Bundesstelle für
Flugunfalluntersuchung

German Federal Bureau of
Aircraft Accident Investigation

Factual Report

The Investigation Report was written in accordance with para 18 of the 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:	29 December 2012
Location:	Near Rehagen
Aircraft:	Helicopter
Manufacturer / Model:	Eurocopter / AS 350B
Injuries to Persons:	Pilot and passenger suffered minor injuries
Damage:	Aircraft severely damaged
Other Damage:	Minor crop damage
Information Source:	Investigation by BFU
State File Number:	BFU 3X165-12

Factual Information

History of the Flight

On the day of the accident the pilot and his acquaintance wanted to go on a sightseeing flight with the helicopter AS 350B from Mellensee Special Airfield for Helicopters. The pilot stated he checked the hydraulic system of the helicopter after

engine start-up. At that moment problems with the radio or rather with the intercom occurred. After he had checked the headsets and the plug connections he had brought the engine to flight power and then adjusted the friction of the stick. Once he released the pitch safety catch and pulled at the same time the helicopter suddenly turned left. Since he had the impression he might collide with the hangar he had increased the power on the pitch so that he would fly over the hangar. He realised it was almost impossible to steer around the yaw axis. The pedals had been "as hard as plank" and the pitch was stiff. After the helicopter had yawed several times in about 10 m he brought it down about 50 m away from the take-off site.

At about 1340 hrs[1] the helicopter landed hard, the left skid broke and the helicopter turned over. The pilot shut down the engine which was still running, all power users and the main switch. At the site fuel and oil leaked onto the ground.

Accident site and helicopter Photo: Operator of the helicopter

The helicopter came to rest on its left fuselage side and the pilot and the passenger could leave the helicopter unaided. Both persons suffered minor injuries on one hand each.

The pilot salvaged the helicopter the same evening and put it in the hangar.

The following day, the BFU was informed of the accident. During the subsequent field investigation the pilot did not claim any technical defects as cause for the accident.

1 All times local, unless otherwise stated.

Personnel Information

The 52-year-old pilot held a German Private Helicopter Pilot's License initially issued according to JAR-FCL 2 on 21 March 2005 and valid until 30 March 2015. The license carried the entries: Type rating as Pilot in Command (PIC) on AS350, HU 269 and R44 and the Night Flight Qualification (NFQ). He held a class 2 medical certificate with the restriction to wear glasses issued according to JAR-FCL 3; it was valid until 8 December 2014.

After receiving his license and type ratings, his total flying experience on helicopters was about 535 hours; about 57 hours of which were on the type.

Aircraft Information

The single-engine helicopter AS350 B manufactured by Eurocopter is a lightweight multi-purpose helicopter for up to six occupants. It was certified according to FAR/JAR Part 27 in 1977. It is equipped with a Turbomeca Arriel 1B engine, a Star-Flex three-blade main rotor, landing skids and a tail rotor for anti-torque. Maximum take-off mass is 1,950 kg.

To reduce the workload of the pilot the helicopter is equipped with hydraulic control system. It consists of one hydraulic fluid reservoir, one belt drive hydraulic pump, a control unit, three main rotor hydraulic servo units with pressure reservoir and one tail rotor hydraulic servo unit without pressure reservoir. The hydraulic system is controlled by two switches:

1. The cut-off switch on the pitch to deactivate the hydraulic system and to empty the pressure reservoir,
2. the Hyd Test pressure switch in the centre console to check the pressure reservoir. Prior to the flight the following checks should be conducted.

- Carry out the hydraulic cheks :

CAUTION : IF NOT LOCKED, THE COLLECTIVE PITCH WILL COME UP WHEN THE ACCUMULATORS ARE DEPLETED OR WHEN THE HYDRAULIC CUTOFF SWITCH IS SET TO "OFF".

Accumulators check :
. Collective pitch - - - - - - - - - Checked correctly locked.
. "HYD TEST" pushbutton - - - - - - Depress on center console.
. Warning panel - - - - - - - - - - Check HYD light on, Horn sounds.
. Collective and cyclic controls - Hands on.
. Move the cyclic control 2 or 3 times on each axes (+/- 10 % of travel) and check for accumulator hydraulic assistance on pitch and roll (no control loads). Check that forces are felt on the pedals.
. "HYD TEST" pushbutton - - - - - - OFF : set in up position.
. Warning panel - - - - - - - - - - Check HYD light goes off, Horn stops.

