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Schweizerische Unfalluntersuchungsstelle SUST  
Service d'enquête suisse sur les accidents SESA  
Servizio d'inchiesta svizzero sugli infortuni SISI  
Swiss Accident Investigation Board SAIB

Aviation Division

# **Final Report No. 2221 by the Swiss Accident Investigation Board SAIB**

concerning the serious incident (Airprox)

involving the Airbus A320 aircraft, registration G-EUUD

operated by British Airways  
under flight plan call sign BAW 3ZL

and the Agusta Westland AW139 helicopter,  
registration HB-ZUV

operated by the Federal Office of Civil Aviation  
under flight plan call sign HB ZUV

on 29 May 2012

4 NM west-south-west of Zurich Airport

## General information on this report

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

In accordance with Art 3.1 of the 10<sup>th</sup> edition, applicable from 18 November 2010, of Annex 13 to the Convention on International Civil Aviation of 7 December 1944 and Article 24 of the Federal Air Navigation Act, the sole purpose of the investigation of an aircraft accident or serious incident is to prevent accidents or serious incidents. The legal assessment of accident and serious incident causes and circumstances is expressly no concern of the 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 serious incident, 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.

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## Final Report

### Synopsis

#### Aircraft 1

Owner	LBI Leasing Ltd., United Kingdom (UK)
Operator	British Airways, Harmondsworth, UK
Manufacturer	Airbus S.A.S., Toulouse, France
Aircraft type	A320-232
Country of registration	United Kingdom
Registration	G-EUUD
Flight number	BA 713
Flight plan call sign	BAW 3ZL
Radio call sign	Speedbird three Zulu Lima
Flight rules	Instrument flight rules (IFR)
Type of operation	Scheduled flight
Departure point	Zurich (LSZH)
Destination point	London Heathrow (EGLL)

#### Aircraft 2

Owner	Air Engiadina AG, Samedan, Switzerland
Operator	Swiss Jet AG, Zurich Airport, Switzerland
Manufacturer	Agusta Westland, Costa di Samarate, Italy
Aircraft type	Agusta Westland AW139
Country of registration	Switzerland
Registration	HB-ZUV
Flight plan call sign	HB ZUV
Radio call sign	Hotel Bravo Zulu Uniform Victor
Flight rules	IFR
Type of operation	Private, training flight
Departure point	Zurich (LSZH)
Destination point	Les Eplatures (LSGC)
Location	4 NM WSW Zurich Airport
Date and time	29 May 2012, 12:03 UTC
ATS unit	Zurich aerodrome control
Airspace	Class C
Minimum separation of the aircraft	0.24 NM horizontally and 750 ft vertically
Minimum prescribed separation	3 NM horizontally or 1000 ft vertically
AIRPROX category	ICAO category A - high risk of collision

## Investigation

The serious incident occurred on 29 May 2012 at 12:03 UTC. The notification was received on 30 May 2012 at approx. 11:10 UTC. The investigation was opened on 5 June 2012.

The SAIB notified the serious incident to the UK authorities. The UK appointed an authorised representative. The investigation report is published by the Swiss Accident Investigation Board (SAIB), Aviation Division.

## Summary

On 29 May 2012 at 11:58:27 UTC the AW139 helicopter, registration HB ZUV, reported to Zurich aerodrome control that it was ready for an instrument flight to Les Eplatures. The aerodrome controller then cleared the crew of HB-ZUV to take off from the Heliport West and to follow standard instrument departure (SID) Willisau 2Q. At 11:59:09 UTC the crew of the British Airways Airbus A320 commercial aircraft with the flight plan call sign BAW 3ZL reported to aerodrome control short of runway 28 ready for take-off and received clearance to roll to the take-off position on runway 28. At 12:00:43 UTC they received take-off clearance and followed their assigned standard instrument departure VEBIT 3W. The crew of HB-ZUV was informed by the aerodrome control (ADC) air traffic controller of the departing A320 and then reported visual contact with the Airbus. The two aircraft were initially on a parallel heading, in a westerly direction. Following the SID, the crew of BAW 3ZL, shortly after initiating the left turn, received a resolution advisory from their traffic alert and collision avoidance system (TCAS). They then increased their rate of climb in accordance with the resolution advisory and halted the left turn. The crew of helicopter HB-ZUV initiated a descent. The two aircraft crossed at a lateral distance of 0.24 NM and an altitude difference of 750 ft.

## Causes

The serious incident is attributable to the fact that the air traffic control officer underestimated the speed and climbing performance of a helicopter, which resulted in a dangerous convergence with a commercial aircraft which had taken off after the helicopter, involving a high risk of collision.

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

- The air traffic control officer had little experience in handling the SID WIL 2Q and with helicopters in IFR-operation.
- The air traffic control officer was mistaken in his assessment of the situation, because he made this assessment exclusively according to sight and without using the tool available (radar display).

## Safety recommendations

In the context of the investigation, no safety recommendations were issued.

## 1 Factual information

### 1.1 Pre-flight history and history of the serious incident

#### 1.1.1 General

The recordings of the radio communication, radar data and the stored data from the traffic alert and collision avoidance system (TCAS) as well as the statements of crew members and air traffic controllers were used for the following description of the pre-flight history and history of the serious incident.

On aircraft BAW 3ZL the commander was pilot flying (PF) and the copilot was pilot not flying (PNF); on helicopter HB-ZUV the second pilot in the right hand seat was pilot flying and the commander in the left hand seat was pilot not flying.

Air traffic control was conducted from Zurich aerodrome control centre's aerodrome control (ADC) workstation.

Both flights took place under instrument flight rules.

#### 1.1.2 Pre-flight history

All four workstations envisaged for the shift in the Zurich control tower were occupied.

