



**Statens haverikommission**  
Swedish Accident Investigation Board

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## ***Report RL 2008:07e***

### **Accident with helicopter SE-HPS at Sisjön, Västergötland county on 24 April 2007**

Case L-06/07

SHK investigates accidents and incidents with regard to safety considerations. The sole objective of the investigations is the prevention of similar occurrences in the future. It is not the purpose of the activity to apportion blame or liability.

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Swedish Civil Aviation Authority

601 73 NORRKÖPING

### **Report RL 2008:07e**

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The Swedish Accident Investigation Board (SHK) has investigated an accident which occurred on 24 April 2007 at Gothenburg/Sisjön, Västergötland county to a helicopter with registration SE-HPS..

In accordance with section 14 of the Ordinance on the Investigation of Accidents (1990:717) the Board herewith submits a final report on the investigation.

The Board will be grateful to receive, by 31 March 2009 at the latest, particulars of how any recommendations included in this report are being followed up.

Göran Rosvall

Henrik Elinder

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L-06/07

Report finalized 2008-10-01

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Aircraft; registration and type	SE-HPS, Eurocopter EC135
Class, airworthiness	Normal, valid Certificate of Airworthiness
Owner/Operator	Rikspolisstyrelsen ( The Swedish National Police Board)
	Box 12256, 102 26 Stockholm
Time of occurrence	2007-04-24, 1029 hrs. in daylight
	Note: All times are given in Swedish summer time (UTC+ 2 hours)
Place	Gothenburg/Sisjön, Västergötland county, (pos. 57.37,01N 011.59,34E; approx. 50 m above sea level)
Type of flight	Police operations.
Weather	According to SMHI (Swedish Meteorological and Hydrographical Institute) analysis : Wind, south, 5 knots, visibility 3- 8 km, haze, cloud 8/8 stratus, with base 500-800 ft, temp./dewpoint +11/+10 °C, QNH 1019 hPa
Persons on board:	
Crew members	1
Passengers	3
Injuries to persons	Pilot fatally injured, 3 passengers seriously injured
Damage to aircraft	Total wreck
Other damage	Fouling of the ground at the site with kerosene and oil
Pilot :	
Genus, age, licence	Male, 42 years, CPL
Total flying time	3640 hours, of which 1100 hours on the type
Flying time during previous 90 days	50,5 hrs, all on type
Number of landings during previous 90 days	Approx. 50, all on type

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The Swedish Accident Investigation Board (SHK) was notified on 24 April 2007 that an accident with a helicopter with registration SE-HPS had occurred at Gothenburg/Sisjön, Västergötland county on that day at approximately 1030 hours.

The accident has been investigated by SHK represented by Göran Rosvall, Chair person, Henrik Elinder, Chief investigator, flight operations, Agne Widholm, operational investigator, and Patrik Dahlberg, investigator, fire brigade activity.

SHK has been assisted by Liselotte Yregård, medical expert, Hans Landström, MTO expert and Jimmy Lundgren, expert, flight operations.

The investigation has been monitored by Gun Ström, Swedish Civil Aviation Authority. A representative appointed by the relevant German Accident Investigation Commission has been Axel Rokohl.

### Summary

The helicopter was used in a training exercise in coordination between the Swedish Police Wing (SPW) and the Gothenburg police picket force at the Sisjön sports area. The exercise included the transport of picket groups, each of three policemen, between different points in the terrain.

The final part of the exercise consisted of so-called environment training in which the picket groups were to be given experience of the “feeling” of the violent effects on passengers of “tactical” helicopter flying. The first group of policemen were passengers on the flight which ended in the accident.

After five minutes flying time, the helicopter returned to the start point, flying at “tree-top” altitude. After some seconds, it climbed abruptly to an estimated altitude of 100 meters where it appeared to lose speed with elevated nose before yawing to port and beginning a steep dive with subsequent recovery in the direction of the start point. At the conclusion of this manoeuvre, with high forward speed, the helicopter impacted the ground, the underside of the tail boom first and then the undercarriage skids. It then capsized and rolled several times before coming to rest in a water-filled ditch. During the rolling, the cabin disintegrated and the passengers were ejected, fastened in their seats. The pilot remained sitting in the wreck and partly under water.

No technical fault has been found in the helicopter. The investigation has shown that the flight was performed with departures from approved procedures and close to and partly outside the specified limits of the helicopter’s operational capacity. The accident may have been due in part to the snow skids mounted on the helicopter’s undercarriage which may have affected its manoeuvrability in an exceptional flight situation.

“Environment training” had been performed regularly in the coordination exercises of the type involved without the knowledge of the higher command of SPW. This can be attributed to shortcomings in the management of the SPW, its routines and regulations and an unsatisfactory working climate within the organization.

The accident was the result of, partly, deficiencies in the direction of SPW, partly, the unclear granting of permits by the Civil Aviation Authority and its inadequate inspection which permitted a dangerous flying activity. Triggering factors were the pilot’s performance of the flight in combination with the possibility that the snow skids mounted on the helicopter may have affected the flight properties of the helicopter under extreme flying conditions.

## **Recommendations**

It is recommended that Luftfartsstyrelsen (Civil Aviation Authority):

- develop national regulations adapted to the activities of SPW and where relevant, follow in these, the requirements of JAR-OPS 3 for civil operators. These should also include procedures for the type of operation specific to SPW including requirements for crew configuration and crew cooperation etc. (RL 2008:07 R1) and
- review the internal routines of the Civil Aviation Authority for granting permission for and inspection of commercial flight activities (RL 2008:07 R2).

# 1 FACTUAL INFORMATION

## 1.1 History of the flight

### 1.1.1 Purpose of the flight

The helicopter was to be used in an exercise in coordination between units of the Swedish Police Wing (SPW) in Gothenburg and the Gothenburg Police picket force at the Sisjön sports area immediately south of Gothenburg.

The pilot, together with a systems operator, started from the SPW base at Säve airfield at 0926 hrs and flew directly to the exercise area where he landed and stopped the engines. The pilot and the director of the exercise at the site informed the picket police at the site about the planned exercise

The exercise was to include the transport of four picket groups, each of three policemen, between different places in the terrain. The four groups were divided into two teams, the first of which was to begin train in activities associated with helicopter transport and the other to train in other police activities. After lunch, the teams were to exchange training activities and the second team was to train with the helicopter.

The exercise was primarily intended to train the picket police, with their personal equipment, to embark onto and disembark from the helicopter in an effective way, unaided, with the engines and rotors in operation and with the pilot still at the controls. The exercise was to be performed at places with varying ground characteristics and slope and with the helicopter partly or entirely hovering.

After the explanation period, the pilot began the flying with the transport of the first two groups. This was followed by a series of transports of the groups, from place to place, for approximately 30 minutes. The pilot was then to pick up the different groups and fly them back to the starting point. As the exercise was to be performed with the least load possible, the systems operator remained on the ground.



Coordination exercise on the day of the accident

Part of the exercise in connection with the return flight was so-called “environment training” to familiarize the picket police with “tactical helicopter flying” including different types of more or less violent manoeuvre (see Chap. 1.17.10) . The accident occurred during the environmental training part of the return flight with the first group, the second group awaiting their turn to be flown back.

### 1.1.2 *The accident*

The helicopter was started from a firing mound at the north of the training area. Several witnesses observed the helicopter start and fly southward. It was seen to make a number of steep turns and “wingovers” over the forested area south of Sisjön.

After approximately five minutes, the helicopter returned, flying at tree-top height in a northeast direction along a line of trees at the east of the area. After some seconds, it climbed steeply to an estimated altitude of 100 metres where it remained stationary some seconds with nose up before pitching over to port, beginning a steep dive and a subsequent recovery in a west-north-west direction toward the starting point.

At the end of this manoeuvre, the helicopter struck the ground at high forward speed the tail skid impacting first, followed by the landing skids. It then capsized and rolled several times before coming to rest in a water-filled ditch. During the rolling on the ground, the cabin was demolished and the passengers were ejected, remaining fastened in their seats. The pilot remained sitting in the helicopter wreck, partly under the surface of the water in the ditch. Witnesses who saw the accident notified SOS Alarm and hurried to the site of the accident to begin the rescue of those on board.

The accident occurred in daylight at 1029 hours at position 57.37,01N 011.59,34E; approximately 50 m above sea level.

### 1.1.3 *Evidence of the passengers*

The passengers have much the same memories of the sequence of events during the flight. The embarkation/disembarkation training on sloping and inaccessible terrain was completed and the purpose of the final phase of the flight was to provide the so-called environment training in connection with the return flight to the starting point.

The passengers were not connected to the internal and voice-activated radio system (intercom). However, all on board could communicate via their portable and manually operated radio systems of Radio system 80 type.

Before the start, the passengers understood the pilot to have said “OK, we are off. Is anybody afraid of flying?” One experienced the take-off as being abrupt. All of the passengers have stated that during the following flight, the helicopter made a number of steep turns with high G-forces and manoeuvres which occasionally gave them a feeling of weightlessness.

One of the passengers with much experience of helicopter flying during his police career has stated that he had never previously felt so large G-forces during a helicopter flight.

Toward the end of the flight, the passengers had the impression of high speed in level flight at low altitude followed by a steep climb followed by a steep turn and a steep dive.

At this point, one of the passengers had feelings of abnormality and discomfort and gained the impression that the situation was critical. Immediately before impact, some of the passengers realized that the helicopter would hit the ground and tensed their muscles in preparation for the impact. Only one of the passengers has any memory of the impact itself. The others lost consciousness.

None of the passengers heard the pilot say anything during the flight.

None of the passengers had any definite idea of the purpose of the so-called environment training except that they were to be given the opportunity of feeling how it could be to fly under extreme conditions. All were of the opinion that such flights could be included in certain of the normal duties of the picket group.

### 1.1.4 *Other witness evidence*

The three police of the waiting picket group remained at the pick-up point with the training area and the site of the accident clearly visible. Their memories of the events



are largely the same. The helicopter come flying diagonally toward them along the edge of the forest and at tree-top altitude. They saw the climb and the steep turn with the subsequent steep depression of the nose.

The witnesses' impression of the angle of depression of the nose at this point varies from about 60 degrees to 90 degrees. All saw that the attitude of the helicopter during its descent toward the ground changed to an approximately 5-10 degree nose-up. They also have the impression that the rotor sound changed character, immediately before impact, to something "harder".

