C I V I L A E R O N A U T I C S B O A R D
ACCIDENT INVESTIGATION REPORT

Adopted: February 15, 1954 Released: February 23, 1954

MIAMI AIRLINE, INC. - NEAR SELLECK, WASHINGTON, APRIL 14, 1953

The Accident

A Miami Airline DC-3, N 65743, crashed about seven miles east of Selleck, Washington, shortly after 0222,1/ April 14, 1953, following failure of both engines. Four passengers and the two pilots were killed in the crash; a fifth passenger later died of injuries. There were 22 passengers (all military personnel), a stewardess, and two pilots aboard. The aircraft was demolished; there was no fire.

History of the Flight

The flight departed Washington National Airport, Washington, D. C., at 0007 EST, April 13, with 12 passengers and crew consisting of Captain L. T. Brannan, Copilot O. T. Thorson, and Stewardess A. Long. At Wilkes-Barre, Pennsylvania, 10 additional passengers plus relief crew Captain A. J. Lerette and Copilot W. E. Harshman boarded the aircraft. These pilots were deadheading to Fargo, North Dakota, where they were to relieve the other pilots. The destination for all passengers was Seattle, Washington. The flight stopped at Cleveland, Ohio, for fuel and oil and arrived at Chicago at 0735 CST.

Shortly after takeoff at Chicago, the flight returned owing to rough operation of the left engine. The left magneto of this engine was replaced by a spare carried on the aircraft and the flight again departed at 1215 CST for Minneapolis, made a fuel stop there, and arrived at Fargo, North Dakota, at 1640 CST. Captain Brannan and Copilot Thorson left the flight at this point. One of the relief pilots inquired about the availability of an engine mechanic, stating that one of the engines was spitting and coughing. When he was told it would take about 15 minutes to get a mechanic, he said to disregard it. The left engine started with some difficulty. The flight departed Fargo at 1748 CST and made fuel stops at Billings, Montana, and Felts Field, Spokane, Washington. The pilots did not report any mechanical difficulties over this segment.

The flight departed Spokane at 0035, April 14, on an IFR flight plan via Green Airway 2, 5,000 feet to Ephrata, Washington, 7,000 feet to Ellensburg, Washington, and 8,000 feet to Seattle. Routine position reports were made, the last being over Ellensburg at 0143 and climbing to 8,000 feet from 7,000.

At approximately 0200 the Seattle ARTC Center heard a call on 120.3 megacycles from an unidentified aircraft which was believed to be N 65743, advising that estimated time of arrival at Seattle was 0227 and that the aircraft was standing by on Boeing Field Tower frequency (118.3 megacycles). At 0207 the pilot of N 65743 reported an engine failure and requested further clearance. Seattle Center advised the aircraft to contact Seattle Approach Control or

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

Boeing Tower as soon as practicable and cleared it to cross Seattle at or above 4,000, no delay expected. Later transmissions from the aircraft were on Boeing Field Tower frequency, rather than the Approach Control frequency of 119.5 megacycles. Signals from the aircraft were weak and difficult to read by both Approach Control (located in the Seattle-Tacoma Tower) and by the Boeing Field Tower. However, Approach Control had less difficulty than Boeing Field Tower in hearing the aircraft on 118.3 megacycles, so the controller cooperated with Boeing Tower in furnishing them with the content of messages through interphone. The pilot could apparently hear Boeing Tower, but not Approach Control. At 0214, Approach Control heard the pilot of N 65743 report that he was icing up and losing altitude. The flight was cleared for an approach to Boeing Field by the Boeing Field controller upon instructions from Approach Control, and was given current Seattle weather conditions. The last transmission from the aircraft was received at 0222, reporting that the flight was at 4,800 feet. Search and rescue activities were instituted shortly thereafter.

