

C I V I L A E R O N A U T I C S B O A R D
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CAPITAL AIRLINES LOCKHEED CONSTELLATION,
N 2735A, KANAWHA COUNTY AIRPORT,
CHARLESTON, WEST VIRGINIA, MAY 12, 1959

SYNOPSIS

Capital Airlines Flight 983 of May 12, 1959, a Constellation model L-049, N 2735A, following a landing at 1529 e.s.t., on a wet runway, was intentionally ground looped and during the maneuver skidded and slid down a steep embankment beyond the boundary of the airport at Charleston, West Virginia. One of the 38 passengers and one of the six crew members died in the fire which followed; one passenger was seriously burned and all others on board the aircraft escaped with little or no injury; the aircraft was destroyed.

The aircraft was landed within the first third of the runway and the captain said that finding braking to be ineffective, he chose to ground loop the aircraft rather than risk going down a sharp declivity at the far end of the runway. The aircraft left the runway about 600 feet from the far end.

Investigation revealed operational deficiencies in the conduct of the approach and touchdown, and that crew coordination throughout the emergency was poor. Because of crew statements, the brakes were believed to have been capable of functioning in a normal manner; however, water on the runway would have permitted the aircraft to aquaplane and thus make them ineffective.

Investigation

Capital Airlines Flight 983 of May 12, 1959, originated in Washington, D.C., with its destination Atlanta, Georgia, and with intermediate stops at Rochester and Buffalo, New York; Pittsburgh, Pennsylvania; and Charleston, West Virginia. The flight departed Washington at 0957 ^{1/} and was routine to Buffalo.

At Buffalo a scheduled crew change was made. The new crew consisted of Captain R. Ohm, First Officer C. Spoth, Flight Engineer Howanski, Flight Engineer-Trainee B. J. Morrison, and Hostesses N. F. Marshall and E. Viera. Flight 983 departed Buffalo at 1244 and flew direct to the Greater Pittsburgh Airport, arriving there at 1347.

The flight departed Pittsburgh at 1433 and was cleared to Charleston on an IFR (instrument flight rules) flight plan to the Kanawha County Airport at Charleston via Old Concord intersection to cross the 260-degree radial of Pittsburgh omni at 3,000 and to maintain 5,000 via 193-degree radial of Imperial omni. At the time of takeoff the aircraft weighed 81,253 pounds, which was 4,284 pounds under the maximum allowable gross takeoff weight at Pittsburgh for an intended landing at Charleston. The maximum allowable gross landing weight for L-049 aircraft for runway 32 at the Kanawha County Airport is 83,000 pounds. There were 44 persons on board which included 38 passengers and a crew of six. Two of the passengers were nonrevenue company employees and one was an infant.

At approximately 1518 the flight reported to the company at Charleston that it was in range and had 1,800 gallons of fuel on board, and was estimating the Kanawha County Airport at 1525. At that time the special U. S. Weather Bureau report No. 7 was given the flight as follows: clouds 600 feet scattered, higher clouds 1,500 feet scattered, estimated overcast 3,000 feet; visibility 5 miles; light rain showers; ground fog; wind east-northeast 3 knots; remarks, ground fog rising from the valleys. At 1522 the Charleston tower cleared the flight to make an ILS (instrument landing system) approach to runway 23 and upon reaching the outer marker to circle visually to runway 32; the wind was given as north-northwest 3 knots, and the flight was advised to report when reaching the outer marker and that it was cleared to land. This clearance was acknowledged. In a short time the flight advised the tower that the approach was being abandoned and seconds later the crew advised that it was in the clear

1/ All times herein are eastern standard based on the 24-hour clock.

and would cross the airport, make a left turn, and would again report on downwind leg. Captain Ohm, who was seated in the left pilot's seat, took control of the aircraft at this time. A normal downwind leg report was made and the flight was again cleared to land on runway 32. Tower personnel said the flight disappeared from their view momentarily behind scud or ground fog when turning to base leg but, following this, remained at all times in clear sight.

According to eyewitnesses, the approach appeared to be normal and the aircraft touched down 800 to 1,000 feet from the approach end of runway 32 and within the first third of the runway distance. The aircraft did not appear to decelerate and just before it approached the intersection of runways 32 and 23 it veered to the left; a blast of engine power was heard at that time. It continued across runway 23 and left the paved surface at the far left side of the intersection. The aircraft continued a left ground loop as it crossed the sodded area. At the edge of the embankment it crossed a ridge two feet high then disappeared from sight over the edge of the steep embankment. When it went over the embankment it appeared to do so right wing first and then the tail section, almost as if it were traveling backwards. As the aircraft came to rest it immediately caught on fire and was destroyed. One passenger and the flight engineer-trainee were killed. The time of the accident was 1529.

The alarm was quickly sounded and the fire apparatus responded immediately; however, because of the steep downgrade it could not get closer than 200 feet to the aircraft. Efforts were largely centered on getting occupants away from the burning wreckage and up the hill.

It was later determined that one passenger left the aircraft through the emergency exit over the left wing; the other passengers departed through the passenger entrance door at the rear of the aircraft, and the crew departed through the cockpit windows.

