

Accident with the aircraft D-EDVJ of the model Piper PA-28-140

The Swedish Accident Investigation Authority has investigated an accident at Fagerhult, Skåne County 24 August 2025

28 May 2026



About the Swedish Accident Investigation Authority

The Swedish Accident Investigation Authority (SHK) investigates accidents and incidents from a safety perspective regardless of whether they occurred on land, at sea or in the air. The authority's accident investigations are intended to disseminate knowledge and provide a basis for actions by authorities, companies, organisations, and individuals that improve safety and reduce the risk of accidents. The activities should also contribute to people feeling secure and having trust in society's institutions and the confidence in transportation systems. The mission also includes assessing the efforts made by the rescue services in connection with an accident. However, the investigations should not assign blame or liability, whether criminally, civilly, or administratively.

The investigations by SHK aim to answer three questions:

- What happened?
- Why did it happen?
- How can a similar accident/incident be avoided in the future?

Investigations of aviation accidents and incidents are primarily regulated by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation and the Act (1990:712) on the investigation of accidents. The investigations are conducted in accordance with Annex 13 of the Chicago Convention.

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Summary

On 24 August 2025, an accident occurred involving a private aircraft of the type Piper PA-28-140 during take-off from Skånes-Fagerhult Airport. On board were two people, the pilot, who escaped without injuries, and a passenger who sustained minor injuries. The aircraft sustained extensive damage, and some environmental impact occurred at the site.

The accident occurred when, during take-off in gusty north-westerly winds, the aircraft failed to reach sufficient height to clear the rising terrain and forest immediately beyond the runway end. The recommended procedures in the aircraft's flight manual were not followed, and the excess speed after rotation was used to climb instead of accelerating to the best angle of climb speed. As a result, the speed required to safely clear obstacles were never reached. When the pilot attempted to avoid the treetops by raising the nose further, the aircraft ended up on the wrong side of the drag curve, which meant that it was not possible to climb without first increasing the airspeed.

After passing the first wooded area, the pilot briefly managed to increase speed in a clearing area, but despite this, he was still unable to clear the following copse of trees. In an attempt to avoid a nose-first collision with the trees, the pilot instinctively pulled the control yoke back. The critical angle of attack was exceeded and lift decreased just before the collision.

No technical faults have been identified on the aircraft that could have contributed to the accident. The pilot was qualified, but the risk assessment prior to the flight was inadequate.

After the Joint Rescue Coordination Centre (JRCC) had directed the Fire and Rescue Service Skåne Nordväst, to the correct location, the rescue operation was carried out effectively. The crew's use of seatbelts and the cushioning effect of the vegetation helped prevent serious personal injuries.

Causes of the accident

The accident was caused by a number of interacting factors; insufficient performance calculation, deviation from the recommended take-off procedures, and the gusty wind, which resulted in insufficient margins for a safe take-off.

Safety recommendations

None.

The investigation

SHK was informed on the 24 August 2025 that an accident involving one aircraft with the registration D-EDVJ had occurred in Fagerhult, Skåne County, on the same day at 15:44 hrs.

The accident was investigated by SHK represented by Ms Anna Stenberg Chairperson, Mr Johan Nikolaou, Investigator in Charge and Operations Investigator, and Mr Tony Arvidsson, Technical Investigator.

Mr. Ekkehart Schubert participated as accredited representative on behalf of the German safety investigation authority Bundesstelle für Flugunfalluntersuchung (BFU).

The investigation was followed by Dr Matthew Hilscher as adviser of European Aviation Safety Agency (EASA) and Mr Magnus Axelsson of the Swedish Transport Agency.

The following organisations have been notified: EASA, EU-Commission, BFU, NTSB and the Swedish Transport Agency (Transportstyrelsen).

Investigation material

- Interviews have been conducted with the pilot, the passenger and a witness.
- The accident site and the aircraft have been examined, and the damages have been documented.
- The aircraft's documentation has been collected.
- Information from the pilot's navigation application has been retrieved.
- Weather data for the area at the time of the accident has been obtained from SMHI.

A meeting with the interested parties was held on the 12 February 2025. At the meeting, SHK presented the facts discovered during the investigation, available at the time.

Final report SHK 2026:08e

Data	
Aircraft	Registration, type: D-EDVJ Model: PA-18-140 Class, Airworthiness: Normal, Certificate of Airworthiness and Valid Airworthiness Review Certificate (ARC) ¹ Serial number: 28-7225453 Owner: Privat
Time of occurrence:	24 August 2025, 15:44 hrs in daylight Note: All times are given in Swedish daylight-saving time (UTC ² +2 hours)
Place	Fagerhult, Skåne County, (Position 56°23'N 013°28'E, 115 metres above mean sea level)
Type of flight	Private
Weather	According to SMHI's analysis: wind 270 10–15 knots, Gusts up to 26 knots, visibility >10 kilometres, clouds few with bas at 3 000 feet, temperature/dewpoint 18/13 °C, QNH ³ 1013 hPa
Persons on board	In total: 2 Passengers: 1
Injuries	Personal injuries: The passenger was slightly injured Damage to the aircraft: Significant Other damage: Damage to the ground and to the fence enclosing the horse paddock
Pilot in command:	Age: 78 years Licence: PPL ⁴ Total flying hours: 1 987 hours, all hours on type Flying hours previous 90 days: 24 hours Number of landings previous 90 days: 27

¹ ARC – Airworthiness Review Certificate.