The systems operator and a police officer, standing at a lower level but with the training area and the site of the accident visible, have a similar memory of the events.

They noticed particularly that the banking of the helicopter performed during the flight was very steep, up to 90 degree. They had never previously seen this performed during corresponding flights.

Immediately after the accident, the systems operator telephoned SOS Alarm describing the accident but is uncertain if the message was understood correctly. He also notified LKC ( the County Communication Central) via Radio system 80 but is also uncertain if this message was understood.

#### 1.1.5 *Rescue efforts*

An emergency call via the cell telephone network, from persons in the coordination exercise group, was received by SOS Alarm at 1031 hrs. A poor connection between the sender and receiver made it difficult for the SOS operator to understand the message clearly, gaining the impression that there had been a helicopter accident with seven persons on board. The locality was given as Sisjöns exercise field with no more detailed specification.

The primary care of those on board was begun at an early stage by some of the police in the training group. They were able to lift parts of the helicopter debris by hand and were able to sever the pilot's safety belt and free him from the wreck.

A total of seven ambulances and an ambulance helicopter were notified to proceed to the site. At about the same time, two fire brigade stations were alerted and the first of their units arrived at 1042 hrs.

The information from SOS Alarm was clarified while the units were driving to the site, indicating that the accident had occurred at or near the rifle range and that there had been four persons on board the helicopter.

Police met the fire brigade units at the Fässberg junction and then the first ambulance which arrived at 1047 hrs. After directing these units to the site of the accident, this guidance function was withdrawn.

The ambulance alerted first had difficulty in locating the site because there are several entries to the area and was consequently the last to arrive. The ambulance arriving first at the site was designated the unit in charge and directed the subsequent first aid work.

On arrival at the site, the fire brigade secured the area against fire by spreading foam from pressurized fire extinguishers. Cooperation was established between the fire brigade, police and ambulance units and a coordination centre was set up. When the accident situation was deemed to be stabilized, rescue personnel were directed to assist in the care of the injured.

Activities at the site of the accident were, initially, somewhat chaotic. Persons from both the first unit in charge and other ambulance personnel arriving had identification labels as persons with command authority and this created a certain confusion.

Because of a technical fault in the ambulance helicopter, an SAR<sup>1</sup>-helicopter was despatched with the ambulance helicopter personnel on board. The doctor arriving on the SAR helicopter was considered by the other ambulance personnel to have adopted a passive role in the medical efforts. The helicopter was not used for trans-

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<sup>1</sup> SAR – Search And Rescue

port of the injured who were transported by ambulances to the Sahlgrenska University Hospital.

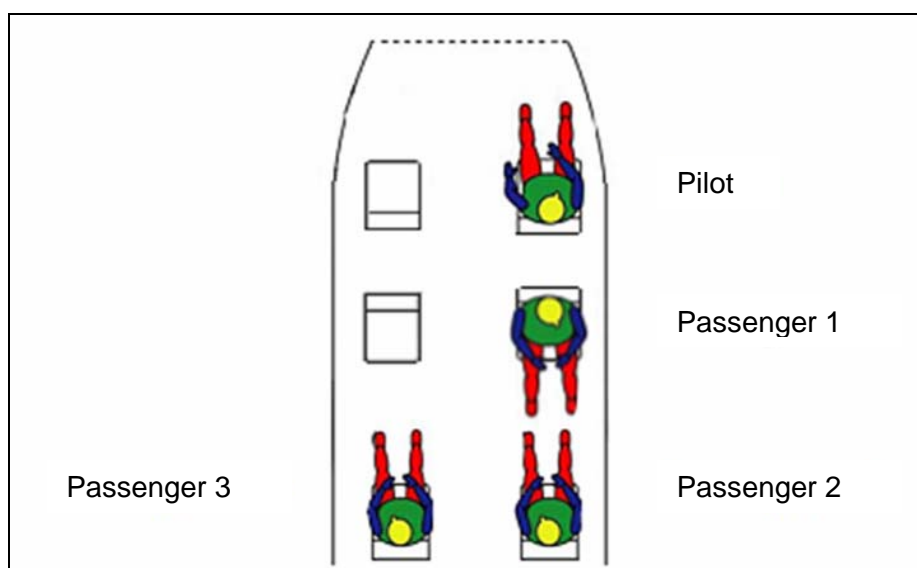
Some of the ambulance personnel originally experienced the situation and atmosphere at the accident site as being “strained” with the many armed picket police milling around.

The first ambulance left the site at 1108 hrs and all ambulances had reported the completion of their task by 1132 hrs. Efforts to save the life of the pilot were discontinued on arrival at the Sahlgrenska University Hospital

The rescue operation was concluded at 1252 hrs and the site was then left in the charge of the police.

## 1.2 Injuries to persons

	Crew	Passengers	Others	Total
Fatal	1	–	–	1
Serious	–	3	–	3
Minor	–	–	–	–
None	–	–	–	–
Total	1	3	–	4



The location of those on board the helicopter during the flight

### *Pilot*

The pilot was killed in the accident. An autopsy showed that the pilot had extensive injuries to the chest with numerous fractures of the ribs, fracture of the sternum and injury to the lungs, fracture of the second cervical vertebra, injury to the brain and spinal chord and lacerations/abrasions over the entire body. Forensic tests for the presence of alcohol, drugs and medical substances in his body gave negative results i.e. no such substances were detected.

### *Passenger 1*

Passenger 1 survived the accident with a fractured tibia and laceration/abrasions to the face and one lower leg.

### *Passenger 2*

Passenger 2 survived but suffered serious injuries in the form of an injury to the

liver, several fractured ribs, injury to the lung, fractures to the first and second thoracic vertebrae and a scalp wound on the crown of the head.

#### *Passenger 3*

Passenger 3 survived with fractures of the first, third and fourth cervical vertebrae, fracture of the second thoracic vertebra, slight injury to the lung and lacerations/abrasions on both legs and one arm.

### 1.3 Damage to the aircraft

Destroyed.

### 1.4 Other damage

Helicopter parts, kerosene fuel and oil were distributed along the path of the helicopter after impacting on the ground, over an area approximately 110 x 25 metres and at the final location of the wreck.

### 1.5 Personnel information

#### 1.5.1 *Pilot*

The pilot, male, was 42 years and had a current CPL-H<sup>2</sup> with IFR<sup>3</sup> validity.

Flying time (hours)			
	24 hours	90 days	Total
Previous	2	50,5	3640
All types	2	50,5	1100
This type	2	50,5	

Number of landings, this type, during the previous 90 days: approximately 50..

Flight training on this type began during late 2001 and concluded 7 December 2001. Latest PC (Proficiency Check) carried out 14 April 2007 on helicopter type EC135.

#### 1.5.2 *Pilot's professional background*

The pilot entered basic police training in 1988 and graduated in 1990, being posted to Norrmalm in Stockholm for duty there. In 1993, he was accepted for police pilot training which he began in August that year. He then served in the Swedish Police Wing until his death.

After completing flying training, he was posted to Boden. From July 1997, he was stationed at the Gothenburg base for which, in summer 2006, he was appointed base leader.

#### 1.5.3 *Pilot's duty schedule*

After two weeks vacation (see Chap. 1.13.1) the pilot was on duty for the two weeks prior to the accident, on flying duty on two days and performing five flights of a total of almost seven flying hours. On the day before the accident, 23 April, he was on non-flying duty during the evening until 2300 hrs. He was not on duty during the two previous 24 hour periods ( 21 and 22 April ) and is reported as having slept well during this period.

On the day of the accident, the pilot began his duty at 0800 hours, his period of sleep during the previous night being estimated as 7 hours.

<sup>2</sup> CPL-H – Commercial Pilot License - Helicopter

<sup>3</sup> IFR – Instrument Flight Rules

He was not rostered for flying duties according to the original flight plan for the base for the day of the accident but because the pilot originally selected was not available, he accepted this duty.

## 1.6 Aircraft information

### 1.6.1 General

#### *Aircraft*

Manufacturer	Eurocopter	
Type	EC135 P2	
Serial number	203	
Year of manufacture	2001	
Gross mass	Max. authorised start/landing mass 2835 kg, actual XXX kg	
Position of C. of G.	Within permitted limits	
Total flying time	4405,7 hours	
Number of cycles	9197	
Flying time since latest inspection	397 timmar	
Fuel loaded before event	Jet A1	

#### *Engine*

Engine manufacturer	Pratt & Whitney	
Engine type	PW206 B2	
Number of engines	2	
Engine	No 1	No 2
Total operating time	1498,0 hours	1461,5 hours
Operating time since over-haul	397	397

#### *Rotor*

Rotor manufacturer	Eurocopter	
Rotor operating time		
Main rotor	3911(2 blades)/1849(2 blades) hours	
Tail rotor	2561.5 hours	

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### The helicopter had a valid Certificate of Airworthiness

### 1.6.2 Helicopter type

The EC135 type helicopter has two engines, is equipped for instrument flying and in its normal version, accommodates two pilots and six passengers. It is not authorised for aerobatics<sup>4</sup>.

SPW (Swedish Police Wing) helicopters have places for two pilots and a maximum of five passengers. They can be equipped with different kinds of equipment for police operations such as an external winch, heat-sensitive camera, video camera, equipment for linking pictures, loudspeakers, direction-finding equipment and abseiling<sup>5</sup> equipment

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<sup>4</sup> Aerobatics – Flight with roll > ±60° or pitch > ±30°

<sup>5</sup> Abseiling – Exiting to the ground from a hovering helicopter by means of a line.



EC135 P2 helicopter as used by Swedish Police Wing

### 1.6.3 Snow skids

The helicopter had been relocated from the SPW base in Boden, where it had been stationed for a time, to Gothenburg on the day before the accident. While at Boden, it had been provided with snow skids to facilitate start and landing in snow-covered terrain. (See photo below).



Snow skids

The use of snow skids on the helicopter type was approved according to EASA<sup>6</sup> FMS<sup>7</sup> 9.2-41 rev. 4.1 dated 1 August 2007. According to this approval, when the snow

<sup>6</sup> EASA – European Aviation Safety Agency

<sup>7</sup> FMS – Flight Manual Supplement

skids are installed, the rate of climb of the helicopter is reduced by 25 – 30 foot/minute, depending on the start mass but the installation introduces no restrictions otherwise on the manoeuvring of the helicopter.

