

## C I V I L A E R O N A U T I C S B O A R D

## ACCIDENT INVESTIGATION REPORT

Adopted: May 19, 1949

Released: May 20, 1949

ALASKA AIRLINES, SEATTLE WASHINGTON, NOVEMBER 30, 1947

The Accident

At 1435\*, November 30, 1947, Alaska Airlines' non-scheduled Flight 009, a C-54 airplane, NC-91009, went off the end of a wet runway at the Seattle-Tacoma Airport, Seattle, Washington, and collided with a moving automobile. Eight of the 28 occupants of the aircraft and one occupant of the automobile were killed. Seventeen occupants of the aircraft suffered injuries. The aircraft was destroyed.

History of the Flight

Flight 009 departed from Anchorage, Alaska, at 0804, November 27, 1947, for Seattle, Washington, with a fueling stop planned at Yakutat, Alaska. The crew consisted of James E. Farris, captain, Richard F. Whitting, first officer, and Reba E. Monk, stewardess. The aircraft carried 26 passengers,\*\* including one infant, 7,755 pounds of freight, and 1,875 gallons of fuel. Total airplane weight at takeoff was reported as 63,000 pounds, which was within the maximum allowable. At 1033, the flight arrived at Yakutat, where it remained 2 days because of unfavorable weather, and during this time the aircraft stood in almost continuous rain. Difficulty in starting the engines on the morning of November 29 was experienced, but once started they operated satisfactorily, and at 0414 the flight departed for Seattle. Alternates were Annette Island and Gustavus, in Alaska, with a fueling stop planned at Port Hardy, British Columbia.

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\*All times noted herein are Pacific Standard and based on the 24-hour clock.

\*\*One of the 26 passengers left the flight at Yakutat.

Flight 009 flew to within 15 minutes of Port Hardy, British Columbia, which is approximately 356 miles by airways from Seattle, when the crew learned that the weather at Port Hardy had gone below minimums; and that all points farther along the route either were closed or forecasted to close. Moreover, 3 engines were operating roughly, so the flight turned back and landed at Annette Island at 0835. After mechanics there had removed considerable water from the ignition harnesses and magnetos on all engines, and had replaced all spark plugs in engine 1, and half of those in engine 2, all engines operated normally.

The following morning, November 30, at 1041, Flight 009 departed from Annette for Seattle with Portland, Oregon, being designated as the alternate airport. At the time of takeoff all engines appeared to be operating normally, and the flight proceeded for approximately the first 1-1/2 hours without difficulty. A Mr. Leslie Greening, a former Alaska Airlines traffic agent, occupied the engineer's seat, and then after takeoff stood behind the copilot. Between 1-1/2 and 2 hours after departure from Annette, Captain Farris left his station and took a seat in the passenger cabin. Mr. Greening then occupied the right hand or copilot's seat while Copilot Whitting handled the controls from the left or the pilot's seat.\* Approximately a half an hour later, and when the aircraft was in the vicinity of Comox, British Columbia, 226

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\*Civil Air Regulation - 42.40 Pilots at controls. In the case of aircraft requiring two or more pilots, two pilots must remain at the controls at all times while landing and taking off, and while the aircraft is en route except when the absence of one is necessary in connection with his regular duties or when he is replaced by a person authorized under the provisions of § 42.41.

42.41 Admission to pilot compartment. In aircraft having a separate pilot compartment, no person other than a crew member, a check pilot, an inspector of the Administrator or a representative of the Board in pursuance of official duty, or a person whose admission is approved by the first pilot, may be admitted to the pilot compartment. In the latter case, the first pilot must remain at the controls.

miles from Seattle, Copilot Whitting requested Captain Farris to return to the cockpit. One hour previously Pan American had landed at Comox because of adverse weather ahead, and Copilot Whitting desired Captain Farris to make the decision as to whether a landing should be made at Comox or whether the flight should continue on to Seattle.

The flight arrived over the Seattle radio range station at 3,000 feet on its initial approach to the Boeing Airport at 1357. Shortly before Captain Farris had reported to Seattle Radio that he had 2 rough engines, but he did not declare an emergency. The condition of engine roughness is discussed below. Weather at Boeing Field, Seattle, Washington, was reported to be ceiling indefinite 500 feet visibility one mile. An instrument approach for landing at Boeing Field was made, but not completed because of the low ceiling and visibility, so the flight returned to an altitude of 1,500 feet on the northwest course of the Seattle radio range. During this time Copilot Whitting remained in the left seat and flew the airplane.

