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Aircraft Accident Investigation Bureau AAIB

# **Final Report No. 2114 by the Aircraft Accident Investigation Bureau**

concerning the accident involving  
the Robinson R22 Beta II helicopter, registration HB-ZHB  
on 27 May 2010  
"Auzelgli", municipality of Uzwil/SG  
approx. 12 km south-west of Sitterdorf aerodrome

**Ursache**

Der Unfall ist darauf zurückzuführen, dass im Rahmen einer Autorotationsübung der Fluglehrer nicht zeitgerecht eingriff und der Helikopter in der Folge auf dem Boden aufschlug.

Zum Unfall haben die folgenden Faktoren beigetragen:

- Der Flugschüler leitete keinen Abfangvorgang ein.
- Der Fluglehrer hatte bezüglich der fliegerischen Fähigkeiten des Flugschülers eine unzutreffende Erwartung.

## General information on this report

This report contains the conclusions of the Aircraft Accident Investigation Bureau (AAIB) on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Art 3.1 of the 10<sup>th</sup> edition, applicable from 18 November 2010, of Annex 13 to the Convention on International Civil Aviation of 7 December 1944 and Article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.

The definitive version of this report is the original in the German language.

All times in this report, unless otherwise indicated, are stated in local time (LT). At the time of the accident, Central European Summer Time (CEST) applied as local time in Switzerland. The relation between LT, CEST and UTC is:  $LT = CEST = UTC + 2 \text{ hours}$ .

## Final Report

<b>Aircraft type</b>	Robinson R22 Beta II	HB-ZHB
<b>Operator</b>	Heli Sitterdorf AG, Postfach 8, 8589 Sitterdorf, Switzerland	
<b>Owner</b>	Heli Sitterdorf AG, Postfach 8, 8589 Sitterdorf, Switzerland	
<b>Flight instructor A</b>	Swiss citizen, born 1972	
<b>Licence</b>	Commercial pilot licence helicopter (CPL(H)) according to joint aviation requirements (JAR), first issued by the Federal Office of Civil Aviation (FOCA) on 15 June 1998 and valid till 27 April 2015	
<b>Essential ratings</b>	Flight instructor's rating FI(H), restricted according to JAR-FCL 2.320B, issued on 8 April 2009 and valid till 8 April 2012 Type ratings R22 and Bell206	
<b>Medical fitness certificate</b>	Class 1, without restrictions, issued on 19 March 2010 and valid till 18 April 2011	
<b>Flying hours</b>	<b>total</b>	2588:06 h
	<b>on the accident type</b>	308:03 h
	<b>as flight instructor</b>	338:47 h
	<b>during the last 90 days</b>	142:45 h
	<b>during the last 90 days</b>	0:00 h
	<b>on the accident type</b>	97:37 h
<b>Trainee pilot</b>	Swiss citizen, born 1969	
<b>Licences</b>	Private pilot licence helicopter (PPL(H)) according to federal aviation regulations (FAR), first issued by the Federal Aviation Administration (FAA) on 7 January 2006 Trainee pilot licence helicopter (Trainee(H)), first issued by the Federal Office of Civil Aviation (FOCA) on 28 April 2009 and valid till 10 October 2010	
<b>Essential ratings</b>	None according to JAR	
<b>Medical fitness certificate</b>	Class 1 according to JAR-FCL 3, without restrictions, issued on 18 December 2009 and valid till 18 December 2010	
<b>Flying hours</b>	<b>total</b>	approx. 186 h
	<b>on the accident type</b>	approx. 118 h
	<b>during the last 90 days</b>	10:08 h
	<b>during the last 90 days</b>	8:19 h
<b>Location</b>	"Auzelgli", municipality of Uzwil/SG	
<b>Coordinates</b>	727 411 / 257 245	<b>Elevation</b> approx. 500 m AMSL
<b>Date and time</b>	27 May 2010, approx. 15:20	
<b>Type of operation</b>	VFR training	
<b>Flight phase</b>	Autorotation exercise	
<b>Accident type</b>	Collision with the terrain	

**Injuries to persons**

Injuries	Crew	Passengers	Total number of occupants	Others
Fatal	0	0	0	0
Serious	0	0	0	0
Minor	2	0	2	0
None	0	0	0	Not applicable
Total	2	0	2	0

**Damage to aircraft**

Destroyed

**Other damage**

Slight damage to field. Because of the leakage of fuel, oil and lubricants the topmost layer of soil at the final position of the wreckage was removed and disposed of appropriately.

