
Autoflight failure, Airbus A319-131, G-EUPV

Micro-summary: This A319 experienced uncommanded failure of its autoflight systems.

Event Date: 2001-08-09 at 1650 UTC

Investigative Body: Aircraft Accident Investigation Board (AAIB), United Kingdom

Investigative Body's Web Site: <http://www.aaib.dft.gov/uk/>

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Airbus A319-131, G-EUPV

AAIB Bulletin No:	Ref: EW/G2001/08/10	Category: 1.3
Aircraft Type and Registration:	Airbus A319-131, G-EUPV	
No & Type of Engines:	2 IAE V2522-A5 turbofan engines	
Year of Manufacture:	2001	
Date & Time (UTC):	9 August 2001 at 1650 hrs	
Location:	On approach to London Heathrow Airport	
Type of Flight:	Public Transport	
Persons on Board:	Crew - 7	Passengers - 82
Injuries:	Crew - None	Passengers - None
Nature of Damage:	None	
Commander's Licence:	Airline Transport Pilots Licence	
Commander's Age:	42 years	
Commander's Flying Experience:	9,176 hours (of which 535 were on type)	
	Last 90 days - 96 hours	
	Last 28 days - 48 hours	
Information Source:	Aircraft Accident Report Form submitted by the pilot and the operator's technical investigation	

During the two previous sectors, this aircraft had exhibited discrepancies between the airspeed indications displayed on both pilots' Primary Flight Displays (strip type airspeed indicators). In each case, the crew compared their indications with the Standby Airspeed Indicator, and determined that it was the No 1 (commander's) indication that was incorrect.

During the first manifestation of the problem, the commander's airspeed indicator (ASI) display was reported to be reading 20 kts in excess of the first officer's indication. After landing, engineering inspection was carried out and Air Data Reference (ADR)1 and Inertial Reference (IR)1 tests revealed no faults. A ground scan also revealed no faults with the system.

During the subsequent sector, the discrepancy reappeared, with the commander's airspeed indication being 20 kt less than that of the first officer's. This event occurred during a Heathrow to Belfast International sector and the aircraft landed at Belfast uneventfully.

Belfast was not a location where the operator had any immediate repair or replacement capability. After evaluation of the symptoms, it was considered that Air Data/Inertial Reference Unit (ADIRU) number 1 was effectively inoperative as it was thought to have been the source of the erroneous airspeed indications presented to the commander.

The aircraft's Minimum Equipment List (MEL) did not allow dispatch with an inoperative ADIRU1, but did allow for ADIRU3 to be inoperative for dispatch. As the three ADIRU units are identical in function, it was decided to transpose ADIRU1 and ADIRU3 in order to allow dispatch of the aircraft for one sector back to its base at Heathrow, in accordance with the MEL (para 34-10-01) requirements. The circuit breaker for ADIRU3 was then pulled and collared, thus rendering the unit inoperative for the flight. Ground tests of the ADR interface, IR interface and an automatic landing system 'LAND' test were carried out satisfactorily prior to departure.

The sector was uneventful until the aircraft was on the intermediate approach for Runway 27L at Heathrow. Whilst at 6,000 feet, speed 210 kt in cloud, there was uncommanded disengagement of both the Autopilot and Autothrust systems. The commander took positive manual control of the aircraft. The disengagements were coincident with multiple Warnings and Cautions on the Electronic Centralised Aircraft Monitoring (ECAM) display. Multiple crew procedures were therefore displayed for action.

The commander reported that the pattern and sequence of these failure messages, which included ADR Disagree, ADR Fault, Auto Flight Rudder Travel Limit and Flight Augmentation Computer (FAC)2 amongst others, did not indicate a single recognisable failure. It was noted that the airspeed discrepancy was again present, with the commander's indication being 15 kt different from the first officer's and the Standby ASI.

The commander issued a PAN call to advise ATC and the crew carried out the appropriate ECAM actions as displayed. The crew made reference to the Quick Reference Handbook (QRH) procedure for 'Unreliable Airspeed'. The approach was continued with the aircraft in 'Alternate Law' flight control mode. By design, this mode reverts to 'Direct Law' once the landing gear has been selected down. The commander carried out an uneventful landing in 'Direct Law' using configuration 3, with an approach speed appropriately increased in accordance with the manufacturer's recommended procedures. The weather at the time was a surface wind from 320° at 10 kt, visibility 4,000 metres in rain, with broken cloud base 1,800 feet, temperature +14°C.

After landing, the crew halted the aircraft when clear of the runway to fully assess the situation prior to taxiing to the parking stand. Once parked, the passengers deplaned normally.

Operator's Engineering Investigation

After arrival at Heathrow, the aircraft was taken out of service for investigation. A comprehensive series of troubleshooting tasks were carried out as detailed in the manufacturer's Troubleshooting Manual. No faults were found during this process and it became apparent that it was not, in fact, an ADIRU defect.

To ensure that the defective unit was removed from the aircraft, the captain's Pitot probe, Air Data module (ADM), Total Air Temperature (TAT) probe and the hose from the ADM to the Pitot probe were removed and sent to the workshop for examination. Replacement parts were fitted to the aircraft, which was then returned to service and has not experienced any recurrence of the airspeed indication discrepancies.

On examination, the ADM and TAT probe were found to be serviceable. The Pitot probe was inspected and was found to have both (water) drain holes blocked. Particles were also found in the tube. The Pitot probe was dissected and it was found that burrs were present on the internal side of both drain holes. On one of the drain holes, there was the remainder of the drilled central part of the hole, which was attached by a thin sliver of the material. The inner tube also showed signs of heat damage, including a bulge on one side and some carbon like deposits.

The operator passed details of the findings to the aircraft and component manufacturers in order to advise them of the findings and for them to ascertain whether this was an isolated occurrence or a batch production problem.

AAIB informed the CAA and the aircraft manufacturer's Flight Safety Department of the findings in order that they may ensure that the appropriate quality assurance procedures are applied.

It has also been highlighted to the manufacturer that the aircraft's Troubleshooting Manual procedures were not currently adequate to identify this type of defect.

Analysis

The aircraft downgraded to 'Alternate Law' (and subsequently into 'Direct Law' after gear down selection) because a discrepancy had been detected between the airspeed calculations produced by No 1 and No 2 Air Data systems. The 'voting' function that would normally have been available (which would have automatically detected which of the three systems was in error) had been rendered inoperative by the inhibition of No 3 ADIRU prior to flight in accordance with the MEL dispatch procedures.

The numerous Warnings and Cautions displayed on the ECAM were consistent with the aircraft downgrading to 'Alternate Law' and with the airspeed discrepancy.

It is likely that the airspeed discrepancies occurred intermittently as a result of the presence of unwanted material in the No 1 Pitot water drain holes. When the aircraft flew through cloud or rain, it is likely that incorrect drainage of the system occurred, leading to erroneous air pressure sensing in the Pitot system.