

CIVIL AERONAUTICS BOARD

ACCIDENT INVESTIGATION REPORT

Adopted: November 29, 1951

Released: December 5, 1951

PAN AMERICAN WORLD AIRWAYS, INC.—NEAR MONROVIA, LIBERIA,
JUNE 22, 1951

THE ACCIDENT

Pan American World Airways' Flight 151 of June 21, 1951, a Lockheed Constellation L-049, N 88846, en route from Johannesburg, South Africa, to New York, New York, crashed at approximately 0325Z¹, June 22, about 54 miles² northeast of its next scheduled stop, Roberts Field, Monrovia, Liberia. The 31 passengers and crew of nine were all fatally injured and the aircraft was destroyed.

HISTORY OF THE FLIGHT

Pan American's Flight 151 departed Johannesburg at 0812, June 21, and after a routine flight and scheduled stop at Leopoldville, Belgian Congo, arrived at Accra, Gold Coast, at 2125. Following a mechanical delay which required the changing of several spark plugs and a set of magneto points, the flight was dispatched and cleared to Roberts Field, Monrovia, on an instrument flight plan at 16,500 feet with Dakar, French West Africa, and Accra as alternates. Take-off from Accra was at 2352Z. The gross weight at departure was 89,255 pounds, including cargo, mail, 3,340 gallons of fuel, 31 passengers, and a crew of nine. The gross weight of the aircraft and distribution of the disposable load were within the allowable limits.

The en route communication system of the flight sector between Accra and Roberts Field is high frequency radio-telephone utilizing ground stations at Accra and Roberts Field as primary guarding stations. Normal communication with these two stations was maintained as Flight 151 progressed westward after departing Accra.

The flight proceeded in a routine manner, climbing to 16,500 feet MSL in accordance

with the flight plan. At 0057 a position report was given over Abidjan, 258 miles west of Accra, and arrival over Cape Palmas, Liberia, 265 miles farther to the west, was estimated as 0156. At 0156 Flight 151 reported over Cape Palmas at 16,500 feet MSL, on instruments, and estimated arrival at Roberts Field as 0246. (A plantation employee in the Cape Palmas area stated that he heard an airplane inland and very high at approximately 0220, that the moon was bright and the sky was clear at the time. Since no other aircraft was known to have been in the area, this is presumed to have been Flight 151.) At 0220 Flight 151 requested clearance to descend. Roberts Field radio cleared the flight to descend to 3,000 feet and advised that at 0225 the Roberts Field tower would establish contact on VHF. A clear two-way contact was made at 0225 on 118.1 mcs, at which time the tower gave the flight the local weather and altimeter setting, cleared it to descend IFR over Roberts Range Station, and indicated that Runway 05 was in use. At 0237 Flight 151 was again given local weather for Roberts Field: cloud base estimated 1,000 feet, broken, light drizzle and haze, visibility 3 miles. At 0241 the local wind was given as W-WNW variable 7 miles per hour. All of these messages were acknowledged.

At 0255, nine minutes after its ETA at Roberts, Flight 151 was heard calling Roberts Field on VHF 118.1 mcs. The tower responded, repeating the call three times. There was no indication that the aircraft heard the tower, whereupon the tower switched to 3270 kcs and requested the flight to give its current position. There was no reply to this call. Immediately following failure of the aircraft to respond to Roberts tower on 3270 kcs, the Roberts Field high frequency radio-telephone facility established contact advising the flight that

¹ All times referred to herein are Greenwich Civil and based on the 24-hour clock.

² All distances given are in statute miles.

they were unable to read it on 118.1 mcs and that the flight should reply to the tower's call on 3270 kcs. This message was acknowledged at 0301. At 0305 the flight again contacted Roberts tower on 3270 kcs advising that the Dakar radio beacon was interfering with the Roberts Field radio beacon and that they would "be back in 15 minutes." Roberts tower advised Flight 151 that Dakar would be requested to turn off the beacon and this message was acknowledged. (Because of incoming traffic to Dakar, the beacon there was not turned off until 0410.) At 0315 Flight 151 again called Roberts tower on 3270 kcs and the latter transmitted the latest weather. The flight did not acknowledge this transmission on 3270 kcs but called Roberts tower on 118.1 mcs. Roberts tower then replied on 118.1 mcs but received no acknowledgment. Thereafter, the tower repeatedly called Flight 151 on both 118.1 mcs and 3270 kcs, requesting the aircraft's position and broadcasting the weather. However, the incomplete contact at 0315 was the last transmission received from the flight.

