Statens haverikommission
Swedish Accident Investigation Authority

Final report RL 2022:06e

Accident at Åsäng, Västernorrland County on 16 November 2021 involving the helicopter LN-OYH of the model AS 350 B3, operated by Heliscan

File no. L-84/21

7 November 2022

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring in the future, or limiting the effects of such an event. The investigations do not deal with issues of guilt, blame or liability for damages.

The report is also available on SHK´s web site: www.havkom.se

ISSN 1400-5719

This document is a translation of the original Swedish report. In case of discrepancies between this translation and the Swedish original text, the Swedish text shall prevail in the interpretation of the report.

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Content

General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a state authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations are intended to clarify, as far as possible, 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 in the future, 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 guilt, blame 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 incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation and by the Accident Investigation Act (1990:712). The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

The investigation

SHK was informed on 16 November 2021 that an accident involving a helicopter with the registration LN-OYH had occurred in Åsäng, Västernorrland County, the same day at 14:55 hrs.

The accident has been investigated by SHK, represented by Jenny Ferm, Chairperson, Håkan Josefsson, Investigator in Charge, Stefan Carneros, Operations Investigator and Alexander Hurtig, Investigator Behavioural Science.

SHK has been assisted by Liselotte Yregård, medical expert.

Magnus Axelsson has participated as an adviser for the Swedish Transport Agency.

Jon Sneltvedt has participated as an accredited representative of the Norwegian Safety Investigation Authority (NSIA) and Stéphane Veillon has participated as an accredited representative of the French air accident investigation authority Bureau d'Enquêtes et d'Analyses pour la Sécurité de l'Aviation Civile (BEA).

Michel Martin has participated as an adviser for Airbus Helicopters.

The following organisations have been notified: The European Union Aviation Safety Agency (EASA), the European Commission, the Swedish Transport Agency, the BEA and the NSIA.

Investigation material

Interviews have been conducted with the pilot, the loadmaster from Heliscan and a person from the Västernorrland County Administrative Board (Länsstyrelsen). Interviews have also been conducted with people from Heliscan and Jämtlands-flyg.

The accident site and the helicopter have been examined. Photographs and films that have been taken by staff from Länsstyrelsen have been scrutinised.

Two fact finding presentation meetings with interested parties have been held, one on 28 April and one on 2 May 2022. At these meetings, SHK presented the facts discovered during the investigation, available at the time of the meetings.

Final report RL 2022:06e

Aircraft:	
Registration, type	LN-OYH, AS 350
Model	AS 350 B3
Class, airworthiness	Normal, Certificate of Airworthiness and valid Airworthiness Review Certificate (ARC)[1]
Serial number	4461
Operator	Heliscan
Time of occurrence	2021-11-16 at 14:55 in daylight Note: All times are given in Swedish daylight saving time (UTC[2] + 1 hour)
Location	Åsäng, Västernorrland County, (position 62 43N 017 25 E, 54 metres above mean sea level)
Type of flight	Specialised operations
Weather	According to SMHI's analysis: wind variable 2 knots, visibility over 10 km, cloud 8/8 with a base of 6,000–14,000 feet, temperature/dew-point -2°C/-3°C, QNH[3] 1,014 hPa
Persons on board:	1
Crew members including cabin crew	1
Passengers	0
Injuries to persons	One person died in conjunction with the flight
Damage to the aircraft	None
Other damage	None
The pilot in command:	
Age, licence	33 years, CPL(H)[4]
Total flying hours	987 hours, of which 804 hours on type
Flying hours previous 90 days	100 hours, of which 43 hours on type
Number of landings previous 90 days	202

[1] ARC – Airworthiness Review Certificate.
[2] UTC – Coordinated Universal Time.
[3] QNH – barometric pressure at mean sea level.
[4] CPL(H) – Commercial Pilot Licence Helicopter.

SUMMARY

The company Heliscan was transporting timber in sling loads on behalf of the Västernorrland County Administrative Board. Heliscan had three people assigned to this job: a pilot, a loadmaster and a refueller[5]. In conjunction with the helicopter preparing to land, the refueller grabbed the cargo hook on the helicopter and attached a load. The pilot, who was not aware that the refueller had attached a load, adjusted the height prior to landing. The refueller got caught in the cargo strap and was lifted up several metres before falling to the ground. The refueller was severely injured by the impact and later died.

Earlier in the day, the refueller had stepped in and attached loads, despite this not being his task. This did not lead to the operation being halted.

The cause of the accident was that the refueller, on his own initiative, took hold of the cargo hook on the helicopter and attached a load without the pilot and the loadmaster being aware of this. The pilot's adjustment of the height prior to the landing led to the refueller getting caught in the cargo strap and being lifted up into the air. The actions taken by the pilot and the loadmaster during the work in order to ensure that the refueller acted within the scope of his own duties and that the work could be conducted in a safe manner, have not been sufficient.

An underlying cause of the accident was that the employer did not to a sufficient extent take action to achieve a functioning group dynamic.

Safety recommendations

None.

[5] The terms are explained in more detail in section 1.1.1.

FACTUAL INFORMATION

1.1 History of the flight

1.1.1 Circumstances

The company Heliscan was conducting helicopter operations using an Airbus AS 350 B3 on behalf of Västernorrland County Administrative Board (Länsstyrelsen). The work involved using a helicopter to move 30 loads of timber from a forest road to sites in the nearby countryside. The helicopter was equipped for flying with external sling loads. The cargo was attached to a sling using a hook under the helicopter that was manoeuvred by the pilot. The loads of timber had been prepared by staff from Länsstyrelsen, who also received the loads when they had been flown out to their respective location. Heliscan had assigned three people to the job: a pilot who was flying the helicopter, a loadmaster who was responsible for preparing and leading the work on the ground before each flight, and also a person whose task was only to refuel the helicopter, referred to subsequently as the 'refueller'. On the day before the occurrence, final preparations were made at Heliscan in Östersund. At this time, the staff involved went through the job and prepared the equipment. The refueller was not present during these preparations but was informed about the operation in the evening prior to departure.

The pilot, together with the loadmaster, went by helicopter from Östersund to the location in questions in the morning and met up with the staff from Länsstyrelsen. The refueller drove to the location with a vehicle containing fuel for the helicopter and joined the others after the helicopter had arrived on site.

Upon arrival at the loading site, the pilot, together with the loadmaster, conducted an inspection of the loads and the equipment around the loading site. This resulted in some adjustments being made to the loads and some equipment on the ground being removed for safety reasons.

As a result of high surrounding terrain and tall trees, the pilot made the decision to use a 10-metre-long extension to the sling[6], which meant that the total length was 25 metres. In addition, some loads that had to be transported to places that were difficult to access were extended with an extra cargo strap[7] that was six metres long. These extra straps were attached to the prepared loads of timber using a shackle[8].

After a while transportation of the loads of timber began and the loadmaster had an assistant from Länsstyrelsen, who helped to attach the loads to the hook on the helicopter. Both the loadmaster and the assistant were in radio contact with the pilot and these two were the only people who were to be present in the loading area when the helicopter arrived to pick up a new load. The refueller refuelled the helicopter at

[6] Sling – the cargo line that is attached to the helicopter and has a hook at the bottom. See section 1.6.2.
[7] Cargo strap – the arrangement used to attach the cargo. See section 1.6.2.
[8] Shackle – a U-shaped piece of metal secured with a clevis pin or bolt across the opening.

regular intervals when the helicopter came down to land at the loading site. Refuelling was performed as both hot refuelling[9] and with the helicopter shut off when the pilot was taking a break from work.

The original plan was to complete the work in one day.

