Bundesstelle für
Flugunfalluntersuchung

German Federal Bureau of
Aircraft Accident Investigation

Interim Report

Identification

Type of Occurrence:	Serious incident
Date:	4 April 2012
Location:	Near Lugano (Switzerland)
Aircraft:	Airplane
Manufacturer / Model:	Boeing / B737-800
Injuries to Persons:	13 persons suffered minor injuries
Damage:	Aircraft not damaged
Other Damage:	None
Information Source:	Investigation by BFU
State File Number:	BFU FX003-12
Published:	June 2012

Factual Information

On a passenger flight from Bergamo (Italy) to East Midlands (Great Britain) a de-pressurisation occurred during the climb to cruise level. The crew carried out an emergency descent and landed the airplane at Frankfurt-Hahn Airport.

13 passengers suffered minor injuries.

At the time of the occurrence the airplane was in Swiss airspace. The Swiss Accident Investigation Board (SAIB) delegated the investigation into the occurrence to the German Federal Bureau of Aircraft Accident Investigation (BFU).

History of the Flight

At 1056 hrs[1] the airplane had taken off from Bergamo Airport (LIME) to a scheduled service to East Midlands (EGNX). Six crew members and 134 passengers were aboard the airplane.

After about 13 minutes, the airplane was in climb above the Swiss Alps about 30 NM north of Lugano in Swiss airspace when the crew noticed a sudden change in cabin pressure. They reported it had manifested through a draft, a decrease in temperature and pressure on the ears. The indication for the cabin rate change had been at the maximum climb indication of 4,000 ft/min and the cabin altitude had reached and exceeded 10,000 ft. The crew donned the oxygen masks and the Pilot in Command (PIC) requested to complete the *Cabin Altitude Warning/Rapid Depressurization* checklist.

The data of the Flight Data Recorder (FDR) showed that at 1108:40 hrs the master caution and about 20 seconds later the cabin altitude warning (cabin altitude > 10,000 ft) was triggered. The warning ceased about two minutes later.

The crew initiated an emergency descent. At 1111:19 hrs the copilot reported via radio: “Mayday, mayday, mayday […], we have a rapid depressurization. Emergency descent. Descending to ah ah next would be flight level one hundred, turning left on heading two eight five”. Immediately afterwards the airplane began to descent and turned toward north-west. Initially the rate of descent was more than 6,000 ft/min and after about 20 seconds decreased to about 4,000 ft/min. The Flight Level (FL) was decreased in stages to FL100.

According to the radar data the aircraft had been in FL308 when the descent was initiated. At the beginning of the emergency descent of the B737-800 a brief airprox (4.5 NM horizontally and about 325 ft vertically) with an Airbus A319 flying in FL300 also north occurred.

At 1116 hrs the airplane stopped the descent in FL100. The crew decided to fly to Frankfurt-Hahn Airport. The airplane landed there without further problems.

The purser stated she had noticed a sudden change in pressure and temperature. 10-20 seconds later the oxygen masks had deployed. A few passengers had had brief problems putting their masks on.

1 All times local, unless otherwise stated.

Personnel Information

Pilot in Command (PIC)

The 31-year-old PIC was a citizen of Great Britain and held an Air Transport Pilot's License (ATPL(A)) issued by the Irish civil aviation authority in accordance with ICAO and JAR-FCL on 29 August 2009 valid to 28 August 2014. The type rating for the B737-300-900 was valid to 31 December 2012.

His class 1 medical certificate was valid to 8 May 2013.

He had a total flying experience of about 6,000 hours; 5,800 of which on the type in question.

Co-pilot

The 30-year-old copilot was a citizen of Great Britain and held a Commercial Pilot's License (CPL) issued by the Irish civil aviation authority on 9 January 2012 valid to 8 January 2017.

Since 6 December 2011 he held the type rating for the B737-800 valid to 31 December 2012.

His class 1 medical certificate was valid until 30 May 2012.

His total flying experience was about 820 hours; 120 hours of which on the type in question.

Purser

In May 2007, the flight attendant had completed the Initial Safety Training for the B737-800.

Her total flight experience was about 4,500 hours.

