



## Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents from 17<sup>th</sup> December 2014 (OSITI), as of 1<sup>st</sup> February 2015 (SR 742.161) was carried out with regards to the following serious incident. This report was prepared to ensure that lessons can be learned from the incident in question.

<b>Aircraft</b>	Airbus A319-131	G-EUPJ		
<b>Operator</b>	British Airways PLC, Harmondsworth, United Kingdom			
<b>Owner</b>	British Airways PLC, Harmondsworth, United Kingdom			
<b>Pilot</b>	British citizen, born 1964			
<b>Licence</b>	European Aviation Safety Agency (EASA) airline transport pilot licence aeroplane (ATPL(A)), issued by the UK Civil Aviation Authority			
<b>Flying hours</b>	<b>Total</b>	> 10 000 h	<b>During the last 90 days</b>	239 h
	<b>On the aircraft type</b>	> 6 000 h	<b>During the last 90 days</b>	239 h
<b>Co-pilot</b>	British citizen, born 1970			
<b>Licence</b>	EASA airline transport pilot licence aeroplane (ATPL(A)), issued by the UK Civil Aviation Authority			
<b>Flying hours</b>	<b>Total</b>	> 8 000 h	<b>During the last 90 days</b>	156 h
	<b>On the aircraft type</b>	> 4 000 h	<b>During the last 90 days</b>	156 h
<b>Location</b>	In a holding pattern above the BLM VHF omnidirectional radio beacon (VOR) in the German/French/Swiss border area north of Basel	<b>Altitude</b>	FL 180	
<b>Date and time</b>	24 <sup>th</sup> July 2015, 20:05 UTC (LT = UTC + 2 h) All of the information in this report is given in coordinated universal time (UTC)			
<b>Type of operation</b>	Scheduled flight			
<b>Flight rules</b>	Instrument flight rules (IFR)			
<b>Flight phase</b>	Cruise flight			
<b>Type of serious incident</b>	Fume smell in cabin and cockpit			

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**Point of departure** London Heathrow (EGLL)

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**Destination** Zurich (LSZH)

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<b>Injuries to persons</b>	<b>Crew</b>	<b>Passengers</b>	<b>Third parties</b>
<b>Serious</b>	0	0	0
<b>Minor or none</b>	6	125	0

**Damage to aircraft** Oil leak in the auxiliary power unit

**Third-party damage** None

## Background

On 24<sup>th</sup> July 2015, the crew of the Airbus A319, registered as G-EUPJ, began boarding passengers on time for the scheduled flight from London Heathrow to Zurich with flight number BA 718. The auxiliary power unit (APU) and air conditioning pack 1 were switched on. The flight crew then noticed an unusual odour. Both pilots agreed that this odour occurs when oil is heated and evaporates. This fume smell is often described as smelling like 'old socks' or smelling musty and foul.

After the pilots had noticed the smell, they asked the deputy cabin crew manager, who is known as the purser at British Airways and was in the rear galley, whether she smelt something too. She said that she could, and described the odour as what she knew to be a fume smell. She added that she had previously experienced a fume event and that it smelt exactly the same. According to the captain's statement, he switched on the second air conditioning pack before or after the conversation with the purser so that the air conditioning would operate normally. After the purser had explained that she had noticed the same odour at the rear of the aircraft, the flight crew turned off the air conditioning by switching off both air conditioning packs and the APU bleed air. The smell subsequently dispersed. They reported the problem to the technicians and then had the passengers disembark for the period of the fault investigation.

The technicians suspected that the heavy rainfall at London Heathrow had washed oil residues on the aircraft fuselage into the APU air inlet and that due to the burning of these oil residues in the APU, this fume smell had been spread around the aircraft via the air conditioning, which was running on APU bleed air on the ground. After consultation with their managers, the technicians decided to disable the APU bleed air and to flush out the air conditioning packs using bleed air from one engine in order to remove remaining oil residues and fumes.

For the time it took the technicians to complete their job, the flight crew made their way to the terminal to wait there. Two cabin crew members reported physical complaints. The entire cabin crew subsequently decided to withdraw from this flight.

When the captain briefly returned to the aircraft in the meantime to check the progress of the work, he could already notice the smell halfway along the passenger boarding bridge to the aircraft. At that time, the technicians were operating the air conditioning packs using the APU, and the engine had not yet been started. After a brief conversation, the captain returned to the terminal to continue waiting.

Once the air conditioning packs had been flushed out using bleed air from one engine and the APU bleed air had been disabled, an odour could no longer be detected. The aircraft was reapproved for operation by the technicians.

After a brief discussion, the pilots accepted the technicians' decision because of their plausible explanation. The new cabin crew members were deliberately not made aware of the fume smell so that they remained impartial and so that, should the odour reoccur, it could be reported and described in an unbiased manner.