² UTC – Coordinated Universal Time.

³ QNH (Question Nil Height) – the atmospheric pressure adjusted to the mean sea level.

⁴ PPL – Private Pilot License.

1. Factual information

1.1 History of the flight

1.1.1 Preconditions

Earlier in the day, the pilot and the passenger had carried out a flight from Höganäs to Skånes-Fagerhult Airport. The aircraft had been fully refuelled before the flight. The landing was made on runway 17, which meant that the aircraft landed in a southerly direction. After a stop of approximately four hours, the pilot planned to carry out the return flight to Höganäs.

Before take-off, the pilot assessed that the wind direction was from the northwest, which led him to choose to take off from runway 35. To obtain information about the runway, the pilot used an application on his tablet, which indicated that the runway length was 590 metres.

Beyond the runway end, the terrain rise, and on this elevation, there was first a stretch of approximately 100 metres of young forest, followed by about 230 metres of birch forest where the tree height was around 20 metres (65 feet). Thereafter, the terrain opened up into a field which was approximately 100 metres long.



Figure 1. Overview image taken in a northerly direction over the aerodrome with marked available runway length (see 1.10 Aerodrome information). Markings added by SHK. Lantmäteriet dissemination permit no: LM2025/133392.

1.1.2 Sequence of events

The flight commenced at 15:43. According to the pilot, two step of flaps (25 degrees) were used, in accordance with the recommendation for short field take-off in the aircraft's manual. Rotation occurred at a speed of 60 knots, and after lift-off the aircraft accelerated to approximately 70 knots.

The initial phase of the take-off was uneventful and the aircraft passed the nearby tree line. Shortly thereafter, the pilot began to experience severe turbulence. In order to maintain a safe airspeed and avoid flying in to the trees, the pilot attempted to correct the flight path by increasing the pitch. Despite full engine power, the aircraft became increasingly difficult to control and began to lose both speed and altitude.

After passing the wooded area, the pilot attempted to regain speed by lowering the nose, but this resulted in further loss of altitude without sufficient increase in airspeed. Throughout the entire sequence, from take-off to the accident site, full engine power was used.

When a collision with the trees ahead became unavoidable, the pilot tried to avoid a direct impact with the tree trunks by pulling back on the control yoke. This action caused the aircraft to stall and crash belly-first into a copse of trees. The elasticity of the tree branches cushioned the impact.

The pilot did not notice whether the stall warning light had illuminated during the sequence of events, as his focus was on looking outside and flying the aircraft.

The pilot observed that both the throttle and mixture control were still set to full power after the accident. The pilot then turned off the master switch, fuel valve and ignition.

The accident occurred at position 56°23'N 013°28'E, at an altitude of approximately 115 metres above sea level.

1.1.3 Other

A witness, who was a pilot himself, spoke with the passenger before take-off and observed part of the sequence of events. According to the witness, there was a strong, gusty wind from the west-northwest. Based on his experience, severe turbulence and downdrafts often occur over the forested area with that particular wind direction and strength.

The witness felt that the take-off appeared normal, but that the nose of the aircraft was raised significantly as it came over the forest. A steep pitch angle gave the impression that the aircraft was at risk of stalling. Shortly thereafter, the aircraft disappeared below the treetops and a loud noise was heard.

The passenger, who had flown with the pilot for 15 years, stated in interviews that the take-off felt normal and that the subsequent events happened very quickly. According to the passenger, the aircraft buffeted, descended, and ultimately ended up in the trees.

1.2 Injuries to persons

None of the persons on board were injured in the tree collision. After the collision, the passenger opened the door and fell to the ground from a height of approximately eight metres. Tree branches and the soft surface softened the fall, so that the passenger only suffered minor muscular injuries.

1.3 Damage to aircraft

Substantially damaged.



Figure 2. The pictures show the damaged wings and forward part of the fuselage.

1.4 Other damage

During the rescue operation and the recovery of the aircraft, damage occurred to the ground and to a fence enclosing a horse paddock.

1.4.1 Environmental impact

A certain amount of fuel leaked out at the accident site. The leak was caused by damage to the wing tanks' fuel lines from the collision with the trees. The fuel lines that ruptured were located in the leading edges of the wings. Since the aircraft remained hanging in the tree branches, most of the fuel stayed in the tanks.