The second instrument approach was made for a landing at the Seattle-Tacoma Airport, sometimes referred to as the Bow Lake Airport, which is located 4 miles south of the Seattle radio range station. The airplane was flown inbound on the northwest course of the range. Then, after passing over the range station at 1,500 feet, a heading of 193 degrees toward the airport was flown, and a descent made for landing. The aircraft was first observed at the Seattle-Tacoma Airport when approximately 500 feet above the approach end of Runway 20, 5,611 feet long, at which time it was flying at an angle to the left of that runway. An "S" maneuver and rapid descent were made. A right turn was entered and held until the airplane was again over Runway 20, then it turned left. When the airplane first made contact with the runway

it was in the left turn, and the left wing was so low that those who observed the landing thought that it would strike the ground. The first point of touchdown was made 2,748 feet beyond the approach end of the runway.

The airplane progressed over the remaining distance of the runway without apparent deceleration. Captain Farris, who had taken over the controls of the airplane when it was in the left turn, stated that he allowed the airplane to slow down of its own accord to 50 or 60 miles per hour before applying brakes, and that he released the emergency air bottle 1,000 feet from the end of the runway. Before passing over the end of the runway an attempt was made to groundloop the airplane to the left by applying power to engine 4. Nevertheless, the airplane traveled almost straight ahead. It went off the end of the runway, crossed 229 feet of wet ground, and then rolled down a 24-foot embankment. At the bottom of the embankment it struck a ditch which sheared off the left landing gear and the left wing. The aircraft continued on to the intersection of the Des Moines Highway and South 188th Street where it collided with a moving automobile. Spilled gasoline was ignited, and the wreckage was enveloped in flames. The Weather Bureau at the Seattle-Tacoma Airport made an observation immediately following the crash and reported an indefinite ceiling, 400-foot overcast, visibility variable one-half to one mile, and light rain and fog.

#### Investigation

Narratives of the flight as told by Captain Farris, Copilot Whitting, and Mr. Leslie Greening were not entirely in accord. According to Captain Farris and Copilot Whitting, engines 2 and 3 developed roughness when the flight had progressed about half-way to Seattle. Captain Farris stated in effect that engines 2 and 3 became increasingly rough in their operation during the remaining portion of the trip; and that by the time the instrument

approaches were made, first to Boeing Field and then to the Seattle-Tacoma Airport, engine 3 had become so critical in its operation that the propeller normally would have been feathered. On the other hand, Mr. Greening stated that he was at no time aware of a rough operating condition of any of the engines. Though Mr. Greening was not a qualified pilot or mechanic, he had flown the route from Anchorage to Seattle many times before and had accumulated considerable passenger time on the flight deck of C-54 type aircraft. He had had little difficulty in observing the rough operation of the engines during the previous flight when they had returned to Annette Island. Copilot Whitting stated that he observed a rough operating condition of the engines when the flight had progressed about half-way to Seattle, but he said that he was not particularly concerned. He stated that at the time of the two instrument approaches he noticed no malfunctioning of "instruments, gauges, or anything else."

According to official Canadian Weather Bureau reports, Comox, at the time that the flight was overhead, had an indefinite 500-foot ceiling and 10 miles visibility. According to the United States Weather Bureau reports, Seattle at that time had an indefinite 700-foot ceiling, one mile visibility, and light rain and fog. Everett, Washington, 25 miles north of Seattle, had an indefinite 1,500-foot ceiling, one-half mile visibility, and light rain and fog. Portland, Oregon, the flight's alternate and 135 miles south of Seattle, was reporting a ceiling of 2,900 feet and a visibility of 9 miles.

An hour later, when the flight made its first instrument approach to Boeing Field, the ceiling at Boeing had lowered to indefinite 500 feet, and visibility remained at one mile. The Seattle-Tacoma Airport had a 600-foot ceiling and 1-1/4 miles visibility. Everett had 1,500-foot ceiling, and one

mile visibility. Eugene, Oregon, 257 miles south of Seattle, had a 5,000-foot ceiling, and 6 miles visibility. Portland was reporting a 700-foot overcast with 6 miles visibility. All of the above weather information was given to the flight prior to the time that it executed its first instrument approach.

