AIR ACCIDENTS INVESTIGATION
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FINAL REPORT

Investigation on the accident to Schweizer HU269C-1 registration OK-XIS at Šumvald on 25 June 2011

Prague
October 2011

This investigation has been carried out in accordance with EU Regulation No 996/2010. The sole objective of the safety investigation is the prevention of future accidents and incidents without apportioning blame or liability.

The report has been translated and published by the Air Accidents Investigation Institute to make its reading easier for English-speaking people. As accurate as the translation may be, the original text in Czech is the work of reference.

Used abbreviations:

AAII	Air Accidents Investigation Institute
AFIS	Aerodrome flight information service
AGL	Above groud level
BKN	Broken
CAA	Civil Aviation Authority
CU	Cumulus
CPL(H)	Commercial pilot licence (Helicopter)
°C	Temperature in degrees Celsius
EASA	European Aviation Safety Agency
ELEV	Elevation
FAA	Federal Aviation Administration USA
FI(H)	Flight instruktor (Helicopter)
ft	Feet (unit of length - 0,3048 m)
LKOL	Public domestic aerodrome Olomouc
LKSUMV	Microlight airfield Šumvald
km	Kilometre (unit of length)
kt	Knot (unit of speed - 1,852 $km.h^{-1}$)
h	Hours
m	Meter (unit of length)
mb	Milibar (unit if measurement of Atmospheric pressure)
min	Minute (unit if measurement of time)
N	North (cardinal direction)
NIL	None
RWY	Runway
SFD	Sport Flying Device
SCT	Scattered
TCU	Towering cumulus
TRI	Type rating instructor
UTC	Co- ordinated Universal Time
UL	Ultralight
VFR	Visual flight rules
VRB	Variable
VZLÚ	Aerospace Research and Test Establishment

A) Introduction

Operator:	HELIWORK CZ, s.r.o.
Aircraft type:	Schweizer aircraft corporation, 269C-1
Registration:	OK-XIS
Location of accident:	airfield Šumvald
Date and Time:	25. 6. 2011, 15:25 (All times are UTC)

B) Synopsis

On 25 June 2011, AAII got a notification of the accident of a Schweizer 269C-1 helicopter on Sports Flying Device (SFD) Šumvald airfield. The pilot made a flight with another person on board. He was making a run-down landing. Shortly after the skids touched the ground, as it moved forward, the helicopter began to swerve to the right. As the directional control was ineffective, the pilot tried to stop helicopter tilting and lift it by deflecting cyclic pitch control and raising the collective pitch. However, as the skid hit a field surface inequality, the helicopter began to tilt and turned over portside. The crew was not injured. The helicopter was damaged by overturn, its main rotor blades having hit the ground.

The pilot reported the accident to the Police of the Czech Republic. On 26 June 2011 AAII inspectors came to the crash site to gather information relevant to the accident investigation.

The cause of the accident was investigated by an AAII commission comprising:

Investigator in charge:	Ing. Stanislav Suchý
Member:	Ing. Lubomír Stříhavka

The Final report was released by:

AIR ACCIDENTS INVESTIGATION INSTITUTE
Beranových 130
199 01 PRAHA 99

On the 5 September 2011.

C) The Final report includes the following main parts:

1) Factual information
2) Analysis
3) Conclusions
4) Safety recommendation
5) Appendices

1 Factual information

1.1 History of the flight

The pilot and the other person on board gave the following details on the flight and the critical situation. On 25 June 2011, the pilot made a pre-flight inspection and fuelled up the helicopter at the Olomouc airfield. Then he flew over to the airfield Šumvald where he landed and subsequently made a circuit flight to land again. He made both the landing from hover-flight without problems, in a place reserved for helicopter take-offs and landings. After switching off, he talked to the other person about making another flight to take photos of selected places in the neighbourhood.

The pilot took off for the critical flight from airfield Šumvald surface at 15:15. As they were flying over a hilly land to take the first photos, the crew felt strong turbulence and gusts so the pilot decided to suspend the flight, return to LKSUMV and wait for better conditions. On approaching the landing site he decided, taking into account the wind direction, turbulence and a small engine power reserve, to land almost perpendicularly to LKSUMV surface axis.

