar Air Cargo's Risk Assessment Program (RAP) was defined in the company's Safety and Emergency Response Program, and defined as a process for data collection, reporting, and audits. The data collected was used to identify latent unsafe conditions. According to the Director of Safety, Ameristar Air Cargo was in the process of implementing Safety Management System (SMS).[63]

11.1 Risk Assessment Worksheet

According to the Ameristar Air Cargo Safety and Emergency Response Manual (Chapter 2, Appendix B-1, page 2), flight followers were required to review each flight for risks and mitigation strategies, and prepare the flight release in the normal manner, and then complete the inputs for the risk assessment program into a form provided to the pilots with their flight release paperwork

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[60] Aviation Safety Action Program. According to the FAA Advisory Circular 120-66B "Aviation Safety Action Program (ASAP)", the objective of the ASAP is to encourage air carrier and repair station employees to voluntarily report safety information that may be critical to identifying potential precursors to accidents. The Federal Aviation Administration (FAA) has determined that identifying these precursors is essential to further reducing the already low accident rate. Under an ASAP, safety issues are resolved through corrective action rather than through punishment or discipline. The ASAP provides for the collection, analysis, and retention of the safety data that is obtained. ASAP safety data, much of which would otherwise be unobtainable, is used to develop corrective actions for identified safety concerns, and to educate the appropriate parties to prevent a reoccurrence of the same type of safety event.

[61] Flight Operational Quality Assurance. FOQA is an FAA-approved program for the routine collection and analysis of digital flight data gathered during aircraft operations, including data currently collected pursuant to existing regulatory provisions, when such data is included in an approved FOQA program. FOQA programs were designed to use in-flight recorded data collected by airlines to improve safety in the following areas: flight crew performance; training; air traffic procedures; airport maintenance and design; and aircraft operations and design. Operator participation in FOQA is voluntary.

[62] Line Operations Safety Audit. LOSA uses trained peer observers to collect data about flight crew behavior and situational factors on normal flights. The audits are no-jeopardy, and potential threats to safety, errors, and the crew's reactions as part of an overall CRM threat and error management review of the operation. Operator participation in LOSA is voluntary.

[63] According to the FAA, Advisory Circular (AC) 120-92B Safety Management Systems for Aviation Service Providers, provides information for Title 14 of the Code of Federal Regulations (14 *CFR*) part 121 air carriers that are required to implement Safety Management Systems (SMS) based on 14 *CFR* part 5. Specifically, this document provided a description of regulatory requirements, guidance, and methods of developing and implementing an SMS. An SMS is an organization-wide comprehensive and preventive approach to managing safety, and includes a safety policy, formal methods for identifying hazards and mitigating risk, and promotion of a positive safety culture. An SMS also provides assurance of the overall safety performance of an organization.

as part of the Ameristar Air Cargo's Risk Assessment Program (RAP). Flight followers checked the applicable boxes, and the risk was scored by number.

According to interviews, the flight followers would first ascertain crew duty time limitations, assignments (such as captains on high minimums and pairing requirements), aircraft status, weather, flight release information and other considerations, completing a Flight Release Checklist to ensure all flight follower functions were completed. The flight follower would then complete the risk assessment worksheet via a computer program that included elements with numerical values (points) for predetermined operational risks. The data for these inputs was objective information gathered as a part of the trip building process. After the data input had been completed, the program generated a numerical total that identified varying levels of safety thresholds on a 0-30 numerical scale.[64] A score of 1-10 was considered low risk, 11-20 medium risk, and 21-30 high risk. According to the Director of Safety, any score that was 20 or greater would have to have the Director of Operations or Chief Pilot's approval to conduct that flight, and the captain always had the right to discuss any flight with the Chief Pilot or Director of Operations.

The risk assessment conducted for the accident flight by the flight follower and provided to the pilots indicated a total score of "0" (low risk). The box for "WX – Thunderstorms at Departure or Destination or wind gusts above 30 knots" was not checked on the risk assessment worksheet for the accident flight. According to the Ameristar Air Cargo Safety and Emergency Response Manual (Chapter 2, Appendix B-1, page 4), the score for "WX – Thunderstorms at Departure or Destination or wind gusts above 30 knots" was four (4) points.

11.2 Director of Operations Duties

The Director of Operation's duties were listed in the Ameristar Air Cargo GOM, Chapter 1.2.2, and included the following duties in part:

> *Responsibility for assuring that a flight is monitored with respect to at least the following:*
>
> - *Departure of the flight from the place of origin and arrival at the place of destination, including intermediate stops and any diversions.*
> - *Maintenance and mechanical delays encountered at places of origin, destination and intermediate stops,*
> - *Any known conditions that may adversely affect the safety of flight.*
> - *Joint responsibility with the Pilot-In-Command for the initiation, continuation, diversion and termination for a flight in compliance with the FAR's and the Operations Specifications.*

11.3 Flight Followers Duties

Ameristar Air Cargo used a Flight Control Center located at its principal base of operations in Addison, Texas. As a supplemental carrier, the company was not required to use 14 *CFR* 121

[64] The Flight Release Checklist and Risk Assessment worksheet for the accident flight were included in the flight release documentation provided to the NTSB. See Attachment 3 – Flight Release Paperwork.

dispatchers, and used flight followers to plan and monitor its flights.[65] Flight follower training was accomplished through the provisions of Ameristar Air Cargo's FAA-approved Flight Follower Training Program. Ameristar Air Cargo's Operational Control was defined in OpSpecs A008

The flight follower duties were listed in the Ameristar Air Cargo GOM, Chapter 1.2.10, and included the following duties in part:

- *Ensuring the proper monitoring of the progress of each flight with respect to its departure at the point of origin and arrival at its destination. Including intermediate stops and diversions therefrom, and maintenance or mechanical delays encountered at those points or stops.*
- *Prior to flight and during fight, ensuring that the pilot in command is provided with all information necessary for the safety of the flight.*
- *Operational control of the aircraft*
- *Maintaining the necessary knowledge of Ameristar Air Cargo, Inc. procedures for the proper conduct of operational control and flight following.*

12.0 Relevant Systems[66]

The MD-83 had conventional aileron, rudder and elevator control systems. Control surfaces of these systems were protected against gust forces by viscous dampers and hydraulic cylinders. Lateral control was aided by hydraulically operated flight spoilers. The flight spoiler surfaces were also operated as ground spoilers. After landing, all four flight spoiler surfaces could be extended a maximum of 60 degrees to serve as ground spoilers. The ground spoilers operated only during landings and rejected takeoffs.

The rudder was normally hydraulically powered with automatic reversion to aerodynamic tab control when hydraulic power was not available. A yaw damper was installed in the rudder system to provide automatic damping of any lateral directional oscillation. It was selected by a switch on the overhead panel or by engaging the autopilot if the switch was in the OFF position. A light on the annunciator panel illuminated when the damper was off or became inoperative.

Stall warning and maximum speed warning systems were also provided. Conventional slotted flaps were used. The flight spoilers may be armed to extend automatically at touchdown as an aid for wheel braking. A takeoff warning system was provided. Then the throttles were advanced for takeoff and the flaps, spoilers, or stabilizer were not in the correct position, a warning horn would sound intermittently.

Viscous dampers, two on each aileron and tow on the rudder, along with the rudder power cylinder and resilient aileron stops, protected the structure and surfaces from ground gusts. One viscous damper and augmentor cylinder on each elevator surface protected the elevator from ground gusts.

[65] Title 121.395 Aircraft dispatcher: Domestic and flag operations, required dispatchers for "domestic or flag operations." Ameristar Air Cargo operated under Part 121 supplemental regulations.
[66] Source: Ameristar Air Cargo DC-9 AOM, Volume II, page 27-1 and 27-13.

12.1 Hydraulics[67]

Hydraulic power was provided by two separate, hydraulically closed-circuit systems identified as the left and right systems. The right system provided hydraulic power to the rudder, aft entrance stairway and the landing gear actuating subsystem. All other hydraulic subsystems were served by both systems through separate valves and actuators. The primary source of hydraulic power was supplied by two engine-driven pumps and one electrically driven pump.

12.2 Elevators[68]

The longitudinal control system was a pair of elevators attached to the horizontal stabilizer. Elevator control was, for all normal flying, an aerodynamic boost system that operated a single control tab on each elevator. Each control tab was driven by an independent two-way cable system from the corresponding control column in the cockpit. The only interconnection between the two control systems was a bus torque tube that connected the control columns. Movement of the control column moved the control tab, and aerodynamic force generated by the tab moved the elevator. As each elevator moved, an additional tab, geared to elevator movement, moved to assist the control tab. An anti-float tab, geared to horizontal stabilizer movement, was installed on each elevator outboard of the geared tab to improve longitudinal trim in a forward center-of-gravity (beyond ten degrees airplane nose up) landing configuration.

