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Aircraft Accident Investigation Bureau AAIB

Final Report No. 1994 by the Aircraft Accident Investigation Bureau

concerning the accident

to the Schweizer Aircraft Corp. Helicopter 300C Model 269C

registration HB-XQF

on 10 July 2003

Planachaux, Château-d'Oex/VD

18 km west of Gstaad

Ursachen

Der Unfall ist darauf zurückzuführen, dass die Besatzung während des Landeanfluges die Kontrolle über den Helikopter verlor, weil ein Anflug ohne ausreichende Leistungsreserven versucht wurde.

Zum Unfall beigetragen haben:

- Nicht Beachtung bekannter Leistungsgrenzen
- Zu spätes Eingreifen des Fluglehrers

General information on this report

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

In accordance with Annex 13 of the Convention on International Civil Aviation of 7 December 1944 and article 24 of the Federal Air Navigation Law, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent future 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 indicated in the standard time applicable to the area of Switzerland (local time – LT), corresponding at the time of the accident to Central European Summer Time (CEST). The relationship between LT, CEST and coordinated universal time (UTC) is: $LT = CEST = UTC + 2 \text{ h}$.

For reasons of protection of privacy, the masculine form is used in this report for all natural persons, regardless of their gender.

Final Report

Aircraft type	Schweizer Aircraft Corp. Helicopter 300C Model 269C, registration HB-XQF		
Operator	Heliswiss, Bern-Belpmoos Aerodrome, 3123 Belp, Switzerland		
Owner	Heliswiss, Bern-Belpmoos Aerodrome, 3123 Belp, Switzerland		
Flying instructor	Swiss citizen, born 1966		
Licence	CPL (H) valid till 10.03.04, FI (H) MOU(H) valid till 04.06.04		
Flying hours	total	3872:00 hours	during the last 90 days 145:00 hours
	on the accident type	1875:00 hours	during the last 90 days 50:00 hours
Trainee pilot	Swiss citizen, born 1971		
Licence	CPL (H), valid till 18.04.04; MOU(H)		
Flying hours	total	245:50 hours	during the last 90 days 22:00 hours
	on the accident type	98:20 hours	during the last 90 days 2:11 hours
Location	Planachaux, Château-d'Oex/VD		
Coordinates	570 500 / 143 718 Elevation approx. 1925 m, 6315 ft AMSL		
Date and time	10 July 2003, approx. 14:30 LT		
Type of operation	VFR training		
Flight phase	Approach		
Accident type	Loss of control		

Injuries to persons

Injuries	Crew	Passengers	Total number of occupants	Others
Fatal	---	---	---	---
Serious	1	---	1	---
Minor	1	---	1	---
None	---	---	---	---
Total	2	---	2	---
Damage to aircraft	Destroyed			
Other damage	Minor crop damage			

1 Factual information

1.1 Flight preparation and history of the flight

The following information is based on the pilots' statements.

On 10 July 2003 the crew of helicopter HB-XQF, consisting of a trainee pilot and a flying instructor, intended to make a flight in dual-control from Bern-Belpmoos (LSZB) to Geneva Airport (LSGG). On the return flight it was planned to make mountain landings in the *Waadtländer* Alps at up to 2000 m AMSL. The trainee pilot's mountain training had already been completed successfully. It was now a matter of practising more difficult landings and at the performance limit.

The crew met at about 10 o'clock at the Heliswiss AG site in Belp. The trainee pilot completed his flight preparations and made his way to the helicopter. He then fuelled it with 70 litres of AVGAS, corresponding to 18.5 USG and carried out the pre-flight check. The total quantity of fuel on board was approximately 35 USG.

At 11:14 LT the helicopter took off in the direction of the "HW" reporting point. The route led via the aerodromes of Ecuwillens and Lausanne-Blecherette to Geneva.

After about one and a half hours on the ground, which were used for refreshment, flight preparations and refuelling with 60 litres of AVGAS, the helicopter took off at approximately 13:20 LT in the direction of Evian.

