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CIVIL AERONAUTICS BOARD

File No. 1-0116

AIRCRAFT ACCIDENT REPORT

ADOPTED: March 22, 1960 RELEASED: March 25, 1960

SEABOARD & WESTERN CONSTELLATION AND A TRANS-CANADA VISCOUNT, GROUND COLLISION, NEW YORK INTERNATIONAL AIRPORT, NEW YORK, NOVEMBER 10, 1958

SYNOPSIS

At 1101[1/] November 10, 1958, a Seaboard & Western Constellation, L-1049D, N 6503C, became uncontrollable during the execution of a takeoff from runway 31R of the New York International Airport, New York, New York. The aircraft deviated considerably from its intended course and subsequently struck an unloaded Trans-Canada Airlines Viscount, CF-TGL, which was preparing to board passengers. One member of the five-man Constellation crew received minor injuries and a Trans-Canada stewardess fell and was injured slightly while running from the aircraft. Both aircraft were virtually destroyed by fire following impact.

Seaboard & Western's Flight LN-800, a training flight, began its takeoff run on runway 31R of the New York International Airport at 1100. When an airspeed of 117 knots (V_2) was reached, the aircraft became airborne and climbed to an altitude of approximately 25 feet. At this altitude severe control difficulty was encountered, causing the aircraft to veer suddenly to the left and the left wing to lower 20 to 30 degrees. This wing struck the runway and from this point on directional control of the aircraft was lost. The aircraft skidded in a westerly direction into a temporary terminal area and came to rest after striking the Viscount.

Weather was not a factor to this accident.

It was determined by the investigation that an unwanted reversal of the No. 1 propeller had occurred.

As a result of this accident the Board recommended to the Administrator of the Federal Aviation Agency that the inspection and overhaul procedures of the Propeller Division of the Curtiss-Wright Corporation be reviewed to ensure that high standards of airworthiness be maintained; also, that the recently developed and then available power unit, incorporating low-pitch stops designed to prevent propeller blade travel into the reverse pitch range if certain type failures occur, be required as soon as possible on certain model Curtiss electric propellers. As an interim safeguard, it was recommended that immediate inspections and shorter periods of time between the lubrication of these propellers be effected.

1/ All times herein are eastern standard based on the 24-hour clock.

USCOMM-DC-25299

Investigation

Seaboard & Western Flight LN-800, a Lockheed Super Constellation, N 6503C, was planned on November 10, 1958, as a training flight The crew consisted of Captain Henry Van Nuys; Captain Ralph Neary, a company check pilot; Copilot William Dodds; and Flight Engineers Gene Gasselle and Harold Ferrara. The purpose of the flight was to give Copilot Dodds ATR (air transport rating) training and Captain Van Nuys a first officer qualification check. MacArthur Field and Grumman Airport, at Islip and Peconic Long Island, respectively, were to be used for a portion of this training.

All crew members reported for duty at the airport office of Seaboard & Western at approximately 0900. While Captain Neary was discussing the details of the flight with the pilots, the two flight engineers went to the aircraft and performed the preflight check. About 0950 all crew members boarded the aircraft. Captain Van Nuys sat in the left pilot's seat, Captain Neary in the right pilot's seat, and Flight Engineer Gasselle at the flight engineer's station. Copilot Dodds and Flight Engineer Ferrara sat in Compartment A, which is adjacent to the cockpit. The gross weight of the aircraft was 108,150 pounds, which was under the allowable takeoff weight of 132,100 pounds.

The "before starting" and "before taxi" checklists were completed and the aircraft was cleared to runway 31R. While taxiing out, the propeller reversing checks were made and upon arrival at the runup area the flight was advised by the tower that it was number eight in takeoff sequence. The runup checks for Nos. 2 and 3 engines were then made. After a long delay during which time various aircraft were cleared for takeoff (the last of which was a Beechcraft), Flight LN-800 was cleared into position. Prior to moving to takeoff position, engines Nos. 1 and 4 were run up and because of the traffic delay a 140 BMEP (brake mean effective pressure) burnout procedure check was performed on engines Nos. 2 and 3.

At 1100 the flight was cleared for takeoff and advised to make a right turn out. Captain Van Nuys then asked Check Pilot Neary to hold the yoke and to call out V_1 and V_2 speeds when reaching them. A normal takeoff roll was made and shortly after an airspeed of 117 knots, V2 speed, was reached the aircraft became airborne. At 120 knots and approximately 25 feet off the ground Captain Van Nuys called for "gear up." At this instant a muffled explosion was heard which seemed to originate on the left side of the aircraft. Simultaneously a surge of power occurred, and the left wing dropped approximately 30 degrees and struck the runway causing the aircraft to veer sharply to the left. The combined efforts of the crew were unsuccessful in righting the aircraft and it continued veering to the left off the runway. During the remainder of the ground travel the pilot had only partial control. The throttles were retarded but impact forces moved them forward again when the aircraft struck a drainage ditch cover; they were again retarded. Throughout the ground roll the crew applied brakes and in the later stage propeller reversing was attempted; however, the aircraft could not be stopped.

