



Statens haverikommission
Swedish Accident Investigation Board

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Report RL 2003:05e

***Accident involving helicopter SE-JUV
at Stockholm/Bromma airport, AB County,
Sweden on the 28th of August 2002***

Dnr L-073/02

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

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2003-02-17

L-073/02

Swedish Civil Aviation Administration

601 79 NORRKÖPING

Report RL 2003:05e

The Swedish Accident Investigation Board (Statens haverikommission, SHK) has investigated an accident that occurred on the 28th of August 2002 at Stockholm/Bromma airport, AB County, Sweden, involving a helicopter with registration SE-JUV.

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.

Carin Hellner

Monica J. Wismar

Henrik Elinder

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Report finalized 2003-02-17

<i>Aircraft; registration, type</i>	SE-JUV, Robinson R22 Beta
<i>Class, airworthiness</i>	Normal, valid certificate of airworthiness
<i>Owner/Operator</i>	Helicopter Assistance-Heli Romance AB Bromma Airport, 168 67 BROMMA
<i>Date and time</i>	2002-08-28, 11:50 hours in daylight <i>Note:</i> All times refer to Swedish Daylight Savings Time (UTC + 2 hours)
<i>Place of occurrence</i>	Stockholm/Bromma airport, AB County, Sweden (pos 5921N 01756E; 14 m above sea level)
<i>Type of flight</i>	Training flight
<i>Weather</i>	According to SMHI's analysis: wind 240°/6 knots, variable between 180° and 280°, visibility > 10 km, clouds 2-4/8 stratocumulus with cloud bases at 3,200 feet plus higher cloud formations, temp./dew point +22/+14 °C, QNH 1013 hPa
<i>Persons on board;</i>	
<i>crew members</i>	1
<i>passengers</i>	-
<i>Injuries to persons</i>	Minor injuries
<i>Damage to aircraft</i>	Substantial
<i>Other damage</i>	None
<i>Student pilot</i>	
<i>Age, gender, licence</i>	38 year old male, student pilot licence AH
<i>Total flying time</i>	40 hours, all on the type
<i>Flying time previous 90 days</i>	10 hours
<i>Number of landings previous 90 days</i>	6

The Swedish Accident Investigation Board (Statens haverikommission, SHK) was notified on the 28th of August 2002 that an accident had taken place, involving a helicopter with registration SE-JUV at Stockholm/Bromma airport, AB County, Sweden, on that same day at 11:50 hours.

The accident has been investigated by SHK represented by Carin Hellner, Chairperson, Monica J. Wismar, Chief Investigator Flight Operations, and Henrik Elinder, Chief Technical Investigator Aviation.

The investigation has been followed by The Swedish Civil Aviation Administration through Daniel Hummerdal.

Summary

The student pilot was in the process of training for an AH-licence. After an EK-flight¹ from Norrtälje he was supposed to land at Stockholm/Bromma airport. The approach and flare to landing at the helicopter landing ramp proceeded normally. Then the student pilot hovered the helicopter forward, touched down on the apron in front of the hangar and moved the collective²

¹ EK – Solo flight

² Collective – Collective control lever

to the fully down position. Immediately after the touchdown he let-go of the collective and began to tighten the cyclic stick friction brake.

At precisely this moment the student noticed that the collective began to spontaneously move upwards and simultaneously the helicopter began to lift-off. He then took hold of the collective and quickly moved it to the down position. In connection with this maneuver the helicopter began to rotate uncontrollably. During the student pilot's attempt to regain control of the helicopter, it lifted off the ground a few meters and subsequently hit the ground hard. The helicopter came to rest right side up and the student, who sustained only minor injuries, was able to evacuate the helicopter without assistance. The helicopter was extensively damaged.