1.1.2 Sequence of events

When the time had passed twenty to three in the afternoon, the pilot made the assessment that the light conditions had deteriorated and made the decision that it was time to stop work for the day. At this point, 23 of the 30 loads had been transported from the loading site. The pilot informed the loadmaster by radio of the decision to stop work and the loadmaster passed on this message to the assistant and the refueller. The pilot tasked the loadmaster with booking a hotel so they would be able to continue and finish the work the next day. When the helicopter returned to the loading site, the loadmaster requested confirmation from the pilot that it was a landing that would take place and consequently not the loading of a new load of timber. The pilot confirmed landing and the loadmaster went to the place at the loading site designated for landing, in front of the helicopter, in order to receive the hook and take the sling as the helicopter descended.

When the helicopter came in for landing, it was not possible for the pilot to see the sling and the hook. When the helicopter came to a stop, and the pilot was still unable to see the hook, he assumed that it might be dragging along the ground. Consequently, the pilot chose to increase the height with the aim of getting the hook to swing forward so that the loadmaster would be able to catch it. Without the pilot being aware of it, the refueller took hold of the hook hanging from the helicopter and attached a new load to the extra strap that was prepared for the load. The loadmaster saw that the refueller was doing something with the hook but did not realise that he was attaching a new load, and only had time to scream ‘no’ before the load had been attached. The pilot, who was unaware of the fact that the hook was now attached to a load, initiated a climb in order to get the hook in front of himself and climbed a few metres or so but, in conjunction with this, felt resistance during the climb. The loadmaster and the assistant saw the refueller being lifted up into the air and swung round horizontally in the air about five metres above the ground. He then fell to the ground a few metres in front and to the left of the helicopter. The refueller was severely injured upon impact and the loadmaster and assistant began performing cardiopulmonary resuscitation and called SOS Alarm. The pilot joined them once he had landed and shut down the helicopter. The rescue service and an ambulance arrived after approximately 25 minutes. The refueller later died in hospital.

The accident occurred at position 62 43N 017 25E, 54 metres above mean sea level.

[9] Hot refuelling – refuelling with the engine and rotor running.

1.1.3 Additional information

The pilot has stated that he had the electric heating on the rear-view mirror turned on while flying the whole day but that the electric heating did not have the capacity to provide a clear view when the pilot was moving forward due to the prevailing weather conditions.

In the film sequences that were recorded earlier in the day, before the accident took place, the refueller can be seen taking part in the work of attaching loads to the lower hook on the helicopter. They also show the refueller giving the sign to lift off to the helicopter after he had attached the load. This has also been confirmed by both the pilot and the load-master.

The loadmaster and the assistant were equipped with high-visibility clothing and protective equipment in the form of safety shoes, helmets and ear defenders. In the film sequences, the refueller appears not to be wearing high-visibility clothing or protective equipment when he was active on site. According to interviews there was protective equipment and high-visibility clothing available on site for the refueller. During the day, the loadmaster had requested the refueller to put on a helmet and high-visibility vest.

1.2 Injuries to persons

	Crew members	Passengers	Total on board	Others
Fatal	0	0	0	1
Serious	0	0	0	0
Minor	0	0	0	0
None	1	0	1	2
Total	1	0	1	3

1.3 Damage to the aircraft

None.

1.4 Other damage

None.

1.4.1 Environmental impact

None.

1.5 Personnel information

1.5.1 Qualifications and duty time of the pilot

The pilot in command

The pilot in command, was 33 years old and had a valid CPL(H) with flight operational and medical eligibility.

Flying hours				
Latest	24 hours	7 days	90 days	Total
All types	5	28	100	987
Actual type	5	8	43	804

Number of landings actual type previous 90 days: 202.
Type rating conducted on 2 September 2016.
Latest PC[10] conducted on 10 September 2021 on type.

1.5.2 Other affected personnel

The loadmaster

The loadmaster was 37 years old, had a CPL(H) and had been employed by Heliscan since 1 June 2020.

The refueller

The refueller was 58 years old and had been employed by Heliscan since 2019. He was previously employed by Jämtlandsflyg where he had worked as a loadmaster for more than 30 years.

1.6 Aircraft information

General

The Airbus Helicopters AS 350 B3 is a single-engine gas turbine-powered helicopter with a three-bladed main rotor and a tail rotor with two blades. The helicopter is just under 13 metres long and just over three metres high. The three-bladed main rotor has a diameter of almost 11 metres. The landing gear consists of fixed skids. The helicopter has a capacity of five passengers and one pilot.

[10] PC – Proficiency Check.

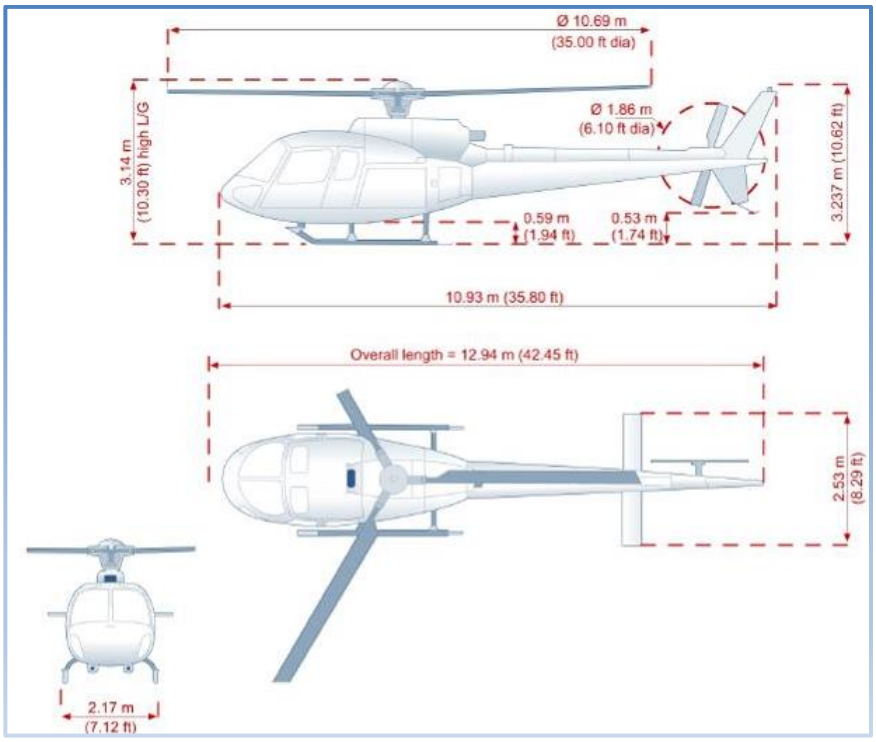

Figure 1. Airbus Helicopters AS 350 B3. Source: Airbus Helicopters.

1.6.1 Helicopter

TC-holder	Airbus Helicopters
Model	AS 350 B3
Serial number	4461
Year of manufacture	2008
Gross mass (kg)	Max. take-off/landing mass 2,250/2,250 actual 1,650
Centre of gravity	Within limits 3.51 metres
Total flying time, hours	6,814
Flying time since latest periodic inspection, hours	5
Number of cycles	43,127
Type of fuel uplifted before the occurrence	Jet A-1
Engine	
TC-holder	Safran Helicopter Engines
Type	Safran HE Arriel 2B1
Number of engines	1
Serial number	46250
Total flying time, hours	6747
Operating time since latest periodic inspection, hours	507
Operating time since latest overhaul, hours	3,317
Deferred remarks	None

The aircraft had a Certificate of Airworthiness and a valid ARC.

