Statens haverikommission
Swedish Accident Investigation Authority





Final report RL 2016:05e

Accident at Malmö Sturup Airport on 27 June 2015 involving aircraft SE-GIC of model Piper-PA34-200T, Seneca II, operated by South Sweden School of Aeronautics AB.

File no. L-61/15

2016-09-02

SHK investigates accidents and incidents from a safety perspective. Its investigations are aimed at preventing a similar event from occurring again, or limiting the effects of such an event. However, it is not the purpose of SHK investigations to apportion blame or liability, whether criminal, civil or administrative.

The report is also available on our website: www.havkom.se

ISSN 1400-5719

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

Cover photo three: Anders Sjödén/Swedish Armed Forces.

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General observations

The Swedish Accident Investigation Authority (Statens haverikommission – SHK) is a state authority with the task of investigating accidents and incidents with the aim of improving safety. SHK accident investigations aim to, as far as possible, determine both the sequence of events and the cause of the events, along with the damage and effects in general. An investigation shall provide the basis for decisions which are aimed at preventing similar events from happening in the future, or to limit the effects of such an event. At the same time the investigation provides a basis for an assessment of the operations performed by the public emergency services in connection with the event and, if there is a need for them, improvements to the emergency services.

SHK accident investigations thus aim to answer three questions: *What happened? Why did it happen? How can a similar event be avoided in the future?*

SHK does not have any inspection remit, nor is it any part of its task to apportion blame or liability concerning damages. This means that issues concerning liability are neither investigated nor described in association with its investigations. Issues concerning blame, responsibility and damages are dealt with by the judicial system or, for example, by insurance companies.

Furthermore, SHK's remit does not include, aside from that part of the investigation that concerns the rescue operation, an investigation into how people transported to hospital have been treated there. Nor does it include public actions in the form of social care or crisis management after the event.

Investigations of aviation incidents are governed mainly by Regulation (EU) No 996/2010 on the investigation and prevention of accidents and incidents in civil aviation and by the Accident Investigation Act (1990:712). The investigation is carried out in accordance with Annex 13 of the Chicago Convention.

The investigation

SHK was informed on 27 juni 2015 that an accident involving one aircraft with the registration SE-GIC had occurred at Sturup Airport, Skåne county, the same day at 18.56.

The accident has been investigated by SHK represented by Mr Mikael Karanikas, Chairperson, Mr Stefan Christensen, Investigator in Charge, Mr Johan Nikolaou, Operational Investigator, Mr Ola Olsson, Technical Investigator (aviation) and Mr Jens Olsson, Investigator Behavioural Science. Ms Pam Sullivan from the NTSB (National Transportation Safety Board) has participated as accredited representative on behalf of the United States.

The investigation was followed by Ms Britt-Marie Kärlin and Mr Toni Reuterstrand of the Swedish Transport Agency.

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

Investigation material
Interviews have been conducted with the commander/instructor, the student, the passenger and with the rescue services and air traffic control at Sturup Airport.

A fact-finding presentation meeting was held with the interested parties on 16 March 2016. At the meeting SHK presented the facts discovered during the investigation which were available at that time.

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Aircraft:	
Registration, type	SE-GIC, PA34
Model	Piper-PA34-200T, Seneca II
Class, Airworthiness	Normal, Certificate of Airworthiness and valid ARC[1]
Serial number	34-7570028
Holder	South Sweden School of Aeronautics AB
Time of occurrence	2015-06-27, at 18.56 hrs. in daylight Note: all times are given in Swedish daylight saving time (UTC[2] + 2 hrs)
Place	Malmö/Sturup Airport, Skåne county, (position 55°32N 013°21 E, 72 metres above mean sea level)
Type of flight	Training flight
Weather	According to Metar ESMS: Wind southeast 5 knots, visibility >10 km, no clouds below 5,000 feet, temperature/dewpoint +17 /+13°C, QNH[3] 1012 hPa
Persons on board:	3
Crew members	2
Passengers	1
Injuries to persons	Serious
Damage to aircraft	Substantially damaged
Other damage	None
Instructor:	
Age, licence	67 years, CPL(A)[4]
Total flying hours	16,000 hours, of which 3,000 hours on type
Flying hours previous 90 days	110 hours, of which 26 hours on type
Number of landings previous 90 days	233, of which 80 on type
Student:	
Age, licence	27 years, PPL(A)[5]
Total flying hours	215 hours, of which 12 hours on type
Flying hours previous 90 days	33 hours, of which 12 hours on type
Number of landings previous 90 days	43, of which 13 on type

[1] ARC (Airworthiness Review Certificate).
[2] UTC (Coordinated Universal Time) is a reference for time anywhere in the world.
[3] QNH (Barometric pressure reduced to mean sea level).
[4] CPL(A) – Commercial Pilot Licence (Aeroplane).
[5] PPL(A) – Private Pilot Licence (Aeroplane).

SUMMARY

An airplane of model Piper PA 34 took off from Malmö/Sturup airport for a training flight. On board were an instructor, a student pilot and an observer. The intention was to carry out a check flight before the student's skill test, where – among other items – engine failure should be trained. Just after lift off the instructor instructor retarded the throttle to the left engine. The student levelled off at about 100-150 feet, but hesitated on further actions. After the instructor repeatedly had called out "speed", he reduced the power even on the right engine and instructed the student to land.

In this position, however, airspeed and height was insufficient for a controlled flare and landing which resulted in the aircraft struck hard onto the runway and was substantially damaged. Of those on board - who themselves could leave the aircraft wreckage - two got back injuries of varying degrees. The instructor had planned to carry out the simulated engine failure during take-off with the intention that the student himself would retard power on the second engine and land straight ahead, so-called "Decision" procedure. The exercise had not been communicated to the student before the flight. No cameras at the airport were directed against the runway system, and the sequence of events in the report is based solely on witness interviews.

The Swedish Transport Agency had approved the current training organization and exerted continuous supervision of the operations. Rules for flight training are based on common regulations issued by the European Aviation Safety Agency (EASA). The practical execution of flight lessons, with associated risk assessment, is not assessed during supervision but is assumed to be managed by the school's quality system.

The Transport Agency, at standardization meetings with their authorized examiners, have discussed a minimum altitude of 300 feet for simulation of engine failure during skill tests in aircraft. This information had not reached the training organization in question, and reportedly neither to all examiners. There is no guidance material (Guidance Material - GM) regarding the practical execution of flight training issued by EASA.

The accident was caused by the following factors:

- Emergency exercise with a high risk factor,
- Inadequate planning of the flight training session regarding options for the handling of hazardous situations,
- Absence of guidance material from regulatory authorities regarding the practical execution of certain exercises in flight training.

Safety recommendations

EASA is recommended to:

- Identify exercises in flight training that might entail an increased risk factor and to issue Guidance Material (GM) for the practical execution of these. (*RL 2016:05 R1*)

- Investigate the conditions for the installation of operational CCTV cameras for investigative purposes at European commercial airports that are covered by EASA's regulations under Regulation (EC) 216/2008. (*RL 2016:05 R2*)

The Swedish Transport Agency is recommended to:

- During the certifying process and operational controls of air training organisations to tighten its supervision concerning the identification of training elements that might entail increased flight safety risks. (*RL 2016:05 R3*)

- Review the process of standardization among its authorized examiners in order to achieve a safe and consistent performance regarding emergency exercises during skill tests in aircraft. (*RL 2016:05 R4*)

1. FACTUAL INFORMATION

1.1 History of the flight

1.1.1 Circumstances

An aircraft of the model Piper PA-34-200T should perform a training flight from Malmö/Sturup Airport. There were three persons on board: an instructor, a student pilot and one additional student pilot in a rear seat accompanying them as an observer. The training flight in question was a check flight before the student's planned skill test.