[67] Source: Ameristar Air Cargo DC-9 AOM, Volume II, page 1-7.
[68] Source: Ameristar DC-9 AOM, Volume II, page 27.83-1.

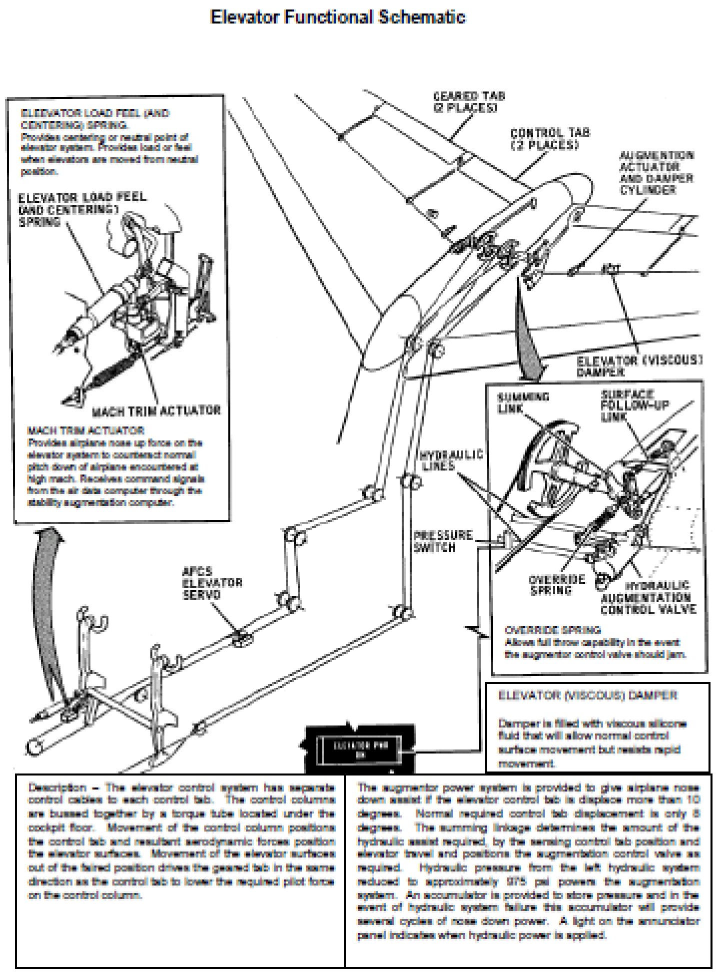

Figure 8: Elevator Functional Schematic.[69]

12.2.1 Elevator Augmentation System[70]

A hydraulic power augmentation system was provided to assure airplane nose down capability under extreme, highly unlikely, high angle-of-attack flight conditions. The system consisted of two control valves in series and an actuator on each elevator surface. The left hydraulic system provided pressure through a pressure reducer; the augmentation system always operated approximately 975 psi. An accumulator was provided to store pressure and provide several cycles of airplane down elevator operation in the event of hydraulic system pressure loss.

The control valves were operated by a summing linkage which determined control valve position as a resultant of control input and elevator response. During normal flying, the maximum elevator nose down tab used was 8 degrees.

If during extreme stall conditions the control tab displacement would reach approximately 10 degrees of airplane nose down because the elevator had not responded, the summing linkage would

[69] Source: Ameristar Air Cargo DC-9 AOM, Volume II, Flight Controls, page 27-14.
[70] Source: Ameristar Air Cargo DC-9 AOM, Volume II, Flight Controls, page 27-10.

operate the control valves to port pressure to the actuator and thus apply nose down elevator. From that point on, the elevator would follow the position of the control column.

The actuator cylinders with restrictor check valves and a low-pressure accumulator in the return line were also used as gust dampers.

To provide the flight crew with operating information, an elevator power-on light was provided on the annunciator panel. The light was operated by a pressure switch and would come on when hydraulic pressure was used to drive the elevator. The augmentation system was tested as part of the Taxi Checklist. For additional information, see Section 14.2 Taxi Checklist of this Factual Report.

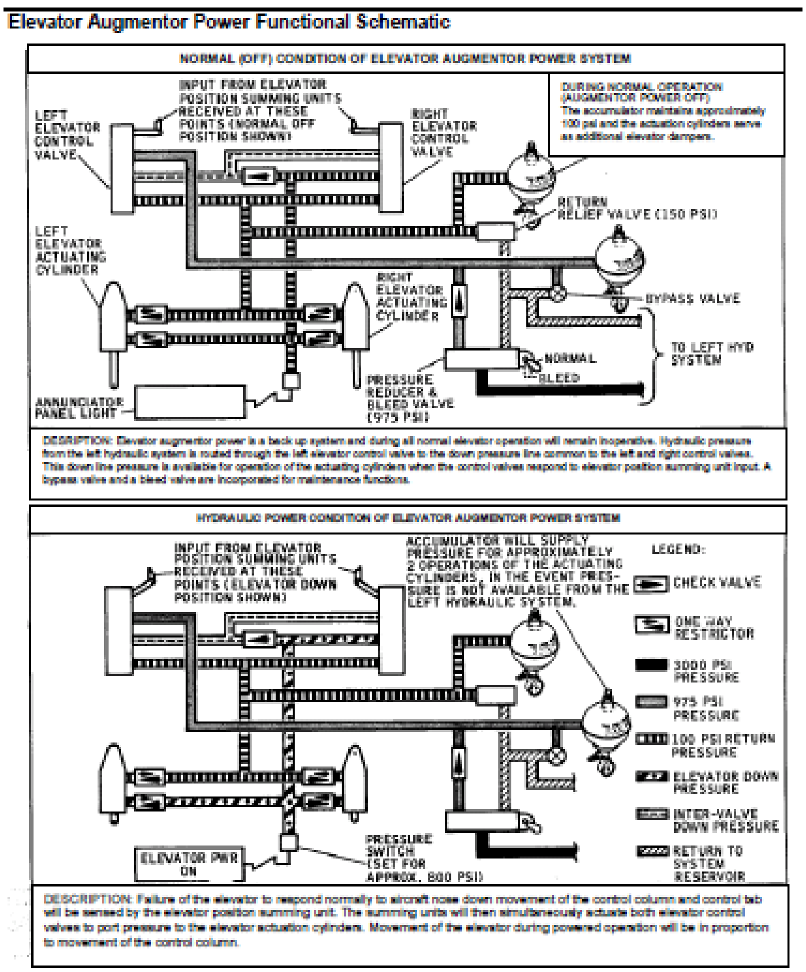

Figure 9: Elevator Augmentor Power Functional Schematic.[71]

[71] Source: Ameristar Air Cargo DC-9 AOM, Flight Controls, page 27-15.

12.3 Flaps[72]

The trailing edge flap system consisted of inboard and outboard flap segments on each wing. Each flap was powered by the left and right hydraulic systems. Although the flaps normally operated on both hydraulic systems, one hydraulic system was capable of operating the flap system at a reduced rate.

Flaps may be positioned in any of the six permanent detents in a 0 to 40-degree range by movement of the Flap/Slat Handle. The authorized flap settings for takeoff in the MD-83 were 4, 6, 11, 15, 17, 20, and 24.[73] A "Flap T.O. Sel Wheel" on the center pedestal would allow the pilot to further position the flaps from the position selected by the Flap/Slat Handle position anywhere in the 0- to 13- and 15- to 24-degree range.[74] This was used to set the final takeoff flap setting, as determined by the runway analysis review for the airport/runway.