At 0410 emergency procedures were initiated at Roberts Field and at 0515 an alert notice was dispatched to appropriate stations that Flight 151 was still unreported and that aerial search would begin at daylight. During the day of June 22 aerial search was conducted but was not successful in locating the missing aircraft. The first definite information received was when a foot messenger arrived from the village of Sanoye at approximately 1430, June 23, with word that in the early morning hours of June 22 an aircraft had crashed into the side of a hill 2.4 miles west of his village, and that everyone on board was killed. Lack of communication facilities between Sanoye and Roberts Field precluded earlier notification.

THE INVESTIGATION

Investigation at the scene indicated that the aircraft struck at high speed in a laterally level and slightly descending attitude at an elevation of 1050 feet MSL,³ with the wing flaps, landing gear, and landing lights in the retracted position. The wreckage was distributed about a line running 178° magnetic from the point of impact. All major

components were found at the scene, and no evidence was found to indicate that any part had become detached prior to impact. An intense flash fire over the entire area of wreckage distribution and several localized fires followed impact, but there was no evidence of any inflight fire.

The propeller dome settings indicated that all four engines were producing approximately the same amount of power. The cockpit instruments recovered were too severely damaged to give any reliable indications of their readings when the crash occurred. Statements of eyewitnesses and stopped watches which had been worn by occupants of the aircraft indicated the time of impact as approximately 0325. At this time the aircraft had about eight hours of fuel remaining, having departed Accra with over eleven hours of fuel aboard.

A thorough review of maintenance records for the aircraft reflected no irregularities and indicated that the aircraft was airworthy when it departed Accra.

The weather at Roberts Field, available at Accra before the flight's departure, was ceiling 3,500 to 5,000 feet and visibility better than 5 miles. Although the weather information available is rather incomplete, it appears that at Cape Palmas the flight should have been in the clear on top at its assigned cruising altitude of 16,500 feet, and that the outside temperature was about 31° and the wind from approximately 80° at 20 knots. In the vicinity of longitude 10° to 11°W, a rather extensive cumulo-nimbus development appears to have existed, with the heaviest rain east to northeast of Roberts Field. It is probable that the flight flew into this cumulo-nimbus development, resulting in bad static and heavy rain.

In the vicinity of the crash, the flight was east of the line of storms but the cloud bases were probably down to near the hill-tops. Witnesses who heard the aircraft flying northerly, and then saw it flying low on a southerly heading just prior to the crash, stated that the night was dark but no rain was falling, although there had been a heavy rain earlier in the evening. No important turbulence appears to have been likely in the immediate vicinity of the crash area and surface wind is believed to have been very light.

³ The minimum en route altitude for the area in which the crash occurred is 6,500 feet.

Weather at the alternates--Accra and Dakar--was above minimum and remained so throughout the period that Flight 151 might have arrived at either of those points, had the captain elected to proceed to one of his alternates

The Roberts Field radio navigational aids consist of a 100-watt standard MRL type radio range, with which is associated a 5-watt Z marker beacon transmitter. In addition, there is a 1200-watt radio beacon which was operating on a frequency of 400 kcs at the time of the accident.⁴ These facilities are not considered primary long-range navigational aids but rather are localizers for the purpose of instrument let-down and landing at Roberts Field after arriving in the area.⁵ However, all Pan American flights through Roberts Field carry a qualified navigator as part of the crew. Testimony of pilots experienced in using these facilities indicates that 50 miles is the maximum distance for effective reception of the radio range, with 75 miles for the radio beacon, under weather conditions similar to those existing the night of the accident.