Hydraulic pressure isolation check :
. Collective pitch - - - - - - - - - Checked correctly locked.
. Hydraulic cutoff switch - - - - - Set to OFF on collective pitch.
. Warning panel - - - - - - - - - - Check HYD light on, Horn remains silent.
. Check that forces are felt immediately and that the cyclic can be displaced in pitch and roll with normal feedback force. Yaw pedals force should stay low (yaw load compensator effect).
. Hydraulic cutoff switch - - - - - Set to ON.
. Warning panel - - - - - - - - - - Check HYD light goes off in 2 to 3 sec. Horn sounds the time for HYD light to go off. Maintenance action must be performed prior to flight if this time is reduced to 1 second or less (at least one of the accumulators is defective).

Hydraulic system tests after engine start-up Source: Excerpt flight manual

In normal flight operations the hydraulic system should be switched on and the Hyd Test switch should be off. The hydraulic system's function is monitored with a warning light in the caution panel and a warning signal for pressure losses which becomes silent as soon as the hydraulic system is shut off with the cut-off switch.

The helicopter was built in 1984 and had the manufacturer's serial number 1790. According to the weighing report, empty weight was about 1,299 kg. The pilot stated the tank was about half full at the time of take-off. The last Airworthiness Review Certificate (ARC) was issued on 27 January 2012. On 28 June 2012 the last 100-hour inspection took place and since then the helicopter had been operated for about 32 hours. At the time of the accident, the helicopter had a total of approximately 4,433 operating hours. The aircraft was registered in Germany. The pilot was also the operator.

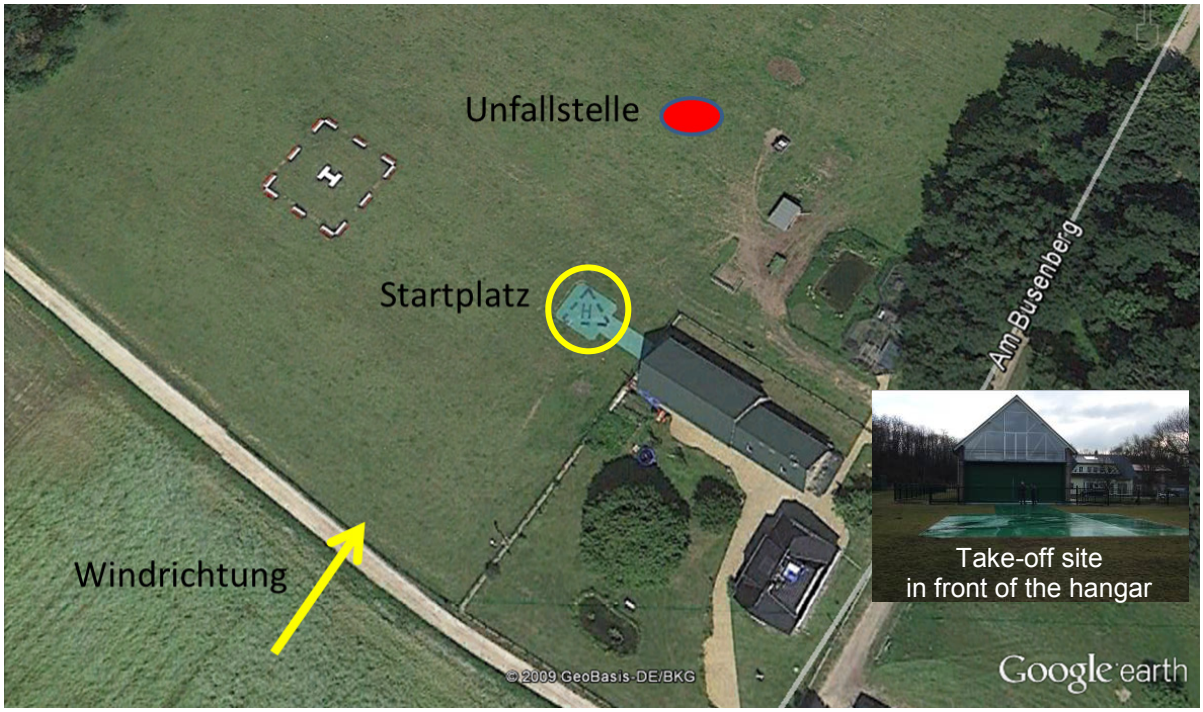
Meteorological Information

According to the Meteorological Aviation Reports (METARs) of Berlin Schönefeld Airport and Berlin Tegel Airport (EDDB and EDDT), at the time of the accident there was a visibility of more than 10 km, wind from 190° with 8 kt, no clouds below 5,000 ft (CAVOK), and a temperature of 8°C with a dewpoint of 5°C. Air pressure (QNH) was 1,018 hPa.