No technical fault has been found on the helicopter. During the investigation it has been found that the student pilot did not follow the checklist sequence regarding application of the friction brakes and that the sequence of the first few items on the checklist is illogical. Since the helicopter manufacturer has decided to revise the checklist regarding this checklist sequencing, SHK has not seen any reason to issue any recommendation in this matter.

The accident was caused by the student pilot losing control of the helicopter when it unintentionally became airborne after touchdown. The helicopter lifted-off due to the fact that the student pilot released the collective without having first applied the friction brake, when at the same time the engine and rotor were operating at high rpm.

Recommendations

None.

1 FACTUAL INFORMATION

1.1 History of the flight

The student pilot was undergoing training for an AH-licence at a flight training organization at Stockholm/Bromma airport. After having accomplished a solo navigation flight from Norrtälje airport he was supposed to land next to the flight school's hangar at the airport.

The approach and flare to landing at the helicopter landing ramp immediately southwest of the hangar proceeded normally. The student then hovered the helicopter forward, touched down on the apron in front of the hangar and moved the collective to the fully down position. Immediately after touchdown, before he had reduced engine/rotor rpm and locked the collective, he released the collective and began to tighten the friction brake for the cyclic stick, which is accomplished on this type helicopter via a wheel mounted on a console in front of the pilot seats.

At precisely this moment the student noticed that the collective began to spontaneously move upwards and simultaneously the helicopter began to lift-off. He then took hold of the collective and quickly moved it to the down position. In connection with this maneuver the helicopter began to yaw rapidly. He is not certain himself of the direction of the yaw but believes it was to the left.

When the student attempted to correct the yaw by use of rudder application the yawing tendency accelerated and the helicopter spun around several times on the apron. After a few revolutions the helicopter also began to "hop" off the surface of the ramp. At this point the student pilot chose to lift the helicopter off the ground in order to attempt to regain control. When the helicopter had ascended a few meters above the ground, still rotating, it also began to "wobble" and subsequently uncontrollably impacted the ground. The helicopter came to rest right side up and the student, who sustained only minor injuries, was able to evacuate the helicopter without assistance. The helicopter was extensively damaged.

The accident occurred on the 28th of August 2002 at 11:50 hours at position 5921N 01756E; 14 m above sea level.

1.2 Injuries to persons

	<i>Crew</i>	<i>Passengers</i>	<i>Other</i>	<i>Total</i>
Fatal	–	–	–	–
Seriously injured	–	–	–	–
Slightly injured	1	–	–	1
No injuries	–	–	–	–
Total	1	–	–	1

1.3 Damage to aircraft

Substantial.

1.4 Other damage

None.

1.5 The crew

The student pilot was a 38-year-old male and held a valid student pilot permit for AH-licence.

<i>Flying hours</i>			
<i>Previous</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	0	10	40
This type	0	10	40
Solo	0	9	9

Number of landings on the type previous 90 days: 6.

1.6 The aircraft

AIRCRAFT

<i>Manufacturer</i>	Robinson
<i>Type</i>	R22 Beta
<i>Serial number</i>	2347
<i>Year of manufacture</i>	1993
<i>Gross mass</i>	Maximum takeoff mass 622 kg, actual 510 kg
<i>Center of mass</i>	Within allowable limits
<i>Total flight hours</i>	4,094 hours
<i>Number of cycles</i>	-
<i>Flight hours since latest periodic check</i>	28.2 hours
<i>Fuel uplifted prior to the event</i>	AVGAS 100 liters

ENGINE

<i>Engine manufacturer</i>	Lycoming
<i>Engine model</i>	O-320-B2C
<i>Number of engines</i>	1
<i>Total operating hours</i>	2,070
<i>Operating hours since latest overhaul</i>	-
<i>Cycles after overhaul</i>	-

ROTOR

<i>Rotor manufacturer</i>	Robinson
<i>Operating hours since date of manufacture:</i>	
<i>Main rotor</i>	2,070 hours (counter-clockwise rotation)
<i>Tail rotor</i>	2,070 hours

The aircraft had a valid Certificate of Airworthiness.