## **1 Factual information**

### **1.1 Pre-flight history and history of the flight**

#### 1.1.1 General

The following description of the pre-flight history and history of the flight is based on statements from flight instructor A and the trainee pilot, flight instructor B, who was responsible for the trainee pilot's practical training, and flight instructor A's supervising flight instructor, and from eyewitnesses and the data from the installed FLARM device.

#### 1.1.2 Pre-flight history

The trainee pilot had begun training as a private pilot in July 2005 at an American flying school. After intensive training during the months of July, August and December 2005 and January 2006, he passed the practical test for acquisition of the private pilot's licence on 7 January 2006. He had previously flown for approximately 86 hours, all on the Robinson R22 type. Subsequently, during the years 2006 to 2008, he flew sporadically in the United States of America and in Switzerland, on different types and always accompanied by a flight instructor. In March 2009 he acquired the type rating for the Bell Jet Ranger (Bell206) in the USA and subsequently flew several hours on this type in America.

Back in Switzerland, the trainee pilot commenced training as a professional pilot and therefore applied for a trainee pilot's licence, which was issued by the Federal Office of Civil Aviation (FOCA) on 28 April 2009. Flight instructor A, who was involved in the accident, and the trainee pilot had known each other for some time. At the time of the accident, flight instructor A, who did acquire his flight instructor's rating for helicopters on 8 April 2009, was not yet in possession of a rating which would have allowed him to give flight training with regard to the acquisition of a commercial pilot's licence for helicopters.<sup>1</sup>

The trainee pilot and flight instructor A made a flight together on 21 May 2009 in a Jet Ranger, but this was not of a training nature, and on 1 July 2009 they made a flight from Sitterdorf in the helicopter subsequently involved in the accident. This was the trainee pilot's first flight in a Robinson R22 in Switzerland, and it was also the first and only joint flight by the trainee pilot and flight instructor A in this type before the flight leading to the accident. This flight was also not of a training nature.

On 24 July 2009 the trainee pilot commenced practical training as a professional pilot. This training took place in the same flying school at which flight instructor A was employed, but with flight instructor B. By 9 April 2010, he had completed a total of 21 lessons, all with flight instructor B, and all on the Robinson R22 Beta II type. By then his total flight time was just over 30 hours. Apart from an interruption in September and October 2009 the lessons took place at fairly regular intervals. In this period, the trainee pilot made two more flights in the Jet Ranger with flight instructor A, but these were not of a training nature. Three more joint flights in the Jet Ranger followed on 24 May 2010, i.e. three days before the accident.

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<sup>1</sup> The precise conditions are stated in JAR-FCL 2.320B and 2.320C.

Since flight instructor B, who was responsible for practical training as a professional pilot, was abroad for a fairly long time, resulting in training being interrupted from 9 April 2010, the trainee pilot asked flight instructor A if he could make a training flight with him in the R22. Flight instructor A agreed. He later stated in relation to the nature of this flight as follows: *"It was not to be a training flight in the CPL program, but rather training to bridge the interruption (...)."* Before the departure of flight instructor B, who was responsible for training, the trainee pilot asked him if he had any objections to a training flight with a different flight instructor during his absence, to which he responded in the negative. However, by his own account flight instructor B did not expect that such a flight would take place. Flight instructor A's supervising flight instructor stated that he was not informed about this training flight.