Investigation

The wreckage was found about eight hours after the accident at 121°46' W, 47°22' N, at about the 3,500-foot level of Cedar Mountain. The accident site was approximately 10 miles east of the Hobart fan marker (the last reporting point before Seattle), and on course to Seattle. The aircraft struck 150-200 foot trees while descending with wings level on a northwesterly heading. The right wing tip was the first portion of structure to contact the trees, and both wing panels were progressively torn away to the center section in a series of decelerations. The fuselage broke into three sections, and the nose section was demolished. All 28 seats in the cabin (23 were occupied) were torn from their attachments. Watches of both pilots, set on Eastern Standard Time, were found stopped at 5:21 (0221 PST). The discrepancy of one minute between the time of the pilots' watches and the time of the last radio contact does not appear to be significant.2/

The flaps were found in the "up" position and the landing gear was retracted. Wing deicer boots appeared to have been in operative condition. The left fuel selector was found in the "left auxiliary" position, and the right on "left main." Mixture controls were in the "emergency rich" position for the right engine and "auto rich" for the left. The right throttle was well forward at a high power position, and the left was full forward. The right propeller control was retarded and broken, while the left was found full forward. All components of the aircraft and power plants were in the area of the impact site.

Both engines were torn free of their mounts. The left propeller was at a blade angle of approximately 16 degrees below the feathered position. The right propeller was against the low pitch stop and showed evidence that it was rotating upon impact.

The engines were partially disassembled at the accident site. Both master rod bearings in the left engine had failed. The rear bearing had overheated, and the front bearing was seized on the crankshaft. The master rod assembly was dry and had evidently been subjected to excessively high operating temperatures. There were flakes of bearing material on the connecting rods, crankcase webs,

2/ The accuracy of the pilots' watches is unknown and the last message could actually have been received by Approach Control between 0221:30 and 0222:30. The minute hand of the clock would have indicated 0222 during this period owing to the fact that it jumps a full minute on the half minute, rather than showing a continuous movement over the 60 seconds.

and counterweight cheeks. Many metal particles were found in the main oil and scavenge pumps, main oil sump, and the main oil screen. The front crankshaft plug assembly was free of any sludge deposits or other foreign material.

Upon inspection of the right engine, it was evident that the front and rear master rod bearings had failed rapidly. The bearing flanges had worked out beyond the crank throw faces, and several large pieces of bearing flange material were found between the crankshaft and crankcase webs. Both master rods showed evidence of having been subjected to excessively high operating temperatures, and the front rod had partially seized on the crankpin. Flying particles from the master rod bearings pitted the counterweights. The oil scraper ring of Nos. 1 and 12 pistons dropped below the cylinder walls, and portions of the piston skirts were broken. The front support plate, the front main bearing and crankshaft support coupling were discolored from having been subjected to excessively high temperatures. This discoloration indicated a lack of lubrication of the front main bearing. The sludge cake in the front crankshaft plug was dry and brittle. As in the left engine, metal particles were found in the oil pump, oil screen, and sump, but not in as great amount.

The No. 3 piston of the right engine indicated that detonation and preignition had taken place. The piston was burned completely through the skirt near the intake valve recess, as well as being burned on the top surface between the intake and exhaust valve recesses. The cylinder head and top surface of the piston had been severely pitted by flying metal particles.

The magneto, removed at Chicago and stored in the aircraft, was found in the wreckage. Upon being inspected and tested, it was found to be in satisfactory operating condition.

Inspection of the LS-87 spark plugs installed in the left engine revealed lead deposits on the core insulators, and a glazed condition on the insulator noses. Five rear row plugs had cracked core insulators. Electrode gap setting in all instances were in excess of limits set by the manufacturer. Examination of company maintenance records revealed that these spark plugs had been in use for 180 hours and 35 minutes.

The LS-87 spark plug is approved by the CAA for use in the R-1830 series engine with the restriction that they be used for a maximum of 120 hours of operation and then discarded, no reconditioned plugs to be used. This approval by CAA was based on information submitted by two irregular air carrier operators to the effect that they had experienced satisfactory results using the LS-87 plugs in R-1830 series engines, in lieu of full scale engine testing which is normally required by the CAA for confirmation of satisfactory operating of the plugs prior to approval. The engine manufacturer, as well as the Board, recommended to the CAA both prior to and following this accident, that the LS-87 spark plug not be used in this series engine. Further, both Pratt & Whitney and the Wright Aeronautical Division have recommended to the Board following this accident that the LS-87 spark plug not be used in any engine manufactured by them due to the plug's marginal characteristics and the Board so advised the Administration. However, the limited approval is still in effect.

