Statens haverikommission
Swedish Accident Investigation Authority

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Accident on 20 June 2011 involving helicopter D-HPHP in Salixbyn, Härjedalen municipality, Jämtland county

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The report is also available on our website: www.havkom.se

In case of discrepancies between English and Swedish language versions of a report, the Swedish text shall prevail in the interpretation of the report.

Statens haverikommission (SHK) Swedish Accident Investigation Authority

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Statens haverikommission
Swedish Accident Investigation Authority

1. Swedish Transport Agency, Aviation Department
2. Swedish Civil Contingencies Agency
3. County Administrative Board of Jämtland County

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The Swedish Accident Investigation Authority (Statens haverikommission, SHK) has investigated an accident that occurred on 20 June 2011 in Salixbyn, Jämtland county, involving a helicopter with registration D-HPHP.

In accordance with Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation, the SHK investigation team submits a final report on the results of the investigation.

The Swedish Accident Investigation Authority respectfully requests to receive, by 1 September 2012 at the latest, information regarding measures taken in response to the recommendations included in this report.

On behalf of the SHK investigation team,

Hans Ytterberg Agne Widholm

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General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is an independent authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended, as far as possible, to clarify the sequence of events and their causes, as well as damages and other consequences. The results of an investigation shall provide the basis for decisions aiming at preventing a similar event from occurring again, or limiting the effects of such an event. The investigation shall also provide a basis for assessment of the performance of rescue services and, when appropriate, for improvements to these rescue services.

SHK accident investigations thus aim at answering three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any supervisory role and its investigations do not deal with issues of blame or responsibility or liability for damages. Therefore, accidents and incidents are neither investigated nor described in the report from any such perspective. These issues are, when appropriate, dealt with by judicial authorities or e.g. by insurance companies.

The task of SHK also does not include investigating how persons affected by an accident or incident have been cared for by hospital services, once an emergency operation has been concluded. Measures in support of such individuals by the social services, for example in the form of post crisis management, also are not the subject of the investigation.

Investigations of aviation accidents and incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation. The investigation is conducted in accordance with Annex 13 of the Chicago Convention.

The investigation

On 20 June 2011, SHK was informed that an accident involving a helicopter with registration D-HPHP had occurred in Salixbyn, Jämtland county, on the same day at 10.20.

The accident has been investigated by an SHK team including Mr. Hans Ytterberg as Chairperson, Mr. Agne Widholm as Investigator in Charge, Ms. Ulrika Svensson as Operations Investigator until 9 March 2012, Mr. Staffan Jönsson as Technical Investigator and Mr. Urban Kjellberg as Rescue Services Investigator.

The work of the investigation team has been followed by the Swedish Transport Agency's aviation division through Mr. Karl-Axel Edén.

Limitations

In the current occurrence two helicopters have been involved. The report only deals with the accident involving D-HPHP. The second helicopter, D-HALP, was standing still at the time but was damaged and in this context is to be considered as a fixed obstacle.

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Aircraft: registration and type	D-HPHP, Robinson R44 II
Class/Airworthiness	Normal, airworthiness certificate with current ARC[1]
Owner	Private ownership by German nationals
Time of occurrence	20/06/2011 at 10:20 in daylight Note: All times are Swedish summer time (UTC[2]+ 2 hours)
Place	Salixbyn, Jämtland County, Sweden, (pos. N 61°45.1' E 14°13.0'; 407 m above main sea level)
Type of flight	Private
Weather	According to the SMHI analysis: Wind: NW at 10 knots, visibility greater than 10 km, 4/8 with base 3,000 feet, temp./dewpoint 17/6° C, QNH[3] 999 hPa
Persons on board:pilot	1
passengers	1
Injuries to persons	According to later information, one person on the ground was seriously injured. Re. uncertainty of this information, see sections on *Injuries* and *Rescue operation*
Damage to aircraft	Significant
Other damage	The second helicopter, D-HALP sustained limited damage. Minor damage occurred to buildings.
Pilot in command:	
Age, licence	61 years of age, PPL (H)[4]
Total flying hours	314 hours, all on type
Flying hours previous 90 days	8 hours 29 minutes, all on type
Number of landings previous 90 days	12, all on type