1.5 Personnel information

1.5.1 Qualifications of the pilot

Pilot in command

The pilot-in-command was 78 years old and held an EASA PPL issued in Germany, was current on SEP (land)⁵, and held a valid medical certificate.

Flying hours - latest	24 hours	7 days	90 days	Total
All types	2	12	24	1 987
Actual type	2	12	24	1 987

Number of landings actual type previous 90 days: 27.

PPL Skill-test performed on 13 August 1988.

Latest PC⁶ (proficiency check) conducted on 25 May 2025 on type.

1.6 Aircraft information

The aircraft is a four-seat, low-wing, single-engine aircraft equipped with a four-cylinder piston engine with a fixed propeller and fixed landing gear. The aircraft is approximately seven metres long and its wingspan is just over nine metres (see Figure 3).

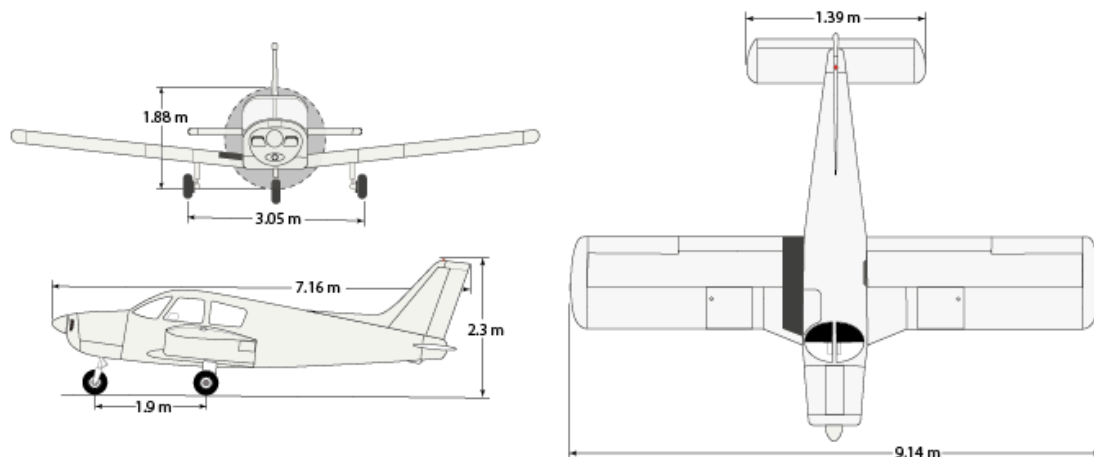


Figure 3. Triplane sketch of the aircraft type.

⁵ SEP (land) - Single Engine Piston (land).

⁶ PC - Proficiency Check.

1.6.1 Airplane

Airplane	
TC-holder	Piper Aircraft Inc
Model	PA-28-140
Serial number	28-7225453
Year of manufacture	1972
Gross mass, kg	Max take-off/landing mass 975 current 940
Centre of gravity	Within limits
Total flying time, hours	5 970
Flying time since latest inspection	33
Number of cycles	13 231
Type of fuel uplifted before the occurrence	91/96 UL

Engine	
TC-holder	Lycoming Engines
Type	O-320-E2A
Serial number	L_31495-27
Total operating time, hours	126
Operating time since inspection, hours	33
Operating time since overhaul, hours	126

Propeller	
TC-holder	Sensenich Propeller Manufacturing
Type	74DM6-0-58
Serial number	A-46945
Total operating time, hours	1 705
Operating time since inspection, hours	33

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**Engine and propeller**

The Lycoming O-320-E3D engine installed in the Cherokee PA-28-140 is rated at 150 horsepower at 2 700 rpm.

The propeller used on the PA-28-140 is a Sensenich M74DM fixed-pitch aluminium alloy unit. Its diameter is 74 inches with a standard pitch of 58 inches. All performance figures are based on the standard 58-inch pitch propeller.

1.6.3 Take-off procedures

According to Piper PA-28-140 Pilot's Operating Handbook (POH), a take-off from a short, soft (grass) field with obstacles in the departure direction should be performed as follows:

Lower flaps to 25° (second notch), accelerate aircraft, pull nose gear off as soon as possible and lift off at lowest possible airspeed. Accelerate just above the ground to best angle of climb speed, 74 miles per hour (64 knots) to climb past obstacle clearance height, continue climb while accelerating to best rate of climb speed, 85 miles per hour (74 knots) and slowly retract the flaps.

1.7 Meteorological information

General weather conditions according to SMHI:

A ridge of high pressure was situated over southern Sweden at the time of the accident. A north-westerly airflow prevailed and the weather was dry with few or scattered cumulus clouds over the area. The cloud base was around 3,000 feet. Visibility was good with an air temperature of 19 degrees Celsius and a dew point of 10 degrees. No moderate or severe turbulence was expected during the period according to the low-level forecast. Towering cumulus clouds were expected in the area around the airfield during the period 10:00–16:00. Mean wind 12–15 knots with estimated gusts of 20–25 knots.

