

## CIVIL AERONAUTICS BOARD

## ACCIDENT INVESTIGATION REPORT

Adopted: November 26, 1946Released: December 2, 1946TRANSCONTINENTAL AND WESTERN AIR, L'C. - CHICAGO, ILLINOIS - July 2, 1946The Accident

A Transcontinental and Western Air's Douglas DC-3, designated as Trip 456, en route from Chicago, Illinois, to New York, N. Y., was landed approximately 1½ miles northeast of the Chicago Municipal Airport at approximately 0910<sup>+</sup>, July 2, 1946, with wheels retracted following failure of both engines in flight. Several of the 21 occupants sustained minor injuries and the aircraft was extensively damaged.

History of the Flight

Flight 456 was scheduled to depart the Chicago Municipal Airport at 0900, with its destination as La Guardia Field, New York, N. Y., and with its first scheduled stop at South Bend, Indiana. Under CFR flight clearance, the flight was reported "off" at 0900, and departed the Chicago Municipal Airport en route for South Bend to cruise at 5,000 feet. Shortly after take-off at an altitude of 600 feet, the left engine failed with no prior warning apparent to the flight crew. Emergency single engine procedures were immediately initiated, however, the propeller was not feathered and the captain continued in an effort to restore operation of that engine. Simultaneously, the first officer contacted the Control Tower at the Chicago Municipal Airport and notified the Tower of the captain's intention to return.

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\*All times referred to in this report are Central Standard Time and based on the 24-hour clock.

The captain entered a turn to the left and, after approximately 90 degrees of turn, the right engine also failed with no prior indication of difficulty. Realizing that it would not be possible to return to the airport, the captain selected a field adjoining the Chicago Belt Railroad, and descended toward that area, maneuvering the aircraft so as to avoid large buildings and the residential sections east of the field. When at an altitude of less than 100 feet, the first officer was instructed to extend full flaps and the aircraft descended into the field with the landing gear retracted. First contact was made at a point approximately 150 yards east northeast of the railroad embankment shortly after which the left wing struck a telephone pole, uprooting the pole and breaking it in two as the aircraft skidded toward the embankment. The aircraft passed underneath the telephone wires and came to rest on the railroad track facing in the direction of its flight path, its left wing having been severed through almost one-half its chord and extensive damage having been sustained by the engine nacelles and fuselage.

Before leaving the aircraft, the first officer turned off the battery and individual engine ignition switches and moved the mixture controls to the idle cut-off position. The occupants of the aircraft were quickly deplaned and moved to a safe distance from the aircraft. No serious injuries were sustained by either the flight crew or passengers. Inasmuch as it was apparent that no danger of fire existed, the captain re-entered the cockpit and turned off the fuel selector valves.

#### Investigation

The wrecked aircraft was lying on the railroad tracks in a slightly nose low attitude facing west southwest. The left wing was almost severed at a point 12 feet outboard of the left engine at which contact had been made with

the telephone pole shortly before coming to rest on the railroad embankment. Both nacelles and the center section were warped and broken. The right engine was almost completely torn from the nacelle, and the propellers of both engines were badly damaged. Extensive wrinkling was observed throughout the entire fuselage rearward as far as the cabin door. The empennage bore no visible indication of damage.

The testimony of the captain and first officer disclosed that the fuel pressure for the left engine dropped to approximately 7 lbs. at the time of complete power loss. Although neither was able to recall whether the fuel pressure warning lights were on at that moment, the pilots indicated that both lights were on after the right engine had also failed. The power loss in neither case was accompanied by surging or engine vibration. No roughness in either engine was apparent to the crew prior to loss of power and no abnormal instrument indications were observed during the take-off.

Exhaustive inspection of both engines failed to disclose any mechanical failure or reasons for malfunctioning in flight. Inspection of the aircraft log and maintenance records revealed no discrepancies, nor did the history of either powerplant indicate any previous malfunctioning similar to that which occurred in this instance. Evidence disclosed that the left auxiliary tank was empty and that the left and right main tanks carried approximately 130 gallons each at time of take-off. The fuel tank selector valves were both found in the "Off" position as were the individual ignition switches. The master ignition switch and the auxiliary fuel pump switches were both in the "On" position. The dump valves had not been used in flight, and the fire extinguisher system had not been operated at any time.