The pilot of helicopter HB-ZUV planned to make two flights that day, one in the morning and one in the afternoon. For this purpose he asked the airport authority of Zurich airport for clearance to take off in each case directly from the Swissjet hangar. Since the Swissjet company's hangar and apron lay outside the official airport site, helicopter movements in this area were subject to approval and limited to single movements per day. The airport authority refused further take-offs directly from the Swissjet hangar. The pilot therefore first rolled to the Heliport West and started his flights from there. During the flight in the morning he acted as inspector during another crew's examination.

The flight of HB-ZUV in the afternoon was intended to maintain his own flight training on this aircraft within the framework of his activities as an inspector for the Federal Office of Civil Aviation (FOCA). On this flight, he acted as pilot not flying (PNF) and left the controls to the second pilot.

#### 1.1.3 History of the serious incident

In the afternoon of 29 May 2012, the crew of helicopter HB-ZUV reported from Heliport West to Zurich delivery and requested clearance for an IFR flight to Les Eplatures. The commander contacted the clearance delivery (CLD) control officer and requested a standard instrument departure from heliport West. After consultation with the supervisor this was approved and SID Willisau 2Q from runway 16 was assigned to the crew of HB-ZUV. This SID initially follows the runway 16 centreline and then makes a right turn towards WIL VOR.

The aerodrome control (ADC) air traffic control officer was informed of the impending take-off of HB-ZUV. Since there was a gap of a few minutes in the IFR departure traffic, the ADC air traffic control officer tried several times between 11:51:43 UTC and 11:57:16 UTC to establish radio contact with the crew of HB-ZUV in order to allow the helicopter to take off during the gap in departure traffic, thus avoiding delays to other traffic. The crew of HB-ZUV reported ready for take-off at 11:58:27 UTC and received take-off clearance from the ADC air traffic control officer immediately: *"Hotel Uniform Victor, roger, depart own discretion heliport, three four zero degrees three knots, and join the Willisau two Quebec de-*

*parture and follow the standard departure route".* This clearance was confirmed by the crew of HB-ZUV.

In principle, for chronological separation of departures, the tower approach coordination (TACO) system is used. This system proposes time intervals between consecutive departures. The air traffic control officer (ATCO) in charge can adapt these intervals according to the situation and the environmental factors. The time interval may be shortened by coordination between aerodrome and departure control, in order to cope with special cases or to improve efficiency.

A few seconds after HB-ZUV took off, the crew of a British Airways Airbus A320 with the call sign "Speedbird three Zulu Lima" reported to the ADC air traffic control officer (ATCO) at 11:59:04 UTC that they were short of runway 28 and ready for take-off and received clearance to roll to the take-off position on runway 28. The ADC air traffic control officer observed the progress of helicopter HB-ZUV which had taken off approximately two minutes before and ascertained that the latter was still following the centreline of runway 16. In agreement with the ground (GRO) control officer and the departure (DEP) control officer, he decided to allow BAW 3ZL to take off; assuming that the Airbus A320 would be higher than the helicopter within a short time and that the crossing of the two SIDs would not represent a conflict. He therefore cleared the crew of BAW 3ZL for take-off at 12:00:43 UTC: "*Speedbird three Zulu Lima, wind zero... three six zero degrees three knots, runway two eight cleared for take off.*" The crew of BAW 3ZL initiated the take-off and after lift-off followed SID VEBIT 3W.

At 12:01:03 UTC, the ADC air traffic control officer gave the crew of HB-ZUV the following traffic information: "*Helicopter Uniform Victor, traffic is an Airbus departing on two eight, will overtake you on the right side*", which was confirmed as follows: "*looking out, Helicopter Uniform Victor.*" At 12:01:42 UTC the crew of HB-ZUV reported: "*Airbus in sight, Helicopter Uniform Victor.*" Meanwhile, the ground air traffic control officer had coordinated a higher flight level for BAW 3ZL with departure control, to enable it to pass an altitude of 5000 ft quickly. At 12:01:49 UTC, the ADC air traffic control officer therefore gave the crew of BAW 3ZL clearance to climb to flight level (FL) 120, and then gave traffic information: "*Speedbird three Zulu Lima, helicopter is joining behind you, has you in sight, no factor.*"

The ADC air traffic control officer observed according to sight the two aircraft and was of the view that the Airbus A320 would easily have climbed above the helicopter before the crossing of the two SIDs. The relatively large helicopter AW139 still seemed to him to be fairly close to the airport. He refrained from consulting the radar display in this phase.

At 12:02:57 UTC, BAW 3ZL had acquired a heading of 197 degrees in the left turn; the TCAS computer on BAW 3ZL issued a resolution advisory (RA) of the type '*climb climb*', requiring a rate of climb of 1500 - 2000 ft/min. Approximately at the same time the ATCO, after a glance on the radar display, recognized that a conflict had arisen. For this reason he asked the helicopter crew at 12:02:58 UTC whether they had the Airbus in sight: "*Helicopter Uniform Victor, confirm you have the Airbus xxx in sight?*" At 12:03:01 UTC, the crew of BAW 3ZL reported as follows: "*Speedbird three Zulu Lima, TCAS RA.*" The traffic alert and collision avoidance system (TCAS) had issued the resolution advisory (RA) "*climb, climb*", which was shortly thereafter downgraded to "*adjust vertical speed, adjust*". The crew managed briefly to establish visual contact with helicopter HB-ZUV. Aircraft BAW 3ZL was at this time accelerating at a reduced rate of climb in order to retract its flaps. The PF disengaged the autopilot and controlled the aircraft manually. For a short time he continued the left turn which had been initiated and then made a transition to a straight climb, resulting in BAW 3ZL flying towards helicopter HB-ZUV.



According to their statements, the crew of HB-ZUV had visual contact with the Airbus A320. When the latter initiated a left turn on the SID and moved rapidly towards HB-ZUV, its PF decided at 12:03:07 UTC to leave 5000 ft and to initiate a descent, which was carried out at a rate of descent of approximately 1500 ft/min and continued to 4500 ft above mean sea level (AMSL).

