

No. 34

Linee Aeree Italiane, DC-6B aircraft, I-LEAD crashed after take-off at Paray-Vieille-Poste, France on 23 November 1956. Report by Commission of Inquiry set up by Order of the Secretary of State for Public Works, Transport and Tourism, France. Report released 24 April 1957.

Circumstances

The aircraft was flying on the regular Rome - New York service and had stopped at Orly for two hours prior to taking-off for Shannon, Ireland, in darkness at 2317 hours Greenwich Mean Time in cold and slightly misty weather. Between 10 and 15 seconds after a normal take-off, the aircraft lost altitude and struck a house located approximately on the extended centre line of runway 26 (the take-off runway), about 600 metres from the runway end. The aircraft broke up and crashed in flames (at 2318 hours) destroying two buildings. All 10 crew members and 23 of the 25 passengers were killed. Both surviving passengers were seriously injured, one subsequently died.

Investigation and Evidence

The local weather was misty with a visibility of 2.2 kilometres, wind 320° at 6 knots, and a ceiling of 4/8 at 240 metres. The temperature was -2°C and the dewpoint -4°C. White frost was forming on the ground.

As the conditions were bordering on icing, the Commission asked the National Meteorological Service to carry out a special study.

The area in which the accident occurred is located in the part of the Commune of Paray-Vieille-Poste which is now being expropriated (Orly airport extension plan).

Most dwellings in that area have been torn down for ground levelling purposes; a few houses and the Town Hall still remain and are occupied. Contrary to the indications given on the visual landing chart, these obstacles were not lighted, but since none of them penetrates above the 1.25 per cent slope, there is no regulation which requires that they be lighted.

Between runway 26 and this area lie the existing Highway 7 and the cutting through

which this road will pass after it has been re-located to run under the airport.

The wreckage was strewn over a distance of 200 metres. The main wreckage covered an area measuring approximately 30 by 15 metres only and had been greatly damaged by the fire which broke out following the crash.

The airframe began to break up with the impact on the house, at the foot of which large fragments of the main longeron were found.

Large units (such as the outer engines, the forward landing gear, the tail unit, etc.) then broke off the main body of the aircraft which came to rest at a point 200 metres from the point of first impact.

The cabin and the cockpit were particularly damaged by the crash and by the fire. Only part of the controls and instruments could be identified, and few could yield any useful information.

The examination of the wreckage revealed no structural defect.

One element of the right stabilizer and its elevator flap, including the controlled trim tab, were the only parts of the control surfaces that could be usefully examined. These parts revealed no defect.

Examination of the hydraulic jacks of the flap control mechanism showed that the shafts of those systems were in different positions:

- one short jack, the shaft of which was retracted;
- one long jack, the shaft of which was fully extended, but not bent;
- the shafts of the other two jacks had come out of their casing and were folded as a result of the impact.

A reconstruction of the setting of the flaps at the time of the accident was attempted

with a DC-6 aircraft belonging to T.A.I. but the varying positions of the jack shafts made it impossible to reach any valid conclusion.

The varying positions of the shafts can only have been the result of an interruption in hydraulic pressure in the jacks due to the breaking up of the aircraft.

The folding of the shafts may lead to the belief that the flaps were out, but cannot be regarded as sufficient proof thereof.

The two main landing gear legs and the forward landing gear were found in the locked and "up" position, which is the correct position for that phase of the flight.

The bottles of CO₂ and oxygen which were carried on board were recovered, but their examination did not reveal any breakage which would indicate that there had been an explosion before the accident.

The engines were examined by experts at the Air France maintenance center at Courbevoie. All the damage and failures observed were the result of the impact at the time of the aircraft's crash. Dismantling revealed no traces of overspeed, jamming or inadequate lubrication.

The oil filters were clean.

The injectors of engines Nos. 1, 2 and 4 were tested and found in working order. The injector of engine No. 3, twisted by the impact, could not be tested.