#### 1.6.4 *Technical maintenance*

According to the helicopter documentation, it had been maintained as required by the relevant instructions. The daily inspection had been performed by the duty technician on the day of the accident.

### 1.7 **Meteorological information**

According to the SMHI (Swedish Meteorological and Hydrographical Institute) analysis: Wind south 5 kts, visibility 3-8 km, haze, cloud 8/8 stratus with base 500-800 ft, temp./dewpoint +11/+10 °C, QNH 1019 hPa. There was no turbulence and the weather improved gradually.

Witnesses at the site stated that at the time, the sky was overcast with relatively low cloud. This was confirmed by photographs taken at the site.

### 1.8 **Aids to navigation**

The helicopter was equipped for instrument flying and with GPS. (See 1.11).

### 1.9 **Communications**

The helicopter operated in uncontrolled air space and during the flight, had no established radio contact with any flight controller. The passengers did not use the helicopter intercom system but communicated with the pilot and each other via the external radio system, Radio system 80 – channel 16. The police personnel on the ground could also communicate with all on board the helicopter via the same system.

### 1.10 **Aerodrome information**

Not relevant.

### 1.11 **Flight recorders**

#### 1.11.1 *General*

The helicopter was not equipped with a crash-safe Flight Data Recorder or Cockpit Voice Recorder, this not being required.

#### 1.11.2 *GPS*

The helicopter was specially equipped with two separate and independent GPS systems which have been investigated by the German Accident Investigation Commission (BFU) at the request of SHK, giving the following results:

*Euroavionics Euronav III Type: RN5-2.9*

Position data from all flights performed since 2003 could be read from the unit data memory. Position data for the flight concerned is registered at 10 second inter-

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vals. The registration does not include altitude information and gives only an approximate indication of the flight path.

*Trimbel freeflight 2101 IO plus*

Certain basic data relating to the flight and the final registered position of the helicopter has been recorded in the unit memory.

1.11.3 *Engine components*

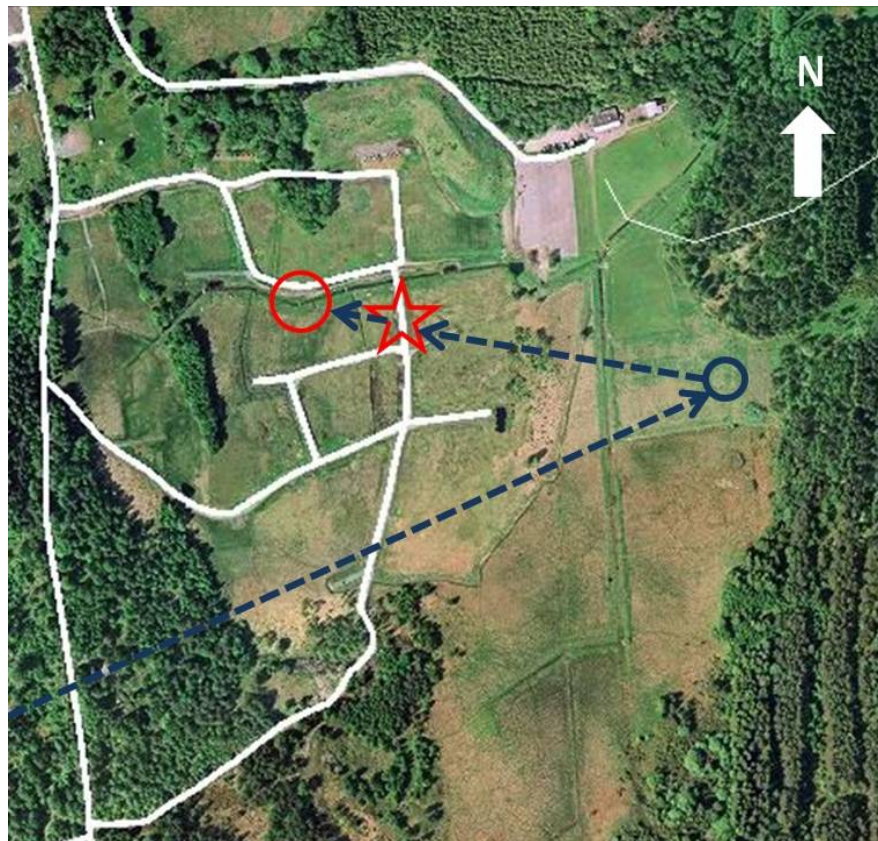
The engines of the helicopter are equipped with an electronic control and registration system which incorporates components with a memory function. These memory functions are in certain cases, dependent on an external voltage supply which can have been interrupted in connection with the accident.

Two of these components have been examined in Canada by the engine manufacturers Pratt & Whitney. None of the information which could be obtained from these components indicates any technical malfunction or abnormal engine function before the impact with the ground.

1.12 **Accident site and aircraft wreckage**

1.12.1 *Accident site*

The helicopter struck the ground on the northern part of a roughly oval open exercise area of diameter approximately 500 metres. This area is surrounded by undulating forest terrain and is traversed by some narrow gravel roads and a water-filled ditch. At the time of the accident, the ground was uneven, saturated and covered with uncut vegetation. The approximate final flight path of the helicopter, the turn with elevated nose, the contact track, impact point and final resting place have been drawn in the following aerial photograph.



Final part of the flight path and impact area. The lesser circle indicates approximately the high point of the final manoeuvre.

The markings on the ground indicate that the helicopter first touched the ground with the rear part of the tail boom approximately 10 metres east of a local gravel roadway. The port landing skid then struck the ground violently at the verge of the roadway, the starboard skid hit the ground and the helicopter swung to port.

Impact marks on the opposite side of the roadway and immediately west of the roadway show that the helicopter structure struck the ground violently there. Several other impact marks and scattered helicopter parts show that at this point, the helicopter rolled to starboard over the nose and then tumbled several times over a distance of 75 metres before finally stopping in a water-filled ditch.



Ground impact marks viewed in the direction of the impact

#### 1.12.2 Aircraft wreckage

The helicopter was completely destroyed. The rear section of the tail boom, parts of the undercarriage, parts of the rotor blades and parts of the helicopter front separated from the helicopter during the first part of the tumbling. Other parts of the structure were crushed or torn loose and spread over an area approximately 110 x 25 m. The remnants of the wreckage consisted mainly of the central structure of the helicopter containing engines, transmission, electronic system etc. and the tail boom. See the photograph below.





Wreckage of the helicopter  
viewed in the direction of the impact with the ground

## 1.13 Medical information

### 1.13.1 Pilot

The pilot had successfully passed the required medical examinations. Barely a month before the accident, at his own request, he had taken two weeks leave because of a difficult social problem. He had returned to duty with the approval of the Operations Manager.

No evaluation of the pilot's psychic health was performed by a professional in connection with this. The relevant medical officer was not contacted and there was no medical examination to judge his suitability for continued flying duties. Since the summer of 2006, the pilot had served as base leader for the Gothenburg base, this being his first service in a leading position. The personnel there gained the impression that he was stressed by the work load in his new role as a leader and by his problems of a private nature.

## 1.14 Fire

There was no fire.

## 1.15 Survival aspects

### 1.15.1 General

The accident sequence was violent and the helicopter cabin was largely demolished. The passengers were ejected, held in their seats by the safety belts. This, and the energy-absorbent nature of the ground at the site may have been factors contributing to their injuries being relatively limited.

### 1.15.2 *Emergency transmitter*

The emergency transmitter ended up under water, its antenna was broken off and its mechanical switch for G-loading was destroyed and therefore no emergency signal was transmitted. Tests performed after the accident indicated that its transmitter function was intact.

### 1.15.3 *Protective equipment*

The pilot wore the ordinary SPW overall and boots and was said to be armed with a police pistol. He was wearing a pilot helmet with a visor which was parked in the "up" position.

The passengers wore the ordinary picket police protective clothing and boots. They were armed with shock grenades, pistols of Sig-sauer 226 type and Heckler & Koch MP-5 submachine guns with magazines loaded with ball ammunition. They were not wearing helmets but wore headsets with so called ear-pieces for reception of radio traffic.

## 1.16 **Tests and research**

### 1.16.1 *Technical investigation at the site of the accident*

A first technical investigation of the helicopter was made at the site of the accident. It could be seen that, at the moment of impact, the helicopter was intact and travelling at high forward speed. After documentation at the site, the wreckage was collected and transported to a nearby building where it was cleaned and examined.

### 1.16.2 *Technical investigation of the helicopter*

The helicopter was essentially demolished. As far as was practically possible, its engine and control system have been checked with respect to their function before impact with the ground. No evidence has been detected indicating that any fault or malfunction in these systems could have affected normal flight.

Electronic components with memory function were extracted from the helicopter wreck and sent to specialist workshops for analysis. See 1.11 above.

### 1.16.3 *Reference flights with snow skids*

SHK has performed reference flights with a police helicopter of the same type and with the same type of equipment as was on the crashed helicopter. The flights were performed by two pilots, both with flying instructor authority for the type, one pilot representing SPW, the other representing SHK.

The reference flights were performed without extra measurement equipment and all results obtained are to be considered as the subjective experience of the pilots performing the test.

The flights were performed as two separate flights in accordance with the same flight programme. One flight was performed without snow skids installed and one with snow skids installed. The purpose was to determine if the flight characteristics of the helicopter were affected in any way with or without snow skids installed.

The primary purpose of the flight programme was to observe the flight characteristics of the helicopter during the programme which, within permitted limits, was to include a steep dive with considerable increase in speed, after leaving an attitude with low speed and elevated nose followed by a recovery to level flight, a manoeuvre similar to that observed by witnesses immediately before the accident, far outside the normal flight envelope but within permitted operational limits.

During the reference flights, both pilots experienced a definite difference in the helicopter's performance during the recovery operation with the snow skids installed as compared with its performance without snow skids. The helicopter felt "sluggish" and the recovery took a longer time with the snow skids installed. This means that a

greater control column deflection is required to obtain the same response from the helicopter when flying with snow skids installed than when flying without snow skids.