At 12:03:17 UTC the two aircraft crossed at a lateral distance of 0.24 NM and an altitude difference of 750 ft (cf. Figure 2). After the crossing, the crew of BAW 3ZL continued to fly for approximately 2 NM on a southerly heading, before they initiated a right turn towards waypoint BREGO and returned to the SID VEBIT 3W. Helicopter HB-ZUV continued to follow SID Willisau 2Q. Both aircraft continued their flights to their destination points.

#### 1.1.4 Location of the serious incident

Position	4 NM west-south-west of Zurich Airport
Date and time	29 May 2012, 12:03 UTC
Lighting conditions	Daylight
Height above sea level or flight level	5000 ft AMSL

## 1.2 Personnel information

### 1.2.1 Crew of BAW 3ZL

#### 1.2.1.1 Commander

##### 1.2.1.1.1 General

Person	UK citizen, born 1964
Licence	Airline transport pilot licence aeroplane – ATPL(A) according to joint aviation requirements (JAR), issued by the UK Civil Aviation Authority.
Ratings	Type rating Airbus A320, valid till 31 July 2012.
Instrument rating	Instrument rating aircraft IR(A) Instrument approaches on Airbus A320, last extended on 14 July 2011, valid till 31 July 2012.
Last proficiency check	Line check on 11 November 2011 Licence proficiency check on 14 July 2011 Operator proficiency check on 28 January 2012
Training regarding ACAS	Initial ACAS training in January 1989 recurrent ACAS training on 28 January 2012
Medical fitness certificate	Class 1, restrictions: VDL (shall wear corrective lenses and carry a spare set of spectacles) Start of validity: 29 December 2011, end of validity: 5 January 2013.
Last medical examination	29 December 2011
Commencement of pilot training	November 1989

1.2.1.1.2	Flying experience	
	Total	15 700 hours
	on the type involved in the incident	2500 hours
	during the last 90 days	209 hours
	of which on the type involved in the incident	209 hours
	during the last 24 hours	3:36 hours
	of which on the type involved in the incident	3:36 hours
1.2.1.1.3	Duty times	
	Start of duty in the 48 hours before the serious incident	27 May 2012, 10:30 UTC 28 May 2012, off duty 29 May 2012, 05:00 UTC
	End of duty in the 48 hours before the serious incident	27 May 2012, 21:44 UTC 28 May 2012, off duty
	Flight duty times in the 48 hours before the serious incident	27 May 2012, 11:14 hours 28 May 2012, off duty
	Rest times in the 48 hours before the serious incident	27 May to 29 May 2012, > 24 hours
	Flight duty time at the time of the serious incident	7:03 hours
1.2.1.2	Copilot	
1.2.1.2.1	General	
	Person	UK citizen, born 1983
	Licence	Commercial pilot licence aeroplane – CPL(A) according to JAR, issued by the UK Civil Aviation Authority.
	Ratings	Type rating Airbus A320, valid till 31 July 2012.
	Instrument rating	Instrument rating aircraft IR(A) Instrument approaches on Airbus A320, last extended on 16 July 2011, valid till 31 July 2012.
	Last proficiency check	Line check on 15 June 2010 Licence proficiency check on 9 July 2011 Operator proficiency check on 9 July 2011
	Training regarding ACAS	Initial ACAS training in May 2008 recurrent ACAS training am 9. Juli 2011
	Medical fitness certificate	Class 1, restrictions: none. Start of validity: 1 May 2011, end of validity: 31 July 2012.
	Last medical examination	1 May 2011
	Commencement of pilot training	October 2006

1.2.1.2.2	Flying experience	
	Total	2721 hours
	on the type involved in the incident	2615 hours
	during the last 90 days	195 hours
	of which on the type involved in the incident	195 hours
	during the last 24 hours	1:40 hours
	of which on the type involved in the incident	1:40 hours
1.2.1.2.3	Duty times	
	Start of duty in the 48 hours before the serious incident	27 May 2012, 10:45 UTC 28 May 2012, off duty 29 May 2012, 05:15 UTC
	End of duty in the 48 hours before the serious incident	27 May 2012, 21:30 UTC 28 May 2012, off duty
	Flight duty times in the 48 hours before the serious incident	27 May 2012, 10:45 hours 28 May 2012, off duty
	Rest times in the 48 hours before the serious incident	27 May to 29 May 2012, > 24 hours
	Flight duty time at the time of the serious incident	6:48 hours
1.2.2	Crew of HB-ZUV	
1.2.2.1	Commander	
1.2.2.1.1	General	
	Person	Swiss citizen, born 1962
	Licence	Airline transport pilot licence helicopter (ATPL(H)) according to the European Aviation Safety Agency (EASA), issued by the FOCA on 31 August 2007.
	Ratings	Type rating A139, valid till 31 January 2013, with instructor rating for single-pilot operation (type rating instructor TRI(H)SP) A139, valid till 31 January 2013. Type rating A139 MP PIC, valid till 31 December 2012, with instructor rating for multi-pilot operation (type rating instructor TRI(H)MP) A139, valid till 31 January 2013.
	Instrument rating	Instrument rating helicopter IR(H) Category I instrument approaches on A139, valid till 31 January 2013. Category I instrument approaches on A139 MP PIC, valid till 31 December 2012.