After leaving the runway the aircraft crossed a taxiway and two perimeter strips, and entered a position on the terminal parking area where it collided with a Trans-Canada Airlines Viscount, CF-TGL. The Viscount was standing at Gate 5 and was to have boarded its passengers for a scheduled departure within a few

minutes of the accident. Stewardess J. Bedard and K. Foch on board the Viscount, alerted by the cries of persons on the ramp and the noise of the approaching Constellation, departed their aircraft as rapidly as possible. The Constellation crew left their aircraft by jumping from the main cabin door which was approximately four feet above ground level. Firefighting personnel had already arrived at the scene and were directing a coverage of foam toward this exit at the time. Both aircraft were virtually destroyed by fire.

The weather was: ceiling measured 2,500 feet broken, 3,000 feet overcast; visibility 14 miles; wind west-northwest 14 knots.

A normal takeoff was to have been made with the instrument hood (venetian blind type) closed only after several hundred feet of altitude had been gained.

First ground contact was made by the left wing tip of the aircraft approximately 3,164 feet from the approach end of runway 31R. Pieces of red glass from the port navigation wing light and a portion of the left lower outboard aileron structure were found in this area. Numerous propeller slash marks made by the No. 1 propeller were found 120 feet beyond. These marks were approximately four feet apart. During the ground travel the left outer wing panel struck a metal drainage cover which severed the panel and, before it came to rest, inverted and reversed it.

Shortly after this occurred the Nos. 1 and 2 engines, the left inner wing panel, and a large section of the left side of the empennage also became detached. Various pieces of the aircraft structure and its components were found along the 2,700-foot groundpath from the point of impact.

There was no evidence found which indicated that either a structural failure or fire occurred prior to impact with the ground. All flight controls and their actuating systems when checked showed no evidence of having failed or malfunctioned during flight. Because of the nature of the accident, attention was focused early in the investigation on the engines and propellers.

All four engines were carefully examined and although they had suffered considerable damage by either ground impact, fire, or both, there was no evidence found to indicate that either an inflight failure or fire had occurred. There were also no indications of overspeeding, combustion chamber distress, or foreign material in the lubricating systems.

The four Curtiss electric propellers were examined in minute detail. Because of crew statements describing the yaw condition that occurred just after takeoff, the possibility of one or more of the propellers having experienced an unwanted reversal was highly suspect. Propellers Nos. 2, 3, and 4 showed no evidence that this had happened. All propellers were damaged somewhat by impact forces or fire.

Examination of the No. 1 propeller, however, clearly confirmed the reversal suspicion. The positions of the blades in relation to the hub index indicated a full reverse pitch position of minus 11.7 degrees. The hub interior was adequately packed with grease and the hub retaining nut and all safeties were in

place and secure. The front and rear cones bore no evidence of abnormal wear or galling. There was no evidence of arcing or burning at the hub switch connector pins.

All of the hub slip rings were in position on the rear face of the hub; however, all were crushed forward in the area of the Nos. 2 and 3 blade sockets. Again there was no evidence of arcing, burning, or inservice failure.

The No. 1 blade socket contained an impact mark made by contact with one screw of the blade early warning cam circuit. Although the hub socket was distorted because of impact forces, a new blade was installed in the socket with the No. 1 blade segment gears installed. The impact mark in the hub was then aligned with the marks on the blade segment gear and the blade angle measured at the reference station was minus 13 degrees. This angle of minus 13 degrees exceeded the maximum allowable reverse pitch angle due to distortion of the hub socket. The blade sockets of the Nos. 2 and 3 blades were not damaged in a manner similar to No. 1

The propeller control brush block assembly was badly damaged by ground impact; however, its examination showed no evidence of operating difficulty.

The propeller control junction box was intact in the engine nose section and all terminals within the box were secure.

The power unit was broken off at the low-speed reducer flange and it was badly burned. All of the limit switches, however, were in place and no evidence was found of arcing, burning, or inflight difficulty.

Examination of the limit switch and cam locations revealed that the reverse segment was in contact with the reverse limit switch. This is equivalent to a blade angle position of minus 11.7 degrees. The same blade angle position was found from the blade's position in relation to the hub index.

The motor brake housing was intact; two bolts of the brake cage were sheared at impact. The brake clearances were within prescribed tolerances. The brake assembly showed no indication of glazing, overheating, or excessive wear.

