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REPORT OF THE CIVIL AERONAUTICS BOARD

Of the investigation of an accident involving aircraft of United States Registry NC 25691, which occurred near Morgantown, West Virginia, on October 2, 1941.

I.

CONDUCT OF INVESTIGATION

An accident involving aircraft NC 25691 occurred at the Municipal Airport, Morgantown, West Virginia, on October 2, 1941, about 9:15 a.m. (EST)^{1/}. The aircraft was being operated in scheduled air carrier service between Pittsburgh, Pennsylvania, and Birmingham, Alabama, as Trip 142 of Pennsylvania-Central Airlines Corporation (hereinafter referred to as "PCA") at the time. The accident resulted in major damage to the airplane and minor injuries to four passengers. The other fifteen passengers and the crew of three escaped injury. The Washington office of the Civil Aeronautics Board (hereinafter referred to as the "Board") was officially notified of the accident about 10:30 a.m. The Board immediately initiated an investigation of the accident in accordance with the provisions of section 702(a)(2) of the Civil Aeronautics Act of 1938, as amended. An Air Safety Investigator of the Board was sent to the scene of the accident and arrived there about 2:40 p.m. that day. In accordance with the instructions of the Board, the damaged airplane had been placed under guard, and had not been disturbed except to the extent necessary to remove passengers, mail and cargo from the wreckage. Upon his arrival, the investigator took custody of the wreckage.

After an examination of the wreckage at the scene of the accident the airplane was released to PCA on that day, with the exception of the component parts of the braking system which were removed to PCA's maintenance shop at Pittsburgh, Pennsylvania, for further inspection and tests.

^{1/} All times used herein are Eastern Standard Time.

A public hearing was held at Pittsburgh, Pennsylvania, on October 23, 1941. Donald W. Nyrop, an attorney for the Board, presided as examiner and the following personnel of the Safety Bureau participated in the hearing: Jerome Lederer, Director; W. K. Andrews, Chief, Investigation Section; W. E. Koneczny, Air Safety Specialist in Aircraft Structures; Allen P. Bourden, Senior Air Safety Investigator; and H. V. Shebat, Air Safety Investigator.

All of the evidence available to the Board at the time was presented at the hearing. Testimony was given by 17 witnesses and 19 exhibits were received in evidence. While the examiner and the representatives of the Safety Bureau were the only ones designated to ask questions directly of the witnesses, the examiner, acting under instructions of the Board, announced at the opening of the hearing that any person who had any evidence, questions or suggestions to be presented for consideration in the proceeding might submit them in writing to the examiner. One question was submitted and was asked of the appropriate witness.

Upon the basis of all of the evidence disclosed by the investigation, the Board now makes its report in accordance with the Civil Aeronautics Act of 1938, as amended.

II.

SUMMARY AND ANALYSIS OF EVIDENCE

Air Carrier

At the time of the accident, PCA was an air carrier operating under currently effective certificates of public convenience and necessity and air carrier operating certificates. These certificates authorized it to engage in air transportation with respect to persons, property and mail over vario

routes, including route No. 55 between the terminal points Pittsburgh, Pennsylvania, and Birmingham, Alabama, via certain intermediate points, including Morgantown, West Virginia.

Flight Personnel

The crew of the flight in question consisted of Captain Russell J. Wright, First Officer Robert J. Bininger and Hostess Jean E. Purucker.

Captain Wright, aged 25, had been employed by PCA on October 26, 1938, and had served as a copilot for approximately two years and four months before becoming a captain on March 4, 1941. At the time of the accident he was a certificated airline transport pilot and had a total of approximately 2773 hours of flight time, of which 563 hours had been in Douglas DC-3 airplanes. He had logged 164 hours of instrument time. His last physical examination, required by the Civil Air Regulations, was taken on May 22, 1941, and showed that he was in satisfactory physical condition. He was involved in a previous accident near Charleston, West Virginia on April 16, 1941 while flying a Boeing 247D for PCA. The Board determined that the probable cause of that accident was loss of power in one engine. It was also determined that Captain Wright's failure to have familiarized himself adequately with the terrain involved and his hesitancy to exercise emergency authority to use additional power were contributing factors.

First Officer Bininger, aged 23, had been employed by PCA on March 17, 1941, and at the time of the accident he had a total of approximately 1031 hours of flight time, of which approximately 377 hours had been on Douglas DC-3 airplanes while serving as a copilot with PCA. He held a commercial pilot certificate with an instrument rating and had logged 55 hours of instrument time. His last physical examination, required by the Civil Air Regulations, was taken on June 11, 1941, and showed that he was in

satisfactory physical condition.

