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Swiss Accident Investigation Board SAIB

Aviation Division

Final Report No. 2202
by the Swiss
Accident Investigation Board SAIB

Concerning the serious incident (near-collision)

involving the Dornier 328-100 aircraft,
operated by SkyWork Airlines AG
under flight number SRK 700

and the Robinson R44 II helicopter, HB-ZSA

on 2 June 2012

in the safety area of runway 32
of Bern-Belp Airport

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General information on this report

This report contains the Swiss Accident Investigation Board's (SAIB) conclusions on the circumstances and causes of the accident which is the subject of the investigation.

In accordance with Art 3.1 of the 10th 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 incident 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, follow the coordinated universal time (UTC) format. At the time of the accident, Central European Summer Time (CEST) applied as local time (LT) in Switzerland. The relation between LT, CEST and UTC is: LT = CEST = UTC + 2 hours

Contents

Final Report

Synopsis

Aircraft 1

Owner	SkyWork Airlines AG, Aemmenmattstrasse 43, 3123 Belp, Switzerland
Operator	SkyWork Airlines AG, Aemmenmattstrasse 43, 3123 Belp, Switzerland
Manufacturer	Dornier Werke GmbH Manzell-Friedrichshafen, Germany
Aircraft type	Dornier 328-100
Country of registration	Switzerland
Registration	HB-AES
Flight number	SRK 700
Radio call sign	Skyfox seven zero zero
Flight rules	Instrument flight rules (IFR)
Type of operation	Scheduled flight
Departure point	Bern-Belp (LSZB)
Destination	Belgrade (LYBE)

Aircraft 2

Owner	Helisupport GmbH, Pappelweg 20, 3084 Wabern, Switzerland
Operator	Mountain Flyers 80 Ltd., Flugplatz / Hangar 7, 3123 Belp, Switzerland
Manufacturer	Robinson Helicopter Company, 2901 Airport Drive, Torrance, CA 90505 USA
Aircraft type	R44 II
Country of registration	Switzerland
Registration	HB-ZSA
Radio call sign	Hotel Bravo Zulu Sierra Alfa
Flight rules	Visual flight rules (VFR)
Type of operation	Private
Departure point	Bern (LSZB)
Destination	Bern (LSZB)
Location	Bern-Belp Airport (LSZB)

	Swiss territory
Date and time	2 June 2012, 10:24 UTC
ATC unit	Aerodrome control tower Bern, ADC workstation
Airspace	Class D
Minimum separation of the aircraft	Unknown (no radar recording)
Prescribed minimum separation	None, traffic information mandatory
AIRPROX category	ICAO Category A – high risk of collision

Investigation

The serious incident occurred on 2 June 2012 at approximately 10:24 UTC. The notification arrived on 6 June at approximately 12 UTC. After the preliminary investigations usual for this type of serious incident, the investigation was opened on 28 June 2012.

The final report is published by the SAIB.

Summary

On 2 June 2012 the pilot of an Mountain Flyers 80 Ltd R44 helicopter with the radio call sign HB-ZSA reported at 10:21:54 UTC to aerodrome control that he was ready for take-off on helipad 1 and requested an '*around the tower'* departure. Air traffic control then immediately gave an instruction to take off under the pilot's own responsibility (*departure approved own discretion*) via taxiway (TWY) KILO *'around the tower*' in the direction of departure point HOTEL.

Approximately one minute later, at 10:23:26 UTC, the crew of a Skywork Airlines Dornier 328-100 aircraft with the radio call sign SRK 700 received take-off clearance after they had backtracked to the take-off point behind a preceding departure from runway 32.

The take-off of the helicopter took place along TWY KILO. A Helvetic Airways Fokker 100 was waiting at the CHARLIE intersection. The helicopter turned right, flew around the Fokker 100 to the north-east and then turned back onto the original departure axis. This resulted in a flight path converging with the centre line of runway 32. A hazardous convergence with SRK 700, taking off on runway 32, occurred, with a high risk of collision.

Before aerodrome control could give an avoidance instruction to the pilot of HB-ZSA, the latter had already turned away to the right.

The lateral distance between the two aircraft at the closest point of approach at approximately the same altitude was determined with the help of estimates to be approximately 80 to 100 metres.

Causes

The serious incident is attributable to the fact that aerodrome control gave take-off clearance to a commercial aircraft on runway 32 without ascertaining the position of the helicopter which the controller had cleared to depart at its own discretion shortly before. The result was that a hazardous convergence with a high risk of collision occurred between these aircraft.

The following factors contributed to the occurrence of the serious incident:

- The absence of a defined final approach and take-off area (FATO) for helicopter operations.
- The absence of specified departure routes to departure points HE, H and HW.

The following factor was determined as neither causal nor contributory, but was acknowledged in the context of the investigation as a risk factor:

The checklists for operation of the Dornier 328-100 commercial aircraft unnecessarily occupy crews' attention, because the latter have to perform checklist points during taxiing which could be carried out before taxiing.

Safety recommendations

In the context of the investigation, two safety recommendations were issued.

According to the provisions of Annex 13 of the ICAO, all safety recommendations listed in this report are intended for the supervisory authority of the competent state, which has to decide on the extent to which these recommendations are to be implemented. Nonetheless, any agency, establishment or individual is invited to strive to improve aviation safety in the spirit of the safety recommendations pronounced.

In the Ordinance on the Investigation of Aircraft Accidents and Serious Incidents (OIAASI), the Swiss legislation provides for the following regulation regarding implementation:

"*Art. 32 Safety recommendations*

1 DETEC, on the basis of the safety recommendations in the SAIB reports and in the foreign reports, shall address implementation orders or recommendations to the FOCA.

2 The FOCA shall inform DETEC periodically about the implementation of the orders or recommendations pronounced.

3 DETEC shall inform the SAIB at least twice a year on the state of implementation by the FOCA."

1 Factual information

1.1 Pre-flight history and history of the serious incident

1.1.1 General

For the following description of the pre-flight history and history of the serious incident, the recordings of the radiotelephone communications between the aircraft concerned and Berne aerodrome control and departure control were used, as well as the statements of crew members and the air traffic controllers in Berne control tower. It was also possible to use flight data monitoring (FDM) recordings. Radar recordings were not available.

In Berne tower (TWR) aerodrome control, the aerodrome control (ADC) and approach (APP) workstations were occupied. Personnel numbers in aerodrome control were reduced because of illness, with the planned six shifts per day reduced to five. Radiotelephone communications took place on the 121.025 MHz Berne tower and 127.325 MHz Berne departure frequencies. The serious incident occurred within the jurisdiction of the ADC air traffic controller. According to his statement, a moderate traffic volume prevailed at the time of the serious incident. The air traffic controller assessed the situation as visible at a glance as long as all traffic behaved as expected.

No technical restrictions or air traffic control restrictions applied.

1.1.2 Pre-flight history

The crew of SRK 700 consisted of a commander acting as pilot not flying (PNF) and a copilot acting as pilot flying (PF). They received the expected route clearance with a MEBOX 2B instrument departure procedure for the planned flight under instrument flight rules (IFR) from Berne to Belgrade. As usual in Berne, a static take-off (cf. Section 1.5) and a type 1[1] noise abatement departure procedure (NADP) were planned.

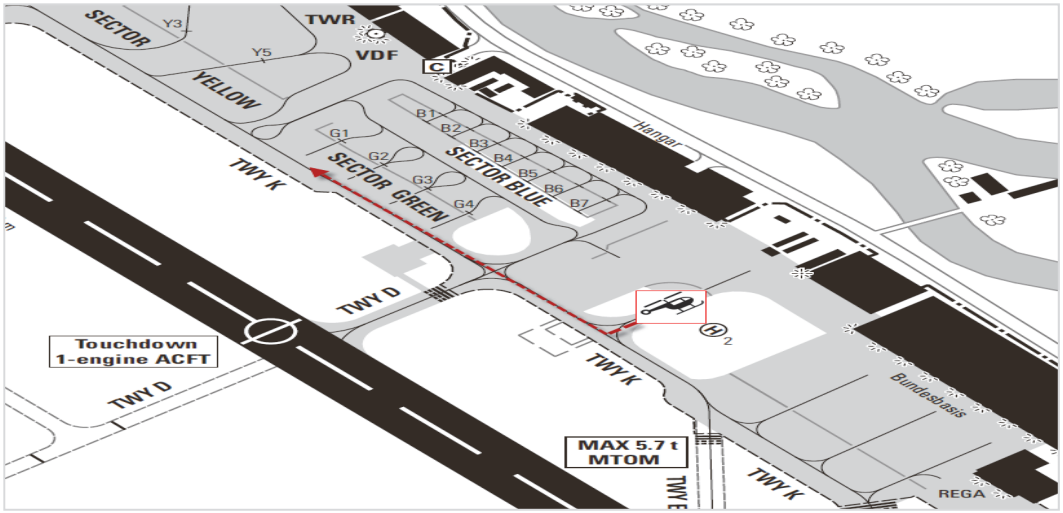


Figure 1: Take-off location (helipad 1) and approximate flight path of HB-ZSA according to statements

Onboard helicopter HB-ZSA, in addition to the pilot, there were two passengers with no aviation experience. A sightseeing flight was planned according to visual

[1] NADP 1: In this case, the power set for take-off is not reduced for the continuing climb before a height of 800 ft (240 m) above ground. At a height of at least 3000 ft (900 m) above ground, the acceleration for the continuing climb then takes place at an increased airspeed (en-route climb speed).

flight rules (VFR) with two interim landings in Uetendorf and Schallenberg. The helicopter was parked on helipad 1 facing the hangar (cf. Figure 1).

