



Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents (OSITI) as of 1st 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.

The German version of this report constitutes the original and is therefore definitive.

Aircraft type	Boeing 767-424 ER	N68061
Operator/owner	United Airlines Inc., Attn: Treasurer Willis Tower, 233 S Wacker Dr, Chicago, IL 60606-7147, USA	
Flight crew	One pilot in command (PIC), two first officers (FOs)	
Licences	Issued by the American Federal Aviation Authority (FAA)	
Location	Audincourt, France	
Coordinates	N 47° 27' 30" / E 6° 45' 00"	Altitude 19,325 ft AMSL ¹
Date and time	23 rd August 2017, 10:27 UTC (LT = UTC + 2 h)	
Type of operation	Commercial	
Flight rules	Instrument flight rules (IFR)	
Departing from	Zurich Airport (LSZH)	
Destination	Washington Dulles International Airport (KIAD), USA	
Flight phase	Take-off and climb	
Type of serious incident	Loss of pressure in the cabin	
Injuries to persons	None	
Damage to aircraft	Minor	Burst air duct in the equipment cooling system
Third-party damage	None	

¹ AMSL: Above Mean Sea Level

Course of events

The Boeing B767-424ER twin-jet airliner, registered as N68061, took off from runway 16 of Zurich Airport (LSZH) at 10:10 UTC on 23rd August 2017 for a regular scheduled flight to Washington Dulles International Airport (KIAD) on departure route VEBIT 3S. The pilot in command (PIC), who was sitting in the left-hand pilot's seat, took on the role of pilot monitoring (PM). The first officer (FO, subsequently identified as FO1), who was sitting in the right-hand pilot's seat, was the pilot flying (PF). The second first officer, who acted as an additional crew member (subsequently identified as FO2), was sitting in the observer's seat behind the other two pilots.

During take-off, the PIC experienced slight ear popping, which he felt was usual and normal for this aircraft type. During the continued climb he once again experienced ear popping at a flying altitude of approximately 8,000 ft AMSL, which he considered to be unusual. He therefore immediately looked at the pressurisation gauge on the overhead panel and noticed that the cabin altitude² was increasing at an unusually high rate. At this time, the B767 was passing a flying altitude just short of 10,000 ft AMSL with clearance from air traffic control up to flight level (FL) 120. As the pressure in the cabin was obviously not increasing as usual, the flight crew requested a climb to FL 100, which was granted by the air traffic controller (ATCO).

By this time, the engine indication and crew alerting system (EICAS) had generated the warning FWD EQPT VAL (forward equipment valve). In addition, the 'valve' warning light had lit up on the equipment cooling panel, which meant that one of the associated valves was not in the required position. FO2 then picked up the corresponding checklist, worked through it and in the process turned the respective selector switch from AUTO to STBY. Subsequently, the pressure in the cabin began to decrease and stabilise. However, the 'valve' warning light still remained on, which, according to the checklist, meant that pressurisation could not be ensured.

The PIC stated that on the basis of the now normal pressurisation he had wanted to climb further, as he had been feeling unsafe at FL 100 due to possible visual flight rules traffic at this altitude and because of the mountainous terrain around Zurich. The minimum sector altitude (MSA) for an aircraft at this point is 4,500 ft. The PIC added that there had still been a problem with the cabin pressure and he had wished to deal with it at a higher flying altitude.

The flight crew thereafter requested clearance to climb to FL 120, and received clearance for FL 130. During this climb, the pressure in the cabin was increasing normally. When asked by the ATCO whether they wished to remain near Zurich or continue along the planned route, the flight crew responded that they wished to continue the flight along the planned route. Four minutes later, the flight crew requested an additional climb and received clearance to climb to FL 230. At 10:27 UTC at a flying altitude of approximately 19,500 ft and whilst flying over the town of Audincourt (France), the PIC once again experienced severe ear popping and, at the same time, noticed that the cabin altitude was again beginning to increase at a higher rate. The flight crew decided to commence an immediate descent and put on their oxygen masks. In addition, they transmitted a mayday call. The 'cabin altitude' warning light on the equipment cooling panel came on, accompanied by the corresponding EICAS and audio warnings. This indicated that the cabin altitude had exceeded 10,000 ft. However, during the further course of events the oxygen masks in the cabin were not deployed, which meant that the cabin altitude never exceeded 13,500 ft.

The descent was approved by the ATCO without delay. The PF descended to FL 100 at idling speed, with extended speed brakes and the autopilot switched off. Radar vectoring provided by the ATCO ensured continued navigation. Approximately 50 km east-north-east of Dijon (France) at 10:34 UTC, the B767 entered a holding pattern at FL 100. FO2 then took over the radio, FO1 continued to fly the aircraft as the PF, and the PIC informed the airline operator via

² The atmospheric pressure in the cabin is expressed in relation to a specified altitude. Instead of referring to atmospheric pressure in the cabin it is therefore also referred to as cabin altitude.

radio and contacted the maintenance company responsible. The problem with the cabin pressure could not be solved with the support of technicians on the ground, and the flight crew, in consultation with the airline, therefore decided to return to Zurich. At this time, the aircraft was still over the maximum permissible landing weight. As there was no urgent need for immediate landing with excessive landing weight, the flight crew subsequently jettisoned approximately 35,000 lbs of fuel and, with landing gear and flaps extended early, burnt approximately another 30,000 lbs of fuel before landing on runway 16 at LSZH at 12:09 UTC.

