NATIONAL TRANSPORTATION SAFETY BOARD

Office of Aviation Safety
Washington, D.C. 20594

April 27, 2022

SURVIVAL FACTORS

Group Chairman's Factual Report

I. ACCIDENT DCA22MA009

Operator: 987 Investments, LLC
Location: Brookshire, TX
Date: October 19, 2021
Time: 1000[1] central daylight time (CDT)
Airplane: DC-9-87 [N987AK]

II. SURVIVAL FACTORS GROUP

Group Chairman : Amanda Taylor
National Transportation Safety Board
Washington, DC

Member : Emily Gibson
National Transportation Safety Board
Washington, DC

Member : Angela Cruz
The Boeing Company
Seattle, WA

III. SUMMARY

On October 19, 2021, about 1000 CDT, a Boeing MD-87, N987AK, operated by 987 Investments LLC, overran the departure end of runway 36 at Houston Executive Airport (TME), Brookshire, Texas, after the crew executed a rejected takeoff. Of the 23 passengers and crew onboard the airplane, two passengers received serious injuries and one received minor injuries. A

[1] All times herein are local and based on the 24-hour clock.

post-crash fire ensued, and the airplane was destroyed. The airplane was operating as a 14 Code of Federal Regulation Part 91 flight from TME to Laurence G. Hanscom Field Airport (BED), Bedford, Massachusetts.

IV. DETAILS OF THE INVESTIGATION

A survival factors group was formed on October 20, 2021. Documentation of the wreckage was accomplished, and interviews were conducted with first responders, passengers, airport personnel, and witnesses.

1.0 Airplane Configuration and Occupant Seating[2]

The airplane was a McDonnell Douglas DC-9-87 originally delivered with a commercial layout interior. In October 2008, it was reconfigured with supplemental type certificate (STC[3]) ST10611SC, to a 19 passenger "VIP configuration" by Phazar Aerocorp. The limitation with this STC included a maximum of 19 passengers and 4 qualified crew members. The airplane was equipped with 5 emergency exits. These include three floor-level door exits (Type I exits 1L and 1R in the forward cabin, and a Type A exit in the aft tailcone); and two overwing Type III exits (see figure 1).

The airplane cabin was equipped with 19 occupiable passenger seats. These included the following: Two forward facing crew rest seats (positions 1, 2) were in separate office configurations with a reclining seat, workstation and included a sliding door. There were two forward facing mid cabin seats (positions 4, 9), two aft facing mid cabin seats (positions 3, 8), and nine side facing divan seats (positions 5-7, 10-15). There was a four-person table with two aft facing club seats (positions 16, 18) and two forward facing club seats (positions 17, 19). In the aft section of the cabin was a state room including a single seat (position 20), which was not to be occupied during taxi, takeoff, or landing per the STC limitations. The airplane cabin was equipped with one double occupancy aft facing retractable flight attendant jumpseat adjacent to the forward exit. The cockpit contained a pilot, copilot, and a retractable observer's seat.

