

No. 14

Lloyd Aereo Boliviano, DC-6B, CP-707, crashed on a mountain in the Tacna District, Peru, on 15 March 1963. Report, dated April 1963, released by the Directorate General of Civil Aviation, Bolivia.

1. Investigation1.1 History of the flight

Flight 905/15 was a scheduled international flight from Cochabamba, Bolivia, to La Paz, Bolivia, and Arica, Chile, and return via the same stops. Three crew members and 36 passengers were aboard.

The aircraft departed from Arica on the return flight at approximately 1327 hours Bolivian time. It was to be an eight-hour, VFR flight, and the aircraft was to cruise at 17 000 ft. Eight minutes after take-off the crew advised Air Traffic Control at Cochabamba of the departure time, the number of passengers aboard, the aircraft's weight and the amount of fuel being carried. Between 1347 and 1348 the air traffic controller at La Paz advised that Panagra flights 701 and 393, flying at 22 000 and 21 000 ft were estimating Charaña at 1355 and Arica at 1351 respectively. Flight 905/15 acknowledged the message. ATC at La Paz called the flight at approximately 1400 hours, and several times thereafter, to report on the new positions of the two Panagra aircraft, which were in the Arica zone but received no reply.

It was determined subsequently that the aircraft crashed into Chachacomani Peak (latitude 17°49'00", longitude 69°50'00"W) in Peruvian territory near the Chilean border at an altitude of 14 250 ft, sometime between 1351 and 1355.

1.2 Injuries to persons

| Injuries | Crew | Passengers | Others |
|-----------|------|------------|--------|
| Fatal | 3 | 36 | |
| Non-Fatal | | | |
| None | | | |

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

No damage was sustained by objects other than the aircraft.

1.5 Crew information

The pilot-in-command, age 40, was the Chief Pilot of Lloyd Aereo Boliviano and had been with the Company for fourteen years. He held an airline transport pilot's licence and was last checked on the La Paz-Lima route in November 1961. He had flown a total of 10 069 hours, including 7 774 as pilot-in-command of which 1 319 hours had been flown on the DC-6B. During the 30 days before the accident he had flown 85 hours on the DC-6B.

The co-pilot, age 29, had a private pilot's licence and had flown 4 034 hours as co-pilot including 910 hours on the DC-6B. During the 30 days prior to the accident he had flown about 48 hours on the DC-6B.

The flight engineer, age 30, held a private pilot's licence. He had flown 5 144 hours as co-pilot including approximately 102 hours on DC-6B aircraft. During the 30 days before the accident he had flown 64 hours on the DC-6B.

All three passed their most recent medical examinations in October 1962.

1.6 Aircraft information

The aircraft had a valid certificate of airworthiness. The last airworthiness check of the aircraft was made on 10 November 1962. It had flown 1 686 hours since its last major overhaul, and the airframe and engines had undergone adequate and systematic periodic maintenance checks.

The weight and balance sheet for the aircraft was incorrectly filled out at Arica. It showed a margin of 249 kg between the aircraft's weight and the maximum permissible. It was found subsequently that the margin was, in fact, 1 298 kg, i. e. the difference between the aircraft's gross weight at take-off (36 632 kg) and the maximum authorized (37 930 kg) in case of landing restrictions at the aerodrome of destination. It was also estimated that at the time of the accident the aircraft's gross weight was 35 965 kg, which was less than the maximum allowable.

On departure from Arica the aircraft was carrying 1 600 gal of fuel weighing approximately - 4 240 kg. The position of the centre of gravity was not mentioned in the report.

1.7 Meteorological information

The following weather conditions were forecast for the subject flight:

"In high terrain, during the early hours of the morning, cloudy, altostratus, with cumulus below, changing to partial cloudiness in the afternoon. On the high plateaus, generally cloudy, stratocumulus, cumulus, focal showers. Coast cloudy, partly cloudy, stratocumulus."

