File No. 1-0002

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 8, 1951 Released: May 10, 1951

PAN AMERICAN WORLD AIRWAYS, INC., LONDON, ENGLAND, JANUARY 3, 1951

The Accident

At approximately 0850Z*, January 3, 1951, a Boeing 377 Stratocruiser, N-1036V, owned and operated by Pan American World Airways, was considerably damaged when the right main landing gear retracted during a landing at Heathrow Airport, London, England. There were no passengers on board and the crew of nine were uninjured.

History of the Flight

The aircraft, N-1036V, arriving in the London area on January 2, as Pan American's Flight 100/01 from the United States, was diverted to Hurn, England, due to the London weather being below minimums. The trip from the United States had been routine and the landing was made at Hurn at 0923. At 1100 the weather at London was still below minimums whereupon it was decided to send the passengers to London by train and to ferry the aircraft to London on the following morning to cover the return Flight 101/03 to the United States. At 0803, January 3, the aircraft departed Hurn for the ferry flight to London, a distance of 79 statute miles. On board were the original crew of Flight 100/01 from the United States consisting of Captain A. L. McCullough, First Officer J. A. Livers, Second Officer P. Ridley, Third Officer John Race, First Engineer L. J. Fleishman, Second Engineer R. E. Lee, Purser J. Swirstik, Stewardess M. McFarland, and Supernumerary C. Mazurek.

* All times noted in this report are Greenwich Meridian and based on the 24-hour clock.

The take-off weight of about 103,576 pounds was approximately 42,000 less than the maximum permissible and the load was so distributed that the center of gravity was within the certificated limits. The runway at Hurn was covered with heavy frost or light snow. However, with the temperature at 28.5°F., it was not wet or slushy. The London Meteorological Office gave the London weather at 0900 as "high scattered, visibility 3,300 yards, wind 300/08, temperature 32.2." The flight plan for this ferry trip carried this notation, "runway braking conditions good at run-up or touchdown, to fair further down runway due slush." This notation taken from the dispatcher's clearance referred to the conditions at London where portions of runways were covered with three to four inches of snow and slush. The flight proceeded normally at altitudes varying from 6,000-7,000 feet with outside temperature about 5°F. A practice GCA approach was made followed by what at first appeared to be a normal landing on Runway 28 at 0850. During the landing roll, however, the right main landing gear retracted permitting the plane to settle down on the No. 3 and No. 4 engine nacelles and the right wing. In this position it skidded to a stop, partly off the runway after turning approximately 110 degrees to the right. There was no violent deceleration and only a slight change of direction down the runway.

Investigation

The aircraft came to rest 4,580 feet from the approach end of Runway 28, which is 9,450 feet in length.

Major damage to the aircraft was confined to the right wing tip, aileron and flap and to the propellers and nacelles of No. 3 and No. 4 engines. The first contact of a propeller with the runway was noted

1,040 feet from where the plane came to rest. Scattered along the runway from this point were various pieces of propeller, propeller filler material, and small pieces of dural. The runway along the portion over which the aircraft traveled was covered with slush from the previous day for which reason it was extremely difficult to establish with certainty the exact point of initial touchdown.

The GCA practice approach and landing was made by First Officer Livers occupying the right or copilot seat. Captain McCullough was in the left seat and took over some of the duties ordinarily performed by the first officer. Due to the known condition of the runways it had been previously decided to use 30 degrees of flap on landing to prevent, insofar as possible, damage to the flaps by snow and ice being thrown against them during the landing roll. Captain McCullough placed the initial touchdown at a point approximately 1,400 feet past the approach end of the runway. He described the landing made by First Officer Livers as a "beautiful landing--very slightly nose up" with the main gear touching down at an indicated air speed of about 110 knots. The nose wheel became grounded almost immediately. The captain reversed No. 2 and No. 3 propellers. After unreversing and noting the slush was getting deeper, he decided to raise the flaps. However, instead of actuating the flap switch, he mistakenly moved the landing gear switch to the "up" position.* Although it was immediately returned to the

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*Note: The gear operating switch is located on the control pedestal approximately 24 inches forward of the flap switch. It is further protected against inadvertent movement by a hinged guard which must be raised before the switch toggle can be operated.

"down" position the landing gear warning horn sounded and shortly thereafter the right wing began to drop.

Competent ground witnesses all agreed that the landing was very smooth. They variously estimated the point of touchdown as anywhere between 2,600 to 3,060 feet down the runway but indicated that the actual point of touchdown was difficult to determine accurately.

There is no testimony or evidence which would indicate that the brakes were at any time effectively applied.

