

File No. 1755-42

Docket No. SA-72

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Released: January 28, 1943

REPORT OF THE CIVIL AERONAUTICS BOARD

On the investigation of an accident involving aircraft of United States registry NC 21711, which occurred on the Bismarck Municipal Airport, Bismarck, North Dakota, on August 29, 1942.

An airplane accident occurred at the Bismarck Municipal Airport, Bismarck, North Dakota, on August 29, 1942, at about 6:28 p.m. (CWT)<sup>1/</sup>. The airplane involved, NC 21711, was being operated at the time in scheduled air carrier service between Seattle, Washington, and Chicago, Illinois, as Trip 2 of Northwest Airlines, Inc. (hereinafter referred to as "Northwest"). All of the seventeen passengers and crew of three escaped injury, with the exception of the captain, who sustained injuries to his left leg. The airplane received major damage.

#### CONDUCT OF INVESTIGATION

The Minneapolis sub-office of the Civil Aeronautics Board (hereinafter referred to as the "Board") was notified of the accident at 7:05 p.m. The Board immediately initiated an investigation in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended (hereinafter referred to as the "Act"). Air safety investigators of the Board were sent to the scene of the accident, the first of whom arrived at approximately 1:40 a.m. the following day. In accordance with the instructions of the Board, the wreckage had been placed under guard. This guard was maintained until the wreckage was officially released to the company. A hearing was held at St. Paul, Minnesota, on September 4, 1942. W. K. Andrews, Chief, Investigation Section, Safety Bureau of the Board, acted as Presiding Officer, and the following personnel of the Safety Bureau participated in the hearing: Herbert V. Shebat,

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<sup>1/</sup> All times mentioned herein are Central War Time unless otherwise indicated.

Senior Air Safety Investigator, and Ray Brown, Air Safety Investigator. Upon the basis of all of the evidence disclosed by the investigation, the Board now makes its report in accordance with the Act.

SUMMARY AND ANALYSIS OF THE EVIDENCE

Air Carrier

At the time of the accident, Northwest was an air carrier operating under a currently effective certificate of public convenience and necessity and air carrier operating certificates. These certificates authorized it to engage in air transportation over Route 3, Chicago, Illinois, to Seattle, Washington, and Winnipeg, Canada, with Bismarck, North Dakota, as one of the intermediate stops.

Airplane and Equipment

Aircraft NC 21711 was a Douglas, model DC3A, manufactured by the Douglas Aircraft Company, Inc. of Santa Monica, California, and purchased by Northwest in April 1939. The airplane was powered with two Pratt & Whitney S1C3G engines, 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 Northwest with 21 passengers and a crew of 4. It had been certificated for operation with a standard weight of 24,400 pounds and a provisional weight of 25,200<sup>2/</sup>, not including de-icer equipment. The

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<sup>2/</sup> The "standard weight" of an airplane is the maximum allowable weight for landing while the "provisional weight" of an airplane is the maximum allowable weight for take-off. When an airplane takes off with a weight in excess of the designated standard weight, the weight of the airplane must be reduced by gasoline consumption, prior to arrival at its next scheduled stop, to the extent necessary to bring it within the standard weight for landing. If sufficient gasoline has not been consumed between the time of take-off and any emergency landing, gasoline can be dumped by the use of tested and approved dump valves in order to reduce the total weight to the approved weight for landing. At the time of the accident, the weight of the airplane had been reduced well below its authorized standard weight.

aircraft was loaded within its allowable limits with respect to both and c.g. location. The evidence indicates that the airplane and equ had received the overhauls, periodic inspections, and checks which a required by company practice and approved by the Civil Aeronautics A ministration, and that the aircraft was in an airworthy condition at time of its departure from Seattle, Washington, on the day of the ac

Flight Personnel.

The crew of the flight in question consisted of Captain Leon S. DeLong, First Officer Theodore M. Finholt, and Stewardess Bernice H. Bertelson.

