ATR42-300, G-ORFH

AAIB Bulletin No: Ref: EW/C2000/02/02 Category: 1.1

Aircraft Type and Registration:	ATR42-300, G-ORFH
No & Type of Engines:	2 Pratt & Whitney PW-120 turboprop engines
Year of Manufacture:	1993
Date & Time (UTC):	5 February 2000 at 0721 hrs
Location:	Teesside, County Durham
Type of Flight:	Public Transport
Persons on Board:	Crew - 3 - Passengers - 18
Injuries:	Crew - None - Passengers - None
Nature of Damage:	Damage to engine bay door, wing, fuselage and sponson
Commander's Licence:	Airline Transport Pilot's Licence
Commander's Age:	34 years
Commander's Flying Experience:	4,300 hours (of which 4,000 hours were on type) Last 90 days - 100 hours Last 28 days - 30 hours
Information Source:	AAIB Field Investigation

Flight

The aircraft was on a scheduled passenger flight from Teesside Airport to Paris. Following take-off from Runway 23 at Teesside at 0719 hrs, the cruising altitude of 19,000 feet was reached around 20 minutes later, with all flight deck indications remaining normal. At this point the flight deck crew was informed by the cabin crew member that a passenger had reported a panel missing from the No 1 engine. The cabin crew member also noted that she had heard a noise during take-off, which she had attributed to movement of baggage in the aft compartment.

The flight deck crew could see from the flight deck that part of the No 1 engine outboard cowl door was broken off and decided to return to Teesside. They informed ATC of a slight technical problem and were radar vectored back to the airport, limiting the airspeed to 180 kt to minimise the possibility of additional damage. The crew declined to declare an emergency but ATC placed the airport emergency services at local standby. During final approach the crew spotted a panel on Runway 23, near its threshold. The aircraft overflew the panel and landed without further incident. A cowl door and a number of pieces of smaller debris were found on the runway near to the point at

which G-ORFH had started its take-off run. No other aircraft had operated from the runway between the time of G-ORFH's take-off and landing.

Component Description

The ATR42 is a high-winged twin-engined monoplane. Two sponsons, fitted one each side of the lower fuselage, house main landing gear bays and aircraft services, including hydraulic reservoirs.

The engines are mounted on sub-frames projecting forward from the wings. The engine bays are covered with an inboard and an outboard cowl door, each approximately 3.2 feet wide and 3.5 feet high, measured circumferentially (0.97 x 1.07 metres), and weighing approximately 15 lb (6.8 kg). The doors are of bonded sandwich construction, with carbon fibre composite skins and a nomex honeycomb core. They are each mounted on two hinges attached to a longitudinal beam fixed along the top of the engine bay and can be propped open on a telescopic stay. Each door is secured closed by two hook-type latches at its lower edge and by two bolt-type latches, one at its forward edge and one at its aft edge. The hook latches contain a hook, operated by an overcentre linkage, that engages in an adjustable latchplate fastened to the fixed lower cowl. An interlock mechanism is intended to prevent the latch from being closed unless the hook has been correctly located in the latchplate. The bolt latches contain a shoot bolt that engages in a latchplate fastened to fixed engine bay members. Both types of latches are operated by a pivoted handle which is locked with a spring-loaded catch.

When unfastened, the latch operating handles are rotated by spring loading to a position where they stick out approximately perpendicular to the door. With the aircraft parked, the hook latches are approximately 8.5 feet (2.6 m) above ground level and the bolt latches are 1.5 feet (0.5 m) higher. Securing a door closed is done by lowering it and closing each latch handle until the catch engages. No flight deck indication system to warn of unlatched cowl doors is provided.

Aircraft History

G-ORFH's home base was at Newcastle Airport. It arrived at Teesside Airport at 1725 hrs on the day prior to the accident and a Licensed Aircraft Engineer (LAE) employed by the operator and based at Newcastle immediately commenced a routine Weekly Check of the aircraft. He completed it at 1845 hrs.

The Check was carried out after dark on the apron in front of the terminal building. The weather was good, not particularly cold or windy and with no precipitation. Apron illumination was provided by high-level sodium lights mounted on standards positioned around the edge of the apron and by other similar lights mounted on a hangar located at the east end of the terminal apron. The aircraft was parked heading approximately 45° left of the normal to the apron edge and therefore had both the main line of lights and the hangar mounted lights on its right hand side.

The LAE co-operated fully with the investigation and gave the impression of being well motivated and professional, with a commitment to quality. He had been licensed for ATR42 line maintenance for 2 years. His duty was organised in a pattern of 4 consecutive dayshifts, nominally 1000-2200 hrs, followed by 4 days off. When he conducted the Check he was working the third day of the pattern. He had started work at 1200 hrs, feeling adequately rested, and the work period prior to the Check had not been excessively busy. He had felt under no pressure to complete the job quickly, particularly as the aircraft had not been due to conduct its usual evening mail flight and

had therefore not been due out until the following morning. He reported that there had been no unusual distractions.

The powerplant inspections included in the Check required the inboard and outboard cowl doors of both engine nacelles to be opened. The LAE worked across the aircraft, starting with the left cowl door of the No 1 engine. He gained access to the nacelles using an 'A-Frame' type stepladder carried in the van that he had brought to the aircraft. A wheeled access platform was available, positioned at the edge of the apron, which provided better and more secure access than the stepladder. The mechanic used the stepladder in preference because he had it immediately available in the van and found it quite adequate, and because he had found the brake on the access platform difficult to engage and release. His normal practice, having opened a cowl door, conducted the required inspections and released the door stay, was to support the door while descending the stepladder far enough to allow the door to hinge closed past his head and then to fasten the door latches. He believed that he had carried out these actions normally in this case.

