

## CIVIL AERONAUTICS BOARD

## ACCIDENT INVESTIGATION REPORT

Adopted: March 21, 1949

Released March 21, 1949

## PAN AMERICAN AIRWAYS—ANNETTE ISLAND, ALASKA—OCTOBER 26, 1947

## The Accident

At approximately 1345,<sup>1</sup> October 26, 1947, Pan American Airways' Flight 923, a DC-4, aircraft NC 88920, crashed on the north side of Tamgas Mountain, Annette Island, Alaska. The 13 passengers and crew of 5 were killed, and the aircraft was destroyed.

## History of the Flight

Flight 923 departed at 1030 October 26, 1947, from Seattle, Washington, for Juneau, Alaska, with an intermediate stop scheduled at Annette Island. Captain Alf N Mosen flew as pilot and First Officer Laurence A Foster as copilot. The airplane carried 13 passengers including an infant, a crew of five, 2,500 gallons of fuel, and 822 pounds of cargo. This load was within the allowable airplane weight and was properly distributed in respect to the center of gravity.

Company weather information given to Captain Mosen before departure was to the effect that there would be unlimited ceiling from Seattle to Comox, British Columbia. Then at the cruising altitude of 9,000 feet, instrument conditions, light icing, and light to moderate turbulence was expected over the route. Winds were forecasted to be from 200 to 230 degrees at 30 to 40 knots. It was also forecasted that at the time of the flight's arrival over Annette there would be an 800-foot overcast, lower broken clouds, visibility of 2 miles, light rain, and a surface wind from the south-southeast at 18 knots. A cold type occlusion or front which was moving toward Annette Island from a point about 375 miles west of there was expected to pass Annette Island before the flight arrived.

Proceeding en route in accordance with an instrument clearance to fly at 9,000 feet, the flight arrived over Annette

Island at 1338 after a routine trip. Earlier, at 1326, the company radio at Annette Island had transmitted a weather observation which reported an indefinite 1,400-foot ceiling, overcast, lower broken clouds, visibility of 3 miles, rain, wind southeast at 28 miles per hour, with gusts to 40 miles per hour. The flight acknowledged receipt of this information.

Airway Traffic Control cleared the flight to pass over the radio range station located 1.5 mile northwest of the airport at 7,000 feet and then to proceed with a normal instrument letdown and approach to the field. The flight acknowledged this clearance, and reported its position over the radio range station at 7,000 feet at 1338. The normal instrument procedure for Annette Island was established with regard to the mountainous terrain east and northeast of the airport, which rises to an elevation of 3,596 feet on Tamgas Mountain. This procedure required the flight, after approaching from the south at 7,000 feet and reporting over the radio station, to remain west of the south course of the range while on instruments.<sup>2</sup>

Five minutes after the flight reported over the range station, at 1343 it advised Annette Radio that it was proceeding to Juneau, approximately 250 miles north-northwest of Annette Island, because of extreme turbulence. This was the first indication that the flight was encountering any difficulty in accomplishing a normal letdown and approach to the airport. In response, Annette Radio asked the flight to report its altitude, but there was no reply. After repeated calls to the flight Annette Radio issued an alert at 1401. It was estimated that the flight at the time of its last radio contact had aboard 9 hours and 16 minutes of fuel.

<sup>1</sup>All times noted herein are Pacific Standard and based on the 24-hour clock.

<sup>2</sup>See Appendix 1

At approximately 1430 the Civil Aeronautics Board was notified, and a search by air, land, and sea was immediately begun. However, adverse weather conditions retarded the search to such a degree that the wreckage was not located until 5 days after the accident October 31, 1947. It was found that the airplane had crashed on the north slope of Tamgas Mountain, approximately 8 miles east of Annette Island Airport and 8 miles east of the south course of the Annette radio range.

## Investigation

The aircraft struck the north side of the mountain at an elevation of approximately 3,400 feet, 196 feet below the summit.<sup>3</sup> Rescue parties ascending the mountain were hampered by rain, snow, and fog. The wreckage, scattered over 20,000 square feet, was buried in snow, and 5 to 6 inches of snow fell while the bodies were being removed. Consequently, a detailed examination of the wreckage was impossible until after the summer thaw melted the snow.

In late August, 1948, the time of maximum thaw on Tamgas Mountain, another party reached the wreckage and made a thorough examination. Airplane parts were scattered on extremely rugged terrain, and were exposed for examination except for the right wing, the major portion of which was in a crevice beneath a deep crust of ice.

