

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: December 27, 1957

Released: January 2, 1958

AMERICAN AIRLINES, INC., CONVAIR 240-0, N 94247,
NEAR TULSA, OKLAHOMA, JANUARY 6, 1957

The Accident

At 0001,^{1/} January 6, 1957, a Convair 240-0, N 94247, owned and operated by American Airlines, Inc., crashed during an instrument approach to Tulsa Municipal Airport, Tulsa, Oklahoma. The accident resulted in fatal injuries to one of the 10 occupants, serious injuries to six, and minor injuries to one. The aircraft was substantially damaged.

History of the Flight

Flight 327 was scheduled between Providence, Rhode Island, and Tulsa, Oklahoma, with intermediate stops including Chicago, Illinois; and St. Louis, Springfield, and Joplin, Missouri. The flight to Chicago was routine; however, the crew, when securing the cockpit, observed that the fire-warning light for the forward cargo and electrical accessory compartments flickered. This was called to the attention of both the ground crew and the relieving crew (a routine crew change was made) and was written in the aircraft log. Because of necessary repairs to the fire-warning system the flight was delayed 1 hour, 40 minutes and it departed Chicago at 1950.

The new crew consisted of Captain Wesley G. Mims, First Officer Paul H. Johnson, and Stewardess Shirley D. Walker. Flight 327 was routine to Joplin and it departed there at 2323 with seven passengers aboard. Leaving Joplin the aircraft weighed 35,940 pounds, which was well under the allowable gross takeoff weight; the load was properly distributed.

The flight was cleared by ARTC (Air Route Traffic Control) to the Owasso "H" facility,^{2/} via airway V-88, to maintain 4,000 feet, and to contact Tulsa approach control on crossing the south course of Chamute low frequency range for further clearance. At approximately 2333, 10 minutes after takeoff from Joplin, ARTC, through the company radio, advised the flight to climb to 4,500 feet, to maintain 4,500 feet, and to report leaving 4,000. This transmission was acknowledged and Flight 327 reported leaving 4,000 feet at 2334. Approximately 10 minutes later company radio at Tulsa gave the flight the Tulsa 2328 weather sequence. The company then gave the flight the local altimeter setting as 30.15 and field pressure as 460 feet above zero. This was acknowledged and Flight 327 reported it was changing over to Tulsa approach control frequency.

^{1/} All times herein are central standard and based on the 24-hour clock; all distances are in nautical miles.

^{2/} A nondirectional radio beacon (homing), power less than 50 watts.

At 2347 the flight reported crossing the south leg of Chamute low frequency range and was immediately cleared by approach control direct to Owasso, to descend to and maintain 3,500 feet, and to report when over Owasso. The 2328 Tulsa weather was given the flight as: Measured ceiling 600 feet, overcast; visibility 2-1/2 miles; very light drizzle and fog; wind calm. Later, the flight reported it was 1-1/2 minutes from Owasso and asked if any delay was expected. Approach control advised no delay was expected since the only local traffic was then making an ILS (Instrument Landing System) approach.

Shortly thereafter approach control advised Flight 327 that the visibility was then 1-3/4 miles, that the U. S. Weather Bureau was checking the ceiling, and asked if an Owasso approach straight in to runway 17 was to be made or if an ILS approach was preferred. The flight advised it would make the Owasso approach and at 2357 was cleared accordingly. It was asked to report when over the Owasso facility inbound.

At 2400 Flight 327 reported over Owasso, inbound, and was cleared to land on runway 17L. Two minutes later a special 2355 weather observation was transmitted to the flight as: Measured 200, overcast; visibility 1-3/4; very light drizzle and fog. This transmission was not acknowledged and nothing further was heard from the flight. Repeated efforts by approach control and other facilities to contact the flight were unsuccessful.

