

# Interim Report

## Identification

Type of Occurrence:	Serious incident
Date:	31 July 2016
Location:	Stuttgart
Aircraft:	Airplane
Manufacturer / Model:	The Boeing Company / B737-800
Injuries to Persons:	None
Damage:	Minor damage to aircraft
Other Damage:	None
State File Number:	BFU16-1061-5X
Published:	November 2016

## Factual Information

### History of the Flight

On 31 July 2016 at 1123:41 hrs<sup>1</sup> the aircraft veered off the operating area after touch-down during taxi from the runway on to the taxiway and came to a stop in the grass. Six crew members and 188 passengers were on board.

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<sup>1</sup> All times local, unless otherwise stated.

The aircraft had been on a flight from Varna, Bulgaria, to Stuttgart, Germany. The Pilot in Command (PIC) was also Pilot Flying (PF). The co-pilot was Pilot Monitoring (PM). The approach was conducted with the help of the Instrument Landing System (ILS) to runway 25. In the vicinity of Stuttgart scattered storm cells had formed.

At about 1119:23 hrs as the airplane was on approach the co-pilot established radio contact with the tower controller. At about 1121:19 hrs the crew received landing clearance. “[Call sign], india approved, wind 190 degrees, 4 knots, runway 25 cleared to land.”

With a ground speed of approximately 150 kt and a landing mass of about 59 t the aircraft touched down within the touchdown zone of runway 25. Immediately after touch-down the thrust reversers and the speed brakes were activated. The auto brake system controlled the wheel brakes. By means of the Flight Data Recorder (FDR) data it was possible to retrace as to when the individual systems had been activated and deactivated. At a ground speed of approximately 92 kt, the speed brakes, the thrust reversers, and the auto brake system were deactivated. In the following approximately 12 seconds the wheel brakes were not activated. The aircraft's speed decreased from approximately 92 kt to about 82 kt.

After the auto brake had been deactivated the brake pressure increased to about 1,000 psi. At that time the aircraft had a taxi speed of about 82 kt and was just about abeam of taxiway H. Then the aircraft left runway 25 and turned, with a taxi speed of approximately 61 kt, into taxiway I. As the aircraft was on taxiway I the brake pressure increased further to the maximum value of 3,000 psi. With a taxi speed of approximately 23 kt the aircraft veered off taxiway I, about abeam of the second lamp of the runway edge lighting.

At about 1123:41 hrs the aircraft came to a stop next to taxiway I. At 1136 hrs the operations manager on duty and a paramedic entered the aircraft via a scaling ladder.

During an interview conducted by the BFU, the PIC stated that a large puddle of water had formed in the intersection region between runway 25 and taxiway I. According to his statement the aircraft had had a maximum taxi speed of 30 kt. Due to the water puddle in the intersection region between runway and taxiway its moving direction was no longer controllable. The braking action had been marginal

## Personnel Information

### Pilot in Command

The 34-year-old PIC held an Airline Transport Pilot's Licence (ATPL(A)) issued on 21 August 2015 by the Luftfahrt-Bundesamt (German aviation authority, LBA) in accordance with Part-FCL. The licence listed the ratings as PIC for Boeing B737 300-900 in accordance with instrument flight rules (PIC IR). The rating was valid until 31 August 2017.

He held a class 1 medical certificate valid until 23 June 2017, which was provided to the BFU.

The PIC had a total flying experience of about 7,550 hours; approximately 7,360 hours of which were on type.

### Co-pilot

The 40-year-old co-pilot held an Airline Transport Pilot's Licence (ATPL(A)) issued on 9 June 2015 by the Luftfahrt-Bundesamt in accordance with Part-FCL. The licence listed the ratings as co-pilot for Boeing B737 300-900 in accordance with instrument flight rules (COP IR). The rating was valid until 31 March 2017. The licence also listed the ratings as PIC for Cessna C500 / 550 / 560 in accordance with instrument flight rules (PIC IR).

He held a class 1 medical certificated with the limitation VDL valid until 10 October 2016, which was provided to the BFU.

He had a total flying experience of approximately 4,170 hours; of which about 2,518 hours as PIC were on other types. He had flown about 72 hours on Boeing B737-800.

## Aircraft Information

The Boeing B737 - 800 is a transport aircraft equipped with two jet engines. The operator provided the following information:

Manufacturer	The Boeing Company
Year of manufacture	2008
Serial number	29 649
Operating hours	30,255
Flight cycles	22,312
Maximum T/O Mass	77,000 kg
Maximum Landing Mass	66,360 kg
Engine type	CFM56-7B26/3

The aircraft had a German certificate of registration and was operated by a German operator.

