

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: December 17, 1947

Released: December 18, 1947

AMERICAN AIRLINES—MICHIGAN CITY, INDIANA, DECEMBER 28, 1946

The Accident

American Airlines' Flight 2207 of December 28, 1946, en route from Buffalo, New York, to Chicago, Illinois, crashed at Michigan City, Indiana, about 0919 CST¹ on December 28. Both pilots were killed, other occupants were injured in varying degrees and the plane, a DC-3, NC 15577, was extensively damaged.

History of the Flight

This flight originated at Buffalo and proceeded uneventfully to a scheduled stop at Detroit, Michigan. Departure from Detroit was at 0748, about six minutes behind schedule, with eighteen passengers, 550 gallons of fuel and on an instrument flight plan to cruise at 2,500 feet sea level. Routine position reports were made at 0800, 0807 and 0822.

At 0840 the flight was instructed by Air Route Traffic Control at Chicago to climb to 4,000 feet sea level which it did immediately. At 0859 Chicago Air Route Traffic Control cleared the flight from South Bend, Indiana, to the Chicago Tower to maintain 4,000 feet sea level until ten minutes after passing South Bend. At 0902 the flight reported passing South Bend.

There were no further radio contacts with the flight until 0918 when it transmitted, "Both engines going bad descending at 1,000 feet per minute looking for opening." This was followed almost immediately by, "Altitude is at present 900 feet." Chicago immediately replied, "Suggest proceed to South Bend immediately if able." This was not acknowledged. The plane crashed at or about that time in the northeastern part of Michigan City at a point approximately two miles from Lake Michigan. The direction of initial impact was just south of

east or about opposite the course from Detroit to Chicago.

Investigation

Weather, both forecast and actual, at the time and place of the accident included an overcast with its top at about 4,000 feet and its base at about 1,000 feet. Within the overcast there existed conditions favorable for light to moderate icing. A profile of these weather conditions is attached.

Examination of the wreckage and control settings indicated there had been no structural failure while in flight. Wheels and flaps were not extended. Alcohol was found at the fittings to both carburetor air scoops. (Alcohol can be fed to the carburetor scoops when carburetor icing exists. Carburetor icing can be and generally is disposed of by supplying hot air to the carburetor.) The position of the heat controls and the carburetor heat valves indicated that heat had been applied to the right carburetor but not to the left. The fuel valves indicated that the left engine was feeding from the left main tank and the right engine from the left main and the left auxiliary tanks, these positions do not necessarily reflect their positions prior to impact.

Further examination of the wreckage revealed a small piece of foreign material wedged between the valve seat and the valve of the right auxiliary tank port of the right engine tank selector valve. This material was masking tape, or a similar substance, and was squeezed to a thickness of about .005 inch. Its presence resulted in the valve being held open to that extent. This valve led to a known empty tank (the right auxiliary).

A series of tests, under various combinations of poppet valve openings and differing quantities of fuel in the four tanks, was conducted. During these tests the

¹All times herein are based on the 24-hour clock and are Central Standard unless specified otherwise

poppet valve was held open for fixed and known distances. The actual opening of the subject poppet valve was estimated at .005 inch, however, it may formerly have been considerably more because the material holding it open was compressible. Tests showed that an opening of .005 inch did not cause engine stoppage but that three or four times that amount could cause stoppage of the engine on the same side as the empty auxiliary tank.

In general, these tests, although not conclusive, indicate that any appreciable flow of air from an empty tank into the fuel system can cause irregular power output and in particular can delay power recovery of a stopped engine.

American Airlines' flight procedure calls for a change of tankage when starting to cross Lake Michigan. This change would normally be from both engines feeding from the left auxiliary tank to both engines feeding from their respective main tanks. Upon departure from Detroit the aircraft carried 210 gallons in each main tank and 130 gallons in the left auxiliary. There was none in the right auxiliary.

Passenger testimony indicates that power stoppage or impairment occurred only a very few minutes before the crash, while the aircraft was cruising above the overcast. Testimony of passengers also confirms the formation of wing ice in the overcast, both on going up through it at Detroit and when coming down through it just before the crash. People on the ground testified that from the time the plane came into their vision from the bottom of the overcast about 1,000 feet above them until it crashed the engines were running improperly or not at all.

