WP. 22

CIVIL AVIATION AUTHORITY
AIRWORTHINESS DIVISION

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INCIDENT ANALYSIS REPORT

OCCURRENCE NO.	82/01926
CAADRP NO.	

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Incident Analysis Report No 8	
Titler- B747 Engine Failure on Take-off due birdstrikes. Melborne 11.7.82	
Issue 1	Date July 1982

1. Summary

The B747-136 aircraft flew into a number of birds between 54 and 97 ft AAL causing the starboard inner (No 3) engine to run down and the outer (No 4) to produce reduced power. The Vibration measuring equipment (VME) showed the levels on No 4 to be within limits so the decision was made to keep it running until after touchdown.

Inspection after landing showed evidence of birdstrikes on both of these engines and consequently both were replaced. The birds were racing pigeons (Columba livia) which weigh about 250 grams and had been released nearby.

2. Captains Report

On raising gear a loud bang occurred followed by E/O calling engine failure. Engine fire drill executed for No 3 engine, No 4 engine showed high VME reading but I decided to keep it running as readings within limits. Co-pilot landed the aircraft without further incident. Fire services were requested and No 4 engine shut down at end of landing run. No mention on ATIS of bird activity but this was observed on arrival 4 hours previously.

3. Flight Engineers Report

At approx 500 ft AGL after T/O from Melbourne, with graduated T/O power (1.34 EPR) set, there was a loud bang, No 3 Engine was seen to be running down, and No 4 engine V.M.E. Light began to flash. The max E.G.T. observed on No 3 engine was 958°C, before engine fire drill carried out. When power was reduced on No 4 engine, the VME readings reduced, so the decision was made to keep No 4 engine running until after touchdown.

Evidence of birdstrike found on both engines. All drills carried out in accordance with flight manual.

4. Station Engineers Report

No 3 engine nose cowl and fan blades extensively damaged. EGT max indicator 1001°C, No 3 engine and nose cowle to be changed.

No 4 engine, nose cowl, fan blades and fan case extensively damaged. Boroscope to 8th and 15th compressors carried out, minor damage found. No 4 engine and nose cowl to be changed on advice from LHR.

(Authors note:- It is believed that 3 or 4 birds were ingested into No 3 and 2 or 3 into No 4).

5. Aircraft Data

5.1 The aircraft was a B747-136 which was being operated at the low take-off weight of 209 tonnes due to the short, 450nm sector. This enabled the crew to use a graduated (reduced) power setting for the take-off run. This was set at 1.34 EPR against the approximate maximum available of 1.44 EPR.

5.2 At 209 tonnes, using 10° of flap and the graduated power levels, the scheduled speeds and pitch attitudes for a temperature of 16°C at sealevel are:-

V_1	115 KCAS
V_R	121 KCAS
V_2	139 KCAS
V_4	149 KCAS
PSCHED (4 Eng)	18°
PSCHED (3 Eng)	16°

Contd ....

6. Flight Recorder Analysis

6.1 The FDR trace for the incident is shown in Figure 1.

6.2 The aircraft was rotated at 127 knots (V_R+6) and lifted off at about 145 knots (V_2+6), some 33 seconds after the start of roll.

6.3 Speed built up to 160 knots (V_2+21 or V_4+11) in the next seven seconds, by which time the aircraft was between 54 and 97ft AAL with the gear retracting. The pitch attitude was approaching 16° nose up, the three engine scheduled pitch attitude.

6.4 At this point the No 3 EPR's drop from 1.301 to 0.964 within one second and No 4's fall from 1.316 to 1.225. Some 50% of available rudder was instantly applied and the aircraft continued on the runway heading.

6.5 The airspeed dropped to a minimum of 150 knots (V_2+11) over the next seven seconds, when the crew closed the throttles on No 3. During this time the nose was lowered to 10° and subsequently the speed built up again aided by No 4 engine's increasing thrust, as seen from the change in EPR from 1.225 to 1.290.

6.6 The average rate of climb from engine failure to 1500ft was 1000ft per minute, with a maximum and minimum of 1350 and 800 FPM respectively.

6.7 At no time did the crew select maximum take-off power on the two undamaged engines, probably due to the very low weight, and during the short circuit flap was kept at 10° (except for the landing). The maximum speed seen was 208 knots and the circuit was flown at 2000ft AAL.

6.8 The subsequent landing after a short circuit was at well below the maximum landing weight of 265 tonnes without the need for any fuel to be dumped.

Time → Seconds
Pitch Attitude
Target
3 Deg.
Control Column
Pitch
Roll
Longitudinal Acceleration
Airspeed
V_2+70
V_2
V_A
Rotation
Unstick
Failure
Normal Acceleration
Airspeed
Engine EPR's
No 3
No 4 EPR
Throttle Closed
Pressure Altitude
Heading
Rudder
Gear Retraction
10° Flap
22° max
Final Datum

FIGURE 1