

CIVIL AERONAUTICS BOARD
ACCIDENT INVESTIGATION REPORT

Adopted: February 25, 1952

Released: February 29, 1952

PENINSULAR AIR TRANSPORT - CHICAGO, ILLINOIS, SEPTEMBER 16, 1951

The Accident

A C-46D Aircraft, N-74689, operated as Flight 108 by Peninsular Air Transport, an irregular air carrier, was crash landed shortly after takeoff from Midway Airport, Chicago, Illinois, at about 1047 CST^{1/} on September 16, 1951. The aircraft was extensively damaged. Thirty-six of the 49 passengers and four crew members were injured in varying degrees; thirteen were unhurt and there were no fatalities.

History of the Flight

The day before the accident the aircraft was flown from Miami, Florida, to the Midway Airport at Chicago, with stops at St. Petersburg, Florida, and Covington, Kentucky. The first two legs of the flight, Miami-St. Petersburg and St. Petersburg-Covington, appear to have been completely routine.

Following takeoff from Covington, malfunctioning of the left engine was experienced. This trouble manifested itself by intermittent misfiring, and was corrected by the use of full-rich mixture. The aircraft climbed to its cruising altitude of 4,500 feet. There the left mixture control was placed in auto-lean, whereupon the engine started cutting out again. The mixture was then changed to auto-rich, which

^{1/} All times referred to herein are Central Standard Time and based on the 24-hour clock.

partially stopped the trouble. Application of a full-rich mixture stopped it completely, and the engine ran normally. The pilot then tried both magnetos of the left engine individually and ascertained that the roughness returned when operating solely on the right magneto. The flight continued uneventfully to Chicago with the mixture in full-rich and with the ignition switch on the "Both" position.

At Chicago the passengers were deplaned and the aircraft was taxi-
ed to the aviation division of the Butler Company, a CAA-approved repair station. The captain left instructions relative to refueling and check-
ing the left engine. The aircraft was refueled late in the evening of
the same day, September 15, and maintenance work on the left engine
was performed by Butler aviation personnel on the following morning,
September 16. Cowling of the engine was removed, whereupon it was
discovered that the rear spark plug of No. 12 cylinder was gone and its
lead wire was burned. The spark plug, with its threads badly burned,
was found in the engine cowling.^{2/} The threads of the plug bushing had
been partially burned away. A tap was run into the bushing to clean
the threads. A new spark plug was then installed and screwed in place
more firmly than usual. A new lead to the spark plug was also in-
stalled, and a small leak in the hydraulic system was repaired. The
engine was run up several times with power settings of 30 inches of mani-
fold pressure and 2,000 RPM. It performed to the satisfaction of main-
tenance personnel and the aircraft's captain, whereupon the Butler
Company service manager, a certificated mechanic, approved the work.

2/ See Appendix A.

The flight was to be over the reverse route and with the same stops as had been made on the previous day and with the same crew -- Captain B. J. Mountain, Copilot R. L. Tracy, and Stewardesses Paulette Hasselbrink and Marion Lipps. The captain checked the weather and ascertained that visual flight rule conditions prevailed between Chicago and Covington. He did not file a flight plan, intending to do so while en route. Forty-nine passengers, including one infant, were embarked, and the aircraft was cleared by the Chicago tower to take off on Runway No. 31L. At the time of departure the aircraft's center of gravity was within specified limits. The Weight and Balance Manifest showed the take-off weight to be 45,000 pounds, the maximum allowable for this particular aircraft. However, the authorized gross weight was exceeded by approximately 1,960 pounds, as will be shown later in this report.

The aircraft was taxied to the end of the runway where the captain and the copilot went through the take-off check list. Take-off clearance was then obtained from the tower, and the aircraft started down the runway. It became airborne at a speed of about 100 or 105 miles per hour, and simultaneously the left engine started misfiring. The captain instructed the copilot to raise the landing gear; the copilot complied. The left engine continued misfiring and started backfiring. The captain placed the left mixture control in the full-rich position. This did not stop the misfiring, and he then turned off the left engine's right magneto. The engine continued to fire erratically, the captain put the magneto switch back on both magnetos, the engine then lost all power, and its propeller was feathered. The aircraft started a slight turn to the left.

