

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: August 29, 1950

Released: August 30, 1950

AIR TRANSPORT ASSOCIATES, INC., SEATTLE, WASH., JULY 19, 1949**The Accident**

A C-46F aircraft, N-5075N operated by Air Transport Associates, Inc., a large irregular carrier, crashed following takeoff, 3,500 feet north of Boeing Field, Seattle, Wash., at 2101,¹ July 19, 1949. Two of the 28 passengers were killed; two passengers and the crew of four were seriously injured; and 15 received minor injuries. In addition to those in the aircraft, five other persons were killed and four others seriously injured as a result of impact damage to dwellings struck by the aircraft.

History of the Flight

The flight, scheduled to fly from Seattle, Wash., to Chicago, Ill., non-stop, taxied from the loading ramp at Boeing Field at 2043, July 19, 1949. On board were the 28 passengers and crew of four, 8,010 pounds of fuel and 912 pounds of baggage. Total aircraft weight was 44,907 pounds which was within the allowable limit of 45,000 pounds, and the aircraft was properly loaded so that its center of gravity was within the certificated limits.

The Captain, Merle Edgerton, was in the left seat flying as pilot, and the First Officer, Anthony Gjessing, was in the right seat flying as copilot. Another captain of the company, James M. Adams, who rode as a reserve pilot, was seated on the flight deck behind Captain Edgerton and Copilot Gjessing. The crew taxied the aircraft to the south end of runway 31, where they parked for a period of 13 minutes to accomplish the before takeoff check list. The engines and other components of the aircraft appeared to operate normally, so at 2058, after receiving clearance from the tower, takeoff was started. Fuel selector valves

for both engines had been positioned to the front tanks which contained 91 octane gasoline. Wind was from the northeast at six miles per hour, and visibility was eight miles, under a ceiling of 8,500 feet.

Power was advanced to 45 inches of manifold pressure and to 2,700 RPM's for takeoff. The aircraft rolled approximately 3,500 feet down the runway, then became airborne at an air speed of 105 miles per hour. During the takeoff run one of the engines was heard to sputter and backfire, and an unusual amount of torching or exhaust flame was observed coming from both of the engines. Because the left engine did not seem to be developing full power, Captain Edgerton, at an altitude of about 20 feet, retarded the throttles, and the aircraft settled back to the runway.

Runway 31 at Boeing Field is 7,500 feet long. At the time of the accident, the green threshold lights at the north end of the runway had been moved in 1,700 feet for runway repair purposes, in effect reducing the length of the runway to 5,800 feet. However, this north portion of the runway was usable for takeoff. Captain Edgerton after touching down on the runway, approximately 4,500 feet from the start of the takeoff and 1,300 feet from the green threshold lights, did not believe that he had sufficient runway remaining to accomplish a safe stop, so he advanced the throttles to the limit of 52 inches. Both engines responded, but the left continued to misfire. After a momentary ground roll the aircraft again became airborne at an air speed of 105 miles per hour.

The landing gear was retracted, air speed increased slowly to approximately 110 miles per hour, and the flight passed over the north end of the runway at about 50 feet above the ground in a nose

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

high attitude. Sufficient altitude could not be obtained to fly over power lines and poles to the north of the airport, and 1,500 feet north of runway 31 the aircraft struck a 56-foot pole two feet below its top. The impact tore away six feet of the right horizontal stabilizer and elevator. A second pole, 1,480 feet from the first, was struck, then a third pole 200 feet from the second. As a result of striking these poles air speed and altitude were lost, and 200 feet from the third pole the aircraft crashed into a three-story frame house. The aircraft carried away the entire top story of this structure, then it plunged into and demolished a single-story brick dwelling. The aircraft came to rest on the foundation of the brick dwelling in an upright position.

Many high tension lines, carrying up to 26,000 volts, had been severed. As a result, there was considerable electrical arcing which started several scattered fires in the vicinity of the accident. Fire was started in the area of the aircraft's fuel tanks immediately after the aircraft had come to a full stop. The tail section aft of the main cabin door and the nose section forward of the flight deck were separated from the cabin portion of the fuselage. Passengers and crew were evacuated through these open ends of the cabin before fire progressed into the fuselage.

