

**FINAL REPORT ON THE ACCIDENT
TO THE EUROCOPTER AS355 F1
REGISTERED OO-HSH AND THE
AGUSTA BELL AB206A REGISTERED
OO-SKE IN ANTWERP ON JUNE 25TH
2006**

Ref. AAIU-2006-04-Antwerpen-HSB
Issue date: 23 February 2009
Status: FINAL

Table of Content.

Foreword.....	iii
Synopsis.....	iv
1. Factual information.....	5
1.1. Chronology of the events.....	5
1.2. Injuries to persons.....	7
1.3. Damage to aircraft.....	7
1.4. Other damage.....	8
1.5. Personnel information.....	8
1.6. Aircraft information.....	9
1.7. Meteorological information.....	11
1.8. Aids to Navigation.....	11
1.9. Communication.....	12
1.10. Airport information.....	13
1.11. Flight Recorders.....	14
1.12. Wreckage and Impact information.....	14
1.13. Medical and Pathological information.....	16
1.14. Fire.....	16
1.15. Survival Aspects.....	16
1.16. Test and Research.....	17
1.17. Organizational and management information.....	17
2. Analysis.....	18
3. Conclusions.....	20
4. Safety recommendations.....	21

FOREWORD

This report is a technical document that reflects the views of the investigation team on the circumstances that led to the accident,

In accordance with Annex 13 of the Convention on International Civil Aviation, it is not the purpose of aircraft accident investigation to apportion blame or liability. The sole objective of the investigation and the Final Report is the determination of the causes, and define recommendations in order to prevent future accidents and incidents.

In particular, Article 13 of the Royal Decree of 9 December 1998 stipulates that the safety recommendations made in this report do not constitute any suspicion of guilt or responsibility in the accident.

Unless otherwise indicated, recommendations in this report are addressed to the Regulatory Authorities of the State having responsibility for the matters with which the recommendation is concerned. It is for those Authorities to decide what action is taken.

The investigation was conducted by D. Croon and A. Cloots.
The report was compiled by D. Wintershoven

NOTE: For the purpose of this report, time will be indicated in UTC, unless otherwise specified.

Synopsis

Date and hour of the accident

June 25th 2006, ± 12:55 -13.00 UTC

Aircraft

Type:

- Eurocopter AS355 F1 Ecureuil 2 / Twinstar (OO-HSH)
- Agusta Bell AB206A (OO-SKE)

Accident Location:

Federal police heliport of D'Herbouville Kaai, Antwerp Belgium; 5.8km WNW of EBAW.

Aircraft Owner

Heli Service Belgium

Type of flight

Aerial work

Persons on board

Injuries	Pilot	Passenger	Others	Total
Fatal	0	0	0	0
Serious	1	1	0	2
Minor	1	1	0	2
None	0	0	0	0
Total	2	2	0	4

Abstract.

Two helicopters of Heli Service Belgium (HSB), an AB206A (OO-SKE) and an AS355 (OO-HSH), are positioned and about to take-off at the federal police heliport of D'Herbouville Kaai in Antwerp to broadcast a cycling race.

OO-HSH, positioned at the right side behind OO-SKE, takes off followed immediately by OO-SKE. Due to faulty communication (different communication frequencies) between the pilots on one hand, and between ground crew and pilots on the other hand, neither pilot is aware of the other helicopter's take-off. A slight deviation to the right of OO-SKE leads to a collision of both helicopters; OO-SKE's main rotor tears through the tail boom, vertical fin and the tail rotor of OO-HSH. Because of this, the latter crashed and impacts the wall of a building. The pilot of OO-SKE is able to make an emergency landing.

1. Factual Information

1.1. Chronology of the events

Heli Service Belgium was hired for the aerial filming coverage of the Belgian Championship cycling Race. The circuit is 53 km long and goes through the districts of the city of Antwerp; Merksem, Ekeren, Borgerhout, Deurne, Berchem, Wilrijk, and Hoboken, mostly dense inhabited area.

The helicopters arrived on June 24th on the federal police heliport at the D'herbouville Kaai, in the vicinity of the track, and remained on the heliport during the night.

There were training sessions before the actual flight, each one preceded by a briefing. These sessions, one on the 24th and another on the 25th both with a briefing, were done together with the filming crew and the tower of Antwerp Airport so to prepare as accurately as possible for the event.

The race started on the Grote Markt of Antwerp on the 25th of June at 10:00 UTC and finished on the America lei around 18:00 UTC. The helicopters were supposed to follow the circuit together, starting from 13:00 UTC until the end.

HSB had selected two of their helicopters out of their fleet of 10 helicopters (3 AS355, 1 AS350, 3 (A)B206, 3 R-44) to perform the task;

- OO-SKE; a single engined AB206A
- OO-HSH; a twin engined AS355F1

While OO-HSH had to fly at lower altitude (300 -1000 ft) to serve as filming unit, OO-SKE had to fly at minimum 1000 ft above the Schelde river to serve as a relay unit to which the different filming crews (motorcycles) on the ground and the OO-HSH would send their footage. OO-SKE would send the footage to a reception car on the ground. This configuration is shown below.

