Bundesstelle für
Flugunfalluntersuchung

German Federal Bureau of
Aircraft Accident Investigation

Interim Report

Identification

Type of Occurrence:	Serious incident
Date:	28 June 2018
Location:	Siegerland Airport
Aircraft:	Airplane
Manufacturer / Model:	Embraer / EMB-500
Injuries to Persons:	No injuries
Damage:	Minor damage to aircraft
Other Damage:	Minor crop damage
Information Source:	Investigation by BFU
State File Number:	BFU18-0878-7X

Factual Information

On 28 June 2018 an airplane Embraer EMB-500 landed on runway 13 at Siegerland Airport during a check flight. The flight crew was not able to stop the airplane on the runway; it overshot the end of the runway by approximately 15 m.

There were no injuries to persons; damage to the aircraft was minor.

History of the Flight

The flight crew stated that the EMB-500 was on a charter flight from Amsterdam, the Netherlands, to Siegerland Airport, Germany. At about 1910 hrs[1] the flight crew was on approach to Siegerland Airport. Initially, landing occurred on runway 13. According to the Journey Log the captain, a co-pilot, and four passengers were on board. The aircraft left runway 13 via taxiway C. After the passengers had disembarked the crew changed. The co-pilot took a seat in the cabin. A Type Rating Instructor (TRI) boarded and took the right seat in the cockpit. It was intended that the captain performs a checkflight. Among other things, an approach with simulated engine failure would be conducted. The Operational Flight Plan (OFP) noted that the flight should be conducted in accordance with a visual pattern. According to the OFP the landing mass of the airplane was 4,317 kg.

At about 1940 hrs the crew was on approach to runway 13 of Siegerland Airport. The captain was Pilot Flying (PF). This approach was conducted with a simulated engine failure. The analysis of the Cockpit Voice Data Recorder (CVDR) showed that until touch-down N1 of the left engine was 35% and N1 of the right engine varied between 85% and 35%. According to the CVDR (Air Ground Signal), at 1941:34 hrs the aircraft touched down approximately 700 m beyond the threshold of runway 13. The ground speed the CVDR recorded at the time of touch-down was about 110 kt. At about the same time the CVDR recorded an increase in brake pressure (left and right). On the left side it increased to 2,000 PSI, on the right to 1,300 PSI. The recorded brake pressure reached 0 twice in short order and then increased again. At 1941:46 hrs, the time of the first decrease of the brake pressure, the CVDR had recorded the master caution “BCU Brake Fail” and 12 s later the master caution “BCU Anti-Skid Fail”. Approximately 7 s after the first caution the recorded brake pressure value decreased to 0 and remained there for about 6 s. Over about 13 s it increased to 2,600 PSI (right) and decreased again to 0. Between the time the brake pressure first decreased and then reached 2,600 PSI ground speed decreased from about 80 kt to 0 kt.

The flight crew stated that the aircraft had touched down in the area of the first white double bars of runway 13 and initially decelerated normally. Suddenly, the brake pressure had decreased for a short time. This had happened twice. The aircraft veered left due to the marginal and erratic braking action. The captain had steered

1All times local, unless otherwise stated.

the aircraft back towards the centre of the runway. The emergency brake had been activated. The flight crew was of the opinion that a go-around procedure was no longer possible. The co-pilot in the cabin had not noticed anything unusual after the landing until suddenly the braking action had slowed down and then started again.

The airplane came to a stop in the grass approximately 15 m beyond the end of runway 13 of Siegerland Airport.

Personnel Information

Pilot in Command

The 69-year old Pilot in Command (PIC) was a German citizen and already retired. He held an Airline Transport Pilot's License (ATPL(A)). It had been issued by the Luftfahrt-Bundesamt (German civil aviation authority) on 29 July 2013 in accordance with Part-FCL. The Field XII, Ratings, listed the rating for aircraft type EMB-500/505 as PIC in accordance with Instrument Rules (IR). The rating was valid until 30 June 2019. It also listed the instructor rating for EMB-500/505 (TRI) valid until 30 September 2018 and the Flight Instructor (FI(A)) rating for commercial pilots (CPL) and private pilots (PPL) and IR.