Captain DeLong, age 48, had been employed by Northwest and its predecessors as a captain since December 5, 1928. He had had approximately 24 years of flying experience. He held an airline transport pilot certificate with a multi-engine 1050-3150 h.p. rating, and had total of 12,801 hours flying time, of which approximately 2,700 hour had been on Douglas DC-3 equipment. DeLong had a total instrument t of approximately 553 hours. His last physical examination, required the Civil Air Regulations, was taken on May 27, 1942. His rest peri prior to departure from Billings on August 29, 1942, was approximate. 21 hours.

First Officer Theodore M. Finholt, age 29, held a commercial pi

certificate with an instrument rating, and was properly qualified as a second pilot in scheduled air carrier operation. He had been employed by Northwest since June, 1941, and had a total of approximately 1246 hours flying time, about 1050 of which were with Northwest on DC-3 equipment. His last physical examination required by the Civil Air Regulations was taken on June 4, 1942. His rest period prior to departure from Billings was approximately 21 hours.

Both Captain DeLong and First Officer Finholt were physically qualified and held proper certificates and ratings for the flight involved.

Bernice Bertelson, stewardess, and the third member of the crew, had flown approximately 2060 hours as a stewardess.

#### History of the Flight

Northwest's Trip 2 of August 29, 1942, originated at Seattle, Washington, with Chicago, Illinois, as its destination. Several intermediate stops were scheduled, including Spokane, Washington, and Missoula, Butte, and Billings, Montana. Trip 2 arrived at Billings 30 minutes behind schedule, due to a delay in handling cargo. Captain DeLong, First Officer Finholt, and Stewardess Bernice Bertelson took over as the flight crew at this point. The flight departed Billings at 3:00 p.m. (MTT) and arrived at Miles City at about 3:55 p.m. Departure from Miles City for Bismarck was made at 4:00 p.m. with Fargo, North Dakota as an alternate. There were 420 gallons of fuel on board. The flight was made under contact conditions at 9,000 feet until time for descent to the Bismarck Airport. At approximately 6:20, when in the vicinity of the Judson marker, about 25 miles west of Bismarck, the trip was informed that Bismarck was overcast, ceiling 3500, visibility 1 3/4 miles, light thunderstorms, and light rainshowers. The Northwest radio operator advised Trip 2 that the storm

was moving in a northerly direction. Light rain was encountered by the flight as it crossed the Missouri River at a point about 3 miles southwest of the airport. While over the Missouri River the flight was advised that the wind was varying from 20 to 40 degrees, velocity 20 to 30 m.p.h. and gusty. Had the captain considered weather conditions at Bismarck unsafe for landing, his remaining fuel supply of approximately 250 gallons was ample to reach his alternate, only 190 miles away. At this time the airport was clearly visible to the captain and remained so throughout his final approach and landing. The landing gear was lowered and locked. The first officer then asked the Northwest radio operator if the northeast-southwest runway could be used. He was advised that only the northwest-southeast runway was available, and that the wind was now varying between 10 and 60 degrees, velocity 20 to 25 m.p.h. The radio operator failed to log the part of the conversation concerning use of the northeast-southwest runway.

At about 6:27 p.m., the captain made a normal turn south of the airport, and from an altitude of about 2000 feet the approach was straight in toward the northwest on the northwest-southeast runway. Flaps were not used. The approach was normal and the air seemed relatively smooth until the aircraft had passed over the fence which enclosed the airport. At this time the air became noticeably gusty. The captain stated that his approach speed was about 100 m.p.h.; that his drift to the left had been corrected and that no drift was noticeable at the moment of contact with the ground. The left wheel contacted the center of the runway about 400 feet from the approach end, and the right wheel touched about 280 feet beyond. The right wing then lifted slightly beyond level, but this was corrected almost immediately. A long sustained gust of wind then struck from the right, lifted