The Tacora Passes were expected to be open, and the winds forecast were as follows:

| | |
|---------------------|--------------------------|
| 10 to 14 000 ft: | 200°/10 kt |
| 15 to 18 000 ft: | 300°/15 kt |
| winds on the coast: | 5 - 10 000 ft: 180°/8 kt |
| | 15 000 ft: 200°/8 kt |
| | 20 000 ft: 240°/10 kt |

An analysis of the weather data provided by Charafia indicated that the strato-cumulus and cumulonimbus cloud bases were lowest during the day. It also showed that the Tacora Passes remained open, stratus and cumulonimbus clouds and showers being concentrated west-southwest and northwest of Charafia. This indicated a predominance of low clouds and rain in the passes.

Even in clear weather, there is continuous and severe turbulence at midday throughout the mountain zone of the country. The formation of cumuliform clouds and of cumulonimbus cloud, (2/8 were reported by Charafia), indicated that the weather conditions in the area were marginal for flights conducted below 17 000 ft.

Two Panagra aircraft were flying the route at 21 000 and 22 000 ft in the vicinity of the accident at about the time it occurred. The crew members said that the Tacora Volcano pass was cloudy and rainy and that it was not open for VFR flight even above 17 000 ft. Information provided in their statements included the following: "... We flew IFR in rain and clouds from a point immediately southwest of Charafia outside the Tacora pass." "The Tacora pass was covered by stratus of the low type. The zone of the accident as well as the Tacora mountain itself appeared covered with clouds. We could see through the pass at 16 500 to 17 000 ft over the top of the clouds and light rain."

1.8 Aids to navigation

The aids available along the route were not indicated in the report.

The aircraft was equipped with the following aids: two VHF VOR/localizers, two VHF glide scopes (ILS), one marker beacon, two automatic radio compasses and weather radar. All were in satisfactory working condition.

1.9 Communications

The aircraft carried an HF transceiver and a VHF transmitter.

Communications were normal until 1350 when the aircraft exchanged messages with Cochabamba. This was the last contact.

1.10 Aerodrome and ground facilities

Not relevant to the accident.

1.11 Flight recorders

No mention of flight recorders was made in the report.

1.12 Wreckage

The aircraft first struck the mountain peak at an altitude of 14 250 ft, leaving a scar on the rocky terrain caused mainly by the right lower part of the aft fuselage. Propellers No. 3 and 4 struck immediately thereafter. The wreckage was scattered over a uniformly ascending area 400 ft wide and 900 ft long, up to an altitude of 14 550 ft on a true compass heading of 80°. The first impact made a crater about 24 ft wide and 3 ft deep.

The distribution of the wreckage and the almost complete disintegration of all the wing surfaces and components, centre section of the wing and right side of the stabilizer showed that those were the parts that were destroyed first, and the most completely. The parts and components of the left side, of relatively larger size, were dispersed and fell further away than those of the right.

1.13 Fire

The general distribution of the wreckage showed that there was no fire such as could have been produced by the approximately 1 400 gal of fuel aboard the aircraft at the time of the accident. This was due to the violence of the impact loads, which atomized the fuel. The explosion which followed impact produced only slight burns on the wreckage, which showed no signs of intense heat. Ninety percent of the wreckage bore no marks of fusion, fire or soot.

1.14 Survival aspects

No information was contained in the report concerning the search for the aircraft.

All the supports of the passenger seats were broken, and the frames were twisted. A number of the seats had disintegrated completely. Some of the seat belts had broken under tension, and others apparently were not fastened at impact.

1.15 Tests and research

No information in this respect was contained in the report.

2. Analysis and conclusions

2.1 Analysis

Communications received from the aircraft while en route were normal, and no difficulties were reported regarding the flight up to the time of impact.

The aircraft was supposed to be flying VFR at 17 000 ft. However, it could not fly in accordance with its flight plan because of the prevailing weather conditions. Other pilots, of aircraft in the area around the time of the accident, stated that the Tacora Volcano pass was closed to low level visual flight, and there was low stratus cloud, rain and severe turbulence in the area.

