

Interim Report

Identification

Type of Occurrence:	Accident
Date:	2 August 2016
Location:	Oberschleissheim Special Airfield
Aircraft:	Helicopter
Manufacturer / Model:	Agusta S.p.A. / A 109E
Injuries to Persons:	One person suffered minor injuries
Damage:	Aircraft severely damaged
Other Damage:	None
State File Number:	BFU 16-1082-3X
Published:	November 2016

Factual Information

History of the Flight

On the day of the accident the crew consisting of two pilots wanted to conduct a training flight with an Agusta A 109E helicopter. At 1453 hrs¹ they took off from Ottobrunn Helicopter Special Airfield (EDMR) and flew west around Munich to Oberschleissheim Special Airfield (EDNX). In Oberschleissheim three southern traffic circuits (glider traffic circuit) were conducted with simulated one-sided engine failure

¹ All times local, unless otherwise stated.

with an approach direction to runway 26. The crew stated that during the approaches the nose wheel lock had been engaged and the main rotor rpm selected to 102%.

The two pilots stated that during the first single-engine approach a rolling landing with approximately 25 kt horizontal velocity on runway 26 had been conducted. During the second approach the intent was to conduct a CAT A approach to a limited space prior to the runway. The Type Rating Instructor (TRI) had simulated the one-sided engine failure prior to the Landing Decision Point (LDP). The pilot flying aborted the approach and conducted a single-engine go-around. During the following approach, the TRI simulated the one-sided engine failure after the LDP. The pilot flying conducted the approach with approximately 20 kt and a rate of descent of less than 300 ft/min to the intended touch-down point prior to runway 26. By adhering to the maximum allowable single-engine power he touched down with low horizontal velocity and reduced the pitch rapidly.

After the helicopter had stood firmly on the ground and the TRI deactivated the single-engine training mode, the helicopter suddenly began to swing vertically. Both pilots concluded it had to be ground resonance. The TRI wanted to stop them and therefore pulled the pitch. But the helicopter responded with increased vertical oscillations and added horizontal rocking motions. Finally the helicopter sprang from the left to the right main landing gear and back again. Due to the resulting tilting the main rotor had ground contact. Subsequently, the fuselage yawed and at about 1515 hrs the helicopter reached its final position lying partly on the fuselage after the engines had been shut off by emergency shut-down. The left main landing gear had been torn off.

Both pilots were able to leave the severely damaged helicopter unaided. During the accident the TRI suffered a cut at the back of his head.



Overview damages on the helicopter

Photo: BFU

Personnel Information

Pilot with TRI

The 53-year-old pilot, seated in the left-hand seat, held an Airline Transport Pilot's Licence Helicopter (ATPL(H)) issued in accordance with Part FCL. The license listed the entries: type rating as Pilot in Command (PIC) on AS350/EC130, AW109, BK117, EC135/635 and EC145(BK117). In addition, he held the instructor rating for flight training (FI(H)) and the instructor rating (TRI) for twin-engine helicopter. He held a class 1 medical certificate with restriction (TML) valid until 20 October 2016. He had a total flying experience of 9,021 hours.

Pilot Flying

The 62-year-old pilot, seated in the right-hand seat, held an Airline Transport Pilot's Licence Helicopter (ATPL(H)) issued in accordance with Part FCL. The license listed the entries: type rating as Pilot in Command on AS350/EC130, AW109 and EC135/635. He held a class 1 medical certificate with restriction (VDL) valid until 12 November 2016. He had a total flying experience of 10,340 hours, of which approximately 840 hours had been flown on the type in question.

Aircraft Information

The twin-engine helicopter Agusta A 109E manufactured by Agusta S.p.A., currently Leonardo S.p.A. Helicopters, is a lightweight multi-purpose helicopter for up to eight occupants. It was certified in 1993 in accordance with FAR/JAR Part 27 and partly Part 29. The helicopter is equipped with two Pratt & Whitney Canada PW206C engines, a four-blade main rotor, a fully articulated rotor head with elastomers, a retractable tricycle landing gear, and a tail rotor for anti-torque. Maximum take-off mass is 2,850 kg.

