

AIRCRAFT ACCIDENT REPORT

ADOPTED: August 30, 1966

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ALLEGHENY AIRLINES, INC.
CONVAIR 340/440, N8415H
MONTOURSVILLE, PENNSYLVANIA
JULY 23, 1965

SYNOPSIS

Allegheny Airlines, Inc., Flight 604, a Convair 340/440, N8415H, crashed 5 miles east-northeast of the Williamsport-Lycoming County Airport, Montoursville, Pennsylvania, on July 23, 1965. The 36 passengers, 3 crewmembers, and 1 jumpseat rider survived but received varying degrees of injuries. The flight, regularly scheduled from Pittsburgh, Pennsylvania to Newark, New Jersey, with intermediate stops at Dubois, Phillipsburg, Williamsport, and Wilkes-Barre, Pennsylvania, departed Runway 9 at 1503 e.d.t. Shortly after takeoff smoke and fire were observed coming from the right engine and at approximately 1505:30 the captain advised "Six oh four is coming back in, we've got the right engine feathered." The crash occurred moments later on the crest of a ridge approximately 600 feet above the airport elevation. The aircraft was destroyed by fire. The failure of the right engine is attributed to the failure of the front row master rod and all the associated link rods. Damage to the rod ends precluded any determination of the cause of the master rod failure.

The Board determines that the probable cause of this accident was the failure of the crew to implement proper procedures for an engine failure on takeoff.

1. INVESTIGATION

1.1 History of the Flight

Allegheny Airlines, Inc., Convair 340/440, N8415H, operating as scheduled passenger Flight 604, from Pittsburgh, Pennsylvania to Newark, New Jersey, with intermediate stops at Dubois, Phillipsburg, Williamsport, and Wilkes-Barre, Pennsylvania, departed Runway 9 at the Williamsport-Lycoming County Airport at 1503^{1/2} in accordance with Visual Flight Rules. Within 2.5 miles of the airport, personnel in the tower observed smoke trailing from the right engine, and the local controller attempted to contact the flight. At 1505:30 the following transmission was received, "Six oh four is coming back in, we've got the right engine feathered." This was acknowledged, and when asked to advise which runway they desired, the reply was "Okay." The flight did not respond to any further transmissions.

The reports of witnesses on the ground indicate that the flight remained south of the extended centerline of Runway 9 for approximately 2.5 miles, and that the aircraft

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

was not very high, nor was it climbing very fast. Smoke and fire were observed in the area of the right engine. An aircraft mechanic observed the aircraft at an estimated altitude of 500 feet with both propellers still turning. The flight continued in a northeasterly direction, passed over a house, approximately 850 feet m.s.l. and disappeared beyond a ridge. A woman in the house stated that, "As he disappeared over (the) ridge the sound of motors quieted. I heard a few pops and then sounds like the wrinkling of paper."

Passengers reported unusual noises, smoke, and flame emanating from the right engine within two minutes after takeoff. The propeller was quickly feathered. The stewardess, who had gone to the flight deck, returned to the cabin and announced that they were returning to Williamsport. Some felt that the left engine sound changed, others were expecting an increase in sound, but heard none. Two described an easy left turn after the engine was feathered, but the others did not notice. Impact occurred approximately one minute after the right engine was feathered.

The captain and first officer testified that they could not recall any of the events surrounding the flight. The pilot-trainee who occupied the jumpseat stated that the first officer was flying the aircraft from the left seat during the takeoff, and the captain was in the right seat. He stated that the captain retracted the landing gear four to five seconds after liftoff, but he did not observe the flap retraction. The aircraft remained in a climbing attitude, any turns were very slight, and the flight from takeoff to impact was smooth. His first indication of abnormality was when the first officer reached up to shut off the fuel, and the captain reached up and pressed the feathering button. He also recalled the first officer saying ". . . 100 knots A1. . . ." just before impact.

The aircraft crashed at approximately 1506, during daylight, at 41° 17' N latitude and 76° 49' W longitude. The elevation was approximately 1,100 feet m.s.l.

1.2 Injuries to Persons

<u>Injuries</u>	<u>Crew</u>	<u>Passengers</u>	<u>Others</u>
Fatal	0	0	0
Non-fatal	4	19	0
None	0	17	

1.3 Damage to Aircraft

The aircraft was destroyed by impact and fire.

1.4 Other Damage

The aircraft severed an electric line pole and uprooted and burned small trees along the wreckage swath.