Flight instructor A had begun training as a private pilot in 1995, which he completed successfully in 1996. The training was carried out on the Hughes 269 type. Subsequently, also in 1996, he acquired the type rating for the Robinson R22 helicopter in America. This stay was associated with a safety course on the manufacturer's actual premises. Back in Switzerland, he acquired the extension for mountain landings in 1997 and began training as a professional pilot, which he completed successfully on 15 June 1998. In the same year there followed a safety course on the premises of the Bell helicopter manufacturer. He then worked as a professional pilot until 2008, mainly on the Jet Ranger and Eurocopter EC 120 types. In 2009 he trained to become a flight instructor in Germany. After this training, he commenced his employment as a flight instructor at that flying school in the context of which the flight leading to the accident took place. By the time of the accident he had flown approximately 340 hours as a flight instructor, of which approximately 100 hours were on the Robinson R22 type. He occasionally conducted flights in the Jet Ranger with the trainee pilot. Flight instructor A and the trainee pilot had made one joint flight in a R22 before the flight leading to the accident. All these flights with the trainee pilot did not serve for the acquisition of the commercial pilot's licence.

Flight instructor A had last practiced autorotations as a flight instructor on 21 May 2010 on the Robinson R44 type. On the R22 type, he had last instructed autorotations on 22 February 2010.

### 1.1.3 Preparation and briefing

The trainee pilot and flight instructor A met on Thursday 27 May 2010 at approximately 13:00 at Sitterdorf aerodrome for the planned joint training flight. Since the two of them had a relatively large amount of time at their disposal, particularly since initially there were light showers over the airfield, they devoted themselves to detailed pre-flight preparation and the briefing. There were detailed discussions about the Daily Airspace Bulletin Switzerland (DABS), the Notices to Airmen (NOTAM), the aviation weather forecast, the General Aviation Forecast (GAFOR) and the General Aviation Meteorological information (GAMET). The flight instructor took the opportunity to check the trainee pilot's theoretical knowledge and complement it where necessary. According to the crew's statements, a weight and performance calculation was also undertaken.

The programme for the subsequent flight was to take place according to the announcements of flight instructor A and include the following elements: off-airport landings, low RPM recovery, autorotations, attitude flying. The individual manoeuvres were mentioned but not discussed in detail. Flight instructor A justified this approach with reference to the training level of the trainee pilot: *"(...) Moreover, his level of training was such that he should have been acquainted with and mastered every conceivable manoeuvre, as he was just about to take the test."*

Nor was the route fixed in advance; it was to be determined in flight by flight instructor A, on an *ad hoc* basis.

Following the briefing, helicopter HB-ZHB was taken out of the hangar. Flight instructor A filled the main tank – according to the flight notification, the fuel was supplemented with 54 litres to give a total of 20 US gallons – while the trainee pilot performed the pre-flight inspection. In the process, various technical aspects were discussed together.

#### 1.1.4 History of the flight

On 27 May 2010, shortly after 15:00, the Robinson R22 Beta II helicopter, registration HB-ZHB, took off from Sitterdorf aerodrome. During the departure in a southerly direction, the crew had to avoid two birds during the climb. The trainee pilot's reaction and the evasive manoeuvre were adequate, according to flight instructor A. The helicopter passed the South Sector of Sitterdorf aerodrome and then continued to fly in a south-south-westerly direction. To the west of Gossau, flight instructor A specified a field for an off-airport landing. The trainee pilot commenced the reconnaissance of the designated landing site and then started his approach. The approach was too high and furthermore an agricultural vehicle was crossing the field. Thus flight instructor A ordered a go-around. This took place at approximately 15:15.

The crew then followed the A1 motorway in a westerly direction and climbed to approximately 3000 ft QNH. During horizontal cruise, flight instructor A throttled back a little using the twist-grip, in order to cause a low RPM situation as well as the corresponding warning. The trainee pilot reacted promptly and with the correct measures.

Then – the helicopter was now to the north of Niederuzwil – flight instructor A sighted an appropriate field. This field had often served him in the past for various exercises, especially autorotations. He asked the trainee pilot whether he was ready for an autorotation exercise, and the latter replied in the affirmative. Flight instructor A then turned on the carburettor heating, got ready at the controls and closed the twist-grip. The reaction of the trainee pilot – collective pitch control (collective) down and cyclic control (cyclic) slightly back – was correct.