The minimum en route altitude from Cape Palmas to Roberts Field, when not more than 5 miles either side of a direct route, is 4,500 feet, when outside these limits, the minimum altitude is 6,500 feet. There are no radio navigational aids along the route, and prior to arriving within effective reception range of the Roberts Field aids, the only means by which a flight can determine its position under instrument conditions is dead reckoning or a celestial fix.

There were no reported malfunctions of the navigational aids at Roberts Field during the time Flight 151 was within range, with the exception of the reported interference of the Dakar beacon, operating on 403 kcs. No aircraft was heard passing over or near Roberts Field during the time Flight 151 was expected to arrive, although competent personnel were waiting and listening for it, and the flight gave no position report of any kind except the statement, "will be back in 15 minutes."

⁴ On July 21, 1951, the frequency of Roberts Field radio beacon was changed from 400 kcs to 372 kcs

⁵ See Appendix "A"

ANALYSIS

The last reported position from Flight 151 was at 0156 over Cape Palmas, on instruments at 16,500 feet. Since Cape Palmas has no radio facility this position must have been determined by dead reckoning or a celestial fix. From Cape Palmas to Roberts Field, a distance of 231 miles, a change of heading is required from 275°M to 319°M. This new heading is almost identical to the toward-the-station heading of the southeast leg of Roberts range, which is 317°M.

The next contact with the flight was at 0220, at which time clearance to descend was requested. Clearance was granted via radio-telephone to descend to 3,000 feet. At 0225 Roberts Tower gave the flight local weather and cleared it to descend IFP over the range station. Although competent personnel at Roberts Field were waiting on the ramp and listening for the arrival of Flight 151, it was never heard either before or after its ETA, 0246. From this it must be concluded that the flight not only failed to overhead the range station, but also never reached the general area of Roberts Field.

The flight was nineteen minutes beyond its ETA at Roberts when it reported that the Dakar beacon was overriding the Roberts beacon. This, together with the location of the crash, leads to the conclusion that the flight at this time was beyond the effective range of the Roberts beacon. As a result of this and previous reports of interference from Dakar, the frequency of the Roberts radio beacon was changed to 372 kcs to provide a greater separation of frequencies between the two beacons. However, had the flight been in the immediate vicinity of Roberts Field, interference by the Dakar beacon would not have precluded a landing, since the radio range, which was functioning normally, is the facility provided and normally used for instrument approach.

In the absence of any indications of mechanical trouble, there is no logical explanation for the captain's action in descending without having positive knowledge of the flight's position.⁶ It must be concluded, therefore, that he made this descent with the mistaken belief the flight's position was such that he could safely descend

⁶ See Appendix "B"

below the prescribed minimum altitude. There was no known necessity for immediate descent as the flight still had ample fuel to proceed to either of its alternates, Accra or Dakar, and weather at both remained above minimums during the time the flight might have arrived at either point.

On July 24, 1951, Pan American World Airways made a change in operating procedures and issued the following instructions to all personnel concerned with African flights:

UNTIL FURTHER NOTICE MINIMUM INSTRUMENT APPROACH ALTITUDE ROBERTS FIELD 8,000 FEET AIRCRAFT WILL LOSE ALTITUDE BY THREE MINUTE SHUTTLES ON THE SOUTHWEST ROBERTS FIELD RANGE LEG REPORTING EACH ONE THOUSAND FEET, PROCEDURE TURN, AND RANGE OVERHEAD INSTRUMENT APPROACH SHALL START FROM RANGE OVERHEAD WITH VISUAL AND AURAL "Z" MARKER INDICATIONS AND BE EXECUTED IN ACCORDANCE WITH MANUAL PROCEDURE WITH AIRCRAFT REPORTING INBOUND PROCEDURE TURN, LOW CONE, FIELD NOT IN SIGHT OR MISSED APPROACH * * *

As a result of a survey of the navigational facilities at Roberts Field by the Civil Aeronautics Administration subsequent to the accident, Pan American World Airways' operations into Roberts Field were, on August 9, 1951, restricted to VFR day operations only.

Subsequent improvement in the Roberts Field facilities resulted in this restriction being removed to the extent that PAWA was authorized to return to the original operations specifications, except that all night operations are to be in accordance with IFR rules.