Captain Wright had had a rest period of more than 24 hours prior to going on duty October 2, 1941. First Officer Binger had had a rest period of about eight hours prior to going on duty October 2, 1941, and had flown 2 hours and 50 minutes during the 24-hour period preceding the departure of the trip in question.

Thus, it appears from the evidence that both Captain Wright and First Officer Binger were physically qualified, and held proper certificates of competency for the flight involved.

Airplane and Equipment

Aircraft NC 25691 was a DC-3, manufactured by Douglas Aircraft Company, Inc., of Santa Monica, California, and was purchased by PCA on September 28, 1940. It was powered with two Wright Cyclone G102A engines, each rated at 1100 h.p. for take-off, and was equipped with Hamilton Standard, constant speed, hydromatic, full-feathering propellers. This model airplane had been approved by the Civil Aeronautics Administration for air carrier operation over the routes flown by PCA with 21 passengers and a crew of three. The airplane, as equipped with de-icers had been certificated for operation with a standard weight of 24,546 pounds.^{2/} At the time of departure of Trip 142 from Pittsburgh, the total weight of the aircraft was approximately 23,630 pounds including mail, cargo, 325 gallons of fuel, 40 gallons of oil, 19 passengers and a crew of three. The record further shows that the airplane was loaded in

^{2/} The "standard weight" of an airplane is the maximum allowable weight for landing.

accordance with the current approved loading schedule prescribed by the Civil Aeronautics Administration.^{3/}

The total operating time on the airplane at the time of the accident was approximately 2,261 hours, 558 of which had been accumulated since July 20, 1941, the date of the last overhaul. Approximately 31 hours of operating time had been accumulated since the last 150-hour inspection. A "turn around" inspection had been made at Pittsburgh on the day of the accident. The maintenance records produced by PCA indicate that the airplane and its equipment had received the overhauls, periodic inspections, and checks which are required by company practice and approved by the Civil Aeronautics Administration. Furthermore, the evidence indicates that the airplane was in an airworthy condition when it was dispatched from Pittsburgh, Pennsylvania, on the day of the accident.

History of the Flight

PCA's Trip 142 on October 2, 1941, originated at Pittsburgh, Pennsylvania, with Birmingham, Alabama, as its destination. Several intermediate stops were scheduled, the first at Morgantown, West Virginia. During the landing at that point, the accident occurred.

Departure from Pittsburgh had been delayed for approximately 35 minutes because the ceiling and visibility at the Morgantown Airport had been below the weather minimums prescribed in the operations specifications issued to PCA by the Civil Aeronautics Administration. These specifications permitted landings only under contact conditions, with a minimum ceiling of 1000 feet

^{3/} A loading schedule for an aircraft provides for distribution of passengers, cargo and fuel in such manner as to maintain the center of gravity within approved limits.

and a minimum visibility of one mile.^{4/}

The United States Weather Bureau report issued for Morgantown at 8:30 a.m. indicated that there existed a ceiling at an estimated height of 2000 feet, three miles visibility, dark broken clouds, a light ground fog which was dissipating rapidly, a temperature of 64 degrees and a dew point of 63 degrees.

The flight took off from Pittsburgh at 8:50 a.m., having been cleared as far as Knoxville, Tennessee. According to the testimony of Captain Wright and First Officer Bininger the flight proceeded normally toward Morgantown, making a radio position report at 9:00 a.m. over South Brownsville, Pennsylvania, flying contact at 2000 feet above sea level. About 9:10 a.m. PCA's radio operator at Pittsburgh advised the flight that PCA's Morgantown station reported light rain, visibility down to about one mile and wind from the west about 6 m.p.h.^{5/} The flight acknowledged receipt of this message at 9:11 a.m. and reported that the airplane was over the Morgantown airport.

In accordance with the usual PCA landing procedure at Morgantown, Captain Wright circled the airport to the left to check the field for other traffic and the wind direction. The captain stated that, while circling the field, the flight encountered a moderate rain squall west of the airport. Captain Wright opened the side window and the sliding windshield so that he might have the benefit of the resulting increased visibility. As they circled the field and upon reaching a point approximately south of the airport the captain stated that they ran out of the

4/ See Appendix A for United States Weather Bureau reports issued at Morgantown on the morning of the accident.

