

## CIVIL AERONAUTICS BOARD

## ACCIDENT INVESTIGATION REPORT

Adopted: June 23, 1948

Released: June 24, 1948

## PAN AMERICAN AIRWAYS, INC.,—SHANNON, EIRE,—APRIL 15, 1948

## The Accident

A Pan American Airways' Lockheed Constellation, aircraft NC-88858, Flight 1-10, en route from London, England, to Shannon, Eire, crashed near the Shannon Airport at 0234,<sup>1</sup> April 15, 1948. Twenty passengers, including one infant, and 10 crew members were fatally injured. One passenger escaped with minor injuries. The aircraft was totally destroyed by impact and fire.

## History of the Flight

Pan American's Flight 1-10, originating in San Francisco, California, April 10, 1948, was scheduled to fly around the world to New York, New York. In accordance with company practice the flight changed to a different aircraft, NC-88858, at the Pan American Airways' base in Calcutta, India. The flight took off from Calcutta, April 13, 1948, and continued without incident via Damascus, Syria, and Istanbul, Turkey, to Brussels, Belgium. During a night landing approach at Brussels the fluorescent lighting on the left or pilot side of the cockpit went out. Since the only other lighting immediately available was a chart light which was focused on the automatic direction finder indicator, the flight instruments could not be read, and the remainder of the landing approach was accomplished without visual reference to the flight instruments.

An examination was made of the fluorescent lights after the landing. They appeared to operate normally, so the flight departed from Brussels, continuing without difficulty until on the final landing approach into London. When the power was reduced the same pilot's fluorescent lights again went out. This time the chart light was focused on the air-speed indicator. The approach was continued, and the landing was accomplished without incident.

<sup>1</sup>All times noted in this report are Greenwich Meridian and based on the 24-hour clock.

A faulty rheostat switch was found to be the cause of the fluorescent light failure, but since a spare switch could not be located, it was not changed at London. An entry describing the defect was placed in the aircraft's Form C, the airplane flight log, and the captain and the flight engineer of the new crew were informed by the company's maintenance supervisor of the condition. Though no actual maintenance was accomplished, the lights again appeared to be operating normally, so the captain, F. C. Jakel, decided to take-off, departing from London at 0035, April 15, 1948, for Shannon. At this time available weather forecasts indicated that at the estimated time of the flight's arrival at Shannon the ceiling there would be 700 feet with a higher cloud layer at 1,000 feet, and visibility 4 miles.

At 0159, April 15, 1948, the flight reported being at an altitude of 4,500 feet, contact, over the Limerick Junction fan marker, located 25 statute miles southeast from the Shannon Airport, and requested permission to make a practice approach to the field with the use of the instrument landing system. Shannon Tower cleared the flight for this approach. The tower advised that 3 hours previously the instrument landing system equipment on the airport had been reported faulty, but that it had since been serviced and was operating normally according to its monitoring board, though not flight-checked.

At 0210, the flight reported that it was proceeding to the outer marker, 5.2 statute miles northeast of the Shannon Airport, and also made a report, routine for Pan American flights, "mechanical condition okay." In response Shannon Tower advised the flight that the weather over the field was "fog patches, 3 miles visibility, cloud base 400 feet, sky 6/10 covered, wind from 325 degrees at 4 miles per hour." The flight was instructed to land on runway 23, the runway for which the instrument

landing system was projected. It was also requested to report when making the 180 degree procedure turn for the inbound instrument approach to the field, and when over the outer marker. The requested position reports were not received by the tower, but at 0220 the flight did report a "missed approach,"<sup>2</sup> and advised that it was going around for a second approach. At this time the flight was observed through a break in the clouds by the Shannon Tower, which was the first time that the aircraft had been seen in the vicinity of the Shannon Airport. The aircraft was reported as 500 feet above the ground, over, and in line with runway 23. Power was heard being increased, and the aircraft was observed turning left.