The armature had been subjected to intense heat from external fire. The armature splines were worn beyond specified limits. The greatest wear was one-fourth of an inch inboard from the outer end of the shaft. This worn area was "cupped" and the splines were rolled and flattened. There was no evidence of chipping or breaking.

Lubrication of the spline assemblies of this propeller consists of packing the sleeve assembly with lubriplate and molybdenum disulfide which is retained by a seal. When examined the seal assembly on the reducer sleeve was very brittle because of its subjection to intense heat, and therefore positive determination of its condition prior to the accident could not be determined. In this case, however, no charred deposits of lubricant were found and this is contrary to what would be expected if the seal had been in normal condition before the accident.

Examination of the ball bearings which support the rotor assembly revealed the lubricant to be caked by the ground fire. The rear motor bearing, which is on the spline end of the rotor shaft, was found loose on the shaft in excess of its specified fit. The balls were blued by overheating; half of the balls were indented because of heavy pressures between the balls and the raceways. The front bearing exhibited similar damage and the raceways contained evidence of scuffing. This bearing also fit loosely on the shaft.

As part of the investigation the propeller division of the Curtiss-Wright Corporation asked the operators using these propellers to campaign their fleets on all propellers having 1,000 to 1,200 hours operating time to inspect and relubricate the splines of the rotor and speed reducer sleeve. This resulted in a rejection by Seaboard & Western of eight of twelve units with 1,000 to 1,200 hours of service; 14 out of 26 units with a total time of 1 to 1,000 hours of service; and two of three spare units from the Curtiss-Wright overhaul facility. These rejections were because of excessive wear or damaged oil seals.

Depositions were taken of a number of persons from whom it was thought pertinent information could be obtained. Among those deposing were representatives of the manufacturer of the propellers involved, Curtiss-Wright Corporation, which also overhauls them for Seaboard & Western.

They testified that based on tests made, the pitch-change rate with a disengaged power unit could be in excess of 40 degrees per second. The normal pitch-change rate is 10 degrees per second. This is subject to functional torque of the blades and the inertia effect of the speed reducer which has a reduction rate of 6,000 to 1. They further testified that in this instance when the aircraft reached 120 knots and 3,250 b.h.p. during the climbout, the blade angle would have been 27 degrees, and that because of the worn armature spline condition the pitch-change motor could then become disengaged from the propeller and speed reducer. Once disengaged the blades could move to the full reverse position in approximately one second.

The propeller manufacturer's representatives also said that they knew of six other cases involving disengagement of power unit motors and mating speed reducer assemblies which were caused by excessive wear. In all of these instances the aircraft were in the cruise configuration and the propellers involved immediately reversed. Loss of control occurred in each case but was regained after a loss in altitude and a reduction in airspeed The excessive wear was attributed to lack of lubrication because of seal failures.

The wear pattern of the components in the subject case was the same as the six mentioned above. However, the cupping effect found in the worn areas of components of the Seaboard & Western aircraft was not present in the others.

Records indicated that engines and propellers, including power units, had been overhauled within the prescribed time limits and that all pertinent modifications had been accomplished.

The Port of New York Authority and the New York Fire Department handled an extremely difficult situation in a most efficient manner.

Analysis

With respect to the controllability of the aircraft in flight with an outboard propeller in full reverse pitch, full power applied and full forward power on the other three engines, it was determined that if a sudden application of negative thrust on the left side occurred, there would be a drag on that side which would cause a yaw and bank to the left. It would be extremely critical for this to occur at airspeed as low as 112 knots at low altitude since a sacrifice of altitude is necessary to regain sufficient speed for restoring control.

It is evident that the pilots could do little more than they did to prevent this accident. During the time the aircraft traveled from the initial ground contact point to the collision with the parked aircraft, the pilots had only partial control. The events which occurred in rapid succession, such as the initial impact of the left wing with the ground, the resultant bounces on first one gear and then the other, the loss of the left wing and the two engines on that side, and the additional unwanted thrust gained when the throttles again jumped forward, bear evidence to this fact. Intermittent ground marks which were found throughout a large portion of this travel indicate that brakes were being applied.

Several facts were apparent when the No. 1 propeller and assembly were examined. The wear of the rotor spline and mating speed reducer sleeve was of sufficient magnitude to cause complete disengagement between the power unit motor assembly and the speed reducer, thus preventing electrical control of the propeller. These conditions would permit the centrifugal forces on the blades to move them to the flat pitch position and beyond.

It is evident that the condition of the rear motor bearings as explained under the investigation section of this report was not caused by impact forces or heat, and that it contributed materially to the wear and cupping of the associated parts. In addition, this was not an isolated case; in fact, there had been six other cases of excessive spline wear and/or lubricating seal failures. Although portions of the reverse electrical circuits could not be examined because of fire, it is believed that an electrical malfunction did not cause the reversal.