To the question from flight instructor A about where the trainee pilot intended to land, the trainee pilot mentioned the same field which flight instructor A had already sighted. The trainee pilot had never performed an approach to this field before. With a S-turn, i.e. a left turn followed by a right turn, the trainee pilot reduced excessive height. After completing the turns, the final approach ensued, in a north-westerly direction, with the airspeed and rotor speed within the desired range.



Flight instructor A turned off the carburettor heating. He now realised that the trainee pilot was not transitioning to the flare. Such a flare is essential on approaching the terrain in an autorotative descent; pulling back the cyclic reduces both the rate of descent and the forward speed. Flight instructor A described this phase as follows: *"Normally, trainees tend to carry out a high flare. In this case, nothing happened."*

Flight instructor A took hold of the controls and assumed control of the helicopter. In his judgement the helicopter was already too close to the ground to be able to initiate a normal flare, as such a flare would have led to an impact between the ground and the tail boom. According to the flight instructor A's assessment, it was also too late to initiate a go-around, he therefore concentrated on making contact with the ground in as controlled a manner as possible. Shortly before or during contact with the ground, he pulled the collective.

It could not be ascertained whether and when flight instructor A opened the twist-grip again.

The helicopter impacted the field in an approximately horizontal attitude with forward speed. The landing gear was deformed laterally by the high impact forces and the underside of the fuselage also left distinct traces of impact. The helicopter then tipped forward, the rotor blades struck the ground and the tail boom became detached. After flipping over once or twice the helicopter came to lie on its right side and slid in this position a few metres further before it came to a standstill, destroyed.

Flight instructor A, who sustained a slight injury to the head, was able to exit the wreckage unaided and helped the trainee pilot, who was also slightly injured, to exit the helicopter. Both crew members did not wear a helmet. Since fuel was leaking, flight instructor A asked the trainee pilot to close the fuel valve. The trainee pilot did so. Together with an eyewitness who rushed to give assistance, the crew then righted the helicopter to prevent further leakage of fuel, oil and lubricants.

The rescue team, alerted by the eyewitnesses, arrived at the scene approximately fifteen minutes after the accident. Flight instructor A and the trainee pilot were taken to hospital for outpatient treatment.

The investigation was started at the scene of the accident on the same day, in cooperation with the St. Gallen cantonal police.

The topmost layer of soil at the final position of the helicopter had to be removed and disposed of because of the leakage of fuel, oil and lubricants.



**Figure 1:** Main wreckage of the helicopter after the accident. The helicopter was righted after the accident to prevent further leakage of fuel, oil and lubricants. In the background, other individual components and various traces of impact can be seen, allowing the direction of approach to be determined (approximately the reverse of the camera angle).



**Figure 2:** In the foreground, the initial traces of impact of the skids and the underside of the fuselage can be seen, further back is one of the two main rotor blades, which was torn off and which stuck in the ground, the main wreckage can be seen to the rear.





**Figure 3:** Initial impact traces, other impact traces and individual components, plus the main wreckage, photographed from the air from the approximate direction of approach.

## 1.2 Aircraft information

### 1.2.1 General

The Robinson R22 helicopter is a light-weight, two-seater helicopter of composite construction consisting of a tubular steel frame, fibreglass mouldings and a sheet aluminium structure. The dynamic system, consisting of a semi-rigid two-bladed main rotor and a two-bladed tail rotor, is driven by a four-cylinder piston engine. The drive and control systems consist of purely mechanical components.

### 1.2.2 Fuel

Helicopter HB-ZHB was operated with AVGAS 100 LL. According to the flight notification there were 20 US gallons of fuel on board before the flight leading to the accident, which would have allowed a flight time of approximately two hours. Up to the time of the accident, the flight had lasted approximately 20 minutes.

The quality of the fuel was tested and was found to be in order.

### 1.2.3 Calculation of mass and balance

According to the crew, a mass and balance calculation was carried out before the flight. Taking the 20 US gallons of fuel present according to the flight notification as a basis, an estimate shows that the mass of the helicopter at the start of the flight leading to the accident was close to the maximum take-off mass of 1370 lb.

