



Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents (OSITI), 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.

Aircraft	AVRO 146-RJ100	HB-IYW	
Operator	Swiss Global Air Lines AG, Malzgasse 15, 4052 Basel (Switzerland)		
Owner	Swiss International Air Lines Ltd., Malzgasse 15, 4052 Basel (Switzerland)		
Pilot	Swiss citizen, born 1974		
Licence	Airline transport pilot licence aeroplane (ATPL(A)) according European Aviation Safety Agency (EASA), issued by the Federal Office of Civil Aviation (FOCA)		
Flying hours	Total 9535 h	During the last 90 days 142 h	
	On the incident type 5888 h	During the last 90 days 142 h	
Copilot	Swiss citizen, born 1969		
Licence	EASA ATPL(A), issued by FOCA		
Flying hours	Total 9423 h	During the last 90 days 127 h	
	On the incident type 9112 h	During the last 90 days 127 h	
Location	2 NM east of runway 10 in Nuremberg		
Coordinates	---	Altitude approx. 2000 ft AGL ¹	
Date and time	15 September 2016, 13:27 UTC		
Type of operation	Scheduled flight		
Flight rules	Instrument flight rules (IFR)		
Flight phase	Climb		
Type of serious incident	Smell of oil in the cockpit, use of oxygen masks		
Point of departure	Nuremberg Airport (EDDN)		
Destination	Zurich Airport (LSZH)		
Injuries to persons	Crew	Passengers	Third parties
Minor	0	0	0
None	4	90	-
Damage to aircraft	Not damaged		
Third-party damage	None		

¹ AGL: above ground level

Course of events

On 15 September 2016, the AVRO 146-RJ100 aircraft, registered as HB-IYW, under the IATA flight number LX 1191 and the radio call sign “*Swiss One One Five Golf*”, was ready for engine start-up when the flight crew received a message at 12:59:55 UTC stating that there was a passenger on board the aircraft who had not checked in to fly to Zurich. For this reason, the passenger boarding bridge had to be docked once more and the doors had to be opened. 2 pilots, 2 cabin crew members and 90 passengers were on board.

At 13:02:19 UTC, the pilot informed the passengers about the problem with the passenger and announced an expected delay of 20 minutes. Due to this delay and the high external temperature of 29 °C, the flight crew decided to start the auxiliary power unit (APU) in order to use its bleed air to cool the cabin (see brief description in the next section).

According to the flight crew’s statements, after 5 minutes² they activated air conditioning pack (PACK) 1 and after a few seconds changed to air conditioning PACK 2. At approximately the same time, the flight crew noticed a smell of oil in the cockpit. They therefore decided to immediately turn off the APU again³. The cabin crew subsequently asked the flight crew about the lack of cooling in the cabin, whereupon the flight crew informed them at 13:06:20 UTC that they had a problem with the APU’s bleed air.

The flight crew discussed this situation and the associated consequences for a flight to Zurich. They reached the conclusion that the APU was responsible for the contaminated air. The conversation also indicated that there was still some doubt as to whether it was possible that PACK 1 had caused the smell of oil. The flight crew therefore decided that after take-off, they would only activate PACK 2 for the flight to Zurich, and operate it using bleed air from engines 3 and 4.

At 13:11:05 UTC, the pilot addressed the passengers once again. He informed them that the initial passenger problem had now been rectified but that another passenger would be boarding. A delay of 10 minutes was still to be expected.

At 13:15:09 UTC, the flight crew received clearance for push-back and during this process the engines were started. At 13:17:36 UTC, the pilot requested that the “*check after engine start*” checklist be worked through.

At 13:19:14 UTC, the flight crew received clearance to proceed to runway 10 via taxiway Fox-trot. After less than a minute, the pilot requested the “*taxi check*”. Among other things, this included verification of the take-off briefing. In the process, at 13:20:24 UTC the copilot once again confirmed that they would fly to Zurich with only PACK 2 switched on. Another short discussion about whether PACK 1 could actually also be activated led to the definitive decision to only use PACK 2.

At 13:23:02 UTC, the flight crew received clearance to taxi to the starting position on runway 10. After receiving clearance for take-off, the pilot initiated take-off and, with the instruction “*your controls*”, handed over control to the copilot at 13:24:46 UTC, who was then the pilot flying (PF) for the scheduled flight. The pilot took over the function of pilot monitoring (PM).

The take-off proceeded without incident and, at 1500 ft above ground, climb power was set. Subsequently – as discussed – PACK 2 was activated and fed with bleed air from engines 3 and 4.

Initially, the flight crew judged the air quality to be good. However, just two minutes after take-off, at 13:27:28 UTC, the copilot said that he could detect a sweet, oily odour. The pilot was

² According to operating procedures, the APU has to warm up for at least 5 minutes before its bleed air may be activated using the air conditioning pack.

