No. 17

New Zealand National Airways Corporation Douglas DC-3, crashed near Paraparaumu, New Zealand, on 22 May 1954. Report of Court of Inquiry, New Zealand

Circumstances

The aircraft, engaged on a scheduled flight from Harewood to Paraparaumu, left Harewood on 22 May 1954 with two crew and twenty six passengers, (including six children and infants). While approaching Paraparaumu and at approximately 500 feet both engines cut out and the aircraft crashed in Kokutuhutu Road at 09.23 hours. The aircraft caught fire and was destroyed. Three children lost their lives.

Investigation and Evidence

The aircraft was flown by the co-pilot seated in the left seat who was carrying out command practice and the captain, who was seated in the right seat, was carrying out the co-pilot's duties.

The flight was a normal one until within a few miles of Paraparaumu. Flight had been maintained at 6,000 feet for most of the journey until, in the Cook Strait area, height was decreased to 1,500 feet due to frontal conditions, and from then on proceeded under Visual Flight Rules. On approaching Paraparaumu, and about ten miles away, height was further decreased to 1,000 feet. From this height and while still six to seven miles from the airport, the aircraft turned in towards the beach in line with Runway 03. Pre-landing drill was carried out, the engine power reduced, and the aircraft descended to 500 feet when both engines cut out simultaneously. The captain grasped the controls and throttles and found that the co-pilot had already anticipated him in trying to open up the engines. He stated that he carried out a quick cockpit check to find if anything had been overlooked in the pre-landing drill. Feeling if the fuel selectors were in position was part of this check. During this time the aircraft had come down to a very low altitude and was about to cross the beach. It had dropped to a very low flying speed and was dangerously near a completely stalled condition. At this point the engines opened up to high power, the port engine immediately, the starboard engine within a matter of seconds, and the aircraft from a stalled condition assumed a climbing attitude. It would then be below the level of the small hillocks and the trees on them at the back of the beach. From this climbing attitude the aircraft quickly rolled to its starboard side until the wings assumed a vertical position. At this point and condition the starboard wing contacted the corner of a house which carried away about 12 feet of wing. The aircraft continued on through the narrow opening between the house and the adjoining house on the south side, tearing off the top of a water tank, breaking through the boundary fence between the properties, and then demolishing about 10 feet of trellis fencing before impacting a substantial macrocarpa tree, which was uprooted. Other fairly large trees about 76 feet beyond on a bank below the trellis were broken off, and it is considered that in collision with these trees the port and starboard propellers, together with part of the front fuselage, were torn away. At this stage, it is also considered that the underside of the nose of the aircraft sustained damage, and it is likely that the top of the cockpit above the pilot positions was aiso broken, thereby facilitating the departure of the captain and the co-pilot along with the left-hand crew seat when they were forcibly ejected from the aircraft. This seat was found 15 feet in front of the port main plane, but the right-hand seat remained with the wrecked aircraft. The aircraft, following the impact with the trees, commenced a rotating movement through about 215° and, travelling a further 47 feet, brought down low tension power supply lines and a small telephone pole. The aircraft dropped to the ground in a port-main-plane-down attitude so that the initial shock was taken by the port main plane and the port tail plane. After hitting the ground the aircraft slid backwards a matter of 10 feet in an attitude where the cockpit was facing in the general direction from which the aircraft had come, the remainder of the starboard plane lay across the deep depression on the northern side of Khoutuhutu Road, and the port plane across the road at about 25°. It is clear the series of obstructions which the aircraft hit before settling on the road were sufficient to slow it down without completely wrecking it. It is considered this minimized appreciably more general physical injuries to passengers.

It was established that both propellers were delivering power when they became detached from their respective engines following impact with the obstacles.

On settling on the road, a serious fire almost immediately broke out in the area of the starboard wing root. It is considered it developed in two stages. Initial damage was caused to the starboard main petrol tank during the final crash. This damage, occurring when engines are still running and hot exhaust flames are still in existence, would eject a relatively small quantity of fuel which together with a considerable quantity of alcohol de-icer fluid and some hydraulic fluid, would originate an intense fire of short duration. The second stage, involving residues from the first stage, consumed passengers' baggage in the forward freight compartment, destroyed the cockpit structure, and ignited the cabin through the right-hand side of the forward bulkhead near the floor level. Leaking petrol coming from a broken fuel line of the port main tank added fuel to this fire, for a time, at over a gallon a minute. Subsequent examination established that neither of the engines nor any area in their immediate vicinity bore any sign of fire. The port main tank and port auxiliary with the starboard auxiliary, each containing quantities of 100 octane petrol, were neither holed nor consumed in the crash, by fire, or explosion.

The angle at which the wreckage was inclined caused the contents of the main port tank to be concentrated at the end nearest the starboard main tank. This would cover the inside of the walls of the tank nearest the fire and would provide to some degree a cooling and absorbing effect in this area. A similar effect would operate with the remaining intact tanks.

The opinion formed by the Court is that the major damage to the starboard tank, excluding the impact damage already referred to, would be mainly caused by the fact that there was no petrol in the tank. There was nothing to insulate the thin sheet metal of the tank's structure, and provided the fire continued for some time, as this did, no particularly high heat was required to melt the aluminum alloy.

A check was made of the fuel remaining in the aircraft after the fire. The fuel was pumped into 44 gallon drums and the estimated quantities were as follows:

75 gallons from the port main tank;

25 gallons from the port auxiliary tank;

35 gallons from the starboard auxiliary tank.