In the meanwhile the copilot had told the Chicago tower that the flight had an engine "out" and was returning to the airport. The tower acknowledged, telling the flight to use any runway. Evidence indicates that the aircraft climbed slowly on its right engine to an altitude estimated at from 150 to 200 feet. Captain Mountain stated that at this point, he believed that the right engine was losing power. The aircraft continued to turn gradually to the left, with the air speed never going over 110 miles per hour, and sometimes as low as 100 miles per hour. The direction of flight was now at about 90° to the left of the take-off direction, and altitude was being lost. Ahead the captain saw a sizable stretch of open land and aligned the aircraft with it. Over the edge of this open land, then at an altitude of about 75 feet, the captain decided to crash land. He cut the power on the right engine, nosed the aircraft down, quickly flared it out, and landed exceptionally hard with landing gear and flaps retracted. The severity of contact broke both engines completely free of their mounts. The aircraft rode over both engines, bounced several times and slid to a stop. The crew helped evacuate all passengers in a hasty, but orderly, manner. Emergency apparatus arrived shortly, and all passengers and crew members were taken to nearby hospitals for check-up and emergency treatment.

At the time the weather was excellent and did not contribute to this accident.

Investigation

The crash landing was in an open level area approximately 2,000 feet long and 1,000 feet wide, one of a few such areas within a radius

of three miles of Midway Airport. The location is about 500 yards east-northeast of 63rd Street and Harlem Avenue, Chicago, and about one and three-quarters miles west of the west boundary of the airport.

Damage to the aircraft consisted of the tearing free of both engines, the crushing in of the bottom of the fuselage from impact and sliding over the ground, and the tearing of the undersides of both wings from riding over their respective engines. The empennage was practically undamaged, except for the right elevator being somewhat distorted by ground contact. There was no indication of any failure of the aircraft's structure or any malfunctioning of its controls prior to the crash landing.

Within the cabin there was no extensive damage. A few safety belts were broken and a few seats had failed at their attachments.

The left propeller was found to be in the feathered position.

There was evidence of a small ground fire at a broken oil line of the right engine; it appeared to have been self-extinguished.

Investigation centered on, first, the mechanical condition of the powerplants, particularly in regard to their ignition systems, especially that of the left engine, and second, the actual take-off weight of the aircraft.

Spark plugs of the left engine were removed and examined. All appeared to be normal, except for some impact damage, with the exception of both ^{plugs} from No. 12 cylinder. The front spark plug gave indication of having run hotter than normal. The rear spark plug (the new one that had been installed on the day of the accident) was burned away for three-eighths of an inch of the circumference of its shell and the

burning extended; decreasingly, for seven-sixteenths of an inch from the inner end. Eight threads of this spark plug were partially filled with material from the bushing; it had fused to the plug. Of the four shell electrodes, one had melted and another had fused to the center electrode; all four had been subjected to extreme heat.^{3/}

This spark plug was damaged in the same manner, but to a lesser degree, as the spark plug that came out during the flight to Chicago.

Cylinders of the left engine were removed and examined. All appeared to be normal, with the exception of No. 12. Its intake valve showed signs of abnormally high temperature. This cylinder's piston evidenced high operating temperatures in the portion adjacent to the rear spark plug. The interior of No. 12 intake pipe showed conclusive evidence of backfiring and torching into the induction system.

The cylinder itself showed burning of three cooling fins adjacent to the rear spark plug, and the inner threads of the rear spark plug bushing were burned away with only traces of the root areas of the threads remaining unburned.^{4/}

Both magnetos of the left engine were examined. On the right magneto it was found that about one-half of the center high tension rotor contact was missing, and the remainder was badly burned. The mating high tension contact in the magneto cover was about 60 per cent eroded and shaped to a point. The left magneto of this engine displayed no abnormality that could have caused it to malfunction.

