

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

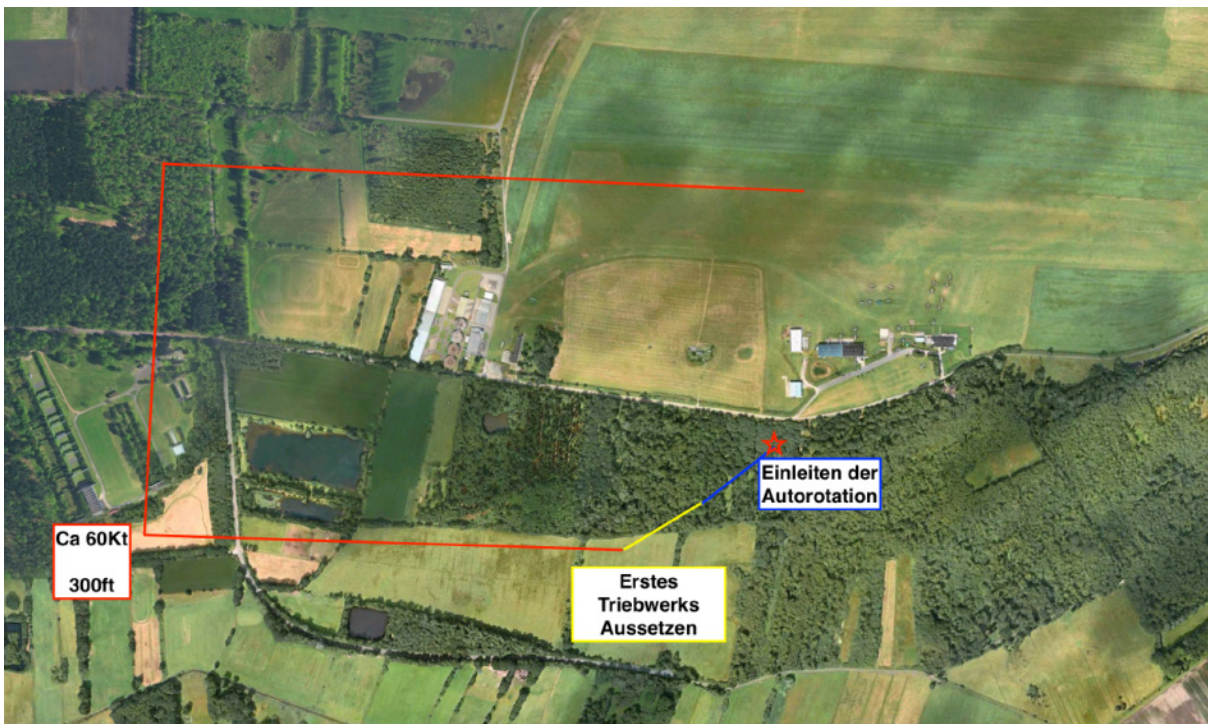
Type of Occurrence:	Accident
Date:	2 April 2018
Location:	Near Uetersen/Heist Airfield
Aircraft:	Helicopter
Manufacturer / Model:	Bell Helicopter Textron Canada (BTHC) / Bell 206L-1
Injuries to Persons:	None
Damage:	Aircraft severely damaged
Other Damage:	Damage to forest
State File Number:	BFU 18-0324-3X
Published:	September 2018

Factual Information

History of the Flight

According to the pilot's statement he wanted to refuel the Bell 206L-1 helicopter for a planned ferry flight the next day to a Part-145 maintenance organisation. He intended

to fly the helicopter via a shortened traffic circuit to the gas station at the Uetersen/Heist Airfield (EDHE). After an uneventful pre-flight check he had started the engine at about 1105 hrs¹. At approximately 1109 hrs he had taken off from runway 27 after a Cessna 172. He had followed the Cessna with approximately 60 KIAS and at the end of the crosswind leg reached about 300 ft GND. At the downwind leg, approximately abreast of the threshold of runway 09, he pulled the pitch to increase speed and climb. Subsequently, an engine malfunction had occurred, i.e. something like "Verschlucken (chocke)". He had then turned toward the airfield and informed the Flugleiter (A person required by German regulation at uncontrolled aerodromes to provide aerodrome information service to pilots) via radio. Then the engine had stopped, or rather it had abruptly become "leise (quiet)". He initiated autorotation and realised he would not be able to reach the airfield.