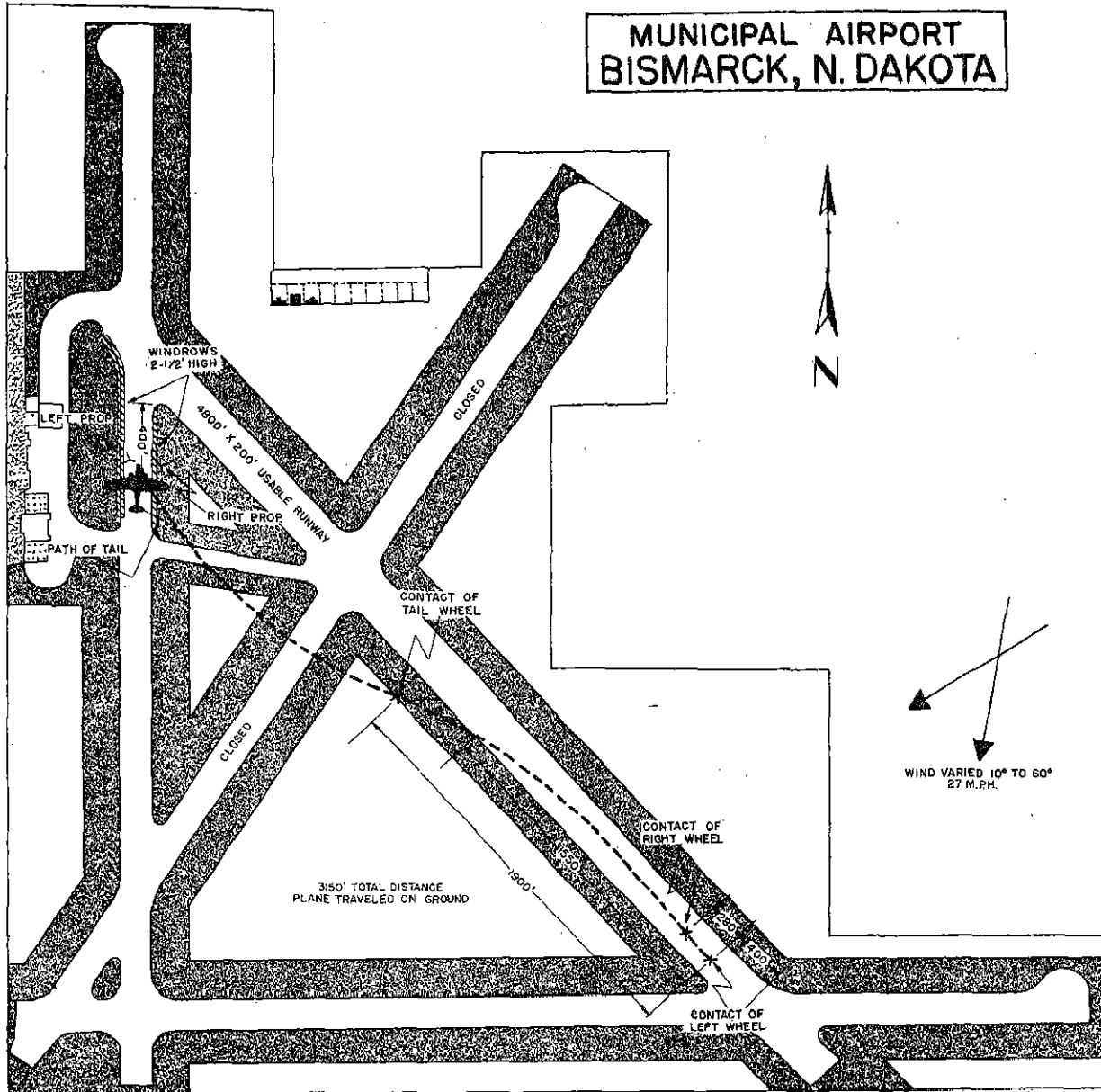
the right wing and changed the heading of the aircraft about 15 degrees to the left. Despite the captain's efforts, he was unable to effect recovery and bring the plane back to its original track. Almost immediately the plane went off the runway and onto the adjacent wet and slippery surface.