During the descent, the cabin altitude was in line with the flying altitude of the aircraft (unpressurised aircraft). Over the course of the flight, the PIC informed the cabin crew and passengers about the problem with the cabin pressure several times and informed them of the decision to return to Zurich. Neither the cabin crew nor the passengers noticed the unusual increase in cabin altitude.

Findings

The aircraft was examined after landing and the following was ascertained:

- The equipment cooling overboard exhaust valve was fully open.
- The electrical connector on the equipment cooling overboard exhaust valve was unplugged.
- The air duct connected to the equipment cooling overboard exhaust valve was severely damaged (see Illustration 1).
- No fragments of the damaged air duct were found in the aircraft.
- The rotary switch on the equipment cooling panel in the overhead panel was in the STBY position.

Further evaluations revealed that, during pre-flight preparation, the flight crew had noticed the status message FWD GND EXH VAL on the EICAS. Two technicians from SR Technics, who possessed the necessary licenses required for maintenance work on a B767, subsequently carried out an error analysis and concluded that AVS/IFE inboard/outboard exhaust valve 1 was defective. This valve is part of the alternative ventilation system (AVS) and the cooling system for the inflight entertainment system (IFE) on the ground respectively. In consultation with United Airlines' maintenance control centre (MCC) it was decided that the aircraft could be given clearance in accordance with the minimum equipment list (MEL), which stipulates the deactivation of this valve.

In the office, one of the two technicians subsequently studied the procedure for deactivating the valve described in the MEL. In addition to pulling the appropriate circuit breaker, the electrical connector to the valve should be pulled and secured in accordance with operating procedures, and the valve should be fully opened manually. Additionally, a sticker should be placed on the equipment cooling panel in the cockpit to make the flight crew aware that the valve has been deactivated.

The technician subsequently returned to the aircraft without taking a written form of the operating procedures described in the MEL with him. Following that, he deactivated the equipment overboard exhaust valve instead of AVS/IFE inboard/outboard exhaust valve 1. He did not apply the appropriate warning sticker in the cockpit. The flight crew did this themselves before departure.

During this time, the second technician remained in the office and finished administrative duties.

During the investigation carried out by the STSB, it was established that the term AVS/IFE inboard/outboard exhaust valve was not used consistently in the aircraft maintenance manual (AMM) and in United Airlines' MEL: in some places the term AVS/IFE inboard/overboard exhaust valve was used.



Illustration 1: The damaged air duct (red arrow) connected to the equipment overboard exhaust valve (green arrow). The image on the right shows the removed damaged air duct.

Analysis and conclusions

The equipment cooling overboard exhaust valve closes automatically when the rotary switch on the equipment cooling panel is in the AUTO position and both engines are running whilst on the ground or when the aircraft is in the air. Because the electrical connector for the valve had been mistakenly unplugged by the technician, the valve remained fully open, and remained so even after the flight crew had set the switch to the STBY position during the flight.

The air duct to the equipment cooling overboard exhaust valve is not designed to withstand larger pressure differences as the valve is designed to normally be closed during flight. In the present case with an open valve, the air in the air duct could escape into the atmosphere unhindered. The crew stated that the pressure in the cabin stabilised upon switching the selector switch from AUTO to STBY and that the cabin altitude began to slightly decrease again. This can probably be attributed to the fact that in the new configuration the cabin air was no longer being actively conveyed across the aircraft by a fan.

During the continued climb, the pressurisation system was no longer able to compensate for the loss of pressure occurring due to the open equipment cooling overboard exhaust valve, and as a result the cabin altitude began to rise again. At a flying altitude of approximately 19,500 ft, the 'cabin altitude' warning light came on, which meant that the cabin altitude had now increased above 10,000 ft. At this time, the crew noticed that the problem with the pressure in the cabin persisted and consequently initiated an emergency descent.

It seems obvious that the air duct was not able to withstand the increased strain resulting from the occurring pressure difference and therefore burst.

The flight crew's decision to continue the climb along the intended flight path to a flying altitude of over 10,000 ft AMSL, even though pressurisation of the cabin was not ensured according to the processed checklist, was not in accordance with the operating procedures and was risky.

The mix-up by the technician, who deactivated the wrong valve in the open position, was the cause of the serious incident. The approach of working from memory, without taking a written form of the operating procedures described in the MEL with him, was identified as a contributory factor during the investigation.

The inconsistent use of valve designations in the AMM and MEL may have facilitated the mix-up and was identified as a factor to risk during the investigation.

Measures already taken

The competent maintenance company, SR Technics, carried out an internal investigation into this incident. The result was recorded in a report, which was made available to the Federal Office of Civil Aviation (FOCA). FOCA passed the report on to the American Federal Aviation Authority (FAA).

The following measures were implemented at SR Technics:

- information about the incident was passed to all SR Technics stations to be forwarded to all technicians;
- the ensuring that the corresponding documentation for all maintenance work is available at the aircraft;
- introduction of a two-man principle when carrying out maintenance work in accordance with the MEL.

Based on these findings, the Swiss Transportation Safety Investigation Board concludes that, with regards to the serious incident under investigation, no other findings are expected which would need to be addressed to prevent such an incident. Therefore, based on article 45 of the OSITI, the STSB will not investigate further and concludes the investigation with this summary report. The German version of this report constitutes the original and is therefore definitive.

Bern, 11th April 2018

Swiss Transportation Safety Investigation Board