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## **Report RL 2001:26e**

***Accident involving helicopter SE-JUZ  
in Tierp, C County, Sweden  
on the 24<sup>th</sup> of March 2001***

**Case L-013/01**

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Translated by Dennis Lynn Anderson  
From the original Swedish at the request of the Board of Accident Investigation.

In case of discrepancies between the English and Swedish texts, the Swedish text is to be considered the authoritative version.

2001-08-24

L-013/01

Swedish Civil Aviation Administration  
601 79 NORRKÖPING

**Report RL 2001:26e**

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The Board of Accident Investigation (Statens haverikommission, SHK) has investigated an accident that occurred on the 24<sup>th</sup> of March 2001 in Tierp, C County, Sweden, involving a helicopter with registration SE-JUZ.

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

A translation to English of the report is enclosed.

Ann-Louise Eksborg

Monica J Wismar

Henrik Elinder

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## Report RL 2001:26e

### L-013/01

Report finalized 2001-08-24

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<i>Aircraft: registration, type</i>	<b>SE-JUZ</b> , Sikorsky S76A++
<i>Class/airworthiness</i>	Normal, Valid certificate of airworthiness
<i>Owner/Operator</i>	GE Capital Equipment Finance AB / Norrlandsflyg AB, Box 24, 982 21 Gällivare
<i>Date and time</i>	The 24 <sup>th</sup> of March 2001 at 11.45 hrs. in daylight <i>Note:</i> All times in the report are given in Swedish standard time = UTC + 1 hour
<i>Place of occurrence</i>	Tierp, C County, Sweden, (position 6021N 1731E, approximately 30 meters above sea level)
<i>Type of flight</i>	Ambulance flight
<i>Weather</i>	According to SMHI's (Swedish Meteorological and Hydrological Institute) analysis: wind ap- proximately 230°/03 knots, visibility unlim- ited, clouds 1–3/8 cumulus with cloud-base at approximately 4,000 feet, temp./dewpoint +1/–8 °C, QNH 1017 hPa.
<i>Persons onboard:</i>	
<i>crew</i>	1 (The co-pilot was situated outside the aircraft)
<i>passengers</i>	–
<i>Injuries to persons</i>	None
<i>Damage to aircraft</i>	Slightly damaged
<i>Collateral damage</i>	Minor damage to trees
<i>The commander:</i>	
<i>age, certificate</i>	41 years old, ATPL Helicopter (Swedish DH)
<i>total flying time</i>	4,645 hours, of which 460 hours on the type
<i>flying time the previous</i>	
<i>90 days</i>	61.5 hours, all on the type
<i>number of landings</i>	
<i>previous 90 days</i>	130
<i>The co-pilot:</i>	
<i>age, certificate</i>	32 years old, Commercial Helicopter License with Instrument Rating (Swedish BH)
<i>total flying time</i>	462.8 hours, of which 258.7 hours on the type
<i>flying time the previous</i>	
<i>90 days</i>	86.5 hours, of which 74.9 hours on the type
<i>number of landings</i>	
<i>previous 90 days</i>	230, of which approximately 210 on the type

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SHK was notified on the 24<sup>th</sup> of March 2001 that an accident involving a helicopter with registration SE-JUZ had taken place in Tierp, C County, Sweden, on the same day at 11.45 hrs.

The accident has been investigated by SHK represented by Ann-Louise Eksborg, Chairman, Monica J Wismar, Chief Investigator Flight Operations, and Henrik Elinder, Chief Technical Investigator Aviation.

SHK has been assisted by Johan Agin as operational expert.

The investigation has been followed by the Swedish Civil Aviation Administration through Gun Ström.

### **Summary**

The commander was to park the helicopter on a new location since the first landing area was unsuitable to park on. Because of this he requested the first officer, herein referred to as the co-pilot, to proceed to a nearby parking lot to determine if it was possible to land and park there.

When the co-pilot had reached the parking lot, he gave a positive signal to the commander in the form of a “thumbs up”. The commander hovered the helicopter up and over a row of trees and reached the area. He hovered the helicopter forward towards the co-pilot, and decreased his height above the ground, whereupon snow and sand started whirling around the helicopter, which forced the co-pilot to turn his head away and cover his eyes. At the same instant the commander noticed a plastic bag which was whirling up from the ground. He then decided to quickly put the helicopter on the ground to prevent the plastic bag from being entangled in the rotor. Just prior to the wheels coming in contact with the ground he felt a light vibration in the helicopter.

After the landing the commander performed an external check of the helicopter and the surroundings. At this time he observed that the tail rotor had collided with some branches of a tree that stood along the edge of the parking lot.