About a week before the flight in question, the student had made a check flight with the instructor. On that occasion the instructor assessed that there was a need for further training on engine failure. The student had previously trained engine failures at take-off on a few occasions but not immediately after lift-off. On those occasions, these exercise elements had been the subject of pre-flight briefing. The philosophy of the school is that the students should be able to handle an engine failure at any time.

The intention was for the student to rehearse engine failure and instrument approaches and subsequently conclude the flight at Malmö/-Sturup. The student was positioned in the front left seat and the instructor was sitting in the right front seat.

Figure 1. The aircraft in question SE-GIC. Photo: Mårten Mårtensson.

Preparations for the flight were performed according to the school's normal procedures and with no known problems. An operational flight plan had been prepared, but it was not filled in on all points; minimum altitudes were missing and it was not signed by the commander. The operational and weather-related conditions were good.

A full briefing was not provided in connection with the flight in question; it was instead decided that a debriefing would take place after the flight. However, it had been agreed that engine failure would be practised during the flight, though it was not specified when.

Before the flight, the instructor telephoned the air traffic control tower and informed of the intention to simulate an engine failure (unknown to the student) in connection with take-off.

1.1.2 Sequence of events

In connection with engine start the instructor reported via the aircraft's radio that the intention was to train ILS approaches runway 17.

The aircraft taxied out and commenced the take-off from the threshold of runway 17, which meant an available runway length of 2,800 metres. The take-off initially proceeded normally, and the aircraft lifted off at a stated rotation speed of 79 knots.

After lift-off, at a height of about 100 feet and with the aircraft still in take-off configuration, i.e., with the landing gear extended, the instructor retarded the throttle to the left engine. The student then levelled out at 100 to 150 feet and compensated using rudder, whilst at the same time the speed decreased. In this situation, when the student – according to the instructor – hesitated about what action to take, the instructor repeatedly called "speed". The instructor then also decreased the power on the right engine and instructed the student to land.

According to those on board, the speed during this phase did not go below 66 knots, i.e., the red line marking on the airspeed indicator. The student pushed the control wheel forward and despite subsequently pulling the wheel back with full elevator deflection, the aircraft crashed horizontally on the runway with the landing gear extended and the flap retracted.

The aircraft came down hard on the runway and then slid just over 200 metres before coming to a final stop. Upon impact – which has been assessed to be largely horizontal – all three landing gears broke, and the aircraft sustained substantial damage to wings, engines and fuselage. No fuel leakage arose during the crash.

All those on board were able to exit the aircraft wreckage themselves. The instructor suffered serious back injuries and the passenger minor back injuries in the crash. Both were taken to hospital.

The accident occurred at position 55°32N, 013°21E, 72 metres above mean sea level.

1.2 Injuries to persons

	Crew members	Passengers	Total on board	Others
Fatal	-	-	0	-
Serious	1	-	1	-
Minor		1	1	Not applicable
None	1		1	Not applicable
Total	2	1	3	-

1.3 Damage to aircraft

Substantially damaged.

1.4 Other damage

No known damage.

1.4.1 Environmental impact

Minor spillage of oil at the accident site. No fuel leakage found.

1.5 Personnel information

Instructor

The instructor was 67 years old and had a valid CPL(A) with flight operational and medical eligibility. At the time of the occasion, the instructor was Commander.

Flying hours				
Latest	24 hours	3 days	90 days	Total
All types	00	05	110	16,000
Actual type	00	00	26	3,000

Number of landings actual type previous 90 days: 80.
Latest PC[6] conducted on 22 april 2015 on MEP(land)[7].

Student

The student was 27 years old and had a valid PPL(A) with flight operational and medical eligibility. At the time of the occasion, the student was PF[8].

[6] PC - Proficiency Check.
[7] MEP(land) – Multi Engine Piston (land).
[8] PF (Pilot Flying).

Flying hours				
Latest	24 hours	3 days	90 days	Total
All types	1	1	33	215
Actual type	0	0	12	12

Number of landings actual type previous 90 days: 13.
Type rating: Not applicable.

1.6 Aircraft information

1.6.1 General

The Piper PA-34-200T (Seneca II) is a low-wing aircraft powered by two turbocharged six-cylinder piston engines with constant speed counter-rotating propellers. The aircraft is constructed of metal. The model does not have a pressurized cabin but has retractable landing gear. There are normally six seats on board.

The PA-34-200 was certified in 1971 and over 5,000 units in different versions have been manufactured in total. The model is not normally used for commercial flight operations but has its largest area of use in private aviation and training flight operations.

Aircraft

TC-holder	Piper Aircraft Inc.
Model	Piper-PA-34-200T (Seneca II)
Serial number	34-7570028
Year of manufacture	1974
Gross mass, kg	Max start/landing mass 1999/1970, actual 1,800
Centre of gravity	Within limits.
Total flying time, hours	5,714
Flight time since latest inspection, hours	30
Number of cycles	No information
Type of fuel uplifted before the occurrence	100LL

Engine		
TC-holder	Continental Motors	
Engine type	TSIO-360-EB, LTSIO-360EB	
Number of engines	2	
Engine	No 1	No 2
Serial number	225170-R	808086-R
Operating time since latest inspection, hours	30	30
Operating time since overhaul, hours	800	800

Propeller		
TC-holder	Hartzell Propeller Inc	
Type	BHC-C2YF-2CKUF, BHC-C2YF-2CLKUF	
Propeller	No 1	No 2
Serial number	AN6967A	AN1063
Operating time since inspection, hours	30	30
Operating time since overhaul, hours	444	192
Limitations, hours/cycles	2,000	
Deferred remarks At the time of the accident there was one deferred remark: *Right Turn Coordinator U/S.*		

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

1.6.2 Climb performance

The aircraft is equipped for flight under instrument flight conditions. The airspeed indicator has a red marking for the minimum speed (66 knots IAS) for controlling the aircraft on one engine (VMC)[9], and a blue marking for the best climb speed (89 knots IAS) on one engine. The aircraft's stall speed[10] is lower than VMC and is dependent on factors including actual mass and configuration.

In most school flight conditions, the PA34 has sufficient engine performance to be able to climb on one engine following an engine failure in connection with take-off. However, in certain special conditions, such as a fully loaded aircraft combined with high pressure altitude and temperature, the available engine power can be insufficient to be able to climb on one engine following an engine failure during take-off. The PA34 is certified in accordance with FAR-23, which does not cover climb requirements with one engine inoperative.

The type certificate holder (Piper) has therefore published emergency procedures in the flight manual for cases where an engine failure occurs on take-off in marginal performance conditions, (POH emergency procedures, section 3.3). The following three cases are described:

Speed below 85 knots IAS:

If engine failure occurs – on the ground or in the air – the throttles are to be closed immediately and the aircraft stopped, or the aircraft immediately landed straight ahead.

[9] VMC: Minimum control speed.
[10] Stall: The relationship between speed and the wing's angle of attack regulates lift. When these parameters reach certain negative limit values, lift decreases and the wing stalls.

Speed above 85 knots IAS:

If engine failure occurs a decision is to be made with reference to the remaining runway length. If sufficient runway length remains, the throttles are to be immediately closed and the aircraft landed straight ahead. If the remaining runway length is not considered sufficient for landing, the pilot must decide whether the take-off should still be aborted or whether it should be continued.