5/ At the time of the accident there was no control tower at the Morgantown airport, nor did PCA have a radio transmitter there. Weather and traffic information from Morgantown was communicated by teletype to PCA's Pittsburgh radio station, which relayed the information to the flight for which it was intended.

rain squall and that the visibility was from three to four miles. Captain Wright also testified that the wind sock, which is on top of the Airport Administration Building, indicated that the wind was south-southwest and that upon the basis of this observation he selected the northeast-southwest runway, which is 3200 feet long, upon which to make his landing. Although the north-northwest--south-southeast runway was 400 feet longer, he considered that the northeast-southwest runway, in addition to being more nearly parallel with the wind, had the advantage of having less obstructions on the end from which the approach would be made.

The captain stated that he was approximately three miles north of the airport when he made his final turn for the approach and lined up the airplane with the northeast-southwest runway. During the approach he ordered First Officer Bininger to lower the flaps. The captain testified that at the time the flaps were in full down position the airplane was traveling at an estimated air speed of approximately 110 m.p.h., that they were approximately one mile from the airport, and at an altitude of about 300 feet above the ground. Captain Wright stated that the airplane crossed the north boundary of the runway at an altitude of approximately 10 to 15 feet and with an estimated air speed of between 85 and 90 m.p.h. According to the captain's testimony the airplane first made contact with the runway at a point approximately 800 feet from the northeast end of the runway. He further testified that the ship bounced once and again made contact with the runway approximately 1000 feet from the approach end of the runway. Captain Wright stated that after making this contact with the runway he was able to get the tail wheel on the runway almost immediately, within 100 to 200 feet.

The captain then allowed the airplane to roll approximately 1500 feet with the flaps in the full down position to effect a drag upon the airplane and thus aid deceleration. He stated that no attempt was made to use the brakes until the airplane had given no indication of slowing down further by use of flaps. The captain testified that after the airplane had rolled approximately 1500 feet and was within 700 feet of the southwest end of the runway, he began to apply pressure to the brake pedals. He stated that after getting the brakes "clear to the bottom" he discovered that there were no brakes or that he had no braking action. Since there was insufficient runway left to take off and circle the field to make another landing, he stated that he immediately unlocked the tail wheel preparatory to groundlooping the airplane, still applying pressure to the brake pedals. He estimated that the period during which he attempted to apply the brakes lasted about two or three seconds, and that during that period the airplane rolled about 175 feet. After the tail wheel had been unlocked, the captain released the pressure from the right brake pedal, applied full left brake and left rudder and opened the right throttle. The captain testified that the airplane started to groundloop to the left but that it became apparent that the groundloop was not progressing sufficiently to prevent the airplane from going over the 25-foot embankment along the edge of the airport.

During the early part of the groundloop Captain Wright had instructed First Officer Bininger to raise the flaps for the purpose of avoiding damage to them. The captain was of the opinion that the flaps were in the full up position by the time they started over the embankment. The captain cut the master ignition switch and the electrical switch as the airplane skidded sideways off the airport, down a 25-foot embankment and came to rest on the brush-covered hillside. The landing gear sheared off during the skid and the airplane slid to a stop on the underside of the wings and fuselage.

First Officer Bininger testified that during the approach, and after the captain's order, he lowered the flaps to the full position and then directed all of his attention to the calling of air speed. Since he was directing all of this attention to the instrument panel he did not recall the altitude or speed of the airplane as it crossed the boundary of the airport, and he was further unable to determine with any degree of accuracy the air speed of the airplane at the time it first made contact with the runway. First Officer Bininger was unaware of any brake failure and stated that the first time he realized that it was possible that they might encounter difficulty was when the captain applied full power to the right engine in an attempt to groundloop the airplane. The first officer further testified that during the attempted groundloop, upon instructions from the captain, he raised the flaps and was of the opinion that the flaps were in the up position at the time they skidded down the embankment.

Captain James C. Graham, Chief Pilot, Southern Division, PCA, was a passenger on the flight in question. He was seated in the cabin in the first seat in the single row on the right side. He stated that the trip from Pittsburgh to Morgantown was normal and that from his position in the cabin the landing appeared to be normal. At the time the airplane made contact with the runway, Captain Graham estimated that they were approximately 900 feet from the northeast end of the runway. He stated that after the landing had been effected he paid no more attention to the progress of the airplane until power was applied to the right engine. Captain Graham stated that he then looked out of the window and could see that the pilot was trying to groundloop the airplane. He testified that during the approach

a light rain was falling but that he did not determine whether there was water on the surface of the runway as the airplane landed. Captain Graham further testified that there was no indication in the cabin of the brakes having been applied. In explaining this statement, he stated that when the brakes are applied suddenly and with full pressure, the braking effect can be felt in the cabin.

