

# Investigation Report

EX003-0/06  
April 2008

## Identification

Type of occurrence: Serious incident  
Date: 4 March 2006  
Location: Munich  
Aircraft: Transport aircraft  
Manufacturer / Type: Airbus Industrie / A310-300  
Injuries to persons: No injuries  
Damage: Aircraft not damaged  
Other damage: Crop damage  
Information Source: Investigation by BFU

## Factual information

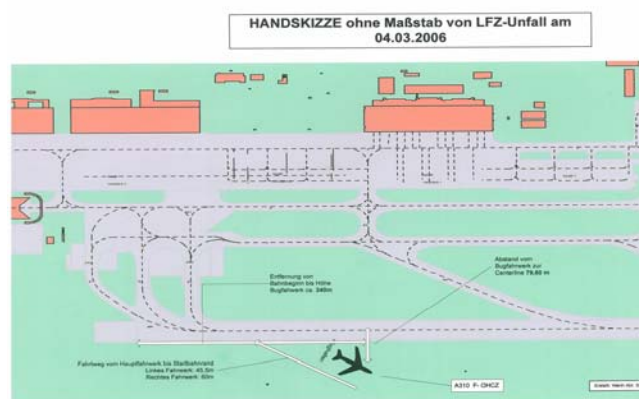
### History of the flight

On 4 March 2006 at Munich Airport an Airbus A310 with 166 passengers and nine crew aboard taxied to holding point B1 via taxiway S. After de-icing and clearance given by the aerodrome controller the aircraft taxied to runway 08R and began its take off run at 17:31<sup>1</sup> hrs almost level with intersection B3. The co-pilot was pilot flying at the time whereas the pilot-in-command operated the thrust levers.

The crew stated that after pushing the thrust levers forward the LH engine increased speed faster than the RH and the aircraft started to drift to the right. After that the pilot-in-command pulled the thrust levers back and both engines returned to ground idle.

The second time the engines once again increased speed unequally. This time the crew was not able to

keep the airplane on the runway. The Airbus veered off the runway at an angle of approximately 45°, about 250 m after the beginning of the take off run and at a speed of approximately 30 kt. The airplane came to a stop on unpaved terrain about 60 m to the right of the runway. Nobody was injured and the airplane remained undamaged.



It had been snowing all day, the runway was covered with wet snow and braking action was medium to poor, according to the crew.

### Personnel information

Both pilots held valid licences and ratings in order to conduct the flight.

The 43-year-old Russian pilot-in-command had about 8,000 hours total flight experience, of which about 4,500 hours were on Airbus A310. He is also an instructor on A310. Flight time of the last 90 days was 270 hours and within the last 24 hours prior to the incident 14 hours. Flight duty time on the day of the incident was 8 hours and 25 minutes. Prior to this duty period he had a rest period of six days.

<sup>1</sup> Unless otherwise specified, all times are indicated in local time

The 48-year-old Russian co-pilot had about 11,000 hours total flight experience, of which about 40 hours were on Airbus A310. Flight time of the last 90 days was 40 hours and within the last 24 hours prior to the incident 3 hours and 25 minutes. Flight duty time on the day of the incident was 8 hours and 25 minutes. Prior to this duty period he had a rest period of four days.

There were no medical restrictions.

#### Aircraft information

The airplane was a transport category aircraft of the type Airbus A310, MSN 457. The French civil aviation authority issued the airworthiness certificate on 28 February 2005. Total operating hours were 44,150 hours. The computer load sheet revealed that take off mass was 126,197 kg (maximum take off mass 157,000 kg) and the centre of gravity was within limits.

The airplane was equipped with two General Electric CF-6-80-C2A2 engines.

A cockpit check showed that several aircraft systems had been out of order. These included: "Engine Trim" because of a Power Management Computer 2 (PMC2) failure and the High Pressure Valve 2 (HP Valve2).

#### Meteorological information

On the day of the incident it had been snowing all day in the Munich region and snow removal had been going on constantly. At 15:59 UTC a SPECI METAR was broadcast on the ATIS frequency.