Once the engines had been started using a portable air starter unit and the air conditioning was running as normal on bleed air from the engines, there was no longer a fume smell.

## History of the serious incident

At 18:55 UTC on 24<sup>th</sup> July 2015, the crew of the Airbus A319 took off on the scheduled flight from London Heathrow to Zurich with flight number BA 718. 125 passengers and 6 crew members were on board. At 19:55:44 UTC, BA 718 contacted Swiss radar on frequency 128.050 MHz. Due to storms in the Zurich area, the air traffic controller instructed BA 718 to reduce its speed and fly a holding pattern above the Basel (BLM) VHF omnidirectional radio beacon (VOR), and informed the pilots that they should expect a delay of around 15 minutes.

The flight attendant working at the rear of the aircraft cabin was, according to her statement, in the third-last row of seats approx. 15-20 minutes before landing when she noticed a strong odour, comparable to the smell of evaporated oil. She subsequently checked the situation in the rear galley, where the smell was even stronger. She then made her way to the front of the aircraft to find out where the odour was coming from. She was able to detect the smell until she reached the middle area of the cabin. Once in the front galley, she informed the purser and the cabin crew manager. At 20:05:22 UTC, when BA 718 was on the outbound leg of the holding pattern, the manager immediately reported this via interphone to the first officer, who was the pilot monitoring at the time. She told him that there was a strong odour at the rear of the cabin, comparable to the smell of evaporated oil. At the same time, the pilots also noticed the odour at the front in the cockpit. After a brief discussion about the situation and further action to be taken, the first officer informed air traffic control of the problem at 20:07:30 UTC and declared an urgency condition (PAN PAN). He requested permission for immediate continuation of the flight and approach to Zurich, or, should that not be possible, a diversion landing in Basel. The air traffic controller made it possible for BA 718 to immediately continue flying to the Trasadingen (TRA) VOR, which is located 14.6 NM north-north-west of Zurich airport.

The cabin crew was instructed to prepare the cabin for landing, to wear smoke hoods if necessary and, if possible, not to inform the passengers of the situation to avoid distress. The remaining flight time until landing was estimated to be 10 minutes. With the exception of the purser, all of the flight attendants used smoke hoods. According to the statement made by the cabin crew, the odour was becoming even stronger and, in the cabin, very fine smoke was visible. The passengers did not notice anything, except for the two rearmost passengers who were fanning their hands in front of their noses.

On the way to TRA, the flight crew first of all prepared for the instrument approach to runway 14 in Zurich. At 20:10:09 UTC, they were given clearance by Swiss radar to descend from flight level (FL) 180 to FL 140, which was however cancelled 15 seconds later because another aircraft was flying at FL 170. As the descent to FL 140 had already been initiated, BA 718 was already at FL 177 and immediately had to climb back to FL 180. For a short time, this led to a somewhat higher workload.

According to the cockpit voice recorder (CVR), at 20:11:24 UTC, the captain stated that he felt the need to use an oxygen mask and that the smoke drill should be completed in accordance with the 'Smoke, Fumes and Avionics Smoke Checklist'. Shortly afterwards, at 20:11:50 UTC, BA 718 was directed to the Zurich Final frequency of 125.225 MHz. However, this frequency had been incorrectly communicated, meaning that no radio contact was achieved. Returning to the original frequency, they were only told the correct frequency after the air traffic controller had made further enquiries by telephone. At 20:13:14 UTC, the first contact with Zurich Final was made on the correct frequency of 125.325 MHz. At that time, BA 718 was flying at FL 140 and was instructed to descend to FL 80. The air traffic controller offered the pilots a direct approach to runway 14 and asked whether the remaining 27 NM would be sufficient, or whether they would need more time to be able to approach directly from that altitude. The first officer answered the question by saying, "Okay, stand by, *Speedbird Seven One Eight*".

Subsequently, the speed was reduced, the flaps were extended to level 2, and the landing gear was deployed so that it was possible to descend more steeply to enable a direct approach to Zurich. Immediately afterwards, at 20:13:44 UTC, the smoke drill was carried out. This involved the first five points on the 'Smoke, Fumes and Avionics Smoke Checklist' – the most

important actions to be taken straight away, should smoke, fumes or avionics smoke occur. This minimises further spreading of the smoke or fumes, cuts the power supply to the galleys, and ensures communication with the cabin crew.

At 20:14:37 UTC, BA 718 was instructed to descend to an altitude of 6,000 ft above mean sea level (AMSL), whereupon the crew reduced the speed further and extended the flaps to position 3. Approximately two seconds after the flaps had been extended further, the air traffic controller made contact again to inform the pilots that they were nearing the localiser, and to ask whether they would like to approach directly or fly on the current heading through the extended approach axis. The pilots decided to remain on the current heading for a further 5 NM and then turn back again to make the approach to runway 14. The first officer, who was still the pilot monitoring at the time, completed the approach checks and approach briefing.

