

# 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:	10 September 2011
Location:	Hanover
Aircraft:	Helicopter
Manufacturer / Model:	Eurocopter France / AS350 B2
Injuries to Persons:	None
Damage:	Aircraft severely damaged
Other Damage:	Damage to a building
Information Source:	Investigation by BFU external experts for field investigation
State File Number:	BFU 3X148-11

## Factual Information

### History of the Flight

On the day of the accident, the pilot conducted several transport flights with a helicopter AS350 B2 and external loads. The external loads were prepared for transport next to a factory workshop and were to be transported to the roof of a hall. The distance between preparation area and hall was only a few hundred meters. After a flight time of about 55 minutes and nine successfully conducted transport flights a load of about 790 kg was to be transported to the roof before breaking to re-fuel. At about 1145 hrs<sup>1</sup> an engine failure occurred on the way to the roof. The pilot lowered the helicopter onto the pitched roof area of the shed roof using hover-autorotation. The helicopter was severely damaged and the roof also suffered damage.



Overview pick-up location, drop area and accident site on the shed roof

Photo: Police

The pilot stated that during the approach the fuel pressure indicator (FUEL P) illuminated suddenly. According to his memory at that time the fuel quantity indicator

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

showed a remaining fuel quantity of about 7%. The fuel quantity indicator (FUEL) had already been illuminated for 15 minutes. Because he had anticipated an engine failure and did not want to put anyone from the ground crew in danger, he decided to steer the helicopter to the left and put the external load down between the pitched roof areas. At that very moment the engine failed and he made a hover-autorotation onto the roof.

## Personnel Information

The 58-year old pilot held a Commercial Helicopter Pilot's License issued according to JAR-FCL 2 and valid until 4 September 2014. His licenses include valid type ratings as pilot in command and type instructor for AS350/350B3 and a flight instructor rating for trainings of private pilots. He held a class 1 medical certificate with the restriction to wear glasses issued according to JAR-FCL 3; it was valid until 20 November 2011.

He had a total flying experience of about 9,408 hours; 5,000 hours of which were on the type in question. His flying experience with external loads was about 2,000 hours.

## Aircraft Information

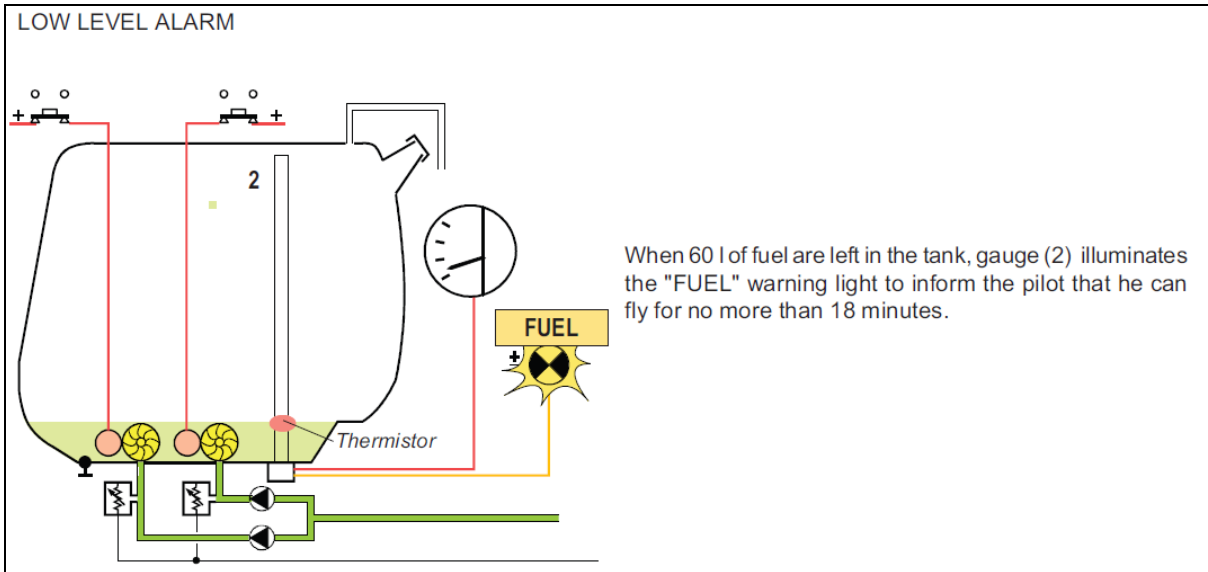
The single-engined helicopter AS350 B2 manufactured by Eurocopter France is a lightweight multi-purpose helicopter for up to seven occupants. It was certified according to FAR/JAR Part 27 in 1989. It is equipped with a Turbomeca Arriel 1 D1 engine, a three-blade main rotor, landing skids and a tail rotor for anti-torque. Maximum weight is 2,250 kg; 2,500 kg with external load.

