

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: July 5, 1956

Released: July 10, 1956

EASTERN AIR LINES, INC., MARTIN 404, N 445A,
OWENSBORO, KENTUCKY, FEBRUARY 17, 1956

The Accident

At approximately 1458,^{1/} February 17, 1956, Eastern Air Lines Flight 156, a Martin 404, N 445A, crashed during landing at the Owensboro Airport, Owensboro, Kentucky. There were no reported serious injuries to the three crew members and 20 passengers. The aircraft was damaged beyond economical repair.

History of the Flight

Eastern Air Lines Flight 156 of February 17 was a scheduled operation between Evansville, Indiana, and Chicago, Illinois, with intermediate stops at Owensboro and Louisville, Kentucky. It utilized the aircraft and flight crew of Trip 157 from Chicago, which terminated at Evansville. The crew consisted of Captain Charles R. Hard, Pilot Raymond F. Rozman, and Flight Attendant Robert T. Schroeter. The Chicago to Evansville flight arrived at 1422, 43 minutes late because of traffic and ground delays. It was reported routine in all other respects.

During the short ground time at Evansville Captain Hard reviewed the weather forecasts for the flight Evansville to Chicago, and received the latest weather observation reports for Owensboro, the first stop. These indicated the flight to Owensboro would be in accordance with Instrument Flight Rules and that an instrument approach to the airport there would be necessary. Accordingly, an IFR flight plan was filed and an instrument clearance was given the crew before departure. Clearance was direct to Owensboro at 2,000 feet.

Flight 156 departed at 1441. Gross takeoff weight was 41,471 pounds, which was less than the maximum allowable, 43,306 pounds. The load was properly distributed with respect to the center of gravity limits of the aircraft.

The crew reported its position en route to ATC (Air Traffic Control) according to its clearance and thereafter at 1447 called the company radio located on the Owensboro Airport. Routine information exchanged between

^{1/} All times herein are central standard and are based on the 24-hour clock. Altitudes are mean sea level.

flight and ground personnel included giving the flight the latest weather and altimeter information. There being no control tower at Owensboro, the company there advised the flight that surface wind favored landing on runway 5.

A few minutes later N 445A was observed to descend below the clouds just north of the airport, flying on a southerly heading toward the field. It was observed to level out and turn right onto a downwind leg for runway 5. In the limited visibility, reported as one mile in rain and fog, the aircraft disappeared from view near the southwest boundary of the airport while still on its downwind leg. Shortly thereafter it came back into view, proceeding toward the landing runway. It suddenly struck the ground, right wing down, rolled to an inverted position, and slid to a stop beside runway 5.

Investigation

Airport and company personnel reached the scene less than two minutes after the accident. On arrival they found the passengers had already evacuated the aircraft through emergency window exits Nos. 4 and 8 located on the left side. The crew, last to leave, were momentarily pinned in the cockpit but escaped using the forward loading door. All concerned reported that under the circumstances the evacuation was very orderly and prompt. The Owensboro Municipal Fire Department, on call for the airport, responded promptly; however, there was no fire.

Weather conditions reported at the time were: Precipitation ceiling 600 feet, sky obscured; visibility 1 mile; moderate thundershowers, fog; wind northeast 3; altimeter setting estimated 29.66. At 1510, a few minutes after the accident, conditions were reported as: Precipitation ceiling 1,000 feet, sky obscured; visibility 2 miles; moderate thundershowers, fog; wind calm; altimeter setting estimated 29.68; thunder overhead, movement unknown; lightning in clouds, cumulo-nimbus. The testimony of many witnesses, including the flight crew, indicated without controversy that the actual weather conditions were equal to or somewhat better than those reported. Several witnesses said a thunderstorm was located southwest of the airport and it was evidenced by at least two lightning flashes observed from it.

Investigation at the accident scene revealed that the initial ground contact of the aircraft was made by the right dual wheels of the extended landing gear. Wheel tracks began 125 feet to the right and 330 feet short of runway 5 (50 degrees magnetic). They were 31 feet long on a magnetic heading of approximately 30 degrees. Physical characteristics of the wheel tracks in the soft, rain-soaked ground showed the aircraft was not slipping or skidding and only a portion of its weight was on the ground. The depth of the tracks gradually increased and then decreased over the distance. There were no marks to indicate the left main or nose gear touched the terrain.