Investigation

The scene of the accident was on rolling ground 3.6 miles north of the approach end of runway 17L of the Tulsa Municipal Airport, at an elevation of 613 feet a. s. l. (above sea level). It was determined that the aircraft first struck the top of a tree, breaking branches, and then hit the ground in an almost laterally level attitude 225 feet farther on, while on a heading of approximately 174 degrees. First ground contact was made by the main landing gear and nose wheel. This was apparent by the presence of deep tire marks. A few feet beyond, along the ground path, were marks made by the blades of both propellers. These marks were followed closely by gouges in the ground, which indicated the total collapse of the entire landing gear at this point. The aircraft slid along the ground to the top of an upslope and then jumped a deep and wide ditch, finally coming to rest approximately 540 feet from the point of initial touchdown. Fire did not occur.

A search was made back along the flight path for portions of structure which might have broken off and fallen from the aircraft but no such parts were found. Subsequently, all components were accounted for in the main wreckage area.

Both wings were severely damaged. The left wing, although held by cables, etc., was lying flat on the ground and the right wing was folded back along the fuselage. The severed tip of the right wing was found a considerable distance back along the groundpath.

Substantial damage to the fuselage included buckling of the fuselage structure in the cabin area, which caused internal distortion of cabin flooring, seats, and overhead racks. Cabin seats were found in varying degrees of failure and collapse. No seat belts were torn or broken. The nose section of the fuselage was crushed inward and the belly was badly damaged.

In the cockpit both pilot seats were torn from their sliding tracks and the left seat was damaged.

The nose gear was torn from its attachment. The main gear broke at its attach fittings and folded rearward. The gear struts appeared undamaged. It was determined that the nose gear and main landing gear were down and locked at impact.

Both engines were found near the main wreckage, detached from the aircraft and damaged by impact forces. Disassembly and examination of these engines revealed nothing that would have affected power output or engine response during the flight.

All blades of both propellers were either broken or bent rearward. All parts of the propellers were found and although damaged these revealed no evidence of failure or malfunctioning in flight. Examination of the damaged governors indicated that the left and right engines were turning 2,255 and 2,260 r. p. m., respectively, at impact. The crew testified that the aircraft and all components were operating in a normal manner throughout the approach.

All aircraft navigational instruments were bench checked. Both ADF and omni indicators were found to function within allowed tolerances. The two airspeed and rate-of-climb indicators and the captain's artificial horizon also functioned properly. The first officer's artificial horizon was damaged by impact and was not operable.

Altimeter settings were: Captain's, 29.41 (475 above sea level); first officer's 30.12. Both altimeters when tested functioned within normal tolerances below 6,000 feet. No evidence of internal failure, leaks, dust, foreign material or moisture was found in either instrument. Static lines to the altimeters were damaged and broken, and portions were not found. All recovered portions of these lines were examined; nothing was found which could have affected adversely the functioning of the instruments.

All radio units were tested in accordance with standard procedures and found to operate in a normal manner.

The ground navigational facilities serving Tulsa were flight checked subsequent to the accident and found to be satisfactory.

On the morning of January 6 a cold air mass which consisted of a ridge of high pressure covered the eastern portion of the United States and extended to the southwest from the St. Lawrence River Valley into Mississippi and Alabama. Southern Missouri and northeastern Oklahoma were on the western side of the high pressure ridge within the northward return flow of the air mass. The modification of this air mass during its return flow resulted in a cool, moist layer of air, extending from the ground to an approximate height of 4,500 feet m. s. l., over northeastern Oklahoma, with fog and drizzle at Tulsa.

The U. S. Weather Bureau forecast for northeastern Oklahoma, for the period 1900 January 5 to 0700 January 6, indicated overcast conditions with a ceiling of 2,500 feet and a top of 5,500 feet. It also indicated that the ceiling would lower after midnight to 1,000 to 1,500 feet and that visibility would be three to six miles in fog.

The terminal forecast for Tulsa for the period 2300 to 0300 of the same dates indicated: Ceiling 800 feet, overcast; visibility 4 miles; with fog and occasional light drizzle. The 2355 special weather observation giving the ceiling as 200 feet was transmitted to the flight by the tower controller at 0002. The crew said they did not receive it.