The accident helicopter was built in 1998 and had the manufacturer's serial number 11014. The last airworthiness inspection was conducted on 24 September 2015. The last release to service was issued on 8 July 2016 at total operating time of 1,951 hours and 3,661 cycles. At the time of the accident, the helicopter had a total flight time of about 1,966 hours and 3,700 cycles. According to the weight report of 10 September 2015 the empty mass was about 2,002 kg. At the time of take-off in Ottobrunn the helicopter had 430 kg fuel on board. The helicopter was registered in Germany and the operator was also German.

The manufacturer stated that in the past events involving ground resonance had occurred with A 109E / S helicopters:

Date	Type	Location	Findings
08.11.2005	A 109E	USA	Uncontrolled landing
19.01.2006	A 109E	USA	Sudden braking during ground taxiing turn
22.08.2009	A 109E	Saudi Arabia	Main Rotor FOD
18.09.2009	A 109E	Kazakhstan	Hard landing
20.11.2009	A 109E	Poland	Asymmetrical hard landing
09.07.2012	A 109S	Germany	Instability during taxi turn
03.10.2015	A 109E	Iran	Improper manoeuvre during lifting up the helicopter nose

Part 2 Normal Procedures of the Flight Manual contained the caution:

CAUTION

**The helicopter is free of ground resonance.
However if, for some reason, ground resonance should occur, lift the helicopter free of the ground immediately. If unable to become airborne, lower collective and shut-down engines.**

Meteorological Information

Approximately five minutes after the accident the corresponding aviation routine weather report (METAR) of 1520 hrs at Munich Airport ((EDDM), located about 11 Nautical Miles (NM) away, reported the following weather conditions:

The wind was 280°/6 kt. Ground visibility was more than 10 km; slight precipitation, few clouds in 3,300 ft, and scattered clouds in 5,500 ft. Air temperature was 21°C, dewpoint 11°C. Barometric air pressure (QNH) was 1,018 hPa.

Aids to Navigation

An iPad® with two installed Apps for navigation (Air Nav Pro® und Jeppesen Mobile FD®) was found in the helicopter's cockpit, which was equipped with substantial avionics. The Air Nav Pro – Logbook had stored the accident flight with take-off and landing times and location. But neither the Air Nav Pro nor the Jeppesen Mobile FD had stored any flight path data.

Radio Communications

Radio communications with the Flugleiter (A person required by German regulation at uncontrolled aerodromes to provide aerodrome information service to pilots) at Oberschleissheim Special Airfield were not recorded.

Aerodrome Information

Oberschleissheim Special Airfield (EDNX) is located north of Munich. It has one asphalt runway oriented 08/26 with a length of 808 m and a width of 15.6 m. South of the main runway the towrope pull-out area and two grass strips, which are 250 m long and 30 m wide, for gliders are located. The traffic circuit for powered airplanes is located north and the one for gliders south of the runway. Aerodrome elevation is 1,596 ft AMSL.

Prior to the beginning of runway 26 parts of the concrete runway surface of the old military airfield still remain. The underground is firm but covered with loose stones, weeds, and larger moss areas.



Overview beginning of runway 26, intended touchdown point, and accident site

Image: BFU/ Google earth™

Flight Recorder

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

Due to the software version of the units (year of manufacture 1998) the analysis of the data collecting units of the two engines did not reveal any information regarding the engine parameters during the approach or the accident.

Wreckage and Impact Information

The accident site was located approximately 100 m prior to runway 26 of Oberschleissheim Special Airfield. The helicopter stood upright slightly tilting left towards approximately 320°. The retractable landing gear was extended. The left main landing gear had collapsed outward. The nose landing gear had been twisted to the left. The pin of the nose wheel centre mechanism was not engaged. After the accident, the lever for the nose wheel locking in the cockpit was not completely in the “Lock” position.