The investigation shows that the size of the landing site did not fulfill the company's minimum margins and was also otherwise unsuitable. Also, clear routines were lacking concerning crew co-operation in connection with ground marshalling during landing on a landing site with nearby obstacles.

The accident was caused by the fact that the landing was carried out in an area where the safety distance to the nearest obstacle was too small so that the helicopter's tail rotor collided with some branches of a tree. Contributory causes could have been, that the landing was forced because the pilot wanted to avoid a plastic bag which was flying around, from being sucked into the rotor and that he did not receive any marshalling assistance.

### **Recommendations**

The Swedish Civil Aviation Administration is recommended to make every effort to ensure that helicopter aviation companies – which operate according to a two-pilot system, or with one pilot and an assistant – develop and use established routines for crew co-operation when landing on a landing site with nearby obstacles (*RL 2001:26e R1*).

## 1 FACTUAL INFORMATION

### 1.1 History of the flight

On the 24<sup>th</sup> of March 2001 at approximately 11.25 hrs. the crew, who had on-call duty with the ambulance helicopter stationed in Uppsala, received a so called "Primary alert, priority 1" (PRIO1 –alert)<sup>1</sup>. The flight mission was to pick up a patient at Tierp's health-care center for transportation to the University Hospital in Uppsala.

The pilots departed from the helicopter base on the southern outskirts of Uppsala and flew to the hospital in the city to pick up a doctor and a nurse. From there the flight continued to Tierp. When they arrived at the health-care center they decided to land on a snow-covered area a short distance from the center, because they were uncertain of the landing conditions at the area adjacent to the building. They dropped-off the doctor and the nurse but did not shut down the engines. The commander considered the area to be an unsuitable parking site for the helicopter. Partly because the main rotor extended out over a road and partly because it would be necessary to lift the patient over a snow bank. Because of this he requested the first officer, herein referred to as the co-pilot, to proceed to a parking lot in front of the health-care center's ambulance entrance to determine if it was possible to land and park there.

When the co-pilot had reached the parking lot, he gave a positive signal to the commander in the form of a "thumbs up". The commander hovered the helicopter up and over a row of trees and chose a site, which he considered suitable with regard to the ambulance entrance and cars parked on the parking lot, to land on. When he reached the area he hovered the helicopter forward towards the co-pilot, who was standing on the parking lot with his back towards the wall of the building. When the commander decreased his height above the ground, snow and sand started whirling around the helicopter, which forced the co-pilot to turn his head away and cover his eyes. At the same instant the commander noticed a plastic bag which was whirling up from the ground. He then decided to quickly put the helicopter on the ground to prevent the plastic bag from being entangled in the rotor. Just prior to the wheels coming in contact with the ground he felt a light vibration in the helicopter.

After the landing the commander performed an external check of the helicopter and the surroundings. At this time he observed that the tail rotor had collided with some branches of a tree that stood along the edge of the parking lot.

The accident occurred in position 6021N 1731E, approximately 30 meters above sea level.

### 1.2 Injuries to persons

	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>	<i>Total</i>
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	–	–	–	–
None	2	–	–	2
Total	2	–	–	2

<sup>1</sup> PRIO1-alert = To transport medical care to an individual, or transport the individual to medical care, when the situation is life-threatening.

### 1.3 Damage to aircraft

Slightly damaged.

### 1.4 Other damage

Minor tree damage.

### 1.5 The crew

#### 1.5.1 The commander

The commander was 41 years old at the time and had a valid ATPL Helicopter License, (Swedish DH).

##### *Flying time (hours)*

<i>previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	0.7	61.5	4,645
This type	0.7	61.5	460

Number of landings actual type previous 90 days: 130.

Flight training on the type concluded during May of 1999.

Latest Periodic Flight Training (PFT) carried out on the 19<sup>th</sup> of December 2000.

#### 1.5.2 The co-pilot

The co-pilot was 32 years old at the time and had a valid Commercial Helicopter License, (Swedish BH), with Instrument Rating.

##### *Flying time (hours)*

<i>previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	0.7	86.5	462.8
This type	0.7	74.9	258.7

Number of landings actual type previous 90 days: approximately 210.

Flight training on the type concluded on the 26<sup>th</sup> of May 2000.

Latest Periodic Flight Training (PFT) carried out on the 26<sup>th</sup> of May 2000.