Wind velocity: 150° / 5 kt  
 Visibility: 1,000 m, runway visibility range on 08R – 1,200 m, snowfall,  
 Clouds: SCT 400 ft, BKN 2,800 ft  
 Temperature/Dewpoint: -2 / -2  
 QNH: 995 mb  
 Temporarily, visibility 800 m, heavy snowfall  
 Runway conditions: 58690195

Code for runway conditions:

58 = runway 08R  
 6 = snow slush  
 9 = 50 – 100% of runway covered with contamination  
 01 = height 1 mm  
 95 = braking action good

At 16:20 UTC another METAR was broadcast:

Wind velocity: 040° / 5 kt

Visibility: 1,000 m, runway visibility range on 08R – 1,200 m, snowfall,  
 Clouds: SCT 300ft, BKN 2,800 ft  
 Temperature/Dewpoint: -2 / -2  
 QNH: 994 mb  
 No significant weather changes were to be expected.  
 Runway conditions: 58690195

#### Communication

The pilot-in-command conducted all radio communications because his knowledge of the English language allowed him to do so. The transcript prepared by the DFS was made available to the BFU.

#### Aerodrome information

Munich Airport is located 28.5 km north-east of Munich city at an elevation of 1,487 ft MSL. It has two parallel 4,000-meter long runways each with a width of 60 m. Their true bearings are 082° and 262°, respectively. The lateral distance between the two runways is 2,280 m.

Because of the weather situation all available snow removal vehicles were in service. The tower's daily report showed that runway 08R was cleared between 15:33 and 15:54 UTC for the last time prior to the incident. Immediately after snow removal braking action was measured and mean braking action was good (50 / 53 / 49). The runway was treated with de-icing fluid with a ratio of 50 g liquid to 40 g granulate. Since it continued to snow the runway was immediately covered with snow again and the de-icing fluid caused it to melt and become wet snow which in turn made the runway slippery.

The measuring chard showed in the first third of runway 08R a braking action of 30 (medium).

#### Flight recorders

The airplane was equipped with a Sunstrand UFDR, P/N 980 – 4100 - DXUS, S/N 9993 flight data recorder. 136 parameters were recorded continuously. The recorder was in excellent condition. It was seized and the BFU's avionic laboratory evaluated it with the Recovery Analysis Presentation System (RAPS) (attachment 1).

The following parameters for the RH and LH engine were analysed:

1. Position of thrust levers in degrees (TRA)
2. N1 in %
3. Fuel consumption in kg/h (FF)
4. Magnetic heading

After line up with runway 08R the thrust levers were positioned at 43° for two seconds and then moved continuously forward. The RH thrust lever was moved to 47° and the LH to 52°. The RH engine reached an N1 of 54% and the LH of 76%. Afterwards both thrust levers were pulled back into idle for a short period of time. The RH thrust lever for four seconds and the LH for two seconds.

During the second acceleration phase both thrust levers were continuously moved to 59° and 60°, respectively, within six seconds. The RH engine reached an N1 of 56% and the LH of 96%. Without delay both thrust levers were moved back to idle.

In both phases the fuel consumption of the RH engine never exceeded 2,700 kg/h whereas the LH engine consumed a fuel quantity of 4,300 kg/h at the first acceleration phase and 8,500 kg/h at the second.

#### Wreckage and impact information

The airplane stood on unpaved terrain about 250 m beyond the intersection B3 and perpendicular to the runway. The terrain was covered with approximately 40 cm of snow and the ground was frozen solid. During the runway excursion the RH engine had ingested a larger amount of snow. Soil stuck to the landing gears. The airplane was not damaged.

Engine No. 2 was subject to further investigation.

In spring of 2005 the engine was repaired at Lufthansa Technik in Frankfurt and received its release to service on 15 June 2005 with the EASA 1/FAA Dual Release form. The engine was lent out to a third operator who did not put the engine into use, however. The engine was installed in the involved Airbus A 310-300 on 6 December 2005. At that time the engine life time was 39,806 hours and 22,332 cycles.

On 12 February 2006 the Deferred Item Opening List showed the following entry: PMC#2 FAULT (Power Management Control Failure). Until the incident on 4 March 2006 the engine's time since installation was 506 hours and 106 cycles.

Low pressure and high pressure compressors were subject to a Boroscope Inspection. It showed soil and grass but no damages to the engine. After the engine had been cleaned the engine test run was normal.

#### Additional information

The aircraft returned to service on 10 March 2006 and completed another 15 cycles with this particular engine. On 15 March 2006 the leasing period expired

and the engine was taken to an EASA Part145 repair station in Frankfurt.

On 23 March 2006 an engine test run without the defective PMC was conducted on the engine test stand in Frankfurt. Test run and another Boroscope Inspection showed no results.

