# Bleed faults, Airbus A320-231, G-MEDA, 9 November 2001

**Micro-summary:** **After both engines on this A320 produced bleed faults, the crew decided to divert.**

**Event Date:** **2001-11-09 at 0852 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 A320-231, G-MEDA, 9 November 2001

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| **AAIB Bulletin No: 2/2003** | **Ref: EW/A2001/11/01** | **Category: 1.1** |
| **Aircraft Type and Registration:** | Airbus A320-231, G-MEDA | |
| **No & Type of Engines:** | 2 International Aero Engine V2500-A1 turbofan engines | |
| **Year of Manufacture:** | 1994 | |
| **Date & Time (UTC):** | 9 November 2001 at 0852 hrs | |
| **Location:** | Lorno, N37 24.0, E 19 00.0 | |
| **Type of Flight:** | Public Transport (Passenger) | |
| **Persons on Board:** | Crew - 7 | Passengers - 50 |
| **Injuries:** | Crew - None | Passengers - None |
| **Nature of Damage:** | None | |
| **Commander's Licence:** | Airline Transport Pilot's Licence | |
| **Commander's Age:** | 57 | |
| **Commander's Flying Experience:** | 16,432 hours (of which 2,400 were on type) | |
| | Last 90 days 128 hours | |
| | Last 28 days - 43 hours | |
| **Information Source:** | AAIB Field Investigation | |

## History of flight

The aircraft departed from Alexandria at 0717 hrs and 3 minutes later during the climb a No 1 engine valve failure was annunciated to the crew via the Electronic Centralised Aircraft Monitor (ECAM) as an AIR ENG 1 BLEED FAULT warning message. The No 1 engine bleed valve would not re-open so the crew continued the flight with No 2 engine bleed supplying both air conditioning packs. At approximately 0845 hrs the No 2 engine HP bleed valve started to cycle between the open and closed positions but appeared to stop cycling after about five minutes. At 0852 hrs, however, an ECAM warning AIR ENG 2 BLEED FAULT was annunciated to the crew. The crew declared an emergency and began an emergency descent to FL100. The cabin crew were advised and during the descent the APU was started. The passenger oxygen masks deployed however as the cabin altitude increased to approximately 12,000 feet. A diversion to Brindisi was initiated but after discussion with the company the aircraft diverted to Rome.

On the previous day the aircraft had operated from London Heathrow to Alexandria and then onto Addis Ababa. The same fault on the No 1 engine bleed system was reported during the climb from Addis Ababa; however, the fault cleared after resetting the system and which operated satisfactorily during the cruise and descent. The system operated normally on the sector prior to the incident flight from Addis Ababa to Alexandria.

**Engine bleed system description**

Each engine bleed system is controlled and monitored by a Bleed Monitoring Computer (BMC). Air is normally bled from the intermediate pressure (IP) stage of the compressor. At low engine speed the system bleeds air from the high pressure (HP) stage in order to maintain the correct values of temperature and pressure. The temperature of the bleed air is regulated by a heat exchanger using cooling air from the engine fan which is supplied through the Fan Air Valve (FAV). The bleed air temperature is maintained at 200°C (±15°) by controlling the cooling air through the FAV by the Temperature Control Thermostat (TCT). When the temperature is below the limit the FAV remains closed. Above this temperature differential expansion of the control sensing element of the TCT causes a valve within the regulator assembly to open an orifice allowing a pressure signal to be sent through the thermostat to the opening chamber of the FAV. An anticipation sensing element reacts before the control sensing element to prevent an over-temperature condition.

A crossbleed duct interconnects the engine bleed systems. When this is isolated either engine can then supply air to both air conditioning packs (single bleed operation), and when open, as in normal operation, both engines supply air (dual bleed).

**Maintenance actions**

Both Bleed Monitoring Computers were tested via the Built-In Test Equipment (BITE) and no faults were found. The initial No1 engine bleed fault was traced to a loose union within the sensor line for the No 1 Pressure Regulating Valve (PRV) from the FAV TCT. This had caused the FAV to close and therefore the No 1 engine bleed to overheat and shutdown. An engine run determined that pressures and temperatures on both engines were within limits with dual and single bleed operation. The aircraft returned to London Heathrow on a non-revenue flight for further investigation.

No faults were identified with the No 2 bleed system. As a precaution the No 2 FAV TCT (Part Number 342D020000 / Serial Number 00133), No 2 pack flow control valve, and No 1 pressure regulating valve (PRV) control solenoid were removed. All sensor lines were inspected and No 1 bleed control sensor line was replaced.

Strip examination of the No 2 TCT revealed that the valve within the regulator assembly was sticking within its guide and a leak test of the unit was out of tolerance.