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FINDINGS

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

- 1 The carrier, crew and aircraft were properly certificated.
- 2 The gross weight of the aircraft and disposition of the disposable load were within allowable limits.
- 3 There was no malfunctioning of the aircraft or any of its components prior to the accident, nor was there any malfunctioning of the navigational aids of Roberts Field.
- 4 Weather at Roberts Field was above minimums at the time Flight 151 was expected to arrive and remained so throughout the night.
- 5 At the time of the crash the flight had ample fuel remaining to have proceeded to Dakar or returned to Accra, its designated alternates.
- 6 The aircraft never overheaded the Roberts Field range station and a let-down was made without positive determination of the flight's position.

PROBABLE CAUSE

The Board determines that the probable cause of this accident was the action of the captain in descending below his en route minimum altitude without positive identification of the flight's position.

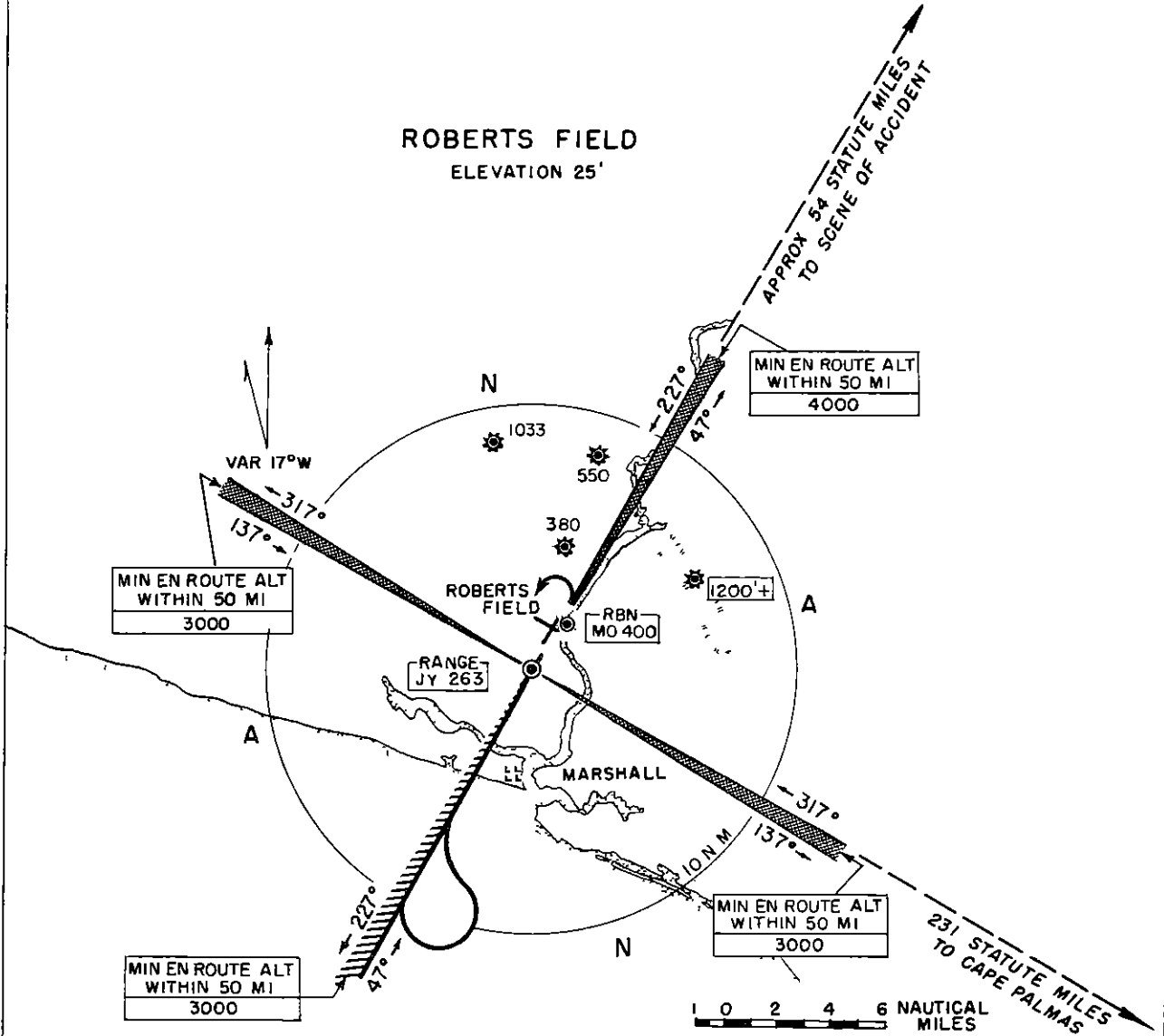
BY THE CIVIL AERONAUTICS BOARD

(s/ DONALD W NYROP
 /s/ OSWALD RYAN
 /s/ JOSH LEE
 /s/ JOSEPH P ADAMS
 /s/ CHAN GURNEY

APPENDIX "A"

ACCIDENT NEAR MONROVIA, LIBERIA, JUNE 22, 1951

ROBERTS FIELD
ELEVATION 25'



FACILITY	RANGE	BEACON	TOWER
TRANSMITS	263	400	3270 118 126 9
RECEIVES			3270 118 126 9
SAFE ALTITUDE RADIUS 10 MI 3000 25 MI 3000 50 MI 4000 100 MI 4000			

Supplemental Data

INVESTIGATION AND HEARING

The Civil Aeronautics Board was notified at 1145Z, June 22, 1951, that PAWA Flight 151 was overdue at Roberts Field, Monrovia, Liberia, and that search and rescue facilities had been alerted. The wreckage was located in mid-afternoon on June 23 and the Liberian Government delegated investigation of the accident to the United States Civil Aeronautics Board. 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, and investigators were dispatched to the scene. A public hearing was ordered by the Board and was held in New York, New York, August 8, 9, and 10, 1951.

At the Board's invitation, the Liberian Solicitor General attended the hearing as his government's official representative. The Civil Aeronautics Board desires to express its appreciation of the cooperation extended by the Liberian Government during the investigation of this accident.