SMHI's analysis of the weather conditions at the time of the accident:

- Location: Fagerhult Airfield ESMF, Skåne County, 68°23'N 013°28'E
- Wind: NW/10–15 knots, gusts up to 26 knots
- Visibility: Over 10 km
- Weather: No precipitation
- Clouds: Few or scattered cumulus with cloud base at 3,000 feet
- Temperature: 19 °C
- Dew point: 10 °C
- QNH: 1013 hPa

1.7.1 Turbulence and downdrafts

During take-off over uneven or variable terrain, such as mountains, hills, forests or buildings, strong and gusty winds can negatively affect the performance of the aircraft. By gusty wind is meant that both wind direction and wind speed vary significantly within short time intervals. It is not uncommon for gusts to temporarily reach up to twice the mean wind speed.

When such wind conditions prevail over terrain, the airflow can be disturbed and create turbulence. This turbulence can in turn cause air to be locally forced down towards the ground, resulting in so-called downdrafts. Especially in windy and unstable weather conditions, downdrafts can occur suddenly and cause strong, downward-directed gusts.

Downdrafts are thus not only associated with thunderstorms or convective clouds, but can also occur when the wind interacts with the terrain and forces the air rapidly downward. This is common in strong gusts, especially in areas with varied topography. During take-off, such downdrafts and turbulent gusts can make it difficult for an aircraft to accelerate and climb.

1.8 Aids to navigation

Not applicable.

1.9 Communications

After the accident, the pilot attempted to send a distress message to Sweden Control without receiving any response. The reason was that the communication antenna had been broken.



Figure 4. Picture of the damaged communication antenna.

1.10 Aerodrome information

The airfield is listed in KSAB⁷, Swedish Airfields.

The aerodrome is a so-called “*aerodrome not requiring approval*”. However, the person who designs and operates such an aerodrome must comply with the regulations and general guidance applicable to this type of aerodrome.

Runway 35, which was used for take-off, had a take-off runway available (TORA⁸) of 520 metres, including an extension at the beginning of the runway. The total runway length was 590 metres. The runway surface consisted of short-cut grass. The runway was located at an elevation of 115 metres (378 feet) above sea level.

⁷ KSAB (a company owned by KSAK, the Royal Swedish Aero Club) – sells aviation-related products.

⁸ TORA – Take-Off Runway Available.



RUNWAY LENGTHS

Main runway (grass)

TORA 17: 560 m

LDA 17: 490 m

TORA 35: 490 m

Inc extension 520 m

LDA 35: 560 m

Figure 5. Aerodrome chart with runway lengths. Excerpt from KSAB Svenska Flygfält.

The pilot only had access to the SkyDemon⁹ application, which indicated an available runway length of 590 metres. However, no specific information on the available take-off run (TORA) for runway 35 was provided in the application. In addition to information about the total runway length, the aerodrome frequency and contact details, including telephone number, were also shown. There was also a note from a pilot who had previously visited the aerodrome, stating that severe turbulence and wind shear¹⁰ could occur, especially in westerly winds.

1.11 Flight recorders

The aircraft was not equipped with any flight data or cockpit voice recorders. Nor is it subject to any requirement for recording equipment.

1.11.1 Flight recorders (GNNS¹¹)

The pilot used a tablet equipped with the SkyDemon application, which recorded the flight. SHK has extracted the data, which is presented in the report.

According to data from SkyDemon, the highest point of the flight above the ground was 20 metres (65 feet). The area also contained trees that were approximately 20 metres (65 feet) high.

⁹ SkyDemon – flight planning and navigation software.

¹⁰ Wind Shear – a meteorological term for a sudden change in wind speed and/or wind direction over a short distance, either horizontally or vertically in the atmosphere.

¹¹ GNNS – Global Positioning System.

Figure 6 shows the recorded flight, from take-off to the accident site. The image is oriented in an easterly direction. The ground roll distance was 360 metres, and the distance to 50 feet height above the runway was 600 metres from the start of the runway. The speech bubbles in the figure indicate the aircraft's ground speed (GS), calibrated airspeed (CAS) corrected with the mean wind based on SMHI's analysis for the area, as well as height above ground and vertical speed (VS) at different points after the aircraft had lifted off.