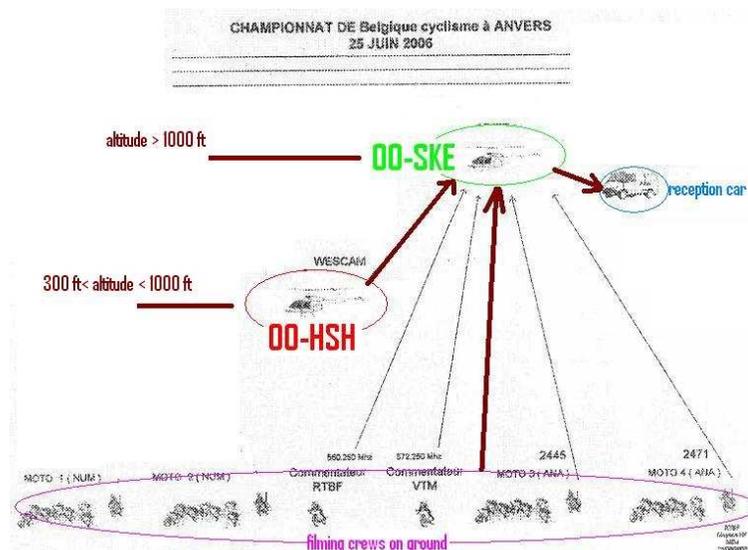


Figure 1: sketch of broadcasting configuration

HSB used the federal police heliport at D'herbouville Kaai in Antwerp located 5.8 km WNW of Antwerp airport (EBAW).

During the briefing between the crews the following take-off procedure was agreed: first the Antwerp tower would be contacted (by phone) for take-off clearance, once in flight the communication between pilots would be on the company frequency of 129.87MHz and on 135.2MHz for communication with the tower. The OO-HSH pilot stated it was agreed to switch to the 128.00MHz channel as soon as they would reach the TRA (temporary reserved area) for further internal communication.

After the briefing before flight, the crew went to their respective helicopters. Each of them was equipped with broadcasting material and had a technician on board. The ground crew was also present at the site.

The pilots performed the pre-flight checks.

OO-HSH was positioned at the right hand side, behind OO-SKE.

The pilot of OO-HSH stated that he had selected 129.87MHz for communication. He notified by radio that he was taking off. He did not get any reply from OO-SKE, and assumed he was still busy performing the pre-flight check so that his radios were still turned off. Subsequently OO-HSH took off.

At that same moment, the pilot of OO-SKE having no vision on OO-HSH as being stationed in front of it, decided to take-off as well. He did so without communicating and with the intension to clear the way for the other helicopter.

During the first seconds of flight, none of the two pilots were aware of the position of the other helicopter.

After a slight deviation to the right, the pilot of OO-SKE heard a brief 'metallic' sound.

Both helicopters collided; OO-SKE's main rotor tore through the tail boom, vertical fin and the tail rotor of OO-HSH. Because of this, the latter began to spin uncontrollably around its yaw axis, impacted the wall of a building with its main rotor and crashed on to the ground. The main rotor was torn off due to the impact. Both engines of OO-HSH caught fire, which was extinguished by the ground crew. OO-SKE was able to make an emergency landing on an open spot.

The crew climbed out of the wreckage and suffered only minor injuries. The pilot of the OO-HSH was seriously wounded, while his passenger escaped with minor injuries.

1.2. Injuries to persons

Injuries	Pilot	Passenger	Others	Total
Fatal	0	0	0	0
Serious	1	1	0	2
Minor	1	1	0	2
None	0	0	0	0
Total	2	2	0	4

1.3. Damage to aircraft

Both helicopters were completely destroyed.



Figure 2: OO-HSH



Figure 3: OO-SKE

1.4. Other damage

The broadcasting equipment of the Belgian broadcasting company (camera, emitters, receivers, ...), on board of both helicopters was destroyed. The wall of the building on which OO-HSH impacted, was slightly damaged (scratched by the main rotor blades).