## Flight Operations Manual (FOM)

The Operations Manual Part B, Volume 1 - Limitations and Procedures describes the Landing Roll and After Landing Procedures:

After touch-down the PF should activate the thrust reversers and the PM monitor the speed brakes' lever movement. As soon as a taxi speed of 60 kt is reached the PM should call "SIXTY". Then the PF should set the thrust reverser levers to idle and subsequently to full down.

Before reaching taxiing speed the auto brake system should be deactivated. After leaving the runway the After Landing Procedure should be applied. This procedure stipulates as to when the speed brakes should be retracted again.

**25. Landing Roll Procedure**

Pilot Flying	Pilot Monitoring
Disengage the autopilot. Control the airplane manually.	
Verify that the thrust levers are closed. Verify that the SPEED BRAKE lever is UP. If the SPEED BRAKE lever is not UP, manually raise the SPEED BRAKE lever. Without delay, fly the nose wheel smoothly onto the runway.	Verify that the SPEED BRAKE lever is UP. Call "SPEED BRAKES UP". If the SPEED BRAKE lever is not UP, call "SPEED BRAKES NOT UP". Monitor the rollout progress.
Verify correct autobrake operation.	
<b>WARNING! After the reverse thrust levers are moved, a full stop landing must be made. If an engine stays in reverse, safe flight is not possible.</b>	
Without delay, move the reverse thrust levers to the interlocks and hold light pressure until the interlocks release. Apply reverse thrust as needed.	Verify that the forward thrust levers are closed. When both REV indications are green, call "REVERSERS NORMAL". If there is no REV indication(s) or the indication(s) stays amber, call "NO REVERSER ENGINE NUMBER 1", or "NO REVERSER ENGINE NUMBER 2", or "NO REVERSERS".
By 60 knots, start movement of the reverse thrust levers to be at the reverse idle detent before taxi speed.	Call "SIXTY"
After the engines are at reverse idle, move the reverse thrust levers full down.	
Before taxi speed, disarm the auto brake by manual braking and announce "MANUAL BRAKING".	When AUTO BRAKE DISARM light illuminates, call "AUTO BRAKE DISARM"

**Note:** Controls should not be transferred above 60 knots.

(1) Excerpt OM B Vol.1 - Landing Roll Procedure

Source: OM operator

**26. After Landing Procedure**

Start the After Landing Procedure when clear of the active runway.

Engine cool-down recommendations:

- run the engines for at least 3 minutes
- use a thrust setting normally used for taxi operations
- routine cool-down times less than 3 minutes are not recommended.

Pilot Flying	Pilot Monitoring
Move or verify SPEED BRAKE lever DOWN.	
	Set the PROBE HEAT switches to AUTO or OFF.
	Set the LANDING light switches to OFF.
	Set the TAXI light switch to ON.
	Start the APU, as needed.
	Set the ENGINE START switches as needed.
	Set the POSITION light switch to STEADY.
Set the weather radar to OFF.	
	Set the AUTO BRAKE select switch to OFF.
	Set the flap lever to UP.
	Set the transponder mode selector to ALT OFF.

**Note:** Consider delayed APU start according to taxi in distance.

(2) Excerpt OM B Vol.1 - After Landing Procedure

Source: OM operator

## Meteorological Information

At the time of the occurrence daylight and Visual Meteorological Conditions (VMC) prevailed.

According to the aviation routine weather report (METAR) of Stuttgart Airport of 0920 hrs visibility was more than 10 km. The wind direction varied with 3 kt. Slight storm activity with rain prevailed. The clouds in 2,000 ft were 3/8 to 4/8 and in 3,400 ft 5/8 to 7/8 with cumulonimbus clouds. Temperature was 19°C, the dewpoint 18°C, and the barometric air pressure (QNH) 1,014 hPa.

EDDS 310920Z VRB03KT 9999 -TSRA SCT020 BKN035CB 19/18 Q1014 BECMG NSW=

## Weather Conditions at the Airport

According to the aviation routine weather report (METAR) of 0850 UTC, prior to the time of the occurrence, a storm with rain moved through the area of the airport.

METAR EDDS 310850Z 29004KT 9999 -SHRA FEW020 SCT039TCU BKN050 21/17 Q1014  
TEMPO TSRA BKN040CB=

After the occurrence rain still prevailed in the vicinity of the airport.

METAR COR EDDS 310950Z VRB02KT 9999 VCTS SCT017 SCT036CB BKN060 20/18 Q1014  
RETSRA NOSIG=



(3) Photo taken immediately after the aircraft had come to a stop

Source: Private

## Aids to Navigation

An ILS approach was flown to runway 25 at Stuttgart Airport.