The PIC had a total flying experience of about 11,500 hours. He had a flying experience on type of about 600 hours.

His Class 1 Medical Certificate was valid until 28 June 2018. It had been issued in accordance with Part-MED. Field XIII, Restrictions, listed the restriction to wear correction for defective distant, intermediate and near vision (VML).

Captain

The captain was 45 years old and a German citizen. He held a Commercial Pilot's License (CPL(A)) issued by the Luftfahrt-Bundesamt on 9 December 2014 in accordance with Part-FCL. The Field XII listed the type rating EMB-500/505 as PICIR. The rating was valid until 30 June 2018.

He had a total flying experience of about 5,700 hours. He had a flying experience on type of about 700 hours.

His Class 1 Medical Certificate was valid until 10 January 2019. It had been issued in accordance with Part-MED without restrictions.

Aircraft Information

According to the Type Certificate Data Sheet EASA IM.A.157 the aircraft EMB-500 (Phenom) is a low-wing business jet with a T-tail. It consists mostly of aluminium and is equipped with two turbofan engines which are mounted to the tail section. The three landing gears are retractable and single tired.

Manufacturer:	Embraer Empresa Brasileira de Aeronáutica S.A.
Year of Manufacture:	2010
Manufacturer's serial number:	50000180
Maximum take-off mass:	4,800 kg
Engines	Pratt & Whitney Canada PW617 F-E
Length:	12.82 m
Wing Span:	12.30 m

The Agência Nacional de Aviação Civil, Brasil, certified the EMB-500 in accordance with CS-23.

The aircraft involved was operated by a German operator. A valid airworthiness certificate was provided to the BFU.

The aircraft was equipped with wheel brakes for deceleration after landing.

The manufacturer's Pilot's Operating Handbook describes the main braking system of the aircraft as follows: *"The main brake consists of a brake-by-wire system controlled by either the Pilot or Copilot via rudder pedals. Rudder pedals actuate the pedal transducers that send the brake inputs to the Brake Control Unit (BCU). Then, the BCU, [...], receives all brake interface signals and controls the Shutoff Valve (SOV) and both Brake Control Valves (BCV´s) for braking capability."*

According to the manufacturer the signal which is transmitted from the rudder to the BCU normally varies between 2% (pedal not actuated) and 97% (pedal actuated until the mechanical stop).

The BCU of the aircraft involved was analysed by the aircraft manufacturer. The data showed a maximum value of 105%. When such a value is reached the BCU switches into Fail Mode and disconnects the hydraulic pressure to the brakes.

The aircraft was fitted with a BCU-6. The BFU was provided with information that BCU-7 is available which does not show such behaviour.

Quick Reference Handbook

According to the Quick Reference Handbook (QRH) the factored landing distance was 1,420 m and the approach speed (V_{Ref}) 104 kt for the landing mass of 4,317 kg the flight crew had entered into the OFP.

Quick Reference Handbook Emergency and Abnormal Procedures, Hydraulic:

BRK FAIL MESSAGE DISPLAYED?

Yes: Emergency/Parking Brake……..APPLY

Meteorological Information

According to the aviation routine weather report (METAR) of Siegerland Airport of 1920 hrs the wind came from 040° with 09 kt, visibility was more than 10 m, there were no clouds below 5,000 ft AGL (CAVOK). The temperature was about 22°C, dewpoint 10°C, and air pressure (QNH) 1,020 hPa.

At the time of the incident it was daylight.

Aids to Navigation

The approach was conducted in accordance with visual references.

Aerodrome Information

Siegerland Airport is located 8.6 NM south of the city Siegen. Aerodrome elevation is 1,928 ft. It has one runway with the orientation 128° (13) and one with the orientation 308° (31). Runway 13 has a length of 1,620 m and is 30 m wide. The Aeronautical Information Publication (AIP) shows the landing distance available (LDA) for runway 13 as 1,620 m.

A Precision Approach Path Indicator (PAPI) was available for runway 13. If the PAPI is followed correctly the runway threshold is overflown in 42 ft which equals a glideslope of 3°.