It was not possible to withdraw all fuel from the tanks due to the angle at which the aircraft came to rest, and also due to the baffle system in the tanks. Its angle of rest, however, was accurately determined, and a later check made to find how much fuel was not removable. In the case of the starboard main tank, which is relevant to this crash, there would remain 11 gallons. The aircraft, during the whole of its flight, would have used approximately 120 gallons of fuel. If each engine had drawn its fuel from separate main tanks, which the pilots assert was the case, this would leave approximately 50 gallons in each tank. There was, however, 70 to 75 gallons estimated as taken from the port main tank. The broken fuel pipe from this tank, found leaking after the crash, showed after subsequent tests, a leakage rate of over a gallon a minute, and it is estimated that this leakage accounted for a total of 18 gallons. This, added to 11 gallons not recoverable from the port main tank, makes a total of 29 gallons to be added to the 75 recovered. It would appear, therefore, that while from the pilot's evidence he has selected throughout the flight the starboard and port main tank respectively to each engine, this could not have been the case, due to the amount of fuel obviously remaining in the port main tank. On the other hand, the amount used from the starboard tank, if both engines were connected to this, would have sustained the aircraft approximately to the point where the engines cut out.

It was shown in evidence that the sight and feel of the selector setting is of the greatest importance, and it is a fundamental responsibility of a pilot to check the proper setting. If the click in the fuel cock is properly engaged there can be no cross-feeding. On the other hand, if the selection lever is sighted into position without the accompanying click, cross-feeding might occur. After full consideration of all relevant factors, however, it was decided that no cross-feeding occurred in this aircraft.

The sequence of events from the point where the engines cut out, the levelling of the aircraft as it crossed the beach, and the picking up of the engines immediately after this point was completely consistent with a situation where during flight both engines were operating from a starboard main tank which became deficient in fuel, the pilot changed the port selector valve to the port main tank, and the engines opened up in the fashion described by both pilots and witnesses Due to the angle of approach of the aircraft on its descent from 1,000 feet the smaller amount of petrol left in the starboard tank would run forward due to the angle of the aircraft and uncover the outlet. If, later, when the aircraft levelled out across the beach the port selector was turned to the port tank, the fuel in the port tank would pick up the port motor immediately, and either then or within seconds the remaining fuel in the bottom of the starboard main tank, due to the changed attitude of the aircraft, would again run into the outlet and the starboard engine would again be fed by fuel, causing it to open up also. This sequence of events is considered to be consistent with the sequence of trouble the aircraft experienced.

There are twenty-five cabin seats each equipped with a safety belt, eleven on the starboard side and fourteen on the port side. Three emergency exit windows having a clear area of 23 inches by 20-1/2 inches when opened are provided, one on the port side alongside seat No. 17, and two on the starboard side alongside seats 19 and 22 respectively. Each of these exits is placarded at eye level with the word "EXIT" and an indicating arrow, the placard being in red. These emergency exits are operated by a clearly indicated handle being turned and the window pushed open. The main cabin door is on the port side at the rear end of the cabin and is operated from both inside and outside by a lever-type handle with a press-button insert. Operation is by pressing the button and turning the handle. This can be done with one hand.

Probable Cause

The conclusions reached by the Court were that:

a) Either throughout the flight or a substantial portion of it both engines were drawing fuel from the starboard main tank.

b) The selector valves or valve were moved after the engines cut out, and the valves, when found and checked later, indicated a final setting of each engine to its respective port and starboard main tank.

c) The total fuel usage recorded for sixty hours of service by the engines of this aircraft prior to this flight establish that the fuel was used normally by each engine from each tank and there was no malfunctioning of the selector equipment.

d) The failure of the engines of this aircraft was due to exhaustion of fuel in the starboard main tank, to which both engines had been selected.

e) Having regard to the position and condition of the aircraft at the time of engine failure the subsequent accident to the aircraft was inevitable.

Recommendations

1. Emergency Exits

a) A clearer method of marking exits was desirable, and consideration should be given to a luminous method of marking the emergency exits which might be incorporated in the procedure of pre-take-off and pre-landing check action.

b) The information about emergency exits in the conventional folder available in DC-3 passenger aircraft seemed to have been put to no use. Not one of the passengers used the auxiliary window exits, though one at least confessed to a clear knowledge of them.

Accordingly, the Court recommended that an addition be made to the duties of a co-pilot to require him to call the attention of all passengers to the emergency exits and how to use them. In addition, he should explain the fastening arrangements of the main cabin entrance door, and also how to use it.

2. Cabin Attendant

It is not a requirement for cabin attendants to be carried on internal routes in New Zealand. While the aircraft are of the existing seating capacity and the flights between stops of such short duration it did not appear necessary to make such a provision.

3. Fire Equipment

It seemed highly desirable that the mobile fire equipment should carry an asbestos suit and/or a smoke helmet. It was considered such articles, if available, would have enabled a fireman to proceed safely into the aircraft to make a final check, or in appropriate circumstances perform rescue work on passengers.

4. Control of Small Children (Particularly before Take-off and Landing)

This was considered a difficult matter, but it was agreed that consideration should be given to the devising of a method of improving the custody and security of smaller children where necessary in the air, whether for rough air conditions, pre-landing, or take-off. It was considered that for larger children the existing belt system is both appropriate and effective.

5. Method of Check

It was recommended that the National Airways Corporation introduce an operational procedure that all pre-flight and in-flight checks carried out by the pilots be by specific verbal challenge and reply.

6. Main Cabin Door

It was recommended that some method be used whereby this door may be opened with less force than is required at present. The principle of the present door appeared satisfactory except for the fact that there was a double action required to open the door, the press button was small and stiff to operate, and the handle was also fairly stiff to turn. If the press button was enlarged in size this would make it easier to operate, and if the turning of the handle in its original form cannot be made easier, an extension of two or three inches in its length might be incorporated to give greater leverage.