#### 1.5.3 The pilots' work schedule

The week prior to the accident the pilots had the following schedule:

	<i>The commander</i>	<i>Flying time</i>	<i>The co-pilot</i>	<i>Flying time</i>
2001-03-17	day off	-	day off	-
2001-03-18	day off	-	day off	-
2001-03-19	day off	-	day off	-
2001-03-20	9 hour duty	2.3	day off	-
2001-03-21	9 hour duty	3.6	day off	-
2001-03-22	9 hour duty	0.4	day off	-
2001-03-23	9 hour duty	0.3	9 hour duty	0.3

2001-03-24 9 hour duty 0.4 9 hour duty 0.4

**1.6 Aircraft information**

## THE AIRCRAFT

*Manufacturer:* Sikorsky Aircraft  
*Type:* S76A++  
*Serialnumber:* 760282  
*Year of manufacture:* 1985  
*Gross weight:* Maximum allowable 10,800 lbs (4,898 kg),  
 actual 9,385 lbs (4,257 kg)  
*Center of gravity:* Within allowable limits  
*Total flight hours:* 6,313 hours  
*Flight hours since latest  
 periodic check:* 26 hours  
*Fuel uplifted  
 Before event:* JET A1, 600 liters

## ENGINE

*Manufacturer:* Turbomeca  
*Model:* Arriel (1S1)  
*Number of engines:* 2  
*Engine* No. 1 No. 2  
*Total flying time, hours:* 3,880 3,592  
*Time since overhaul:* 1,727 1,439

## ROTOR

*Manufacturer:* Sikorsky  
*Operating time  
 Since basic overhaul*  
*Main rotor:* 6,313 hours  
*Tail rotor:* 6,313 hours

## DIMENSIONS

*Length:* 13.44 meters  
*Rotor diameter:* 13.41 meters

The aircraft had a valid certificate of airworthiness.

**1.7 Meteorological information**

A weak high pressure ridge dominated the area with light winds and only partially cloudy conditions.

According to SMHI's analysis: wind approximately 230°/03 knots, visibility unlimited, clouds 1-3/8 cumulus with the cloud base at approximately 4,000 feet, temp./dewpoint +1/-8 °C, QNH 1017 hPa.

**1.8 Aids to Navigation**

Not applicable.



## **1.9 Communications**

Not applicable.

## **1.10 Aerodrome information**

Not applicable.