#### 1.2.4 Wreckage information

The helicopter's landing gear was laterally deformed by the impact and partially torn off as the accident unfolded. The traces on the helicopter and in the field testify to a violent ground contact at high vertical speed and considerable forward speed. The tail boom was severed and the tail rotor shaft was torn out. One of the two main rotor blades stuck fast in the ground on impact and was torn off. The substructure of both pilots' seats was deformed. The carburettor heating was off and the fuel valve was closed.

#### 1.2.5 Operating hours and maintenance

Helicopter HB-ZHB with serial number 3984 was built in 2005 and was equipped with an hourmeter activated by the engine oil pressure. After the accident, this read 2291.8 operating hours.

However, the operating hours relevant for maintenance and overhaul were not determined using this meter, but by multiplication of the manually determined flight time by a factor of 1.12. The R22 maintenance manual includes the following relevant passage on page 3.1:

*"3.002 Time-in-Service Records*

*It is the operator's responsibility to maintain accurate time-in-service records of the airframe and life-limited components. An hourmeter activated by engine oil pressure is standard equipment in the R22 helicopter and is an acceptable means of recording time-in-service.*

*The approved overhaul intervals and the fatigue service lives listed in the Airworthiness Limitations Section are based on FAA Advisory Circular 20-95 which assume that 10.5% of the operating time will be in autorotation, runup or shut-down. Therefore, if an hourmeter activated by the collective control is used to record the time-in-service, the values recorded must be multiplied by 1.12 when determining replacement times for life-limited components, engine and air frame overhaul periods, and other periodic inspection requirements."*

Helicopter HB-ZHB was not equipped with a meter coupled to the collective, but with a stopwatch.

The last 100-hour inspection took place on 3 May 2010 at 1969.25 hours manually determined flight time. According to the calculation applied by the operator this corresponds to 2205.56 in-service hours.

At the time of the accident, the helicopter had flown for approximately 1988 hours manually determined flight time, which multiplied by a factor of 1.12 corresponds to approximately 2225 in-service hours. The manually determined flight time was recorded in the technical logs; the in-service hours were not immediately apparent. For the two flights prior to the flight leading to the accident, the total flight time section in the technical logs was not completed.

The Robinson R22 type must undergo an overhaul after 2200 hours of operation. According to information from the person responsible for the maintenance of helicopter HB-ZHB, it was envisaged to operate the helicopter until 2431 operating hours as per the hourmeter. This corresponds to 2200 hours plus 10.5%.

The maintenance programme for helicopter HB-ZHB submitted by the operator to the FOCA and examined and signed by the competent inspector of this authority on 9 November 2009 specifies a service interval for the overhaul of 2200 operating hours or a maximum permitted age of the helicopter of 12 years.

Helicopter HB-ZHB was equipped with a Lycoming O-360-J2A type engine. For this engine there is a maximum time between two overhauls (TBO) of 2000 hours. According to Lycoming Service Instruction No. 1009AU, this period may be exceeded by 200 hours if the engine is used regularly. For this, the manufacturer requires that the engine be operated for at least 40 hours per month from the time of installation.

According to technical bulletin TM 02.020-30 of the FOCA effective from 20 October 2008, *"the manufacturer's recommended time between overhaul (TBO) of engines, propellers and components of engines and propellers are also binding"* on aircraft which are used in training, sightseeing, leasing and IFR applications [bold type in original].

### 1.3 Training syllabus and the trainee pilot's training level

The training syllabus for the commercial pilot's licence provides for a programme of approximately 20 lessons with a flight time of at least 30 hours and serves as a guideline. According to JAR-FCL 2.155 and 2.165, the requirements for a candidate for a commercial pilot's licence with modular training include at least 185 hours total flight experience on helicopters and at least 30 hours flight time on dual controls during training.

The trainee pilot had been in practical training for the commercial pilot's licence from July 2009 onwards. The last training flight, lesson number 21, took place on 9 April 2010, i.e. more than six weeks before the accident. The 21 lessons completed by then with the same flight instructor B and a total flight time of just over 30 hours were documented in detail.