As he was turning to the place of intended landing, the wind drifted the helicopter so the pilot increased the elevation and forward speed. In approaching, apparently owing to a gust, he felt a drop and got under the optimum angle of descent. Regarding the small altitude above the ground and even terrain ahead of the copter, the pilot, who did no want to stall, decided to make a run-down landing on the free grass surface ahead of RWY.

After the skids had touched the ground, judging by traces approximately 38 m ahead of airfield surface edge, the helicopter began to swerve right. The pilot increased pressure on the directional control left pedal, got a feeling of its movement forward, but the helicopter did not respond to the pedal movement and continue to turn right. So he tried to avoid turning over by moving the cyclic pitch control lever to the right to get a feeling that the helicopter was sliding on its right skid. He responded to the unfavourable situation by lifting the helicopter through raising the collective. But the pilot suspended this control manoeuvre at once due to the sliding movement and increasing tendency to turn right. As the right hand skid hit a transverse bump, the helicopter began to turn over onto its portside. The pilot has said he gave a strong lift to the collective and moved the cyclic control lever to the right, but failed to avoid capsizing. The main rotor blades struck the ground, got damaged and the helicopter turned over to its portside, see Fig. 1. The helicopter´s left and front parts, fuselage and fuel tank were damaged.

After capsizing, the pilot reduced the engine throttle, pulled the throttle flap, shut off magnetos and the battery. He helped the passenger unfasten his safety belts, and leave the cabin first through the right door. Then the pilot unfastened his belt and left the cabin.

Fig. 1 The site of the accident - OK-XIS

1.2 Injuries to persons

Injuries	Crew	Passengers	Others
Fatal	0	0	0
Serious	0	0	0
Minor/None	0/1	0/1	0

1.3 Damage to aircraft

The helicopter got damaged as it crashed into the ground. The main rotor blades were destroyed and the main rotor hub was damaged. As a result of crash and rollover, the fuselage and the skids were damaged too. There was no other damage on the crash site due to handling the helicopter.

1.4 Other damage

Damage on the accident site was not calculated.

1.5 Personnel information

1.5.1 Pilot

Personnel data:

- Male, aged 54 years,
- He held valid commercial pilot licence for helicopter (CPL (H), issued by CAA on 27. 4. 2009,
- valid type rating BO-105, Bell 206/206L, HU 269,
- valid rating FI(H),TRI (Bell 206/206L, BO-105H)

- last medical certificate Class 1, 26. 1. 2011.
- completed a proficiency check in 17. 11. 2009

Flying experience:

Total pilot time on all types of helicopter: 6 140 hours,

- in last 90 days: 28 hours 30 minutes,

Total pilot time on HU 269C-1: 91 hours 45 minutes

- of wich as PIC: 84 hours
- in last 90 days: 13 hours 20 minutes,
- in last 24 hours 2 hours 11 minutes,

The pilot was seated in the right seat.

1.5.2 Other person aboard

- male, aged 39 years,

He held pilot license for ultralight helicopter

Flying experience:

Total pilot time on ultralight helicopter: 168 hours.

1.6 Aircraft information

1.6.1 Basic helicopter information

Type:	269C-1
Registration:	OK-XIS
Manufacturer:	Schweizer aircraft corporation
Year of manufacture:	1998
Serial number:	0088
Certificate of airworthiness:	valid
Total flight time:	5 139 hours 21 minutes
Total flight time from last inspection:	56 hours 59 minutes
Assurance certificate:	valid to18. 4. 2012

Power plant:

Type of engine:	Lycoming O-320 B2C
Manufacturer:	Textron Lycoming
Total flight time:	6558 hours 17 minutes

1.6.2 Operation of the helicopter

The helicopter was operated at the LKOL airfield. On 7 September 2010, a service centre, a holder of maintenance and repair work certificate, carried out inspection as set for 100-hour operation with the result: “Aircraft airworthy”. The inspection included, among other things, a check on pedals of directional control.

1.7 Meteorological information

1.7.1 Synoptic situation

Cold ocean air streamed to the Czech Republic from north-west.