History of the flight

The occurrence in question was observed by the two German citizens who were pilot and passenger in the helicopter D-HALP. One of them took two photographs used in this report in order to depict the occurrence. SHK has interviewed these two witnesses, as well as the passenger and pilot in helicopter D-HPHP. The description of the course of events is based on these interviews, on marks on the ground and damage to the helicopters and the buildings at the site of the accident. SHK does not have knowledge of any other witnesses to the occurrence.

[1] Airworthiness Review Certificate.
[2] Universal Time Co-ordinated, UTC.
[3] QNH refers to the atmospheric pressure at sea level.
[4] Private licence for helicopter.

Four German pilots with two German registered helicopters, D-HPHP and D-HALP, had planned to conduct a private flight between Leksand and Östersund. The helicopters departed at 09:22 from Leksand and flew in an extended formation with one pilot and one passenger in each helicopter.

After about 45 minutes, the passenger in D-HALP needed to take a short break and therefore those onboard searched for a suitable landing site. The choice was Salixbyn, where D-HALP landed at 10:12, parked and shut down the engine. D-HPHP took a holding position in the air. The pilot and passenger of D-HALP went out of the helicopter.

A few minutes after D-HALP landed, the passenger from D-HALP, using a portable radio, communicated with the pilot in D-HPHP, who subsequently commenced an approach to the site with the intention to land. From the ground and with the help of directing signs as well as radio communications, the passenger from D-HALP indicated to the pilot of D-HPHP where it was suitable for the helicopter to land.

Picture 1: D-HPHP hovering before landing (Photo: Pilot of helicopter D-HALP)

The pilot of D-HPHP hovered over the lake towards the intended touchdown site. When the left landing skid had touched down and the right skid came into contact with the ground, the pilot offloaded by lowering the collective. The helicopter then tipped backwards, which the pilot corrected by quickly raising the collective and moving the cyclic forwards, after which the helicopter both tipped and moved forward, see Picture 2. The tip of one of the skids touched the ground at the same time as the helicopter yawed to the right, which resulted in the helicopter rotating to the right.

The passenger from D-HALP, who was standing in front of and facing D-HPHP when the pilot lost control of the helicopter, threw himself to the left and lay as close to the ground as possible. When the helicopter had swung round about half a turn the tail rotor of D-HPHP hit one of the blades of the main rotor on D-HALP. The main rotor blades on D-HPHP hit the ground and also a woodshed.

Picture 2: D-HPHP after initial first touchdown (Photo: Pilot of helicopter D-HALP)

D-HPHP then damaged the tail boom, fin and tail rotor on D-HALP during its continued clockwise rotation. One of the tail rotor blades cut a hole in the roof of the nearby building. When the skids finally touched down, D-HPHP rotated to a stop with the tail boom resting against the guttering of the house. The tail rotor blades on D-HPHP separated and landed on the other side of the house. Both main rotor blades, which had hit the ground, were deformed and one was so buckled that it during its rotation damaged the cockpit, where the pilot and passenger in D-HPHP still were.

Picture 3: D-HPHP in final position with D-HALP in background (Photo: SHK)

The helicopter remained upright on the skids after the accident, but with significant damage. The pilot had noticed no technical faults on the helicopter. No fire broke out.

Injuries to persons

None of the persons onboard D-HPHP was injured. The passenger from D-HALP on the day after the occurrence stated to the SHK investigation team that he was unharmed and also showed no signs of injury during the interviews that were conducted. However, the investigation team later received information that he had sustained injuries during the accident in the form of a fracture of the sacrum, bruises in different places on his body and pain.

Technical investigation

D-HPHP showed both structural damage and damage to the main and tail rotor. The helicopter fuselage sustained damage to its load-carrying, lower part and to the frames where the main rotor gearbox is attached. The main rotor gearbox with rotor mast had damaged attachment points and was slightly tilted forward. The tail boom had pressure damage to its upper surface and the top right side of the frame that connects to the fuselage. There were also indications of damage from impact of the main rotor blades. Both the tail skid and the tail boom's ventral fin were deformed and were almost horizontally bent to the right.

