

CIVIL AERONAUTICS BOARD  
ACCIDENT INVESTIGATION REPORT

Adopted: December 23, 1953

Released: December 31, 1953

DELTA AIR LINES, INC. - NEAR MARSHALL, TEXAS,  
MAY 17, 1953The Accident

A Douglas DC-3, N 28345, owned by Delta Air Lines and operated as Flight 318 of May 17, 1953, crashed approximately 13 miles east of Marshall, Texas, about 1415 CST.<sup>1/</sup> Of the crew of three and seventeen passengers, only one passenger survived.

History of the Flight

Flight 318 departed Dallas, Texas, on a VFR Flight Plan at 1310, on time, for Atlanta, Georgia, with a scheduled stop at Shreveport, Louisiana. The crew consisted of Captain Douglas B. Volk, First Officer James P. Stewart and Stewardess JoAnne Carlson; there were 17 passengers including one infant. The aircraft's gross weight on departure from Dallas was 24,099 pounds, which was within the allowable weight of 25,200 pounds, and the center of gravity was within the prescribed limits.

Flight 318 proceeded normally and at 1352 reported to the company station at Longview, Texas, that it was then west of Gladewater, Texas. Longview gave the flight the latest Shreveport weather which was dark scattered clouds at 1,000 feet, ceiling estimated 4,000 feet broken clouds, overcast at 20,000 feet, visibility 10 miles, thunderstorms, light rain showers, wind south 10. Remarks were thunderstorms south, occasional lightning cloud to cloud south. The flight was also advised by the company's Longview operator that he had been watching thunderstorms east and southeast of the Longview field and suggested that the flight stay well to the north. Flight 318 answered "OK."

At 1408, in the vicinity of Marshall, Texas, the flight made a routine radio contact with Delta's Shreveport station, during which it was given the Shreveport altimeter setting of 29.78. At this time the flight advised it was changing over to the Shreveport Control Tower frequency. At about 1412, four minutes later, Flight 318 called the Shreveport Control Tower, which cleared it to make a right-hand turn for landing approach to Runway 13 and gave the wind as southeast 10 miles per hour. Flight 318 acknowledged this message and requested the Shreveport weather which was transmitted as dark scattered clouds at 1,000 feet, ceiling estimated 4,000 feet, overcast at 20,000 feet, visibility 10 miles, thunderstorm, light rain shower. The tower also advised of a thunderstorm approximately 15 miles west of Shreveport. This transmission also was acknowledged by the flight.

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<sup>1/</sup> All times herein are Central Standard and based on the 24-hour clock.

At 1416 the Shreveport Control Tower asked Flight 318 to give a position report. No reply was received, and a number of unsuccessful attempts were then made to contact the flight. At 1428 the tower was advised that an aircraft had crashed near Marshall, Texas.

### Investigation

The wreckage was located approximately 13 miles east-southeast of Marshall, Texas, one-half mile south of Highway 80 in a heavily wooded area. Broken tree limbs, markings on the ground, and distribution of the wreckage indicated that the aircraft first struck the trees while in a shallow angle of descent, under power, in approximately wing-level attitude and on a 50-degree heading. It continued ahead, cutting a swath through trees for a distance of approximately 500 feet, struck the ground, skidded, and came to rest in a mass of wreckage 870 feet from the point of initial contact with the trees. The aircraft partially burned following impact. There was no evidence found at the scene of the accident to indicate fire in flight or collision with any object, other than the trees, prior to impact, and no evidence of hail damage.

Both engines and propellers were examined. Indications are that both engines were delivering power at the time of impact, and that both propellers were in low pitch range.

The company's maintenance records of N 28345 were examined as a part of the Board's investigation. These records showed the aircraft had received the required overhauls, inspections, and maintenance. The aircraft had received its last inspection just prior to departure from Dallas. No irregularities were reported. Moreover, the crew that flew the aircraft from Atlanta to Dallas on the morning of May 17 stated that its performance was normal.