The flight continued into the area of the Lac de l'Hongrin / Ayerne, where various outlandings were carried out in the mountains up to an elevation of 1600 m/AMSL. The trainee pilot was given the task of making a landing on the Planachaux, taking reconnaissance into account. The chosen landing area was a small area at the north-eastern end of the ridge. The crew estimated the wind as 5 – 10 kt from 030 – 070 degrees.

The first approach was made from the south-west at a flat angle along the ridge at an engine speed¹ of 3200 rpm. At this time, fuel remaining was approximately 25 USG. The landing took place as planned, but there was some room for improvement on a number of points. For this reason the flying instructor felt it necessary to arrange for a second and third approach to be performed.

The third approach was rather short. In the course of the increased power demand that was necessary in this phase, the engine speed dropped first to 3000 rpm and then shortly afterwards to 2800 rpm. A landing at this place was not possible. In this phase, the flying instructor took over the controls and attempted to turn away from the peak to the south, towards the sloping terrain. Despite a slightly decreased load on the collective, it was not possible to bring the main rotor speed back up again. The helicopter touched down at a low forward speed with its nose pointing down the slope. In the process the skids caught in a cattle fence. The helicopter then rolled several times around its transverse axis. The tailboom was torn off. After rolling twice, the trainee pilot released the buckle of his belt and leapt out of the cabin to the left. The flying instructor remained strapped in the cabin. After rolling two more times, the helicopter came to a standstill lying on its right side on the steep terrain.

¹ On the Schweizer 269C it is normal to designate the engine speed as a variable. An engine speed of 3200 rpm corresponds to a main rotor speed of approx. 475 rpm. The normal rotor speed operating range (the green zone) is between 3000 and 3200 rpm).

The trainee was seriously injured and the flying instructor was slightly injured. The helicopter was destroyed and minor crop damage was caused.

1.2 Aircraft information

1.2.1

General

Registration	HB-XQF
Aircraft type	Schweizer 300C Model 269C
Characteristics	Lightweight piston-engined 3-seater helicopter with a fully articulated 3-blade main rotor
Manufacturer	Schweizer Aircraft Corp.
Year of construction	1993
Serial number	S1635
Engine	Textron Lycoming HIO-360-D1A S/N L-26150-51A Power: 190 HP (142 kW)
Operating hours, airframe	4472:32 hours
Airframe, number of landings	Unknown
Max. permitted take-off mass	2050 lb (930 kg)
Maintenance	Swiss Helicopter Maintenance AG (SHM AG), Berne Airport, 3123 Belp The last 200-hour check on the airframe and the 300-hour engine check were carried out and certificated by SHM AG on 23.05.03. The last 50-hour check on the airframe and engine was carried out and certificated by SHM AG on 25.06.03.
Technical limitations	The following point was entered in the hold item list: <i>"Squelch COM defective"</i>
Fuel grade	AVGAS 100LL
Fuel remaining	At the time of the accident there were approximately 25 USG (95 l) of fuel on board.
Registration certificate	Issued by the FOCA on 29.05.97 / No. 1
Airworthiness certificate	Standard / Normal Issued by the FOCA on 03.07.97 / No. 1, valid till revoked
Certification in non-commercial use	VFR day and night
Certification in commercial use	VFR by day
Last condition check	Carried out by the FOCA on 28.08.2001. No complaints.

1.2.2 Helicopter equipment

Helicopter HB-XQF was equipped with two fuel tanks. The main tank has a capacity of 30 USG and the additional tank has a capacity of 19 USG.

The helicopter was equipped with an "EXHAUST MUFFLER INSTALLATION" (muffler) P/N 269A8801-5.

The "MAIN ROTOR BLADE TAPE KIT" (abrasion tape) P/N M10060-1 was not fitted, according to the documentation.

1.2.3 Mass and centre of gravity at the time of the accident

According to the weighing record dated 01.04.1999 the empty mass of helicopter HB-XQF was 1216.6 lb (551.8 kg).