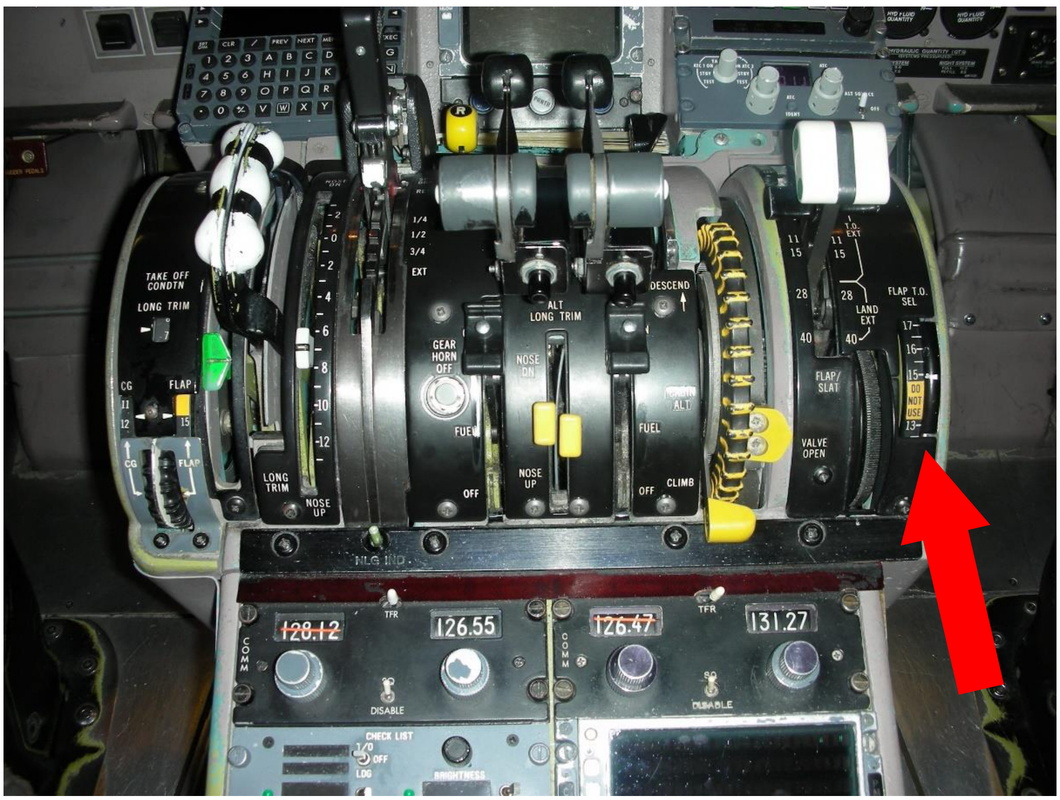

Photo 1: MD-83 Center Quadrant. Red Arrow depicts the location of the "Flap T.O. Sel Wheel" to the right of the Flap/Slat handle.[75]

The flap position indication was on the System Display Panel. The display had pointers and a linear strip graduated in degrees of flap travel. Each outboard flap was linked to a separate position

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[72] Source: Ameristar Air Cargo DC-9 AOM, Volume II, page 27.83-2.
[73] Source: Ameristar Air Cargo DC-9 AOM, Volume II, page 5-2.83-12.
[74] The Ameristar Air Cargo MD-83 COM, Limitations, page 1-24, stated "Flaps (AFM): Do not use flap settings between 13 and 15 degrees."
[75] Photo was taken on April 11, 2017 during MD-83 simulator testing at the American Airlines training facility in Ft. Worth, Texas. See Attachment 11 – YIP Simulator Test Plan.

transmitter that operated one of the dual pointers. The pointers indicated actual flap position rather than Flap Handle position.

For the accident flight, according to the Ameristar Air Cargo Load Manifest, the crew positioned the flap handle to the 15-degree detent. Following review of the performance analysis for YIP runway 23L, the crew positioned the Flap T.O. Sel Wheel to “16.4” degrees for a final takeoff flap setting, based on the YIP runway 23L analysis data they used for selecting their takeoff V-speeds (10 knot headwind, 146,600 maximum takeoff weight).[76]

12.4 Braking System[77]

Each main gearwheel was equipped with a disk-type power brake. There were two completely independent hydraulic brake systems designated left (powered by the left hydraulic system) and right (powered by the right hydraulic system. Either system could be selected for brake operations by moving the BRAKES selector handle, located on the upper instrument panel, to L HYD SYS or R HYD SYS. Only one system was in operation at a time. Each system had its own hydraulic system selector valve, an anti-skid servo for each brake, and a separated brake pressure gauge.

Mechanical controls common to both brake systems were the brake pedals and linkages and the parking brake mechanism. The cable systems were rigged independently to the right system manual brake control valve in the right wheel well, and the left system manual brake control valve in the left wheel well.

The braking system also had an anti-skid system to provide a means for metering the pressure return at each brake to permit maximum braking efficiency (just before impending skid) while preventing a skid condition of any wheel.

12.5 Windshear Alert System[78]

The MD-83 was equipped with a Windshear Alert System that provided flight crews with visual and aural alerts of the proximity of a windshear sufficient magnitude to be hazardous to the aircraft. The Mode 7 windshear alerting was available on takeoff when the airspeed was greater than 80 knots and the body angle of attack was greater than 4 degrees, or radio altitude less than 1,500 feet and greater than 9 feet. The takeoff windshear alerting would remain enabled until the aircraft climbed above 1500 feet or was configured for landing.

13.0 Performance

According to the Ameristar Air Cargo MD-83 Cockpit Operating Manual (COM) – Limitations, page 1-3, Ameristar Air Cargo MD-80 pilots were not allowed to takeoff or land on a runway unless approved aircraft performance data had been supplied. The approved runway analysis for specific airports was provided to Ameristar Air Cargo by Automated Systems and Aircraft

[76] See Attachment 8 – YIP Runway 23L Performance Analysis.
[77] Source: Ameristar Air Cargo DC-9 AOM, Volume II, page 32-11.
[78] Source: Ameristar Air Cargo DC-9 AOM, Volume II, page 85-10.

Performance (ASAP), and was required to be carried onboard the airplane.[79] The runway analysis could be transmitted to the pilots via fax or telephonically from Flight Control. The runway analysis was used by the crew to determine the V-speeds for takeoff, increased rotation speeds (if applicable), final takeoff flap setting, thrust settings, and maximum takeoff weight for the runway based on the actual temperature.[80]

13.1 V-Speeds

According to the Ameristar Air Cargo DC-9 AOM, Volume 1, Standard Maneuvers and Configurations, page 4-3, Ameristar Air Cargo used Takeoff and Approach Speed Cards, placed on the center console of the instrument panel, to provide ready takeoff and approach speed information to the pilots. These speeds were based on various operating weights and flap configurations and display additives for high temperature and high elevation. The displayed speeds provided the required performance for stall and maneuvering protection as well as adequate gust margins. The referenced speeds were to be set on the airspeed indicator using a system of movable bugs. If available, airspeed reference bugs were to be set on the airspeed indicator on the MD-80 prior to each departure at the following speeds:

> V_1
> V_2
> *0/EXT*
> *0/RET*
> *Clean Min Maneuver*
> *250 knots*

According to the Check Airman, the crew elected to use "normal max" for takeoff from runway 23L.[81] The procedure to determine the V-speeds for the takeoff were found in the Ameristar Air Cargo DC-9 Aircraft Operating Manual (AOM) Volume 1, page 5-1.83-6. For a normal thrust takeoff, the pilots used the Runway Analysis for the specific runway (YIP 23L), and used the following procedure to set the V_1, V_R and V_2:

> *Read down the appropriate wind column to a weight equal to or greater than the actual takeoff weight. Use the flap setting and takeoff speeds noted. Use the Normal EPR [engine pressure ratio] setting for takeoff with the ART [Automatic Reserve Thrust][82] switch in AUTO and press the T.O. button on the TRI [Thrust Rating Indicator].[83] The TRI display should agree with the EPR NORM at the actual OAT.*

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[79] Aeronautical data supplied to Ameristar Air Cargo by ASAP and Jeppesen were approved via OpSpecs A009. This data was contained on the crew iPads (EFBs).
[80] See Attachment 8 – YIP Runway 23L Performance Analysis.
[81] See Attachment 1 – Interview Summaries.
[82] According to the Ameristar Air Cargo DC-9 AOM, Volume II, page 72-83-1, in the event of an engine failure on the MD-83, the ART system would increase the thrust on the remaining engine.
[83] According to the Ameristar Air Cargo DC-9 AOM, Volume II, page 72-83-1, the TRI was interfaced with the ram air temperature probe and the Digital Flight Guidance Computers (DFGC) 1 and 2. Ram Air Temperature (RAT) and EPR LIM (limit) were displayed on the indicator. Mode buttons were provided on the indicator for selection of the desired mode (T.O, TO FLX, GA, MCT, CL, and CR). The DFGCs supplied data to the indicator for automatic display of EPR LIM for the mode selected.

Since the crew had calculated the weight of the airplane at 145,076, they rounded the figure up to 146,000 pounds for use of the speed card (see Figure 9 below). The crew then entered the YIP 23L performance chart in the "10-knot headwind" column and used the V-speeds for the 146.6 (146,600 pound), which were 139 (V_1), 142 (V_R), and 150 (V_2). As previously mentioned, the most recent complete METAR to YIP indicated that at 1653Z, and the winds were 260 degrees at 35 knots, gusts to 50 knots, with a peak wind recorded at 1639Z at 260 degrees at 55 knots.