Tire marks on the runway indicated that the brakes were first applied 1050 feet beyond the point of initial contact. The plane skidded off the runway to the left 1550 feet from the first point of contact. The tail wheel made contact with the ground 350 feet after the plane left the runway and remained in contact thereafter. The aircraft then rolled across the southwest leg of the southwest-northeast runway just west of the intersection and for some distance beyond. At this point the captain ordered the tail wheel unlocked. About the same time he applied more power to the left engine, and applied right rudder in an effort to head the ship into the wind, and to avoid windrows of tar-mix surfacing which was piled 30 inches high along the east side of the north-south runway, about 400 feet ahead. While this effort succeeded in partially turning the airplane, it skidded almost broadside through one windrow of surfacing material, shearing off the left landing gear and buckling the right. The aircraft came to rest on the left engine nacelle and right landing gear, headed due north on the north-south runway, about 3150 feet beyond the point where the left wheel first touched the ground.

#### The Airport

The Bismarck Municipal Airport is located on a plateau 1650 feet above sea level. It is an L-shaped field of approximately 300 usable acres, with one 200 x 4800-foot surfaced runway in use. (See map opposite page.) At

# MUNICIPAL AIRPORT BISMARCK, N. DAKOTA





the time of the accident construction work was in progress, necessitating the closing of the field except for the northwest-southeast runway. The day preceding the accident, the surfacing of the northeast-southwest runway had been laid and rolled. It was probably in a usable condition but had not been officially opened.

#### Weather Conditions

The weather conditions in the vicinity of Bismarck for several hours prior to the accident and until 7:05 p.m., when broken clouds were reported, were substantially as reported by radio to Captain DeLong<sup>3/</sup>. The ceiling ranged from 3000 to 3600 feet except for a short period during the heaviest part of a thunderstorm, during which time the ceiling lowered to 2500 feet. Visibility at the time of the accident was about two miles, and the surface winds which had been north-northwest from 4:30 p.m. to 6:01 p.m. shifted to north-northeast at about 6:10 p.m., and increased rapidly in velocity, holding between 10 and 60 degrees, velocity 20 to 25 m.p.h., and gusty. This was approximately 18 minutes prior to the landing of Trip 2. Local winds varied from northeast to northwest as the storm approached, and shifted back to northeast, accelerating the velocity and producing gustiness, as the thunderstorm passed to the north of Bismarck. According to the U. S. Weather Bureau airway observations, the wind velocity never exceeded 30 m.p.h.

The cup anemometer will not register an instantaneous change in velocity during gusts or lulls, but indicates more correctly the average wind velocity in miles per hour. The range between gusts and lulls is

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<sup>3/</sup> See appendix for Synoptic Situation and Hourly Sequence Reports.

dependent on the mean velocity of the wind, and the exposure of the anemometer. It is a well known fact that wind velocities can fluctuate as much as 100%. For example, a wind velocity of 30 m.p.h. could range between 15 and 45 m.p.h. in gustiness.

#### Condition of the Wreckage

The aircraft struck the windrow while skidding broadside at an estimated speed of about 20 m.p.h. Almost instantly the propeller tips struck the ground, tearing both propellers and nose sections from the engines. Inspection disclosed that twelve inches of one propeller tip was broken off and all blades were badly bent. The left propeller struck the ground, broke free from the engine, then cut into the side of the fuselage at the pilots' compartment, severing the control column before coming to rest in front of the plane. The right propeller broke free, struck the right side of the fuselage, just aft of the co-pilot's seat, cut a hole about 18 inches long in the side of the pilots' compartment, and came to rest about 400 feet to the right and slightly ahead of the plane. The brakes and all controls were found to be normal and in an operative condition. There was no indication of any mechanical failure of the aircraft or engines prior to impact.

