INCIDENT

Aircraft Type and Registration:	Boeing 747-412, 4X-ELS
No & Type of Engines:	4 Pratt & Whitney PW4056 turbofan engines
Year of Manufacture:	1992
Date & Time (UTC):	10 January 2006 at 1220 hrs
Location:	10 miles East of London Heathrow Airport
Type of Flight:	Public Transport (Passenger)
Persons on Board:	Crew - 15 Passengers - 450
Injuries:	Crew - None Passengers - None
Nature of Damage:	None
Commander's Licence:	Not known
Commander's Age:	Not known
Commander's Flying Experience:	Not known
Information Source:	AAIB Field Investigation

Synopsis

During an ILS approach to Runway 27R with the autopilot engaged, the aircraft descended to 1,200 ft altitude at about 8 nm from the runway threshold. The flight crew recovered the aircraft to the ILS glidepath manually and landed normally. Investigations revealed no fault, either on the aircraft or in the ground equipment, to explain the incident.

History of the flight

On arrival in the London area, ATC directed the aircraft towards an ILS approach to land on Runway 27R at Heathrow, and the crew prepared for an approach using the autopilot. The visibility was good below a cloudbase of about 1,500 ft. The flight crew established the aircraft on the localiser in level flight at 4,000 ft and were instructed to descend with the glideslope. At about 14 nm from touchdown, the autopilot captured the glideslope and the aircraft began a descent.

The flight crew reported that after a short time, they identified that the glideslope indications were showing progressively greater 'fly down' commands, and the autopilot was attempting to pitch the aircraft's nose down to follow these indications. Seconds later, the glideslope failure indication appeared, and the EICAS[1] caution message 'NO AUTOLAND' was displayed to both pilots. The co-pilot (who was PNF) asked ATC whether there was a fault with the glideslope but congestion on the frequency and a misunderstanding rendered the communication ineffective.

Footnote

[1] Engine Indication and Crew Alerting System

The ATC controller communicating with the aircraft noticed the aircraft's unusually low altitude as it passed about 1,600 ft, and instructed the aircraft to climb, reassuring the flight crew that the glideslope was serviceable.

The aircraft reached a minimum altitude of about 1,200 ft at about 8 nm from touchdown and the maximum rate of descent had been in the order of 1,800 ft/min. The commander (who was PF) disconnected the autopilot and climbed the aircraft to 1,800 ft. With the glideslope indications then looking reasonable again, and no failure indications, the commander armed the autopilot to capture the glideslope, and it did so. A successful autopilot approach was completed and the landing was accomplished manually.

The flight crew passed a message to ATC as they taxied the aircraft towards its parking stand, explaining that the glideslope had fluctuated. Controllers asked subsequent landing aircraft whether they had perceived any problem and none had. No other landing aircraft reported any difficulties during the minutes preceding and immediately following the incident.

Ground Proximity Warning System (GPWS)

Had the aircraft continued its descent at 1,800 ft/min, approximately 18 seconds prior to ground impact the crew would have received a synthetic voice warning of "SINK RATE". Approximately 9 seconds before impact they would have received a synthetic voice instruction to "PULL UP".

Reporting

The incident was reported by ATC at the airport as a 'Level Bust'; the flight crew did not submit an incident report although they did complete the necessary entry in the aircraft's Technical Log. The AAIB did not become aware of the incident until some weeks after its occurrence. By that time the aircraft's Flight Data and Cockpit Voice Recorders had overwritten the incident flight.

Ground equipment

The air traffic service provider at London Heathrow also maintains the airport's navigation aids. The ILS equipment for each approach is self-monitoring with backup systems which activate rapidly should a fault occur in the active system. Electronic logs are kept of any faults or failures. The relevant logs showed no faults of failures on the day of the incident.

Engineering investigation

After arrival at London Heathrow the aircraft's central maintenance computer was interrogated and a report of any faults recorded during the flight was retrieved. This revealed the following fault:

'C 221000100
D 2287310JAN0612162211
Q L205 R205'

The above gives a fault code '22873' that was recorded on the 10 Jan 06 at 12:16 hours and relates to the ATA 100[2] code 2211. The Fault Isolation Manual (FIM) indicates that the code '22873' relates to an 'ILS BEAM ERROR (FCC[3])' and that no action is required by maintenance staff. Further discussions with the aircraft manufacturer revealed that this code is an indication of a loss of the external ILS signal and that the additional diagnostic codes of 'L205 and R205' indicate that the

Footnote

[2] ATA 100 coding is an international numbering standard for aircraft manuals that relate to aircraft systems. For example, ATA code 2211 relates to autopilot systems.

[3] Flight Control Computer (FCC).

fault was generated by a glideslope beam error that was detected by both the left and right ILS receivers. For these faults to be recorded, the glideslope must have already been detected and captured, followed by an error with the glideslope beam. Purposely flying below the glideslope after it has been captured does not generate these fault messages.

The loss of the glideslope beam, following its capture whilst in approach mode and with the autopilot engaged and the flight director ON, results in the flight director bars biasing out of view and an amber line through the glideslope mode indication on the primary flight display, coupled with a caution message on the EICAS.

A review of technical log entries made before and after the incident flight, which were made available to the AAIB, revealed several occurrences of 'NO LAND 3' messages, either during approach or shortly after landing. The information provided with the technical log reports does not indicate what the cause of the messages was; however, it did reveal that the FCCs were swapped on two occasions (left for centre and later right for centre), the left ILS receiver was replaced and the go-around switches were suspected as being faulty during troubleshooting. It is not known if the faults that generated the 'NO LAND 3' messages were related to this incident. The other significant defect that was reported over the period of December 2005 to February 2006 was an intermittent fault with the heading select switch on the autopilot mode select panel.

Conclusion

The available evidence suggested that an error in the glideslope signal arriving at the aircraft was sensed by both FCCs after the autopilot captured the glidepath. However, monitoring equipment on the ground showed no fault and no cause could be found for the error recorded on board the aircraft.

The AAIB is not aware of any similar incidents immediately before or after this event. Consequently, based on the available evidence, the problem was either external to the aircraft but experienced only by 4X-ELS, or an unidentified internal fault within the aircraft. However, the lack of recorded flight data and the inability to evaluate the aircraft soon after the incident rendered further investigation impracticable.

In this incident, the risk was minimal because visibility below the 1,500 ft cloud base would have permitted the flight crew to gain visual contact with terrain in good time to avoid any Controlled Flight Into Terrain (CFIT) hazard. Had the cloud base been lower, the aircraft's GPWS should also have provided a timely warning of proximity to the ground.