For the next 16 feet there were no contact marks. Then for 20 feet there followed a series of irregular slash marks in the ground made by the right propeller. This irregularity indicated that the engine nose

section and its propeller were torn off while the marks were being made. These components were found 230 feet beyond the last slash marks.

At a point opposite the last propeller mark, gouges showed the right wing struck with sufficient upward and rearward forces to break it off. The right wing center section was sheared practically flush with the side of the fuselage. Characteristics and the sequence of wheel tracks, the propeller cuts, and gouges made by the right wing showed that the aircraft, while still airborne, was rolling to the right along its longitudinal axis.

The fuselage then made ground contact with its right side and rolled toward an inverted position while sliding forward. When the aircraft became inverted the left wing contacted the ground, thus stopping the rolling action but sliding continued for several hundred feet. The ground path swerved gradually to the right. As the fuselage moved forward it also turned on the vertical axis about 180 degrees and when it came to rest the nose of the aircraft was facing back along its path. The left and right horizontal stabilizers were torn off and the vertical unit was bent 90 degrees to the left.

Examination determined that all landing gear components were extended and locked. The left inboard and outboard flaps were found extended and held firmly by wing distortion. Measurements of the extensions of the flap actuating piston rods corresponded to the takeoff position. The right outboard flap remained attached to its hinges and to the rod of its actuating cylinder but was free to move because of severed hydraulic lines. The right inboard flap was torn from its hinges. The cockpit control was found positioned to select approach flaps. Because of the ruptured hydraulic lines, all flaps could have moved during the breakup and their positions as found were not conclusive as to their positions at initial impact.

Investigation disclosed no evidence of structural failure or malfunction of the aircraft prior to impact and the flight crew stated none was experienced.

Following preliminary examination at the scene, the engines were sealed and transported to the company's principal base at Miami, Florida. There, under supervision of a Board investigator, the engines were examined in detail. Results of this examination revealed no evidence of failures or condition which would cause malfunctioning. Both engines were determined to have been in good condition at the time of the accident and were capable of normal operation.

The propellers were also examined. There was no indication of malfunction of these units. Marks on the shin plates of the right propeller showed the following blade positions at the instant of impact: No. 1 blade, 38-1/2 degrees; No. 2 blade, 40 degrees; and No. 3 blade, 40 degrees. The settings of the left propeller blades were: No. 1 blade, 37 degrees; No. 2 blade, 35-1/2 degrees; and No. 3 blade, 43-1/2 degrees. The propeller governors indicated engine speeds at impact of 2,270 and 2,325 r. p. m. for the left and right engines, respectively. Assuming an airspeed between 95 and 110 knots, the average blade position found indicated that appreciable power, nearly maximum, was being produced by both engines at impact.

The Owensboro Airport is located 29 miles southeast of Evansville at a field elevation of 407 feet. Runway 5 is one of two runways and is 3,700 feet in length. Terrain surrounding the airport is gently rolling with the runway approaches unobstructed.

Eastern Air Lines is authorized to operate into the airport under both visual and instrument conditions. A commercial broadcast station, WVJS, located 1.9 miles north of the airport on a bearing of 14 degrees, serves as the approved navigational facility for an ADF (Automatic Direction Finder) instrument approach to the airport. Eastern's Martin 404 minimums for this approach, the only type approved, are: Ceiling 500 feet, visibility 1 mile.

In accordance with a clearance, Evansville to Owensboro, direct, the instrument approach procedure required Flight 156 to pass over the commercial broadcast facility and establish an outbound track of 14 degrees. The instrument approach then requires a procedure turn to an inbound track of 194 degrees. This, if maintained, again takes the flight over the commercial station to the airport. Descent in two intervals is required during the procedure to the minimum altitude, whereupon visual reference should be established with the ground normally just north of the airport. The aircraft is then positioned to land straight-in or circle to the runway of intended landing.

During the investigation and public hearing Captain Hard and Pilot Rozman related in detail the events concerning the accident. They stated the flight to Evansville was routine, as were preparations for the Owensboro segment of Flight 156. Pilot Rozman flew the aircraft to Owensboro, noting that there was a strong westerly wind at the cruising altitude of 2,000 feet. Pilots and passengers said the trip was very smooth with the ground dimly visible through restricted vertical visibility and clouds. Above, there was an overcast from which moderate rain fell intermittently. Thunderstorm turbulence forecast to exist was not encountered.

