

Gusty Winds Cause a Tail Strike in London

The aircraft was on a scheduled flight from London Heathrow Airport to Perth Airport in Australia. Following a normal engine start and taxi, the aircraft was cleared for takeoff

for an approach to Runway 27L at Heathrow, where an overweight landing was made.

This is accompanied by an aural warning and master caution light being presented in the cockpit.

Tail Strike Protection System

Recorded Information



Figure 1

from Runway 27R with the surface wind reported as 220° at 28 kt gusting 44 kt. Acceleration was normal in the strong wind and, at VR of 172 KIAS, the PF initiated a rotation which was coincident with a strong gust. Shortly after becoming airborne, the EICAS tail strike message was displayed. The crew elected to hold to the southwest of Heathrow at 6,000 ft whilst they carried out relevant actions from the Quick Reference Handbook (QRH), which prevented aircraft pressurisation and prepared to return to Heathrow. The aircraft was then radar-vectored

The Boeing 787 is fitted with a tail strike protection system that automatically adjusts the position of the elevators so as to reduce the potential for tail contact with the ground during takeoff and landing. The system does not degrade takeoff performance. Tail strike detection and alerting system Tail strike detection is provided by a 2" blade sensor fitted to the rear lower fuselage of the aircraft (Figure 1). If the electrical circuit within the sensor is compromised due to contact with the ground, a tail strike caution message is displayed on EICAS after five seconds.

Flight data was available from the aircraft's Continuous Parameter Logging (CPL)¹ system and FDR. Parameters included the aircraft's airspeed, the position of its wing spoilers, cockpit control columns and wheels, and pitch rate and tail height (which indicated the distance between the tail strike detection sensor and the ground). The aircraft manufacturer advised that due to factors including aircraft loading and runway slope, the tail height parameter may not always reach zero when the aircraft tail contacts the ground.

The aircraft was correctly configured for takeoff, with the flaps set to five, and VR was 172 kt. The data showed that during the takeoff run, there were airspeed fluctuations consistent with the gusty wind conditions. Upon reaching an airspeed of 160 KIAS, the airspeed rapidly increased to 175 KIAS, at which point the PF initiated the rotate (Figure 3 - Point A)

As the aircraft pitched up, the airspeed reduced to 172 KIAS, where it briefly stagnated (Figure 3 - Point B). The PF had progressively moved the control column aft to 4° (Figure 3 - Point C)