Mr. Arlin P. Martin, Chief of Maintenance Personnel, PCA, was also a passenger on board Trip 142, occupying seat number two, which is the front seat on the left side of the aisle. Mr. Martin testified that from his observation the flight was normal in every respect, including a very smooth landing which appeared to be on the two landing wheels. He also stated, however, that as the airplane crossed the approach end of the runway, it appeared to be a little too high. He testified that by the time the airplane had slowed down to a point where he expected the pilot to apply brakes, he noticed the revving up of the right engine. The airplane started to turn to the left and then slid sideways over the embankment and came to a stop.

Mr. Theodore E. Snyder, PCA's Morgantown Station Manager, from a position in front of the Administration Building, observed the final approach of Trip 142, the landing, the roll along the runway, the attempt to ground loop the airplane and its disappearance over the 25-foot embankment. Mr. Snyder testified that the landing appeared to be normal and that it did not appear that the airplane had excessive speed at the time it made contact with the runway. Snyder further testified that a light rain was falling at the time Trip 142 landed at the airport, that it had rained during the night, and that at the time the landing was made the runway was quite wet. Snyder estimated the visibility to be about two miles at the time of the accident.

Examination of the Wreckage

The examination of the wreckage did not reveal any evidence of failure of the airplane or any of its parts prior to the time that it left the runway.

As previously mentioned, the component parts of the braking system were removed to PCA's Pittsburgh shops, where they were thoroughly inspected and tested. The following participated in the inspection and tests: W. E. Koneczny, Air Safety Specialist (Structures), and H. V. Shebat, Air Safety Investigator, Safety Bureau, Civil Aeronautics Board; J. E. McAdam and R. L. Simons, Civil Aeronautics Administration Inspectors; and W. Howard Clarke, Superintendent of Maintenance for PCA. The brakes functioned normally during the tests, and all component parts were found to be in satisfactory condition. Nothing was revealed which would indicate that a brake failure had occurred. In addition, tests were conducted with a DC-3 airplane after squirting about 3 gallons of water into the four brake drums. The wetness of the brakes resulted in no perceptible delay in brake action.

Conduct of the Flight

The evidence shows that the flight was properly dispatched from Pittsburgh, Pennsylvania, and that it was properly conducted up to the time that the landing at Morgantown, West Virginia, was begun. It appears, further, that the weather conditions at Morgantown were above the prescribed minimums and satisfactory for a landing at the time.

It seems apparent that the probable cause of the accident is to be found in a combination of several factors. The evidence leads us to

conclude that the pilot would not have been justified in expecting to complete the landing without an extended use of brakes. In view of the fact that no more than 2200 feet of runway remained after the airplane had made final contact with the ground, and particularly since the runway was wet, it was not consistent with good operating practices for the pilot to permit the airplane to roll to within 700 feet of the end of the runway without any application of brakes.

PCA's Chief Pilot, Southern Division, testified that it was established PCA practice, in making a landing with full flaps on runways of normal length, to let the airplane roll without applying brakes until the flaps were no longer effective in slowing the airplane. He stated that PCA pilots were instructed accordingly, but that they were instructed, also, that brakes should be applied as needed at the discretion of the pilot. Subsequent to the accident, however, PCA issued instructions that brake operation should be checked immediately after contacting the ground, during the first part of the landing roll.

It is impossible to determine whether the brakes were definitely ineffective at the time of the accident, and, if so, to what extent they were ineffective. As previously stated, thorough inspection and tests of the brakes subsequent to the accident showed them to be functioning properly at the time. Although an examination was made of the tracks made by the wheels of the airplane on the runway, no definite conclusions with respect to braking action could be derived therefrom. The track of the left wheel was more distinct than that of the right wheel, and in an area between about 900 and 1200 feet from the end of the runway four indentations in the track were observed, where the track narrowed from a width of about 10 inches to about 3 inches.

It is possible that water on the runway reduced braking effectiveness by causing the wheels to slide, even though the brakes themselves were functioning properly. While the wet condition of the runway surface could not have completely eliminated braking effectiveness, a reduced effectiveness may have been sufficient to induce the pilot to believe that he had no brakes at all.

In any event, if an attempt to apply the brakes had been made in the early part of the landing roll, in all probability the accident would have been avoided. In that case, if they had been found to be inoperative, or ineffective, there would have been sufficient runway remaining to permit a take-off, and another landing could have been made using the full extent of the runway.

Having concluded that it was improper, under the circumstances in this case, to delay the application of brakes in the manner earlier described, we must consider whether the action of the captain in attempting a groundloop was justified. If the captain was correct in concluding that the airplane could not be stopped by continued application of brakes, his attempt to execute a groundloop was an exercise of sound judgment under the circumstances existing at the time. If, on the other hand, he was wrong in that conclusion, it would appear that application of power to the right engine resulted in an increase in speed of the airplane and thus contributed to cause it to slide off the runway and over the embankment.