Company maintenance records further reflected that the spark plugs in the right engine had also been operated in excess of the normal maintenance inspection time. Inspection of the front plugs, type R-37S-1, revealed excessive electrode gaps, and four plugs were shorted internally. The rear spark plugs,

type C-35S, showed evidence of excessive erosion of the ground and center electrodes, and excessive gap settings.

A No. 3 inspection on the aircraft was performed by Associated Airmotive, Inc., San Antonio, Texas, on March 26, 1953, using a Miami Airline inspection form. Spark plugs were required to be changed on a No. 3 inspection. The inspector for Associated Airmotive inquired of the captain (Captain Lerette) if a plug or component change was due at that time, and the captain's reply was in the negative. The plug change was therefore not made; the front and rear row plugs in the left engine had 108 hours at that time; in the right engine, the front row plugs had 70 hours, and the rear row plugs 108 hours.

N 65743 was brought to the shop of Airline Services, Inc., at Friendship International Airport, Baltimore, Maryland, on April 5, 1953, for a No. 2 inspection. Upon checking the engines, it was found that there was an excessive r.p.m. drop on the right magneto of the left engine. After drying the magneto harness to remove moisture, operation of the engine was normal. It was not required that the inspection agency change plugs at a No. 2 inspection.

Captain Brannan and Copilot Thorson testified that the left engine ran roughly between Minneapolis and Fargo, but the difficulty seemed to clear up before arrival at Fargo. Survivors stated that one of the engines ran roughly before the accident, but did not know which engine failed first.

Miami Airline records concerning the engines reflected that the left engine, a Pratt & Whitney R-1830-65-92, was overhauled by American Airmotive Corporation on December 30, 1952, and was installed on the aircraft on January 23, 1953. American Airmotive Corporation, a CAA-approved repair station, was the only organization designated by Miami Airline's maintenance manual to perform engine overhauls for Miami Airline.

The right engine, a Pratt & Whitney 1830-90D (company records indicated that it was an 1830-92) was overhauled by Florida International Engine Service Company, a noncertificated shop owned by the president of Miami Airline, Mr. R. W. Duff, and operated by a CAA-certificated mechanic. Florida International Engine Service obtained ownership of the engine by transfer from Miami Airline and completed overhaul of it on November 20, 1952. The overhaul was performed under the supervision of a CAA Aviation Safety Agent of the General Maintenance Section, who was given the assignment following request for an Agent by Florida International Engine Service which was required in case of overhaul by a nonapproved shop.

The engine was then given a test cell run at American Airmotive Corporation; during the initial test run it was necessary to shut down the engine owing to the fact that several parts had been left out during assembly. After installation of these parts and a final test cell run, the engine was approved by the Agent. Ownership of it was then transferred back to Miami Airline by bill of sale dated November 30, 1952. The engine was installed in the right position of N 65743 on December 1, 1952.

The CAA Air Carrier Aviation Safety Agent assigned to Miami Airline for maintenance testified that several months prior to overhaul of the right engine, Mr. Duff requested permission to use engines overhauled by a nonapproved shop employing a certificated mechanic (Florida International Engine Service), but the request was refused on the basis that the carrier's maintenance manual

specifically provided that the only agency approved to perform engine overhaul for Miami Airline was American Airmotive.

Miami Airline operates under the provisions of Civil Air Regulations Part 42, Irregular Carrier and Off-Route Rules. Pursuant to the requirements of CAR 42.31 (d), the company maintenance manual contained a provision that overhauled aircraft engines to be used by Miami Airline were to be overhauled only by American Airmotive Corporation and approved for operation by the CAA Aviation Safety Agent assigned to Miami Airline for maintenance matters. CAA representatives testified, however, that it was permissible for Miami Airline to purchase, or to effectuate a transfer of ownership as was done in this case, and install an engine newly overhauled by a nonapproved repair station, provided the engine was overhauled in accordance with the provisions of CAR Part 18 (Maintenance, Repair, and Alteration of Certificated Aircraft and of Aircraft Engines, Propellers, and Instruments) and approved for installation on an aircraft by a representative of the CAA who supervised the overhaul. These conditions, testimony disclosed, were met.