1.6.2 Description of parts or systems related to the occurrence

Sling load equipment

The helicopter was equipped with sling load equipment, with a cargo hook under the helicopter that had been installed by Airbus. The cargo hook can be opened in two ways, electrically or mechanically. Electric opening is done by pressing the upper button on the cyclic control. Mechanical opening is done by pressing a handle on the underside of the collective control that is linked to a release wire. According to the aircraft flight manual, the cargo hook has to be inspected with regard to electrical and mechanical opening before each flight with a sling load. Such an inspection was conducted in the morning before the first take-off with a sling load.

Figure 2. Sling load equipment with a cargo hook.

The sling with a lower hook

A sling with a lower hook was attached to the cargo hook on the helicopter. The load that was to be transported was attached to the lower hook. The sling contained an electrical connection to the lower hook, which meant that the pilot was able to open it in order to release the cargo. During the flight in question, a sling that was 15 metres long was being used, to which was also attached a 10-metre-long extension sling. These slings had the same construction.

Figure 3. The sling with a lower hook (on the right) and the 10-metre-long extension sling.

Figure 4. Close-up image of the lower hook.

The straps

Each load of timber was lashed down with cargo straps that were attached to the lower hook on the sling. Some loads were equipped with an extra strap that also formed an extra extension to the entire line under the helicopter. This extra strap was six metres long and was attached to the other straps by a shackle.

Figure 5. The cargo straps in yellow and the extension strap, which is coloured green.

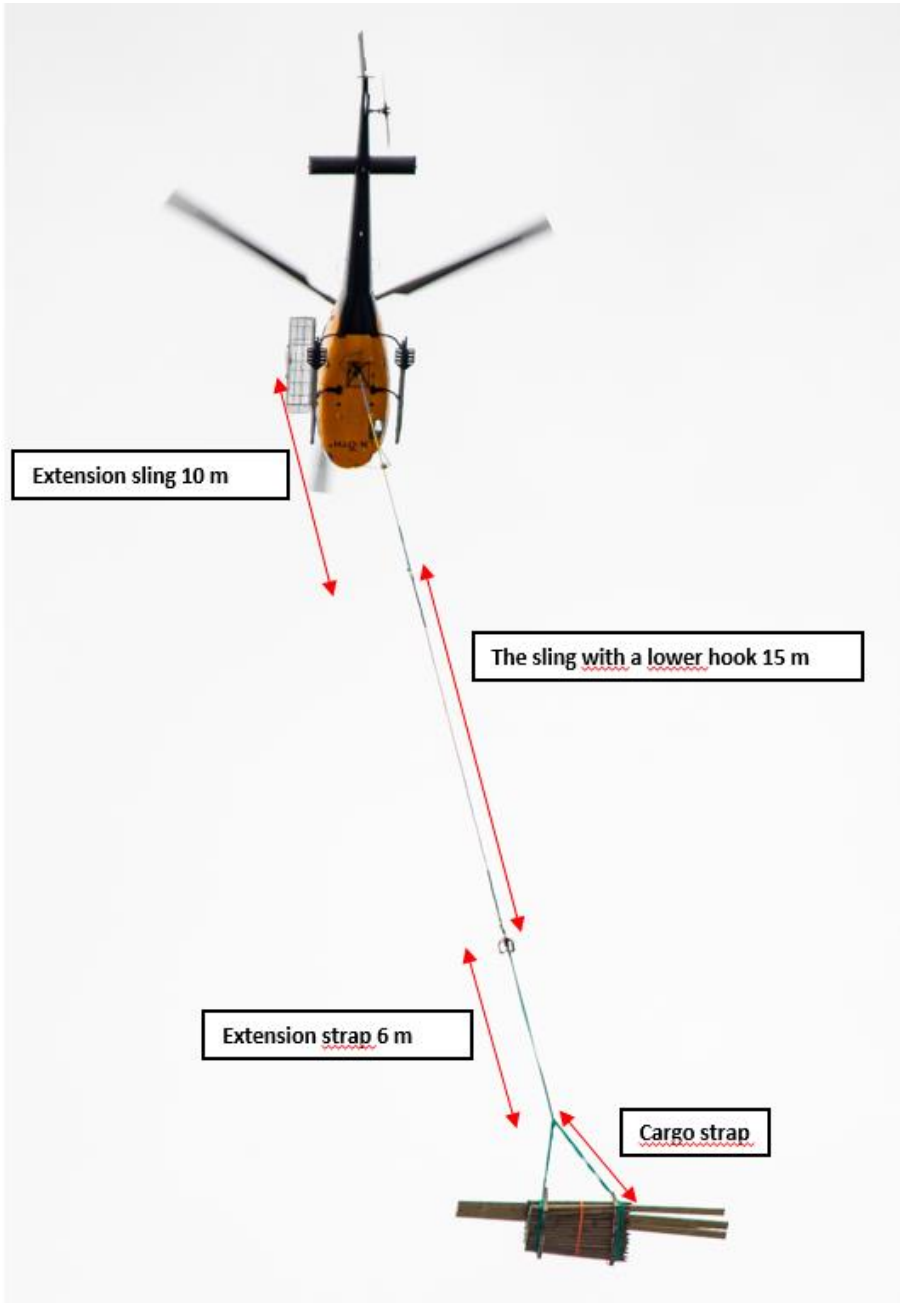

Figure 6. Picture showing the sling load and clearly indicating the constituent parts of the sling and straps. Markings made by SHK. Photo: Erik Engelro, Västernorrland County Administrative Board.

The cockpit

The cockpit is designed such that the pilot is able to see the cargo through a window in the floor just to the right of the pilot's position. In addition, there is a rear-view mirror mounted outside and in front of the cabin that allows the pilot to see behind and below towards the cargo. The rear-view mirror outside of the cabin has electric heating. In order to perform an emergency release of the cargo hook and thus release the entire sling, the pilot can push an emergency release button on the cyclic control that opens the cargo hook electrically. In addition, there is an emergency release handle on the collective that can open the cargo hook mechanically. An electronic release button that sits on the cyclic control is used to release the cargo. However, the release button is separate from the emergency release button for the cargo hook.

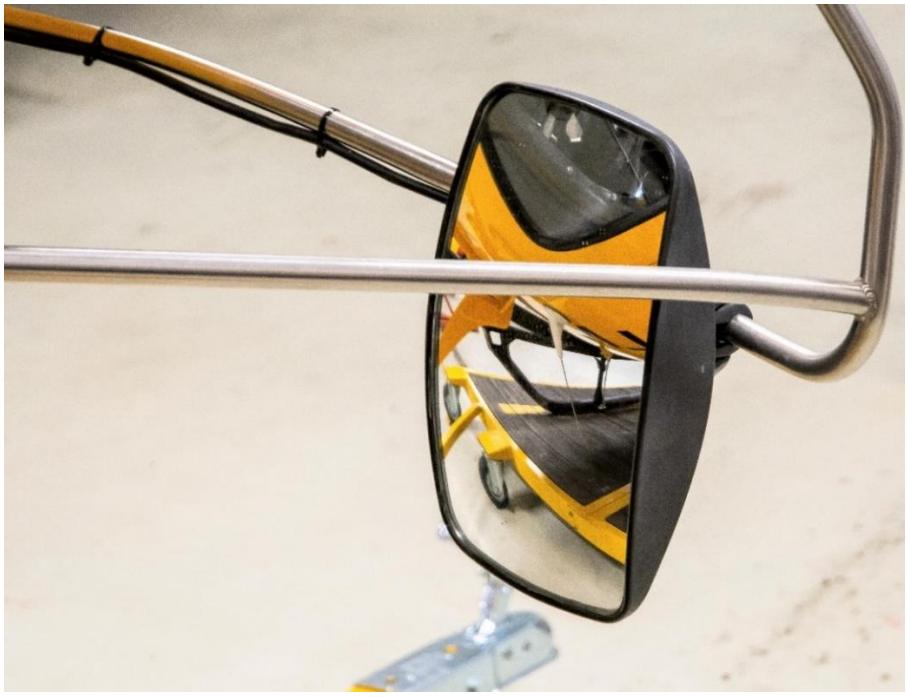

Figure 7. Electrically heated rear-view mirror.