Consideration was also given to the tail wheel lock. This device, controlled from the cockpit by a lever located under the throttle quadrant pedestal, keeps the tail wheel in line during the take-off and landing and while in flight. The captain stated that he unlocked the tail wheel prior to initiating the ground loop, and the tail wheel was found unlocked during the examination of the wreckage. It is possible, however, that the airplane was turning to the left before the lever was moved to the unlocked position, and that the resulting pressure on the latch prevented it from disengaging. If this occurred, it may have prevented the successful completion of a ground loop which otherwise would have kept the airplane from going off the runway.

III.

CONCLUSION

Findings

We find, upon all of the evidence available to the Board at this time, that the facts relating to the accident involving aircraft NC 25691, which occurred near Morgantown, West Virginia, on October 2, 1941, are as follows:

1. The accident, which occurred about 9:15 a.m. to Trip 142 resulted in minor injuries to four passengers. The other fifteen passengers and the crew of three escaped injury. The airplane was substantially damaged.

2. At the time of the accident, PCA held a currently effective certificate of public convenience and necessity and an air carrier operating certificate authorizing it to conduct the flight.

3. Captain Wright and First Officer Binninger were physically qualified and held proper certificates of competency to perform their duties on the flight in question.

4. Aircraft NC 25691 was currently certificated as airworthy at the time of the accident, and was in an airworthy condition at the time of departure from Pittsburgh, Pennsylvania, at 8:47 a.m. that day.

5. Trip 142 was cleared in accordance with company procedure from Pittsburgh, Pennsylvania, to Knoxville, Tennessee, with several scheduled intermediate stops, the first of which was Morgantown, West Virginia.

6. Trip 142 proceeded uneventfully to the vicinity of the Morgantown Municipal Airport, circled the field and commenced to land.

7. The weather conditions were above the proscribed minimums and were satisfactory for landing at the time. The field was wet from rain, and it was raining intermittently before, and at the time of, the accident.

8. The airplane contacted the ground about 800 feet from the approach end of the runway, skipped about 200 feet and then rolled approximately 1500 feet to a point about 700 feet from the end of the runway before the captain attempted to apply the brakes.

9. The captain attempted to apply the brakes during a period of 2 or 3 seconds, became convinced that he could obtain no braking action, and attempted to initiate a groundloop about 500 feet from the end of the runway.

10. The airplane turned about 90 degrees to the left and slid sideways off the runway and down an embankment at the edge of the field.

11. The approach to the field was either too high or too fast, or both, to permit safe completion of the landing without fully effective brake action.

12. The late application of brakes resulted in the airplane being placed in such a position that, when the captain became convinced that he had no braking action, he could not elect to take off and thus avoid over-running the field.

PROBABLE CAUSE

Upon the basis of the foregoing findings and of the entire record available at this time, we find that the probable cause of the accident to aircraft NC 25691 on October 2, 1941, was the failure of the captain to apply the brakes in time to permit a successful take-off when they were found to be ineffective.

CONTRIBUTING FACTORS

1. Company policy in not using the brakes during the early stages of the landing run.
2. Slippery runway.
3. Failure of the captain to take account of the runway conditions and land as close as possible to the end of the runway.

BY THE CIVIL AERONAUTICS BOARD:

/s/ L. Welch Pogue

/s/ Oswald Lynn

/s/ Harlow Branch

/s/ Edward Warner

Baker, Member, did not take part in the decision.

APPENDIX A.

United States Weather Bureau reports issued at Morgantown the morning of the accident.

6:30 a.m. Ceiling estimated 1000 feet, overcast, visibility 1/2 mile, moderate fog, temperature 61, dew point 61, wind calm.

7:30 a.m. Ceiling estimated 2000 feet, dark broken clouds, visibility 1/2 mile, moderate ground fog, light rain, temperature 61, dew point 61, wind calm.

8:15 a.m. (Special Report) Ceiling estimated 2000 feet, broken clouds, visibility 1 mile, light ground fog, light rain, temperature 62, dew point 62, wind calm.

8:30 a.m. Ceiling estimated 2000 feet, dark broken clouds, visibility 3 miles, light ground fog, temperature 62, dew point 62, wind calm, fog dissipating rapidly.

9:30 a.m. Ceiling estimated 2000 feet, dark broken clouds, visibility 2 miles, light ground fog, light rain, temperature 64, dew point 63, wind calm.