

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:	22 October 2014
Location:	Frankfurt/Main
Aircraft:	Airplane
Manufacturer / Model:	The Boeing Company / B 747-422
Injuries to Persons:	None
Damage:	Minor damage to aircraft
Other Damage:	None
Information Source:	Investigation by BFU
State File Number:	BFU EX008-14

Factual Information

During the landing on runway 25L at Frankfurt Main Airport the lower surface of engine No 4 (outer right) touched the surface of the runway. Thus the engine cowling was damaged. Persons were not injured.

History of the Flight

The description of the course of events is based on the statements of the Pilot in Command (PIC) and the analysis of the Flight Data Recorder (FDR).

The aircraft had taken off on 21 October 2014 at 1928 hrs¹ in Chicago, USA. Sixteen crew members and 291 passengers were on board the airplane. The flight had been uneventful, and the aircraft landed at Frankfurt/Main Airport at 0958 hrs. A precision approach (ILS) had been conducted to runway 25L. The co-pilot was pilot flying. The PIC stated the approach had been stable throughout. The crew had determined the target speed as 157 kt. The FDR had recorded a computed airspeed of 158 kt in a radio height of 1,000 ft. During the time between passing a radio height of 1,000 ft and 50 ft the maximum computed airspeed the FDR recorded was 165 kt and the lowest 151 kt. The PIC stated that during the flare the aircraft had encountered a gust. The co-pilot corrected the flight attitude with the aileron. In the cockpit no incidents like unusual sounds or vibrations had been observed. On the FDR a bank angle of 5.5° to the right was recorded two seconds after the activation of the air ground switch. The aircraft left runway 25L and taxied to the parking position.

At the parking position the crew noticed the damages on the lower surface of the cowling of engine No 4.

Personnel Information

Pilot in Command

The PIC was 58 years old. He had a total flying experience of 22,000 hours. He had flown 3,172 hours on Boeing 747.

The PIC held an Air Transport Pilot (ATP) licence issued on 20 April 2010 by the US American Federal Aviation Administration (FAA). The rating for Boeing 747 was listed

¹ All times local, unless otherwise stated.

in the licence. The class 1 medical certificate issued on 11 April 2014 was made available to the BFU.

Co-pilot

The 63-year-old co-pilot (pilot flying) held an Air Transport Pilot (ATP) licence issued on 9 June 2008 by the FAA. The rating for Boeing 747 was listed in the licence. He had a total flying experience of 24,000 hours; 6,500 hours of which on Boeing 747. A class 1 medical certificate issued on 24 June 2014 was made available to the BFU.

Second Co-pilot

The 44-year-old second co-pilot (Relief First Officer) held an Air Transport Pilot (ATP) licence issued on 4 February 2009 by the FAA. The rating for Boeing 747 was listed in the licence. He had a total flying experience of 11,900 hours. His flying experience on Boeing 747 was 7,600 hours.

Aircraft Information

The Boeing 747-400 is a wide-body aircraft. It is powered by four turbo-fan engines. The specific information originates from the FAA Registry.

Type:	747-422
Serial number:	29 166
Manufacturer:	The Boeing Company
Year of manufacture:	1999
Engines:	Four Pratt & Whitney PW 4 000 SER
Maximum Take-Off Mass:	362,465 kg

A valid airworthiness certificate had been provided to the BFU. The aircraft had an US American certificate of registration and was operated by an US American air operator.

Meteorological Information

At the time of the landing the valid aviation routine weather report (METAR) of 0950 hrs at Frankfurt/Main Airport described the weather conditions as follows:

Wind: 260°/ 15 kt
Visibility: More than 10 km
Weather: Slight rain showers
Clouds: Few clouds in 2,000 ft
1 to 2 oktas cumulus clouds in 2,700 ft
5 to 7 oktas clouds in 3,000 ft
Temperature: 8°C
Dewpoint: 4 °C
Barometric air pressure (QNH): 1,016 hPa

The PIC stated that ATIS reported wind information as 290°/15G30 kt. In 500 ft above ground wind speed had been 32 kt.

The PIC's report shows that the crew had requested wind information during the approach. The Tower had given the wind velocity with 270°/16 kt.

Aerodrome Information

Frankfurt/Main Airport is located 6.5 Nautical Miles (NM) south-west of Frankfurt City. Aerodrome elevation is 364 ft AMSL.