The records indicate that, in the estimation of flight instructor B who was responsible, the trainee's learning progress was only moderate and the training did not proceed optimally. There are no indications of any difficulties during autorotation exercises. According to the records, the last autorotation exercises took place in February 2010.

According to his own statements, the trainee pilot had carried out approximately 100 autorotations from cruising flight on the R22 type up to the time of the accident. None of these autorotations took place with the flight instructor A.

### 1.4 Flight instructor A's experience and background

Flight instructor A had been working as a commercial pilot for several years and had considerable flight experience, particularly on the Jet Ranger type. However, he had only had a flight instructor's rating since April 2009, i.e. for approximately one year. In this first year as a flight instructor he instructed for a total of approximately 340 flying hours, of which just under 100 hours were on the Robinson R22 type. Until the accident he experienced no particular incidents, particularly during autorotation exercises.

In the 90 days prior to the accident, flight instructor A did not fly in the R22. The last flight in a R22 dated from 22 February 2010. This was a training flight from Sitterdorf in the helicopter subsequently involved in the accident.

According to his own statements, flight instructor A had carried out approximately 100 autorotations from cruising on the R22 type in his function as flight instructor up to the time of the accident. None of these autorotations took place with the trainee pilot.

Since flight instructor A knew the trainee pilot personally, every now and then he asked flight instructor B, who was in charge of training, how it was progressing. According to flight instructor B this exchange was rather superficial and was of an informal nature.

## 1.5 Supervising flight instructor

The flying school's chief flight instructor was responsible for continuing internal training, check flights and supervision of flight instructor A. After flight instructor A was inducted into the flying school, a check flight was carried out in the R22. Flight instructor A then trained for more than 50 hours, without instruction on emergency procedures. On a subsequent check flight in relation to instruction of emergency procedures, the supervisory flight instructor reviewed several aspects, including the intervention behaviour of flight instructor A and found this to be satisfactory.

After the accident, the supervising flight instructor carried out another check flight with flight instructor A to review intervention behaviour in the training of emergency procedures. He felt that flight instructor A *"(...) intervened rather late. We had to correct this behaviour."*

After the accident, the supervising flight instructor also took over the further training of the trainee pilot in his capacity as chief flight instructor. When he did so, he noted that the latter was far from the level required for the CPL examination. The trainee pilot also had difficulties in correcting identified and discussed shortcomings on subsequent flights.

## 1.6 Medical findings

Flight instructor A and the trainee pilot suffered cuts and bruises, which necessitated outpatient hospital treatment.

The result of the breath test immediately after the accident showed an alcohol content of 0.00 ‰ for both pilots.

## 1.7 Survival aspects

Neither of the pilots was wearing a helmet.

The helicopter's landing gear and the two pilots' seats absorbed a large part of the impact energy through the deformation caused by the accident.

The seat belts withstood the loads imposed during the accident.

## 1.8 Meteorological information

### 1.8.1 General

The information in sections 1.8.2 and 1.8.3 was supplied by the Federal Office of Meteorology and Climatology, MeteoSwiss.

## 1.8.2 General situation

*The weather over Central Europe was characterised by a flat distribution of pressure. A westerly high-altitude airflow was introducing waves of humid air, coupled with showers and isolated thunderstorms.*

## 1.8.3 Weather conditions at the time and location of the accident

The following information on the weather at the time and location of the accident is based on a spatial and temporal interpolation of the observations of different weather stations.

*Cloud 1-3/8 at 3400 ft AMSL, 3-4/8 at 10 000 ft AMSL*

*Weather Isolated rain showers*

*Visibility More than 20 km*

*Wind West north-west at 5 kt, gusting to 11 kt*

*Temperature/dewpoint 16 °C / 11 °C*

*Atmospheric pressure QNH LSZR 1011 hPa*

*QNH LSZA 1011 hPa*

*Position of the sun Azimuth 233°, elevation 55°*

*Hazards None detectable in the vicinity of the accident location*

## **2 Analysis**

### **2.1 Technical aspects**

There is no evidence of the existence of any technical defects or limitations which could have caused or influenced the accident.

At the time of the accident, the helicopter had exceeded the manufacturer's specified maximum operating time of 2200 hours. This had no influence on the accident.