In addition to the above weather information the flight was advised by the Seattle airport traffic controller that a ground control approach (GCA) could be made at the Naval Air Station at Sand Point, Washington, which is approximately 13 miles to the north of the Seattle radio range station and which at that time had a ceiling of 700 feet and visibility of 2-1/2 miles. Minimums at Boeing Field for landing were ceiling 800 feet and visibility 2 miles. Minimums at the Seattle-Tacoma Airport were ceiling 500 feet and visibility one mile. Weather conditions as reported for Everett, Seattle-Tacoma, Portland, and Eugene were above landing minimums.

At the time of landing the left outboard tire made a mark on the runway 105 feet long. This mark started from the point of first touchdown, 2,748 feet from the approach end of the runway. From the end of this mark none of the aircraft's tires left marks for a distance of 60 feet. Then, for 293 feet there were marks left by both tires on the left main landing gear, and these were in turn followed by marks of all four of the main landing gear tires for a distance of 117 feet, after which the right landing gear tires left no marks for 136 feet. Marks from all 4 landing gear tires appeared again 711 feet from the point of initial touchdown, and continued to the end of the runway. A nosewheel tire mark 144 feet long was left on the runway at a point where all 4 of the main landing gear marks first appeared. These marks on the runway were examined shortly after the accident. Ten months later some of the marks at the far end of the runway were still

clearly visible and these were again examined at which time it was found that the tires had rubbed or scuffed the top particles of sand free from the concrete thereby exposing a whiter surface.

Both left tires were skidworn from the landing, the outboard one being worn through the rubber tread and through several layers of fabric. The right inboard tire could not be inspected for wear because it was almost entirely consumed by fire, but the right outboard tire was skidworn from the landing similar to the tires on the left landing gear.

The left and right landing gear assemblies were removed from the scene of the accident and taken to a hangar where the shuttle valves for the operation of the emergency air brake system were tested. Three of the shuttle valves operated normally. The fourth did not operate because it had been damaged by the extreme heat of the fire.

Since evidence was subsequently submitted to the effect that foreign matter was in the hydraulic system at the time of the accident, a more detailed examination was later made of the hydraulic and brake systems than was accomplished immediately after the accident. No foreign matter was found in what remained of the hydraulic and brake systems which would have in itself resulted in total failure of the brakes. In addition, hydraulic fluid was taken from above and below the deooster valves and sent to the National Bureau of Standards for testing. It was found that this fluid contained no foreign matter which would have impaired the functioning of the brake mechanism.

Aircraft records for NC 91009 revealed that on October 14, 1947, 6 weeks

before the accident, a complete failure of the hydraulic system was experienced due to a loss of hydraulic fluid. As an in flight emergency measure, the system was filled with a mixture of hydraulic fluid, coffee, water, and fire extinguishing chemicals. After landing, the system was flushed and refilled, and the seal changed in the check valve. The next day the hydraulic system was again flushed out, the hydraulic pressure regulator was changed, and the brakes and both deboostor valves were bled. The system was flushed a third time November 4, 1947. The emergency air brake valve was checked November 3, 1947. This check consisted of disconnecting the line at the brake side of the emergency air brake valve and discharging the air bottle from the pilot's seat and from the copilot's seat. The line was then again connected, after which the entire brake system operated normally. Some difficulty was experienced with the brakes November 7, 1947, the left brake being reported inoperative and the right brake weak. The brakes were bled and then recorded in the aircraft log as operating normally.

Flushing the hydraulic system after introducing other fluids for emergency operation was not in itself sufficient to cleanse all lines and parts. Cylinders, valves, and other units should have been removed and disassembled sufficiently to assure that no foreign matter or deposits had lodged in any line or orifice of the system.

Company records pertaining to the aircraft were subjected to a detailed analysis. Apart from the failure to disassemble the hydraulic system after reported difficulties, no specific item of aircraft maintenance was found that could have contributed to the cause of this accident. This failure to disassemble the hydraulic system was subsequently determined not to have contributed to the cause of the accident.



Tests were conducted with a C-54 on Runway 20 of Seattle-Tacoma Airport, April 28, 1948, to observe the stopping distance and braking action of a C-54 under conditions as nearly similar as possible to those which existed at the time of the accident. But, at the time of these tests the amount of rainfall was considerably less, and the runway was accordingly drier. The test airplane was loaded to 55,000 pounds, the estimated weight of NC 91009 at the time of landing. The first landing was made at an air speed of 95 miles per hour with flaps fully down. Brakes were applied so that the tires were skidded intermittently. The braking distance, the point of touchdown to the point where brakes were released, was measured by the Board's investigators to be 2,144 feet.