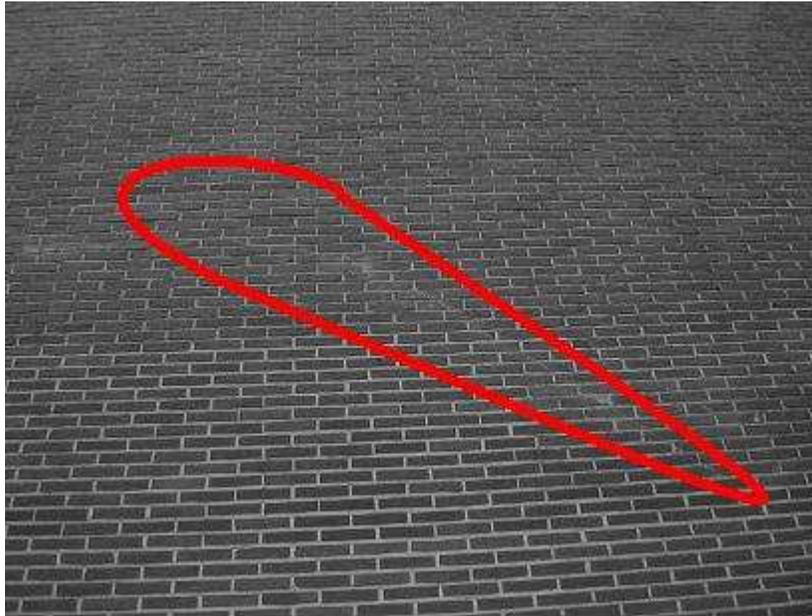


Figure 4: Building wall

1.5. Personnel information

Pilot.

OO-SKE:

Sex: male

Age: 48 years old

Nationality: Belgian

License: commercial helicopter pilot license (CPLH) 100042, delivered on 24/05/2006, valid until 23/11/2007

Medical: class 1, valid until 23/11/2006

The pilot had a total of approximately 20000 flight hours (FH) as a helicopter pilot of which approximately 250 FH on B206. He was licensed to fly AS355, B206, R22, R44, VFR only. He was also a licensed instructor.

OO-HSH:

Sex: male

Age: 52 years old

Nationality: Belgian

License: commercial helicopter pilot license (CPLH) 100212, delivered on 27/02/2006, valid until 31/03/2007

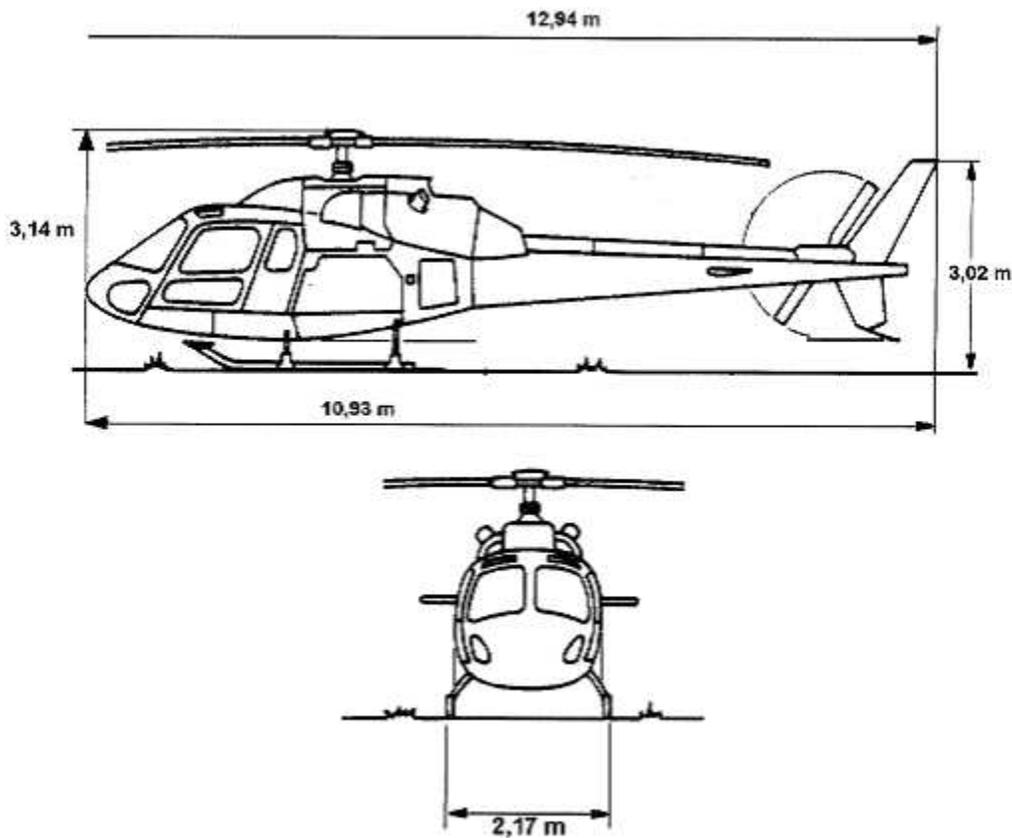
Medical: class 1, valid until 22/12/2006

The pilot had a total of approximately 6650 flight hours (FH) as a helicopter pilot of which approximately 872 FH on AS355. He was licensed to fly AS355, AS350/B3, B206, R22, R44. He was also a licensed instructor.

1.6. Aircraft information

1.6.1 Aerospatiale (Eurocopter); OO-HSH

The AS355 F1 is a twin-engine helicopter with a maximum capacity of 7 (crew and passengers). It is equipped with two Allison 250 C20F turbo shaft engines. The AS355 F1 has a MTOW of 2400kg. The main dimensions are given below.



