CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: February 4, 1948 Released: February 5, 1948

TRANSCONTINENTAL AND WESTERN AIR, INC.—CAPE MAY, N. J., MAY 11, 1947

The Accident

Transcontinental and Western Air's Lockheed Model 049, Constellation, NC-86508, crashed into Delaware Bay at 0939,[1] May 11, 1947, while on a local training flight. The aircraft was demolished by impact with the water and subsequent explosions, which resulted in fatal injuries to the four crew members.

History of the Flight

NC-86508, hereinafter referred to as Aircraft 508, was temporarily assigned to the New Castle County Airport, New Castle, Delaware, for use in the transition training program of the International Division of TWA. Aircraft 508, with a flight instructor, a student captain, a flight engineer instructor and a student flight engineer aboard, was cleared for a local training flight and departed New Castle at 0817, May 11, 1947. The aircraft was observed at approximately 0930 circling the airport at the Cape May Coast Guard Operating Base, Cape May, New Jersey, at an approximate altitude of 1,200 feet, and shortly after, was observed one mile south of Cape May Point flying in a westerly direction toward the Brandywine Shoal Lighthouse.

The aircraft approached the lighthouse at an altitude of approximately 2,500 feet in straight and level flight. While still east of the lighthouse, the aircraft was observed to start a left turn, and as the turn progressed, the bank increased sharply. As the turn continued, the aircraft assumed a nose-down attitude, and entered what appeared to be a tight diving spiral to the left, which witnesses describe as continuing for either 3/4 or 1 3/4 turns. After the rotation was stopped, the aircraft continued its descent in a steep diving attitude. As partial recovery from the dive was being effected, a loud roar of the engines was heard. The aircraft struck the water in a nose-down attitude at an angle of approximately 45°. After impact, two or three muffled explosions were heard followed by smoke and fire.

Investigation

Investigation disclosed that the aircraft had crashed in 6 to 20 feet of water approximately 500 yards south-southeast of the Brandywine Shoal Lighthouse. Nearby fishing boats, located at various bearings from the point of impact, immediately proceeded to the scene of the accident to render assistance, but there were no survivors. Three wallets, the back of a seat, an oxygen tank, a landing light, and miscellaneous papers were found floating and were recovered.

Diving operations were initiated on May 14, by the United States Navy under the direction of Board personnel. Prior to the arrival of the Navy divers, and during the diving operations, which were continued through May 20, grappling operations from small boats were also conducted. The diving and grappling operations resulted in the recovery of several pieces of the aircraft structure and one cylinder from No. 3 engine. Inspection of these parts revealed exceptionally high impact forces and complete disintegration of the aircraft due to impact and subsequent explosions. The Navy was requested to make underwater photograpns of the wreckage but the murkiness of the water prevented satisfactory coverage.

The Navy furnished its best available equipment for the salvage operations. However, the strong current and the roughness of the water over the relatively unprotected shoal on which the aircraft crashed made the salvage operations exceedingly difficult. Furthermore, considerable difficulty was experienced in locating parts of the

[1] All times referred to herein are Eastern Daylight Saving and based on the 24-hour clock

wreckage and as salvage operations progressed the current moved parts of the wreckage and other parts became buried in the sand. Operations were discontinued when it became apparent that further salvage was impractical.

Testimony indicated that the 1,000 pounds of ballast, which is carried on Model 049 transition training aircraft to provide a proper center of gravity, was properly loaded and secured. Inspection of company maintenance records indicated that the aircraft was in airworthy condition at the time of its departure from New Castle and that the aircraft had undergone a 50-hour check immediately preceding the last flight. Captain R. E. Weeks, the flight instructor on the fatal flight, had flown this aircraft on the flight immediately preceding the last 50-hour check and no discrepancy of any consequence was reported. No radio reports were received from the aircraft to indicate that any difficulty had been experienced prior to the accident.

While east of the lighthouse, prior to the start of the last turn, witnesses stated there was a perceptible change in the sound of the engines as if an engine or engines were being throttled. Witnesses also stated there was no explosion or fire prior to impact, but some testified that there was a structural failure during the attempted pull-out immediately prior to impact.