The compressor starting selectors of engines Nos. 1, 2 and 3 were found in their normal first gear position. The selector of No. 4 engine could not be checked because of damage sustained in the accident.

In short, nothing was found to indicate that the engines were not in sound working order.

Only three fuel pumps were found, namely, pumps Nos. 1, 3 and 4. These were examined by experts at the Air France maintenance center at Orly. This equipment was properly assembled and the component parts were in good shape. No traces of jamming or scratching were found.

The cross-feed valves of the fuel tanks were found connected with the main tanks, which is the normal take-off position.

The four (Stromberg Bendix PR 58 E5) carburetors with which the engines were equipped were examined by experts at the Zenith works at Levallois-Perret.

These carburetors were considerably damaged by the impact and fire, and could not be bench-tested. All evidence pointed to the damage having been caused by the accident. As the carburetors of engines Nos. 1 and 2 were found with perforated poppet valve membranes, comparative tests were carried out with a stock Zenith carburetor, first with a membrane in working order and then with a perforated one.

The tests showed that damage to the membranes did not affect the fuel flow at take-off power. When the regulator is fully open and the pressure is at its maximum, the flow is limited by the jets. At all other power settings, rupture of the membrane increases the richness of the mixture and causes faulty operation of the choke.

Furthermore, the "derichment" membrane was torn in carburetor No. 4. Since it was felt that such an anomaly could affect the operation of the engine, a comparative test was carried out with Pratt & Whitney R. 2800 CB 17 engine No. 35741 at Bouviers. The split membrane was not found to have any effect on the functioning of the engine with water injection at 2 600 or at 2 800 rpm.

Examination of the take-off water injection regulators gave no indication of malfunctioning.

The four (type 43 E 60) propellers were examined by experts at the Air France maintenance centre at Orly. These propellers had broken away from the engines at the time of the accident as a result of the failure of the reduction gear.

Of the twelve blades, only one remained whole, although even this one was bent. The eleven others were broken and twisted. They appeared to have been developing power when they struck the obstacles.

The pitches at the time of the impact were ascertained with reasonable accuracy by noting the position of the mobile cams in the case of propellers Nos. 1, 2 and 3 and by the marks left on the "shim plates" at the blade anchorage in the case of all four propellers.

The average pitches thus ascertained were as follows:

Propeller No. 1: 32°; propeller No. 2: 35°; propeller No. 3: 38°; propeller No. 4: 30°.

The lower pitch setting of propellers Nos. 1 and 4 may have been due to two reasons:

- the fact that these engines drive accessories and that for a given number of engine revolutions the torque of the propellers is smaller;
- the fact that these engines touched ground some time after the impact of engines Nos. 2 and 3 against the house.

In short, it may be concluded that the governors for propellers 1, 2 and 3, and very probably No. 4 as well, were on.

Only two propeller governors, those of engines Nos. 1 and 2, and an electric head belonging to engine No. 3 or engine No. 4 were sufficiently well preserved to be examined.

In the case of governors 1 and 2, tests were carried out with their own springs and their electric heads in their position at the time of the accident. The results of these tests were as follows:

Engine No. 1: 2 514 rpm.

Engine No. 2: 2 586 rpm.

These were probably the rates at the moment of impact. For the same governors, the bench rpm in low pitch stop position, gave the following figures for take-off: 2 807 and 2 839.

The electric head of one of the star-board engines was tested on an Air France governor with the following results:

- in the position of the head at the time of the accident: 2 473 engine rpm;
- in low pitch stop position, three different tests with the Air France governor and then with the springs of the governors of engines Nos. 1 and 2 of aircraft I-LEAD gave the following results: 2 701, 2 876 and 2 904 engine rpm.

Taking into consideration the differences in spring calibration, there is ample reason to believe that the governor and engine to which that head belonged had been functioning normally.

The result of the examination seems to indicate that the first reduction had already been carried out.

