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DEPARTMENT OF COMMERCE
Washington

June 10, 1938

REPORT OF AIRCRAFT ACCIDENT INVESTIGATION

Statement of probable cause concerning an accident which occurred to an aircraft of the United Air Lines Transport Corporation, in the vicinity of Cleveland, Ohio on May 24, 1938

In an order dated May 25, 1938, issued by the Secretary of Commerce, pursuant to the Air Commerce Act of 1926, as amended, relating to the investigation of accidents in civil air navigation in the United States, Bryan W. Jacobs, Assistant Director, George W. Vest, Chief, Regulation and Enforcement Division, and Phil C. Salzman, Airline Maintenance Inspector, all of the Bureau of Air Commerce, Department of Commerce, were designated as a Board to investigate the facts, conditions and circumstances of an aircraft accident which occurred on the night of May 24, 1938, in the vicinity of Cleveland, Ohio, and to make a report thereon. Major Clarence D. Barnhill, Commanding Officer of the 112th Observation Squadron, Ohio National Guard, was designated as an advisory member of the Board. All members of the Board had arrived in Cleveland, Ohio, by the night of May 25, 1938. After a field investigation had been made, public hearings were held from May 23, 1938, to June 1, 1938, inclusive, in the New Post Office Building, Cleveland, Ohio.

The following facts, conditions and circumstances appear to the Board to have attended the accident.

On May 24, 1938, at approximately 10 17 P. M., at a point approximately $8\frac{1}{2}$ miles east of the Cleveland, Ohio, Municipal Airport, an airplane of United States registry, while being flown in scheduled interstate operation, carrying mail, passengers, and express, met with an accident which resulted in death to all on board and destruction of the aircraft.

The First Pilot of the airplane, designated by the company as Captain, James L. Brandon, held a current and appropriate Federal Pilot Certificate of Competency and the required ratings for the flight involved. The report of his last physical examination, as required by the Department of Commerce and taken on May 2, 1938, showed him to be in satisfactory physical condition. Pilot Brandon had a total of over 12,000 hours of flying experience, over 9,000 hours of which were with this company or its predecessors. He had flown this type of airplane since March, 1937, and had been assigned to the Eastern Division, Newark-Chicago, for approximately $7\frac{1}{2}$ years. The Second Pilot, Austin S. Merrifield, designated by the company as First Officer, held a current and appropriate Federal Pilot Certificate of Competency and the required ratings. His last physical examination, taken on December 7, 1937, showed him to be in satisfactory physical condition. Both pilots enjoyed excellent professional reputations with their fellow pilots and their company. The Flight Stewardess was Mildred A. Macek.

Passengers on board were:

John Rodd Moffett,
Chicago, Illinois.

Elling H. Veblen,
Brentwood Heights, Cal.

Ralph Parker Morrell,
Bronxville, N. Y.

John K. Brostuen,
Chabonneau, N. D.

Richard Charles Lewis,
Ansonia, Conn.

Charles T. Lickel,
St. Albans, L. I., N. Y.

L. Arthur Doty,
Watertown, Mass.

The aircraft, a Douglas twin-engine cabin sleeper land monoplane, Model DST-A, was inspected and approved as airworthy by the Department of Commerce on April 20, 1938. It bore Federal Aircraft Certificate (License) NC-18108 and company number 108. It was owned by United Air Lines Transport Corporation with main offices in Chicago, Illinois, and at the time of the accident was being operated by that corporation on Trip No. 9, scheduled from Newark, N. J., to Chicago, Ill., with an intermediate stop at Cleveland, Ohio. This operation was conducted under a currently effective Letter of Authority issued by the Department of Commerce.