Aerodrome Information

The helicopter was based at Mellensee Special Airfield for Helicopter. On 1 April 2009, the Obere Luftfahrtbehörde Berlin-Brandenburg (regional regulatory authority) certified the airfield for flights in accordance with Visual Flight Rules (VFR).

The special airfield has one concrete square area in front of the hangar and in the middle of a large grass area has a marked square for approaches and take-offs.



Mellensee Special Airfield for Helicopter Photo: Google Earth ™ / BFU

Flight Recorder

The helicopter was not equipped with a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR). There were no legal requirements for such equipment to be fitted.

Wreckage and Impact Information

The accident site was about 50 m north-east of the take-off site, which was in front of the hangar, on a meadow. Once the BFU arrived at the site there were no more traces visible on the ground, the soil had been replaced.

The helicopter stood on its skids in the hangar. Two of the three rotor blades had been removed from the rotor head. All three rotor blades showed damages to the outer area and the Star-Flex to all three blades was torn off. The mounting of the main gear box was severed. The coupling between the main drive shaft and the gearbox flange was sheared of. The turbine had slipped within the retaining clamps of the flexible fuselage mounting. The control rods to the main rotor hydraulic servo units were fractured in the area of the firewall gateway. The control rods from the servos to the swash-plate and to the blade grips had a frictional connection. The driving belt of the hydraulic pump was jammed between belt pulley and pump. The chip detectors in the engine, in the hydraulic system and in the tail rotor gear box were free of chips. The chip detector for the main gear box was torn off. The tail boom's underside showed folds. The area of the shaft coupling in the front segment of the tail rotor shaft cowling was milled from the inside out. The front short tail rotor drive shaft was severed from the long aft tail rotor drive shaft. The tail rotor control rod had been cut off below the tail rotor drive shaft coupling and was bent back. The tail rotor was undamaged and the tail rotor gear box was filled with oil. The left fuselage was oily and it smelled strongly of fuel.

Detailed images of the damages on the helicopter — Photos (6): BFU

The field investigation did not reveal any technical defect prior to the accident.

A checklist was aboard the helicopter. It consisted of two laminated DIN-A4 pages printed front and back and held together with a ring.

Fire

There was no fire.

Additional Information

The Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (French civil aviation safety investigation authority, BEA) stated in the past there had been occurrences when training hydraulic system failure with the helicopter type in question. Instead of performing a slip landing, it was either tried to land the helicopter in hover or it was neglected to switch on the hydraulic system before taking off again.

The helicopter manufacturer stated that between 1994 and 2011 six occurrences became known in which the helicopter had inadvertently lifted off when the hydraulic system was switched off because the pitch safety catch was released. Due to these occurrences the hydraulic system test procedure in the flight manual was amended by a caution and the check point "collective pitch - checked correctly locked" (page 4). This hydraulic system test is now additionally prescribed for fuel control lever in position "flight idle" instead of "flight".

Books and articles on the internet regarding human performance, crew resource management and investigation reports continue to draw attention to the benefits, the use and the correct design of checklists for complex situations. Good checklists should help to complete complex situations and to avoid mistakes or operating errors (refer to, among others, Badke-Schaub, Hofinger, Lauche "Human Factors", 2008, p 281; Dismuke, Berman, Loukopoulos "The Limits of Expertise", p 314; BFU 3X131-0/09)

The one-pilot cockpit especially requires easy access to and simple use of a checklist. In addition, all checkpoints have to be clearly formulated and short so that individual points cannot be overlooked (refer to Air Pilot's Manual "Human Factors & Pilot Performance" p 160ff).

Investigator in charge:	Axel Rokohl
Field Investigation:	Holger Röstel, Axel Rokohl
Braunschweig,	11 February 2013

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.

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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