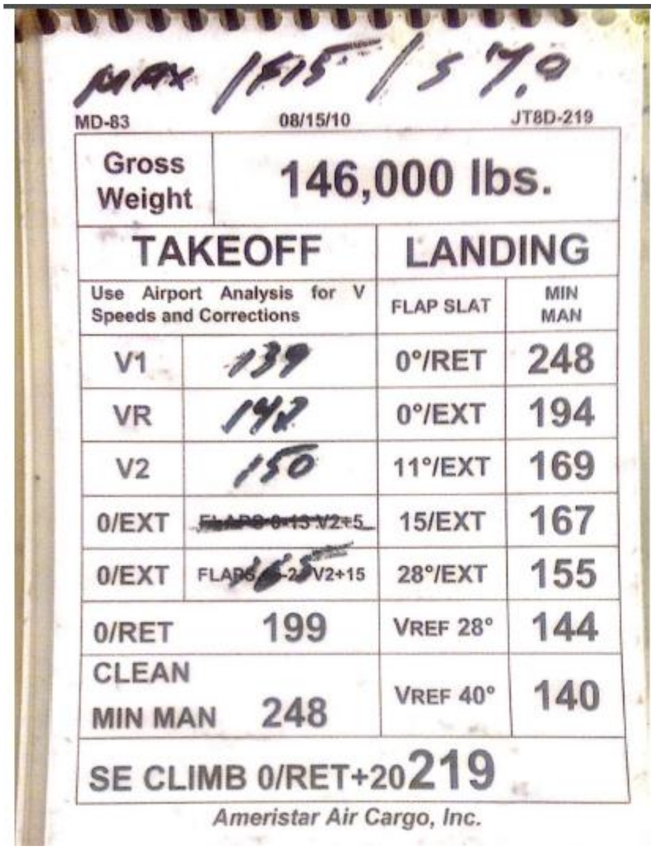

Figure 10: TO/Landing speeds chart recovered from the accident airplane.[84]

13.1.1 V-Speed Definitions

The Ameristar Air Cargo DC-9 AOM, Volume I, page 4-13, provided the following definitions for specific V speeds:

> *V_1 – Takeoff action speed. V_1 means the maximum speed in the takeoff at which the pilots must take the first action (e.g., apply brakes, reduce thrust, deploy speed brakes) to stop the airplane with the accelerate-stop distance.[85] V_1 also means the minimum speed in the*

[84] The V-speeds written in the V_1/V_R/V_2 boxes were derived from the YIP runway 23L performance analysis provided to the pilots (see Attachment 8 – YIP Runway 23L Performance Analysis). The "MAX/F15/S7.0" indicated the thrust setting/flap setting/stab trim setting.

[85] According to FAA AC 120-62 Takeoff Safety Training Aid (dated September 12, 1994), accelerate-stop distance is defined as the horizontal distance from the start of the takeoff to the point where the airplane is stopped in the runway or runway and stopway, when the stop is initiated at V_1 and completed using the approved procedures and specified

takeoff following the failure of the critical engine at V_{EF}, at which the pilot can continue the takeoff and achieve the required height above the takeoff surface with the takeoff distance.

The Takeoff Safety Training Aid states:
"…V_1 is the maximum speed at which the rejected takeoff maneuver can be initiated and the airplane stopped with the remaining field length under the conditions and procedures defined in the FAR's. It is the latest point in the takeoff roll where a stop can be initiated. Second, with respect to the "Go" criteria, V_1 is also the earliest point from which an engine out takeoff can be continued and the airplane attain a height of 35 feet at the end of the runway."

V_R – The speed at which rotation to the initial climbout attitude is initiated.
V_2 – The speed used for initial climb following an engine failure on takeoff.
0/EXT – The minimum airspeed at which flap retraction is accomplished
0/RET – The minimum airspeed at which slat retraction is accomplished
Clean Min Maneuver – The minimum airspeed used for maneuvering in the terminal area with the wing in a clean configuration.

13.2 Increased Rotation Speed

According to the Check Airman, the winds were "pretty gusty" and they decided on an increased rotation speed of about 5 knots for their maximum runway weight of 156-157,000 pounds. The Ameristar Air Cargo DC-9 AOM Volume I, Standard Maneuvers and Configurations, provided precautions for pilots to take to mitigate the potential for windshear and microbursts during takeoff, and page 4-98 stated the following:

Takeoff Precautions

- *Use Maximum Rated Takeoff Thrust*
- *Use Longest Suitable Runway*
- *Consider Using Recommended Flap Setting*
- *Consider Using Increased Rotation Speed*

The Ameristar Air Cargo DC-9 AOM Volume I, Standard Maneuvers and Configurations, page 4-92, provided additional information for each of these precautions.[86] According to interviews, the increased rotation speed was not set via an airspeed reference bug on the airspeed indicator, and was verbally called out by the PM during takeoff upon reaching that airspeed. Both pilots had briefed the increased rotation speed prior to takeoff during the taxi checklist, and the Check Airman told the Captain "don't rotate until I call for rotate."[87]

conditions.
[86] See Attachment 12 - Ameristar Windshear Avoidance (AOM excerpts).
[87] See Attachment 1 – Interview Summaries.

13.3 Headwind/Tailwind

The headwind/tailwind component chart was found in the Ameristar Air Cargo DC-9 AOM, Volume I, Performance, page 5-1-24. According to their interviews, neither pilot calculated a crosswind component for the departure runway (23L), and they used the wind sock located on the field to determine the most appropriate runway for departure.[88] According to the Ameristar Air Cargo MD-83 COM, Limitations, page 1-6, the maximum demonstrated crosswind component for the MD-83 was 30 knots. The maximum takeoff tailwind component was 10 knots.

Headwind and Tailwind Component Conversion Chart

HEADWIND COMPONENT CONVERSION CHART																		
	Wind Angle																	
Wind	10°		20°		30°		40°		50°		60°		70°		80°		90°	
Knots	HW	CW	HW	CW	HW	CW	HW	CW	HW	CW	HW	CW	HW	CW	HW	CW	HW	CW
2	1	0	1	0	1	0	1	1	1	1	1	1	0	1	0	0	0	2
4	3	0	3	1	3	1	3	2	2	3	2	3	1	3	0	3	0	4
6	5	1	5	2	5	2	4	3	3	4	3	5	2	5	1	5	0	6
8	7	1	7	2	6	3	6	5	5	6	4	6	2	7	1	7	0	8
10	9	1	9	2	8	4	7	6	6	7	5	8	3	9	1	9	0	10
12	11	2	11	4	10	5	9	7	7	9	6	10	4	11	2	11	0	12
14	13	2	13	4	12	6	10	8	8	10	7	12	4	13	2	13	0	14
16	15	2	15	5	13	7	12	10	10	12	8	13	5	15	2	15	0	16
18	17	3	16	6	15	8	13	11	11	13	9	15	6	16	3	17	0	18
20	19	3	18	6	17	9	15	12	12	15	10	17	7	18	3	18	0	20
22	21	3	20	7	19	10	16	14	14	16	11	19	7	20	3	21	0	22
24	23	4	22	8	20	11	18	15	15	18	12	20	8	22	4	23	0	24
26	25	4	24	8	22	12	19	16	16	19	13	22	8	24	4	25	0	26
28	27	4	26	9	24	13	21	17	17	21	14	24	9	26	4	27	0	28
30	29	5	28	10	26	14	22	19	19	22	15	25	10	28	5	29	0	30
32	31	5	30	10	27	15	24	20	20	24	16	27	10	28	5	31	0	
34	33	5	31	11	29	16	26	21	21	26	17	29	10	30	5			
36	35	6	33	12	31	17	27	23	23	27	18	31	12		5			
38	37	6	35	12	32	18	29	24	24	29	19		12		6			
40	39	6	37	13	34	19	30	25	25	30	20		13		6			
42	41	7	39	14	36	20	32	26	26		21		14		7			
44	43	7	40	15	38	21	33	28	28		22		15		7			
46	45	7	43	15	39	22	35	29	29		23		15		7			
48	47	8	45	16	41	23	36	30	30		24		16		8			
50	49	8	46	17	43	24	38		32		25		17		8			

NOTE: Interpolation will be required for wind velocity not shown. Shaded Areas = Exceeds Maximum Crosswind
HW = Headwind CW = Crosswind Maximum Crosswind is 31 knots

Figure 11: MD-83 Headwind Component Conversion Chart.[89]

14.0 Relevant Procedures

14.1 Pre-flight Inspection

Prior to repositioning to the east ramp, the Captain conducted an exterior pre-flight inspection (walk-around) of the airplane. According to the Ameristar Air Cargo DC-9 AOM Volume I, Normal Checklist – Amplified, page 1.2-2, "the walk-a-round inspection of the aircraft helps provide assurance of its airworthiness. This inspection will normally be performed by the FO, and is assumed the aircraft will be powered and the parking brakes set (to allow check of brake wear indicators)." The check was required to be accomplished prior to each flight segment, and according to the crew interviews, the Captain conducted this pre-flight inspection prior to repositioning the airplane to the AvFlight east facility where they met the charter passengers.