An IFR departure of a Helvetic Airways Fokker 100 with the radio call sign OAW 908, destination Zurich, was also planned for around mid-day.

1.1.3 History of the serious incident

On 2 June 2012 the crew of the Dornier 328-100 with the call sign SRK 700 reported at 10:19:08 UTC to Berne tower aerodrome control that they were ready to taxi. After receiving the taxi clearance at 10:19:35 UTC the aircraft then left the stand in front of the terminal behind an aircraft from the same company, towards the taxi holding point of the FOXTROTT branch. Approximately two minutes later, the crew received clearance from the aerodrome controller to back track to the start of the runway behind a Dash-8 which was taking off on runway 32.

Immediately afterwards, at 10:21:40 UTC, the crew of OAW 908 also requested taxi clearance. They were instructed by the ADC controller to taxi to the CHARLIE intersection taxi holding point. Then, OAW 908 taxied onto taxiway (TWY) KILO parallel to runway 32 and came to a halt near the intersection with TWY CHARLIE (cf. Figure 2). The ADC air traffic controller later stated that he had the Fokker 100 in sight.

A short time later, at 10:21:54 UTC, the first call was received from the helicopter pilot of HB-ZSA. He reported that he was ready to depart and requested clearance from aerodrome control to take off from the helipad 1, departing towards destination point HOTEL and then Thun; he requested a departure *'around the tower'.* The ADC controller replied as follows: *"Hotel Bravo Zulu Sierra Alpha hello, wind three hundred degrees, four knots, departure approved own discretion, caution Seneca just crossing behind you on taxiway KILO, thereafter around the tower outbound HOTEL Thun"*. There was no reference to the Fokker 100 on TWY KILO.

The ADC controller's planned departure sequence envisaged allowing helicopter HB-ZSA to take off first, then SRK 700 and finally OAW 908. In his view, he expected HB-ZSA to be hovering within one to two minutes after receiving the clearance. The pilot of HB-ZSA later stated that his understanding was that he should start hovering in the direction of TWY KILO within approximately 30 seconds of receiving the departure clearance.

The pilot of the helicopter acknowledged the clearance at 10:22:22 UTC, and the ADC controller observed HB-ZSA lift off from helipad 1 and hover backwards towards TWY KILO, where it rotated left about its vertical axis and aligned itself parallel to the centre line of runway 32. HB-ZSA then accelerated near the ground along TWY KILO parallel to runway 32 in a north-westerly direction. In this acceleration phase, at an estimated speed of approximately 50 kt, the helicopter pilot decided to initiate a right turn around OAW 908 before the intersection of TWY CHARLIE to avoid passing over the waiting Fokker 100 (cf. Figure 2: dashed line).

The aerodrome controller also observed how the helicopter turned right and according to his statement expected a continuation of the right turn around the tower towards departure point HOTEL (cf. Figure 2: dotted line), as he himself later stated. Then he looked to the left towards the DO328, losing the helicopter from his field of vision, and cleared the crew of SRK 700 at 10:23:26 UTC to take off as follows: "*Skyfox seven hundred, wind three four zero degrees three knots, runway three two cleared for take-off.*"

Abeam of the Fokker 100 waiting on TWY KILO near the CHARLIE intersection, HB-ZSA turned left in the direction of TWY KILO (cf. Figure 2: dashed line) on a trajectory converging on the centre line of runway 32.

On completing the 180 degree turn for take-off on runway 32, the crew of SRK 700 acknowledged the take-off clearance at 10:23:31 UTC. Approximately 30 seconds later, at 10:23:59 UTC, SRK 700 started its take-off roll. The ADC controller watched the take-off roll of SRK 700, which lifted off, according to the crew, shortly before TWY CHARLIE. He then noticed helicopter HB-ZSA, also in its initial climb, close to the centre line of runway 32.

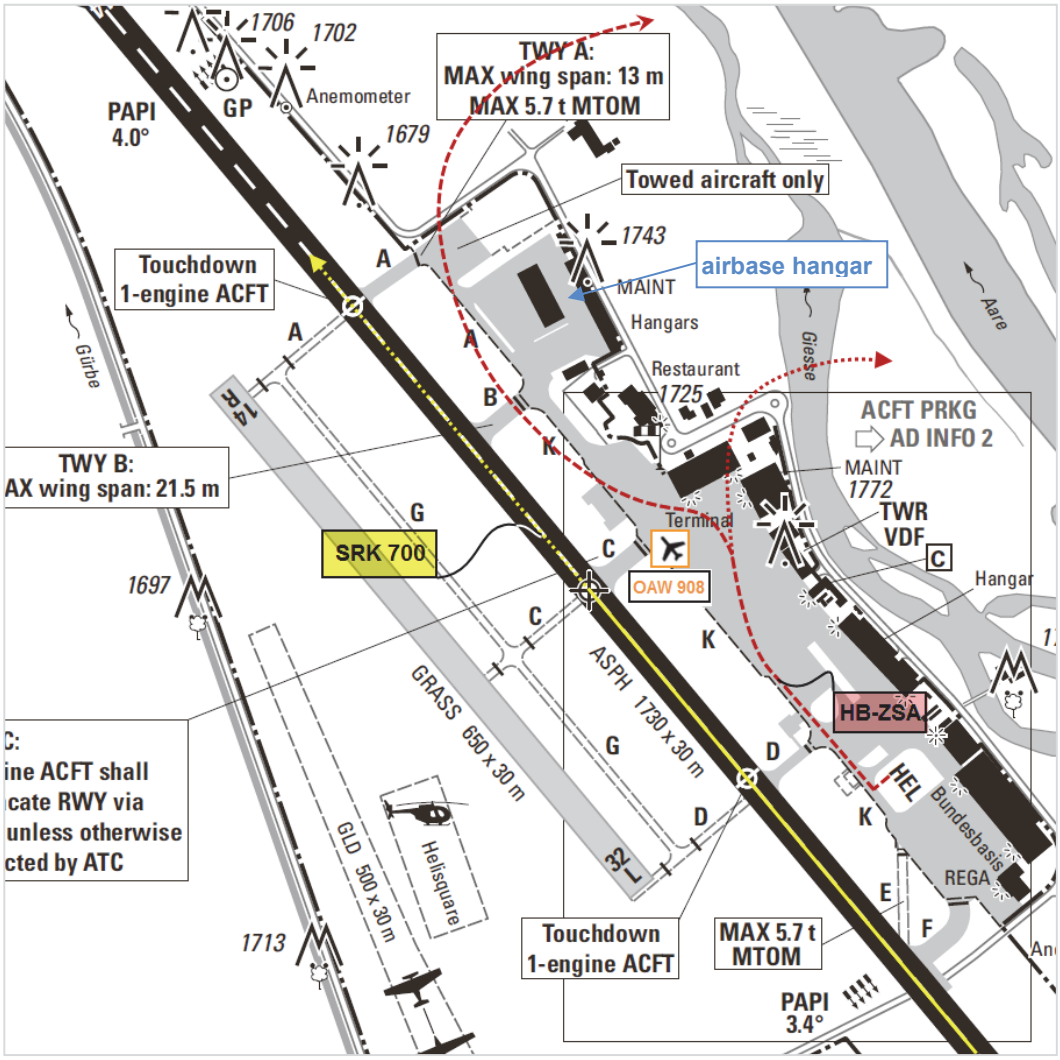


Figure 2: Approximate flight path of HB-ZSA (dashed, red) and SRK 700 (yellow); the red dotted representation of the flight path corresponds to the expectations of the ADC air traffic controller

According to the ADC controller, for a short time there was an unusually close convergence between SRK 700 and the helicopter, close to the centre line of runway 32.

Before the aerodrome controller could give avoidance instructions to the pilot of HB-ZSA, the latter was already in a right-hand turn around the airbase hangar in the direction of departure point HOTEL.

During the initial climb, the crew of SRK 700 made no comment about the convergence with the helicopter and were subsequently instructed by the ADC controller at 10:25:03 UTC to call departure control on the 127.325 MHz frequency.

After the first call to departure control was made at 10:25:25 UTC, the crew received an instruction to continue climbing to FL 100. Then the crew of SRK 700 complained to the Berne departure controller (DEP) at 10:26:13 UTC as follows: *"Ah, the helicopter ah taking off just in front of us, ah was deviating toward the centre line and ah I thought it was not very nice for us ". […] "Ya, we had it in sight anyway, but ah, ya just to know what is the correct procedure then".* The DEP controller responded that the convergence had also been observed. At the end of the conversation both the crew of SRK 700 and the DEP air traffic controller gave each other to understand that they would each file a report.

As the pilot of HB-ZSA reported at 10:27:25 UTC that he had left the control area in the direction of Thun, the ADC controller asked him for the reason for the left turn in the direction of runway 32. The pilot of the HB-ZSA, surprised, replied that he had flown around another aircraft and on turning back had perhaps strayed rather too much to the left. As he later stated, at no time did he have visual contact with SRK 700 which was taking off.

The lateral distance between the two aircraft at the time of the closest point of approach at approximately the same altitude was determined with the help of estimates to be approximately 80 to 100 metres.