The flight was scheduled to arrive at Cleveland, Ohio, at 10:15 P.M. The departure of the flight from Newark, N. J., scheduled for 7:30 P.M., was delayed, according to the testimony, for a passenger connection. Actual departure from Newark, N. J., was 7:41 P.M. The weather was favorable and remained so throughout the flight. Instrument flying was authorized in the clearance to permit over-the-top flying between Newark, N. J., and the vicinity of Bellefonte, Penn. Department of Commerce airway aids and facilities over the Cleveland-Newark Airway were operating normally during the period of the flight with the exception that the voice broadcast at the Bellefonte, Penn. radio range was inoperative from 9:00 P.M. to 9:40 P.M. and the boundary and obstruction lights at the intermediate field at Mercer, Penn. were inoperative from 9:00 P.M. until 2:30 P.M. the following day. Evidence indicates that neither of

these outages was a contributing factor to this accident. All radio contacts were normal until after the aircraft had passed Parkman, Ohio. In the last radio contact, the flight reported over Parkman, at 10:07 P.M. flying at 4,000 feet (above sea level) and that the weather was clear. This was the last radio contact made with the flight although several attempts to contact the flight were made subsequent to 10:17 P.M. (the time later established as the time the airplane struck the ground). The next radio position report after Parkman would normally have been made from near Bedford, Ohio, at which time the pilot would request landing instructions from the Cleveland Airport Control Tower. The accident occurred at a point between Bedford and the Cleveland Municipal Airport.

Witnesses who observed the airplane at various points from east of Bedford, Ohio, to the place of the accident aided the Board in tracing the flight path of the airplane from west of Parkman to the scene of the accident. The first witness, about two miles east of Bedford, observed the airplane pass approximately overhead at what he described as normal altitude, normal course, both engines sounded normal and no fire was observed. One witness in Bedford stated that when he first saw the airplane, both engines sounded normal but there appeared to be a fire under the right engine nacelle. Almost immediately after sighting the airplane, the engines were heard to splutter and appeared to stop as the airplane disappeared from view behind high trees. A number of persons between Bedford and the scene of the accident heard and saw the airplane. From the testimony, it is evident that fire occurred in flight and was first observed under the right engine and continued to burn throughout the remainder of the flight. The airplane continued in approximately straight flight at lower ~~than~~ normal altitude with one engine functioning at what witnesses described to be greater than normal

R. P. M. The airplane was then observed to strike the trees with the left wing low, come to rest in a wooded ravine and burn. Both of the airplane's landing lights were observed to be on during the last three miles of flight. A subsequent search of the area disclosed that the aircraft had broken the top from a high oak tree about 600 feet east of the final resting place of the airplane.

An examination of the wreckage disclosed that the left wing of the airplane had been torn off as the airplane flew low into the wooded area. The airplane had rotated to the left but continued in approximately the same line of flight to the far bank of a dry ravine. The resultant impact tore off the right wing and the right engine and threw them separately clear of the main portion of the fuselage and beyond the fire area. Except for the tail group, the remainder of the airplane, including the left engine and left landing gear, was so destroyed by fire that little could be learned from the instruments, control settings, flight recorder, etc., or from the left engine.

There was evidence that the right side of the landing gear was down and locked in the landing position. The left side of the landing gear was destroyed. Both flares were recovered near the wreckage and gave no evidence of having been released by the crew.

The left propeller, although badly damaged as a result of the fire after the impact, gave evidence that the left engine was turning over at less than normal cruising speed at the time of impact. The right propeller, thrown clear of the fire with the right engine, indicated that this engine was not developing any power at the time of impact.

The right engine, thrown clear of the fire at the time of impact, came to rest in an inverted position and showed signs of only a small fire after

impact. It did, however, show evidence of an intense fire prior to impact.

In reviewing the facts and circumstances surrounding the flight, there was no evidence to indicate that any difficulties were experienced prior to reaching Bedford, Ohio, where number 3 cylinder barrel of the right engine failed which in this case resulted in a fire in the right engine nacelle. This fire apparently could not be extinguished in flight and grew to such an intensity that it is believed the pilot decided to make an emergency landing rather than attempt to reach the Cleveland Municipal Airport, approximately ten miles ahead. It is further believed that while maneuvering for this landing, the airplane struck the top of the tall oak tree with the result that the pilot was unable to reach the field selected.