On the second approach, at 0227, the flight reported making its 180 degree procedure turn and was cleared for landing by the tower. One minute later, weather conditions at the field were transmitted to the flight as "fog patches, visibility 2 1/2 miles, 6/10 cloud base 400 feet, 4/10 cloud base 300 feet, wind 325 degrees, 3 miles per hour, altimeter 30.29." The flight reported approaching the outer marker at 0231 at which time the tower advised that another flight which had just taken off had reported a ceiling of 500 feet when northwest of the field. Flight 1-10 acknowledged this information, which was the last communication received. The aircraft was not observed at any time during the second approach: until after it struck the ground.

The aircraft struck the ground 2,380 feet northeast of the approach end of runway 23, and directly in line with that runway. Flames followed immediately after impact, and consumed a great portion of the wreckage.

The sole survivor, a representative of the Lockheed Aircraft Service, Inc., seated in the cabin at a location slightly behind the trailing edge of the right wing, stated that on the first approach all engines seemed to be operating normally, and no unusual maneuvering of the aircraft was experienced. He stated that he did not observe the runway lights and other field lighting until the aircraft was directly over the field. The altitude of the aircraft

appeared too high to him for the landing, and he heard power being applied to the engines for the "pull up."

According to this passenger, the engines seemed to be operating normally also during the second approach. The "fasten seat belt--no smoking" sign was on. He heard the flaps extend, and observed that the flight attitude was normal. He stated that the first contact with the ground felt as though the airplane had made a hard landing on the runway. Immediately following, however, severe jolts were felt, and flames swept through the cabin from the forward part of the fuselage. He then realized that the airplane had crashed. He had been thrown forward in his seat but was saved from injury by his safety belt. When the aircraft stopped, he noticed that though filled with flames the cabin remained substantially undamaged, and that all passengers were in their seats, but made no sound or movement. He said that he did not believe himself physically or mentally capable of opening any of the emergency exits, so he crawled toward the rear of the cabin, and dropped through a large tear in the fuselage to the ground.

### Investigation

The aircraft first struck a stone fence, which collapsed the nose and left main landing gear, and tore the right main landing gear from its mounting. All four engines were also torn from the aircraft during the course of the crash, and came to rest slightly forward of the main wreckage which was 1,780 feet northeast of the end of runway 23. The empennage, broken into three sections, was scattered around the fuselage and wings.

Marks on the ground made by the propellers indicated that at impact all had been rotating with normal glide power. The governor for the No. 1 propeller was bench-checked and found to be set at 2300 revolutions per minute. The distance between the individual blade marks for propellers Nos. 1, 2, and 3 were all about 38 inches apart. Forward speed of the aircraft was calculated to be approximately 108 miles per hour. Since considerable deceleration probably occurred before the propeller blades marked the ground, the speed of the aircraft on final approach before first impact was substantially greater.

<sup>2</sup>This phrase is used in all cases when the pilot wishes to advise the tower that the aircraft will not land but will circle for a second landing approach.

All evidence found and the statement of the surviving passenger indicated that all engines were operating normally during the approach. An examination of the cockpit controls and instruments was impossible because of complete fire destruction, however, no indication was found that other than normal operation was experienced before the crash. Likewise, the almost complete destruction of the airborne radio equipment made it impossible to determine its operational status prior to the accident, but all communications between the flight and the tower were made without any difficulty.

A complete examination of the records of Shannon Airport revealed that the radio range and instrument landing system equipment were operating normally at the time of the accident. A ground and flight check of all the instrument landing system equipment was accomplished after the crash, which included checking the localizer and glide path, the outer, middle, and inner markers, and the compass locators. The operation of the complete system was found normal. Various types of failures were simulated, and the monitoring equipment was found to give adequate indication of malfunctioning within the 70 second cycle which was required for one complete scan of the alarm circuit.

The ground control approach (GCA) equipment at Shannon Airport was not operating at the time of the accident. Shannon Airport, however, is completely equipped with the necessary radar equipment for ground control approach. At the time of the accident this equipment was being used only during hours of daylight to train ground personnel.

Runway 23 at Shannon Airport, for which the instrument landing system was projected, is 7,000 feet long and 220 feet wide. Though the Bartow lights on the runway were on at the time of the accident, the installation of Bartow approach lights to the runway had not been completed and were not operating. Terrain northeast of runway 23 consists of low rocky hills, covered with brush, trees, and stone fences. Elevation at the point of impact was 12 feet above runway 23.