The Ameristar Air Cargo DC-9 AOM Volume I, Normal Checklist – Amplified, page 1.2-2, stated the following caution[90] for the MD-80:

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[88] According to FAA AC 150/5345-27D, Paragraph 3.2.2, a taper or fabric windsock from the throat to the trailing end must be designed to cause the windsock to fully extend when exposed to a wind of 15 knots.
[89] Source: Ameristar Air Cargo DC-9 AOM, Volume I, Performance, page 5-1-24.
[90] The Ameristar Air Cargo DC-9 AOM, Volume I, Introduction, page INTRO 13, stated "a caution is used to highlight

Caution
Airplanes that are exposed to high-sustained winds, or wind gusts, greater than 75 MPH (approximately 65 knots) are susceptible to elevator damage and/or jamming. In accordance with the Aircraft Maintenance Manual, airplanes suspected to have been exposed to these conditions must have visual and physical inspections (moving surfaces by hand) of all flight controls and operational check of these.

On June 25, 2001, following an RTO event where the pilot was unable to rotate the airplane at V_R, Boeing published a Flight Operations Bulletin detailing how that accident airplane had been subjected to high winds the night prior, and provided additional alternatives to mitigate the potential for wind damage on the elevators.[91]

According to the Boeing MD-80 Aircraft Maintenance Manual (TP-80MM-AAL, page 202), dated August 01, 2015, the following caution and warning was listed under Parking: General Procedures:

WARNING:
If wind gusts are expected to exceed 69 MPH (60 knots), aircraft should be headed into wind to prevent structural damage to primary control surfaces.

CAUTION:
If there is any possibility that aircraft has been subjected to winds in excess of 75 MPH (65 knots), and aircraft has not been headed into wind or wind direction changed during parking, perform visual and physical inspections (moving the surfaces by hand) of all flight controls and an operational check of these systems.

The Ameristar Air Cargo Director of Operations, when asked what the pilot's responsibility was regarding the 75-mph wind limitation, said the pilot would have to alert maintenance if they knew the winds exceeded that limit. He said that at Ameristar Air Cargo, they did not have a process or procedure to monitor those winds, and Ameristar Air Cargo did not have a policy placing a duty on a specific person or persons to take action when winds in excess of 75 mph are forecast or have occurred effecting one of its airplanes.[92] There was no expectation for the pilots to monitor the winds when they were off duty since that would be considered duty time.[93]

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specific information which, if not followed, could cause damage to the equipment." The same page of the AOM Volume I, Introduction stated that "a warning is used to highlight specific information which, if not followed, could cause damage to the equipment and harm to the operator and occupants."

[91] See Attachment 9 – Boeing Flight Operations Bulletin.

[92] Source: Email from the Ameristar Air Cargo Director of Operations to the NTSB Investigator in Charge (IIC), dated March 20, 2017 at 20:00 EDT.

[93] According to the Ameristar Air Cargo GOM, page 41, Flight Duty Period (FDP) was "a period that begins when a flight crewmember is required to report for duty with an intention of conducting a flight, a series of flights, or positioning or ferrying flights, and ends when the aircraft is parked after the last flight and there is no intention of further aircraft movement by the same flight crew member. A flight duty period includes the duties performed by the flight crewmember on behalf of Ameristar that occurs before a flight segment or between flight segments without an intervening required rest period." Further, according to Ameristar Air Cargo, duty time is different from FDP, and can included activities related to ground school, company errands, or activities that are company directed but not associated with a flight.

According to the Director of Quality Control/Assurance, Ameristar Air Cargo did not have procedures in place for notification of winds in excess of 75 mph. When asked who should be responsible for the inspection, he said it should be maintenance that would conduct the inspections. He said it would take a system to monitor the airplane and airport at all times to determine who would notify maintenance of the winds. He said the most reasonable people to monitor the winds would be flight control, and on the day of the accident, no one notified maintenance that the winds may have exceeded 75 mph.

According to the flight follower for the accident flight, when asked about the Boeing Bulletin for the 75-mph limitation requiring a visual and physical inspection of the elevator, he said he did not have knowledge of that bulletin prior to the accident, and did not know about it at the time he completed the paperwork for the flight. He did not know if it was the pilot's responsibility or mechanics to monitor the winds when the airplane was on the ground. He did not know if the pilots were responsible for the information contained in the maintenance manual, and said he did not monitor winds when the airplane was sitting on the ground.

The Ameristar Air Cargo GOM Section 1.2.6 Pilot-In Command and Section 1.2.7 First Officer listed the duties and responsibilities of Ameristar Air Cargo's flight crews, and did not include a procedure or responsibility to monitor what winds may have affected a particular airplane when they were not operating that airplane (i.e. during an overnight situation where the airplane would not fly).

The Ameristar Air Cargo Normal Checklist (DC-9 AOM Volume I, page 1.2-8) for the exterior preflight inspection of the elevators, stated the following:

> *Elevators and tabs . . . . Condition Good*

The Ameristar Air Cargo DC-9 AOM Volume I, Normal Checklists – Amplified, page 1.2-3, detailed the items that flight crews should check during the preflight inspection, and included the following in part:

> *Surfaces and Structures:*
> *Undamaged (pay particular attention to cargo doors and airplane skin areas adjacent to the cargo doors), no missing parts, windows, no fluid leakage, structural integrity, flight control surfaces clear.*

There was no procedure for the flight crew to conduct a physical inspection of the elevators.

14.1.1 Preflight Inspection Training

Ameristar Air Cargo pilots were trained (during initial and recurrent) on the pre-flight inspection of the MD-83. Pilots were also required to be evaluated on the preflight of the airplane, per 14 *CFR* 121.441. Appendix F to 14 *CFR* 121, Item I(b) stated the following in part:

> *Preflight inspection. The pilot must—*

(1) Conduct an actual visual inspection of the exterior and interior of the airplane, locating each item and explaining briefly the purpose for inspecting it; and
(2) Demonstrate the use of the prestart check list, appropriate control system checks, starting procedures, radio and electronic equipment checks, and the selection of proper navigation and communications radio facilities and frequencies prior to flight.

Except for flight checks required by §121.424(d)(1)(ii), an approved pictorial means that realistically portrays the location and detail of preflight inspection items and provides for the portrayal of abnormal conditions may be substituted for the preflight inspection.

Ameristar Air Cargo was approved per OpSpecs A005, exemption 4416Q, to utilize "Advanced Pictorial Preflight" for its training and checking. A review of the pictorial preflight inspection slides showed that for slide 14, depicting a review of the elevators, an accompanying description of the slide indicated that the check was for "condition good." [94]

Both accident pilots were evaluated on the preflight of the MD-80 on their most recent proficiency checks using the preflight pictorial, and both were graded as "satisfactory."[95]

14.2 Taxi Checklist

After completion of the After Start Checklist and receipt of the all-clear-for-taxi signal from the ground marshaller, pilots were directed to release the parking brake and begin taxiing. Flaps were not to be extended until clear of all objects by more than a horizontal distance of 10 feet. Upon departure and determining that the taxi path was clear, the captain would call for the anti-skid to be armed, flaps to be set, and direct the FO to run the Taxi Checklist. Both pilots were responsible for completing items on the Taxi Checklist.

The Taxi Checklist was found in the Ameristar Air Cargo DC-9 AOM Volume I, Normal Checklist, page 1.1-5.[96] The Taxi Checklist was run by the FO where the FO would challenge/respond to each checklist item except as noted on the checklist with a (B), and included the following items to be completed:

- *Flaps/Slats (B)* — *__, __, __ TO BLUE LT*
- *Flight controls/Elev Aug (B)* — *Checked*
- *APU* — *(Capt) ON/OFF*
- *Fuel Heat* — *OFF*
- *Takeoff Briefing (B)* — *COMPLETED*[97]

[94] For additional information, see Attachment 6 – MD-83 Preflight Pictorial (slide 14 excerpts).
[95] At the time of both accident pilot's most recent proficiency checks, exemption 4416Q was in effect and had an expiration date of March 31, 2017. The FAA extended the exemption in a March 15, 2017 letter to Airlines for America (which included Ameristar Air Cargo – FAA-2016-9142 by amendment), and exemption 4416R was added to the Ameristar Air Cargo OpSpecs A005 with an expiration date of March 31, 2020.
[96] See Attachment 7 – Ameristar MD-83 Checklists.
[97] According to the Ameristar Air Cargo DC-9 AOM, Volume I, page 1.2.31, for the Taxi Checklist, "on all legs, the Captain will give an abbreviated briefing concerning the takeoff and departure phase of the flight. This briefing must