Reconstruction of the flight path

Source: Pilot

Above the trees he had flared the helicopter, pulled the pitch fully and in the last moment yawed consciously by about 180°, because he did not want hitting the trees in a forward direction. Then the helicopter had fallen from only a few meters vertically into the trees.

¹ All times local, unless otherwise stated.



Final position of the helicopter in the trees

Source: BFU

Hanging in the trees he had closed the twist grip and actuated the fuel-cut-off switch. He realised the engine was still emitting sound.

The cockpit door of the pilot's side was blocked. Therefore the pilot exited the helicopter via the burst right front window.

During the emergency landing in the forest the helicopter was severely damaged.

Personnel Information

The 40-year-old pilot held a Commercial Helicopter Pilot's Licence (CPL(H)) issued by the Luftfahrt-Bundesamt (German civil aviation authority, LBA) in accordance with Part FCL. The valid CPL(H) licence listed the ratings as pilot in command for Bell 206 and R 44. He had the flight instructor rating for single engine helicopter and air-planes. He was LBA approved flight examiner (FE PPL(H)) and type rating examiner for Bell206, R44 and HU269 (TRE(H)).

He held a class 1 medical certificate issued in accordance with Part-MED without restrictions; valid until 31 March 2019.

He stated he had a total flying experience of 10,371 hours, of which about 5,000 hours were flown on helicopters, of which approx. 513 hours on Bell 206B/L.

Aircraft Information

The Bell Helicopter Textron Canada (BTHC) helicopter Bell 206L-1 has a capacity of up to seven seats. It has skids, a two-blade main rotor, and a tail rotor for anti-torque. Maximum take-off mass is 1,837 kg. The helicopter is equipped with a Rolls-Royce 250-C28B turbine engine. The basic Bell 206 type certificate was issued in 1964. The variant L-1 was approved in 1978 and produced up until 1983.

The helicopter in question, year of manufacture 1983, manufacturer's serial number 45790, had a certificate of registration issued by the LBA. According to the weight report of 21 April 2017 the empty mass was about 1,110 kg. Take-off mass at the day of the accident was about 1,305 kg including the pilot, 20 kg additional weight on the co-pilot's seat, and approximately 210 lbs fuel. The last Airworthiness Review Certificate (ARC) was issued on 24 April 2017. The last Release to Service was attested on 11 October 2016, about six flight hours prior to the accident. At the time of the accident, the helicopter had a total of about 13 632 operating hours.

The helicopter was maintained by a maintenance organisation certified in accordance with Part-145. The helicopter was operated by a commercial operator.

Up until May 2017 the helicopter had been registered in the USA and maintained in accordance with requirements of the Federal Aviation Administration (FAA). On 31 March 2017 the last annual inspection of the helicopter and the engine was documented at a total operating time of 13,591.1 hours. The maintenance documentation did not show when and during which maintenance procedure the screw fitting of the fuel pipe on the fuel filter had last been loosened.

Meteorological Information

Approximately five minutes after the accident the corresponding aviation routine weather report (METAR) of 1120 hrs at Hamburg-Fuhlsbüttel (EDDH), located about 12 Nautical Miles (NM) away, reported the following weather conditions:

Wind from 290° with 4 kt variable 210-220°, ground visibility more than 10 km, few clouds (FEW), temperature 5°C, dewpoint at -2°C, barometric air pressure (QNH) 1,011 hPa.

Radio Communications

The pilot had radio contact with the Flugleiter at Uetersen/Heist Airfield. Radio communications were not recorded. On enquiry by the BFU the Flugleiter confirmed the emergency call of the pilot.