The flight was cleared on a visual flight plan. At the time of the accident, weather reports indicated that in the vicinity of the Brandywine Shoal Lighthouse the sky was clear, the visibility was approximately 8 miles, the surface wind calm, the winds aloft northwesterly, light to moderate, and the air smooth.

The International Division of Transcontinental and Western Air maintains its central training school at the New Castle County Airport. The curriculum of the school, which has been approved by the Civil Aeronautics Administration includes flight instruction in Model 049 aircraft and during the course of such instruction, engine failures which would not normally be experienced in scheduled operations are simulated for the purpose of familiarization with the flight characteristics of the aircraft under such conditions. The curriculum does not specify a minimum altitude for the conduct of these operations.

A review of the flight training requirements of the curriculum for Model 049 aircraft indicates a minimum of 13 hours of flight training is required and up to the time of this flight, Captain McKeirnan had obtained 7 hours of the required flight instruction. There remained 10 minutes of air work,[2] 1 hour and 50 minutes of day landings and all 4 hours of simulated instrument time.

Training flights are conducted with and without control boost for pilot familiarization. The boost, in this instance, is a hydraulic system designed to give the pilot mechanical advantage in the operation of the control surfaces. In the Model 049 aircraft, the mechanical advantage is 9 to 1, and consists of a primary and secondary system which are actuated by hydraulic pumps located on the Nos. 1 and 2 engines and the Nos. 3 and 4 engines respectively. In addition, the emergency system, which actuates only the rudder and elevator, is located in the tail cone. The source of power for the latter system is electric hydraulic pumps.

The flight had been properly cleared on a local flight for the purpose of giving a student captain and a student flight engineer transition flight training. Captain Weeks, the instructor, a captain on the International Division, had accumulated a total of 3,300 hours flying time, of which 155 hours had been obtained in Model 049 aircraft. He had been an instructor at New Castle since August 1, 1946. This was his first flight with Student Captain McKeirnan, who had accumulated a total of 3,795 hours mostly in DC-3 type aircraft, had learned to fly in 1941, and was employed by TWA as a Student First Officer in June 1942. Captain McKeirnan had been promoted to captain June 1, 1945, and, prior to his assignment to New Castle for International Division captain training, he had been flying in the Transcontinental Division of TWA. Upon his assignment to New Castle, he had first been given transition training on Douglas C-54 type aircraft and had completed this training on March 9, 1947. On March 22, 1947, he received the first

[2] Air work, in this instance, refers to such maneuvers as turns, glides, climbs, engine feathering exercises, etc

of six instruction flights in Model 049 aircraft.

Flight Engineer Luke Vollack, the flight engineer instructor, had accumulated a total of 3,060 hours flying time, of which approximately 190 hours had been obtained in Model 049 aircraft and he had been an instructor since February 3, 1947. Student Flight Engineer M. W. Heller had accumulated a total of 17 hours in Model 049 aircraft while assigned to the school at New Castle

It is not definitely known which pilot was occupying the pilot's seat at the time of the accident but it is very probable, since it was a training flight and Captain McKeirnan had progressed more than half-way through the course in his flight training, that he was in the pilot's seat and that Captain Weeks was in the co-pilot's seat.

During the course of the investigation it was revealed that, while on a recent instruction flight, Captain Weeks and a student captain had an unusual experience in a Model 049 aircraft At the time the altitude was 7,000 feet, boost was on the elevators only, and both right engines were throttled. Banked turns of 15 and 30 degrees, alternating to the right and left, were being practiced and, in order for the student to maintain an air speed of 170 miles per hour, as requested by Captain Weeks, there was a gradual loss of altitude At approximately 5,500 feet altitude, Captain Weeks informed the student that a constant altitude could be maintained in the banked turns by either feathering the throttled engines or simulating a feathered condition by increasing the power to 13 inches of mercury. In this instance, the power was increased, following which an attempt was made to roll out of a 30 degree left bank, however, the aircraft would not respond to the controls. Rudder trim was then applied without effect. As the bank became steeper, the nose began to go down. Captain Weeks, at this time, assisted the student on the controls in attempting to recover, but both of the pilots were unable to decrease the bank As the air speed increased, the bank became steeper and the nose continued to drop. Captain Weeks then throttled Nos 1 and 2 engines, however, this action increased the bank. Power was then applied to all four engines but still, with both pilots on the controls, they were unable to effect a recovery. The bank had increased to approximately 80 degrees when control boost was engaged and immediately the aircraft was brought under control. An air speed of approximately 280 miles per hour was obtained and approximately 2,000 feet of altitude were lost during the maneuver.