1.7.2 Actual situation

According to the Czech Hydrometeorological Office, the weather situation at the accident site was as follows:

Surface wind:	290°- 340°/ 7 – 14 kt, at time 12:30 – 13:00, gust 20 – 25 kt
Wind:	2000 ft 320°/ 20 kt
Present weather:	cloudy, at time 15:30 – 16:00 STC
Visibility:	over 10 km
Sky condition:	BKN / STC CU, TCU 3000 - 3500 ft AGL
Turbulence:	moderate

Extract from SYNOP reports from the nearest meteorological stations Přerov (LPV) and Červená (CER near Budišov) at 15:00:

Station	Sky condition	Wind direction/Speed	Visibility	Cloud amount/ Height	Temperature
LPV	5	330° 8 kt, MAX 23 kt	50 km	2 CU 4700 ft	17,9°C
CER	4	VRB 4 kt	55 km	4 CU 3300 ft	12,7°C

The pilot assessed the weather during takeoff and landing at LKSUMV as highly turbulent, particularly over the hills in the intended zone of flight. Wind on the surface was strong and gusty as showed by the

1.8 Aids to navigation

A wind direction indicator is located at LKSUMV.

1.9 Communications

The pilot established radio contact on frequencies AFIS LKOL.

1.10 Aerodrome information

The LKSUMV surface is not open to the public. It borders a village of Šumvald, 8 km north of Uničov, uses a grass RWY 05/23, ELEV 902 ft, size 450 x 25 m. A grass surface joining the southern side of the RWY is designed for helicopter landings. There was no other traffic on the surface at the time of the accident.

1.11 Flight recorders

On board the helicopter there was no equipment whose record could have been used to the flight analysis.

1.12 Description of crash site and aircraft

The 25 long traces in the grass and on the ground indicated that the helicopter with a heading of 345 deg sat down 30 m ahead of the place where it turned over, first on its right skid and 2 m farther on the left one, too. When running down, the skids left direct traces 12 m long in the grass surface, then there was a trace from one skid in the original direction, and 8 m farther there was a larger skidding trace. It ended up in the distance of 25 m from the touchdown where there was a deeper trough as the helicopter struck a land bump. The capsized helicopter was lying on port side on the grass surface adjacent to the edge of the airfield surface.

The fuselage left side was dented on several places. The cabin left door was damaged and left door windows were broken. The fuel tank was distorted, see Fig. 2. The tube structure was deformed in places where the power unit and the tail beam were attached. The skid struts were damaged.

All the three main rotor blades were destroyed; the blade control rods were deformed. The main rotor hub was damaged. Possible damage of the shaft was not apparent at the visual inspection.

The tail beam and the tail rotor showed no damage.

Fig. 2 Damaged left side of the helicopter OK-XIS

Cockpit instruments were not damaged. The altimeter set at the pressure of 1,022 mb showed 865 ft. Manifold pressure showed basic value. Other instruments showed zero values. The battery main switch was at “OFF” position and the magnetos switch was in “OFF” position.

At the accident site in the cockpit, the left pedal of directional control on the right-hand side, which was broken off, was found. No evidence of other faulty control elements was found during inspection or at subsequent technical examination.

1.13 Medical and pathological information

During the flight the pilot was not influenced by drugs prohibited when flying. CR Police had the crew breathalysed with negative results

1.14 Fire

There was no fire at the accident location.

1.15 Search and rescue

There were no facts relevant to survival aspects in this incident.

1.16 Tests and research

Professional examination of the fracture character of the helicopter directional control left pedal was carried out at VZLU. The expert survey states the following results:

The nature of fracture mechanics analysis done indicates that the fracture was probably caused by fatigue failure that followed visible damage of casting internal structure through impurities of unknown origin. Those places could have developed high stress concentration leading to forming fatigue cracks. Other evidence for fatigue failure hypothesis is cracks in the second transition radius, in several nearby planes perpendicular to the direction of the applied loading force. Through joining these cracks together, one magistral crack formed, which might cause a small fragment to break off in the second transition radius. Fatigue cracks along with impurities in the casting reduced the cross-section load bearing capacity up to fracture.[1]

Chemical composition of the damaged part was not examined

1.17 Organizational and management information

The helicopter was used for training pilots to get qualification PPL(H) in the registered facility for pilot training No. 126 and for aerial work under CAA permission no. 888/LPR.