**Previous Incidents**

The loss of both bleed systems has occurred on several occasions in the past. This led to the issue of a manufacturers Technical Follow Up Document (TFU reference 36.11.43.005) first issued in 1998. This noted that several operators had reported cases of simultaneous failures of both air engine bleed system due to over-temperature conditions. The investigation revealed that a simultaneous failure of both systems could be due to a dormant failure within one TCT, which only

became apparent after the first system failure. The remaining TCT could not compensate for the normal increase of the bleed air temperature resulting from the increase in air bleed demand on the remaining system.

Strip examination of TCTs removed from these aircraft revealed that there was movement within the regulator valve guide assembly which could result in a permanent or temporary limitation in the orifice section through which operating pressure is sent to the FAV opening chamber. As a consequence the FAV cannot reach the fully open position which is required in the case of increased bleed temperature, such as occurs in single bleed operation. As an interim solution the size of the guide bore was slightly increased in production from unit serial number 2706 and was also applied on units returned for repair through revision 3 of Vendor Service Bulletin (VSB) 342-36-02.

In order to prevent any potential movement of the regulator valve guide a special ring together with a change in assembly process has been defined and introduced through VSB 342-36-04 with a new Part Number 342B030000 / 342D030000.

**Safety Action**

On October 31, 2001 the French DGAC issued a Recommendation Bulletin BR 2001/56(B):

> *Recently, during cruise, an aircraft had to proceed an emergency descent and to divert consequently to the loss of both air bleeds.*
>
> *Investigations revealed that the consecutive loss of both temperature control thermostatic switches (TCT N1 et TCT No2) was the root of this situation. The failure of the first circuit (whichever the cause) generated the failure of the second circuit due to an over temperature resulting to the "as per design" increasing of the air flow associated to the "as per design" increasing of the temperature of the second circuit.*
>
> *ln order to prevent new occurrences of such situations, the recommendations of DGAC are as follows*
>
> *On each aircraft, install at least one temperature control thermostatic switch (TCT) (P/N 342B030000 or 342D030000) whose serial number (S/N) is over S/N 2706 (exclusive) or which has received implementation of Service Bulletin LIEBHERR AEROSPACE Toulouse (VSB) 342-36-04 revision 03.*
>
> *Accomplish a temperature monitoring of the bleed air circuits by performing at A-check opportunity a reading of "class 3" failures recorded by BMC 1 & 2 computers; this enables the detection of an alteration of the temperature control performances of the air bleed circuit.*

The purpose of the DGAC recommendation was to limit the risk of a dual bleed system loss due to this failure by fitting at least one bleed system with a modified TCT. Performance of the bleed temperature monitoring system can be monitored through the BMC Class 3 Report available post flight through the Centralised Fault Display System (CFDS). If this report contains a fault message relating to the engine bleed system, it is recommended, as a preventative action, to check the TCT-FAV sensor line for leakage and if no leak is found to replace the TCT.

In June 2002 the manufacturer published an Operations Engineering Bulletin (OEB) 149 which addressed single bleed loss with the aim of avoiding dual bleed loss. This involves crew monitoring bleed temperatures and managing systems using bleed air in the event of a bleed failure via updated Flight Crew Operating Manual (FCOM) procedures. These new procedures are cancelled by the fitting of the new standard TCT.

In the case of a single bleed fault the aircraft can still be dispatched with the associated bleed valve switch selected to OFF and the cross bleed valve selected open, in accordance with the MMEL 36-11-01, provided that icing conditions are not predicted and the altitude is limited to 31,500 feet.

All of the operators A320 fleet has been fitted with the modified TCTs, and the manufacturer reports that approximately 70% of the A318/A319/A320/A321 TCTs are already modified.

**Further Actions**

The manufacturer reports some cases of single bleed failure on aircraft fitted with the latest TCT standard (Part Number 342B03000/342D03000). Further investigation has shown that the cause of the regulator valve sticking in its guide is irregular thermal expansion of the existing guide material in hot temperature conditions. A new material has been defined together with modification of seals, adjusting screw and thermostat body materials that will be included in a new standard of TCT.

The AAIB report into the above occurrence stated that the manufacturer proposed a new standard of Temperature Control Thermostat (TCT). TCT Part Number 342B030000/D030000, with the serial number 2707 or later, or modified to VSB 342-36-04 Revision 3, represents the final solution to the sticking of the regulator valve in its guide as described in the report. This modification has been available since the end of 1999. An inspection VSB is planned to request the upgrade of the remaining un-modified TCTs. A new TCT standard 342B040000 has been introduced as part of a Bleed Improvement Program and is unconnected with a dual bleed loss as occurred in this event.

**BULLETIN ADDENDUM**

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| **AAIB File:** | **EW/A2001/11/01** |
| **Aircraft Type and Registration:** | Airbus A320-231, G-MEDA |
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**AAIB Bulletin No 3/2003, page 3/4 refers**

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