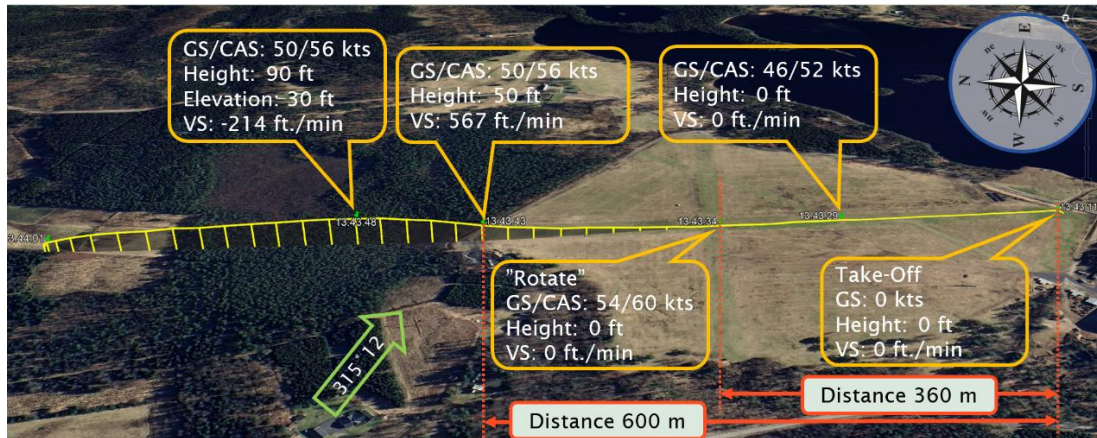


Figure 6. The flight path is shown in Google Earth from take-off to the accident site. Markings added by SHK.

Figure 7 shows the flight's acceleration in groundspeed (GS) with a red line and height above runway with a blue line in feet. The brown area indicates ground elevation, and the green area indicates tree height. The added elevation information from the Copernicus GLO-30 digital elevation model (DEM) has a grid size of 30 metres, with an absolute vertical accuracy of 4 metres.

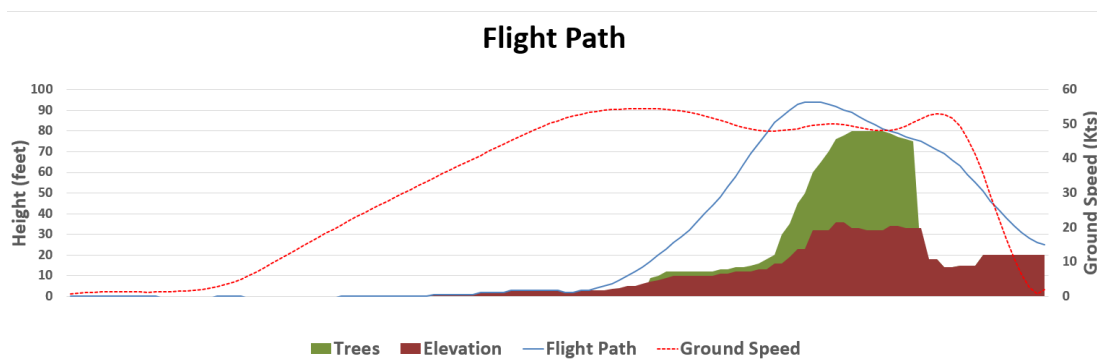


Figure 7. The flight path with groundspeed. The image is not to scale in height and distance.

The data shows that the groundspeed at the moment of rotation was 54 knots and the groundroll distance was 360 metres. SMHI's analysis indicated that the mean wind speed, converted to calibrated airspeed, corresponded to about 60 knots. During the subsequent phase of flight, the speed did not increase as expected, but instead decreased slightly, and then dropped rapidly just before the collision.

1.12 Accident site and aircraft wreckage

1.12.1 Accident site

The aircraft collided with a birch forest and finally came to rest 450 metres north of the runway end at Skånes-Fagerhult Airport. The aircraft's final position was approximately eight metres above the ground, measured from the cabin door.



Figure 8. The final position of the aircraft.

1.12.2 Aircraft wreckage

Both wings had sustained damage to the leading edge and wing spar. The fuel line on the left side had broken off in front of the wing spar and was leaking fuel. The engine cowlings were damaged, and the tip of one propeller blade was bent forward from the propeller hub on one side.



Figure 9. Damages on the right wing.



Figure 10. Damages on the left-wing root.



Figure 11. Damages in front of the fire wall.

1.13 Medical and pathological information

There are no indications that the pilot's mental or physical condition was impaired before or during the flight.

1.14 Fire

No fire occurred.

1.15 Survival aspects

1.15.1 Rescue operation

An alert from a witness was received by SOS ALARM at 15:44.

The Swedish Maritime Administration, JRCC¹² initiated an air rescue operation at 15:45 and dispatched a SAR¹³ helicopter to the scene. Even the municipal fire and rescue service, Fire and Rescue Service Skåne Nordväst, initiated a rescue operation at 15:48 and called out rescue resources to the site. At this time, the exact location of the crash site was still unknown.