	Last proficiency check	Licence proficiency check on 17 January 2012.
	Training regarding ACAS	Initial ACAS training on the occasion of acquisition of type rating Cessna C560XL recurrent ACAS training in June 2012 on aircraft simulator Cessna C750.
	Medical fitness certificate	Class 1, restrictions: none Start of validity: 6 October 2011, end of validity: 23 October 2012.
	Last medical examination	6 October 2011
	Commencement of pilot training on helicopters	1980
	All information available indicates that the pilot started his flight rested and healthy. There are no signs that at the time of the serious incident fatigue had played a role.	
1.2.2.1.2	Helicopter flying experience	
	Total	8472 hours
	on the type involved in the incident	276 hours
	during the last 90 days	78:31 hours
	of which on the type involved in the incident	7:03 hours
	during the last 24 hours	00:58 hours
	of which on the type involved in the incident	00:58 hours
1.2.2.2	Second pilot	
1.2.2.2.1	General	
	Person	French citizen, born 1965
	Licence	Commercial pilot licence helicopter (CPL(H)) according to JAR, issued by the FOCA on 21 December 2007.
	Ratings	Type rating A139, expired on 22 December 2011.
	Instrument rating	Instrument rating helicopter (IR(H)) Instrument approaches IR Cat I on A139, expired on 22 December 2011.
	Last proficiency check	January 2011
	Training on ACAS	None
	Medical fitness certificate	Class 1 for single pilot operation, restrictions: none. Start of validity: 4 May 2012, end of validity: 30 November 2012.
	Last medical examination	4 May 2012
	Commencement of pilot training	Helicopter: 1985

All information available indicates that the pilot started his flight rested and healthy. There are no signs that at the time of the serious incident fatigue had played a role.

#### 1.2.2.2 Helicopter flying experience

Total	14 000 hours
on the type involved in the incident	unknown
during the last 90 days	150 hours
of which on the type involved in the incident	0 hours

#### 1.2.3 Air traffic control personnel

##### 1.2.3.1 ADC air traffic control officer

###### 1.2.3.1.1 General

Function	Aerodrome control (ADC)
Person	Swiss citizen, born 1979
Duty days before the day of the incident	27 May 2012, off duty 28 May 2012, 13:10 - 20:10 UTC
Start of duty on the day of the incident	29 May 2012, 11:15 UTC
Licence	Air traffic control officer licence based on European Community Directive 2006/23, first issued by the FOCA on 17 July 2003, valid till 13 August 2013. English Level 5, valid till 8 July 2014
Relevant ratings	ADI, LSZH TWR valid till 13 August 2013
Medical fitness certificate	Class 3, no restrictions, valid till 13 August 2013.

###### 1.2.3.1.2 Additional Information

The ATCO stated that in his eight years of work he had only once given the SID WIL 2Q to an aircraft. He further stated that air traffic services in Zurich do generally have poor experience with helicopters in IFR operation.

### 1.3 Aircraft information

#### 1.3.1 BAW 3ZL

Registration	G-EUUD
Aircraft type	Airbus A320-232
Characteristics	Twin-jet short-haul and medium-haul aircraft
Manufacturer	Airbus S.A. S., Toulouse, France
Year of manufacture	2002
Owner	LBI Leasing Ltd. United Kingdom
Operator	British Airways

	Relevant equipment	TCAS II
1.3.2	HB-ZUV	
	Registration	HB-ZUV
	Aircraft type	Agusta Westland AW139
	Characteristics	Twin-engine multi-purpose helicopter with max. 14 seats
	Manufacturer	Agusta Westland, Costa di Samarate, Italy
	Year of manufacture	2009
	Owner	Air Engiadina AG, Samedan, Switzerland
	Operator	Swiss Jet AG, Zurich Airport, Switzerland
	Relevant equipment	Traffic advisory system (TAS)



**Figure 1:** Picture of HB-ZUV for purposes of illustration

## 1.4 Meteorological information

### 1.4.1 General meteorological situation

Switzerland was on the eastern edge of a shallow high pressure ridge which extended from Iceland over the British Isles as far as Madeira.

### 1.4.2 Weather at the time of the serious incident

The weather was dry and mainly sunny with 2/8 cloud in the form of towering cumulus.

### 1.4.3 Astronomical information

Position of the sun	Azimuth: 202°	Elevation: 63°
Lighting conditions	Daylight	

#### 1.4.4 Aerodrome meteorological reports

In the period from 11:50 UTC up to the time of the serious incident, the following aerodrome routine meteorological report (METAR) was valid:

*METAR LSZH 291150Z VRB03KT 9999 FEW055TCU 24/11 Q1015 NOSIG*

In clear text, this means:

On 29 May 2012, shortly before the 11:50 UTC issue time of the aerodrome meteorological report, the following weather conditions were observed at Zurich Airport:

Wind	Wind direction variation greater than 180 degrees, 3 kts
Meteorological visibility	10 km or over
Precipitation	None
Cloud	1 – 2/8 towering cumulus at 5500 ft AAL
Temperature	24 °C
Dewpoint	11 °C
Atmospheric pressure (QNH)	1015 hPa, pressure reduced to sea level, calculated using the values of the ICAO standard atmosphere
Landing weather forecast	No significant change expected.

The convergence took place at a pressure altitude of approximately 4900 ft, i.e. below the cloud base. According to an eye-observation at Zurich airport, meteorological visibility was 30 km.

### 1.5 Communications

The communications between air traffic control and the crews involved in the serious incident took place without any problems.

### 1.6 Aerodrome and airspace information

#### 1.6.1 General

Zurich Airport is in north-east Switzerland.

The Zurich Airport runways have the following dimensions:

Runway	Dimensions	Elevation of runway thresholds
16/34	3700 x 60 m	1390/1386 ft AMSL
14/32	3300 x 60 m	1402/1402 ft AMSL
10/28	2500 x 60 m	1391/1416 ft AMSL

The reference elevation of the airport is 1416 ft AMSL and the reference temperature is 24.0 °C.

The heliport is located at the west of the airport between runways 28 and 16.

#### 1.6.2 Runway equipment

Zurich Airport is characterised by a system of three runways; two of these runways (16 and 28) cross at the airport reference point. The approach route of two

other runways (16 and 14) intersect approximately 850 metres north-west of the threshold of runway 14.