#### Conduct of the Flight

The evidence indicates that the flight was properly dispatched and that its operation was normal until it arrived at Bismarck. Weather conditions were above the prescribed minimums. Neither the captain nor the operator considered the strong cross-winds, which were variable in direction and velocity, as being unsafe for landing under the existing conditions. The weather encountered during the landing approach, and the first part of the landing run, was substantially as reported by radio to Captain DeLong.

He stated that during the approach and the beginning of his landing run, he had no difficulty compensating for the cross-wind condition and preventing drift; that only after he had lost speed and used an appreciable amount of runway did the plane encounter the sustained gust of great strength which forced him off the runway and onto the wet clay field. It appears that long familiarity with difficult conditions encountered along their regular run has accustomed Northwest's personnel to accept as normal, conditions which elsewhere might be considered marginal. Prior to this accident there were no definite limitations as to wind velocities in which a landing could be made.<sup>4/</sup> Subsequent to the accident a conference was held by the Civil Aeronautics Administration air carrier inspectors of the Third Region and Northwest personnel, and the following cross-wind landing limitations were issued: (1) When the wind is 0° to 30° off the center line of the runway normal operations may be conducted. (2) When the wind is 30° to 60° off the center line of the runway the maximum velocity will be 25 m.p.h. (3). When the wind is 60° to 90° off the center line of the runway the maximum velocity will be 15 m.p.h. These limitations have been set up for normal operations into an airport with only one runway available. It appears that Northwest's Bismarck radio operator might have been more alert and referred to proper authority the first officer's inquiry as to the availability of the northeast-southwest runway. This runway had been surfaced and rolled the day before, and was awaiting official

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<sup>4/</sup> The manufacturer's Handbook of Instructions for the operation of the model DC-3 states the following regarding cross-wind landings: "It is not advisable to attempt to land this airplane in cross winds of 20 m.p.h., or more, with the direction of landing more than 10 degrees out of the wind."

opening. The northeast-southwest runway was directly in line with Trip 2's approach, and a successful landing could probably have been effected almost directly into the wind. It therefore seems reasonable to expect that there should have been closer cooperation between the airport personnel and Northwest's Bismarck station personnel in handling Northwest's flights. However, there was more than sufficient fuel on board the aircraft for the flight to have been continued to a landing at Fargo, the alternate, where more favorable weather conditions prevailed, had the captain elected to do so.

### CONCLUSIONS

#### Findings

We find, upon all the evidence available to the Board at this time, that the facts relating to the accident involving aircraft NC 21711, which occurred at the Bismarck Airport, Bismarck, North Dakota, on August 29, 1942, are as follows:

1. The accident, which occurred at approximately 6:28 p.m. to Trip 2, resulted in a leg injury to the captain. The 17 passengers, first officer, and stewardess were not injured. The airplane received major damage.
2. At the time of the accident Northwest Airlines, Inc. held a currently effective certificate of public convenience and necessity and an air carrier operating certificate authorizing it to conduct the flight.
3. Captain DeLong and First Officer Finholt were physically qualified and held proper certificates to perform their duties on the flight in question.
4. The aircraft NC 21711 was currently certificated as airworthy at the time of the accident.

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5. The plane was loaded within allowable limits, and the load was properly distributed with reference to the c.g. location.

6. During landing there was a cross-wind which may have reached a maximum velocity in excess of the indicated 20 to 25 m.p.h.

7. The weather encountered during the approach and landing was substantially as reported by radio to Captain DeLong and was within the allowable ceiling and visibility minimums.

8. Since this accident, limitations, approved by the Civil Aeronautics Administration, have been issued by Northwest for cross-wind landings, imposing restrictions not previously in effect.

9. A prolonged gust of wind, of considerable force, exerted sufficient pressure on the right side of the plane to change its track about  $15^{\circ}$  to the left, causing the plane to skid off the runway onto the slippery mud where the brakes were ineffective. The captain, in an effort to effect recovery, slightly changed the heading of the aircraft but it continued to skid sideways until it struck the windrow. The plane came to rest on its crumpled landing gear and left engine nacelle on the north-south runway, heading north.