This decision is to be based on the aircraft's mass, pressure altitude, obstacles, weather, and the pilot's skill. If the decision is made to continue the take-off, the propeller on the faulty engine is to be feathered and the landing gear retracted. After take-off with the landing gear still in the down position and with sufficient runway for landing, the throttles are to be immediately closed and the aircraft landed straight ahead.

During climb

If engine failure occurs below 66 knots, the power on the running engine is to be reduced in order to maintain lateral control of the aircraft. The nose shall then be lowered to enable the aircraft to accelerate to 89 knots, which is the speed for the best climb performance.

Piper's flight manual only contains recommendations on how these emergency procedures are to be executed in a real situation. There is no information on how to give instruction or training concerning these procedures.

1.7 Meteorological information

According to SMHI's analysis: Wind southeast 5 knots, visibility >10 km, no clouds below 5,000 feet, temperature/dewpoint +17 /+13°C, QNH 1012 hPa. The flight was performed in daylight.

1.8 Aids to navigation

Not applicable

1.9 Communications

Radio communication was established with the air traffic control at Sturup tower. SHK has had access to this communication and has not found any deviations from the witness statements given by those involved in the event.

1.10 Aerodrome information

The airport had operational status in accordance with the Swedish AIP[11]. At the time of the accident the runway was dry. SHK has examined the fixed cameras that were installed within the airport area. However, no cameras were directed towards the runway or approach sectors, instead having apron and parking areas as their primary target areas.

1.11 Flight recorders

There were no flight data and cockpit voice recorders (FDR, CVR), nor are these mandatory in this type of aircraft. A panel-mounted GPS of the model Garmin GNS 430W was secured, but it did not contain any information that could be used for investigation purposes.

1.12 Accident site and aircraft wreckage

1.12.1 Accident site

SHK's calculation of take-off performance according to the flight manual indicated a ground roll distance – at rotation speed 79 knots – of 323 metres, and 396 metres to a height of 50 feet. The sketch in Figure 2 shows the rotation point, followed by a calculated dis-tance of about 850 metres when the aircraft was in the air.

[11] AIP – Aeronautical Information Publication.

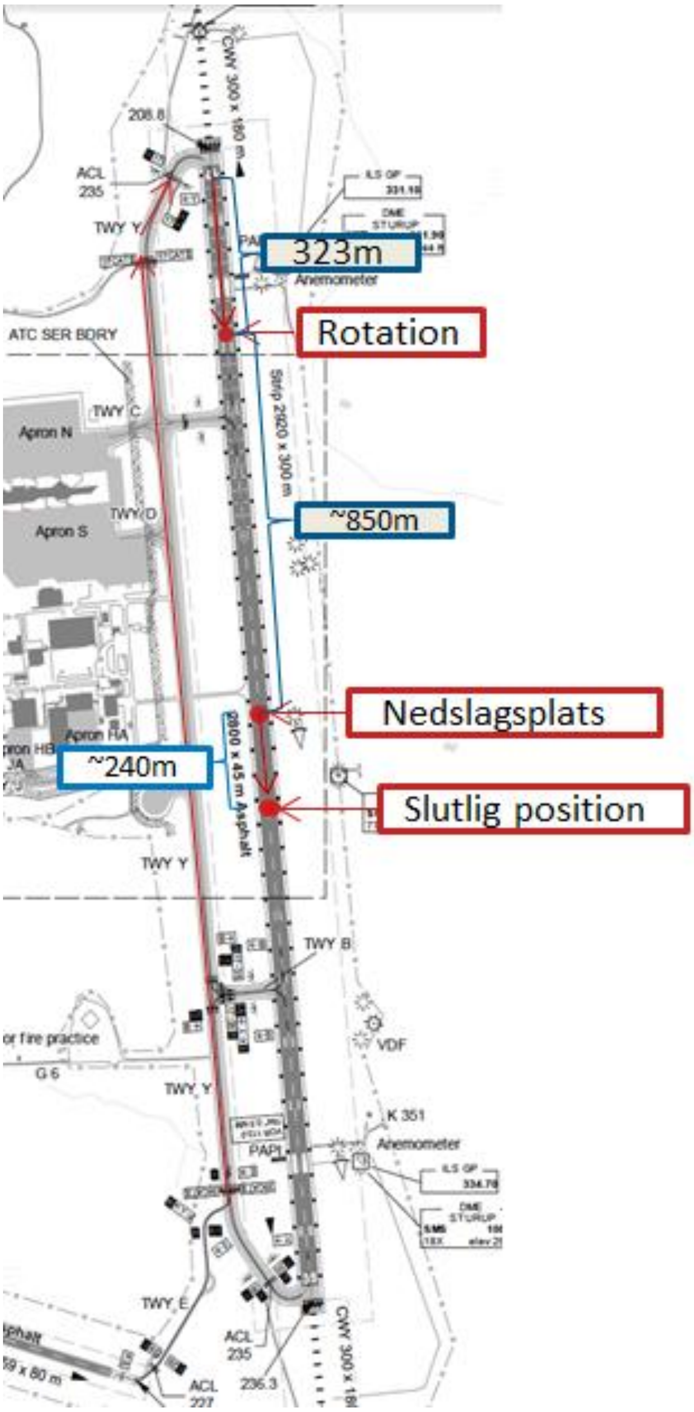

Figure 2. Sketch of the accident sequence and accident site. [Note: Nedslagsplats - Point of impact; Slutlig position - Final position.]

After impact on the runway, the aircraft slid approximately 240 metres before coming to a final stop about 1,450 metres from the beginning of runway 17. An assumed average speed of 70 knots from lift-off to impact means an approximate time of 24 seconds during which the aircraft was airborne.

1.12.2 Aircraft wreckage

The aircraft sustained substantial damage. See Figures 3 and 4.

- Both main landing gear were damaged.
- The nose landing gear was pressed into the fuselage.
- The windscreen was broken.
- Damage to the right stabiliser – probably caused by the damaged main landing gear on the right side.
- Both propellers had damage indicating that they had developed low thrust at impact.
- Damage to wings, wing flaps and to the underside of the fuselage.

Figure 3. The aircraft after the crash. Photo: Emergency services Malmö/Sturup.

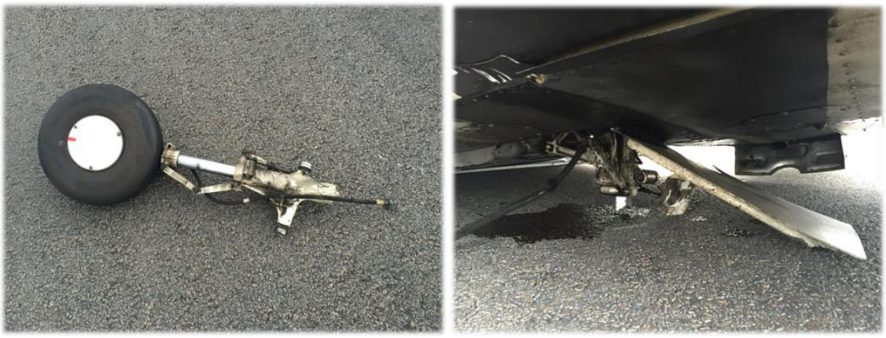
Figure 4. Left and right main gear. Photo: Emergency services Malmö/Sturup.

Following the accident, the aircraft was deemed irreparable, i.e. a total loss.

1.13 Medical and pathological information

Nothing indicates that the mental and physical condition of the pilots were impaired before or during the flight.

1.14 Fire

There was no fire.