The main rotor blades were both severely swept backwards relative to the direction of movement; one of the blades had a pronounced buckle 0.7 metres from the mast and downwards approximately 30°. One blade tip was bent upwards and the other downwards. The oil in the blade bearing housings of the main rotor hub had leaked onto the dorsal side of the rear fuselage.

Both tail rotor blades had separated from the hub and were retrieved 19 and 29 m from the helicopter's tail rotor. The tail rotor drive shafts were intact and the Thomas couplings showed no visually observable damage.

The steering controls were examined and their function was judged to be normal. The damage exhibited by the main rotor hub and the push rods to the swash plate[5] resulted when the blades came in contact with the ground.

The engine has a mechanical fuel injection system and is not affected by icing in the intake manifold or similar.

The engine function was validated at speeds up to 102% of engine rpm, and the rpm drop at the magneto check was within permitted limit. Damage to the rotor blades and the main rotor hub made torque loading of the engine impossible.

The total length and rotor diameter of the helicopter in question governs the size of the obstacle-free area required at the selected landing site. According to the type certificate holder, the figures are as follows: total length is 11.7 metres and rotor diameter is 10.1 metres.

Crew

At the time of the accident the pilot held a private pilot's licence for helicopters, PPL(H), and had a total flying time of 314 hours. He had been trained in Germany where takeoff and landing during private flying with helicopters may only be carried out at specific landing sites.

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[5] The swash plate is located on the mast and transfers the stationary control inputs to the rotating main rotor hub.

Picture 1: General view after the accident (Photo: Police authorities in Östersund).

Landing site

The landing site consisted of sandy ground with a slope consisting of loose stones down towards the lake. The ground also sloped off slightly to the right relative to the direction of flight. Marks on the ground showed where the helicopter's landing skids had touched down. The surface of the obstacle-free area of the landing site was measured as 14.4 x 14.5 metres with high surrounding obstacles.

Rescue operation

Rescue operation events

One of the four persons who had flewn in the helicopters alerted the SOS centre in Östersund via the emergency number 112 at 11:27. From the call, which was delivered in English, it emerged that two helicopters had been involved in an accident and that the occurrence had not resulted in any injuries. No information was given that the accident had occurred about an hour earlier. At the start of the call, the SOS centre was given the coordinates of N 61°45.1' E 14°12.95' as the place where the accident had occurred. After about two minutes the call was transferred to the air rescue coordinator at JRCC, the Joint Rescue Coordination Centre. At the same time, the SOS operator continued to listen to the resumed interview conducted by the air rescue coordinator. During the call the previously specified coordinates of the accident site were repeated. The whole call via 112 continued for a total of 10 minutes.

After concluding the interview, the air rescue coordinator in discussion with the SOS operator who answered the 112 call requested that the municipal rescue services be alerted. They also decided to hold the ambulance, since information from the accident site indicated that nobody was injured. The air rescue coordinator took responsibility for informing the police about the occurrence. During the dialogue, the air rescue coordinator passed on the coordinates stated by the person who had alerted via 112. The dialogue between JRCC and the SOS centre lasted four minutes.

The alarm operator at the SOS centre who was responsible for alerting the municipal rescue services at 11:46 called the operations coordinator on duty at the Rescue Services Härjedalen. Information was provided about the accident and the geographic location was stated without accuracy as being south of Lillhärdal, Orrmo, Östansjö and Högen in the terrain around 300 m from a forest road. During the dialogue, the coordinates were not stated but the alarm operator showed doubts about whether the received coordinates were correct. It was decided to alert the fire station in Lillhärdal and off-road vehicles from the fire station in Sveg. The dialogue took eight minutes.

The fire station in Sveg was alerted at 11:54 and the fire station in Lillhärdal, which was closest to the accident site, was alerted one minute later, which is 28 minutes after answering the 112 call.