The refuelling vehicle

The refueller drove and was responsible for the refuelling vehicle that Heliscan had on site. The refuelling vehicle was a van and the cargo space contained a tank of fuel for the helicopter. While the work was taking place, the refuelling vehicle was parked close to the loading site (see Figure 10) in order to be as close as possible to the helicopter during refuelling.

Figure 8. The refuelling vehicle.

1.7 Meteorological information

According to SMHI's analysis: Wind variable 2 knots, visibility over 10 km, cloud 8/8 with a base of 6,000–14,000 feet, temperature/dew-point -2°C/-3°C, QNH 1,014 hPa.

A weak ridge of high pressure was located over the middle of Norrland at the time of the accident. There was fair weather at the time. The temperature was below freezing and there was a minor risk of icing. The freezing level was at around 5,000 feet in the area.

Civil twilight begins when the sun drops below the horizon and ends when the sun is six degrees below the horizon.

At the accident site, the sun dropped below the horizon at 13:59 UTC and was six degrees below the horizon at 14:58 UTC.

1.8 Aids to navigation

Not pertinent.

1.9 Communications

Radio communication took place between the pilot and the loadmaster on the ground. The assistant from Länsstyrelsen was also equipped with a radio. The refueller did not have a radio. The refueller communicated with the loadmaster using signals and conversations during the work.

No radio chatter between the pilot and the ground staff have been recorded.

1.10 Aerodrome information

Not pertinent.

1.11 Flight recorders

Not pertinent.

1.12 Site of occurrence

The accident took place twelve kilometres north of Åsäng at a turning area at the end of a forest road. The turning area was being used as a loading site with prepared loads of timber. The forest road is 720 metres long and goes from county road 331 in a south-westerly direction towards the valley of the river Mjällån.

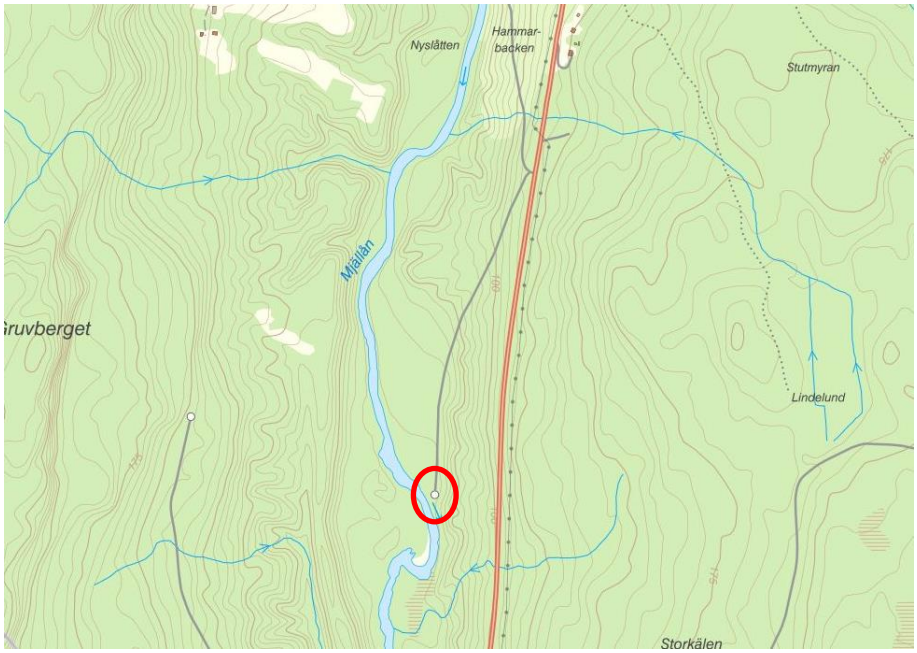

Figure 9. The accident site is marked in red by SHK. Source: © Lantmäteriet.

1.12.1 Accident site

The ground in the turning area consisted of a mixture of hard snow and ice.

At the time of the accident, the people on site were located as shown in Figure 10.

Figure 10. The accident site with the positions of the people involved drawn in by SHK.

1.12.2 Location of the load

SHK has obtained photographs and videos from Länsstyrelsen. One photo has been taken from above the loading site with a drone before the work started and shows where the loads were located at the loading site. SHK has taken a photo from a similar vantage point that show the site after the occurrence; the photo shows where the load that was attached to the helicopter at the time of the occurrence was located afterwards. This photo indicates that the load was moved a few metres in conjunction with the accident (see Figures 11 and 12). The load in question is estimated to have a weight of around 1,000 kg.

Figure 11. Photo of the loading site before work started. The location of the load that was attached to the helicopter at the time of the occurrence has been circled in red by SHK. Photo: Erik Engelro Västernorrland County Administrative Board.

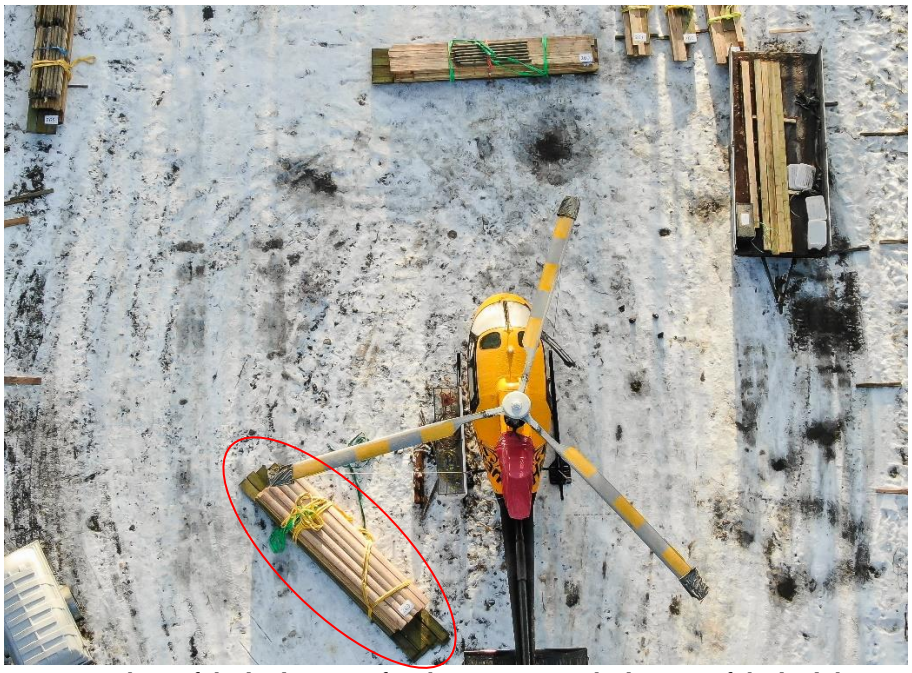

Figure 12. Photo of the loading site after the occurrence. The location of the load that was attached to the helicopter at the time of the occurrence has been circled in red by SHK.

1.13 Medical and pathological information

There is nothing to indicate that the mental or physical condition of any of the people involved was impaired before or at the time of the occurrence.

1.14 Fire

Not pertinent.