1.7 Meteorological information

According to SMHI's analysis: wind 240°/6 knots, variable between 180° and 280°, visibility > 10 km, clouds 2-4/8 stratocumulus with cloud bases at 3,200 feet plus higher cloud formations, temp./dew point +22/+14 °C, QNH 1013 hPa.

At the time the helicopter received landing clearance the air traffic controller reported the wind from 250° at 8 knots.

1.8 Aids to navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome information

The airport had operational status in accordance with the Swedish AIP³.

1.11 Flight and voice recorders

There was no requirement to carry a Flight Data Recorder (FDR) or a Cockpit Voice Recorder (CVR) on board and neither was fitted.

1.12 Accident site and aircraft wreckage

1.12.1 *The accident site*

The helicopter impacted the ground on an asphalt parking apron approximately 25 meters from the flight school's hanger. The hanger door was partially open and maintenance operations were in progress in the hanger. A small twin-engine aircraft was parked between the hanger and the helicopter and another small piston engine driven helicopter was parked approximately 25 meters from the crash site.

1.12.2 *Aircraft wreckage*

The helicopter's landing gear was broken and the cabin was deformed. The main rotor transmission had been partially broken loose from the structure of the helicopter. The main rotor blades were bent and chafed from having come in contact with the ground. One of the rotor blades had severed the tail boom. Parts of the tail boom and the tail rotor and its 90-degree gear-box were spread around an area at a distance of from 10 to 50 meters from the helicopter wreckage. The damage that could be observed on the tail rotor and the tail rotor spur has been determined to have occurred subsequent to the tail boom being torn off.



³ AIP –Aeronautical Information Publication

1.13 Medical information

Nothing has been found that would indicate that the physical or mental condition of the student pilot was impaired prior to or during the flight.

1.14 Fire

A few seconds after the helicopter had impacted with the ground a small fire broke-out within the helicopter's engine compartment. The fire was extinguished by on-scene personnel with the help of a portable fire extinguisher.

1.15 Survival aspects

The emergency locator of type ACK-001 was not activated. The student pilot was secured with a four-point safety harness and the pilot cabin remained relatively intact. He sustained only minor injuries.

1.16 Tests and research

The student has stated that he did not experience any technical problems with the helicopter prior to the accident.

The helicopter's flight control and rotor systems have been investigated and functionally tested to the extent that it has been practicably possible. Nothing in the investigation would indicate that any technical failure or abnormality existed within the systems that could have influenced the sequence of events.

The friction brake for the cyclic stick was locked and the friction lever for the collective was unlocked.

1.17 Organizational and management information

The main activities of the aviation company is pilot training (AH and BH-license), aerial photography, air taxi operation and helicopter sales/rental. At the time of the accident the company operated with four single-engine helicopters of types Robinson R22 and R44. The company is also the Swedish general sales agent for this type helicopter.

1.18 Additional information

1.18.1 Rescue service

The accident was observed by personnel in the air traffic control tower who immediately notified the airport rescue service. After a couple of minutes, when the first rescue unit had arrived on the scene, the small fire which had broke-out had already been extinguished and the student pilot had exited the helicopter. As fuel had leaked out, the helicopter wreckage and accident site were secured with foam.

1.18.2 Witnesses

Several witnesses observed the entire accident sequence or portions of it. Witness testimony is by and large unanimous. Only one of the witnesses who were interviewed has a distinct recollection of which direction the helicopter rotated on the ground and in the air and is of the opinion that the helicopter rotated to the left (counter-clockwise).

1.18.3 Checklist

It is stated in the helicopter's checklist that the following first items are to be accomplished after landing and prior to engine shutdown:

Collective down	<u>Friction on</u>
Cyclic/pedals neutral	<u>Friction on</u>
Governor	<u>Off</u>
Idle at 70 to 80 %	<u>CHT drop</u>
Throttle	<u>Closed</u>
ETC.	