## **1.17 Organisation and direction of the Swedish National Police Board**

*(at the time of the accident)*

### *1.17.1 General*

The SPW (Swedish Police Wing) is incorporated within the National Police Board organisation and is under the direction of the National Criminal Police Executive Department. SPW has five fixed bases and a Flight Training School. At the time of the accident, the section was manned by a total of 29 persons of whom 25 were pilots.

### *1.17.2 The police flying activity*

SPW is a resource available to the police authorities as required for:

- Mountain rescue and mountain safety.
- Searches for missing persons.
- Rescue operations relating to aircraft.
- Rescue operations relating to marine activities.
- Rescue operations otherwise over land.
- Search and monitoring activities in relation to serious crime.
- Activities in relation to special events.
- Provision of information to authorities and County Information Centres via picture transmission or visual observation.
- Urgent transport operations.
- Surveillance of specific objects.
- Border surveillance.
- Surveillance of nature, hunting and fishing activity.
- Documentation by means of film and photography.
- General surveillance in areas with frequent serious crime.

A local police authority requests helicopter assistance via RKC (the National Criminal Police Radio Communication Central). The duty helicopter crew then decides, in consultation with RKC, if the operation can and shall be executed.

SPW in Stockholm has the special responsibility of flying and cooperating with NI (National Special Police Force).

SPW operated previously with single-engine helicopters in accordance with VFR and one pilot. SPW currently operates with a total of seven twin-engine helicopter of type Eurocopter EC 135 and one single-engine helicopter of type Bell 206B which is flown partly in accordance with IFR and with night vision goggles. Approximately 8500 operations are performed annually, principally rescue operations and flights in connection with police action against criminal activities.

### *1.17.3 Technical responsibility*

The technical responsibility for SPW helicopters is delegated to an approved maintenance organisation which has its main base at Stockholm/Arlanda airport and has certificated aircraft technicians stationed at SPW bases.

### *1.17.4 Cooperation between SPW and the Gothenburg picket police force*

SPW in Gothenburg has developed cooperation with the Gothenburg picket police force for combating serious crime, which, to a degree, is similar to the cooperation

between SPW and NI in Stockholm. This cooperation has been organised locally by the directions of the Gothenburg base and the Gothenburg picket police force.

The scenario of combined exercises has on several occasions consisted of a simulation of actions in a dangerous outdoor environment with increased risk. This has required special activities with helicopters, the arming of the picket police, the formation of groups after disembarkation from the helicopter, direct use of weapons from the helicopter in flight etc. Local SOP (Standard Operation Procedures) have been developed for these activities.

According to the direction of the National Criminal Police, the use of weapons from helicopters carrying picket police is not normally permitted. Such activity is limited to cooperation with NI in accordance with special regulations.

#### 1.17.5 Operative regulations

According to the Operations manager of SPW, its activities are primarily governed by the following regulations:

##### Operational manual (DHB - Drifthandbok)

The SPW Operational Manual (DHB) refers in certain parts to the requirements of the Civil Aviation Authority according to Regulations for Civil Aviation (BCL) –D 2.3 (Civil Aviation Authority Code of Statutes 2007:49) (Luftfartsstyrelsens författningssamling (LFS) 2007:49), relating to commercial civil aviation. Examples of flight operations are given in Chap. 1.17.2.

In the SPW DHB with the Civil Aviation Authority's requirements of a DHB relating to an approved operator, operating in accordance with BCL –D 2.3 (LFS 2007:49), SHK has found, inter alia, the following differences and uncertainties:

- Information about which regulations the DHB is based on is not given clearly.
- Detailed descriptions of the different types of SPW operational activities are unclear or absent.
- Training requirements for police operations are unclear or absent.
- No flight safety objective is specified.
- The description of the internal control system of the organisation is unclear.
- There is no formal reference to a two pilot system and no routines for such have been developed. At the same time, the minimum weather conditions specified are specified as being dependent on whether the flight is to be performed with one or two pilots.
- Many operations to be performed by SPW require a crew of at least two persons. There are no instructions governing how these are to cooperate.
- Regulations for flights with advanced equipment such as NVG<sup>9</sup>, are unclear.
- There are no regulations for flights with armed passengers or dangerous loads.
- There are no regulations requiring all on board to wear flying helmets during low-level flights.

From interviews with SPW pilots, SHK has gained the impression that the SPW DHB is considered by them as being out of date and unsuitable and is therefore seldom used in practice.

##### Standard Operation Procedures (SOP)

The purpose of SOP in commercial aviation is to standardize flight operation procedures so that all crew members perform their respective duties in a uniform manner.

The direction of SPW describe the use of SOP within SPW as follows: "Its purpose is to describe how a particular flying operation is to be performed and thereby become uniform at all bases." A new SOP is developed by the preparation of a preliminary SOP proposing how an operation is to be performed. This is then evaluated and revised as necessary by the Flight Training School. Not until it has been tested for a time in operations and adjusted as necessary is it finally adopted.

SHK has not found in DHB or any other document any description of how an SOP is to be developed and used. There is no official compilation of SOP's already issued with information about the person responsible, dates of preparation and adoption, revision status etc.

Different types of operation descriptions have been documented, some of these documents being designated SOP. In most cases, these are local operational instructions which apply only at one base. In most cases, no status information is provided.

An example of such a so-called "SOP" is the training document: "Lecture plan Block 3/2007", dated 2007-02-26", which describes the exercise concerned, including so-called "Environment training in tactical flying with helicopter".

By means of interviews with SPW pilots, SHK has gained the impression that the few SOP developed are seldom used in practice. Several pilots refer instead to TA (Taktiska Anvisningar – Tactical Instructions) , as below, as guiding documents for flight operations.

#### TA - ( Tactical Instructions )

Police activity includes the combating of organized criminality and the TA which the police follow in doing so are not made public. For part of its activities, SPW has also developed TA which are said to describe in detail relevant flight operations. It has not been possible for SHK to study these.

According to the direction of SPW, the Civil Aviation Authority has approved of such TA not being made public.

The process of development and approval of TA has not been described for SHK and is not described in DHB.

#### Flight regulations

Flight regulations are instructions of permanent character. The process by which they are developed and approved have not been described for SHK and are not described in DHB.

#### Flight bulletins

Flight bulletins consist of information and regulations of short term character.

### 1.17.6 Helicopter bases

SPW has five permanent bases – Stockholm, Gothenburg, Malmö, Östersund and Boden and a Flight Training School at the Gothenburg base. The future of the Malmö base is under consideration. At each base there are hangars, office and personnel facilities and the equipment required locally for the activity.

The activity at each base is directed by a base leader, previously designated base manager, who also serves as a pilot. A system operator who assists the pilots with police operation information during flights is stationed at some of the bases.

The Operations Manager has delegated to each base leader, in accordance with DHB, the duties as follows, in addition to flying duties:

- The direction of the work at the base and, as required, cooperation with the other bases.
- The preparation of monthly plans and their submission to the Operations manager.
- The preparation of daily plans, allocating tasks to pilots and helicopters on the basis of their individual competence.

- The preparation of duty rosters, approved vacations and compensatory leave and the notification of unauthorized absence to the Operations manager and relevant units and authorities.
- The management of the economy of the base within specified limits.
- In consultation with the responsible technicians, the planning of the maintenance of the helicopters,
- The planning, in consultation with the Operations manager, of the pilots' PC and current training and the training otherwise of the personnel at the base.
- The provision of information to and cooperation with the police and other authorities and community functions within the area of responsibility of the base.
- The provision to the personnel of information, necessary for the effective performance of their duties and otherwise of significance for the operation of the base.
- The notification to those concerned of any cancellation due to unexpected events, changes in priority, technical malfunction or weather conditions of activities planned.
- The immediate reporting to the Operations Manager of a lack of flying ability or any other deficiency which might make a pilot unsuitable for flying duties.
- The immediate reporting to the Operations manager of any event which might be of significance for flight safety.
- The training of a deputy base leader.
- The inspection of the service logs at weekly intervals and sending these to the operations manager.
- The tabulation and presentation of statistics relating to working hours, flight hours and duties performed.

The base leaders are not provided with administrative support but may cooperate for certain administrative tasks.

#### *The base in Gothenburg*

During 2006 and 2007 the number of pilots at the Gothenburg base was reduced from seven to four, one being the base leader. The personnel experience no reduction in the work to be performed which means that the work load per man is heavier. It has been said that this has led to the personnel, regularly and on a voluntary basis, often exchanging duty periods and leave periods to enable the base to maintain the status of readiness required.

#### *1.17.7 Direction function*

According to the Civil Aviation Authority definition, the Executive Manager of the National Criminal Police (C RKP) is the leader of an organisation with responsibility for maintaining the availability of resources corresponding to the scope of its activity. Directly subordinate to C RKP is the Executive Manager of the Executive Police Department (C OPE), who is responsible for six sections of which SPW is one.

SPW is directed by an Operations Manager, who, together with the School Manager reports directly to C RKP (According to DHB, the School Manager is subordinate to the Operations Manager). The Operations Manager has the operational responsibility for the flying activities of SPW and is provided with an administrative assistant. As mentioned above, the Operations Manager has delegated many administrative duties at the bases to the base leaders concerned.

From conversations with personnel at SPW bases in Gothenburg and Stockholm, SHK has gained the impression that the direct control of flying is exercised by the base leader. At the same time, the individual pilots have, in general, been given considerable responsibility and freedom in the planning and execution of the flights.

The control exerted by Operations Manager appears to be mostly of a general character, consisting mostly of regular visits to the different bases, monthly meetings with the base leaders, the performance of certain checks (PC<sup>8</sup>) of pilot competence, annual pilot conferences etc.

The Flight Training School is directed by a School Manager who is responsible for the activity in accordance with the rules of the Civil Aviation Authority rules, JAR<sup>9</sup>-FCL 2. The school provides basic helicopter flight training, theoretical and practical, conversion training, IFR training and flight training using NVG.

#### 1.17.8 *Flight safety objective and internal-control*

As the leader of an organisation, C RKP has the responsibility for the activities of SPW being in accordance with the relevant regulations and that the organisation has a functional internal control system.

The DHB of SPW requires its activity to be characterised by a high degree of flight safety in combination with efficiency and good judgement and that the standard of flight safety shall be in accordance with the regulations BCL-D 2.3 and JAR-FCL of the Civil Aviation Authority and in certain cases, rules in DHB which are even more strict.