1.15 Survival aspects

1.15.1 Rescue operation

The pilot and loadmaster began cardiopulmonary resuscitation promptly and continued until an ambulance arrived and the ambulance personnel took over.

The assistant from Länsstyrelsen called 112 immediately after the accident. The alarm call was received by SOS Alarm at 14:56 o'clock. SOS Alarm sent one ambulance from Härnösand at 14:58 o'clock and one from Kramfors at 14:59 o'clock. The rescue service from Viksjö was sent at 15:04 o'clock and was the first unit on site at 15:19 o'clock. The first ambulance, the one from Härnösand, arrived at the accident site at 15:23 o'clock. The second ambulance waited at the entrance of the road that led to the accident site. When the rescue service arrived at the site, they took over the cardiopulmonary resuscitation and were, at that time, able to detect a pulse but limited breathing, and the rescue service personnel then focussed on creating unobstructed airways. When the first ambulance arrived at the accident site, the ambulance staff took over the care. The contribution by the rescue service then consisted of supporting the ambulance personnel by driving the ambulance away from the accident site. The ambulance from Härnösand left the accident site at 15:54 o'clock with the injured and unconscious refueller and arrived at Sundsvall Hospital 30 minutes later.

1.15.2 Injuries sustained

The refueller sustained head injuries as a result of the fall and those injuries were deemed to be the cause of death. There were injuries to the index finger and middle finger on the left hand. According to the investigation's medical expert, these injuries may have been caused by the hand getting caught in something.

1.16 Tests and research

1.16.1 Reconstruction of the occurrence on the ground

SHK has conducted comparative tests with equivalent equipment for the purpose of reconstructing the sequence of events and gaining a better understanding of the occurrence. These tests involved the use of a cargo strap, a weight that weighed 500 kg in order to symbolise the loads of timber and a mannequin. A crane with variable length and speed was used to simulate the lift.

The outcome of the tests was that when the crane was raised and the straps that were wrapped around the mannequin were stretched, the sequence of events was almost identical to that described by witnesses to the accident.

1.17 Organisational and management information

1.17.1 Västernorrland County Administrative Board (Länsstyrelsen)

Länsstyrelsen had procured the helicopter services from Heliscan for work preparing Västanåfallet Nature Reserve in the valley of the river Mjällån. It was the unit Protected Nature within Länsstyrelsen that was responsible for the works at the nature reserve. This unit operates throughout the entire county and is tasked to create reserves, maintenance and management of the county's nature reserves. Länsstyrelsen had procured the helicopter services from Heliscan following a tendering procedure in 2021 and a contract was signed in May 2021. At the time of the occurrence, Länsstyrelsen had staff on site to load and unload the shipments in the nature reserve together with Heliscan.

1.17.2 Heliscan

Heliscan is a Norwegian helicopter operator that has its registered office in Frosta in Norway. The company has had an operating licence since 2010. Heliscan's organisational structure and nominated responsible persons are shown in Figure 13.

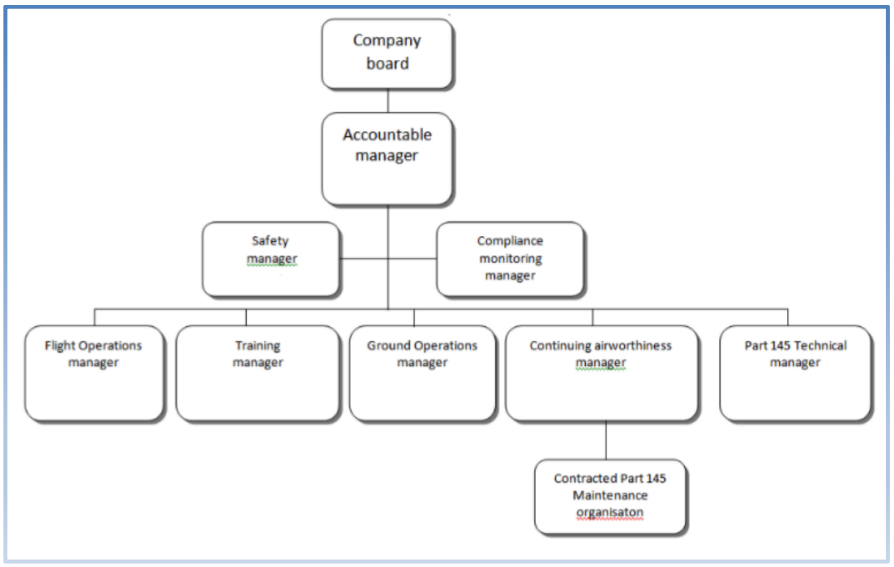

Figure 13. Organisational structure Heliscan. Source: Heliscan operations manual.

In addition to its base in Norway, Heliscan also has two bases in Sweden, in Östersund and in Handöl. The company has operating licences in both Norway and Sweden. Heliscan's operations consist of conducting various types of helicopter operations for customers, a large proportion of which take the form of HELSO[11].

Operations at the base in Östersund are run by a base manager. The remit of the base manager consists primarily of managing administrative duties, leading staff, managing tenders and generally taking responsibility for ensuring that the work at the base proceeds according to plan

[11] HESLO – Helicopter External Sling Load Operations.

and that they are working as a team. With regard to flight operations, the base manager is the contact point for the flight operations manager and the manager who is responsible for the loadmaster's function – the ground operations manager.

For complex jobs, the base manager plans the work together with the affected responsible persons and the relevant operations team. For simple jobs, planning is delegated to a pilot who takes over this duty and plans the job. The base manager has a computerised support tool for planning and follow-up. The tools lets the base manger choose which part of the company's SOP[12] is to be linked to which pilots and their current status at the time. The pilots can be assigned to each job on the basis of this. The job in Åsäng was managed as a complex job. An extensive logistics planning procedure together with the client began as early as three weeks before implementation.

Operations manual

Heliscan's operations are governed by an operation manual (OM).

According to 8.2 of Annex V to Regulation (EU) 2018/1139[13] operations must only be undertaken in accordance with an aircraft operator's operations manual. This manual must contain all necessary instructions, information and procedures for all aircraft operated and for operations personnel to perform their duties. The operations manual and its revisions must be compliant with the approved flight manual and be amended as necessary.

Heliscan has produced an operations manual[14]: Heliscan Operations Manual (Heliscan OM). This manual contains information and instructions for the operation of helicopters that are operated by Heliscan. This has been produced on the basis of laws, regulations, the terms of Heliscan's air operator certificate (AOC) and the procedures for the state where the operations are conducted. All staff employed by Heliscan have to adhere to this manual.

The sections of the Heliscan OM that are relevant to the case now in question are:

- Part A General/Basic, which covers all non-type-related operational policies, instructions and procedures
- Part E, which covers standard operating procedures (SOP).

[12] SOP – Standard Operating Procedure.
[13] Regulation (EU) 2018/1139 of the European Parliament and of the Council on common rules in the field of civil aviation and establishing a European Union Aviation Safety Agency.
[14] In its OM, Heliscan has referred to Regulation (EC) 216/2008, which has been repealed and replaced by Regulation (EU) 2018/1139.

Part A General/Basic

Part A General/Basic contains a description of tasks and responsibilities for the commander of the helicopter. A selection of these is provided below:

- *The PIC/Commander is while flying, responsible for the safety of the aircraft, all passengers, task specialist and cargo on board*
- *The PIC/Commander has full command over all operations personnel in the duty time*
- *The PIC/Commander is responsible that standard operating procedures and emergency procedures are followed at all times*
- *The PIC's responsibility for the external load.*

In addition, there is the following description of tasks and responsibilities for a task specialist[15].