1.5 Crew Information

Captain Allen J. Lauber, age 36, held airline transport pilot certificate No. 562471, with ratings for DC-3, M-202/404, and CV-240/340/440 aircraft. He was hired

on May 25, 1955 and had accumulated 10,071 total flying hours of which 1,296 hours were in this type aircraft. His FAA first-class medical certificate was issued May 5, 1965, with the limitation that the holder must wear glasses while exercising the privileges of his airman certificate. Captain Lauber testified that, "I assume that I was wearing the prescription sunglasses, because they weren't recovered." His last proficiency check was accomplished on June 24, 1965. He had 10:37 hours rest in the previous 24 hours.

First Officer James P. McClure, age 33, held commercial pilot certificate No. 1320819. He was hired on August 27, 1961, and had 5,061 total flying hours of which 1,410 hours were in this type aircraft. His FAA first-class medical certificate was issued May 17, 1965, with no limitations. His last proficiency check was conducted in a Martin 202 on May 3, 1965. The last proficiency check in a Convair was on September 24, 1964. In a letter dated April 7, 1964, he received company authorization to occupy the left seat during scheduled operations at the captain's discretion. He had 19:00 hours rest in the previous 24 hours.

First Officer-Trainee Robert V. Leeman, age 30, held commercial pilot certificate No. 1371151 and an FAA first-class medical certificate dated June 18, 1965, with no limitations. He was hired on July 21, 1965, and as a pilot-trainee, had no specific duties in connection with the operation of the flight.

Hostess Barbara A. Creske was hired on February 28, 1963. She completed her last recurrent training on May 27, 1965.

1.6 Aircraft Information

N8415H, a Convair 340 modified to 440 engine power pack configuration, serial number 125, was manufactured October 14, 1953, and at the time of the accident had accumulated a total time of 26,266 hours. It was configured to accommodate 52 passengers, and had been maintained in accordance with FAA requirements.

The aircraft was equipped with two Pratt & Whitney R2800 CB 3 engines and Hamilton Standard Model 43E60 propellers. It was serviced with 100/130 octane fuel. The engines were installed as follows:

<u>Position</u>	<u>Serial No.</u>	<u>Time Since Overhaul</u>	<u>Total Time</u>
1	31269	1,666:08	18,361:42
2	33074	639:53	23,814:60

The takeoff gross weight was 45,155 pounds, which was below the maximum allowable of 47,580 pounds. The center of gravity (c.g.) was within limits. The reported weight in cargo compartment D was 550 pounds which was within the allowable range of 360 to 650 pounds.

1.7 Meteorological Information

The surface weather observation recorded by the U. S. Weather Bureau at 1513 was 4,000 feet scattered clouds, visibility 4 miles in haze, temperature 78° F, dewpoint 68° F, wind from 180 degrees 6 knots, altimeter setting 29.88.

The accident occurred in daylight.

1.8 Aids to Navigation

All aids to navigation serving the airport, including the ILS localizer, glide slope, and marker beacons, and the VOR radio range, were operating properly.

1.9 Communications

There were no reported problems with communications. The captain was making all transmissions.

1.10 Aerodrome and Ground Facilities

The Williamsport-Lycoming County Airport is located in the Susquehanna River valley which is approximately one mile wide at the airport. The elevation is 528 feet m.s.l. The principal runway, Runway 9-27, is 5,050 feet long and 150 feet wide with a bituminous surface. This runway essentially parallels Bald Eagle Mountain which forms an east-west ridge 12 miles long and over 2,000 feet high just south of the airport. The mountain extends approximately six miles east of the airport at which point the valley opens to the southeast. The terrain to the north and northeast of the airport is composed of numerous knolls and valleys which rise rapidly to an elevation of 1,300 feet m.s.l. Approximately nine miles northeast of the airport is Allegheny Ridge, with rough, heavily wooded terrain over 2,000 feet m.s.l.

1.11 Flight Recorder

The aircraft was not required to have a flight recorder, and none was installed.

1.12 Wreckage

Initial impact occurred in an open field on the upslope of a small hill, at an elevation of approximately 1,100 feet m.s.l. The aircraft skidded approximately 320 feet in a northeasterly direction over the top of the rise and down a steep slope on the opposite side, finally coming to rest on a heading of 035 degrees. The outboard 23 feet of the right wing was separated from the aircraft when it struck and severed an electric line pole at the top of the hill. The outboard 38 feet of the left wing was separated and broken into three sections. The fuselage ruptured between the cockpit and cabin area, leaving a large hole on either side, just forward of the passenger compartment. The aircraft was gutted by ground fire several minutes after impact.

The landing gear and flaps were up at impact. The rudder, aileron, and elevator trim box rod extensions as found in the wreckage, were set on a sister aircraft to determine the approximate tab positions. The rudder and aileron trim tabs were neutral and the elevator was 2-1/2 degrees noseup.