SHK has been unable to find in DHB any specifically expressed flight safety objective or how SPW is to act to achieve such an objective.

From interviews with the personnel, it appears that few in the organisation have any clear view of the SPW general flight safety objective or the detailed flight safety objectives at the different bases. Some have said that there is no flight safety objective and that they have established their own objective of the "We shall not crash" type.

The SPW internal control system, described in the SPW DHB is, in the opinion of SHK, incomplete and obscure. There are no detailed routines or forms for reporting and handling flight safety-related abnormalities and flight safety matters.

The instruction in DHB can be interpreted as requiring such reports to be made in the so-called flight log, a report form kept in each helicopter in which such matters as flight times, fuel statistics, daily inspections, work performed on the helicopter and other relevant matters are recorded. As an alternative, abnormalities can be reported in Duty logs, Training logs or other similar documents.

In addition, a document designated Safety Report (SR), not described in DHB or elsewhere, and which is used in certain cases for reporting events related to flight safety is used in SPW activity.

SHK has been provided with a number of such Safety Reports. In many of these, the person handling the matter is not named nor is there any attempt made to classify the degree of seriousness of the matter. It can be said, however, that the frequency of such classifications in Safety Reports has increased during 2005 and later.

Several Safety Reports relate to serious occurrences which have not been reported to the Civil Aviation Authority nor been included in the inspection report of the National Police Board relating to police flying activities.

One of these was an incident in which a passenger was seriously injured when he disembarked from an airborne helicopter at an altitude of 5-10 metres. For some reason unknown, this accident has been reported in two SR versions with different descriptions of the occurrence.

According to DHB, all flight safety related reports are to be analysed and evaluated at routine monthly meetings. The necessary actions are to be taken and all persons concerned informed. SHK has not seen any documentation indicating that this routine is observed.

A study of SPW Flight Instructions and Flight Bulletins shows that these occasionally contain information about occurrences and actions taken.

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<sup>8</sup> PC - Proficiency Check

<sup>9</sup> JAR - Joint Aviation Requirements

According to DHB, reports received shall be compiled on an annual basis and an analysis of reports received shall be performed annually. Information about the results of the analyses and actions taken shall be submitted by the Operations Manager at annual pilot conferences. It is not clear which reports are intended nor how they are to be handled.

The only annual compilation of abnormality reporting within SPW submitted to SHK is of a statistical nature. It contains no information about analyses performed with decisions requiring corrective measures for improving flight safety. Information submitted to annual pilot conferences in this respect has not been documented.

This is confirmed by interviews with the flying personnel. The personnel feel that they do not admit to their own mistakes and those of others because of their fear of the unnecessarily negative attitude of their superiors. Many regret the absence of a so-called "Blame Free Culture"<sup>10</sup>.

From a broad analysis of the abnormality reporting and the classification of flight safety-related events performed, SHK has observed an increasing trend toward the classification of errors as "Major" during the years 2003-2006. Many reports have been written on accidents occurring in connection with coordination with NI and certain of these have been judged as having been of a very serious nature.

#### 1.17.9 Recruiting/Training

Candidates for police flight training are recruited via advertisements in the National Police Board Personnel Bulletins. The basic requirement is that candidates are police with at least four years police experience including any training at the Police College.

Candidates are to satisfy the requirements of the Civil Aviation Authority and to undergo tests associated with police activities. They are to satisfy the requirements of an approved test for psychological suitability for pilot training including a Defence Mechanism Test DMT.

In the case of the pilot concerned in this report, the results of his psychological suitability test and DMT were only marginally successful but he was considered to be acceptable after discussion in the selection board.

Police helicopter pilots were originally given flight training by the Swedish army at Boden and Linköping. Since the beginning of the 1990's, SPW has had its own Flight Training School, initially at different bases in the Stockholm area and later at the Gothenburg base. The training is ab initio helicopter training for new pilots. These are graduated after testing by Civil Aviation Authority inspectors. The Flight Training School also trains helicopter pilots for the Norwegian police.

SHK has gained the impression that the Flight Training School has not participated to any degree in the development of new police helicopter operational methods such as the embarkation and disembarkation of picket forces, abseiling from helicopters, operations with NI etc.

#### 1.17.10 Environment training

From conversations with personnel at the Gothenburg base, it is clear that the flight operation "environment training" is an established and normal practice used for several years at the base in the selection of new system operators but primarily in coordination exercises with picket police groups.

That which is included in the environment training and how it is to be performed varies, depending on the circumstances and the pilot concerned.

When SPW use environment training in selecting new operators, the purpose is to determine if the prospective operator can be expected to perform his duties in a flying environment, for example, that he does not risk becoming air-sick during an operation. The procedure is for the operator to attempt to perform his normal du-

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<sup>10</sup> "Blame Free Culture" – The possibility of presenting a critical report without risking reprisals



ties, operating his technical equipment on board while the pilot performs a series of manoeuvres with the helicopter which can cause air-sickness.

In the case of the environment training of picket police, the purpose and the execution are not so well defined. Some consider it to be a selection instrument to identify the picket police who may become airsick during demanding flying and are then unable to perform their duties on landing, when the police duties are to begin.

Others view environment training as a means of providing picket police with the experience of helicopter flying under demanding conditions and knowledge of the range of possible helicopter manoeuvres they can expect.

The picket police coordinator for the exercise concerned considers that there was a documented SOP with instructions for the execution of the exercise and refers to the lecture plan used for the flight, dated 2007-02-26.

"Environment training in tactical flying with helicopter" and "Tactical loading and unloading of helicopter during landing, hovering and support are included in this lecture plan, Block 3/2007.

The same document, under the heading "Execution in accordance with exercise plan Block 3, 2007", states that "The purpose of the training is to maintain the capability of the unit to make use of transport by police helicopters".

It states further that the requirement after the training is to be "the ability, without guidance, in daylight, in groups, to perform tactical embarkation onto and disembarkation from helicopters" and under "Execution" – "Introductory theoretical training in dangerous situations in terrain... annually perform training for qualification for participation in tactical embarkation and disembarkation .....".

Those who witnessed the relevant "environment training" have described the flight in terms of "steep climbs", "steeply banked turns", "tough flying", "steep dives", "advanced flying", "dramatic", "damned advanced – tough", "flying at tree-top level".

All on board are required to wear flying helmets during civil commercial low-flying activity. SHK has not found any requirement in the police instructions for the flight that the picket police are to wear helmets.

The Operations Manager states that he was completely unaware of the expression "environment training" in connection with the coordination exercise with the picket police or the selection of new operators and the type of flying this involves. The operation is said not to have been authorized by the SPW direction and there is no centrally prepared and approved SOP or TA which controls this activity.

## **1.18 Additional information**

### *1.18.1 Relevant regulations*

The SPW operational activity can be separated into two parts, one part of which is performance of "Air traffic of special type" with permission regulated by Luftfartslagen ( Civil Aviation Laws ) and Luftfartsförordningar (Civil Aviation Regulations) and the other, the performance of flight training in accordance with Civil Aviation Regulations and relevant requirements in accordance with JAR-FCL 2.

The Civil Aviation Authority has granted SPW a "Permit for Air Traffic activity of special type" based on Para. 89 in the Civil Aviation Regulations. This gives the police permission to perform "Flights for police operations, traffic surveillance and surveillance of forest fires from the air" and "Flights involving participation in rescue operations and civil defence exercises".

With respect to flying operations, reference is made in the permit to BCL-D 3.1. For helicopter operations specifically, BCL-D 3.1 refers in turn to BCL-4.1 (LFS 2007:59) which mainly regulates "private flying with helicopter" The SPW permit also includes flight activity in accordance with IFR and in darkness.

According to Civil Aviation Law Chap 15 Para 2. the government, or the authority delegated by the government, is responsible for imposing regulations relating to civil air traffic, or, in individual cases, to grant exemption from certain regulations.

There is no such delegation or exemption for SPW which means that its activity is to be in accordance with the currently valid regulations for civilian air traffic.

In its operational manual (DHB) the police have chosen, in certain parts, to refer to BCL-D 2.3, (LFS 2007:49) which regulates commercial flight activity with helicopters in Sweden. This is a departure from the regulations to which the permission refers.

According to the Operations Manager of SPW, the reason for this is that it was considered that BCL-D 2.3 (LFS 2007:49) is, in certain cases, more relevant to SPW activity than BCL D-4.1 (LFS 2007:59).

#### 1.18.2 *The Civil Aviation Authority inspection activity*

The Civil Aviation Authority has an inspection responsibility for all civil aviation activity in Sweden requiring permission. When a new aviation company is to be established, the Civil Aviation Authority first performs a so-called approval control of the organisation. When all the specified operative and technical criteria are satisfied, an operational permit in which the nature of the activity is clearly regulated is granted.

The Civil Aviation Authority is to perform regular inspections, according to the current regulations, of all organisations with such an operational permit. This is normally performed by means of regular contacts with the organisation and through periodic activity controls during which the operational and technical activities of the organisation are inspected. The activities of commercial aviation companies, the inspections are on an annual basis.

Special activity inspections are performed in connection with extensions or expansions of the scope of the air traffic permit.

The responsibility of the Civil Aviation Authority to inspect SPW embraces both the operational flight activity and the Flight Training School.

SHK has observed that the inspection activity of the Civil Aviation Authority with respect to SPW has not been in accordance with the norm for civilian aviation enterprises and organisations with permission to operate in accordance with BCL-D 3.1 and BCL-D 2.3 (LFS 2007:49) respectively.

It has been discovered during the investigation that no routines have been established for periodical inspections of the SPW operation by the Civil Aviation Authority. Such inspections are only performed when requested by SPW. Whether or not the direction of SPW have been fully aware of this routine inspection requirement is not certain.

There has been no periodic or other activity inspection of SPW since 2002 at which time, an activity inspection was performed in connection with the renewal of the SPW permit.

With respect to the Flight Training School activity, it appears that the Civil Aviation Authority inspections have been performed in accordance with the relevant current routines for corresponding civilian flight training schools.,

#### 1.18.3 *JAR-OPS 3*

Joint Aviation Requirements (JAR)-OPS 3 is a set of national regulations based on an international agreement for civilian commercial personnel and freight transport, embracing ambulance flights with NVG and under IFR (international designation : Commercial Air Transportation (helicopters)) .