The helicopter's mass at the time of the accident was approximately 1717 lb (779 kg) and was therefore below the maximum permitted take-off mass.

The centre of gravity of the helicopter was within the permitted limits at the time of the accident.

1.2.4 Power calculation

The helicopter manufacturer has commented as follows on questions relating to the power calculation:

"HIGE performance has been established by actual tests during certification of the 269C model aircraft. Data from those test has been correlated and depicted it in the pilots' flight manual as charts figure 5-4, 5-5 and 5-6. From those charts the expected HIGE with an airworthy engine and airframe are;

At 3000 RPM in a 2 ft hover, 7600 ft PA less muffler factor of 189 ft or 7411 ft

At 3200 RPM 2 ft hover and 80% humidity, 8400 ft PA less muffler factor of 223 ft or 8177 ft PA.

At 3200 RPM 2 ft and zero humidity, should be 8800 ft PA less muffler factor of 218 ft for about 8582 ft PA

HOGGE performance is not required by FAA for certification therefore it is not in the FAA approved section of the manual. It was also established by actual flight test during certification and is represented in a chart Figure 8-1.

At the assumed gross weight and temperature HOGGE is about 7000 ft PA less 200 ft muffler factor or 6800 ft PA."

In the chapter of the pilot's flight manual (PFM) entitled "ADDITIONAL OPERATIONS AND PERFORMANCE DATA" there is a table (page 8-2, figure 8.1) for hover out of ground effect (HOGGE), but only for the standard helicopter configuration without muffler and abrasion tape. This chapter is part of additional information material which is provided by the manufacturer but not checked by the FAA. It is relatively difficult for a user to identify the parts of the PFM (pilot flight manual) which are recognised by the FAA. There is no individual page identification of the individual pages of the PFM.

The operator appended an instruction with the following text to the PFM (translated from German):

“Caution!

Power calculation Schweizer 300C

Hover ceiling calculations must all be performed **Out of Ground Effect**² (page 8-2). An additional **approx. 2000 ft** must be deducted from the values shown in the HOGE table.

These measures are essential as the values shown in the HOGE table are overly optimistic and cannot be achieved in practice.

15 March 1999”

Experience has shown that one is in the vicinity of practicable values subject to these limitations.

1.3 Meteorological information

1.3.1 General

The information in chapters 1.3.2 to 1.3.4 was provided by MeteoSwiss.

1.3.2 General weather situation

“A flat pressure distribution over Europe determined the weather in Switzerland. Dry air was being conveyed at altitude from the north-west, and this additionally stabilised the atmosphere.”

1.3.3 Weather 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 chronological interpolation of the observations of different weather stations.

Weather/cloud	1-2/8 cumulus base at approx. 9000 ft AMSL	
Visibility	Over 30 km	
Wind	West-north-west at 5 to 10 knots	
Temperature/dewpoint	15 °C / 5 °C	
Atmospheric pressure	QNH LSGG 1019 hPa QNH LSZH 1019 hPa	
Hazards	None detectable	

1.3.4 Astronomical information

Position of the sun	Azimuth: 208°	Elevation: 64°
Natural lighting conditions	Daylight	

² Emphasis in the original text

1.3.5 Radio sonde Payerne

Rise at 12:00 UTC:

At an altitude of 1969 m an atmospheric pressure of 809.0 hPa was measured.

1.4 Wreckage and impact information

1.4.1 Wreckage

A visual inspection of the wreckage provided no indications of pre-existing defects which might have caused the accident.

1.4.2 Site of the accident

The site of the accident was located approximately 18 km to the west of Gstaad on a slope oriented to the south-east. The planned landing area was on a ridge in the "Planachaux" location at an elevation of 1925 m AMSL or 6315 ft AMSL respectively. Under the given atmospheric conditions this corresponds to a pressure altitude of about 6000 ft.

The landing area was a barbeque area, approximately 2 m in diameter at the north-east end of the ridge.



