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Report RL 2001:43e

**Accident involving aircraft SE-GBR
at Norrtälje/Mellingeholm airport, AB county,
Sweden, on 29 July 2001**

Case L-051/01

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

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from the original Swedish at the request of the Board of Accident Investigation.
In case of discrepancies between the English and the Swedish texts, the Swedish text is to be considered the authoritative version.

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2001-11-27

L-051/01

Swedish Civil Aviation Administration

601 79 NORRKÖPING

Report RL 2001:43e

The Board of Accident Investigation (Statens haverikommission, SHK) has investigated an accident that occurred on 29 July 2001, at Norrtälje/Mellingeholm airport, AB county, Sweden, involving an aircraft with registration SE-GBR.

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.

Olle Lundström

Monica J Wismar

Sakari Havbrandt

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Report finalized 2001-11-27

<i>Aircraft; registration and type</i>	SE-GBR , Piper PA 28-151
<i>Class/airworthiness</i>	Normal, valid certificate of airworthiness
<i>Owner/operator</i>	Roslagens Aero Club
<i>Time of occurrence</i>	2001-07-29, at approximately 19:45 hrs. in daylight <i>Note:</i> All times are given in Swedish daylight saving time = UTC + 2 hours
<i>Place</i>	300 meters West of Norrtälje/ Mellingeholm airport, AB county, Sweden (pos 5944N 01842E; 12 meters above sea level)
<i>Type of flight</i>	Private
<i>Weather</i>	According to SMHI ¹ 's analysis: wind southwesterly 5–10 knots, good visibility, no clouds, temp./dewpoint +23/+13 °C, QNH 1012 hPa.
<i>Persons on board:</i>	
<i>crew</i>	1
<i>passengers</i>	2
<i>Injuries to persons</i>	None
<i>Damage to aircraft</i>	Destroyed
<i>Other damage</i>	Minor damage to forest underbrush.
<i>Pilot in command:</i>	
<i>Age, certificate</i>	32 years old, German Private Pilot's License, PPL-A (Aeroplane)
<i>Total flying time</i>	295 hours, of which 63 hours on the type
<i>Flying hours previous 90 days</i>	23 hours, of which 1 hour on the type
<i>Number of landings previous 90 days</i>	9, of which 1 on the type

The Board of Accident Investigation (SHK) was notified on 29 July 2001 that an aircraft with registration SE-GBR had had an accident at Norrtälje/Mellingeholm airport, AB County, on that same day at approximately 19:45 hours.

The accident has been investigated by SHK represented by Olle Lundström, Chairman, Monica J Wismar, Chief investigator flight operations and Sakari Havbrandt, Chief investigator flight operations (appointed as expert until the 30th of September 2001).

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

Summary

Together with two passengers the pilot was going to do a flight around the area of Norrtälje. Prior to takeoff he performed the customary pre-flight checks according to the checklist and the aircraft flight manual. Maximum RPM was checked as well and was shown to be normal. The flaps were selected to position number one, corresponding to 10 degrees.

¹ SMHI = Swedish Meteorological and Hydrological Institute

The takeoff was performed as a normal rolling takeoff and took place on runway 25, the initial portion of which has an upward slope. Both the pilot and the passenger in the right hand forward seat experienced the acceleration as sluggish. They checked both foot brakes and the parking brake to be free. The airplane became airborne a few times but bounced onto the runway again prior to the final liftoff, which took place less than 50 meters from the runway end. The stall warning was activated during a major portion of the takeoff run.

After approximately 100 meters of flight the aircraft collided with a bush. After an additional 200 meters, without an increase in either airspeed or altitude, the aircraft began to turn to the left. Thereafter the left wing collided with brushwood forest of an approximate height of 3–4 meters. The left wing was broken off and the aircraft crashed in the forest. The aircraft came to rest right side up and a fire immediately broke out. All onboard managed to exit the aircraft through its only door on the right side. No one was injured.

No technical failure has been found on the aircraft.

During the investigation it has been found that the pilot was not qualified to perform a flight with passengers onboard. For all practical purposes the runway was too short due to the uphill slope and correction factors for uphill slope are not included in either the aircraft operations manual or in BCL-D². The flap setting that was used for takeoff was disadvantageous on a short runway and in addition the takeoff procedure for short field takeoff was not used.

