Summary Report

A summary investigation, in accordance with article 45 of the Ordinance on the Safety Investigation of Transport Incidents (OSITI), was carried out with regards to the following accident or serious incident. This report was prepared to ensure that lessons can be learned from the incident in question.

Location of the serious incident (airprox)	Bern Belp Airport (LSZB)		
Date and time	21 November 2016, 18:06 UTC		
Coordinates	---	**Altitude**	Approximately 1700 ft above mean sea level
Air traffic service	Bern aerodrome control tower		
Airspace	Class D		
Closest proximity of the two aircraft	Approx. 300 m horizontally		
Separation minima	None		
Airprox category	ICAO[1] category B		

Aircraft 1	AT-3 R100	HB-SRB
Main operator	Alp-Aircraft GmbH, 3123 Belp	
Main owner	Alp-Aircraft GmbH, 3123 Belp	

Type of operation	Training			
Flight rules	Visual Flight Rules (VFR)			
Flight phase	Approach			
Point of departure	Bern Belp Airport (LSZB)			
Destination	Bern Belp Airport (LSZB)			
Crew members	1			

Pilot	Swiss citizen, born 1978			
Licence	Private Pilot Licence Aeroplane (PPL(A)) according European Aviation Safety Agency (EASA), issued by the Federal Office of Civil Aviation (FOCA)			
Flying hours	**Total**	79:30 h	**During the last 90 days**	5:07 h
	On the incident type	77:00 h	**During the last 90 days**	5:07 h
Flight instructor	Swiss citizen, born 1944			
Licence	Airline Transport Pilot Licence aeroplane (ATPL(A)) according EASA, issued by FOCA			
Flying hours	**Total**	24 700 h	**During the last 90 days**	98 h
	On the incident type	1420 h	**During the last 90 days**	18 h

[1] ICAO: International Civil Aviation Organisation

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Aircraft 2	EC120 B		HB-ZIE	
Main operator	Swiss Helicopter AG, Hartbertstrasse 11, 7000 Chur			
Main owner	Swiss Helicopter AG, Hartbertstrasse 11, 7000 Chur			
Type of operation	Training			
Flight rules	Visual Flight Rules (VFR)			
Flight phase	Approach			
Point of departure	Düdingen, canton of Fribourg			
Destination	Bern Belp Airport (LSZB)			
Crew members	2			
Pilot	Swiss citizen, born 1979			
Licence	Private Pilot Licence Helicopter (PPL(H)) according EASA, issued by FOCA			
Flying hours	**Total**	395:15 h	**During the last 90 days**	12:17 h
	On the incident type	103:55 h	**During the last 90 days**	12:17 h
Flight instructor	Belgian citizen, born 1980			
Licence	Commercial Pilot Licence Helicopter (CPL(H)) according EASA, issued by FOCA			
Flying hours	**Total**	3550 h	**During the last 90 days**	76 h
	On the incident type	189 h	**During the last 90 days**	15 h

Background and course of the serious incident

On the evening of 21 November 2016, the flight instructor and the pilot met at Bern Belp Airport (LSZB) for the second session of night flight training on the fixed wing aeroplane AT-3 R100, registered as HB-SRB. The planned programme included flying several traffic patterns (aerodrome circuits) with dual controls, followed by the pilot's first solo circuit flights. The aerodrome control tower was informed of the solo circuits using the words "*two solo circuits with full stop*".

The same evening, a flight instructor and a pilot were carrying out night flight training southwest of Bern in an EC120 B helicopter, registered as HB-ZIE, and performed an off-airport landing near Düdingen, canton of Fribourg.

After an uneventful return flight, the pilot of HB-ZIE contacted the aerodrome control tower at 17:57:48 UTC to request entry into the control zone via waypoint W1 and an approach to runway 14. Approximately one minute after the air traffic controller had given clearance for HB-ZIE to enter via W1, he gave the pilot of HB-SRB take-off clearance RWY14, to be followed by left-hand circuits.

At 18:00:58 UTC, the air traffic controller instructed the crew of HB-ZIE to fly directly the right base leg of runway 14 once they had crossed waypoint W1 (see figure 1). At 18:02:56 UTC, the pilot of HB-SRB, which was on the left downwind leg, contacted the air traffic controller to request a full stop landing. At 18:03:00 UTC, the air traffic controller informed the pilot of HB-SRB that he was scheduled to be number 2 following a helicopter on a long final approach and that he should report once he had the helicopter in sight. The pilot of HB-SRB acknowledged this by saying, "*Number two, Hotel Romeo Bravo*".