1.15 Survival aspects

1.15.1 Rescue operation

The air traffic controller saw the sequence of events and triggered a crash alarm at 18.56 hrs. The red checklist was followed, i.e., alarm level A; Crash with known crash site, 1-9 persons on board.

The airport rescue services arrived at the crash site fairly immediately. First at the site was a fireman, who at the time was cutting the grass on the field. Two persons were lying on the ground (instructor and passenger) with back pain, and one person was standing up and appeared unhurt (student).

Soon after this the rescue team arrived, which took care of those injured while other rescue personnel secured the crash site before rescue services from Svedala and police arrived.

No fire or significant leakages occurred, and runway 17/35 was opened again at 23.15 hrs the same day.

The ELT[12] of type ARTEX ME406. was not activated. An ELT of this model should be activated automatically at an acceleration force of 2.3G along the aircraft's longitudinal axis. According to SHK's calculations, the acceleration forces along the longitudinal axis of the aircraft upon impact had probably not reached the force required to activate the ELT.

1.15.2 Position of and injury to those on board, and use of safety belts

The student who sat in the left front seat sustained no injuries. The instructor who sat in the right front seat suffered serious back injuries. The passenger who sat in one of the rear seats suffered minor back injuries. Safety belts were used by all those on board during the event and have been examined by SHK without remarks.

[12] ELT (Emergency Locator Transmitter).

1.16 Tests and research

1.16.1 Reference flight

In order to recreate the sequence of events and to evaluate the aircraft's characteristics, SHK carried out a reference flight on 15 December 2015. The flight was performed with a PA34-200T, Seneca II, SE-GPX, i.e., the same model as the aircraft involved in the accident in question, see Figure 5.

The conditions of the flight with respect to mass and balance essentially corresponded to the prevailing conditions of the accident flight. The flight was performed with two persons in the front seat and one in a rear seat. All tests were carried out at altitudes above 1,000 feet.

The flight was conducted as follows: The speed was reduced to about 66 knots with extended landing gear and 0° flap. After this a manifold pressure of 38 inches was set. The aircraft was accelerated in order to simulate a lift-off at 79 knots. An attitude of 12 degrees was stabilised, whereby the left engine throttle was immediately retarded to idle.

The aircraft's speed was allowed to drop twenty knots below the “blue line speed”[13] (89 knots) while maintaining attitude of 12 degrees and landing gear in the extended position. The remaining right engine throttle was then retarded to idle. The intention was to gain an idea of the aircraft's attitude changes and rate of descent with an unfeathered engine at idle and the landing gear extended.

Figure 5. SE-GPX, the aircraft used in the reference flight. Photo: Roger Andreasson.

The test then continued with an evaluation of the aircraft's behaviour, with the second engine throttle also being retarded at a speed of about 66 knots in the same configuration.

The result of the first part of the test was that with one engine throttle retarded to idle and while maintaining attitude, altitude could be maintained at the same time as the speed decreased slowly. The time from retardation to the speed being 66 knots was clocked at about 25 seconds. If the speed was maintained, the aircraft descended at a couple of hundred feet per minute.

[13] Blue line speed – the best rate of climb with one engine inoperative.

In the second part of the test, it could be established that when the second engine throttle also was retarded, it was no longer possible to maintain the attitude, i.e., the nose dropped and the aircraft gained a high vertical acceleration.

1.17 Organisational and management information

1.17.1 General

At the time, South Sweden School of Aeronautics AB was an approved ATO (Air Training Organisation) holding a valid training certificate with the number SE-ATO-022 issued by the Swedish Transport Agency. The most recent control of operations was carried out on 28 August 2014.

The flight school had permission to conduct the flight training operations carried out during the flight in question.

On its programme, the school had several courses for both private and commercial pilot licences and for other specialised recurrent training courses for pilots. According to the school about 60 % of the flight operations consists of training for commercial pilot licences. The flight in question was part of training for IR(A) ME[14]. Operations were conducted using a number of single and twin-engine aircraft, including the PA 34 Piper Seneca that now crashed.

South Sweden School of Aeronautics AB was founded in 2012 and has around ten instructors attached to its operations. The school previously had its operations in Eslöv but moved the practical part of flight training to Malmö/Sturup Airport. The instructor for the flight in question is also owner of the company and responsible for the school's operations (Head of Training) with respect to the regulator, the Swedish Transport Agency.

1.17.2 Training goals and purposes

According to the school's own marketing of the commercial pilot training offered, this has the following objective:

> *The training is designed for those with no previous flying experience to equip them to the level required to find employment as co-pilot for an airline. The student also has the theoretical training required for commander (Captain), which he is expected to become after a number of years of service.*

Note. The text section above is translated from Swedish by SHK.

In the interviews undertaken with the company's owner it was emphasised that the training is designed to train students who aim to work as pilots in commercial aviation. The courses– and the flight training

[14] Instrument Rating (Aeroplane) Multi Engine.

programmes – has therefore focused on meeting the requirements that the industry places on newly trained first officers.

1.17.3 The school's training programme

The aircraft type PA34 is common in connection with instruction in and flight training with multi-engine aircraft. The type has dual controls for operation from both the left and right pilot's seats. A signify-cant part of the programme for twin-engine instruction consists of training in handling the aircraft on only one engine and correctly and safely manage an engine failure.

The school's training manual "SPME, lesson 7" states the following:

"*Practise, after take-off roll, simulated unannounced engine failure*" and "*engine failure immediately after lift-off*". The training manual has no description of the procedure during engine failure in terms of handling, before rotation, after rotation, before "Decision" and after the landing gear has been retracted.

As mentioned above, the PA34 is not certified in a class where climb performance with one engine inoperative is a requirement. Since flight training operations are usually performed with relatively lightly loaded aircraft, the school can select training alternatives for simulated engine failure after lift-off as follows:

- The take-off is continued after the engine failure, and climb and climb-out are performed with only one engine.
- The take-off is aborted after the engine failure, and a landing manoeuvre straight ahead is applied (the "Decision" procedure).

According to the interviews with the Head of Training, the basic principle for the training of "Decision" during take-off is to retain the take-off/landing configuration as long as the remaining length of runway is deemed sufficient for landing in the event of engine failure. Only when this point – or height – has been passed is the landing gear retracted, and the climb continues according to normal routines.

The execution of the exercise is not specifically described in the school's training manual. For information on the procedure, reference is made to the emergency procedures in the aircraft's manual (see Section 1.6.2).

Performance calculations for large aeroplanes, i.e., the transport category, are made with calculated speeds for V_1, V_R and V_2 according to established rules, where a take-off is only aborted before or in connection with the decision speed V_1. Engine failures after this speed are continued. Training of this is part of the school's theoretical training programme.

1.17.4 The Swedish Transport Agency's view of the "Decision" procedure

SHK has consulted the Swedish Transport Agency (TS) regarding the application of this procedure, and has received the following response:

- In the planned training of "Decision", performance calculations are to be made, calculating required runway length as the sum of the take-off roll distance, climb to 50 feet and thereafter the landing distance (with or without flaps) to full stop. If the runway is longer than the calculated distance, "Decision" can be increased to the corresponding degree. With a shorter runway, the height is to be lowered in a corresponding degree.

- Prevailing conditions such as T/O mass, wind, friction coefficient, etc. should be taken into account in the performance calculations.

- Under IMC, the rules of the Swedish Transport Agency's regulations (LFS 2007:50) and general advice on all-weather operations for aircraft are to be followed. These rules establish, among other things, operating minima for take-off and landing.

- There is no established set of regulations – in addition to the flight manual for the aircraft in question – which prescribes how this manoeuvre is to be calculated and applied during normal flight.