1.1.4 Location of the serious incident

Position	Bern-Belp airport
Date and time	2 June 2012, 10:24 UTC
Lighting conditions	Daylight
Coordinates	N 46° 54' 44" / E 007° 29' 57"
Altitude above sea level or flight level	1673 ft AMSL

1.2 Information on persons

1.2.1 Flight crew SRK 700

1.2.1.1 Commander

1.2.1.1.1 General

Person	Swiss citizen, born 1963
Licence	Airline transport pilot licence aeroplane (ATPL (A)) according to European aviation safety agency (EASA) flight crew licensing (FCL), first issued by the Federal Office of Civil Aviation (FOCA) on 28 October 2003
Ratings	Type rating Dornier DO328-100, valid till 31 August 2012 Radio telephony English Language proficiency English level 4, valid till 31 August 2013
Instrument rating	Instrument flight aeroplane IR(A) Category III instrument approaches on DO328, valid until 31 August 2012

	Last proficiency check	Licence/operator proficiency check: 9 February 2012 Line check: 30 September 2011
	Training on TCAS [2]	Initial training September 1999
	Medical fitness certificate	Class 1, restrictions: VNL (shall have available corrective lenses), start of validity: 15 May 2012 end of validity: 22 June 2013
	Last aviation medical examination	15 May 2012
	Beginning of flight training	June 1992
1.2.1.1.2	Flying experience	
	Total	5142 hours
	On the type involved in the incident	530 hours
	Of which as commander	530 hours
	During the last 90 days	176 hours
	Of which on the type involved in the incident	176 hours
1.2.1.1.3	Crew times	
	Start of duty prior to the serious incident	31 May 2012, office duty 1 June 2012, 03:20 UTC 2 June 2012 04:10 UTC
	End of duty prior to the serious incident	31 May 2012, office duty 1 June 2012, 08:08 UTC
	Flight duty times prior to the serious incident	1 June 2012, 04:48 hours
	Rest periods prior to the serious incident	31 May / 1 June 2012, over 24 hours 1 / 2 June 2012, 20:02 hours
	Flight duty time at the time of the serious incident	6:14 hours
1.2.1.2	Copilot	
1.2.1.2.1	General	
	Person	Italian citizen, born 1983
	Licence	Commercial pilot licence aeroplane (CPL(A)) according to joint aviation requirements (JAR), first issued by the Ente nazionale per l'aviazione civile

[2] The name of the basic concept of this collision prevention system is airborne collision avoidance system (ACAS). The International Civil Aviation Organization (ICAO) uses this term when laying down the standards with which the system must comply. The traffic alert and collision avoidance system (TCAS) is a concrete implementation of this concept.

		(ENAC) on 20 August 2007
	Ratings	Type rating Dornier DO328-100, valid till 1 December 2012 Radio telephony English Language proficiency English level 4, valid till 13 October 2013
	Instrument rating	Instrument flight aeroplane IR(A) Category III instrument approaches on DO328, valid till 31 December 2012
	Last proficiency check	Licence proficiency check: 7 October 2011 Operator proficiency check: 19 May 2012 Line check: 9 November 2011
	Training on TCAS	December 2007
	Medical fitness certificate	Class 1, restrictions: VDL (shall wear corrective lenses) Start of validity: 11 April 2012 End of validity: 10 April 2013
	Last aviation medical examination	11 April 2012
	Beginning of flight training	April 2001
1.2.1.2.2	Flying experience	
	Total	1824 hours
	On the type involved in the incident	985 hours
	During the last 90 days	181:45 hours
	Of which on the type involved in the incident	181:45 hours
1.2.1.2.3	Crew times	
	Start of duty prior to the serious incident	3 May 2012, 04:00 UTC 1 June 2012, 03:40 UTC 2 June 2012, 03:55 UTC
	End of duty prior to the serious incident	31 May 2012, 13:55 UTC 1 June 2012, 12:48 UTC
	Flight duty times prior to the serious incident	31 May 2012, 9:55 hours 1 June 2012, 9:08 hours
	Rest periods prior to the serious incident	31 May / 1 June 2012, 13:45 hours 1 / 2 June 2012, 15:07 hours
	Flight duty time at the time of the serious incident	6:29 hours

1.2.2	Pilot HB-ZSA	
1.2.2.1	General	
	Person	Swiss citizen, born 1986
	Licence	Private pilot licence helicopter (PPL(H)), issued by the FOCA on 11 May 2012
	Ratings	Type rating Robinson R44 as pilot in command, valid till 11 May 2013 Radio telephony English Language proficiency: not demonstrated
	Last proficiency check	PPL (H) skilltest / Robinson R44 type rating skilltest: 11 May 2012
	Training on TCAS	No relevant training
	Medical fitness certificate	Class 1, restrictions: VDL (shall wear corrective lenses) Start of validity: 22 May 2012 End of validity: 22 May 2013
	Last aviation medical examination	22 May 2012
	Beginning of flight training	11 May 2011
1.2.2.2	Flying experience	
	Total	50:30 hours
	On the type involved in the incident	29:15 hours
	During the last 90 days	10:32 hours
	Of which on the type involved in the incident	10:32 hours
1.2.3	Air traffic control personnel	
1.2.3.1	ADC air traffic controller	
1.2.3.1.1	General	
	Function	Aerodrome control (ADC)
	Person	Swiss citizen, born 1979
	Duty times prior to the day of the incident	31 May 2012, 04:50 – 11:50 UTC 1 June 2012, 04:50 – 11:50 UTC
	Start of duty on the day of the incident	03:50 UTC
	Licence	Air traffic controller licence, based on European Community Directive 2006/23, first issued by the Federal Office of Civil Aviation (FOCA) on 20 December 2011
	Relevant ratings	Aerodrome instruments (ADI), approach control surveillance (APS)
	Medical fitness	Class 3, no restrictions, issued on 11

April 2011, valid till 11 April 2013

1.2.3.1.2 Additional information of the ADC air traffic controller

The air traffic controller stated that at the start of his duty on the day of the incident, for approximately one hour he had occupied both workstations (aerodrome control – ADC and approach control - APP) in accordance with double sector single man operation (double sector SMOP).

Almost every day there were short-term, operational constraints which would usually only be communicated verbally, e.g. static tests or refuelling on the TWY.

1.2.3.2 DEP air traffic controller

1.2.3.2.1 General

Function	Departure control (DEP)
Person	Swiss citizen, born 1971
Duty times prior to the day of the incident	31 May 2012 08:30 - 15:30 UTC 1 June 2012, 03:40 - 10:40 UTC
Start of duty on the day of the incident	03:30 UTC
Licence	Air traffic controller licence, based on European Community Directive 2006/23, first issued by the Federal Office of Civil Aviation (FOCA) on 17 December 1998
Relevant ratings	Aerodrome instruments (ADI), approach control surveillance (APS)
Medical fitness	Class 3, no restrictions, issued on 29 February 2012, valid till 7 April 2013

1.2.3.2.2 Additional information of the DEP air traffic controller

The DEP air traffic controller was not able to observe the sequence of events of the incident, in particular the converging heading of HB-ZSA to the axis of runway 32, and was only alerted to this by his ADC colleague. He could therefore provide no information on the position of the closest point of approach of the two aircraft.

1.3 Aircraft information

1.3.1 SRK 700

Registration	HB-AES
Aircraft type	DO328-100
Characteristics	Twin-engined commuter aircraft with turboprop propulsion, constructed as a cantilever high-wing monoplane in all-metal construction with retractable undercarriage in nosewheel configuration
Manufacturer	Dornier GmbH, later Fairchild-Dornier
Year of manufacture	1995
Works number	3021

Engines	Pratt & Whitney type PW 119
Owner	SkyWork Airlines AG, Aemmenmattstrasse 41, 3123 Belp, Switzerland
Operator	SkyWork Airlines AG, Aemmenmattstrasse 41, 3123 Belp, Switzerland
Equipment	Honeywell TCAS 2000, Software Version 7.0

1.3.2 HB-ZSA

Registration	HB-ZSA
Aircraft type	R44 II
Characteristics	Light single-engine multipurpose helicopter
Manufacturer	Robinson Helicopter Company
Year of manufacture	2004
Works number	10,365
Engine	Lycoming IO-540-AE1A5
Owner	Helisupport GmbH, Pappelweg 20, 3084 Wabern, Switzerland
Operator	Mountain Flyers 80 Ltd., Flugplatz / Hangar 7, 3123 Belp, Switzerland
Equipment	The helicopter was not equipped with a traffic alert and collision avoidance system. Garmin GTX328 Mode S Transponder with altitude transmission The data from the GPS recording was no longer available.

1.4 Meteorological information

1.4.1 General meteorological situation

A flat ridge stretched from Iceland across Central Europe to the Central Mediterranean.

1.4.2 Weather at the time of the serious incident

Sky clear conditions and weak local wind from the north-west.

