

BULLETIN ADDENDUM

The following information was included in the original bulletin.

No: 8/92

Ref: EW/C92/4/8

Category: 1a

Aircraft Type and Registration: BAe ATP, G-PEEL

No & Type of Engines: 2 Pratt and Whitney 126 turboprop engines

Year of Manufacture: 1990

Date & Time (UTC): 19 April 1992 at 1942 hours

Location: Liverpool Airport

Type of Flight: Scheduled passenger

Persons on Board: Crew - 4 Passengers - 29

Injuries: Crew - None Passengers - None

Nature of Damage: Nose gear collapsed; nose gear door torn off; abrasion to underside of nose and damaged tips on the right propeller

Commander's Licence: Airline Transport Pilot's Licence

Commander's Age: 45 years

Commander's Flying Experience: 10,528 hours (of which 1,410 were on type)
Last 90 days - 112 hours
Last 28 days - 28 hours

Information Source: AAIB Field Investigation

Summary

Shortly after take-off from Liverpool, when the first-officer had raised the landing gear lever, there was a loud 'thump' from beneath the flight deck. The gear was then re-cycled. The main gear legs locked down, and up, but the nose gear indication remained red throughout the cycle; the gear was then selected down and the nose gear position light remained red. The appropriate drills for hydraulic overheat and emergency lowering of the landing gear were completed, but the nose gear remained unlocked. The commander decided to land at Liverpool and asked for full emergency services standby.

He elected to burn-off fuel and to land on runway 09 from a visual approach. Whilst the commander held the nose gear off the runway, the first officer simultaneously shut down both engines, activated the engine fire extinguishers and switched off the batteries. The commander held the nose wheel off for several additional seconds before lowering it gently onto the runway. However the nose leg collapsed forwards almost immediately and the underside of the nose contacted the runway. The emergency services arrived within seconds and used foam to cool the underside of the nose. All the passengers were evacuated through the left forward exit door after the escape slide had inflated. There were no injuries. Some time later the passengers' baggage was removed from the aft baggage compartment. The girt bar of the rear right escape slide was not disconnected from the floor brackets before this door was opened and the associated escape slide inadvertently deployed. After deployment it was noted that this slide terminated about 3 feet above the runway

AAIB Bulletin 8/92 contained detailed information on the causes of the nose landing gear collapse and of the corrective actions since taken. That Bulletin stated that JAR 25, to which the aircraft was certificated, requires that "Each aeroplane emergency exit.....more than 6 feet from the ground.....must have an approved means to assist the occupants in descending to the ground as follows:.....It must be of such length after full deployment, that the lower end is self supporting on the ground and provide safe evacuation of occupants to the ground after collapse of one or more legs of the landing gear." (JAR 25.809.f.1.iii). The Bulletin also stated that the discrepancies between the slide certification demonstration and the actual slide deployment on G-PEEL were reported as 'complex' and that the AAIB would monitor resolution of this problem so that associated information could be published in an Addendum.

Supplementary information

The Certification Process

To achieve certification, the door sill height applicable to a collapsed nose landing gear was assessed by calculation, using normal oleo compression and assuming nil damage to the aircraft. This height was calculated to be 110 inches. The slide manufacturer constructed a test rig which could be raised to various sill heights, and which accurately represented the aircraft fuselage and door geometry. The slide was then demonstrated to the French DGAC and shown to meet the requirements of JAR 25.809, i.e. that the slide should be self supporting on the ground and provide safe evacuation at normal and maximum sill heights. The DGAC certificated the slide and the CAA and FAA validated that certification. However the certification test rig, as approved, had made no allowance for the deck angle which occurred in such actual conditions - ie 7° nose down with the nose gear retracted. This angle had the effect of raising the rear edge of the slide by between 3 and 4 inches and lowering the front edge by a similar amount. It was also noted that this method of demonstrating compliance with the requirements of JAR 25 had also been used in certifying slides manufactured for the Airbus A320.

Trials

Following the accident, the slide was removed from G-PEEL and returned to the slide manufacturer. It was then fitted to the test rig which had been used for certification and found to extend to within a few inches of the ground at the calculated 110 inch sill height, with only slight weight required to make it self supporting. The angle of the slide in this attitude was some 55°, as closely as could be measured at the time. (JAR 25.809 does not specify any maximum angle for deployed slides). The rig was checked dimensionally and compared with G-PEEL and several production aircraft, but no significant differences were found. BAe conducted detailed analytical work which showed that the slight damage to the nose sustained in the accident and a greater than nominal oleo extension could have combined to result in the sill height increasing significantly beyond that previously calculated, resulting in the slide not reaching the ground. The calculations also showed that it was quite possible that a greater oleo extension might have occurred, increasing the gap considerably. In addition, it was considered that dimensional tolerances on the slide itself appeared to have an effect, and the 7° deck angle would have tended to make the slide appear higher.

As a result of this work, BAe have now assessed the likely sill height in this kind of event as being 117 inches. At this sill height, the slide angle is 56° 'free-floating' and 66° once the slide has been deflected to the ground. A trial was conducted of the slide at this height; it was claimed that this demonstrated 'reasonably safe evacuation' under these conditions.

Advice to Manufacturers

As stated above, JAR 25.809 required that the slide should be self supporting on the ground (but with no specified maximum angle for a deployed slide) in the event of any one, or more, of the landing gears having collapsed. No Advisory Circulars, Joint (ACJs) material exists, but there are several other documents which provide some guidance. Current industry practice is to assume nil structural damage, level ground and nominal oleo extensions when calculating sill heights for evacuation purposes.

Safety Recommendations

As a result of these findings, the AAIB has made the following Safety Recommendations:

92-90 The CAA, in consultation with the JAA and FAA, should review the advice available to manufacturers on evacuation slide certification with a view towards issuing revised material, additional to current industry practice, for the high sill height cases. This new material should take account of likely combinations of structural damage and oleo extension after the collapse of one or more legs of the landing gear to ensure that such slides provide a safe means of evacuation, with acceptable maximum slide angles.

92-91 The CAA, in consultation with the JAA and FAA, should re-examine existing aircraft/slide configurations to determine whether, in the event of the likely conditions arising from the collapse of one or more legs of the landing gear, the safe evacuation requirements of JAR/FAR 25.809 can be met.