Both the captain and first officer, according to company procedure, reported to the Dallas operations office approximately one hour prior to departure time. During this time, the crew studied the weather conditions over the route from weather data available to them at the company office. The company dispatcher, based in Atlanta, had issued the flight a routine instrument clearance by teletype as is customary. The captain, after analyzing the en route weather, filed a VFR (Visual Flight Rules) flight plan to which the dispatcher agreed. Sequence weather reports, issued by the United States Weather Bureau at 1230 and available to the crew at the company's office, indicated good visibility en route to Shreveport with cloud layers ranging from scattered to overcast with bases 1,000 feet or higher. Thunderstorms were indicated to the south of the route from Longview to Shreveport. Pilot reports showed a heavy thunderstorm 40 miles south of Shreveport with moderate to heavy turbulence and hail one-fourth inch in diameter. One pilot reported hail damage. The regional forecast indicated widely scattered thunderstorms in northeast Texas with bases about 2,000 feet and tops to 30,000 feet. The terminal forecasts for Tyler and Longview, Texas, were for broken clouds at 2,500 feet, occasionally becoming overcast at 2,500 feet, moderate thundershowers after 1400 and possibly hail with gusts to 50 miles per hour after 1800. The terminal forecast for Shreveport indicated broken clouds at 2,000 feet occasionally becoming overcast at 2,000 feet with moderate thundershowers after 1430 and

possible hail with gusts to 50 miles per hour after 1800. Moderate to heavy<sup>2/</sup> turbulence was forecast at all levels in the vicinity of thunderstorm activity. Also available to the flight before departure was this severe weather forecast: "There is a possibility of a few tornadoes in northeast and central Louisiana and west central Mississippi this afternoon until 9:00 p.m."

At departure from Dallas these latest weather sequence reports and terminal weather forecasts, together with winds aloft for the Dallas-Atlanta area, were attached to the flight's clearance, as were the severe weather forecast and pilot reports previously mentioned.

Delta's flight dispatching center is at Atlanta, and has direct communication with its stations along the route involved. Flights en route can be contacted either direct by radio from Atlanta or by wire to, and radio from the several company stations. Current weather reports and forecasts from the U. S. Weather Bureau are received by teletype and the Dallas, Shreveport and Atlanta company offices. Investigation disclosed that on May 17 all of the above facilities and services, including the dispatching and monitoring of Flight 318, were routine and adequate.

During the flight of 318 VFR conditions with good visibility prevailed from Dallas to Marshall. East of Marshall occasional thunderstorms existed and it appears that ceiling in some of the heavier storms was near the surface with tops probably at 30,000 to 35,000 feet. One of these storms was on course between Marshall and Shreveport. Information from witnesses both on the ground and in the air indicate that the thunderstorm was plainly visible from the west side but did not look nearly as severe as it did from the east and northeast sides. Witnesses also indicate that the storm was local in extent and could have been flown around; in fact another flight did go around it. Delta's Flight 318 was seen by several witnesses to fly into the storm.

Investigation discloses that the thunderstorm was first noted south of Marshall, moving rapidly northeastward. During that time it was picked up as an intense echo on the radar scope at Barksdale Field. A U. S. Air Force reconnaissance flight was then dispatched to reconnoiter the storm to determine its probable severity. An Air Force pilot and his copilot therefore departed from Shreveport in a C-47 (DC-3) at 1340, about 35 minutes before the accident.

They proceeded westward in the direction of Marshall, Texas, toward the thunderstorm, and observed weather conditions over the Shreveport area to be 3,000 to 5,000 feet, scattered to broken clouds; visibility unlimited. However, as the C-47 approached the storm area, the ceiling began to slope steeply downward in the proximity of the storm. The estimated height of the base of the storm cloud varied from approximately 1,000 feet at the outer edges to zero feet near the center. Heavy rain and severe cloud-to-ground lightning were observed in the thunderstorm. The Air Force pilot then skirted the storm to the north and west, and while flying at an altitude of approximately 2,500 feet MSL on a southwesterly heading, he observed a Delta DC-3

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<sup>2/</sup> The Weather Bureau interprets "heavy turbulence" as: "Usually associated with the interior of thunderstorms either frontal or isolated. Difficult to maintain flying altitudes."

approximately one-half mile south, and at about the same altitude, headed on a straight easterly course toward the storm. In fact, he watched the Delta aircraft, in what appeared to be normal cruising attitude, enter the storm and disappear at about 1415. At no time did the flight request an Instrument Flight Rules clearance.