Aerodrome Information

Uetersen/Heist Airfield (EDHE) is located north-west of Hamburg. Aerodrome elevation is 22 ft AMSL.

The airfield has one grass strip runway with the orientation 087°/267°. It has a length of 1,100 m and a width of 40 m. The runway is located approximately central of a large grass area. The part north of the runway is used for sailplane operation and the southern part for parking of aircraft and taxiing.

The traffic circuit for powered aircraft is located south of the runway 09/27.

Flight Recorder

The helicopter was not equipped with a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR). These recording devices were not mandatory.

Wreckage and Impact Information

The accident site was located approximately 60 m south of the airfield street and about 450 m south of runway 09/27 in a wooded area.

The helicopter stood/hung upright tilted slightly to the right towards 190° at the southern edge of a young forest plantation with fir trees about 5 m high.



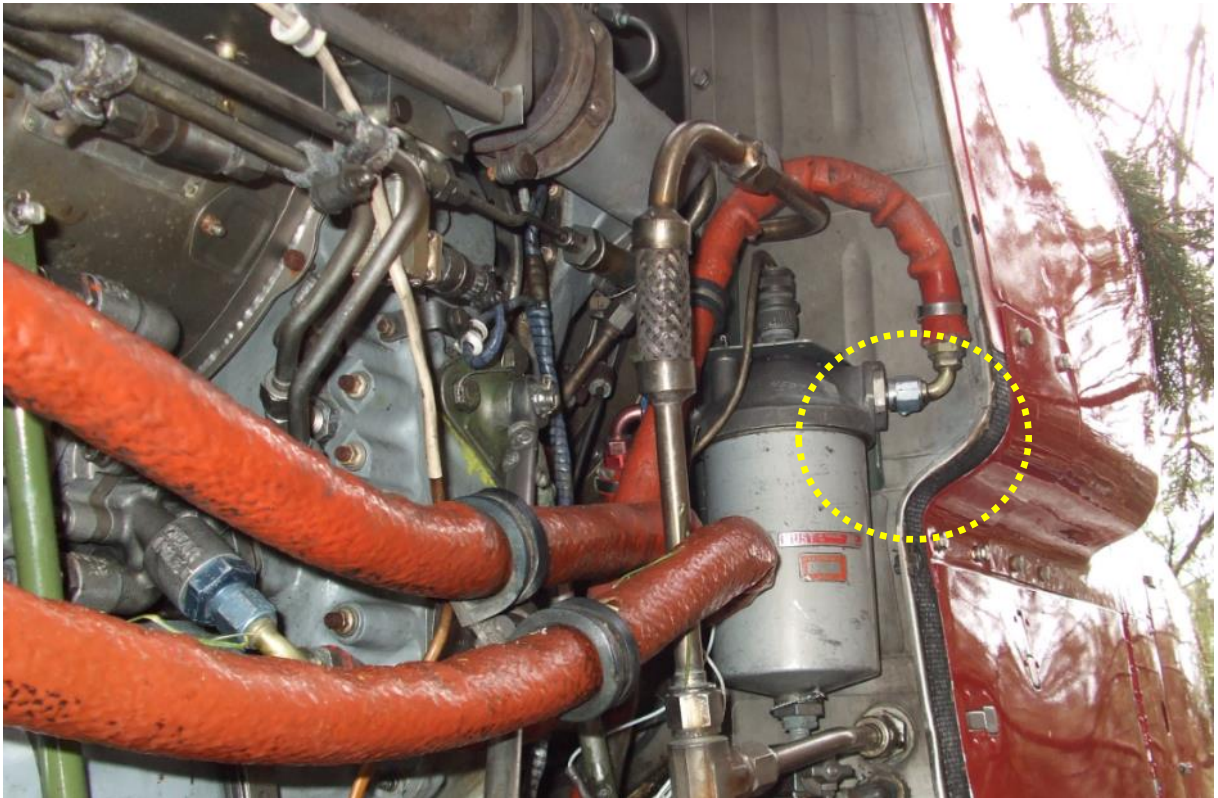
Accident site south of EDHE Airfield

Source: Pilot

The helicopter had sustained damage primarily to the right fuselage side. There the fuselage showed several holes. The tail rotor drive shaft had been twisted and severed at approximately half its length. The main drive shaft was intact. The free-wheeling unit opened and locked as designed. The main rotor blades showed multiple damages in the area behind the leading edges or the holm profile, respectively. The right skid tip was bent and torn from the front crosstube towards the fuselage centre. The tail boom showed several dents.