PROBABLE CAUSE: Loss of control during cross-wind landing due to extremely strong gust.

APPROVED:

/s/ L. Welch Pogue  
L. Welch Pogue

/s/ Edward Warner  
Edward Warner

/s/ Harliee Branch  
Harliee Branch

## APPENDIX

Report of weather conditions at Bismarck Airport on the evening of August 29, 1942, based on synoptic charts, five hours preceding and one hour succeeding the time of the accident, as taken from the weather maps of the U. S. Weather Bureau and prepared by the Board's Air Safety Specialist in Meteorology:

### SYNOPTIC SITUATION

The weather map shows a combined mass of polar marine and polar continental air in Canada and covering the greater portion of North Dakota, western South Dakota, and the west and north portions of Wyoming, and tropical marine air to the southward of that area. These were separated at the surface by a warm front extended from just south of Duluth, Minnesota, thence northwest to a position between Fargo and Grand Forks, North Dakota, thence southwestward crossing southern boundary of South Dakota due south of Bismarck, and thence to southwest corner South Dakota to a wave crest in east-central Wyoming.

In North and South Dakota this front was moving northwestward about 10 m.p.h. but did not reach Bismarck at any time on August 29. In fact, there is no evidence of a frontal passage of any type at Bismarck at the time or near time of accident.

The tropical marine air which was convectively unstable was flowing northwestward and flowing over the polar air north of the line where the warm front was at the surface. Due to the lifting of this air mass, thunderstorms were forming in the tropical marine air.

In the case of the thunderstorm approaching Bismarck, convergence was occurring in the air flow to the north of the warm front which resulted in the deflecting of the surface wind at Bismarck temporarily to a north-northwesterly direction.

As the center of the thunderstorm passed to the north of Bismarck, the squall winds accompanying the thunderstorm combined with the northeasterly gradient flow caused a sudden increase in velocity with the wind shifting to northeasterly and becoming relatively strong and gusty. This occurred near the time of the accident.

Overcast had prevailed at Bismarck for several hours previous to the accident and until 7:05 p.m. when broken clouds were reported. Ceiling ranged from 3000 to 3600 feet except lowering to 2500 during heaviest part of storms. Visibility decreased from unlimited previous to 5:30 p.m., reaching  $3/4$  mile at 6:01 p.m., but was about two miles at the time of the accident. The surface winds which had been north-northwesterly from 4:30 p.m. to 6:01 p.m. shifted to north-northeastward at 6:10 p.m. increasing rapidly in velocity with a recorded but unfiled observation in-

dicating north-northeast 21 at 6:18 p.m., but a regular observation at 6:30 p.m. recorded northeast 27. Rain showers were in progress at Bismarck from 4:13 p.m. to 6:41 p.m. and were reported as heavy at 6:01 p.m. Moderate thunderstorm prevailed from 5:39 p.m. to 6:30 p.m.

Hourly weather sequence reports:

Special - 5:39 p.m., contact, ceiling estimated 3500, overcast, visibility 7 miles, moderate thunderstorm, light rain showers, wind north-northwest, thunder southeast.

Special - 6:01 p.m., closed, ceiling estimated 2500, overcast, visibility  $\frac{3}{4}$  mile, moderate thunderstorm, heavy rain showers, wind north-northwest 13, thunder overhead.

Special - 6:10 p.m., instrument, ceiling estimated 2500, overcast, visibility  $1\frac{1}{2}$  mile, moderate thunderstorm, moderate rain showers, wind north-northeast 10, thunderstorm moving northwest.

Record - 6:30 p.m., instrument, ceiling estimated 3000, overcast, lower broken, visibility 2 miles, moderate thunderstorm, moderate rain showers, wind northeast 27, thunderstorm moving north, visibility 3 west.

Special - 6:41 p.m., contact, ceiling estimated 3000, overcast, lower broken, visibility 4 miles, light rain showers, wind north-northeast 32, strong gusts, thunderstorm moving north, visibility 2 east.