Figure 1: view of the planned landing area on the ridge from the approach direction and the final position of the helicopter



Figure 2: Final position of the helicopter

1.5 Survival aspects

The two occupants were not wearing helmets.

The lap and shoulder belts were fastened and withstood the load.

After the helicopter had rolled over twice, one crew member decided to exit after releasing his belt.

The accident was survivable for the pilot who remained in the helicopter because the helicopter came to rest on the steep terrain after rolling several times.

The helicopter's compact construction protected the occupants.

1.5.1 Emergency transmitter

The helicopter was equipped with an ACK E-01 ELT emergency location beacon aircraft (ELBA). The device was installed and transmitted a locatable signal. The device was switched off by the crew after the rescue services had been alerted.

2 Analysis

2.1 Technical aspects

There are no indications of any pre-existing technical defects which may have contributed to the accident.

2.2 Human and operational aspects

The trainee pilot's mountain training had already been completed successfully. It was now a matter of practising landings of increased difficulty and at the helicopter's performance limit, with a flying instructor. It is up to the flying instructor to select the landing area taking into account level of training, environmental factors and a risk analysis.

Various outlandings were carried out in the Lac de l'Hongrin / Ayerne area in mountains up to 1600 m/AMSL. The next landings were carried out on the Planachaux, at an elevation of 1925 m/M (6316 ft). The first two approaches resulted in landings on the planned landing area on the barbeque area. The crew estimated the wind as 5 – 10 kt from 030 – 070 degrees, i.e. from dead ahead or perhaps from the front left in relation to the chosen approach direction and to the alignment of the ridge. Under these circumstances, the crew were expecting a slight updraught, which would have favoured the performance situation.

A weak north-west wind prevailed in the free atmosphere. Wind circulation up the slope was present as a result of the strong sunshine in this area. In the area of the peak, therefore, wind conditions as reported by the crew could have occurred temporarily.

The third approach was rather short. In the course of the increased power demand that was necessary, the engine speed dropped first to 3000 rpm and then shortly afterwards to 2800 rpm. When the crew realised that a landing was not possible ahead of the envisaged landing site and that the power was not sufficient to fly to the envisaged landing area, they initiated a go-around. This decision was taken too late.

In terms of go-around possibilities, the landing area was a good choice, but it did necessitate a go-around decision in good time and consistent application.

In view of the small size of the landing area and its location on the ridge, the power calculation should be performed for hover out of ground effect (HOGE). According to the manufacturer's information the limit under the prevailing conditions is approximately 6800 ft PA. In consideration of the operator's restriction, this was at approximately 4800 ft PA.

The performance information in the PFM concerning HOGE is clearly overly optimistic.

No documentation on performance calculations was available to the pilot for HOGE in the configuration with a muffler.

No procedures for checking performance were defined. The manufacturer merely refers to the take-off procedures defined in the PFM, which, however, do not enable measurement of the power effectively delivered. Nevertheless, it must be borne in mind that the condition of the engine and rotor blades, instrument errors, handling of the controls, etc. have an effect on the power actually available.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- Helicopter HB-XQF was rated for commercial transport, VFR, by day.
- The helicopter's mass at the time of the accident was below the maximum permitted take-off mass.
- The centre of gravity of the helicopter was within the permitted limits at the time of the accident.
- There are no indications of any pre-existing technical defects which may have caused or contributed to the accident.
- The 200-hour check on the airframe and engine was certificated on 23.05.2003.
- The 50-hour check on the airframe and engine was certificated on 25.06.2003.
- The last condition check by the FOCA took place on 28.08.2001 without any complaints.

3.1.2 Crew

- The pilots were in possession of the necessary licences for the flight.
- There were no indications of the pilots suffering any health problems during the flight involved in the accident.