## Radio Communications

Radio transmissions with air traffic control were conducted in the English language. A transcript was provided to the BFU for evaluation.

## Aerodrome Information

The information regarding Stuttgart Airport was copied from the Aeronautical Information Publication (AIP). Stuttgart Airport is located 13 km south of the city of Stuttgart. Aerodrome elevation is 1,276 ft.

### Runways

Runway	Dimensions	Surface
25 (254 Degrees)	3,345 m x 45 m	Concrete

Runway 25 had an ascending slope of 0.9%.

The Landing Distance Available (LDA) of runway 25 was 3,345 m.

Taxiway I was 30 m wide and had a longitudinal slope of 1.9% in the direction of the apron. The transverse slope of the taxiway was below the maximum of 1.5% (ICAO Annex 14 and Commission Regulation (EU) No 139/2014).

### Taxiway Friction Measurement

Compared to runways, there was no requirement to conduct friction measurement of taxiways. On 13 July 2016 the last friction measurement on the runway was conducted in accordance with the provisions of the manufacturer of the measurement device.

## Flight Recorder

The CVR and the FDR were seized by the BFU and read out at the avionics laboratory at the BFU facility. Both recorders did not show any damages.

### FDR and CVR Information

#### Cockpit Voice Recorder

Manufacturer	Honeywell
Model	SSCVR
Part Number	980-6022-001
Serial number	10156

FDR  
Manufacturer Honeywell  
Model SSFDR  
Part Number 980-4700-042  
Serial number 10018

At the time of the publication of this report the analysis of the CVR is still on-going.

## Wreckage and Impact Information

The operator's maintenance organisation had conducted a Runway/Taxiway Excursion inspection. According to the provided documentation the wheels Nos 1, 2, and 3 of the main landing gear and both wheels of the nose landing gear were replaced. The Steering Metering Valve Assy of the nose landing gear was defective and therefore replaced.

Extension and retraction of the nose landing gear was checked.



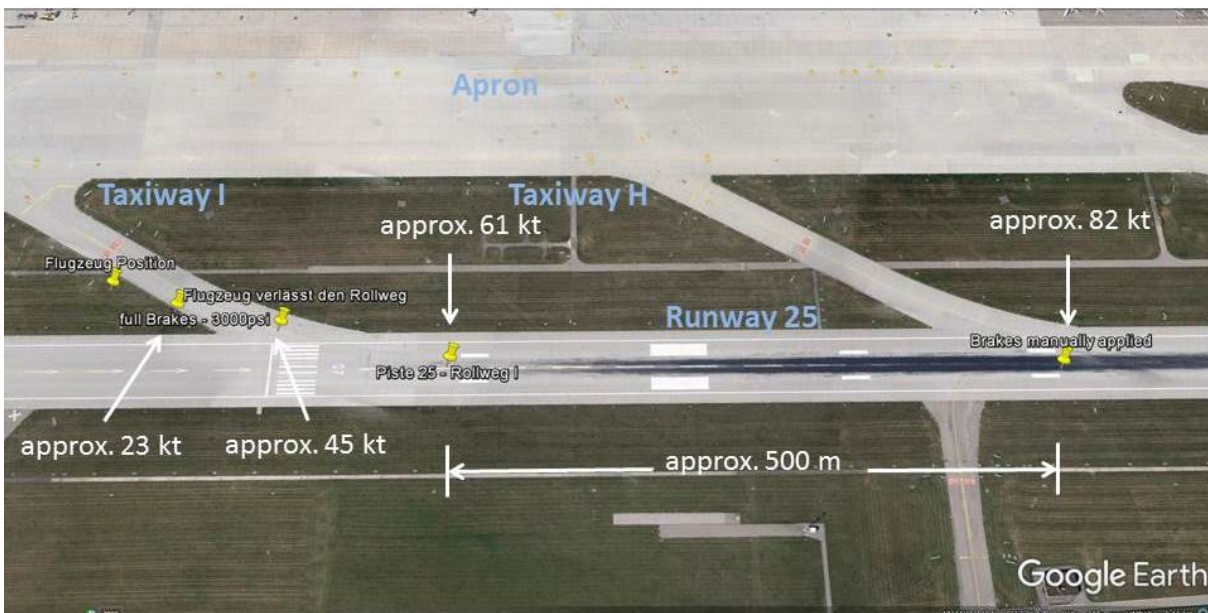
(4) Aerial photo of the runway excursion