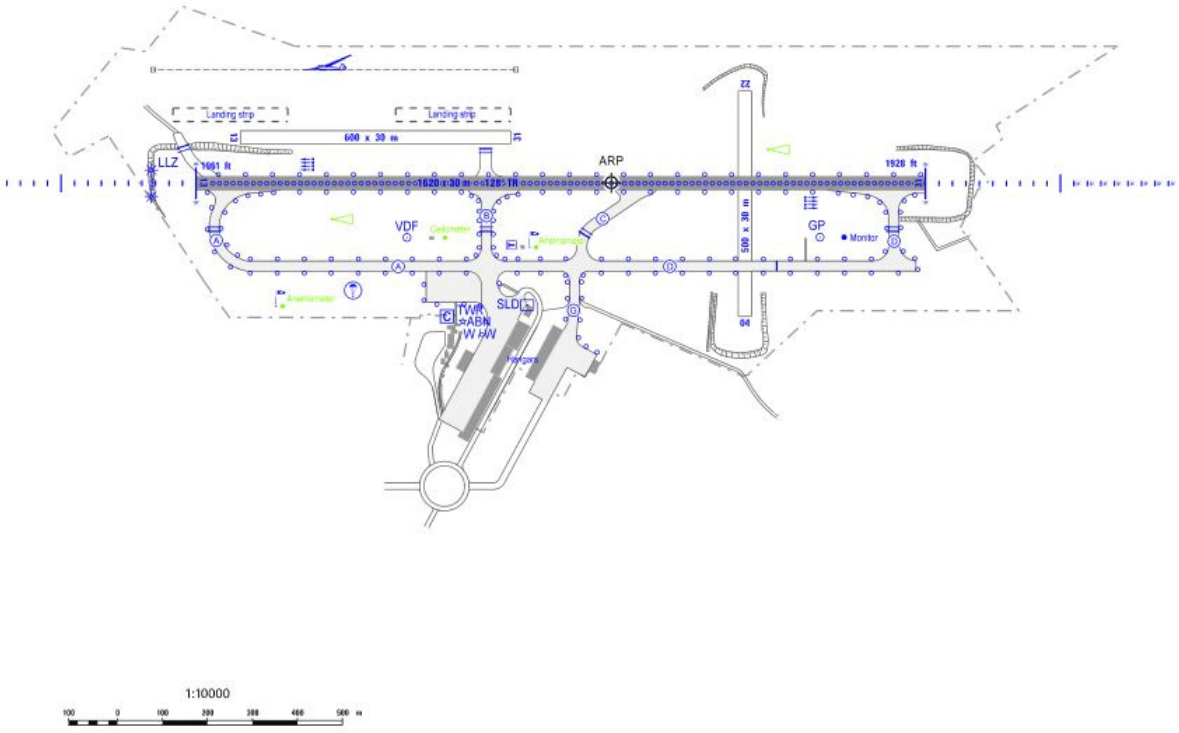


Fig. 1: Aerodrome chart Source: AIP

Flight Recorders

According to aeronautical regulations it was not mandatory to equip the aircraft with a FDR or CVR. For the recording of flight parameters, conversations, and sounds in the cockpit the aircraft was equipped with a Cockpit Voice Data Recorder (CVDR). The CVDR was seized, and read-out at as well as analysed by the BFU.

VOICE AND DATA RECORDER MODEL FA 2 100

Part number: 2100-3083-50

Serial number: 000647030

The data recorded by the FDR allowed for the calculation of the touchdown point. The aircraft touched down approximately 700 m beyond the threshold of runway 13.

Wreckage and Impact Information

The aircraft stood about 15 m beyond the paved end of runway 13 in the grass. The fuselage was pointing in the direction of the landing direction. The last heading the FDR recorded was 130°. The left main landing gear and its wheels showed minor damage (Fig. 3). On runway 13 a skid mark was found about 200m beyond the intersection with taxiway C. It was interrupted and started again about 60 m before the end of the runway (Fig. 4).

Fig. 2: Aircraft beyond runway 13 in the grass Source: BFU

Fig. 3: Left main landing gear with minor damage Source: BFU

Fig. 4: Interrupted skid mark on runway 13 of Siegerland Airport Source: BFU

Additional Information

As a consequence of this event the operator equipped every Embraer 500 with BCU-7.