Based on the wreckage pattern, the collision with the peak occurred as follows. There was no structural failure of the aircraft or its engines prior to impact. The aircraft first hit the peak with the lower right rear portion of the fuselage and propellers No. 3 and 4. At the time it was in a pronounced climbing attitude practically parallel to the slope of Chachacomani Peak, which has a gradient of 55° at this point. After impact the aircraft's trajectory on the surface of the peak sloped 23.5° upwards for a distance of 300 ft and the underside of the fuselage, particularly the right side disintegrated, and main components broke away. The aircraft continued climbing along a line approximately parallel to the surface of the peak, i. e. at a nose-up angle of about 55°. The wing centre section, the lower part of the fuselage and a portion of the passenger compartment came to rest against a large rock 300 ft further on. The rest of the top and left parts of the fuselage and the seats continued on for some distance, together with 20 passengers, who were thrown forward in free fall.

All four propellers had blades broken at the roots. Splinter analysis showed a typical static rupture on all the propeller blade fragments found. The position of the propeller blades could not be an indication of their exact pitch before the crash since the distribution valves had been moved from their original position as a consequence of impact. However, the position of the blades that remained on the hubs did provide evidence of high power and rpm.

The damage to the four engines was similar. There was more damage to the lower cylinders than to the others. All engines had their gear shafts and impeller shafts broken by rapid deceleration. This confirmed they were running at high power at impact.

The manner in which the aircraft was destroyed, the uniform distribution of the wreckage, and the high degree of disintegration led to the conclusion that the aircraft was flying at a speed of approximately 180 kt. At that speed impact loads would be high. This would account for the magnitude of the break-up. The majority of the main structural parts showed the characteristics of instantaneous ruptures of the static type, which resulted from loads well in excess of their structural limits. The loads were a combination of compression, torsion, flexion and shearing. None of the parts showed signs of a free fall. The destruction of the aircraft resulted entirely from impact loads. An explosion followed impact.

The pilot-in-command knew his position with respect to the pass normally used in this part of the mountain range. This was established by the trajectory of the wreckage, which was oriented on a true heading of 80°.

The normal pass orientation is 50°. This means that on account of the weather the aircraft flew farther north looking for a better pass. It then needed a heading of 80° to intercept the usual route to Charaña.

The time of the accident was between 1350 Bolivian time (when the aircraft made its last contact with Cochabamba) and 1400 hours (the approximate time of the unanswered call from Air Traffic Control at la Paz).

This represents an en-route flight time from Arica to the crash site of between 18 and 28 minutes, of which the average is 23, during which the aircraft flew a distance of 68 NM at an average true airspeed of 177 kt.

2.2 Conclusions

Findings

The crew members on the subject flight were duly qualified.

The aircraft had a valid certificate of airworthiness and had been properly maintained. Its gross weight at the time of departure from Arica was below that authorized for the Arica-La Paz segment of the trip.

Except for the fact that the aircraft's dispatch form was incorrectly filled out, the flight dispatching requirements had been satisfactorily completed.

Because of the existing weather conditions, the aircraft could not fly in accordance with its flight plan which called for VFR flight at 17 000 ft. Instead, it was flying at approximately 14 000 ft.

A study of the area of the accident proved that 16 000 ft was the minimum altitude at which the Tacora pass could be flown VFR in visual meteorological conditions.

Examination of the wreckage and of its distribution indicated clearly that at impact the engines were functioning at high rpm, and there was no structural failure of the aircraft prior to impact.

Cause or
Probable cause(s)

A flight under visual flight rules was attempted below the minimum altitude indicated in the flight plan in weather conditions that were marginal for this type of operation and were associated with the severe turbulence which usually exists in that region (western area).

3. Recommendations

No recommendations were contained in the report.