The first units from the fire and rescue service arrived at the northern part of the airfield's runway at 15:54; however, this did not correspond to the position indicated in the alert. JRCC and the fire and rescue service communicated about the position, and JRCC then instructed the fire service to proceed to a farm located approximately 600 metres north of the airfield.

Two firefighters began walking north through a wooded area on foot from the northern end of the runway. The firefighters met three witnesses who were also searching for the aircraft, and the five formed a chain search to search together. At 16:10, the aircraft was located by a firefighter. One firefighter carried the passenger, who was outside the aircraft, to a safe location where there was no risk of the aircraft falling on them. The fire service officer on site requested an aerial platform to assist in evacuating the pilot from the aircraft. The remaining rescue units then joined at the farm just north of the crash site.

The fire and rescue service identified four main risks to be considered during the operation:

- Leaking fuel from the aircraft. This risk was managed by having firefighters equipped with breathing apparatus and water ready to handle any potential fire.
- The risk of the aircraft falling down. This was managed by cordoning off an area around the aircraft to protect personnel on the ground and by carrying away the passenger who was lying on the ground.
- The risk that the downwash from the SAR helicopter could cause the aircraft to fall from the tree. This risk was eliminated by having the helicopter fly farther away from the site.
- The safety of the pilot and the working environment for the firefighters during the pilot extraction. When removing the pilot from the aircraft, he was secured with a harness and rope to the basket of the aerial platform, which would support him if he fell. The basket was positioned against the aircraft in such a way that it would remain unaffected if the aircraft started to slip. During the extraction, the stabilisers of the aerial platform were also monitored by fire personnel to ensure they did not sink into the ground and become a safety risk.

¹² JRCC – Joint Rescue Coordination Centre.

¹³ SAR – Search and Rescue.

When the aircraft was located, the Swedish Maritime Administration ended the air rescue operation at 16:25. The Höganäs fire and rescue service was called at 17:00 to provide an air cushion at the site. The air cushion was intended to break the pilot's fall if he fell from the aircraft. When the aerial platform arrived at 17:06, the operation proceeded as planned and the pilot was extracted and attended to. The municipal fire and rescue service concluded their operation at 17:59.

The ELT¹⁴ of the type KANNAD 406 AF-COMPACT was not activated during the accident.

1.15.2 Position of crew and passengers and the use of seat belts

Both occupants used the installed three-point seat belts.

1.16 Tests and research

1.16.1 Technical examination of the aircraft

A technical examination of the aircraft was carried out. The examination revealed, among other things, the following:

- The operation of the throttle and mixture controls to the carburettor was inspected without any remarks.
- The operation of the carburettor heat control was inspected without any remarks.
- The fuel filter and the fuel in the fuel bowl showed no abnormalities.
- The engine and its components were inspected without any remarks.
- The elevator and rudder trim were set for take-off.
- A leak test was performed on the engine when cold. One cylinder had a value below the approved level. For a leak test to be reliable, it should be performed when the engine is warm, which has not been possible. An inspection of the cylinder and exhaust valve was carried out using an inspection camera. The inspection was performed without any remarks.

1.17 Organisational and management information

Not applicable.

1.18 Additional information

1.18.1 Calculation of required take-off distance

SHK has calculated that the aircraft's mass at the time of take-off was 940 kg, which is 35 kg below the maximum permitted take-off weight. Performance data for calculating take-off distance for wind effects and a grass runway is missing from the aircraft flight manual.

SHK has calculated the required take-off distance for the aircraft using the performance data in the flight manual and based on the following conditions:

- Weight – 940 kg (maximum take-off weight)
- Flaps – 25° (two steps of flaps)
- Outside air temperature – 19°C
- Pressure altitude – 378 feet, uncorrected (QNH 1013 hPa)

¹⁴ ELT – Emergency Locator Transmitter.

SHK's calculations (see Table 1) show that the required take-off run was within the available runway length of 520 metres, including the extension at the beginning of the runway.

Wind	Ground run	Over 50 ft obstacle
Zero	200 metres	520 metres

Table 1. Calculated required ground roll and take-off distance to 50 feet altitude.

1.18.2 Flight Safety Programme

EASA publishes flight safety information on its website under the name Sunny Swift. If the flight manual lacks data on performance adjustments for the current runway condition, EASA recommends applying an additional 15 percent to the performance values that are stated for dry, short-mown grass.

AOPA¹⁵ Germany recommends an addition of 20 percent for take-off from a dry, firm and level grass runway with short-mown grass¹⁶.

The Swedish KSAK¹⁷'s Flight Safety Program recommends an addition of 10 percent for hard, short mown grass runways.

1.18.3 TEM

TEM (Threat and Error Management) is a working method that helps general aviation pilots to fly more safely by systematically identifying, managing and minimising the risks that may arise before, during and after the flight.