Investigation

Excepting the aft portion of the fuselage with the empennage attached, the wreckage was extensively destroyed by fire, and the parts were scattered over the scene of the accident from rescue and fire fighting operations. The landing gear was found in the "up" position, but no determination could be made of the flap position; however, Captain Edgerton stated that he had taken off with the flaps "up." Flight controls and control surfaces were so badly damaged from the crash and fire that no reliable information as to their position prior to impact could be secured.

Investigation further disclosed that 91 octane fuel was used for runup on the ground and for the takeoff with the engines operating on the front main tanks. Although the center tanks were filled with 100 octane gasoline, the takeoff was not made on these tanks due to the

left center fuel pressure boost pump being inoperative. The aircraft, N-5075N, was certificated under a specification issued to Skyways International Trading and Transportation Company of Miami, Fla. This specification provided only for the use of fuel of 100 octane rating or above. It was found, however, that the aircraft was being operated by the company in accordance with a CAA Approved Slick Airways Flight Manual, which provided for the use of 91 octane fuel for cruise. However, 91 octane fuel was not authorized in the Slick Manual for take off.

The engines and propellers were taken to a hangar at Boeing Field where they were completely disassembled. Defects found in the left engine were: There was no contact spring for the left magneto distributor finger; there was a substantial crater and cone condition in the contact points of both magnetos; there was excessive end movement in one of the rocker arm bearings; and there was a wet or oily condition in the combustion chambers, diffuser section, and intake pipes. Defects found in the right engine consisted of a broken outer exhaust valve spring, and a wet or oily condition in the combustion chambers, diffuser section, and intake pipes, but to a lower degree than that found in the left engine. No evidence was found of detonation in either engine.

No definite conclusion could be made concerning the operating condition of the spark plugs in either of the two engines. No excessive eroding, gap clearance, or burned ceramics and electrodes were found. Both engines had been subject to intense heat from fire followed by quenching with water. This quenching could have damaged the plugs sufficiently to have destroyed their normal operating characteristics under test. Accordingly, the laboratory tests of the spark plugs did not result in any definite information as to whether or not all of them were operating before the accident. The ignition harnesses were completely destroyed by fire.

A day before the accident a flight from Seattle to Fairbanks, Alaska, and return had been completed in the same aircraft, N-5075N. During this trip trouble had been experienced with the left engine. On takeoff from Annette, Alaska, the left engine had started to

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misfire just after the aircraft left the ground and considerable torching was observed coming from the exhaust stacks. The mixture control was placed in the auto lean position which resulted in smoother engine operation. At Fairbanks the takeoff was accomplished with the mixture control in the auto lean position to avoid trouble similar to that experienced at Annette. The aircraft was cruised for the entire return trip in this manner, and at Everett, Wash., where the company had much of their maintenance work performed, the mixture control unit was removed from the left carburetor. The parts were checked, and then replaced along with a new manual mixture control disk. After the completion of this work, the engine operated normally. The aircraft was then flown from Everett to Seattle for the flight during which this accident occurred. The left carburetor could not be given a complete operational test after the accident because of the extensive damage caused by fire.

The engines installed in N-5075N were a war model of the Pratt and Whitney R-2800-75. Because this model of engine was obsolete and manufactured only for use by the armed services, no instructions, other than Army Technical Orders, were published for the maintenance and repair of the engine. Company maintenance personnel testified that they had an extreme amount of difficulty in obtaining the necessary Army Technical Orders, and that no service bulletins or other maintenance information was available from the manufacturer. However, the company did have one complete file of the necessary Army Technical Orders for maintenance of their aircraft.

Captain Edgerton, age 26, received his flight training and experience with the United States Air Forces and with the non-scheduled air carriers. At the time of the accident he had a total of 3,743 flying hours, of which 700 were in C-46 type aircraft. His last physical examination was passed March 8, 1949, and he held a valid airman certificate with a commercial pilot rating. He was the second pilot to be employed by the company which was shortly after the company was organized, his date of employment being October 15, 1948. Because of his previous experience and time

in the C-46 airplane, he was employed as captain and assumed command of his first flight after completing two as copilot.

Copilot Gjessing, age 35, received training in the United States Air Forces and with a scheduled airline. He had a total of 7,800 hours, of which 200 were in C-46 type aircraft. His last physical examination was passed February 26, 1949, and he held a valid airman certificate with a commercial pilot rating. He was employed by the company July 16, 1949, which was just three days before the accident occurred. The only training and instruction that he received from the company consisted of his own study of the company's operating manual. No instruction or check flight was accomplished in the company's aircraft prior to the time that he made his first flight which terminated in this accident.