Airframe

Manufacturer: Eurocopter

Type: AS355 F1

Serial Number: 5157

Built year: 1982

Registration: OO-HSH

Certificate of Registration: 5026, issued on 04/09/2000

Certificate of Airworthiness: 5026

Engine

Manufacturer: 2 Allison

Type: 250 C20F

Total Flight Hours: UNKNOWN

Serial number:

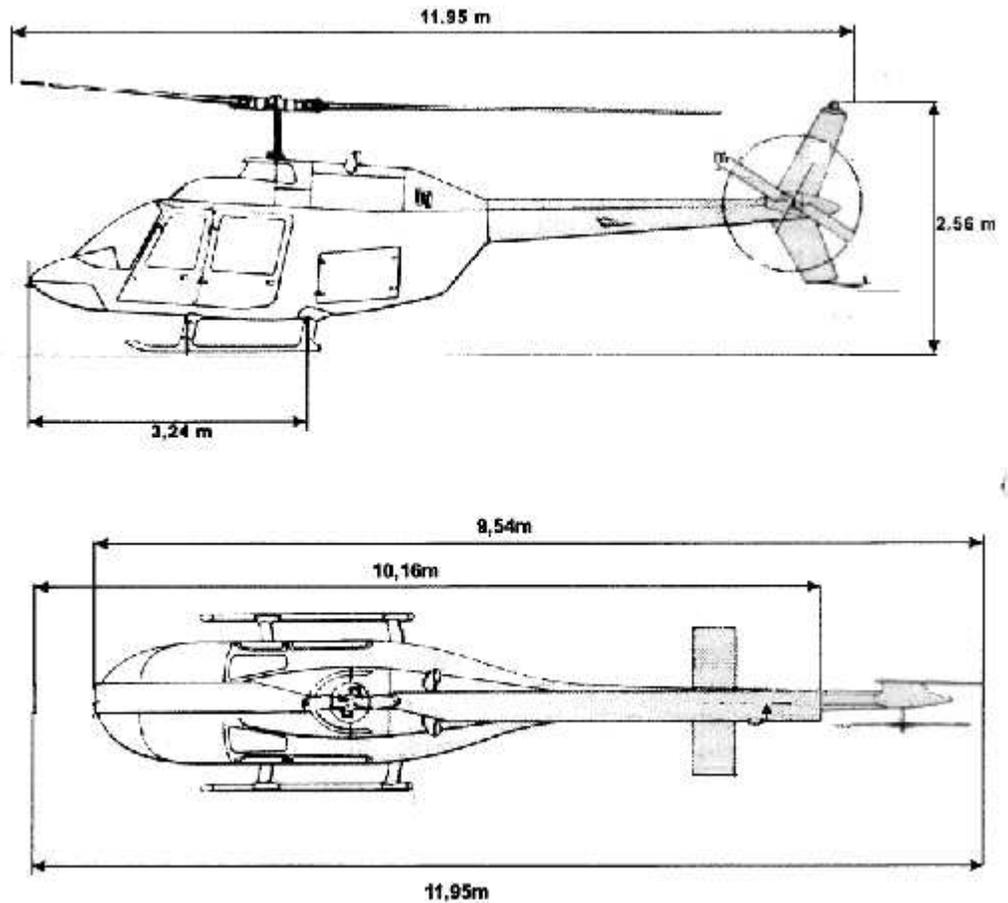
- Engine 1: 840255
- Engine 2: 840265

Owner

Heli Service Belgium HSB

1.6.2 Agusta Bell AB206A; OO-SKE

The AAB206A is a single-engine helicopter with 5 seats (crew and passengers). It is equipped with one Allison 250 C20 turbo shaft engine. The AB206A has a MTOW of 1451,5kg. The main dimensions are given below.



Airframe

Manufacturer: Agusta Bell
Type: AB206A
Serial Number: 8331
Built year: 1972
Registration: OO-SKE
Certificate of Registration: n°2779, issued on 11/ 12/2003
Certificate of Airworthiness: 2779

Engine

Manufacturer: Allison
Type: 250 C20
Total Flight Hours: UNKOWN

Owner

Heli Service Belgium HSB

1.7. Meteorological information

Observed at Antwerp Airport (EBAW); 5.8km ESE of the accident location.

12.50 UTC: a wind blowing at 8KT from 340°, a visibility of 4000m, light rain, mist, few clouds at 2000ft, broken clouds at 3200ft, a temperature of 18 °C with a dew point at 15 °C, an QNH 1012 hPa,

13.20 UTC: a wind blowing at 9KT from 340°, a visibility of 5000m, mist, no significant clouds, a temperature of 18 °C with a dew point at 16 °C, an QNH of 1011 hPa.

According to the Royal Decree of 15/09/1994 art. 71, the weather conditions at 12.50 UTC did not meet the VFR (visual flight rules) requirements (for class A, B, C, D, E, F, G airspace and altitude between 1000-10000ft as well as for class A, B, C, D, E airspace and altitude below 1000ft). These conditions were indeed IMC (instrument meteorological conditions), because the visibility was less than 5000m.