At the site the controls could be checked. They did not show any damages or blockages. The oil levels of the main and tail rotor gear boxes and the engine were within normal ranges. No fuel or oil leaked from the helicopter. At the site a fuel sample was taken from the fuel sump. It did not show any visible dirt or water.

After the battery had been reconnected the caution and warning lights were checked. Warning lights for metal chips did not illuminate. The fuel gauge showed more than 200 lbs. One after the other, both electrical fuel pumps were switched on. The function of the pumps could be heard. Once the respective fuel pressure was reached the warning light shut off. After fuel pressure had been generated leakage at the screw fitting at the fuel pipe from the fuel filter to the engine fuel pump was determined. Fuel leaked directly at the filter. The screw fitting was only hand-tight.

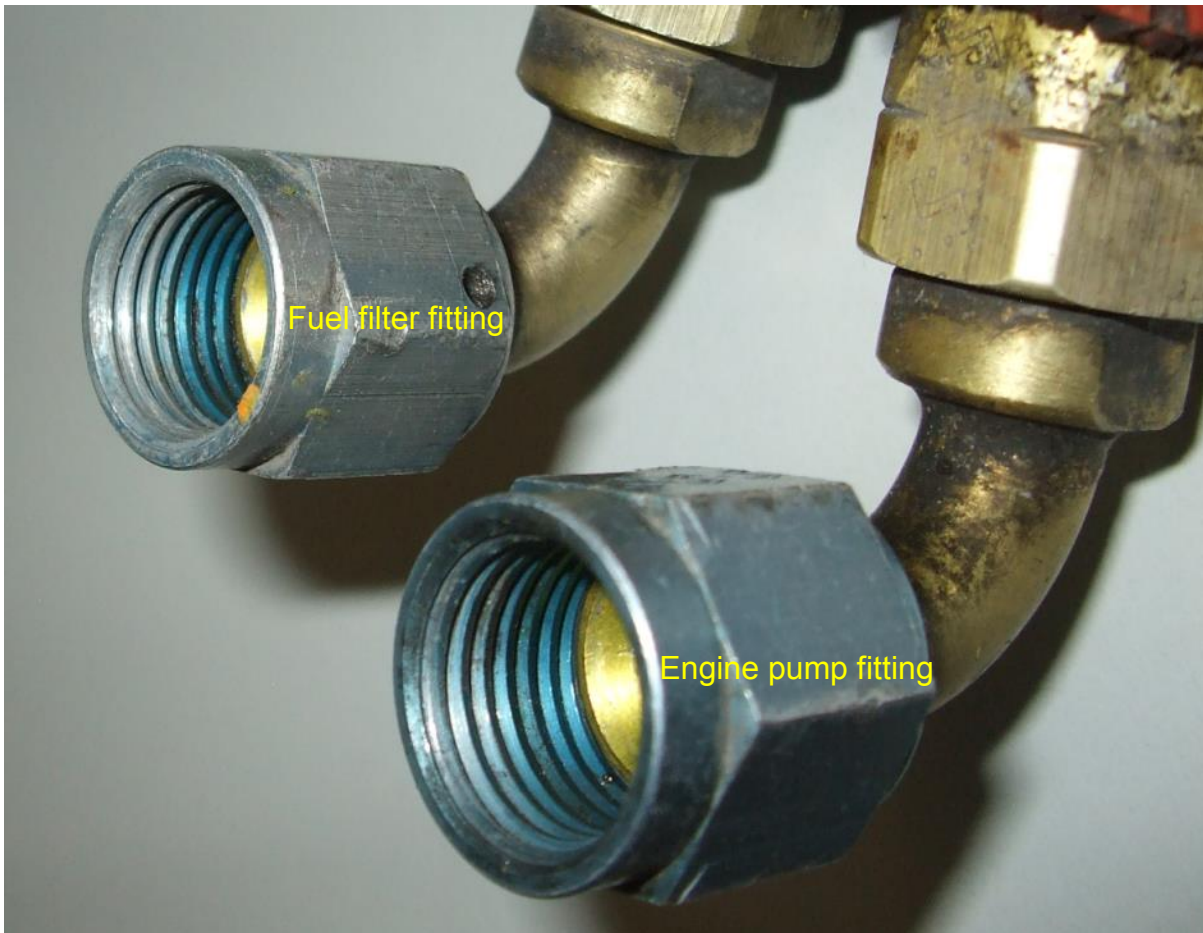


Leaking screw fitting

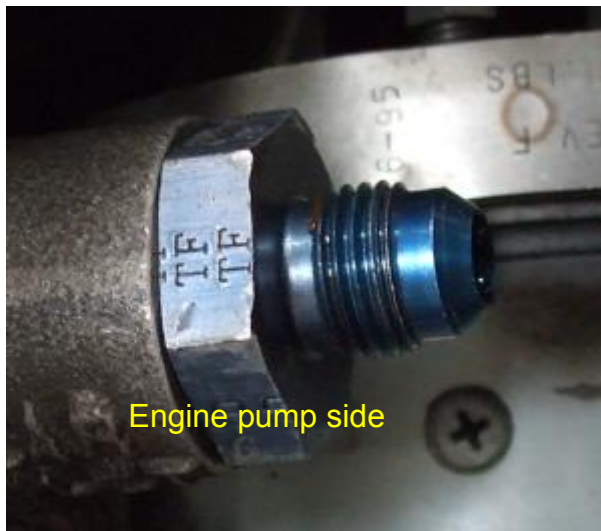
Source: BFU

On 7 April 2018 the BFU examined the engine together with an expert from the engine manufacturer. No external damages, which could have been considered to be the cause for the engine failure, were determined. N1 and N2 power trains could be rotated. No indications for any technical malfunction were found. The expert noticed individual screw fittings and maintenance actions, which were uncommon. In addition, almost no screw fitting at the engine showed any torque seal or lacquer. Often times only residue of old markings was visible.

At the beginning of May the engine was removed for a planned engine run-up on a test stand.



Fuel filter side



Engine pump side