The cockpit was completely crushed and destroyed by the fire. Nevertheless, it was possible to note a few facts of interest -

- The elevator controls parking lock was found unlocked;
- Contacts: engine 1, contact on left magneto; engine 2, contact on right magneto; engine 3, contact on both magnetos; engine 4, contact on both magnetos;
- "BMEP" - Only the indicators of engines Nos. 1, 2 and 3 were found. Their pointers had stopped at 251, 169 and 190 PSI. These indications cannot be accurately interpreted because of the heavy damage sustained by these dials;
- Automatic feathering: switch in the "on" position;
- Manual feathering: engines 1, 2 and 4 in normal position. In the case of engine No. 3, the button was pushed in, but its protective casing was bent. Consequently, this position cannot be taken into account.
- Pilot-in-command's altimeter: This altimeter was found set at the QNH (30.29): the pointer showed 820 feet; this anomaly was the result of the impact;
- Course indicator: on the panel of the pilot-in-command, the pointer of the flux-gate showed 260°;
- The pointer of the ammeter for the de-icer heating elements left a mark on the dial at 10 amperes. It was impossible to determine from the state of the connections which of the heating element circuits was connected with the ammeter, but, judging by the intensity value registered, it would appear to have been the pitot heating element;

- Cockpit lighting: the white lighting potentiometer closed the circuit and was, therefore, used at the time of the accident. The red lighting potentiometers were destroyed as was the emergency lighting control switch panel.

Analysis of fuel samples from the tank from which the aircraft was refuelled at Orly showed no abnormal characteristics.

Reconstruction of the configuration of the aircraft at the time of the impact

A 1/50 scale model was made in order to reconstruct with the greatest possible degree of accuracy the configuration of the aircraft at the time of its impact against the first house.

Sufficient characteristic signs were left to permit determination of the attitude of the aircraft in the three dimensions:

1) The lower cable of a sheet of overhead power cables was found intact, while a piece of a broken conductor, torn off during the aircraft's passage, was found caught in the cabin air intake.

2) The very clear outline on the upper surface of a propeller blade of several layers of bricks on the side of a chimney.

3) A notch in a roof purlin made by a section of the blade of a working propeller.

It would appear that, at the time of the initial impact, the aircraft was flying more or less on course without bank, on the take-off heading and about 15 metres to the left of the extended runway centre line.

The bottom of the fuselage was 10 metres above the ground.

The four engines must have been running normally.

Study of the flight path

Only two points of the aircraft's flight path are known with certainty: the spot where the pilot opened the throttle, that is at the beginning of runway 26, and the point of impact

against the house at Paray-Vieille-Poste, 600 metres from the runway and in line with the centre of the left half of that runway.

Nevertheless, the information gathered during the investigation from many witnesses makes it possible to reconstruct an approximate flight path.

According to the controller on duty in the tower, the take-off was made from a point between runways 21L and 21R, about 1 500 metres from the beginning of the runway. Furthermore, a qualified witness who was on the highway believes that the aircraft flew over the latter at a height of about 30 metres. This probably represents the highest point of the flight path because witnesses had the impression that the aircraft lost altitude from that point on.

The total time which elapsed from the opening of the throttle was about 35 seconds, so that the aircraft must have flown for about 15 seconds at most. This gives some idea of the extremely narrow limits within which the event which could have brought about the accident must be sought.

Discussion

The accident occurred some 15 seconds after a night take-off which apparently entailed no special difficulties. The aircraft was relatively light (6 tonnes below the authorized maximum weight). The load sheet indicated that the centre of gravity was properly located, well within the authorized limits. The night was opaque, but, despite a slight mist, the visibility was about 2 km; the temperature was near 0° and the wind slight.

The investigation showed that, at the time of the accident, the aircraft was on course, approximately over the extended centre line of the runway, with landing gear up. The aircraft struck one of the unlighted obstructions which were in the take-off path.

It is again pointed out that the existing regulations did not require that they be lighted.

The Commission found no evidence whatever to support any suggestion of malicious intent, or of fire or explosion on board.

In the circumstances, the Commission concentrated its study on the following points:

Failure of one or more powerplants

There was no indication that either the fuel systems or the quality of the fuel was involved.