The alarm operator at the SOS centre then checked with the police's county communications centre, (LKC), that they had received information about the accident from JRCC. The police read back the coordinates of the location, which were now presented to the SOS centre for the fourth time. It was discovered that the alarm operator at the SOS centre had a partly different, incorrect coordinate of E 14°12', which meant that the geographical location of that coordinate would be about 700 m west of the accident site as indicated. It has not been possible to establish how the incorrect coordinate arose.

Operational crew in the rescue services vehicle from Lillhärdal, during a telephone dialogue that lasted three minutes, received road directions for how to drive. The coordinates that both the SOS centre and JRCC had received during the 112 call were never given to the operational crew in the fire engine from Lillhärdal. Nor was any other information communicated relating to a geographical map that could have shown the location of the accident site. The fire crew from Lillhärdal stated in the conversation with the alarm operator that they did not have access to a map. This was subsequently shown to be incorrect since there was a paper map with a user-defined coordinate system in the fire vehicle.

The operations coordinator from Sveg had access to a digital map in his vehicle. It has not been possible to establish which geographical position of the accident the alarm operator at the SOS centre may have sent to the digital map.

In the report from the rescue services it was stated that it was difficult to get the right address and to find the accident site.

The air rescue coordinator at JRCC called the SOS centre at 12:22 when the people by the helicopters had noticed the rescue services vehicle driving past the scene of the accident. The operations coordinator from Sveg communicated at 12.34 that people from the helicopters had been found. The rescue services vehicle arrived at the accident site at 12:38, which was 1 hour 11 minutes after the 112 call was answered.

A few minutes after the rescue services arrived at the accident site, the national air rescue services' duties were terminated and responsibility was handed over to the municipal rescue services.

No discharges were observed and no medical care or other actions from the rescue services were needed at the site. The cockpit on the most severely damaged helicopter was covered over with plastic to protect it against rain. Responsibility was subsequently handed over to the police at the site.

A summary of the course of events during the rescue operation, with time references, is shown in table 1 of appendix 1 (excluded in the English translation of the final report).

Alerting services agreement between the Swedish state and the company 'SOS Alarm Sverige Aktiebolag'

The company 'SOS Alarm Sverige Aktiebolag' (SOS Alarm) is jointly owned, 50 per cent each, by the Swedish state and the company 'SKL Företag AB', a subsidiary of the Swedish Association of Local Authorities and Regions (Sveriges Kommuner och Landsting, SKL).

The state has an alerting services agreement with SOS Alarm, whose activities are carried out at SOS centres. The purpose of the agreement is to ensure an effective SOS service via 112 and make it possible to call or get in contact with the police, state or municipal rescue services and the ambulance service. An SOS operator shall by interview primarily establish what has happened and where it has happened. With the help of this information the SOS operator shall determine what assistance is needed. The alerting services agreement thus includes the primary interview and not, for example, alerting the municipal rescue services.

On 1 December 2011, the government decided to set up a commission to review Sweden's alerting services. The commission will report not later than 14 December 2012.

The Swedish Civil Contingencies Agency, MSB, has the task to exercise supervision and monitoring of the commitments arising from the alerting services agreement.

Cooperation agreement between SOS Alarm and the rescue services in a municipality

According to Chapter 6 Section 10 of the Civil Protection Act (2003:778) municipalities, which are responsible for rescue services, shall ensure that there are facilities for alerting rescue organisations.

The responsibilities with respect to the alerting of rescue services have been regulated in an agreement from 1997 between Rescue Services Härjedalen in Härjedalen municipality and SOS Alarm. The agreement contains that when incoming emergency calls via 112 concern the municipal rescue services, SOS Alarm assesses the need for assistance and issues alerts in accordance with the alerting plans established by the rescue services. To make alerting possible, information needs to be gathered about the exact needs for assistance, the address, driving directions and if possible coordinates for stating the position.