Inspection of the fuel system disclosed no evidence of malfunctioning or failure. The fuel tank selector valve controls were both found to be properly rigged and synchronized exactly with the detents on the valves and were installed in proper sequence. All fuel lines from the tanks to the selector valve and from the valve to both engines were intact and contained no indication of loose fittings, fractures, or leakage from any other source. No water was found in the fuel system. Performance tests of the engine fuel pumps revealed these pumps to be in satisfactory operating condition. Both auxiliary fuel pumps tested subsequent to the accident provided a flow of approximately 300 gallons per hour each against no restrictions. Carburetor flow tests indicated that both carburetors were in normal operating condition. All tank vents and vapor vent return lines from the carburetor to the main tanks were clear. The internal mechanism of the tank selector valves was found to be in good condition in each valve and no leakage in the "Off" position was observed under suction tests ranging from 0 to 20 inches of mercury. The poppet valve to the left auxiliary tank was found to be properly seated, and no possibility of air leakage into the fuel system was observed. No restrictions were found in the air intake passages.

Both engine ignition switch circuits were thoroughly checked, with the exception of the lines in the right engine from the fire cell carbon plugs to the magnetos, and all circuits were found to be functioning satisfactorily. The ignition switch was disassembled and no indications of electrical shorts were observed. Both electrical fuel booster pumps were found to be operating within the normal pressure limits after having been removed and tested. No indications of electrical system failures affecting the operation of the powerplants were observed in any of the tests conducted.

The engines were removed from their respective mounts and were brought to Transcontinental and Western Air's overhaul shops at Kansas City, Missouri under seal. With the exception of three damaged cylinders for which serviceable cylinders were substituted, the engines were mounted on test stands with the original components installed in the aircraft involved in the accident. The engines were run at several power settings up to and including take-off power, and several mixture control settings were used with normal climbing power. Throughout all of these tests both engines operated normally.

### Discussion

Examination of the damage to the engines and propellers as a result of impact and the propeller marks on the ground indicate conclusively that no power was being developed at the time of contact, but that the propellers were windmilling. All of the damage sustained by the engines and the aircraft proper were identified as results of impact with objects on the ground. No indications were found of structural failure in flight and the cause for the engine stoppage was not determined.

The testimony of the captain indicates that the turn back to the field following failure of the left engine was made to the left in order to avoid the congested residential areas to the south and to place the aircraft in the most advantageous position for landing at the airport. Under the circumstance imposed by engine failure, the flight crew had no alternative but to land in the manner in which the emergency landing was accomplished.

Requirement for the dual fuel system had been incorporated into the Civil Air Regulations by the Civil Aeronautics Board to replace the single systems specifically in order to avoid the possibility of mechanical failure or vapor lock affecting both engines simultaneously.

Engineering data available to the Board at the present

moment indicates that mechanical failure or vapor lock in any one system could not have caused failure of both engines almost simultaneously. The dual fuel system installed in all Transcontinental and Western Air's aircraft had, until this accident, proved to be completely satisfactory.

In view of the complete absence of any indications of material malfunctioning, it was found necessary to examine records of powerplant difficulties which appear to be of a similar nature in order to determine if the history of the powerplant and the fuel system employed by Transcontinental and Western Air, Inc., reveal previous difficulties of this nature. No incidents were observed which indicated that the experience of Flight 456 had been previously duplicated. In view of the evidence available and the testimony of the flight crew, it can be concluded that this accident is novel in the experience of accident investigation. The Board has reviewed all possibilities for engine stoppage and concludes that the only valid cause for the failures which occurred in this case was that of fuel starvation as, for instance, exhaustion of fuel supply in flight. It was determined through flight tests conducted subsequent to the accident that engine stoppage of the nature which occurred in this accident could be expected had the pilot accomplished his take-off using a tank which contained fuel sufficient only for take-off and climb to an altitude of 600 feet. However, it was further disclosed that the sequence and the manner in which the engines failed due to fuel starvation would not necessarily follow an exact pattern. It can be concluded therefore that fuel exhaustion of the gasoline tank being used during take-off could have produced results similar to those which occurred in this accident.