3.1.3 History of the flight

- At approximately 13:20 LT on 10 July 2003 the Schweizer 269C helicopter, registration HB-XQF, took off from Geneva Airport on a training flight for mountain landings up to 2000 m/AMSL. The trainee pilot and the flying instructor were on board.
- Various outlandings were carried out in the Lac de l'Hongrin / Ayerne area in mountains up to 1600 m/AMSL.
- The next landings were carried out on the Planachaux, at an elevation of 1925 m/AMSL. The first two approaches resulted in landings on the planned landing area.
- The third approach was somewhat short. In the course of the increased power demand that was necessary, the engine speed dropped first to 3000 rpm and then shortly afterwards to 2800 rpm. The necessary power to correct the angle of approach was no longer available.
- On the RPM-Indicator, the normal engine operating range (the green zone) is between 3000 and 3200 rpm.
- During the go-around, the helicopter became caught in a cattle fence and rolled several times around its transverse axis. The trainee pilot was seriously injured and the flying instructor was slightly injured.

3.1.4 General conditions

- The performance information in the PFM were certificated by the licensing authority only in relation to HIGE.
- The performance information in the PFM relating to HOGE is provided as additional information by the manufacturer. It is clearly overly optimistic.
- No documentation on performance calculations was available to the pilot for HOGE in the configuration with a muffler.
- The operator appended the following instruction to the PFM (translated from German):

“Caution!

Power calculation Schweizer 300C

Hover ceiling calculations must all be performed **Out of Ground Effect**³ (page 8-2). An additional **approx. 2000 ft** must be deducted from the values shown in the HOGE table.

These measures are essential as the values shown in the HOGE table are overly optimistic and cannot be achieved in practice.

15 March 1999”

3.2 Causes

The accident is attributable to the fact that during the approach the crew lost control over the helicopter because an approach without adequate power reserves was chosen.

The following factors contributed to the accident:

- non-compliance with recognised performance limits
- intervention by the flying instructor which was too late

³ Emphasis in the original text

4 Safety recommendations and measures for improving flight safety

4.1 Previous safety recommendations

On 21 July 1999 a comparable accident occurred in Adelboden to the same helicopter type, registration HB-XZC. The following safety recommendations Nos. 262 and 263 were published with the final report dated 30 April 2003 (translated from German):

"The AAIB recommends to the FOCA:

- The overly optimistic HOGE and HIGE tables in the PFM for the Schweizer 269C helicopter should be reviewed and adapted. Appropriate consideration must be given to the effect of additional equipment (muffler, resonator, abrasion tape).
- An interim temporary restriction on operation of the Schweizer 269C helicopter should be considered."

The Federal Office for Civil Aviation made the following comments on the above safety recommendations in a letter dated 19 November 2003 (original text):

„L'OFAC est d'accord avec les recommandations susmentionnées du BEAA et les soutient. Pour les mettre en pratique l'OFAC adoptera les mesures suivantes:

- ***A la fin de l'année 2003***

Une lettre sera envoyée aux opérateurs de machines équipées de moteur à pistons pour les rendre attentifs aux risques inhérents aux opérations à altitude densité élevée. Cette lettre mentionnera les points suivants :

- Les tables dans les AFM sont en général, basées sur des conditions idéales (conditions techniques de la machine par rapport à l'humidité). Or les performances réelles sont souvent très inférieures.

- L'indication donnée par les tables montre une condition nécessaire, mais pas suffisante pour une opération sûre.

- Le pilote doit soustraire au moins 2000 pieds des valeurs déterminées à l'aide des tables.

- En prenant en compte un risque raisonnable, le pilote doit développer une méthode pour identifier la marge de puissance qu'il a réellement à disposition. Pour cela il comparera la puissance maximum disponible avec celle d'une manoeuvre connue de référence.

- Un atterrissage pourra être uniquement effectué si les conditions ci-dessous sont réunies:

la masse en vol est 150 lbs inférieure à celle déterminée par les tabelles pour l'endroit d'atterrissage prévu

OU

l'altitude d'atterrissage est 2000 ft inférieure à celle déterminée par les tables sous les conditions de température et masse prévues

ET

la marge de puissance entre la manoeuvre de référence et la puissance disponible est suffisante pour effectuer l'atterrissage envisagé.