The Air Force pilot testified that at all times he flew visually and that he was able to stay clear of the thunderstorm. Once when he approached quite close, while on the east side, moderate turbulence was encountered. He turned away stating that the storm looked too severe to probe with safety. At one time while skirting the storm he noted a "snout" form under the cloud, disappear, then form again, suggestive of a tornadic development, extending from the cloud base but not reaching the ground. He also stated that on the east side the storm was as black and threatening as any he had ever seen, but on the west side, the side that the sun was shining on, it looked much less threatening although heavy cumulus and rain could be seen.<sup>3/</sup> Other witnesses on the ground near Marshall testified that the storm was quite severe. Some stated that they observed the Delta aircraft proceeding in an easterly direction toward the storm in straight and level flight. Others testified as to the intensity of the storm. They stated that there was very heavy rain with hail for a very short period of time, and that the wind seemed to be quite strong. There was no evidence, however, in the vicinity of the crash, of any characteristic tornado effect such as the uprooting of trees or damage to property. The one surviving passenger, who was on her initial flight, stated that the flight seemed normal and that she was asleep most of the trip. She had her seat belt fastened when the aircraft entered the storm area, and her last impression was that the left wing of the airplane was down; she remembers nothing further until after being rescued.

Captain Volk had been employed continuously by Delta since May 1945. He flew as a captain or first officer from June 1946 until May 1951, when he was assigned as a permanent DC-3 captain. His total flying time with the company was 7,120 hours, nearly all of which had been on DC-3's. His last instrument check, in March 1953, was satisfactory, as was his last route check on May 22, 1952.

The company's operations manual, with which the captain should have been familiar, sets forth:

- "5032.3 Completion of schedules takes third place and is considered of major importance after safety and passenger comfort.
- "5032.4 It is the policy of Delta Air Lines to circumnavigate thunderstorms insofar as practicable.
- "5032.5 It is the policy of Delta Air Lines to avoid flight through turbulent air by variation of altitude, or course, or both. If impracticable to avoid such flight, the effect of turbulence shall be lessened by reduction of speed."

<sup>3/</sup> The purpose of the military reconnaissance flight was to ascertain weather conditions in the general area of Barksdale Air Force Base. This is routine procedure customarily carried out under conditions of threatening weather to allow adequate time to effect safety precautions to airplanes on the ground.

## Analysis

Twenty-two minutes before the accident the flight received and acknowledged the weather at Shreveport, its next scheduled stop. This weather was dark scattered clouds at 1,000 feet, ceiling estimated 4,000 feet broken clouds, overcast at 20,000 feet, visibility 10 miles, thunderstorms, light rain showers, wind south 10. Remarks were thunderstorms south, occasional lightning cloud to cloud south. The thunderstorm was entered with no known change of altitude (from 2,500), and with no apparent attempt to change course. About 1412, with Shreveport only 21 miles ahead, and reporting good ceiling and visibility, the captain evidently elected not to by-pass the storm and to remain VFR which he could have done, but flew directly into it, and in so doing acted contrary to Civil Air Regulations,<sup>4/</sup> as well as to company directives. The crash occurred about six miles beyond his point of entering the storm and only some two miles from its eastern, or far, edge.

The thunderstorm in which the crash occurred was very active at the time the flight went into it, elliptical in shape, and about ten to twelve miles in extent. Heavy to severe turbulence was indicated to have existed, including vortices which apparently did not become mature tornadoes. This was not known by the captain of the Delta flight and he may have believed that the storm did not look too severe. Although he may have further believed that the Air Force plane had come through it, he should have known that the storm was local and could be by-passed (it was visible to him), and that pilots had already encountered heavy thunderstorms with heavy turbulence and damaging hail in the general area. He was getting into a thunderstorm area which farther to the east had been forecast to possibly develop tornadoes, and it had been suggested to him by ground personnel to by-pass the storm to the north. In view of these known facts there appears to be no logical reason why Captain Volk did not alter his course to avoid the storm, inasmuch as company instructions required him to by-pass thunderstorms when practicable.

The exact nature of the conditions within the storm cannot be determined. However, it is known that the storm appeared to be a very severe one, with zero ceiling conditions and extremely heavy rain accompanied by hail, with strong, gusty surface winds and sharp cloud-to-ground lightning. These factors are indicative of other conditions such as extreme turbulence accompanied by violent updrafts and downdrafts. It is known that turbulence, if sufficiently severe, is capable of rendering an aircraft uncontrollable. Instruments have been known to vibrate and fluctuate, even in a shock-mounted panel, so violently that they become unreadable. Although investigation disclosed no evidence of lightning strike, there may be the possibility that lightning flashes temporarily blinded the crew members, since cloud-to-ground lightning of strong intensity was seen by air and ground witnesses.