### 1.6.3 Standard instrument departure routes

The two aircraft involved in the serious incident were assigned the following standard instrument departures (SIDs):

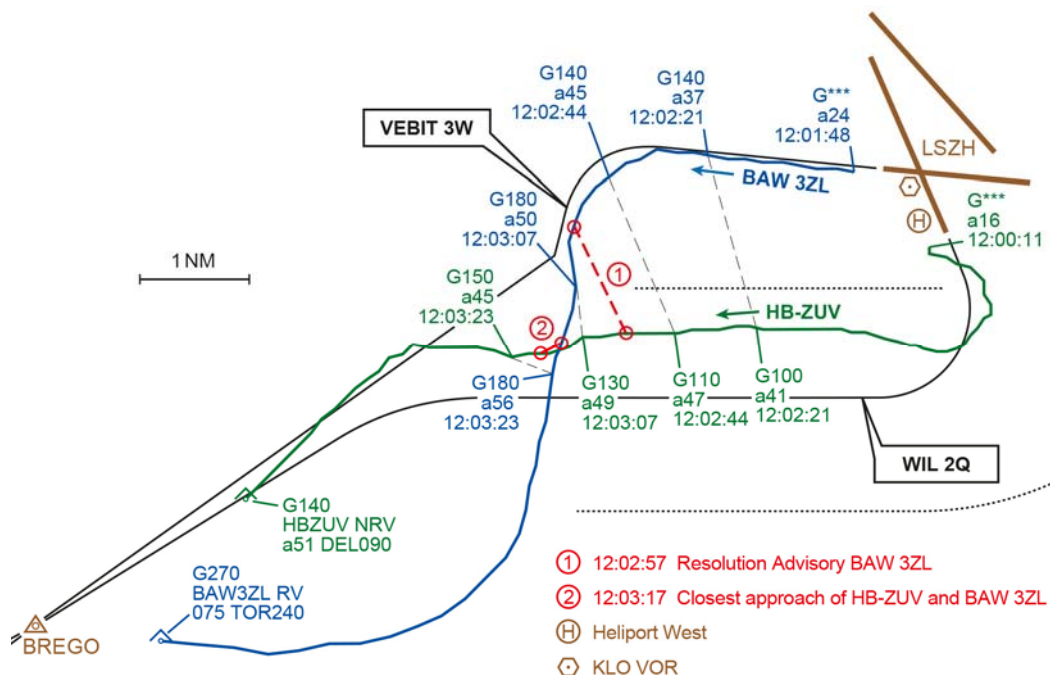
VEBIT 3W: (BAW 3ZL)

*Climb straight ahead. At D2.3 KLO turn left. Intercept R055 WIL. Proceed via BREGO, ZH554, ZH558 to VEBIT. Initial climb clearance 5000 ft. Cross BREGO at 5000 ft or above, ZH554 at 6000 ft or above, ZH558 at 7000 ft or above. When instructed, contact Zurich DEP 125.950.*

WIL 2Q: (HB-ZUV)

*Climb straight ahead. Short visual right turn, but not before D1 KLO or when instructed by ATC. Turn within 3 NM of KLO. Establish TR270 to intercept R055 WIL. Proceed via BREGO, ZH555, ZH551 to WIL. Initial climb clearance 5000 ft, maintain visual ground contact to 4400 ft. Cross BREGO at 5000 ft or above, ZH555 at 6000 ft or above, ZH551 at 7000 ft or above. When instructed contact Zurich DEP 125.950.*

Standard instrument departure route WIL 2Q is an SID which is very seldom assigned; it is assigned only to propeller-driven aircraft and exclusively when visibility is good. The right turn after take-off is flown visually and takes place between 1 and 3 NM from KLO VOR.



**Figure 2:** The two nominal flight paths SID VEBIT 3W und WIL 2Q from Zurich airport are shown in black lines. The black dotted lines show the corridor borderlines as part of the SID WIL 2Q, based on the SID specification. The flightpath of HB-ZUV is shown as green line and the flightpath of BAW 3ZL as blue line. The radar labels consist of three lines that include the following information: first line: ground speed in knots; second line: altitude in hundreds of feet; third line: time in UTC. The red dotted lines show the point of time of the TCAS resolution advisory (RA) triggering in aircraft BAW 3ZL ①, respectively the point of time of the minimal distance between the two aircraft ②.



## 1.7 Organisational and management information

### 1.7.1 Operator Swiss Jet AG

#### 1.7.1.1 General

At the time of the serious incident the Swiss Jet AG company operated two Agusta Westland AW139 helicopters. Four other Agusta Bell AB139 helicopters of a structurally identical type were operated by another company, mainly abroad.

#### 1.7.1.2 Training of Federal Office of Civil Aviation inspectors

In order to maintain the training level of the inspectors of the Federal Office of Civil aviation, two inspectors had access to the Swiss Jet AG company's two AW139 helicopters. There was a verbal agreement on the leasing of the two AW139s between Swiss Jet AG and the Swiss Federal Office of Civil aviation. The two inspectors had access to these at any time, provided the helicopters were not on Swiss Jet AG missions, in order to maintain their level of training.

#### 1.7.1.3 Operation of helicopters with one or two pilots

The helicopter type AW139 can be flown in visual and instrument flight mode either with a multi-pilot crew (MP), or in single-pilot (SP) operation. For operation with a multi-pilot crew, both pilots must possess an AW139 type rating with a rating for MP operation. Most of the Swiss Jet AG pilots had the rating to fly the AW139 type as commander in single-pilot operation; a few pilots had the rating to fly the AW139 as a two-pilot crew. According to information provided by Swiss Jet AG, however, the AW139s were always operated with two pilots, in which case the second pilot did not have to possess a valid type rating but only had to be listed on the pilot roster in the Swiss Jet AG flight operations manual.