All civilian commercial transport activity by helicopter in Sweden which is not categorised as so-called "Aerial work"<sup>11</sup> is performed since 2003 in accordance with JAR-OPS 3.

JAR OPS-3 does not apply to government flying activity. Such activity is presumed to be regulated via national rules.

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<sup>11</sup> Aerial work – Specific flight commission

#### 1.18.4 MTO (Man, Technology Organisational) aspects

The MTO – perspective means that in different situations, the community attempts to take into consideration the complex interaction between Man, Technology and Organisations.

Managers and leaders have considerable influence over how work is performed within an organisation. Technology and organisation interact through the technical equipment used, the availability of personnel, their education, competence development, production tempo, work time distribution, etc. Organisation and company culture also affect relations between colleagues, how the individual feels and functions in his/her situation.

In the investigation of this accident, SHK has attempted to take into consideration any MTO aspects by searching for any background factors in the organisation, management, culture etc of SPW which may have had significance for the accident. For this, SHK has studied the following documents:

- Polisflygarnas Förenings (PFF) (Police Aircrew Association) questionnaire 2003.
- Investigation into the working environment within the Swedish Police Wing Dec. 2005.
- Analysis (2006) by the Executive Manager of the Executive Police Department of the results of the above working environment investigation.
- Study of the Police Flying Activities by Rikspolisstyrelsens (The National Police Board) Oct. 2006.
- Comments on the above Study of the Police Flying Activities Jan. 2007.

The results obtained from this study which SHK consider reflect such conditions and events are presented below.

##### *1 Police Aircrew Association (PFF) questionnaire 2003*

In 2003, PFF sent a questionnaire to its members with the purpose of obtaining the opinions of members regarding how they should “handle” their Operations Manager with whom many were dissatisfied. The questionnaire indicated that approximately one third of the members (answering the questionnaire) were in favour of his immediate dismissal. The results of the questionnaire were presented to C OPE and the Operations Manager.

##### *2 Investigation into the working environment within the Swedish Police Wing, Dec 2005*

During 2005, The National Criminal Police Board performed an investigation into the working environment within SPW which embraced pilots, base leaders and one administrative officer. The results included both positive and negative responses/opinions from the MTO point of view.

The results indicated that the majority were satisfied with their total working situation and were fully engaged in the work and that they had good base leaders. The pilots added that the colleagues at each base cooperated well but that cooperation between the bases was unsatisfactory.

One of the reasons given for the unsatisfactory cooperation between the bases was the considerable difference between the pilot’s salaries resulting from the individual (I) salary system. Some considered that there was rivalry between certain bases. L

The majority were satisfied with the physical working environment. Most said that they were not exhausted after their work and had recuperated after a 24 hour rest period and that their employment was not incompatible with parenthood.

Two thirds of the personnel said that their competence had been developed and that they have had competence development interviews during the last year. A third

of the personnel say that they have never or seldom had any meeting with their superiors to discuss their professional development. A majority of the personnel feel that they had seldom or never received feedback and appreciation from the direction above the base leader level for work well done and they missed such recognition of their efforts.

In answer to the question "does the Executive Manager of the Executive Police Department (C OPE) work in a way which develops police flying activity?" more than half of the personnel answer that they are doubtful or that they have no real knowledge of what he does.

Most of those asked, have no faith in the Operations Manager and relate this to flight safety and personnel welfare questions. Almost all had themselves experienced unjust treatment or known of another who had been unjustly treated in relation to the job. Half of these were related to considerable differences in salaries and the other related to some incident involving a pilot and the Operations Manager. A quarter of the personnel considered that it was a large problem that the Operations Manager alone determined salaries, safety, flight testing, economy etc. and that they therefore felt insecure with him.

The participants were able to present "Other comments" and almost all did so.

In their comments, approximately half of the personnel stated that the latest wage-setting was a considerable problem. They were dissatisfied with the large unexplained differences in salaries. This led to much speculation among the personnel. Many were also disappointed that they have had their payment interviews only after the salaries had been decided upon and that it was not their base leader who set their salaries.

The salary problem, from a flight safety point of view, is presented in "Minutes of a meeting of base personnel at Myttinge 2007-05-07", as follows: "That the flight safety risk induced by the individual salary system should also be discussed was the opinion of the meeting. The risk is considerable, and there have been recent examples, that personnel withhold information of flight safety significance in order to be able to impress the direction in the hope of being awarded a larger salary in the near future".

Approximately a third of the personnel had the feeling that the organisation had no clear objective or visions and that they received insufficient information from the direction.

### *3 The analysis by the Executive Manager of the Executive Police Department of the results of the above working environment investigation March 2006*

In the analysis, it is stated that the SPW personnel "are in general satisfied with their work situation and the physical working environment". With respect to wage-setting, it is said there that the then Executive Manager of the National Criminal Police Department, at a pilot conference, presented the guiding principles and that the influence of the Executive Manager of the Executive Police Department, C OPE, and the Operations Manager over wage-setting was marginal. With respect to the future, the analysis states that C OPE and the Operations Manager are only to adjust any obvious anomalies.

The interpretation by the analyst of the lack of confidence of half of the personnel in the Operations Manager is that "he is sitting on too many chairs and he does not manage personnel welfare questions satisfactorily".

The opinion of the analyst is that "The Operations Manager has responsibility for the personnel and the budget but also a responsibility to the Civil Aviation Authority to establish norms for the execution of the flying activities and to monitor the status and annual proficiency checks of the pilots, duties which mean that he "is sitting on too many chairs". "This is not seen as a problem from the employer's point of view but rather as an advantage, as the responsibility for the economy does not need become a hindrance to the development of flight safety".

In conclusion, the analyst states that the employer has taken note of the valuable comments submitted by the personnel in the investigation and to the best of his ability, will improve the working environment within SPW.

#### 4 Study of the Police Flying Activities by the National Police Board Oct. 2006

The directive for the study was to perform a comprehensive review of SPW flying activities. Its purpose was to determine if the flying activities accord with established priorities and guidance and if they are executed rationally, effectively from an economic point of view, legally correctly and, in general, are administered efficiently.

According to the directive, opinions shall be developed regarding situations and conditions where inadequacies have been observed or where a further development of the activities is judged to be urgently required.

The Inspection group arrived at, inter alia, the following conclusions:

- SPW has itself had considerable influence over the development of the present flying activity.
- There were no serious accidents or incidents with the new helicopter type before the turn of the year 2005/2006. (A helicopter accident due to icing occurred at Östersund in December 2005 and in April 2006, a helicopter was the target of small-arms fire in connection with the pursuit of a bank robber).
- Each base has prepared its work schedule on the basis of its own preconditions and requirements.
- The SPW does not make use of the two-pilot system.
- For safety reasons, flying under conditions of darkness is preferable with two pilots.
- The National Police Board should apply more direct control over the direction and the guidance of the flying activities. The work schedules and leave and training plans should be coordinated by a central instance to a higher degree than at present.
- The SPW base at Malmö should be closed.

#### 5 Comments on the above Study of the Police Flying Activities Jan. 2007.

The brief comments, prepared by C OPE and signed by C RPS, include a few opinions which apply primarily to the economics and guidance of the activities. Of the conclusions listed above, it is only the possible closure of the Malmö base which is mentioned.

#### *Summary of MTO-aspects*

The study by SHK of the above documents gives a clear picture of a widespread discontent with the direction of SPW and certain working conditions. Comments confirming this have been made to SHK during interviews with the personnel.

#### 1.18.5 *Actions taken after the accident*

##### SHK

In copies of a document addressed to the Civil Aviation Authority and the National Criminal Police Department, dated 15 June 2007, SHK has reported that during its investigation of the accident concerned, it found uncertainties with respect to permits, rules, manuals, routines and inspections which have had negative effects on the level of flight safety within SPW.

##### Civil Aviation Authority

After the accident, the Civil Aviation Authority has:

- performed a thematic inspection of the activities of SPW,

- performed a juridical investigation with respect to the permission granted the National Police Board to engage in air traffic activities of a special nature, and
- submitted a proposal to amend the Air Traffic Laws and Air Traffic Regulations with respect a widening of the concept of service aviation activity.

#### Swedish Police Wing

- In a Flight Bulletin. 05-07, the Operations Manager has advised that a "SOP" with respect to coordination exercises with the picket police in Gothenburg has ceased to apply with the result that abseiling with dog and loading and unloading are to be performed in accordance with the routines for ordinary passengers.
- According to the RPS direction, the following reorganization of the SPW has been performed or is in progress:
  - The combined appointment as Operations Manager and Section Manager has been separated and two new Managers have been appointed.
  - The appointment as Accountable Manager has been transferred from the Executive Manager of the National Criminal Police (C RKP) to a lower level within the organisation.
  - A dialog with The Civil Aviation Authority has begun regarding operational permits and the question of a new set of regulations will be settled during Autumn 2008. The SPW has established a Continuing Airworthiness Management Organisation (CAMO) for which a Quality Manager has been appointed to supervise the technical and operational activities with respect to quality.
  - A new operational manual (DHB) will be submitted to the Civil Aviation Authority in October 2008.
  - The newly appointed Operations Manager will perform a review and updating of all relevant flying regulations.

#### 1.18.6 *Fire Brigade in Gothenburg*

In the Law (2003:778) relating to protection against accidents, rescue service consists of the rescue operations which the state or local governments are to provide in the case of accidents or imminent risk of accidents, to hinder and limit injury to persons, property or the environment. On the occasion of the accident concerned, the Fire Brigade in Greater Gothenburg was responsible for the local government rescue service at the site of the accident.

The local government fire brigade and ambulance organisations were alerted via SOS Alarm in Gothenburg.

#### 1.18.7 *Ambulance flights with helicopter - general*

Ambulance flights within Sweden are performed in accordance with the international rules for "Helicopter Emergency Medical Service" (HEMS). HEMS flights are performed under IFR and with NVG in a crew consisting of either two pilots or one pilot and a so-called HEMS Crew Member whose duty is to assist the pilot.

HEMS is regulated under JAR-OPS 3 with the associated Appendix 1 JAR OPS-3 .005 (d) which inter alia, requires strictly defined crew cooperation.