Section 3 of the agreement describes the responsibilities of the municipality, i.e. that the municipality shall have map equipment as agreed. As far as the SHK investigation team has been able to ascertain, there is no documentation of any such agreement between the parties. The rescue chief of Rescue Services Härjedalen and representatives of SOS Alarm told the investigators that they do not know of any existing agreement regarding map equipment.

There are no details in the agreement on how SOS Alarm shall contribute to the definition of the position of an accident in an agreed and quality-assured manner, so that rescue service units can find their way to accident sites quickly and efficiently.

The supervisory authority for the municipal rescue services is the County Administrative Board in each county. On a national level the supervisory control is exercised by MSB.

Geographical maps and definitions of positions

The SOS centre in Östersund has no maps in paper format. The centre only uses a digital map support system with recognized maps. From the user point of view, there are substantial possibilities for determining the position of different geographical locations. It is also possible, for example, to send a particular geographical position to a mobile receiver that has access to a digital map, in which the position is presented in the map picture. This system of digital maps in vehicles is commonly used in ambulance services but is still under development for fire vehicles in municipal rescue services in Sweden.

The SOS centre in Östersund lacked knowledge of what map equipment the fire vehicles from Resque Services Härjedalen had access to. The map that was in the fire engine from Lillhärdal, but which was not used, was a topographic map with a scale of 1:50,000 with a user-defined coordinate system that was withdrawn from sale about 15 years ago. The map has a coordinate system in which the squares, 1 km x 1 km, are designated by coordinates introduced at a later date in the form of letters for the y axis in the easterly direction. The corresponding division does not exist on the maps in the SOS centre's digital map support system.

There were no established and agreed procedures for cooperation between SOS Alarm and Rescue Services Härjedalen regarding accurate stating of positions outside built-up areas.

In cases where the rescue services only have paper maps in fire vehicles, SOS Alarm AB lacks prepared procedures for how a geographical location shall be described in a rapid and safe manner, by coordinates or in some other way in order to provide a link to suitable map equipment. Since there are no such established procedures, there is also no corresponding basic and refresher training for emergency operators. In occurrences that take place where there are no street addresses, it is common that the SOS operator gives driving directions orally in the manner that took place in connection with this helicopter accident. There are also topographic maps with a scale of 1:50,000 that are used by the Swedish rescue services, in which four coordinate digits are printed in each box (1 km x 1 km) as a means of quickly describing a position in connection with, for example, an emergency alert.

The Swedish Civil Contingencies Agency develops and maintains RIB[6], which is a source of information for the area of civil contingencies. RIB connects databases that together provide comprehensive information on how an accident can be handled. In RIB there is a number of systems that present information on a map. LUPP is a program for the management and follow-up of rescue operations, which is included in the RIB software package. Information from LUPP, such as positions for operations and units, is displayed on the map included in RIB.

Reviews conducted

Twice annually MSB conducts a review of how SOS Alarm meets its commitments under the alerting services agreement. Representatives from SOS Alarm headquarters have been involved on these occasions. Some years visits have been conducted at some of the 18 different SOS centres. For the SOS centre in Östersund, there is one documented visit in 2002.

[6] RIB: Rescue Agency's (now MSB) Information Bank

The County Administrative Board of Jämtland County conducted its latest review of the rescue services in Härjedalen municipality in November 2007. The County Administrative Board has carried out reviews of Rescue Services Härjedalen at four-year intervals. Alerting issues have not been followed up during recent reviews.

Statement regarding the flight

Conditions at the site were deemed by the pilot as not being a restriction to the present landing. To this may certainly have contributed that the pilot received help with directions from the ground.

The helicopter was put down on uneven ground, which resulted in the helicopter momentarily tipping backwards and towards the lake. Marks in the ground suggest the pilot probably first put down the left landing skid, which came to rest on a small bump on the ground so that about two decimetres of the skid were on the ground. The right hand skid touched the ground slightly lower than the left. When the helicopter continued to be lowered to the ground, the rear part of the skids probably came to touch the ground lower than the front parts, which made the helicopter tip backwards. One of the witnesses confirmed that the uncontrolled course of events started when the helicopter tipped slightly backwards.