Position helicopter, beginning of runway 26, and underground of the landing area

Photo: BFU

The nose was damaged. Individual electronic equipment had been torn out. The right side of the Plexiglas cockpit top was damaged; the pitot tubes on the roof were bent towards the rotation direction of the main rotor. The bracket of the main gear box had penetrated the roof of the cabin.

All four main rotor blades and the rotor head were damaged. The four mounting rods of the main gear box on top of the fuselage were fractured. The hydraulic lines of the control servos essentially held the main gear box in place. The tail rotor drive shaft had been torn off the main gear box in the area of the rotor brake. The leading edge of one blade tip of the tail rotor showed an egg-sized spherical indentation.

The helicopter was salvaged and further examined with the help of an organisation certified in accordance with Part 145. The visual inspection did not reveal any causal technical defects on the rotor head or the landing gear as cause for the ground resonance.

The four main rotor blade led/lag-dampers and the three landing gear shock absorbers including the nose-wheel-lock were removed for further examination at the manufacturer.

In October, the examinations were conducted in the presence of experts of the helicopter manufacturer and the BFU at the facilities of the respective damper supplier. They revealed no technical malfunction of the dampers or the nose-wheel-lock mechanism.

Fire

There was no fire.

Additional Information

Ground Resonance

Excerpt from the Rotorcraft Flying Handbook of the Federal Aviation Authority (FAA):

Ground resonance is an aerodynamic phenomenon associated with fully-articulated rotor systems. It develops when the rotor blades move out of phase with each other and cause the rotor disc to become unbalanced. This condition can cause a helicopter to self-destruct in a matter of seconds. However, for this condition to occur, the helicopter must be in contact with the ground.

If you allow your helicopter to touch down firmly on one corner (wheel type landing gear is most conducive for this) the shock is transmitted to the main rotor system. This may cause the blades to move out of their normal relationship with each other. This movement occurs along the drag hinge.

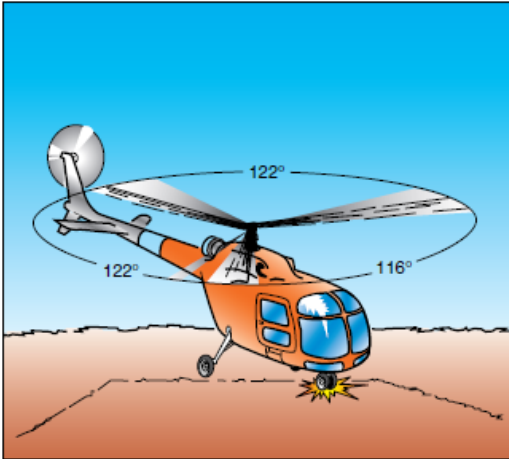


Figure 11-5. Hard contact with the ground can send a shock wave to the main rotor head, resulting in the blades of a three-bladed rotor system moving from their normal 120° relationship to each other. This could result in something like 122°, 122°, and 116° between blades. When one of the other landing gear strikes the surface, the unbalanced condition could be further aggravated.

If the r.p.m. is low, the corrective action to stop ground resonance is to close the throttle immediately and fully lower the collective to place the blades in low pitch. If the r.p.m. is in the normal operating range, you should fly the helicopter off the ground, and allow the blades to automatically realign themselves. You can then make a normal touchdown. If you lift off and allow the helicopter to firmly re-contact the surface before the blades are realigned, a second shock could move the blades again and aggravate the already unbalanced condition. This could lead to a violent, uncontrollable oscillation.

This situation does not occur in rigid or semirigid rotor systems, because there is no drag hinge. In addition, skid type landing gear are not as prone to ground resonance as wheel type gear.

Investigator in charge: Axel Rokohl

Field investigation: Hans Rachl, Philipp Lampert, Axel Rokohl

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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