#### 1.18.8 *Environmental aspects*

After the accident, kerosene fuel and oil leaked into the ditch where the helicopter wreck finally lodged. At the request of the environmental authority the fire brigade laid out "absorbent snakes" downstream to limit the spread of the contamination and collect the remaining oil. Absorbents were spread around the wreck and its fuel

tanks, which had been dislodged by the impact, to absorb fuel from the ground. A decontamination entrepreneur was present at the site when the wreck was salvaged.

#### 1.18.9 *Questions relating to genus equality*

The accident has been investigated from the point of view of genus equality i.e. against the background of the question if there were circumstances which suggest that the occurrence or its effects were caused by or affected by any women or men concerned not having the same possibilities, rights and responsibilities in different respects. No such circumstances have been detected.

## 2 ANALYSIS

### 2.1 The flight prior to the accident

Training in coordination between the Swedish Police Wing in Gothenburg and the Gothenburg police picket group had been performed for several years. The pilot concerned had taken part himself on several occasions and participated in the development of the operational details.

He should therefore have been familiar with the flying operation concerned and the manoeuvres to be executed, despite not having been originally selected for this duty. The weather was not the best but it was acceptable for the operation planned.

The concluding part of the coordination exercise consisted of the so-called environment training. As described in 1.17.10, environment training required flying outside the normal flight profile, including steep manoeuvres with both high positive and almost negative G-loading, performed partly at low altitude and high speed. This was a demanding type of flying for which neither the pilot nor the helicopter were approved.

Even if the beginning of the exercise was performed in accordance with the usual routine, there are signs that the flight leading to the accident was not performed completely normally. The start was abrupt and the passengers experienced the manoeuvres as being violent, with abnormally high G-forces and steep turns. Several witnesses, including those who had seen this type of operation previously, noticed in particular, that the manoeuvres during the environment training were steeper than usual.

Before the accident, the pilot had requested and been granted two weeks leave for private social reasons. He returned to flying service two weeks before the accident and during this time had flown on only two days. No professional evaluation of his psychic condition and suitability for a return to flying duties was performed.

Private problems can affect the psychic health of a person and introduce the risk of reduced concentration capacity and less ability to focus in mentally demanding situations.

It has not been possible to obtain reliable information about the mental status of the pilot at the time of the accident. It cannot be excluded that such factors can have contributed to the unusual way in which the pilot performed the final flight.

Nothing in the pilot's actions during the flight suggest however that there was any helicopter malfunction, this being confirmed by the technical investigation.

The helicopter was equipped with snow skids which are not installed on the helicopters which the SPW pilots in Gothenburg normally fly. Even if, according to the manufacturer, snow skids do not significantly affect the performance of the helicopter, the reference flights performed for SHK show that they can do so when the flight approaches the permitted limits to operations with the helicopter type.

During the reference flights, during recovery after a steep dive at high speed, the helicopter was felt to be sluggish and the manoeuvre took more time with snow skids installed than without.

The final sequence of events suggest that the pilot intended to perform some kind of "wingover" with the helicopter. The manoeuvre began with the helicopter climbing steeply from low altitude. At the top of the climb, at low speed and with elevated nose, the helicopter rotated on its vertical axis and entered a steep dive. The intention of the pilot was probably, after an abrupt recovery, to fly past the firing mound at high speed.

Everything indicates that the pilot, beginning this manoeuvre and during its execution, misjudged the attitude, speed and altitude of the helicopter. The result was that the final dive became steeper and the recovery at an altitude lower than he intended.

That the pilot, in attempting to recover, did not succeed in reducing the high speed of descent before it struck the ground, may also have depended, in addition to the insufficient altitude margin, on his being surprised by the somewhat sluggish reaction of the helicopter during the critical recovery, because of the snow skids, with which he did not normally fly.

The evidence of witnesses that the rotor sound, immediately before the impact, was "abnormally" hard", suggests that the pilot, in an attempt to reduce the rate of descent, loaded the rotor disk excessively. This can generate such a rotor sound and such an action confirms the view that the pilot was fully conscious and aware during the entire flight until the impact.

The marks of the impact with the ground show that the pilot had succeeded in raising the nose of the helicopter but that the rate of descent was then still high.

After the helicopter hit the ground and overturned, it rolled, uncontrolled, in the direction of impact until the wreck lodged in the ditch.

SHK consider it remarkable that the so-called environment training has been used repeatedly as a part of the training in, inter alia, coordination between SPW and the Gothenburg picket police without the knowledge of the central direction of SPW.

Even if the purpose may have been good, i.e. to give the picket police, already accustomed to psychic and physical stress, the opportunity for a brief experience of "tactical flying", it may be suspected that certain of the pilots include an element of "bravado" in the environment training flight in front of their earth-bound police colleagues.

For most of the pilots concerned, it appears that they have known clearly that these flights included departures from the SPW operational flying regulations and close to or partly beyond the permitted operational limits for the helicopter type.

The explanation of this is largely found in the direction problem mentioned in Chap. 2.2. below.

## 2.2 Organisation and direction of the Swedish Police Wing

The duties of SPW are extensive and range over many areas of activity.

The central direction is located in Stockholm whereas the daily direction of operations is, in practice, delegated to the different base leaders.

The SHK investigation into the activities of SPW has clearly shown that its direction in Stockholm has not had complete insight into and control over the activities at the bases. An awareness of the inadequate direction has resulted in many of pilots questioning the competence, capacity and interest of the direction to lead and develop the activity.

The SPW DHB is to function as an effective controlling instrument and compilation of rules for all flying activities. It is to be current, relevant and comprehensive. All personnel concerned are to have confidence in its contents and follow its directions.

The opinion of SHK is that the SPW DHB does not fulfil this function. It is unclear in many points and does not cover the entire range of the operational activities of SPW, including the special and complicated, specifically police-related flying ac-



tivities to be performed. Descriptions of the different types of SPW tasks and the training requirements for these are unclear or absent.

Instead of introducing such information into DHB, different types of unclearly defined instructions, both from the central direction and the base level have been published internally within the organisation. In certain cases, these have been designated "SOP" which is misleading as SOP define standard operational flying procedures used within civil aviation, a context different from police aviation.

The instructions are in certain cases unregistered and untraceable with respect to validation, revision status, the person originating the instruction, the approving instance etc. A consequence of this is that certain instructions have come to exist without the knowledge and control of the central direction.

Shortcomings and uncertainties in DHB can be factors leading to the personnel not accepting the internal rules with the resultant risk that regulations and instructions may not be observed and flight safety endangered.

It is well known that people working within organisations demanding a high degree of safety, naturally create their own procedures and rules in the absence of suitable and accepted rules. Within aviation, it is therefore of the greatest importance that the direction of the organisation continually monitors its collection of rules and keeps it current and relevant.

The development of new operational instructions within SPW has been partly developed on local levels and in accordance with ambitions and standards at the local level with the result that the organisation does not operate in a uniform manner.

There can be a risk to flight safety if one base borrows personnel from another, if those concerned have an operational profile not in agreement with that of the borrowing base.

DHB therefore does not give the guidance needed by SPW pilots to perform their duties in a suitable and uniform manner with the flight safety required.

In addition to the shortcomings in the direction and management of the activity, it has appeared during the investigation that the psycho-social working atmosphere within SPW, as experienced by the personnel, has not been satisfactory. This also can have a negative effect on the safety of its flying operations.

SHK consider it remarkable that the central direction of SPW has not reacted to these factors, in particular, as they have been noted during the internal investigations performed.

It is the opinion of SHK that the Operations Manager has been given, or taken upon him, more tasks than can reasonably be performed effectively by one person. There are many indications that the work loads on the base leaders have also been too heavy.

Instead of identifying these deficiencies in the organisation and taking the necessary action to correct the situation, the direction appears to have chosen to trivialise the problems.

With a well functioning central direction of SPW, there would probably never have been the irregular and dangerous environment training flights at the Gothenburg base. The pilot involved in the accident would probably not have been permitted to return to flying duties after two weeks leave for personal reasons if he had not first been interviewed by an expert in aviation medicine.

## 2.3 Internal control

A functioning internal control system is one of the essentials in operating a safe aviation activity. With such a system, the organisation can itself specify a flight safety objective, identify errors and departures from the norm, initiate corrective measures and in due course confirm that the objective has been achieved. The result becomes a quality-assured activity.

As is shown above at 1.17.8, SHK considers that the SPW internal control system suffers from several serious deficiencies and does not satisfy the requirements of such an extensive and complex activity.

There is no well defined flight safety objective, firmly established on all levels of the organisation. Without such, there is no benchmark against which its activity can be compared. There is then no possibility of identifying weaknesses and shortcomings to permit corrective action.

The reporting of errors and departures from the norm, which is one of the most important components in an effective internal control system appears to function poorly. Routines for when and how reports are to be submitted and by which means are not clear.

Even the handling of reports received is performed in an unstructured manner without any person responsible being named.

These deficiencies can result, inter alia, in the following:

- The loss of information important for the safety work and the development of the organisation.
- Diminished motivation to report further occurrences which results in a reduction in the feedback to the system.
- Misleading flight safety statistics.

An explanation of the shortcomings in the internal control system can be that there is no instance responsible for the operation and development of the system, with the task of training the personnel and motivating them to take an active part in the system by reporting errors and deviations from the normal.

The SHK investigation has shown that there is a culture within SPW which to a degree restricts this type of productive reporting. It happens that personnel do not report serious occurrences and their own mistakes in fear of incurring disciplinary action of different kinds.

This, together with the relatively small number of reports submitted indicates that to all intents and purposes, there is no "Blame Free Culture" within SPW, this being a serious deficiency which can hinder effective flight safety work.

SHK consider it remarkable that there have been accidents and serious incidents which have not been reported to the Civil Aviation Authority in accordance with current regulations, despite their being known to the direction of SPW. It has happened instead that such occurrences have been trivialised without being analysed and without relevant action being taken.

The direction of SPW has not developed an effective system for processing statistically the information generated by the internal control system to enable recognition of trends, critical activity areas, differences in relation to other operators, the readiness to submit reports etc. Such a system would be an effective tool for use in advancing flight safety

SHK further questions the suitability, when recruiting new pilot trainees for SPW, of requiring the candidates to be policemen with several years police experience. There is a risk that such a rule limits to an excessive degree, the number of suitable applicants with the optimum requirement profile.