At 20:15:57 UTC, the captain put on his oxygen mask. Three seconds later, clearance was given to descend to 5,000 ft AMSL and at 20:16:21 UTC, the first officer reported that they were ready for the approach and would therefore like to turn back again in the direction of the approach. The air traffic controller authorised this and gave the instruction, "*Speedbird Seven One Eight, roger. Turn right, heading one seven zero, cleared ILS approach runway One Four, report established, descend to four thousand feet.*" The first officer then also put on his oxygen mask.

At 20:17:32 UTC, BA 718 was aligned to the localizer of runway 14's instrument landing system (ILS). The flight crew subsequently started the APU in order to have another source of electricity available, should the fire service require the engines to be shut down after landing. When asked about their intentions after landing, the crew advised the air traffic controller that they would taxi as normal to the parking position and open the windows in the cockpit. The approach was uneventful and BA 718 landed in Zurich at 20:23:00 UTC. After landing, the pilots opened both cockpit windows, took off their oxygen masks and taxied the aircraft to the parking position accompanied by the fire service.

Several firemen entered the cockpit for a short time following the arrival of the aircraft. Once the flight crew had briefly described the situation, the firemen left the aircraft discreetly and the passengers were able to disembark as normal.

### Technical investigation

Initial investigations into G-EUPJ were carried out the day after the serious incident. As part of these investigations, the APU was first examined and switched on. The two air conditioning packs were then put into operation using APU bleed air. When the cabin was ventilated with air conditioning pack 1, a very slight fume smell could be detected. It was not possible to reproduce the way in which the fumes developed during the serious incident.

The following day, the aircraft underwent a detailed inspection in accordance with defined procedures<sup>1</sup> to determine the source of the fumes that had occurred during the serious incident. In the process, both engines were examined using a borescope; no anomalies could be identified. The engines, which had supplied the air conditioning packs with bleed air during the serious incident, could thereby be eliminated as the source of the fumes.

Indications of an oil leak were found in the APU bay in the aircraft's tail cone, even though the APU bay had been cleaned and inspected on the previous day, prior to the APU being switched on. The leak consisted of engine oil from the APU which was dripping from the APU generator drain plug onto the APU air inlet duct in small quantities (see illustration 1).

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<sup>1</sup> ATP 3556 TSM, *cabin/flight deck oil smell isolation/rectification procedure*



**Illustration 1:** View of the open APU bay in the aircraft's tail cone. The air required for the operation of the APU is sucked in through the air inlet (1) and reaches the APU via the air inlet duct (2) attached to the hatch. When the APU bay is closed, the top of the air inlet duct acts as a drip tray, which is emptied to the outside via the drain mast (3); the drain mast is located directly behind the air inlet.

Based on the assumption that the oil leak found in the APU was the cause of the contamination of the air conditioning system, for the further course of the investigation, the APU was neither used for the power supply nor for supplying bleed air. The two air conditioning packs were operated using an external compressor and their outlet led to the exterior to remove remaining contaminants.

Finally, a test run of the engines was carried out, during which the air conditioning packs were operated using bleed air from the engines. The test run lasted around 45 minutes and involved all possible configurations of the air conditioning system and all possible engine power settings. During the tests, all of the systems functioned without fault and there were no other noticeable indications of contamination of the cabin ventilation system.

Following the reinstallation of a flight data recorder and a cockpit voice recorder as well as other finishing work, G-EUPJ was approved for operation with a decommissioned APU. The aircraft could then be flown to London without passengers.

## Conclusions

The serious incident can most probably be attributed to the air conditioning packs being contaminated with engine oil from the APU, which was dripping from the APU generator drain plug onto the APU air inlet duct in small quantities. From the air inlet duct, the oil was drained to the outside via a drain mast, which is located directly behind the APU air inlet. It is therefore probable that the leaked oil reached the APU air inlet when the APU was in operation on the ground, potentially assisted by the effect of tailwind.



**Illustration 2:** View of the open APU inlet duct on the underside of the aircraft's tail cone. The drain mast can be seen to the left of it.

The flight crew had the aircraft inspected after the first occurrence of fumes and then continued with their duties. The cabin crew felt unable to continue with their duties after this event. Both decisions are understandable because the adverse effect caused by malodorous or even toxic fumes can vary depending on the person's location within the aircraft.

Cleaning of both the air supply and inlet duct appeared to rectify the problem. However, as the oil leak in the APU had obviously not been discovered, this resulted in another contamination of the air supply, which this time only had an effect some time after the APU had been switched off.

The crew acted in a safety-conscious manner by protecting themselves and immediately performing a precautionary landing.

Bern, 27 June 2017

Swiss Transportation Safety Investigation Board