The aircraft's attitude, level laterally and in a slight descent with power being developed when it struck, does not necessarily eliminate the possibility of lost control.

Considering the possibility that the pilot, after encountering instrument

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<sup>4/</sup> See CAR Section 60.30(b) and 31(c), Visual Flight Rules (VFR); and Section 60.40, Instrument Flight Rules (IFR).

flight conditions at his altitude, was descending to establish visual contact, it may be assumed that the pilot was faced with a combination of various hazardous conditions, described above, lost control of the aircraft and was unable to effect recovery in time to prevent impact with the trees.

The Board is well aware that the forecasting of thunderstorm severity and behavior is far from being an exact science, and that scheduled flights must frequently traverse undeterminable conditions. But it has long been held to be good practice to skirt thunderstorms when possible, either laterally or vertically, or both. This is paramount when tornadoes are possible and the Severe Weather Bulletin, previously mentioned, did forecast possible tornadoes not too distant. Delta's operations manual pointedly prescribed avoiding thunderstorms; this could readily have been done in this case.

### Findings

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

1. The carrier, the crew and the aircraft were certificated for the subject flight.
2. The carrier had prepared adequate written instructions against the unnecessary traversing of thunderstorms.
3. The captain should have had knowledge of these company instructions.
4. While en route, close to and approaching the storm, it was suggested to the captain by company ground personnel that he stay well to the north to avoid the thunderstorm.
5. The captain flew directly into the storm without changing course or altitude.
6. The captain while on an airway proceeded from VFR into IFR weather without first obtaining an appropriate IFR clearance.
7. A very intense localized thunderstorm, accompanied by frequent cloud-to-ground lightning, hail, heavy rain, turbulence, and high winds, was entered by the flight.
8. The flight met extraordinary conditions within the storm and was forced to the ground.
9. The carrier's dispatching, pilot briefing and weather dissemination, were satisfactory.

### Probable Cause

The Board determines that the probable cause of this accident was (1) the encountering of conditions in a severe thunderstorm that resulted in loss of

effective control of the aircraft, and (2) the failure of the captain to adhere to company directives requiring the avoidance of thunderstorms when conditions would allow such action.

BY THE CIVIL AERONAUTICS BOARD:

/s/ OSWALD RYAN

/s/ HARMAR D. DENNY

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

# S U P P L E M E N T A L   D A T A

## Investigation and Hearing

The Civil Aeronautics Board received notification of the accident through CAA Communications at Fort Worth, Texas, at about 1455, May 17, 1953. An investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was held in connection with the investigation of this accident at Dallas, Texas, June 17 and 18, 1953.

## Air Carrier

Delta Air Lines, Inc., is a Louisiana corporation with general offices located at Municipal Airport, Atlanta, Georgia. At the time of the accident it was operating as an air carrier under currently effective certificates of public convenience and necessity, and air carrier operating certificates issued pursuant to the Civil Aeronautics Act of 1938, as amended. These certificates authorized the carriage of persons, property and mail over the route described in this report. By merger with Chicago & Southern Air Lines, Inc., on May 1, 1953, the Civil Aeronautics Board authorized Delta, the surviving corporation, to do business under the operating name of Delta-C&S Air Lines.

## Flight Personnel

Captain Douglas B. Volk, age 32, had been employed continuously by Delta Air Lines since May 1945. He held a currently effective airman certificate with airline transport rating. He flew as a captain/first officer from June 1946 until May 1951, when he was assigned as a permanent DC-3 captain. His total flying time with the company was 7,120 hours, nearly all of which had been in DC-3's. His last instrument check, in March 1953, was satisfactory, as was his last route check on May 22, 1952.

First Officer James P. Stewart, Jr., age 32, had been employed continuously by Delta Air Lines since August 1950. His total flying time with Delta was 2,114 hours, of which 803 hours had been in DC-3's. His last physical examination on July 23, 1952, was satisfactory.

Stewardess JoAnne Carlson had been employed by Delta Air Lines since August 4, 1952, and had satisfactorily completed the necessary company training courses.

## The Aircraft

N 28345, a Douglas DC-3, was manufactured February 7, 1940. It had a total time of 39,000 hours, of which 69 hours had been since its last 100-hour check. Examination of maintenance and inspection records of this aircraft revealed no item having any particular significance in connection with this accident.