

# Investigation Report

The Investigation Report was written in accordance with para 18 Law Relating to the Investigation into Accidents and Incidents Associated with the Operation of Civil Aircraft stating facts only.

## Identification

Type of Occurrence:	Serious incident
Date:	14 May 2017
Location:	Near Munich
Aircraft:	Airplane
Manufacturer / Model:	Boeing / B737-600
Injuries to Persons:	None
Damage:	None
Other Damage:	None
State File Number:	BFU17-0501-EX

## Factual Information

### History of the Flight

On 14 May 2017 at 0925 UTC the Boeing 737-600 took off from runway 24 at Prague Airport, Czech Republic, for a flight to Jerba/Zarzis, Tunisia. According to the available voice recordings depressurisation in the cabin occurred at approximately 0939 UTC in German airspace, while passing Flight Level (FL) 320, which triggered the oxygen masks for the passengers.

According to the statement of the Pilot in Command (PIC) both pilots donned their oxygen masks and initiated an emergency descent to FL100. According to the available voice recordings at 0940:14 UTC the cockpit crew informed Munich Radar about the emergency descent. At 0940:17 UTC Air Traffic Control (ATC) issued descent clearance to FL100. The crew decided to divert to Munich Airport and prepared for the approach to runway 26L. At 0955:37 UTC the cockpit crew informed ATC that they were ready for the approach. Subsequently, at 0955:41 UTC the Boeing was cleared for the approach to runway 26L: "[...] *roger turn left heading two three zero descend four thousand feet cleared ILS two six left*".

At approximately 1005 UTC the Boeing 737-600 landed on runway 26L and taxied to aircraft stand 196.

According to the medical services at Munich Airport neither passengers nor crew members had reported any health impairments.

## Personnel Information

### Pilot in Command

The 44-year-old pilot held a valid Airline Transport Pilot's License (ATPL(A)), issued by the Tunisian Ministry of Transportation. His licence listed the following ratings:

- ME/IR B737 300-800, valid until 30 June 2017
- TRI/SFI, valid until 31 March 2020

He had a total flying experience of about 12,295 hours. Within the last two weeks prior to the incident he had conducted more than 15 take-offs and landings. His class 1 medical certificate was valid until 30 September 2017.

### Co-pilot

The 33-year-old co-pilot held a valid Commercial Pilot's Licence (CPL(A)) issued by the Tunisian Ministry of Transport. His licence listed the following ratings:

- ME/IR B737 300-800 valid until 30 April 2018

He had a total flying experience of about 3,344 hours. His class 1 medical certificate was valid to 28 February 2018.

## Aircraft Information

The Boeing 737-600 is the smallest model of the B 737 Next Generation (NG) series, designed in the 1990s by the Boeing Company. It is equipped with two CFM56 engines. It has a maximum take-off mass of 61,869 kg and can seat up to 149 passengers.

On 31 January 2014 the aircraft received a Tunisian certificate of registration. The last certificate of airworthiness was issued on 6 March 2017.

The Boeing 737 is equipped with an automatic warning system which acoustically warns the crew if the pressure drop exceeds a cabin pressure altitude of 10,000 ft. If the cabin pressure altitude exceeds 14,000 ft the passenger oxygen masks are triggered automatically. The pilots can also trigger the oxygen masks for the passengers manually.

## Meteorological Information

According to the aviation routine weather report (METAR) of Prague Airport the following weather conditions prevailed at 0900 and 0930 UTC:

METAR LKPR 140900Z VRB03KT 9999 FEW030TCU 20/12 Q1020 TEMPO TS SCT030CB=

METAR LKPR 140930Z 27004KT 230V360 9999 FEW030TCU SCT035 20/10 Q1020 TEMPO TS SCT030CB

According to the aviation routine weather report (METAR) of Munich Airport the following weather conditions prevailed at 0920 and 0950 UTC:

METAR EDDM 140920Z 24004KT 180V290 9999 SC033 BKN090 18/12 Q1022 NOSIG=

METAR EDDM 140950Z 24005KT 190V290 9999 BKN030 SCT090 18/11 Q1022 NOSIG=

## Radio Communications

Radio transmissions were recorded by the responsible ATC unit and the recording was made available to the BFU for evaluation.