When approximately 20 miles from Owensboro the company radio was contacted and the flight received the latest weather conditions reported on the airport. Procedural information was exchanged and according to established procedures the company notified the commercial station of the flight's approach and the station broadcast its identification. This was received by the flight. According to the crew the instrument procedure was followed precisely and completely. During it, the aircraft was slowed to approach speed, takeoff flaps were extended, and the landing gear was lowered. The propellers were adjusted to 2,300 r. p. m. and other prelanding checks were completed. Visual contact was established approximately one mile north of the airport at about 550 feet above the ground.

Captain Hard and Pilot Rozman had agreed that upon sighting the airport the position of the aircraft relative to the runway would govern which one of them made the approach and landing. The position favored a left-hand pattern; therefore, Captain Hard took control when the airport was sighted. He stated that when slightly northeast of the field he turned right to

position the aircraft on its downwind leg. According to the crew the aircraft was then at an airspeed of approximately 120 knots, 400-450 feet above the ground. Captain Hard said that when approximately opposite the threshold of runway 5 he began a left turn, using a normal 30-degree bank, and asked Rozman to apply approach flaps. Pilot Rozman stated he complied, setting the control to that position; the captain checked the flap position.

The crew members stated that when 45-60 degrees from the runway heading there was a slight vibration through the aircraft. This was followed by a gradual lowering of the left wing which steepened the bank. Both agreed and stated that the wing went down gradually and was not caused by any control movement. Captain Hard added power to 38-39 inches of manifold pressure and called, "Roz give me a hand." Together they applied control to raise the wing and stated it responded normally. Airspeed was 110 knots.

The crew members stated that the aircraft was then on final approach, descending with its wings level. The runway was approximately one-fourth mile ahead but the aircraft heading had exceeded (overshot) runway alignment to the left 5 or 10 degrees. Both crew members said there were a few seconds during which the aircraft descended with wings level in a normal approach attitude. Then, the pilots said, the right wing dropped without warning but accompanied by a shudder and buffet, minor in degree. Captain Hard immediately applied corrective control to lift the wing and also raise the nose. Believing the worst that could happen would be a hard landing off the runway, the captain said he did not attempt to abandon the approach. While still attempting to correct the wing-low position and raise the nose of the aircraft, ground contact occurred.

In response to direct questions the captain and pilot stated that moderate rain was falling during the approach and that visibility and ceiling conditions were better than reported, with the runway visible throughout the entire circling approach. No turbulence was encountered. Captain Hard added that he did not believe the aircraft was stalled and stated that there were definite intervals between the left wing going down, the recovery, the straight-in approach, and the final dropping of the right wing.

Several passengers were called to give testimony at the public hearing, while several others gave formal statements. These were principally in agreement with the testimony of the crew until the aircraft was near Owensboro. None recalled the turning maneuvers associated with the instrument approach procedure, as described by the crew, but several recalled when the flight became contact and the right turn onto the downwind leg. In this area several passengers, including a commercial and instructor-rated pilot, stated the flight was considerably lower, in their opinion, than 400-450 feet. Several of them recalled the left turn, the slight shudder, and the gradually increased bank described by the crew. They, however, placed the events considerably closer to the accident and at a lower altitude than did the crew.

All who testified said the aircraft turned left for some period at a normal degree of bank, then there was gradual steepening of the bank. Two passengers said that during the left turn they thought the left wing would hit the ground and another thought that it did. Their testimony indicates that the aircraft, without any time interval or recovery, rolled from a steep left bank to the right in a continuous motion and hit the ground. Nearly all stated that during this sequence an application of power, comparable to that used at takeoff, was heard. The pilot-passenger felt a gradual but positive application of back pressure during the same sequence. He described the events, from his instructor's experience, as an "over-the-top stall." Two passengers stated that the flight attendant exclaimed, "We've had it!" and braced himself just before the initial ground contact. The attendant stated he did not recall his exclamation but remembered he had braced himself by placing his feet against the back of the seat ahead.

A few ground witnesses saw the aircraft pass over the northeast boundary of the airport, turning right to establish the downwind leg. All agreed that at that time the engines sounded normal and that the position and altitude were comparable to other flights under similar conditions. There were no ground witnesses who saw the aircraft from the time it disappeared on the downwind leg until a few seconds before it crashed. At this time three witnesses saw it proceeding toward the runway. Two stated the left wing was down and the aircraft was low. These witnesses said the aircraft rolled to its right, from left bank to right, without stopping until the right wing hit the ground causing a spray of mud and water. One witness believed there was an interval when the aircraft was level between the left-to-right rolling action.