Captain F. C. Jakel had logged a total of 6,230 flying hours, of which 1,564 were in Constellations. He had completed the Pan American training

course offered for familiarization with the instrument landing system. This course included 2 hours of Link trainer time, and 4 hours of actual practice in an airplane. Captain Jakel after the completion of this training was also given refresher training. He was considered a competent pilot by the company, and was familiar with the airport and surrounding area at Shannon, Eire.

A synoptic surface weather chart prepared in the London Meteorological Office, at 2100, April 14, 1948, showed that a high-pressure area extended northeasterly from the Azores covering the route flown by Flight 1-10. This high-pressure area resulted in a westerly flow of relatively warm moist maritime air over the land area in the vicinity of Shannon. A weak warm front was represented on the same chart, extending from Iceland southeasterly through Eire. No adverse weather was associated with this front in Eire, and at the time of the flight it had become practically stationary.

At the time of take-off from London good flying conditions existed over the entire route. Strato-cumulus clouds with bases at approximately 4,300 feet were formed over the London area. At this time Shannon was reporting "ceiling and visibility unlimited, and wind from 270 degrees at 3 miles per hour." Forecasts available to the flight prior to its departure indicated that generally clear weather would be encountered for approximately the first two-thirds of the trip, then layers of broken clouds. These same forecasts indicated that at the time of the flight's arrival, Shannon would be covered by a layer of broken stratus clouds at approximately 700 feet, and that visibility would be 4 miles. Prestwick, Scotland, the alternate, was predicted to have ceilings at 1,200 feet, visibility of 15 miles, and occasional light rain. A new terminal forecast for the Shannon Airport received in London, at 2222, predicted that the cloud base would become as low as 300 feet during the night hours of April 14, 1948. This new forecast was not received by the flight in London, but was delivered to Pan American Airways at Shannon.

Conditions actually encountered by the flight en route were substantially the same as those forecasted, except that ceiling and visibility were

considerably lower than had been indicated to the flight by the forecast furnished at London. When the flight approached the Shannon Airport, fog patches had formed, visibility was reduced to 3 miles, and there were layers of broken clouds, with a ceiling of 400 feet. The wind was from 325 degrees at 4 miles per hour.

At 0228, one minute after Flight 1-10 had reported making its 180 degree procedure turn for its second approach to the Shannon Airport, visibility was reported as reduced to 2 1/2 miles, and a layer of broken clouds was reported with a ceiling of 400 feet with scattered clouds below at 300 feet. Fog patches were also reported, however, as mentioned above, another flight that departed from Shannon at approximately this time reported the ceiling northwest of the field to be 500 feet.

#### DISCUSSION

In view of the surviving passenger's testimony, it appears highly improbable that any mechanical difficulty, other than the possible failure of the pilot's fluorescent lights, occurred in the operation of the aircraft prior to the time of impact. The survivor was very familiar with the airplane, and observed no abnormal maneuvers or sounds which would have indicated trouble with either the engines or the aircraft. Furthermore, the flight, before initiating its first approach, reported "mechanical condition okay", and the crew at no time after this report indicated in any manner that mechanical trouble was being experienced. Also, no evidence was found during the course of the investigation which indicated any mechanical malfunctioning or structural failure.

The possibility of a defect in the operation of the instrument landing system at the Shannon Airport was thoroughly investigated, since a distortion of the glide path might contribute to an aircraft making an approach too low to clear the ground. The instrument landing system was found to be operating normally when flight checked. Furthermore, no deviation had been observed on the instrument landing system monitoring board immediately before the landing approaches made by Flight 1-10, and the monitoring system was found to give a true indication of any material deviation of the glide path. Other

components of the instrument landing system, the localizer, the outer, middle, and inner markers, and the compass locators, were all found to operate normally when examined and flight-checked after the accident. Therefore, the possibility that the airplane struck the ground as a result of maloperation of the ground installation for the instrument landing system also seems to be extremely remote.