Inasmuch as testimony of both the captain and the co-pilot indicate that the fuel selector valve was turned to the left main tank for the left engine

and the right main tank for the right engine at the time they entered the aircraft prior to starting the engines and that these controls were not moved until after the aircraft came to rest on the railroad embankment, it is manifestly impossible to determine the exact cause for this accident.

### Findings

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

1. The company, aircraft, and crew were properly certificated.
2. At the time of take-off, the left and right main tanks contained approximately 130 gallons of gasoline each and the auxiliary tank was empty, with the exception of residual fuel contained within the lines and that portion of the tank below the screen.
3. Shortly after take-off from Chicago Municipal Airport at an altitude of approximately 600 feet, the left engine, without prior warning, ceased delivering power.
4. The captain turned to the left intending to return to the airport for an emergency landing.
5. After approximately 90 degrees of turn the right engine failed in a similar manner.
6. The aircraft continued in its turn for an additional 90 degrees and was headed toward the airport while descending.
7. An emergency landing was made without power and with the wheels retracted and, after skidding approximately 150 yards, the aircraft came to rest on a railroad embankment.
8. No indication of mechanical failure or malfunction<sup>ing</sup> was observed in any part of the aircraft.
9. The loss of power in both engines resembles that experienced during fuel starvation when operating on an empty fuel tank.

10. The testimony of the flight crew indicated that take-off was accomplished with the left and right engines operating from the left and right main tanks, respectively.

Probable Cause

The Board determines that the probable cause of this accident was the complete loss of power in both engines due to fuel starvation necessitating an emergency landing in an unfavorable area. The cause for fuel starvation of the engines has not been determined.

BY THE CIVIL AERONAUTICS BOARD:

/s/ J. M. Landis

/s/ Oswald Ryan

/s/ Harllee Branch

/s/ Josh Lee

/s/ Clarence M. Young



## SUPPLEMENTAL DATA

### Investigation and Hearing

The Civil Aeronautics Board was notified of the accident at 0925 CST, July 2, 1946. An investigation was immediately initiated in accordance with Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. The Senior Air Safety Investigator of the Board's Chicago Office arrived at the scene of the accident at 0945 CST, the same day, and was later assisted in the investigation by other members of the Safety Bureau staff. A public hearing was ordered by the Board and was held at Chicago, Illinois, July 23, 1946.

### Air Carrier

Transcontinental and Western Air, Inc., incorporated under the laws of Delaware, with headquarters at Kansas City, Missouri, was operating 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 Transcontinental and Western Air, Inc., to transport persons, property, and mail between various points in the United States, including Chicago, Illinois, and New York, N. Y.

### Flight Personnel

Captain S. J. Gracey, age 29, of New York, N. Y., was pilot of the aircraft. Up to the date of the accident he had accumulated a total of 2559 hours' flying time, of which 2,261 hours were obtained in the DC-3 equipment. First Officer L. J. Conway, age 28, of New York, N. Y., had accumulated a total of 2,939 hours, of which 381 hours were as co-pilot in DC-3 equipment. With the exception of that portion of his flying experience as co-pilot with

TWA, Conway's flying time was almost entirely obtained in the J.F. Miss Jane Lackas of Jackson Heights, New York, was Stewardess. The captain and first officer were properly certificated for their respective duties, and the captain was qualified over the route.

#### Aircraft

NC-28383, a Douglas DC-3, had been used by TWA for a period of five years and four months, during which time it had accumulated a total of 14,043 hours, 49:20 hours of which had been obtained since the last major overhaul. Two Wright G-202L engines, equipped with Hamilton Standard propellers, were installed. The left and right engines had accumulated a total of 5,651 hours and 14,942 hours, respectively, and both were in service 49:21 hours since the last major overhaul. At the time of take-off from the Chicago Municipal Airport, the aircraft was within its maximum gross weight limits and the load was distributed with respect to its center of gravity within approved limits.