The accident was caused by improper takeoff technique in combination with failure to correct the required takeoff distance for the uphill slope of the runway.

Recommendations

The Swedish Civil Aviation Administration is recommended to work for that:

- BCL-D 1.5 is supplemented with factors for takeoff with an uphill slope – (positive runway gradient) and for landing with a downhill slope (negative runway gradient) (*RL 2001:43e R1*);
- The methodology to reject the takeoff if flying airspeed is not attained prior to a predetermined distance from the runway end, determined by the pilot, is introduced into basic pilot training. (*RL 2001:43e R2*)

² BCL-D - Swedish Rules of Civil Aviation – Operational Regulations

1 FACTUAL INFORMATION

1.1 History of the flight

The pilot was a German citizen on vacation in Sweden. He and a friend, who is also a pilot, were to become members of the Roslagen aero club. The flight in question was to be an orientation flight, together with a club official, according to the club's routine. The club official was not an instructor pilot, which was made clear prior to the flight. The German pilot's friend sat in the back seat and the club official in the right-hand forward seat.

During the daily inspection the fuel amount was checked, which was standard tankage, i.e. 68 liters in the left wing tank and approximately 3–4 centimeters under standard (48 liters) in the right wing tank. Prior to takeoff the pilot performed the customary pre-flight checks according to the checklist and the aircraft flight manual. Maximum RPM was checked as well and was shown to be normal. The flaps were selected to position number one, corresponding to 10 degrees.

The takeoff was performed as a normal rolling takeoff and took place on runway 25, the initial portion of which has an upward slope. Both the pilot and the club official experienced the acceleration as sluggish. They checked both foot brakes and the parking brake to be free. The airplane became airborne a few times but settled onto the runway again prior to the final liftoff, which took place less than 50 meters from the runway end. The stall warning was activated during a major portion of the takeoff run.

Even the passenger in the rear seat experienced the takeoff as abnormally sluggish and because of this he checked the instruments just before liftoff. The airspeed indicator showed 65 mph and the tachometer 2,500 rpm.

When the stall warning sounded just after liftoff, the club official felt that the nose of the aircraft was too high, which he stated to the pilot, and pushed the control column forward somewhat. After approximately 100 meters of flight the aircraft collided with a bush. After an additional 200 meters, without an increase in either airspeed or altitude, the aircraft began to turn to the left. Thereafter the left wing collided with brushwood forest of an approximate height of 3–4 meters. The left wing was broken off and the aircraft crashed in the forest. The aircraft came to rest right side up and a fire immediately broke out. The persons aboard were able to quickly evacuate the aircraft through its only door on the right hand side.

The accident took place on 29 July 2001 at position 5944N 01842E; 12 meters above sea level and in daylight.

1.2 Injuries to persons

	<i>Crew</i>	<i>Passengers</i>	<i>Others</i>	<i>Total</i>
Fatal	–	–	–	–
Serious	–	–	–	–
Minor	–	–	–	–
None	1	2	–	3
Total	1	2	–	3

1.3 Damage to aircraft

Destroyed.

1.4 Other damage

Minor damage to brushwood forest.

1.5 Personnel information

The pilot in command was 32 years old at the time and had a valid German Private Pilot's License (PPL-A).

Flying hours

<i>latest</i>	<i>24 hours</i>	<i>90 days</i>	<i>Total</i>
All types	0	23	295
This type	0	1	63

Number of landings this type previous 90 days: 1.

Flight training on type concluded in 1991.

Latest PC (proficiency check or equivalent in Germany) carried out 2001-06-24 on the GROB G 109.