An erroneous reading of an altimeter, of the instrument landing system indicator (ILS), or of any of the flight instruments could have misled the pilot during his execution of the second approach. This possibility cannot be totally eliminated, since the flight instruments were destroyed by fire, however, an instrument approach is not made by reference to any one instrument. Furthermore, one purpose in specifying a minimum approach altitude is to provide for a margin of safety to compensate for possible errors in flight instruments. In view of the fact that this flight executed one practice approach without reporting difficulty, it appears very unlikely that any substantial maloperation of the flight instruments existed. Certainly there was adequate opportunity for cross reference and comparison of the readings of all the flight instruments before initiating the second approach.

It was impossible at the scene of the accident to determine who occupied the pilot's seat. It may have been the first officer who had just previously to this flight unsuccessfully flown a standard radio range approach into the Shannon Airport. Nevertheless, the captain was responsible for the safe operation of the aircraft, and it is to be presumed that he would have fulfilled his duty by assuming control of the airplane, though he may have been in the co-pilot's seat, had he become aware of any hazardous condition of flight.

The only explanation of this accident that appears reasonable, considering all known circumstances, is that the aircraft was flown too low in the approach for landing. It is apparent that the airplane would not have struck the ground short of the runway had the flight been able to establish clear visual reference to the field, or had the flight not descended below the minimum approach altitude of 415 feet in the

execution of its second instrument approach. Accordingly, it must be concluded that the airplane was flown below the minimum approach altitude when no clear visual reference to the field existed.

No reliable evidence was obtained during the course of the investigation to conclusively determine ceiling and visibility conditions over the approach area to runway 23. The weather conditions that existed in the vicinity at that time, however, were conducive to the formation of fog and low stratus clouds, and it is highly probable that low layers of stratus clouds were formed very near the ground between the outer marker and the end of runway 23. In view of the fact that the surviving passenger stated that he was able to see the airport lights when the airplane first passed over the airport, at which time it was at an estimated altitude of 500 feet, and that the ceiling was reported northwest of the field to be 500 feet by another flight, ceiling and visibility conditions over and to the west of the airport may have been considerably better than they were over the area northeast of the field from which the landing approaches were made. Therefore, the pilot in his execution of the second approach may have felt confident that he would establish clear visual reference to the field in ample time to safely execute a landing, and so continued below the minimum approach altitude while still in instrument weather.

Had the aircraft been flown "on instruments" below the minimum approach altitude, and had the pilot's fluorescent lights then failed, the captain would have been in the highly critical situation of being close to the ground without any means of flight orientation. On the other hand, had the fluorescent lights failed prior to the time that the flight reached its minimum approach altitude, there should have been sufficient time and altitude to allow the captain and co-pilot to accommodate themselves to the emergency.

If the pilot had had unobstructed visual reference to the runway, failure of the fluorescent light on his side of the cockpit would not in itself account for any particular difficulty in his completion of the landing approach. Airspeeds and altitudes could have been called out by the co-pilot. If there had been a failure of the pilot's

fluorescent light before Captain Jakel established visual reference to the runway when at or above the minimum approach altitude of 415 feet, there should have been sufficient time and altitude to place a flashlight into use, or to focus the overhead chart light on the pilot's instrument panel. In fact, he could have adjusted himself to watching the instruments on the right instead of the left side of the instrument panel. However, had the pilot's fluorescent light failed when there was no or only intermittent visual reference to the runway, and had the aircraft been flown close to the ground without clear visual reference, the pilot might have been left without immediate means of flight orientation at a time when a small loss of altitude would result in a crash. Therefore, a failure of the fluorescent light might have contributed to this accident, but could not be, in itself, the cause.