The helicopter's tank has a fuel capacity of about 540 litres. Mean fuel consumption per flight hour is about 180 litres. The fuel quantity in the tank is shown in the cockpit in per cent. In the warning panel a FUEL indication illuminates once a fuel quantity of about 60 litres is reached. According to the flight manual about 18 minutes of flight time remain once the warning indication is on; large changes in the flight attitude are to be avoided. The remaining usable fuel in cruising attitude is about 1.25 litres.

COMB FUEL	Fuel quantity less than 60 litres (15.8 US.Gal)	- Avoid large attitude changes. <b>NOTE</b> : Remaining usable fuel allows approximately 18 minutes' level flight at maximum continuous power.
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Description fuel warning indication

Excerpt: Flight manual / Eurocopter



Schematic diagram of the fuel warning indication

Excerpt THM / Eurocopter



Fuel indicator and warning display in the cockpit



Photos (2): BFU

The helicopter was built in 1991 and had the manufacturer's serial number 2585. The empty weight was about 1,376 kg. The last annual inspection took place on 21 April 2011. Since then the helicopter had been operated for 38 hours. At the time of the accident, the helicopter had a total of 2,919 operating hours. The helicopter was registered in Germany and the operator was also German.

Taking into account the atmospheric data, the altitude, the empty weight of the helicopter, the additional equipment (external cargo hook and external load mirror) and the weight of the pilot about 1,000 kg capacity for transport and fuel were available. The helicopter's manufacturer confirmed these calculations.

## Meteorological Information

According to the Meteorological Aviation Report (METAR) of Hanover Airport, at the time of the accident there was a visibility of more than 10 km, wind from 220° with 8 kt, few clouds (FEW) in 2,500 ft GND, and a temperature of 23°C with a dewpoint of 17°C. Air pressure (QNH) was 1,012 hPa.

## Flight Recorders

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 located on factory premises in Hanover. The helicopter stood nose down on one of the pitched roof areas of the shed roof of the factory workshop. The external load stood behind the helicopter and was still attached to it. The load rope was stretched tightly.

All three rotor blades were severely damaged and the blade roots were partially fractured. The nose was damaged. The tail boom was bent level with the registration markings. No fuel was leaking onto the accident site. Roof panels beneath the landing skids and on the shed roof in front of the helicopter and windows were damaged.

After the salvage operation of the helicopter, a remaining fuel quantity of about 2 litres was drained from the tank.



Accident site overview

Photo: BFU

## Fire

There was no fire.

## Organisational and Management Information

The owner of the helicopter was an operator certified by the Luftfahrt-Bundesamt (LBA) according to JAR-OPS 3.

The operator had permission for aerial work with helicopters issued on 10 June 2010 by the Niedersächsische Landesbehörde für Straßenbau und Verkehr; it was valid until 31 July 2012.

On 7 September 2011 the Landesluftfahrtbehörde (regional civil aviation authority) approved the transport flights with external loads and the infringement of the minimum safety height on the factory premises in Hanover on the basis of the permission for aerial work.

JAR-OPS 3, German, regulates commercial flight operations with helicopters. JAR OPS 3,540 ff stipulates for single-engined helicopters (flight performance class 3) that the conduct of the flight is to be planned and conducted in a way that an emergency landing in case of engine failure is possible at all times. In Germany external load operations are classified as aerial work. These are not part of JAR-OPS 3 regulations.

When conducting aerial work the Regulation on Operation of Aircraft (LuftBO) must be adhered to. Para 29 Operating Fluids of the Regulation on Operation of Aircraft requires:

*Engine controlled aircraft must carry sufficient quantities of fuel, oil, engine coolant, etc. which ensure the safe conduct of flight taking weather conditions and expected delays into consideration. Additionally, a quantity reserve of fuel, oil, engine coolant, etc. must be carried along which allows for unexpected situations and the flight to an alternate airport if an alternate airport was filed in the flight plan.*

Para 53 Single-engined Aircraft of the Regulation on Operation of Aircraft requires:

*(1) Single-engined aircraft are only permitted to operate during the day, under visual meteorological conditions (VMC) and only on flight routes which provide sufficient emergency landing options. [...]*

*(2) Subsection 1 applies to twin-engined aircraft which can no longer reach their destination or alternate airport after one engine failure.*

Para 54 Aerial Work of the Regulation on Operation of Aircraft requires:

*The owner of the aircraft has to ensure that while conducting aerial work all crew members are familiar with the safety regulations and that all safety regulations which are relevant to the avoidance of all dangers emanating from aerial work are adhered to.*

## Additional Information

In 2002 the Bureau d'Enquêtes et d'Analyses pour la sécurité de l'aviation civile (French aircraft accident investigation authority; BEA) published a study - Fuel Starvation in General Aviation - based on the frequency of occurrence of engine failures due to fuel starvation. The study concluded the following: *Good knowledge of the performance and characteristics of the aircraft, as well as comparison between the information in the logbook, gauges and the level in the tanks are necessary to avoid*

*fuel starvation. These elements are an essential part of flight preparation. Good fuel management during the flight will then allow the right decision at the right time: to divert or continue the flight.*

Investigator in charge: Axel Rokohl  
Field Investigation: Joachim Schütte  
Braunschweig 21 October 2011

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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