A detailed examination and tear down inspection of the right engine disclosed that number 3 cylinder, its piston and link rod had failed in flight. An analysis of the failures by representatives of the Department of Commerce, the engine manufacturer and the airline disclosed that the cylinder barrel had failed first. On a subsequent down stroke of the piston, the skirt of the piston apparently caught the broken edge of the lower portion of the failed cylinder barrel and as a result of this sudden stop of the piston, the link rod piston pin bearing strap pulled loose permitting the link rod on its next up stroke to drive the piston against the head of the cylinder. This excessive upward travel of the piston lifted the upper portion of the cylinder and pulled the intake pipe out of the blower section. This also caused the exhaust pipe sleeve which connects the cylinder to the exhaust pipe to become canted, leaving an opening between the sleeve and the exhaust pipe, from which exhaust flame could escape. Other internal and external damage resulted.

The evidence leaves little or no doubt that the fire resulted from the failure and lifting of number 3 cylinder with the subsequent displacement of other parts described in the preceding paragraph. This displacement of parts

created numerous possibilities for the ignition of fuel, oil or their vapors. Exactly how the fire was ignited is indeterminable from available evidence and must remain a matter of conjecture.

In tracing the fire from its origin through its progression, there is positive evidence of three separate although related stages, the first and second of which occurred in the air. The fire originated in the power section of the engine ahead of the diaphragm which separates the power section from the accessory section. The second and more serious stage of the fire occurred behind the diaphragm in the engine accessory section as a result of the initial fire in the power section. The final stage of the fire resulted from the bursting of the fuel tanks on or immediately after impact.

The progression of the initial fire through the diaphragm which separates the power section of the engine from the accessory section, proved serious and is unique in the history of airline operation. Holes in the diaphragm are provided for the passage of oil lines, ignition wires, controls, etc. In this case, the evidence indicates that sufficient flame was blown through one of the holes to burn through an oil line. This resulted in a continuous oil fire intensified by air blowing through the openings in the diaphragm. As a result, the pilot was confronted with an emergency which required that he decide between an immediate landing or continued flight. Although no flares had been released, the fact that the landing lights had been on the last three miles of flight and that the landing gear was found locked in the down position, leads to the belief that the pilot elected to make an immediate landing.

In summation, the evidence indicates that the flight was dispatched out of Newark in accordance with normal company procedure and in conformity with existing Federal regulations. It had progressed normally and was proceeding by visual contact as it approached the last position reporting point, Bedford, Ohio. In the vicinity of Bedford, a cylinder barrel of the right engine failed which resulted in a fire of such intensity within and about the right engine nacelle that the pilot elected to make an immediate landing as the safest procedure. From the testimony of numerous witnesses from Bedford to the scene of the accident and several witnesses to the actual end of the flight, it is evident that the pilot, knowing the terrain from more than seven years experience flying over this section of the country, selected a field and made an approach for an emergency landing. Clipping the top of a high tree prevented completion of the approach and made collision with the nearby wooded area unavoidable.

In conclusion, the Board feels that because of the circumstances which obtained, the crew was beyond criticism in any decision that an immediate landing was a safer procedure than to attempt to continue to the Cleveland Airport. A study of the adjacent terrain and the pilot's familiarity with the country suggests that he was approaching a field in which he believed an emergency landing could be made.

The Board wishes to state further that immediate steps have been taken both by the Department of Commerce and by the operator to develop a diaphragm for use between the power section and the accessory section of the engine which will prevent any fire from traveling from one to the other under similar circumstances.

Laboratory examination and tests of the cylinder barrel which failed were made by the National Bureau of Standards. Its preliminary report is 9652

attached and made a part of this report.

It is the opinion of the Investigating Board that the probable cause of this accident was a fire in the right engine accessory section which resulted from the failure of a cylinder barrel and was fed from the right engine oil supply.

Respectfully submittea.

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Assistant Director (Chairman).

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