Expert examination of the engines and their accessories did not reveal any mechanical defect or faulty adjustment prior to the accident.

Examination of the propellers indicated pitches corresponding to operation with normal setting for that phase of the flight.

Tests carried out with governors showed that, most probably, the first reduction had already been carried out.

Lastly, it should be emphasized that the aircraft was well in the line of the take-off path.

Faulty operation of landing gear or flaps

The landing gear was up and locked.

There was no mechanical indication that the flaps were raised, while the position of the jacks seemed to indicate that they were down. It is probable, therefore, that they were still in the take-off position, and that, even if the order to raise them was given, there was not time to carry it out.

Malfunctioning of controls

The elevator controls were not locked for parking.

Icing of wings

The aircraft appears to have taken off within a normal distance and to have initiated its climb at the usual rate. The presence of a film of white frost on the upper surface of the extremity of each wing, which had been reported by the refuelling employees at Orly, does not seem, therefore, to have affected the take-off.

It seems improbable that this condition could have deteriorated in the prevailing weather and in so short a time, and such an assumption is contradicted by the first reduction of engine power.

Inaccurate instrument indications

An incorrect airspeed indication or a malfunctioning of the Sperry horizon can mislead the pilot.

Indeed, the pilot might be misled into easing pressure on the control column either upon seeing an airspeed reading which is less than the actual value, or upon seeing a mal-adjusted miniature, which appears to be on the flight path when the aircraft is actually coming down.

As regards the airspeed indicators, examination of aircraft I-LEAD showed that the pitot tubes and the static pressure intakes were heated at the time of the accident. Furthermore, the dynamic and static circuits of the DC-6B are protected against the risk of obstruction. Moreover, it may be assumed that if the airspeed reading had been lower than the normal value, the crew would not have been likely to reduce power.

As regards the gyro horizon, if the pilot used a badly adjusted bar which tended to cause descent, the speed must have been increased much faster than usual. At night, however, it is imperative to maintain optimum climbing airspeed during the initial climb.

Lighting failure

Several witnesses reported that they had not seen any cabin lights and the surviving passenger reported that the light was off before the impact. The investigation showed that the white lighting circuit was connected at the time of the accident.

In the circumstances, and assuming that there was a failure of the cabin and cockpit lighting, the (radium) luminescence of the dials in the DC-6B is such that the second pilot, if he had looked only inside the aircraft, should not have been inconvenienced by the disappearance of the red lighting or a failure of the white lighting, as the emergency lighting can be obtained very rapidly and the eyes of an observer who has not looked at the runway lights can accommodate almost instantly.

Nevertheless, it is necessary to bear in mind the difficulties inherent in an instrument take-off, especially when the crew finds itself suddenly and unexpectedly in these conditions.

Finally, the incident which caused the observed loss of altitude occurred during a phase of the flight, in which the numerous manoeuvres that immediately follow take-off are carried out at an extremely rapid tempo and in a sequence which requires perfect co-ordination in its execution.

Therefore, especially at night, the slightest incident occurring at this critical moment may have the most serious consequences unless immediately detected and remedied.

Conclusions

The Commission found:

- that the crew was qualified to carry out its assigned duties on this type of aircraft and on the Rome-Paris-New York route, and had had sufficient rest before leaving Rome;
- that the aircraft was used in conformity with operational regulations,

particularly with regard to load carried, load distribution and flight planning;

- that the ground installations were in conformity with the standards in force.

The Commission was unable to find any malfunctioning of the aircraft or its equipment which would make it possible to determine why the aircraft followed the observed flight path.

The Commission, therefore, believes that:

- the aircraft's slight loss of altitude soon after take-off was the main cause of the accident. There is no explanation for this loss of altitude.
- although the regulations in force were observed, the presence of unmarked obstructions in the take-off path constituted an aggravating factor;
- the initial and direct cause of the accident remains unknown.