It is likely that the pilot was surprised by the helicopter tipping backwards and overcorrected with the collective, while at the same time quickly pushing the cyclic forwards. The risk of tipping backwards, down into the lake, as well as the site's limited obstacle clearance, has contributed to the pilot overcorrecting the movements with the steering controls in order to avoid a collision with obstacles.

The damage that both helicopters display, damage to buildings and marks on the ground support the SHK view of the course of events.

There is nothing to indicate that any technical failure in the helicopter contributed to the occurrence.

Statement regarding the rescue operation

Calls via the emergency number 112

Already at an early stage of the call via 112 to the SOS centre the coordinates of the accident site were clear. At a total of four different times the SOS centre received the coordinates read via telephone while working with the occurrence. At the same time it can be noted that the personnel in the fire engine from the fire station in Lillhärdal did not realise the exact position of the accident site until they were made aware that they had taken a wrong turn and turned back and were met by the persons from the helicopters.

The rescue coordinator at JRCC immediately understood during the 112 call where the accident site was located as described by the coordinates.

Alarm concerning the rescue effort

The information from the person who alerted via 112 resulted in uncertainty concerning the need for assistance at the scene of the accident since it, amongst other things, was stated that nobody was injured. This may have contributed to the extended time of 27 minutes for processing the alarm before the fire station in Sveg was alerted by the SOS centre.

It is important that even unclear conditions concerning an accident can be quickly assessed, in order to be able to begin rescue operations. Accidents involving aircraft are also very uncommon, for which reason the number of rescue operations in this context cannot be a problem for the different rescue organisations.

Uncertain conditions concerning an accident, which from experience may involve serious injuries, should result in a turnout without delay in order to clarify conditions concerning factual need for assistance at the site. It appears that an overly hesitant and cautious attitude at the SOS centre contributed to the handling of the alert taking an extended time.

It is possible that the directives from the rescue services to SOS Alarm need to be clarified to ensure that a rescue operation in similar cases can commence within an acceptable time when the extent of the accident initially is not clear.

When the rescue services arrived at the accident site, the injury situation certainly indicated a very limited need for assistance. At the same time, uncertain circumstances are in reality almost impossible to get a clear picture of before the situation at the accident site has been examined by personnel from the rescue services. It was therefore, in practical terms, necessary for the rescue services to turn out. This was the case, even though the actual need for assistance at the scene of the accident would not, according to the provisions in force, formally have justified a rescue services response, if the need for assistance had been established with certainty from the beginning.

Map systems and position definition

SOS Alarm has access to a well-developed digital map support system that provides extensive functions which are continuously evolving. The functions of the system have proved to be significantly greater than the existing knowledge of them.

It cannot be deemed as acceptable that the SOS centre lacks knowledge of which map equipment is used by a rescue service, at the same time as the municipal rescue service has no knowledge of the maps that are located in the fire engines. This results in far too uncertain conditions that could give rise to rescue operations being unnecessarily delayed and in serious negative consequences for both persons and property.

The Swedish municipal rescue services have map support systems, developed to varying degrees. There are digital map systems at alarm and control centres and similar in-vehicle map support systems that can receive position definitions and display geographical positions on a map image. There is also map data in the form of paper maps of varying qualities. Maps with user-defined coordinate systems, like the one in the fire engine from Lillhärdal, are not functional and have become obsolete. The maps should be replaced without delay in order to make it possible to introduce systems for efficient position definitions outside built-up areas.

Swedish municipal and national rescue services, as well as other cooperating organisations, need to use map support systems and systems for the accurate definition of geographical positions based on Sweden's official reference system for general maps. Map support systems should also be adapted to the operations in question. They must be well known and designed in such a way as to make it possible to present and communicate information related to geographical positions in an easy and safe manner, both within the organisation in question and when interacting with other others. A comparison may be made with the systems in RIB that MSB is developing and providing. These

also include applications that display geographical information in different ways.