### Findings

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

1. The aircraft, the carrier, and the crew were properly certificated.
2. The aircraft, at the time of its departure from London, England, to Shannon, Eire, had a known defective fluorescent light which illuminated the pilot's instrument panel.
3. The flight departed from London, at 0035, April 15, 1948, when available weather information at London indicated that a night instrument approach would be required for the landing at Shannon.
4. Weather conditions encountered en route were substantially as forecasted though ceiling and visibility conditions over the Shannon Airport were lower than had been expected. At the time of the flight's instrument approach, a ceiling of 400 feet was reported over the Shannon Airport with scattered clouds underneath, visibility was reported to be 2 1/2 miles, with fog patches.
5. Except for the possible failure of the defective fluorescent light described above, there is no evidence to indicate that any mechanical difficulty was experienced in the operation of the aircraft before the time of impact.
6. The instrument landing system at Shannon and all navigational radio aids in the vicinity of the Shannon Airport were operating normally at the time of

the accident. The aircraft made a practice approach, using the instrument landing system, flew over the field at approximately 500 feet, and proceeded in the accomplishment of its second and attempted final approach without reporting any difficulty.

7. The aircraft, while executing a second instrument approach, using the instrument landing system, struck the ground 2,380 feet from the approach end of the intended runway, and was immediately enveloped in flames.

#### Probable Cause

The Board determines that the probable cause of this accident was the

continuation of an instrument approach to an altitude insufficient to clear the terrain.

A contributing factor may have been the failure of the pilot's instrument fluorescent light.

BY THE CIVIL AERONAUTICS BOARD

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

*/s/ OSWALD RYAN*

*/s/ JOSH LEE*

*/s/ HAROLD A. JONES*

Adams, Member, did not participate.

## Supplemental Data

### Investigation and Hearing

The Civil Aeronautics Board was notified of the accident shortly after midnight on April 15, 1948, by CAA communications at LaGuardia Field, 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 departed from New York, New York, April 16, 1948, for Shannon, Eire, and assisted in an investigation conducted by a representative of the Irish government. A public hearing was ordered by the Board and was held in New York, New York, May 13, 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 awarded by the Civil Aeronautics Board, which authorizes the company to conduct flight operations between New York, New York, and Calcutta, India. Service under this certificate has been conducted through the Shannon Airport, Shannon, Eire, since October 20, 1945, under an air carrier operating certificate issued by the Civil Aeronautics Administration.

### Flight Personnel

Captain F. C. Jakel, age 35, possessed a valid airline transport pilot rating. He was employed by Pan American Airways May 5, 1941, and at the time of the accident had logged a total of 6,230 flying hours, of which 1,564 were obtained in Constellations. His last instrument check was accomplished October 10, 1947, and his last route check April 5, 1948. He successfully passed a CAA physical examination March 9, 1948. First Officer C. M. Henson, age 27, possessed a valid airline transport pilot rating.

He was employed by the company December 23, 1942, and had logged a total of 3,310 flying hours, of which 956 were in Constellations. He had successfully passed an instrument check December 22, 1947. However, just previous to this flight he had unsuccessfully flown an instrument approach into the Shannon Airport. His last CAA physical examination was accomplished February 25, 1948. The co-pilot-navigator, E. G. Wallace, age 28, possessed a commercial pilot rating. He was employed by the company June 25, 1945. At the time of the accident he had logged 2,288 flying hours, of which 1,361 were in Constellations. His last CAA physical examination was accomplished May 23, 1947. His last instrument check was accomplished November 22, 1947. Third Officer H. R. LeBlanc, age 29, possessed a commercial pilot rating. He was employed by the company October 30, 1946. He had a total of 3,566 flying hours, of which 1,020 were in Constellations. His last CAA physical examination was accomplished August 19, 1947. His last instrument check was accomplished January 9, 1948.

### The Aircraft

NC-86858, was a Lockheed Constellation, Model 49. It had a total of 3,861 flying hours, 2,407 of which had been accumulated since overhaul. The last inspection was accomplished April 9, 1948. This aircraft had installed four 745C18BA3 engines.

The No. 1 engine had a total of 2,491 hours, and 666 since the time of overhaul. The No. 2 engine had a total of 1,739 hours, and 247 since overhaul. The No. 3 engine had a total of 2,149 hours, and 667 since overhaul. The No. 4 engine had a total of 2,627 hours, and 643 since last overhaul.

The aircraft was equipped with Hamilton Standard propellers, Model 33E-60-79.