Conditions of the second test were similar to those of the first except that the brakes were applied so that the tires were skidded continuously. Braking distance was measured to be 2,138 feet by the Board's investigators. The third test was made by landing the airplane at stalling speed, 78 miles per hour. The runway at the time of this landing was dry enough so that the tires, when skidded, made the characteristic dry skid squeal. Stopping distance was measured to be 2,104 feet by the Board's investigators. Tests for a landing at an air speed in excess of 95 miles per hour were not made. An experienced airline pilot who rode in the cockpit of the aircraft during the test landings stated that he was amazed to find that the wheels of the airplane had skidded during the test landings, and that he did not believe previously that a heavily loaded airplane could skid so far. Since the tests were not made under the same conditions as those that existed at the time of the accident the results were not controlling in determining the cause of the accident. The only significances of the tests were that a wet runway

was more slippery than a dry one, and that brakes could be applied on a wet runway without any braking effect being apparent to those in the cockpit.

Douglas Aircraft operating data for the C-54 shows that when the airplane is loaded with 55,000 pounds and landed on a hard, dry surface runway at 78 miles per hour, 990 feet of braking on the runway is required for a full stop. If the touchdown were made at 100 miles per hour, 1,950 feet of braking would be required, and if the touchdown were made at 110 miles per hour, 2,730 feet of braking would be required. Since the landing of NC 91009 was made on a wet runway the required braking distance to come to a full stop would be greater for the coefficient of friction on a wet concrete surface is less than it is on a dry concrete surface.

### Analysis

According to his own testimony, Captain Farris left his seat in the cockpit between 1-1/2 and 2 hours after departure from Annette, or when the flight was about half-way to Seattle. This was the time that he and Copilot Whitting said that roughness developed in engines 2 and 3. It appears very unusual that the captain of a flight would ride in a passenger cabin and leave his copilot alone or with a man entirely unqualified as a pilot when engine trouble was being experienced. This, coupled with the fact that Mr. Greening observed no engine roughness at any time during the flight, leads to the conclusion that engine roughness, if it existed, was present only in a very minor degree. Certainly, it could not have been so critical as to require an emergency landing at either Boeing Field or the Seattle-Tacoma Airport if Mr. Greening was never aware of the condition and if Mr. Farris thought his presence in the cockpit unnecessary. Fuel on board, according to Captain Farris' statement, was sufficient for flight to either Portland

or Eugene, Oregon, where weather conditions were well above minimum. Thus, neither engine trouble nor lack of fuel appears to be a substantial factor in the cause of this accident.\*

It is also evident that the hydraulic and brake systems of NC 91009 were operating at the time of the landing. Hydraulic pressure was observed to be normal at the time of the pre-landing check; the flaps extended to the full down position on final approach for landing; and the brakes operated effectively enough to skidwear the tires and cause the tire marks on the runway which have been described above, parts of which were clearly visible 10 months after the accident. Accordingly, the cause of this accident cannot be attributed to a failure of brakes.

The instrument approach to the Seattle-Tacoma Airport was not made in conformity with a standard procedure. The airplane was flown over the range station and then on a heading of 193 degrees toward the airport. Neither Captain Farris nor Copilot Whitting had previously made an instrument approach to and landing at the Seattle-Tacoma Airport, and they did not make a track, but rather a heading, of 193 degrees from the range station to the field. As a result they were not properly aligned for landing on Runway 20. An "S" turn and rapid descent were executed to align the flight path with Runway 20 and to lose the excessive altitude. In doing so, almost half of the runway was flown over before the airplane touched the ground.

That the airplane had considerable speed in excess of stalling at the

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\*Because violation of certain Civil Air Regulations was indicated, the Administrator of Civil Aeronautics addressed a letter to the pilot asking for payment of a civil penalty. Since payment was refused, an action was filed in the United States District Court in Seattle by the United States Government praying for judgment against the pilot in the sum of \$1,000.

time of initial contact is indicated by the fact that even though the airplane was banked so steeply that the left wing tip almost touched the ground there was still sufficient directional control. Excessive speed is also indicated by the fact that after the airplane had skidded 105 feet on the left outboard tire, it became airborne and flew 60 feet before again making contact with the runway. Furthermore, all 4 main landing gear wheels were not solidly on the runway until after 711 feet had been traversed from the point of initial touchdown. Thus, the airplane was landed not only after half the runway had been flown over, but also when the air speed was above normal stalling speed.