At 18:03:08 UTC, the crew of HB-ZIE were given landing clearance on runway 14, which they immediately acknowledged.

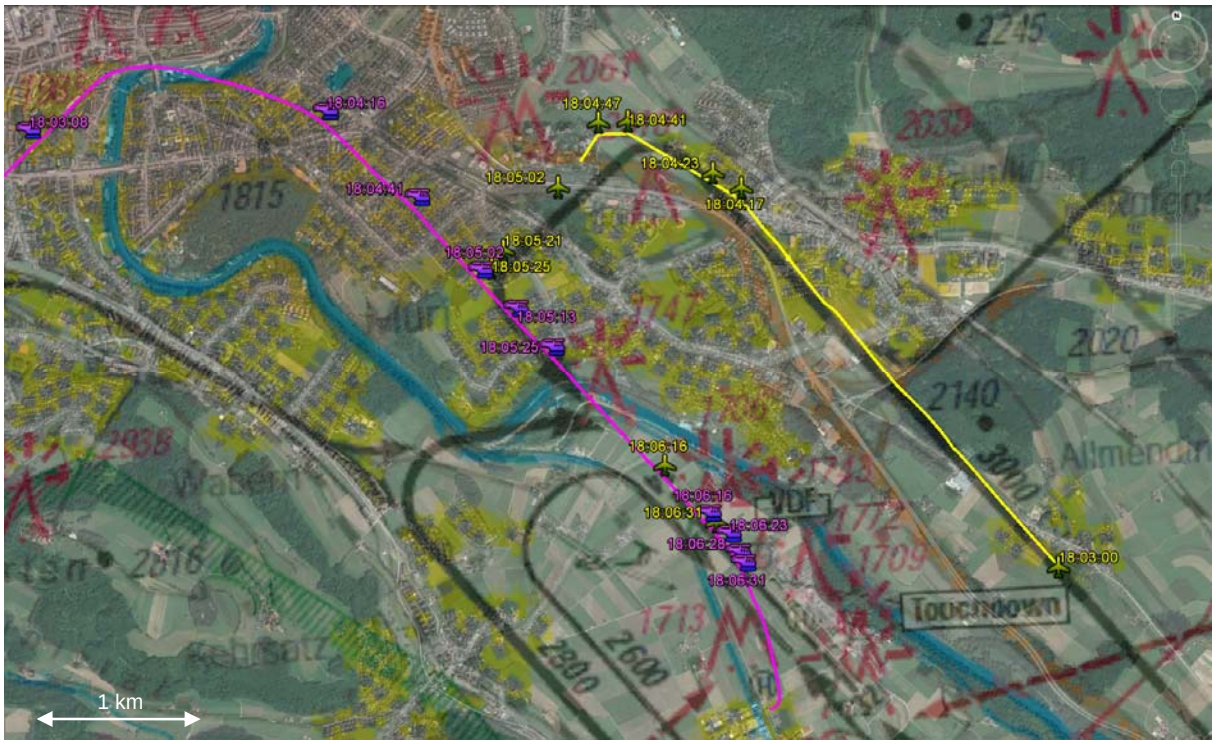

Figure 1: A radar record of the aeroplane HB-SRB (yellow) and GPS data[2] of the helicopter HB-ZIE (pink) projected onto the aerodrome circuit geometry in accordance with the specifications of Bern Belp Airport's (LSZB) visual approach chart, displayed in Google Earth; HB-SRB's further positions along the aerodrome circuit (yellow dots) were extrapolated assuming the typical approach speed of 65 knots; all times given in UTC. Overlay reproduced with the permission of the Swiss Federal Office of Topography Swisstopo (JA150149).

Approximately one minute later, at 18:04:12 UTC, the air traffic controller contacted the pilot of HB-SRB again and asked him if he had the helicopter in sight. When the pilot responded in a negative manner, the air traffic controller gave him the following instruction at 18:04:17 UTC, "*Hotel Romeo Bravo, Roger, continue downwind, report in sight, it is slow moving so we need a bit of spacing.*" At 18:04:23 UTC, the pilot of HB-SRB then responded, "*Helicopter in sight, Hotel Romeo Bravo,*" and at 18:04:35 UTC, "*Say again, uh, proceed? Hotel Romeo Bravo.*"

Subsequently, the air traffic controller informed the pilot of HB-SRB about the situation once again at 18:04:38 UTC by saying, "*Hotel Romeo Bravo, you are now passing the traffic, it should be on your left, at 9 o'clock position. Leave a good spacing behind. It is relatively slow moving.*" The pilot of HB-SRB responded, "*Ah, uh that is copied, traffic in sight, Hotel Romeo Bravo.*"

When asked by the air traffic controller, the crew of HB-ZIE informed him that they did not intend to make a full stop landing, but wanted to continue directly to the Swiss Helicopter base south of the runway 14 threshold.