Prior to the departure of Flight 327 from Chicago, a company meteorologist there briefed the crew on the weather, advising that clouds with ceilings of 500 to 600 feet and with tops 4,500 to 5,000 feet, together with visibilities of 1-1/2 to 2 miles, could be expected at Tulsa between 1900 and 2100 January 5. The crew was advised further that conditions would lower gradually after that time.

Captain Mims testified that the flight was routine until approaching Tulsa. Throughout the flight from Chicago to Tulsa he and the first officer alternated flying the aircraft, without changing seats, one flying one leg and the other the next, and from Joplin to Tulsa the first officer was at the controls. The captain said that a short time after reaching cruising altitude (4,000 feet) they went on instruments because of weather and remained on instruments until shortly before striking the tree. As the aircraft approached Owasso, Tulsa approach control asked what type of instrument approach the flight wished to make. The captain said he decided on an ADF straight-in approach to runway 17, thereby using the back course of the ILS and the Owasso facility as reference for proper alignment. Accordingly, having been cleared, the flight crossed the Owasso facility initially at 3,500 feet m. s. l. and began the usual 2-minute standard holding pattern while awaiting approach clearance. Both captain and first officer said they had their ADF approach plates in readiness. While flying outbound on a heading of 354 degrees for 1-1/2 minutes the flight was cleared to land. Captain Mims said he told the first officer that he could descend to 700 feet, but he did not remember telling him 700 feet on the field level altimeter. (The company's landing minimums for a straight-in approach to runway 17L for Convair aircraft are 400 feet and 1 mile.) The captain said he then told the first officer to establish a rate of descent of 1,000 feet per minute. Thirty seconds later a descending standard right turn to a heading of 174 degrees was begun, the landing gear was lowered, and the flaps were extended 21 degrees. The captain stated that with the checklist completed they crossed the facility at an altitude of approximately 1,200 - 1,300 feet, according to his altimeter. The distance from the facility to the approach end of runway 17L is 5.6 miles.

In AAL aircraft both captain and first officer have an altimeter in front of them on the instrument panel. According to American Airlines' procedure, when a landing is to be made the captain's altimeter is set to field level pressure so that it would read in actual feet above the airport and zero when on the ground. The first officer's altimeter is set to mean sea level barometric pressure and thus would read, in this instance, 674 feet, the elevation of the field, when on the ground.

Throughout the approach the captain performed the duties of first officer, with the first officer executing the approach from the right seat. The captain said he did remember looking at his altimeter from time to time during final descent and that he last observed it when it read 700 feet. He fully expected they would be visually contact at 600 feet. He said the rate of descent remained about 1,000 feet per minute throughout the entire descent with the

airspeed between 120 and 130 knots. He turned on the landing lights during the final portion of the descent but the reflection from the cloud was so great he immediately turned them off. He next remembered glancing out his window and seeing lights to his left. Suddenly realizing he should check the descent, he started to apply additional power but as he did he "felt something grab the airplane or hit it." He immediately pulled all power off.

The first officer testified that he did not remember anything after the start of the approach except that at one point during the descent he noted a reading of 1,500 feet on his altimeter.

All survivors left the aircraft through the rear service door, the emergency exits, and the left pilot's window.

Captain Mims had flown the Chicago-Tulsa route for 1-1/2 years and had approximately 4,000 hours in Convair aircraft. First Officer Johnson had about 900 hours in Convair aircraft. The Chicago-Tulsa route was new to him and this was his first actual instrument approach to Tulsa. This flight was also the first time these pilots had flown together.

Analysis

As indicated previously the possibility of a failure or malfunctioning of one or both altimeters was thoroughly explored during the investigation. However, the fact that these altimeters, when bench tested, operated correctly at altitudes below 6,000 feet, coupled with the evaluation of the significance of the altimeter settings found after impact, indicates clearly that these instruments could not have of themselves produced erroneous readings which could have contributed to this accident.