The airport has three parallel runways oriented 069°/249° and one runway oriented 179°. The ILS heading for runway 25L is 248° and the glide slope is 3°. This equals a descent gradient of 5.2%. If the glide slope is adhered to correctly the threshold is crossed in 68 ft. The runway is 4,000 m long and 45 m wide.

Flight Recorders

The Flight Data Recorder (FDR) and Cockpit Voice Recorder (CVR) were removed and read out at the BFU.

FDR

Manufacturer: Honeywell
Type: SSDFDR
Part Number: 980-4700-042
Serial Number: 5865

The recorder was undamaged. All recorded parameters were readable. The FDR recordings were used to present the factual information and are depicted in the Appendix as graph.

CVR

Manufacturer:	Honeywell
Type:	HFR5-V
Part Number:	980-6032-001
Serial Number:	1215

The recorder was undamaged and could be read out.

Three audio files of 120 minutes recorded time and one audio file of 180 minutes were produced. The CVR recordings did not contain any information relevant for the safety investigation.

Wreckage and Impact Information

A certified maintenance organisation determined the damages on the lower surface of the cowling of engine No 4. The operator's Engineering Change/Repair Authorization (EC/RA) documented under EC/RA#: 7831-02059 the following damages on the cowling of engine No 4: A scratch mark of 17.8 cm width and 5 cm length on the six o'clock position on the engine inlet cowl; a scratch mark of 28 cm width and 86 cm length on the right lower engine cowling; scratch marks on the reverser cowling of 10 cm width and 35.5 cm length, as well as of 20 cm width and 35.5 cm length, each in the six o'clock position. In addition, the reverser lower fairing showed cracks and torn off pieces (see Appendix).

Organisations and their Procedures

The item 3.200.4 of the operator's flight manual noted: "*[...] WARNING: With the main landing gear compressed, the outboard engine pod contacts the ground at about 6° of bank [...]*"

The operator's Flight Operations Manual item 6.80.1 (stabilised approach) noted: "*[...] A stabilized Approach is characterized by a constant angle, constant rate of descent approach profile ending near the touchdown point. [...]*." Among other things,

the operator made the following stipulations in the Flight Operations Manual concerning a stabilised approach:

Reaching an approach height of 1,000 ft above ground:

- Landing configuration
- Indicated speed maximum +15 and minimum -5 kt of the target speed
- On the localizer
- On the glide slope, correct with maximum +-300 FPM climb or sink rate

Additional Information

The target speed is the calculated indicated speed for the aircraft taking into account the landing mass, a certain landing configuration, and the wind information.

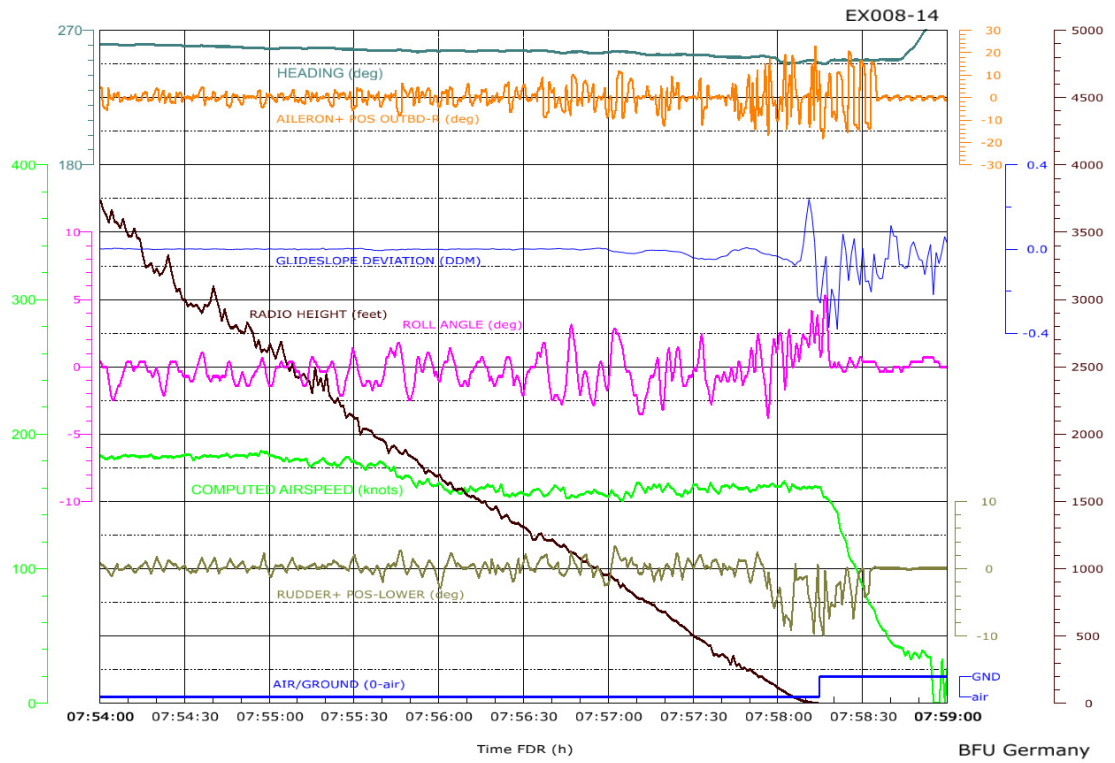
Investigator in Charge:	Lutz Jäkel
Flight Data:	George Blau, Dieter Ritschel
Braunschweig	28 th August 2015