^{3/} See Appendix A

^{4/} See Appendix A

No significant irregularities were found in any of the other accessories of the left engine.

In regard to the right engine, all spark plugs appeared to be normal and nothing significant was found in any of the other engine accessories, except in this engine's right magneto. Its center high tension rotor contact was broken and lying in the bottom of the rotor cup and bore evidence of abnormal heat as a result of arcing. The mating high tension contact in the magneto cover was completely eroded.

According to the Weight and Balance Manifest of the attempted flight, the aircraft was loaded within the maximum allowable gross weight of 45,000 pounds and the center of gravity was within specified limits. To check this stated weight all baggage was removed from the aircraft and weighed. It was found that the total baggage weight was substantially the same as appeared on the manifest. The manifest also carried the total weight of passengers and crew which was presumed to be correct. However, the amount of fuel shown to be aboard was 670 gallons, and this figure was in error. The aircraft left Miami the previous day with 1,000 gallons of fuel and 337 gallons were added at Covington. (None was added at St. Petersburg.) At Chicago, the evening before the accident, 722 gallons were added. Based on flight time and on normal fuel consumption, the flight should have used 1,062 gallons between Miami and Chicago. The difference between 1,337 and 1,062 is 275. As 722 gallons were added at Chicago, the total fuel at time of takeoff was 997 gallons. The manifest showed 670 gallons. The difference is 327 gallons, which would weigh about 1,962 pounds. This latter weight cannot, of course, be taken as exact as allowance

has not been made for run-up and taxiing time at Chicago or for the increased fuel consumption due to running the left engine in auto-rich mixture between Covington and Chicago. But these factors could not have accounted for more than about 100 pounds of fuel, leaving the take-off weight approximately 1,860 pounds more than the maximum allowable of 45,000 pounds, or 46,860 pounds.

Maintenance records of the aircraft were examined carefully.

The allowed operating time between overhauls on this model engine is 800 hours. Records indicate that at the time of the accident the left engine had 764 hours and that the right engine had 552 hours since overhauls. Peninsular Air Transport's engine checks are performed at intervals of 40 hours for No. 1 check; 80 hours for No. 2 check, and 120 hours for No. 3 check. No. 2 check had been performed immediately prior to the aircraft's departure from Miami for Chicago. This check includes a visual inspection of the spark plugs and spark plug leads, and it thus appears that any looseness or blowby in the No. 12 rear spark plug of the left engine should have been found at that time.

All spark plugs had been replaced during the last No. 3 engine check which was 82 operating hours before the accident; the allowable time for spark plug replacement is 240 hours. Therefore, it is definitely indicated that the spark plug trouble developed in flight between Miami and Chicago.

Examination of the previous maintenance records of this aircraft showed that the records themselves, as well as the maintenance work that they indicated, were in compliance with the Company's Maintenance Manual of Procedures.

Analysis

The main factors of this accident obviously were the malfunctioning of the ignition system of the left engine and the overloading of the aircraft.

Before the new spark plug was installed in the rear of the No. 12 cylinder of the left engine, the service manager in the employ of the Butler Company recommended that the spark plug bushing be replaced. However, no bushing was readily available, inasmuch as it was Sunday. Captain Mountain who was present also inspected the bushing and it was agreed with the Butler personnel to install a new spark plug in the old bushing and, if it held properly during the engine run-up, to proceed to Miami. Accordingly, the spark plug was screwed in place tighter than usual in an attempt to detect any giving away of the bushing threads. No such giving away was sensed, and it was presumed that the spark plug was properly secured. The engine was then run up three times after which the captain and the Butler Company service manager decided that the spark plug would hold. Accordingly, the service manager "signed off" the work with the notation that a new bushing should be installed soon.