- **En 2004**
Un budget sera demandé pour un programme d'essai en vol pour effectuer des mesures à différentes altitudes et températures (ISA, ISA +10, ISA +20 °C). Ces essais en vol serviront à la définition des limitations d'utilisation.
- **À la fin de l'année 2004**
Sur la base des essais un AD sera publiée.

Within the framework of this investigation the FOCA was asked about the state of implementation of the safety recommendations (SR) and commented as follows on 04.10.2007 (translated from German):

"With regard to your enquiry "Status of SRs published in final report 1763 HB-XZC", we are able to provide you with the following complementary information:

FOCA letter of 19 November 2003 concerning: Ref "En 2004" and "À la fin de l'année 2004"

With reference to the above-mentioned FOCA letter of 19 November 2003 (Reg number 921.00) we have the following additional information/comments:

Since it lies within the area of responsibility of the competent authority of the State of Design to carry out test flights and issue airworthiness directives (ADs), it has not been possible to implement the two measures envisaged at the time. In addition, the former is a time-consuming, cost-intensive and complex procedure. The numerous parameters would have to be flown in a multiple series of tests with 2 to 3 helicopter types in order to obtain sound and demonstrable proof.

SR 1132 Landing and take-offs by piston-engined helicopters

For this reason, on 01 April 2004 the FOCA – as an immediate measure – issued a safety recommendation "SR 1132 Landing and take-offs by piston-engined helicopters" and sent it to all pilots, keepers, flying schools, companies and operators of piston-engined helicopters." (Annex 2)