### **2.2 Human and operational aspects**

Flight instructor A and the trainee pilot had known each other for some time and had also flown a few times together in the Jet Ranger. However, these flights were not of a training nature and neither was the only joint flight in a Robinson R22, in July 2009. Flight instructor A was therefore largely unaware of the flying-related aspects of the trainee pilot, at least in his role as a trainee pilot on training flights. In particular, flight instructor A had never practiced autorotations with the trainee pilot, either in the Jet Ranger or in the R22.

As the two knew each other, flight instructor A had spent several years as a professional pilot and was now a flight instructor himself, and the trainee pilot was pursuing the goal of a professional career as a helicopter pilot, it is understandable that flight instructor A wished to support and encourage the trainee pilot in his development. However, since he did not hold the required ratings yet in order to train the trainee pilot with regard to the acquisition of a commercial pilot's licence, it is conceivable that he wished to support the trainee pilot as far as he was able, with the introductory flight in July 2009, the mediation with the flying school and occasional joint flights in the Jet Ranger. This fits in with the trainee pilot's request, as a result of the prolonged absence of his own flight instructor B, to the flight instructor A whether he could take a training flight with him in the R22, and with the flight instructor A's consent.

This training flight was also essentially appropriate with a view to bridging the interruption in training. However, insufficient attention was given to the fact that the two had not yet flown together on a training flight and in particular had never practiced emergency procedures such as autorotations together.

This was apparent, for example, from the flight preparation. The latter was conducted extensively and in detail with regard to the weather, NOTAM and DABS. Although the planned manoeuvres were discussed, their precise implementation was not. Flight instructor A assumed that the trainee pilot should have been acquainted with all manoeuvres, since in his view the trainee pilot would be taking the examination shortly. The records of the previous training, however, showed that the trainee's learning progress was not optimal and that he was not yet ready for the examination, despite the 30 hours he had flown in the course of the training for the commercial pilot's licence and the approximately 185 total flying hours completed. This assessment was confirmed by the chief flight instructor after the accident after he had taken over training the trainee pilot.



A consultation by flight instructor A with flight instructor B, who had been responsible for the previous training, would very probably have made the former more aware of the trainee's actual level. Obviously, the informal conversations between flight instructor A and B were not sufficient to provide flight instructor A with an adequate overview.

However, the fact that the flight progressed without incident up to the accident and that the trainee pilot reacted promptly and correctly to various actions by the flight instructor A shows that the trainee pilot did have a degree of knowledge and skill. The trainee pilot also displayed the correct reaction during the autorotation exercise after flight instructor A closed the twist-grip. By flying turns to extend the flight path, the trainee pilot also demonstrated that he had mastered some demanding manoeuvres. This may have given the flight instructor A a false sense of security, reinforced by the fact that he knew the trainee pilot. This could explain that flight instructor A was surprised when the trainee pilot did not initiate the flare.

Why the trainee pilot did not initiate the flare is an open question. It can be assumed that he was essentially aware of the procedures during an autorotation. However, he had last practiced autorotations in February 2010, so his training level was not very high in this regard.

Flight instructor A reacted just shortly before impact by concentrating on achieving controlled contact with the terrain, as far as possible. Nevertheless, the vertical and horizontal impact speed was high and a rollover of the helicopter could not be prevented any more. The fact that the pilots were only slightly injured is at least in part attributable to the design of the Robinson R22 helicopter, which meant that the helicopter's landing gear and airframe were able to absorb much of the impact energy.

The fact that flight instructor A had not flown in the R22 for more than three months may have made it more difficult for him to identify and remedy the dangerously evolving situation.

### 3 Conclusions

#### 3.1 Findings

##### 3.1.1 Crew

- Flight instructor A and the trainee pilot were in possession of the necessary licences for the flight.
- There is no evidence that the state of health and capabilities of the pilots had been adversely affected during the flight leading to the accident.
- Flight instructor A and the trainee pilot had known each other for some time, but had never flown together on a training flight.
- Flight instructor A had not flown in the R22 for more than three months.
- Flight instructor A had last practiced autorotations as a flight instructor on the R22 type on 22 February 2010.
- The trainee pilot had last practiced autorotations in February 2010.