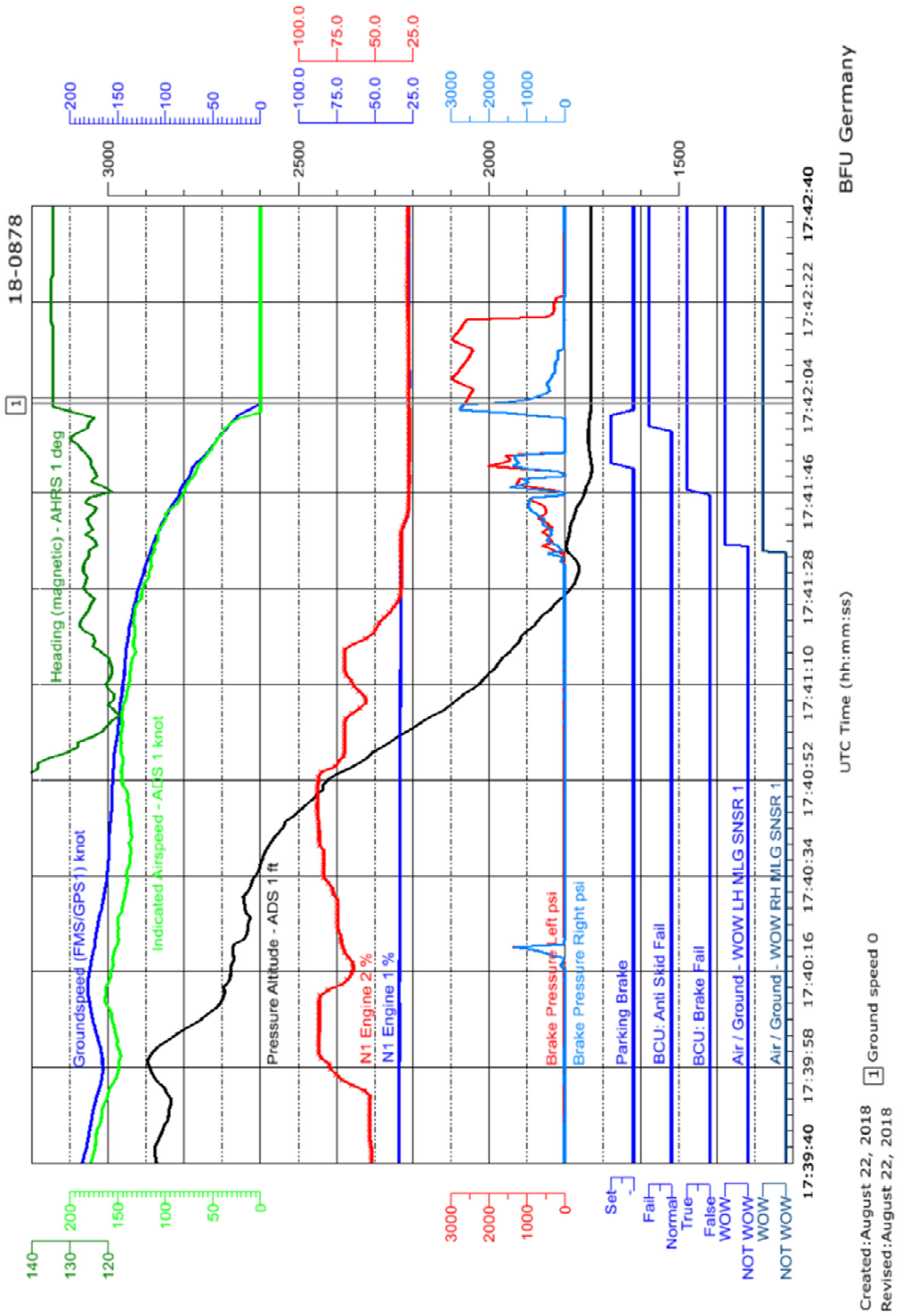
Fire

There was no evidence of fire in flight or after the landing.

Investigator in charge:	Jäkel
Assistance:	Kostrzewa, Lampert
Field Investigation:	Welke

Appendices

CVDR read-out



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 - FlUUG*) 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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