Berne, 9 September 2008

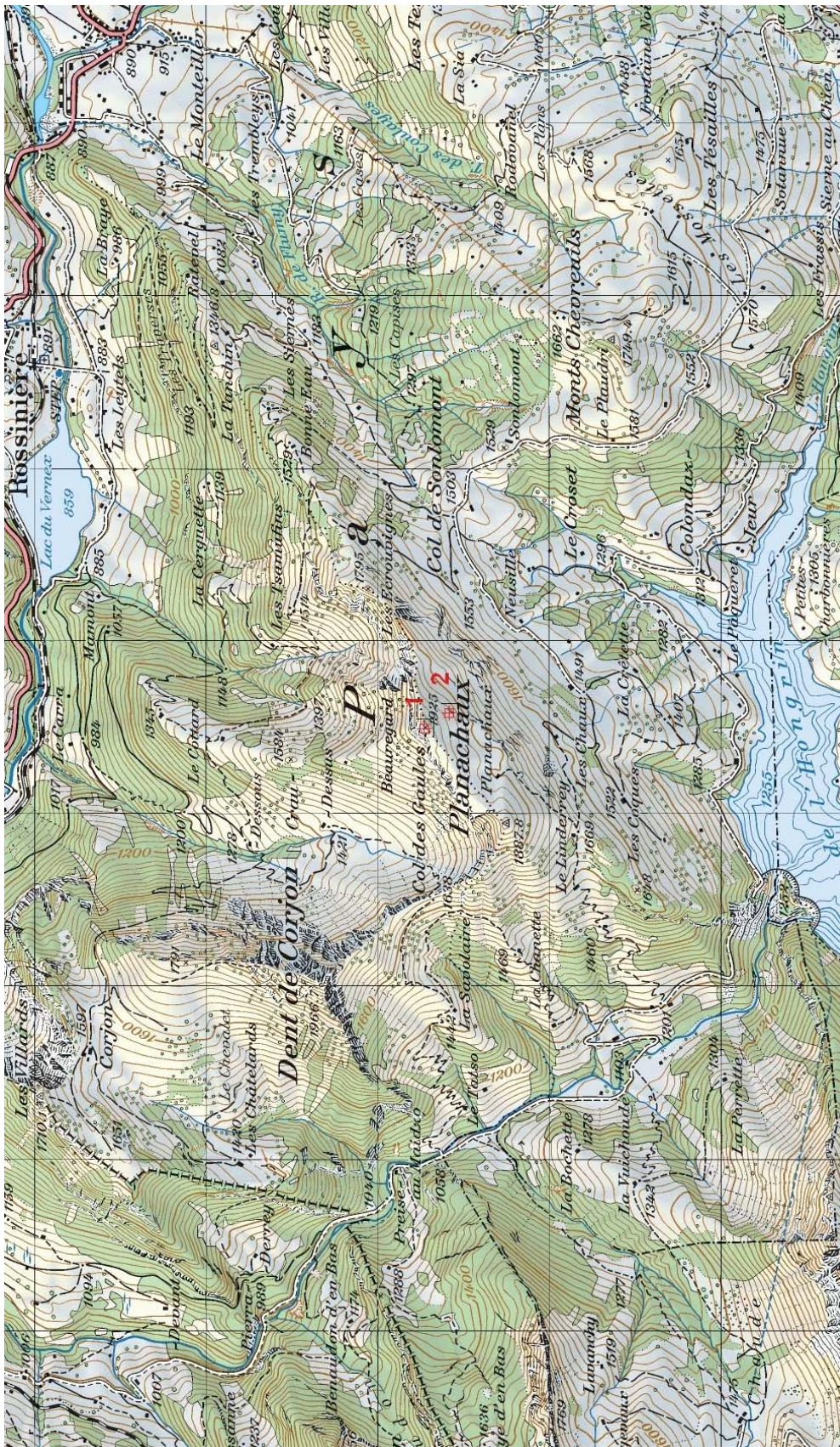
Aircraft Accident Investigation Bureau

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Annex 1



Section of map, scale 1:50 000

Position 1 shows the planned landing area

Position 2 shows the final position of helicopter HB-XQF

Annex 2

Bundesamt für Zivilluftfahrt (BAZL) Office fédéral de l'aviation civile (OFAC) Ufficio federale dell'aviazione civile (UFAC) Federal Office for Civil Aviation (FOCA) Maulbeerstrasse 9 CH-3003 Berne Switzerland	Sicherheitsempfehlung Recommandation de sécurité Raccomandazione di sicurezza Safety recommendation	FOCA SR SR 1132
Datum Date Data Date	30 March 2004	

Landungen und Starts von Helikoptern mit Kolbenmotoren

PILOTEN, VERTRAUT NICHT BLIND DEN ANGABEN DER LEISTUNGSTABELLEN!

Die folgenden Unfälle und Vorkommnisse haben eine gemeinsame Ursache: Ungenügende Leistungsreserve für die sichere Durchführung des Fluges in Verbindung mit ungenügender Berücksichtigung von Umweltbedingungen.

21.7.1999, Adelboden, Hughes 300: Während einer Umkehrkurve nach dem Start kann der Pilot den vorgesehenen Flugweg nicht mehr einhalten und der Helikopter schlägt am Boden auf. Keine Verletzten, Maschine schwer beschädigt.

25.08.1999, Uetliberg, Enstrom 280C: Unmittelbar vor der Landung verliert der Pilot die Kontrolle über die Hochachse und der Helikopter stürzt drehend ab. Zwei Schwerverletzte, Maschine zerstört.

05.06.2000, Schindellegi, Hughes 300: Im Verlauf einer Umkehrkurve unmittelbar nach dem Start verliert der Pilot die Kontrolle und der Helikopter schlägt am Boden auf. Keine Verletzten, Maschine schwer beschädigt.

10.07.2003, Planaschaud, Hughes 300: Im Endanflug misslingt der Durchstart, der Helikopter schlägt am Boden auf und überschlägt sich. Zwei Leichtverletzte, Maschine erheblich beschädigt.

06.11.2003, Walleg, R 22 beta: Während einer Drehung über dem Landeplatz verliert der Pilot die Kontrolle über die Hochachse, der Helikopter schlägt am Boden auf und kippt um. Keine Verletzten, Maschine erheblich beschädigt.