## 2.4 Inspection responsibility of the Civil Aviation Authority

### *The SPW operational permit*

During recent years, SPW has undergone an extensive modernisation, both operational and technical. From having operated previously with smaller single-engine helicopters, according to VFR (Visual Flying Rules ) with one pilot, SPW now flies advanced twin-engine helicopters according to IFR (Instrument Flying Rules) and in darkness, ordinarily with two pilots and in certain cases with a so-called system op-

erator on board. The flying operations are of a number of different types, some particularly demanding and requiring the use of advanced extra equipment on board the helicopter.

The SPW can therefore be considered to be comparable with a civilian commercial helicopter enterprise. In consideration of the scope of its activity and its geographic distribution, the organisation must be considered to be one of the largest helicopter operators in the country.

Against this background, SHK considers it most questionable that the Civil Aviation Authority, in its permit for the activity, refers to BCL-D 3.1 "Aviation activity of special character" which in its turn, with respect to its contents of specifically helicopter nature, refers to BCL-4.1 (LFS 2007:59) "Private aviation" which relates to flying activity of a considerably simpler nature. Such activity is largely private flying performed by volunteer organisations.

The Civil Aviation Authority seems not to have realized the consequences of the expansive development of SPW and the need to perform a comprehensive upgrading of its permit to a corresponding degree. The same applies to the need to adapt the corresponding inspection activity.

The Authority has instead chosen to grant SPW different kinds of special permit e.g. for flying according to IFR and with NVG. The Authority has also accepted that without special permission, SPW may perform transport of persons and freight for which permission according to JAR-OPS 3 is normally required.

The fact that SPW, in certain parts of its DHB, refers to BCL-D 2.3, can be interpreted as meaning that its operational direction has itself realized that it is with commercial service flying activity with helicopters that SPW should be primarily compared. However, as the Civil Aviation Authority has no such requirement of the organisation and its DHB, the level of requirement of the activity has varied without definite norms.

The lack of Civil Aviation Authority decisiveness in this respect can have hampered the development of SPW operational routines. and, to a degree, may be an explanation of certain of the shortcomings in its activities and its DHB which have been noted during this investigation.

HEMS flights are a civil helicopter activity which could be compared with SPW. Such flights are often flown under difficult conditions in accordance with IFR and with NVG. The crew consists either of two pilots or of one pilot and a so-called HEMS Crew Member whose duty is to assist the pilot. For HEMS flights, the crew cooperates in accordance with established procedures.

JAR-OPS 3 with an associated Appendix 1 JAR OPS-3 .005 (d) applies to HEMS – flights.

SHK considers therefore that the Civil Aviation Authority should develop a national set of rules adapted to the activities of the SPW and, where appropriate, including the requirements of JAR-OPS 3 for civilian operators with respect to organisation, management responsibility, documentation, internal instructions, training, internal control etc. In such a set of regulations, procedures corresponding to those applied to HEMS flights could be developed for SPW-specific tasks including requirements for crew configuration and crew cooperation in accordance with established rules.

#### *Inspections by the Civil Aviation Authority*

The purpose of the inspection activity of the Civil Aviation Authority is to ensure that approved aviation enterprises perform their activities in accordance with the requirements of the aviation authorities concerned and the enterprise itself. This is performed by means of regular contacts and periodic activity controls.

SHK find it difficult to comprehend that the Civil Aviation Authority has not established routines for performing periodic checks of the SPW activity but has only performed such at the request of SPW. It must be considered remarkable that there has been no regular activity control of the operational flying activity for almost four years.

Many of the deficiencies in SPW activity had probably been made good if the Civil Aviation Authority had exercised control over SPW equivalent to that normally applied to commercial helicopter operators in Sweden.

Another result of the inadequate inspection by the Authority may be that SPW has not had natural contacts with civilian commercial helicopter activity and has had difficulty in keeping abreast of developments in relevant regulations, flight safety work, procedures, rules and routines etc.

The Flight Training School appears to have been operated in accordance with current regulations in JAR-FCL 2. The SPW, however, has not to any degree, made use of its competence to develop operational flight routines and provide further training of the personnel for new police operational tasks.

## 2.5 MTO-aspects

For a large and complicated organisation, a correct handling of MTO questions is of great importance, in the case of SPW, for reasons of both flight safety and a satisfactory working environment. Many of the personnel feel that the working environment and psycho-social working conditions are unsatisfactory. See 1.18.4 above.

In summarizing, it can be said that communication within the organisation and the management of the activity by the central direction has serious inadequacies. It is apparent that the Operations Manager does not have the confidence of the majority of the personnel.

It is a serious matter that the direction of SPW has not reacted to the information, received from different quarters, that the organisation has MTO problems. This has meant that no concrete measures have been taken to improve the situation.

Instead, the central police direction has attempted to explain away the opinions of the personnel and to a degree, defended the direction of SPW. SHK can state that the ambitious "Study of the Police Flying Activities by the National Police Board" failed to recognize and solve the MTO problems.

## 2.6 Rescue services

SPW in Gothenburg informs LKC of its daily activities as a routine procedure. SPW send a flight plan to LKC and confirm their takeoffs by radio. SOS Alarm is not normally informed of police exercises. On the day concerned, the picket police informed LKC of the proposed exercise at Sisjön with SPW and later, the police helicopter signalled that they were airborne. More exact details were not given.

The operator at SOS Alarm, as a routine procedure, interrogates the person sending the alarm, to obtain as far as possible, the exact position of the occurrence with the help of recognized landmarks which can be of help in directing the units alerted to the site. For the police and fire brigade units, who knew the area, the site was clearly defined as the rifle range but this was not clear to all of the ambulance drivers. It is not impossible that inadequate mobile telephone communication contributed to the loss of important information about location and road approach.

Means were taken to direct the rescue units correctly. Police motor cyclists met the first units from the fire brigade and the first ambulance at the Fässbergs exit to Sisjön. to guide these. The guidance function ceased after the motor cyclists led these units into the area. No other detailed information was transmitted to the other units. When the first ambulance reached the site of the accident and sent a status report to SOS Alarm, the correct information was transmitted to the other units.

If the guidance function had been maintained, or if the Fässbergs exit had been named as the most suitable way to the site, it is probable that all of the units had driven directly to the site. It is important to ensure that all alerted units receive sufficient information to be able to reach the site of an accident quickly. This should be understood by all the organisations concerned.

At the site of the accident, the ambulance personnel encountered a number of armed picket police working desperately to extricate the pilot from the wreckage and to assist their injured colleagues. The rescuers were covered with clay and mud, stressed, and anxious to convey their view of the accident and what should be done. It is understandable that the ambulance personnel experienced the situation as tense.

In consideration of the “double” involvement of these police in the accident, they must be seen in a way as “victims” as distinct from the police who subsequently arrived at the site.

## 2.7 Medical care

### Initial medical care

Early notification of and prompt attention by qualified personnel are, most often, decisive for the results of trauma with serious bodily harm. The primary care of the injured by the police personnel at the site began immediately and must be regarded as positive. As mentioned above, several of the ambulances had difficulty in locating the site which probably means that the availability of qualified assistance was delayed.

There has been no reliable explanation of why several of the ambulance personnel were labelled as “site commanders”.

It may be that it was because other qualified personnel at the site were not being used optimally which led to the apparent passivity of the ambulance helicopter doctor.

In conclusion, these circumstances, in combination with the initial chaotic situation which some experienced as “threatening”, probably hindered the work of the ambulance personnel and delayed the evacuation of the injured.

Even if, in the view of SHK, this did not have unduly negative effects on the injured, there is reason to reconsider the routines for pre-hospital treatment and its organisation in the case of accidents with several injured.

When the leadership at the site had been established and the rescue work began, the direction of the medical care and the cooperation between police, fire brigade and ambulance personnel appears to have functioned satisfactorily under the circumstances.

### Injuries to persons

All on board were held in their seats by wearing safety belts. Only the pilot wore a helmet. The injuries to the passengers are judged to have been caused by the impact of the helicopter with the ground and when the passengers were ejected from the helicopter and hit the ground.

The pilot remained in his place and was held fast under the central sections of the helicopter. He died from the results of a violent compression of the thorax.

The passengers remained fixed in their seats and their injuries were not more extensive because of this and the soft, energy-absorbing nature of the ground.

All the passengers facing forward suffered fractures of the vertebrae. Passenger 2 suffered a wound to the scalp which he may not have suffered if wearing a helmet.

That passenger 1 was the least injured may have depended on his travelling facing to the rear and his body probably decelerating less violently on the first impact with the ground.

## 3 CONCLUSIONS

### 3.1 Results of the investigation

- a) The pilot was authorized to perform the flight within permitted limits.
- b) The helicopter had a valid certificate of airworthiness.
- c) No technical fault has been found in the helicopter.
- d) The flight performed included departures from the relevant regulations and close to or partly outside the permitted operational limits of the helicopter type .
- e) The snow skids installed can probably affect the manoeuvrability of the helicopter type in certain flying attitudes.
- f) Deficiencies have been noted in the direction of SPW, its inspection activities, routines and rules.
- g) The working atmosphere and psycho-social conditions within SPW have been unsatisfactory.
- h) Deficiencies have been observed in the issue of permits by the Civil Aviation Authority to SPW and in the inspection of the SPW operational activities.
- i) There had been no inspection of SPW operational activity for almost four years.
- j) Guidance of rescue vehicles to the site was withdrawn before all the ambulances despatched had arrived at the site of the accident.

### 3.2 Causes of the accident

The accident was the result of, partly, deficiencies in the direction of SPW, partly, the unclear granting of permits by the Civil Aviation Authority and its inadequate inspection which permitted a dangerous flying activity. Triggering factors were the pilot's performance of the flight in combination with the possibility that the snow skids mounted on the helicopter may have affected the flight properties of the helicopter under extreme flying conditions.

## 4 Recommendations

It is recommended that Luftfartsstyrelsen (Civil Aviation Authority):

- develop national regulations adapted to the activities of SPW and where relevant, follow in these, the requirements of JAR-OPS 3 for civil operators. These should also include procedures for the type of operation specific to SPW including requirements for crew configuration and crew cooperation etc. (RL 2008:07 R1) and
- review the internal routines of the Civil Aviation Authority for granting permission for and inspection of commercial flight activities (RL 2008:07 R2).