1.6 Aircraft information

AIRCRAFT

<i>Manufacturer:</i>	Piper Aircraft Corp. USA
<i>Type:</i>	PA-28-151
<i>Serial number:</i>	28-7415587
<i>Year of manufacture:</i>	1974
<i>Gross weight:</i>	Max authorized 1,055 kg, actual 1,014 kg
<i>Center of gravity:</i>	Within allowed limits
<i>Total flying time:</i>	Approx. 7,700 hours
<i>Flying time since latest inspection:</i>	Approx. 20 hours
<i>Fuel loaded before event:</i>	0

ENGINE

<i>Manufacturer:</i>	Textron Lycoming
<i>Model:</i>	O-320-E3D
<i>Number of engines:</i>	1
<i>Total operating time, hrs:</i>	Approx. 6,600
<i>Operating time since overhaul</i>	Approx. 700

PROPELLER

<i>Manufacturer:</i>	Sensenich 74 DM 6-O-58
<i>Operating time since latest overhaul:</i>	Approx. 700 hours

The aircraft had a valid Certificate of Airworthiness.

During the 100-hour inspection on 2001-07-18, static engine revolution was measured at 2,200 rpm.

1.7 Meteorological information

According to SMHI's analysis: wind southwesterly at 5–10 knots, good visibility, no clouds, temp./dewpoint +23/+13 °C, QNH 1012 hPa.

1.8 Aids to navigation

Not applicable.

1.9 Communications

Not applicable.

1.10 Aerodrome information

Norrtälje/Mellingeholm airport consists of an asphalt runway 650 meters in length and 18 meters wide. There is an uphill slope when departing on runway 25. The altitude difference between the two runway ends is eight meters. The greatest portion of this climb takes place on the first 400 meters of runway 25. The airport description plate, found in the Swedish airport information publication, KSAB Svenska Flygfält, does not provide any information concerning the height differences.

1.11 Flight recorders

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

1.12 Accident site and aircraft wreckage

1.12.1 Accident site

The aircraft impacted the ground approximately 300 meters from the airport on the extended centerline of runway 25. The terrain here consisted of about three to four meter high brushwood forest.

1.12.2 Aircraft wreckage

The left wing was broken off and came to rest upside-down under the fuselage, which was right side up. The right wing remained attached. The aircraft hull was completely gutted by fire between the engine firewall and the tail fin.

1.13 Medical information

Nothing indicates that the mental or physical condition of the pilot was impaired prior to or during the flight.

1.14 Fire

Fire broke out immediately.

1.15 Survival aspects

The emergency locator beacon (ELT) of type EBC-102A was consumed in the fire. It is not known if it was activated and managed to transmit any signals prior to being destroyed.

The cabin of the aircraft was intact after the impact. Despite the fact that the aircraft broke into flames, the persons on board were able to evacuate the aircraft through the only door, located on the right hand side.

1.16 Tests and research

A measurement control of the fuel tank contents was carried out on aircraft SE-GVE, which has the same type of fuel tanks. The volume was 48 liters when the fuel level was four centimeters below the so-called standard level indicator.

1.17 Organizational and management information

Not applicable.

1.18 Additional information

1.18.1 Takeoff performance

According to the aircraft operations manual, the following takeoff distances are applicable with flap position 0 and 25 respectively, at a temperature of +23 degrees C and a five-knot headwind. Performance with flap position 10 is not addressed in the operations manual, however it should lie between the values for 0 and 25. The values within parentheses have been calculated by SHK.

Flap position	0	25	(10)
Takeoff roll distance	329	466	(398)
To 15 m (50 feet) above the runway	686	549	(617)

The pilot has stated that he did not perform any takeoff performance calculation prior to departure.

1.18.2 Runway slope

Correction factors for runway uphill slope are not presented in the aircraft operations manual nor in the BCL-D 1.5. SHK has found that correction factors for uphill slope do exist in operations manuals for a few other aircraft types.

According to SHK's calculations pertaining to the reduction of acceleration, the takeoff roll in the case in question should have been increased by 100 meters due to the up-slope. The takeoff roll would then become 498 meters and the distance to a height of 15 meters would become 717 meters.

According to BCL-D 1.5, the available runway length shall be at least that distance which is required to reach a height of 15 meters above the runway.

1.18.3 Qualification for flying with passengers

According to the rules applicable to German license holders, "LuftPersV" § 122, a pilot is not authorized to have passengers aboard an aircraft to be flown, if he has not performed at least three takeoffs and landings as the flying pilot in an aircraft of the same or similar type during the immediate previous 90 days.