The pilot was well informed on weather conditions, having been briefed at Fargo and Billings, and by telephone at Spokane. Unstable maritime air was flowing from the west across Washington, resulting in clear to partly cloudy skies in the valleys, and a generally overcast situation with snow showers over the mountains. VFR conditions existed en route up to the Cascade Mountains, following which the flight was on instruments most of the time. Occasional light to moderate turbulence and light to moderate icing were forecast. The forecast freezing level was 3,000 feet. Winds aloft at cruising altitudes were from the northwest at 20-30 knots. Snow showers were occurring at the scene when the accident occurred.

Investigation disclosed that the aircraft was over provisional allowable gross weight takeoff from Billings (accountability for runway length, gradient, field altitude, and temperature) and over provisional gross weight for operation on the segment Billings-Spokane (accountability for terrain clearance considering theoretical engine failure). Although the provisional gross weight was exceeded in the above instances, the load was properly distributed with respect to center of gravity limits.

Prior to this accident, numerous alleged violations with regard to provisional gross weight had been filed with the Civil Aeronautics Administration against the carrier and/or its pilots by CAA agents, but were later ruled not enforceable by CAA attorneys, since there appeared to be reasonable doubt that the carrier's personnel knew the proper method for obtaining the maximum provisional gross weight figures from graphs and other material carried on each aircraft. A simplified table for quick reference in obtaining maximum provisional gross weight was then obtained by Miami Airline, approved by the CAA, and company pilots were instructed in its use. The carrier was advised by CAA agents, prior to the accident, of the proper method for doing this, including use of the quick reference table. Testimony disclosed the pilots involved in this accident had received company instruction on the proper methods of such computation.

Investigation disclosed that the company, aircraft, and crew were currently certificated.

Analysis

In reconstructing the sequence of events which led to this accident,

available evidence indicates that the left engine failed, forcing the crew into single-engine operation. Following a short period at high power output, the right engine then failed. The fact that the left propeller was not fully feathered could be attributed to an attempt to restart the left engine after loss of power on the right.

The history of ignition malfunctioning and resulting rough engine operation and backfiring during the flight, the necessity for using carburetor heat and related higher operating temperatures following the high horsepower demand during takeoff and climb out from Spokane, Washington, on the last segment of the flight, the absence of any sludge or foreign material in the front crank shaft plug assembly and evidence of detonation and preignition, are definitely indicative of the cause of the failure of the master rod bearings in the left engine due to the resultant excessively high operating temperatures and bearing loads.

There was considerable evidence that detonation and preignition had occurred in the right engine, and it was apparent that the engine failed quite rapidly while being operated in the high power range as the result of single-engine operation. The conditions were indicated by the burned piston, fused and eroded spark plugs, condition of the bearings, and other internal evidence. The poor condition of the spark plugs, evidenced by cracked core insulators and excessive erosion of the electrodes, indicated a susceptibility to detonation and preignition. This caused the failure of No. 3 piston and the master rod bearing due to excessively high temperatures and bearing loads.

In studying the physical evidence presented by the engines, maintenance records of the company on engines and airframe, and testimony with reference to the reporting and correction of items requiring maintenance, the Board must conclude that the management has not exhibited a proper concern for maintaining aircraft in accordance with a high standard of airworthiness, but rather has been satisfied with acceptance of considerably lower standards.

In this connection, the Board was interested in knowing of enforcement action being taken or contemplated by the CAA, and addressed an inquiry to the Administrator of Civil Aeronautics. The Administrator advised by letter dated January 25, 1954, that the CAA had conducted an investigation of the carrier and that a number of maintenance and operational discrepancies were indicated with respect to this flight. Certain aircraft instruments were being used in excess of the allowable overhaul time; the radio equipment had been operated in excess of the maximum period specified in the carrier's maintenance manual; the pilot had not forwarded a revised flight manifest to the carrier's operations base upon departure from Spokane; and previous malfunctioning of the left engine had not been recorded in the flight log. Several alleged violations of Civil Air Regulations which occurred on other flights were also discovered, as well as a number of maintenance irregularities. The CAA concluded that a civil penalty should be imposed against the carrier; in determining the amount of such penalty, consideration was given to the fact that on April 27, 1953, Miami Airline voluntarily suspended operations for a period of 15 days. In view of this circumstance, and since the carrier's recent operations have indicated to the Administrator that they have been conducted in compliance with the provisions of Civil Air Regulations, it was concluded by the CAA that a compromise offer by the carrier of $2,000 would be satisfactory settlement of the alleged violations. The CAA is presently taking steps to effect such a settlement.