Task specialist is a person assigned by Heliscan or a third party, or acting as an undertaking, who:

- *Performs tasks on the ground directly associated with a specialised task; or*
- *Performs specialised tasks on board or from the aircraft.*

Company Task Specialists

Company Task Specialists are personnel employed by Heliscan to assist the PIC in order to maintain a safe and efficient operation.

The Task Specialist is obliged to, without delay, to inform the PIC of factors which he/she believes pose a danger to the safety of the crew, passengers, other personnel, helicopter etc.

The document also contains a description of the tasks and responsibilities of a task specialist who is not employed by Heliscan. A selection of these is provided below:

Persons other than company employees, such as a customer, may be assigned tasks directly related to an operation. Such person should be well briefed on his/her duties, operational and safety aspects as appropriate. The content of the safety brief may vary depending on the type of task to be performed. Before starting the operation, he/she should demonstrate or confirm the understanding of the safety brief to the PIC or a company task specialist. If more than one task specialist is required for a task, one should be nominated to lead the ground operation.

[15] The description is based on the EASA requirements for special operations and these are regulated in SPO.GEN.106, which regulates the tasks and responsibilities of a task specialist.

There is also a description of the tasks and responsibilities of a task specialist who is operating on the ground. A selection of these is provided below:

Task Specialist operating on the ground is responsible for the safe organisation of the ground operation:

- *Ensure that no unauthorized personnel are close to the helicopter when the rotor is running*
- *Preparing and securing of the pick-up/drop-off sites*
- *Preparing and securing of loads/cargo*
- *Refuelling the helicopter*
- *Appropriate communication and assistance to the PIC and other task specialists.*

Part E SOP

Vertical Reference – Long-line Operations (sling load) is regulated in *Part E – SOP Appendix 8*. Amongst other things, this document contains a description of what responsibility a task specialist operating on the ground has and what equipment requirements apply.

Task Specialist operating on the ground is responsible for the safe organisation of the ground operation … and assisting the pilot via radio.

Ground crew shall use protective equipment, such as;

• Protective helmet with integrated ear protection

• Work gloves

• Safety footwear

• The ground crew who directs the helicopter shall use clothing of a contrasting colour. It is an advantage that the work gloves are of a good contrasting colour so that the hand signals are clear.

• Ground crew shall give the appropriate ready signal when the load, and any control rope / tagline /wire is clear of the ground, and the cargo can be flown away.

• Ground crews must stay clear of the designated emergency landing and take-off areas.

1.17.3 Risk management high-risk operations

A sling load operation[16] is classified as a high-risk operation according to the Heliscan OM Part E – SOP Appendix 8. This is associated with specific requirements in terms of risk management and how risks are dealt with. Heliscan uses ICAO SMS risk matrix v. 3 2014 rev. 1 as a

[16] Sling load operation – job with a suspended load.

support tool. Ahead of the job, the commander conducted a final risk assessment on site in accordance with the company's document *Safe Job Analysis*. This document states that staff involved were informed by the pilot of their respective tasks and limitations on their roles and that a safety review was conducted. Participants in the safety review were the pilot, the loadmaster, the assistant and colleagues of the assistant. The risk assessment did not include the option for anyone to act outside of their duties. There is consistent information that corroborate the fact that the refueller was not present during the joint safety briefing. However, the pilot conducted a separate briefing with the refueller about his task and how the mission would be carried out.

1.17.4 Allocation of roles according to the Heliscan OM

The pilot

The pilot was commander and the person who was ultimately responsible on site for implementation of the job.

The loadmaster

The loadmaster was a task specialist and had the responsibility for the ground operations during the implementation of the job. It is standard practice at Heliscan for a pilot to act as task specialist in the role of loadmaster in order to be introduced to operations before they begin flying as pilot on missions.

The assistant

The assistant who represented Länsstyrelsen was a task specialist who was not employed by Heliscan.

The refueller

At Heliscan, the refueller's responsibilities included maintenance of equipment and was otherwise a 'jack of all trades'. During the job in question, he acted as a task specialist with a limitation on his role to supplying fuel and refuelling the helicopter.

1.17.5 Work environment

According to the Work Environment Act (1977:1160), the work environment shall be satisfactory, taking into account the nature of the work and the social and technical development in society. Furthermore, the work shall be planned in such a way that it can be conducted in a sound and safe environment (Chapter 2, Sections 1–2).

Machinery, tools and other technical facilities shall be construed and located and used in such a way that satisfactory protection against ill health and accidents is provided (Chapter 2, Section 3). If satisfactory protection against ill health or accidents cannot be achieved in another way, personal protective equipment shall be used (Chapter 2, Section 7).

The employer shall implement all measures required in order to prevent the employee from being subjected to ill health or accidents and shall systematically plan, lead and inspect operations in a way that leads to the work environment complying with the stipulated requirements of a good work environment (Chapter 3, Sections 2–2a).

The Swedish Work Environment Authority's regulations on systematic work environment management (AFS 2001:1) define systematic work environment management as the employer's work to investigate, implement and follow up its operations in order to prevent accidents and ill health (Section 2). The systematic work environment management shall encompass all physical, psychosocial and social conditions that are of significance to the work environment (Section 3) and there shall be procedures in place that describe how the systematic work environment management is to be conducted (Section 5).

The employer shall regularly investigate the working conditions and assess the risks of anyone suffering from ill health or accidents at work (Section 8). This can be done through, for example, risk inventories or through experiences obtained from members of staff, e.g. exception reports and suggested improvements.

1.17.6 Actions taken

Following the occurrence, Heliscan has, in partnership with Länsstyrelsen, conducted a training programme in two stages with relevant staff from Länsstyrelsen in order to review sling load operations using helicopters. This training programme encompassed both theory and practical exercises with sling loads.

1.18 Additional information

1.18.1 Working hours

The pilot was working on a schedule that ran over 18 days. The day in question was day 15 of this schedule. The pilot had had three full rest days during the period. Two days prior to the accident, the pilot had had a weekly rest period of a total of 48 hours.

The loadmaster was working on a normal 5/2 schedule with work predominantly on weekdays and time off on weekends. The day in question was a Tuesday and day two after the weekend off.

The refueller was also working on a normal 5/2 schedule. Aside from the job at Heliscan, the refueller also had a second job driving buses for a bus company whose business included arranging day trips. On the Monday prior to the accident, the refueller had driven a bus on a full-day job for the bus company. This second job was only partly known of within Heliscan. As far as SHK understands it, the refueller was off work on the weekend prior to the accident. According to his timetable, the refueller was not scheduled to drive a bus again during the week in question.

1.18.2 Crew resource management

Crew resource management (CRM) is used in various fields including aviation to describe a system of effective and safe methods for a group of people that work together. CRM encompasses a broad foundational knowledge of skills that are essential to achieving a good result and an understanding of how different attitudes affect cooperation within a group. For example, this can relate to how people communicate, decision-making, situational awareness and problem-solving. CRM is based on duties and procedures being well-defined and roles and functions being clearly allocated. It is also important within the scope of CRM that there is an ability to deal with various disruptive elements and maintain an orderly work situation in a consistent manner.

One concrete example of CRM in the present case is the use of hand signals during various stages of the operation. For example, the loadmaster used hand signals in order to guide the pilot during landing and take-off. Hand signals were used because it was not possible to use the radio due to the noise caused by the helicopter. The hand signals were defined in advance and the loadmaster and the pilot were well-practised in the use of these signals.