The Swiss Jet AG general flight operations manual (FOM), Revision 30 dated 5 April 2012 states the following, among other things [translated from German]:

*"2.3 Minimum crew, general: the minimum crew depends on the AFM of the corresponding aircraft type.*

*2.4. VFR minimum crew: 1 pilot. VFR flights with passengers are made with two pilots as required.*

*2.5. IFR minimum crew: 1 pilot. IFR flights with passengers are made with two pilots as required."*

On the flight on 29 May 2012 which involved the serious incident, the pilot flying, in the right-hand seat, was a part-time pilot for Swiss Jet AG. He had an A139 single-pilot type rating which had expired on 22 December 2011 and an instrument flight rating for the AW139 type which had expired on the same date. He was not in possession of a type rating to operate the AW139 in two-pilot operation and had never acquired one previously.

The pilot in the left-hand seat had both a valid AW139 SP and MP type rating, as well as a rating as a flight instructor for helicopters, for both single- and multi-pilot operation (TRI(H) SP / TRI(H) MP).

### 1.7.2 Air navigation services provider skyguide

Clarifications within the air navigation services provider skyguide showed that according to cadre members and safety department representatives it is common practice in aerodrome control to use the radar system only in restricted visibility. Traffic in the vicinity of the aerodrome is handled mainly according to sight. This practice was also ascertained in other investigations.

## 1.8 Information on safety nets

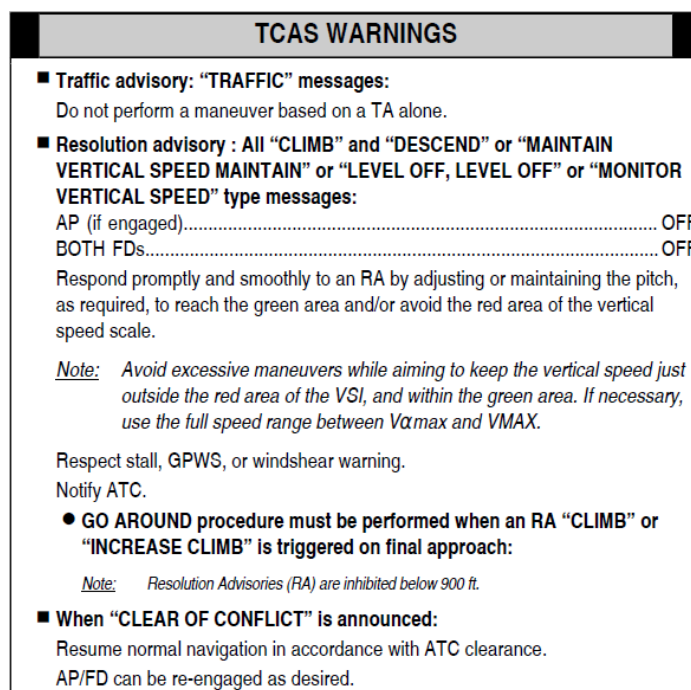
### 1.8.1 Aircraft-based traffic alert and collision avoidance systems

#### 1.8.1.1 Commercial aircraft BAW 3ZL

The British Airways Airbus A320 registration G-EUUD was equipped with a traffic alert and collision avoidance system (TCAS) manufactured by Honeywell. After the take-off from runway 28, the flight path of BAW 3ZL was initially to the west, i.e. parallel to the flight path of helicopter HB-ZUV. At the beginning of the left turn approximately 2 nautical miles after passing the end of runway 28, BAW 3ZL began to converge rapidly with HB-ZUV; the flight paths now had a point of intersection. When in the course of the left turn the TCAS computer's flight path extrapolations indicated that the vertical distance between the two aircraft at the closest point of approach (CPA) would fall below a minimum value, the TCAS initially triggered a traffic advisory "traffic traffic". This then rapidly changed to a resolution advisory, which specified an upward direction for the evasive action with the aural command "climb climb" and indicated the rate of climb of 1500-2000 ft/min to be achieved by means of a superimposed red and green area on the vertical speed display. The commander of BAW 3ZL, acting as pilot flying, disengaged the autopilot and the flight director and immediately obeyed the resolution advisory.

At the time when the autopilot and flight director were disengaged, BAW 3ZL was in a left turn to intersect with radial 055 inbound to the VOR Willisau. In the course of the vertical avoiding manoeuvre, the aircraft maintained its current bank angle for longer than was necessary for intersecting with the WIL R055 inbound, and therefore turned a further 15° to the south (or to the left) and was no longer following the SID.

According to the aircraft manufacturer, the instructions shown in Figure 3 apply; they must be memorised by the crew.



**Figure 3:** Excerpt from the quick reference handbook of the Airbus A320 commercial aircraft type involved in the serious incident, in relation to dealing with TCAS alerts. This procedure published by the aircraft manufacturer is identically published in the operator's documents.

This procedure does not provide information about the case in which a TCAS resolution advisory occurs in a turn.

#### 1.8.1.2 Helicopter HB-ZUV

The AW139 helicopter HB-ZUV was equipped with a Honeywell type KTA 970 traffic advisory system (TAS). Such a system meets the requirements of a TCAS I. The main difference from the TCAS II is that a TAS issues only traffic advisories but not resolution advisories.

According to the KTA 970's operating instructions this serves the following purpose:

- *"The KTA 970 is approved for VFR and IFR operation as an aid to visually acquiring traffic.*
- *The pilot must maneuver the helicopter based only on ATC guidance or positive visual acquisition of the conflicting aircraft."*
- *As a reaction to both the TRAFFIC alert appearing in the PFD and the corresponding aural alert "traffic traffic" the following is required: "The crew should attempt to gain visual contact with the intruder and be prepared to manoeuvre upon visual acquisition."*

The device is configured such that, if the current flight path were to be maintained, the "traffic traffic" alert is triggered 30 seconds before the vertical distance to the approaching aircraft would fall below 800 feet.