An examination of the runway surface was made by competent persons prior to the arrival of the Civil Aeronautics Board investigators to determine if possible the exact point of initial touchdown. The runway had been used the preceeding night after the snowfall and as a result all landing marks were not entirely distinguishable. However, from the evidence available the touchdown point was placed at approximately 1,200 to 1,400 feet past the runway approach end.

A thorough examination was made of the right main landing gear and all of its components, following which operational and functional tests were conducted. No mechanical or electrical failure of the gear or gear control system was found and all tests indicated normal operation.

Each landing gear oleo strut is equipped with two micro-switches which are actuated when the landing gear wheel is grounded firmly enough to compress the strut approximately one-half inch of its travel. These switches are a part of two entirely separate safety systems, the purpose of one being: to prevent the throttles being moved into the reverse thrust position before the aircraft is grounded, and the purpose of the other, to prevent an extended landing gear from being retracted after it is firmly grounded

even though the landing gear control switch is placed in the gear "up" position.

However, it is not necessary that all three landing gear units be firmly on the ground before the throttles can be manually moved into the reverse thrust position. This can be accomplished as soon as any one of the landing gear units is supporting sufficient weight to actuate the appropriate micro-switch. However, if the landing gear control switch is placed in the gear "up" position during landing roll, any landing gear unit will unlock and retract if there is not sufficient weight maintained to hold the micro-switch in its actuated position.

Later the micro-switch concerned was removed from the right gear and further examination and functional tests conducted under the supervision of a Board investigator at the instrument shop of the Pan American World Airways at International Airport, New York. To simulate a condition possibly existing at the time of the landing at London, the spring-loaded switch plunger was compressed and wired in the closed position. The protecting rubber boot was then filled with water and the switch packed in dry ice until the water was frozen. When the wire was cut the plunger still functioned normally opening the circuit to the landing gear operating motor. With the circuit open the gear will not retract. This test was repeated with the same result. The switch itself was then disassembled for inspection. All parts were found to be in excellent working condition.

Analysis

There are two situations which could account for the retraction of the right main landing gear, had either existed at the time the gear control switch was momentarily placed in the "up" position: (1) mechanical or

electrical malfunctioning of the landing gear control system including the safety switch; (2) insufficient weight on the right gear to actuate the safety switch or to hold it in its actuated position throughout the landing roll.

Exhaustive tests failed to reveal any evidence of mechanical or electrical malfunctioning of the landing gear control system. It must, therefore, be concluded that there was not sufficient weight on the landing gear to actuate the safety switch at the moment the gear control switch was moved to the "up" position.

Findings

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

1. The carrier, the aircraft and the crew were properly certificated.

2. The runway surfaces at Heathrow Airport were covered with slush; however, conditions were satisfactory for landing.

3. The landing was smooth, the aircraft touching down approximately 1,400 feet past the approach end of a 9,450-foot runway.

4. There was no malfunctioning of the aircraft or any of its components prior to the accident.

5. The landing gear operating switch was moved to the gear "up" position during the landing roll.

Probable Cause

The Board determines that the probable cause of this accident was the captain's action in mistakenly placing the landing gear control switch in the "up" position during landing roll.

BY THE CIVIL AERONAUTICS BOARD:

/s/ OSWALD RYAN

/s/ JOSH LEE

/s/ JOSEPH P. ADAMS

/s/ CHAN GURNEY

SUPPLEMENTAL DATA

Investigation

The Civil Aeronautics Board received notification of the accident at 0904 EST, January 3, 1951, from the Civil Aeronautics Communications at New York. An investigation was immediately initiated in accordance with the provisions of Section 702 (a)(2) of the Civil Aeronautics Act of 1938, as amended. Two air safety investigators were immediately dispatched to the scene.

Air Carrier

Pan American World Airways, Inc., is a New York corporation with head offices at 135 East 42nd Street, New York 1, New York. The company holds a certificate of public convenience and necessity authorizing it to engage in air transportation between New York, New York, and London, England.

Flight Personnel

Captain A. L. McCullough, age 54, was employed by Pan American World Airways, November 1, 1933. He had accumulated 8,752 hours on Pan American equipment, of which 1,269 were on the type of equipment involved. He held a valid airline transport pilot rating. His last instrument check was accomplished on October 23, 1950, and route check December 24, 1950.

First Officer J. A. Livers, age 29, was employed by Pan American World Airways, November 1, 1942. His total time on Pan American equipment was 6,028 hours, of which 1,318 were on the type of equipment involved.

Both pilots were fully qualified to fly the Boeing 377.

The Aircraft

N-1036V, a Boeing 377, was manufactured by the Boeing Airplane Company, Seattle, Washington, and was currently certificated as airworthy.