Witnesses on the ground, including weather observers, said the wind was nearly calm for a considerable period before and after the accident. Testimony indicated moderate rain was falling during the accident period and it did not vary in intensity. Several persons also saw at least one lightning flash from a thunderstorm a short distance southwest of the airport. It appeared to the witness that the flash occurred close to the aircraft when the accident occurred. Neither the crew nor the passengers reported any lightning flashes, nor did any part of the airplane indicate a lightning strike.

During the investigation of this accident the records of Captain Hard were carefully reviewed. He, at the time of the accident, had been a pilot for the company more than 16 years and a captain since 1948. His records indicated he was trained for his position in accordance with the company program and had received the regular and frequent captain proficiency checks required; these were passed satisfactorily. Captain Hard was qualified over the route involved and had landed at Owensboro an estimated 100 times. Captain Hard qualified on the Martin 404 in 1952, had flown it more than 3,000 hours, and had flown it exclusively for several years.

Weather conditions that existed in the Owensboro area at the time of the accident were dominated by a low pressure area centered in east Texas from which a trough extended northeastward through the subject area, then

northward to the Great Lakes. Also factors in the conditions were two quasi-stationary fronts emanating from the low and extending northeastward through the area. The northernmost front passed through southeastern Oklahoma, northern Arkansas, central Indiana, and into northern Ohio. The other was parallel to it but well south of the Evansville-Owensboro sector. These factors produced showers and thunderstorms in the frontal zone with overcast conditions over the entire route. Moderate to severe turbulence was forecast in the thunderstorms, with ceilings and visibilities near minimums at Owensboro. The icing level was expected to exist between 8,000 and 10,000 feet.

Analysis

Analysis of the available surface, upper air, and synoptic weather information indicates that at the time of the accident moist, unstable, warm air was overrunning a stable cooler layer in the Evansville-Owensboro area. It appears the cooler layer extended from the surface to between 3,000 and 4,000 feet. Flight 156 cruised at 2,000 feet remaining in this stable air which accounts for the smooth flight to Owensboro. Although thunderstorms existed they were above the stable air.

There was no evidence of an overriding wind below 500 feet. Surface winds were consistently reported calm or very light for substantial periods before and after the accident. Also it appears there was little change in these conditions between reports. Lightning was observed southwest of the field in the direction of the approach area to runway 5. Winds were from the southwest at altitudes controlling the movement of the thunderstorms; therefore, the thunderstorm southwest of the field should have shortly thereafter passed over the field. Official weather observations indicated that the lightning was in the clouds instead of cloud-to-ground. This indicates a thunderstorm cell in a dissipating stage rather than one with vigorous downdraft. If a downdraft and strong outflow existed at low altitudes, it would likely cause the surface wind to be at least fitful or gusty and the barograph tracing to have sharp changes, both of which were negative. It is, therefore, considered very doubtful that any strong or shifting winds affected the flight during the approach. Weather reports and observations by all concerned indicated the ceiling and visibility conditions at Owensboro were above the minimums for landing.

Available evidence indicates that Flight 156 was properly planned and flown in a normal manner to the vicinity of the Owensboro Airport. It indicates that visual reference to the ground was established about one mile north of the airport and that this position was normal after completion of an instrument approach. At this time the aircraft was in a better position for its crew to make a left-hand pattern for landing on runway 5. The cockpit position of Captain Hard, being on the left or inside of the pattern, made it reasonable for him to execute the approach; therefore, he took control and flew the aircraft thereafter.

The evidence, except for statements of the crew, indicates that the position on the downwind leg from which the left turn was started to align the aircraft with runway 5 did not allow sufficient distance for a normal

turn to the runway and resulted in an abnormally steep bank. Further, it is apparent from nearly all passenger observations that the turning was continued to a low altitude. The Board is of the opinion that these factors indicate poor planning and execution of the approach by Captain Hard. Undoubtedly his actions were influenced by the limited visibility; however, as the turn progressed the miscalculation should have become apparent to him with sufficient opportunity to have discontinued the approach.