AIR CARRIER

Pan American World Airways, Inc., a New York corporation with its main offices at 135 East 42nd Street, New York, New York, holds a certificate of public convenience and necessity authorizing it to engage in air transportation between New York, New York, and Johannesburg, Union of South Africa, with various stops en route, including Roberts Field, Monrovia, Liberia.

FLIGHT PERSONNEL

Captain F. J. Crawford, age 37, held a valid airline transport rating and a current radio-telephone license, and had flown a total of 7818 hours, of which 426 were in

L-49 equipment. He was employed by Pan American on June 16, 1941, and was qualified as a captain on November 15, 1943. Captain Crawford had had 305 hours of navigating experience but he was not a certificated navigator. His last CAA physical examination was December 12, 1950, his last route check was April 8, 1951, and his last instrument check was June 10, 1951.

First Officer G. A. Alcock, age 34, held a valid airline transport rating and a current radio-telephone license, and had flown a total of 5134 hours, of which 2776 were in L-49 equipment. He was employed by Pan American on July 6, 1944, and was qualified as a first officer on June 16, 1945. His last CAA physical examination was May 15, 1951, and his last instrument check was March 3, 1951.

Second Officer R. F. Detwiler, age 31, was the flight's navigator. He held commercial pilot, and flight navigator certificates, and a radio-telephone license. His experience consisted of 5,696 flying hours, of which 3027 were on L-49 equipment, and 886 hours of navigation time.

The remainder of the crew consisted of Third Officer F. S. Bowne, Fourth Officer G. Havlena, First Flight Engineer F. W. Bush, Second Flight Engineer G. Kissling, Purser R. Tunstall, and Stewardess B. Picou.

THE AIRCRAFT

N 88846, a Lockheed Constellation Model L-049, had a total of 13,343 flying hours and was currently certificated by the Civil Aeronautics Administration. It was equipped with four Wright engines, Model 745C18BA3, and the propellers were Hamilton Standard, Model 33E60, equipped with #6801 blades.