When the engine was run up, after this new spark plug was installed, it was operated under power conditions of 30 inches of manifold pressure and 2,000 RPM for several short intervals. Such power settings would produce certain temperatures and pressures within the cylinder. There is no evidence as to whether or not the engine was run up to take-off power conditions prior to the start of the takeoff. However, during the takeoff itself, it was run up to full take-off conditions, which are about 52 inches and 2,700 RPM.

It must obviously follow that the spark plug failed during these higher power settings with their higher pressure and temperature. As a considerable portion of the thread of the plug was burned away, and as the great majority of the mating surface of the spark plug's bushing had been burned away, it is apparent that there had been insufficient metallic contact between the spark plug and its bushing to allow the spark plug to cool sufficiently. Such a condition would readily result in the overheating of the spark plug to such an extent that two of its four shell electrodes melted, one fusing to the center electrode.

The physical and thermal effects of this condition could cause the spark plug to act as a point of heat concentration sufficiently hot to fire incoming fuel simultaneously with the opening of the intake valve. The condition of the interior of the cylinder, the intake valve, and the intake pipe attest to this having happened. Thus it is evident that blowback into the intake pipe and induction system caused the complete power loss.

The condition of the right magneto of the left engine, as previously described, could not have contributed to or augmented the failure of No. 12 rear spark plug, inasmuch as this magneto fires the front plugs. However, the fact that the magneto was defective could well have caused some power loss entirely apart from the failure of the rear spark plug.

In connection with the belief of the captain that he experienced a power loss from the right engine after the left engine had been feathered, it is also possible that the condition of the right magneto of this engine could have been instrumental in causing a certain small power loss. Subsequent bench tests of the right magnetos from both engines showed them to be functioning abnormally at take-off speeds.

The Civil Aeronautics Administration Airplane Flight Manual states that the break-ground speed for a C-46 aircraft is 105 MPH indicated air speed at maximum gross weight of 45,000 pounds. But this aircraft was overloaded by about 1,860 pounds, and this is a fact with which the captain should have been familiar. He is to be criticized not only for taking off an overloaded aircraft, but for allowing it to leave the ground at too low an air speed, so low, in fact, that it never could acquire adequate air speed to maintain single engine flight, which is what happened in this instance. Criticism must also fall on the Butler Company service manager who approved and signed for the use of this eroded bushing despite the captain's acceptance of this work because full responsibility for satisfactory work rested with the service manager.

As a result of this accident, the Administrator of Civil Aeronautics filed charges of violations of the Civil Air Regulations and the Civil Aeronautics Act of 1938, as amended, against the aircraft's captain and identical charges against the carrier, Peninsular Air Transport. These charges are:

- (1) Violating Sections 42.71(b), 43.10(b)(1) of the Civil Air Regulations, and Section 610(a) of the Civil Aeronautics Act of 1938, as amended, in that the aircraft was operated at a gross weight in excess of that authorized in its airworthiness certificate and the prescribed operations limitations contained therein, and at a weight in excess of the maximum takeoff weight for said aircraft for the elevation of Chicago Midway Airport.

(2) Violating Section 60.12 of the Civil Air Regulations in operating the subject aircraft in a careless and reckless manner so as to endanger the lives and property of others.

A hearing with respect to the alleged violations of the carrier has been set for February 26, 1952. No hearing date has been set for the captain.

The Civil Aeronautics Administration has also brought charges against the service manager of the Butler Company for violation of Sec. 16.20 of the Civil Air Regulations involving repairs affecting airworthiness. A hearing has already been held on this matter and the service manager's airman certificate has been suspended for a period of three months.

Findings

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

1. The carrier and the crew were properly certificated, but the left engine was not in an airworthy condition.
2. The aircraft was loaded above its maximum gross weight by about 1,860 pounds.
3. The ignition systems of both engines were found to be defective.
4. The aircraft was taken off with a defective spark plug bushing in the left engine.
5. This defective bushing caused a complete power loss during, or immediately after, takeoff.
6. The left propeller was feathered and the air speed at the time was too low to allow single-engine flight.
7. Sufficient control remained to allow a crash landing in a nearby field.