Although both crew members stated the left wing of the aircraft went down when 45-60 degrees from the runway heading, it is our opinion that this occurred much later during the approach and just before the accident. It is believed that the aircraft was turning left almost continuously until it began to roll from left to right. It appears that the rolling action resulted from a stalled condition of the aircraft caused by insufficient airspeed and increased back pressure as Captain Hard attempted to raise the nose and left wing of the aircraft to avoid striking the ground. This is supported by many passengers who said the left wing nearly hit the ground and one who believed that it did. Two ground witnesses, who saw the aircraft only a few seconds before the crash, also said the left wing was down and that the aircraft was nearly aligned with the runway when the roll began. Nearly all of these witnesses said that the roll was continuous from left to right.

Evidence indicates that the situation became critical during the latter portion of the approach and that Captain Hard was aware of it. That corrective action was attempted by power application is substantiated by passenger testimony and by physical evidence which showed that the engines were developing nearly full power at impact. Although the power application was too late to prevent the accident it undoubtedly decreased the force with which the aircraft struck the ground.

Findings

On the basis of all available evidence the Board finds that:

1. The company, the aircraft, and flight crew were currently certificated.
2. The flight was properly dispatched and cleared according to Instrument Flight Rules to Owensboro, a scheduled stop.
3. At departure the aircraft was loaded to a weight less than the maximum allowable and the load was properly distributed.
4. En route weather conditions were correctly forecast except thunderstorm turbulence expected was not encountered.
5. Weather conditions reported were above the minimums for the flight to execute an ADF approach, circle, and land.
6. Weather conditions experienced by the flight were equal to or better than those reported.

7. The flight established visual contact with the ground at a position which was normal following the completion of the specified instrument approach procedure.

8. A circling approach was begun to land on runway 5.

9. The position on the downwind leg from which a left turn was begun to align with runway 5 resulted in little or no straight-in portion of the approach and an abnormally steep turn.

10. During the latter phase of the approach while at low altitude the aircraft rolled from a steep left bank to the right in a continuous motion.

11. The aircraft struck the ground short of and to the right of the runway of intended landing in an uncontrolled attitude.

12. There was no evidence of malfunction or failure of the aircraft, its engines, or propellers.

13. Thunderstorm turbulence, wind shift, and lightning were not factors in the accident.

Probable Cause

The Board determines that the probable cause of this accident was an improperly executed final approach, resulting in a stall, during a steep left turn at an altitude too low to permit recovery.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE
/s/ JOSEPH P. ADAMS
/s/ CHAN GJRNKY
/s/ HARMAR D. DENNY
/s/ G. JOSEPH MINETTI

S U P P L E M E N T A L D A T A

Investigation and Hearing

The Civil Aeronautics Board was notified of this accident at 1650, February 17, 1956. An investigation was immediately commenced in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing ordered by the Board was held at Owensboro, Kentucky, on March 22 and 23, 1956.

Air Carrier

Eastern Air Lines, Inc., a Delaware corporation with principal offices in New York City, is engaged in the transportation by air of persons, property, and mail under current certificates of public convenience and necessity issued by the Civil Aeronautics Board. The carrier possesses an air carrier operating certificate issued by the Civil Aeronautics Administration for various routes, including the one over which the accident occurred.

Flight Personnel

Captain Charles R. Hard, age 41, was employed by Eastern Air Lines on December 9, 1938, and became a pilot for that company in 1942. He was promoted to captain on March 1, 1948, and had accumulated 10,491 flying hours at the time of the accident. Of these hours, 3,182 were in the Martin 404 and 1,442 were instrument. Captain Hard held an airline transport rating and a rating on the equipment involved. His last instrument check was successfully completed November 12, 1955, and his most recent CAA physical was passed, without waivers, August 21, 1955.

Pilot Raymond F. Rozman, age 31, was employed by the company on February 11, 1952. He had 4,292 flying hours, of which 2,616 were in the type equipment involved. He held a currently valid airman certificate with commercial and instrument ratings. Pilot Rozman received his last CAA physical examination October 8, 1955.

Flight Attendant Robert T. Schroeter, age 28, was employed September 12, 1950, by Eastern Air Lines and was promoted to flight attendant October 9, 1950. His training for emergency procedures was complete and current at the time of the accident.

The Aircraft

N 445A, a Martin 404, manufacturer's serial number 11122, was owned and operated by Eastern Air Lines and had accumulated 12,373 hours since its manufacture December 16, 1951. It was powered by Pratt and Whitney R-2800-CB3 engines equipped with Hamilton Standard 43E60-349 propellers.