File No. 1-0039

CIVIL AERONAUTICS BOARD
ACCIDENT INVESTIGATION REPORT

Adopted: February 3, 1954 Released: February 8, 1954

WESTERN AIR LINES, INC. - LOS ANGELES, CALIFORNIA
JUNE 29, 1953

The Accident

A DC-3A aircraft, N 15569, owned and operated by Western Air Lines, Inc., a scheduled air carrier, crashed shortly after takeoff on the Los Angeles, California, International Airport, at about 1726 PST,1/ June 29, 1953, while on a routine test flight following a major overhaul. The two crew members were injured, and a company aircraft inspector on board was killed. The aircraft received major damage.

History of the Flight

N 15569 was cleared by the tower at 1723 for takeoff on Runway 25R, for a local VFR flight.

On takeoff run at 1725, just when becoming airborne, and near the intersection of Runway 25R with Runway 22-4, it appeared that control of the aircraft had been lost. The right wing dropped and shortly struck the ground. The aircraft was then 15-20 feet high and the right wing remained down and the tail rose. It then veered to the right of the runway, cartwheeled over its nose, and came to rest upside down. Fire broke out a few seconds later in the forward portion of the fuselage.

Captain Johnson received minor injuries, Copilot Williams was seriously burned, and Company Chief Inspector Stromisky, sitting in the jump seat, was killed.

Tower personnel had alerted emergency equipment when the aircraft first appeared to be in trouble, and fire apparatus arrived at the scene within a few minutes and extinguished the fire.

The gross weight of the aircraft at the time of takeoff was 21,203 pounds, well below the prescribed maximum of 25,346 pounds, which was distributed within the approved C. G. limits.

Weather at the time and place was good, with unlimited ceiling and visibility and a southwest wind at 10 m.p.h.

Investigation

Examination of marks on the runway showed that first contact by the right wing tip was 1,879 feet from the takeoff end of Runway 25R. This mark was 68½ feet long. Forty feet beyond, another wing mark started and continued for 36 feet. There were no runway markings for the next 399½ feet. At that point another wing mark started, continuing for 335 feet.

1/ All times referred to herein are Pacific Standard and based on the 24-hour clock.

The airplane came to rest inverted, about 950 feet from the point where the right wing tip first contacted the runway, or about 2,830 feet from the takeoff end of Runway 25R.

The right wing, with its aileron and flap attached, lay on the ground in an upright position, torn from the fuselage. The entire fuselage, with its undamaged left wing and aileron attached, lay inverted. The nose section of the fuselage from the wing leading edge forward, was completely severed by impact and fire, and the cockpit area was demolished. Only the aircraft and engine control cables and some electric wiring extending from the cockpit rearward into the center section were still attached and unbroken. The empennage was intact except for the tips of the right stabilizer and elevator, which were found bent and torn. The right power plant and the right landing gear had been torn free; the left power plant and landing gear remained attached to the structure.

Inspection of the control pedestal revealed the throttles to be in approximately cruise position, carburetor mixture controls were set for takeoff and climb, propeller controls were in full low pitch position, and all flight control trim tabs in neutral positions.

During this initial examination the captain suggested that the difficulty may have been in the aileron control. This coupled with the observed behavior of the aircraft during the takeoff run, pointed to an isolation of the trouble in the aileron control system. Accordingly, it was studied throughout for defect.

An immediate inspection was made of the flight control cables. All cable attachments to the aircraft control surfaces were found attached and safetied. There was no evidence that normal movement of the controls had been impaired prior to impact.

The aileron trim tab control drum of the right wing was found with its cable attached to the center of the drum and with four loops of this cable on both sides of the center, corresponding with the control trim tab being in neutral. Similarly, the rudder and elevator control trim tabs were observed to be in neutral positions. This corresponded with their indicated positions on the control pedestal.

Examination of the control system revealed that the aileron control cable within the control column housing had been reversed.

Specifically, the replacement pulleys, one aluminum and one micarta, located at the elbows of both control columns, had been transposed during assembly. The correct position of these pulleys is, aluminum pulley aft, micarta pulley forward. Over each of these pulleys passes a control cable. The ends of these cables attach to ends of a bicycle chain that runs over a sprocket attached to the shaft of the control wheel. The aforementioned pulleys being transposed, the assembly mechanic, from then on correctly following a diagram in the Overhaul Manual,2/fastened the cable passing

2/ Containing information from Douglas Drawing 5002644, View B-B (also USAF TO 01-40NL-2, Page 78, View C-C).

over the micarta pulley to the upper end of the bicycle chain and the one passing over the aluminum pulley to the lower end of the chain. The above-mentioned error resulted from the mechanic assuming that the diagram was of the captain's left side looking forward. Although this diagram was ambiguous in that it did not illustrate graphically which wheel was depicted nor the direction from which it was viewed, instructions applicable to the diagram indicate that it referred to the copilot's wheel looking aft. The result was a reversed motion of the ailerons.

Investigation disclosed that the mechanic was unaware of having made a mistake during the assembly and subsequently initialed the item on the Plane Overhaul Record as having satisfactorily completed the work.