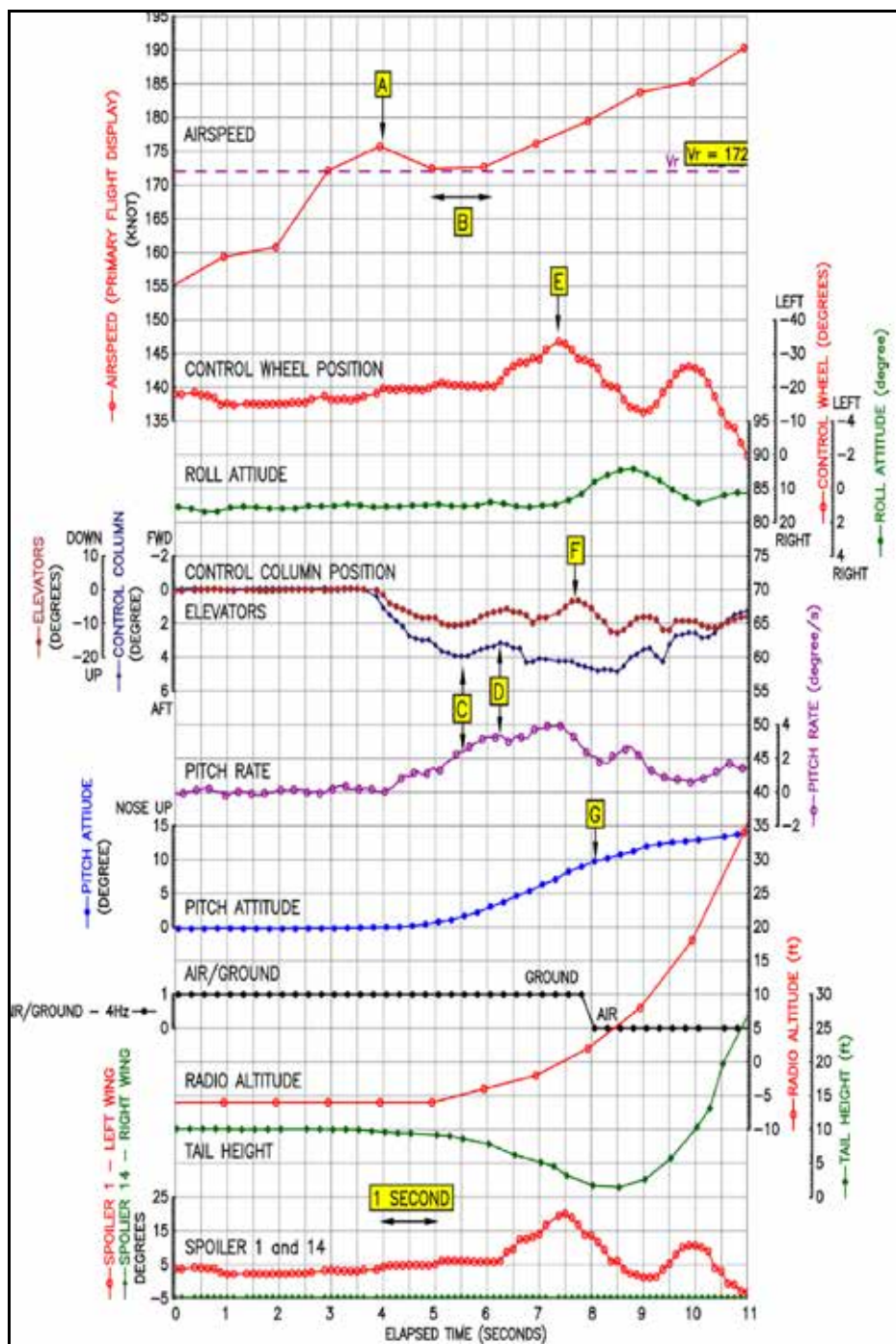


Figure 3
Salient flight data parameters

at which point the pitch rate was just over $2^{\circ}/s$; the maximum aft movement of the control column was 9.8° . The control column was then moved slightly forward (Figure 4 - Point D) to 3° , but the pitch rate increased to $3.2^{\circ}/s$. The airspeed then started to increase, which coincided with the PF pulling back on

the control column whilst also moving the control wheel from 20° counter-clockwise (CC) to 33° CC (Figure 3 - Point E). This caused the left spoilers to further deploy from 5° to 20°

As the pitch attitude increased through 6.3° nose-up, the pitch rate was nearly

$4^{\circ}/s$, and the calculated tail height above the runway was 4.5 ft. The aircraft's tail strike prevention system then started to move the elevators (Figure 3 - Point F), which reduced the pitch rate to just over $2^{\circ}/s$. The pitch attitude at takeoff was about 9.7° (Figure 3 - Point G) and the tail height indicated just less than 2 ft.

The aircraft manufacturer analysed the FDR and CPL data and stated: 'The near tail contact was the result of a combination of factors including: high pitch rate close to lift-off, airspeed stagnation, and control wheel usage deploying spoilers on the left wing. The high pitch rate allowed pitch attitude to increase towards the tail contact attitude prior to airspeed reaching lift-off speed. The deployed spoilers on the left wing decreased lift and necessitated a higher pitch attitude for lift-off.'

Analysis

The aircraft was being operated within its weight, CG and wind limitations for the takeoff. The weather conditions created strong gusting winds which, just before the point of rotation, rapidly increased the aircraft's airspeed from 160 KIAS to 175 KIAS. The initial pitch rate of $2^{\circ}/s$ increased to $3.2^{\circ}/s$ and then $4^{\circ}/s$, when the tail strike prevention system activated and reduced the pitch rate to $2^{\circ}/s$. The lateral control wheel inputs caused the left spoilers to deploy from 5° to 20° , decreasing the lift. The combined effect was that during rotation, an increase in aircraft pitch angle with the main landing gear wheels still on the runway, led to the tail contact angle of 9.7° being reached and the crew receiving an EICAS tail strike message. Having been alerted to the tail contact by the EICAS message, the flight crew actioned the QRH and prevented the aircraft pressurising. After holding, the aircraft was flown to Heathrow in accordance with the checklist