Weather/clouds	Sky clear
Visibility	10 km or more
Wind	320 degrees, 4 kt
Temperature/ Dew point	22 / 13 °C
Atmospheric pressure	1015 hPa QNH

Hazards	None	

1.4.3 Astronomical information

Position of the sun	Azimuth: 147°	Elevation: 62°
Lighting conditions	Daylight	

1.4.4 Aerodrome meteorological reports

In the period from 10:20 to 10:50 UTC the following aerodrome routine meteorological report (METAR) applied:

METAR LSZB 021020Z 32004KT CAVOK 22/13 Q1015 NOSIG=

In plain language this means:

On 2 June 2012, the following weather conditions were observed at airport LSZB shortly before the time of issue of the aerodrome meteorological report at 10:20 UTC:

Wind	From 320° at 4 kt
Meteorological visibility	10 km or more
Clouds	Ceiling and visibility OK (CAVOK)[3]
Temperature	22 °C
Dew point	13 °C
Atmospheric pressure	1015 hPa pressure reduced to sea level, according to the ICAO standard atmosphere
Short term forecast	NOSIG, no significant change expected

1.4.5 Forecasts

In the period during which the serious incident occurred, the following terminal aerodrome forecast (TAF) applied:

TAF LSZB 020825Z 0209/0218 34005KT 9999 FEW050=

In plain language this means:

Wind	From 340° at 5 kt
Meteorological visibility	10 km or more
Clouds	1-2/8 at 5000 ft AGL

1.5 Take-off procedure

On the taxiway from the parking stand in front of the terminal to TWY KILO, the crew of SRK 700 had to perform the taxi check consisting of three points; the second point included four sub-points.

[3] CAVOK means: meteorological visibility 10 km or more, no clouds below 5000 ft or below the highest minimum sector altitude (MSA), if this is higher than 5000 ft above aerodrome level (AAL); at LSZB the MSA is 15,000 ft AAL. No cumulonimbus (CB) or towering cumulus (TCU) at any altitude. No significant weather phenomena.

After receiving clearance to taxi onto the runway and backtrack to the take-off point, the crew had to perform the line-up check consisting of ten points. According to the commander's statement this took approximately 30 seconds.

The take-off mass of SRK 700 was 13,283 kg. The decision speed calculated for take-off on runway 32 (V_1 [4]) was 113 kt.

1.6 Communications

Radio communications between the crews and the air traffic controller concerned took place in English and without any technical restrictions up to the time of the serious incident.

1.7 Aerodrome information

1.7.1 General

Bern-Belp airport is located 9 km south-east of the city of Berne on the territory of the municipality of Belp.

Passenger volumes increased from 2005 to 2011 by 82.5%. The number of flight movements increased from 2010 (56,100) to 2011 (62,000) by more than 10%.

At the time of the serious incident, SkyWork Airlines AG had its head office at Bern-Belp airport and in the summer of 2012 operated from this location four Dornier DO328-100 aircraft, each with 31 passenger seats, and three Bombardier Dash-8 Q400 aircraft, each with 72 passenger seats.

At the time of the serious incident, several helicopter companies had their headquarters at Bern-Belp Airport.

The runways at Berne Airport have the following dimensions:

Runway	Dimensions	Elevation of runway thresholds
14	1730 x 30 m	1668 ft AMSL
32	1730 x 30 m	1675 ft AMSL
14R / 32 L	650 x 30 m	-

The airport reference point (ARP) has the coordinates N 46° 54' 44"/ E 007° 29' 57" and is located at the intersection of the runway and TWY CHARLIE. The reference elevation is 1673 ft AMSL and the aerodrome reference temperature is 23.5 °C.

1.7.2 Helicopter operation

1.7.2.1 Landing area

According to the instructions in the aeronautical information publication (AIP), AIP AD2-16 LSZB HELICOPTER LANDING AREA, the helicopter landing area had the following dimensions:

"Coordinates TLOF or THR of FATO (†)	*NIL*
TLOF and/or FATO elevation	*1673 ft / 510 m*
TLOF:	
TLOF and FATO area dimensions, surface, strength, marking:	

[4] V_1 is the maximum speed at which, in the event of an aborted take-off, the aircraft can still be brought to a standstill on the runway. Once speed V_1 is reached, a take-off will be continued.

HEL stands, marked circles with diameter	*8.0 m*
ASPH and GRASS, Max OAL or OAW	*16.0 m*
Distance between HEL stands centres	*24.0 m*

(†) TLOF: touch-down and lift-off area, FATO: final approach and take-off area

The following locations are available:

Helipad 1	*For non based Helicopters (PPR) and Mountain flyers*
Helipad 2	*Only for Mountain flyers*
Heliport Heliswiss	
Heliport REGA	
Tarmac BAZL / BABLW"	

1.7.2.2 Helicopter arrival and departure procedures

In Section 4, 'TOWER', of the air traffic management manual (ATMM) II LSZB, '*HELICOPTER OPERATIONS'* were noted (in excerpts) as follows:

"11.1 GENERAL

VFR Helicopter arrival and departure procedures are based on the VFR AREA-/VISUAL APPROACH CHART LSZB [cf. Annex 2] *and the official publication in AIP CH* [AIP AD 2 LSZB 2.20. p3 'Non-based helicopters PPR']*. Deviations from these procedures may be carried out for ATC reasons.*

(…)

11.3 TAKE-OFF AND LANDING PROCEDURES

There is no official defined "Final APCH and TKOF area" (FATO) in LSZB so that the flight path of the current traffic can be adjusted.

(…)

TAKE-OFF AND LANDING OUTSIDE OF THE RUNWAY

For take-off and landing outside of the runway, an authorization shall only be issued AT OWN DISCRETION due to missing FATO (Final area for take-off and landing).

(…)

11.5 LARGE HELICOPTER / IFR HELICOPTERS

Take-off and landing of large helicopters (e.g. AS32) and IFR helicopters should be carried out on the concrete runway, taxiing should be handled similarly to fixed-wing aircraft."

Due to the absence of a final approach and take-off area (FATO), helicopters of little mass typically took off via TWY KILO. Only a take-off instruction 'at own discretion' was given. It is not only at Berne-Belp, but also on several other aerodromes in Switzerland with helicopter flight operations and aerodrome control that clearance for take-offs and landings are not given; instead the wording 'take-off/landing at your own discretion' is used.

Helicopter pilots taking off via TWY KILO had to obey the following instruction published in the Bern-Belp Airport (LSZB) aerodrome information (AD INFO) of the VFR Manual:

"(…)

1.2 Approach and departures shall be carried out via the published reporting points or HEL routes. Overflying of buildings and ACFT at the airport is prohibited.

(…)"

Apart from this restriction, no further requirements were known which prohibited a take-off instruction for helicopters taking off via TWY KILO when the latter was occupied by aircraft or vehicles.

In the VFR Manual for Switzerland, no helicopter departure routes to the departure points HE, H or HW were published or prescribed on the visual approach chart (VAC) (cf. Annex 2) for Berne (LSZB). According to the ADC controller, in practice this meant *"No man's land" for* aerodrome control. Helicopters taking off on the runway were apparently "controllable", but not those taking off from the helipad.

In a few cases, convergences also occurred with traffic on final on runway 32, since helicopters flew from the helipad in a left turn over the runway and as a result crossed the approach centre line.

1.7.2.3 Special instruction 'around the tower'

According to information from the Federal Office of Civil Aviation (FOCA), there was no published departure procedure *'around the tower'* at Bern-Belp airport. Also, according to the statements of the aerodrome controller and the pilot of HB-ZSA, the additional take-off information '*around the tower*' did not correspond to any prescribed and published procedures. The said departure route was mainly used by helicopter pilots with Airport Bern-Belp as their homebase. The pilot of HB-ZSA stated that he learned the departure '*around the tower'* during his training and he was used to taking off this way in case of north-westerly winds.

According to the aerodrome controller, the initiation of the right turn could take place at different times, sometimes in the direct vicinity of the control tower with overflight of the buildings bordering to the north-west, but usually however only those beyond the airport buildings. A few pilots even made the turn only at the end of runway 32.

1.8 Flight recorders

1.8.1 Flight recorder SRK 700

1.8.1.1 Flight data recorder and cockpit voice recorder

The digital flight data recorder (DFDR) and cockpit voice recorder (CVR) recordings could no longer be analysed, as the aircraft continued its flight to the destination airport and the recordings of the take-off had therefore been overwritten.

1.8.1.2 Flight data monitoring

The flight data monitoring (FDM) recordings could be analysed successfully.

1.8.2 Flight recorder HB-ZSA

No recording devices were present on the type R44 II helicopter. The data from the GPS recording was no longer available.

1.9 Information on Bern air traffic control procedures

1.9.1 General

Bern-Belp Airport air traffic control had two workstations in the control tower for actual traffic management, i.e. aerodrome control (ADC) and approach control (APP). Among other things, the latter handled traffic control for IFR traffic departing from Berne, under the radio call sign Berne departure (DEP). Another person, working in the background, was the chief on duty (COD), who did not carry out any active air traffic control.

Personnel numbers in aerodrome control were reduced because of absences due to illness, with the planned six shifts per day reduced to five. This meant longer times spent at the respective workstations, as well as taking over all the functions of the COD workstation, which was not occupied at the time of the serious incident.

1.9.2 Tasks of the aerodrome controller

Since skyguide had not made provision in the Berne control tower for a ground controller (GRO), the tasks of an ADC were very diverse and complex, especially when they also had to take over the tasks of the APP (and COD). These were specified in detail in the *"Duties of TWR Crew"*, Section 4, Tower 4-3-1 of the ATMM II (cf. Annex 3). The introduction states:

"The successful provision of ATS requires close team cooperation between TWR and APP control units. Potential individual work overloads may be avoided through mutual support.

ADC shall assume APP and CODS when these working positions are not manned. (…)"

Section *9*, *§1.1, 1.2* of the ATMM II LSZB also states:

"CONTROL OF AERODROME TRAFFIC

The primary objective of aerodrome control is the prevention of collisions and the aerodrome controller is also required to maintain a continuous watch on all flight operations on and in the vicinity of an aerodrome.