Nevertheless these conditions still allowed the possibility for the ATC to grant permission for a special VFR flight (ground visibility for helicopter at least 800m at adapted speed). This decision would have been entirely up to the tower and may have, or may not have been granted if a request was made.

The meteorological conditions had no immediate impact on the accident.

1.8. Aids to Navigation

Not applicable.

1.9. Communication

Both helicopters were equipped with two radio boxes. This would allow tuning in on the tower frequency, as well as another frequency for communication among pilots simultaneously.

The manager of the cycling race requested the BCAA the setting of a temporary reserved area (TRA) above the event.

The over fly rules of the race were defined from 11.15 UTC until 16.00 UTC.

The no fly zone was defined by the geographical points:

- Schelde (Galgeweel) 511250N042225E
- Berchem (post office) 511201N042605E
- Ring to the south till E19 (Craeybeckstunnel) 511022N042451E
- Crossing A12-R11 511024N042316
- Between GND and
- 3000ft msl (mean sea level)

This was done in order to restrict the over flight of the event to federal police and search and rescue (SAR) operations.

The TRA authorization did not define communication rule within the area.

As the race was also to be broadcasted from the air, HSB was contracted. HSB had therefore requested a deviation to the TRA requirements, in order to be granted access to the TRA, and also a deviation to the Royal Decree of 15/09/1994 art.74 to be allowed to fly at 300ft instead of 1000ft.

The use of the frequency to communicate between pilots was at some point discussed before flight.

According to the OO-HSH pilot the procedure was to call the tower by phone for take-off clearance because there was no direct line of sight and therefore no radio communication possible. Once in flight the helicopters would be in contact with the tower on the official frequency (135.2MHz) and would communicate with each other on their company frequency (129.87MHz). The pilot also states that it was agreed to switch to the 128.00MHz frequency once they would reach the TRA for communication.

However, while one of the pilots (OO-HSH) was tuned in on the radio frequency of the Antwerp tower (EBAW; 135.2MHz) as well as on the company frequency during take-off, it is not clear on which frequency the other pilot was tuned in during take-off.

No take-off or landing in formation was planned. (Note, it is prohibited by art.17 of the Royal Decree of 15/09/1994 to perform take-off and landing in formation.)

Except for the message "OO-HSH is taking off" on the frequency of 129,87 MHz (the company frequency) by the AS355's pilot to which there was no response, there was no form of communication during the flight between the two pilots, nor was there any communication between ground crew and the pilots.

EBAW tower stated never having received any call from the helicopters.

1.10. Airport information

The heliport of d'Herbouvillekaai in Antwerp is property of the Flemish community. It is managed and used by the Federal Police. This heliport is normally used only for State helicopters, and is subsequently not required to be approved by BCAA. It is not a certified civil heliport.

The final approach and take-off area (FATO) measures 31m. The touchdown and lift off area (TLOF) measures 13,5m. The underground of the helipad consists of concrete.

The heliport has two main take-off axes:

- 090° (MAG) with no obstructions.
- 270° (MAG) with 15% obstructions.

The heliport does not comply (section 2.2) with the ICAO/Belgian requirements for a permanent heliport, which needs at least two take-off axes without obstructions (Royal Decree 24/12/1970).

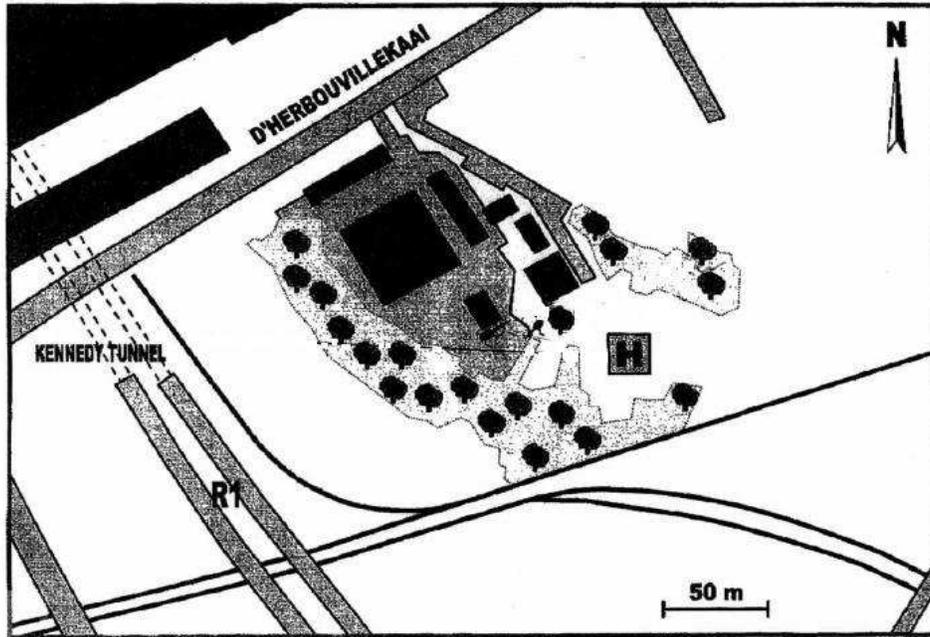
However, the heliport does comply with the ICAO/Belgian requirements (Royal Decree 15/03/1954, Royal Decree 24/12/1970) for a temporary heliport.