Probable Cause

The Board determines that the probable cause of this accident was the poor technique used by the pilot in taking off at too low an air speed to maintain single engine flight, followed by a critical loss of power from the left engine, and subsequently a partial loss of power from the right engine, conditions which were aggravated by the effects of the overload.

BY THE CIVIL AERONAUTICS BOARD:

/s/ DONALD W. HYROP

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAS GUNNEY

S U P P L E M E N T A L D A T A

Investigation

The Board immediately initiated an investigation in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. The accident occurred near the Board's Chicago office at Midway Airport and investigators reached the scene with little delay.

Air Carrier

Peninsular Air Transport is a partnership owned and operated by W. R. Robinson, L. A. Mobley and H. B. Robinson, Miami Springs, Florida, Post Office Box 209. It operates a nonscheduled airline business under Letter of Registration No. 723, issued by the Civil Aeronautics Board on August 5, 1949, and operational certificate No. 2-298, issued by the Civil Aeronautics Administration on October 30, 1947, and renewed on June 13, 1951. Operations are between Miami and New York, Miami and Chicago, Miami and Burbank and New York and Burbank. At Burbank and Miami the organization maintains its own repair facilities; elsewhere repair work is done by other parties.

Flight Personnel

Captain Bernard J. Mountain held a flight airman certificate with an airline rating. His total flying time was 4,800 hours of which 800 hours had been in C-46 aircraft. He had been employed by Peninsular Air Transport since October 16, 1950, and passed his last CAA flight physical examination on April 24, 1951.

Copilot Robert Lee Tracy held a valid commercial pilot certificate with appropriate ratings for the subject aircraft. His total flying time was 785 hours of which 505 hours had been in C-46 aircraft. Mr. Tracy

had been employed by Peninsular Air Transport since September 29, 1950.

The two cabin attendants were Paulette Hasselbrink and Marion Lipps.

The Aircraft

The aircraft, a Curtiss Model C-46D, N-74689, had been manufactured in December 1944 as a military transport. At the time of the accident it was certificated in the name of Kathryn R. Martin and had been flown 5,754 hours. It was equipped with Pratt and Whitney R-2800-75 engines and Curtiss Electric propellers.



PHOTO 1
SPARK PLUG THAT
WORKED OUT EN ROUTE
TO CHICAGO
NO. 12 CYLINDER
(REAR)

PHOTO 2
NEW SPARK PLUG
INSTALLED AT CHICAGO
SHOWN AFTER ACCIDENT
NO. 12 CYLINDER
(REAR)

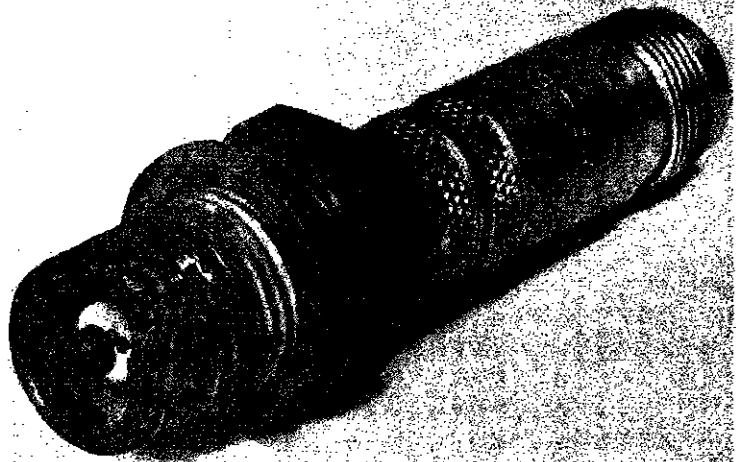


PHOTO 3
SPARK PLUG BUSHING
NO. 12 CYLINDER
(REAR)

PENINSULAR AIR TRANSPORT
C-46D N 74689
CHICAGO MIDWAY AIRPORT
SEPTEMBER 16, 1951

APPENDIX A