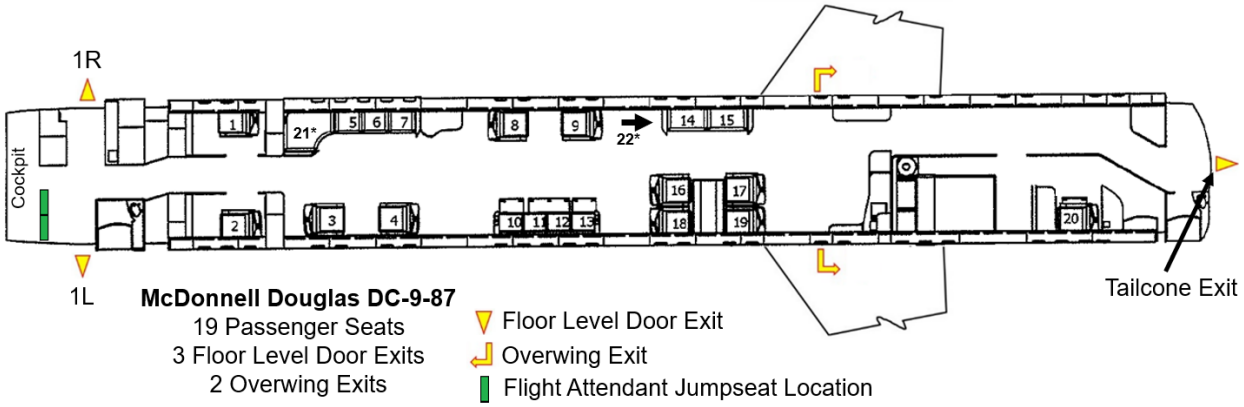

Figure 1. Cabin configuration of N987AK with occupant and exit locations.

[2] Additional seating locations are noted with an asterisk in figure 1.

[3] A supplemental type certificate (STC) is a certificate issued when an applicant has received FAA approval to modify an aeronautical product from its original design.

Twenty-three occupants were onboard the flight. There were two pilots in the cockpit, a flight mechanic in seat 1, the airplane owner in seat 2 and 19 passengers[4]. The flight attendant and the cockpit jumpseats were unoccupied. During passenger interviews, multiple passengers reported that two additional seating locations with seatbelts, not identified on the STC, were used by passengers on the flight (locations are identified with asterisks on figure 1). Seat 21* was an aft facing seat located on the forward four-person couch, and 22* was the forward most position located on the aft right side facing couch. Additionally, through passenger interviews all seats were described as having a lift latch, lapbelt assembly. On scene documentation to corroborate this was not possible due to the post-crash fire.

2.0 Emergency Equipment

The emergency equipment was consumed by the post-crash fire and on-scene documentation was not possible. Based on information contained in the STC the airplane was equipped with a portable oxygen bottle with two masks, a first aid kit, smoke hood, three life vests, and a fire extinguisher in the cockpit. In the airplane cabin, the forward right hand closet, aft of door 1R, held a portable oxygen bottle, first aid kit, two fire extinguishers, and a flashlight. The aft right-hand closet, located next to the tailcone exit, held a portable oxygen bottle, first aid kit, fire extinguisher, and a flashlight. This airplane had three fire extinguishers through the cabin area one aft of the left-hand four-person couch, one in the life raft cabinet just aft of the right overwing exit, and one in the state room. There were two life rafts located in cabinets just aft of the overwing exits. There was a life vest for each seat location and two additional life vests in the state room.

Photograph 1. Pre-accident, aft-facing view of the cabin taken near seat 3.

[4] When asked the airplane owner considered himself crew.

Photograph 2. Pre-accident, forward-facing view of the cabin taken near the right overwing exit.

Photograph 3. Pre-accident view of the right crew rest seat taken from the aisle.

Photograph 4. Pre-accident view of the left overwing exit and bar taken near seat 17.

3.0 Airplane Documentation

The survival factors group documented the wreckage site on October 20, 2021. The airplane was mostly consumed by post-crash fire (see photograph 5).

Photograph 5. N987AK after the post-crash fire was extinguished.

3.1 Airplane Doors and Evacuation Slides

The airplane was equipped with two forward exits (1L and 1R), two overwing exits, and a tailcone exit. Door 1L, door 1R and the tailcone were equipped with evacuation slides. The overwing exits were not equipped with slides.

3.1.1 Door 1L and Evacuation Slide

Door 1L was damaged by fire. The door was on the ground with the door hinge attached to the deformed door frame. The door and associated door handle were in the open position. A portion of evacuation slide was found under the exit door (see photograph 6). The slide material was under the door and the slide aspirator and pressure cylinder were found under the deformed doorsill.

Photograph 6. N987AK door 1L and evacuation slide.

3.1.2 Door 1R and Evacuation Slide

Door 1R and the surrounding fuselage structure was damaged by fire. The lower portion of the door and door frame indicated the door was in the closed position. The door 1R evacuation slide was destroyed by fire (see photograph 7).

