No. 10

Air New Zealand Limited, Douglas DC-8-52, ZK-NZB, accident at Auckland International Airport on 4 July 1966. Summary of accident report dated 15 September 1966, produced by Accidents Investigation Branch, Department of Civil Aviation, New Zealand.

1. - Investigation

1.1 History of the flight

The aircraft was making the first take-off of a routine crew training flight at Auckland International Airport, New Zealand. Time of departure was 1559 hours New Zealand Standard Time. All five occupants were seated on the flight deck. Shortly after rotation, the starboard wing dropped, the aircraft failed to accelerate and gain height normally and side-slipped inward until the wing tip struck the ground. The aircraft then cartwheeled clockwise about the nose radome and progressively disintegrated. Initial impact took place 3 865 feet beyond the threshold and 97.5 ft to starboard of RW 23, the active runway. Geographic location: Lat. 37° 00' 36" S., Long. 174° 47' 29" E. Elevation 22 ft AMSL.

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	2		
Non-fatal	1	2*	
None			

1.3 Damage to aircraft

The aircraft was destroyed.

1.4 Other damage

None.

1.5 Crew information

The crew were properly certificated. The pilot-in-command, aged 46, held an ALTP Licence and had 17 966 hours total experience, with 497 hours on DC-8 aircraft. He occupied the right front seat and was giving the co-pilot continuation training.

The co-pilot, who was flying the aircraft from the left front seat, had some 4 200 hours total experience and 21 hours on DC-8 aircraft. The flight engineer had 4 250 hours air experience and held a DC-8 type rating.

* Supernumerary crew

The pilot-in-command and the flight engineer lost their lives; the co-pilot was seriously injured.

1.6 Aircraft information

The Certificate of Airworthiness and attendant documentation were valid at the time of the accident. Weight and c.g. were within prescribed limits. The aircraft had been properly maintained.

1.7 Meteorological information

Weather was not a factor in this accident.

1.8 Aids to navigation

Not applicable.

1.9 Communications

No distress message was received from the aircraft.

1.10 Aerodrome and ground facilities

Not applicable.

1.11 Flight recorders

A UDC Type FA542B flight data recorder installed in the radio rack on the flight deck was recovered intact and a readout obtained. It indicated a heading divergence of half a degree to port for four seconds following rotation, after which progressive divergence to starboard occurred until wing tip impact with the ground. V_r was 118 kt, maximum airspeed reached was 124.5 kt and airspeed at wing tip impact was 118 kt. No accurate determination of height was possible owing to the very narrow range of altitude involved.

1.12 Wreckage

Ground scars indicated an angle of bank of at least 40° to starboard at wing tip impact. The flight deck separated from the rest of the fuselage and came to rest inverted. Nos. 1, 3 and 4 engines separated from their pylons during disintegration. Distance from initial impact point to the point where the wreckage trail ended was 1 070 ft.

1.13 Fire

Fire broke out in the vicinity of the starboard wing root during disintegration. Fire in the hot section of No. 2 engine resulted in the rear half of the fuselage being gutted. Water and foam were successfully used to extinguish all fire. Fire did not reach the flight deck.

1.14 Survival aspects

Death and serious injury resulted from impact forces and general destruction in the flight deck area. The pilot-in-command and co-pilot were wearing shoulder and lap strap harness. The flight engineer is believed to have been wearing lap strap harness only.

1.15 Tests and research

Post-accident tests carried out by the investigative body and by the manufacturer, and involving at least three other DC-8 aircraft, showed that in some but not all cases in which an engine power lever was moved very rapidly rearward to the backstop to simulate engine failure, inertia force generated by the movement could cause the associated thrust brake lever to rise toward or enter the reverse idle detent, thereby arming the engine for reverse thrust. The pilot of the aircraft had been seen to snap the lever rearward by holding the spoiler disarm spigot on No. 4 power lever, not the knob.

1.16 Other pertinent information

Engine failure was simulated at or just after V_1. Witnesses saw the fan cascade doors in an open configuration between V_1 and V_r. The same doors were seen open at an undetermined time after lift-off.

2. - Analysis and Conclusions

2.1 Analysis

A copy of the full report analyses the evidence in detail. From the conclusions below, circumstances which precipitated the accident will be apparent.