About 50 feet above the location of the wreckage on a projecting wall of rock there were 4 marks made by the No. 4 propeller. These marks, which were equally spaced, showed that the aircraft had struck the wall of rock at an angle of about 45 degrees to it, and in a 20 degree climbing attitude. From these markings and the markings left by the nose of the fuselage it was estimated that the true course of the airplane had been about 145 degrees at the time of impact. Since the actual propeller-pitch setting could not be determined, or the rpm setting known, the distance between propeller blade marks was not reliable in computing the air speed of the aircraft at the time of impact.

<sup>3</sup>U S Coast and Geodetic Survey charts, reissued May 19, 1938, and the Aeronautical charts available to the crew of Flight 923, showed the elevation of Tamgas Mountain to be 3,610 feet. A recomputation of the elevation subsequent to the accident showed it to be 3,596 feet, or 14 feet lower than the published elevation.

A few parts of the 12 propeller blades were not recovered, but all the propeller hubs and domes were located. The shearing of the engine nose sections, and the degree of propeller breakage indicated that none of the propellers were feathered. One engine was badly shattered. The remaining 3 engines were found relatively intact.

A flash fire occurred at the time of impact, but there was no evidence of a fire in flight.

The Fluxgate Compass was found with the needle jammed at 116 degrees, and adding the 29 degrees which would have been subtracted for easterly deviation, results in a true course of 145 degrees, or the same as estimated from the ground markings. Excepting the Fluxgate Compass, all flight instruments were battered beyond readability. In like manner the flaps and landing gear, and their actuating mechanism were damaged too extensively to determine positions.

The slopes of Tamgas Mountain and the surrounding area, much of which was covered with forest, were observed from the air in a search for parts which might have fallen in flight. None were found, nor were any marks in the ground or abrasions on the trees discovered which would have indicated contact by the aircraft prior to the accident.

All of the maintenance records of NC 88920 from the time of its acquisition by the company were carefully examined, and the operating history of the aircraft since its date of manufacture was studied. From all the records it appeared that the aircraft had been properly maintained, and was airworthy at the time of its departure from Seattle.

Captain Monsen, age 47, held an airline transport pilot rating and had logged a total of 13,565 hours, 514 of which were in DC-4 type airplanes. He had been employed as a pilot in Alaska since 1928, and employed by Pan American Airways since 1932. In 1941, preparatory to the opening of a Pan American Airways route between Seattle and Alaska, Captain Monsen was sent to Brownsville, Texas, for training. After 66 hours in DC-3 airplanes and 44 hours in Stinson airplanes, 38 hours of which was instrument time, he received an airline transport pilot rating. He was then sent on a flight of 66 hours to Trinidad, British West Indies, in a DC-3 airplane, following which he returned to

Seattle and was one of the pilots who opened the new route. Thereafter, he continued to fly for the company until the accident. Out of the 72 hours preceding the accident, Captain Monsen had flown 9 hours and 11 minutes, and had had a rest period of 48 hours immediately preceding his departure from Seattle. His last CAA physical examination was taken October 2, 1947. His last instrument flight check was taken March 10, 1947, and his last route check over the route of the accident was taken April 10, 1947.

First Officer Foster, age 39, held an airline transport pilot rating and had logged a total of 12,412 flying hours, of which 359 had been in DC-4 type airplanes. After over 8 years of experience as a captain for United Air Lines, he had been hired as a captain by Pan American Airways. However, because of a temporary reduction in personnel, at the time of the accident Mr. Foster was serving as a senior first officer. His last CAA physical examination was taken October 10, 1947, and his last instrument check was taken August 15, 1947. Mr. Foster had had a 48-hour rest period immediately preceding his departure from Seattle.

Both pilots had completed a familiarization course in DC-4 airplanes in March 1947, at the time these aircraft were put into operation by Pan American Airways. Although Captain Monsen was expected to complete one hour a month, and First Officer Foster 2 hours a month in link trainer instruction, no records were available to show whether this training was accomplished.

C. L. Dunwoody, the flight engineer, age 28, held a flight engineer certificate and had flown approximately 2,292 hours. His last CAA physical examination was taken June 20, 1947, and he had had a 48-hour rest period immediately preceding his departure from Seattle.

A flight check of the Annette Island Radio Range on October 28, and 29, as soon after the accident as the weather permitted, showed that the northwest course was in error 3 1/2 degrees clockwise, or towards the northeast.<sup>4</sup> Errors of 1 1/2 degrees or less are considered within tolerance. A United States Air Force pilot, who landed at Annette Island 23 minutes before Flight 923 reported

being over the station, testified that the operation of the radio range was substantially normal. The range is continuously monitored by the Petersburg, Alaska, CAA Communications Station, and its records indicate that the signal received, signal strength, and the functioning of the Annette Island Range was normal.