At the time of the accident, Reserve Captain Adams, age 25, had a total of 3,624 flight hours, of which 400 were in C-46 type aircraft. He had been previously trained in the United States Air Forces, and with a nonscheduled air carrier. His last physical examination was passed January 28, 1949, and he also held a valid airman certificate with a commercial pilot rating. Captain Adams was employed June 20, 1949, as copilot and promoted to captain July 5, 1949. His training with the company consisted of an oral examination on the aircraft and the completion of one flight as copilot.

The company had established a training program at the time that the accident occurred which included flight instruction and ground study, but this training program was not required to be completed by any of the pilots that had been previously employed. When Captain Edgerton was examined concerning procedure for single engine takeoff, he was not able to state what air speed was required to accomplish a safe single engine takeoff.

Several obstruction lighted poles extending to as high as 63 feet above the surface of the runway are located 1,500 feet north of runway 31. These poles protruded above a glide angle of 40 to 1 measured from the north end of runway 31; but below this angle if it is measured from the green threshold lights which, as previously stated, had been moved 1,700 feet in from the north end

of the runway for the accomplishment of runway repairs.

Analysis

The backfiring or misfiring which was heard during takeoff, together with the testimony of the pilots to the effect that the left engine did not develop normal power during takeoff clearly establishes that full continuous power was not available from the left engine. This lack of power may have been contributed to by the defects found in the left engine, though the defects in themselves could not have resulted in any substantial loss of power. How much power, if any, was produced by the left engine is questionable. The most valuable evidence of engine performance, the condition of the combustion chambers, spark plugs, ignition harnesses and carburetor, was largely destroyed by fire, so no conclusion or estimate as to the extent of failure could be made. However, the use of 91 octane fuel for the takeoff could have caused the maloperation of the engine and resultant loss of power. This is particularly true since the pilot stated he used 91 octane fuel with a power setting of 2700 RPM and 45 inches M.P. for the first takeoff. Further, upon resumption of the takeoff, after cutting the throttles and making a short roll, the power was increased to 2700 RPM and 52 inches M.P.

Though no evidence was found of detonation in the disassembly of the engines, it is probable that it occurred during takeoff, for the high power settings used far exceeded the limitations of 91 octane fuel.² If there had been detonation, there would have been a substantial loss of power.

Regardless of the possible effects in using 91 octane fuel, the pilot's indecision in not discontinuing the takeoff at the first indication of engine malfunctioning precipitated the accident. After climbing to an altitude of 20 feet, throttles were retarded and the takeoff discontinued. Then, after touching down, power was applied again for takeoff. This change of mind consumed runway length which would have permitted acceleration to a higher speed, and which may have permitted a successful climb from the airport. It is also obvious that if

² See Supplemental Data for power settings using 91 octane fuel.

the initial 20 feet of altitude had not been lost by retarding throttles before continuing ahead, the aircraft would have been at least 20 feet higher at the point in its flight where the first pole was struck, and so would have been 18 feet above the pole, rather than two feet below. On the other hand, if the pilot had not changed his decision to abandon takeoff after power failure, there would have remained 3,000 feet of usable runway in which to stop, a distance which should have been ample.

In conclusion, consideration should be given to the fact that no training program or company "flight check" was required of the pilots that were in this aircraft. It is apparent that if Captain Edgerton had clearly understood what minimum air speed was required for a safe single engine takeoff he would have been able to decide in the first instance whether he should continue taking off or stop. His indecision stemmed from his lack of knowledge as to what constituted a safe air speed after failure of one engine. It should be also noted that neither the reserve captain nor the copilot had demonstrated to the company their ability to handle such emergencies before they had been dispatched on this particular flight.

Findings

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

1. The carrier, the aircraft, and the crew were properly certificated.
2. Ninety-one octane fuel was used for takeoff although not authorized in the aircraft specification or in the CAA Approved Flight Manual.
3. During takeoff, the power settings used far exceeded the limitations of 91 octane fuel.
4. The aircraft, after a takeoff roll of approximately 3,500 feet, became airborne at an air speed of 105 miles per hour and climbed to an altitude of about 20 feet, at which time the left engine failed to develop full power.
5. Immediately following the loss of power in the left engine, throttles were retarded after which the aircraft made contact with the runway approximately 4,500 feet from the start of the takeoff run, and 1,300 feet from the green threshold lights at the north end of the runway.