The air traffic controller later stated that he had observed HB-SRB turning into the left base leg (see black line in figure 1) following the normal geometry of Bern Belp Airport's (LSZB) visual approach chart (VAC). After having informed the pilot of HB-SRB of the traffic situation several times and once the pilot had reported visual contact with the helicopter and had acknowledged the approach as number 2 behind, the decision about a landing on runway 14 was now at the discretion of the pilot of HB-SRB. He did not want to put the pilot under pressure with a possibly

[2] The GPS data available for the investigation includes information on location and time – the data points were recorded at different time intervals. Only three data points were available along the final approach to runway 14. The other points were therefore interpolated.

late landing clearance and left the decision to the pilot by giving him the following clearance at 18:05:21 UTC, "*Hotel Romeo Bravo, the helicopter will not stop on the runway, they will proceed direct to Swiss Helicopter, the wind 170 degrees, 4 knots, RWY 14, cleared touch and go.*" As the air traffic controller later stated, he assumed that the pilot was able to assess the situation himself. He did not perceive any hazard with regards to the horizontal proximity between the two aircraft and mentioned that he intended to instruct HB-SRB to perform a go-around if necessary.

The flight instructor of HB-ZIE was sitting in the left-hand seat and realised that HB-SRB was on the base leg as he could see its landing lights on the left-hand side.

When landing clearance was given, HB-SRB turned left into the final approach to runway 14 and at 18:05:29 UTC the pilot read back the clearance to land as follows, "*Uh, cleared for land, to land, Hotel Romeo Bravo, runway 14*." As he later stated himself, with the approach lights of runway 14 in the background he only saw the helicopter's red beacon. However, he could not see the fuselage, let alone identify the helicopter type. In keeping with this, he did not perceive any hazard and continued the flight for the time being.

During the final approach, HB-ZIE's average ground speed (GS) was approx. 60 kt.