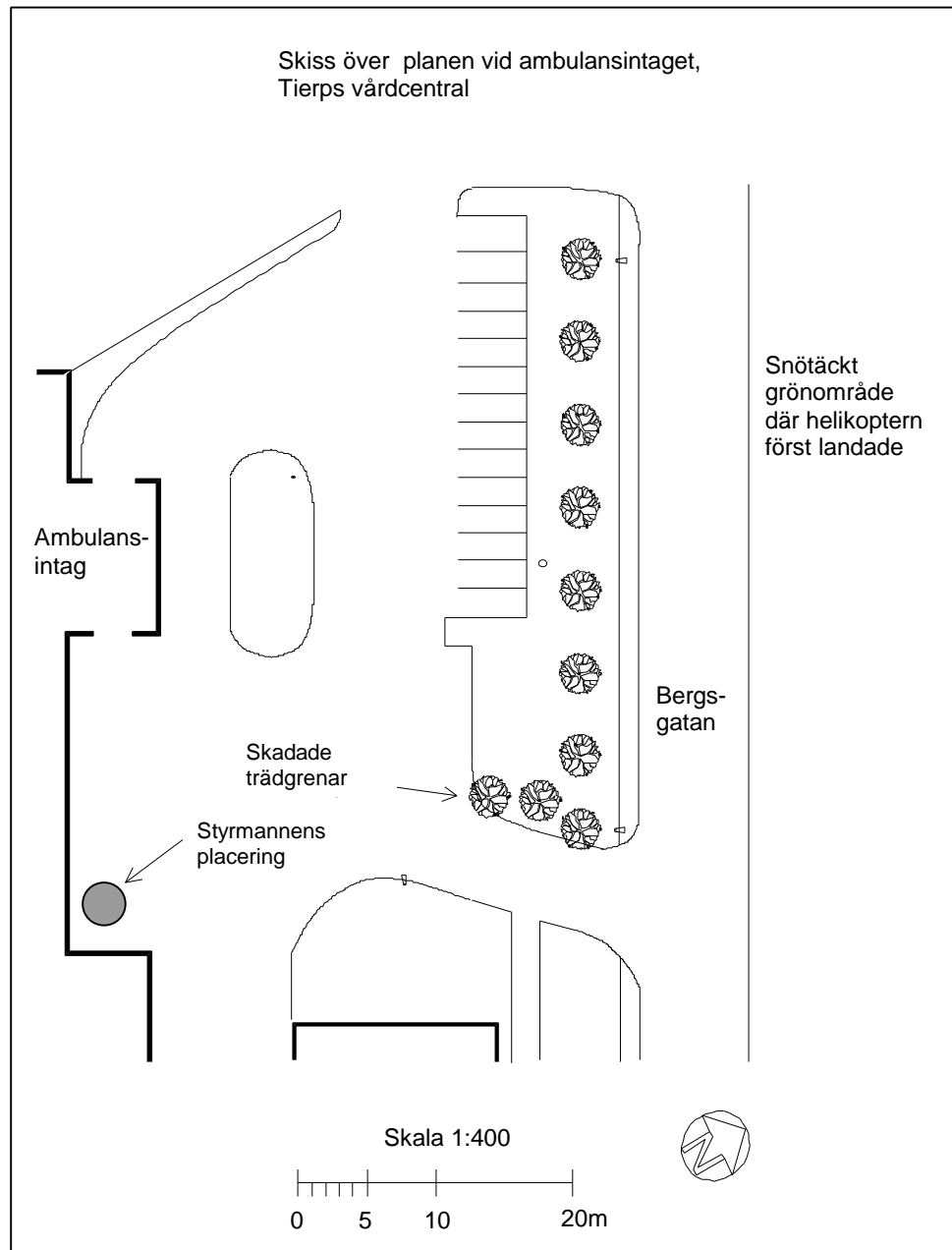
## **1.11 Flight recorders**

There was no requirement to carry a Flight Data Recorder (FDR) nor was one installed. A Cockpit Voice Recorder (CVR) of type Fairchild A 100 was installed on board. Recorded information from the flight has not been analyzed.

## **1.12 Accident site and aircraft**

### *1.12.1 Accident site*

The tail rotor collided with some branches of a tree that stood at the very edge of the car parking lot as depicted in the police survey sketch below.



### 1.12.2 Aircraft

Damage was caused to the helicopter's tail rotor blades.

### 1.13 Medical information

Nothing indicates that the mental or physical condition of the pilots had been impaired.

### 1.14 Fire

There was no fire.

### 1.15 Survival aspects

The emergency transmitter was not activated during the accident.

## 1.16 Tests and research

Not applicable.

## 1.17 Organizational and management information

### 1.17.1 General

The aviation company has its headquarters in Gällivare and operating stations in Björkliden, Kiruna, Kvikkjokk, Nikkaluokta, Ritsem and Uppsala. The company holds a commercial flight operations permit for single and dual engine helicopters. The company performs various types of helicopter missions such as personal transport, transport of goods, power-line inspection, aerial photography, reindeer herding etc. The operations include utility aviation according to VFR<sup>2</sup> and IFR<sup>3</sup>. Instrument flight is only performed with the helicopter of type Sikorsky S76A. Detailed instructions for flight accomplishment is presented in the company's Flight Operations Manuals.

### 1.17.2 Flight Operations Manual (FOM)

According to the FOM, landing with the helicopter type in question may only be carried out on a landing area that is obstacle-free 32 meters in all directions. SHK has not found any written instruction regarding ground marshalling in connection with landing.

The company has pre-determined landing sites at the medical-care centers that they traffic regularly. The medical-care center in Tierp was not trafficed regularly and there was no pre-determined landing site there.

### 1.17.3 Equipment onboard

There was a portable radio that could be connected to the headset, located onboard the helicopter but it was not utilized on this occasion.

## 1.18 Additional information

### 1.18.1 Ground marshalling

When landing on a landing site with immediately adjacent obstacles it is usual, according to what SHK has learned – in those cases where one of the pilots or other assistant is located on the ground – that this person places him– or herself at a suitable location with respect to the intended landing site and marshals the pilot in the helicopter with a portable radio during the landing maneuver. It also occurs that goggles or a helmet with visor is used in order to prevent the marshalling person from getting whirling dust or gravel in the eyes.

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<sup>2</sup> VFR – Visual Flight Rules

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

### 1.18.2 *Equipment*

Some helicopter companies have implemented as a routine, that crews involved in this type of flight operation are required to wear a helmet with built-in microphone and headphones. The crewmember that then leaves the helicopter normally carries a radio, which can easily be connected to the helmet as soon as he/she exits the helicopter.

## 2 ANALYSIS

### 2.1 The landing

The commander did indeed have a reason to locate a better parking site for the helicopter than the area where they first landed, but a valid reason to select an area directly adjacent to the medical-care center did not exist.