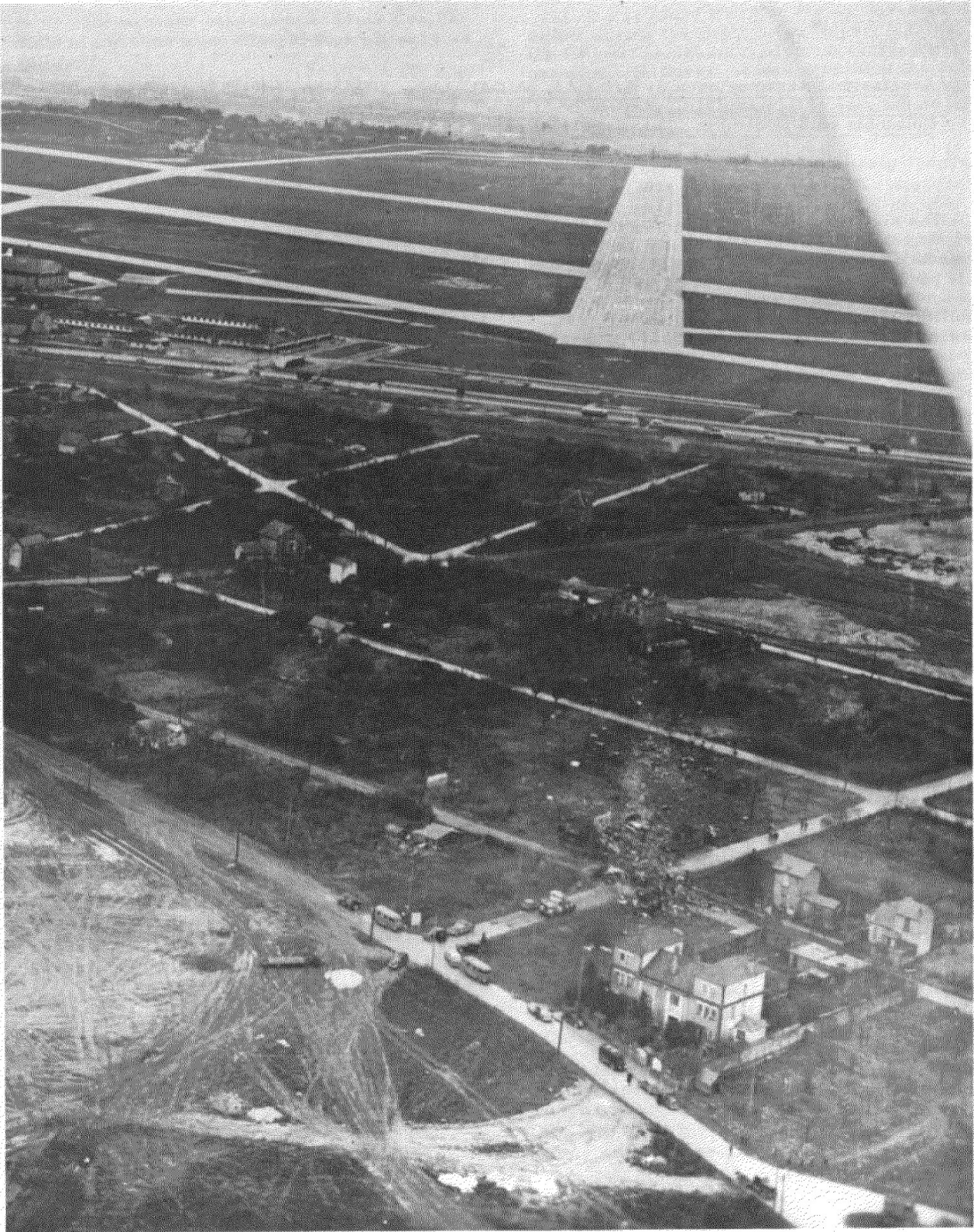


Figure 26

Wreckage area of Linee Aeree Italiane DC-6B, I-LEAD, which crashed following take-off from Orly Airport, Paris, on 23 November 1956.