Appendices

FDR parameter during the approach

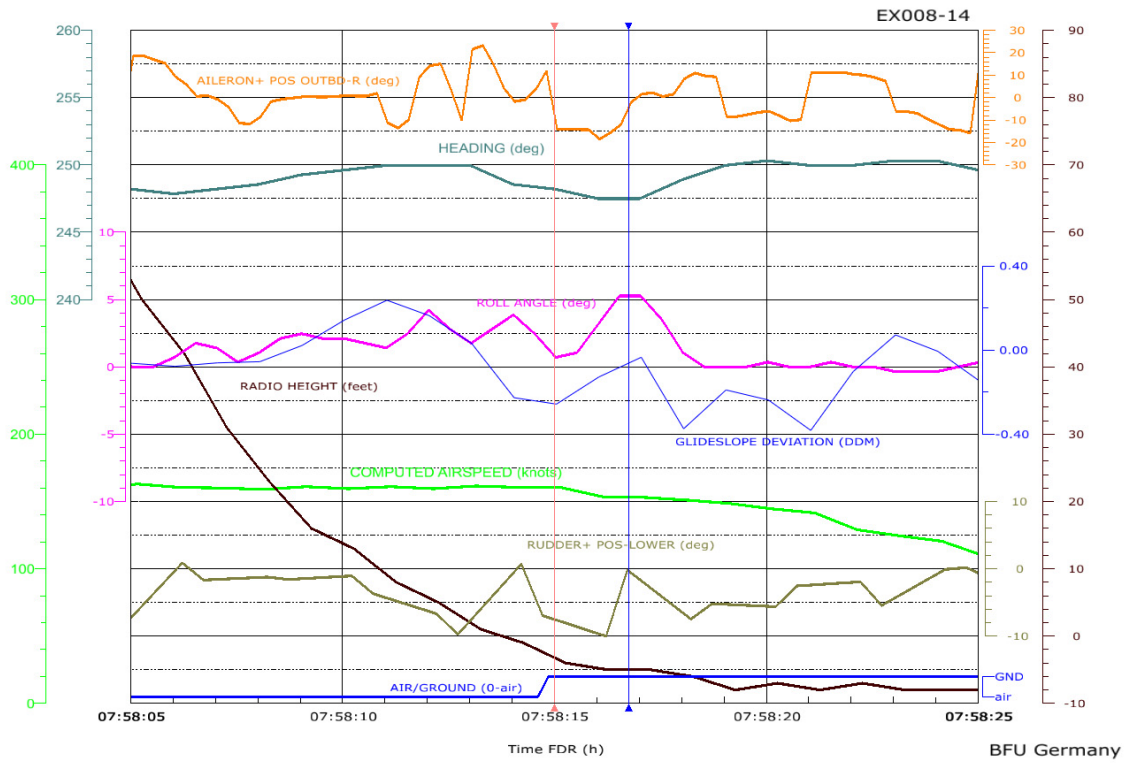
FDR parameter during the landing

Photos of the damaged lower surface of engine No 4



FDR parameter during the approach

Source: BFU



FDR parameter during the landing

Source: BFU



Lower surface of engine No 4

Photo: Operator



Damages on the lower engine cowling

Photo: Operator



Damages on the reverser lower fairing

Photo: Operator

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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