Map support systems and other methods for defining geographical positions agreed upon by a municipality and SOS Alarm, should be documented and, where appropriate, explicitly included in agreements between these actors concerning alerting services. The same applies to different forms of interaction between other rescue services.

SOS centre procedure for giving road directions
The operator at the SOS centre for more than three minutes gave oral directions by telephone to an area in the vicinity of the accident site. The emergency operator described how the rescue service personnel should drive by specifying the route and where they should turn onto another road and so on.

The description of a route that, according to an emergency operator, should be chosen must be correctly understood by the person receiving the information. Otherwise there is a risk of misunderstanding, and confusion may occur as to whether the right information has really been perceived. At the same time, it is difficult for personnel at an SOS centre to make sure that the information has been perceived as intended. For this reason the quality of work can often not be ensured to the extent necessary and procedures become confused, with an obvious potential for errors. The fire engine from Lillhärdal also drove past the area where the alarm operator at the SOS centre had assessed the accident site to be located.

Supervision
Swedish municipal rescue services, in cooperation with SOS Alarm and other rescue services, need to have established procedures whereby position definitions outside built-up areas where there are no street names can be communicated in a simple, clear and safe way, even to units that lack digital map support systems. Such procedures should make it possible to easily follow-up and ensure that the position definition as given was perceived correctly.

MSB, in its supervisory guiding role, should make the county administrative boards aware of the need for monitoring the municipal rescue services' system for geographical position definition.

The county administrative boards should in turn, within the regional supervision of municipal rescue services, follow-up that the use of map support systems and procedures for stating positions is coordinated with SOS Alarm and other cooperating rescue organisations.

MSB should also, at the national level, work to ensure that systems for geographical stating of positions are coordinated with other rescue organisations, which may be relevant in the national and municipal rescue services. This may also give advantages when cooperating with our neighbouring countries within already established rescue service cooperation.

Causes

The accident was caused by a combination of the following factors, which taken together made the landing site unsuitable for landing:

- The ground at the landing site was uneven and sloped down towards the lake, which caused the helicopter to momentarily tip backwards.
- The restricted obstacle-free space meant that the area gave small margins for corrective manoeuvres.

The rescue operation was affected by the following factors:

- SOS Alarm alerted the first fire station 27 minutes after the 112 call was answered.
- Personnel from Rescue Services Härjedalen did not know that there was a map in the rescue vehicle.
- The geographical position of the accident was not known by the fire-fighting personnel in the first fire engine, which drove past the accident site.
- The SOS centre lacked knowledge of which maps the rescue services were using.
- SOS Alarm did not have established procedures for clearly defining positions outside built-up areas.
- Rescue Services Härjedalen used an old topographic map divided into a grid system that had separately introduced coordinates, which were not in the map support system at SOS Alarm.
- The parties were not aware of any agreement regarding map equipment that the rescue services should possess according to the agreement between SOS Alarm and Rescue Services Härjedalen.

Recommendations

The Swedish Civil Contingencies Agency is recommended to:

- within the framework of their supervisory activities, make the County Administrative Boards aware of the need to, within the regional supervision of rescue services, ensure that municipal rescue services organisations, in cooperation with SOS Alarm and other relevant actors, have the necessary equipment and established procedures so that, in cases where there are no street names, it is still possible to state geographical positions in a simple, clear and secure manner, also to units that do not have digital map systems for receiving and displaying a geographical position. *(RL 2012:13e R1).*

- take measures to ensure that procedures, such as those mentioned in recommendation RL2012:13e *R1*, are used nationally and are coordinated with other relevant rescue organisations, as well as with Sweden's neighbouring countries, within the framework of already established cooperation. *(RL 2012:13e R2).*

The County Administrative Board of Jämtland county is recommended to:

- within the framework of its supervision of municipal rescue services, take measures to ensure that municipal rescue services organisations, in cooperation with SOS Alarm and other relevant actors, have the necessary equipment and established procedures so that, in cases where there are no street names, it is still possible to state geographical positions in a simple, clear and secure manner, also to units that do not have digital map systems for receiving and displaying a geographical position. *(RL 2012:13e R3).*