2 ANALYSIS

The pilot had only flown the aircraft type one hour and performed one landing during the previous 90 days and was therefore, according to the regulations, not qualified to fly with passengers aboard. In addition, he was not familiar with the airport and the runway conditions. Also, according to reports, no performance and takeoff distance calculations were accomplished. The runway that was used for takeoff has an uphill slope and the difference in altitude between the runway ends is eight meters. This affects the takeoff roll and the takeoff distance and requires that a correction be applied to these. In the case in question, the takeoff roll would have been 498 meters and the takeoff distance to 15 meters above the runway threshold would have been 717 meters, according to SHK's calculations. Therefore, the available runway length was insufficient considering the conditions that existed. Both BCL-D 1.5 and the aircraft operations manual lack the basic data for corrections to be applied for runway up-slope, which can be considered as a deficiency.

During the investigation, none of the parts that remained of the aircraft indicated that any technical failure had occurred that could have influenced the course of events. According to testimony provided, the tachometer indicated 2,500 rpm and in the opinion of SHK, the engine provided full power. It would be very unlikely that two failures occurred simultaneously, i.e. that the tachometer indicated a higher rpm than actual at the same time that the engine power was diminished.

The pilot performed a normal rolling start with 10 degrees of flaps and the aircraft lifted-off a few times prior to the definite liftoff. These transient liftoffs depleted energy from the aircraft, resulting in an increase of the takeoff distance. When the aircraft finally became air-borne the nose-up attitude was increased, which depleted the airspeed. After that, the airspeed was probably so low that excess power was not available. Furthermore, to takeoff with 10 degrees of flaps is disadvantageous when the runway is short.

The involuntary liftoffs and the raising of the nose during the definitive liftoff indicate that the control column was held too far aft. The stall warning was activated during the course of the takeoff, which indicates that improper takeoff technique was used. Contributory to the aircraft's subsequent poor climb performance was that the outside air temperature was as high as + 23 °C.

Immediately prior to the collision with the brushwood forest, the aircraft turned somewhat to the left. This turn could have been due to the pilot himself initiating it in order to avoid the vegetation in the direction of flight; but it can also indicate that the airspeed of the aircraft was so low that it entered a stall, with the left wing leading edge stalling first.

It can be attributed to fortunate circumstances that the aircraft came to rest in a right side up position so that those on board were able to evacuate the aircraft through the only existing door. The fuel that flowed out of the

broken-off wing on the left-hand side ignited immediately and the entire cabin area was quickly engulfed in flames.

In retrospect, one can ask why the pilot did not reject the takeoff when he experienced that the aircraft accelerated slower than normal, thus increasing the takeoff distance. During several accident investigations involving smaller aircraft, SHK has found that pilots have not discontinued takeoffs in time. Therefore, to reject the takeoff if flying airspeed is not attained prior to a predetermined distance from the runway end, determined by the pilot, should be included in basic pilot training.

3 CONCLUSIONS

3.1 Findings

- a) The pilot was not qualified to perform the flight.
- b) The aircraft had a valid Certificate of Airworthiness.
- c) No technical failure has been found on the aircraft.
- d) According to the computational data in the aircraft operations manual the runway was of sufficient length.
- e) For all practical purposes the runway was too short due to the uphill slope.
- f) Disadvantageous flap setting was used for takeoff on a short runway.
- g) The takeoff procedure for short field takeoff was not used.
- h) Correction factors for uphill slope are not included in either the aircraft operations manual or in BCL-D.

3.2 Causes

The accident was caused by improper takeoff technique in combination with failure to correct the required takeoff distance for the uphill slope of the runway.

4 RECOMMENDATIONS

The Swedish Civil Aviation Administration is recommended to work for that:

- BCL-D 1.5 is supplemented with factors for takeoff with an uphill slope (positive runway gradient) and for landing with a downhill slope (negative runway gradient) (*RL 2001:43e R1*);
- The methodology to reject the takeoff if flying airspeed is not attained prior to a predetermined distance from the runway end, determined by the pilot, is introduced into basic pilot training (*RL 2001:43e R2*).