From the perspective of CRM, it can be established in the present case that there were four different functions that were manned on the work site. The pilot flew the helicopter and had the overall decision-making mandate, the loadmaster directed the work from the ground, the representative from Länsstyrelsen assisted the loadmaster on the ground and the refueller conducted refuelling when necessary. When implementing measures related to preparing, securing and lifting cargo, it was the pilot, the loadmaster and the assistant who had defined functions within the scope of the job in question.

It has also been stated that, as part of the preparations for the job, a decision was made that the refueller would not have a communication radio. The reason for this was that it was not deemed necessary and because the pilot believed this to be associated with a risk of disruptive elements over the radio if more people than the loadmaster and the assistant had radios.

1.18.3 The refueller's background

The refueller had extensive experience working within the helicopter industry. He was previously employed by Jämtlandsflyg and had worked there as a loadmaster for more than 30 years.

In 2019, Heliscan took over the base where Jämtlandsflyg had previously been operating. In conjunction with this, the refueller was transferred to Heliscan. At Heliscan, the refueller's responsibilities included maintenance of equipment and was otherwise a "jack of all trades". On jobs, he was responsible for refuelling the helicopters.

He was not tasked with being a loadmaster at Heliscan because Heliscan had a policy that a loadmaster should be pilot trained.

It has been stated during interviews that, while working for Jämtlandsflyg, the refueller was regarded as a competent loadmaster but that discussions had taken place between the refueller and other pilots in the company about how various tasks could be performed in a more efficient way. The company's senior management had become aware of these discussions and this resulted in meetings at the company.

SHK has also established that, on one occasion following Heliscan's takeover, there had been situations in which the refueller had opinions about how a pilot was performing their duties and that this was communicated to the base manager in Östersund. It is unclear whether this was passed on to the company's senior management.

1.18.4 The interaction between the parties at the loading site

It has been made clear that the team from Heliscan had worked together previously, but in different constellations. The loadmaster and the refueller knew each other well and, prior to the day in question, had spoken several times about how the work would be conducted on site. The loadmaster was concerned that the refueller would not stick to his specific task and would instead step in and work in the high-risk area as well. The loadmaster had repeatedly asked the refueller to simply stick to the refuelling, most recently on the evening before the accident.

The pilot and the loadmaster arrived at the work site on the morning of 16 November and met the assistant there. The refueller joined them at the work site after the pilot and loadmaster had arrived.

The pilot initially had opinions about the appearance of the loading site with regard to safety. Consequently, before the work of transporting the loads began, loose parts were tidied away and there was an inspection of how the loads were fixed together.

The pilot, the loadmaster and the assistant then conducted a reconnaissance round with the helicopter in order to point out the unloading site out in the countryside.

After these steps had been completed, the refueller told the pilot that the preparations had taken too long and that they need to get started on the job. The pilot pointed out that he had full responsibility for the operation and that the refueller's only task was to refuel the helicopter.

Once the work got under way, the refueller remained close to the refuelling vehicle and refuelled the helicopter at regular intervals when it came in for landing. The majority of the refuellings were performed as hot refuellings, but there was also one full-stop landing in order to allow the pilot to take a break and eat and drink. During this stop, the refueller again expressed to the pilot that the job was taking too long.

During the afternoon, the refueller, on his own initiative, intervened more and more in the work of attaching the loads to the helicopter. It is documented that on at least one occasion the refueller attached a load and gave the signal to the pilot that it was ready to be lifted. According to the witnesses, this may have occurred one more time during the latter part of the day. The loadmaster did not give the refueller any clear instruction or reprimand not to stay in the loading site when the helicopter was operating within that area, but suggested that that he would have a cup of coffee in the refuelling vehicle in order to get him to stay out of the loading site.

Later in the afternoon, there was again a discussion, this time about the uncertainty that it would be possible to complete the job that day. At this time, the pilot asked the loadmaster to investigate whether there were any available hotel rooms. The loadmaster answered that they would do this after the pilot had landed the helicopter. The refueller demonstrated his irritation that the work would not be completed that day and he said that he had to go home. The loadmaster has stated that this was not a problem and that the refueller could go home and then come back the next day. According to Heliscan, the client and those involved on site, there was nothing that prevented the job from being continued the following day.

When the pilot decided to stop the operation with the intention to continue the next day, he announced this to the loadmaster over the radio, which was also heard by the assistant. The loadmaster conveyed this decision to the refueller. The refueller then questioned this and insisted that the pilot must continue because people were standing out on the drop sites waiting.

Just after this, the loadmaster asked the pilot whether he was landing, which was confirmed by the pilot. When this was confirmed, the refueller was no longer standing in the same place as the loadmaster and the assistant. It is therefore not certain that the refueller heard the confirmation stating the intention to land the helicopter for the day.

The loadmaster and the assistant positioned themselves in the agreed way for landing. When the helicopter approached the loading site, the refueller, on his own initiative, took hold of the hook and attached it to the cargo.

1.19 Special methods of investigation

None.

2. ANALYSIS

2.1 Preparations

2.1.1 Composition of the working party

In an aviation company's organisation, the nominated responsible persons' duties and responsibility for aviation safety are clearly defined. However, certain corporate structures may involve duties being allocated in such a way that members of staff who are not involved in flight operations have a function that has a direct impact on operations and thus also a function that has an indirect impact on aviation safety. One of those who has a function that has an impact on operations at Heliscan is the base manager, who is responsible for finances and staff at the base. The base manager has no direct operational control over the management of flight operations and has no function within flight operations. It is the flight operations manager that is responsible for flight operations. As the local head of operations, however, the base manager is the recipient of tasks and jobs. The base manager implements these jobs and puts together the teams that will be working on the jobs. It is in this respect that the base manager can also be said to have an indirect impact on flight operations. Nonetheless, the base manager has no responsibility for aviation safety.

It has been clearly identified that the present working team from Heliscan had in fact worked together previously and that the loadmaster was concerned that the refueller would not keep to his specific duties. The loadmaster had repeatedly asked the refueller to keep to refuelling, most recently on the evening before the accident.

The fact that the refueller could, on occasions, exceed his assigned duties had been conveyed to management at the base in Östersund and management had also informed the refueller that he was to only conduct refuelling during the job in question. It has been made clear that the refueller, who had previously worked as a loadmaster, and who was regarded as competent in this function, could make comments about and get involved in situations that were outside of his job description. It has also been made clear that there have in the past been differences of opinion between the refueller and other pilots. These situations have involved such matters as how pilots have acted at a loading site. It is possible to conclude that the misgivings that had been voiced prior to the day in question materialised.

It is important in a team effort involving various individuals that everyone knows what is to be done and that there is clear communication between those involved. The composition of a working team is of great importance to the effectiveness of the work. It is not just the knowledge and abilities of specific individuals that are important to successful cooperation, other values such as personality, attitude, attentiveness, ability to work in a team and ability to communicate are also important. In the present case, it has been clear that the refueller, despite his exten-

sive experience, did not comply with the instructions and requests he had been given. It is also possible to question whether sufficient action had been taken to prevent the situation that arose. It ultimately always falls on the employer to ensure there is a safe work environment by identifying such situations and taking action in order to achieve a functioning group dynamic.

2.1.2 Risk management ahead of the cargo operation

The risk management began as early as during the planning of the job in the week prior to its implementation, and the final preparations were made on the day before the work was done. At this time, the staff involved went over the job and the equipment that would be taken along. The refueller was not present during the preparations on Monday as he had been working for another employer on that day.

After the pilot and the loadmaster had arrived on site and some adjustments had been made, the pilot conducted a risk assessment and a document – *Safe job analysis* – was drawn up. The risk assessment did not include the option for anyone to act outside of their duties. A safety review was then conducted with those who were to be at the loading site. The refueller was not present during the safety review. However, the pilot had made it clear to the refueller that his only job was to refuel the helicopter.