Discussion

The pilot was instructed by Air Route Traffic Control through the company radio to stay at 4,000 feet until ten minutes beyond South Bend. This message was received and acknowledged. Under company regulation he could cross the farther (Chicago) side of Lake Michigan at no less than 2,500 feet. At 0912, at which time he was ten minutes beyond South Bend, he was approximately 40 miles east of the far side of the lake with only 1,500 feet of altitude to lose. It would seem, therefore, that he would not have started a normal 300-foot per minute rate

of descent until about 12 miles from the far side which would have been at about 0923. To do otherwise would have put the aircraft into the icing overcast below sooner than necessary and for an unnecessarily long time. Since passenger opinion is generally in accord with the premise that he was in clear weather slightly above the overcast when the power interruption originated, it appears probable he was in cruising flight at 4,000 feet altitude when he experienced his initial trouble resulting in the first emergency message (at 0918).

The nature of this initial trouble has not been definitely determined. There is the possibility that the pilot accidentally exhausted his left auxiliary tank before changing to the main tank.² If that is so the small amount of additional air entering the fuel system from the fouled valve may have delayed power restoration until enough altitude had been lost to put the plane into the icing overcast not far below.

The cruising altitude of 4,000 feet was probably slightly above the tops of the overcast and the free-air temperature at this level was approximately 22 degrees. It is improbable that carburetor ice would have formed at that level under the existing conditions. However, improper use of carburetor air preheat can cause ice to form in the carburetion system. Had the pilot set the preheat control to provide a carburetor air temperature sufficient only to prevent formation of carburetor ice while at the cruising altitude, subsequent loss of power in the engines would cause rapid decrease in the carburetor preheat temperature. This reduction in preheat temperature could reduce the air temperature to a range where rapid ice accretion may be experienced. Any wing or carburetor ice would have been dissipated when examination of the wreckage was first made because of the residual heat of the engines and the prevailing ground temperature. Evidence indicates that the pilot applied alcohol to the carburetors. However, alcohol dissipates carburetor ice slowly and approximately three minutes would have been needed to dissipate the probable accretion. A DC-3 without

²The amount of fuel normally consumed from the time of takeoff to the time of the accident would have been about the amount carried in the left auxiliary tank. Also the type of fuel gauge on the plane can be in error by as much as 25 gallons

power will descend about 3,000 feet in three minutes and the plane was cruising 3,300 feet above the ground. (Cruising altitude—4,000 feet sea level, terrain elevation—700 feet sea level.)

The evidence in this case is meager, and conclusions concerning the cause of the initial engine failure and the reason for the pilot's inability to restore engine operation must necessarily be conjectural. However, careful study of all circumstances and reconstruction of the existing evidence concerning the sequence of events immediately preceding the crash, point strongly to the fact that carburetor ice impeded power recovery. Since the rate of ice accretion necessary to prevent recovery of power in this instance was greater than the rate which would be expected under the existing conditions, it appears that improper use of carburetor air preheat must have been involved.

Findings

Upon the basis of available evidence, the Board finds that:

—18110

1. The carrier, crew, and aircraft were properly certificated.

2. The flight had been entirely routine until the time of the initial trouble shortly before 0918 when complete or partial power loss occurred.

3. The aircraft descended into an overcast, carburetor ice formed rapidly, and could not be eliminated.

4. Normal power was not restored prior to the crash.

Probable Cause

The probable cause of this accident was the accumulation of carburetor ice following the loss of power in both engines as a result of fuel starvation. The reason for fuel starvation has not been determined.

BY THE CIVIL AERONAUTICS BOARD:

/s/ J. M. LANDIS

/s/ OSWALD RYAN

/s/ HARLEE BRANCH

Lee, Member, did not take part in the decision.

Supplemental Data

Investigation and Hearing

The Civil Aeronautics Board received notification of the accident about twenty minutes after it occurred and immediately initiated an investigation in accordance with the provisions of Section 702(a) (2) of the Civil Aeronautics Act of 1938, as amended. An Air Safety Investigator of the Board's Chicago, Illinois, office arrived at the scene about 1220 the same day and was later joined by other Safety Bureau personnel.