This separation is achieved by visual observation by the aerodrome controller, and not by establishing fixed distance minima, as in the case when radar separation is applied.

USE OF VISUAL MEANS TO PROVIDE SEPARATION

Separating arriving or departing aircraft at a controlled aerodrome using visual means is an important means to improve efficiency and airport throughput, without having a negative impact on safety.

Adequate separation can be provided by the aerodrome controller when each aircraft is continuous visible to this controller. He is required to issue "essential traffic information" to the pilots involved, and if necessary instructions with the objective of preventing a collision in terms of distance."

1.9.3 Tasks of the departure controller

The departure (DEP) controller performed radar control for the aircraft under his control within his area of responsibility (AOR). To do this, he operated his most important resources, such as the tower air situation display (TASD), tower approach coordination system (TACO) and VHF direction finder (VDF).

IFR departures could be transferred by the ADC controller to the DEP departure controller if there were no separation issues within the AOR of the ADC air traffic controller.

1.10 Other observations

1.10.1 Crew of OAW 908

The convergence between SRK 700 and the helicopter near the centre line of runway 32 was also observed by the crew of OAW 908. They later stated that the helicopter had for a short time come fairly close to the right-hand edge of runway 32. Then HB-ZSA turned northwards. Shortly afterwards, SRK 700 lifted off and passed the previous position of HB-ZSA in its climb. When SRK 700 passed abeam of the helicopter, the latter was located approximately in the extension of the TWY ALPHA centre line. This corresponds to a distance from the centre line of runway 32 of approximately 100 m.

1.10.2 Crew of SRK 700

When the DO328 was increasing its speed from approximately 60 to 80 kt during its take-off roll, the crew of SRK 700 observed HB-ZSA for the first time, ahead on the right, on a trajectory which was slowly converging with the centre line of runway 32. According to the commander's observations, SRK 700 overtook HB-ZSA at approximately the same altitude just before TWY BRAVO. The helicopter had just initiated the right-hand turn at this time. The distance between the two aircraft was approximately 80 m at this time. According to the observations of the co-pilot of SRK 700, HB-ZSA was already in its right turn when the DO328 lifted off. According to his observation, the closest point of approach occurred at a time when HB-ZSA was at an altitude of approximately 200 ft AGL and the DO328 had not yet lifted off.

2 Analysis

2.1 Technical aspects

There are no indications of any pre-existing technical defects which might have caused or influenced the serious incident.

2.2 Human and operational aspects

2.2.1 Bern-Belp airport arrival and departure procedures

Due to the absence of a final approach and take-off area (FATO) at Bern-Belp Airport, the procedures envisaged generally permitting helicopters of little mass to take off via taxiway (TWY) KILO and large helicopters and those under IFR from the hard-surface runway. By means of the departure of helicopters via TWY KILO, traffic flow could be optimized and delays reduced. However, the take-offs made via TWY KILO took place without actual clearance from aerodrome control and only at the pilot's own discretion. For take-offs by helicopters, this meant that aerodrome control expected them to be hovering towards TWY KILO within one to two minutes of the take-off instruction being given. The extent of this period during which a helicopter can begin its effective take-off via TWY KILO makes it difficult for aerodrome control to chronologically separate departures of fixed-wing aircraft on runway 32 from such helicopter departures.

Apart from the provision published in the aerodrome information (AD INFO) section for Bern-Belp Airport (LSZB) (cf. Section 1.7.2.2), according to which overflying of buildings and other aircraft at the airport was prohibited, there were no further requirements which prohibited a take-off instruction to departing helicopters via TWY KILO when occupied by aircraft or vehicles. In the present case the instruction was given at a time when TWY KILO was still occupied by OAW 908 before the TWY CHARLIE intersection (cf. Figure 2). Complying with the stipulation not to fly over any other aircraft, the pilot of HB-ZSA routed his departure around OAW 908, making the take-off even more difficult during the acceleration phase.

The tight spatial conditions of TWY KILO, which was used by fixed-wing aircraft to taxi to runway 32, and which was used in the opposite direction as an unobstructed departure area for helicopters of little mass, plus the simultaneous use of runway 32 which runs in parallel with it, for take-offs and landings at only short lateral distance are part of an operating concept which is not error-tolerant and is inappropriate, and contributed to the occurrence of the serious incident.

As described in Section 1.7.2.2, in the aeronautical information publication (AIP) there was no documented departure route from the two helipads to departure points HE, H and HW. The departure route *'around the tower'* used when there were a north-westerly winds, was not prescribed or published (cf. Section 1.7.2.3), but was common practice, mainly by pilots with Bern-Belp Airport as their homebase. Neither aerodrome control nor pilots were able to refer to a published departure route from the two helipads to departure points HE, H and HW. This lack of a basis left helicopter pilots free to configure their departure path to the above-mentioned exit points. For aerodrome control, however, this meant more effort spent on monitoring. Moreover, there is little sense in giving traffic information to aircraft which are not following a predictable flight path. The increased monitoring effort, coupled with the limited influence of aerodrome control over the traffic situation in the immediate vicinity of the aerodrome, leads to a high workload for the air traffic controller.

The absence of mandatory departure routes from the helipads to departure points HE, H and HW contributed to the dangerous convergence of the two aircraft and therefore to the occurrence of the serious incident.

2.2.2 Aerodrome controller

According to the statement of the ADC air traffic controller involved, there was a moderate volume of traffic at the time of the serious incident, which was *"manageable, as long as everybody played along"*. In view of the specifications in the ATMM II (cf. Annex 3), and the fact that that the scheduled six duty sessions per day had been reduced to five, this statement is not particularly surprising; the mixed traffic involving aircraft with different performance characteristics in the dynamic environment at Bern-Belp Airport places demanding requirements on an aerodrome controller. The statement does indicate, however, that there are no safety margins in the event of an irregularity. The present case, which led to the dangerous convergence of two departing aircraft due to a deviation from the departure route expected by the air traffic controller, makes this state of affairs clear.

The ADC controller's planned departure sequence envisaged allowing helicopter HB-ZSA to take off first, then SRK 700 and finally OAW 908. The ADC air traffic controller later stated that he had the Fokker 100 in his field of vision. With the own-discretion clearance to the pilot of HB-ZSA on helipad 1, he at the same time gave traffic information referring to the Seneca passing behind HB-ZSA "*(...) caution Seneca just crossing behind you on taxiway KILO (...)*." This warning was safety-conscious, since the Seneca was not easy to see for the pilot of HB-ZSA in rearward hovering flight on TWY KILO.

There was no corresponding information referring to the Fokker 100 waiting on TWY KILO at the CHARLIE intersection. The planning of the ADC air traffic controller, however, was clear: that the Fokker 100 would only leave its position there after the take-off of HB-ZSA and SRK 700 and OAW 908 would therefore represent an obstacle for HB-ZSA to fly around during the acceleration phase. The fact that the ADC controller did not alert the departing HB-ZSA to the waiting Fokker 100 indicates that he did not take into account the possibility of an overflight or an avoidance manoeuvre by the pilot of HB-ZSA.

As described in Section 1.7.2.2, there were no documented departure routes from the helipads to departure points HE, H and HW. The departure route 'around the tower' did not correspond to any prescribed or published procedure (cf. Section 1.7.2.3), but was common practice and was mainly used when runway 32 was in use. It is therefore not surprising that the initiation of the right-hand turn was executed differently. This is in line with the statement of the aerodrome controller, according to which the right-hand turn took place immediately after passing the tower or a long way after overflying TWY ALPHA (cf. Annex 1). It is therefore surprising that apparently no restrictions are imposed as a general rule on departing helicopters in relation to the initiation of the right turn around the control tower.

According to the aerodrome controller's statement, he observed how HB-ZSA turned right above TWY KILO in front of the Fokker 100. The initiation of this right turn caused the ADC controller to assume that this was the beginning of the right turn around the control tower towards HOTEL (cf. Figure 2: dotted line) and that HB-ZSA therefore no longer represented a potential conflict with the DO328. Consequently, without corresponding traffic information concerning HB-ZSA, the air traffic controller turned to the DO328 which was ready for take-off at the take-off point of runway 32 and at 10:23:26 UTC cleared the crew of SRK 700 to take off.

In order to check the plausibility of the events described from memory, an assessment can be done based on the following assumptions:

- The take-off clearance to SRK 700 was given one second after HB-ZSA initiated the putative right turn around the tower .
- The closest point of approach was latest abeam TWY ALPHA (cf. figure 2).

Kinematical considerations based on known distances and velocities allow the following conclusions to be drawn:

- At the time of the readback of the take-off clearance at 10:22:22 UTC, the pilot of HB-ZSA had approximately 39 seconds to lift off from helipad 1, hover backwards towards TWY KILO, turn about its vertical axis to the left and line up parallel to the centre line of runway 32 and initiate the take-off at approximately 10:23:01 UTC. A period of 39 seconds for this manoeuvre and another 24 seconds for the take-off up to the initiation of the right turn, at 10:23:25 UTC, does not seem unrealistic.
- HB-ZSA then would have passed a position abeam of TWY ALPHA at approximately 10:23:39 UTC, hence about 20 seconds prior to the initiation of the take-off roll of SRK 700 at 10:23:59 UTC.