The TAS installed in HB-ZUV warned the crew about the approaching BAW 3ZL with the aural alert "traffic traffic". The crew of the helicopter themselves had to determine and assess the position of BAW 3ZL, its direction and its altitude in relation to HB-ZUV, both according to sight, and with help of their navigation display. The HB-ZUV pilot flying, who had established visual contact with the British Airways A320 and who had also been informed of BAW 3ZL by the control tower, initiated a descent of approximately 500 ft, in order to remain below the flight path of BAW 3ZL. The increased rate of climb adopted by the crew of the British Airways Airbus A320 and the descent initiated by the crew of HB-ZUV resulted in a vertical separation of 750 feet at the closest point of approach.

#### 1.8.1.3 TCAS commands when performing a turn

Clarifications during the investigation showed that at the time of the serious incident no procedures, regulations or standards were in force which describe the prescribed behaviour of a crew experiencing a TCAS RA when performing a turn. The TCAS II system gives only vertical resolution advisories intended to ensure that the vertical separation between two aircraft does not fall below a minimum value. If, in the case of a climb resolution advisory, insufficient energy is available to achieve the required rate of climb because the aircraft is performing a turn, it may be appropriate to halt the turn in order to increase the rate of climb. In the present case, everything indicates that the rate of climb required by BAW 3ZL's TCAS could have been achieved even if it was performing a turn.

#### 1.8.2 Ground-based safety nets

Zurich aerodrome control was equipped with a ground-based short term conflict alert system (STCA). This system and its application are described in Part 7, Chapter 14 "SHORT TERM CONFLICT ALERT" of the Air Traffic Management Manual (ATMM) Switzerland. Chapter 14.1 "INTRODUCTION" includes the following:

"The generation of STCA is a function – a "safety net" – based on surveillance data integrated into an ATC system. The objective of the STCA function is to assist the ATCO in preventing collision between aircraft, by generating in a timely manner an alert, of a potential or actual infringement of separation minima.

In the STCA function the current (proximity alarm) and predicted (predicting alarm) three-dimensional positions of aircraft with pressure altitude reporting capability are monitored for proximity. If the distance between the three-dimensional positions of two (or more) aircraft is, or is predicted to be, reduced to less than the defined applicable separation minima within a specified time period, an acoustic and visual alarm will be generated at the CWP(s) where the control of the aircraft involved is accepted ("assumed").

Although STCA and TCAS are independent and non coordinated systems, the two alerts may occur almost simultaneously.

(...)

*Note: STCA does not suggest conflict resolution actions."*

Although the STCA, because of its parameterisation, is not primarily designed for defusing conflicts which occur on arrival at and departure from airports, in this case the system did issue an alert 25 seconds before the dangerous convergence (cf. Figure 4). The STCA alert occurs only visually in the aerodrome control centre but visually and acoustically in the departure control centre.



**Figure 4:** Representation of the situation just before the point of closest approach of the two aircraft according to the legal recording. The above picture serves as illustration of the STCA alert who also was displayed in aerodrome control. The red flight plan call signs and the red directions of movement show the STCA warnings and indicate an impending conflict.

## 2 Analysis

### 2.1 Technical aspects

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

### 2.2 Human and operational aspects

#### 2.2.1 Air traffic control

The ADC air traffic control officer had begun his shift at the ADC workstation approximately 45 minutes before the serious incident. According to his statement, he had experienced the use of standard instrument departure route WIL 2Q only once in his eight years of work. Although the helicopter crew was following the SID correctly, the ADC air traffic control officer had expected the right turn to be made later and therefore a flight path which was further to the south.

After take-off of a helicopter on SID WIL 2Q it is usually necessary to wait for some three to four minutes before a take-off can be made from runway 28, until the helicopter has reached at least 5000 feet. For reasons of efficiency and in agreement with GRO and DEP, the ADC air traffic control officer decided to allow the Airbus holding on runway 28 to take off earlier, on the assumption that within a short time it would be higher than the helicopter. In doing so he underestimated the good climbing performance of the 14-seater AW139 helicopter, which had only two people on board. Though flight BAW 3ZL was early cleared to a greater altitude than the helicopter, it was evidently not taken into account that, in the case of commercial aircraft, for departures from Zurich the rate of climb is normally temporarily reduced around 3000 ft AAL, respectively approximately 4500 ft AMSL, because airspeed is increased in order to be able to retract the flaps.

The ADC air traffic control officer assessed the situation purely visually from the control tower and did not consult his radar display until the conflict happened. In doing so, he was apparently misled by the silhouette of the large helicopter and wrongly believed the latter to be closer to the airport and lower than it actually was. He was convinced, until shortly before the serious incident, that BAW 3ZL would have a sufficient altitude margin at the intersection of the standard instrument departure route with that of HB-ZUV. At 12:02:10 UTC, approximately one minute before the serious incident, he informed the crew of the Airbus about the helicopter: "*Speedbird three Zulu Lima, helicopter is joining behind you, has you in sight, no factor.*" The radar display showed that at this time the two aircraft were at approximately the same altitude. As cadre members and representatives of skyguide's safety department stated, the radar system is used only in restricted visibility and the traffic in the vicinity of the aerodrome is handled mainly according to sight. It is quite clear that as in visual flight, when a pilot should generally be looking outside, an air traffic control officer handling traffic visually should primarily be looking outside from the control tower. However, the evidently common practice at skyguide of not taking note of the radar system as additive in aerodrome control centre under visual conditions must be scrutinised. The present case clearly indicates that the aerodrome control officer involved allowed himself to be deceived by sensory perceptions and held an incorrect expectation. The illusions of sensory perceptions originate from the usual limitations of human performance. Just as in visual flight, where a pilot, despite good air traffic monitoring, should occasionally consult, for example, engine monitoring instruments, the altimeter or a navigation tool in the cockpit, for an air traffic control officer working visually a radar system is also a tool which can provide information which cannot be acquired merely by looking outside. In the serious incident under investigation,

this approach focusing unilaterally on sensory impressions and the failure to use technical aids which could have corrected the misperceptions, contributed to the occurrence of the dangerous convergence.