The probability of an error in altitude being introduced by accumulation of water in the static system was also considered. In this connection, it must be realized that the static system is common to both the airspeed and rate-of-climb instruments, as well as to the altimeters. Any effect on the altimeter would be accompanied by a similar effect on the airspeed indicator. Furthermore, the captain's and first officer's pressure instruments are served by separate and independent static systems.

It was established that it would be necessary to have a considerable amount of water accumulation in the static system to produce an error in altitude indication of a magnitude necessary to have caused this accident. Moreover, this relatively large quantity of water would have caused airspeed indications much higher than actual. It is possible that the pilot would not have properly diagnosed these errors during the approach; however, he should have been alerted to the fact that something was wrong. Since he testified that the airspeed indications were normal throughout the approach and descent, it is apparent that an altimeter error of any sizeable magnitude could not have been present. In any event, because of the duplication of static systems, it is extremely unlikely that an error in one system would occur at the same time and with the same magnitude in the other system. According to American Airlines, the static system drain manifolds are drained at each periodic check, scheduled at periods not greater than 125 hours. The static drain manifolds on this aircraft were drained seven days prior to the accident. A review of the service history of American Airlines' Convair 240 aircraft indicates no

unusual operational characteristics of their static system. These records also reflect that this static system compares favorably with the static systems of other aircraft in the carrier's fleet. The Board therefore concludes that altimeter malfunctions of such a magnitude arising from water in the static systems are remote and improbable and that this possibility can be eliminated.

It is worthy to note that this was the first trip Captain Mims and First Officer Johnson had flown together and that it was also First Officer Johnson's first instrument approach into Tulsa. This is not meant to imply that First Officer Johnson was a novice in instrument flying but rather that his degree of proficiency was unknown to Captain Mims and therefore this approach, being made under rapidly deteriorating weather conditions, should have been monitored with the utmost care.

Another factor that must be carefully considered is the weather and what possible effect it may have had on the captain's judgment. The company meteorologist at Chicago briefed the crew of Flight 327, prior to departure on the probable en route and terminal weather conditions and the expected deterioration of the weather at Tulsa after 2100. When the flight reported crossing the south leg of the Chamute low frequency range, Tulsa approach control gave the 2328 Tulsa weather as: Measured ceiling 600 feet, overcast; visibility 2-1/2 miles; very light drizzle and fog; wind calm. A short time later the flight was advised that the visibility was then 1-3/4 miles and that the U. S. Weather Bureau was checking the ceiling. Notwithstanding the fact that the visibility was lowering and that he did not have the latest ceiling check, Captain Mims continued the approach, apparently assuming that the last ceiling report of 600 feet would hold.

Whether the captain, because of this last ceiling report, had a feeling of false security is not known. It is true, however, that with his knowledge that the visibility had actually lowered three-fourths of a mile in a few minutes, coupled with his knowledge of the company terminal forecast, he should have expected the ceiling then to be less than that previously reported. This is of primary importance since it was obligatory that the captain not permit the aircraft to descend below the approved minimum altitude.

As has been stated, it is AAL policy to set the captain's altimeter to field pressure and the first officer's to mean sea level pressure prior to an approach. Captain Mims testified that the altimeters were cross checked twice prior to the approach to Tulsa and that the readings were found to have the correct relationship to each other.

Captain Mims further testified that the descent to Tulsa began at an altitude of 3,500 feet and that he told the first officer he could descend to an altitude of 700 feet. In giving these instructions to the first officer he made no reference to which altimeter should be used. Since the first officer's altimeter was set to mean sea level, a descent to a reading of 700 feet on his altimeter would have placed the aircraft at or near ground level.