Taking off with helicopters outside a (permanent) heliport may be granted by the BCAA, which could define, according to the case, possible additional conditions (for example no wind condition).

Below an overview of the heliport is given after the accident.



Figure 5: Overview of heliport



HELIPORT HERBOUVILLEKAAI - SKETCH MAP

Figure 6: map D'Herbouville Kaai

1.11. Flight Recorders

Not applicable.

1.12. Wreckage and Impact information

Inspection of the wreckage of both helicopter showed that all damages were caused by either the collision of both helicopters, or the impact of the crash (for the OO-HSH). No evidence of failures or damages dating from prior to the accident was found.

Several pieces of debris were found scattered on the site. The lower piece of the tail boom section of the OO-HSH was found at a distance of approximately 50m from the wreckage. Also the tail rotor and the vertical fin of the OO-HSH were severed found at a distance of about 20m from the wreckage.



Figure 7: Wreckage distribution 1

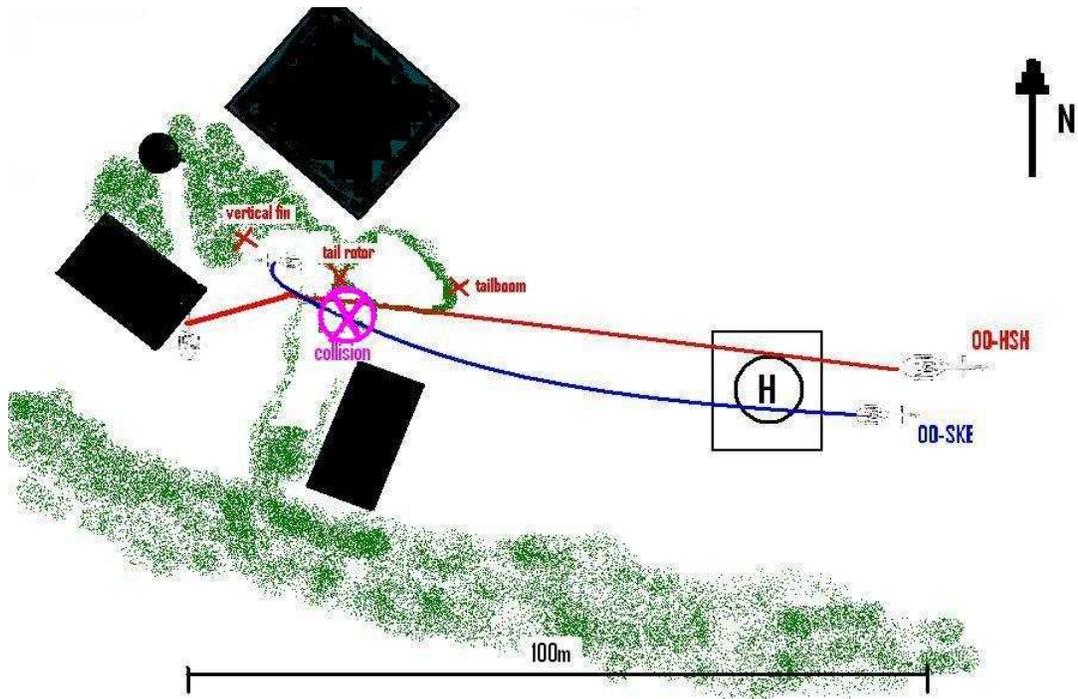


Figure 8: Sketch wreckage distribution

1.13. Medical and Pathological information

OO-SKE:

The pilot suffered a superficial head injury. The passenger was hospitalised and discharged the next day with only minor injuries.

OO-HSH:

The pilot was hospitalised with major injuries. The passenger suffered a spinal injury and was hospitalised.

Two more men on the ground present at the time of the accident suffered a psychological shock.

1.14. Fire

After impacting the building wall, both engines of OO-HSH caught fire. The fire was quickly put out by the ground crew. A portable extinguisher was used.

1.15. Survival Aspects

A police helicopter, refuelling nearby at the Antwerp airport (Deurne), received the message of the accident after which it headed towards the accident site where it arrived approximately two minutes after the accident and started capturing the event on film.

The ground crew notified by phone the ambulance immediately.

Because the accident took place at a federal police heliport the ambulance arrived only 8 minutes after the crash and a lot of policemen were on site to help, which was favourable for the survivability of both pilots and passengers. The Belgian Air Accident Investigation Unit (AAIU (be)) was notified at 13.06 UTC and the investigator in charge (I.I.C.) arrived at the scene at 14.00 UTC (16.00 LT) by helicopter.

At that time the local police had already brought two of the four men involved in the accident to the UIA hospital, in Antwerp.