Both control columns were installed in the aircraft a few days later by the same (assembly) mechanic, who then went on vacation. The company inspector (the same individual who was killed in the accident) signed off the Plane Overhaul Record indicating that he was satisfied with the work.

The next step in the overhaul procedure was the rigging, or connecting and adjusting, of the entire control system. This was done and likewise signed off by another mechanic, a rigger, on the Plane Overhaul Record as having been completed satisfactorily. In addition, the same (deceased) company inspector signed off the Plane Overhaul Record again indicating that he was satisfied.

The next step was to check full travel of controls against full travel of control surfaces. A mechanic in the cockpit moved the controls while the travel of the control surfaces was observed by another mechanic and the (deceased) inspector standing on the ground.

All controls and control surfaces moved freely and with full travel. (Actually the normal aileron control, or wheel rotation, was reversed in relation to the aileron motion but this went unnoticed.) This phase of the work was also signed off by the same (deceased) inspector.

Before the subject flight was started, the captain made a "walk around" visual inspection of the aircraft. This type of inspection did not, and could not, reveal the abnormality in the aileron control system. Upon boarding the aircraft, the captain went through his cockpit check list. This included moving all controls to ascertain if they moved freely and fully. It did not include a check of the proper direction of control surface travel in relation to the control wheel. This latter check was not then required of flight crews.

Accordingly, takeoff was started with the crew unaware of the aileron system being improperly connected.

Investigation revealed that all maintenance, inspection and flight personnel involved were certificated for their respective duties by the Civil Aeronautics Administration.

Analysis

It was developed that a misinterpretation of a diagram in the Overhaul Manual by the assembly mechanic was the cause of the reversed assembly. An explanation of this diagram and the seeming cause for its misinterpretation has appeared under Investigation. The use of this diagram resulted in an interchange of the cable pulleys, following which the bicycle chain ends were attached to the cables crossing over the pulleys specified in the Overhaul Manual. In this manner, a compounded error produced the reversal of aileron motion in relation to the cockpit aileron control wheel.

The Board, after careful consideration of all the facts developed in this investigation, concludes that had the proper functional checks been made by either the mechanic or the inspector, the improper installation of the aileron controls would have been detected. This functional check is a required item in both installation and inspection, with which the personnel involved were well acquainted. All were certificated mechanics and had considerable experience in working on DC-3 type aircraft. Of course, had the company's maintenance procedures been more explicit, it is unlikely that the assembly mistake would have been made.

The crew were regularly scheduled line pilots and according to normal DC-3 flight operating procedures were required to check for free and full travel of the controls only. This was accomplished; however, had they been sufficiently alert while acting as a test crew during the pre-flight inspection of the aircraft, the reversal of the controls should have been detected.

On July 3, 1953, four days after the accident, Western Air Lines, in revision No. 132 of July 3, 1953, of their DC-3 Overhaul (Maintenance) Manual, specified that checks be made by maintenance, inspection and flight crews of not only free and full travel of controls, but direction of the control surface travel relative to movement of the cockpit controls.

Findings

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

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

2. The aircraft was loaded well below its maximum allowable takeoff weight and the load was properly distributed in relation to the approved C. G. limits.

3. The flight was for the purpose of initial test following major overhaul of the aircraft.

4. During overhaul, aileron control cables were improperly connected.

5. Inspection, or lack of inspection, failed to detect this error.

6. Lateral control was lost during takeoff and the aircraft overturned.

7. Weather at the time was good and had no bearing on the accident.

Probable Cause

The Board determines that the probable cause of this accident was reversed installation of aileron control cables and pulleys, and failure of the inspection department to detect this mistake.

BY THE CIVIL AERONAUTICS BOARD:

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

SUPPLEMENTAL DATA

Special Investigation

The Civil Aeronautics Board was notified of this accident about 1845 PDT on June 29, 1953, at Santa Monica, California. An investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. In connection with the investigation, depositions were taken and other documents including photographs were made a part of the record at Los Angeles, California, in lieu of a public hearing.

Air Carrier

Western Air Lines, Inc., is a scheduled air carrier, incorporated in the state of Delaware, with its principal business office at Los Angeles, California. It operates under a currently effective certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration. These certificates authorize the company to transport by air persons and property over numerous routes within the continental limits of the United States and certain points in the Dominion of Canada.

Flight Personnel

Captain Robert V. Johnson, age 31, was employed by Western Air Lines, Inc., on September 22, 1944. He held a valid airline transport certificate with a DC-3 type rating. Captain Johnson had a total of 6,793:44 flying hours, with a total of 2,783:26 hours in DC-3 aircraft. He received his last CAA physical examination on April 18, 1953.

First Officer William E. Williams, age 27, was employed by Western Air Lines, Inc., on November 21, 1952. He held a valid airman certificate with a commercial rating for single- and multi-engine land aircraft, and an instrument rating. First Officer Williams had a total of 1,600 flying hours, with a total of 162:51 hours in DC-3 aircraft. He received his last CAA physical examination on February 9, 1953.

The Aircraft

N 15569, a Douglas DC-3A, was owned and operated by Western Air Lines and was currently certificated by the Civil Aeronautics Administration. It had a total aircraft time of 30,793:38 hours, and none since overhaul, as the last major overhaul was completed June 29, 1953, the day of the accident.