- Both international (EASA) and national (TS) regulations also lack references regarding whether – and if so, how – the "Decision" procedure should be included as a training element during flight training.

According to information, the flight school in question has not made any specific performance calculations when planning the practice of the "Decision" procedure during flight lessons. It has also not emerged how the school applies the regulations concerning operating minima for take-off and landing in connection with "Decision" exercises.

The only performance-related regulations/instructions that SHK has obtained are that the procedure is only applied on runway lengths exceeding 1,200 metres. However, SHK has established that in practice, the procedure is usually applied through an assessment by the pilot of whether the remaining runway length is "enough" to land on.

1.17.5 Regulations for operations

Flight operations to be conducted within the EU are subject to the joint aviation provisions issued inter alia by Regulation (EC) No 216/2008 of the European Parliament and of the Council on common rules in the field of civil aviation and establishing a European Aviation Safety Agency. Control of compliance is on the union level carried out by the European Aviation Safety Agency (EASA), which also exercises supervision of the member states' national aviation organisations and regulators.

Flight training operations of the type conducted at the school in question are governed by Commission Regulation No 1178/2011, Annex VII, Part ORA, subpart ATO. This Regulation prescribes the requirements that an Approved Training Organization (ATO) must meet to obtain permission to conduct flight training. Among other things, the requirements concern finances, personnel, training manuals, operation manuals, premises, and aircraft equipped with dual controls. The requirements also include the operations in question having established a quality and safety management system, SMS (Safety Management System) and CMS (Compliance Monitoring System).

The national regulator for aviation, i.e., the Swedish Transport Agency in Sweden, is to approve the planned operations and also exercise supervision during operations.

Responding to a question from SHK, EASA has stated that flight training operations are not considered as Commercial Air Transport (CAT), i.e. the transport of passengers, cargo or mail for remuneration or hire. However a flying school should aim to meet the same level of flight safety that applies to operators flying under the CAT provisions.

According to article 18 c) of the European Parliament and Council Regulation (EC) No 216/2008, EASA shall, when necessary, issue acceptable means of compliance as well as any guidance material for the application of the Regulation and its implementing rules.

Any guidance material has not been issued for practical performance of flight training at approved flight training organizations.

1.17.6 Approval of the school's operations

Before starting up operations, an audit of the company is carried out. This access control is carried out by the Swedish Transport Agency in accordance with the requirements prescribed in ORA. Also participating among the inspectors performing the access control is the inspector, PI – Principal Inspector, who has been assigned the task of carrying out the continuous supervision of the undertaking during operations.

The audit during an access control also includes approval of the undertaking's SMS and CMS according to the regulations in Part ORA.GEN200. According to these regulations, the operator's SMS is to show how the organisation assesses and manages the potential flight safety risks that can arise in its operations.

CMS is intended to ensure that the operator has a plan for systematic safety management, where operations are continuously monitored and deviations and risks can be pinpointed. The system is to minimise the risks in the operations and also rectify the identified shortfalls in safety.

The school's training manual, with the syllabus for the different courses to be applied, is audited during the access control and is to be approved by the Swedish Transport Agency. The current regulations determine which elements are to be included in various kinds of flight training. However, there is no set of regulations describing how exercises covering these elements are to be executed.

The practical application, i.e., the execution of the training flights, is therefore not subject to audit during the access control; it is assumed that the school's quality system can manage this. The exercise being practised when the accident occurred is described in the school's training manual as follows: *Practise, after take-off roll, simulated unannounced engine failure.* The manual does not indicate the altitude at which the instructor is to retard the engine throttle and stage the simulated engine failure.

After the access control, there is a consultation with participating inspectors from the Swedish Transport Agency where the overall picture of the flying school is assessed for a possible approval of the operations. On this occasion, the undertaking is also assigned a risk level that is to form the basis for the forthcoming supervision during operations.

1.17.7 Supervision during operations

According to the regulations of Annex VI, part ARA, subpart ATO, the national regulator is to exercise regular supervision of flight training operations. In Sweden, supervision is carried out through recurrent operational controls, VK1 and VK2. The major supervision, VK1, means that the entire company's operations are reviewed. The control is performed at intervals of 12-24 months, depending on the undertaking's established risk level. The minor supervision, VK2, is an intermediate, less comprehensive supervision, normally carried out every 12 months.

The operational controls are carried out in accordance with a checklist which is determined in accordance with part ARA. The main purpose is to check the compliance of operations both with respect to regulations and to the procedures and systems that the undertaking has described in its manuals. The implementation of VK1 includes a practical element where the Swedish Transport Agency's inspector – normally PI – participates as an observer during at least one training flight lesson.

According to information from the Swedish Transport Agency, only minor remarks and deviations have been noted during the operational controls carried out at the school. However, it was known at the Swedish Transport Agency that the school applied the above-mentioned exercise element with unannounced engine failure after take-off roll and that the "Decision" procedure was included as a practical consequence of the exercise.

1.18 Additional information

1.18.1 Regulations from the Swedish Transport Agency regarding simulated engine failure

The skill tests conducted by the Swedish Transport Agency's authorized examiners include the element of unannounced engine failure in connection with take-off. The test uses form L-1647 and is conducted in accordance with the requirements for class rating for single-pilot aircraft. EU Regulation 1178/2011, Appendix 9, describes the contents of the training/skill test. Among these, Section 6.1 describes how the training of engine failure is to be executed: "*simulated engine failure during take-off (at a safe altitude unless carried out in FFS or FNPT II*[15]*)*".

According to information to SHK, the Swedish Transport Agency's authorized examiners, in interpreting this rule at standardization meetings, have agreed to apply a praxis whereby 300 feet is considered an acceptable and reasonable altitude for executing the manoeuvre. This altitude gives a margin to the ground, at the same time as the aircraft is still in take-off configuration. According to the Swedish Transport Agency, the recommendation of a minimum altitude of 300 feet has been issued for flight safety reasons.

SHK has also written to EASA on the question of how the term "safe altitude" is to be interpreted. EASA replied that this cannot be stated with any specific figure, but varies with conditions and aircraft type on the occasion in question.

The inspector's manual issued by the Swedish Transport Agency states the following advice:

- Use discernment when simulating emergency situations and do so in a safe manner.
- Always be clear during simulated engine failure in the aircraft that it is a simulated situation.

[15] FFS and FNPT II are designations for flight simulators.

- In multi-engine aircraft, also be clear about which engine can be used and how, and about who has command of the engine controls.

Note.

The instructor at the flight - who is also the head of training at the company - has in a letter to SHK stated that he had not heard about the discussions to apply the 300 foot minimum altitude when training simulated engine failures during take-off. The instructor , who is also authorized examiner from the Swedish Transport Agency, also stated that the other examiners he had contacted nor had heard of this .

According to the instructor , it is rather the opposite relationship that exists , where the school feels pinch prepared to practice engine failure during take-off because this is not an unusual exercise during the skill tests conducted by the Transport Agency's authorized examiners .

1.19 Special methods of investigation

Not applicable

2. ANALYSIS

2.1 The event

2.1.1 Circumstances

The prevailing conditions on the day in question were good. The weather was fine and no operational or technical difficulties were known before the flight. According to the interviews with the students, only a short briefing of the elements to be trained during the flight had been conducted before take-off.

The flight training that should be carried out meant a control ahead of the upcoming skill test. The student had at an earlier stage made such a control flight, and at that occation been assessed by the same instructor - who is also the “Head of Training" – that further training of engine failure was nesessary . At the previous occation , however, had no unprepared engine failure immediately after takeoff performed.