##### 3.1.2 Helicopter

- The helicopter was licensed for VFR operation by day.
- There are no indications of any pre-existing technical shortcomings which might have caused or influenced the accident.
- The operating hours relevant for maintenance and overhaul were determined from the manually determined flight time by multiplication with a factor of 1.12. Helicopter HB-ZHB was equipped with a stopwatch.
- The manually determined flight time was recorded in the technical logs. The operating hours were not immediately apparent.
- At the time of the accident, the helicopter had exceeded the manufacturer's specified maximum operating time of 2200 hours before the next overhaul.
- The landing gear and seats absorbed much of the impact energy.

##### 3.1.3 General conditions

- The trainee pilot was in practical training for the acquisition of a commercial pilot's licence and up to the time of the accident had completed 21 lessons on the R22 with the same flight instructor B, with a flight time of approximately 30 hours.
- The training records reveal that in the estimation of flight instructor B who was responsible for the training, the trainee's learning progress was not optimal.
- As a result of the absence of flight instructor B, who was responsible for practical training, no training had taken place since 9 April 2010.

- The flight leading to the accident was intended to be practice to bridge the interruption in training. The flight did not take place as part of the CPL training.
- No consultation took place before the flight leading to the accident between flight instructor A and flight instructor B, who was responsible for practical training. However, there was an informal exchange concerning the trainee pilot's training progress.
- Flight instructor A possessed a restricted flight instructor's rating, which did not allow him to train professional pilots.
- The programme for the flight envisaged off-airport landings, low RPM recovery, autorotation exercises and attitude flying. These manoeuvres were addressed in the briefing but not explained in detail.
- The helicopter's mass and balance were within the prescribed limits.
- The weather had no influence on the accident.

#### 3.1.4 History of the flight

- Flight instructor A asked the trainee pilot whether he was ready for an autorotation exercise and the latter replied in the affirmative.
- Flight instructor A turned on the carburettor heating and closed the twist-grip.
- The trainee pilot reacted correctly and commenced an autorotation.
- When flight instructor A asked about the chosen landing area, the trainee pilot opted for the same area which flight instructor A had already envisaged.
- The trainee flew a left turn followed by a right turn in order to lose height.
- When the turns had been completed, the final approach followed. By then, airspeed and rotor speed were in the desired range.
- Flight instructor A turned off the carburettor heating.
- The trainee pilot did not make any control inputs which let the helicopter transition to the flare.
- Flight instructor A realised this too late, took over control and concentrated on making as controlled a contact with the terrain as possible.
- The helicopter hit the ground with vertical and forward speed and rolled over.
- Both occupants were slightly injured and were able to exit the wreckage unaided.

### 3.2 Cause

The accident is attributable to the fact that the flight instructor did not intervene in a timely manner in an autorotation exercise and the helicopter then impacted the ground.

The following factors contributed to the accident:

- The trainee pilot did not initiate a flare.
- The flight instructor had incorrect expectations about the trainee pilot's flying skills.

## **4 Safety recommendations and measures taken since the accident**

### **4.1 Safety recommendations**

None.

### **4.2 Measures taken since the accident**

According to the statement of the chief flight instructor of the flying school, the following internal measures were taken as a result of the accident:

- Every four to six weeks a meeting takes place with all the flight instructors. At this meeting, information is exchanged about the training progress of all trainees.
- Before any training flight which does not take place with the flight instructor usually responsible for the training of the trainee pilot concerned, the flight instructors involved must exchange the necessary information.

Payerne, 22 September 2011

Aircraft Accident Investigation Bureau

This report contains the conclusions of the AAIB on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Art 3.1 of the 10<sup>th</sup> edition, applicable from 18 November 2010, of Annex 13 to the Convention on International Civil Aviation of 7 December 1944 and Article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident/incident causes and circumstances is expressly no concern of the accident investigation. It is therefore not the purpose of this investigation to determine blame or clarify questions of liability.

If this report is used for purposes other than accident prevention, due consideration shall be given to this circumstance.