An airport weather observation made one minute after the accident indicated an estimated ceiling of 4,000 feet with scattered clouds at 600 and 1,500 feet; visibility 6 miles; light rain showers; ground fog; temperature 68 degrees; dewpoint 62 degrees; and a wind of four knots from the east-southeast. Rain was falling during the approach and touchdown and had been for some time previously; the runway was thoroughly wet with localized areas of standing water.

The Kanawha County Airport is built on the top of a mountain. Runway 32

is 4,750 feet long and runway 23, the ILS runway, is 5,200 feet long. On May 12, 1959, the latter runway was closed for repairs; it was being lengthened 600 feet. Both runways are paved with a surface consisting of an asphalt and concrete mixture. The terrain at the end of the runways slants downward abruptly.

The Civil Air Regulations require that transport category airplanes in scheduled service can be landed within 60 percent of the effective length of the runway on a dry runway in still air. The effective length of runway 32 is approximately 3,830 feet, 60 percent of which is 2,300 feet. According to the FAA Approved Airplane Flight Manual the stopping distance for a Lockheed L-049 aircraft weighing 78,700 pounds when landed on this runway is 2,300 feet. The remainder of the effective runway length is intended to provide a safety margin.

First tire marks were found 3,450 feet from the approach end of runway 32. These marks were made by the tires of both the main landing gear and nose gear wheels, and their relation to each other indicated that the aircraft was skidding with the nose gear slightly to the left. Additional tire marks were found 200 feet farther on. At approximately 3,730 feet down the runway more tire marks were found. These marks indicated a slightly more pronounced skid and the beginning of a left turn. From this point to where the aircraft went over the embankment, tire marks were continuous. Tire tracks made by the nose gear and the left main gear wheels crossed each other at a point where the aircraft entered runway 23. The main gear tire marks crossed each other 70 feet from the edge of the bank. All of the tire marks were merely a whitish discoloration on the runway surface and definitely not the dark marks usually found on a dry runway under similar circumstances.

It was found that the nose of the aircraft was turning as in a left ground loop; however, the forward movement of the aircraft was a gentle left curve from the paved runway surface to the edge of the embankment. This is best illustrated by the fact that when the aircraft went over the embankment the nose was heading 180 degrees; however, the direction of travel was 290 degrees. The distance from where the aircraft left the runway to the boundary of the airport is 286 feet.

The main aircraft wreckage was found 200 feet down the 32-degree slope. The vertical depth from the surface of the airport to the wreckage is 95 feet. It was determined that the right main landing gear collapsed when the aircraft struck the ridge at the top of the hill.

During the slide down the slope the No. 3 engine was torn from its mounts

and completely reversed its position. When this occurred, a portion of a broken propeller blade penetrated the left main fuel tank, and the fuselage broke open on both sides just aft of the forward bulkhead in the forward lounge.

Except for the empennage surfaces, outer wing panels, and the nose gear, the entire structure was destroyed by fire. All powerplants had been subjected to such intense fire that most of the magnesium casings completely burned out. Each engine, with the exception of the No. 3, was found on the ground in its correct position with relation to the wings and fuselage. All propellers had broken blades and all blades were bent forward and counter to rotation. Because of the severe damage to these engines and the fact that the crew said they were functioning in a normal manner when the accident occurred, a teardown examination was not made.

The crew said the approach was made in a normal manner and that the flaps were extended late in the final approach and were fully down at touchdown. They also said that during the final portion of the approach an airspeed of 105 knots was carried. Witnesses said the flaps were completely down at or just after touchdown. According to the company's flight manual for this type aircraft, the approach speed when crossing the airport boundary (fence speed) is 95 knots.

The crew said further that touchdown was made within the first third of runway distance and that the brakes were applied immediately. Although the brake system appeared to be functioning in a normal manner, with brake pressure normal and hard pedals, the aircraft failed to respond to all efforts to slow it down. The captain said that he ordered the first officer to raise the flaps early in the landing roll to put weight on the wheels and increase traction; the first officer did not hear the command. When it became evident that the airplane could not be stopped within the limits of the runway and that it also could not be flown out safely, the captain decided to make a left ground loop and called for full power on No. 4 engine. The flight engineer misunderstood this command and applied power to all four engines. When the aircraft did not respond as the captain wished, he glanced quickly at the control pedestal and, recognizing that all throttles were forward, quickly closed throttles one, two, and three. The aircraft then began the left turn but too late to remain within the airport boundaries.

Eyewitnesses to the accident stated that the airplane touched down within or about the first third of the runway. An air traffic controller in the tower said that the approach appeared to be normal. Several persons thought the airplane

landed faster than this type airplane usually landed. All were in agreement that there was no apparent deceleration of the aircraft in the early stages of the landing roll. One witness said the aircraft was rolling on all three landing gears when 2,000 feet down the runway.

Three other aircraft were landed at the Kanawha County Airport near the time of this accident and when the weather conditions were similar. One, a scheduled air carrier flight reported normal braking while the second, also an air carrier, reported poor braking. The third, a light airplane, experienced difficulty in braking.