2.2 Conclusions

Findings

1. No failure or defect was present in or occurred in the airframe, flight controls and allied systems, or instrumentation before the aircraft struck the ground.

2. Until they became dislodged at impact, all four engines were responding faithfully to commands transmitted to them through their respective controls.

3. Simulated failure of No. 4 engine was initiated by the pilot-in-command at or immediately after V_1; he moved the power lever very rapidly rearward by using the spoiler disarm extension.

4. Inertia force generated by very rapid rearward movement of the power lever caused the associated thrust brake lever to enter the reverse idle detent, thereby arming the engine for reverse thrust.

5. Arming of the engine for reverse thrust allowed the engine to exert powerful reverse thrust during initial stage of spooldown, particularly at and immediately after rotation.

6. The fan cascade doors and other reversal components became activated for reverse thrust between V_1 and V_r.

7. The co-pilot flying the aircraft was able to maintain directional control when the aircraft was on the runway largely because the nose wheel was still in contact with the ground.

8. A state of reverse thrust was not detected by any occupant of the aircraft before it became airborne.

9. The aircraft was rotated at a predetermined V_r which, however, was much below that necessary to allow the pilot to control the aircraft under the circumstances prevailing.

10. When the aircraft rotated and for some time afterward, No. 4 engine remained armed for reverse thrust.

11. Application of full left rudder after lift-off was effective in preventing a large amount of yaw, but not all yaw.

12. Thrust imbalance, coupled with loss of lift occasioned by disturbance of the air flow through No. 4 engine being in reverse thrust, induced a strong rolling moment to starboard which, with side-slip, continued until the wing tip struck the ground.

13. At no time after lift-off did the aircraft reach a V_{mca} appropriate to the thrust imbalance and angle of bank incurred; the pilot was never able to gain control.

14. Failure to accelerate and gain height were due to an increase in induced drag and loss of lift resulting from the effects of uncontrollable roll.

15. At an undetermined time after lift-off, reverse thrust was recognized and eliminated.

16. No. 4 engine was delivering no thrust at the time when it separated from its pylon.

17. After elimination of reverse thrust, insufficient time and height were available to permit recovery before the wing tip struck the ground.

18. The pilot did not misuse the flying controls or take any action which might adversely have affected the performance of the aircraft under the circumstances which prevailed.

19. If a power lever of a DC-8-52 aircraft is moved rearward very rapidly, it is possible for inertia force generated by that movement to cause the associated thrust brake lever to rise and enter the reverse idle detent and thereby arm the engine for reverse thrust.

20. Prior to the occurrence of this accident, neither Air New Zealand Limited nor the Department of Civil Aviation in New Zealand was aware from its own experience or had learned from any source elsewhere that a state of reverse thrust might result from very rapid rearward movement of a DC-8 power lever or of a power lever of similar design and mode of operation installed in other types of aircraft.

Cause or
Probable cause(s)

The primary cause of this accident was the incurrence of reverse thrust during simulated failure of No. 4 engine on take-off.

That condition arose when very rapid rearward movement of the power lever (customary only on crew training flights involving simulated engine failure) generated an inertia force which caused the associated thrust brake lever to rise and enter the reverse idle detent.

After lift-off, the minimum control speed essentially required to overcome the prevailing state of thrust imbalance was never attained and an uncontrollable roll, accompanied by some degree of yaw and side-slip in the same direction, ensued.

When the condition of reverse thrust was recognized and eliminated, insufficient time and height were available to allow the aircraft to recover from its precarious attitude before it struck the ground.

3. - Recommendations

To prevent a recurrence of an accident of this nature, it is recommended:

(1) That engine handling techniques be revised to ensure that the rate at which any power lever is moved backward is insufficient to create inertia which may cause its associated thrust brake lever to rise toward or enter the reverse idle detent; additionally, that the power lever always be held in such a manner that rearward movement of the fingers or hand does not impart a rotary motion to the knob of the thrust brake lever;

(2) That some form of mechanical protection be incorporated into the power lever/thrust brake lever system so that, should the measures recommended in (1) above not be adhered to, incurrence of unwanted reverse thrust will be rendered impossible.

Training
Take-off
Loss of control
Power plant - engine control system

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