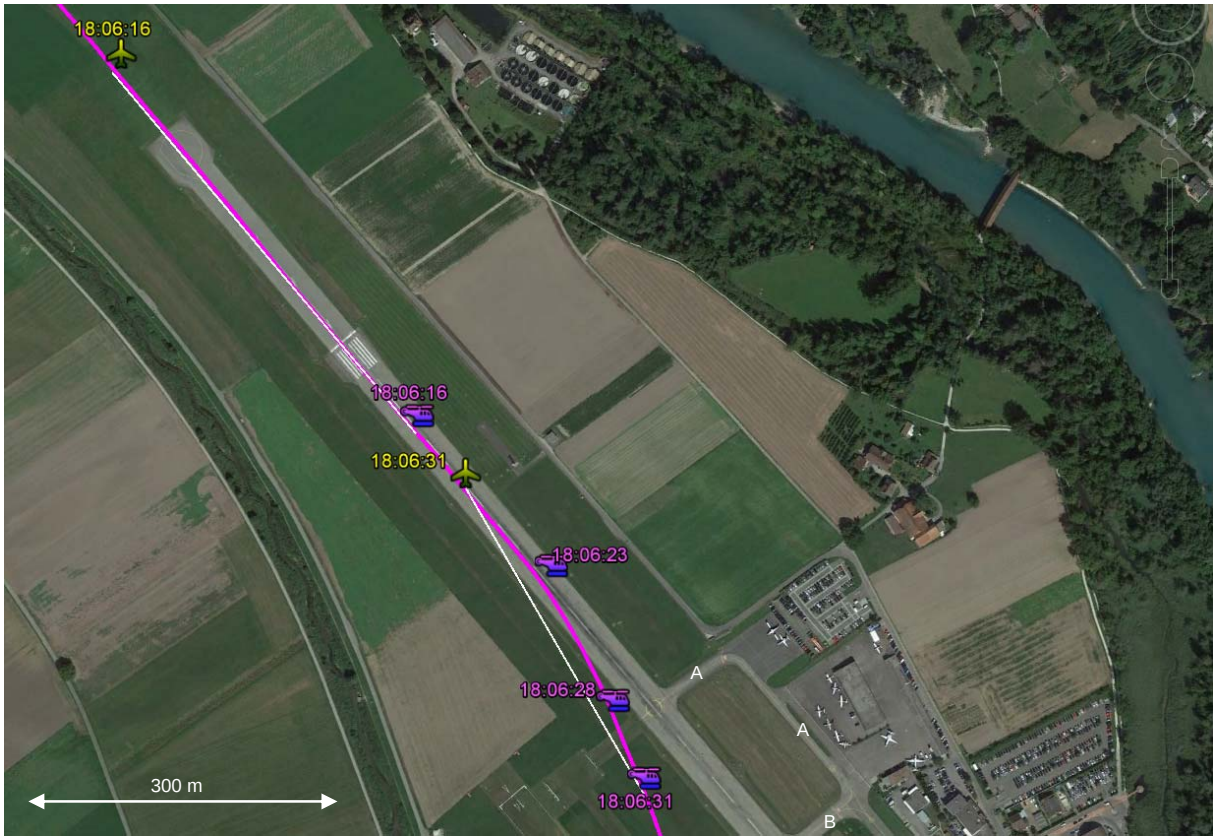

Figure 2: The flight path of HB-ZIE (pink) and extrapolated positions of HB-SRB (yellow points) on the final approach to runway 14 at Bern Belp Airport (LSZB) with horizontal distances (white) at 18:06:16 UTC and 18:06:31 UTC as well as taxiways A and B (white), displayed in Google Earth. All times given in UTC.

Almost one minute later, at 18:06:16 UTC (see figure 2), the flight instructor of HB-SRB, who was in close proximity to the intersection Alpha at this time, instructed the pilot of HB-SRB via a handheld radio on the tower frequency to perform a go-around. At this time, HB-SRB was at a horizontal distance of approximately 400 metres behind HB-ZIE along the direction of the

runway axis. HB-ZIE hover-taxied along the runway and left it a few seconds later at a GS of 50 kt in the direction of the Swiss Helicopter base.

According to his statement, the pilot of HB-SRB was surprised by the instruction to perform the go-around. However, he followed it immediately. 15 seconds later, at 18:06:31 UTC, he confirmed the go-around. By this time, HB-ZIE had already left the runway and was approximately 50 metres south of the runway at a horizontal distance of approximately 300 metres from HB-SRB. The flight instructor assessed this to be a dramatic airprox between two aircraft during which HB-SRB passed over the helicopter, which was slowly hover-taxiing above the runway, at a vertical distance of approximately 15 metres.

From a distance of approximately 600 metres and due to the darkness, the air traffic controller could according to his own statement not assess the horizontal and vertical proximity between the two aircraft from his location in the tower.

The pilot of HB-SRB believes he passed over HB-ZIE when he was performing the go-around.

The crew of HB-ZIE had been listening to the radio communication between air traffic control and HB-SRB and were aware that the aeroplane had to be behind them on its final approach. According to their statements, the pilots aimed to clear the runway axis as quickly as possible.

Weather at the location and time of the dangerous airprox

A strong trough off Western Europe with a low-pressure centre over the western English Channel led to a strong southerly foehn wind in the Alps.

There was cold air at ground-level in the Aare valley and at Bern Belp Airport. The wind remained light below an altitude of approximately 2,600 ft above mean sea level. The weather was dry. Visibility was more than 10 km.

Weather	Dry
Cloud	3/8 to 4/8 at 13 000 ft AAE[3] 3/8 to 4/8 at 18 000 ft AAE
Visibility	10 km or more
Wind	Variable, 3 kt
Temperature / dew point	6°C / 5°C
Atmospheric pressure (QNH)	1003 hPa (pressure reduced to sea level, calculated with the values of the ICAO standard atmosphere)
Outlook	No significant change
Light conditions	Night

Analysis and conclusions

Due to the poor data available because of the very limited radar coverage and the incomplete GPS data, it was not possible to accurately determine the horizontal and vertical distances between the two aircraft at the moment of their closest proximity as part of this investigation. However, as described in the section on the course of the serious incident, it was possible to estimate the horizontal distance between the helicopter HB-ZIE, which was ahead of HB-SRB and on its final approach to runway 14, and the aeroplane HB-SRB, which was following based on plausible assumptions.

Independent of the resulting level of danger, the STSB identified various issues concerning prevention from the preliminary enquiries, which is why an investigation was opened on the

[3] AAE: above aerodrome elevation

basis of article 20, paragraph 4 of the Ordinance on the Safety Investigation of Transport Incidents (OSITI).