OO-SKE: both pilot and passenger were strapped onto their seats. This protected them adequately during the collision and emergency landing. They were both able to climb out of the helicopter on their own.

OO-HSH: both pilot and passenger were strapped onto their seats. This protected them adequately during the crash.

The engine fire was immediately put out by the ground crew, which improved the chances of survival of pilot and passenger. The pilot manages to climb out of the wreckage on his own, while the passenger was pulled out of the wreckage by a camera technician on the ground. This person stayed with the passenger and talked to him until the medical assistance arrived.

1.16. Test and Research

Inspection of the wreckage of both helicopter showed that all damages were caused by either the collision of both helicopters, or the impact of the crash (for the OO-HSH). No evidence of failure or damages prior to the accident was found.

1.17. Organisational and management information

HSB is a Belgian helicopter operator holding at that time an air operate certificate (AOC) compliant with JAR OPS 3 regulation.

The company was founded in 1992 under the name Heli Service Belgium by the current owner.

The services provided by HSB include: aerial photography, aerial filming, sightseeing tours, Medevac services as well as pilot training. Aerial filming, in particular, is one of the major activities of HSB. For 5 years, HSB had been covering about 20 races per year, allowing to build up a significant expertise in that field.

It can be seen in the organisation chart given below that different positions are held by the same person. In particular it is person 2 (in the organisation chart) that was also the pilot of OO-HSH involved in the accident. Amongst others, the OO-HSH pilot is also the operation manager of HSB. The pilot of OO-SKE also holds more than one position in the company, including ground operation manager.

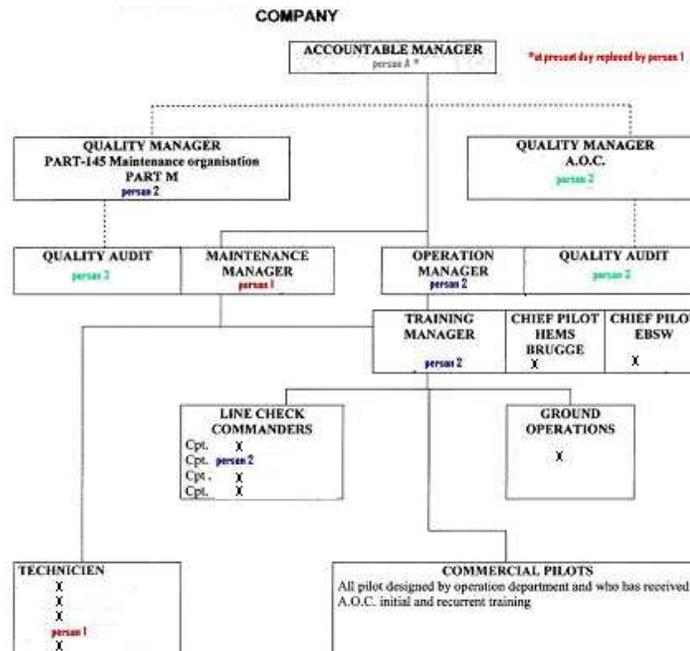


Figure 9: Organization chart of HSB

After the accident, HSB extended its company operations manual on the subject of aerial work. This extension includes procedures for video and relay broadcast operations.

Particularly, the pre-flight briefing and lift-off/take-off procedures are discussed. This includes the radio communication aspects, the fleet formation and coordination for safe separation during flight.

2. Analysis.

2.1. Communication

The two helicopters used two different radio frequencies during the take-off phase or one pilot's radio was still turned off.

Furthermore, the pilot of OO-SKE had no visual information on the OO-HSH on the ground because the latter was localized in his blind spot.

During briefing, mostly the timing aspects of the flight were considered; communication (radio frequency, agreements between pilots, ...) aspects may not have been discussed as extensively.

Nevertheless, as both helicopters stayed within the CTR of EBAW, the standard rules are that the frequency of the ATC Tower should be used (135.2 MHz). No deviation from this rule was formally requested nor granted.

It is however common practice that the pilots communicate with each other on a different channel (frequency) so to avoid overloading the tower frequency. Different official channels can be used to do so.

If non-official channel is chosen, as it is the case for 128.00MHz, a formal procedure should be followed to reserve one in advance (request should be made at BIPT, Belgocontrol). In the general aviation world, this is considered as a burdensome procedure, and consequently seldom used.

The communication conditions discussed during briefing were not recorded in writing, and it is unclear that they were fully understood by both pilots. In any case, it can be said that there were 3 frequencies mentioned for communication. The official tower frequency (135.2MHz), a company frequency (129.87MHz) and a third frequency of 128.00MHz.

In particular, the conditions for the take-off were not formally recorded; the helicopters had to take-off one after the other and the priority was not clearly defined during briefing. The simultaneous take-off was not considered.

OO-HSH took off first, after having tried to contact the other helicopter; the absence of reply was understood as an OK.

OO-SKE was in front of OO-HSH and assumed he could take-off first.