The left engine from accessory section, with the propeller installed on the propeller shaft, was detached from, but adjacent to, the power section which had also separated. The power section was severely damaged by impact and intense heat from ground fire. The propeller blade angles as indicated by impact markings on the blade shim plates were 34-35 degrees. There were slash marks from the left propeller blades at successive distances of 2 feet 8 inches, 2 feet 8 inches, 4 feet 8 inches, and 7 feet. The position of the propeller governor electric head high RPM adjusting screw indicated an engine RPM of 2750. Computations based on this RPM and the initial propeller slash marks revealed that the aircraft was traveling at an airspeed of 98 knots at impact.

The right engine was basically intact externally but the front and rear accessory cases were burned away. The front row master rod failed and all link rods were separated. The cylinder barrel skirts were bent in the direction of engine rotation. The master rod piston pin was intact and the piston pin bushing was in place around the pin. The rear row master rod and all link rods were intact. The Nos. 1 and 2 propeller blade shim plates indicated an impact blade angle of 95 degrees, which is the feathered angle for this propeller. The No. 3 blade left no impression on the shim plate.

The left and right fuel shutoff valves were open. The firewall shutoff valves were destroyed by fire.

1.13 Fire

Fire was observed in the vicinity of the right engine while the aircraft was in flight. A flash fire occurred on the right side of the aircraft during the skid along the ground, and an intense ground fire gutted the aircraft several minutes after impact.

1.14 Survival Aspects

This was a survivable accident, there were no fatalities. The cabin attendant rushed to the cockpit when she observed smoke coming from the right engine. The captain advised her that they were returning to the airport. She returned to the cabin, advised the passengers to fasten their seat belts, that they were returning to the airport, and then sat down next to a female passenger in need of comfort. She stated that she barely had time to fasten her seat belt when the aircraft crashed. She was thrown forward at impact and landed on a passenger in seat 9D (a right window seat). The passenger in seat 1D reported his seat broke loose at impact.

Most passengers exited through the large opening at the forward end of the cabin. Eighteen went out the right side where some difficulty was encountered in the underbrush and limbs which had piled up ahead of the aircraft. Ten people went out of the left side of the split fuselage. Evacuees on the right side were approximately four feet above the ground and those on the left side had to jump or slide down the fuselage about ten feet. The forward left overwing window exit was opened by a female passenger, and utilized by a total of nine passengers.

The captain was assisted from the aircraft by the first officer and hostess. She also re-entered the burning aircraft to make certain that all passengers had escaped.

1.15 Tests and Research

The Convair engineering test pilot who flew the majority of the certification flights for the Convair 340 testified regarding the performance characteristics of the aircraft. He pointed out that the failure of the right engine is less critical than the left engine, and that in any case the aircraft should be trimmed with the dead engine higher than the operating engine. This would necessitate less rudder

trim and resulting drag. He also noted that in demonstrations^{2/} of simulated engine failure at V_1 ^{3/} ". . . we would wait until we had around eight or nine hundred feet (m.s.l.), and were approximately four and a half or five miles off the end of the runway before attempting to go to a clean configuration." With regard to the minimum airspeed of 126 knots for the clean configuration he stated that ". . . if you get low enough in airspeed, without any flaps, that you can get into buffet onset, where if by extending the flaps before you get into this critical area, you can perhaps regain and get back some of the performance that you would lose if you got into buffet. His solution would be a ". . . configuration with takeoff power on, and water, all 11 degrees of flap. Climb performance in that condition is almost twice the climb performance in the single-engine (en route climb) configuration." This would develop a straight-ahead climb to 1,500 feet in approximately three minutes with a temperature of 78 degrees. He stated that the turning radius for 140 and 150 m.p.h. should have been 0.58 to 0.7 miles respectively, using a 20-degree bank.

1.16 Crew training

The Director of Flights for Allegheny testified regarding company training and operating procedures. He stated that all pilots are trained to "fly the aircraft" at crucial times such as an engine failure on takeoff. The recommended procedure for this type of an emergency, in addition to feathering the engine and fighting any fire, includes climbing straight ahead to an altitude of at least 400 feet before retracting flaps. He pointed out that the manual also requires at least one knot of airspeed in excess of 115 knots for every degree flaps are raised from the 11-degree takeoff setting, and that the best rate of climb is obtained with zero flaps providing the airspeed exceeds 126 knots. The pilots are taught the effect of lowering flaps from the clean configuration in order to bring the aircraft out of the pre-stall buffet zone if airspeed does decay, and they also practice turns using 30 degrees of bank during single-engine operation. He estimated that under normal circumstances, flaps would be retracted approximately 1:15-1:30 minutes after takeoff at Williamsport.

2. ANALYSIS AND CONCLUSIONS

2.1 Analysis

The aircraft had been maintained in accordance with FAA regulations, and the gross weight and c.g. were within allowable limits. The crew was properly certificated.