Aircraft Information

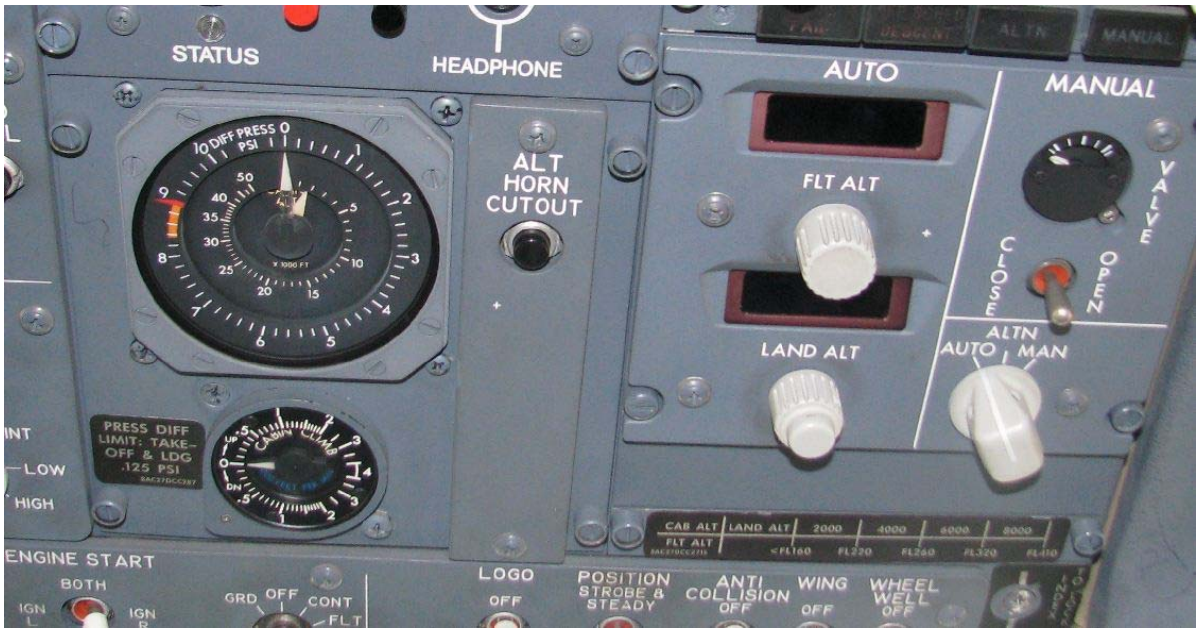
Manufacturer:	Boeing
Type:	B737-8AS
Manufacturer's Serial Number (MSN):	33546
Year of manufacture:	2003
MTOW:	66,900 kg
Engines	CFM International, CFM56-7B

The aircraft had a valid Irish certificate of registration and was operated by an Irish operator.

At the time of the occurrence the airplane had a total of 31,180 operating hours and 20,400 flight cycles.

The pressurized cabin mainly consisted of the airframe, the air-conditioning packs, an outflow valve, an overpressure relief valve and a negative pressure relief valve. The aircraft was equipped with two Cabin Pressure Controllers (CPC) one of which was in control. The second CPC served as the redundant system.

The operating and indication panel of the digital cabin pressure control system was part of the overhead panel in the cockpit. Indications for the cabin altitude and the differential pressure, the cabin rate of climb indicator (maximum 4,000 ft/min) and the outflow lave position indicator were installed.



Digital Cabin Pressure Control System Photo: BF

The Quick Reference Handbook (QRH) included the checklist *Cabin Altitude Warning/ Rapid Depressurization*.

1 Don oxygen masks and set regulators to 100%.

2 Establish crew communications.

3 Pressurization mode selector . . . . . MAN

4 Outflow VALVE switch . . . . . Hold in CLOSE until the outflow VALVE indication shows fully closed

5 If cabin altitude is not controllable:

Passenger signs . . . .ON

If the cabin altitude exceeds or is expected to exceed 14,000 feet:

PASS OXYGEN switch . . . . . ON

►►Go to the Emergency Descent checklist on page 0.1

6 If cabin altitude is controllable: Continue manual operation to maintain correct cabin altitude.

When the cabin altitude is at or below 10,000 feet: Oxygen masks may be removed.

The checklist Emergency Descent stipulated the following actions:

> *1 Announce the emergency descent. The pilot flying will advise the cabin crew, on the PA system, of impending rapid descent. The pilot monitoring will advise ATC and obtain the area altimeter setting.*
>
> *2 Passenger signs . . . . . ON*
>
> *3 Without delay, descend to the lowest safe altitude or 10,000 feet, whichever is higher.*
>
> *4 ENGINE START switches (both) . . . . . CONT*
>
> *5 Thrust levers (both) . . . . Reduce thrust to minimum or as needed for anti-ice*
>
> *6 Speedbrake . . . . FLIGHT DETENT*
>
> *7 Set target speed to Mmo/Vmo.*
>
> *8 When approaching the level off altitude: Smoothly lower the SPEED BRAKE lever to the DOWN detent and level off. Add thrust and stabilize on altitude and airspeed.*

Meteorological Information

At the time of the occurrence, daylight prevailed as well as Visual Meteorological Conditions (VMC) in the relevant flight level.