Amplified descriptions of each action were included in the Ameristar Air Cargo DC-9 AOM, Volume I, Normal Checklists Amplified, page 1.2-30.[98] For the flight control and elevator augmentation checklist included the following amplified description on page 1.2-31:

> *Control column to the full aft position while noting that the ELEVATOR POWER ON Light is off and then pushing the control column full forward while noting that the Blue ELEVATOR POWER ON Annunciator Light illuminates indicating the elevator augmentation system is working. While still holding the control column full left and noting hydraulic.*
>
> *Aileron/Spoiler Operational Check: The First Officer will check elevators by noting fluctuations on both hydraulic pressure indicators. Observe illumination of the Amber SPOILER DEPLOYED Annunciator Light in relation to spoiler panel extension. The last check is to note that the ELEVATOR POWER ON light goes out after releasing the control column. The Captain will perform the rudder check, keeping a firm hold on the nose steering wheel to prevent nosewheel deflections.*

Photo 2: Overhead annunciator indications with control column full forward. "Elevator Pwr On" light indicated by arrow.[99]

consist of at least the initial heading, altitude and who's flying the aircraft (See SOPA for details)". According to the Ameristar Air Cargo DC-9 AOM, Volume I, page 3-9, a list of 15 briefing items were provided for the captain to brief the FO with prior to reading the Before Start Checklist. Item 10 of the takeoff briefing included the following language: "In the event of an engine fire/failure or any other significant malfunction which will render the a/c unable to fly prior to V_1, I will reject the T/O. Note the speed at point of rejection, state normal landing callouts and advise tower/center of reject."

[98] See Attachment 14 – Taxi Checklist (AOM excerpts).

[99] Photo was taken on April 11, 2017 during MD-83 simulator testing at the American Airlines training facility in

According to the crew interviews, the Check Airman, as pilot monitoring in the right seat, conducted the flight control check. When he moved the yolk forward, he saw the blue elevator power light to ensure they had additional pressure for stall recovery, which was the elevator augmentation check. He stated that the control tabs should be the only thing moving when you move the yolk forward, and that the elevators would not physically move during the check. The Check Airman, who performed the flight control check prior to takeoff, did not recall feeling anything different on the check. He also brought the yolk back, and did not recall ever feeling anything unusual.

14.2.1 Boeing Taxi Expanded Procedures

The Boeing MD-80 Flight Crew Operations Manual (FCOM), dated October 15, 2009, also included supplemental language for specific taxi procedures. The taxi expanded procedures covering the flaps and slats, on page Chkl.60.1, stated the following in part:

> *Operate control wheel, column, and rudder pedals throughout full range of travel. Determine if controls are free and normal.*
>
> *Observe SPOILER DEPLOYED annunciation is on as control wheel is rotated. When control column is full forward, observe ELEVATOR PWR ON light illuminates.*
>
> *NOTES: flight spoiler surfaces will start to extend only after approximately 5 degrees control wheel throw.*
>
> *During ground operations, when any spoiler panel is extended 10 degrees of more, SPOILER DEPLOYED annunciation will be on.*
>
> *Occasionally, in gusty, quartering, or tail winds, elevators and their column tabs may assume an asymmetric position full against their mechanical stops. If this occurs, control columns will feel blocked and an elevator rollout cannot be performed. This condition is not abnormal, but will require that rollout be delayed until direction or velocity of airplane with respect to wind is changed.*
>
> *After heading airplane into the wind (or taxiing fast enough to cancel any tail wind component), apply pull force to control column until it moves to a full aft position. Forces required may be as high as 85 pounds. Determine ELEVATOR PWR ON light is extinguished, then apply full nose down force to activate elevator augmentation system. ELEVATOR PWR ON light should illuminate during this part check.*

14.3 Before Takeoff Checklist

The Before Takeoff Checklist was found in the Ameristar Air Cargo DC-9 AOM, Volume I, Normal Checklist, page 1.1-5, and was to be accomplished "to the line" as the aircraft approached

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Dallas, Texas. See Attachment 11 – YIP Simulator Test Plan.

number one for takeoff.[100] The Before Takeoff Checklist was run by the FO where the FO would challenge/respond to each checklist item except as noted on the checklist with a (B), and included the following (to the line) items:

Flaps/Slats (B)	*___,___,___ TO BLUE LT*
V-Speeds (B)	*___, __,___ RECHKD*
Stab Trim (B)	*___ SET*[101]
Annunciators	*CHECKED*
Flight Attendants	*SEATED*

Once takeoff clearance was received, the crew would complete the Before Takeoff Checklist items (below the line), which included the following items:

Departure Runway (B)	*CONFIRMED*
Ignition	*ON*
Radar/EGPWS (Terrain Display)	*ON*
Transponder	*TA/RA*
Landing Lights	*ON*
Runway Alignment (B)	*Checked*[102]

14.4 Normal Takeoff Procedure

The normal MD-80 Takeoff Procedure was defined in the Ameristar Air Cargo DC-9 AOM, Volume I, Standard Operating Procedures, page 3-22. After accomplishing the Before Takeoff Checklist (below the line) items and when the airplane was aligned with the runway and rolling, the PF would advance the throttles to 1.4 EPR or 80% N2, which was about when the throttles were in the vertical position. The PF would check the engine instruments for reasonable indications, then press TOGA (if not previously selected) and call for the PM to engage the autothrottle. The PF would then smoothly advance the thrust levers to achieve takeoff thrust by 60 knots. He would then call "Set Takeoff Thrust," and the PM would check EPR, N1 and autothrottle FMA (flight mode annunciator) mode, adjusting thrust as necessary.

For takeoffs with the autothrust engaged, the pilots would verify that clamp (CLMP – Computer Limited Manual Power) mode was engaged by 60 knots. The autothrust system CLMP mode engaged on takeoff when the Central Air Data Computer (CADC) sensed 60 knots airspeed.[103]

[100] See Attachment 7 – Ameristar MD-83 Checklists.
[101] The captain would momentarily advance the throttles to a vertical position and insure no takeoff warning was heard. According to the Ameristar Air Cargo DC-9 AOM, Volume II, Flight Controls, page 27.83-4, when both throttles were advanced for takeoff, and an intermittent audible warning signal and voice warning would activate for the following conditions: stabilizer setting does not agree with the Takeoff Condition Long Trim Readout; Flap/Slat handle (after being positioned to the T.O. flap setting) does not agree with the value in the Takeoff Condition computer Flap Readout; Slats are not mid-sealed or fully extended; spoiler lever is not full forward; parking brake is set.
[102] After aligning the aircraft on the departure runway, each pilot was required to compare the runway's heading to their individual HSI (horizontal situation indicator) for agreement. Each pilot was also required to indicate confirmation of the assigned runway.
[103] According to the Ameristar Air Cargo DC-9 AOM, Volume 1, Standard Operating Procedures – Amplified, page 3-23, if a rolling takeoff was made, and/or if the takeoff was made into a significant headwind, 60 knots may be achieved before the autothrust system could properly set takeoff EPR.

During CLMP mode, power was removed from the autothrottle servo, and the throttles would remain stationary.[104]

According to the Check Airman, they set normal thrust for takeoff, takeoff was selected on the TRI panel, flight directors were both in view, and TO/TO/Altitude (3,000 feet) were armed on the FMA. They were aligned with runway and agreed with their heading. The thrust was initially set to about 1.4 EPR, and the auto throttles were then turned on. He made sure the thrust was set as indicated on EPR panel and per the reference bugs, and the thrust came up and they had the correct EPR annunciation.

As the airplane began the takeoff roll, both pilots were required to monitor the flight and engine instruments, and monitor for caution and warning indications. According to Ameristar Air Cargo SOPs, the pilot making the takeoff would initially advance the throttles to 1.4 EPR, and the captain would then keep his right hand on the thrust levers until the V_1 speed was reached. According to the Ameristar Air Cargo DC-9 AOM, Volume I, Standard Maneuvers and Configurations, page 4-35, the Captain kept his right hand on the thrust levers so he could "respond quickly to a decision to reject the takeoff regardless of who is performing the takeoff. The decision to continue or reject the takeoff will always be made by the captain."

During the takeoff roll, the PM would call "80 knots" followed by "V_1" and "Rotate" when the airplane reached V_R speed. At V_R, the PF would rotate the airplane about 3 degrees per second to an initial takeoff attitude of approximately 8 degrees nose up.