The removed PMC was taken to a maintenance organisation in Hamburg for further investigation. The failure was attributed to a defective power supply. During flight the power supply is secured by the control alternator which is directly adapted to the engine's gearbox. The error mode indicated that the PMC did not recognize the supply by the alternator. After the power supply was changed the PMC test showed no results.

#### Analysis

Analysis of the FDR data showed that the fuel consumption of the RH engine never exceeded 2,700 kg/h independently of the position of the thrust levers. Also N1 of the RH engine was with 54% and 56%, respectively, very close in both phases.

The BFU is of the opinion that the Power Management Control No 2 failure influenced the acceleration performance of the engine; even though the regulation of the engine through the PMC does not occur before 61% N1. The question as to why the engine accelerated so slowly below 61% N1 remains unanswered.

It is known that engines of this type may have problems when accelerated from ground idle by temperatures close to freezing point. For example, shortly after this incident the engine of the same type mounted on an Airbus A 300-600 shut down during taxiing for take-off without any discernible reason.

The engine can be in operation without PMC according to the minimum equipment list (MEL); provided the required procedure is adhered to.

In this case the respective procedure was not applied correctly. Contrary to the specification the thrust levers were continuously moved from ground idle to take-off power without watching N1.

As described above, this particular engine type can be subject to unequal acceleration performance and that is the reason why the following procedure from the MEL 03-73-01A of the Operating Manuals/Part B (OM/B) of the operator is to be applied:

**Crew Operating Procedure:**

- Select the ENG TRIM P. B. switch OFF (P. B. switch pressed-in).
- The associated N1 command pointer and N1 Actual digital counter are inoperative. The associated MEC (Main Engine Control) is inoperative and engine trim must be made manually.
- For takeoff, apply the following procedure:
  - The ATS may be armed with no mode engaged.
  - Release the brakes.
  - Trigger the "GO" levers and advance the throttles in order to set N1 = 70%.
  - If ATS is armed, depress A/THR instinctive disconnect pushbutton(s) to disengage THR mode.
  - Adjust throttles promptly and smoothly to obtain takeoff N1.
  - Check takeoff N1 is set prior to reaching 80 kt.
- After landing gear retraction ATS must be reselected ON.

It is essential that both thrust levers are moved forward slowly and that N1 is watched until both engines have an N1 of 70%. Once both engines have a stable N1 the thrust levers can be moved to take-off power.

This procedure is part of the operator's Operating Manuals (OM/B) and the pilots were aware of this.

Adherence to this procedure is especially important if, like in this case, braking action is affected by snow or ice.

**Conclusions**

- Both pilots held the necessary licenses and ratings required for the conduct of the flight.
- Because of the marginal experience of the co-pilot on this type (40 hours) and his insufficient knowledge of the English language, the pilot-in-command and instructor carried most of the work load.
- It could not be determined whether the extremely slow acceleration performance of the RH engine was caused by technical failure.

The investigation has been conducted in compliance with the Law relating to the Investigation into Accidents and Incidents Associated with the Operation of Civil Aircraft (Flugunfall-Untersuchungsgesetz - FIUUG) dated 26. August 1998. According to the Law, the sole objective of the investigation shall be the prevention of future accidents and incidents. It is not the purpose of this activity to apportion blame or liability or to establish claims.

- The BFU is of the opinion that PMC failure is no reason as to why an engine should accelerate erratically as long as the procedure required by the operator is adhered to.
- Low temperatures and heavy snowfall may have influenced the acceleration performance of the RH engine.
- The unequal acceleration of the two engines was caused by the inaccurate adherence to the respective procedure.
- Because of the erratic acceleration of the engines and the limited braking action it was not possible to keep the aircraft on the runway.

**Cause**

The runway excursion was caused by the strong unequal acceleration of the two engines provoked by the incorrect use of the procedure which is to be applied by failure of one or two PMC according to MEL.

Contributory factors were heavy snowfall at temperatures around freezing point and therefore limited braking action.

Investigator-in-charge	Müller
Assistance	Thiel

**Appendicies****1. FDR Analysis**

mail: box@bfu-web.de  
 http://www.bfu-web.de  
 Tel: 0 531 35 48 0  
 Fax: 0 531 35 48 246

Editor/Distribution:  
 Bundesstelle für  
 Flugunfalluntersuchung  
 Hermann-Blenk-Str. 16  
 38108 Braunschweig

Attachment 1