³ The usage of individual controls relating to the APU, APU bleed air, engine bleed air and the air conditioning packs is based on the flight crew’s statements because the use of these controls is not recorded on the AVRO-RJ100’s digital flight data recorder (DFDR).

not able to confirm this, but decided they should put on the oxygen masks in the interests of safety. At 13:29:44 UTC, the flight crew confirmed that they would continue with the flight to Zurich and that the passengers did not have to be informed at that time.

After giving a heading instruction and clearance at flight level (FL) 60, at 13:31:20 UTC air traffic control asked the flight crew, *“One One Five Golf, sorry, are you on oxygen?”* The flight crew responded with, *“That is correct, smell in the cockpit, request proceeding to Zurich immediately.”* Air traffic control acknowledged this answer and asked whether the flight crew wanted to declare an emergency. The flight crew responded in the negative and repeated their request for priority. Once again, air traffic control acknowledged this and nevertheless asked once more whether or not an emergency would be declared. At 13:31:59 UTC, the flight crew, replied by saying, *“This is smell in the cockpit.”* And when air traffic control asked, *“You continue to Zurich?”* the flight crew responded with, *“That’s correct, it’s just in the cockpit, the cabin is fine.”* After this, at 13:33:06 UTC, air traffic control granted clearance to fly on a direct heading to the Dinkelsbühl waypoint.

After another frequency change, the flight crew informed the cabin crew at 13:34:46 UTC that they were wearing oxygen masks in the cockpit and asked whether the air in the cabin was good. The cabin crew said that it was just a little warm, but that the air was good.

The rest of the flight to Zurich was uneventful and, due to only one PACK being activated, took place at FL 130. As the flight crew had taken on 1600 kg of additional fuel in Nuremberg for the flight to Zurich, the flight, which was originally planned for FL 230, was able to be completed without any problems.

At 13:52:44 UTC, the flight crew sought permission from Zurich air traffic control to taxi directly to the parking position after landing and to allow the passengers to disembark normally, as the serious incident did not affect them. Air traffic control accepted this request and advised the flight crew at 13:53:02 UTC that the fire service had been informed and was on standby.

In the interests of safety, the flight crew decided to use autoland. For this reason, control of the aircraft was switched once again upon approach, with the pilot now acting as PF and the copilot as PM. The approach was uneventful and the aircraft touched down at 14:04:15 UTC on runway 14.

The flight crew taxied the aircraft HB-IYW directly to the allocated parking position and the passengers were able to leave the aircraft in the normal way. Subsequently, the fire service entered the aircraft. They were unable to detect anything out of the ordinary using their detectors.

Brief description of the air conditioning system

The pressure ventilation system supplies the cockpit and the cabin with conditioned air. This is taken as bleed air from the APU or the engines and processed by two air conditioning packs (PACKs). Both PACKs are located at the rear of the aircraft (see illustration 1).