1.18 Additional information

NIL

1.19 Useful or effective investigation techniques

The cause of the accident was investigated in accordance with Annex 13.

[1] Examination of the nature of fracture of the pedal of directional control - Schweizer HU 269, VZLÚ a.s. 2011

2 Analysis

It followed from the information given by the pilot and the other person and from the helicopter inspection at the site of the accident that the loss of control was likely caused by a control handling failure just during the landing run-down.

2.1 Pilot's rating and experinece

The pilot was airworthy, skilled and experienced. After taking off from LKSUMV, the pilot decided to suspend the flight and return because the meteorological conditions for flight in the hilly land were getting worse. He reacted to the strong, gusty wind and took the decision to land upwind perpendicular to RWY 05/23 axis.

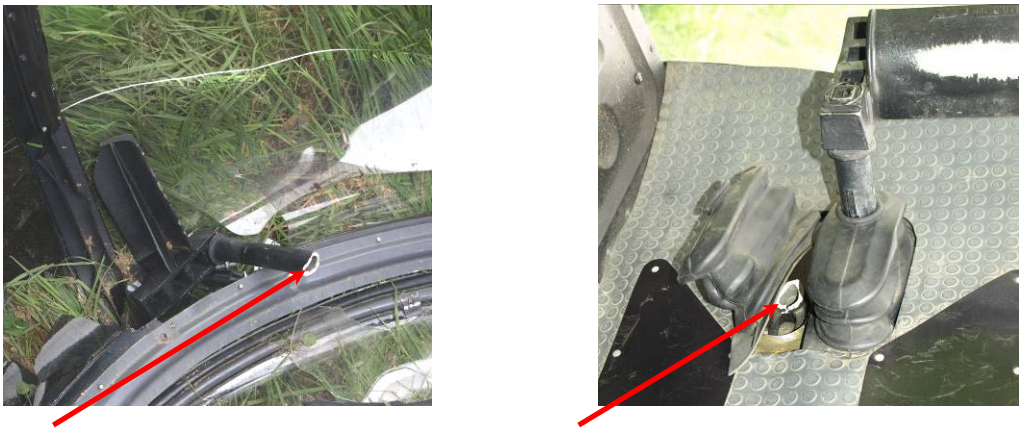
The pilot justified his decision to land not on RWY but instead to make a run-down landing on a free meadow with higher growth by taking into account a gust-caused sudden lost of altitude during approach. He did not notice any failure of directional control during the flight till the touch-down.

2.2 Critical situation

After the skids touching down, trying to prevent the helicopter from turning right when on the ground, the pilot applied pressure on the left pedal of directional control. The pilot has said that the directional control was ineffective because he did feel the pedal move forward, but the helicopter did not react and continued turning.

So he wanted to correct turning and tilting through moving cyclic pitch control lever to the right and lifting the helicopter by increasing its collective. But these moves seemed to be rather inconvenient. The helicopter started slipping and, as the skid crashed sideways into a land bump, it turned over.

The pedal web is made of a light alloy casting. The fracture took place in transition into the socket. On the socket, the fracture surface divided and there was a small adjacent fragment. The web broke, which led to a directional control failure, see Figs. 3 and 4.



a) b)

Fig. 3 View of directional control pedals of OK-XIS helicopter; a) Broken left pedal, b) Rest of web and right pedal.

Fig. 4 Disassembled broken web of left pedal

It followed from the fracture mechanics analysis of the left pedal fracture surface that the internal structure of the pedal web casting was visibly damaged through impurities, see Fig. 5, which caused loss of integrity of the material. Stress concentration might have increased there, leading to forming fatigue cracks in the web.

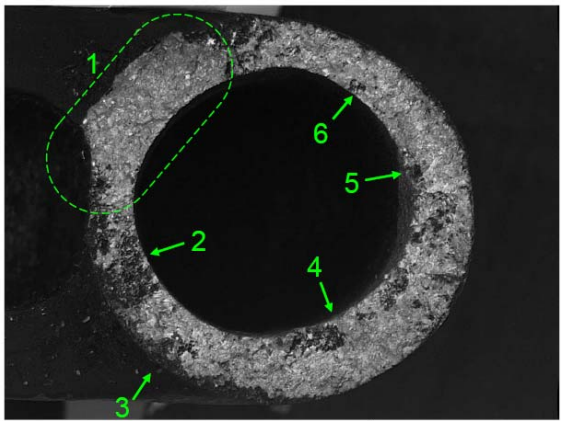


Fig. 5 Impurity localities (2. – 6.) in casting and region of small fragment. (1.).