According to the routines of the flight school, all student pilots shall be able to accomplish the first five checklist items by memory. This is something that the student pilot was aware of and also capable of doing. He cannot explain why he on this occasion interchanged the first and second items on the checklist.

Subsequent to the accident the helicopter manufacturer has announced that in an upcoming revision of the checklist, they intend to change the sequence of the first four checklist items, insofar as reduction of engine/rotor rpm shall be accomplished prior to application of the friction brakes.

2 ANALYSIS

2.1 The landing

The prerequisites for the flight were good. The student pilot felt that he had full control of the helicopter during the entire landing phase, including the touchdown in front of the hangar. The difficulties began when he released the collective in order to apply friction to the cyclic stick instead of first applying the collective friction according to the checklist sequence. The collective was then able to spontaneously move upward due to the vibrations of the helicopter. Due to the fact that the engine/rotor rpm was still high, lift was created which caused the helicopter to begin to lift-off.

In connection with lift-off of a helicopter a yawing vector is created due to the increased engine power, something that a pilot must compensate for by application of a certain amount of rudder. On helicopters with counter-clockwise rotation of the main rotor, as was the case here, this is accomplished by application of left rudder. It is therefore possible that the student pilot reflexively and subconsciously applied a certain amount of rudder to the left when the helicopter began to lift-off.

When he subsequently moved the collective down quickly it is hardly probable that he simultaneously corrected the rudder input for the reduced yaw tendency. This may be an explanation for why the helicopter yawed to the left when he lowered the collective.

No technical failure has been found within the control systems of the helicopter, which could explain why the student pilot was not successful in stopping the yaw. Since the student was surprised by the helicopter lifting-off and by the sudden left-hand yaw, this would strongly indicate that he became somewhat stressed and applied left rudder deflection instead of right. Such a type of faulty maneuver is not entirely unusual in such circumstances. The student's modest flying experience may also have been contributory. This could also explain why the yaw velocity increased instead of decreased.

The situation became even more difficult for the student pilot when he thereafter entirely lifted the helicopter off the ground and it began to "wobble" while airborne. He then completely lost control of the helicopter and was not able to prevent it from hitting the ground.

The impact took place in the immediate vicinity of persons, aircraft and buildings and it must therefore be ascribed to fortunate circumstances that no serious injuries to persons resulted and that the material damage was limited to the helicopter involved.

2.2 The checklist

Irrespective of the fact that the student pilot in this case did not follow the checklist sequence concerning application of the friction brakes, SHK is of the opinion that the prescribed sequence of the first four checklist items is illogical. This sequence entails that the pilot shall release the collective or the cyclic stick in order to be able to apply the friction brakes while at the same time the engine/rotor rpm is still high. Since the controls are easily moveable at this time, this constitutes an obvious risk that the helicopter may start to move. The first step to be taken after touchdown should instead be to reduce the engine/rotor rpm. Had this been accomplished in the case at hand, the sequence regarding the application of the friction brakes would not have been of any great significance. Since, as a consequence of this accident, the helicopter manufacturer has decided to revise the checklist regarding this, SHK sees no reason to issue any recommendation in this matter.

3 CONCLUSIONS

3.1 Findings

- a) The student pilot was qualified to perform the flight.
- b) The helicopter had a valid Certificate of Airworthiness.
- c) No technical failure has been found on the helicopter.
- d) The student pilot did not follow the checklist sequence regarding application of the friction brakes.
- e) The after landing checklist's first items have an illogical sequence.

3.2 Causes of the accident

The accident was caused by the student pilot losing control of the helicopter when it unintentionally became airborne after touchdown. The helicopter lifted-off due to the fact that the student pilot released the collective without having first applied the friction brake, when at the same time the engine and rotor were operating at high rpm.

4 RECOMMENDATIONS

None.