Photograph 7. N987AK door 1R.

3.1.3 Overwing Exits

The two type III overwing exits were destroyed by fire. No portion of the exit hatches were identified in the wreckage. The overwing exits were not equipped with evacuation slides.

3.1.4 Tailcone Emergency Exit

The tailcone exit and the passageway leading to the tailcone exit were destroyed by fire. The tailcone slide appeared intact and undamaged but was not accessed due to on-site safety concerns (see photograph 8 and 9).

Photograph 8. N987AK tailcone exit.

Photograph 9. N987AK tailcone slide still in packaging.

4.0 Airport Information

Houston Executive Airport (TME) located about 28 miles east of Houston, Texas at an elevation of 165.9 feet. The airport was served by one runway (18/36) and an ATC tower. Two

cameras located on the canopy structure adjacent to the terminal captured part of the taxi and the beginning of the takeoff roll. The video did not show the crash.

4.1 Runway 36 Information

The accident flight departed on runway 36. Runway 36 was 6,610 feet long and 100 ft wide. It was asphalt, and in good condition with an elevation of 163 feet. The runway had non precision markings in good condition and runway end identifier lights. The runway safety area extended 600 feet off the end of the runway to the airport fence line and was 250 feet from the centerline on either side.

4.2 Airport Operation

TME was a privately owned airport and not required to hold an operating certificate issued by the FAA as outlined in 14 CFR Part 139. However, TME had implemented some of the Part 139 requirements. The airport conducted daily inspections, implemented a wildlife hazard program, conducted training, and maintained logs and records. There was no aircraft rescue and firefighting on airport property, however, TME had established procedures for emergency alerts in the event of aircraft incident or accidents. These were described in the airport's emergency response plan provided by the executive director.

5.0 Accident Summary[5]

The passengers, who were all personal friends and business colleagues of the airplane owner, arrived at the airplane about 30 minutes before the flight. Once on the airplane they received a briefing from the owner on the use of seatbelts, the location of the lavatories and emergency exits, and a description of the length of flight[6]. After the owner completed the briefing, he checked the passengers to ensure they were seated, and that their seatbelts were buckled. He then sat in seat 2. The flight mechanic closed and armed door 1L, notified the flight crew of door closure, then took a seat in seat 1.

The passengers described the boarding and initial taxi as normal based on their previous experiences. The airplane was equipped with a camera that allowed a view forward of the airplane to be displayed on screens in the cabin. The passengers described takeoff as sounding and feeling normal, however it lasted longer than they thought it should. They felt the nose wheel come off the ground, but then it came back down followed by strong braking action.

Passengers initially assumed they would taxi back to the terminal area; however, as they saw the pavement end and grass and dirt on the video screens they knew something was not right; and some described it as feeling rough before experiencing a very hard bump. They felt like they

[5] Passenger and witness interviews were conducted by members of the survival factors group. Summaries produced from the interviews and written statements from some passengers are included in attachments 1 and 2, respectively. Summaries produced from the interviews and additional written statements from witnesses are included in attachments 5 and 6, respectively. The information obtained was used to create this narrative.

[6] 14 CFR § 91.519 "Passenger briefing," details what must be briefed to all passengers. The pilot in command, or a member of the crew, was required to conduct this briefing orally. The briefing had to consist of: smoking, the use of safety belts, location and means for opening the passenger entry door and emergency exits, ditching procedures for flights over water, and use of oxygen equipment.

were coming to a stop but also felt the airplane rotating. As the airplane was decelerating passengers 10 and 11 were thrown to the forward part of the cabin. They had removed their seatbelts after the cabin check had been completed but prior to takeoff. Passengers saw sparks outside the airplane through the windows. Several passengers described seeing the left engine on fire while the airplane was coming to a stop in the field.