Conclusion

As a result of this accident, the Board submitted two recommendations for corrective action to the Federal Aviation Agency. The first called for immediate inspection and relubrication of the splines of the armature rotor and speed reducer sleeve assemblies, as well as incorporation of the mechanical low pitch stop assembly, as soon as possible. On December 15, 1958, Airworthiness Directive 58-25-2 was issued requiring the mandatory inspection of the splines of the affected parts, not to exceed 1,250 operating hours. Since issuance of the above AD, one additional case of excessive spline wear was reported with less than 600 hours of service. As a result, Airworthiness Directive 59-7-1, issued April 6, 1959, superseded the original AD. The AD 59-7-1 called for inspection of the armature and sleeve bearing fits at each 600 hours of service and in addition eliminated the use of molybdenum disulfide as a spline lubricant, thus

approving only lubriplate 315 as the approved lubricant. On September 8, 1959, AD 59-18-3 was issued requiring the installation of an improved model power unit on all Curtiss C34S-C400 and -C500 propellers. This model assembly incorporates a new armature rotor assembly with a longer shaft, with splines of a larger pitch diameter, and a new mating speed reducer splined sleeve, and high speed drive gear. Lubrication for this new assembly is provided by the speed reducer oil supply.

The Board's second recommendation to the FAA resulted from the high rejection rate by Seaboard & Western Airlines of the subject parts. It was evident from this fleet campaign that the inspection and quality control procedures of the propeller manufacturer were not conducive to required standards of airworthiness. A review board established by the FAA examined the overhaul facility of the Propeller Division of the Curtiss-Wright Corporation and made recommendations to the management for prompt corrective action of unsatisfactory procedures and conditions.

Probable Cause

The Board determines that the probable cause of this accident was an unwanted propeller reversal at a low altitude occurring immediately after takeoff. A contributing factor was the inadequate overhaul procedure employed by the propeller manufacturer.

BY THE CIVIL AERONAUTICS BOARD:

/ s / JAMES R. DURFEE
Chairman

/ s / CHAN GURNEY
Vice Chairman

/ s / G. JOSEPH MINETTI
Member

/ s / WHITNEY GILLILLAND
Member

/ s / ALAN S. BOYD
Member

SUPPLEMENTAL DATA

Investigations and Depositions

The Civil Aeronautics Board was notified of this accident the morning of November 10, 1958. An investigation was immediately begun in accordance with Section 702(a)(2) of the Civil Aeronautics Act of 1938, as amended. Depositions of pertinent witnesses were taken in New York, New York, December 9 and 10, 1958, and in Washington, D. C., January 5, 1959.

Air Carrier

Seaboard & Western Airlines, Inc., is a Delaware corporation with its principal office in New York, New York. The corporation operates as an air carrier under a certificate of public convenience and necessity issued by the Civil Aeronautics Board, and an air carrier operating certificate issued by the Federal Aviation Agency (formerly Civil Aeronautics Administration). These certificates authorize the carrier to engage in air transportation of cargo between the United States and various points in foreign countries.

Flight Personnel

Captain Ralph Charles Neary, age 37, held a valid airman certificate with an airline transport rating and ratings for L-1049, DC-4, and C-46 aircraft. He had a total of 12,652 flying hours, of which 1,634 were in L-1049 aircraft. On February 15, 1956, he was designated as a check pilot on L-1049 aircraft. Captain Neary was designated as an ATR and flight examiner by the CAA.

Henry B. Van Nuys, age 38, held a valid airman certificate with an airline transport rating and ratings for L-1049, DC-4, and C-46 aircraft. He had a total of 13,642 flying hours, of which 2,488 were in L-1049 aircraft.

Flight Engineer Gene Gasselle, age 32, held a valid flight engineer certificate. He had approximately 2,825 hours in L-1049 aircraft. He had been employed by the company since 1955.

The Aircraft

N 6503C, a Lockheed Constellation L-1049D, serial number 4165, owned by Aviation Equipment Corporation and leased by Seaboard & Western Airlines, Inc., had a total of 11,980 flying hours. It was equipped with four Wright engines, model 972 TC-18 DA-3. No. 1 engine had a total time since overhaul of 451:38 hours, No. 2 -495:57 hours, No. 3 -536:01 hours, No. 4 -751:03 hours. The aircraft was also equipped with Curtiss electric propellers, model C634S. No. 1 propeller had a total time since overhaul of 1374:47 hours, No. 2 -451:38 hours, No. 3 -2:00 hours, and No. 4 -1470:17 hours.