The next morning the captain of the accident flight crew carried out a pre-flight walk-round inspection, at 0650 hrs, before daybreak, using a torch. He believed that all engine bay doors had been flush with the surrounding panels although, because of their height above ground, he was not able to confirm that the latches were engaged.

Aircraft Examination

Examination showed that the panel recovered from the runway comprised the lower three-quarters of the left cowl door of the No 1 engine bay. A generally longitudinal fracture had separated this portion from the remainder of the door, which remained attached to the door hinges. The fracture was consistent with the effects of gross overload. The fasteners attaching the longitudinal beam on which the door hinges were mounted had failed due to overload, and the beam had pivoted around the right door hinges. The right door remained attached by its latches and retained the beam. The left door was reportedly found with the forward and lower latch operating handles open and the aft latch with its operating handle and spring-loaded catch closed. Localised impact damage to the engine mount frame was found.

Aircraft examination showed that the detached portion of door had struck the airframe in a number of places, resulting in the following damage:-

- A 5 inch split in the left wing leading edge, inboard of the No 1 engine.
- Shattering of the outer pane of the left No 7 cabin window and damage to the inner pane.
- Scrape damage to the fuselage left side below the left No 10 cabin window.
- Impact damage to the left sponson hydraulic reservoir access door. The composite material was sliced, causing the catch to open and the door to tear off its hinges. The door was retained by its bonding strap.
- Minor impact damage to the left hydraulic reservoir filler cap.
- Battering damage to the left sponson composite fairing by the detached hydraulic reservoir access door.

Detailed examination revealed no evidence that the door or its latches or latchplates had been defective or damaged before the door portion broke off. Markings found did not conclusively indicate that any of the latches had been fastened with its hook or bolt incorrectly located relative to the respective latch plate. Checks on the similar door installation on the No 2 engine suggested that such a condition would be difficult to achieve, and would leave the lower part of the door standing significantly proud of the adjacent nacelle fixed panels. This was also the case when the door was allowed to hinge down but remain unlatched, and in this event further visual cues were provided by the operating handle of each latch sticking out from the door.

Previous Cases

No evidence was found that previous similar cases of engine bay door loss from the ATR42 had occurred. However, the accident closely followed the loss of a fan cowl door from a UK registered Airbus A320 at rotation while taking-off from Gatwick Airport (G-VCED, AAIB Bulletin 7/2000). Damage to the powerplant, engine pylon, wing, slats, flaps, fuselage and fin resulted. Available information indicated that at the time there had been at least 7 previous cases of fan cowl door loss from A319, A320 or A321 aircraft, over the period 1992 to 1999, that had been attributed to inadvertent failure to latch the doors. The loss generally occurred at take-off rotation. In the year since the accident, reports indicate that there have been 4 further similar cases.

Discussion

The evidence indicated that the left door of the No 1 engine bay had not been restrained by its latches and had hinged open under the influence of the propeller slipstream when engine power had been increased at the start of the take-off run. Aerodynamic loads on the door had failed the door mounting beam fasteners and fractured the left door. No failure of the door latches had occurred and no reason was found for them to have disengaged, and there was apparently no history of such occurrences. The possibility that they had been incorrectly engaged could not be totally dismissed, but appeared to be unlikely. The most likely cause of the failure therefore appeared to be that the door had inadvertently not been latched following the Weekly Check, and that this had not been noticed during the pre-flight walk-round inspection. Such a condition could be expected to generally be quite noticeable, with the door standing somewhat proud of the surrounding panels and the latch handles protruding. However, both the Check and the inspection were conducted in the hours of darkness, with the aircraft positioned such that the door would have been shadowed from the apron lights, which could have caused an element of dazzle when viewing the left side of the aircraft.

Recommendations

The damage to the airframe in this case was not severe but was extensive and the potential for more serious consequences existed. This was particularly the case as the aircraft had been reconfigured and climbed to an appreciable altitude by the time the crew was first made aware, by passengers, that it had sustained damage on take-off. Additionally, the door debris posed a hazard to other aircraft operating on the runway. These were also common features of the referenced cases of fan cowl door loss from Airbus aircraft. While a number of access doors on modern aircraft are instrumented to provide flight deck warning if they are unlatched, this is not generally the case for engine cowl doors, although the latter are relatively large and can detach violently if left unlatched and cause extensive damage. The following recommendations have therefore been made:

Recommendation No 2001-29

It is recommended that the operator review its procedures and working practices aimed at ensuring that all aircraft access doors are correctly latched before flight.

Following investigation and analysis of the incidents involving Airbus aircraft previously referred to, the AAIB made the following Recommendation (No 2000-30) in 2000, AAIB Bulletin 7/2000.

Recommendation No 2000-30

It is recommended that the JAA and the FAA consider a requirement for future aircraft certification for a system to provide flight deck warning of all unlatched access panels or doors that could hazard the aircraft if left unfastened (a similar AAIB recommendation (No 2000-30) was made in 2000, reference AAIB Bulletin 7/2000).

Response to this Recommendation is still awaited.