The instructor had already decided before commencing the exercise that the flight training session would include the handling of an engine failure immediately after take-off. He had also informed the ATC about it, but the student was never briefed about it.

Although the student was not directly aware of what was to occur during the take-off sequence, he had been trained in this in earlier flight training lessons, and was also aware of that engine failure would be practised during lesson in question . Therefore, the student can to some extent be considered to have been prepared for the eventuality that the instructor would simulate an engine failure during some part of the take-off sequence.

2.1.2 Preparation of the training flight

In flight training lessons of this kind the instructor is always commander. The flight's setup and the exercises to be performed, shall – besides the educational content – be planned in such a way that flight safety can be maintained during all phases of the flight. A student in training cannot be presumed to master all situations that can arise during flight, even if it is a matter of the final phase of training and in connection with a final check. The responsibility for this rests with the instructor regarding both the flight's planning and the handling of unexpected situations during flight.

As previously mentioned, the student had in previous lessons been trained in the “Decision” procedure, i.e., landing straight ahead in the event of an engine failure immediately after take-off. Although these previous exercises may have led to the development of certain notions with the student that such a scenario could occur, it is SHK's view that this does not relieve the instructor of the responsibility to inform the student prior to take-off of the planned sequence of events. As this never was done, it can be assumed to have had a negative impact on the student's ability to manage the engine failure.

When the take-off was executed, it was with a student who did not fully know what he could expect and with an instructor who did not know with certainty how his student would react. According to SHK, the immediate confusion that arose at the time – where the student was slow in his evaluation at the same time as the instructor was expecting a quick reaction of the student – is likely a result of the planned scenario not being reviewed with the student before take-off.

2.1.3 *The simulated engine failure*

The instructor retarded the left engine throttle at an altitude of about 50-100 feet. The student compensated for the engine failure with rudder and initially continued the climb to about 100-150 feet where he levelled out. When the speed dropped below the blue line, the instructor called “speed” three times. The moment after this, the instructor reduced the power also on the right engine and at the same time gave the command to the student to land. At this moment, a significant nose-down attitude of the aircraft occurred.

With low speed and insufficient height, there was no margin to make any recovery and the aircraft thus came down hard on the runway. According to consistent information, the student pulled the wheel fully back before impact.

Regardless of the exact sequence of events, it can be established that it was unclear as to who executed the various manoeuvres in the final phase. According to SHK, this indicates that the instructor had not sufficiently prepared the student, and that he himself was not prepared to take over in a safe manner in the event of an unplanned situation.

When the student did not react in the way the instructor was expecting upon engine failure – i.e., to immeadetly lower the nose to reduce the current climb attitude, retard also the second engine throttle and land – there were various options for the instructor to avoid a dangerous situation arising.

The first option was to restore power on the left engine, retract the landing gear and climb. The second option was to feather the engine, retract the landing gear and continue the climb. The third option could be to immediately take over the controls and execute the procedure that the student had been expected to execute – landing straight ahead.

The option which came to be executed in practice was that the instructor waited for the student to take the measures that he was expected to execute. When the student finally did this, however, it was too late to avoid an accident. SHK can understand that the student was to some extent surprised by the sudden engine failure and for a few crucial seconds hesitated about which measures were to be executed.

2.1.4 *Principles during flight training*

Hesitation or indecision in a student pilot is not an abnormal feature of flight training and should be part of a flight instructor's mental preparation ahead of every flight training lesson. It is therefore of the utmost importance that an instructor always has an alternative plan of action and/or readiness to act in case a planned exercise does not go as calculated.

To get to know the aircraft and being able to master it in various conditions is the core of all flight training. During such training are also practiced various potentially hazardous situations, but always at a safe altitude where there are margins for an instructor to take over control of the aircraft should the student not manage to overcome the situation.

The investigation has however shown that the current flight training organisation conducted such exercises - occasionally with unprepared students - frequently at very low altitude during take-off.

2.1.5 *The accident*

When the instructor had retarded the throttle on the left engine and hesitation arose in the student about what measures he was expected to carry out, the aircraft's speed was continuously dropping. This is reflected by the instructor's repeated calls "*speed, speed*" during the sequence of events.

The entire length of the flight has been estimated at about 24 seconds. If this time is reduced by five seconds at both ends, (from lift-off to engine failure and from the forward movement on the wheel to impact), there remains a time period of about 14 seconds during which the established uncertainty of the two pilots in the front seats prevailed.

During this period of time, the speed dropped towards the critical speed area where the aircraft's manoeuvrability and lift decrease. However, the flight tests performed by SHK show that the speed during this time probably did not reach the speed which is indicated as a red line on the airspeed indicator (66 knots). This is also verified by the witness statements of those on board.

SHK therefore draws the conclusion that the accident not primarily was caused by a low speed situation, but by a too high rate of descent at the end of the sequence of events. The aircraft's rapid loss of altitude was probably a combination of the wheel being pushed forward at the same time as the nose-down attitude upon retarding the remaining engine - as established in the test flights - reinforced the movement. However, both speed and altitude were insufficient for a recovery, why the aircraft hit the runway at a high rate of descent.

The unclear perceptions regarding who did what in the final stage also indicate that neither the student nor the instructor was sure of who had control of the aircraft. If the instructor takes over control of a flight – or parts thereof – this is to be done with a clear command: “My controls”. According to SHK, also shutting down the second engine without simultaneously taking control of the entire flight - which is what happened during the event - contributed to the confusion that prevailed in the seconds before the crash.

2.2 The exercise

2.2.1 “Decision” as an element of commercial pilot training

Besides the obvious flight safety risks that exist in practising the “Decision” procedure in the way that the flight training organisation did, the exercise's suitability whatsoever in connection with commercial pilot training can also be questioned.

According to the school's stated principles, the goal of commercial pilot training is to train and prepare the students for a future pilot career in the transport category of aviation. Operations within this segment of aviation are not based on any “Decision” procedures.

“Decision” is an emergency procedure which, according to the manufacturer, is to be applied in the event of engine failure under marginal performance conditions when the remaining engine power is not sufficient for the aircraft to climb on one engine. According to SHK, such a situation can be likened to a loss of power in a single-engine aircraft, where a landing (straight ahead) is the only option (cf. SHK report RL 2016:02).

A pilot who, for example, is undergoing type training on the aircraft to use it privately, could possibly benefit from training of – or practising – the procedure during initial flight training on the aircraft. However, in most flight training conditions for future commercial pilots, the aircraft's climb performance on one engine is sufficient, for which reason it is difficult to consider the practical training of a hazardous emergency procedure to be necessary.

Practical training of an emergency procedure for a light twin-engine aircraft during commercial pilot training might, in SHK's view, also not only counteract the routines that the student will later be trained in when training on other aircraft types, but also to some extent instil a behaviour that may constitute a potential risk in the future professional career.

Overall, SHK believes that the exercise element “Decision” can for the following reasons be questioned in training programmes for commercial pilot training:

- The element is an emergency procedure for light twin-engine aircraft under marginal performance conditions.
- Practical planning of the exercise requires extensive performance calculations.
- The exercise entails an obvious, increased flight safety risk.
- “Decision” is a procedure that is not normally part of the future professional role for which the student pilots are being trained.

However, since the procedure is included in the emergency checklist of the aircraft in question, it is appropriate for training regarding this to be part of the theoretical component during the students' type training, or – where a need is identified – in a simulator or at a safe altitude in an aircraft.