According to a Boeing engineer, the MD-80 would rotate to a lift-off attitude or approximately 8 degrees in 2.5 seconds until reaching the required takeoff pitch attitude to attain V_2 or V_2+10 within an additional 2.5 to 3.5 seconds. Typically, an attitude of 16-20 degrees was used for the initial climb. The required control column deflection depended strongly on CG position. As a rule of thumb estimate, takeoff control column deflection was around 2-8 degrees aft, though a push may be required after liftoff.[105]

As the airplane became airborne, the rotation would continue to obtain at least a speed of V_2+10 knots minimum during the initial climb. The maximum pitch during the initial climb was 20 degrees. A tailstrike would occur on the MD-80 at 10.5 degrees nose up attitude with the main gear on the ground.

According to the Captain, he had initial aileron input to the right to account for the right crosswind during the takeoff roll, which he rolled out prior to rotation. Both pilots indicated that the callouts, indications and directional control of the airplane were normal during the takeoff roll, and at the "Rotate" callout from the PM, the Captain removed his right hand from the thrust levers and attempted to rotate the airplane.

[104] Source: Ameristar Air Cargo DC-9 AOM, Volume II, System 22 Autoflight, page 22.83-11.
[105] Source: Email from Boeing to the NTSB, dated March 21, 2017 at 1527

14.5 Rejected Takeoff

According to the Captain, after removing his hands from the thrust levers at the "Rotate" call, he began a normal rotation of the airplane. When the airplane did not rotate initially, the captain applied more back pressure until the control column was "half past his thighs," not quite to the physical stop of aft movement, but "further back than for a normal rotation."[106] He stated that the "yolk felt heavy, like there was a stack of bricks on the nose of the airplane since it was not coming off the ground." According to interviews, the Captain made a statement to the Check Airman in the right seat that "this thing is not flying" and called for a reject of the takeoff.[107] During the initial stages of the rejected takeoff, the captain also never felt the nosewheel come down to the runway. According to both pilots, they applied maximum braking of the airplane following the rejected takeoff, but the aircraft exited the end of the runway.

General guidance and rejected takeoff procedures were defined in the Ameristar Air Cargo DC-9 AOM, Volume I, Standard Maneuvers and Configurations. Page 4-35 provided the following general guidance:

> *At high speeds (at or near V_1), consideration should be given to the effect of a high-energy reject. Experience has shown that, in many cases, rejected takeoffs at high speed have had far more negative or catastrophic results than would have been likely if the takeoffs had been continued. This is especially true when the aircraft is operating from shorter runways where the accelerate-stop parameters are marginal. In general, if the aircraft's flying performance has not been affected (such as in a tire failure), the safer course of action may be to continue the takeoff and then land under a controlled condition at a lighter weight and slower speed.*
>
> *Therefore, as a consideration, a rejected takeoff above 100 knots should be made only for safety of flight items such as the occurrence of an engine failure or a condition where there is serious doubt that the airplane can safely fly.*[108]

According to the Captain's interview, during the rejected takeoff, he brought the throttles to idle, initiated reverse thrust, applied braking, and then deployed the spoiler handle. Specific rejected takeoff procedures for the MD-80 were defined in the Ameristar Air Cargo DC-9 AOM, Volume I, Standard Maneuvers and Configurations, page 4-35. The procedure called for the following:

- *Disconnect Autothrottles.*
- *Retard the throttle levers to idle.*

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[106] See Attachment 1 – Interview Summaries.

[107] See Attachment 1 – Interview Summaries.

[108] In 1989, in reaction to a number of takeoff accidents resulting from improper rejected takeoff decisions and procedures, a joint FAA/industry taskforce studied what actions might be taken to increase takeoff safety. Airframe manufacturers, airlines, pilot groups, and regulatory agencies developed a training resource dedicated to reducing the number of rejected takeoff (RTO) accidents. This resource was announced via FAA AC 120-62 on September 2, 1994, and subsequently published by the FAA (Source: FAA). Section 2 of the Pilot Guide to Takeoff Safety (updated in 2004), page 2.11, stated "It is therefore recommended that pilots consider V_1 to be a limit speed: Do not attempt an RTO once the airplane has passed V_1 unless the pilot has reason to conclude the airplane is unsafe or unable to fly. This recommendation should prevail no matter what runway length appears to remain after V_1." Source: FAA.

- *Manually deploy the spoilers, simultaneously apply maximum wheel braking*
- *Apply reverse thrust.*
- *The F/O should advise ATC.*
- *Clear the runway, if practical, and notify the tower. This is especially important during low visibility conditions. Clearance of the runway is assured when the aircraft is parallel to the runway exited from.*
- *Take the necessary steps to assure the safety of passengers, crew and the aircraft.*
- *Consider and [sp] Emergency Evacuation*
- *Make PA [public address] to passengers:*
    - *If evacuation is not warranted, advise the flight attendants"*
        - *"FLIGHT ATTENDANTS REMAIN SEATED" announce three (3) times.*
    - *If an evacuation of the aircraft is necessary and after the aircraft comes to a stop, complete the Evacuation Checklist and use the evacuation commands:*
        - *"EVACUATE, EVACUATE, EVACUATE" announce three (3) times*
- *Call for the After Landing Checklist.*
- *Do not set the parking brake unless and [sp] evacuation of the aircraft has been ordered*
- *Taxi to a brake cooling area and install nose wheel chocks. Call for wheel chocks if the aircraft cannot be moved.*

According to Ameristar Air Cargo DC-9 AOM, Volume I, Standard Operating Procedures – Amplified, page 3-39, normal landing callouts were to be made following a rejected takeoff. This included the PM calling "SPOILERS DEPLOYED" or "NO SPOILERS", "TWO LIGHTS" when the reverse unlock lights illuminated, "FOUR LIGHTS" when the reverse thrust lights illuminated, "EIGHTY KNOTS," and "SIXTY KNOTS." Ameristar Air Cargo SOPs also requried any transfer of aircraft control to be accompanied by "I HAVE THE AIRCRAFT" followed by "YOU HAVE THE AIRCRAFT."

Rejected Takeoff Considerations were defined in the Ameristar Air Cargo DC-9 AOM, Volume I, Standard Maneuvers and Configurations, page 5-1-6, and included the following:

> ***The Go/No-Go Decision***
> *Every takeoff has the potential for a rejected takeoff (RT). An RTO close to V_1 must use maximum deceleration to stop on the remaining runway. The most critical condition is an engine failure close to V_1 at a weight near the Runway Limited Takeoff Weight.*
>
> ***Factors Affecting Go/No-Go Decisions***
> *The decision to continue or reject a takeoff rests solely with the Captain. The RTO decision must be made, and appropriate procedures initiated, before reaching V_1 so that deceleration begins at or before V_1. Stopping ability is directly dependent on the kinetic energy which increases as a square of the ground speed. A change in speed has a greater impact on kinetic energy that a proportional change in weight. A 10% increase in speed*

increases kinetic energy by approximately 21%, while a 10% increase in takeoff weight only increase (sp) kinetic energy by 10%.

Page 5-1-7 of the same section of the AOM, Volume I, stated the following in part:

V_1

V_1 is the end of the Go/No-Go decision process, not the beginning.

- *If brakes have not been applied by V_1, the go decision has been made by default.*
- *If an engine failure is recognized and maximum braking applied no later than V_1, an RTO can be accomplished on the remaining runway.*
- *If an engine failure is recognized at or after V_1, the takeoff can be continued with a climb to 35 feet before reaching the end of the runway.*

Consequences of an early or late go/no-go decision were outlined in the Ameristar Air Cargo DC-9 AOM, Volume I, Performance, page 5-1-8, and stated the following in part:

Consequences of an Early or Late go/No-Go Decision

When takeoff weight is at or near the runway limited takeoff weight (due to field length, not obstacle clearance), the balanced field length approaches the available runway. In this scenario:

- *An RTO past V_1 (late decision) results in the aircraft unable to stop on the remaining runway. Delaying an RTO 4 to 6 knots beyond V_1 (approximately 1 second) may cause the aircraft to leave the end of the runway at approximately 70 knots or more. The shaded area shows that anything less than maximum deceleration significantly increase that speed.*
- *Conversely, an engine failure prior to V_1, coupled with a decision to continue the takeoff (early decision), results in less that 35 feet clearance at the end of the runway.*