It is evident that under these conditions, no dangerous convergence with the DO328 taking off from runway 32 would have occurred. A different chronological sequence of events therefore suggests itself, according to which the right turn by HB-ZSA cannot have been the trigger for issuing the take-off clearance to SRK 700. This took place ultimately regardless of the position of HB-ZSA and this created an essential precondition for the occurrence of the serious incident.

Only after the take-off of SRK 700 did the aerodrome controller become aware of HB-ZSA close to the runway centre line, also in its initial climb. Before the ADC aerodrome controller could give an instruction to the pilot of HB-ZSA, the latter was already making the right turn towards departure point HOTEL.

Within the framework of the investigation, it was not possible, on the basis of the available information and the sometimes divergent observations, to draw any conclusions about the location of the closest point of approach of the two aircraft.

After the crew of SRK 700 had complained to the DEP controller about the convergence and stated that they would submit a report, he informed his ADC colleague who became aware of the full consequences. Subsequently, the ADC air traffic controller in turn demanded an explanation from the helicopter pilot. However, no information was given to the pilot of HB-ZSA about the intended report by the crew of SRK 700 or about any report by himself.

2.2.3 Crews

2.2.3.1 Pilot of HB-ZSA

During his initial call, the pilot of HB-ZSA reported that he was ready to depart and requested clearance from aerodrome control to take off from helipad 1, departing towards departure point HOTEL and then Thun; he requested a departure *'around the tower'*. As mentioned in Section 1.7.2.3), the departure route '*around the tower'*, which allows a take-off into the wind on TWY KILO in the event of north-westerly winds and provides for a subsequent right turn around the tower, does not correspond to any prescribed and published procedure. However, this procedure has been taught and practised for years by the flying school based at Bern-Belp Airport. At the time of the serious incident, there was a light wind from the north-west. Given the pilot's lack of flying experience and the fact that this departure procedure was familiar to him, it is clear that he was adhering to a process familiar to him.

There was no corresponding traffic information in relation to the Fokker 100 waiting at the CHARLIE intersection. According to the planning of the ADC controller, however, it was clear that the Fokker 100 would only leave its position after the take-off of HB-ZSA and would therefore represent an obstacle for HB-ZSA to fly around during the acceleration phase. The absence of information would probably have given the pilot a moment of surprise when he encountered the Fokker 100.

As the pilot later stated, at no time did he have visual contact with SRK 700 which was taking off. He did not receive any stipulations from the aerodrome controller in relation to the departure route in a north-westerly direction, neither a southerly limit nor in relation to the initiation of a right turn. This turn, according to the pilot, took place after passing the airbase hangers (cf. Figure 2) and was therefore in accordance with the departure route *'around the tower'* assigned to him.

2.2.3.2 Crew of SRK 700

The aerodrome controller gave take-off clearance to SRK 700 at 10:23:26 UTC, without accompanying traffic information about HB-ZSA, which had taken off from TWY KILO. On completing the 180 degree turn for the take-off, the crew confirmed this at 10:23:31 UTC and began their take-off roll approximately 30 seconds later. In these seconds the crew was busy lining up the aircraft for take-off on runway 32 and performing the last checklist before take-off (the line-up checklist cf. Section 1.5). Often, the perception of the crew in this phase is limited to their own radio call sign; an active request from air traffic control for confirmation that visual contact has been established with another aircraft, e.g. with the departing HB-ZSA, could help to detect possible conflicts in the dynamic phase of a take-off roll.

After setting take-off power, the crew were concentrating on the take-off roll; the copilot, as pilot flying (PF), was focusing primarily on controlling the aircraft and the commander, as pilot not flying (PNF), had to monitor the parameters relevant to the take-off roll. It is therefore not surprising that the DO328 was already passing an estimated speed of approximately 60 to 80 kt when the crew of SRK 700 observed HB-ZSA for the first time, ahead on the right, on a trajectory which was slowly converging with the centre line of runway 32. The decision speed calculated for the actual take-off (V_1) of 113 knots, up to which the aircraft can be brought to a standstill on the runway in the event of an aborted take-off, was still a long way from being reached. The question which arises here is whether aborting the take-off at this point would have involved a lower risk than a continuation of the take-off in which the crew of the DO328 had few possibilities of avoidance. Since only the statements of the crew members involved are available in relation to this point, reaching a final assessment about it is difficult and speculative.

It is essentially the task of ATC to separate the controlled movements on the runway and within the control zone, and to provide aircraft with traffic information in visual meteorological conditions (VMC). However, the question arises as to how aircraft crews can obtain an overview of the current traffic situation by radio monitoring (frequency awareness). The expanded line-up checklist used by the operator consists of ten points, some of which could be performed before taxiing; this would allow the crew greater capacity to monitor the traffic situation on the airport.

The crew of SRK 700 did not speak about the convergence with the helicopter during their initial climb but complained only after making contact with departure control. They allowed time for this and correctly implemented the priorities generally recognised in aviation: "*fly – navigate – communicate"*.

3 Conclusions

3.1 Findings

3.1.1 Technical aspects

- The Dornier 328-100 commercial aircraft was certified for transport according to instrument flight rules (IFR).
- Helicopter HB-ZSA was certified for transport according to visual flight rules (VFR).
- The investigation found no evidence of pre-existing technical defects which might have caused or influenced the serious incident.
- The air traffic control systems were operational.

3.1.2 Crews

- The crew of SRK 700 were in possession of the necessary licences for the flight.
- The pilot of HB-ZSA was in possession of the necessary licences for the flight.
- There are no indications of either crew suffering any health problems during the flights involved in the incident.

3.1.3 Air traffic control personnel

- The air traffic controllers were in in possession of the licences necessary to exercise their activities.
- There are no indications of the air traffic control officers suffering any health problems at the time of the serious incident.
- Personnel numbers in aerodrome control were reduced, because of illness, with the planned six shifts per day reduced to five.

3.1.4 History of the serious incident

- The pilots of SRK 700 were making a scheduled flight according to IFR from Bern-Belp to Belgrade.
- The pilot of helicopter HB-ZSA was making a flight according to VFR with stopovers in Uetendorf and Schallenberg.
- The pilots of OAW 908 were making a scheduled flight according to IFR from Bern-Belp to Zurich.
- At 10:19:08 UTC the crew of SRK 700 reported they were ready to taxi.
- At 10:19:35 UTC the ADC controller gave the crew of SRK 700 taxi clearance to taxi to the right to the taxi holding point at the FOXTROTT intersection.
- The crew of SRK 700 were instructed at 10:21:29 UTC by the ADC controller to backtrack behind a departing Dash 8 on runway 32.
- At 10:21:40 UTC, the crew of OAW 908 requested taxi clearance. They were instructed by ADC to taxi to the taxiway (TWY) CHARLIE intersection and to hold short of the runway there.

- At 10:21:54 UTC the first call from the pilot of HB-ZSA took place. He requested a take-off from helipad 1 *'around the tower'* towards HOTEL - Thun.
- The ADC promptly gave the helicopter pilot clearance to take off at his own discretion (departure approved own discretion) around the control tower in the direction of HOTEL - Thun, with an indication to take note of a Seneca which was crossing behind him on TWY KILO. There was no traffic information in relation to OAW 908 which was holding short at the CHARLIE intersection.
- The pilot of HB-ZSA confirmed the take-off clearance at 10:22:22 UTC.
- At 10:23:26 UTC the ADC gave the take-off clearance to the crew of SRK 700 on runway 32, without traffic information in relation to the departing HB-ZSA.
- The crew of SRK 700 confirmed the take-off clearance at 10:23:31 UTC.
- The crew of OAW 908 observed from their holding point as the helicopter, after flying around the Fokker 100, drifted to the left towards the departing SRK 700 and then turned again to the right.
- At 10:25:03, ADC gave the crew of SRK 700 the instruction to contact the departure controller on the 127.325 MHz frequency and said goodbye. Neither ADC nor the crew of SRK 700 gave any indication of the convergence.
- The crew of SRK 700 crew reported at 10:25:25 UTC to Berne departure on the 127.325 MHz frequency while climbing on the MEBOX 2B departure route. They received clearance to continue climbing to flight level 100.
- At 10:26:13 UTC the crew of SRK 700 informed the DEP controller about a helicopter which had taken off in front of them and drifted towards the centre line, and complained about this.
- The crew wanted to know the precise procedure and finally informed the ATC that they intended to submit a report.
- The pilot of HB-ZSA, in response to an enquiry from the ADC controller, stated that he had flown around another aircraft and on turning back had perhaps strayed rather too much to the left.

3.1.5 Procedures

- At Bern-Belp airport there was no touch-down and lift off area (TLOF) or final approach and take-off area (FATO) for handling helicopter flight operations.
- The take-off instruction 'around the tower' did not correspond to any prescribed or published procedure.
- At Bern-Belp Airport no departure routes from the helipad 1 or 2 parking areas to departure points HE, H and HW were published.

3.1.6 General conditions

- No radar recordings were available.
- The weather conditions had no influence on the serious incident.

3.2 Causes

The serious incident is attributable to the fact that aerodrome control cleared a commercial aircraft to take off on runway 32 without ascertaining the position of the helicopter which the controller had shortly beforehand cleared to depart at its own discretion. The result was that a dangerous convergence of these two aircraft occurred with a high risk of collision.

The following factors contributed to the occurrence of the serious incident:

- The absence of a defined final approach and take-off area (FATO) for helicopter flight operations.
- The absence of fixed departure routes to departure points HE, H and HW.