The investigation found that helicopters usually depart from Zurich airport via runway 28 when they are being operated under instrument flight rules. This allows simple chronological separation, because the same runway is used as for the other departing traffic. In the present case, however, this would have led to delays, so air traffic control decided to allow a departure from a different runway. Although a highly developed readiness to provide service is to be welcomed, the present case clearly indicates that in this instance air traffic control, in the pursuit of efficiency, went too far, creating a situation which it could no longer control safely.

#### 2.2.2 Procedures

Since the equipment installed in HB-ZUV was not a TCAS but a TAS, the avoiding manoeuvre between BAW 3ZL and HB-ZUV was not coordinated. In the case of avoiding action involving two aircraft equipped with TCAS, the two TCAS computers coordinate which aircraft is to descend and which is to climb, on the basis of the geometry of approach and in some rare cases according to a logic based on priority. If only one of the aircraft involved is equipped with TCAS, and the other is equipped with a transponder capable of altitude reporting (at least Mode C), an avoidance manoeuvre "not agreed between the equipment" takes place, i.e. the aircraft equipped with TCAS, as long as the crew obeys the TCAS resolution advisories, takes avoiding action in the vertical direction which produces the greatest possible vertical separation at the closest point of approach (CPA).

#### 2.2.3 Crew of HB-ZUV

The crew of HB-ZUV consisted of a FOCA inspector in the left-hand seat with a valid type rating for both single-pilot and multi-pilot operation, as well as a rating as flight instructor on this type, again for single- and multi-pilot operation. In the right-hand seat, which is intended for the commander in single-pilot operation, sat a former Swiss Jet AG pilot with an expired rating for single-pilot operation of the AW139 type who was in control of the helicopter during this flight.

Upon departure the crew followed the guidelines of the SID WIL 2Q, whereat due to the high climb rate, the low forward speed and the short-term turn over the required heading of 270 degrees resulted in a flightpath relatively wide north of the nominal flightpath but still within the SID corridor.

The crew of HB-ZUV realised, from traffic information provided by air traffic control, that their flight path would come very close to that of BAW 3ZL. When, in a left turn, they acquired visual contact with the British Airways Airbus A320 turning towards them at almost the same height, they immediately initiated a descent in order to remain below the flight path of the A320. This behaviour is understandable and appropriate and together with the avoiding action by the commercial aircraft meant that at least a minimum vertical distance of 750 feet was achieved at the closest point of approach.

#### 2.2.4 Crew of BAW 3ZL

The crew of BAW 3ZL followed the procedure laid down for a TCAS RA. When the autopilot was disengaged, the aircraft was banking to the left. During the transition to the steeper climb ordered by the TCAS, the pilot flying brought the aircraft into a straight climb. This meant that BAW 3ZL veered away from the

standard instrument departure (SID), which in turn led to a further lateral convergence with HB-ZUV.

The behaviour of the crew corresponded to the procedures as laid down for dealing with TCAS resolution advisories and also to the experience they had acquired previously on flight duty and in the simulator. The pilots had never before experienced or practised a TCAS resolution advisory in a turn. Simulations have shown that the halting of the turn and the subsequent straight climb did not exacerbate the serious incident after triggering of the TCAS RA.

### 3 Conclusions

#### 3.1 Findings

##### 3.1.1 Technical aspects

- Both aircraft were licensed for IFR traffic.
- The investigation did not reveal any indications of any pre-existing technical faults which might have caused the serious incident.

##### 3.1.2 Crew

- There are no indications of the pilots suffering any health problems during the flight involved in the serious incident.

##### 3.1.3 Air traffic control personnel

- The air traffic control officer was in possession of the licences necessary to exercise his activities.
- There are no indications of the air traffic control officer suffering health problems at the time of the serious incident.

##### 3.1.4 History of the flight

- At 11:58:50 UTC helicopter HB-ZUV took off from the Heliport West and followed SID WIL 2Q.
- At 12:00:50 UTC BAW 3ZL took off on runway 28 and followed SID VEBIT 3W.
- The air traffic control officer monitored the two aircraft exclusively visually until the dangerous convergence became apparent.
- Both crews received traffic information from the ADC air traffic control officer about the other aircraft.
- At 12:02:57 UTC the crew of BAW 3ZL received the resolution advisory "*climb, climb*" from their TCAS.
- At 12:03:07 UTC the crew of HB-ZUV decided to initiate a descent and descended to 4500 ft.
- At 12:03:17 UTC the two aircraft crossed at a lateral distance of 0.24 NM and an altitude difference of 750 ft.

##### 3.1.5 General conditions

- Standard instrument departure (SID) WIL 2Q was rarely used, especially by helicopters.
- The aerodrome control officer had a radar system available, which issued warnings.
- The weather conditions had no influence on the serious incident.



### 3.2 Causes

The serious incident is attributable to the fact that the air traffic control officer underestimated the speed and climbing performance of a helicopter, which resulted in a dangerous convergence with a commercial aircraft which had taken off after the helicopter, involving a high risk of collision.

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

- The air traffic control officer had little experience in handling the SID WIL 2Q and with helicopters in IFR-operation.
- The air traffic control officer was mistaken in his assessment of the situation, because he made this assessment exclusively according to sight and without using the tool available (radar display).

**4 Safety recommendations and measures taken since the serious incident****4.1 Safety recommendations**

None.

**4.2 Measures taken since the serious incident**

Skyguide stated that in a sense of "share the experience" all air traffic control officers had been informed about this serious incident by the OZTinfo 02/2013. At the same time they had, based on the present case, pointed out to the problem of IFR helicopter procedures.

Payerne, 29 October 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, 18 December 2014*