Communication

The radio communications recordings of the various air traffic service providers were made available for the investigation.

Flight Recorders

The aircraft was equipped with a Honeywell Solid State Flight Data Recorder (SSFDR) and a Honeywell Solid State Cockpit Voice Recorder (SSVCR). The data recorders were read out at the BFU.

The radar data recordings of the various air traffic service providers were made available to the BFU.

Wreckage and Impact Information

It was determined that the oxygen masks stowed next to the two pilot seats in the cockpit were pulled out.

In the cabin all the oxygen masks had deployed. On the left side of the cabin in the rows 2, 3, 4 and on the right side of the cabin in rows 2 and 3, on the right overwing emergency exit and in the forward toilet the oxygen masks had deployed but the oxygen generator had not been activated.

The two cabin pressure controllers were installed in the electronic equipment compartment behind the nose landing gear. The static port on the CPC#1 was covered with a black shipping plug.

Cabin Pressure Controller #1 Static Port Photo: BF

Read-out of the Cabin Pressure Controllers

The recorded data of the non-volatile memory of the two CPCs was downloaded. The analysis of the data showed that during climb the CPC#2 was in control.

During the climb phase transmission errors occurred (fault code 39 RS422_XMIT_FAIL and fault code 40 RS422_WA_FAIL). Subsequently CPC#2 changed to standby and CPC#1 took over. At that time CPC#2 had measured an ambient pressure of 4.28 PSI and 4.27 PSI (about 295 hPa), respectively. This was about flight level 305. The cabin pressure was measured with 12.10 PSI and 12.09 PSI (about 833 hPa), respectively. Twelve seconds later CPC#2 recorded fault code 17 (CABIN_10000FT_MESSAGE). The measured ambient pressure was 4.22 PSI and the cabin pressure 10.10 PSI. The cabin rate of climb was measured with 6776.25 ft/min at that time. Six seconds late fault code 18 (CABIN_13500FT_MESSAGE) was recorded. The measured ambient pressure was 4.20 PSI (289 hPa) and the cabin pressure 8.80 PSI (607hPa). At that time the cabin rate of climb was at 7656.5 ft/min.

CPC#1 recorded a cabin pressure of 15.16 PSI (1,045 hPa) and an ambient pressure of 4.20 PSI. The outflow valve was opened by 76.83°. At that time fault code 90 (OFV_CAB_PRESS_SWITCH_Active) was recorded. About 36 seconds later, the CPC#1 recorded fault code 58 (MANUAL_MODE_SWITCH_Active). At that time the cabin pressure measured by CPC#1 was 15.16 PSI and the ambient pressure 4.21 PSI.

Fire

There was no fire.

Additional Information

On the day prior to the day of the occurrence problems with the cabin pressure control system had occurred during a flight. The crew had reported these problems by entering them into the technical logbook.

During the maintenance work carried out at night the data of the two cabin pressure controllers was downloaded to analyse the recorded current and former fault codes from the non-volatile memory. No fault codes were found. The subsequently conducted ground tests of the two CPCs did not produce any fault codes either. The compu-

ter No 1 for the cabin pressure control system was changed due to the problems which had occurred during the previous flight.

The BFU is in the possession of a written statement of one of the maintenance employees which describes the content and process of the maintenance work carried out the night before the serious incident. The operator stated the employee held the license for certified category B2 personnel (Avionic). He stated that during the night he had downloaded the CPC data from the non-volatile memory (NVM). Afterwards he had assisted in finding out which of the two CPCs had been "in control" during the previous flights. The NVM had not recorded any fault codes. Subsequently carried out pressurization system ground tests on both CPCs did not reveal any faults. Since they had to wait for a spare part to arrive the work on the airplane had been interrupted and continued in the morning. Among other things, the CPC#1 was changed. During installation of the CPC he had forgotten to remove the shipping plug.

Afterwards the aircraft had flown to East Midlands in a cruising altitude of FL370. During the flight CPC#2 was "in control". No problems had occurred.