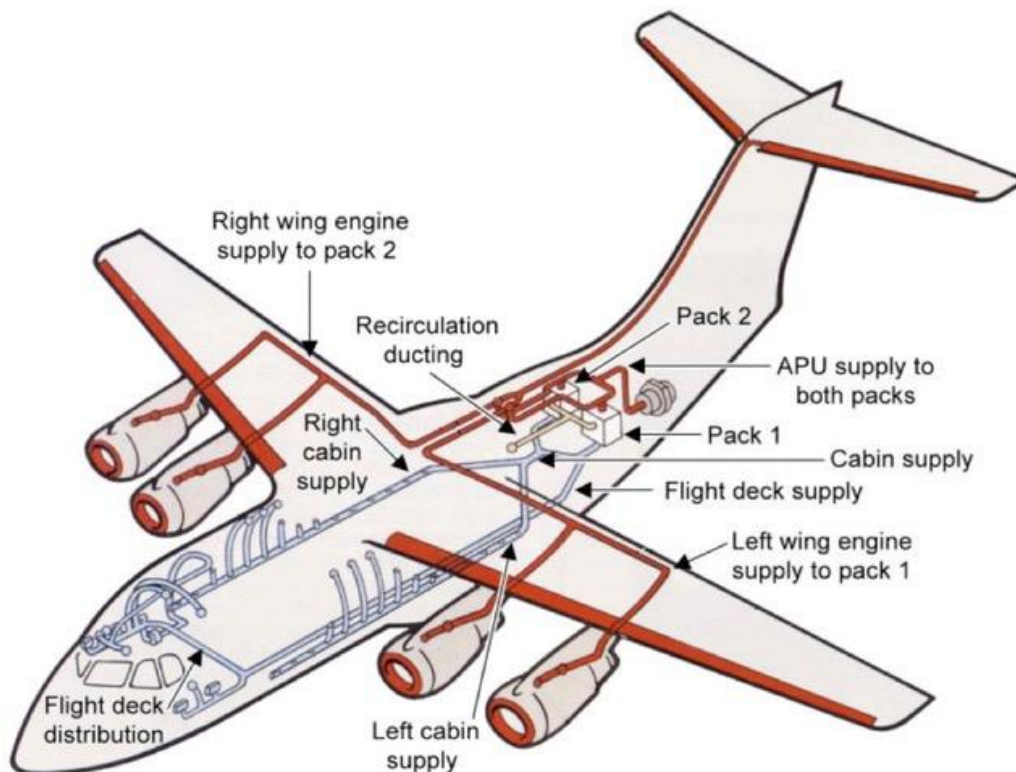


Illustration 1: Bleed air system (source: flight crew operation manual (FCOM) of Swiss)

PACK 1 is supplied by the APU or the left-hand engines, PACK 2 is supplied by the APU or the right-hand engines. Under normal circumstances, PACK 1 supplies the cabin and the cockpit, and PACK 2 only supplies the cabin. When only one PACK is in operation, it supplies both the cabin and the cockpit.

Findings

The maintenance company carried out inspections on different components as stipulated for cases such as this. These included the following, amongst others, and proved inconclusive:

- Inspection of all air and air conditioning configurations possible with the aerotracer⁴;
- Inspection of the air conditioning packs;
- Search for traces of contamination in and around the APU;
- Borescope inspection of engines 1 and 2.

In addition, the following work was also carried out:

- The cabin and cockpit filters were replaced;
- A small oil leak in IDG⁵ 1 was fixed;
- The compressor for engine 1 was cleaned.

As there were no clear findings that have explained the smell of oil, a test flight was carried out after the work had been completed. During this flight, all of the air and air conditioning configurations possible were activated. The test flight showed no abnormalities and a smell of oil was not detected at any time.

⁴ The aerotracer is a device designed to detect contaminated air. Amongst other things, the manufacturer's information states that, "The aerotracer allows within short time to detect and identify volatile compounds used in and for the aircraft, like hydraulic fluids or lubrication oils, and is sensitive enough to rate odour concentrations into a sensing scale."

⁵ IDG: integrated drive generator; an engine-driven generator

Previous incident

The maintenance files show that the aircraft HB-IYW had a history with regards to smell.

On 4 July 2016, the flight crew on the flight from Lyon (LFLL) to Zurich (LSZH) noticed an electrical smell and suspected that it was originating from the overhead panel. They declared Pan Pan and received radar vectoring for an immediate landing on runway 14 in Zurich. Approach and landing proceeded without incident.

Upon boarding the aircraft, the maintenance team was unable to identify the electrical smell. They did, however, replace three slightly damaged cables behind the overhead panel in the course of their examination and subsequently carried out intensive zonal inspections. In addition, they concluded that there was no need to change the existing maintenance programme for such inspections.

Based on the history of the flight and the clear findings and appropriate actions of the maintenance team, the STSB decided on 11 August 2016 not to open an investigation.

Analysis and conclusions

As an oily smell developed after turning on the APU bleed air and the air conditioning pack, the crew decided to turn the APU off again. In doing so, they acted in a safety-conscious manner and took precautions to prevent the cabin from being supplied with contaminated air. On the other hand, rapidly switching from PACK 1 to PACK 2 and immediately switching off the APU after the smell of oil developed left no time for a systematic investigation as to the source of the oily smell: from PACK 1, from PACK 2 or the APU.

The flight crew concluded that it was the bleed air from the APU and subsequently no longer used it. However, according to their statements they also had doubts with regards to PACK 1, which is why they decided to only use PACK 2 with engine bleed air for the flight to Zurich. This decision was arguably based on their experience rather than a systematic analysis.

After the copilot detected the oily odour when activating the engine bleed air and PACK 2, the flight crew immediately put their oxygen masks on. This was a safety-conscious decision and appropriate for the situation. However, the subsequent decision to continue with the flight to Zurich under these conditions can be questioned, as the cockpit and cabin were both supplied with the same air from PACK 2 (see illustration 1). This decision must have also surprised air traffic control, as they asked twice whether the flight crew really wanted to continue with the flight to Zurich or declare an emergency. According to the flight crew's statements they made this decision, among other reasons, in order to transport the passengers to Zurich in a timely manner and to guarantee their ability to make connecting flights.

The flight crew's decision to continue with the flight to Zurich may well have been partly attributable to the fact that an increased number of similar situations had been registered in the AVRO fleet in the past – where an unidentifiable odour occurred during flight, but no cause for the smell could be found after landing. This can lead flight crews into underestimating the dangers of contaminated air.

Payerne, 22 March 2017

Swiss Transportation Safety Investigation Board