According to the company manual, landing with this type of helicopter may only be carried out with an obstacle-free landing area larger than 32 meters in all directions. As shown in the police survey sketch in section 1.12.1, the actual parking lot width was only approximately 29 meters and therefore did not fulfill the minimum distance requirement for a temporary landing site. SHK is aware of the fact that it can be difficult to judge the distance to stationary objects with an accuracy of a meter or two. Therefore one should— in those cases where a crewmember is located on the ground— step-off the distance if it is not obvious that the margin of safety is sufficient.

The proximity of the building and the parked cars made the area— apart from the fact that the area was smaller than demanded by the manual— unsuitable to land and park upon.

The purpose of safety distances to stationary objects when landing is that small unexpected and natural movements in the horizontal plane are able to be tolerated without this resulting in a risk of collision. In the case of the landing in question the margins were too small, which resulted in the tail rotor coming in contact with some branches of a tree in connection with the hovering prior to touchdown. Contributory can have been that the pilot forced the touchdown in order to avoid a plastic bag which was flying around to be sucked into and damaging the rotor.

In the case in question, the collision with the tree resulted only in material damage to the helicopter, but could have had catastrophic consequences, had the tail rotor collided with a more robust object and been rendered non-functional.

The occurrence shows the importance of relevant safety margins being stipulated in applicable regulations and that these are understood and always followed by all persons involved.

### 2.2 Company culture

When a company operates simultaneously from several bases there is a possibility that different cultures arise within the company and that the regulations established centrally are not fully followed everywhere. Especially when the operations consist of transporting sick and injured persons, there is a risk that the pilots successively elevate the quality of the service, which can consciously or unconsciously, lead to the diminishment of safety margins. This is a phenomenon that has been noticed in other

countries also. Thus, the National Transport Safety Board, NTSB, USA, has conducted a safety study (NTSB report number: SS - 88 – 01, NTIS, report number: PB 88 – 917001) with an analysis of this type of problem complex.

## 2.3 Ground marshalling

This aviation company operates an ambulance helicopter service according to a two-pilot concept where both pilots are qualified to fly the helicopter. This is not a general requirement of the authorities with respect to VFR flight, but favorable with regard to flight safety.

Instructions concerning the co-operation between the pilots is also included in the company's operational regulations for different types of flights. However, in these regulations SHK has not found any instructions regarding crew co-operation during ground marshalling, in connection with landing on a landing site with adjacent obstacles.

Suitable actions during such landings, in those cases where a crewmember is located on the ground, is that one should place him- or herself in a suitable position with reference to the intended landing site and marshal the flying pilot with a portable radio during the landing.

The landing under investigation reveals several shortcomings;

- Established routines for crew co-operation were lacking for the situation at hand.
- Established visual signals between the pilots were lacking.
- The pilots lacked instruction and training regarding ground marshalling.
- The co-pilot did not carry a portable radio when he left the helicopter.
- The co-pilot did not perform a closer examination of the landing area's size in regard to the company's minimum margins.
- The co-pilot placed himself inappropriately regarding the landing site, which meant that he had to turn his head away and close his eyes when his supervision was most required.
- The commander chose to land on a, for several reasons, inappropriate landing site.
- The commander carried out the landing despite the fact that he did not have any support from the co-pilot during the hovering and touchdown phase.

SHK is of the opinion that one should utilize the collective capacity of two pilots or a pilot and an assistant when performing difficult landings of this type. The Swedish Civil Aviation Administration should therefore make every effort to ensure that helicopter companies which operate according to this system also develop routines for crew co-operation for "marshalled landings" and adapt the equipment to such co-operation. The personnel involved should also be instructed and trained regularly for such landing maneuvers.

## 3 CONCLUSIONS

### 3.1 Findings

- a) The pilots were qualified to perform the flight.
- b) The helicopter had a valid certificate of airworthiness.

- c) The size of the landing site did not fulfill the company's minimum margins and was also otherwise unsuitable.
- d) Clear routines were lacking concerning crew co-operation in connection with ground marshalling during landing on a landing site with nearby obstacles.

### **3.2 Causes**

The accident was caused by the fact that the landing was carried out in an area where the safety distance to the nearest obstacle was too small so that the helicopter's tail rotor collided with some branches of a tree. Contributory causes could have been, that the landing was forced because the pilot wanted to avoid a plastic bag which was flying around, from being sucked into the rotor and that he did not receive any marshalling assistance.

## **4 RECOMMENDATIONS**

The Swedish Civil Aviation Administration is recommended to make every effort to ensure that helicopter aviation companies, which operate according to a two-pilot system, or with one pilot and an assistant, develop and use established routines for crew co-operation when landing on a landing site with nearby obstacles (*RL 2001:26e R1*).