The right engine power loss is attributed to a failure of the front row master rod, and subsequent breakup of the associated link rods. Since the piston pin bushing was found still wrapped around the piston pin, it is believed that the failure occurred in the strap area of the master rod. The peened and rolled over condition of the front row master and link rods prevented determination of the exact point and cause of the failure.

The amount of power being developed by the left engine at impact was derived from pertinent evidence and data. The calculations revealed that the power was 2,215 HP for a 34-degree propeller blade angle and 2,410 HP for a 35-degree blade angle. Since

^{2/} The demonstrations were made at San Diego, California.

^{3/} V_1 is defined as the critical-engine failure speed.

the engine has a dry takeoff rating of 2,050 HP at 2700 RPM, and a wet rating of 2,400 HP at 2800 RPM, it is believed that the engine was producing takeoff power at the time of impact.

The weather is not considered to have appreciably affected the operation of the flight, if at all. The haze restriction to visibility may have eliminated a clearly defined horizon, but the crew was very familiar with the topography, and the higher elevations to the northeast were within four miles of the runway. In addition, the haze would not affect vertical visibility and the estimation of altitude above the terrain, nor would it preclude visual reference to the river valley to avoid high terrain. Likewise, the temperature would only reduce performance about ten percent below standard day values. Neither of these circumstances represents causal involvement. The pilot-trainee stated that the air was smooth, and therefore turbulence did not aggravate the situation.

Despite the lack of information from the pilots, and the lack of a flight recorder on the aircraft, a certain meaningful sequence of events has been established. The testimony of the pilot-trainee revealed that the liftoff and gear retraction were normal. While he did not observe the flaps being retracted, he did recall that the propeller was manually feathered by the captain. Since the autofeather switch is not turned off until the flaps are raised, it is believed that they were retracted prior to the engine difficulty, and after acceleration to 126 knots. If the flaps had been raised prematurely, and then the engine failed, the crew would have lost control of the aircraft prior to climbing over 500 feet and traversing in excess of five miles to the crash site. However, a correlation of the estimated time at which the flaps would normally be retracted, 1:15 to 1:30 minutes after takeoff, and the transmission that the right propeller was feathered, 2:30 minutes after takeoff, indicates that the engine failure occurred very shortly after the flaps were retracted. During the next 1:30 minutes the right engine failed, the propeller was feathered, and the aircraft crashed 45 degrees left of the takeoff heading, approximately two miles north of the extended runway centerline.

The investigation established that the aircraft has the capability to accomplish a straight-ahead, single-engine climb to an altitude of 1,500 feet m.s.l. in approximately three minutes, even when the temperature is 78 degrees and the engine failure occurs at V_1 . Further, that the diameter of turn under these conditions would be just over one mile using a nominal bank angle of 20 degrees. This should have enabled the flight to avoid surrounding high terrain and negotiate a successful single-engine landing at the airport. Since Allegheny requires the pilots to practice single-engine turns in either direction, using 30 degrees of bank, on proficiency checks the captain should have performed such maneuvers within the preceding 30-day period.

Based upon the evidence it is apparent that subsequent to the engine failure the crew did not follow prescribed operating procedures for a straight-ahead single-engine climb. Because of the lack of information from the crewmembers, who testified that they could not recall any of the events surrounding the flight, the Board will not undertake to speculate as to the reasons why the crew deviated from the runway heading, except to state that if the proper emergency procedures for single-engine operation had been followed the accident might not have occurred.

The final opportunity to possibly avert the accident was lost when the crew did not comply with the company procedure of lowering the flaps to offset the loss of climb capability as the airspeed decayed. It is not known whether the airspeed was permitted to decrease in an effort to trade airspeed for altitude, or if it was lost prior to feathering the propeller and while the crew attempted to retrim the aircraft. Obviously the crew reaction compounded rather than controlled the emergency situation that confronted them when the right engine failed, thereby precipitating an accident.

2.2 Conclusions

a. Findings

1. A power loss occurred in the right engine shortly after the flaps were raised on takeoff.
2. The left engine was developing takeoff power at impact.
3. The crew failed to execute a straight-ahead single-engine climb to an altitude which would enable them to clear obstructions.
4. The crew failed to lower the flaps to improve climb capability when the airspeed decayed below 126 knots.
5. This was a survivable accident.

b. Probable Cause

The Board determines that the probable cause of this accident was the failure of the crew to implement proper procedures for an engine failure on takeoff.

BY THE CIVIL AERONAUTICS BOARD:

/s/ CHARLES S. MURPHY
Chairman

/s/ ROBERT T. MURPHY
Vice Chairman

/s/ G. JOSEPH MINETTI
Member

/s/ WHITNEY GILLILLAND
Member

/s/ JOHN G. ADAMS
Member