Safety Recommendation

Safety Recommendation No. 24/2012

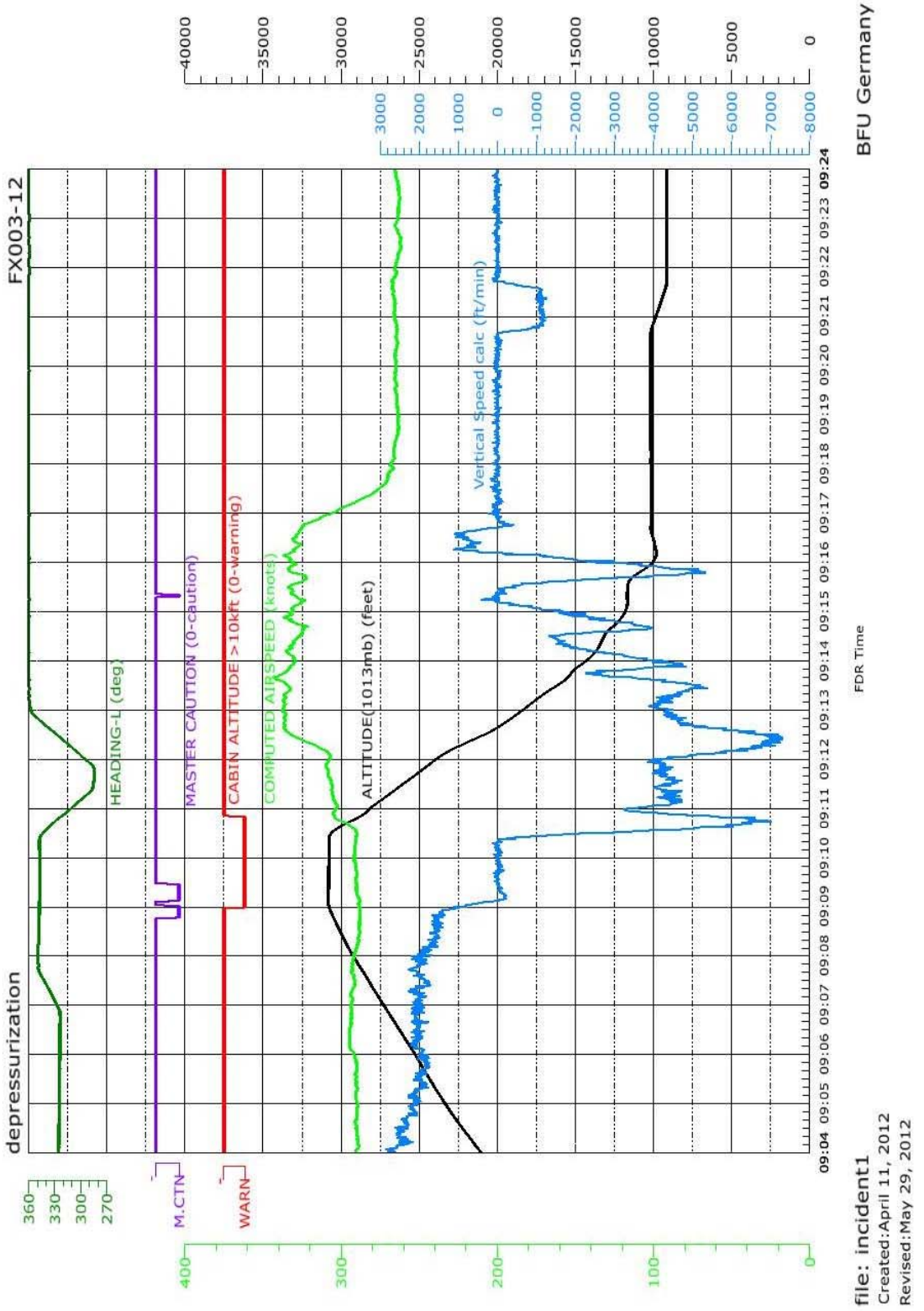
The Federal Aviation Administration (FAA) should require Boeing to re-design the shipping plugs in a way which makes them more recognisable. The shipping plugs should also be coupled with an eye-catching tag.

Maintenance and Repair Organisations should only cover the static ports of a cabin pressure controller with a shipping plug which is clearly visibly coupled with a tag.

Investigator in charge: Jens Friedemann

Appendices

Excerpt FDR data


FX003-12
depressurization
HEADING-L (deg)
MASTER CAUTION (0-caution)
CABIN ALTITUDE >10kft (0-warning)
COMPUTED AIRSPEED (knots)
ALTITUDE(1013mb) (feet)
Vertical Speed calc (ft/min)
M.CTN
WARN
FDR Time
BFU Germany
file: incident1
Created:April 11, 2012
Revised:May 29, 2012

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 - FlUUG) of 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 asign blame or liability or to establish claims.

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