Investigation of this accident was extended to the subject of decreased braking effectiveness because of wet runway surfaces. The National Aeronautics and Space Administration furnished the results of data compiled when tests were made using various runway surfaces and with varying degrees of moisture on these surfaces. These tests indicated that it was possible under certain conditions of speed, weight, moisture, etc., for an aircraft to ride on the film of water (aquaplane) and for the aircraft's brakes to be completely ineffective when this occurs. Detailed information on this subject may be had from publications listed under BIBLIOGRAPHY at the end of this report.

Analysis and Conclusions

The Board has determined that this aircraft did aquaplane throughout a portion of the landing roll. The white tire marks found on the runway are the color of tire marks definitely associated with aquaplaning. The Board also believes that the approach speed of the aircraft was faster than the recommended approach speed and that this extra speed was partially caused by the lowering of the landing flaps on the final approach. It is further believed that although the aircraft was landed within the first third of the runway, under the conditions which existed, namely a wet runway and without a headwind component, a landing should have been made closer to the approach end, in the interest of safety. Coupling these conditions with the first officer's failure to hear and comply with the captain's order to raise flaps in order to put weight on the wheels, it is easy to understand why an early deceleration was impossible.

The above facts, however, are not the complete story. At some point in the landing roll the captain realized that something must be done immediately or the speed of the aircraft would take it over the embankment at the end of the runway. At that time he was faced with a real emergency and it does not seem in keeping

with the gravity of the situation that he would delegate the handling of the power controls to the flight engineer. Recognizing that the power to delegate is discretionary with the captain, the Board nevertheless believes that in this instance this was not optimum procedure and that instead the handling of the throttles by the captain may well have resulted in less disastrous results. It is interesting to note that since the accident the company has placed the prohibition on the landing of all Constellation aircraft on runway 32 unless the runway is dry and there is a headwind component.

Probable Cause

The Board determines that the probable cause of this accident was the pilot's action of landing the aircraft too fast on the wet runway under conditions conducive to aquaplaning, making early deceleration impossible. An additional factor was the poor coordination of the crew throughout the approach and landing.

BY THE CIVIL AERONAUTICS BOARD:

/s/ WHITNEY GILLILLAND
Chairman

/s/ CHAN GURNEY
Vice Chairman

/s/ G. JOSEPH MINETTI
Member

/s/ ALAN S. BOYD
Member

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 on May 12, 1959, shortly after occurrence. An investigation was immediately initiated in accordance with the provisions of Title VII of the Civil Aviation Act of 1958. The Board ordered a public hearing which was held at Charleston, West Virginia, June 24-25, 1959.

Air Carrier

Capital Airlines, Inc., is a Delaware corporation with principal offices in Washington, D. C. The company holds a current certificate of public convenience and necessity issued by the Civil Aeronautics Board to engage in the transportation by air of persons, property, and mail. It also holds an air carrier operating certificate issued by the Federal Aviation Agency.

Flight Personnel

Captain Richard Vincent Ohm, age 32, was employed by Capital Airlines on February 15, 1957. He was properly certificated and rated for the subject flight. Captain Ohm had a total piloting time of 4,966 hours, of which 408 had been as copilot on Constellations and 293 as captain on Constellations. His last physical examination was satisfactory and his rest period during the 24 hours preceding this flight had been 17 hours and 35 minutes. During the 30 days preceding this accident he made six landings at the Kanawha County Airport.

First Officer Charles Victor Spoth, age 27, was employed by Capital Airlines in February 1957. He was properly certificated and rated for the subject flight, and had 822 hours as Constellation copilot. His total piloting time was 2,321 hours. He also had been into Kanawha County Airport four times within the previous 30 days, and had 21 hours of rest during the 24 hours preceding this flight.

Flight Engineer John Howanski, age 39, was employed by Capital in June 1950. His total time as a flight engineer on Constellations was 6,830 hours and he was properly certificated and rated. Mr. Howanski had had 17 hours of rest during the 24 hours preceding this flight.

Hostesses Evelyn Viera and Nancy Marshall had satisfactorily completed the company's training courses, including those for emergency procedures.

The Aircraft

The aircraft was a Lockheed Constellation, model 49E-46, N 2735A, serial number 1978. It had been purchased by Capital Airlines in October 1954. At the time of the accident it had been operated a total of 29,589 hours. All overhauls and inspections were current and maintenance had been kept current. Engines were Wright Cyclone, model 3350BA-3, and propellers were Hamilton Standard, model 33E60. All powerplant maintenance was satisfactory.

BIBLIOGRAPHY

1. NASA Technical Note 4406, "Low Tire Friction and Cornering Forces on a Wet Surface," Harrin, September 1958.
2. NASA Memorandum 2-23-S9L, "Tire-to-Surface Friction Especially Under Wet Conditions," Sawyer, et al, March 1959.
3. NASA Report 20, "Tire-to-Surface Friction - Coefficient Measurements with a C-123B Airplane on Various Runway Surfaces," Sawyer and Kolnick, June 1959.