The following factor was established as neither causal nor contributory but was recognised within the framework of the investigation as a risk factor:

The checklists for operation of the Dornier 328-100 commercial aircraft unnecessarily occupy crews' attention, because the latter have to perform checklist points whilst taxiing which could be carried out before taxiing.

4 Safety recommendations and measures taken since the accident

According to the provisions of Annex 13 of the ICAO, all safety recommendations listed in this report are intended for the supervisory authority of the competent state, which has to decide on the extent to which these recommendations are to be implemented. Nonetheless, any agency, establishment or individual is invited to strive to improve aviation safety in the spirit of the safety recommendations pronounced.

In the Ordinance on the Investigation of Aircraft Accidents and Serious Incidents (OIAASI), the Swiss legislation provides for the following regulation regarding implementation:

"*Art. 32 Safety recommendations*

1 DETEC, on the basis of the safety recommendations in the SAIB reports and in the foreign reports, shall address implementation orders or recommendations to the FOCA.

2 The FOCA shall inform DETEC periodically about the implementation of the orders or recommendations pronounced.

3 DETEC shall inform the SAIB at least twice a year on the state of implementation by the FOCA."

4.1 Safety recommendations

4.1.1 Reduction of systemic risks

4.1.1.1 Safety deficit

On 2 June 2012 the pilot of an R44 II helicopter, following his request, received from aerodrome control the instruction to take off at his own discretion via taxiway (TWY) KILO *'around the tower'* towards departure point HOTEL. Approximately one minute later, air traffic control gave the crew of a commercial aircraft, a type Dornier 328-100, clearance to take off on runway 32.

As a result of an avoidance manoeuvre, the take-off of the helicopter resulted in a trajectory converging on the centre line of runway 32. A dangerous convergence occurred with the commercial aircraft taking off on runway 32, with a high risk of collision.

In the opinion of SAIB, the following points contribute to an inappropriate and not error-tolerant operation while runway 32 is in use:

- Some large aircrafts can use TWY KILO south of TWY CHARLIE with restrictions only.
- Use of TWY KILO as an unobstructed departure area for helicopters;
- Parallel use of TWY KILO and runway 32 for take-off and landing.

The following points were raised as contributory factors in the context of the formulation of the cause:

- The absence of a defined final approach and take-off area (FATO) for helicopter flight operations.
- The absence of fixed departure routes to departure points HE, H and HW.

4.1.1.2 Safety Recommendation No. 479

The Federal Office of Civil Aviation (FOCA), in cooperation with the airport operator and skyguide as air navigation service provider, should ensure the establishment of a final approach and take-off area (FATO) and the establishment of helicopter departure and arrival routes to waypoints HE, E and HW at Bern-Belp Airport.

4.1.1.3 Safety Recommendation No. 480

The Federal Office of Civil Aviation, in cooperation with skyguide as air navigation service provider, the airport operator and users of Bern-Belp airport, should carry out a comprehensive analysis of operating procedures and take all appropriate measures to reduce complexity and systemic risks.

4.2 Measures taken since the serious incident

On 13 December 2013, a new visual approach chart (VAC) as well as a new area chart was handed in to the FOCA by the airport owner ALPAR. Amongst others, this publication contains a VAC for Helicopters on which the route 'around the tower' is described (cf. Annex: 4).

Payerne, 21 January 2014 Swiss Accident Investigation Board

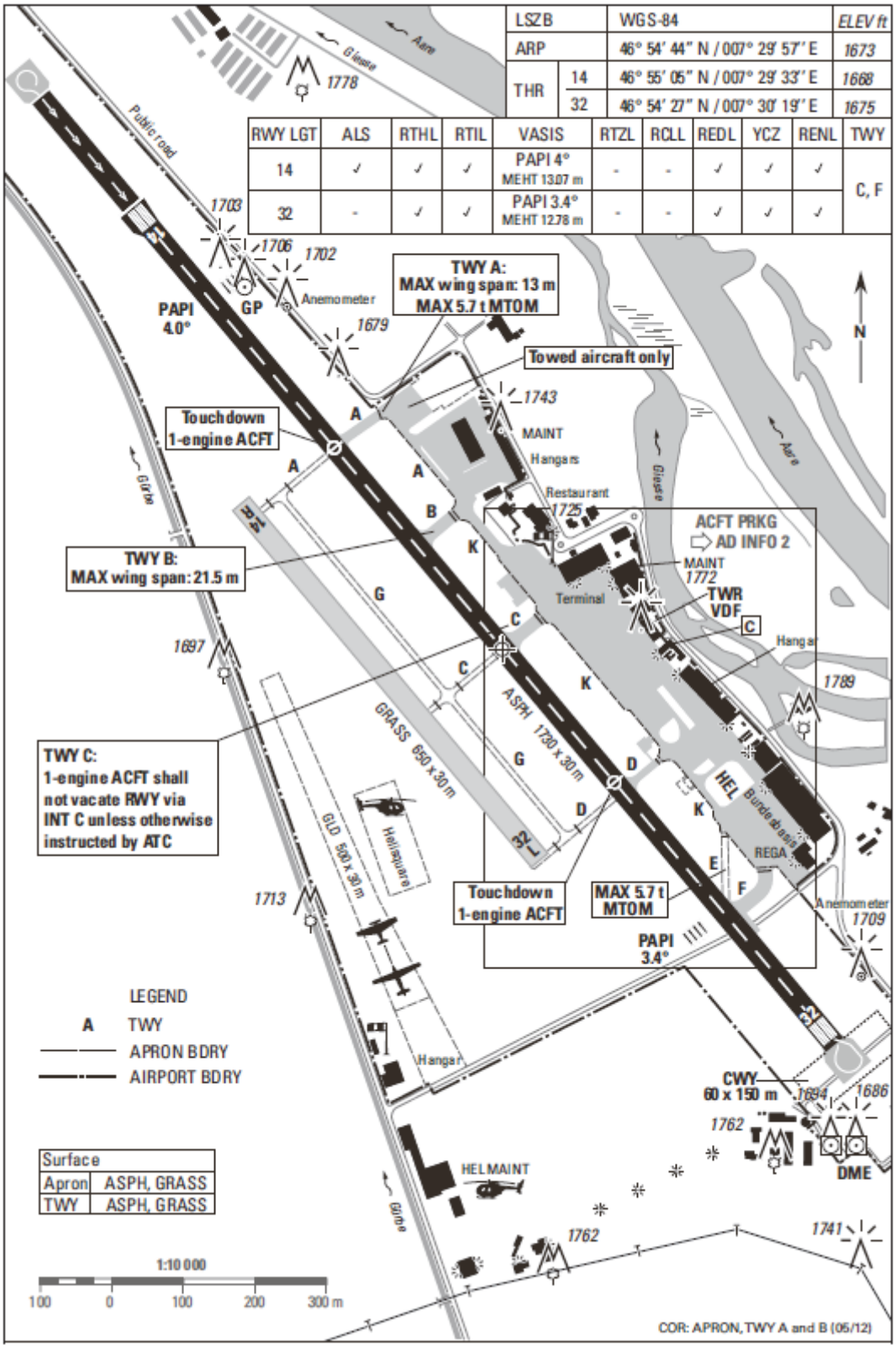
This final report was approved by the management of the Swiss Accident Investigation Board SAIB (Art. 3 para. 4g of the Ordinance on the Organisation of the Swiss Accident Investigation Board of 23 March 2011).

Berne, 9 September 2014

Annex 1: Ground chart of the VFR Manual for Bern-Belp Airport (LSZB)