An aftercast of weather over the route of Flight 923 showed that the forecast was substantially correct except for the high winds and turbulence which existed over Annette. The departure from Seattle was made under conditions of unlimited ceiling and good visibility, with a light surface wind from the northeast. When the flight had climbed to cruising altitude, 9,000 feet, the wind became southwesterly at 15 to 20 miles per hour. Upon arriving over Comox, British Columbia, the flight encountered scattered to broken high and low clouds, which increased to occasionally-broken overcast as the flight progressed. Southwest winds at 30 to 35 miles per hour were encountered upon the flight's arrival over Port Hardy. From there until it reached Annette Island, the flight was either in clouds or between cloud layers, with variable icing and light to moderate turbulence. Winds progressively increased in velocity to 50-60 miles per hour. Descending to Annette Island Airport, the flight experienced a veering of the winds to the south at 5,000 feet, and to the southeast near the ground. Below 5,000 feet the passage of strong winds over the mountainous terrain produced a marked increase in turbulence. Particularly was this true over and to the leeward of the mountains, where strong to locally-severe turbulence and downdrafts on the northern slopes were likely.

The flight was conducted within a barometric pressure field of a very regular pattern, without fronts or marked squall lines. Consequently, any sudden changes in wind velocity or direction above 7,000 feet between Seattle and Annette Island would have been very unlikely. At low altitudes, as stated, the terrain would disturb the flow of winds both as to direction and velocity.

Upon the flight's arrival in the Annette Island vicinity, there was transmitted at 1256 a special surface weather observation, which was Ceiling indefinite, 1800 overcast, lower broken, visibility 4 miles, moderate rain, wind east

<sup>4</sup> This displacement was adjusted and the northwest course was found within tolerance on a re-check October 29th

southeast 28, strong gusts, altimeter 29.57, overcast estimated at 2600

The Army pilot who landed at Annette Island 23 minutes before the arrival of Flight 923 described the weather conditions en route from Tacoma, Washington to Annette. In letting down preparatory to landing at Annette Island, the pilot testified that he encountered slight turbulence at 6,000 feet, which grew progressively more severe down to about 400 feet. Prior to descending, he had encountered intermittent light rime ice at 7,000 feet, and during the descent light to moderate rain.

Approximately 3 hours after the last transmission of Flight 923, a non-scheduled air carrier aircraft landed at Annette Island from Whitehorse, Y. T., Canada. Moderate ice was encountered between 9,000 and 7,000 feet in the vicinity of Annette Island, and upon descending to 6,000 feet turbulence was experienced which grew progressively severe as the aircraft descended. The pilot of this flight stated that the turbulence had been so severe on several occasions to almost tumble the gyro flight instruments.

Six hours after the Army flight accomplished a normal landing at Annette Island, the pilot took off again. Immediately after leaving the ground he encountered extreme turbulence which decreased in severity until he reached smooth air at about 6,000 feet. Between 4,500 and 6,000 feet severe icing was encountered. At 8,000 feet altitude could no longer be maintained because of ice though full power was applied, so a return to Annette Island was necessary.

Prior to the departure of Flight 923 from Seattle, the company meteorologist forecasted that the occluded front moving shoreward toward Annette Island would pass there before the flight's arrival. This forecast was not in accordance with the forecasts of the United States and Canadian Weather Bureaus. At 1229, when the flight was approaching Annette Island, the company meteorologist dispatched a revised forecast "Expect occlusion reach Annette Island and Juneau 0000Z (1600 Pacific Standard time). On arrival Annette Island terminal 1000 overcast, visibility 3, light rain, SE 25, gusts to 50....." Since no record of a transmission acknowledging receipt of this revised forecast was found, it probably did not reach Flight 923. Actually, at the time of the accident the front was

still approximately 100 miles west of Annette Island. The original forecast was in error also in respect to the wind velocities. It should have been evident to the company meteorologist that the synoptic situation existing over the northeast Pacific would result in crowded isobars along the Canadian and southeast Alaska coast. Had this been realized, he would have forecasted much more severe turbulence at low altitudes in ample time for the information to have been available to the pilot either before or shortly after his departure from Seattle

### Analysis

Since no evidence was found which would indicate structural or mechanical failure, and since the maintenance and historical records of the aircraft showed no discrepancies, there is no basis for attributing the cause of this accident to a mechanical failure in the airplane or any of its components.