After the airplane came to a stop, shouts were heard signaling there was a fire and to get out. The flight mechanic had unbuckled his lapbelt during the accident sequence to evacuate "as fast as he could." Once the airplane stopped, he ran to door 1L and saw flames outside the door window, so he did not open it. He then ran to door 1R to assess. Simultaneously, passenger 3 went to door 1L, opened the door, and did not wait for the slide to inflate. He jumped out immediately. He felt a sharp pain in his ankle but was able to run away from the airplane. The flight mechanic saw passenger 3 jump out. He moved back to door 1L and "kicked the girt bar" to help the slide inflate "faster." Passengers 4, 5, and 21* evacuated from door 1L followed by the flight mechanic. Once outside, the flight mechanic assisted others as they came off the slide.

After the airplane stopped, passenger 10 (who had removed his seatbelt during taxi and was thrown forward during the accident sequence) went back to assist his father who was sitting in seat 13. Passenger 7 was an older gentleman who had difficulty evacuating due to an injury. Other passengers assisted him and his wife, passenger 6, out of door 1L, down the slide and off into the field.

Passenger 17, who was seated at a four-person table, opened the left overwing exit. There were flames outside so she attempted to close it with help from passenger 16 but was unable to. Passenger 17 ran forward and evacuated through door 1L. After failing to close the left overwing exit, passenger 16 moved to the right overwing exit and opened it. Passenger 16 and passenger 19 evacuated through the right overwing exit. Passengers 14 and 15 attempted to evacuate through the tailcone exit. However, when they opened the interior door that led to the tailcone ramp they observed smoke. They closed the door and went forward evacuating through door 1L.

The airplane owner walked through the cabin quickly to determine if all passengers had evacuated and then exited through door 1L, prior to the flight crew. Both flight crew exited out of door 1L. All passengers except 16 and 19 exited out door 1L.

The evacuation slide at door 1L was described as fully inflated at the beginning of the evacuation; however, later passengers described it as being less inflated (see photograph 10). After evacuating, passengers walked toward a road. Passenger 7 was unable to walk due to back pain and several passengers helped to move him away from the airplane. Emergency responders met passengers and put passenger 7 on a backboard and several passengers helped carry him to where emergency vehicles were located.

Photograph 10. Passenger photograph of N987AK showing door 1L and slide at 1001 CDT[7], after evacuation.

Because the airplane was one of the largest airplanes to operate at TME, there were many witnesses who observed the airplane takeoff. They described the airplane taxiing to the runway via taxiway Charlie and Alpha. They heard the engines spool up as the airplane moved into position for takeoff and reported that everything looked normal. The airport director stated he did not see "the nose come up" as expected as the airplane approached the end of the runway. There was a maintenance worker in the field adjacent to the runway that observed the flaps down, and the nose gear approximately two feet off the ground. He stated the airplane was traveling at "full speed" and he observed the thrust reversers deploy and a puff of smoke from hard braking. He lost sight of the airplane as it rolled off the end of the runway, over a ditch, past a tree line and across Morton Road. Moments later he saw a fireball and smoke.

Upon seeing the fireball, the airport director ran into the terminal yelling for someone to call 911. He grabbed a radio and got in his company truck with a mechanic. While making his way toward taxiway Alpha, he picked up the maintenance worker in the field and drove down taxiway onto the grass past the runway, stopping at a deep ditch that was the airport's border along Morton Road. When they arrived, there were about 10 or 11 passengers outside the airplane. The director and mechanics crossed the ditch on foot to the main gate of a privately owned pasture, directly north of the airport. The main gate to the pasture, west of where the airplane came to rest, was locked (see figure 2). They tried several combinations with no luck as the lock was frozen, then a road grader, who had been working on Morton Road, arrived and forced the gate open.

[7] Time was obtained from metadata extracted from the digital photograph.