After the flight instructor and the pilot of HB-SRB had performed several aerodrome circuits with dual controls, the air traffic controller was informed of the subsequent solo circuits. However, as these were not announced as part of a flight training programme being completed by a pilot with limited total flying experience and no night flying experience, it is understandable that the air traffic controller did not deduce from the radio message "*two solo circuits with full stop*" that these were the first solo circuits being performed by a pilot with limited flying experience. Subsequently, the air traffic controller did not give his instructions to the pilot of HB-SRB in the form of several short and concise radio messages. This may also explain why – after his radio message at 18:03:00 UTC regarding the approach sequence, which was acknowledged by the pilot with the message "*Number two, Hotel Romeo Bravo*" – it took him more than a minute to follow up on the subject, asking the pilot if he had visual contact with the helicopter.

Despite the two instructions to the pilot of HB-SRB to continue flying on the left downwind leg, the fact that the pilot turned into the base leg in accordance with the visual approach chart (VAC) (see black line in figure 1) shows that he had obviously not understood the air traffic controller's instruction. When giving the second instruction at 18:04:38 UTC, "*Hotel Romeo Bravo, you are now passing the traffic, it should be on your left, at 9 o'clock position. Leave a good spacing behind. It is relatively slow moving*," the air traffic controller probably intended to give the pilot of HB-SRB an overview of the situation. However, this implicit instruction to continue the downwind leg failed to have the desired effect and did not comply with easily understandable standard phraseology.

The pilot of HB-SRB confirmed that he had understood the air traffic controller's radio message from 18:04:38 UTC and reported visual contact with HB-ZIE. As the air traffic controller had no radar data available, he relied on compliance with confirmed instructions to efficiently manage aerodrome traffic. It was therefore up to the pilot of HB-SRB to keep asking questions until he understood the content of the instruction.

The air traffic controller later stated that he had observed HB-SRB turning into the left base leg of runway 14 (see figure 1). Despite the crew of HB-ZIE confirming that they did not intend to make a full stop landing on the runway but to continue flying directly to the Swiss Helicopter base, the air traffic controller should have anticipated that the helicopter would be flying at a lower speed near the runway. The averaged GPS data shows that the GS of HB-ZIE during the final approach until leaving the runway level with intersection Alpha was between 50 and 60 kt, i.e. well above the translational speed. On the basis of HB-SRB's assumed approach speed of 65 kt, the horizontal distance between the two aircraft probably reduced slightly after HB-SRB had turned into the final approach to runway 14. The horizontal distances at 18:06:16 UTC (when the instruction for a go-around was given) and at 18:06:31 UTC (when HB-ZIE had already left the runway and was approximately 50 metres south of it) were estimated based on this assumption and confirm the accuracy of this theory.

After the pilot had been informed by the air traffic controller about the traffic situation several times, he had reported visual contact with HB-ZIE and had accepted approaching as number 2 following the helicopter, the decision about a landing on runway 14 was at the discretion of the pilot. Irrespective of the pilot's limited total flying experience and the fact that in the present case it was his first solo night flight, it needs to be noted that the ability of a pilot to estimate distances accurately at night can be severely limited depending on light conditions. In the present case, the pilot of HB-SRB was on the final approach behind HB-ZIE, which complicated matters as – with the red approach lights of runway 14 in the background – he could identify the helicopter's red beacon but not its fuselage, let alone the helicopter type. In conditions such as these, it is impossible to accurately estimate distances to a helicopter flying in front of you. Instead of leaving it to the pilot to assess whether it is possible to land or necessary to go around, it is sensible for air traffic control to intervene at an early stage in a case like this.

When the pilot of HB-SRB read back the early clearance for landing at 18:05:29 UTC by saying, "*Uh, cleared for land, to land, Hotel Romeo Bravo, runway 14*," there was a noticeable amount of uncertainty. The pilot of HB-SRB had continued the final approach to runway 14 without perceiving any hazard.

At 18:06:16 UTC, the flight instructor told the pilot of HB-SRB, which was on the runway axis approximately 400 metres behind HB-ZIE, to perform a go-around. This was a clear decision which led to the situation being defused.

If HB-ZIE had in fact been passed over, as stated by the pilot and the flight instructor of HB-SRB, this represented an additional hazard.

The fact that the aeroplane quickly climbed above the helicopter, which continued its flight a few metres above ground in the direction of the Swiss Helicopter base, meant that its rotor downwash did not pose any hazard to HB-SRB in the present case.

Based on article 29, paragraph 1 of the OSITI, the STSB will not investigate further and concludes the investigation with this summary report in accordance with article 45 of the OSITI.

Bern, 13 June 2017 Swiss Transportation Safety Investigation Board