EASA recommends the use of TEM as a central part of safety work in both commercial air transport and general aviation. The aim is that pilots should:

- become more aware of risks and threats before and during the flight
- be able to detect and manage errors before they lead to incidents
- learn from their experiences and thereby enhance their flight safety

One example of practical application in general aviation is that, prior to the flight, the pilot recognises that the runway is a grass runway. If this is not described in the AFM this is identified as a threat. The pilot therefore allows for additional take-off distance, in accordance with the recommendations.

1.18.4 Required engine power at different airspeeds

Diagram 12 illustrates the required power at different airspeeds in level flight. The green horizontal line shows the maximum engine power that the engine can deliver. At high airspeeds, this maximum power limits how fast the aircraft can fly – that is, it sets an upper limit for the cruising speed in level flight. In order to fly even faster than this, the aircraft must begin to descend, since less power is then required to overcome drag.

¹⁵ AOPA (Aircraft Owners and Pilots Association) — an international interest organization for aircraft owners and pilots, with national associations in several countries, including Germany (AOPA Germany) and Sweden (AOPA Sweden). The organization works, among other things, to promote general aviation, support pilots, and safeguard their interests.

¹⁶ AOPA – Germany Safety Letter, Berechnungen und formeln für piloten Nr 49. Juni 2020.

¹⁷ KSAK (Kungliga Svenska Aeroklubben) – the Royal Swedish Aeroclub.

In the same way, there is a lowest airspeed at which the engine, even at full power, can just manage to keep the aircraft at the same altitude. If the speed decreases further, the drag increases to the point where the engine is no longer capable of keeping the aircraft in level flight. The aircraft will then start to descend. This is because, at low airspeeds, an aircraft must increase its angle of attack to maintain altitude, which results in increased drag.

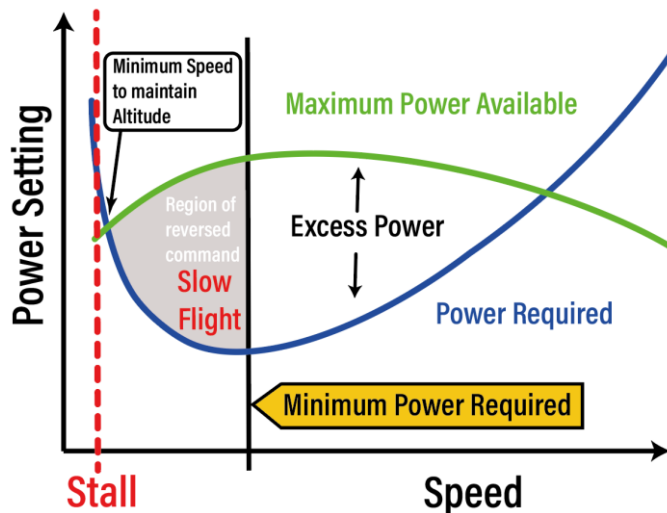


Figure 12. The relationship between engine power and speed (schematic).

The Back Side of the Power Curve

The back side of the power curve is also referred to as the “region of reversed command” and lies to the left of the point at which the minimum engine power is required to keep the aircraft in the air. At a certain airspeed, a balance is achieved where the total drag is at its lowest – this is where the engine needs to work the least for the aircraft to be able to maintain the same altitude in level flight.

Reversed Command

In this region of the curve, a different principle applies: the slower you fly, the more power the engine must provide to maintain the same altitude. This is because induced drag (which arises when lift is generated) increases exponentially at low speed, and this increase is greater than the reduction in parasite drag (friction and form drag) that occurs when flying more slowly. The result is that the engine has to work harder to keep the aircraft in the air at very low speeds.

Control Logic

In this speed range, the aircraft is controlled according to the principle of “reversed command”: the elevator (pitch) is used primarily to adjust speed, while engine power controls whether the aircraft climbs, descends, or maintains its altitude. If the nose is raised without a simultaneous increase in engine power, drag will increase so much that the aircraft will lose altitude and begin to descend.

1.18.5 Actions taken

None.

1.18.6 Similar events

SHK has investigated similar events previously. One example is the accident involving a Piper PA-28-161 during take-off from Siljansnäs on 30 June 2017 (RL 2018:05). Similarly as in this case, the aircraft ended up on the back side of the power curve during the take-off.

1.19 Useful or effective investigation techniques

None.

2. Analysis

2.1 Initial Considerations

Based on analyses of data and information from the pilot and witnesses, a sequence of events has been established.

The aircraft was airworthy at the time of the occurrence. In the technical examinations, no technical faults or deficiencies have been identified that could have contributed to the accident.

2.2 Flight Planning

At the time of the accident, there was a north-westerly wind of 10–15 knots, with gusts up to 26 knots. According to witness statements, this wind direction and strength often cause severe turbulence and downdrafts over the forest immediately beyond runway 35. These conditions can cause wind shear and increased drag. This leads to reduced climb performance and lift, which in turn results in a loss of airspeed and altitude.