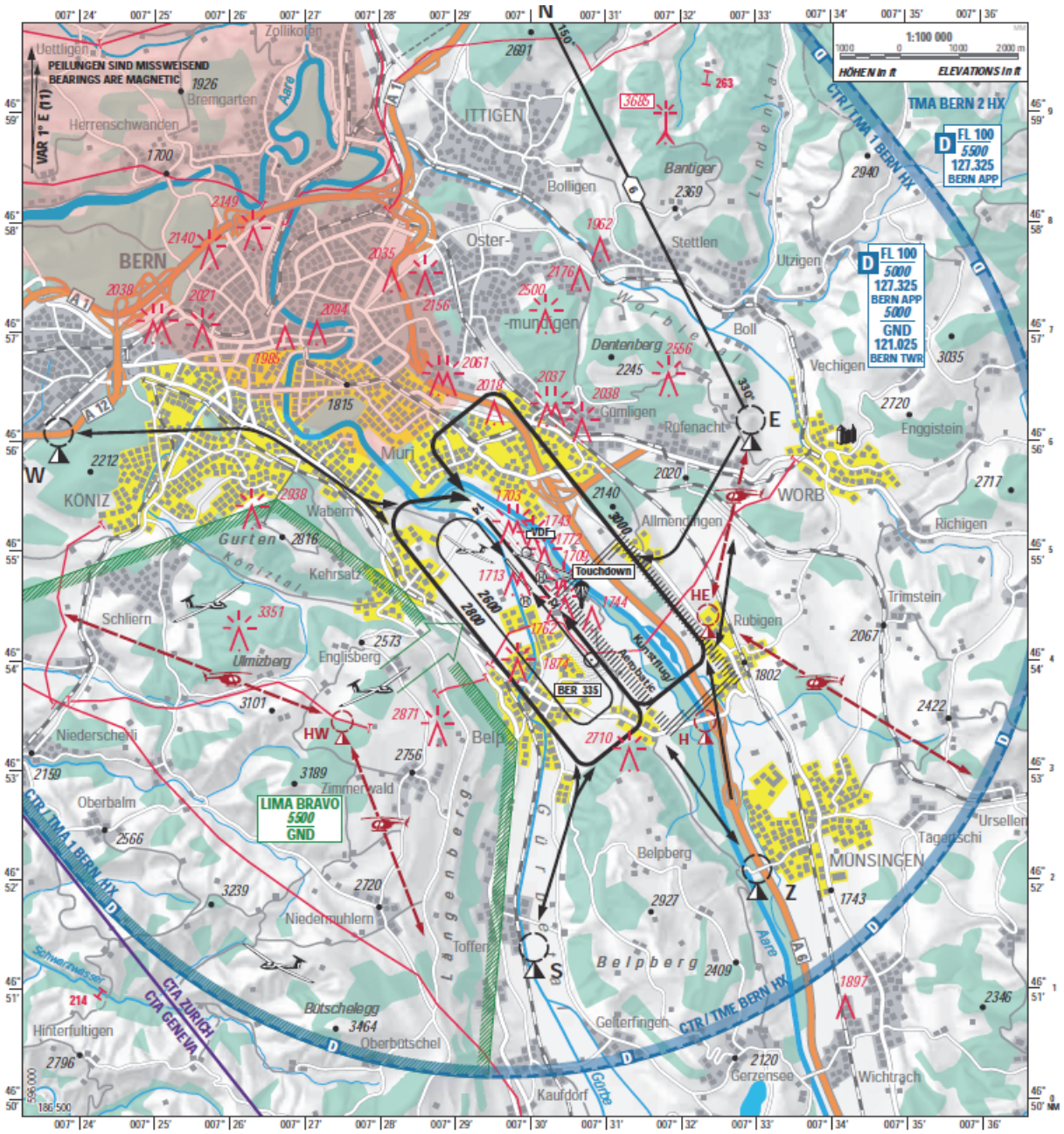
AD INFO 1 BERN-BELP

LSZB



05/12 MAY 03 SKYGUIDE, CH-8602 WANGEN BEI DÜBENDORF LSZB 1

Annex 2: Visual approach chart of the VFR Manual for Bern-Belp Airport (LSZB)



Annex 3: Excerpts from the air traffic management manual (ATMM) II, LSZB Section 4, Tower 4-3-1

DUTIES OF TWR CREW

The successful provision of ATS requires close team cooperation between TWR and APP control units. Potential individual work overloads may be avoided through mutual support.

ADC shall assume APP and CODS when these working positions are not manned.

Tasks of the ADC Controller

- *Operate*
  - *TWR-, GND-,UNI- and emergency frequency*
  - *Bright Display (TASD)*
  - *VDF*
  - *Fire Brigade radio*
  - *ICS 200/60 telephone equipment*
  - *Runways and approach lighting (REDL, ALS, PAPI, IDENT)*
  - *TACO*
  - *INCH*
  - *Intercom equipment*
  - *Cerberus equipment*
- *Alerting service during emergencies and irregularities in accordance with "Emergency Checklist LSZB"*
- *determining RWY in use*
- *determining VMC/IMC based on the prevailing weather conditions*
- *setting the departure sequence in consideration of ATMM slot and coordination with APP*
- *coordinate IFR departures with APP via TACO*
- *checking of ATC clearances received from APP and transmissions to the flight crew*
- *checking of ATFM slot and APP when limits are exceeded discrepancies occur*
- *issuing startup clearances for IFR, SVFR and NVFR flights*
- *issue advisory service for taxi according AIP CH*
- *updating the control strips with the necessary flight plan data*
- *processing of revisions*
- *support APP as far as practicable*
- *obtaining the departure release from APP*
- *coordination with RC*
- *reporting diversion landings to AIS ZHR and if departed outside Switzerland to ALPAR*
- *monitoring the frequencies on the overhead speakers*
- *managing allocated SSR codes*

- *maintaining the traffic list*
- *checking of the technical installations at the start of the early shift in accordance with the checklist.*

VFR ARRIVALS AND DEPARTURES

VFR arrival and departure procedures are based on the VFR AREA-/VISUAL APPROACH CHART LSZB and the official publication in AIP CH. Deviations from these procedures may be carried out for ATC reasons.

HELICOPTER OPERATIONS

Take-off and landing procedures

There is no officially defined "Final APCH and TKOF area" (FATO) *in LSZB so that the flight path of the current traffic can be adjusted*.

Take-off and landing outside of the runway

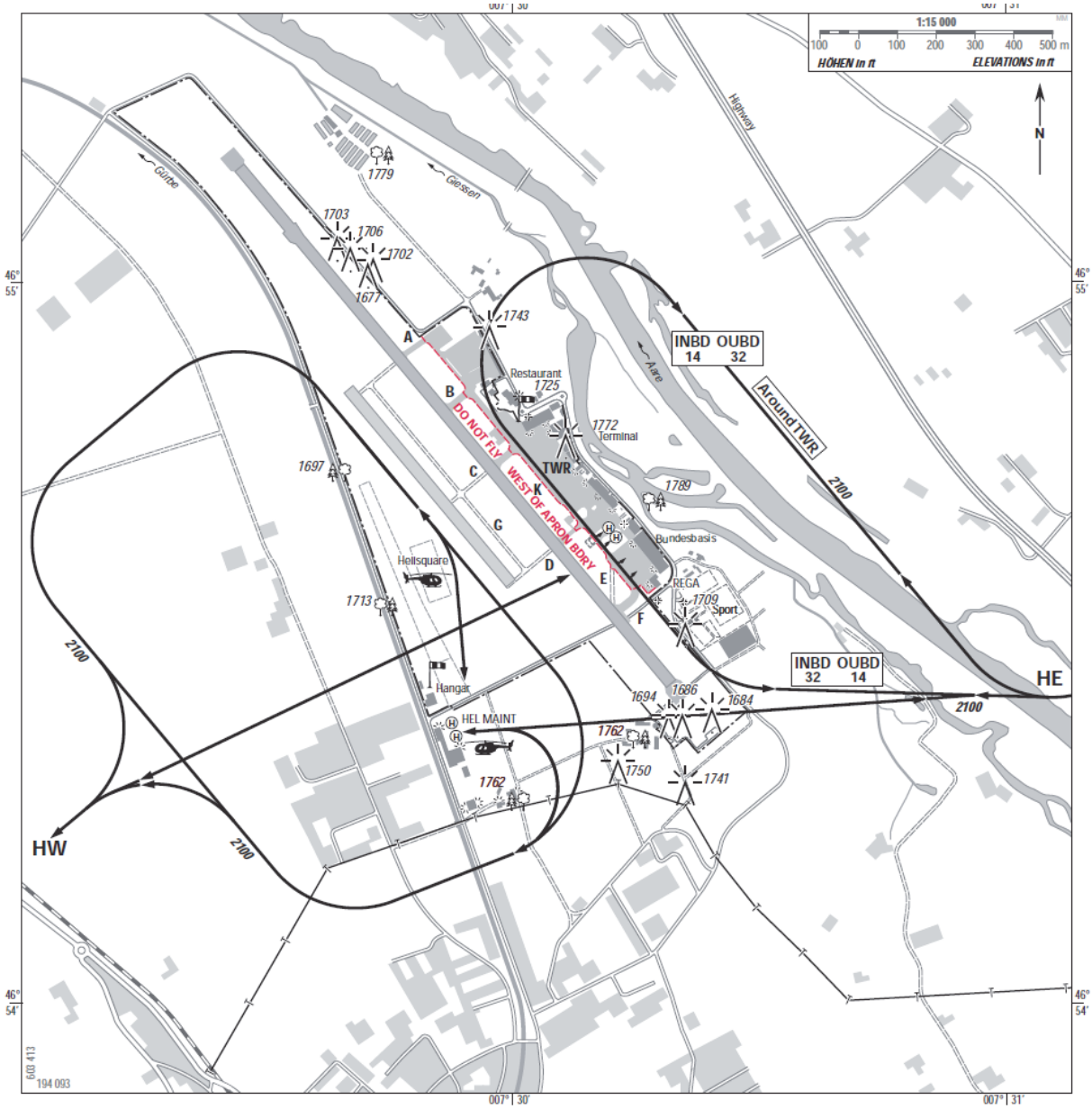
For take-off and landing outside of the runways, an authorization for take-off and landing shall only be issued at own discretion due to missing FATO *(Final area for take-off and landing).*

Example: *HBXQG, WIND 340°, 5 KNOTS, DEPARTURE AT YOUR OWN DISCRETION, LEAVE CTR VIA SCHWARZENBURG.*

Take-off and landing of large helicopters (e.g. AS32 and IFR helicopters should be carried out on the concrete runway, taxiing should be handled similar to fixed-wing aircraft.

Annex 4: Visual Approach Chart for Helicopter Arrival and Departure routes

(handed in as draft to the FOCA on 13 December 2013)



ARR ROUTES:
HOTEL WHISKEY: HW DCT
HOTEL ECHO: HE DCT

DEP ROUTES:
HOTEL WHISKEY: DCT HW
HOTEL ECHO: DCT HE

ARR/DEP
MULTI ENGINE HEL
Use standard VAC for landing on
concrete RWY, Inform TWR on first call.