2.2. Heliport

The heliport of the federal police at d'Herbouville Kaai is used by State helicopters. It was not certified by BCAA as required for all civilian used heliports. No request for certification was recorded prior to the crash.

In the absence of such certification, the use of the heliport is subject to the general conditions laid down in KB 24/12/1970 for take-off and landing outside (civilian) heliports.

The following conditions have to be met.

Landing and take-off outside a certified civilian airport is prohibited in urban areas.

Outside urban areas the landing and take-off of helicopters is allowed if:

- It is performed with headwind.*
- It is performed in a plane with an angle of 12,5°s stretching from the side of the landing area to a distance of 250m with at that point a width of at least 75m. And if this plane is not obstructed by objects. If there is only one take-off axis available, landing and take-off are only allowed when the no wind condition is met.*

These conditions (primarily the first one) were not met by the two helicopters, firstly because they were located in an urban area, and secondly because the no wind condition was not met.

The pilots assumed that the heliport of the federal police could be used as a certified heliport. No history of an inspection and evaluation by the BCAA of the heliport by HSB prior to the crash was found.

An evaluation of the heliport was performed by BCAA on request of AAIU (be) after the crash.

The results are as follows; the heliport has one take-off axis in easterly direction (090°MAG). A second axis in 270°MAG is obstructed by 15%. According to this, the heliport does not meet the requirements for a permanent civilian heliport as defined per KB 31/08/1954. Nevertheless it does comply with the requirements of a temporary heliport as defined per KB 31/08/1954. This is however only valid for twin-engine helicopters.

Nevertheless, the certification status of the heliport used had no influence on the accident.

2.3. Organisation and management

In this case it is worth mentioning the influence of the organisation and management on the cause of the accident. This influence is certainly not a direct cause, but should nevertheless be studied.

As mentioned in section 1.17, both pilots involved in this accident held other positions within HSB, aside being pilots. Particularly they were both involved in the operations management.

The OO-HSH pilot held the position of operation manager. According to the operation manual (Part A) the responsibilities include amongst others:

- The safe operation of all helicopters owned, operated, or managed by the company.
- Carrying out the company's policies and for compliance with all laws, rules, and regulations governing those flights.
- Surveillance of flight safety.
- Operational control and communication.

The OO-SKE pilot held the position of ground operation manager. The responsibilities include:

- Responsibility for the security procedures around the helicopter.
- Cooperate with the operation manager in correcting known safety hazards.

There could therefore be no doubt about the awareness of both pilots about the necessary precautions and actions needed for a safe flight.

Furthermore, it is clear that the emphasis during the preparation of the flight laid on the timing. It can be deduced that the pilots may have been under some stress to arrive at the site on time and therefore may have given less priority to the safety aspects.

3. Conclusions.

3.1. Findings

- The two pilots held CPL(H) licences and were fully qualified and experienced.
- The two helicopters had a valid airworthiness certificate.
- All the damage observed on the two helicopters originated from the collision or the impact with the wall and the ground.
- At some point agreements were made about the radio frequency to be used by the pilots to communicate. This was not done in an unambiguous, clear manner and thus not thoroughly understood by all involved persons.
- The heliport discussed above was found not to be a certified civil heliport. But, with appropriate request, would have been approved as a temporary heliport if certain conditions were met.

3.2. Causes.

The cause of the accident is the lack of situational awareness of the pilots taking off almost simultaneously in the same direction.

The contributing factors are;

- Use of different frequencies during take-off between the pilots.
- Poor briefing prior to the start of the mission.

- The disregard for the radio contact procedures because of time pressure.
- The absence of visual contact during take-off as a consequence of the relative positions of the two helicopters on the ground.
- The absence of coordination and guidance from the ground crew.

4. Safety recommendations.

4.1. To BCAA (operator / aircraft owner / flight crew)

We recommend a sensibilization campaign for the pilots and operator, in order to identify the dangers of inadequate communication in general and particularly for helicopters during take-off and landing phase. Emphasis should, amongst other subjects, be put on:

- The importance of two-way communication i.e. always to wait until response is given, and never to make assumptions.
- The potential effects and consequences of working under (time) pressure.

In particular this sensibilization campaign should be addressed to the responsible person (e.g. operation manager) as well as to the pilots.

It is mentioned here that the above recommendations have, in part, been established by the compiling of an operations manual (section 1.17.) by HSB after the accident in which emphasis is laid on these subjects.

Particularly to the BCAA and BIPT we recommend a review of the regulations on:

- Communication during flight, particularly when flying in CTR and in TRA's. This includes the preparation before flight (i.e. use of tower frequency, reservation of a frequency when needed at the official regulatory bodies, use of official air-to-air frequencies; 123,45 channel,) the procedure for take-off clearance at take-off, and the use of different frequencies during flight.
- The landing and take-off in urban and rural areas with respect to the approach surfaces.
- The difference between civilian and non-civilian heliports, and the formal procedures on how to request a temporary heliport.

We recommend the BCAA to publish a regulation (e.g. national circular) describing the procedures to be followed for a TRA request.