### Findings

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

1. The carrier, airplane, and crew were properly certificated.
2. No evidence was found of mechanical or structural failure which could have contributed to the cause of the accident.

3. Approximately 1-1/2 hours after departure from Annette Island, Alaska, Captain Farris left his seat on the flight deck and rode for approximately 30 minutes in the passengers' cabin, during which time First Officer Whitting handled the controls from the pilot's seat, and a Leslie Greening, not possessed of any pilot qualifications, occupied the copilot's seat.

4. The flight made an instrument approach to Boeing Field after Boeing Tower informed the flight that the ceiling there was 500 feet and the visibility was one mile.

5. At the time the flight was over Seattle, weather conditions above minimums existed at Payne Field, Everett, Washington, 25 miles north of Seattle; at Portland, Oregon, 135 miles south of Seattle; and at Eugene, Oregon, 257 miles south of Seattle.

6. The second instrument approach was made at the Seattle-Tacoma Airport, prior to which the tower reported the weather there to be ceiling 600 feet and visibility 1-1/4 miles. Immediately after the accident the Weather Bureau observed the ceiling at the Seattle-Tacoma Airport to be 400 feet and the visibility variable one-half to one mile.

7. The flight arrived over the approach end of the intended runway too high and not properly lined up for a normal landing.

8. First touchdown was made at a point 2,748 feet from the approach end of Runway 20, 5,611 feet long, at which time the airplane was in a left bank steep enough to place the left wing tip almost on the ground.

9. The left outboard main landing gear tire marked the runway for a distance of 105 feet after which the airplane flew 60 feet. Seven hundred and eleven feet of runway were traversed from the first point of touchdown before all 4 main landing gear wheels were solidly on the runway.

10. The airplane went off the end of the runway, crossed 229 feet of wet ground, rolled down a 24-foot embankment, then collided with the moving automobile at the intersection of Des Moines and South 188th Street.

#### Probable Cause

The Board determines that the probable cause of this accident was the landing of the airplane too far from the approach end of a wet runway and at a speed too great to accomplish a full stop on the runway.

BY THE CIVIL AERONAUTICS BOARD:

/s/ JOSEPH J. O'CONNELL, JR.

/s/ OSWALD RYAN

/s/ JOSEPH LEE

/s/ HAROLD A. JONES

/s/ RUSSELL B. ADAMS

## S U P P L E M E N T A L D A T A

### Investigation and Hearing

Notification of the accident was telephoned to the Chief of Region VII of the Civil Aeronautics Board. An investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. A public hearing was held in Seattle, Washington, December 11 and 12, 1947, and a second hearing was held October 1 and 2, 1948, in Seattle, Washington, because of newly discovered evidence.

### Air Carrier

Alaska Airlines was incorporated in the Territory of Alaska. Its executive offices and main operating base were at Anchorage, Alaska. Alaska Airlines held a certificate of public convenience and necessity issued by the Civil Aeronautics Board to operate as a scheduled carrier in the Territory of Alaska. It held a letter of registration from the Civil Aeronautics Board and an operating certificate issued by the Administrator of Civil Aeronautics to operate as a non-scheduled carrier from Anchorage, Alaska, to Seattle, Washington.

### Flight Personnel

Captain James E. Farris, age 36, held an airline transport pilot rating. At the time of the accident he had logged a total of 6,352 flying hours, 738 of which were in DC-4 aircraft. His last CAA physical examination prior to the accident was passed May 24, 1947. First Officer Richard E. Whitting, age 29, held an airline transport pilot rating. At the time of the accident he had logged a total of 3,220 flying hours, 1,483 of which were in DC-4 aircraft. His last CAA physical examination prior to the accident was passed May 27, 1947. Reba E. Monk was stewardess.

## The Aircraft

NC-91009 was a Douglas C-54-A airplane. It had a total of 5,548 flying hours since the date of manufacture and was currently certificated by the Administrator. The engines were Pratt and Whitney's, R-2000-7. Engine 1 had a total of 1,418 hours, engine 2 had a total of 2,204 hours, engine 3 had a total of 1,932 hours, and engine 4 had a total of 1,514 hours. Propellers 1 and 2 had 516 hours since a major inspection, propeller 3 had 433 hours, and propeller 4 had 524 hours.