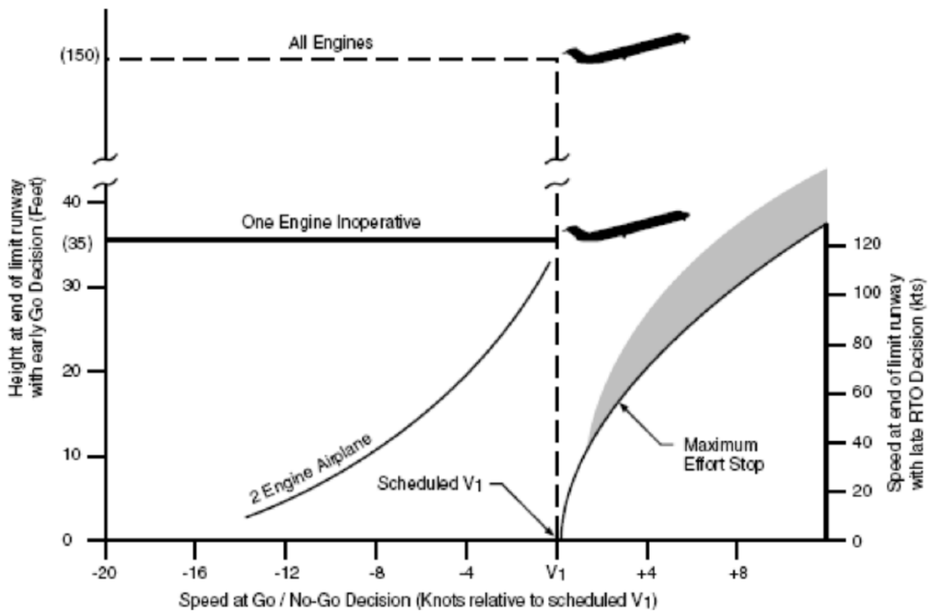

Figure 12: Speed at Go/No-Go Decision (Knots relative to scheduled V_1).[109]

14.5.1 Boeing Rejected Takeoff Guidance

Manufacturer recommended guidance for rejected takeoffs in the MD-80 was found in the Boeing MD-80 Flight Crew Operations Manual (FCOM), Procedures & Techniques – Takeoff, pages PT.20.14 through PT20.16, and included the following language in part:

> *The Captain has the sole responsibility for the decision to reject the takeoff. The rejected takeoff maneuver must be initiated no later than V_1. The takeoff should be rejected for any of the following reasons:*
>
> - *Captain considers the airplane unsafe or unable to fly.*
> - *Fire or fire warning.*
> - *Master Caution light illuminates.*
> - *Master warning light illuminates.*
> - *Engine failure.*
> - *Predictive windshear warning.*
>
> *Rejecting the takeoff after V_1 is not recommended unless the Captain judges the airplane to be incapable of flight.*

15.0 Rejected Takeoff Training

Ameristar Air Cargo MD-80 pilots were trained at the American Airlines Training Center in Ft. Worth, Texas. Ameristar used their own instructors and check airmen to conduct training and

[109] Source: Ameristar Air Cargo DC-9 AOM, Volume I, Performance, page 5-1-8.

evaluations. MD-80 simulator training was conducted in an American Airlines Level C simulator.[110]

The Ameristar Air Cargo training program was outlined in the Flight Crewmember Training Program (dated December 1, 2016), and was designed to fulfill the requirements set forth in 14 *CFR* 121 Subpart N and Subpart O, and Appendices E, F, & H. Rejected takeoff training was included in the initial and recurrent training programs. According to the Check Airman/Instructor Guide, page 37, rejected takeoff training was accomplished "during a normal takeoff run after reaching a reasonable speed determined by giving due consideration to aircraft characteristics, runway length, surface conditions, wind direction and velocity, brake heat energy, and any other pertinent factors that may adversely affect safety or the airplane." According to interviews and a review of the company training documents, Ameristar Air Cargo did not train MD-80 pilots on rejected takeoffs past a speed of V_1.

According to Ameristar Air Cargo Flight Crewmember Proficiency Check and Training Validation form, the Captain performed a rejected takeoff and was graded "satisfactory" during his most recent proficiency check.

According to Ameristar Air Cargo Flight Crewmember Proficiency Check and Training Validation form, the Check Airman performed a rejected takeoff and was graded "satisfactory" during his most recent proficiency check. An Aviation Safety Inspector (ASI) from the FAA's DFW (Dallas/Ft. Worth) Certificate Management Office (CMO) was an observer in the simulator for the Check Airman's proficiency check.

16.0 Emergency Evacuation

Following the rejected takeoff and overrun of the runway, the flight crew elected to evacuate the airplane. The Ameristar Air Cargo GOM, Chapter 7, page 7, stated the following in part:

> *It is the responsibility of the PIC to determine the requirement for and order evacuation of the aircraft. If the PIC is incapacitated, this responsibility will follow the chain of command to other flight crewmembers.*

The evacuation checklist was found on two emergency checklist cards installed in the cockpit of the MD-80. When the Captain decided to evacuate the airplane, the flight crew were trained to initiate the red-bordered Emergency Evacuation checklist, and command the evacuation once directed by the checklist by using the PA and announcing "Evacuate" 3 times. The checklist was then to be accomplished to completion to secure the airplane.[111]

[110] See Attachment 11 – YIP Simulator Test Plan.

[111] According to the Ameristar Air Cargo MD-83 COM, page 2-3, "In all cases, the red-bordered checklist and the Cockpit Operating Manual are to be used as the primary references for emergency or abnormal conditions." Page 2-6 of the COM stated "when an emergency occurs that is referenced in the red-bordered checklist, the applicable checklist should be read first. If there is no step directing the PM to the Cockpit Operating Manual, the procedure in the COM can be assumed to be identical to the red-bordered checklist and the COM does not have to be referenced."

EMERGENCY EVACUATION	
Tower (time permitting)	CALL
Parking Brakes	SET
SPD BRK / SPOILER Lever	RETRACTED
Flaps	28°
Fuel Levers	OFF
EMER PWR Selector	ON
Command Evacuation	EVACUATE (3) TIMES
EMER LTS Switch	ON
Engine Fire Handles	PULL
Fire Bottles (if required)	DISCHARGE
APU FIRE CONT Switch (if APU operating)	OFF & AGENT ARM
Cockpit Voice Recorder C-B (Upper EPC F6)	PULL
See COM 6-18	

Figure 13: Ameristar Air Cargo MD-80 Emergency Evacuation Checklist.[112]

According to the Ameristar Air Cargo GOM, Chapter 6, page 28, flight attendants were directed to wait for evacuation command from the flight deck over the PA: "Evacuate, Evacuate, Evacuate." If a signal was not given and there was no response from flight deck, the flight Attendants were directed to initiate the evacuation if necessary.

The Ameristar Charters Flight Attendant Manual, Emergency Procedures, page 12-3 provided the following guidance to Flight Attendants in part:

> ***Evacuation Criteria***
> *Whether planned or unplanned, the decision to do an emergency evacuation must be made by a crewmember. The following must be taken into consideration:*
>
> 1. ***Necessity of evacuation*** *– Is it in the best interests of the passengers to get out of the aircraft? Injuries often result while passengers are evacuating. If the aircraft is still intact and the emergency is under control, evacuation may not be necessary. This situation may occur in an aborted takeoff or runway excursion.*
> 2. ***Best way to evacuate*** *– This decision will be made by the FA's in most cases. They will command the passengers to proceed to the nearest and most accessible exit.*
> 3. ***Who will decide*** *– Preferably the Captain decides if an evacuation is necessary. However, the decision will rest upon the FA's should a signal form the flight deck not be received. Normally the Captain decides in a planned emergency, while the decision rests on the FA's in an unplanned emergency.*[113]

[112] Source: Ameristar Air Cargo. See Attachment 7 – Ameristar MD-83 Checklists.

[113] According to the Ameristar Air Cargo GOM, Chapter 6, page 27, "a planned emergency is considered when you have 10 minutes or more to plan. An unplanned emergency is when there is 10 minutes or less to prepare."

According to the Ameristar Air Cargo GOM, Chapter 7, page 18, when the evacuation had been completed, the Captain should direct whatever activities are necessary concerning the general welfare of the crew.

The Ameristar Air Cargo MD-83 COM, page 6-18 through 6-20 provided additional duties for the flight crewmembers during the evacuation. In general, following completion of the Evacuation Checklist, the Captain was to remain on the airplane and assist in the cabin as necessary, ensuring all passengers had evacuated, and the FO was to exit and assist outside the airplane as necessary.

F. LIST OF ATTACHMENTS

Attachment 1 - Interview Summaries
Attachment 2 - Witness Statements
Attachment 3 - Flight Release Paperwork
Attachment 4 - Pilot Information
Attachment 5 - Weight and Balance Documents
Attachment 6 – MD-83 Preflight Pictorial (Slide 14 excerpts)
Attachment 7 - Ameristar Checklists
Attachment 8 - YIP Runway 23L Performance Analysis
Attachment 9 - Boeing Flight Operations Bulletin
Attachment 10 - FAA Response 17-125
Attachment 11 - YIP Simulator Test Plan
Attachment 12 - Ameristar Windshear Avoidance (AOM excerpts)
Attachment 13 - Ameristar RTO Procedures (AOM excerpts)
Attachment 14 - Taxi Checklist (AOM excerpts)
Attachment 15 - Party Forms

Submitted by:

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David Lawrence
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