Study of the wreckage showed conclusively that structural damage to the airframe was due entirely to impact.

Findings

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

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

2. The flight between Washington, D. C., and Chicago was routine.

3. The flight returned to Chicago a few minutes after departure owing to malfunction of the left engine, and the left magneto was changed; this magneto was later found to be in a satisfactory condition.

4. Although engine malfunctions were again experienced while en route west of Chicago, the pilots failed to have the difficulties corrected.

5. First one engine, then the other, progressively failed while the flight was on its last route segment, resulting in a crash in the Cascade Mountains.

6. There was evidence that detonation and preignition took place in both engines and that they ultimately failed as a result of master rod bearing failures.

7. Spark plugs in both engines had been operated beyond their normal maintenance inspection period and exhibited evidence of a condition conducive to detonation and preignition.

Probable Cause

The Board determines that the probable cause of this accident was the progressive failure of both engines, due to the lack of compliance with proper maintenance standards.

BY THE CIVIL AERONAUTICS BOARD:

/s/ CHAN GURNEY

/s/ HARMAR D. DENNY

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

SUPPLEMENTAL DATA

Investigation and Hearing

The Civil Aeronautics Board was notified of this accident at 0315, April 14, 1953. An investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was ordered by the Board, and was held in two phases: Seattle, Washington on May 13 and 14, 1953, and Coral Gables, Florida on June 11 and 12, 1953.

Air Carrier

Miami Airlines, Inc., an irregular air carrier, incorporated under the laws of the State of Florida, maintains its principal place of business at Building 401, Twentieth Street Airport, Miami, Florida. It holds Letter of Registration No. 85, issued by the Civil Aeronautics Board, and Air Carrier Operating Certificate No. 2-264 issued by the Civil Aeronautics Administration, authorizing it to engage in irregular interstate, overseas, and foreign air transportation.

Flight Personnel

Captain Albert J. Lerette, Jr., age 29, was employed by Miami Airline on March 22, 1952. He held a valid airman certificate with an air transport rating, and a C-46 type rating. Captain Lerette had a total of 5,100 flying hours, of which 2,061 were in DC-3 equipment, and over 312 hours of instrument flying time. His last first-class CAA physical examination was completed on October 10, 1952, without limitations.

Copilot William E. Harshman, age 28, held a commercial pilot certificate with multi-engine, land, and instrument ratings. Mr. Harshman had a total of 1,840 flying hours, of which nearly 38 were instrument flying time. He received a first-class CAA physical examination on November 1, 1952. Mr. Harshman was employed by Miami Airline on October 12, 1951.

The Aircraft

N 65743, a Douglas DC-3C, Serial No. 20432, was owned by Mr. R. W. Duff and leased to Miami Airline (of which Mr. Duff is president). It had a total of about 12,185 flying hours, and was equipped with Pratt & Whitney engines and Hamilton Standard Propellers. The right engine had approximately 396 hours since overhaul, and the left had accumulated almost 576 hours. A complete change of spark plugs was made on both engines on March 1, 1953, at Miami. Subsequent to this, the right front plugs were changed on March 5, again on March 12, and had accumulated approximately 142 hours to the time of the accident. The right rear spark plugs had approximately 124 hours at the time of the accident.

The right engine was purchased by Mr. R. W. Duff from war surplus after World War II; ownership of the engine was later transferred to Florida International Engine Service Company. Mr. Duff, President of Miami Airline, had formed Florida International Engine Service Company some time ago and later became president of Florida International Engine Service, Inc., upon its change from company form of organization and incorporation on January 31, 1953. At the time the right engine was overhauled, Florida International Engine Service Company was not a CAA-approved repair station; the successor organization was given such approval by the CAA after the accident, on May 7, 1953.