Air Carrier

American Airlines, a Delaware corporation with general headquarters in New York City, was operating as an air carrier under a Certificate of Public Convenience and Necessity and an Air Carrier Operating Certificate, both issued pursuant to the Civil Aeronautics Act of 1938, as amended. These certificates authorized the company to fly persons and materials between var-

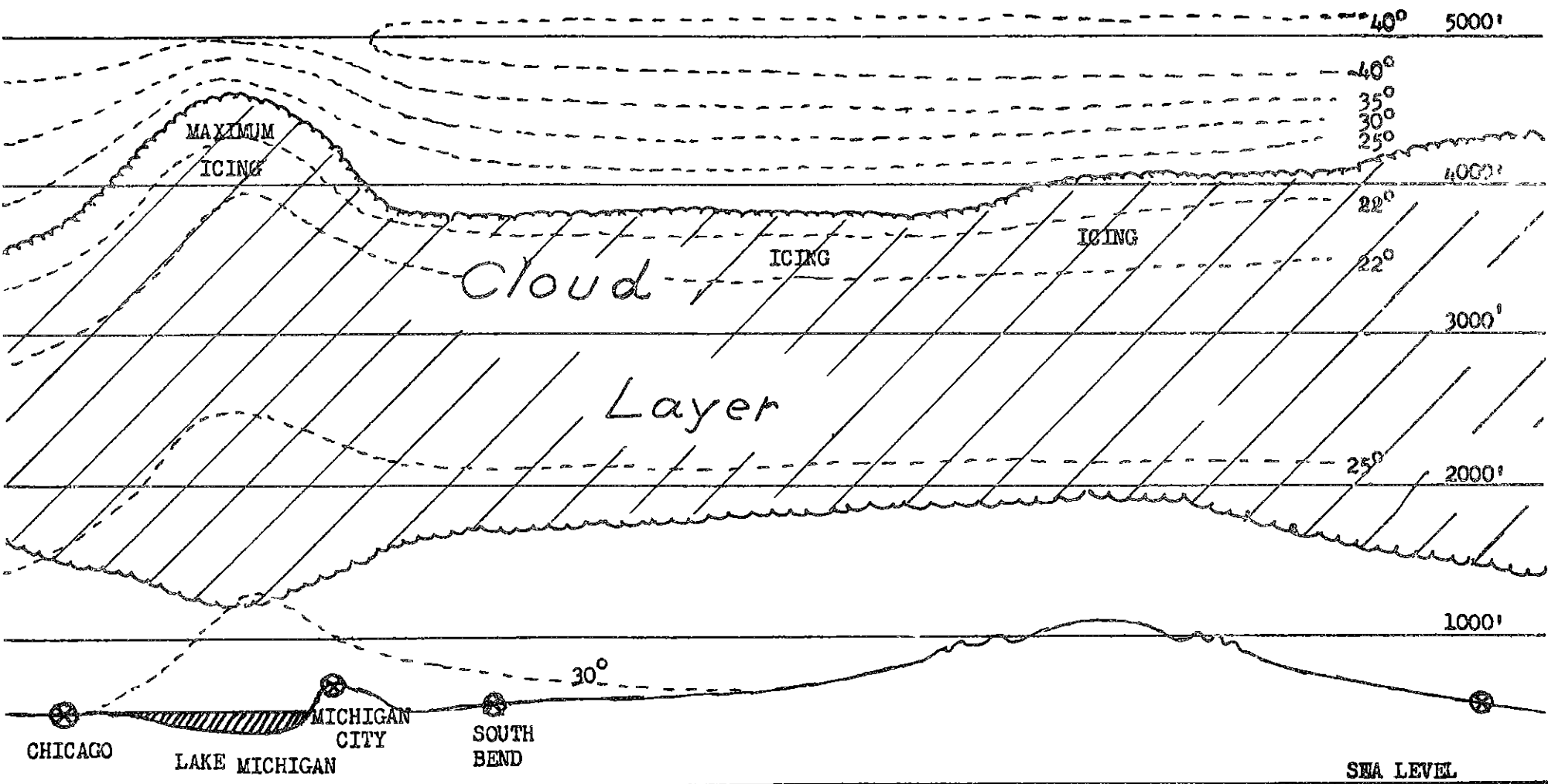
ious points in the United States including Detroit, Michigan, and Chicago, Illinois.

Flight Personnel

Frank Mapes Ham, Jr., age 25, was Captain of the aircraft. He had piloted a total of 3,559 hours of which nearly all had been on DC-3's. Harman Edwin Ring of Chicago was the First Officer. He had piloted about 2,000 hours of which about 1,000 hours had been on DC-3's. Both were properly certificated and the Captain was qualified over the route.

Aircraft

NC 15577, a Douglas DC-3 manufactured in July 1941, was powered by two Wright G-102 engines. At the time of the accident it had been flown 11,920 hours and all overhauls had been made within required time limits. The gross weight on departure from Detroit was 24,870 pounds as against a maximum allowable of 25,200 pounds.



PROFILE OF PROBABLE WEATHER AT TIME OF AMERICAN AIRLINES ACCIDENT AT
 MICHIGAN CITY, INDIANA, DECEMBER 28, 1946