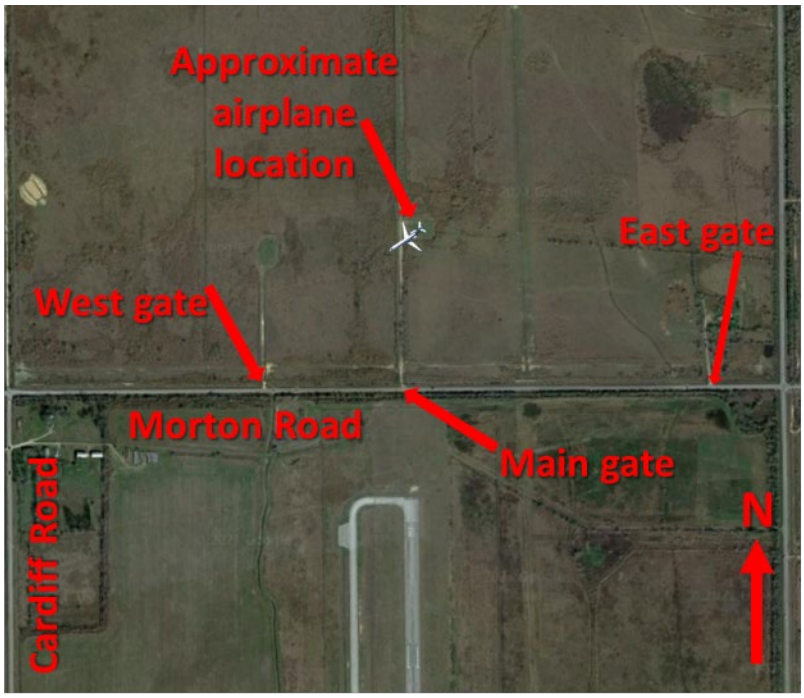

Figure 2. Diagram depicting gate locations and road access from approximate airplane location.

6.0 Emergency Response Summary[8]

About 1001 the Waller-Harris Emergency Service District were dispatched to "1900 Cardiff Road" at the Houston Executive Airport, runway 36 for a "helicopter crash." Police officers arrived on-scene about 1007 and began directing traffic for emergency vehicles. About 1013, the first firefighting vehicle (Engine 71) arrived on-scene from Brookshire Fire Station 71, which was approximately 5 miles away. It had a crew of two and a chief who took command. The fire was described as "intense" with one of the airplane engines still running. Power lines had been torn down across the dirt road by the main gate area and posed additional hazard.

As engine 61 arrived on-scene, they saw the passengers walking from the field. They stopped east of Cardiff Road on Morton Road to assist them. The firefighters opened the west gate into the pasture with bolt cutters. Approximately nine passengers were at the gate with others walking toward them. Emergency personnel put a passenger with a back injury on a backboard and transported to Medic 5 who had just arrived. One firefighter sustained a laceration and was treated on site. Medic 15 transported a passenger with smoke inhalation and medic 5 transported the passenger with back injury to Memorial Hermann Katy Hospital approximately 10 miles away. A separate passenger with an ankle injury was transported via passenger vehicle from Houston Executive Airport to Houston Methodist West in Katy Texas approximately 15 miles away.

Engine 6 arrived on-scene behind Tanker 6 and Brush Pump 6 at approximately 1015. The crews from Engine 71 and Engine 6 ran a 2½ inch water line from the engines to the airplane. At

[8] Emergency service personnel and witness interviews were conducted by members of the survival factors group. Summaries produced from the interviews and additional written statements from emergency personnel are included in attachments 3 and 4, respectively. The information obtained was used to create this summary.

the same time a firefighter from Engine 71 made his way to the airplane to assess the scene and look for passengers. Brush Pump 6 arrived at the main gate but was then redirected to the east gate with an airport maintenance supervisor. They used bolt cutters to open the gate because the lock was frozen and approached the airplane from the east toward the tail section. Both water and foam were used to fight the fire. At about 1240, most of the fire was extinguished and very little to no smoke was coming from the wreckage site. Operations were turned over to Community Fire Station, Engine 93. In total, four engines, two tankers and one brush pump supported firefighting operations and one engine, and three ambulances were used in the medical response.