The descent from an altitude of 3,500 feet was begun at 2357 and the accident occurred at 0001; therefore, approximately four minutes elapsed from the start of the descent to striking the ground. Since the elevation of the terrain at the scene of the accident was 613 feet m. s. l., the aircraft

descended 2,887 feet at an average rate of 721 feet per minute. This is slightly lower than the constant rate of descent of 1,000 feet per minute which the captain, in his testimony, said occurred. However, considering such variables as initial lag in establishing the descent and the decrease in rate of descent when a last-minute attempt was made to slow the aircraft down, it is probable that when observed the captain's rate-of-climb indicator did register as he stated.

This average rate of descent strongly suggests that the captain observed a reading of 1,200 - 1,300 feet on the first officer's altimeter instead of his own when crossing the facility inbound. This is a logical assumption since at that time the first officer's altimeter should have registered 1,200 - 1,300 feet and that of the captain approximately 700 feet; it is further supported by the fact that the accident occurred about one minute after the facility was crossed. The thought that the reading was made on his own altimeter may have led Captain Mims to believe he had some 800 - 900 feet to descend before reaching his minimum altitude, and thus may have prompted him to permit the descent to continue without realizing the close proximity of the ground. Also, the first officer, in interpreting the captain's instructions to descend to 700 feet, may have planned the approach so as to descend over the station to a 700-foot indication on his own altimeter. Clearly, there was misunderstanding and lack of alertness on the part of both the captain and first officer throughout the entire approach.

Findings

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

1. The carrier, the aircraft, and the crew were properly certificated.
2. The weight of the aircraft was under the maximum allowable and the load was properly distributed.
3. The flight from Joplin to Tulsa was conducted under instrument flying conditions.
4. This flight was the first time the captain and first officer had flown together.
5. The first officer flew the aircraft from Joplin and during the instrument approach.
6. The aircraft and its components, including altimeters, functioned in a normal manner throughout the flight and approach.
7. The last weather report received by the flight indicated weather conditions were rapidly deteriorating.
8. The captain told the first officer he could descend to 700 feet, without specifying mean sea level or above the elevation of the airport.
9. The captain allowed the aircraft to be flown below the company's approved landing minimums for this type approach and to an altitude precluding terrain clearance.

Probable Cause

The Board determines that the probable cause of this accident was the captain's lack of alertness in allowing the first officer to continue an instrument descent to an altitude too low to permit terrain clearance.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JAMES R. DURFEE

/s/ CHAN GURNEY

/s/ HARVARD D. DENNY

/s/ G. JOSEPH MINETTI

/s/ LOUIS J. HECTOR

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 the accident at approximately 0130, January 6, 1957. An investigation was immediately begun in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was held February 27-28, 1957, in Tulsa, Oklahoma.

Air Carrier

American Airlines, Inc., is a Delaware Corporation, and maintains its principal office in New York, New York. The company possesses a certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration, which authorize the carriage of persons, property, and mail over the route described in this report.

Flight Personnel

Captain Wesley G. Mims, age 35, was employed by the company on March 8, 1943. He held a currently effective airman certificate with ratings of airline transport pilot, single- and multi-engine land, Convair, and DC-6/6B. He had 8,655 flying hours, with approximately 4,100 hours in Convair aircraft. His last CAA first-class physical examination was passed October 24, 1956, without waivers.

First Officer Paul H. Johnson, age 34, was employed by the company on June 24, 1946. He held a currently effective airman certificate with ratings of commercial pilot, instrument, and single- and multi-engine land. He had a total of 2,170 flying hours, of which 924 were in Convair aircraft. His last instrument check was taken on October 15, 1956, and his last line check was taken on January 2, 1957. He passed his last first-class CAA physical examination on June 29, 1956, without waivers.

Shirley D. Walker, age 23, was employed by the company on May 12, 1955.

The Aircraft

N 94247, a Convair model 240-0, serial number 104, owned by American Airlines, Inc., was manufactured October 7, 1948. Total flight time on the airframe was 18,062 hours. It was equipped with two Pratt and Whitney R 2800-83AM4A engines and Hamilton Standard model 43E60 propellers. Both engine time and propeller time was within CAA approved limits.