2.2.2 *The Swedish Transport Agency's supervision*

The Swedish Transport Agency is responsible for the national application of the European regulations in the area of aviation. During the access control performed at undertakings such as the one now in question, there is an audit of the school's conditions for conducting flight training in an appropriate and safe manner. Since ORA does not contain any regulations regarding the practical execution of flight lessons, it is understandable that the “Decision” procedure was not addressed in connection with issuing permission for the school's operations.

However, the Swedish Transport Agency knew that the school applied the training of “unannounced engine failure after take-off roll” and that this exercise could be followed by the aforementioned “Decision” procedure. Since the school had not prescribed any altitude for the exercise in its syllabus, the element was not, according to the Swedish Transport Agency, specifically discussed during the operational controls of the flying school.

In SHK's view, the designation of the exercise – “after take-off roll” – is sufficient for drawing the conclusion that this is intended to take place immediately after lift-off, i.e., at very low height. The suitability of such exercises can be discussed from a flight safety viewpoint. An unannounced engine failure at low altitude in an aircraft with limited climb performance in most cases entails an increased element of risk.

If this is to be applied during flight training with student pilots of varying status, it places very high demands on the instructor – and the instructor's planning – so as not to further raise the level of risk, see Figure 6.

Figure 6.The aircraft after the accident. Photo: Emergency services Malmö/Sturup.

The goal of exercises containing engine failure is for students to learn to master their aircraft on one engine and to be able to take the measures that are required on the aircraft type in question. SHK is of the opinion that this can be carried out with the same training value at a higher altitude, which would result in a greater safety margin if something goes wrong. The only training-related change would be that the exercise element “Decision” – with subsequent landing – naturally should become more difficult to apply during flight training.

2.2.3 Standardization of exercises with simulated engine failure

The Swedish Transport Agency has communicated that it has been agreed at its instructor meetings that the minimum altitude of 300 feet for simulated engine failure shall be applied in skill tests on aircraft of the class now in question. The altitude recommendation has been introduced for flight safety reasons and is considered to provide sufficient margin if something unforeseen occurs, at the same time as the aircraft is still in take-off configuration.

The above had not reached the examiners at the training organization in question. Reportedly, other examiners have stated that they were not aware of the discussions at standardization meetings.

Accident Commission notes that it appears to prevail confusion among the Transport Agency’s authorized examiners regarding altitude recommendations for simulated engine failure exercises during skill tests on aircraft. This means that the purpose of the Transport Agency's standardization – consistancy and coordination of performance at the tests – not have been achieved in this regard, and that air safety recommendations have not reached out to all examiners authorized by the Transport Agency.

According to SHK's opinion should therefore the Swedish Transport Agency review the process of standardization among its authorized examiners in order to achieve a safe and consistent performance regarding emergency exercises during skill tests in aircraft.

The Swedish Transport Agency should consequently, when certifying flight training organizations and during supervision, put particular focus on checking that exercises containing simulated engine failures in aircraft is not executed at a lower altitude than the 300 feet that has been considered as a safe altitude for emergency exercises of this kind.

2.2.4 SMS

The SMS, intended to identify risks and flight safety in an activity in organizations, has in this case not functioned as intended . The reason for this is likely to be sought in the absence of guidance material . The expected – and obvious – consequence of this deficiency is that organizations themselves must make a subjective assessment of risk levels, for example during flight training.

As mentioned earlier in this report , there are different views on what can be considered as safe altitude for the simulation of engine failure in aircraft. The organization in question believes that the exercise can be performed immediately after lift-off , while a minimum altitude of 300 feet have been discussed at standardization meetings among authorized examiners. Other training organizations might have another opinion regarding the expression "safe altitude" for similar exercises.

This shows that flight safety and risk levels can be assessed differently within training organizations operating in the same flight training category. What is assessed as a safe operation within one organization can be assessed being unsafe by another .The conclusion is that SMS can not be considered as reliable for risk assessment as long as guidance material and references from the competent authority is missing. This is from a flight safety perspective unfortunate.

2.2.5 EASA

If pilots are to be appropriately trained for a career in commercial aviation it is necessary that flight safety is also given the highest priority through all phases of the training stage. It is SHK's understanding that the exercises performed today at some flight training organisations do not fulfil that requirement.

The training of commercial pilots should not focus on producing individuals who sort out engine failure at the lowest altitude in the fastest and most effective way or overcome a deep stall in the best manner. The training should focus on creating individuals who with discernment – and a flight safety culture learned from the foundation up – can take on a future in commercial aviation and the responsibility this demands.

The EU has set up the joint aviation safety agency EASA in order to satisfy the requirements of a high level of flight safety within the Union. The work with this cannot only focus on existing aviation, but must, according to SHK, already take place in the training of the individuals who will manage and improve joint flight safety in the future. Within the framework of this, EASA can probably further improve flight training – and the flight safety level– at flight training organisations within the EU.

SHK is currently investigating two total losses that have occurred during training on light twin-engine aircraft at Swedish flight training organisations, the accident in the present report and an accident at Ängsö, Västerås in January 2016. The accidents have resulted in serious injuries to persons. Both accidents have had the common factor that the *application* of the content of the flight lessons was probably a contributing factor during the events.

EASA is the agency that prescribes the content of the flight training courses conducted within the EU. This then becomes a regulation by a decision of the European Parliament and the Council, and cover minimum levels regarding what is to be trained in various categories of flight training. However, there are no guidance material for flight training organisationson how these exercises are to be performed in practice or on which limitations should be applied to the training of specific elements.

The absence of such guidance may result in greater difficulty identifying elements that might entail increased flight safety risks during training. SHK considers this to be a deficiency, while noting that this stands in contrast to EASA's stated objective that flight training operations are to be assigned the same safety requirements as commercial aviation.

Guidance in this area would imply the following:

- The flight training organization´s identification of risk factors, under the provisions of the SMS, would be facilitated if guidance material and references regarding reasonable and acceptable levels of risk were available.

- Flight training organisations would obtain an aid for the content and execution of flight lessons.

- The standardisation of flight training courses within the EU would be improved.

- National regulators would gain a tool to use during access controls and continuous supervision, with the intention of identifying deviations and potentially dangerous conditions.

In light of what has been stated, SHK believes that EASA – in accordance with the provisions in Regulation (EC) 216/2008 – should consider the possibility of issuing Guidance Material (GM) for flight training organisations regarding the practical execution of flight training or alternatively some specifically selected parts of these.

2.3 Installation of operational CCTV cameras at Swedish commercial airports

The accident in question occurred in the middle of the runway at Sweden's third largest airport. As mentioned earlier, there were no CCTV (closed-circuit television) cameras directed towards the airport's runway system, i.e., the area where the accident occurred. This condition affects negatively the possibility to effective investigate accidents involving this class of aircraft where it is not mandatory for recording equipment to be carried on board. During the accident in question, there was neither equipment carried on board nor filmed material, for which reason the reconstruction of the sequence of events has largely been based on witness information. This must be classified as a deficiency.

SHK has previously pointed out this deficiency (see SHK report RL 2016:02) and has in this, by means of safety recommendations to the Swedish Transport Agency, proposed measures to facilitate rectification of the problem in the long term.

Among other things, the report stated the following.

The Swedish Transport Agency shall work for the achievement of the transport policy objectives, including the adaption of formation, function and use of the transport system in such a way that nobody is killed or critically injured, the Agency should consider if the use of CCTV cameras, in the long term, could contribute to the meeting of those objectives.