The pilot chose runway 35 based on the assessment that the wind was most favourable for this direction. The pilot's only source of information was the SkyDemon application, where the total runway length was stated as 590 metres. However, it was not apparent that the available take-off distance had been reduced to 520 metres due to terrain and forest immediately beyond the runway. SkyDemon also contained a note about severe turbulence and downdrafts in westerly winds, but this information was not noticed. No additional information was obtained from the aerodrome operator. The pilot therefore lacked information about these conditions.

Performance data for older aircraft can be inadequate. In this case, the flight manual lacked performance data for the effect of wind and for take-off from a grass runway. If only the figures for asphalt are used, there is a risk that the take-off distance will be underestimated, which may result in the runway being insufficient or the safety margins becoming too small. If the flight manual lacks data for grass runways, the pilot must use recommendations from other sources, such as EASA, AOPA, or KSAK's flight safety programme. According to SHK's calculations, with AOPA Germany's addition of 20 percent for grass, the required take-off distance becomes 104 metres longer than the distance available for take-off.

In this case, the aircraft's required take-off distance was not calculated using the available performance data. Instead, the pilot relied on previous experience from short runways. Experience is an asset, but it can also lead to important safety routines being omitted. This underscores the importance of using a structured approach to threat and error management in line with EASA's recommendations, regardless of the level of experience.

Taken together, the shortcomings in information gathering and the inadequate performance calculation meant that the risk assessment was insufficient and reduced the safety margins.

2.3 Sequence of events

According to the aircraft's flight manual, the speed for best angle of climb (64 knots) should be reached as quickly as possible and maintained to ensure a sufficient climb gradient for obstacle clearance. The pilot took off with two steps of flaps (25 degrees), and rotation was carried out at a slightly higher speed than recommended in the aircraft's flight manual. The excess speed was used to climb instead of initially accelerating to the speed for best angle of climb. Data from SkyDemon, converted to indicated airspeed, shows that the speed decreased after rotation and never reached the speed for best angle of climb. Conducting the take-off in this manner meant that the aircraft was unable to achieve the optimal speed for best angle of climb in sufficient time to clear the terrain with an adequate safety margin.

During the continued flight, the pilot maintained a steep climb attitude and raised the nose further when passing the tree line, which led to a critical low-speed situation. The flight entered the wrong side of the drag curve, which meant that the aircraft could only climb by first increasing its speed. For this to be possible, the pilot would have needed to push the control yoke forward and descend, but since the aircraft was at low height above the trees, this was not an option.

When the pilot then passed a clearing beyond the forest, he attempted to accelerate by pushing the control yoke forward, but did not manage to gain sufficient speed to climb over the next wooded area. In an attempt to avoid a nose-first collision with the trees, the pilot instinctively pulled the control yoke back. The critical angle of attack was exceeded and lift decreased just before the collision.

The occurrence demonstrates how crucial it is to apply a structured approach to threat and error management in order to identify and manage risks prior to flight, such as carefully assessing the weather and local hazards, carrying out performance calculations, and following recommended procedures.

2.4 The Rescue Operation

Both the Swedish Maritime Administration and the municipal fire and rescue service responded quickly when the alarm was received and, in general, carried out effective rescue operations. The first rescue unit from the Fire and Rescue Service Skåne Nordväst initially went to the wrong location, but JRCC communicated with the unit and was able to direct them in the right direction.

No serious injuries occurred thanks to the fact that both persons on board were wearing seatbelts and that the vegetation had a cushioning effect.

3. Conclusions

3.1 Findings

- The pilot was qualified to perform the flight.
- Nothing has emerged to indicate that the pilot's mental or physical condition was impaired before or during the flight.
- The aircraft had a Certificate of Airworthiness and valid ARC.
- The aircraft's mass and balance were within the approved range.
- With an addition for a grass runway, the required take-off distance to clear an obstacle (50 feet/15 metres height) exceeded the available runway length.
- According to the aerodrome's contact person, the prevailing wind conditions (gusty north-westerly wind) entailed a risk of turbulence and downdrafts over the forest beyond the end of runway 35.
- The flight entered the wrong side of the drag curve, which resulted in the aircraft ultimately being unable to climb above the terrain.
- The pilot pulled back on the control yoke which led to that the critical angle of attack was exceeded and lift decreased just before the collision.
- No technical faults or deficiencies that could have contributed to the accident have been identified.
- The use of seatbelts and the vegetation contributed to preventing serious injuries.

3.2 Causes

The accident was caused by a number of interacting factors; insufficient performance calculation, deviation from the recommended take-off procedures, and the gusty wind, which resulted in insufficient margins for a safe take-off.

4. Safety recommendations

None.

On behalf of the Swedish Accident Investigation Authority,

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Johan Nikolaou