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6. Following the touchdown on the runway, throttles were advanced for the continuation of the takeoff, and the aircraft became airborne for the second time at an air speed of 105 miles per hour.

7. The left engine continued to misfire during the entire takeoff and climb from the airport, but there was not sufficient evidence from which to conclude or estimate the amount of power, if any, which was developed.

8. The aircraft struck a 56-foot pole, two feet below its top, which was located 1,500 feet north of the north end of runway 31, after which the aircraft struck other poles and power lines resulting in loss of air speed and altitude, following which the aircraft crashed in a residential area north of Boeing Field, Seattle, Wash.

9. Fire was started in the area of the aircraft's fuel tanks immediately

after the aircraft had come to a full stop.

Probable Cause

The Board determines that the probable cause of this accident was the indecision of the pilot in continuing a takeoff after loss of power in the left engine, which loss was probably caused by the use of 91 octane fuel, necessitating the operation of the aircraft's engines in excess of the approved operating limitations.

BY THE CIVIL AERONAUTICS BOARD:

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ HAROLD A. JONES

Russell R. Adams, Member of the Board,
did not participate in the adoption of
this report.

Supplemental Data

Investigation and Hearing

The Civil Aeronautics Board received notification of the accident at 2200 PST, July 19, 1949, from CAA Communications and immediately initiated an investigation in accordance with provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. As part of the investigation, a hearing was held August 4, 1949, at Seattle, Wash.

Air Carrier

Air Transport Associates, Inc., was incorporated May 1948, under the laws of the state of Washington with its principal place of business located at Seattle, Wash. At the time of the accident the company held an air carrier operating certificate No. 7221, issued by the Civil Aeronautics Administration. It also held a letter of registration as a large irregular carrier No. 1896 issued by the Civil Aeronautics Board. The company was authorized to carry passengers and cargo within the continental limits of the United States, and Alaska.

Flight Personnel

Captain Merle Edgerton, age 26, received his flight training and experience with the United States Air Forces and with the non-scheduled air carriers. At the time of the accident he had a total of 3,743 flying hours, of which 700 were in C-46 type aircraft. His last physical examination was successfully passed March 8, 1949, and he held a valid airman certificate with a commercial pilot rating. He was the second pilot to be employed by the company which was shortly after the company was organized, his date of employment being October 15, 1948.

Copilot Anthony Gjessing, age 35, received training in the United States Air

Forces and with a scheduled airline. He had a total of 7,800 hours of which 200 were in C-16 type aircraft. His last physical examination had been completed February 26, 1949, and he held a valid airman certificate with a commercial pilot rating which was currently effective. He was employed by the company July 16, 1949.

Reserve Captain James M. Adams had a total of 3,624 flight hours, of which 400 were in C-46 type aircraft. He had been previously trained in the United States Air Forces, and with a non-scheduled air carrier. His last physical examination was successfully completed January 28, 1949, and he also held a valid airman certificate with a commercial pilot rating which was currently effective. He was employed by the company June 20, 1949.

The Aircraft

N-5075N, a C-46F aircraft, was owned by Air Transport Associates, Inc., and was currently certificated by the Civil Aeronautics Administration. At the time of the accident it had been flown a total of 255 hours. It was equipped with two Pratt and Whitney R-2800-75 engines and two Hamilton Standard Hydromatic propellers. The engines and propellers had a total time of 255 hours.

CAA approved operating limitations for the C-46-F airplane, which is equipped with R-2800-75 engines, provide for the use of 91 octane fuel as follows:

Cruise Power Limits for 91 Octane Fuel

Maximum cruise:	BHP	RPM	In. hg.	Altitude	Mixture
Low blower	1200	2100	37.0		S.L. Auto-Rich
Low blower	1200	2100	34.0		8500 Auto-Rich
High blower	1090	2100	34.0	Above 8500	Auto-Rich
Desired cruise:					
Low blower	1070	2100	34.0		S.L. Auto-Lean
Low blower	1070	2100	31.0		10500 Auto-Lean
High blower	970	2100	31.0	Above 10500	Auto-Rich