Discussion

The transition flight training schedule does not specify the instruction to be given on each flight, but the instructor, by checking the personnel record sheet in the student's flight training jacket, determines the instruction for the subsequent flight period. This record also indicates the grades and any pertinent remarks made by the flight instructor. The flight transition requirements specify a minimum of 4 hours simulated instrument time and up to the time of the flight involved, Captain McKeirnan had no instrument time in Model 049 aircraft.

It is reasonable to assume that Captain Weeks, in reviewing his student's record, observed the previous type of instruction and flight time. Due to Captain McKeirnan's lack of instrument training in Model 049 aircraft and having completed all but 10 minutes of the airwork, it is possible that on this flight Captain McKeirnan was under the hood as the lighthouse was approached

Captain McKeirnan was considered by the company to be progressing satisfactorily in his transition training, however, his flight training record indicated that he was particularly weak in his ability to maintain altitude in turns at reduced speed The change in the sound of the engines heard by the witnesses would indicate that one or two engines were throttled in order that he might practice turns under these power conditions Difficulty in maintaining a constant altitude could be increased by one or two engines on the same side being throttled and not having the aircraft completely trimmed for this condition of flight would further aggravate the situation. Once the nose of the aircraft dropped, recovery would be attempted. In this instance, it appears that recovery was attempted, but not enough altitude remained to recover prior to striking the water

The investigation revealed that the Model 049 aircraft from the original concept was designed to include control boost due to the high control forces that would be necessary to maneuver the aircraft. It is possible to fly the aircraft without boost, provided it is trimmed for the particular condition of flight, but due to the mechanical advantage with boost and the resultant light control forces required, normal practice is always to use it.

During transition training, portions of the flight are usually conducted without boost under various power conditions to give the student the feel of the aircraft under such conditions. Had the maneuver incident to the crash been entered without boost, there were available the primary, secondary, and auxiliary boost control to aid in recovery, or had the maneuver been entered while using any one of the three systems, there were available the remaining two. The evidence indicated that the aircraft recovered from what appeared to be a tight spiral, that the wings were fairly level, and that there was a definite improvement in the pull-out attitude of the aircraft prior to striking the water. (See Appendix I.)

It is possible there could have been a structural failure immediately before impact due to excessive loads imposed upon the aircraft structure in an attempt to effect recovery. The evidence indicates the aircraft had accelerated to a high speed at the time it was recovering from the dive following the tight spiral, and the force applied to the controls of the aircraft to avoid the water at this low altitude may have exceeded the design load of the structure. The loud roar heard shortly before impact was probably the application of power to the engines.

Every effort was made to recover the wreckage as its salvage was considered most important in determining whether structural or equipment malfunctioning contributed to the cause of the accident. As only minor parts of the aircraft were salvaged, it is impossible to make a finding in this respect. In the absence thereof it is necessary to rely primarily upon the testimony of lay witnesses. It is apparent that the cause of this accident lies in the loss of control of the aircraft by the flight crew; however, due to the meager evidence available, it is not possible to determine whether this loss of control was a result of failure of the flight controls or control system or the employment of improper technique in the use of the flight controls by the crew,

Findings

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

1. The company, aircraft, and crew were properly certificated for the flight.
2. The total weight of the aircraft at the time of departure was less than the maximum allowable, and the load was distributed with respect to the center of gravity within approved limits.
3. The flight progressed normally until approaching the Brandywine Shoal Lighthouse where a turn to the left was established with sharply increasing bank.
4. This turn was continued until the aircraft assumed a nose-down attitude and entered what appeared to be a tight spiral.
5. Rotation of the aircraft stopped and its descent continued in a steep diving attitude.
6. Partial recovery from the steep diving attitude was effected but the aircraft crashed into the water before complete recovery could be made.
7. The aircraft was demolished by impact and subsequent explosions.
8. No radio contacts were received to indicate any difficulties on board the aircraft.

Probable Cause

The Board finds that the probable cause of this accident was loss of control of the aircraft for reasons undetermined.