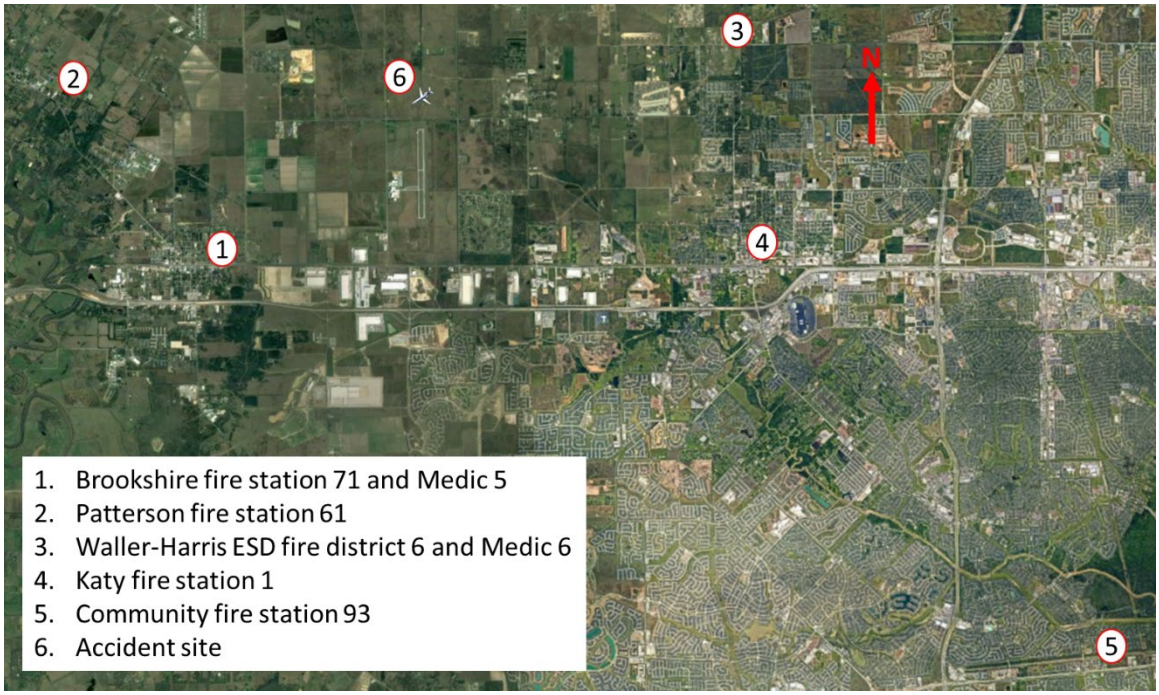

Figure 2. Google Earth map locations of responding emergency services in reference to the accident site.

7.0 Medical and Pathological Information

Two passengers were transported to Memorial Hermann Katy Hospital, in Katy Texas for treatment. A 47 year old female passenger, that was transported via ambulance, sustained an injury to her lungs. During her interview she stated the injury was as a result of the intense heat from the fire after she opened the left overwing exit door. A 78 year old male, transported via ambulance, had injuries to his back, according to statements from emergency responders. A third passenger was later transported by a friend from Houston Executive Airport to Houston Methodist West in Katy Texas with a self-reported fractured ankle.

7.1 Injury Table

Type of injury	Crew[9]	Passengers	Total
Fatal	0	0	0
Serious	0	2	2
Minor	0	1	1
None	4	16	20
TOTAL	4	19	23

8.0 Attachments

Attachment 1: Passenger Interview Summaries
Attachment 2: Passenger Written Statements
Attachment 3: Emergency Response Interview Summaries
Attachment 4: Emergency Response Written Statements
Attachment 5: Witness Interview Summaries
Attachment 6: Witness Written Statements

Amanda Taylor
Survival Factors Investigator

[9] When asked the airplane owner considered himself crew.