The manufacturer requires pedals to be visually checked every 100 hours of operation. In the period from the last visual check of pedals the helicopter accumulated 56 hours 59 min.

The evidence found and the helicopter reactions on the ground did not make it possible to find out the moment the pedal broke completely. This failure occurred most likely as the pilot intended by using directional control to eliminate transversal skidding and in this way to prevent the helicopter overturn.

2 Conclusions

3.1 The commission determined the following conclusions:

- The pilot was rated for the flight, had a valid medical and enough experience;
- The helicopter had valid airworthy certificate;
- Since the pilot lost altitude, he decided to make a run-down landing on a meadow ahead of RWY;
- It is likely that failures occurred before the pedal web broke, which was caused by fatigue cracks reducing load bearing capacity of the cross-section along with impurities in the web casting;
- After landing, the left pedal broke so it could not be used for directional control;
- As the helicopter swerved, the pilot probably manipulated improperly cyclic and collective pitch control. The helicopter slipped, its skid hit a bumpy land and the pilot failed to prevent the helicopter from turning over;
- The helicopter was damaged by forces induced by turning over port.

3.2 Causes

The probable causes were a failure of the helicopter directional control due to the break of a pedal web and the pilot´s inconvenient handling with cyclic and collective pitch controls.

4 Safety recommendations

4.1 On the basis of the findings from the accident of the OK-XIS helicopter, the AAII issues safety recommendations as follows:

The Federal Aviation Administration, in conjunction with the European Aviation Safety Agency should consider the way of inspection of the directional control pedals which are used on Schweizer 269 C-1 helicopters with the aim of lowering to minimum the possibility of cracks being formed leading to a similar failure.

Appendices
Appendix 1 Photographs

Distribution:
AAII – Czech Republic
Federal Aviation Administration
European Aviation Safety Agency

Photographs

The evidence at the accident site

The helicopter

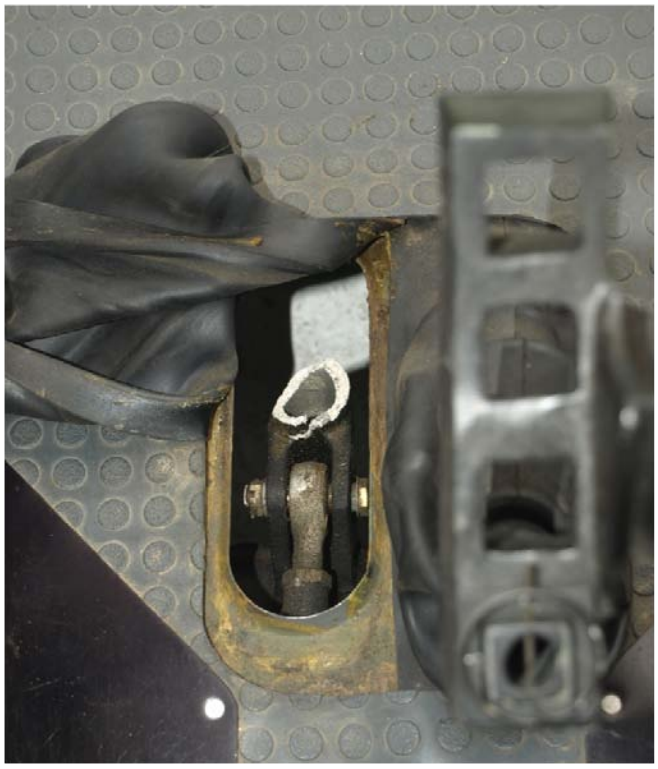
The main rotor blades

The tail rotor gearbox

The evidence of impact of main rotor blades

Parts of the cabin

Damaged blade control rods



The broken socket of the left pedal

Damaged skid

The transmission shaft and boom