BY THE CIVIL AERONAUTICS BOARD:

/s/ OSWALD RYAN
/s/ HARLLEE BRANCH
/s/ JOSH LEE

Appendix I

ELEVATOR BOOST CONTROL FAILURE IN A MODEL 049 AIRCRAFT

During the course of the investigation of this accident, information was received concerning the failure of the elevator boost control unit on a Model 049 aircraft while cruising at an altitude of 19,000 feet. This failure resulted in loss of control until the emergency elevator control was engaged. The loss of control was indicated by a sudden excessive climb which was impossible to overcome by forward pressure on the yoke. The pilot, in attempting to stop the excessive climb, placed his feet on the control column and exerted sufficient pressure to break his seat. The angle of climb increased and as the aircraft started a turn to the right, Nos. 1 and 2 engines were throttled, at the same time the 4 hydraulic suction shutoff valves were closed and the aircraft entered a diving turn to the left. Nos. 3 and 4 engines were then throttled and as the emergency elevator control was at this time engaged, the aircraft was brought under control to straight and level flight.

A teardown inspection of the elevator boost control valve disclosed faulty locking on the ball shaft assembly as the cause of the loss of control. This permitted the ball shaft to unscrew and restricted the movement of the control valve until finally the control valve went "over" center and the elevator began to travel upwards and could not be held by forward pressure on the control column. In this instance the aircraft had sufficient altitude in which to effect recovery to straight and level flight.

The incorrect cockpit procedure in closing the hydraulic shutoff valves, which had the effect of freezing the aileron and rudder control, should be noted.

Supplemental Data

Investigation and Hearing

The Civil Aeronautics Board received notification of the accident at 1450, May 11, 1947, and immediately initiated an investigation in accordance with provisions of Section 702(a)(2) of the Civil Aeronautics Act of 1938, as amended. An air safety investigator of the Board's New York Office arrived at the scene of the accident at 1750 the same day and later was assisted in the investigation by other members of the Safety Bureau's staff. A public hearing was ordered and held in Wilmington, Delaware, May 27 and 28, 1947.

Air Carrier

Transcontinental and Western Air, Incorporated, operating under laws of the State of Delaware and having established headquarters in New York, New York, was conducting a training program for flight personnel of its International Division at New Castle, Delaware. The training school, including both flight and ground curriculums, was approved by the Civil Aeronautics Administration.

Flight Personnel

Captain Robert Eugene Weeks, age 30, of Elsmere, Delaware, flight instructor in command of the aircraft, possessed a valid airline transport pilot rating and until the date of the accident had accumulated a total of 3,300 hours flying time, of which 155 had been obtained in Model 049 aircraft. Captain Patrick Steven McKeirnan, age 28, of Pomeroy, Washington, student pilot of the aircraft, possessed a valid airline transport pilot rating and until the date of the accident had accumulated a total of 3,795 hours flying time, of which 7-1/2 hours had been obtained in Model 049 aircraft. Both Captain Weeks and Captain McKeirnan had learned to fly in civilian aviation and had no military experience. Flight Engineer Luke Vollack, age 25, of Cheyenne, Wyoming, the flight engineer instructor on the aircraft, possessed an aircraft and engine mechanic's rating and until the date of the accident had accumulated a total of 3,060 hours flying time, of which approximately 190 had been obtained in Model 049 aircraft. Student Flight Engineer Martin William Heller, age 30, of Baltimore, Maryland, possessed an aircraft and engine mechanic's rating and until the date of the accident had obtained 17 hours flying time in Model 049 aircraft. All flight crew personnel were properly certificated and qualified for their respective duties.

The Aircraft

NC-86508, a Lockheed Model 049 Constellation, was operated and registered in the name of Transcontinental and Western Air, Incorporated. The aircraft had accumulated a total of 2,214 hours since its manufacture in November, 1945. It was equipped with four Wright R-3350-35 engines on which Hamilton Standard propellers were installed. Engines Nos. 1, 2, and 4 had been operated a total of 371 hours since overhaul and No. 3 engine 391 hours. At the time of departure from New Castle, the total weight of the aircraft was 15,870 pounds less than the allowable maximum gross and the load was distributed with respect to the center of gravity within approved limits.