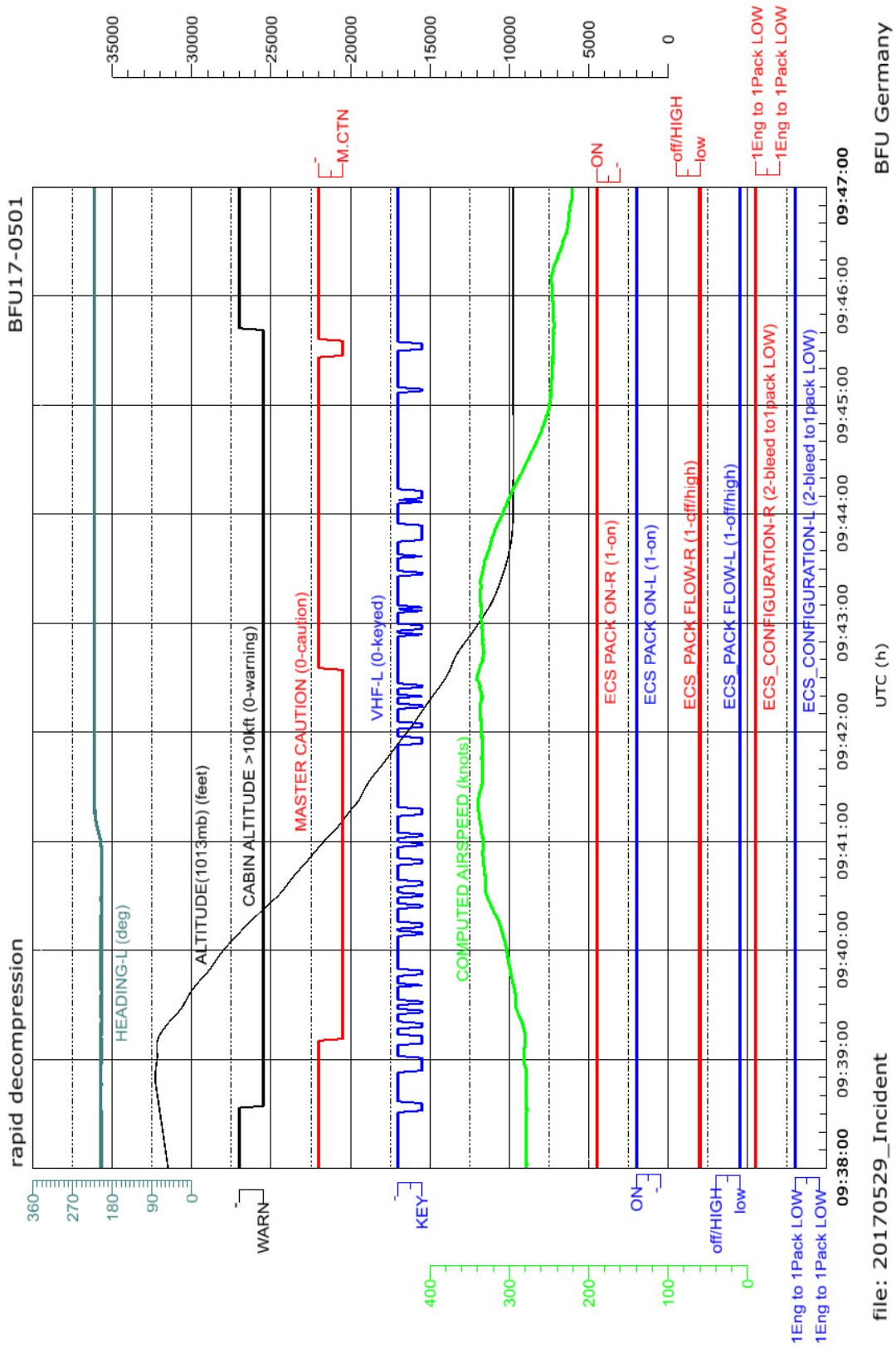
## Aerodrome Information

Munich Airport (EDDM) has two parallel runways, which are 4,000 m long and 60 m wide, oriented 081°/261°. The tower is located in the centre between the two runways. The threshold of runway 26L has an elevation of 1,470 ft AMSL.

## Flight Recorder

The aircraft was equipped with a Flight Data Recorder (FDR) and a Cockpit Voice Recorder (CVR). The BFU was able to read out and analyse the data.

The following graph shows the technical reaction of the cabin altitude switch (CABIN ALTITUDE > 10kft) during the time of the event until a flight altitude of 10,000 ft was reached. The black line (ALTITUDE 1013mb) represents the progression of the barometric altitude until an altitude of 10,000 ft was reached. Both packs were switched on.



## Wreckage and Impact Information

The technical examination revealed the following:

All passengers and the cabin and cockpit crews had used their oxygen masks.

A leaky valve at the bulk seal at the keel beam of the APU bleed duct was identified as reason for the depressurisation.

Another leakage was found in the area of the left-hand pack.

The following photo shows the loose clamp in position 2 which should have been above the bulk seal in position 1.



Bulk seal including loose clamp

Source: BFU

Both Cabin Pressure Controllers (CPC) were read out. Both had recorded the error High Cabin Air Leak Rate. One condition for this error being recorded is that the cabin pressure rate was more than 2,000 SLFPM (sea level feet per minute).

After the irregularities had been eliminated a cabin pressure test was conducted which revealed leakage at the left-hand pack. After the left-hand pack had been closed down the leak tightness of the pressurized cabin was established and the aircraft cleared for service in accordance with the Minimum Equipment List (MEL) for a flight without passengers up to FL250.

## Organisations and their Procedures

The MEL lists all functions, instruments, and systems, which may be defect, but it is still permitted to operate the aircraft. The MEL also indicates how long a system may be defect or when it has to be repaired. It also contains limitations for the operation of the aircraft. One example is the operation of a defect aircraft without passengers to fly it to the maintenance organisation. If a system is not part of the MEL its function is required for the operation of an aircraft. The responsible aviation authority has to approve the MEL.

Investigator in charge:           Pfefferl  
Assistance:                        Hempelmann  
Field Investigation:               Rattelmüller  
Braunschweig, 19 September 2017

This investigation was conducted in accordance with the regulation (EU) No. 996/2010 of the European Parliament and of the Council of 20 October 2010 on the investigation and prevention of accidents and incidents in civil aviation and the Federal German Law relating to the investigation of accidents and incidents associated with the operation of civil aircraft (*Flugunfall-Untersuchungs-Gesetz - FIUUG*) of 26 August 1998.

The sole objective of the investigation is to prevent future accidents and incidents. The investigation does not seek to ascertain blame or apportion legal liability for any claims that may arise.

This document is a translation of the German Investigation Report. Although every effort was made for the translation to be accurate, in the event of any discrepancies the original German document is the authentic version.

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