The possible introduction of CCTV monitoring also raises questions about costs, possibilities to document aircraft movements during varying meteorological conditions like low visibility or precipitation, and ultimately the socio-economic benefits. The range of the equipment also var-ies from simple small webcams to major camera systems used for RTC (Remote Tower Control) where both costs and function vary considerably.

Which systems that could be suitable for use, and are economically justifiable is not possible to say in the current situation, even if it appears likely that it will be in the lower end of the range. The footage from the airport cameras would definitely found a wider basis for the authoritie's investigations, and would contribute to more robust and safer analyzes, enhancing the opportunities to take adequate measures to prevent a reoccurrence.

A decision on these questions is depending on a closer evaluation of the conditions. Since it is primarily the safety investigating authority that benefits from any photodocumentation can such an evaluation be made in consultation with SHK.

According to the Swedish Transport Agency´s reply to the safety recommendations, the agency has conducted an analysis and considered the issue. The Swedish Transport Agency has thereby concluded, inter alia, that the limitations in the use and the expected costs that this would entail are deemed by the agency to be too great to consider the benefits, especially because the effect of introducing camera surveillance only indirectly has a limited impact on safety in case of an investigation.

According to the agency´s analysis CCTV monitoring of the runway system at commercial airports is not a good idea. The Swedish Transport Agency has also stated that the agency questions the effect of such measures and how such requirements addressed to airport operators is a part of the agency´s mission and responsibilities.

SHK has assessed the reply to the safety recommendations as follows.

As the report shows and according to Regulation (2008:1300) with instruction for the Swedish Transport Agency, the agency shall work for the achievement of the transport policy objectives, including the adaption of formation, function and use of the transport system in such a way that nobody is killed or critically injured.

Furthermore, the tasks shall focus on to contribute to an internationally competitive, environmentally sound and safe transport system. One way to work for increased safety is to conduct analysis of occurrences, both individual accidents and incidents and statistical trend analysis, to obtain a basis for proactive safety measures so that the regulator can take appropriate action where there are identified risks.

Such investigations and analyzes are something that both SHK (individual accidents and incidents) and the Swedish Transport Agency (statistical trend analysis) does today. In order to carry out reliable analyzes the basis must be as comprehensive and robust as possible.

Surveillance cameras could, as stated in the final report, contribute to this. It is therefore somewhat surprising that the Swedish Transport Agency questions how this is a part of the agency´s mission and responsibilities, in particular when there are already requirements for technical equipment in the aircraft (CVR and FDR), which in principle has the same purpose.

When it comes to the analysis that the Swedish Transport Agency has conducted, SHK makes the following assessment. As SHK stated in the final report it is not possible today – without a closer study – to express an opinion of what camera systems that could be suitable for use and the cost of these. It is therefore surprising that the Swedish Transport Agency, without such a study, considered the agency able to assess the limitations as well as to conclude that the costs are too large to outweigh the benefit.

Against this background, SHK did not consider the reply to the recommendations as adequate and disagreed with the decision to take no action. SHK has therefore decided to make a renewed recommendation in the matter, this time to EASA.

2.4 Overall assessment of the accident

The training at the flight training organisation in question can be viewed from different perspectives. Formally, the training performed entails competence to fly light twin-engine aircraft under instrument flight conditions. However, this competence is not the ultimate goal for most of the student pilots who invest in this professional training.

The goal for the students– and the objective of the school – is to lay the foundation for a future pilot career in commercial aviation. The aircraft that is used for the training – in this case PA34 – should thus only be considered a tool that is used for the basic training on twin-engine aircraft. It is SHK's understanding that it is not justified to include the training of risky emergency manoeuvres applicable for this aircraft model, or for this category of aircraft, as an element of the training of future commercial pilots.

SHK cannot see that the training value of the exercise now in question would exceed the obvious risks that low-altitude exercises of this kind entail. Exercises of this kind can also result in student pilots gaining an undesirable picture of the concept of flight safety culture. One foundational piece of knowledge that a future commercial pilot is to gain from flight training is that flight safety always has the highest priority.

The foremost task of aviation regulators is to safeguard flight safety. It must be possible for student pilots – who constitute a category that is neither crew nor passengers – to be guaranteed the same level of safety in their flight training as a passenger in commercial aviation. From this perspective, it cannot be considered reasonable that exercises at flight training organisations, entailing an increased risk factor, are not identified and rectified. These deficiencies are reflected in the recommendations issued by SHK in the present report.

3. CONCLUSIONS

3.1 Findings

a) The instructor was qualified to perform the flight.
b) The aircraft had a Certificate of Airworthiness and valid ARC.
c) The school was an approved Air Training Organization (ATO).
d) The flight in question was a check flight before the student's skill test for the ATPL.
e) The student had not been informed that the instructor had planned a simulated engine failure directly after lift-off.
f) The Instructor’s intention of the exercise was that the student should reduce power also on the other engine and land straight ahead on the remaining runway length – the so-called "Decision " procedure.
g) No performance calculations had been carried out for the planned "Decision " – exercise.
h) The procedure to land straight ahead is presented as an alternative emergency procedure in the type certificate holder's operating handbook.
i) When the instructor simulated engine failure on the left engine, the student hesitated about what action was appropriate.
j) After a short moment of time – during which the airspeed decreased – the instructor reduced the power also on the right engine and instructed the student to land.
k) Airspeed and height were insufficient for a controlled landing and the aircraft struck hard onto the runway and was substantially damaged.
l) The Swedish Transport Agency’s access control and continuous supervisions do not include risk assessment of individual exercises during flight training.
m) According to the regulations issued by EASA, flight safety and risk assessment should be managed by the operator’s SMS and CMS.
n) At the standardization meetings among the Swedish Transport Agency’s authorized examiners, 300 feet have been assessed – from a flight safety point of view – to be a reasonable and acceptable altitude for simulation of engine failure in aircraft.
o) The instructor, who also was an authorized examiner, had not heard about the minimum height of 300 feet for simulated engine failures.
p) The Swedish Transport Agency was aware of that simulated engine failure at low altitude with subsequent landing straight ahead, ("Decision "), was included in the flight training syllabus for commercial pilots at the ATO.
q) EASA publishes no recommendations regarding minimum heights for exercises with simulated engine failure in aircraft and does not issue any Guidance Material (GM) for the practical execution of flight training exercises.
r) None of the airport's survillance cameras were directed towards the runway.

3.2 Causes

The accident was caused by the following factors:

- Emergency exercise with a high risk factor,
- Inadequate planning of the flight training session regarding options for the handling of hazardous situations,
- Absence of guidance material from regulatory authorities regarding the practical execution of certain exercises in flight training.

4. SAFETY RECOMMENDATIONS

EASA is recommended to:

- Identity exercises in flight training that might entail an increased risk factor and to issue Guidance Material (GM) for the practical execution of these. *(RL 2016:05 R1)*
- Investigate the conditions for the installation of operational CCTV cameras for investigative purposes at European commercial airports that are covered by EASA's regulations under Regulation (EC) 216/2008. *(RL 2016:05 R2)*

The Swedish Transport Agency is recommended to:

- During the certifying process and operational controls of air training organisations to tighten its supervision concerning the identification of training elements that might entail increased flight safety risks. *(RL 2016:05 R3)*
- Review the process of standardization among its authorized examiners in order to achieve a safe and consistent performance regarding emergency exercises during skill tests in aircraft. *(RL 2016:05 R4)*

The Swedish Accident Investigation Authority respectfully requests to receive, by **1 December 2016** at the latest, information regarding measures taken in response to the safety recommendations included in this report.

On behalf of the Swedish Accident Investigation Authority,

Mikael Karanikas Stefan Christensen