Screw fitting of the fuel pipe

Source: BFU

On 16 April 2018 a Part-145 maintenance organisation examined the screw fitting of the fuel pipe to the fuel filter. According to the engine manufacturer it should be fastened with 80-120 lb/in. Already with a slight fastening torque (less than 40 lb/in) the fitting was free of leakage under normal operating pressure (30 psi).

On 26 June 2018 the engine was examined in the USA under the supervision of the FAA and the presence of the expert of the engine manufacturer. Engine start-up and the test run were uneventful. All test run parameters required by the engine manufacturer were met. The expert of the engine manufacturer did not notice any indications of other causes for the engine failure than the loose fuel pipe found at the accident site.

Fire

There was no evidence of in-flight fire.

Additional Information

The engine manufacturer stated that there are experiences over the last decades that the numerous unsecured screw fittings at the jet engine M250 did not come loose due to vibrations, if the manufacturer's requirements regarding the fastening torque were met.

According to the statement of the helicopter manufacturer regarding the Bell 206 there were no entries of loose fuel pipes in the safety data base.

A good practice recommended in aviation as basically useful action: *Mark installed hardware with torque seal/lacquer after it has passed torque check. The marking allows visual detection of hardware that may have loosened before it falls off.*

Investigator in charge: Axel Rokohl

Field Investigation: Axel Rokohl

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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