Photo: BFU



(5) Aerial photo of the runway excursion

Photo: BFU



(6) Overview of the runway excursion

Source: google-earth / BFU

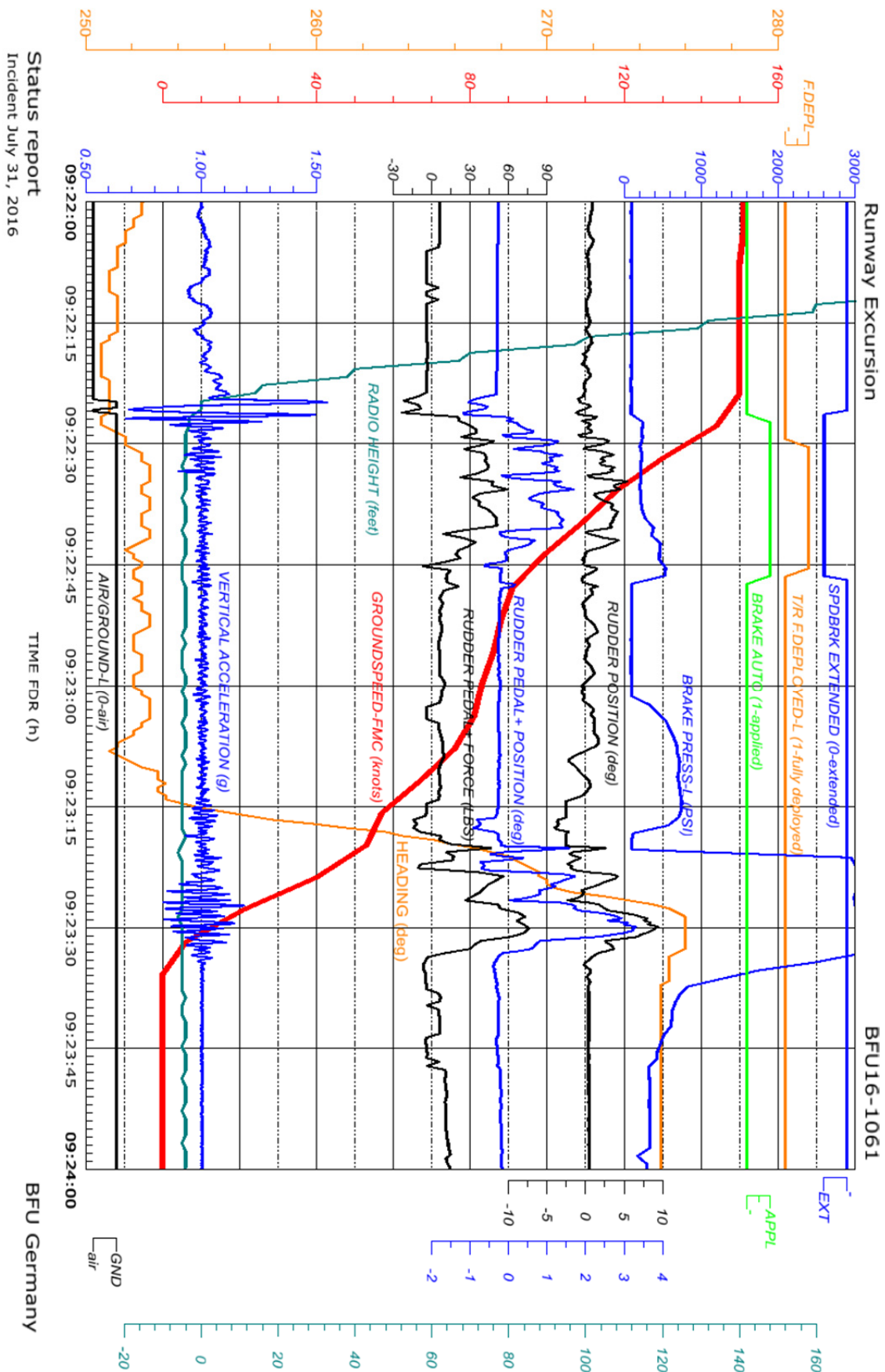
Investigator in charge: Norman Kretschmer  
Field investigation: Jens Friedemann, Hans Wegener  
Avionic laboratory Hans-Werner Hempelmann

## Appendix

### Overview FDR Parameters

Based on the FDR data it was possible to identify the time when the aircraft left the runway centreline. The heading, in combination with longitude and latitude positions, was used. The aircraft turned into taxiway I with a taxi speed of approximately 61 kt.

A graph using the following FDR parameters was created: Air/Ground Switch, Heading (deg), Vertical Acceleration (g), Radio Height (feet) Ground Speed (knots), Rudder Pedal Force (lbs), Rudder Pedal Position (deg), Brake Pressure (lbs), Auto Brake (applied/not applied), Thrust Reverser (deployed/not deployed) and Speed Brakes (extended/not extended).



(7) Overview FDR parameters

Source: BFU

This investigation is 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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