Displacement of the northwest course of the Annette Island Radio Range cannot be considered contributory to the accident. Even if deflected 3 1/2 degrees east, the northwest course of the range would not at the closest point be less than 10 miles from the mountains northeast of the radio range station. It is evident, therefore, that had the flight followed this course, it could not have flown into Tamgas Mountain. Furthermore, the Army Air Force pilot who used the range and landed at Annette 23 minutes before Flight 923 arrived, reported the operation of the range to be substantially normal <sup>5</sup>

Underestimation of wind velocities at the time of flight planning resulted in the flight's arrival at Annette before the time originally calculated. But this does not appear in itself to be significant. Apart from turbulence, the effect, if any, of stronger than expected winds, in view of their easterly component in the vicinity of Annette, would have been to drift the airplane away from the accident area rather than toward it. However, turbulence was the product of the high southeasterly winds in the vicinity of Annette Island. A more accurate forecast of these winds and the resultant turbulence may have served

<sup>5</sup> See Appendix 1

to warn the crew of Flight 929 of the very condition which they reported in their last transmission

There are several possible explanations for this accident. Severe turbulence may have caused a loss of control of the airplane. There may have been severe icing which resulted in a loss of control. There are other possible theories, but it remains impossible to explain why the flight was unable to stay on the proper side of the radio range, and why it was flying a heading of 145 degrees. Outside of the fact that severe turbulence and icing conditions existed over Annette through which the flight had to descend, there is no real evidence to support any particular theory for the cause of this accident. Therefore, the probable cause of this accident remains undetermined.

### Findings

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

- 1 The aircraft, crew, and carrier were properly certificated
2. The aircraft maintenance and historical records indicated that the airplane had been properly maintained and was airworthy at the time of takeoff for the flight from Seattle at 1030, October 26, 1947
- 3 The company forecast did not include information concerning the excessive turbulence which the flight experienced over Annette Island, though excessive turbulence could reasonably have been forecasted from available weather data.

—16577

4 Routine position reports were received from the flight until 1339 when it reported being over the Annette Island Radio Range Station at 7,000 feet

5 The flight reported to the Annette Island Radio at 1343 that it was abandoning its approach due to extreme turbulence, and that it would proceed to Juneau. No further communication was received from the flight

6 The aircraft was on a true heading of 145 degrees and in a 20 degree climbing attitude at time of impact.

7 The flight crashed on the north side of Mt. Tamgas at a point eight miles east of the Annette Island airport, eight miles east of the south course of the Annette radio range, and at an elevation of 3,400 feet

8 No evidence was found of engine malfunctioning or structural failure prior to the time of the crash

9 Annette Island Range was functioning normally at the time of the accident except for a displacement of 3 1/2 degrees east of the northwest course

### Probable Cause

The Board finds that there is not sufficient evidence to determine the probable cause of this accident

BY THE CIVIL AERONAUTICS BOARD

/s/ JOSEPH J. O'CONNELL, JR.  
 /s/ OSWALD RAY  
 /s/ JOSH LEE  
 /s/ HAROLD A. JONES  
 /s/ RUSSELL B. ADAMS

## Supplemental Data

### Investigation and Hearing

The Civil Aeronautics Board was notified at 1430, October 26, 1947. An investigation was begun immediately in accordance with the provisions of Section 702 (a) (2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was ordered by the Board and held in Seattle, Washington, December 3, 1947, and September 29, 1948

### Air Carrier

Pan American Airways, Inc., a New York corporation with headquarters in New York City, is a holder of a certificate of public convenience and necessity issued by the Civil Aeronautics Board and an air carrier operating certificate issued by the Civil Aeronautics Administration.

### Flight Personnel

Captain A. N. Monsen, age 47, possessed a valid airline transport pilot rating and had logged a total of 13,565 flying hours, of which 514 were in DC-4 type airplanes. His last instrument check was taken March 10, 1947, and his

last check over the route involved, April 10, 1947. His last CAA physical examination was on October 2, 1947. First Officer L. A. Foster, age 39, possessed a valid airline transport pilot rating and had logged a total of 12,412 flying hours, of which 359 were in DC-4 type airplanes. His last instrument check was taken August 15, 1947. His last CAA physical examination was on October 10, 1947.

The flight engineer, Curtis L. Dunwoody, age 28, held flight engineer certificate 575026. His last CAA physical examination was passed June 19, 1947. The other two members of the crew were the check purser, Mary E. Chidiac, and the purser, Helen H. Darrah.

### The Aircraft

NC 88920, a Douglas DC-4A aircraft, had been flown a total of approximately 4,146 hours.

The No. 1 engine had a total of 1,157 hours, the No. 2 of 1,181 hours, the No. 3 of 1,170 hours, and the No. 4 of 1,218 hours. All had had 232 hours since overhaul.

APPENDIX I

