

Airbus A320-231, G-OOAB

AAIB Bulletin No: 12/98 **Ref: EW/C98/6/8 Category: 1.1**

Aircraft Type and Registration: Airbus A320-231, G-OOAB

No & Type of Engines: 2 International Aero Engine V2500-A1 turbofan engines

Year of Manufacture: 1992

Date & Time (UTC): 26 June 1998 at 2303 hrs

Location: Bristol Airport

Type of Flight: Public Transport

Persons on Board: Crew - 7 - Passengers - 179

Injuries: Crew - None - Passengers - None

Nature of Damage: Scrape damage to underside of aft fuselage and drain masts

Commander's Licence: Airline Transport Pilot's Licence

Commander's Age: 34 years

Commander's Flying Experience: 5,100 hours (of which 2,421 were on type)
Last 90 days - 220 hours
Last 28 days - 83 hours

Information Source: AAIB Field Investigation

History of flight

The commander was at home on standby when he was requested to report for a flight to Heraklion because the first officer scheduled for the trip was unwell. The airline has a policy of qualifying all its Captains to operate as non-handling pilot in the co-pilot's seat once they have been 'on the line' for six months. If they occupy the right hand-seat but are not qualified as a training Captain, then Captains are not permitted to act as handling pilot except in an emergency. Consequently, the commander expected to operate as a non-handling co-pilot for both legs but, because it was going to be a 'long night', the Captain scheduled to command both flights offered to share the flying. This was to be achieved without infringing company policy by exchanging seats for the return flight and the Captain who was on standby was offered the choice of outbound or inbound sector. He chose the outbound sector and thus became the commander for that sector.

The aircraft was full and loaded to 73.1 tonnes for a CONFIG 3 take-off (slats 22° flaps 20°) from Runway 27. The weather was: wind 210°/9 kt, visibility 30 km, cloud scattered at 300 feet and broken at 500 feet with QNH 1006 mb. The take-off speeds of V1 127 kt and VR/V2 of 139 kt were calculated and set for a TOGA (full power) take off. The take-off roll was normal and these speeds were called by the Captain who was acting as co-pilot. The commander rotated the aircraft and shortly afterwards felt a bump. At first, both pilots thought that the rotation rate had been normal and that they had encountered turbulence but within a minute the senior cabin crew member made her way to the flight deck. She reported that the cabin crew at the rear of the aircraft were convinced that the tail had struck the runway on take-off because they heard and felt the impact.

The Captain performing the co-pilot's role suggested that they ought to return to Bristol to have the aircraft checked for damage and the commander agreed. The APU was started and the aircraft was vectored for a radar intercept for the ILS to Runway 27. Passenger briefings and the approach briefing were carried out on the downwind leg and the overweight landing checklist was carried out. The commander handled the aircraft using the autopilot until late finals when he took manual control and executed a gentle landing at 2315 hrs. Full reverse thrust and wheel braking were used to stop the aircraft on the wet runway without undue difficulty. When the damage was assessed the crew cancelled the flight. The passengers were flown to Heraklion in another aircraft by a different crew.

Examination of the aircraft

Examination of the aircraft confirmed that damage was present to the lower rear fuselage in that various drain masts exhibited clear evidence of contact with the runway. A later more detailed examination in this region revealed that slight deformation had occurred to the structure around the lowermost stringer adjacent to a fuselage frame close to the rear pressure bulkhead. Examination of Runway 27 at Bristol by the airfield authorities revealed evidence of a scrape mark on the surface attributable to this aircraft approximately 20 feet either side of a centreline light. This light, which was located 692 m from the far end of the paved surface of the 2,011 metre runway, exhibited fresh damage to its painted upper surface.

Flight data recorders

The flight data recorder (FDR) and cockpit voice recorder (CVR) were removed from the aircraft and replayed. Both recorders were fully serviceable and the information retrieved was used to assist in construction of the history of flight and subsequent analysis of the accident. A time history of relevant parameters recorded during the accident take off are at Figure 1.

Analysis

The FDR data indicated that the commander had initiated rotation at the correct speed but he had rapidly applied appreciably more rearwards sidestick than any other pilot within a sample of seven other flights. He had also applied a large lateral sidestick deflection before and during rotation which was sufficient to deploy the roll spoilers on the left wing. Spoiler deployment during rotation has two undesirable effects: it decreases wing lift and it increases the nose-up pitch rate. The combined effect of the aft and lateral sidestick inputs was a sustained pitch rotation rate of more than twice the recommended rate of 3°/sec.

The aircraft manufacturer also analysed the FDR data and stated that the magnitude of the lateral sidestick input during rotation was sufficient alone to cause a tailscrape with a 'normal' pitch sidestick input. The manufacturer also discounted the possibility of windshear having any significant effect on the take off.

Sidestick training

Because there is no mechanical linkage between sidesticks in the Airbus 'fly-by-wire' aircraft, it is very difficult for a trainee to learn the correct technique by 'following through' the actions of his trainer. Moreover, the amount of rearwards sidestick movement required to achieve a satisfactory rotation rate varies with conditions and configuration so it is not practicable to specify or teach a 'standard' technique. The difficulty of consistently achieving the 3°/sec recommended rotation rate is illustrated by the fact that the rotation rate commonly achieved by the aircraft manufacturer's test pilots is 4°/sec. Airline pilots do not have a ready means of discovering what pitch rate they achieved on take-off and so assessment of the correct rate 'on the line' is highly subjective. Pilots have to learn by making a sidestick input, assessing the aircraft's reaction and then adjusting their initial input. Consequently, it is very important for trainees to be given accurate, consistent and comprehensive advice during type conversion.

The AAIB was aware that in the past, some A320 training organisations had given pilots inconsistent advice on sidestick handling during a crosswind take off. When the aircraft is on the ground the sidestick position is displayed by the sidestick order indicator (a Maltese Cross) on the Primary Flying Display. The presently accepted 'limit' of sidestick application which can be made

without deploying the spoilers is reached when the edge of the Maltese Cross touches the central index.

Standard operating procedures

The AAIB has previously investigated two tailscrapes in Airbus A340 aircraft and in both cases became aware of the undesirable consequences of using too much lateral sidestick during rotation. Following the second A340 investigation, advice to pilots regarding rotation technique was amended in the A340 Flight Crew Operating Manual (FCOM) in May 1995. Comparable changes have since been incorporated into the A320 FCOM to reflect the need to minimise any lateral sidestick input during a crosswind take-off and to centralise the sidestick (in the lateral sense) during rotation.

Comparisons were made between the Operator's Standard Operating Procedures (SOPs) dated 1 April 1998 and the current A320 FCOM. Emphasis in the operator's SOPs was placed on the need to rotate at the 'proper rate' of 3°/sec but there was no mention of the need to centralise a sidestick lateral input. In the Airbus FCOM SOPs at Revision 24 (undated), the third explanatory note to "ROTATION.....PERFORM" was *"If some lateral control has been applied on the ground, centre the stick during rotation so that the aircraft gets airborne with a zero roll rate demand"*. It appears that this technique is now being advocated by the various A320 training organisations but the commander said that he had never been taught this technique during his conversion training.

Safety action

As soon as the operator discovered the difference between company SOPs and the Airbus FCOM SOPs, it issued a notice to its pilots to inform them of the revised Airbus advice. Moreover, both pilots appreciated that starting the APU after a suspected tail scrape and converting the departure into an immediate return to Bristol were unwise. In view of the operator's swift reaction and the advice in the manufacturer's FCOM SOPs, the AAIB did not make any safety recommendations.