According to SHK's assessment, it would have been appropriate for all those who were to be present at the loading site to have attended a joint safety briefing so that they all had the same understanding of how the work was to be conducted.

A further assessment is that it is not entirely consistent to assume that the refueller would not be present at the loading site during loading given the fact that he was tasked with refuelling the helicopter, especially when refuelling with the engine running, but also during full-stop landings.

2.2 Sequence of events

When the pilot informed the loadmaster that he intended to land for the day, this message was passed on by the loadmaster to the others who were at the loading site. The pilot's decision was questioned by the refueller who had a different view on how the job should proceed. The loadmaster chose to ask the pilot again, after which the pilot confirmed the decision to the loadmaster. It is not entirely clear if this confirmation, that the intention was to land, reached the refueller. The fact that the loadmaster and the assistant positioned themselves for landing should however have indicated that a landing was to take place.

It has not been possible to establish the reason why the refueller, at this stage, took hold of the hook and attached a new load. One possible scenario may be that the refueller was doing so in order to forcibly persuade the pilot to continue the day's work by also flying out this load. One other possible scenario is that the refueller did not perceive the pilot's final confirmation of his intention to land and also did not perceive that the loadmaster and assistant had positioned themselves for landing and was therefore mentally prepared for the operation to continue; as he had questioned the pilot's intention to stop for the day. Irrespective of the scenario, the refueller may have been so prepared to attach a new load that he consequently underestimated the risk and made an incorrect assessment of the risk of getting hold of the hook and attaching a new load.

The fact that the refueller attached a new load despite this not being his assignment was not immediately noticed by the loadmaster or the assistant because they did not realise what the refueller intended to do. In light of this, it is understandable that neither the loadmaster nor the assistant intervened at this stage. The fact that the refueller was able to go forward and get hold of the hook may be due to the fact that the refueller had also been attaching loads earlier that day and the others did not intervene on these occasions either.

When coming in for landing, the pilot did not see the hook and therefore assumed that it was dragging along the ground. The fogged up rear-view mirror may at this point have resulted in the pilot's view of the hook being restricted. The pilot initiated a climb in order to get the hook in front of himself. The pilot did not see any risk associated with this manoeuvre as he was in contact with the loadmaster and the assistant who were positioned in front of the helicopter. In addition, the loadmaster and the pilot had been in radio communication with each other and the pilot understood from this communication that everyone realised that the helicopter was going to land. The pilot was not aware at this stage that someone had questioned the decision to stop for the day.

It has not been possible to establish any detail about the way in which the refueller became caught and was lifted up into the air. However, the injuries to the fingers of his left hand suggest that his hand got stuck in the hook. The film material and the investigations conducted by SHK also suggest that the refueller was standing in a loop in the strap while attaching the load. When the pilot initiated a climb, the refueller was lifted up into the air as the loop was tightened. As the loop straightened out, the body rotated. Once the strap had straightened out, the refueller was released and he fell to the ground.

2.2.1 Group dynamics and management of specialists

In the present case, it was explicit stated that the loadmaster and refueller were to act as task specialists in accordance with the company's OM. However, the refueller's role as task specialist was limited to only include refuelling of the helicopter. In addition to this, the pilot had decided that the refueller would not be equipped with radio in order to minimise any disruptions while the operation was taking place. Despite the refueller being at the loading site, he did not wear protective equipment in accordance with the company's manual. The loadmaster had encouraged the refueller to put on protective equipment on at least one occasion. The equipment was available on site but the refueller chose not to use it.

The refueller went in and attached loads, despite this not being his task. None of the others made any real attempts to prevent this. It is in this context that the refueller's previous experience of cargo operations within the helicopter industry may have contributed to the other people from Heliscan who were on site accepting the refueller's involvement in the loading. However, on one occasion during the day, the loadmaster urged the refueller to sit in the refuelling vehicle so as not to be involved in the loading. The loadmaster and the refueller had past experience of working together and this meant that the loadmaster was aware that he might have opinions about how the work was to be conducted.

It is easy in retrospect to see that the obvious action of stopping all work, at least temporarily, should have been taken because the rules of procedure were departed from on several occasions during the day. In summary, it can be concluded that it may be difficult to manage others who have, in comparison, much more extensive experience.

2.3 Risks when working with cargo straps

Working with long and light cargo straps in conjunction with lifting loads with a helicopter is always associated with some risk. The straps can be affected by the rotor downwash from the helicopter, which can be strong in certain cases.

Using a six-meter-long extra strap as an extension on certain loads meant that the safe distance to obstructions in certain places was improved. However, the fact that the extension was attached to the load that was on the ground entailed an increased risk of these straps lying free on the ground, which thus increased the risk of becoming caught in them. It has been established that no specific risk analysis was conducted in respect of attaching an extra strap to the loads. The film material depicting the work before the occurrence showed that people and also the refueller have been moving around and have been standing inside the cargo straps that were lying on the ground before the helicopter lifted the load.

Consequently, it is worth noting that there is room for improvement with regard to how risks are identified and managed within the scope of the risk analyses conducted ahead of loading operations.

2.4 Rescue services

The team involved in the operation alerted SOS Alarm and began cardiopulmonary resuscitation immediately. The rescue service was the first to arrive on site as they had the shortest distance to drive. When the rescue service arrived, followed by the ambulance, they took over the life-saving efforts. SHK has not had any reason to investigate the rescue operation further.

2.5 Final comments

It is possible to establish that the refueller did not adhere to applicable regulations and instructions. It is a challenge in terms of leadership for a small company or autonomous units to manage members of staff with varied ambitions and experience, and to deal with staff who do not adhere to the rules provided. This issue is by no means unique to this type of operation. It is also present in other industries and fields with high demands on safety.

In the present case, the pilot and the loadmaster had to balance between the company's safety requirements and alleviating the effect of differing levels of ambition among the individuals on site. Essentially, this appears to be a question of the composition of the team and how to achieve a functioning group dynamic, which there is reason for the operator to study further. The findings of the investigation do not however suggest that there were any underlying systemic shortcomings. Therefore, SHK chooses not to issue any safety recommendations.

3. CONCLUSIONS

3.1 Findings

a. The pilot was qualified to perform the flight.

b. The helicopter had a valid Certificate of Airworthiness and a valid ARC.

c. A risk analysis in the form of a *Safe Job Analysis* had been conducted prior to the start of the job.

d. The risk analysis resulted in action being taken on site before the work commenced.

e. The cargo straps that were used had been extended by six metres.

f. The refueller was a task specialist whose duties were limited to only refuelling the helicopter.

g. The pilot, the loadmaster and the assistant from Länsstyrelsen were equipped with radio communication and protective equipment.

h. The refueller was not equipped with protective equipment.

i. The refueller became caught in an extension strap, was lifted up into the air and then fell to the ground.

j. The refueller died as a result of the injuries he sustained when he fell to the ground.

3.2 Causes/contributing factors

The cause of the accident was that the refueller, on his own initiative, took hold of the cargo hook on the helicopter and attached a load without the pilot and the loadmaster being aware of this. The pilot's adjustment of the height prior to the landing led to the refueller getting caught in the cargo strap and being lifted up into the air. The actions taken by the pilot and the loadmaster during the operation, in order to ensure that the refueller acted within the scope of his own duties and that the work could be conducted in a safe manner, have not been sufficient.

An underlying cause of the accident was that the employer did not to a sufficient extent take action to achieve a functioning group dynamic.

4. SAFETY RECOMMENDATIONS

None.

On behalf of the Swedish Accident Investigation Authority

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