Sie machen die Risiken deutlich, wenn Helikopter mit Kolbenmotoren in Höhen von mehreren tausend Fuss eingesetzt werden. Sie erinnern erneut an die seit der Einführung dieser Maschinen bekannte Tatsache, dass die Angaben in den Leistungstabellen erwiesenermassen zu optimistisch sind.

Die Werte in den Tabellen wurden unter idealen Bedingungen ermittelt, so wie sie bei uns in der Praxis selten oder nie vorgefunden werden.

Der oft entscheidende Einfluss der folgenden Faktoren erscheint nicht in den Tabellen: Alter und Zustand der Motoren, Verschlechterung des Blattprofils infolge Abnutzung oder Schmutz, ungünstiger Wind, Luftfeuchtigkeit, Bodenbeschaffenheit, Trägheit des Systems, Pilotenfehler irgendwelcher Art..

Die Erfahrung hat gezeigt, dass die effektiv erbrachte Leistung sehr oft bedeutend geringer ist als die aus den HIGE Tabellen und - falls überhaupt vorhanden (!) - aus den HOGE Tabellen abgelesenen Werte. Abhängig von Helikoptertyp und Weiterbedingungen werden Unterschiede in den Leistungen beobachtet, welche einer Höhendifferenz in der Grössenordnung von bis zu 6'000 ft (!) entsprechen können. Ebenfalls kann festgestellt werden, dass diese Unterschiede mit zunehmender Temperatur und Feuchtigkeit nochmals markant grösser werden.

Bundesamt für Zivilluftfahrt (BAZL) Office fédéral de l'aviation civile (OFAC) Ufficio federale dell'aviazione civile (UFAC) Federal Office for Civil Aviation (FOCA) Maulbeerstrasse 9 CH-3003 Berne Switzerland	Sicherheitsempfehlung Recommendation de sécurité Raccomandazione di sicurezza Safety recommendation	FOCA SR SR 1132
Datum Date Data Date	30 March 2004	

Indem man die Werte der HOGE Tabellen generell um 2'000 ft vermindert, wird eine Leistungsreserve geschaffen, welche in den meisten Fällen genügen sollte. Unter Umständen genügt aber auch diese Reserve nicht!

Die Risiken werden vermindert durch:

1. Die Sicherstellung einer genügenden Leistungsreserve.
2. Eine genaue Planung der beabsichtigten Flugmanöver.

Es ist unbedingt nötig, dass die Piloten ein Vorgehen entwickeln und auch anwenden, welches erlaubt, mit annehmbarer Zuverlässigkeit die für die geplante Landung oder den Start notwendige Leistung festzuhalten. Damit wird auch der Betrag der zur Verfügung stehenden Leistung ermittelt.

Zu diesem Zweck wird ein „Leistungskontrolle nach dem Recco“ geplant, welches erlaubt, die notwendige Leistung (power required) vor der Landung festzustellen.

Die grundsätzlichen Schritte:

1. Der maximal erlaubte Ladedruck wird ermittelt.
2. Mit Hilfe der „Leistungskontrolle“ wird festgestellt, ob die Leistungsreserve für die geplante Landung oder den Start ausreicht.
3. Im Zweifel: kein Start, keine Landung!

Das beschriebene Verfahren erlaubt, die tatsächlichen Parameter und die effektiven Bedingungen der Umwelt zu berücksichtigen. In jedem Fall aber ist das Resultat abhängig von der Qualität der geplanten und durchgeführten Leistungskontrolle..

Landungen sollen nur erfolgen, wenn die zur Verfügung stehende Leistung den Schwebeflug ausserhalb Bodeneffekt erlaubt.

Im Ausnahmefall dürfen Landungen und Starts, im Bodeneffekt, geplant und durchgeführt werden, wenn der Lande- oder Startplatz bezüglich Bodenbeschaffenheit, Grösse und näherer Umgebung ähnliche Verhältnisse wie ein Flugplatz aufweist.

Zusammenfassend muss festgehalten werden: Die Verwendung der Leistungstabellen ist ein notwendiger Teil für die Planung einer Landung aber leider genügt dies nicht immer für die sichere Durchführung.